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PROVISIONAL APPLICATION FOR PATENT COVER SHEET – Page 1 of 2

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No. EV 656512188 US

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TITLE OF THE INVENTION (500 characters max):

OVERALL ASPECTS FOR LTE SYSTEM

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ENCLOSED APPLICATION PARTS ***(check all that apply)***

☐ Application Data Sheet. See 37 CFR 1.76
☐ CD(s), Number of CDs ______
☑ Specification *Number of Pages* 17
☐ Other (specify) ______
☐ Drawing(s) *Number of Sheets* ______

Fees Due: Filing Fee of $200 ($100 for small entity). If the specification and drawings exceed 100 sheets of paper, an application size fee is also due, which is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

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☐ Applicant claims small entity status. See 37 CFR 1.27.
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TELEPHONE 213-623-2221   Docket Number: 2101-9196

PROVISIONAL APPLICATION COVER SHEET
Additional Page

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First Named Inventor	Young-Dae Lee	Docket Number	2101-9196

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Number 1 of 1

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PROVISIONAL APPLICATION FOR UNITED STATES PATENT IN THE NAMES OF

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R2-05xxxx

Agenda Item : 11
Source : LG Electronics
Title : Considerations on LTE multicast & broadcast
Document for : Discussion and Decision

1 Introduction

This document proposes some considerations on LTE multicast/broadcast.

2 Bandwidth scenarios and UE capability for multicast/broadcast

At this moment, whether multicast/broadcast is mandatory or optional is not clear in the UE side. Decision on this would impact on specification of LTE multicast/broadcast.

If multicast/broadcast is mandatory in the UE side, minimum UE capability for multicast/broadcast is 10 Mhz because it was decided to be 10 Mhz last month. In this case, if cell bandwidth is larger than 10 Mhz, UE may need to select which service it should receive when multicast/broadcast and unicast services are simultaneously transmitted. In some cases, UE may lose the multicast/broadcast in case the multicast/broadcast service has a lower priority than the unicast service.

If we wish to avoid this situation, every LTE UE needs to support a larger than 10 Mhz with multicast/broadcast (10 Mhz + multicast/broadcast service bandwidth). Furthermore, if there is a dedicated carrier for multicast/broadcast services which is different from a carrier for unitcast services, every LTE UE needs to support a dual receiver to receive a carrier for unicast services and another carrier for multicast/broadcast services. If it is difficult to mandate larger minimum UE bandwidth than 10 Mhz or dual receiver to LTE UE, then multicast/broadcast may need to be optional in the UE side.

Based on the discussion above, we think that the following points should be decided before design of multicast/broadcast transmission:

Q1) Should UE support multicast/broadcast in a mandatory or optional manner?

Q2) What is minimum UE bandwidth with multicast/broadcast?

Q3) Should UE supporting multicast/broadcast feature support dual receiver in a mandatory or optional manner?

3 Multicast/broadcast service scenarios

The current discussion on MBMS requirements [1] show there are two types of service scenarios: cell specific contents and cell group contents. The cell specific contents could be R99 CBS-like service i.e. message distribution, which are a single cell transmission. The cell group contents could be TV broadcasting services, which is a multi-cell transmission.

We think multi-cell transmission should use a combining technique (desirably soft combining), so that a channel for multi-cell transmission of multicast/broadcast services is somewhat different from a DL shared channel which is used for most of cases. And multi-cell transmission of a multicast/broadcast service would cover multiple eNode Bs. Therefore, a central node is needed as a source of multi-cell transmission. (NOTE: In this case, one PDCP entity exists for one service in aGW.)

On the other hand, single cell transmission dose not need any combining. Thus, characteristics of the single cell transmission channel seem to be different from the multi-cell transmission channel. We think that a DL shared channel could support the single cell transmission, instead of introducing another single cell transmission channel. And single cell transmission covers only one cell or one eNode B. In this case, locating single cell transmission at the centor node is questionable. However, one common architecture may be preferable for both single and multi-cell transmissions. (NOTE: In this case, one PDCP entity exits per cell/eNode B or per a group of cells for one service in aGW. FFS)

Furthermore, if a text message distribution like R99 CBS is supported, it is questionable whether a L2 entity like a BMC entity is needed or not. R99 BMC did storing, formatting, scheduling, transmitting and repeating CBS messages. On the other hand, in R6 MBMS, such functions were mostly done at BM-SC. Thus, we need to discuss need for a specific handling of message distributions in Layer 2. (NOTE: if repetition at lower layer is necessary e.g. for safe distribution of text or multimedia messages, ARQ layer at E-Node B could do repetition of broadcast/multicast packets like R99 BMC.)

Q1) Should LTE support both multi-cell and single cell transmission?

Q2) Does message distribution service like R99 CBS require a L2 entity like R99 BMC layer in the LTE access network?

4 Interworking with MBMS on WCDMA

It is questionable whether or not the following scenarios between WCDMA MBMS and LTE MBMS is feasible:

1) In the case a UE supporting both WCDMA MBMS and LTE MBMS moves from a WCDMA MBMS area to a LTE MBMS area or moves from LTE MBMS to WCDMA MBMS while receiving the same MBMS service
2) In the case a UE camping on a WCDMA cell receives MBMS from a LTE cell e.g. on a dedicated carrier to LTE MBMS.
3) In the case a UE camping on a LTE cell receives MBMS from a WCDMA cell e.g. on a preferred layer.

We need to discuss if one or more of the scenarios above need to be supported or not. The first point above may show a possibility to share the same BM-SC node between LTE MBMS and WCDMA MBMS for one MBMS service.

5 Conclusion

We propose in this document that some points should be discussed before detailed discussion on LTE multicast/broadcast.

References

[1] RP-060215, "Introduction of specfic requirements for support of Broadcast mode in MBMS in LTE", Orange

Agenda Item : joint meeting 3.2
Source : LG Electronics
Title : Scenarios of synchronized Random Access
Document for : Discussion and Decision

Introduction

After Denver meeting, the discussion on RACH has discussed via e-mail reflector. Then some possible points are clarified and captured into TP on RACH. However, some points to be clarified still exist. One of them is when a UE uses synchronized RACH. So, the purpose of this document is to clarify that point and discuss the scenarios on it.

Discussion

According to the TP on RACH, the synchronized random access is used when a UE uplink is time synchronized by the node B. And the purpose is for the UE to request resource for uplink data transmission.

In our understanding, since uplink data to be transmitted arrive to buffer of a UE, the UE would use synchronized random access when it does not have valid uplink resource. Therefore, we are assuming that new data arrive to the UE's buffer in below cases in this paper.

We describe possible cases in synchronization as follows.

Case 1. when a UE has uplink data

In this case, the UE is transmitting the uplink data to network. Therefore, since RR (Resource Request) can be sent over in-band signaling, synchronized RACH procedure is not needed.

Case 2. when a UE does not have uplink data but the UE is receiving downlink data from network.

In this case, although the UE doest not have uplink data, uplink resource should be allocated to send control signals associated downlink data such as CQI, ACK/NACK. Regarding allocation for this resource, there would be three possible methods.

i. One is to continuously assign resource for it. However, the cost of this scheme seems to be large since there is a need to reserve resource regardless existence of downlink data. But if a UE uses this resource by means of 1 bit indicator or RR, synchronized RACH procedure is not needed.

ii. Second one is to assign resource when downlink data is sent. The information of SR(Scheduled Resource) could be sent along with downlink data. In this case, since a UE cannot know when downlink data will be sent and the SR will be indicated, UE can not wait to use the SR until downlink data arrives. Therefore, in this case, synchronized RACH procedure should be needed.

iii. Last one is to periodically assign resource according to a sort of downlink traffic. If a sort of downlink traffic is periodical : e.g. MPEG and VoIP, a UE can predict when the next downlink traffic will arrive. In other words, the UE can forecast next SR. Therefore, synchronized RACH procedure might be needed according to interval of traffic.

Case 3. when a UE does not have uplink data and the UE is not receiving downlink data from network, but the UE has not moved to DRX cycle yet.

Although this case looks like DRX due to no uplink and downlink traffic, it could be assumed that this is when UE is moving from ACTIVE to DRX. In this case, a UE should periodically send uplink reference signal to maintain UL synchronization. This interval could be determined by mobility of the UE. If there is a fast moving UE, the UE frequently sends uplink reference signal to get UL synchronization while a stationary UE rarely sends uplink reference signal because the situation of the channel remains unchanged. Thus the UE can predict next time of uplink reference signal. Therefore, in this case, synchronized RACH procedure might be needed according to mobility of the UE.

Case 4. when a UE does not have uplink data and the UE is not receiving downlink data from network and the UE has moved to DRX cycle.

In this case, the UE would send uplink reference signal according to DRX cycle. This case can be treated as CASE 3. Accordingly, in this case, synchronized RACH procedure might be needed according to the length of DRX cycle.

Summary

The following table summarize the Random Access scenarios in synchronized case.

Table 1. Summary on the scenarios on synchronized Random Access

Is the UE having uplink data to be transmitted?	Is the UE receiving DL transmission ?	DRX	Synchronized RACH	comments
Yes	Don't care	No	Not needed	-
No	Yes	No	Not needed	Continuous assignment
			should be needed	Event –triggered assignment
			might be needed	Periodical assignment and according to interval of traffic
No	No	No	might be needed	According to UE mobility
No	No	Yes	might be needed	According to length of DRX cycle

Conclusion

We propose to discuss the scenarios in this paper and to capture the agreeable parts in the TR.

Agenda item:	x.x
Source:	LG Electronics Inc.
Title:	UE state transition in LTE_ACTIVE
Document for:	Discussion, Decision

1. Introduction

At last joint meeting with SA2 and RAN3 in Denver, it was agreed that power saving performance of UE in LTE_ACTIVE should be comparable to that of UE in LTE_Idle. In this document, we look into UE in LTE_ACTIVE.

2. Discussion

2.1 Synchronization in LTE_ACTIVE UEs

In OFDM system, it is important that transmissions from all UEs should be synchronized at eNB. To achieve this, eNB send command to the UE to advance or delay the UE's transmission timing based on the received UE signal. This operation does not occur only once. Due to UE mobility or channel condition, the synchronization status should be monitored continuously and UE transmission timing has to be adjusted according to the measurement.

But this does not come without cost. To measure the transmission synchronization status in uplink direction, UE have to transmit among uplink data, pilot, CQI, or ACK/NACK, etc. Thus, to keep UE in synchronized state, the eNB should schedule uplink transmission even when there is no uplink and downlink data for the UE. This will not only limit the usable radio resources but also reduce the standby or talk-time of the UE.

Thus, when there is no traffic for a UE, to keep a UE synchronized in uplink direction does not seem good approach. Furthermore, if the transition time from non-synchronized state to synchronized state is small, then this impact on the user experience will be quite small.

Accordingly, it is proposed to allow for a LTE_ACTIVE UE not to maintain synchronization in uplink.

2.2 Transition from Non-sync to Sync of LTE_ACTIVE UE

If we agree to allow non-unsynchronized LTE_ACTIVE UE, then there should be a mechanism to bring back the UE to synchronized state. Two use scenarios are seen. First event is when a UE has uplink data to transmit and the second case is when eNB has downlink data to transmit.

In first case, because a UE has no dedicated resource, it has to first perform RACH procedure to synchronize uplink and to notify its buffer status. After that, a UE can transmit uplink data using allocated dedicated resource.

In the second case, following procedures should be performed before actual downlink transmission.

First procedure is to notify upcoming traffic to the UE. If DRX mechanism for LTE_ACTIVE is used for LTE_ACTIVE UE to save power consumption, the eNB will indicate the pending downlink traffic at the wake-up timing of the UE. As a simple solution, UE temporary ID assigned by eNB will be indicated by L1/L2 control information.

Next procedure is to synchronize UE uplink transmission. Without synchronized uplink, paging of incoming data will be useless. It's because low error ratio of data transmission will be ensured by using HARQ and HARQ requires feedback from receiving side. Additionally, receiving side needs to report CQI information to assist transmitter's selection of resource block. To guarantee reliable reception of these pieces of information at eNB, it is required to synchronize uplink before actual downlink traffic transmission.

But to let UE to synchronize uplink by using RACH will not be optimal. Because RACH is contention based channel, it is not free from conflict. Then following two options can be pursued to reduce time in achieving synchronization.

Option 1: To assign UE dedicated RACH signature.

In this option, eNB allocate special RACH signature while notifying pending downlink traffic. Because it is a UE dedicated signature, it's easier for eNB to react. And because it's UE dedicated signature, there will be no confliction between multiple UEs.

Option 2: To assign UE dedicated resources.

In this option, eNB allocate a dedicated radio resource. That resource is used to synchronize UE uplink transmission. Thus, its subframe format will be quite similar to that of RACH. Because the resource is used only by that UE, the detection is reliable and synchronization will be quite small. If eNB allocates radio resource for CQI also, then it will be useful to eNB's scheduling.

Conclusion:

Dedicated radio resource is used to regain uplink synchronization for non-synchronized LTE_ACTIVE UE.

3. Conclusion

It is proposed to discuss and agree to:

- Use of dedicated radio resource to re-synchronize uplink of non-synchronized LTE_ACTIVE UE.

4. Reference

[1] R2-060xxx, LTE, LG Electronics

Agenda Item : 3.1
Source : LG Electronics
Title : Disucssion on LTE Paging and DRX
Document for : Discussion and Decision

Introduction

This document discusses how to specify Paging and DRX procedure and PCH channel in LTE. In this document, the DRX procedure is defined as a procedure controlling inactivity of a UE in active mode for UE battery power saving.

Differences between Paging and DRX

We consider that the paging procedure is used by aGW to find at which cell in a tracking area a UE is and to offer efficient UE battery power management. The paging procedure is applied only to a UE in idle mode. Since a paged UE has no short UE id (e.g. C-RNTI) allocated by a cell, a paging message will carry a longer UE id e.g. IMSI and TMSI. This paging procedure should be distinguished with the DRX procedure for an active UE.

The DRX procedure for active mode is used by eNode B to offer efficient UE battery power management. The paging procedure is applied only to a UE in active mode. If DL/UL traffic is temporarily inactive, eNode B may apply this DRX procedure to a UE in active mode. If this DRX procedure is applied, the UE would discontinuously monitor DRX signaling sent on DL according to a cycle set by the eNode B. Since an active UE has a short UE id (e.g. C-RNTI) allocated by a cell, eNode B can lead a UE with DRX to wake up by indicating the short UE id.

In summary, Idle mode Paging and active mode DRX are different as follows:

	Paging Procedure	DRX Procedure
RRC mode	Idle mode	Active mode
Controlling network node	aGW: paging initiation eNode B: paging transmission	eNode B
Signalled Area	A tracking area	A cell
Signalled UE identity	A long identity (e.g. IMSI, TMSI) allocated by NAS	A short identity (e.g. C-RNTI) allocated by AS in eNode B

What long and short identies are needs to be further studied. However, we think that UE identies for idle and active mode would be different.

It might be a good idea to use the long identity all the time in order to avoid the problems that we had where UEs go to idle mode, and theNodeB believes that they are in connected mode and vice versa... That's a patent that I wanted to make some time from now...

Air Interface for Paging and DRX

In the section above, we discuss how paging and DRX procedures are different. We think the differences between them should be considered when we design the LTE air interface.

At this moment, the PCH channel is defined in TR 25.813 for transmitting a paging message. However, it is not so clear whether or not PCH is also used for DRX of an active UE.

In case of the DRX procedure, a short UE identity which may be equal to or less than 16 bits could be easily embedded into L1/2 control information at the first symbol of a sub-frame. It is because L1/2 control information e.g. for DL/UL SCH would use the short UE identity as well. Thus, wake-up signaling of active UEs with a short UE identity may be compatible with L1/2 control information.

On the other hand, a long UE identity which may be 32 bits may not be compatible with L1/2 control information. It is because L1/2 control information e.g. for DL/UL SCH would not use the long UE identity. Thus, a paging message with the long UE identity could not be embedded into L1/2 control information. However, if PICH is necessary, PICH could be embedded into L1/2 control information because PICH would carry a short size of quick indications.

Therefore, the following points could be concluded.

1) Only a UE in idle mode shall monitor a PCH channel based on a long UE identity for UE power saving.
2) A UE in active mode may monitor L1/2 control information with a short UE identity in a cycle set by eNode B for UE power saving.
3) If an active UE with DRX is scheduled, eNode B will insert the short identity of the UE into L1/2 control information including scheduling information according to the set cycle.
4) If an active UE with DRX is not scheduled, , eNode B will not insert the short identity of the UE into L1/2 control information according to the set cycle.

Paging Indicator Channel

PICH may have a benefit for UE battery saving because UE is quickly able to check its own paging by simply decoding Paging Indications on PICH. Decoding a paging indication will be quicker than decoding a paging message. Thus, the PICH channel may be need in LTE for efficient UE power saving. Furthermore, PICH could do frequency hopping for frequency diversity. The hopping information could be given from system information. Alternatively, L1/2 control information could be used instead of PICH.

I'm not sure whether there is really a gain from the receiver operation, and the message decoding should not be too long, so I am not sure where there is a gain. Sending a small block is difficult to protect for a coding point of view, therefore a big block with th identities immediately might not be a bad idea.

Conclusion

It is proposed to discuss the following points:

- Two UE power saving schemes are used based on RRC mode i.e. the paging procedure for idle moe and DRX procedure for active mode.
- The paging procedure for idle mode relies on the PCH channel, possibly with short indications such as PICH or L1/2 control information.
- The DRX procedure for active mode relies on L1/2 control information which is used for DL/UL SCH.

Source: LG Electronics

Title: LTE Random Access Use Cases
Agenda Item: Joint03.2 - Random Access

Document for: Discussion & Decision

1. Introduction

RACH has been discussed in RAN2 in RAN2 #53, and a LS has been sent to RAN1 in [1] order to progress the discussion we give our view in the following, and provide proposals for further study for different issues.

2. Random Access Use Cases

It has been identified that random access procedure can be used for initial access to obtain L1 synchronization, for resource request when no UL resources are available and for control of UE mobility. Theses use cases can be classified into 3 different states:

- Idle mode UE / Detached modeUE / UE Mobility
- Synchronized active UE without resources
- Non- Synchronized active UE without resources (under FFS in RAN2)

The different possible procedures for each state are discussed in following.

3. Idle mode UE / Detached UE / UE Mobility

Considerations on the Bandwidth and the preamble length

In these states the main purpose should be to detect the UE, calculate the necessary timing alignment, and allocate uplink resources for the UE. According to our understanding the minimum BW for non-synchronized random access transmission should be 1.25 MHz. Indeed as shown in figure below the autocorrelation function presents a lobe for localized mapping scheme which offers better timing estimation than equidistant mapping scheme. The lobe width is approximately equal to 1/BW which should be a fraction of the cyclic prefix for timing uncertainty. For a BW of 1.25 MHz, the autocorrelation lobe is in the order of 0.8 µs which is sufficiently smaller than the typical CP duration (approximately 5 µs). For BW less than 1.25MHz, for instance BW of 375 KHz the uncertainty increases threefold and thus if such a BW would be used it is necessary to evaluate the impact of the timing uncertainty on the uplink transmission, although the this can be advantageous in order to take advantage of the frequency selectivity of the channel.

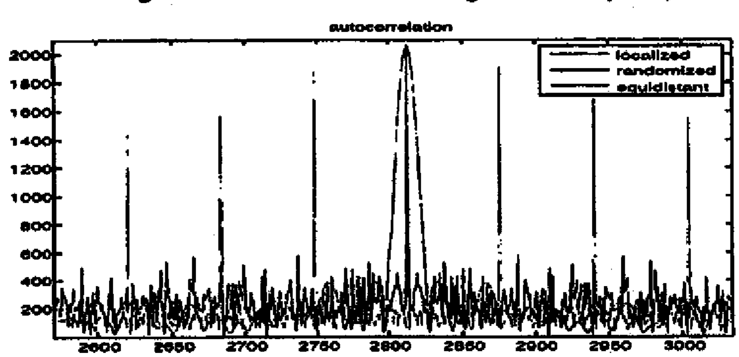

Figure 1: Comparison between localized random and equidistant distribution

According to our analysis [2] it should be possible to have a reasonable performance for the detection in the case of 3 symbols in the case of the TU channel at 3 km/h. However it is important to agree on the assumptions for the simulations.

Proposal:
In order to decide on the above points it is necessary to make assumptions on:

- The required precision for the timing
- The maximum achievable SNR in the UL at the NodeB, i.e. the necessary assumptions on the link budget

Based on these assumptions it should be possible to estimate the number of symbols necessary for the transmission of the preamble for the different bandwidths, and different speed and channels after further simulations in the Mai or June meeting.

Different possible procedures
Three random access procedures are possible as illustrated in Figure 2 below:

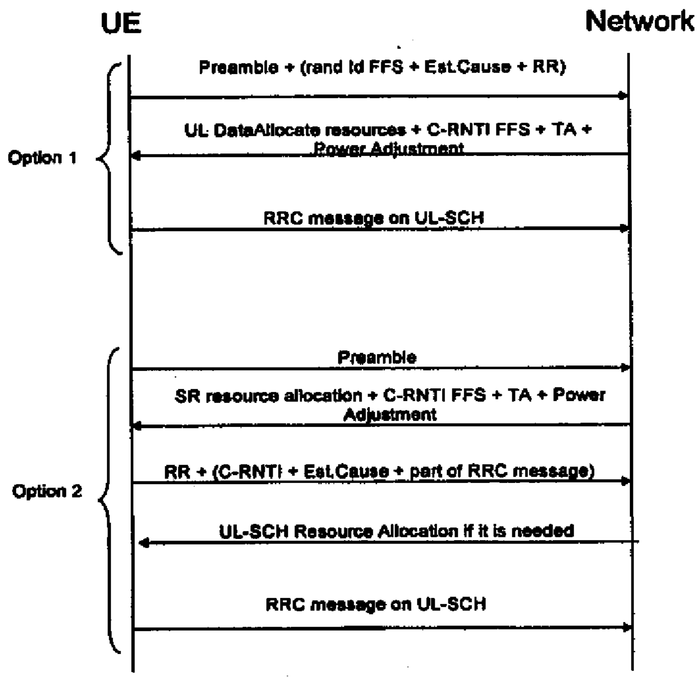

Figure 2: Options for the unsynchronized RACH procedure

In option 1 on contention channel the preamble and message payload including X bits message (TBD) containing some information on UL resources needed, priority, establishment cause, and possibly random Id to assist in resolution of contention, are combined together. After the X bits have been decoded by the network, it responds with the necessary timing advance information to be used on the UL SCH and requested scheduling grant, evt other required information. In a case when no resource request can be sent (due to some coverage issue) the necessary amount of UL resource to allocate can be either constant regardless the random access cause, or based on the preamble linked to the access cause. When getting uplink allocation the UE transmits the L3 messages, MAC data or control PDU, on the scheduled resources.

In option 2, only the preamble is transmitted by the UE on contention based channel. When detected by the network signalling resources are allocated to the UE. Then on scheduled resources the UE send the scheduling grant. The network adjusts the resource allocation depending on the UE needs for message payload part transmission. This procedure avoids that the network allocates inadequate resources for the transmission of the RRC message and to treat priorities correctly.

The choice between the possible options is a trade off between the time that is used for the additional transmission of information to request UL SCH resources and the resources wasted and the interference created by transmitting the resource request together with the preamble which might not be detected or which might be in collision. With all those assumptions we believe that it is very difficult to show a clear benefit for one or the other procedure, as long as the size of the data does not become too big. In order to decide on the scheme we need to have a clear picture of the necessary preamble size, and the required resources per carried data bit in the case it is sent together with the preamble.

Proposal:

We propose to discuss further on this choice in order to clarify the resources required for the preamble and the overhead due to additional data bits.

4. Synchronized Active UE without resources

When the UE sends this type of resource request it has already established synchronization, and thus the timing estimation that can be done from this transmission is not so important. In this case the synchronised random access procedure can be considered for resource request with smaller bandwidth than for non-synchronized access. This bandwidth could be equal to the bandwidth of the uplink resource unit and should be considered based on the number of bits that are required to be transmitted. There is the need to transmit C-RNTI for UE identification. Three random access procedures are possible as illustrated in figure below:

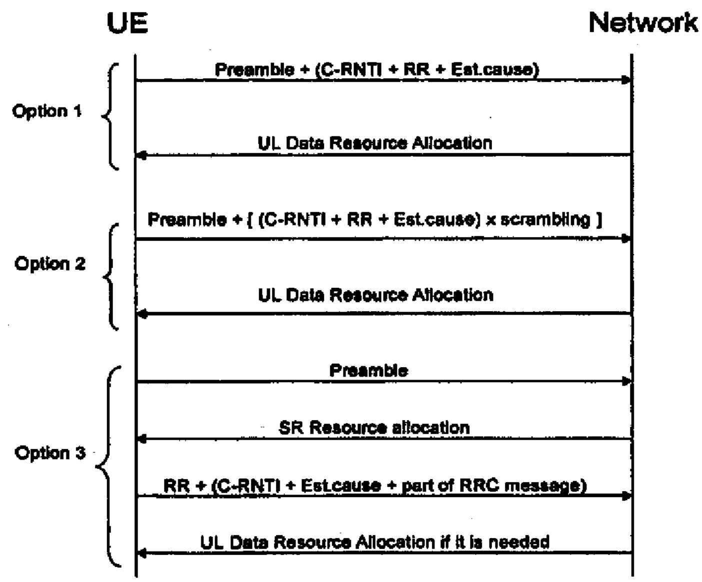

Figure 3: Options for the synchronized RACH procedure

In options 1 a preamble and a C-RNTI and RR are transmitted on a specific resource reserved for the RACH procedure, where the C-RNTI and the RR are protected by a channel coding. A UE that has no occasion of transmitting the RR otherwise chooses a preamble and transmits the preamble and the resource request on the specific resource. If two terminals perform random access procedure in the same time with the same time/frequency resources the C-RNTI and the RR might not be able to be decoded correctly.

In the second option the C-RNTI and the RR are protected by a channel coding, and evtl. additional redundancy. A UE that has no occasion of transmitting the RR otherwise chooses a preamble and transmits the preamble and the resource request on the specific resource, where the C-RNTI and the RR are coded specifically, and in addition to this scrambled by a scrambling code which is specific to the preamble used. Depending on the level of redundancy introduced for the coding the NodeB might be able to decode the C-RNTI and the RR even in the case of a collision.

In the third option the UE chooses one of the available preambles and transmits it on the reserved resource. In case of a collision the NodeB is able to choose one of the preambles and allocates resources to the UE that transmitted this preamble. In the case that two UEs have transmitted the same preamble there is a risk that both UEs will consider the Resource allocation for themselves.

5. Non-Synchronised Active UE without resources

Whether this possibility is necessary depends on the decisions on the sleeping mode in active state and the general handling of synchronization. The possible procedure can be the same as idle mode UE, with exception that the C-RNTI is already available.

6. Random Access Procedure

For inter cell interference mitigation one proposal would be to define in each cell sets of RACH channels which would use different sub-bands. For random access the UE should then choose one of the available sets based on the pathloss that the UE measures, such that UEs with big pathloss, i.e. which are far from the base station would use a specific set, such that the major UL interference is localized in this set. Inside one set the choice of the available resources could be made in a random manner.

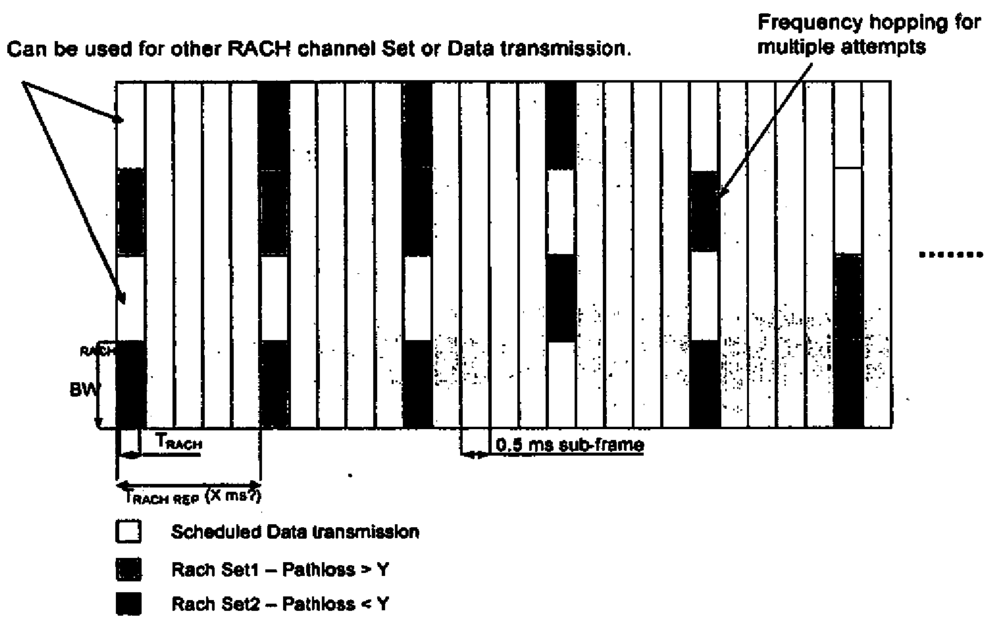

Figure 4: RACH resource allocation

During the random access procedure, the UE transmits RACH burst and the network measures the received signal from terminal. Then it sends a timing advance (TA) command, which commanding terminal to adjust its uplink transmission timing accordingly. A second RACH transmission may be done to verify the adjusted time offset and possibly help for collision resolution. Once synchronisation is obtained message part is sent on the uplink shared resources which are scheduled by NodeB.

Whether there is need for resource request or to maintain time synchronisation in the uplink , RACH or control signalling resources can be used.

Once the signature is sent the UE should wait for the reception of a response message (including ACK / NACK / Timing Adjustment). If uplink system band and downlink system band are the same a one to one mapping for the resources for the RACH signature and the resources for the response message could be defined.. Alternatively the physical resource of the response RACH message could be allocated based on UE specific Info such as UE identity. For example, system information could contain the method of calculation in order to map between UE identity and downlink resource of response RACH message. Then UE can know the position (frequency/time) of response RACH message after sending RACH message according to its calculation. Details of this method of calculation should be investigated.

7. Conclusion

We propose to discuss the proposals in this contribution and to capture the agreeable parts in the TR.

8. References

[1] R1-060061(R2-060144), "LTE L1 related questions to RAN1" RAN2

[2] R1-060531, "Some considerations for LTE RACH" LG Electronics

Source: LG Electronics

Title: Considerations on BCH and 20 MHz system BW

Agenda Item: Joint 3.2

Document for: Discussion & Decision

Introduction

The purpose of this paper is to analyze the usage, and the way that system information should be organized in the future LTE system. As already discussed in R2-060578 especially the possibility of UEs that are able to receive only a smaller bandwidth than the system bandwidth is taken into consideration.

General purpose

We consider that a UE in order to select a cell uses a two step approach, similarly to UMTS:

1) Detect the existence of a cell, find out a cell specific code, e.g. a scrambling code and gain frame timing.

2) Receive system information, e.g. measurement information, PLMN information etc.

In general step 1) should be done using the SCH, whilst step 2) is performed using the BCH.

During the reception of data on the cell, whilst the UE is camping on the cell and during handover the UE might receive the SCH in order to maintain and gain DL synchronization.

During mobility the UE in active and idle mode should be able to receive the BCH information in order to maintain the necessary information for neighbour cells, measurement rules etc.

The UE needs to receive the BCH in case that:

- the UE is switched on
- UE reselects another cell in idle mode
- UE is transferred from active mode to idle mode for cell reselection

In the above cases the UE reads the BCH in idle or in detached mode. However during the discussions on call setup delay in RAN2 it has turned out that the delay due to reading of the system information at transition from active to idle mode significantly increases the delay. Therefore it seems important that the UE is able to receive system information also in active mode.

Mapping of system information

In [1] it is clarified that the BCCH should be mapped on a BCH type of transport channel because the BCH is considered as a fixed rate channel that is transmitted to the whole cell. In the RAN1 text proposal at the moment it is proposed that the BCH should be transmitted on the central bandwidth of 1.25 MHz, similarly to the bandwidth of the SCH, although larger bandwidths are still under discussion.

Our understanding is that the BCH should be read quickly (i.e. no long repetition cycle), whilst there exist different requirements for different information types. This implies in our understanding that it is advantageous to use the maximum available bandwidth for the transmission of the BCH, which in addition would also increase benefits of the frequency diversity.

However the current assumption to transmit the BCH only on 1.25 MHz is kind of contrary to this since it seems to prevent to use the maximum available bandwidth, although we understand that it would allow a relatively simple scheme for the case of different transmission bandwidths.

Special case for the 20 Mhz cell bandwidth

The special case of 20 MHz system bandwidth where a UE is receiving one part of the carriers is shown in Figure 1. There it is shown that the UE that is allocated to one half of the bandwidth it is not able to receive the BCH correctly in the case that the BCH is coded across the ceter frequency. This is e.g. the case for UEs receiving MBMS that is broadcast on one 10MHz part for idle mode UEs, or in the case that the UE in active mode is scheduled to receive one part of the bandwidth.

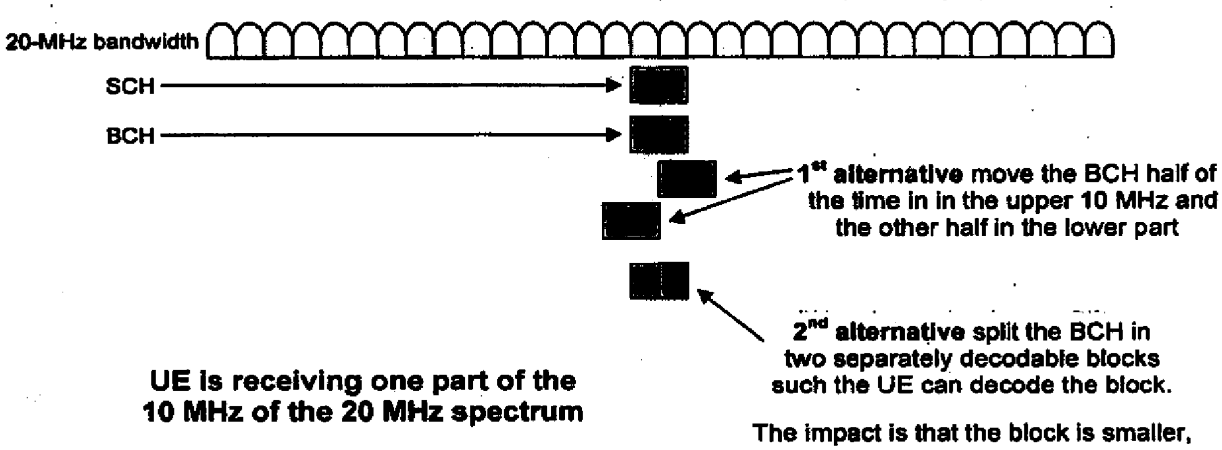

Figure 1: Receiving the BCH in the case of 20 MHz system bandwidth

Thus in order to allow that the UE can receive the BCH in all cases the BCH should be transmitted according to alternative 1 or alternative 2. In alternative 1 the BCH blocks are sent eiter in one or the other 10 MHz block, in alternative 2 the BCH is split in 2 blocks that can be received independently. A UE that can tune to any frequency is able to receive both blocks, a UE that must receive one or the other part will be able to receive half of the BCH transmissions. Therefore the UE is still able to receive the BCH, although not as fast as other UEs.

Resources for System Information

As discussed above we believe that it is essential that system information is sent with lare bandwidths, in order to reduce the time for reception for the UE. Whilst the SCH will probably be transmitted with a repetition cycle in the order of one frame, the repetition cycle for the BCH is probably in the order of 10s or 100s of frames. Thus once that the cell timing has been acquired by SCH reception the BCH should be scheduled, and transmitted on large bandwidths, in order to minimize the time that the UE needs to turn on its receiver.

Since the BCH as described above should be transmitted in the same way for different system bandwidths we believe that a two-step approach for system information would be a promising solution, where system information is split in primary system information, and secondary system information, where:

- **Primary system information**
  comprises the system bandwidth, scheduling information of secondary system information and other basic information as e.g. the MIB in R99. This primary system information would be transmitted as described above on Primary BCH channel. Primary BCH channel has a fixed configuration, evtl. depending on the configuration of the SCH.

- **Secondary system information**
  comprises other system information blocks, and could be transmitted on Secondary BCH. Secondary BCH channel has a flexible configuration that every UE can support with minimum UE capability.

  The configuration of Secondary BCH is provided on the primary system information. If a cell supports a bandwidth wider than 1.25 Mhz, Secondary BCH can support wider bandwidth than 1.25 Mhz, up to the minimum UE receiver bandwidth. Secondary BCH may be allowed to be allocated at any sub-carrier and time based on the scheduling information on Primary BCH. Alternatively, instead of Secondary BCH, DL Shared Channel could be used to transmit the secondary system information in a flexible manner.

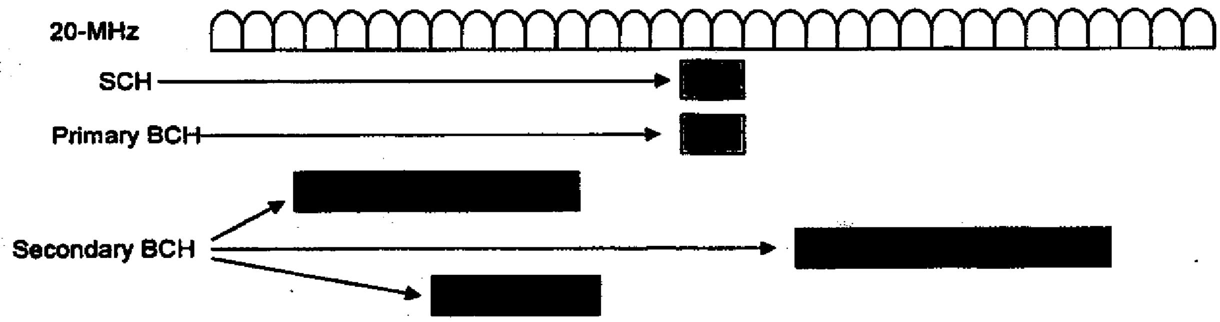

Figure 2: Primary and secondary BCH

Generalization

In order to avoid unnecessary complexity we believe that it would be worthwhile to try to consider only one option that would be used for all bandwidths. Also the split in Primary and Seondary BCH would be advantageous in all kinds of system bandwidths.

Conclusion

It is proposed to discuss the above considerations which are:

- The need for a a 10 MHz class UE to be able to receive the BCH in a system with 20 MHz bandwidth, i.e.
    - To split the BCH across the two 10 MHz parts of a 20 MHz system
- To split the BCH in a primary BCH and a secondary BCH where:
    - The primary system information (e.g. MIB/SB) would be mapped on the primary BCH channel
    - The secondary system information could be mapped on the secondary BCH or (primary) DL-SCH.

Annex:

[1] TR 25.813 V0.6.0, Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network

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PROVISIONAL APPLICATION FOR PATENT COVER SHEET – Page 1 of 2

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No. EV 656510828 US

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Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
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Additional inventors are being named on the ______ *separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max):

OVERALL ASPECTS FOR LTE SYSTEM

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ENCLOSED APPLICATION PARTS ***(check all that apply)***

☐ Application Data Sheet. See 37 CFR 1.76
☑ Specification *Number of Pages* 611
☐ Drawing(s) *Number of Sheets* ______
☐ CD(s), Number of CDs ______
☐ Other (specify) ______

Fees Due: Filing Fee of $200 ($100 for small entity). If the specification and drawings exceed 100 sheets of paper, an application size fee is also due, which is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

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TELEPHONE 213-623-2221 Docket Number: 2101-9222

Customer No: 035884 Attorney Docket No: 2101-9222

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Young-Dae LEE, Myung-Cheul JUNG, Sung-Duck CHUN, Sung-Jun PARK and Patrick FISCHER	Art Unit:
	Examiner:
Serial No: Filed: Herewith For: OVERALL ASPECTS FOR LTE SYSTEM	

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PROVISIONAL APPLICATION FOR
UNITED STATES PATENT
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OVERALL ASPECTS FOR LTE SYSTEM

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3GPP TR 25.814 V1.2.2 (2006-3)

Technical Report

3rd Generation Partnership Project;
Technical Specification Group Radio Access Network;
Physical Layer Aspects for Evolved UTRA
(Release 7)

Keywords

Evolved UTRA, radio, packet mode, layer 1

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Contents

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Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

This document is related to the technical report for physical layer aspect of the study item "Evolved UTRA and UTRAN" [1[1]. The purpose of this TR is to help TSG RAN WG1 to define and describe the potential physical layer evolution under consideration and compare the benefits of each evolution techniques, along with the complexity evaluation of each technique.

This activity involves the Radio Access work area of the 3GPP studies and has impacts both on the Mobile Equipment and Access Network of the 3GPP systems.

This document is intended to gather all information in order to compare the solutions and gains vs. complexity, and draw a conclusion on way forward.

This document is a 'living' document, i.e. it is permanently updated and presented to TSG-RAN meetings.

Six basic L1 concept proposals are evaluated in this TR:

1. FDD UL based on SC-FDMA, FDD DL based on OFDMA
2. FDD UL based on OFDMA, FDD DL based on OFDMA
3. FDD UL/DL based on MC-WCDMA
4. TDD UL/DL based on MC-TD-SCDMA
5. TDD UL/DL based on OFDMA
6. TDD UL based on SC-FDMA, TDD DL based on OFDMA"

1.1 Rationale for RAN#30 decision on way forward for Evolved UTRA multiple access

The following has been considered by TSG-RAN #30 (Dec'05):

- When compared to the reference defined in TR 25.913, and based on the initial system-level evaluations with 5 MHz allocation, the spectral efficiency improvements achievable with a (CDMA-based) system according to an "evolutionary" approach and the spectral efficiency improvements achievable with a new approach (e.g. OFDM-based) are both attractive.
- Using a CDMA based approach enables smoother migration from prior UTRA releases and might offer more extensive physical layer reuse.
- On the other hand, a new Layer 1, with an inherent avoidance of a priori constraints in the air-interface design, allows for a more free choice of design parameters, making it easier to fulfil some of the E-UTRA targets e.g. latency requirements, finer minimum bandwidth granularity, commonality between different duplex modes.
- UE receiver processing is somewhat simpler for an OFDMA-based air interface; the attractiveness in terms of complexity increases with larger bandwidths and/or high order MIMO configurations.

Both approaches to the 3GPP radio-access evolution have their advantages and disadvantages, very much depending on the exact requirements.

On this basis, TSG-RAN #30 has decided that the Long-Term Evolution feasibility study will focus on OFDMA based downlink and SC-FDMA based uplink. TSG-RAN #30 has also re-affirmed that continued evolution of existing UTRA modes is an on-going necessary work activity within 3GPP.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] 3GPP TD RP-040461: "Proposed Study Item on Evolved UTRA and UTRAN".

[2] 3GPP, TR25.848, "Physical Layer Aspects of UTRA High Speed Downlink Packet Access."

[3] 3GPP, TR25.896, "Feasibility Study for Enhanced Uplink for UTRA FDD"

[4] 3GPP TR 25.913, "Requirements for evolved Universal Terrestrial Radio Access (UTRA) and Universal Terrestrial Radio Access Network (UTRAN)"

[5] 3GPP, TR 25.942 V3.3.0 (2002-06), RF System Scenarios, June 2002

[6] ETSI TR 101 112 (V3.1.0): "Universal Mobile Telecommunications System (UMTS); Selection procedures for the choice of radio transmission technologies of the UMTS (UMTS 30.03 version 3.1.0)."

[7] 3GPP, TR25.996, "Spatial Channel Model for Multiple Input Multiple Output (MIMO)

[8] 3GPP TS 45.005 V5.4.0 (2002-06) Radio transmission and reception

[9] 3GPP, R1-040642, "Comparison of PAR and Cubic Metric for Power De-rating", Motorola

[10] 3GPP, R4AH-05045, "UE transmit configuration and E-TFC Selection", Motorola

[11] Nielsen et al, "Statistic of Measured Body Loss for Mobile Phones", IEEE Trans. Antennas and Propagation, VOL. 49, No.9, Pages 1351-3, September 2001.

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[13] Davidson and Hill, "Measurement of Building Penetration into Medium Buildings at 900 and 1500 MHz, "IEEE VTC, VOL. 46, NO. 1, February 1997, Pages 161-168.

[14] Mohammed et al, "Characterization of Indoor Penetration Loss at ISM Band", Environmental Electromagnetics, 2003. CEEM 2003. Proceedings. 4-7 Nov. 2003, Page(s): 25-28.

[15] Zhang and Hwang, "Measurements of the Characteristics of Indoor Penetration Loss", IEEE VTC 1994, 8-10 June 1994, Pages: 1741-1744 vol 3.

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply.

<defined term>: <definition>.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

<symbol> <Explanation>

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

BS	Base Station
CP	Cyclic Prefix
DCT	Discrete Cosine Transform
DL	Downlink
DRX	Discontinuous Reception
DSCH	Downlink Shared Channel
DUSP	Switching point from downlink to uplink
E-DCH	Enhanced Dedicated Channel
E-UTRA	Evolved UTRA
E-UTRAN	Evolved UTRAN
FDD	Frequency Division Duplex
FDM	Frequency Division Multiplexing
FEC	Forward Error Correction
HARQ	Hybrid Automatic Repeat reQuest
HCR	High Chip Rate
HSDPA	High Speed Downlink Packet Access
IFFT	Inverse Fast Fourier Transform
IOTA	Isotropic Orthogonal Transform Algorithm
LCR	Low Chip Rate
LTE	Long Term Evolution
MBMS	Multimedia Broadcast Multicast Service
MIMO	Multiple Input Multiple Output
OFDM	Orthogonal Frequency Division Multiplexing
OFDMA	Orthogonal Frequency Division Multiple Access
OQAM	Offset QAM
QoS	Quality of Service
PRB	Physical Resource Block
PS	Packet Switched
RF	Radio Frequency
SC-FDMA	Single Carrier – Frequency Division Multiple Access
SFN	Single Frequency Network
TDD	Time Division Duplex
UDSP	Switching point from uplink to downlink
UE	User Equipment
UL	Uplink
VRB	Virtual Resource Block

4 Introduction

At the 3GPP TSG RAN #26 meeting, the SI description on "Evolved UTRA and UTRAN" was approved [1].

The justification of the study item was, that with enhancements such as HSDPA and Enhanced Uplink, the 3GPP radio-access technology will be highly competitive for several years. However, to ensure competitiveness in an even longer time frame, i.e. for the next 10 years and beyond, a long-term evolution of the 3GPP radio-access technology needs to be considered.

Important parts of such a long-term evolution includes reduced latency, higher user data rates, improved system capacity and coverage, and reduced cost for the operator. In order to achieve this, an evolution of the radio interface as well as the radio network architecture should be considered.

Considering a desire for even higher data rates and also taking into account future additional 3G spectrum allocations the long-term 3GPP evolution should include an evolution towards support for wider transmission bandwidth than 5 MHz. At the same time, support for transmission bandwidths of 5MHz and less than 5MHz should be investigated in order to allow for more flexibility in whichever frequency bands the system may be deployed.

5 Requirements

(Editor's note: we refer the related requirement in TR25.913)

6 General description of layer 1

6.1 Multiband operation

6.1.1 MC-WCDMA based proposal

By design, it is possible to deploy the MC-WCDMA system in all existing and future UTRA-FDD bands as well as new bands designated for cellular systems. The deployment can be made in either new carriers or in the same spectrum as existing carriers thus enabling simultaneous support for UTRA and E-UTRA UEs in the same spectrum allocation.

The multi-carrier approach is also well suited to simultaneous operation in multiple bands and over discontinuous allocations in the same band. Multi-band operation is primarily limited by the UE RF complexity and the laws of physics associated with the distance between the bands.

6.2 Duplexing

The E-UTRA air interface supports both frequency division duplex (FDD) and time division duplex (TDD) modes of operation.

The downlink and uplink concepts described in sections 7.1, 9.1 and 9.2 are common to FDD and TDD modes of operation unless otherwise stated (i.e. where specific properties/capabilities of FDD and TDD duplex arrangements need to be taken into account).

6.2.1 TDD mode aspects for OFDMA and SC-FDMA

In the TDD mode of E-UTRA, sub-frames can be assigned as either uplink sub-frames or downlink sub-frames (to accommodate different traffic profiles or different functions). A downlink or uplink sub-frame consists of an integer number of symbols (some of which may be idle to allow for timing advance) with a sub-frame structure that is defined by signaling from the network. Thc sub-frame structure may vary from sub-frame to sub-frame within the frame to accommodate different traffic profiles and latency requirements.

Downlink synchronisation reference signals and system information are contained in each frame and only occupy parts of the frame. If the synchronisation and system information signal structures are common to TDD and FDD modes, then it may be possible to realise some benefits in terms of UE complexity.

The traffic sub frame structure for TDD mode operation of E-UTRA is shown in Fig. 6.2.1-1. This structure supports timing advance for cells of various sizes.

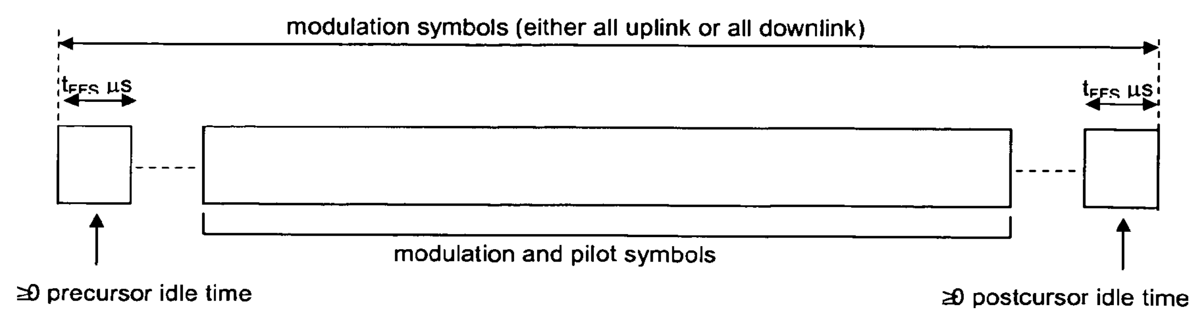


Figure 6.2.1-1 - Traffic timeslot structure TDD mode E-UTRA operation

In the TDD mode of operation common and / or dedicated pilots are used to help exploit channel reciprocity of the link. Distinct pilots from different antennas may be used to support multi-antenna techniques such as MIMO.

E-UTRA, when operating in TDD mode-of-operation, may face additional interference scenarios, compared to when operating in FDD mode of operation. More specifically, direct UE-to-UE and BS-to-BS interference may occur both within one carrier and between neighbour carriers.

If E-UTRA operates in TDD mode, two approaches have been proposed to meet the requirement on co-existence with current UTRA TDD according to TR 25.913. The possibility of adopting both the two approaches can be considered.

Approach 1 is described in section 6.2.1.1, and approach 2 is described in section 6.2.1.2. Either approach can be used depending on co-existence scenario.

In order to meet the latency requirement of TR25.913, it may be necessary to employ additional switching points in E-UTRA TDD compared to UTRA TDD. Any interference problem created as a result between the E-UTRA and the legacy carrier would need to be solved.

6.2.1.1 Approach 1 –Multiple fixed frame structures

According to approach 1, when there is a requirement for co-existence with LCR TDD, the frame structure described in section 6.2.1.1.1 can be used. When there is a requirement for co-existence with HCR TDD, the frame structure described in section 6.2.1.1.2 can be used.

6.2.1.1.1 For co-existence with LCR-TDD

Example of the first traffic sub-frame structure for TDD mode operation of E-UTRA is shown in Fig. 6.2.1-1. There is one pair of switching points within a 5ms E-UTRA radio sub-frame structure. Besides the first guard period set between the DwPTS and UpPTS, more guard periods can be provided by the uplink traffic time slot which follows the DL/UL switching point.

A guard period is required at a DL/UL or UL/DL switching point. Each traffic time slot should contain a small idle period (Timeslot Interval) which can be used for switching guard period from UL to DL traffic time slot. For the DL/UL switching point, if there is only one switching point between DL and UL traffic time slot in a E-UTRA TDD radio traffic time slot structure, a special guard period will be kept between the special downlink timeslot DwPTS and special uplink timeslot UpPTS.

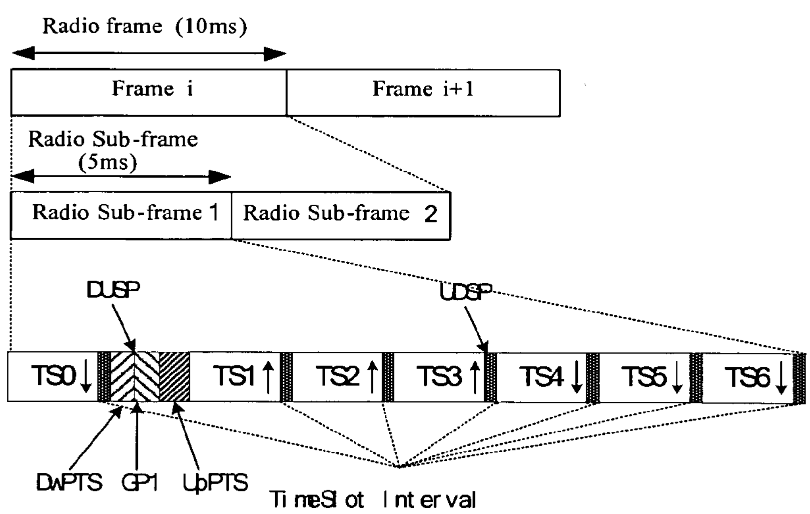


Figure 6.2.1.1-1 Frame Structure of one pair of switching points between DL and UL traffic timeslot

Assuming that a 10 ms frame is divided into 2 equally sized 5 ms radio sub-frames, one radio sub-frame consists of seven traffic time slots (TS0~TS6). The synchronization and guard period is between TS0 and TS1, whose duration is 0.275ms including DwPTS, GP and UpPTS. The TTI of E-UTRA TDD can be 0.675ms, the same as duration of one traffic time slot.

Note: as mentioned in Section 6.2.1, special considerations need to be taken with regards to the E-UTRA frame structure when operating in TDD mode of operation in order to satisfy the E-UTRA requirement on allowing for spectrum co-existence with current 3GPP TDD standards.

The minimum TTI for uplink transmission is equal to the uplink traffic timeslot duration (0.675ms).

A guard period is required at a DL/UL or UL/DL switching point. Each traffic time slot should contain a small idle period (Timeslot Interval) which can be used for switching guard period from UL to DL traffic time slot.

6.2.1.1.2 For co-existence with HCR-TDD

The framing structure of UTRA 3.84Mcps is based upon a radio frame of 10ms divided into 15 timeslots of equal duration ($\approx$666.667μs). Each timeslot may be designated freely as uplink or downlink according to the system configuration.

To facilitate full alignment of the uplink and downlink transmission periods on an E-UTRA carrier with those of a 3.84Mcps TDD carrier for all possible UL/DL timeslot slot configurations, an E-UTRA sub-frame duration of 0.01/(15n) seconds is required, where n = {1,2,3,...}.

However, many common 3.84Mcps TDD deployments use a single switching point per radio frame. This, taken in conjunction with the fact that 3 HCR timeslots are of equal duration to 4x0.5ms sub-frames for E-UTRA (see for example section 7.1.1, 9.1.1, 9.2.1), provides for further E-UTRA/UTRA TDD frame alignment possibilities when an E-UTRA sub-frame duration of 0.5ms is selected.

Thus, co-existence with HCR TDD is provided in one of two ways:

1. Via an E-UTRA sub-frame duration of 0.01/(15n) seconds. Each E-UTRA sub-frame within a 10ms radio frame may be configured as uplink or downlink
2. Via the use of the generic frame structure of 6.2.1.2 with 0.5ms sub-frame duration.

For reasons of commonality with the paired LTE mode, option 2 above is preferred.

6.2.1.2 Approach 2 –Generic frame structure

The second approach uses a generic frame structure to support backward compatibility with existing UTRA TDD systems. The frame structure is aligned with E-UTRA FDD.

<u>HCR-TDD coexistence</u>

The HCR-TDD timeslot duration $T_{HCR-TDD}$ is related to the E-UTRA sub-frame duration T_{E-UTRA} of sections 7.1 and 9.1 / 9.2 according to the relationship:

$$3 \times T_{HCR-TDD} = 4 \times T_{E-UTRA} = 2ms$$

Hence, the E-UTRA uplink and downlink may be aligned with the HCR-TDD uplink and downlink provided that the HCR-TDD UL:DL timeslot split is of the form $3 \times n : 3 \times (5-n)$, where n is an integer. In this case, the E-UTRA UL:DL split is $4 \times n : 4 \times (5-n)$. An example alignment of the HCR-TDD frame to the E-UTRA frame is shown in Figure 6.2.1.2-1 for a 6:9 UL:DL timeslot split. The flexible frame structure of HCR-TDD allows existing HCR-TDD deployments to be migrated to a $3 \times n : 3 \times (5-n)$ timeslot split in readiness for a future E-UTRA deployment in an adjacent carrier. As per the LCR-TDD case, idle symbols / sub-frames may be inserted into the E-UTRA carrier when the HCR-TDD carrier does not utilise a $3 \times n : 3 \times (5-n)$ UL:DL split.

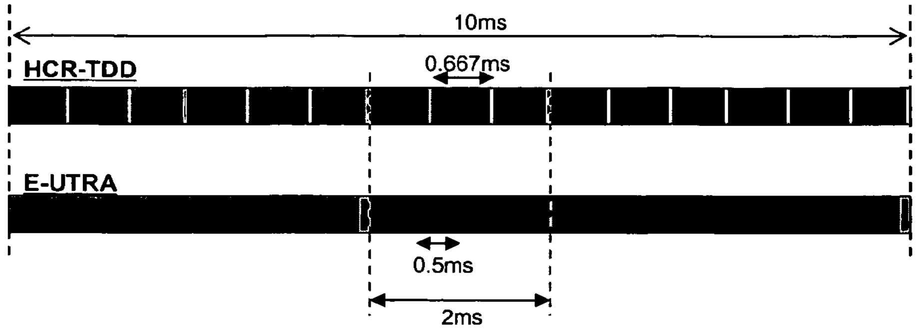


Figure 6.2.1.2-1 - E-UTRA / HCR-TDD co-existence example for 6:9 UL: DL timeslot split

LCR-TDD coexistence

Coexistence between LCR-TDD and E-UTRA may be facilitated by inserting either idle symbols within the E-UTRA frame (these are required for the purposes of timing advance in any case) or idle sub-frames (which may either be inserted by the E-UTRAN scheduler dynamically or their existence may be signalled on the broadcast control channel). Applying a delay or frame offset between the LCR-TDD frame and the E-UTRA frame may allow the time allocated to idle symbols / sub-frames to be minimised. Figure 6.2.1.2-2 shows how coexistence between LCR-TDD with a 3:3 UL:DL traffic timeslot split and E-UTRA (operating in a TDD mode with the numerology of sections 7.1 and 9.1 / 9.2) can be facilitated. To increase spectral efficiency, the idle sub-frame of Figure 6.2.1.2-2 could be replaced by 4 data symbols followed by 3 idle symbols. Similarly, Figure 6.2.1.2-3 shows facilitation of coexistence of between LCR-TDD with a 2:4 UL:DL traffic timeslot split and E-UTRA. Note that the idle sub-frame shown in Figure 6.2.1.2-2 is only required for an adjacent E-UTRA carrier. For a non-adjacent E-UTRA carrier, the idle E-UTRA sub-frame can be replaced by either a downlink E-UTRA sub-frame or an uplink E-UTRA sub-frame.

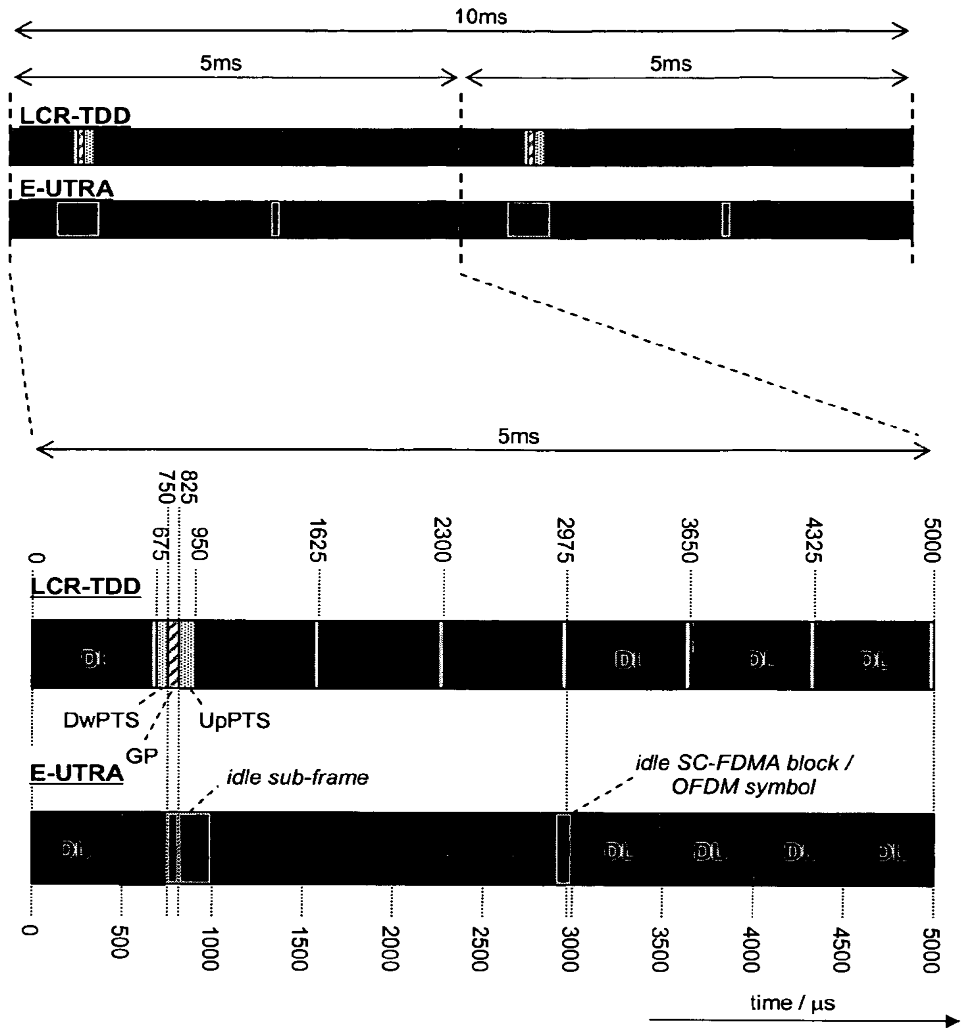


Figure 6.2.1.2-2 - E-UTRA / LCR-TDD co-existence example for 3:3 UL: DL timeslot split

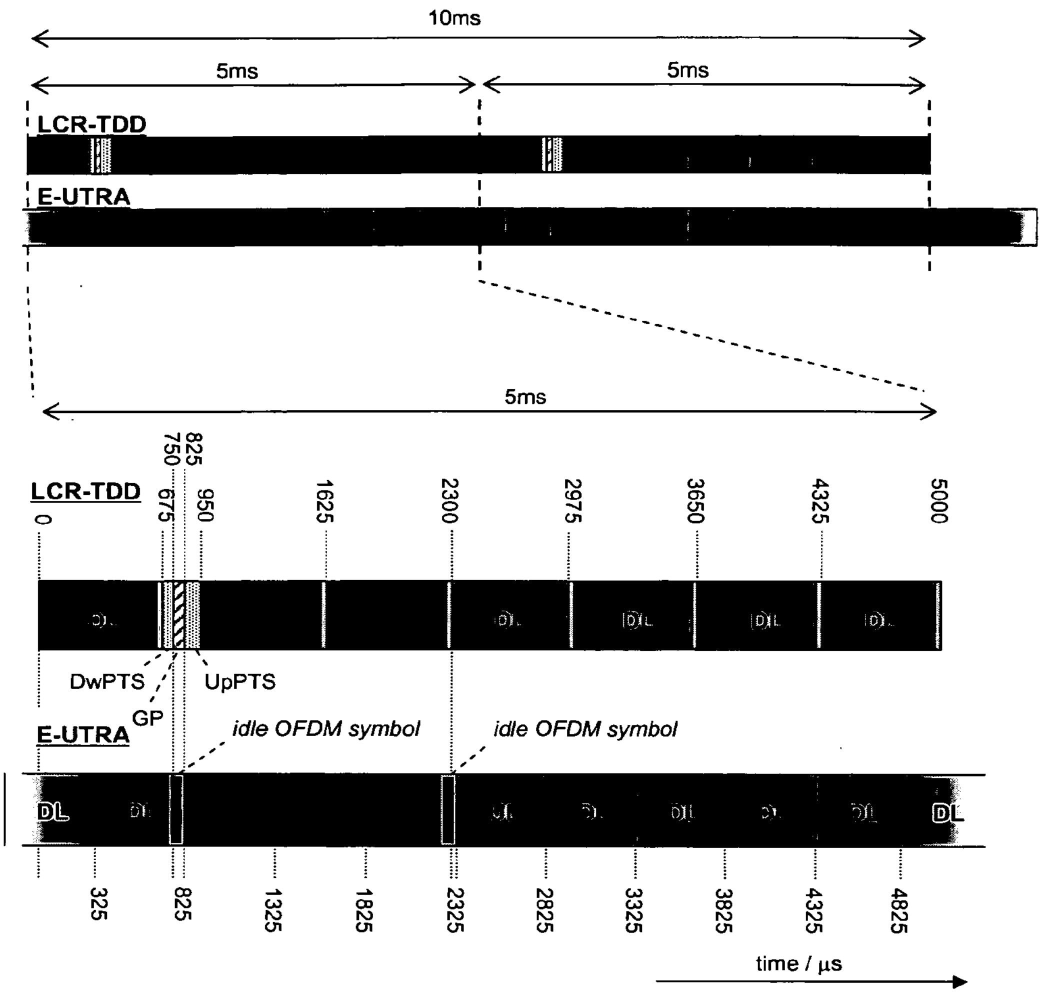


Figure 6.2.1.2-3 - E-UTRA / LCR-TDD co-existence example for 2:4 UL: DL timeslot split

In the case where there are no coexistence issues, this frame structure degenerates to the frame structure of Figure 6.2.1.2-4. This figure is for illustrative purposes only. Idle symbols are required only at DL/UL switching points. The idle period, required in the Node B at UL/DL switching points, is created by timing advance means.

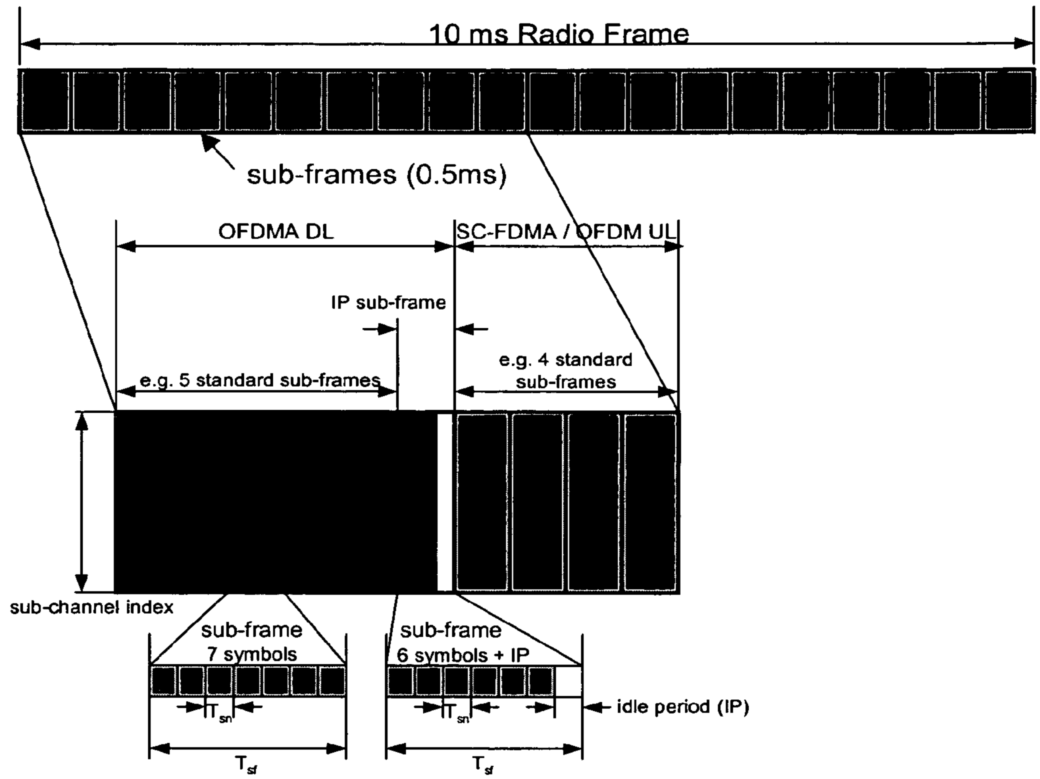


Figure 6.2.1.2-4: frame structure when there are no coexistence issues

6.2.2 Duplexing for the MC-WCDMA based proposal

One of the driving motivations for the MC-WCDMA based proposal is to ensure maximum re-use of the UTRA-FDD access technology in order to minimize the incremental development efforts and allow for deployment in the same spectrum as existing UTRA-FDD systems. The MC-WCDMA based E-UTRA proposal therefore relies on frequency division duplexing for uplink and downlink transmissions and is primarily geared towards usage of paired band allocations.

6.2.2.1 Unpaired spectrum use cases

It is feasible to use unpaired band allocations with the MC-WCDMA based E-UTRA as follows:

- Use the unpaired band allocation for the downlink only transmission of the physical channels in support of E-MBMS; this enables standalone usage of the unpaired spectrum, possibly in time multiplexed manner with legacy UTRA-TDD deployments.
- Use the unpaired band allocation as additional downlink or uplink carriers to support asymmetric multi-carrier configurations.
- Pair various unpaired band allocations.

6.2.2.2 Time duplex operation

As shown during the original UMTS selection phase in the former ETSI SMG2 group, the MC-WCDMA based E-UTRA could also be defined in such a way that it would allow half duplex operation and full time duplex operation.

It would be possible to introduce these new modes of operation as part of the MC-WCDMA based proposal. However, this would require significant changes to the original UTRA-FDD channel structure, timing and procedures and would therefore not benefit in the same way from the UTRA-FDD learning curve.

A more natural approach which is consistent with the underlying backward compatibility philosophy is therefore to consider the existing UTRA-TDD modes and their multi-carrier evolution for standalone time duplex operation in unpaired spectrum allocations.

7 Downlink concepts

Three basic concepts are proposed in downlink:

1. OFDMA (FDD / [TDD])
2. MC-WCDMA (FDD)
3. MC-TD-SCDMA (TDD)

7.1 OFDMA (FDD / [TDD])

7.1.1 Basic transmission scheme

The downlink transmission scheme is based on conventional OFDM using a cyclic prefix, with a sub-carrier spacing Δf = 15 kHz and a cyclic-prefix (CP) duration $T_{CP} \approx 4.7/16.7$ µs (short/long CP). Assuming that a 10 ms radio frame is divided into 20 equally sized sub-frames (of which, in case of TDD operation, a subset is allocated for downlink transmission), this parameter set implies a sub-frame duration $T_{sub\text{-}frame}$ = 0.5 ms. The basic transmission parameters are then specified in more detail in Table 7.1.1-1 below. It may be noted that numerology specified below are for evaluation purpose only.

Table 7.1.1-1 - Parameters for downlink transmission scheme

Transmission BW		1.25 MHz	2.5 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Sub-frame duration		0.5 ms					
Sub-carrier spacing		15 kHz					
Sampling frequency		1.92 MHz (1/2 × 3.84 MHz)	3.84 MHz	7.68 MHz (2 × 3.84 MHz)	15.36 MHz (4 × 3.84 MHz)	23.04 MHz (6 × 3.84 MHz)	30.72 MHz (8 × 3.84 MHz)
FFT size		128	256	512	1024	1536	2048
Number of occupied sub-carriers†, ††		76	151	301	601	901	1201
Number of OFDM symbols per sub frame (Short/Long CP)		7/6					
CP length (µs/samples)	Short	(4.69/9) × 6, (5.21/10) × 1*	(4.69/18) × 6, (5.21/20) × 1	(4.69/36) × 6, (5.21/40) × 1	(4.69/72) × 6, (5.21/80) × 1	(4.69/108) × 6, (5.21/120) × 1	(4.69/144) × 6, (5.21/160) ×1
	Long	(16.67/32)	(16.67/64)	(16.67/128)	(16.67/256)	(16.67/384)	(16.67/512)

†Includes DC sub-carrier which contains no data

†† This is the assumption for the baseline proposal. Somewhat more carriers may be possible to occupy in case of the wider bandwidth

*: {(x1/y1) × n1, (x2/y2) × n2} means (x1/y1) for n1 OFDM symbols and (x2/y2) for n2 OFDM symbols

The sub-frame duration corresponds to the minimum downlink TTI. The possibility to concatenate multiple sub-frames into longer TTIs, e.g. for improved support for lower data rates and QoS optimization, should be considered. In this case, the TTI can either be a semi-static or dynamic transport channel attribute. In case of a semi-static TTI, the TTI is set through higher layer signalling. In case of a dynamic TTI, the number of sub-frames concatenated can be dynamically varied for at least the initial transmission and possibly for retransmissions. It is to be determined to what extent a dynamic TTI can reduce higher layer protocol overhead (e.g. MAC, RLC), L1 overhead (e.g. CRC), and ACK/NACK feedback, as well as reducing latency by reducing segmentation of IP packets. It is initially assumed that the Network (e.g. Node-B) would signal the TTI, either explicitly (e.g. with L1 bits) or implicitly (e.g. by indicating modulation and coding rate and transport block size). The interaction between dynamic TTI, signaling errors, HARQ procedure (time synchronous vs. asynchronous including adaptive or non-adaptive characteristics) and UE complexity needs to be investigated.

Note that the sub-carrier spacing is constant regardless of the transmission bandwidth. To allow for operation in differently sized spectrum allocations, the transmission bandwidth is instead varied by varying the number of OFDM sub-carriers. The necessity for supporting an additional longer cyclic-prefix duration, see Table 7.1.1-1, is under consideration. The longer cyclic prefix should then target multi-cell broadcast and very-large-cell scenarios.

The mapping and indexing of N available physical channel symbols (sub-carriers) in one OFDM symbol in RF spectrum should be done as illustrated in figure below

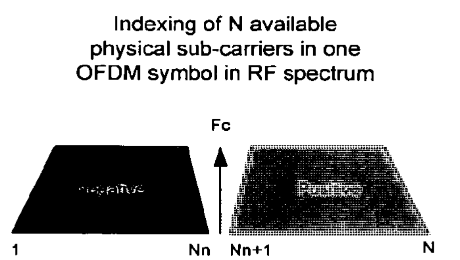


Figure 7.1.1-1: Mapping of physical channel symbols in frequency domain

According numerology in Table 7.1.1-1, N is 75/150/300/600/900/1200 and Nn is 37/75/150/300/450/600 when transmission BW is 1.25/2.5/5/10/15/20 MHz respectively.

For E-UTRA TDD, the frame structure corresponding to Table 7.1.1-1 is supported. In addition, a second frame structure is also supported with the intention of providing co-existence with LCR UTRA TDD. The sampling frequency, FFT size, sub-carrier spacing, and number of occupied sub-carriers is the same as for Table 7.1.1-1. However, with this alternative frame structure, a 10 ms radio frame is divided into 2 equally sized 5 ms sub-frames[1] (of which a subset is allocated for downlink transmission), one sub-frame consists of seven traffic time slots (TS0~TS6) and three special time slots, and one example is shown in Figure 6.2.1.1-1. The synchronization and guard period is between TS0 and TS1, whose duration is 0.275ms. Each time slot should contain a small idle period (Timeslot Interval) which can be used for switching guard period from UL to DL time slots. The basic transmission parameters for this alternative frame structure are specified in Table 7.1.1-2 below.

Table 7.1.1-2 - Parameters for downlink transmission scheme (alternative TDD frame structure)

Transmission BW	1.25 MHz	2.5 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Timeslot duration	0.675 ms					
Sub-carrier spacing	15 kHz					
Sampling frequency	1.92 MHz (1/2 × 3.84 MHz)	3.84 MHz	7.68 MHz (2 × 3.84 MHz)	15.36 MHz (4 × 3.84 MHz)	23.04 MHz (6 × 3.84 MHz)	30.72 MHz (8 × 3.84 MHz)

[1] Note that the term "sub-frame" is, in this case, aligned to the LCR UTRA TDD terminology and not to the terminology currently used for E-UTRA. The E-UTRA term "sub-frame" corresponds to the term "time slot" used here.

FFT size		128	256	512	1024	1536	2048
Number of occupied sub-carriers†, ††		76	151	301	601	901	1201
Number of OFDM symbols per Timeslot (Short/Long CP)		9/8					
CP length (μs/samples)	Short	7.29/14	7.29/28	7.29/56	7.29/112	7.29/168	7.29/224
	Long	16.67/32	16.67/64	16.67/128	16.67/256	16.67/384	16.67/512
Timeslot Interval (samples)	Short	18	36	72	144	216	288
	Long	16	32	64	128	192	256

†Includes DC sub-carrier which contains no data

†† This is the assumption for the baseline proposal. Somewhat more carriers may be possible to occupy in case of the wider bandwidth

7.1.1.1 Modulation scheme

7.1.1.1.1 Basic modulation scheme

Supported downlink data-modulation schemes are QPSK, 16QAM, and 64QAM.

Extension to hierarchical modulation schemes for broadcast should be considered.

7.1.1.1.2 Enhanced modulation scheme

As an alternative to conventional OFDM, OFDM with pulse shaping (OFDM/OQAM) should be studied.

7.1.1.1.2.1 OFDM/OQAM overview

Contrary to conventional OFDM modulation, OFDM/OQAM modulation does not require a guard interval (also called cyclic prefix). For this purpose, the prototype function modulating each sub-carrier must be very well accurately localized in the time domain, to limit the inter-symbol interference for transmissions over multipaths channels.
This prototype function can be also accurately localized in the frequency domain, to limit the inter-carrier interferences (due to Doppler effects, phase noise...). This function must also guarantee orthogonality between sub-carriers both in time and frequency domains.
It is mathematically proven that when using complex valued symbols, the prototype functions guaranteeing perfect orthogonality at critical sampling rate can not be well localised both in time and frequency. For instance the unity function used in conventional OFDM has weak frequency localisation properties and obliges using a cyclic prefix between the symbols to limit inter-symbol interference.
To let the use of accurately localised functions in the time-frequency domain OFDM/OQAM introduced a time offset between the real part and the imaginary part of the symbols. Orthogonality is then guaranteed only over *real* values. The corresponding multi-carrier modulation is an OFDM/OQAM. The OFDM/OQAM transmitted signal is expressed as

$$s(t) = \sum_{n} \sum_{m=0}^{M-1} a_{m,n} \underbrace{i^{m+n} e^{2i\pi m \nu_0 t} g(t - n\tau_0)}_{g_{m,n}(t)} \qquad (7.1.1.1.2\text{-}1)$$

where $a_{m,n}$ denotes the *real valued* information value (can be the real part or the imaginary part of the Offset complex QAM symbol) sent on the m[th] sub-carrier at the n[th] symbol, M is the number of sub-carriers, ν_0 is the inter-carrier spacing, it is the same of the classical OFDM system. τ_0 is the OFDM/OQAM symbol duration, it is equal to Tu/2 (Tu is the OFDM symbol duration), and g is the prototype function.

It is important to notice that OFDM/OQAM symbol rate is twice the classical OFDM symbol rate without cyclic prefix (τ_0 =N/2), meanwhile, since the modulation used is a real one, the information amount sent by an OFDM/OQAM symbol is half the information amount sent by an OFDM symbol. Figure 7.1.1.1.2-1 depicts the signal generation chain of an OFDM/OQAM signal.

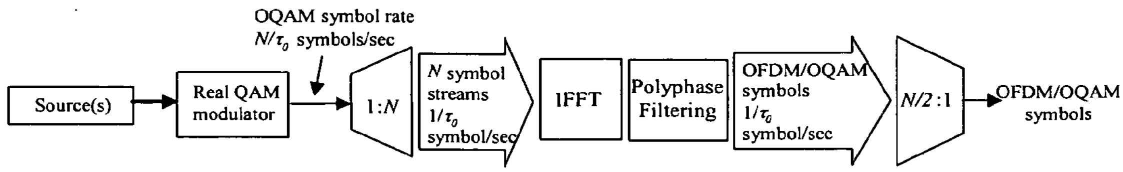


Figure 7.1.1.1.2-1: OFDM/OQAM Signal Generation Chain

The modulator generates N real valued symbols, each τ_0 where $\tau_0 = T_u / 2$. The real valued symbols are then dephased, they are multiplied by i^{m+n} before the IFFT as it is noted in (7.1.1.1.2-1). Figure 7.1.1.1.2-2 shows the time-frequency localisation of the transmitted symbols both for conventional OFDM using complex valued QAM symbols and for OFDM/OQAM.

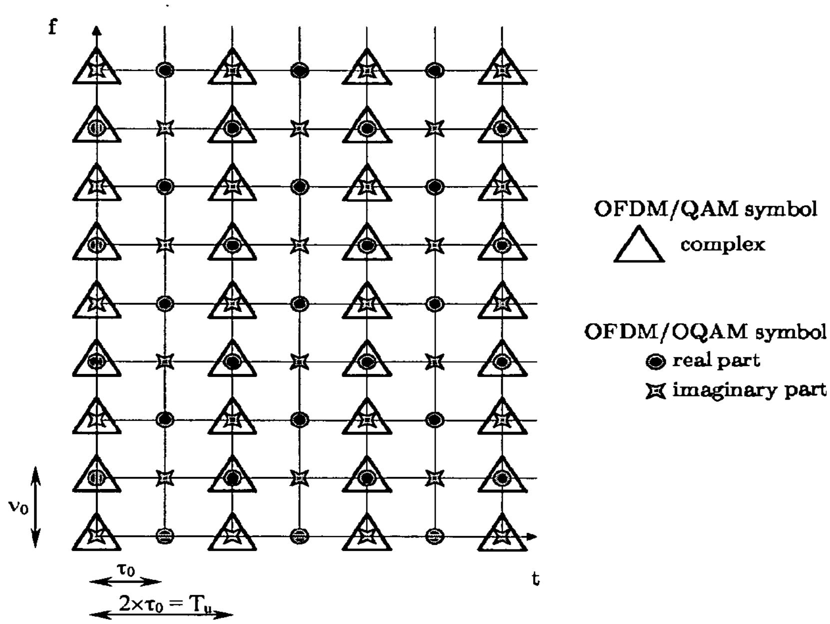


Figure 7.1.1.1.2-2: OFDM/OQAM time and frequency lattices (compared to conventional OFDM w/o guard interval)

The main difference of OFDM/OQAM over conventional OFDM signal generation stays in the filtering by the prototype function g after the IFFT, instead of the cyclic prefix addition.

Thanks to the Inverse Fourier Transform, the prototype function g can be implemented in its polyphase form, which reduces strongly the complexity of the filtering. Moreover the density 2 induces some more simplifications in the polyphase implementation. Figure 7.1.1.1.2-3 shows a possible polyphase implementation of both an OFDM/OQAM modulator and demodulator (G_i are the polyphase components of the prototype filter).

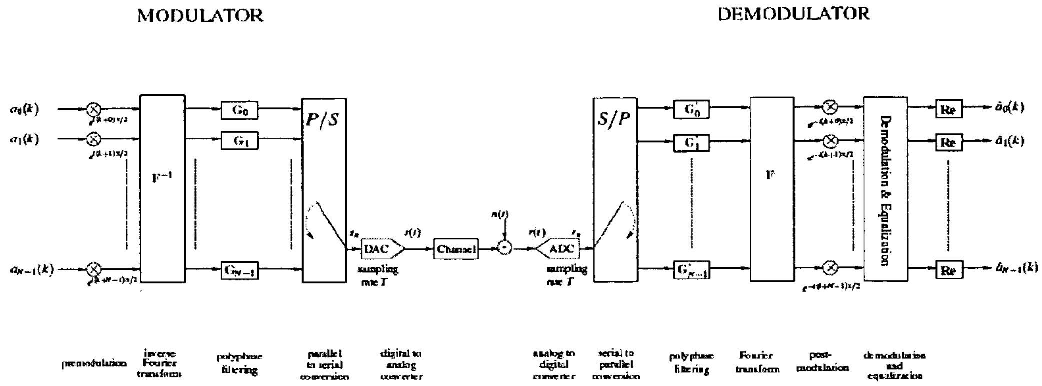


Figure 7.1.1.1.2-3: OFDM/OQAM polyphase implementation

One candidate for OFDM/OQAM filter (g) is IOTA (Isotropic Orthogonal Transform Algorithm) prototype obtained by orthogonalizing the Gaussian function in both time and frequency domains according to Schmidt method. See Figure 7.1.1.1.2-4.

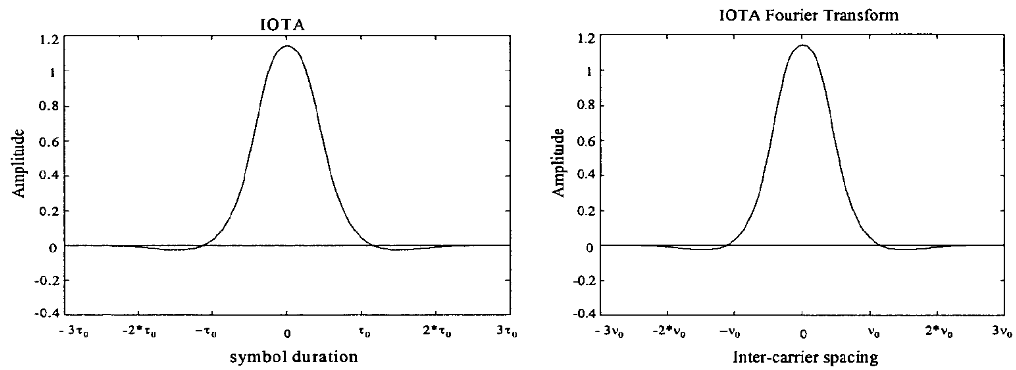


Figure 7.1.1.1.2-4: Temporal and spectral representation of the IOTA prototype filter

Another particularity of IOTA is the spectrum of the generated signal. Thanks to its good frequency localisation, the resulting spectrum is steeper than for conventional OFDM. Figure 7.1.1.1.2-5 depicts the resulting spectra of the signals generated by both rectangular filter used in classical OFDM system and IOTA function used for OFDM/OQAM system. FFT length is 512 and 300 sub-carriers are modulated (parameters corresponding to the 5 MHz case)

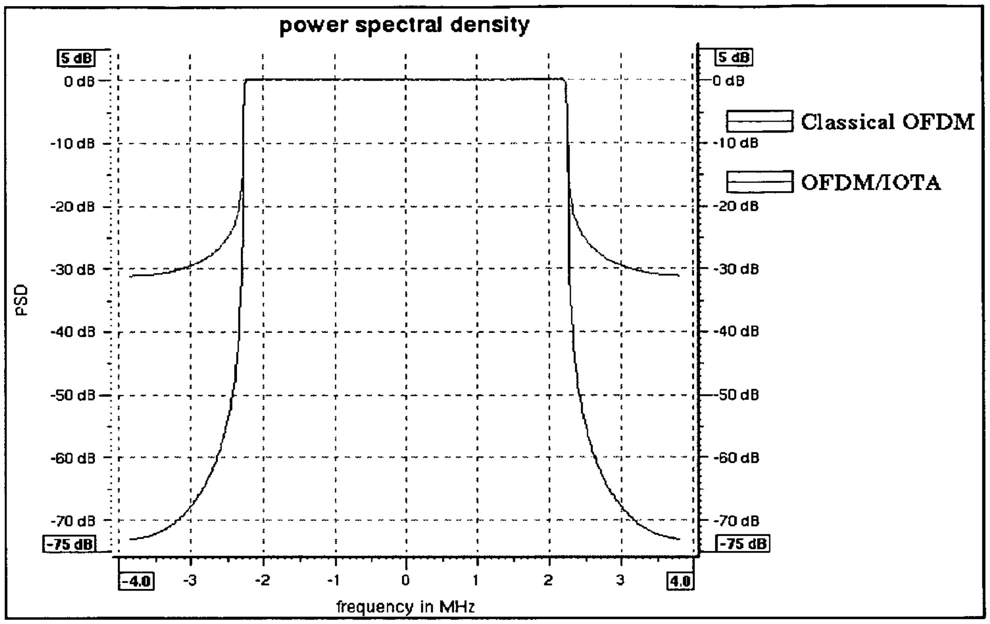


Figure 7.1.1.1.2-5: OFDM/IOTA and conventional OFDM spectra

7.1.1.1.2.2 OFDM/OQAM transmission scheme

The OFDM/OQAM transmission scheme is very similar to the conventional OFDM scheme listed in Table 7.1.1-1, with a sub-carrier spacing $\Delta f = 15$ kHz. Assuming that a 10 ms radio frame is divided into 20 equally sized sub-frames, this parameter set implies a sub-frame duration $T_{sub\text{-}frame} = 0.5$ ms. As for conventional OFDM it may be noted that numerology specified below are for evaluation purpose only. All remarks regarding the support of concatenated TTI remain relevant.

Table 7.1.1.1.2-1 – OFDM/OQAM parameters for downlink transmission scheme

Transmission BW	1.25 MHz	2.5 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Sub-frame duration	0.5 ms					
Sub-carrier spacing	15 kHz					
Sampling frequency	1.92 MHz (1/2 × 3.84 MHz)	3.84 MHz	7.68 MHz (2 × 3.84 MHz)	15.36 MHz (4 × 3.84 MHz)	23.04 MHz (6 × 3.84 MHz)	30.72 MHz (8 × 3.84 MHz)
FFT size	128	256	512	1024	1536	2048
Number of occupied sub-carriers†, ††	76	151	301	601	901	1201
Number of OQAM symbols per sub frame	15*					
CP length	0					

†Includes DC sub-carrier which contains no data

†† This is the assumption for the baseline proposal. Somewhat more carriers may be possible to occupy in case of the wider bandwidth

*: In OFDM/OQAM the symbol rate is twice higher than for conventional OFDM (if no CP was included) and the amount of information transmitted per OFDM/OQAM symbol is half the amount transmitted by 1 conventional OFDM symbol (see section 7.1.1.1.2.1 for more details)

7.1.1.2 Multiplexing including reference-signal structure

7.1.1.2.1 Downlink data multiplexing

The channel-coded, interleaved, and data-modulated information [Layer 3 information] is mapped onto OFDM time/frequency symbols. The OFDM symbols can be organized into a number of *physical* resource blocks (PRB) consisting of a number (M) of consecutive sub-carriers for a number (N) of consecutive OFDM symbols. The granularity of the resource allocation should be able to be matched to the expected minimum payload. It also needs to take channel adaptation in the frequency domain into account. The size of the baseline physical resource block, S_{PRB}, is equal to MxN, where M=25 and N is equal to the number of OFDM symbols in a subframe (the presence of reference symbols or control information is ignored here to simplify the description). This results in the segmentation of the transmit bandwidth shown in Table 7.1.1.2.1-1.

Table 7.1.1.2.1-1 Physical resource block bandwidth and number of physical resource blocks dependent on bandwidth.

Bandwidth (MHz)	1.25	2.5	5.0	10.0	15.0	20.0
Physical resource block bandwidth (kHz)	375	375	375	375	375	375
Number of available physical resource blocks	3	6	12	24	36	48

Using other values such as, e.g. M=15 or M=12 or M=10 or M equal to other values can be considered based on the outcome of the interference coordination study.

The frequency and time allocations to map information for a certain UE to resource blocks is determined by the Node B scheduler and may e.g. depend on the frequency-selective CQI (channel-quality indication) reported by the UE to the Node B, see Section 7.1.2.1 (time/frequency-domain channel-dependent scheduling). The channel-coding rate and the modulation scheme (possibly different for different resource blocks) are also determined by the Node B scheduler and may also depend on the reported CQI (time/frequency-domain link adaptation).

Both block-wise transmission (localized) and transmission on non-consecutive (scattered, distributed) sub-carriers are also to be supported as a means to maximize frequency diversity. To describe this, the notion of a *virtual* resource block (VRB) is introduced. A virtual resource block has the following attributes:

- Size, measured in terms of time-frequency resource.
- Type, which can be either 'localized' or 'distributed'.

All localized VRBs are of the same size, which is denoted as S_{VL}. The size S_{VD} of a distributed VRB may be different from S_{VL}. The relationship between S_{PRB}, S_{VL} and S_{VD} is FFS.

Distributed VRBs are mapped onto the PRBs in a distributed manner. Localized VRBs are mapped onto the PRBs in a localized manner. The exact rules for mapping VRBs to PRBs are FFS.

The multiplexing of localized and distributed transmissions within one subframe is accomplished by FDM.

As a result of mapping VRBs to PRBs, the transmit bandwidth is structured into a combination of localized and distributed transmissions. Whether this structuring is allowed to vary in a semi-static or dynamic (i.e. per subframe) way is FFS. The UE can be assigned multiple VRBs by the scheduler. The information required by the UE to correctly identify its resource allocation must be made available to the UE by the scheduler. The number of signalling bits required to support the multiplexing of localized and distributed transmissions should be optimized.

Details of the multiplexing of lower-layer control signaling is currently TBD but may be based on time, frequency, and/or code multiplexing.

7.1.1.2.2 Downlink reference-signal structure

The downlink reference signal(s) can be used for at least

- Downlink-channel-quality measurements
- Downlink channel estimation for coherent demodulation/detection at the UE

- Cell search and initial acquisition

The basic downlink reference-signal structure, consisting of known *reference symbols*, is illustrated in Figure 7.1.1.2.2-1.

Reference symbols (a.k.a. "*First reference symbols*") are located in the first OFDM symbol of every sub-frame assigned for downlink transmission. This is valid for both FDD and TDD as well as for both long and short CP.

Additional reference symbols (a.k.a. "*Second reference symbols*") are located in the third last OFDM symbol of every sub-frame assigned for downlink transmission. This is the baseline for both FDD and TDD as well as for both long and short CP. However, it should be evaluated if, for FDD, the second reference symbols are needed.

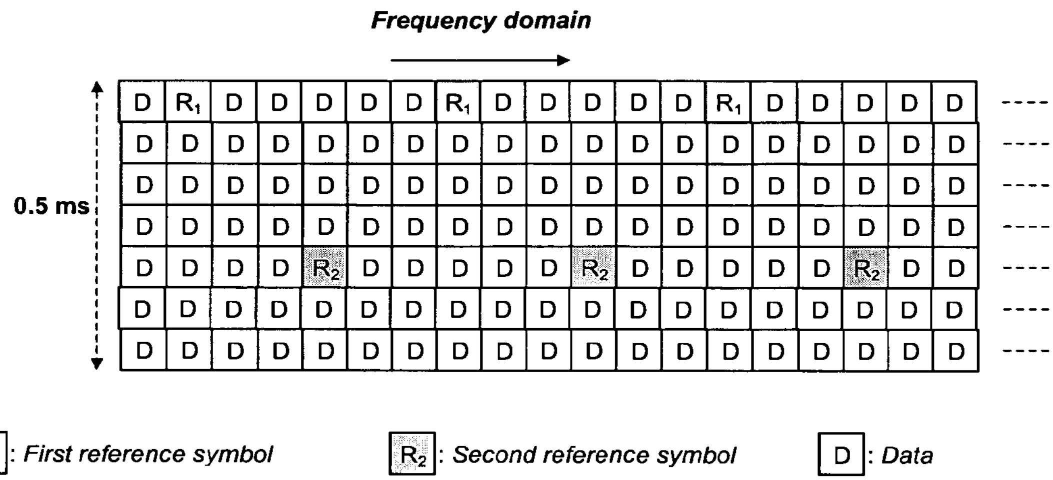


Figure 7.1.1.2.2-1. Basic downlink reference-signal structure[1]

[1] This figure assumes 7 OFDM symbols per sub frame according to Table 7.1.1-1 (short CP). In case of long CP or frame structure according to Table 7.1.1-2, the figure should be modified accordingly.

The spacing (in the frequency domain) between reference symbols of the same OFDM symbol and antennas is M = 6 sub-carriers [*also other values of M could be studied*]. The first and second reference symbols are staggered in the frequency domain as illustrated in Figure 7.1.1.2.2-1 above

The current assumption is that the position (in the frequency domain) of the reference symbols *may* vary from sub-frame to sub-frame and between cells. However, this assumption may be reconsidered if it is in conflict with any future conclusions regarding the E-UTRA cell-search procedure.

In the case that Layer 1 downlink control signaling (more specifically signaling or part of the signaling related to downlink and uplink scheduling) is located at the beginning of the corresponding sub-frame (still TBD if this will be the case or if the Layer 1 signaling is to be spread over the sub-frame), it is currently assumed that demodulation of this information could be carried out without using the second reference symbols of the corresponding sub-frame (however, second reference symbols of previous sub-frames may be used if available).

It should be possible to create multiple mutually orthogonal downlink reference signals.

- To support transmission using multiple TX antennas within one cell (up to a maximum of 4 orthogonal reference signals should be supported to enable higher-order downlink MIMO) within one cell/beam. Note that, for TDD, orthogonal reference signals may not be needed between TX antennas of the same Node B if the multiple TX antennas are used for downlink dynamic beam forming.
- To allow for orthogonal reference signals between sectors and fixed beams of the same Node B.

Orthogonality between reference signals of different TX antennas of the same cell/beam is created by means of FDM. This implies that the reference-signal structure of Figure 7.1.1.2.2-1, with different antenna-specific frequency shifts, is valid for each antenna. CDM should be evaluated as an alternative.

In case of orthogonality between reference signals of different cells/beams belonging to the same Node B, the orthogonality is created in the code domain, i.e. the (frequency domain) sequence of reference symbols are multiplied by mutually orthogonal patterns. [*The assumption regarding CDM-based orthogonality between reference signals of cells/beams of the same Node B is to be confirmed by means of system-level evaluation.*]

Possible transmission of additional UE-specific downlink reference symbols are to be considered for dynamic beam forming or MIMO.

Furthermore, to provide channel estimates for coherent demodulation of multi-cell MBMS transmission, the following approaches are to be considered:

- Cell-common reference signals (transmitted only in the sub-frames in which MBMS is transmitted).
- Cell-specific reference signals, together with group scrambling.

7.1.1.2.3 Downlink L1/L2 Control Signaling

The downlink outband control signaling consists of

- scheduling information for downlink data transmission,
- scheduling grant for uplink transmission, and
- ACK/NAK in response to uplink transmission.

Transmission of control signaling from these groups is mutually independent, e.g., ACK/NAK can be transmitted to a UE regardless of whether the same UE is receiving scheduling information or not.

7.1.1.2.3.1 Downlink Scheduling Information

Downlink scheduling information is used to inform the UE how to process the downlink data transmission. The information signalled to a UE scheduled to receive user data is summarized in Table 7.1.2.3.1-1.

The possible downlink time/frequency location(s) for category 1 information is known to the UE a priori.

The category 3 information is transmitted for every TTI of data to the scheduled user(s).

Table 7.1.1.2.3.1-1 Downlink scheduling information required by a UE

	Field		Size	Comment
Cat. 1 (Resource indication)	ID (UE or group specific)		8-9	Indicates the UE (or group of UEs) for which the data transmission is intended
	Resource assignment		FFS	Indicates which (virtual) resource units (and layers in case of multi-layer transmission) the UE(s) shall demodulate.
	Duration of assignment		2-3	The duration for which the assignment is valid, could also be used to control the TTI or persistent scheduling.
Cat. 2 (transport format)	Multi-antenna related information		FFS	Content depends on the MIMO/beamforming schemes selected.
	Modulation scheme		2	QPSK, 16QAM, 64QAM. . In case of multi-layer transmission, multiple instances may be required.
	Payload size		6	Interpretation could depend on e.g. modulation scheme and the number of assigned resource units (c.f. HSDPA). In case of multi-layer transmission, multiple instances may be required.
Cat .3 (HARQ)	If asynchronous	Hybrid ARQ process number	3	Indicates the hybrid ARQ process the current transmission is addressing.

	hybrid ARQ is adopted	Redundancy version	2	To support incremental redundancy.
		New data indicator	1	To handle soft buffer clearing.
	If synchronous hybrid ARQ is adopted	Retransmission sequence number	2	Used to derive redundancy version (to support incremental redundancy) and 'new data indicator' (to handle soft buffer clearing).

Note: It is FFS whether asynchronous or synchronous hybrid ARQ operation will be adopted.

Note: In case of multi-layer transmission to a UE, multiple instances of (parts of) category 2 and category 3 information may be required.

Note: It is FFS whether information about multi-layer transmission is included in 'resource assignment' or 'multi-antenna related information'.

7.1.1.2.3.2 Uplink Scheduling Grant

Uplink scheduling grants are used to assign resources to UEs for uplink data transmission. The information signalled to a UE receiving an uplink scheduling grant is summarized in Table 7.1.1.2.3.2-1. The modulation and coding scheme to use for uplink transmission is implicitly given by the resource assignment and the transport format.

Table 7.1.1.2.3.2-1 Uplink scheduling grant for a UE

Field		Size	Comment
Resource assignment	ID (UE or group specific)	8-9	Indicates the UE (or group of UEs) for which the grant is intended
	Resource assignment	FFS	Indicates which uplink resources, localized or distributed, the UE is allowed to use for uplink data transmission.
	Duration of assignment	2-3	The duration for which the assignment is valid. The use for other purposes, e.g., to control persistent scheduling, 'per process' operation, or TTI length, is FFS.
TF	Transmission parameters	FFS	The uplink transmission parameters (modulation scheme, payload size, MIMO-related information, etc) the UE shall use. If the UE is allowed to select (part of) the transport format, this field sets determines an upper limit of the transport format the UE may select.

Note: It is FFS whether the transport format the UE uses is mandated by the Node B or controlled by the UE.

7.1.1.2.3.3 ACK/NAK

The hybrid ARQ feedback in response to uplink data transmission consists of a single ACK/NAK bit.

Table 7.1.1.2.3.3-1 ACK/NAK for a UE.

Field	Size	Comment
ACK/NAK	FFS	Up to one bit per uplink transport block. Multiple bits may be

		required to support uplink multi-layer transmission (if hybrid ARQ operates per layer) and in case of TDD.

7.1.1.3 Channel coding and physical channel mapping

Current assumption for the study-item evaluations should be that channel coding for "normal" data [*Layer 3 information*] is based on UTRA release 6 Turbo coding, possibly extended to lower rates by extension with additional code polynomials, extended longer code blocks, and modified by the removal of the tail. However, the use of alternative FEC encoding schemes could also be considered, especially if significant benefits in terms of complexity and/or performance can be shown.

To achieve high processing gain, repetition coding can be used as a complement to FEC.

Channel coding for lower-layer control signaling is TBD.

7.1.1.4 MIMO and Transmit Diversity

The baseline antenna configuration for MIMO is two transmit antennas at the cell site and two receive antennas at the UE. The possibility for higher-order downlink MIMO (four TX/RX antennas) should also be considered.

Since control channel performance can be difficult to improve through other sources of diversity (retransmission, link adaptation, etc.), open loop transmit diversity schemes should be considered for the downlink control channels. The open loop transmit diversity can also be considered for the downlink unicast traffic. Transmit diversity schemes vary with respect to their complexity and ability to support a variable number of transmit antennas. Therefore, the simplicity and scalability of transmit diversity schemes should be compared as well as their performance gains. Open loop block code-based transmit diversity, cyclic shift diversity, and combined space-time (or space-frequency) block code/cyclic shift diversity techniques should be considered.

7.1.1.4.1 Aspects for LTE MIMO

Aspects to consider for LTE MIMO discussions are as follows:

- Micro-cellular/Hot-spot and macro cellular environments should be considered in performance evaluation
- Not increase number of operation modes unnecessarily. Impact on receiver architecture should also be considered
- Realistic assumptions have to be taken into account when comparing different MIMO concepts, such as feedback errors and delays, needed multi-antenna reference signal overhead and its effect on performance, complexity and signalling requirements etc. The resulting reference signal and signalling overheads in both uplink and downlink have to be justified by the shown improvements

7.1.1.4.2 High level principles of MIMO for unicast traffic

Spatial division multiplexing (SDM) of multiple modulation symbol streams to a single UE using the same time-frequency(-code) resource is supported. When a MIMO channel is solely assigned to a single UE, it is known as single user (SU)-MIMO.

Other high level principles are as the followings:

- Maximum antenna configuration for evaluation is 4x4.
- Multiple codewords (including single codeword as a special case) that use the same time-frequency(-code) resource and are independently channel-coded with independent CRC should be investigated. Possible values for the maximum number of codewords per resource block transmitted by the Node B are 1, 2, 3, or 4. Possible values for the maximum number of codewords that can be received by the UE are 1, 2, 3, or 4
- In addition to the SDM, the spatial division multiplexing of the modulation symbol streams for different UEs using the same time-frequency(-code) resource is supported for evaluation, which may be denoted as spatial division multiple access (SDMA) or multi-user (MU)-MIMO. Note that the SDM is a special case of the SDMA.

- Use of pre-coding as a means to convert the antenna domain MIMO signal processing into the beam domain processing should be investigated. It is FFS whether the precoding should be unitary or non-unitary. Because precoding might require less complex (linear) receivers to achieve a given level of performance, both the receiver complexity requirements and the performance of MIMO algorithms should be considered. Any additional feedback required for precoding and any additional related computational complexity in the UE should also be taken into account..
- Rank adaptation (and/or the antenna subset selection), of which exact implementation is FFS, is supported for evaluation as a means to prevent possible performance loss from using higher number of MIMO layers than can be supported by the channel condition.
- An open loop transmit diversity should be investigated as an alternative mode of MIMO operation than the one requiring MIMO-specific feedback from the UE.
- Followings are identified as candidates for the UE feedback information but not limited to:
    - o MIMO channel state information, which may be used by the Node B to determine MIMO processing consisting of e.g., selection of the rank (and/or the antenna subset), and/or the pre-coding, etc.
    - o If, for TDD operation, uplink reference signals should be transmitted to provide channel state information to support downlink MIMO transmission.
    - o Channel quality indicator (CQI), which may be used by the Node B to decide a MCS level(s). In addition to the CQI, another form of feedback signalling, which may be similar to the feedback information (FBI) as defined from Rel-99, should be considered as a candidate feedback signalling.
    - o If multiple operation modes are defined, e.g. MIMO and open loop transmit diversity,, and an open loop MIMO are supported, it may be needed for a UE to inform the Node B of the indication of (preferred) operation mode.

7.1.1.4.3 High level principles of MIMO for E-MBMS

The MIMO transmission for the broadcast traffic should be discussed noting that

- in E-MBMS, there will be a single or multiple transmitting Node B's and multiple receiving UEs
- feedback signalling from the UE may not be feasible.

In the absence of any feedback from the UEs in E-MBMS, the potential candidates for MIMO are either an open-loop transmit diversity scheme, an open-loop spatial multiplexing approach or a hybrid combination of both. Any form of additional transmit diversity is not expected to bring any significant benefit if the number of SFN cells is large enough, because E-MBMS already enjoys from frequency-diversity due to delayed signals received from multiple cells. However, E-MBMS service becomes bandwidth limited in an SFN operation and therefore spatial-multiplexing techniques become attractive. Moreover, the received signal from multiple cells sees increasing decorrelation in an E-MBMS environment which also favors spatial-multiplexing.

Both single code word and multi-code word spatial multiplexing schemes are considered in the study item phase. In case of multi-code word spatial multiplexing, dynamic adaptation of modulation and coding etc. for each code word is not possible due to absence of channel quality feedback. However, different code words can potentially use different modulation and coding and/or power offsets etc. in a semi-static fashion in order to enable efficient interference cancellation at the UE receiver. Since the baseline UE has only two antennas, the number of broadcast codewords are limited to two. E-MBMS for UE's limited to single codeword reception capability should be further considered. E-MBMS signals from Node B's with more than two transmit antennas should be transparent to the UE.

7.1.1.5 Downlink macro diversity

Fast cell selection is one option for macro-diversity for unicast data.. In principle, Intra-Node-B selection should be able to operate on a sub-frame basis while the "speed" of inter-Node-B cell selection will depend on the outcome of discussions on Evolved UTRAN architecture.

An alternative Intra-Node-B macro diversity scheme for unicast is a simultaneous multi-cell transmission with soft-combining. The basic idea of multi-cell transmission is that, instead of avoiding interference at the cell border by means of inter-cell-interference coordination, both cells are used for transmission of the same information to a UE thus reducing inter-cell interference as well as improving the overall available transmit power. Another possibility of intra-Node-B multi-cell transmission is to explore the diversity gain between the cells with space-time processing (e.g. by employing STBC through two cells). Assuming Node-B-controlled scheduling and that fast/tight co-ordination between different Node B is not feasible, multi-cell transmission should be limited to cells belonging to the same Node B

Two alternatives for multi-cell transmission have been proposed,

- Alternative #1
  The same reference signal pattern is used for the transmissions from the two cells. In this case, from a UE point-of-view the multi-cell transmission will be identical to a single-cell transmission using a different antenna pattern,
- Alternative #2
  Different reference signal patterns are used for the transmission from the two cells.

The impact of the two alternatives on the reference signal design and overhead, if any, needs further investigations.

For multi-cell broadcast, soft combining of radio links should be supported, assuming a sufficient degree of inter-Node-B synchronization, at least among a sub-set of Node B's. Mechanisms should be supported in E-UTRAN that allow the network to adapt which cells are in an SFN that will transmit an MBMS service that may be soft combined.

7.1.1.6 MBMS

MBMS transmissions may be performed in the following two ways:

- Multi-cell transmissions
- Single-cell transmissions

In case of single-cell transmission, the MBMS traffic channel (MTCH) can be mapped to the DL shared data channel (DL-SCH). In case of multi-cell transmissions, the MTCH may be mapped to another transport channel type.

In case of multi-cell transmission the cells and content are synchronised to enable for the terminal to combine the energy from multiple transmissions without additional receiver complexity. Tight inter-cell synchronization, in the order of substantially less than the cyclic prefix, is assumed in order for the UE to be able to combine multi-cell MBMS transmissions. Also, in case of cell-common reference signals, the reference symbol design needs to be such that those reference symbols needed for MBMS reception are identical in all cells to be considered for combining.

One dimension of the MBMS design is whether the MBMS transmission is actually sharing the same carrier with unicast traffic or not. For instance, for mobile TV, MBMS data can be sent on a separate carrier not carrying anything other than broadcast/MBMS related information. In that case, the MBMS design shall be able to efficiently benefit from such a situation.

It is desirable to have MBMS transmissions at high instantaneous data rates so that low transmission duty cycle per MBMS "channel" (source content) enables low power consumption for MBMS capable UEs. This may impose some requirements in the multiplexing of different multicast source contents at the physical layer. For the case of multiplexing unicast and multicast traffic within the same carrier, enabling low UE power consumption should be considered in the evaluation of the unicast/multicast multiplexing schemes depicted below.

In case of multiplexing MBMS transmissions with unicast traffic within the same carrier:

- Inter-sub frame TDM and
- intra-sub-frame FDM of unicast and multicast traffic

should be investigated. In both cases, intra-sub-frame multiplexing with DL L1/L2 control channel should be supported. DL L1/L2 signalling associated with uplink data transmissions, e.g. scheduling grants and HARQ ACK may need to be transmitted in every DL sub-frame. The exact multiplexing of such L1/L2 signalling with the multicast transmission is FFS.

When there is no unicast data traffic in sub-frames carrying MBMS, it is to be considered if all the reference signals of Figure 7.1.1.2.2-1 need to be transmitted. In case that not all the reference signals are transmitted in certain sub frames, the impact on L1/L2 control, CQI and synchronization performance needs to be carefully evaluated.

It is to be considered if limiting unicast and multicast transmission multiplexing to inter-sub-frame TDM within a 10 MHz bandwidth would lead to a simplified channel structure without significantly impacting efficiency.

The associated L1/L2 control channel for MTCH may be transmitted less frequently than the associated L1/L2 control channel for DL-SCH.

In case of multiplexing MBMS transmissions is handled using a separate carrier

- There is only TDM multiplexing between different services
- Only long CP is considered for evaluation
- Bandwidths of 5 and 10 MHz are considered for evaluation

7.1.2 Physical layer procedure

7.1.2.1 Scheduling

The Node B scheduler (for unicast transmission) dynamically controls which time/frequency resources are allocated to a certain user at a given time. Downlink control signaling informs UE(s) what resources and respective transmission formats have been allocated. The scheduler can instantaneously choose the best multiplexing strategy from the available methods; e.g. frequency localized or frequency distributed transmission. The flexibility in selecting resource blocks and multiplexing users (7.1.1.2) will influence the available scheduling performance. Scheduling is tightly integrated with link adaptation (7.1.2.2) and HARQ (7.1.2.3). The decision of which user transmissions to multiplex within a given sub-frame may for example be based on

- QoS parameters and measurements,
- payloads buffered in the Node-B ready for scheduling,
- pending retransmissions,
- CQI reports from the UEs,
- UE capabilities,
- UE sleep cycles and measurement gaps/periods,
- system parameters such as bandwidth and interference level/patterns,
- etc.

Methods to reduce the control signaling overhead, e.g., pre-configuring the scheduling instants (persistent scheduling) and grouping for conversational services, should be considered. In addition it should be determined if grouping can more efficiently use time frequency resources resulting in higher capacity.

7.1.2.2 Link adaptation

Link adaptation (AMC: adaptive modulation and coding) with various modulation schemes and channel coding rates is applied to the shared data channel. The same coding and modulation is applied to all groups of resource blocks belonging to the same L2 PDU scheduled to one user within one TTI and within single stream (i.e., different modulation schemes and coding rates may be applied to different streams in case of MIMO). This applies to both localized and distributed transmission.

The overall coding and modulation is illustrated in Figure 7.1.2.2-1

The use of power and modulation adaptation per resource block is FFS.

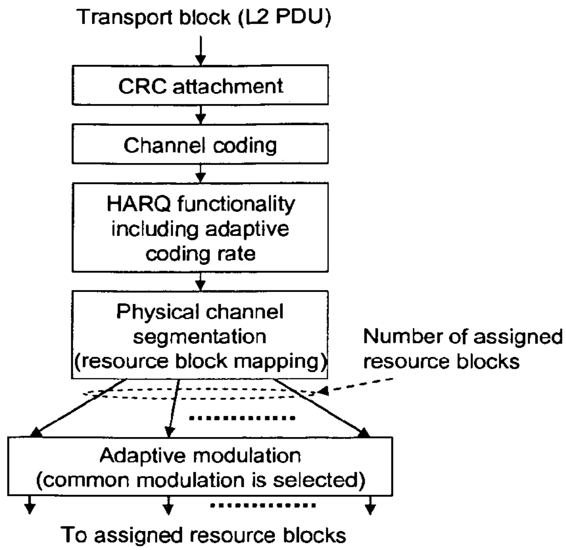


Figure 7.1.2.2-1 – Resource block-common adaptive modulation and resource block-common channel coding rate scheme (for localized and distributed transmission modes).

7.1.2.3 HARQ

Downlink hybrid ARQ (HARQ) should be based on Incremental Redundancy. Note that Chase Combining is a special case of Incremental Redundancy and is thus implicitly supported as well.

The N-channel Stop-and-Wait protocol is used for downlink HARQ.

HARQ can be classified as being synchronous or asynchronous:

- Synchronous HARQ implies that (re)transmissions for a certain HARQ process are restricted to occur at known time instants. No explicit signaling of the HARQ process number is required as the process number can be derived from, e.g., the sub-frame number.
- Asynchronous HARQ implies that (re)transmissions for a certain HARQ process may occur at any time. Explicit signaling of the HARQ process number is therefore required.

In principle, synchronous operation with an arbitrary number of simultaneous active processes at a time instant could be envisioned. In this case, additional signaling may be required. Asynchronous operation already supports an arbitrary number of simultaneous active processes at a time instant. Furthermore, note that, in a synchronous scheme, the transmitter may choose not to utilize all possible retransmission instants, e.g., to support pre-emption. This may require additional signaling.

The various forms of HARQ schemes are further classified as adaptive or non-adaptive in terms of transmission attributes, e.g., the Resource Block (RB) allocation, Modulation and transport block size, and duration of the retransmission. Control channel requirements are described for each case.

- Adaptive implies the transmitter may change some or all of the transmission attributes used in each retransmission as compared to the initial transmissions (e.g. due to changes in the radio conditions). Hence, the associated control information needs to be transmitted with the retransmission. The changes considered are:
  - Modulation
  - Resource Block allocation
  - Duration of transmission

- Non-Adaptive implies that changes, if any, in the transmission attributes for the retransmissions, are known to both the transmitter and receiver at the time of the initial transmission. Hence, the associated control information need not be transmitted for the retransmission.

With those definitions, the HS-DSCH in WCDMA uses an adaptive, asynchronous HARQ scheme, while E-DCH in WCDMA uses a synchronous, non-adaptive HARQ scheme.

The capability of adaptively being able to change the packet format (i.e., adaptive IR) and the transmission timing (i.e., asynchronous IR) yields an adaptive, asynchronous IR based HARQ operation. Such a scheme has the potential of optimally allocating the retransmission resources in a time varying channel. For each HARQ retransmission, control information about the packet format needs to be transmitted together with the data sub-packet.

Synchronous HARQ transmission entails operating the system on the basis of a predefined sequence of retransmission packet format and timing.

The benefits of synchronous HARQ operation when compared to asynchronous HARQ operation are:

- Reduction of control signalling overhead. from not signalling the HARQ channel process number.
- Lower operational complexity if non-adaptive operation is chosen.
- Possibility to soft combine control signalling information across retransmissions for enhanced decoding performance if non-adaptive operation is chosen.

Depending on the actual L1/L2 requirements, asynchronous HARQ may best address the issues of:

- Scheduling flexibility if fully adaptive operation is selected and if both localized and distributed allocations are selected.
- Support for multiple simultaneous (in the same (set of) sub-frame(s)) independent HARQ processes
- Flexibility in scheduling of retransmissions

The desirability of particular L1/L2 features will determine the degree of adaptive operation.

7.1.2.4 Cell search

7.1.2.4.1 Purposes of the SCH, BCH, and reference symbols and information to be detected in the cell search

E-UTRA cell search is assumed to be based on two signals ("channels") transmitted in the downlink, the "SCH" (Synchronization Channel) and "BCH" (Broadcast Channel).

The primary purpose of the SCH is to enable acquisition of the received timing, i.e., at least the SCH symbol timing, and frequency of the downlink signal. The UE can obtain the remaining cell/system-specific information from the BCH, SCH and also from some additional channels, such as the reference symbols. The primary purpose of the BCH is to broadcast a certain set of cell and/or system-specific information similar to the current UTRA BCH transport channel.

Aside from the SCH symbol timing and frequency information, the UE must acquire at least the following cell-specific information.

- The overall transmission bandwidth of the cell
- Cell ID
- Radio frame timing information when this is not directly given by the SCH timing, i.e., if the SCH is transmitted more than once every radio frame, see Section 7.1.2.4.2 for further information.
- Information regarding the antenna configuration of the cell (number of transmitter antennas)
- Information regarding the BCH bandwidth if multiple transmission bandwidths of the BCH are defined, see also Section 7.1.2.4.3
- CP length information regarding the sub-frame in which the SCH and/or BCH are transmitted

Each set of information is detected by using one or several of the SCH, reference symbols, or the BCH.

The information regarding the overall transmission bandwidth of the cell can directly indicate the BCH bandwidth since the BCH bandwidth in relation to the transmission bandwidth of the cell is pre-specified. To facilitate Cell ID detection, several options in embedding the Cell ID into the SCH are possible. For example, the Cell ID may be directly mapped into the SCH, or different Cell ID information may be group-wised. For the case of group ID, cell ID group index can be detected using the SCH, and the Cell IDs within the detected Cell ID group can be detected using reference symbols or the BCH. As an alternative approach, information regarding the BCH bandwidth and CP length may be detected by blind detection from the SCH or BCH, by using hypothesis testing for example.

Detailed information conveyed by the SCH, reference symbols, and BCH should be studied during SI.

7.1.2.4.2 Structure in time

Figure 7.1.2.4.2-1 shows different possibilities for the basic transmission timing of the downlink SCH and BCH during one radio frame. The SCH and BCH are transmitted one or multiple times every 10-msec radio frame. Note that the numbers of SCHs and BCHs per radio frame may not be the same, as can be seen in the lowest part of Fig. 7.1.2.4.2-1. The BCH is placed at a well-defined time instant after/before the downlink SCH by the time delay/advance of τ. The number of SCH and BCH transmissions per radio frame should be studied from the viewpoints of detection probability, cell search time including inter-radio access technology (RAT) measurement for various mobility conditions, and impact on the TDD mode. For the TDD mode, multiple SCH and/or BCH transmissions per radio frame may lead to undesirable restrictions on the TDD framing structure and the set of possible UL/DL asymmetries may be reduced. This is especially true for lower numbers of switching points per frame. For the LCR TDD based frame structure (Figure 6.2.1.1-1), the SCH is transmitted in downlink special time slot DwPTS, and the BCH is transmitted in the TS0 timeslot, for every 5-msec radio sub-frame.

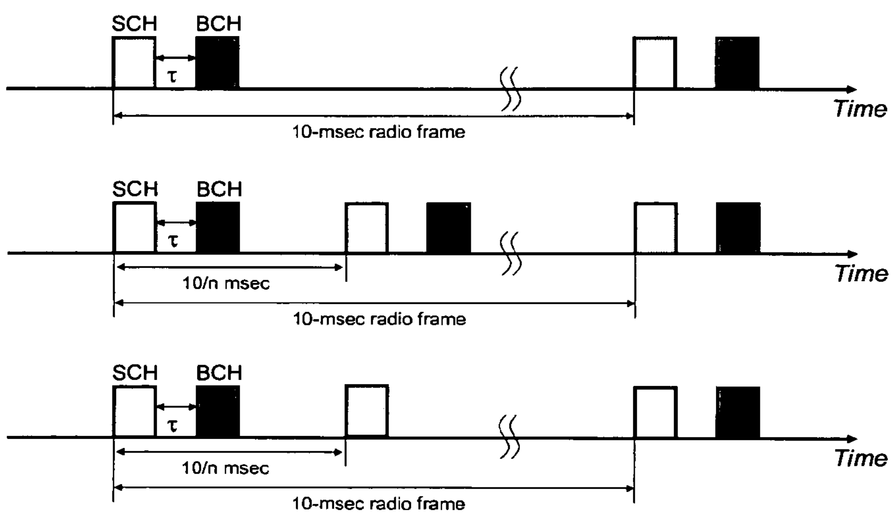


Figure 7.1.2.4.2-1 – Basic transmission timing of downlink SCH and BCH during one radio frame. Please note that this figure is for illustrative purposes only and is not meant to specify the number of SCHs and BCHs per radio frame.

The position of the SCH transmission timing within a sub-frame should be fixed in all sub-frames to which the SCH is multiplexed and the spacing of the sub-frame with the SCH should be constant, in order to allow a simple averaging of the correlations over multiple sub-frames. To achieve constant SCH transmission timing within a sub-frame, the following three SCH symbol multiplexing methods should be investigated.

- SCH symbol multiplexing on the last OFDM symbol within a sub-frame
- SCH symbol multiplexing on the first OFDM symbol within a sub-frame and mandating a short CP length for that OFDM symbol when both short and long CP lengths are used in a cell
- Mandatory usage of the same CP length (either short CP or long CP) for all the sub-frames to which the SCH is multiplexed, along with possible restrictions on the multiplexing of the MBMS channel

Figure 7.1.2.4.2-2 shows the first method. The SCH should be multiplexed into the last OFDM symbol within a 0.5-msec sub-frame. This leads to a fixed SCH symbol transmission timing regardless of the CP length. This configuration achieves sub-frame timing detection without the knowledge of the CP length at the UE. It also allows for a simple averaging of the correlation values over multiple sub-frames. The first method allows flexible CP length allocation, i.e., allocation of long and short CPs to any sub-frame without restrictions from the SCH detection perspective. On the other hand, using this approach, restrictions on the UL/DL switching point for TDD are necessary in the case that the DTX of the last part of the downlink sub-frames is used for creation of the TDD guard time.

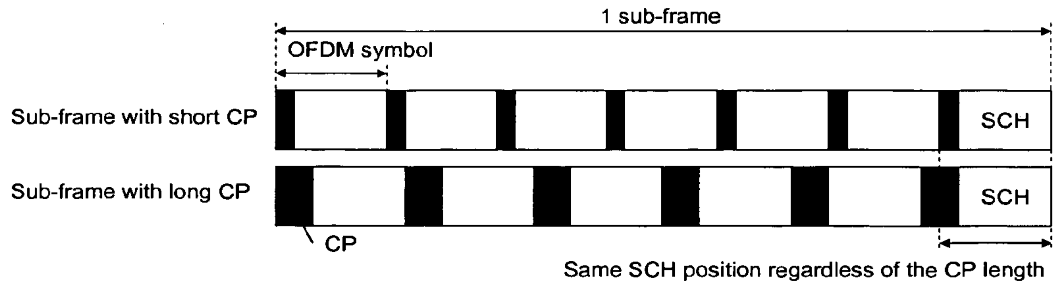


Figure 7.1.2.4.2-2 Basic transmission timing of downlink SCH within sub-frame in the first method. Please note that this figure is for illustrative purposes only.

Figure 7.1.2.4.2-3 shows the second method. In the second method, an SCH symbol is multiplexed into the first OFDM symbol within a sub-frame and a short CP is used for that OFDM symbol regardless of the CP length for the other OFDM symbols within that sub-frame. This method also leads to a fixed SCH symbol transmission timing at the UE and allows flexible CP length allocation and a flexible UL/DL switching point for the TDD mode. On the other hand, the necessity for SFN reception of the SCH from multiple cells, and the decoding procedure and transmission performance of the other channels mapped on the first OFDM symbol with the SCH should be investigated further since the second method cannot apply a long CP to the SCH when applying a short CP to unicast while applying a long CP to broadcast for SFN reception.

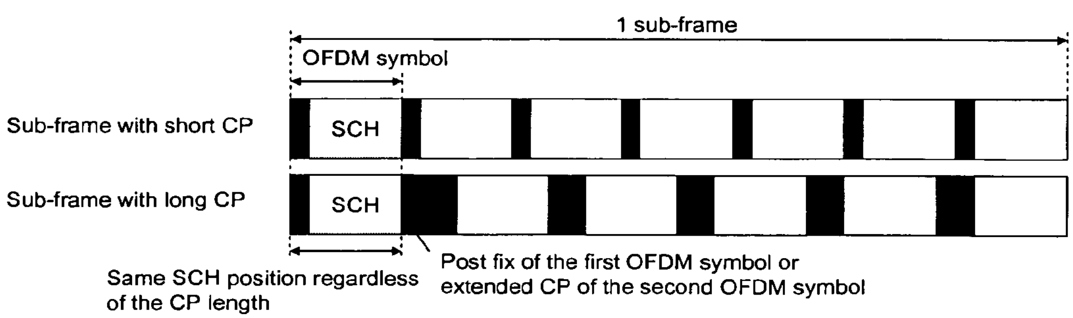


Figure 7.1.2.4.2-3 – Basic transmission timing of the downlink SCH within a sub-frame in the second method. Please note that this figure is for illustrative purposes only.

On the other hand, in the third method, an SCH symbol is multiplexed into any OFDM symbol within any sub-frame as shown in Fig.7.1.2.4.2-4. In this method, one or more arbitrary OFDM symbols of a sub-frame may be used for mapping the SCH. However, since the same OFDM symbol position within a sub-frame and within a radio frame should be maintained, it is necessary to restrict MBMS transmission to sub-frames not affected by the SCH in the case that CPs of different lengths are used for the SCH and MBMS. Note that in all the three methods, if SCH transmission occurs multiple times in a radio frame, the information provided by the SCH may be distributed over multiple transmissions, or may be repeated.

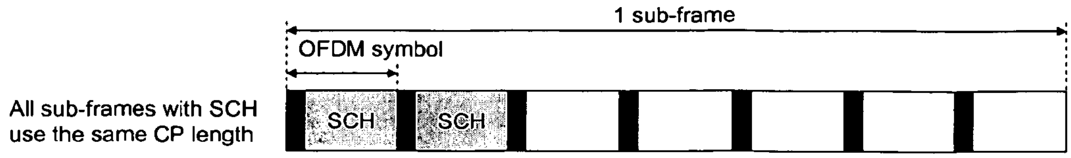


Figure 7.1.2.4.2-4 – Basic transmission timing of the downlink SCH within a sub-frame in the third method. Please note that this figure is for illustrative purposes only.

Additionally, the reference symbol detection method when there are sub-frames with different CP lengths within a radio frame, e.g., for multiplexing the MBMS channel, should be studied. There are two important issues to be studied.

- Restrict the time multiplexing of long-CP and short-CP sub-frames in order to allow performance improvements through averaging
- Modify the CP structure of the first OFDM symbol of a long-CP sub-frame in order to keep the same time-alignment of the first reference signal between short-CP and long-CP sub-frames (Figure 7.1.2.4.2-5)

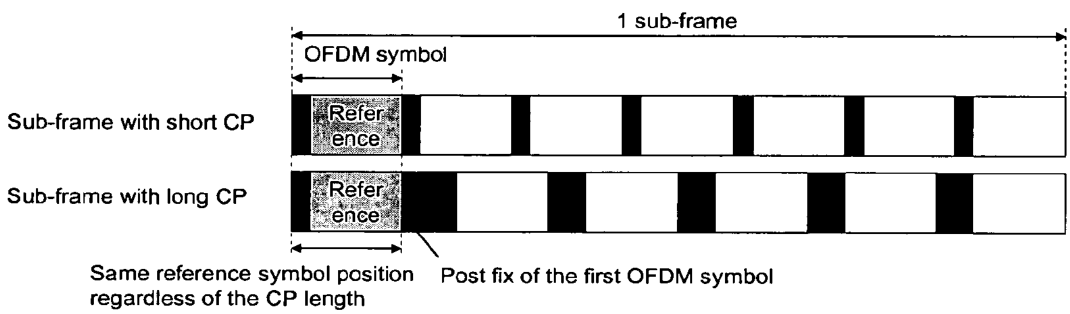


Figure 7.1.2.4.2-5 – Transmission timing of the first reference symbol within a sub-frame with long CP. Please note that this figure is for illustrative purposes only.

7.1.2.4.3 Structure in frequency

Given that whole mobility scenarios are not fully defined yet, the following assumptions are taken for evaluation during the SI phase:

- The center frequency of the center sub-carrier over the overall transmission band of each cell site is to be designed to satisfy the E-UTRA raster condition regardless of the overall transmission bandwidth of the cell site.
- The downlink SCH is transmitted only in the central part of the overall transmission band of the cell. As shown in Fig. 7.1.2.4.3-1, working assumption is to focus the study on a SCH structure based on the constant bandwidth of 1.25 MHz regardless of the overall transmission bandwidth of the cell, at least for initial cell search.
- The downlink BCH is also transmitted in the central part of the transmission bandwidth of the cell. In Fig. 7.1.2.4.3-2, the constant bandwidth of 1.25 MHz is used for the downlink BCH, regardless of the overall transmission bandwidth of the cell. Alternatively, the BCH may be transmitted over a 5-MHz frequency band to increase the frequency diversity effect when the overall transmission bandwidth is equal to or wider than 5 MHz. In the latter case, the UE may acquire the BCH bandwidth from the SCH to reduce the decoding complexity of the BCH, compared to the case when the UE tries to decode all the possible BCH bandwidths. Whether 1.25 MHz or 5 MHz is better as the BCH bandwidth should be investigated during the SI phase. Additionally, it should be investigated during the SI phase whether parts of the system information can be broadcast using a 1.25-MHz BCH and then, if necessary, the remainder of the system information is broadcast using a 5-MHz BCH.

- Regardless of the total transmission bandwidth capability of a Node B, a UE should be able to determine the cell ID using only the central portion of the bandwidth (i.e., the part of the bandwidth containing the SCH) in order to achieve very fast cell search.

Note that Figs. 7.1.2.4.3-1 and 7.1.2.4.3-2 are for illustration purposes only and the details of the SCH and BCH structure should be studied during SI.

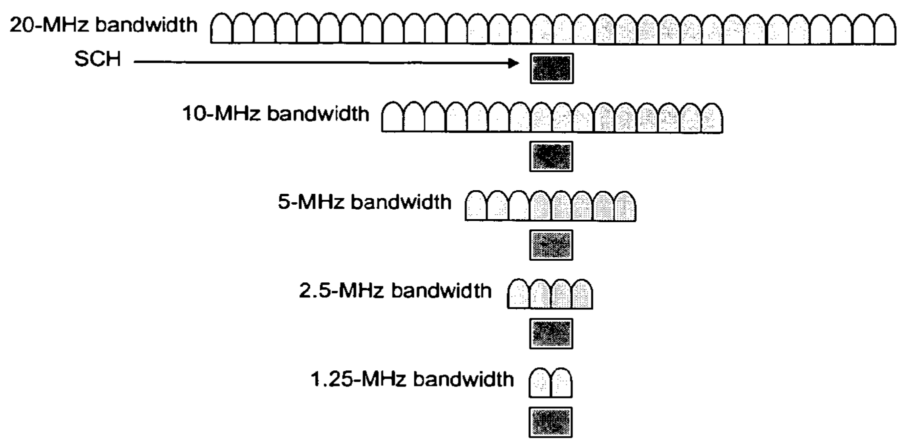


Figure 7.1.2.4.3-1 – Frequency allocation of the downlink SCH. Independent of the overall transmission bandwidth, the SCH is defined for 1.25 MHz and centered in the middle of the overall transmission bandwidth.

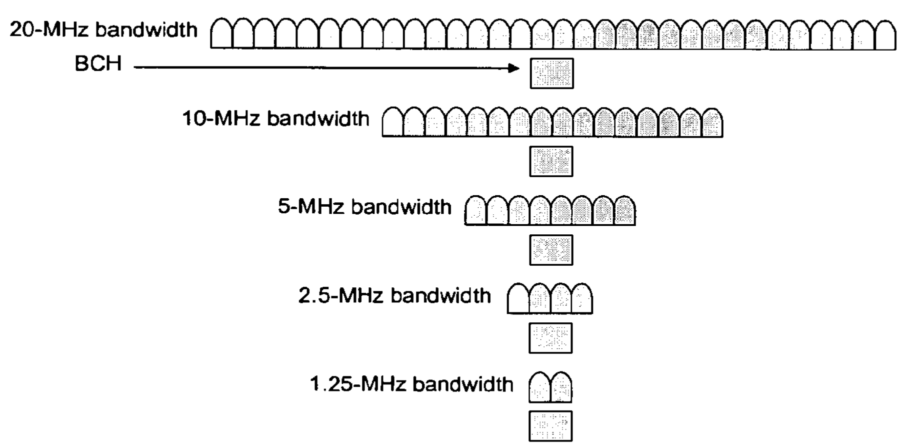


Figure 7.1.2.4.3-2 – Frequency allocation of the downlink BCH. Independent of the overall transmission bandwidth, the BCH is defined for 1.25 MHz and centered in the middle of the overall transmission bandwidth.

Furthermore, allocation of a larger bandwidth for the SCH and BCH with repetition in the frequency domain and time-shifting of the block-wised BCH information in the case of a 20-MHz transmission bandwidth should be considered from the viewpoint of mobility support.

A typical start up procedure would be that a UE first detects the central part of the spectrum regardless of the receiving bandwidth capability of the UE and the transmission bandwidth of the Node B and performs a cell search. Then, the UE moves to the transmission bandwidth for actual communications assigned to it by the system. This procedure is illustrated in Fig. 7.1.2.4.3-3.

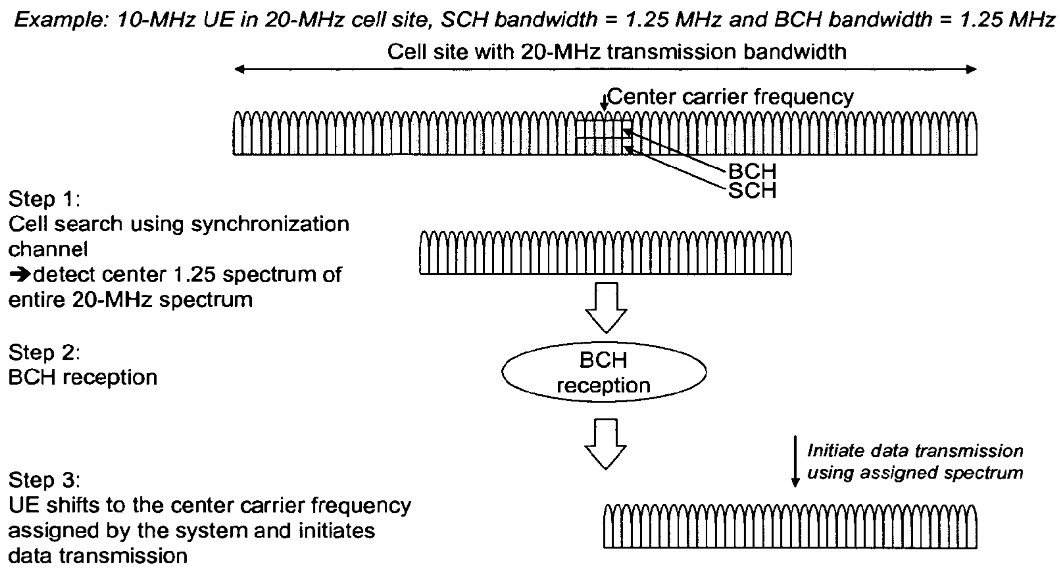


Figure 7.1.2.4.3-3 Principle of the cell search in Evolved UTRA.

7.1.2.4.4 Transmit diversity for SCH and BCH transmission

The SCH is the first physical channel for a UE to acquire. Thus, the SCH must be received without *a priori* knowledge of the number of transmitter antennas of the cell. Thus, transmit diversity methods that do not require knowledge of the number of transmit antennas can be considered for the SCH (e.g., time switched transmit diversity (TSTD), frequency switched transmit diversity (FSTD), and delay diversity including cyclic delay diversity (CDD)).

These diversity schemes can also be considered for the BCH in order to improve the packet error rate (PER) of the BCH. In addition, if the configuration of the transmitter antennas of the cell is provided outside the BCH, e.g., using the SCH or reference symbols, block code-based transmit diversity can be considered.

7.1.2.4.5 SCH signal structure

The two principal structures of the SCH might be identified, depending on whether the synchronization acquisition and the cell ID detection are obtained from the different SCH signals (hierarchical SCH, like in UTRA), or from the same SCH signal (non-hierarchical SCH).

Both SCH signal structures should be studied and compared.

7.2.2.4.5.1 Hierarchical SCH

In the hierarchical SCH, two or three signals are used for synchronisation acquisition and determining the cell ID and possibly other relevant information for the cell or network as mentioned in 7.1.2.4.1. A primary SCH, using the same OFDM waveform in all cells or a small set of OFDM waveforms with each cell using one of the OFDM waveforms, is used for SCH symbol timing and frequency acquisition. A secondary SCH, using a cell specific OFDM waveform, may be used for determining the cell group ID, full cell ID or other relevant information. If secondary SCH carries just cell group ID, not full cell ID, the cell specific common reference symbols can be used for determining the full cell ID. In case no secondary SCH is specified, the reference symbols specify the full cell ID.

7.2.2.4.5.2 Non-hierarchical SCH

In the non-hierarchical SCH, the SCH consists of one or more cell-specific OFDM waveforms. A cell-specific OFDM waveform can be obtained by IDFT either of a complete cell-specific sequence or certain portion of a cell-specific sequence, where the sequence elements are used as the Fourier coefficients at the occupied sub-carrier frequencies. The occupied sub-carrier frequencies may be different on the different OFDM waveforms. The cell-specific sequence may indicate cell ID or cell group ID. Each OFDM waveform is preceded by a cyclic prefix. One or more cell-specific OFDM waveforms are characterized by an exactly or approximately symmetric (centrally symmetric or periodic) shape of their magnitudes at least in those parts of the SCH intended to be used both for the synchronization acquisition and the cell ID/cell group ID information transmission.

7.1.2.5 Power control

Downlink power control for physical/L2-control signaling channel, at least tracking path loss and shadowing, should be investigated during the study item.

7.1.2.6 Inter-cell interference mitigation

Three approaches to inter-cell interference mitigation are currently being considered.

- Inter-cell-interference randomization
- Inter-cell-interference cancellation
- Inter-cell-interference co-ordination/avoidance

In addition, the use of beam-forming antenna solutions at the base station is a general method that can also be seen as a means for downlink inter-cell-interference mitigation.

It should be noted that the different approaches could, at least to some extent, complement each other i.e. they are not necessarily mutually exclusive.

The possibility to perform inter-cell interference cancellation at the UE is considered irrespective of the interference mitigation scheme adopted at the transmitter. The radio interface definition should facilitate the acquisition of channel parameters of a limited number of (strongest) interfering cells (e.g. through orthogonal reference signals).

7.1.2.6.1 Inter-cell-interference randomization

Fundamentally, inter-cell-interference randomization aims at randomizing the interfering signal(s) and thus to allow for interference suppression at the UE in line with the processing gain.

Methods considered for inter-cell-interference randomization includes:

- *Cell-specific scrambling*, applying (pseudo) random scrambling after channel coding/interleaving
- *Cell-specific interleaving*, also known as *Interleaved Division Multiple Access* (IDMA)

A third means for randomization is to apply different kinds of frequency hopping.

With regards to inter-cell-interference randomization, cell-specific scrambling and cell-specific interleaving (IDMA) basically have the same performance (regarding IDMA for inter-cell interference cancellation, see below).

A pseudo-random method can be used to generate the cell-specific interleaver patterns for IDMA. The number of the available patterns (seeds) is determined by the length of interleaver. A UE can identify the interleaver pattern of the cell by checking its interleaver pattern ID. The seeds can be reused between "far-spaced" cells in a manner similar to that of frequency reuse in a cellular system.

7.1.2.6.2 Inter-cell-interference cancellation

Fundamentally, inter-cell-interference cancellation aims at interference suppression at the UE beyond what can be achieved by just exploiting the processing gain.

Two methods have been discussed

- Spatial suppression by means of multiple antennas at the UE. It should be noted that the availability of multiple UE antennas is an assumption for E-UTRA.
- Interference cancellation based on detection/subtraction of the inter-cell interference. One example is the application of cell-specific interleaving (IDMA) to enable inter-cell-interference cancellation.

The IDMA based inter-cell-interference cancellation scheme would imply the following requirements on the system:

1. RB allocation: The RBs accommodating one code block of a UE in the interfered cell should also accommodate, and only accommodate, a code block of a UE in the interfering cell. In other words, the "interfered code block" and "interfering code block" should be accommodated in the same set of RBs.
2. Synchronization: Inter-NodeB synchronization is required.
3. Intra-cell signalling: A UE needs to be signalled whether it can perform a cancellation to the received ICI. When IDMA is used, the interleaver pattern ID also needs to be signalled to the UE.
4. Inter-cell signalling: Interfering signal configurations (e.g. interleaver pattern ID, modulation scheme, FEC scheme and coding rate) should also be signalled to the UE. To cancel the inter-NodeB interference, the signalling of interfering signal configurations can be realized by detecting the interfering control channel at the UE. To cancel the inter-sector interference, the NodeB can straightforwardly signals the interfering signal configurations to the UE via its own controlling channel.

7.1.2.6.3 Inter-cell-interference co-ordination/avoidance

The common theme of inter-cell-interference co-ordination/avoidance is to apply restrictions to the downlink resource management (configuration for the common channels and scheduling for the non common channels) in a coordinated way between cells. These restrictions can be in the form of restrictions to what time/frequency resources are available to the resource manager or restrictions on the transmit power that can be applied to certain time/frequency resources. Such restrictions in a cell will provide the possibility for improvement in SIR, and cell-edge data-rates/coverage, on the corresponding time/frequency resources in a neighbour cell.

Different assumptions can be made regarding UE measurements/reporting needed to support downlink interference co-ordination:

- Alternative #1:
  No additional UE measurement and reporting is needed, in addition to CQI reports anyway needed to support channel-dependent scheduling and link adaptation
- Alternative #2:
  Additional UE measurement and reporting of average path loss (incl. shadowing) to current and neighbour cells. Reporting rate: In the order of once every 100 ms.
- Alternative #3:
  In addition to the measurements/reports of alternative #2, additional measurement and reporting of average interference for the frequency reuse sets. Reporting rate: In the order of once every 100 ms.

Inter-cell interference co-ordination will require certain inter-communication between different network nodes in order to set and reconfigure the above mentioned scheduler restrictions. Two cases are considered:

- Static interference co-ordination
  Reconfiguration of the restrictions is done on a time scale corresponding to days. The inter-node communication is very limited (set up of restrictions), basically with a rate of in the order of days.
- Semi-static interference co-ordination
  Reconfiguration of the restrictions is done on a time scale corresponding to seconds or longer. Inter-node communication corresponds to information needed to decide on reconfiguration of the scheduler restrictions (examples of communicated information: traffic-distribution within the different cells, downlink interference contribution from cell A to cell B, etc.) as well as the actual reconfiguration decisions. Signaling rate in the order of tens of seconds to minutes.

7.1.2.7 Inter-Node B Synchronization

7.1.3 Physical layer measurements

7.1.3.1 UE measurements

7.1.3.1.1 Measurements for Scheduling

7.1.3.1.1.1 Channel Quality Measurements

The UE should be able to measure and report to the Node B the channel quality of one resource block or a group of resource block, see Section 7.1.3.1.1.1.1 in form of a CQI. In order to allow for efficient trade-off between UL signaling overhead and link-adaptation/scheduling performance taking varying channel-conditions and type of scheduling into account, the time granularity of the CQI reporting should be adjustable in terms of sub-frame units (periodic or triggered) and set on a per UE or per UE-group basis. In addition, the amount of overhead should be considered when comparing different CQI reporting schemes. .

7.1.3.1.1.1.1 Channel Quality Indicator

The frequency dimension of OFDM symbols can be organized into an integer number of CQI bands across all carrier bandwidth modes with each CQI band bandwidth corresponding to x (e.g. x=25 or 50) number of consecutive sub-carriers. The granularity of the CQI band bandwidth should be multiples of the minimum resource block bandwidth.

Channel quality indicator (CQI) feedback from UE which indicates the downlink channel quality can be used at Node B at least for the following purposes:

- Time/frequency selective scheduling.
- Selection of modulation and coding scheme.
- Interference management,
- Transmission power control for physical channels, e.g., physical/L2-control signaling channels.

Various techniques or combinations thereof can be considered for reducing CQI feedback which include (as examples) the following:

- Only feedback information from the top M strongest CQI bands
- Differential feedback information in time or frequency
- Bitmap techniques indicating which bands reflect a reported CQI value
- Hierarchical Tree structure based approaches
- Using a set of (orthogonal) functions to approximate frequency selective fading profile (e.g. DCT)

7.1.3.1.1.2 Measurements for Interference Coordination/Management

Channel quality measurements defined in section 7.1.3.1.1.1 and some measurements defined in section 7.1.3.1.2 can be used for interference coordination/management purpose. Additional measurements for interference coordination/avoidance are considered in sections 7.1.2.6.3 and 9.1.2.7.1 for DL and UL respectively.

7.1.3.1.2 Measurements for Mobility

In order to support efficient mobility in EUTRAN, the UEs are required to identify and measure the relevant measurement quantities [FFS] of neighbour cells and the serving cell. Such measurements for mobility are needed in the following mobility functions:

1) PLMN selection
    a. Detecting available PLMNs and high quality PLMNs
2) Cell selection and cell reselection
    a. Detecting suitable cells (i.e., "S-criteria or out-of-range")

b. Determining the most suitable cell for connection, i.e. performing evaluation for cell reselection

3) Handover decision
    a. Intra frequency handover
    b. Inter frequency handover
    c. Inter RAT handover (GERAN, UTRAN)
    d. Measurement gap control (FFS)

7.1.3.1.2.1 Intra frequency neighbour measurements

Neighbour cell measurements performed by the UE are named intra-frequency measurements when the UE can carry out the measurements without re-tuning its receiver. This corresponds to the case when the current and target cell operates on the same carrier frequency and

- the UE maximum bandwidth capability is equal or larger than the network system bandwidth, or
- the UE maximum bandwidth capability is smaller than the network system bandwidth, but the UE is currently "camping" within a band so that the common channels of the target cell as well as the sub-carriers allocated to the UE on the DL shared channel are within the UE receiving bandwidth.

Note that the exact definition of the common channels that are needed for the neighbour measurements as well as the meaning of "camping" are not yet fully agreed upon.

7.1.3.1.2.2 Inter frequency neighbour measurements

Neighbour cell measurements are considered inter-frequency measurements when the UE needs to re-tune its receiver in order to carry out the measurements. This corresponds to the cases when

- the neighbour cell is operating on a different carrier frequency than the current cell, or
- the neighbour cell is operating on the same carrier frequency as the current cell, but the UE maximum bandwidth capability is smaller than the network system bandwidth and the UE is currently "camping" within a band so that the common channels of the target cell are outside the UE receiving bandwidth. Note that depending on the exact structure for the common channels needed for neighbour measurements, this scenario may not happen.

In case of inter-frequency measurements, the network needs to be able to provide UL/DL idle periods for the UE to perform necessary neighbour measurements.

7.1.3.1.2.3 Inter RAT measurements

Neighbour measurements are considered inter-RAT measurements when UE needs to measure other radio access technology cells. For these kinds of measurements, the network needs to be able to provide UL/DL idle periods.

7.1.3.1.2.4 Measurement gap control

In case the UE needs UL/DL idle periods for making neighbour measurements or inter-RAT measurements, the network needs provide enough idle periods for the UE to perform the requested measurements. Such idle periods are created by the scheduler, i.e. compressed mode is assumed not needed. In order to optimise the network, some additional measurements may be used by the network for triggering the generation of UL/DL periods. This is FFS.

7.1.3.2 E-UTRAN measurements

7.2 MC-WCDMA (FDD)

7.2.1 High level principles

This structure prioritizes spectrum compatibility, that is ability for legacy UE and evolved UTRA UEs to co-exist in the same spectrum allocation. The baseline structure, numerology and procedures should be the same as those defined for UTRA-FDD HS-DSCH; in particular:

- Frequency re-use 1
- Node-B scheduling
- Adaptive modulation and coding
- Fast layer 2 re-transmissions
- Fast cell switching without data loss

should be supported. This should be achieved without tight inter-site synchronisation.

The following additions to the baseline multiple access structure should be considered:

- Enhanced MAC/RLC in support of simultaneous transmission over multiple carriers (up to 20 MHz)
- Support for MIMO for HS-DSCH operation.
- Support for simultaneous reception of HS-DSCH and multicast data transmitted according to the simulcast structure and procedures described in clause [X] should be evaluated.
- Added support for 0.96 Mcps and possibly 1.92 Mcps numerology.
- Enhanced downlink control structure and procedures in support of HS-DSCH and E-DCH operation with variable symmetric and asymmetric bandwidth allocations.
- Support for higher order modulation such as 64 QAM.
- Reduced downlink HARQ delay budget.

The system operation should rely on the definition of new demodulation performance requirements as follows:

- Enhanced HS-PDSCH performance requirements relying on:
  - Enhanced reference equalizer such as frequency domain equalizer with decision feedback combined with multi-antenna receive diversity in the UE.
  - Intra and Inter cell interference reduction in the UE.
- Enhanced S-CCPCH performance requirements in support of MBMS relying on:
  - Dual antenna receive diversity in the UE.

7.2.2 Basic Transmission Scheme

This section goes over the specifics for a MC-WCDMA operation on the DL. Section 7.2.2.2 introduces operation over a 1.25MHz bandwidth by means of a low chip rate version of UTRA FDD (WCDMA LCR in the sequel). WCDMA LCR operation is based on direct sequence spreading over 1.25MHz.

The concepts presented are valid for multi-carrier operation based on the 5MHz system (UTRA FDD) as well as the 1.25MHz system (WCDMA LCR) or a 5MHz/1.25MHz hybrid multi-carrier system.

7.2.2.1 Definitions

N: maximum number of DL carriers that a UE may receive at a given time. The notion of "carrier assignment" is implicit with this concept, i.e., the E-UTRAN shall notify the UE that it may receive data on up to N carriers simultaneously.

M: maximum number of UL carriers that a UE may transmit at a given time. Also, the notion of "carrier assignment" is implicit with this concept, i.e., the E-UTRAN shall notify the UE that it may transmit data on up to M carriers simultaneously.

Paired Carriers: carrier frequencies such that for each DL carrier there is an associated UL carrier. The PHY channel timing relationships for paired carriers are the same as those for the currently defined single carrier UMTS system.

Unpaired Carriers: carrier frequencies that do not have an associated DL carrier (in case of M>N) or do not have an associated UL carrier (in case of N>M). The timing of PHY channels of unpaired carriers will be associated with the timing of some paired carriers. Details on this will be provided in the body of this document.

Anchor Carrier: carrier within a cell that contains full R99, R5 or R6 capability, i.e., transmission of SCH, P-CCPCH, S-CCPCH… and supporting reception of UE random access by way of the PRACH. For the downlink, the anchor carrier in a cell constitutes the timing reference for all the carriers in that cell i.e., time synchronization within the carriers in a cell is assumed as stated section 7.2.2.2.

7.2.2.2 WCDMA LCR system numerology

Table 7.2.2.2-1 presents the numerology for the WCDMA LCR system.

Table 7.2.2.2-1. WCDMA LCR system numerology

Parameter	**Value**
Carrier spacing	1.25MHz
Chip rate	960 kcps
Slot duration	0.67ms: 640 chips
Max SF	128
R5/R6 TTIs	2ms: 3 slots 10ms: 15 slots

The chip rate for the WCDMA LCR system comes from a direct translation to a 1.25MHz carrier spacing of the relationship between the carrier spacing and the chip rate for the UTRA FDD, i.e., 3.84Mcps is to 5MHz the same as 960kcps is to 1.25MHz. Therefore, the same pulse shaping filter taps are assumed for the 1.25MHz system, with the difference that the sample duration is 4 times longer in the 1.25MHz system.

The slot duration for the 1.25MHz system corresponds to the UTRA slot duration of 0.67ms. Therefore, since the "chips" of the 1.25MHz system are 4 times longer, the number of chips in a slot is 2560/4=640. The number 640=128x5, and therefore the maximum spreading factor is 128, for which there will be 5 Walsh symbols per slot. For this slot duration, the TTI duration in slots corresponding to the R5 and R6 channels remains the same i.e., 2ms and 10ms, as in UTRA FDD.

7.2.2.3 Assumptions for MC-WCDMA operation in DL

Only the HSDPA channels are eligible to be configured in a multi-carrier fashion i.e., a given UE will receive information from one or more than one carrier.

The time reference for cells connected to the same Node B is assumed to be common across all carriers. Therefore, the DL timing reference i.e., timing of the P-CCPCH or SCH is the same for all carriers in a given cell.

The timing of the PHY channels for *paired carriers* shall be no different than for a single carrier system where the timing of all the DL channels is referenced to the timing of the P-CCPH or SCH.

The timing of the PHY channels for *unpaired carriers* is explicitly covered in this Technical Report.

Multi-Carrier transmission characteristics:

- One cell is the serving HS-DSCH for all carriers supported by a given UE.
- [Multi-carrier] split of the user data buffer is at the Node-B.
- Node-B can do individual carrier scheduling or joint carrier scheduling.
- HARQ PHY re-transmissions on DL takes place at the same carrier as for the first transmission.

Figure 7.2.2.3-1 is a block diagram depicting multi-carrier operation. Each of the colours represents a different DL carrier. Transmission by the serving cell is represented by solid lines, whereas transmissions by other cells are represented by dashed lines. Note that the PHY channels in squared brackets are just transmitted if associated uplink carrier is configured.

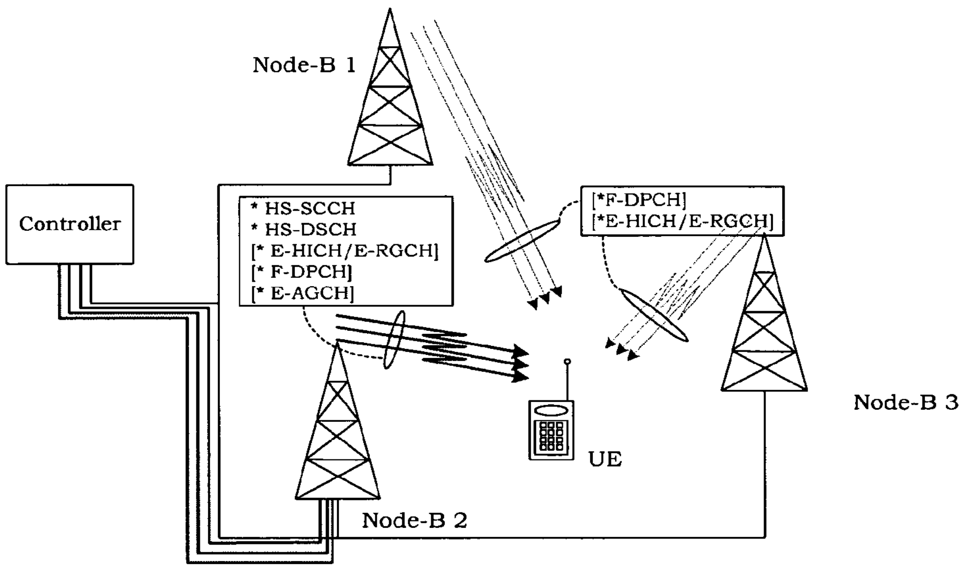


Figure 7.2.2.3-1. Block diagram for multi-carrier operation

7.2.2.4 DL Single-carrier PHY Channels

The DL channels that could be transmitted on one carrier only are listed below.

- SCH: Primary and Secondary Synchronization channels – allowing UE initial system acquisition.
- P-CCPCH: Primary Common Control Physical channel carrying the system information i.e. BCH: Broadcast transport channel.
- S-CCPCH: Secondary Common Control Physical channel carrying the Paging (PCH) and the Forward Access Channel (FACH) transport channels. If there is interest in increased data transmission capabilities over FACH, transmission of the S-CCPCH could take place on more than one carrier in a cell.
    - PICH: Paging Indicator Channel if S-CCPCH carrying the PCH is transmitted over a single carrier.
    - MICH: MBMS Indicator Channel if S-CCPCH carrying the MBMS contents is transmitted over a single carrier.
- DPCH: for e.g., real time services.

7.2.2.5 DL Multi-Carrier PHY Channels

The set of downlink PHY multi-carrier channels is the following:

- Table 7.2.2.5-1 shows the data-payload channels:

Table 7.2.2.5-1. Data-payload Multi-carrier DL PHY channels

Channel	Num carriers
HS-PDSCH	N

- Table 7.2.2.5-1 shows the control/supporting channels:

Table 7.2.2.5-1. Control/supporting Multi-carrier DL PHY channels

Channel	Num required channels	Rationale
HS-SCCH	N	The number of required channels, N, should be multiplied by the number of simultaneous users that may be supported per slot, per carrier
(F-)DPCH	M	UL Power Control commands for M uplink carriers
E-HICH	M	ACK/NAKs for M E-DPCHs
E-RGCH	M	Relative Grants for M E-DPCHs
E-AGCH	M or 1	Absolute Grants for M E-DPCHs

The Absolute Grant messages for a multi-carrier UE with M uplink carriers may be transmitted on M independent E-AGCH PHY channels (in same or different carriers) or could be transmitted on a single PHY channel at a particular DL carrier. In that case, the E-RNTI identifier would require the additional notion of "carrier" on top of the notion of UE identity. Therefore, a UE could have more than one associated E-RNTI e.g., one for each UL carrier that is allowed to use.

7.2.2.5.1 N/M Asymmetry considerations

The following observations can be made for the different relative values of N and M.

- **N=M**: All the DL carriers have an associated UL carrier and vice-versa. PHY procedures for this case (i.e., Power Control, synchronization, HS-DSCH and E-DCH related procedures...) are no different than those for the single carrier case.
- **N>M**: Just the M paired carriers require (F-)DPCH, E-HICH/E-RGCH and E-AGCH (in case of M AGCH channels used). There are (N-M) downlink unpaired carriers carrying the HS-PDSCH and its associated HS-SCCHs.
- **N<M**: There are (M-N) uplink unpaired carriers. Therefore, the following will be required:
  - (M-N) additional (F-)DPCHs for UL power control of the (M-N) uplink unpaired carriers.
  - (M-N) additional E-HICH/E-RGCH channel pairs using (M-N)x2 additional signatures for PHY HARQ ACK/NACK and RG indications of the (M-N) uplink unpaired carriers.

- (M-N) additional E-AGCH channels for transmission of the absolute grants of the (M-N) uplink unpaired carriers if M E-AGCHs are transmitted for a UE with M uplink carriers. If a single E-AGCH is used for the absolute grants of a UE in all the UL carriers, no additional E-AGCHs are needed.

The (M-N) sets of additional channels ((F-)DPCH, E-HICH/E-RGCH and optionally E-AGCH) are related to E-DCH transmissions on the UL. Therefore, the cells in the UE's E-DCH Active Set of each carrier shall transmit to the UE the supporting E-DCH feedback information and the RL TPC commands. For cells belonging to the same Node-B, the transmission of these channels shall take place at the same carriers. It may also be desired, for implementation reasons, that the carriers for transmission of these channels are the same for different Node-Bs.

Note that multiple F-DPCHs on a given carrier may be orthogonally time multiplexed within the same channelisation code by using different timing offsets (multiples of 256 chips). Therefore, the additional F-DPCHs may be time multiplexed within a set of DL carriers. Alternatively, different channelisation codes may be used for the additional F-DPCHs with timing same or different than that of the paired F-DPCH.

Clearly, allocation of F-DPCHs is more advantageous than allocation of DPCHs as multiplexing in time sharing the same channelisation code is possible with the former.

7.2.3 Physical Layer Procedures

7.2.3.1 DL PHY channels timing considerations

As stated before, the timing of PHY channels for symmetric, i.e., $N = M$, multi-carrier configurations is such that each carrier complies with the timing requirements set forth in 25.211.

This section covers the timing specifics of DL PHY channels for asymmetric, i.e., $N \neq M$ multi-carrier configurations.

In the N>M case, there are (N-M) downlink unpaired carriers. The timing of the DL channels in these carriers (HS-PDSCH and HS-SCCH) is well defined since for the DL, the timing of all the PHY changes is referenced to the nominal timing of the P-CCPCH or SCH of the anchor carrier.

In the N<M case, there are (M-N) uplink unpaired carriers. Also, there are (M-N) sets of channels ((F-)DPCH, E-HICH/E-RGCH and possibly E-AGCH) that need to be allocated within the N downlink carriers. The timing of E-HICH is indirectly related to the timing of the associated (F-)DPCH. The timing of the E-RGCH for the serving cell coincides with the timing of the E-HICH. Whereas, the timing of the E-RGCH from a non-serving cell as well as the timing of the E-AGCH is absolute with respect to the nominal timing (2 slots after). In addition, as noted before, the E-AGCH may be transmitted on a single carrier. Therefore, the (M-N) additional (F-)DPCHs (on top of the N ones corresponding to the paired carriers) will have a particular timing multiple of 256 chips which will constitute the indirect reference for the E-HICH and the E-RGCH from the serving cell.

Note that multiple F-DPCHs on a given carrier may be orthogonally time multiplexed within the same channelization code by using different timing offsets (multiples of 256 chips). Therefore, the additional F-DPCHs may be time multiplexed within a set of DL carriers. Alternatively, different channelization codes may be used for the additional F-DPCHs with timing same or different than that of the paired F-DPCH.

7.2.3.2 Synchronization Procedures: Cell Search

7.2.3.2.1 "Cold" Acquisition

The "cold acquisition" denotes the system acquisition from UE power up. Therefore, it is the acquisition of the first carrier (anchor carrier).

There are no changes in the procedure described in 25.214, however just a subset of carriers (the smallest subset being the single anchor carrier) will carry the P-SCH/S-SCH and the P-CCPCH and therefore will enable the UE to perform the three steps for system acquisition.

7.2.3.2.2 "Warm" Acquisition

The "warm acquisition" denotes the addition of DL carriers.

If different carriers from the same cell share a common timing reference (as assumed in section 7.2.2.2), there is no need for steps 1 and 2 in the system acquisition process described in 25.214 (related to the acquisition of the slot and frame timing as well as the identification of the scrambling code group to which the cell belongs, through acquisition of P-SCH and identification of S-SCH). Step 3 (last step) in the system acquisition procedure described in 25.214 may also be avoided if different carriers from different cells use the same scrambling code.

Therefore, the two constraints:

- Common timing reference for all carriers from same cell, and
- Common scrambling code for all carriers from same cell,

bring notorious advantages on the addition of DL carriers procedure and therefore shall be required.

If the common timing reference for carriers from same cell was optional. A signalling message could be defined with the objective of indicating whether or not each of the DL carriers share the same timing as the anchor carrier.

In turn, if the use of common scrambling code for carriers from same cell was optional. The E-UTRAN would have to indicate through signalling (e.g., P-CCPCH or S-CCPCH) the scrambling code used by carriers other than the anchor carrier. This approach would add unnecessary overhead on the DL and is not desired.

7.2.3.3 Synchronization Procedures: Synchronization of Dedicated channels

7.2.3.3.1 Procedure A

This section covers Procedure A step by step identifying the points that could be different for the addition of a new carrier.

Procedure A step "b" in 25.214 currently specifies that the initial transmit power for the DL DPCCH or F-DPCH is set by higher layers. This transmit power could be chosen to be the same as that for one of the established carriers.

The DL chip and frame synchronization described in step "c" may be simplified for the assumption of common timing from different carriers.

Step "d" specifies when the UE may start transmitting. Currently, higher layers need to consider the DL physical channel established and activation time (if provided) reached. After that, transmission of DPCCH start at an initial transmit power set by higher layers. This initial DPCCH power may also be the same as one of the other active carrier's DPCCH. The power control preamble, in this case, may also be reduced to speed up the synchronization.

7.2.3.3.2 Procedure B

Synchronization Procedure B does not involve the UE as it governs the addition of radio links to the existing radio link sets between the UE and E-UTRAN. Therefore, it would not require any change to specifically support multi-carrier operation.

7.2.3.4 Power Control: DL PC

Section 9.3.2.4 covers the UL multi-carrier channels and therefore the DPCCHs carrying the power control commands for the DL (to control the transmission power of the (F-)DPCHs and HS-SCCHs).

For each of the N/M relative values:

- M=N: each UL carrier has its associated DL carrier and vice-versa. Therefore, the M uplink DPCCHs will power control the M downlink (F-)DPCHs, and optionally the HS-SCCHs and the DL E-channels.
- M>N: there are N uplink DPCCHs meaningful for DL power control. Those are the N paired carriers that power control the downlink (F-)DPCHs and optionally HS-SCCHs in the N downlink carriers.
- M<N: the DPCCHs in the M paired carriers will power control the M downlink (F-)DPCHs. Power control of the HS-SCCHs in the (N-M) downlink unpaired carriers may be based on CQI reports for each of the carriers by the UE.

7.2.3.5 HS-DSCH Related Procedures

Transmission of HSDPA related channels is covered in section 7.2.2.5 for the DL (i.e., HS-PDSCH and HS-SCCH) and section 9.3.2.4 for the UL (i.e., HS-DPCCH).

For each of the possible N/M relative values:

- N=M: each DL carrier has its associated UL carrier and vice-versa. Therefore, the N downlink HS-PDSCHs/HS-SCCHs will be fed back by the corresponding N uplink HS-DPCCHs.
- N>M: the HS-PDSCHs/HS-SCCHs in the M paired carriers will be fed back by the corresponding M uplink paired HS-DPCHs. In addition, the UE further conveys CQI and ACK/NACK commands for the (N-M) downlink unpaired carriers for HARQ operation and channel feedback of the HS-PDSCH of those carriers. How that additional information is conveyed is covered in section 9.3.2.4.1.
- N<M: the HS-PDSCHs in the N paired carriers will be fed back by their corresponding HS-DPCCHs in the paired carriers.

7.2.3.5.1 HS-PDSCH Retransmission on Multi-Carrier system

Operation in the multi-carrier system shall guarantee PHY HARQ retransmissions on the carrier that was used for the first transmission.

7.2.4 Physical layer measurements

7.2.4.1 UE measurements

The UE measurements for the MC-WCDMA based proposal are the same as those defined in section 5.1 of 25.215.

7.2.4.2 Measurements support for mobility

For the MC-WCDMA based proposal, measurements and procedures to support mobility towards UTRA and GSM RAT do not differ from currently specified procedures.

Likewise, measurements and procedures to support mobility towards and within E-UTRA do not differ from currently specified procedures.

Measurements periods to support inter-frequency and inter-RAT handover are provided by compressed mode operation and/or new DTX/DRX procedures for the UE.

7.3 MC-TD-SCDMA (TDD)

7.3.1 Basic transmission scheme

The frame and sub-frame structure of 3GPP 1.28Mcps LCR TDD option are shown in the Figure 7.3.1-1 and 7.3.1-2 [7]. The Figure 7.3.1-3 is the frame structure of Multi-carrier TD-SCDMA(MC TD-SCDMA). As shown in Figure 7.3.1-3□for downlink frame structure, a carrier with broad bandwidth can be divided into several sub-carriers of narrower bandwidth, and adjacent sub-carriers do not overlap with each other. Multi-carrier TD-SCDMA can meet different needs in the DL resource allocation and make full use of the resources, by using FDMA, TDMA and CDMA modes altogether.

For the DL multiple access, the bandwidth of each downlink sub-carrier will be allocated as 1.6 MHz.

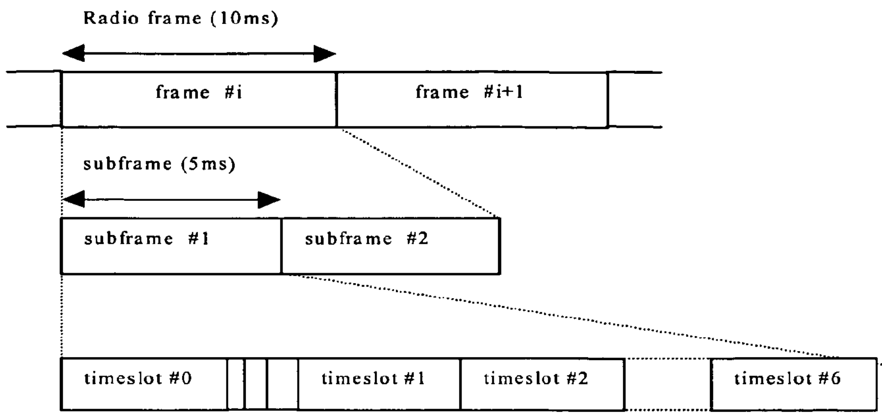


Figure 7.3.1-1: Physical channel signal format for 1.28Mcps TDD option

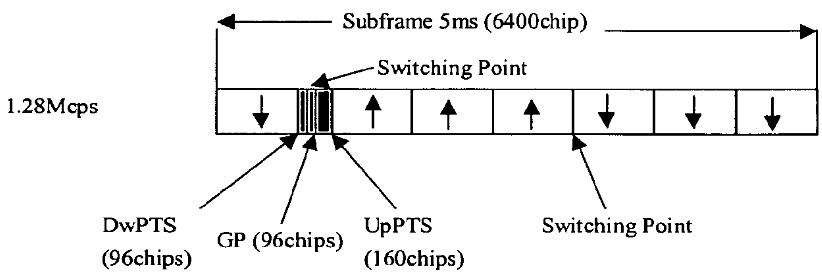


Figure 7.3.1-2: Structure of the sub-frame for 1.28Mcps TDD option

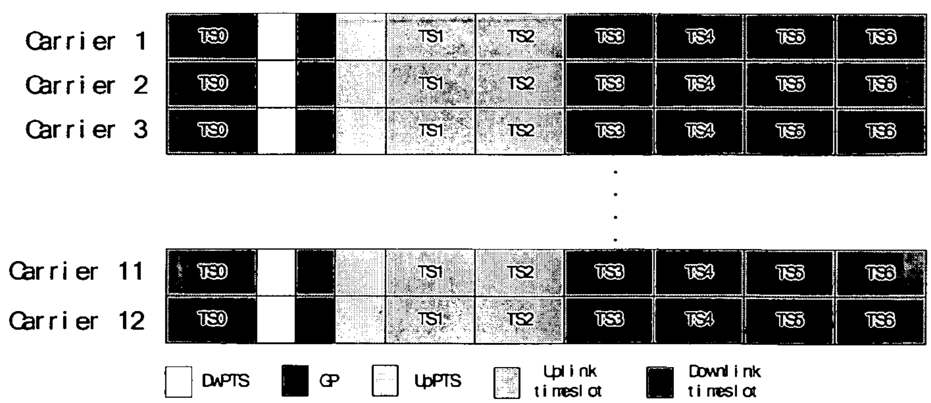


Figure 7.3.1-3: MC TD-SCDMA frame structure based on LCR TDD

The sub-carrier number of DL and UL in the different bandwidths are given in Table 7.3.1-1.

Table 7.3.1-1 the number of UL and DL sub-carriers according to different bandwidths

Bandwidth	1.6MHz	5MHz	10MHz	15MHz	20MHz
DL sub-carrier number	1	3	6	9	12
UL sub-carrier number	1	3	6	9	12

MC TD-SCDMA should have similar structure as LCR TDD (Figure 7.3.1-1), i.e. three layered structure: radio frame, sub-frame and time slot. The number and position of traffic and special time slots are also the same, aligned with current system. The TTI is 0.675ms, the same size as the period of a timeslot.

For general services, MC TD-SCDMA can use the same number of switching points as shown in Figure 7.3.1-2.

More Switching points can be added in the 5ms sub-frame of MC TD-SCDMA to meet special requirements as shortened latency. For example, one pair of switching points can be added as in Figure 7.3.1-4 to meet the 5ms unidirectional user plane latency requirement in the LTE. In Figure 7.3.1-4, TS0, TS2, TS3, TS5 and TS6 are downlink timeslots, while TS1, TS4 act as uplink. One pair of switching points is added to reduce latency.

In Figure 7.3.1-4, TS4 is composed of two parts: the guard period GP and T4. The functionality of GP is the same as special time slot GP, which acts as a protection between downlink and uplink slots. T4 is a part which used to transmit uplink data. To maintain the alignment with LCR TDD system, the length of TS4 remains 0.675ms. The number of switching points can be further increased on the basis of Figure 7.3.1-4 to fulfil even more stringent needs for lower latency.

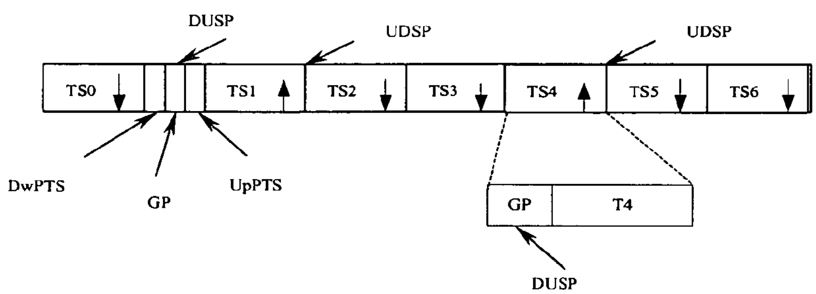


Figure 7.3.1-4 Switching points added in a sub-frame

7.3.1.1 Modulation scheme

The downlink scheme of MC TD-SCDMA supports QPSK, 16QAM and 64QAM modulation schemes.

7.3.1.2 Multiplexing including pilot structure

7.3.1.3 Channel Coding and physical channel mapping

Convolution coding and Turbo coding can be considered for MC TD-SCDMA. Each coding scheme has its own characteristic.

7.3.1.4 MIMO and beam-forming

There are two main multiple antenna technologies, namely Beam-forming and MIMO. MC TD-SCDMA combines these two technologies according to different application environment and channel characteristics.

The baseline antenna configuration for downlink MIMO is to deploy two transmit antennas at the Cell site, and two receive antennas at the UE. The possibility for more transmit antennas should also be considered.

The antenna configuration for downlink beam-forming is to use from four to eight transmit antennas at the Cell site, and one or two receive antennas at the UE.

7.3.2 Physical layer procedure

7.3.2.1 Scheduling

For DL MC TD-SCDMA, frequency diversity, time diversity and space diversity should be considered.

7.3.2.1 Link adaptation

Using AMC to adjust the modulation and coding rate, adaptive link technologies improve the performance of the system.

7.3.2.3 HARQ

Incremental Redundancy (IR) should be used for downlink HARQ. Note that Chase combining is a special case of IR.

7.3.2.4 Cell search

7.3.2.5 Power control

The open-loop and close-loop power control are supported against deep fading, eliminating near-far effect, and fighting multi-user interference.

7.3.3 Physical layer measurements

7.3.3.1 UE measurements

7.3.3.2 Measurements support for mobility

8 Evaluation of techniques for evolved UTRA DL

8.1 Performance evaluation

Evaluation components such as spectral efficiency and throughput requirements are given in [4[4] for characterizing performance of a EUTRA MA proposal and determining whether it meets relative improvement requirements over Release 6 UTRA. The evaluation should at least be performed for a 10MHz bandwidth mode at 2.0GHz and a 1.25MHz bandwidth mode at 900MHz as given in Table 8.1.1-1. It is highly desirable to eventually show 20MHz performance results as well.

8.1.1 Traffic outage and latency requirements

Outage requirements for the different traffic models are needed for alignment. System loading is limited by the outage limit for each traffic type. Outage should also be conditioned on signaling reliability. That is, signaling error types that would result in extra packet loss or retransmissions that would significantly affect performance should be modelled or reported. Note that user packet call throughput by definition [2[2], [3[3] includes the effects of packet scheduling delay. See Annex A.4 for examples of evaluation approaches.

Table 8.1.1-1 – Traffic Outage and Latency requirements for determining maximum load

Traffic Type	Outage Limit and Definition
HTTP – Web Browsing with TCP	2% outage based on user packet call throughput < P P=128Kbps for BW>2.5MHz otherwise P=32Kbps
FTP – with TCP	2% outage based on user packet call throughput < Q Q=128Kbps for BW>2.5MHz otherwise Q=32Kbps
VoIP	2% outage based on user having < 98% of its speech frames delivered successfully within [40] ms (air interface delay). Consecutive speech frames erased < [0.05]% of time
S Kbps Streaming Video S=128 for BW >2.5MHz otherwise 64	2% outage based on user having > 2% dropped packets
Video Conferencing	Audio same as VoIP; Video same as Streaming

8.1.2 Evaluation against reference

Note: absolute results shown in the respective sections should not be compared as the set of assumptions used to derive these respective results may differ.

This section provides initial results of different E-UTRA downlink proposals, comparing with the baseline reference case defined in [x]:

- WCDMA Release-6
- 1 Transmit antenna at the Node-B
- 2 Receive antennas at the UE
- Rake receiver
- 5 MHz transmission bandwidth

Results are normalized to bit per second per Hertz.

8.1.2.1 Evaluation for MC-WCDMA based evolved UTRA DL

The initial evaluation results presented in Table 8.1.2.1-1 are based on full buffer traffic models and proportional fair scheduler. For MC-WCDMA based E-UTRA, the numbers represent the performance assuming receive diversity and linear MMSE equalization in the UE. The downlink overhead is assumed to be 25% for both sets of results.

Table 8.1.2.1-1: Full buffer – 10 users per sector

Case	Speed [km/h]	Reference WCDMA Type I [b/s/Hz]	MC-WCDMA Eql + 2 RxDiv [b/s/Hz]	% w.r.t Reference
1	3	0.988	1.512	+ 53%
2	30	0.664	1.066	+ 61%
3	3	0.922	1.370	+ 49%
4	3	0.938	1.456	+ 55%

Additional benefits from MIMO operation is for further study.

8.1.2.2 Evaluation for OFDMA based evolved UTRA DL

The initial evaluation results presented in Tables 8.1.2.2-1, 8.1.2.2-2 and 8.1.2.2-3 are based on full buffer traffic models and proportional fair scheduler. It is assumed that the scheduler is able to independently allocate individual sub-bands to different UEs at the same time. Further, it is assumed that the UE reports full CQI for all downlink sub-bands.

The downlink overhead for OFDM results in Tables 8.1.2.2-1, 8.1.2.2-2 and 8.1.2.2-3 is assumed to be 25%, 29% and 20% respectively.

Table 8.1.2.2-1: Full buffer – Set 1 – 10 users per sector

Case	Speed [km/h]	Reference WCDMA Type I [b/s/Hz]	OFDM 2 ms TTI 1125 KHz sub-bands [b/s/Hz]	OFDM 0.5 ms TTI 1125 KHz sub-bands [b/s/Hz]	% w.r.t Reference
1	3	0.988	1.616	1.560	+ 64% (2.0 ms) + 58% (0.5 ms)
2	30	0.664	1.070	1.260	+ 61% (2.0 ms) + 90% (0.5 ms)
3	3	0.922	1.526	-	+ 66%
4	3	0.938	1.590	-	+ 70%

Table 8.1.2.2-2: Full buffer – Set 2 – 10 users per sector

Case	Speed [km/h]	Reference WCDMA Type I [b/s/Hz]	OFDM 0.5 ms TTI 375 KHz sub-bands [b/s/Hz]	% w.r.t Reference
1	3	0.988	1.840	+ 86%
2	30	0.664	1.510	+ 127%
3	3	0.922	1.620	+ 76%

Table 8.1.2.2 -3: Full buffer – Set 3 – 10 users per sector

Case	Speed (kph)	Reference WCDMA Type I (bps/Hz)	OFDM 0.5 ms TTI 563 KHz sub-bands (bps/Hz)	% w.r.t Reference
1	3	0.988	1.782	+ 80%

Additional benefits from MIMO operation is for further study.

8.1.3 Evaluation of OFDM based Multicast for evolved UTRA

The initial evaluation presented in Table 8.1.2-1 is based on cases defined in Table A.2.1.1-1 except for the bandwidth which has been set to 5 MHz. The results assume single frequency network operation (SFN), that is all cells in the system transmit the same data at the same time.

Table 8.1.3-1. Spectral Efficiency of OFDM based Multicast for E-UTRA

Case	Band (MHz)	Site to site distance (m)	Speed (kph)	OFDM SFN Multicast 1% BLER 95% coverage (Mbps)
1	2000	500	3	> 5.5 (1.1 b/s/Hz)
2	2000	500	30	> 5.5 (1.1 b/s/Hz)
3	2000	1732	3	< 2.5 (0.5 b/s/Hz)
4	900	1000	3	> 5.5 (1.1 b/s/Hz)

OFDMA based multicast offers potential for significant gains over Rel-6 MBMS. However, these performance gains rely on tightly time synchronized transmission from all cells and are highly sensitive to the combination of band of operation and the site to site distance as illustrated by the performance for case 3 as compared to other cases.

8.2 Analysis of UE complexity

8.2.1 WCDMA based evolved UTRA downlink

8.2.1.1 Baseband

The baseband complexity can be divided in terms of memory and processing. The processing is dominated by the decoder and the receiver front end (user separation, demodulation and channel equalization). The complexity of the decoder is related to the peak data rate. For CDMA based signal the complexity of the receiver front end is essentially linked to the channel equalization.

Receiver front end complexity evaluation for receiver based on frequency domain equalizer shows that the UE has to perform two FFT operations; furthermore a decision feedback can be added to further enhance the equalization performance; a first order measure of the decision feedback block complexity indicates that the complexity is about the same as the complexity of an FFT operation.

One should note that the performance enhancements associated with advance equalizer receivers will also benefit systems which operate Release 5 UTRA-FDD (HS-PDSCH).

8.3 Analysis of Node B impacts

8.3.1 WCDMA based evolved UTRA downlink

8.3.1.1 Baseband

The WCDMA based E-UTRA downlink relies on the existing WCDMA channel structure and procedures and therefore Release 6 Node B should be compatible with the E-UTRA channels structure. The multi-carrier component affects mostly the scheduler and interfaces between the channel elements and the scheduler. The scheduler has to simultaneously control resource allocation across multiple carriers for a UE instead of one per UE in Release 6. The interface from and to each channel element with the scheduler may or may not have to be modified depending on the existing implementation and whether joint scheduling across carriers is supported. No fundamental Node-B complexity issue has been identified for the WCDMA based E-UTRA downlink.

9 UL Concepts

Four basic concepts are proposed in uplink:

1 SC-FDMA (FDD / [TDD])

2 OFDMA (FDD / [TDD])

3 MC-WCDMA(FDD)

4 MC-TD-SCDMA (TDD)

9.1 SC-FDMA (FDD / [TDD])

9.1.1 Basic transmission scheme

The basic uplink transmission scheme is single-carrier transmission (SC-FDMA) with cyclic prefix to achieve uplink inter-user orthogonality and to enable efficient frequency-domain equalization at the receiver side. Frequency-domain generation of the signal, sometimes known as DFT-spread OFDM, is assumed and illustrated in Figure 9.1.1-1. This allows for a relatively high degree of commonality with the downlink OFDM scheme and the same parameters, e.g., clock frequency, can be reused,

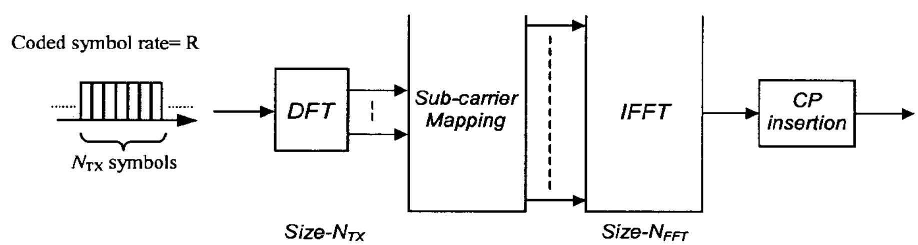


Figure 9.1.1-1 Transmitter structure for SC-FDMA.

The sub-carrier mapping determines which part of the spectrum that is used for transmission by inserting a suitable number of zeros at the upper and/or lower end in Figure 9.1.1-2. Between each DFT output sample L-1 zeros are inserted. A mapping with L=1 corresponds to localized transmissions, i.e., transmissions where the DFT outputs are mapped to consecutive sub-carriers. With L>1, distributed transmissions result, which are considered as a complement to localized transmissions for additional frequency diversity.

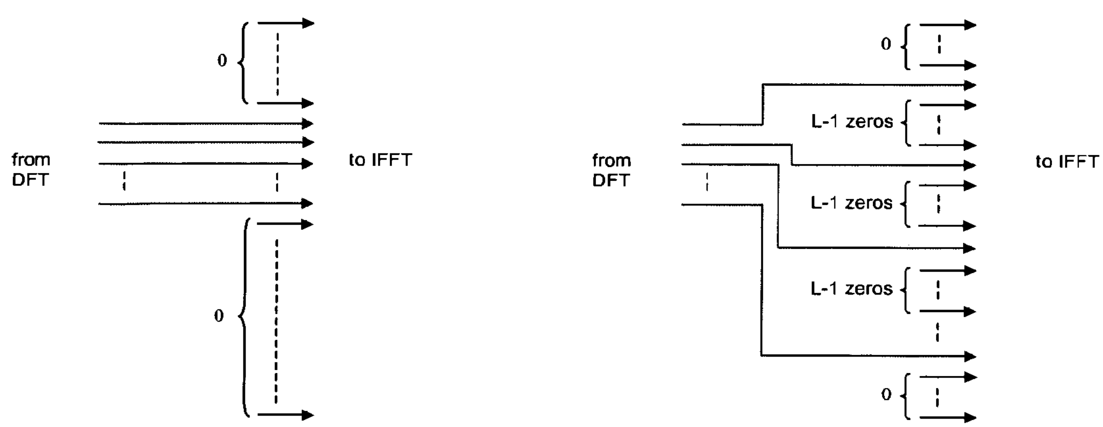


Figure 9.1.1-2 Localized mapping (left) and distributed mapping (right).

The physical mapping to the N available sub-carriers per one DFT-SOFDM symbol in the RF spectrum shall be performed as illustrated in the figure below, where f_c is carrier frequency.

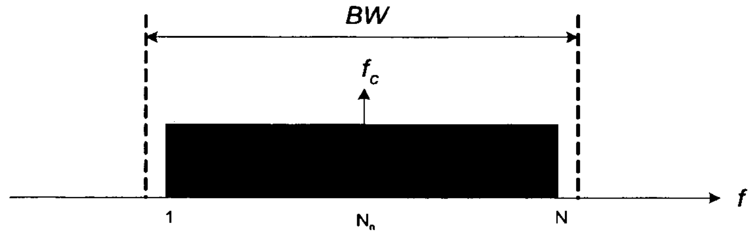


Figure 9.1.1-3. Physical Mapping of one DFT-SOFDM symbol in RF frequency domain

Based on Table 9.1.1-1, when the transmission BW is 1.25/2.5/5/10/15/20 MHz, N is 75/150/300/600/900/1200, and N_n is 38/75/150/300/450/600, respectively.

The basic sub-frame structure for the uplink transmission is given in Figure 9.1.1-4 using two short blocks (SB) and six long blocks (LB) per sub-frame. Short blocks are used for reference signals for coherent demodulation and/or control/data transmission. Long blocks are used for control and/or data transmission. Note that the data could include either or both of scheduled data transmission and contention based data transmission. Furthermore, the same sub-frame structure is used for both localized and distributed transmission.

The numerology for the different spectrum allocations is shown in Table 9.1.1-1. The minimum TTI for uplink transmission is equal to the uplink sub-frame duration. Similar to the downlink, the possibility to concatenate multiple sub-frames into longer uplink TTIs should be considered. In this case, the TTI can either be a semi-static or dynamic transport channel attribute. In case of a semi-static TTI, the TTI is set through higher layer signalling. In case of a dynamic TTI, the number of sub-frames concatenated can be dynamically varied for at least the initial transmission and possibly for retransmissions. It is to be determined to what extent a dynamic TTI can reduce higher layer protocol overhead (e.g. MAC, RLC), L1 overhead (e.g. CRC), and ACK/NACK feedback, as well as reducing latency by reducing segmentation of IP packets. It is initially assumed that the Network (e.g. Node-B) would control the TTI. The interaction between dynamic TTI, signaling errors, HARQ procedure (time synchronous vs. asynchronous including adaptive or non-adaptive characteristics) and UE complexity needs to be investigated.

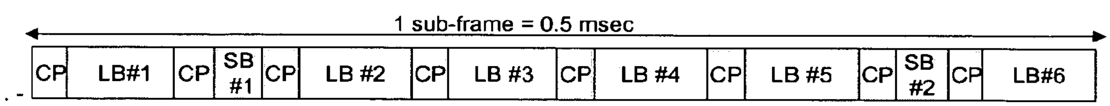


Figure 9.1.1-4. Sub-frame format with two short blocks/sub-frame

Table 9.1.1-1. Parameters for Uplink Transmission Scheme using BW efficiency of ~90%

Spectrum Allocation (MHz)	Sub-frame duration (ms)	Long block size (μs/#of occupied subcarriers /samples*2)	Short block size (μs/#of occupied subcarriers /samples)	CP duration (μs/samples *1)
20	0.5	66.67/1200/2048	33.33/600/1024	(4.13/127) × 7, (4.39/135) × 1*
15	0.5	66.67/900/1536	33.33/450/768	(4.12/95) × 7, (4.47/103) × 1*
10	0.5	66.67/600/1024	33.33/300/512	(4.1/63) × 7,

				(4.62/71) × 1*
5	0.5	66.67/300/512	33.33/150/256	(4.04/31) × 7, (5.08/39) × 1*
2.5	0.5	66.67/150/256	33.33/75/128	(3.91/15) × 7, (5.99/23) × 1*
1.25	0.5	66.67/75/128	33.33/38/64	(3.65/7) × 7, (7.81/15) × 1*[1]

*[1]: {(x1/y1) × n1, (x2/y2) × n2} means (x1/y1) for n1 reference signal or data blocks and (x2/y2) for n2 reference signal or data blocks

*[2]: FFT size = samples

Note that the largest CP duration includes guard time for ramp up + ramp down time

For E-UTRA TDD, the frame structure corresponding to Table 9.1.1-1 is supported. In addition, a second frame structure is also supported with the intention of providing co-existence with LCR UTRA TDD. The sampling frequency, FFT size, sub-carrier spacing, and number of occupied sub-carriers is the same as for Table 9.1.1-1. However, with this alternative frame structure described in section 6.2.1.1, the basic timeslot structure for the uplink transmission is given in Figure 9.1.1-5 using two short blocks (SB) and eight long blocks (LB) per timeslot. The uplink numerology for the different spectrum allocations are listed in Table 9.1.1-2.

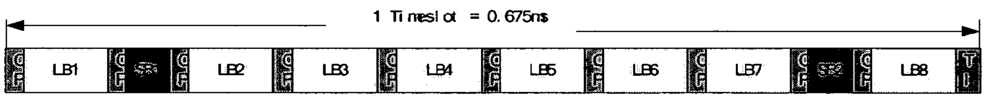


Figure9.1.1-5 Timeslot format with two short blocks/timeslot

Table9.1.1-2 Parameters for Uplink Transmission Scheme using BW efficiency of ~90%

Spectrum Allocation (MHz)	Timeslot duration (ms)	Long block size (μs/#of occupied subcarriers /samples*[2])	Short block size (μs/#of occupied subcarriers /samples)	CP duration (μs/samples *[1])	Timeslot Interval (us/samples)
20	0.675	66.67/1200/2048	33.33/600/1024	(6.71/206) × 9, (6.97/214) × 1*	7.68/236
15	0.675	66.67/900/1536	33.33/450/768	(6.77/156) × 9, (7.11/164) × 1*	6.94/160
10	0.675	66.67/600/1024	33.33/300/512	(6.71/103) × 9, (7.22/111) × 1*	7.42/114
5	0.675	66.67/300/512	33.33/150/256	(6.64/51) × 9, (7.67/59) × 1*	7.54/58
2.5	0.675	66.67/150/256	33.33/75/128	(6.51/25) × 9, (8.58/33) × 1*	7.80/30
1.25	0.675	66.67/75/128	33.33/38/64	(6.25/12) × 9, (10.4/20) × 1*[1]	8.32/16

*[1]: {(x1/y1) × n1, (x2/y2) × n2} means (x1/y1) for n1 reference signal or data blocks and (x2/y2) for n2 reference signal or data blocks

*[2]: FFT size = samples

9.1.1.1 Modulation scheme

The studied uplink data-modulation schemes are π/2-shift BPSK, QPSK, 8PSK and 16QAM.

9.1.1.2 Multiplexing including reference signal structure

9.1.1.2.1 Uplink data multiplexing

The channel-coded, interleaved, and data-modulated information [Layer 3 information] is mapped onto SC-FDMA time/frequency symbols. The overall SC-FDMA time/frequency resource symbols can be organized into a number of resource units (RU). Each RU consists of a number (M) of consecutive or non-consecutive sub-carriers during the N long blocks within one sub-frame (See section 9.1.1). To support the localized and distributed transmission (See section 9.1.1), two types of RUs are defined as follows:

- Localized RU (LRU), which consists of M consecutive sub-carriers during N long blocks.
- Distributed RU (DRU), which consists of M equally spaced non-consecutive sub-carriers during N long blocks.

The granularity of the RU should be able to be matched to the expected minimum payload. The size of the baseline LRU and DRU is same and is denoted as S_{RU}, which is equal to MxN, where M=25 and N is equal to the number of long blocks in a sub-frame. This results in the number of RUs depending on system bandwidth shown in Table 9.1.1.2.1-1.

Table9.1.1.2.1-1 Bandwidth occupied by a resource unit and number of resource units dependent on bandwidth.

Bandwidth (MHz)	1.25	2.5	5.0	10.0	15.0	20.0
Bandwidth (kHz) occupied by a resource unit	375	375	375	375	375	375
Number of available resource units	3	6	12	24	36	48

Using other values such as, e.g. M=15 or M=12 or M=10 or M equal to other values can be considered based on the outcome of the interference coordination study.

One or more RUs can be assigned to a UE by the Node B. When more than one LRUs are assigned to a UE, they should be contiguous in frequency domain. When more than one DRUs are assigned to a UE, the sub-carriers assigned should be equally spaced. The multiplexing of localized and distributed transmission is FFS.

The information required by the UE to correctly identify its resources assigned must be made available to the UE by the scheduler. The detailed signalling support is FFS.

9.1.1.2.2 Uplink reference-signal structure

As indicated in Section 9.1.1, uplink reference signals are transmitted within the two short blocks, which are time-multiplexed with long blocks. Uplink reference signals are received and used at the Node B for the following two purposes:

- Uplink channel estimation for uplink coherent demodulation/detection
- Possible uplink channel-quality estimation for uplink frequency- and/or time-domain channel-dependent scheduling

Provided that uplink transmissions are received in a time-aligned fashion (within the cyclic-prefix tolerance), multiple mutually orthogonal reference signals can be created. Multiple such mutually orthogonal uplink reference signals can be allocated to

- A single multi-transmit-antenna UE to support e.g. uplink multi-layer transmission (MIMO)

- Different UEs within the same Node B

As shown in Figure 9.1.1.2.2-1, the uplink reference-signal structure should allow for:

- Localized reference signals occupying a continuous spectrum.
- Distributed reference signals occupying a comb-shaped spectrum.

Note that, due to the use of the short block for the transmission of reference-signals, the "sub-carrier bandwidth", is twice the "sub-carrier bandwidth" for data transmission in long blocks.

Figure 9.1.1.2.2-1 Distributed (left) and localized (right) reference-signal structure

Orthogonality between uplink reference signals can be achieved using the following methods:

- By transmitting each uplink reference signal across a distinct set of sub-carriers, as in "Figure 9.1.1.2.2-2 left." This solution achieves "signal orthogonality in the frequency domain" and applies to both localized and distributed reference-signal structures. This approach is referred to as FDM below.
- By constructing reference signals that are orthogonal in the "code domain", with the signals transmitted across a common set of sub-carriers (example with contiguous sub carriers in Figure 9.1.1.2.2-2 right). As an example, individual reference signals may be distinguished by a specific cyclic shift of a single CAZAC sequence. This approach is referred to as CDM below.
- Orthogonality in the time domain
- A combination of the methods above

Figure 9.1.1.2.2-2 Reference-signal orthogonality in frequency domain (left) and "code" domain (right) respectively.
Note that orthogonality in the frequency domain is also possible for a localized reference-signal structure.

The applicability of different reference-signal structures to different transmission structures is as follows.

Reference-signal for demodulation/detection in case of localized data transmission:

- To multiplex reference-signals from different UEs occupying different data spectrum, FDM is used.
- Localized reference signal occupying the same spectrum as data transmission or

Distributed reference signal confined within the same bandwidth as the data transmission but occupying a fraction of the data spectrum can be used.

- Multiplexing of reference signals for the case of a UE with multiple antennas or multiple UEs in MU-MIMO is to be studied further.

Reference-signal for demodulation/detection in case of distributed data transmission:

- Reference signal distributed to allow for channel estimation of the distributed data. As mentioned, for FDM, due to the use of short blocks (SB) for reference-signal transmission, each reference-signal "comb finger" is twice as large as the corresponding "comb-finger" for the distributed data transmissions in the long blocks (LB). Thus to provide better frequency sampling of the channel for the channel estimation, frequency-domain staggering of the reference signals of SB2, relative to SB1 may be applied when both the SB1 and SB2 are used for reference-signal for demodulation/detection of distributed data transmission as shown in Figure 9.1.1.2.2-3. Note that the staggering of distributed reference signals in SB1 and SB2 could also be used in case of localized data transmission.

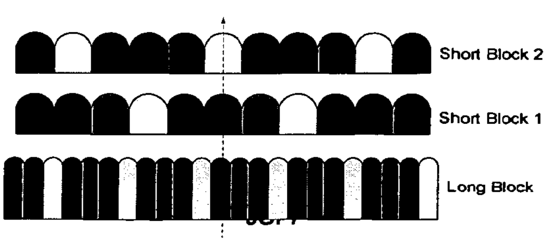


Figure 9.1.1.2.2-3 An example of Frequency-domain staggering of the reference signals of SB2, relative to SB1

- Reference signal that occupies a set of sub-carriers, which may overlap the sub-carriers which are used by the long block (data). An example is portrayed in Figure 9.1.1.2.2-4.

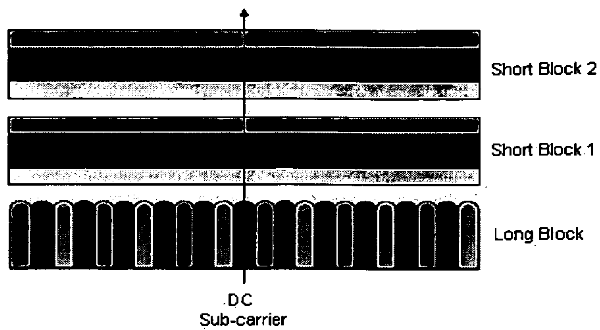


Figure 9.1.1.2.2-4 An example of overlap the sub-carriers which are used by the long block (data).

- For multiplexing reference-signals from different UEs within the same Node B, distributed FDM and/or CDM is used.

Reference-signal for uplink channel-quality estimation (channel sounding):

- Reference signal may occupy at least partly different spectrum than data transmission. This allows for channel-quality estimation also for other frequencies than that used for data transmission and, as a consequence, allows for uplink channel-dependent scheduling.
- For multiplexing reference-signals from different UEs within the same Node B, distributed FDM and/or CDM is used.
- Multiplexing of reference signals for the case of a UE with multiple antennas or multiple UEs in MU-MIMO is to be studied further.
- When reference-signal for uplink channel-quality estimation is transmitted with data symbols within the same sub-frame, a part of this reference-signal can also be used for channel estimation for demodulation/detection of the data symbols.

The two SBs can be used for transmission of reference-signals for different purposes listed above.

When the reference signals occupying the different size of the spectrum (FFS) are multiplexed into overlapped frequency band, different sub-carriers should be assigned for the reference signals within the overlapping frequency band in order to achieve orthogonal transmission.

The uplink reference signals are based on CAZAC sequences. Which exact type of CAZAC sequences is FFS.

9.1.1.2.3 Multiplexing of L1/L2 control signaling

There are two types of L1 and L2 control-signaling information:

- data-associated signaling (e.g., transport format and HARQ information), which is associated with uplink data transmission, and
- data-non-associated signaling (e.g., CQI and/or ACK/NACK due to downlink transmissions, and scheduling requests for uplink transmission).

Furthermore, three multiplexing combinations for the uplink pilot, data, and L1/L2 control signaling within a sub-frame are considered for a single UE:

- Multiplexing of pilot, data, and data-associated L1/L2 control signaling
- Multiplexing of pilot, data, and data-associated and data-non-associated L1/L2 control signaling
- Multiplexing of pilot and data-non-associated L1/L2 control signaling

In single-carrier FDMA radio access, time-domain multiplexing is used for the above-mentioned three multiplexing combinations as shown in Figure. 9.1.1.2.3-1, in order to retain the advantageous single-carrier feature with a low PAPR.

Figure. 9.1.1.2.3-2 shows a multiplexing scheme for L1/L2 control signaling, data, and pilot. In Figure 9.1.1.2.3-2(a), both data-associated and data-non-associated control signaling are time-multiplexed with data and pilot within the sub-frame. Furthermore, the data-associated and data-non-associated control signalling from multiple UEs are multiplexed in the frequency or/and code domains associated with multiple pilot channels. In Figure 9.1.1.2.3-2(b), the data-associated control signaling is time-multiplexed with data similar to the case in Figure 9.1.1.2.3-2(a). The data-non-associated control signaling can also be time-multiplexed with data if UE has UL data transmission. Meanwhile, the data-non-associated control signaling for UEs that transmits only the L1/L2 control, is multiplexed exclusively in a semi-statically assigned time-frequency region. The data-non-associated control signaling of different UEs is multiplexed using the frequency/time/code domain or a hybrid of them within the assigned time-frequency region. The exclusive time-frequency region can be separated into two frequency-time resources. First part can contain data-non-associated control signaling without user identification, e.g. ACK/NACK, and the second part can contain the one with user identification. The possibility for multiplexing of data-non-associated control signaling with data channel by exclusive frequency resource, i.e., frequency-multiplexing, is FFS.

The amount of overhead due to the L1 and L2 signaling and the exact mapping to the time-frequency resources needs further investigation.

Note that Figure 9.1.1.2.3-2 (a) - (b) show localized allocation only but the multiplexing options described above are also applicable to distributed allocation.

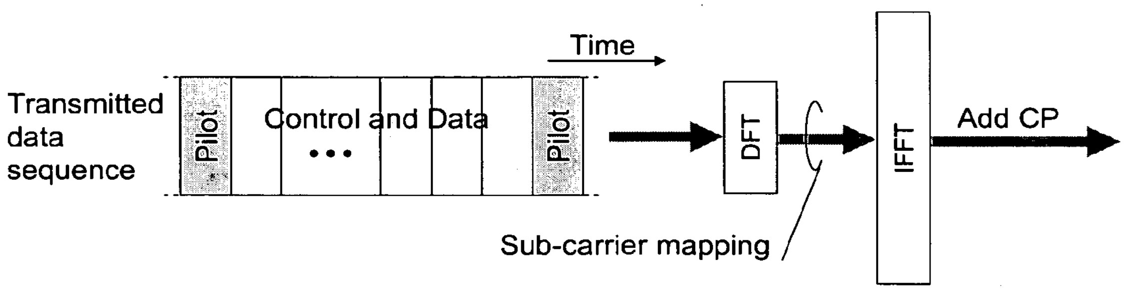
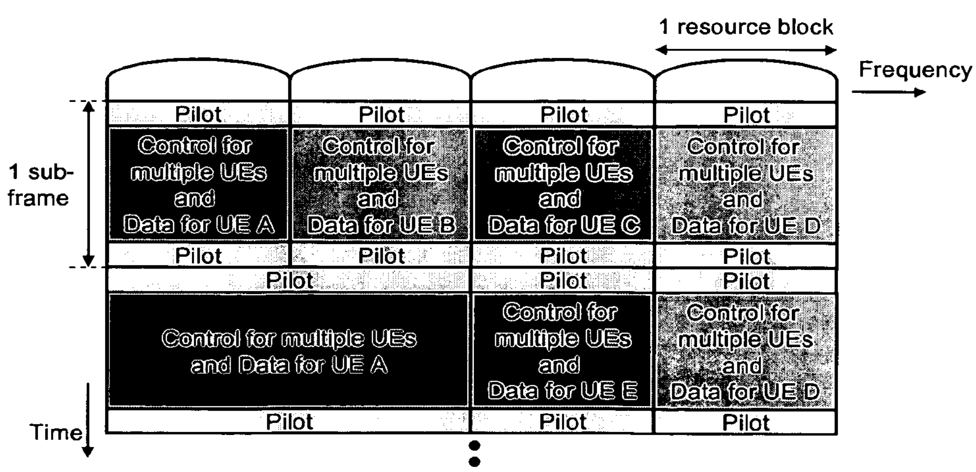
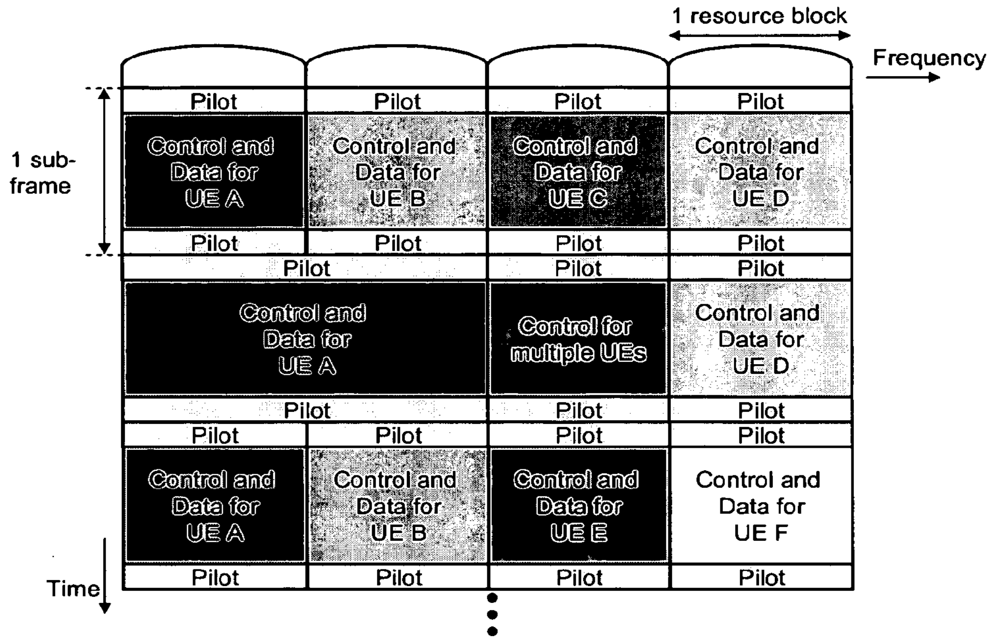


Figure 9.1.1.23-1 – Transmission principle of TDM-based multiplexing

(Note: This figure is used for illustration purposes only, and the positions of pilot, control, and data within the sub-frame do not specify the actual configuration.)



(a) Multiplexing scheme (a)



(b) Multiplexing scheme (b)

Figure 9.1.1.2.3-2 – Multiplexing scheme for L1/L2 control signaling, data, and pilot

(Note: These figures are used for illustration purposes only, and the positions of pilot, control, and data within the sub-frame do not specify the actual configuration.)

9.1.1.2.4 Uplink L1/L2 Control Signaling

Depending on presence or absence of uplink timing synchronization, the uplink L1/L2 control signaling can differ.

In the case of time synchronization being present, the outband control signaling consists of

- Data-associated control signaling
- CQI
- ACK/NAK
- Synchronous random access (scheduling request, resource request)

Transmission of CQI and ACK/NAK may occur in parallel to data-associated control signaling or synchronized random access. Synchronized random access may not be transmitted simultaneously with data-associated control signaling.

In the case of time synchronization not being present, the outband control signaling consists of

- Non-synchronized random access

9.1.2.4.1.1 Data-associated control signaling

Data-associated control signaling can only be transmitted together with user data. The content is summarized in Table 9.1.2.4.1.1-1.

Table 9.1.2.4.1.1-1 Data-associated control signaling

Field			Size	Comment
HARQ related information	If asynchronous hybrid ARQ is adopted	Hybrid ARQ process number	3	Indicates the hybrid ARQ process the current transmission is addressing.
		Redundancy version	2	To support incremental redundancy.
		New data indicator	1	To handle soft buffer clearing.
	If synchronous hybrid ARQ is adopted	Retransmission sequence number	2	Used to derive redundancy version (to support incremental redundancy) and 'new data indicator' (to handle soft buffer clearing).
TF	Transport format		FFS	The uplink transport format (modulation format, transport block size, etc). Only required if UE-based TFC selection is supported.

Note: It is FFS whether asynchronous or synchronous hybrid ARQ operation will be adopted.

Note: It is FFS whether the transport format the UE uses is mandated by the Node B or controlled by the UE.

Note: In case of multi-layer transmission, multiple instances of (parts of) the data-associated control signaling may be required.

9.1.2.4.1.2 CQI

The CQI informs the scheduler about the current channel conditions as seen by the UE. If MIMO transmission is used, the CQI includes necessary MIMO-related feedback.

Table 9.1.2.4.1.2-1 Channel Quality Indicator

Field	Size	Comment
CQI	FFS	

9.1.2.4.1.3 ACK/NAK

The hybrid ARQ feedback in response to downlink data transmission consists of a single ACK/NAK bit.

Table 9.1.2.4.1.3-1 ACK/NAK

Field	Size	Comment
ACK/NAK	FFS	Up to one bit per downlink transport block. Multiple bits may be required to support downlink multi-layer transmission (if hybrid ARQ operates per layer) and in case of TDD.

9.1.2.4.1.4 Synchronized random access (resource request)

The synchronized random access is used by the UE to request resources for uplink data transmission. It is further described in Section 9.1.2.1.

9.1.2.4.1.5 Non-synchronized random access

The non-synchronized random access is described in Section 9.1.2.1.

9.1.1.3 Channel coding and physical channel mapping

Similar to the downlink, the current assumption is that uplink channel coding for Layer 3 information is based on current UTRA release 6 Turbo coding, possibly extended to lower rates by the extension of additional code polynomials, extended to longer code blocks, and modified by the removal of the tail. However, also similar to the downlink, the use of alternative FEC encoding schemes could be considered if significant benefits in terms of complexity and performance could be shown.

To achieve high processing gain, repetition coding can be used as a complement to FEC.

Uplink channel coding for lower-layer control signaling is TBD.

The control channel is multiplexed in time domain and may preferably be mapped on the symbols from which the CP is constructed. The control channel may be transmitted in one or more data block (number and position are FFS)

9.1.1.4 MIMO and Transmit Diversity

The baseline antenna configuration for uplink single-user MIMO is two transmit antennas at the UE and two receive antennas at the Cell site.

The use of both open loop transmit diversity techniques based on block codes as well as cyclic shift diversity, open-loop and closed-loop MIMO techniques, e.g. spatial division multiplexing (SDM) and precoding, should be considered. For the closed-loop mode, techniques for reducing signaling overhead should be evaluated. The possibility for single user higher-order uplink MIMO (more than two TX/RX antennas) should be considered.

Transmit antenna selection at the UE, which assumes fewer RF chains than the number of transmit antennas (e.g. 1 RF chain and 2 transmit antennas), should be considered to potentially lower the UE complexity.

The possibility for SDMA should also be considered. A specific example of SDMA corresponds to a (2x2) virtual MIMO, where two UEs, each of which transmitting on a single antenna, share the same time and frequency resource allocation. These UEs apply mutually orthogonal reference signal patterns in order to simplify Cell site processing (cancellation). Note that from the UE perspective difference between (2x2) virtual MIMO and single antenna transmission is only the use of a reference signal pattern allowing for "pairing" with another UE.

9.1.1.5 Uplink macro diversity

Uplink macro diversity, i.e. the simultaneous reception of the uplink transmission at multiple cell sites should be studied, taking the complexity vs. performance trade-off into account.

9.1.1.6 Power De-rating Reduction

Single-carrier transmission allows for further power de-rating reduction, e.g., through the use of specific modulation or coding schemes, clipping, spectral filtering, etc.

For example, modifications to the basic modulation schemes in section 9.1.1, such as per-symbol phase rotations (π/4-QPSK, π/2-BPSK) and I/Q-offsetting (offset-QPSK, offset-QAM), should be considered.

For example, frequency-domain spectrum shaping can be applied between the output of the DFT and the input of the sub-carrier mapping in Figure 9.1.1-1. The selection of the filter shape is a trade-off between spectrum/link efficiency and power de-rating reduction. For a given spectral efficiency, different spectrum-shaping functions can provide different power de-rating reductions. Note that CM and PAPR are indicators of power de-rating. CM is a more appropriate indicator than PAPR of power de-rating achieved by different power de-rating reduction techniques. The use of spectrum shaping, including the use of different spectrum shaping parameters for different modulation schemes, number of sub-carriers or different scenarios (e.g. capacity/bandwidth limited vs. coverage/power limited), should be considered. Different spectrum shaping functions should be further studied and optimized for different uplink modulation formats considered. In the case of π/2-BPSK modulated signals, both the PAPR and the CM can be reduced significantly by spectrum shaping using the Kaiser window without reducing the spectral efficiency.

Another candidate for power de-rating reduction is the FFT Pre-processing technique. In this approach selected input modulation symbols are attenuated in order to reduce power de-rating as indicated by PAPR/CM at the output of the IFFT. This FFT pre processing approach is valid for any FFT size M and IFFT size N, and for both "localised" or "distributed" sub-carrier variants. This scheme can also be combined with pulse shaping for example RRC filtering implemented in the frequency domain.

9.1.2 Physical channel procedure

9.1.2.1 Random access procedure

The random access procedure is classified into two categories:

- non-synchronized random acccss, and
- synchronized random access.

9.1.2.1.1 Non-synchronized random access

The non-synchronized access is used when the i) UE uplink has not been time synchronized or ii) UE uplink loses synchronization. The non-synchronized access allows the Node B to estimate, and, if needed, adjust the UE transmission timing to within a fraction of the cyclic prefix.

9.1.2.1.1.1 Time Frequency Structure

The random-access procedure is based on transmission of a random-access burst. Time frequency resources for the random-access attempts are controlled by the RRM configuration. This is illustrated in Figure 9.1.2.1.1.1-1, where random-access transmissions are restricted to certain time/frequency resources (FDM/TDM), and in Figure 9.1.2.1.1.1-3, where random access transmissions are not restricted to a particular time/frequency resource (CDM). Note that there are no restrictions set on the uplink scheduler strategy, i.e., depending on the scheduler strategy, a random-access transmissions from one UE may or may not be subject to intra-cell interference due to scheduled uplink data transmissions from other UEs. Interference from data transmissions on a received random access burst has to be handled by the appropriate base station processing, e.g., by relying on the processing gain inherent in the preamble. These aspects are valid for FDD, as well as TDD using the generic frame structure. Note that, in the design of the details of the random access such as power control and preamble-sequence design, the assumption should be that there is a time and/or frequency separation between random access transmissions and scheduled uplink data transmissions.

For co-existing LCR-TDD based frame structure (Figure 6.2.1.1-1), random access time/frequency resources is illustrated in Fig. 9.1.2.1.1.1-2, where physical random access channel and UpPCH channels are used for L1 random access procedure.

The minimum bandwidth, BW_{RA}, allocated for non-synchronized random access transmission is 1.25 MHz. For system bandwidths larger than 1.25 MHz, either the random access transmission uses a larger bandwidth, or multiple random access channels are defined. Multiple 1.25MHz random access channels might be especially useful for selecting a best block using frequency selective channel characteristics (TDD mode). BW_{RA} of less than 1.25 MHz (e.g. BW of the uplink resource unit = 375 KHz) for non-synchronized access is FFS.

The length of the non-synchronized random access burst, T_{RA}, is less than (multiples of) sub-frames (e.g. 0.5 ms) to allow the burst, and the required guard time to account for the uplink timing uncertainty and the propagation loss, to fit within a subframe (or multiples thereof). The random access burst length can be adjusted (e.g. on a cell basis depending on the cell size) to optimize the overhead/latency versus coverage requirements trade-off. It is FFS on how this adjustment is made (e.g. static, semi-static, dynamic).

For co-existing LCR-TDD based frame structure, T_{RA} is less than 0.8 ms for optimum coverage (combining UpPTS (0.125ms) special timeslot and TS1 (0.675ms) timeslot) to allow the burst, and the required guard time to account for the uplink timing uncertainty, to fit within a 0.8ms. Longer T_{RA} may be needed for large cells.

For the co-existing LCR-TDD based frame structure, CDM may be used on physical random access channel (Figure 9.1.2.1.1.1-2) for transmitting control message. The effect of interference on scheduled data and vice-versa needs to be investigated further.

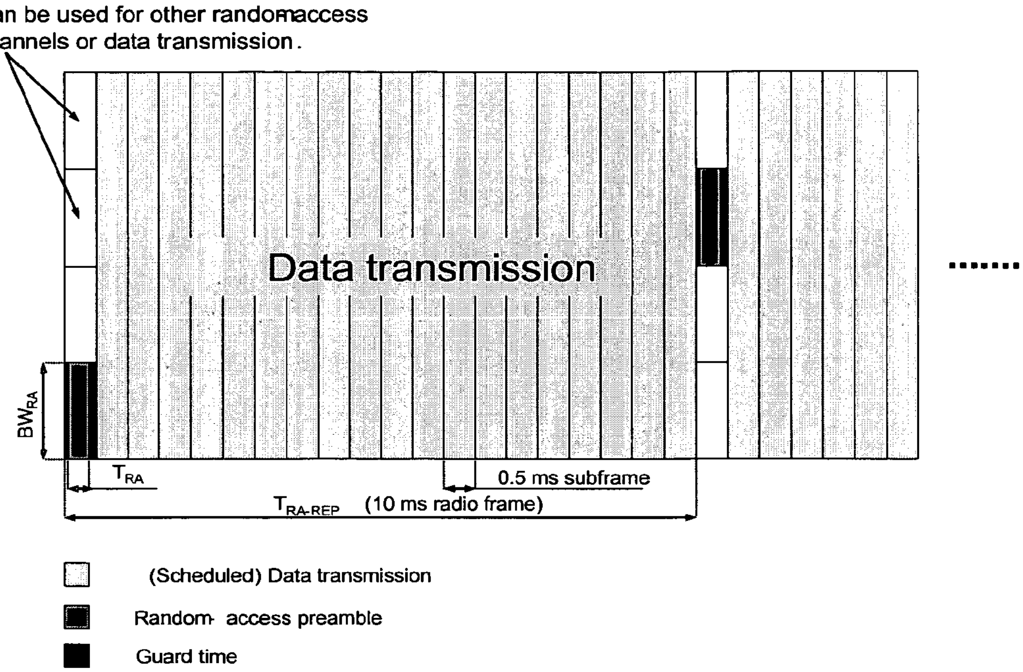


Figure 9.1.2.1.1.1-1 TDM/FDM option example using 1 sub-frame and preamble-only transmission in the random access burst

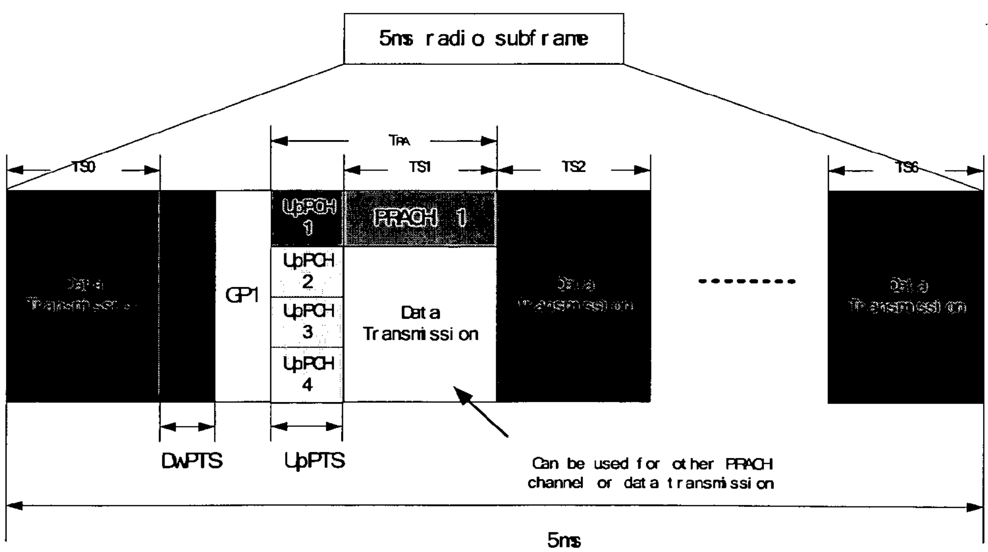


Figure 9.1.2.1.1.1-2 TDM/FDM option example for coexisting LCR-based frame structure (TDD mode) for optimum coverage scenario and preamble-only transmission in the UpPCH channel

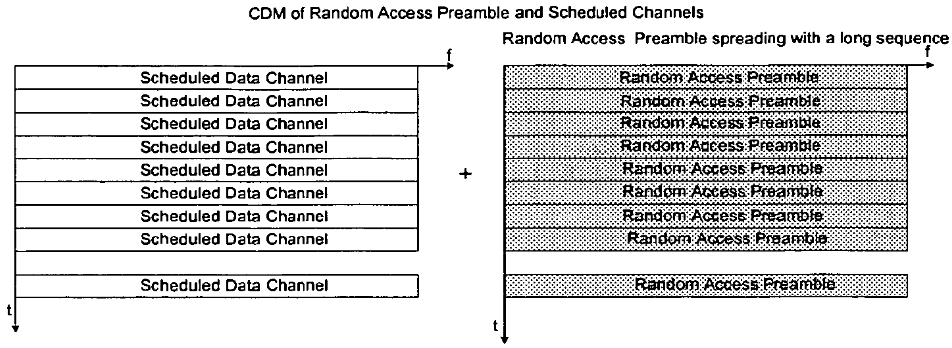


Figure 9.1.2.1.1.1-3 Example of CDM of Scheduled Channels and random access preamble

9.1.2.1.1.2 Preamble and message payload

The non-synchronized random access preamble is used for time alignment, signature detection etc. The message payload comprises any additional associated signaling information. It is FFS whether the message payload can be transmitted in the random access burst along with the preamble as shown in Figure 9.1.2.1.1.2-1, or on the shared data channel upon preamble detection and UL resource allocation by the Node B.

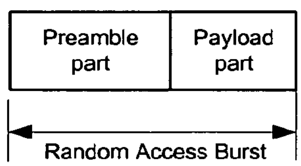


Figure 9.1.2.1.1.2-1 Example of random access burst

9.1.2.1.1.3 Non-synchronized random access procedure

Prior to attempting a non-synchronized random access, the UE shall synchronize to the downlink transmission.

Two possibilities for the random access procedure are considered:

- Approach#1: Figure 9.1.2.1.1.3-1 outlines this approach, where the Node B responds to the non-synchronized random access attempt with timing information to adjust the uplink transmission timing and an assignment of uplink resources to be used for transmission of data or control signalling (possibly including any message payload (e.g. UE ID) not included in the preamble) using the shared data channel. It may be noted that the timing information can also be combined with the uplink data resource allocation. Furthermore, the uplink data resource allocation may be implicitly indicated by associating a reserved time frequency region with a preamble sequence.
- Approach#2: Figure 9.1.2.1.1.3-2 outlines this approach, where the Node B responds to the non-synchronized random access attempt preamble with timing information and resource allocation for transmission of scheduling request (and possibly any additional control signalling or data). UE then sends the scheduling request at the assigned time-frequency resource using the shared data channel or physical random access channel (for co-existing LCR-TDD based frame structure). The Node B adjusts the resource allocation according to the scheduling request from the UE.

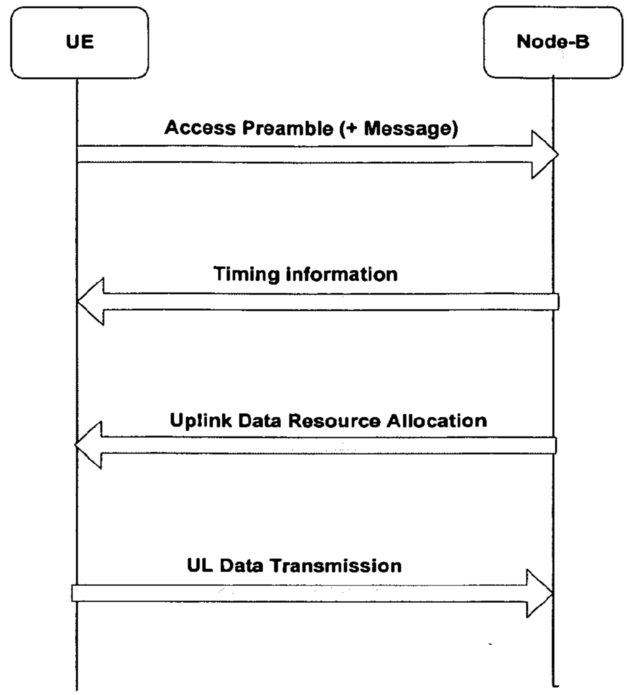


Figure 9.1.2.1.1.3-1. Approach#1, Non-Synchronized Access

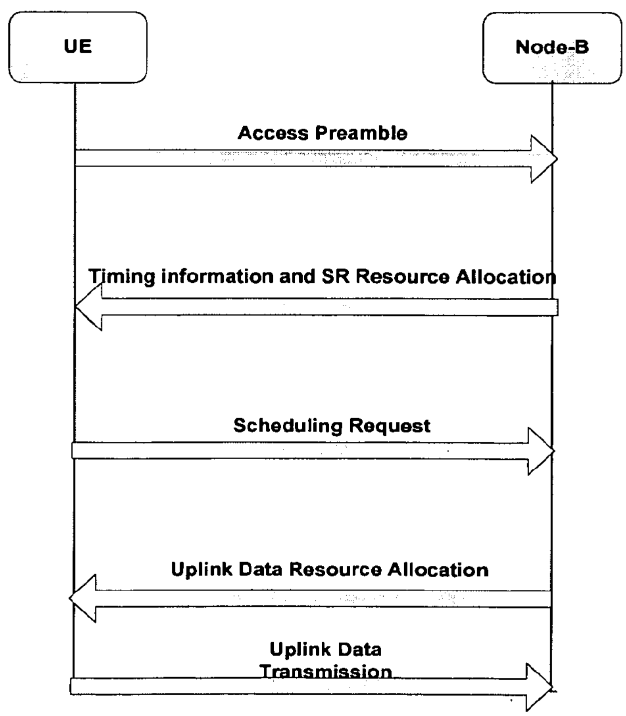


Figure 9.1.2.1.1.3-2 Approach#2, Non-Synchronized Access

9.1.2.1.1.4 Power control for non-synchronized random access

The power control scheme shall be designed assuming no intra-cell interference from data transmissions (i.e., TDM/FDM operation).

Open loop power control is used to determine the initial transmit power level. It is possible to vary the random access burst transmit power between successive bursts using:

a) Power ramping with configurable step size including zero step size for both FDD and TDD case

b) Per-burst open loop power determination for TDD case only

9.1.2.1.2 Synchronized random access:

The synchronized random access procedure may be used when the UE uplink is time synchronized by the Node B. The purpose is for the UE to request resources for uplink data transmission. One of the objectives of the synchronized random access procedure is to reduce the overall latency.

9.1.2.1.2.1 Time Frequency Structure

Synchronized random access and data transmission are also time and/or frequency multiplexed. An example of synchronized random access (applicable for FDD, TDD and co-existing LCR TDD) is shown in Figure 9.1.2.1.2.1-1. It may be noted that the number of long blocks (LB) shown in the figure is for illustration only. The minimum bandwidth, BW_{RA}, allocated for synchronized random access transmission is equal to the bandwidth of the uplink resource allocation unit (e.g. 375 KHz). Also, the random access transmission can use a larger bandwidth, or multiple random access channels using the minimum bandwidth can be defined. Multiple random access channels might be useful for selecting a best block using frequency selective channel characteristics (TDD mode). The length of the synchronized random access burst can be adjusted (e.g. on a cell basis depending on the cell size) to optimize the overhead/latency versus coverage trade-off.. It is FFS on how this adjustment is made (e.g. static, semi-static, dynamic). Synchronized random access can be done every x sub-frames (e.g. x=2).

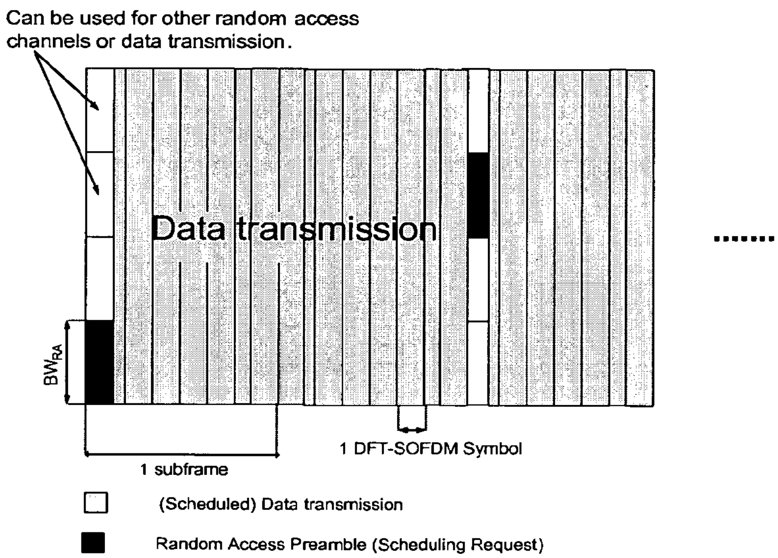


Figure 9.1.2.1.2.1-1 Example of Synchronized Random Access

9.1.2.1.2.2 Synchronized Random Access Procedure

For synchronized random access, Figure 9.1.2.1.1.3-1 and 9.1.2.1.1.3-2 also apply, except the timing information may not be transmitted.

9.1.2.1.2.3 Preamble Design Principle

The preamble sequences shall be designed assuming no intra-cell interference from data transmissions (i.e., TDM/FDM operation).

The random access channel sequence(s) (e.g. based on CAZAC/GCL) used to generate the transmitted random access preamble waveforms should have the following properties:

1. Good detection probability while maintaining low false alarm rate e.g. by maximizing post-decoder $E_s/(N_t+N_e)$ for a occupied random access channel preamble where N_e is the residual interference due to other random access channel transmissions in a given random access channel and N_t is thermal noise.
2. Number of random access channel preamble waveforms should be defined to handle the maximum expected multiple access scenarios (traffic load) while guaranteeing low collision probability.
3. Enable accurate timing estimation (e.g. good autocorrelation properties and sufficient occupied BW).
4. Low power de-rating (low CM/PAPR).

9.1.2.2 Scheduling

The uplink should allow for both scheduled (Node B controlled) access and contention-based access.

In case of scheduled access the UE is dynamically allocated a certain frequency resource for a certain time (i.e. a time/frequency resource) for uplink data transmission. Downlink control signaling informs UE(s) what resources and respective transmission formats have been allocated. The decision of which user transmissions to multiplex within a given sub-frame may for example be based on

- QoS parameters and measurements,
- payloads buffered in the UE ready for transmission,
- pending retransmissions,
- uplink channel quality measurements
- UE capabilities,
- UE sleep cycles and measurement gaps/periods,
- system parameters such as bandwidth and interference level/patterns,
- etc.

Methods to reduce the control signaling overhead, e.g., pre-configuring the scheduling instants (persistent scheduling) and grouping for conversational services, should be considered. Transmission of the reference signals to facilitate the uplink channel quality measurements should be investigated. In addition it should be determined if grouping can more efficiently use time frequency resources resulting in higher capacity.

However, some time/frequency resources can be allocated for contention-based access. Within these time/frequency resources, UEs can transmit without first being scheduled. As a minimum, contention-based access should be used for random-access and for request-to-be-scheduled signaling

In unpaired spectrum, system capacity may be improved through the use of localised FDMA contention-based access channels. The UE may select the access channel based upon knowledge of the channel state information measured on a recent downlink sub-frame

9.1.2.3 Link adaptation

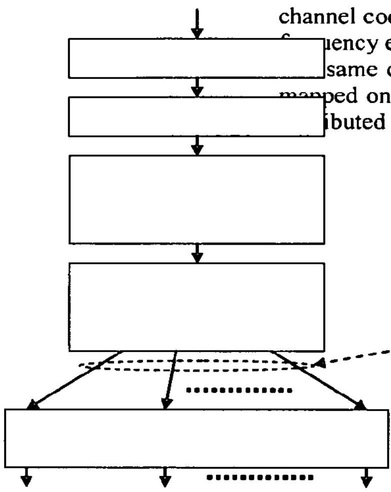
Uplink link adaptation is used in order to guarantee the required minimum transmission performance of each UE such as the user data rate, packet error rate, and latency, while maximizing the system throughput.

For this purpose, uplink link adaptation should effectively utilize a combination of the adaptive transmission bandwidth accompanied with channel-dependent scheduling, transmission power control, and the adaptive modulation and channel coding rate.

Three types of link adaptation are performed according to the channel conditions, the UE capability such as the maximum transmission power and maximum transmission bandwidth etc., and the required QoS such as the data rate, latency, and packet error rate etc. In particular, the three schemes are controlled by channel variation as link adaptation. The basic features of the three link adaptation methods are as follows.

- Adaptive transmission bandwidth
  - The transmission bandwidth of each UE is determined at least based on the averaged channel conditions, i.e., path loss and shadowing variation, in addition to the UE capability and required data rate. Furthermore, the adaptive transmission bandwidth based on fast frequency selective fading accompanied with frequency-domain channel-dependent scheduling should be investigated during the Study Item phase.
- Transmission power control
  - Transmission power control guarantees the required packet error rate and bit error rate regardless of the channel conditions.
  - The target of the received SINR can be different for different UEs in order to increase the system throughput by reducing the inter-cell interference. Thus, the target of the received SINR for the UE at the cell boundary can be smaller than that for the UE in the cell vicinity. The target for the received SINR should also be controlled considering fairness among UEs.

- Adaptive modulation and channel coding rate
  - The adaptive modulation and channel coding rate increases the achievable data rate (frequency efficiency) according to the channel conditions.
  - After the transmission bandwidth and transmission power are determined, the adaptive modulation and channel coding rate control selects the appropriate modulation and channel coding rate that maximizes the frequency efficiency while satisfying the required QoS such as the packet error rate and latency.
  - The same coding and modulation is applied to all resource units assigned to which the same L2 PDU is mapped on the shared data channel scheduled for a user within a TTI. This applies to both localized and distributed transmission. The overall coding and modulation is illustrated in Figure 9.1.2.3-1.



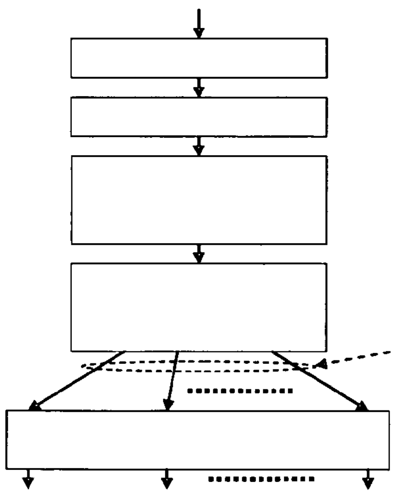


Figure 9.1.2.3-1 – Resource unit-common adaptive modulation and resource unit-common channel coding rate (for both localized and distributed transmission).

The control update interval for each of the three link adaptation methods should be jointly investigated from the viewpoint of the achievable performance such as the throughput, packet error rate, and latency as well as the required signaling overhead.

If the uplink HARQ operation is synchronous in time, two different kinds of link adaptation techniques may be considered:

- The associated UL assignment is sent by the Node-B for the first transmission and all subsequent retransmissions
  - The Node-B has the flexibility to change the modulation order, the set of coded rate-matched bits and resource unit allocation in an adaptive manner
  - For the retransmissions, the Node-B only needs to signal the transmission attributes which are adapted on a non-predetermined basis
- The associated UL assignment is sent by the Node-B only for the first transmission
  - The number of allocated resource units is fixed.
  - The sequence of resource unit mapping, modulation order and set of coded rate-matched bits for each retransmission is pre-determined and known to the Node-B and UE.

The impact of such schemes on link and system performance needs to be evaluated further.

9.1.2.4 Power control

For the uplink, transmission power control, being able to compensate for at least path loss and shadowing should be supported. The benefits and possible means for compensating also for fast (multi-path) fading should be investigated during the Study Item phase.

9.1.2.4.1 Slow Power Control

By performing the slow power control scheme on each UE uplink transmission power, the average inter-cell interference level received at the Node-B is effectively reduced.

The slow power control may be implemented in each Node-B by sending slow updating power control signaling. Alternatively, each UE can derive its own transmission power according to the path loss measurement from downlink pilot.

To achieve good trade-off of the cell-edge performance and the overall spectral efficiency, slow power control scheme that compensates a fraction of the path loss and shadowing should be considered.

9.1.2.4.2 Power Control based upon neighbour cell load

Power control of uplink transmissions may be used to control the degree of inter-cell interference generated by a UE into its neighbouring cells. It should be considered whether these mechanisms require the UE to receive and decode information from neighbour cells (e.g. load indication) and the impacts of this should be investigated.

9.1.2.5 HARQ

Uplink HARQ should be based on Incremental Redundancy. Note that Chase Combining is a special case of Incremental Redundancy and is thus implicitly supported as well.

The N-channel Stop-and-Wait protocol is used for uplink HARQ.

HARQ can be classified as being synchronous or asynchronous:

- Synchronous HARQ implies that (re)transmissions for a certain HARQ process are restricted to occur at known time instants. No explicit signaling of the HARQ process number is required as the process number can be derived from, e.g., the subframe number.
- Asynchronous HARQ implies that (re)transmission for a certain HARQ process may occur at any time. Explicit signaling of the HARQ process number is therefore required.

In principle, synchronous operation with an arbitrary number of simultaneous active processes at a time instant could be envisioned. In this case, additional signaling may be required. Asynchronous operation already supports an arbitrary number of simultaneous active processes at a time instant. Furthermore, note that, in a synchronous scheme, the transmitter may choose not to utilize all possible retransmission instants, e.g., to support pre-emption. This may require additional signaling.

The various forms of HARQ schemes are further classified as adaptive or non-adaptive in terms of transmission attributes, e.g., the Resource unit (RU) allocation, Modulation and transport block size, and duration of the retransmission. Control channel requirements are described for each case.

- Adaptive implies the transmitter may change some or all of the transmission attributes used in each retransmission as compared to the initial transmissions (e.g. due to changes in the radio conditions). Hence, the associated control information needs to be transmitted with the retransmission. The changes considered are:
    - Modulation
    - Resource Unit allocation
    - Duration of transmission
- Non-Adaptive implies that changes, if any, in the transmission attributes for the retransmissions, are known to both the transmitter and receiver at the time of the initial transmission. Hence, the associated control information need not be transmitted for the retransmission.

With those definitions, the HS-DSCH in WCDMA uses an adaptive, asynchronous HARQ scheme, while E-DCH in WCDMA uses a synchronous, non-adaptive HARQ scheme.

The capability of adaptively being able to change the packet format (i.e., adaptive IR) and the transmission timing (i.e., asynchronous IR) yields an adaptive, asynchronous IR based HARQ operation. Such a scheme has the potential of optimally allocating the retransmission resources in a time varying channel. For each HARQ retransmission, control information about the packet format needs to be transmitted together with the data sub-packet.

Synchronous HARQ transmission entails operating the system on the basis of a predefined sequence of retransmission packet format and timing.

The benefits of synchronous HARQ operation when compared to asynchronous HARQ operation are:

- Reduction of control signalling overhead. from not signalling HARQ channel process number
- Lower operational complexity if non-adaptive operation is chosen
- Possibility to soft combine control signalling information across retransmissions for enhanced decoding performance if non-adaptive operation is chosen.

Therefore, for the purpose of the feasibility study, synchronous HARQ operation is assumed for the SC-FDMA based E-UTRA uplink. The impact of ACK/NAK signalling errors on synchronous HARQ operation needs further study.

Adaptive asynchronous HARQ is for further study.

Depending on the actual L1/L2 requirements, asynchronous HARQ may best address the issues of:

- Scheduling flexibility if fully adaptive operation is selected and if both localized and distributed allocations are selected.
- Support for multiple simultaneous (in the same (set of) subframe(s)) independent HARQ processes
- Flexibility in scheduling of retransmissions

The desirability of particular L1/L2 features will determine the degree of adaptive operation.

9.1.2.6 Uplink timing control

In order to keep time alignment between uplink transmissions from multiple UEs at the receiver side, timing-control commands, commanding UEs to advance or retract the respective transmit timing, can be transmitted on the downlink. Two alternatives for timing control commands can be considered:

- Binary timing-control commands implying forward/backward of the transmit timing a certain step size x μs [x TBD] transmitted with a certain period y μs [y TBD].

- Multi-step timing-control commands being transmitted on the downlink on a per-need basis.

As long as a UE carries out uplink data transmission, this can be used by the receiving cell site to estimate to uplink receive timing and thus as a source for the timing-control commands. When there is no data available for uplink, the UE may carry out regular uplink transmissions (uplink synchronization signals) with a certain period, to continue to enable uplink receive-timing estimation and thus retain uplink time alignment. In this way, the UE can immediately restart uplink-orthogonal data transmission without the need for a timing re-alignment phase.

If the UE does not have uplink data to transmit for a longer period, no uplink transmission should be carried out. In that case, uplink time alignment may be lost and restart of data transmission must then be preceded by an explicit timing-re-alignment phase to restore the uplink time alignment.

9.1.2.7 Inter-cell interference mitigation

The basic approaches to inter-cell interference mitigation for uplink are as follows.

- Co-ordination/avoidance i.e. by fractional re-use of time/frequency resources
- Inter-cell-interference randomization
- Inter-cell-interference cancellation
- Frequency domain spreading

Regarding the Frequency domain spreading, a spreading gain can be obtained either explicitly by spreading modulation symbols over multiple carriers or implicitly by using repetition code in the channel coding.

The slow power control (9.1.2.4.1) and power control based upon neighbour cell load (9.1.2.4.2) can also be seen as a means for uplink inter-cell-interference mitigation.

In addition, the use of beam-forming antenna solutions at the base station is a general method that can also be seen as a means for uplink inter-cell-interference mitigation.

It should be noted that the different approaches could, at least to some extent, complement each other i.e. they are not necessarily mutually exclusive.

9.1.2.7.1 Inter-cell-interference co-ordination/avoidance

The common theme of inter-cell-interference co-ordination/avoidance is to apply restrictions or preferences to the uplink scheduling, coordinated between cells. These restrictions can be in the form of restrictions to what time/frequency resources are available to the scheduler or restrictions on the transmit power that can be applied to certain time/frequency resources. Such restrictions for a terminal in a cell will provide the possibility for the improvement in SIR and cell-edge data-rates/coverage, on the corresponding time/frequency resources in a neighbour cell. Similar to the downlink different assumption can be made regarding UE measurements/reporting needed to support uplink interference co-ordination. In addition to the alternatives valid for the downlink, see Section 7.1.2.6.3, one can also assume that, in support for uplink interference co-ordination, the UE may report its current power level with a reporting rate in the order of once every 50 ms.

Regarding required inter-cell interference co-ordination in support for uplink interference co-ordination, two cases are considered similar to downlink interference co-ordination:

- Static interference co-ordination
  Reconfiguration of the restrictions is done on a time scale corresponding to days. The inter-node communication is very limited (set up of restrictions), basically with a rate of in the order of once per day.
- Semi-static interference co-ordination
  Reconfiguration of the restrictions is done on a time scale corresponding to seconds or longer. Inter-node communication corresponds to information needed to decide on reconfiguration of the scheduler restrictions (examples of communicated information: traffic-distribution within the different cells, uplink interference contribution from cell A to cell B, etc.) as well as the actual reconfiguration decisions. Signaling rate in to order of tens of seconds to minutes.

9.1.2.7.2 Inter-cell-interference randomization

Similar to downlink, inter-cell-interference randomization in uplink aims at randomizing the interfering signal(s) and thus to allow for interference suppression at the Node B in line with the processing gain.

Methods considered for inter-cell-interference randomization includes:

- *User/Cell-specific scrambling*, applying (pseudo) random scrambling after channel coding/interleaving
- *User/Cell-specific interleaving*, also known as *Interleaved Division Multiple Access* (IDMA) (IDMA requires planning of interleaving sequences)
- *User/Cell-specific frequency hopping*.

A third means for randomization is to apply different kinds of frequency hopping.

With regards to inter-cell-interference randomization, user/cell-specific scrambling and user/cell-specific interleaving (IDMA) basically have the same performance.

A pseudo-random method can be used to generate the user/cell-specific interleaver patterns for IDMA. The number of the available patterns (seeds) is determined by the length of interleaver. A Node B can identify the interleaver pattern of the cell by checking its interleaver pattern ID. The seeds can be reused between "far-spaced" cells in a manner similar to that of frequency reuse in a cellular system.

The benefits from the randomization of the inter-cell interference come without any restriction on the Node B scheduler or receiver type. However, these benefits are achievable only if the transmitted waveform characteristics support the means to randomize the inter-cell interference. Therefore, means to randomize the inter-cell interference experienced in the reception of all the UE signals may be supported by the definition of the UL signal characteristics.

9.1.2.7.3 Inter-cell-interference Cancellation

Fundamentally, inter-cell-interference cancellation aims at interference suppression at the NodeB beyond what can be achieved by just exploiting the processing gain.

Two methods can be considered:

- Spatial suppression by means of multiple antennas at the NodeB.
- Interference cancellation based on detection/subtraction of the inter-cell interference. One example is the application of cell-specific interleaving (IDMA) to enable inter-cell-interference cancellation.

The IDMA based inter-cell-interference cancellation scheme would imply the following requirements on the system:

- Band allocation: The overlapped frequency resource in the "cell edge" area should be reused with the same "band allocation" in the serving and interfering cells respectively. And the "interfering UE" and the "interfered UE" should transmit using the same band.
- Synchronization: Inter-NodeB synchronization is required.
- Intra-cell signalling: When IDMA is used, a NodeB naturally has the knowledge of the interleaver pattern used by the UEs in the cell, hence no extra signalling is needed.
- Inter-cell signalling: Interfering UE configurations (e.g. interleaver pattern ID, modulation scheme, FEC scheme and coding rate) should also be signalled to the interfered NodeB. To cancel the inter-sector interference in uplink, the NodeB naturally has the knowledge of interfering UE, hence no extra signalling or operation is needed. To cancel the inter-NodeB interference, the signalling of interfering UE configurations to the NodeB is realized by detecting the control channel of the interfering UE.

9.1.3 Physical layer measurements

9.1.3.1 Node B measurements

9.2 OFDMA (FDD / [TDD])

9.2.1 Basic transmission scheme

The uplink transmission scheme is based on conventional OFDM using a cyclic prefix as described 7.1.1. The basic transmission parameters such as sub-carrier spacing, sub-frame duration and a cyclic-prefix (CP) duration are defined in Table 7.1.1-1 and are equally applicable to uplink. The need for longer CP durations is FFS.

It may be noted that the specified numerology is for evaluation purpose only.

The minimum TTI for uplink transmission is equal to the uplink sub-frame duration. Similar to the downlink, the possibility to concatenate multiple sub-frames into longer uplink TTIs should be considered.

Note that the sub-carrier spacing is constant regardless of the transmission bandwidth. To allow for operation in differently sized spectrum allocations, the transmission bandwidth is instead varied by varying the number of OFDM sub-carriers.

9.2.1.1 Modulation scheme

9.2.1.2 Multiplexing including pilot structure

Two types of pilot symbols should be considered

1.) In band pilots - used for coherent data demodulation, e.g. channel estimation. These pilots are transmitted in the part of the bandwidth used for data transmission.

2.) Out of band pilots – used for advanced frequency dependent scheduling and link adaptation. These pilots span a larger bandwidth than the one used for data transmission.

Note that in band pilots may also be used for frequency dependant scheduling and link adaptation.

In-Band-Pilot (IBP) Assignment

Orthogonal in-band pilot symbol patterns are needed in the following cases:

- If a UE transmits on two antennas (Ant A and Ant B) as in the case of MIMO or Tx diversity
- If multiple UEs share the same time and frequency resource, each of the UEs transmitting on a single antenna it is beneficial that UEs use orthogonal pilot patterns (this is described as virtual MIMO, a specific case of SDMA, see section 9.2.1.3).

Orthogonality of in-band pilot symbol patterns can be achieved in the time and/or frequency domain.

Figure 9.2.1.2-1 shows an example of the IBP locations and overheads in the case channel allocation to a UE in the time domain is done in multiple of 7 symbols (a full sub-frame). The exact pilot locations and overhead are FFS.

Figs-9.2.12-2 (a) – (c)show examples of the IBP location and overheads in the case channel allocation in the time domain to a UE is done in multiple of 6 symbols, meaning that the first symbol in a sub-frame may be used for other purposes (e.g. common control signalling). The exact pilot locations and overhead are FFS. Figs-9.2.12-2 (a) – (c) further exemplify different cases of pilot pattern orthogonality:

- Fig 9.2.1.2-2 (a) exemplifies the case of a single UE transmitting on a single antenna for which no orthogonal pilot is used.
- Fig 9.2.1.2-2 (b) exemplifies the case of a UE transmitting on multiple antennas for which orthogonal pilot patterns are transmitted from the multiple antennas
- Fig 9.2.1.2-2 (c) exemplifies the case of multiple UEs, each of which transmitting on a single antenna, sharing the same time and frequency resource. Each UE transmits one orthogonal pilot pattern (virtual MIMO case)

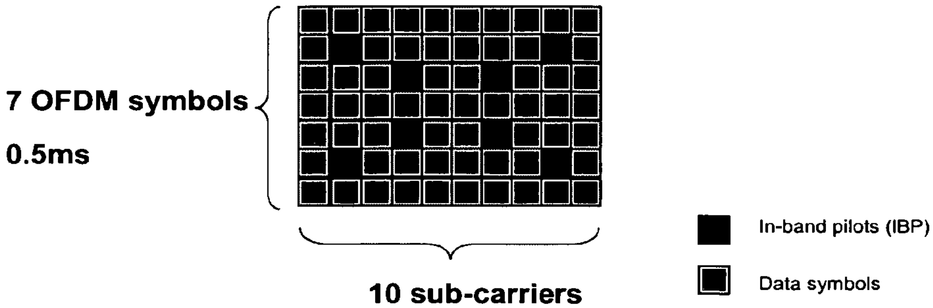


Figure 9.2.1.2-1: Channel allocation in the time domain in multiple of 7 symbols

(Single UE, single antenna transmission case)

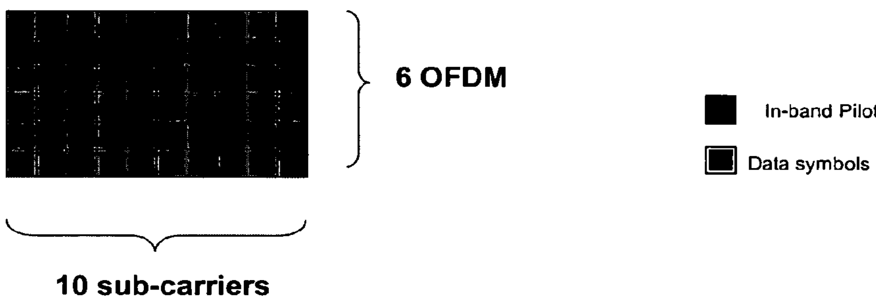


Figure 9.2.1.2-2 (a): Channel allocation in the time domain in multiple of 6 symbols

(Single UE, single antenna transmission case)

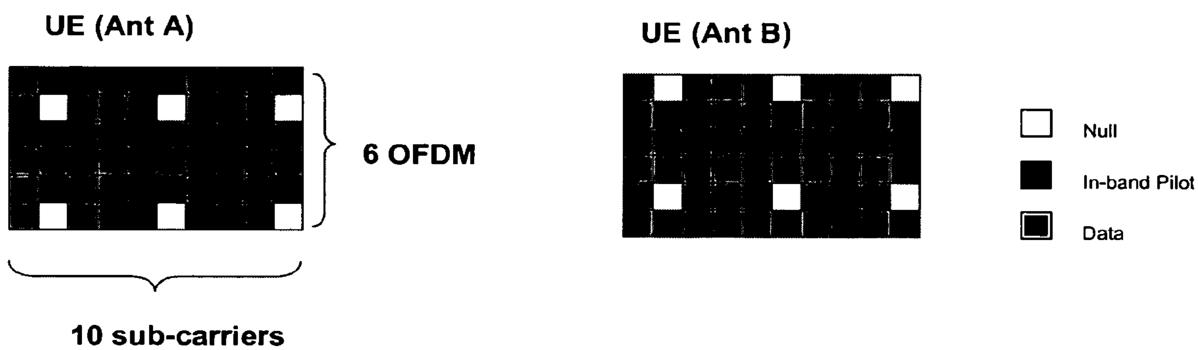


Figure 9.2.1.2-2 (b): Channel allocation in the time domain in multiple of 6 symbols

(Single UE, orthogonal pilot for multiple antenna transmission case)

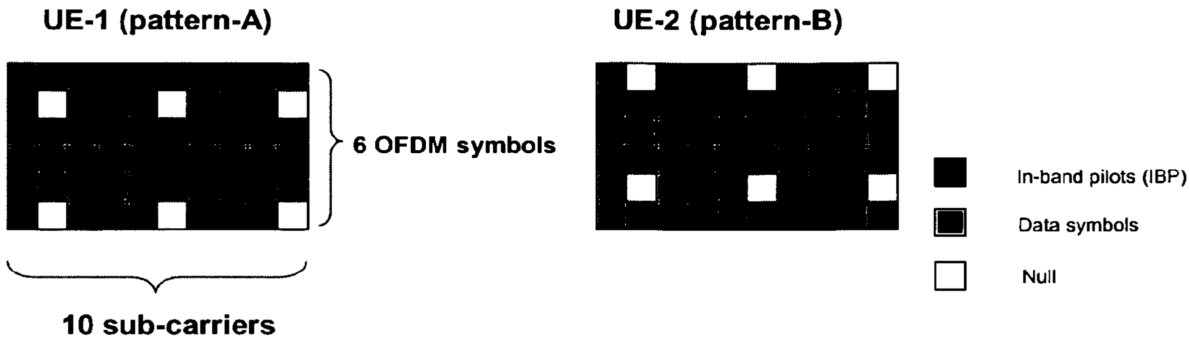


Figure 9.2.1.2-2 (c): Channel allocation in the time domain in multiple of 6 symbols

(Single antenna transmission, orthogonal pilots for virtual MIMO operation)

9.2.1.3 MIMO

The baseline antenna configuration for uplink single-user MIMO is two transmit antennas at the UE and two receive antennas at the Cell site.

The possibility for single-user higher-order uplink MIMO (more than two TX/RX antennas) should be considered.

The possibility for SDMA should also be considered. A specific example of SDMA corresponds to a (2x2) virtual MIMO, where two UEs, each of which transmitting on a single antenna, share the same time and frequency resource allocation. These UEs apply mutually orthogonal pilot patterns in order to simplify Cell site processing (cancellation). Note that from the UE perspective difference between (2x2) virtual MIMO and single antenna transmission is only the use of a pilot pattern allowing for "pairing" with another UE.

9.2.1.4 Peak to Average Power Ratio (PAPR) and its Reduction

OFDMA based UL transmission will lead to higher PAPR than the single carrier transmission schemes, the level of increase being dependent on the number of used sub-carriers and/or presence of out of band pilots for the support of frequency based scheduling. However, several digital processing based PAPR reduction techniques can be employed to mitigate the higher PAPR for the OFDMA UL.

9.2.1.4.1 Tone reservation PAPR reduction method

In Tone Reservation (TR) method [x], both transmitter and receiver agree on reserving a subset of tones $\mathcal{R}$ for generating PAPR reduction signals.

Assuming total of N available tones and K tones are reserved. Let **X** be frequency-domain data signal and $\mathbf{C} = [C_0, C_1, \ldots, C_{K-1}]$ be a code on subset $\mathcal{R}$. The goal of TR method is to find the optimum code value C so that:

$$\min_{\mathbf{c}} \| \mathbf{x} + \mathbf{c} \|_{\infty} = \min_{\mathbf{C}} \| \mathbf{x} + \hat{\mathbf{Q}}\mathbf{C} \|_{\infty} < \| \mathbf{x} \|_{\infty} \qquad (9.2.1\text{-}1)$$

where: **x** is the time-domain signal of **X**,

$\hat{\mathbf{Q}}$ is a NxK sub-matrix of $\mathbf{Q}$,

$\mathbf{Q}$ is the NxN inverse DFT matrix,

and $\|\mathbf{v}\|_{\infty}$ is the ∞ norm of **v**.

In [x], a simple gradient algorithm with fast convergence is proposed. The overall TR iterative algorithm is simply:

$$\mathbf{x}^{i+1} = \mathbf{x}^{i} - \mu \cdot \sum_{|x_n^i|>A} \alpha_n^i \mathbf{p}_n \qquad (9.2.1\text{-}2)$$

where: i is the iteration index;

μ is the updating step size;

n is the index for which sample x_n is greater than the clipping threshold;

$$\alpha_n^i = x_n^i - A \cdot \exp(j \cdot angle(x_n^i)); \qquad (9.2.1\text{-}3)$$

and $\mathbf{p}_n$ is called peak reduction kernel vector. The kernel is a time domain signal that is as close as possible to the ideal impulse at the location where the sample amplitude is greater than the predefined threshold. This way the peak could be cancelled as much as possible without generating secondary peaks. $\mathbf{p}_n$ is derived from original kernel $\mathbf{p}_0$ through right circle shifting (by n-1 samples). The original kernel $\mathbf{p}_0$ can be calculated using 2-norm criteria and is given by the following formula:

$$\mathbf{p}_0 = \frac{\sqrt{N}}{K} \hat{\mathbf{Q}} \mathbf{1}_K \qquad (9.2.1\text{-}4)$$

$\mathbf{1}_K$ is a vector of length K with all one elements.

In a example of the improved tone reservation with reduced complexity all tones except guard band [y] are used to calculate an original kernel. Then, α combined with μ is quantified to form derived reduction kernels. The phase is divided equally into s parts. And the amplitude is divided into t parts represented by some special values according to different FFT size and step length. For example, if FFT size is 1024, the phase is divided equally into six parts represented by $\pm\pi/6, \pm\pi/2, \pm 5\pi/6$ and the amplitude can be chosen among 0.01□0.04□0.08□0.12□0.16. Thus only 30 peak reduction kernels need to be stored.

In order to reduce the computation load, only choose fixed number of peaks to be cancelled in one iteration instead of all the peaks that satisfies $|x_{n_i}| > A$.

The Steps of the improved TR method with reduced complexity is described below:

- <u>*Off line computation:*</u>
    1. Calculate the original kernel vector $\mathbf{p}_0$ based on 2-norm criteria, which is the IFFT of $\mathbf{1}_K$ (all tones except guard band);
    2. Quantify the original kernel to get derived kernels and store them in advance.

- <u>*Online iterations:*</u> The algorithm is based on each input OFDM symbol.
    1. Select the target PAPR value and corresponding threshold A ;
    2. Initially, set $\mathbf{x}^0 = \mathbf{x}$;
    3. Find fixed number of samples (in order)with locations n_i in which $|x_{n_i}| > A$;
    4. If all samples are below the target threshold, transmit $\mathbf{x}^i$. Otherwise, search among the derived kernels (stored in advance) to find matched ones according to Equation 3 and right circle shift them by n_i samples;
    5. Update $\mathbf{x}^i$ according to Equation 2;
    6. Repeat step 3 to step 5 until i reaches maximum iteration limit. Transmit final $\mathbf{x}^i$.

9.2.1.4.2 Circulated clipping and filtering

Clipping is a simple method for PAPR reduction. In order to reduce PAPR meanwhile keep the spectrum characters of the signal, circulated clipping and filtering can be used [1].

Let $x(n)$ stands for transmitted signals without clipping, $y(n)$ stands for signals after clipping, and A is the threshold for clipping which is related to clipping ratio. One of clipping criterions is as the following equation.

$$y(n)=\begin{cases}\frac{A}{\sqrt{|x(n)|^2}}x(n), if\,|x(n)|^2>A^2\\ x(n), if\,|x(n)|^2\le A^2\end{cases} \quad (9.2.1\text{-}5)$$

To suppress out-of-band leakage caused by clipping, filtering has to be added. Since filtering causes re-growth to PAPR, clipping and filtering are repeated in circles for times to depress the PAPR, meanwhile reduce out-of-band leakage to an acceptable degree. The principle of circulated clipping and filtering is given in Figure 9.2.1.4.2-1.

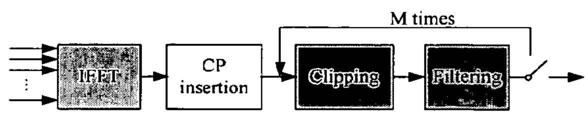


Figure 9.2.1.4.2-1 Circulated clipping and filtering

9.3 MC-WCDMA (FDD)

9.3.1 High level principles

This structure prioritizes spectrum compatibility, that is ability for legacy UE and evolved UTRA UEs to co-exist in the same spectrum allocation. The baseline structure, numerology and procedures should be the same as those defined for UTRA-FDD E-DCH with a 2 ms TTI; in particular:

- Frequency reuse 1
- Node-B scheduling
- Adaptive modulation and coding
- Intra and inter Node-B macro diversity

should be supported. This should be achieved without tight inter-site synchronisation.

The following additions to the baseline multiple access structure should be considered:

- Enhanced MAC/RLC in support of simultaneous reception from multiple carriers (up to 20 MHz).
- Enhanced uplink control structure and procedures in support of HS-DSCH and E-DCH operation with variable symmetric and asymmetric bandwidth allocations.
- Added support for 0.96 and possibly 1.92 Mcps numerology.
- Support for higher order modulation such as 16-QAM.
- Reduced uplink HARQ delay budget.

The system operation should rely on the definition of new E-DPDCH demodulation performance requirements based on the following Node B receiver techniques:

- Pilot and data interference cancellation.
- 2 and 4 antenna receive diversity.

9.3.2 Basic Transmission Scheme

This section goes over the specifics for a MC-WCDMA operation on the UL. Section 7.2.2.2 introduces operation over a 1.25MHz bandwidth by means of a low chip rate version of UTRA FDD (WCDMA LCR in the sequel). WCDMA LCR operation is based on direct sequence spreading over 1.25MHz.

The concepts presented are valid for multi-carrier operation based on the 5MHz system (UTRA FDD) as well as the 1.25MHz system (WCDMA LCR) or a 5MHz/1.25MHz hybrid multi-carrier system.

9.3.2.1 Definitions

Refer to section 7.2.2.1 for definitions relevant for EUTRA operation based on MC-WCDMA multi-carrier operation.

9.3.2.2 Assumptions for MC-WCDMA operation in UL

Only the HSUPA channels are eligible to be configured in a multi-carrier fashion i.e., a given UE will transmit information onto one or more than one carrier.

The timing of the PHY channels for *paired carriers* shall be no different than for a single carrier system where the timing of the UL channels is always referenced to the timing of associated DL channels (see 25.211 for a complete reference).

The timing of the PHY channels for *unpaired carriers* is explicitly covered in this Technical Report.

Multi-Carrier transmission characteristics:

- One cell is the serving E-DCH for all carriers supported by a given UE.
- HARQ PHY re-transmissions on UL takes place at the same carrier as for the first transmission.

Figure 9.3.2.2-1 is a block diagram depicting multi-carrier operation. Each of the colors represents a different UL carrier. Note that the PHY channels in squared brackets are just transmitted if associated downlink carrier is configured.

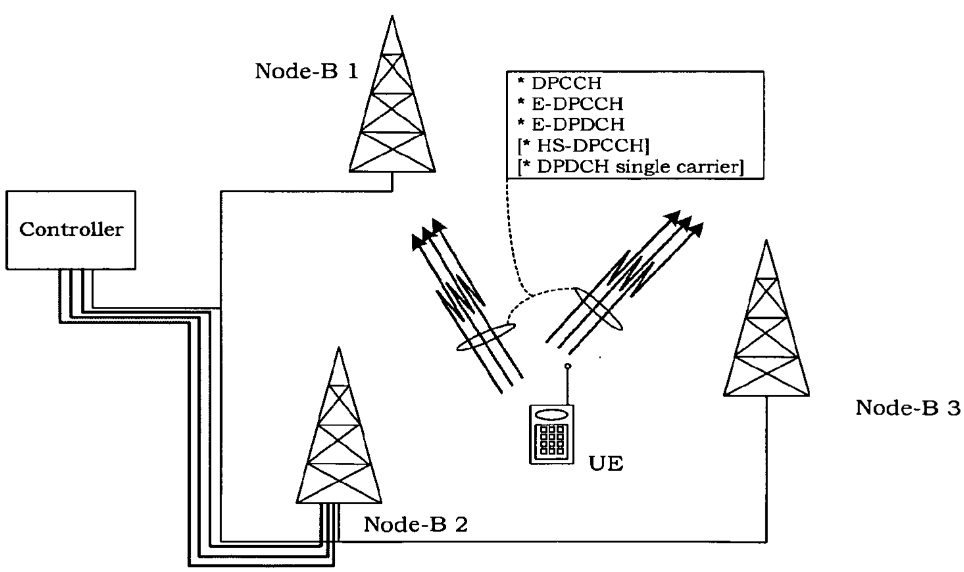


Figure 9.3.2.2-1. Block diagram for multi-carrier operation

9.3.2.3 UL Single-carrier PHY Channels

From the UE viewpoint, the system is accessed by way of the anchor carrier. In turn, the UE shall expect reception of the corresponding AICH (Access Indicator Channel) at the carrier associated with the one used for transmission of the PRACH. For DCH transmission, the UE is expected to use <u>at most</u> one carrier. Multi-carrier transmission is limited to the E-DCH.

9.3.2.4 UL Multi-Carrier PHY Channels

- Table 9.3.2.4-1 shows the data-payload channels:

Table 9.3.2.4-1. Data-payload Multi-carrier UL PHY channels

Channel	Num carriers
E-DPDCH	M

- Table 9.3.2.4-2 shows the control/supporting channels

Table 9.3.2.4-2. Control/supporting Multi-carrier UL PHY channels

Channel	Num required channels	Rationale
DPCCH	M	Phase reference (Pilot bits) for the M uplink carriers and TPC commands for DL power control the M downlink F-DPCHs.
E-DPCCH	M	Just transmitted when associated E-DPDCH channel is active.
HS-DPCCH	N	ACK/NACK and CQI information for the N downlink carriers

9.3.2.4.1 N/M Asymmetry considerations

The following observations can be made for the different N and M relative values.

- **M=N**: All the UL carriers have an associated DL carrier and vice-versa. PHY procedures for this case (i.e., Power Control, synchronization, HS-DSCH and E-DCH related procedures...) are no different than those for the single carrier case.
- **M>N**: Just the N paired carriers will carry the HS-DPCCH and the TPC commands for the N downlink carriers. Therefore, there will be (M-N) uplink DPCCH with no need for DL power control TPC commands.
- **M<N**: There are (N-M) downlink unpaired carriers. Therefore, besides the M paired carriers carrying HS-DPCCHs, the ACK/NACK and CQI information of (N-M) unpaired DL carriers will have to be conveyed from the UE to the E-UTRAN in some way. All the M downlink (F-)DPCHs are power controlled by the paired carriers. The proposed method to convey this additional control information is presented below.

To convey the HSDPA feedback information (i.e., ACK/NAK channel and CQI channel) of the (N-M) unpaired DL carriers is to code division multiplex (N-M) additional HS-DPCCHs within the M uplink carriers.

Doing this code division multiplexing requires the definition of the channelization code to be used by the additional HS-DPCCHs within a carrier. For the single carrier system, 25.213 specifies the SF 256 channelization code and the quadrature phase (depending on the number of DPDCHs configured) to be used by the only HS-DPCCH that may be transmitted at a UE. Therefore, 25.213 would have to further define the channelization code and the quadrature phase to be used by the additional HS-DPCCHs.

The additional HS-DPCCHs themselves would be no different to the HS-DPCCHs of the paired frequencies or the HS-DPCCH of the current single carrier system. The timing of these additional channels would be tied to the associated downlink HS-PDSCH.

As a general rule, in order to limit the impact on peak-to-average of the transmit waveform with an additional code channel, the (N-M) additional HS-DPCCHs would have to be spread across the M uplink carriers as much as possible.

In a similar way as Table 0 in 25.213, the following table summarizes the maximum number of simultaneous uplink dedicated PHY channels configurable at a given carrier.

Table 9.3.2.4.1-1. Maximum number of simultaneous uplink dedicated channels for different M:N carrier asymmetries

M:N Asymmetry	DPCCH	HS-DPCCH	E-DPCCH	E-DPDCH
1:1	1	1	1	4
1:2	1	2	1	3
1:3	1	3	1	2
1:4	1	4	1	1

As seen in Table 9.3.2.4.1-1, the maximum number of code channels allowed within one carrier is no more than the current maximum number of code channels allowed in Table 0 of 25.213.

Observations:

- There is one HS-DPCCH code channel for each HS-DPCCH corresponding to a downlink unpaired carrier.
    - First row in the table above is no different to the no-DPDCH configuration in Table 0 of 25.213.
- Note that the HS-PDSCHs are not power controlled. The TPC bits in the uplink DPCCH power control the downlink (F-)DPCH. Power control of the HS-SCCH and the DL E-channels may be based on the CQI reports by the UE for each of the DL carriers.

9.3.3 Physical Layer Procedures

9.3.3.1 PHY channels timing considerations

As stated before, the timing of PHY channels for symmetric, i.e., $N = M$, multi-carrier configurations is such that each carrier complies with the timing requirements set forth in 25.211.

This section covers the timing specifics for asymmetric, i.e., $N \neq M$ multi-carrier configurations.

In the N>M case, there are (N-M) downlink unpaired carriers. The timing corresponding to the (N-M) additional HS-DPCCHs in the uplink is referenced to the timing of the associated downlink HS-DPCHs and therefore, it is well defined.

In the N<M case, the timing of the PHY channels in the (M-N) unpaired uplink carriers i.e., DPCCH and E-DPCCH timing, is well defined as it is referenced to (M-N) additional (F-)DPCH allocated within the N downlink carriers. Note that for this case, the timing of each of the unpaired UL carriers is referenced to one of the N downlink carriers (the one with the associated (F-)DPCH).

9.3.3.2 Power Control: UL PC

Section 7.2.2.5 covers the DL multi-carrier channels and therefore the (F-)DPCHs carrying the power control commands for the UL.

As indicated in section 7.2.2.5, for each of the possible N/M relative values:

- N=M: each DL carrier has its associated UL carrier and vice-versa. Therefore, the N (F-)DPCH channels will power control the N uplink DPCCHs.
- N>M: there are M necessary (F-)DPCHs that power control the M uplink DPCCHs. Just the paired carriers carry the UL TPC commands over the respective F-DPCH.

- N<M: the (F-)DPCHs in the N paired carriers will power control the uplink DPCCHs in those carriers. In addition, each cell in the UE's active set needs to allocate (M-N) additional (F-)DPCHs within the N downlink carriers to perform power control of the uplink DPCCH of the (M-N) uplink unpaired carriers.

9.3.3.3 Random Access Procedure

There should be no difference in the random access procedure for a multi-carrier system as the initial system access is performed on a single carrier and the addition of carriers is considered to be a dedicated channel establishment or reconfiguration.

9.3.3.4 E-DCH Related Procedures

Transmission of E-DCH related channels is covered in section 7.2.2.5 for the DL (i.e., E-HICH, E-RGCH and E-AGCH) and section 9.3.2.4 for the UL (i.e., E-DPCCH and E-DPDCH).

For each of the possible N/M relative values:

- M=N: each UL carrier has its associated DL carrier and vice-versa. Therefore, the M downlink E-HICH, E-RGCH and optionally E-AGCH will control the corresponding M unlink E-DPCHs.
- M>N: the E-HICH, E-RGCH and optionally E-AGCH in the N paired carriers will control the uplink E-DPCHs in those carriers. In addition, each cell in the UE's active set needs to allocate (M-N) additional E-HICH, E-RGCH and optionally E-AGCH within the N downlink carriers to control the uplink E-DPCH of the (M-N) uplink unpaired carriers. How that additional information is conveyed is subject to different options covered in section 7.2.2.5.
- M<N: the E-HICH, E-RGCH and optionally E-AGCH in the M paired carriers will control the uplink E-DPCHs in those carriers.

9.3.3.4.1 E-DPCH Retransmission on Multi-Carrier system

Operation in the multi-carrier system shall guarantee PHY HARQ retransmissions on the carrier that was used for the first transmission.

9.3.4 Physical layer measurements

9.3.4.1 Node B measurements

The Node B measurements for the MC-WCDMA based proposal are the same as those defined in section 5.2 of 25.215.

9.4 MC-TD-SCDMA (TDD)

9.4.1 Basic transmission scheme

For UL MC TD-SCDMA, a carrier with a wide bandwidth needs to be divided into several narrower sub-carriers and the adjacent sub-carriers do not overlap with each other. Each sub-carrier uses TDMA and CDMA techniques to identify the different users. According to the service's need, the same user can occupy one or several sub-carriers.

For the DL multiple access, the bandwidth of each downlink sub-carrier will be allocated as 1.6 MHz.

9.4.1.1 Modulation scheme

The uplink supports QPSK and 16QAM modulation schemes.

9.4.1.2 Multiplexing including pilot structure

9.4.1.3 Channel Coding and physical channel mapping

Convolution coding and Turbo coding can be considered for MC TD-SCDMA. Each coding scheme has its own characteristic.

9.4.1.4 MIMO and beamforming

The baseline antenna configuration for uplink MIMO is two transmit antennas at the UE, and two receive antennas at the Cell site. The possibility for more receive antennas should also be considered.

The antenna configuration for uplink transmit diversity (beamforming) is one or two transmit antennas at the UE, and the number of receive antennas from four to eight at the Cell site.

9.4.2 Physical channel procedure

9.4.2.1 Random access procedure

9.4.2.2 Scheduling

9.4.2.3 Link adaptation

Using AMC to adjust the modulation and coding rate, adaptive link technologies improve the performance of system.

9.4.2.4 Power control

The open-loop and close-loop power control are supported against deep fading, eliminating near-far effect, and fighting multiple access interference.

9.4.2.5 HARQ

Incremental Redundancy (IR) should be used for uplink HARQ. Note that Chase combining is a special case of IR

9.4.2.6 Uplink timing control

10 Evaluation of techniques for evolved UTRA UL

10.1 Performance evaluation

Note: absolute results shown in the respective sections should not be compared as the set of assumptions used to derive these respective results may differ.

10.1.1 Evaluation against reference

This section provides initial results of different E-UTRA uplink proposals, comparing with the baseline reference case defined in [4]:

- WCDMA Release-6

- 1 Transmit antenna at the UE
- 2 Receive antennas at the Node B
- Rake receiver
- 5 MHz transmission bandwidth

Results are normalized to bit per second per Hertz.

10.1.1.1 MC-WCDMA based evolved UTRA UL

The results presented in Table 10.1.1.1-1 are based on the uplink proposal described in section 9.3 and cases defined in Table A.2.1.1-1 except for the bandwidth which has been set to 5 MHz. The results are based on full buffer traffic models and proportional fair scheduler and compare the reference case and a receiver with successive interference cancellation (SIC); the system operating point is at IOT = 4.5 dB.

Table 10.1.1.1-1: Full buffer, 2Rx

Case	Speed [km/h]	Reference (WCDMA 2 Rx - MF) [b/s/Hz]	(MC-)WCDMA 2 Rx – SIC [b/s/Hz]	% w.r.t reference
1	3	0.33	0.64	+ 94%
2	30	0.32	0.72	+ 125%
3	3	0.32	0.72	+ 125%
4	3	0.32	0.64	+ 100%

10.1.1.2 OFDMA based evolved UTRA UL

The results presented in Table 10.1.1.2-1 are based on uplink proposal described in section 9.2 and cases defined in Table A.2.1.1-1. The results are based on full buffer traffic models and proportional fair scheduler; the system operation point is IOT=4.5 dB.

Table 10.1.1.2-1: Full buffer, 2 Rx

Case	Speed [km/h]	Reference (WCDMA 2 Rx - /MF) [b/s/Hz]	OFDMA 2 Rx Orthogonal [b/s/Hz]	% w.r.t reference
1	3	0.33	0.68	106%
2	30	0.32	0.68	113%
4	3	0.32	0.70	119%

10.1.1.3 Evaluation of SC-FDMA based evolved UTRA UL

The evaluation presented in Table 10.1.1-1 is based on the case 3 defined in Table A.2.1.1-1. The WCDMA reference results that has been obtained with 5 MHz bandwidth (but scaled for fair comparison for bits/Hz/MHz). The results are based on full buffer traffic models and proportional fair scheduler and compare matched filter receiver WCDMA reference case (with E-DCH) and a SC-FDMA receiver with only single user per frequency resource and blind interference coordination at cell level and slow power control. The higher WCDMA reference value is the same as the WCDMA reference simulation result shown in section 10.1.1.1). The reference with lower capacity is based on result in [3GPP TR 25.896.] with higher inter-site distance (2800 M) but no 20 dB penetration loss.

Table 10.1.1.3-1: Full buffer, 10 MHz, 2Rx, Average Capacity

Case	Speed [km/h]	Reference (WCDMA 2 Rx - /MF) [b/s/Hz]	SC-FDMA 2 Rx [b/s/Hz]	% w.r.t reference
3	3	0.26 to 0.32	0.78	+ 143% to 200%

The case in Table 10.1.1.3-2 is the cell edge case (taken from the same simulation run by looking the 5% CDF as in Table 10.1.1.3-1) with the same proportional fair scheduler and interference coordination over the 10 MHz bandwidth. The WCDMA reference gain obtained with 5 MHz bandwidth from [3GPP TR 25.896] with no additional penetration loss but higher inter-site distance and scaled for bits/MHz/cell for comparison (lack of the 20 dB penetration loss with WCDMA will more than compensate the longer inter-site distance in the reference case).

Table 10.1.1.3-2: Full buffer, 10 MHz, 2Rx, 5% CDF Capacity (cell edge)

Case	Speed [km/h]	Reference (WCDMA 2 Rx - /MF) [b/s/Hz]]	SC-FDMA 2 Rx [b/s/Hz]	% w.r.t reference
3	3	0.026	0.087	+ 234%

10.1.2 Evaluation between evolved UTRA UL proposals

The section provides initial results comparing different E-UTRA uplink proposals.

10.1.2.1 Comparison between MC-WCDMA and OFDMA

The comparison presented in Tables 10.1.2.1-1 is based on results provided in section 10.1.1.1 and 10.1.1.2. The results are based on full buffer traffic models and proportional fair scheduler and compare orthogonal OFDMA based system with MC-WCDMA using a successive interference cancellation receiver; both operate at IOT=4.5 dB.

Table 10.1.2.1-1: Full buffer, 2 Rx

Case	Speed [km/h]	MC-WCDMA 2 Rx - SIC [b/s/Hz]	OFDMA 2 Rx Orthogonal [b/s/Hz]	% w.r.t MC-WCDMA 2 Rx - SIC
1	3	0.64	0.68	+ 6%
2	30	0.72	0.68	- 6%
4	3	0.64	0.70	+ 9%

The comparison presented in Table 10.1.2.1-2 assume OFDMA based system operated in non orthogonal manner (i.e. using spatial multiplexing) with MC-WCDMA using a successive interference cancellation receiver; both operate at IOT = 4.5 dB. Note that user separation in case of MC-WCDMA is by means of SIC while user separation in case of (non-orthogonal) MIMO is by means of less complex LMMSE, and can be further improved with SIC.

Table 10.1.2.1-2: Full buffer, 4 Rx

Case	Speed [km/h]	MC-WCDMA 4 Rx - SIC [b/s/Hz]	OFDMA 4 Rx (LMMSE)– Non Orthogonal [b/s/Hz]	% w.r.t MC-WCDMA 4 Rx - SIC
1	3	1.32	1.18	- 11%
2	30	1.48	1.16	- 22%
4	3	1.32	1.18	- 11%

10.1.2.2 Comparison between SC-FDMA and OFDMA

The initial comparison of SC-FDMA vs OFDMA for the uplink is summarized in Table 10.1.2.2-2, where the sector throughput of SC-FDMA and OFDMA are given for different inter-site distances. Full buffers, slow power control with 20 dB SNR target, and round robin scheduling was assumed. Note that results in section 10.1.1.1, 10.1.1.2 and 10.1.1.3 assume proportional fair scheduler.

The remaining simulation assumptions are summarized in Table 10.1.2.2-1.

Table 10.1.2.2-1: Scenarios used in Table 10.1.2.2.-2

Scenario	CF [GHz]	Ploss [dB]	Speed [km/h]	BW [MHz]	Hybrid ARQ	Max PA output power (including back off)
A (case 1, 3)	2	20	3	10	No	24 dBm (SC, QPSK) 23.4 dBm (SC, 16QAM) 21.6 dBm (OFDMA)
B (case 1)					Chase	21 dBm (SC) 19 dBm (OFDMA)

Table 10.1.2.2-2: Sector throughput for SC-FDMA and OFDMA

Scenario	ISD [m]	Average Sector Throughput [b/s/Hz]		SC-FDMA gain vs. OFDMA
		SC-FDMA	OFDMA	
A	500	0.77	0.73	6%
B	750	0.69	0.65	6%
B	1000	0.52	0.48	9%
A	1732	0.46	0.41	10%
A	2800	0.24	0.21	13%

10.1.2.3 Evaluation of Virtual MIMO

The virtual MIMO has been studied for both OFDMA and SC-FDMA, and the results from the more detailed OFDMA studies are presented in Table 10.1.2.3-1 (initial results) is based on case 1 and case 2 defined in Table A.2.1.1-1 except for the channel model PA and VA. The results are based on full buffer traffic models and two virtual MIMO scheduling [3]; random user pairing scheduling (RPS) and orthogonal pairing scheduling (OPS). OFDMA based system operated in orthogonal manner is compared with systems operated in non orthogonal manner (i.e. using spatial multiplexing).

Table 10.1.2.3-1: OFDMA Full buffer, 10 MHz, 2 Rx

Case	Speed [km/h]	OFDMA 2 Rx Orthogonal [b/s/Hz]	Virtual MIMO RPS [b/s/Hz]	Virtual MIMO OPS [b/s/Hz]	% OPS w.r.t OFDMA 2 Rx Orthogonal
1	3	0.64	0.65	0.86	+33%
2	30	0.67	0.68	0.87	+28%

10.2 Analysis of UE complexity

10.3 Analysis of Node B impacts

11 UE capabilities

11.1 UE bandwidth capabilities

11.1.1 Downlink bandwidth capabilities

It is assumed that *all* UEs have a reception-bandwidth capability of at least 10 MHz implying that all UEs can receive all transmission bandwidths specified in Table 7.1.1-1 and 7.1.1-2 up to 10 MHz.

11.1.2 Uplink bandwidth capabilities

It is assumed that *all* UEs have a transmission-bandwidth capability of at least 10 MHz implying that all UEs support all transmission bandwidths specified in Table 9.1.1-1 up to 10 MHz.

11.2 UE antenna capabilities

11.2.1 Receive-antenna capabilities

11.2.2 Transmit-antenna capabilities

ANNEX A: Simulation scenarios

A.1 Link simulation Scenarios

A.1.1 Link simulation assumptions

The link level issues that need to be addressed in order to achieve alignment are given in the following Table. Simulation results should indicate the link to system level mapping methodology used and show supporting link results or give references to such material.

Table A.1.1-1 – Link Level issues for achieving alignment

Issues	Details
DL Modulation	QPSK, 16QAM, 64QAM
UL Modulation	BPSK, QPSK, 8PSK, 16QAM, [64QAM]
Coding for data channel and Mother code rate	Turbo, LDPC
Coding for control channel and Mother code	Turbo, Convolutional, other
DL Peak rates	
UL Peak rates	

Non-ideal receiver functions	Channel estimation,
Available Mappings	MIESM, EESM, ECM, QSA, AVI, etc Account for HARQ, IR, and MIMO

A.1.2 Maximum SNR per channel

For high SNR operation especially with high order modulation or MIMO schemes it will be important to understand practical apparatus impacts and this can be performed by addressing the following topics

Table A.1.2-1 – Maximum SNR limit dependencies

Issues	Details
EVM	
Phase and Doppler self interference	
Adjacent carrier interference	
UE A/D and baseband filtering	
Antenna front-to-back ratio	[20]dB
Non-ideal sector isolation	
Unrecovered power	

A.1.3 Multi-Antenna Link level channel models

For evaluating the performance of different multi-antenna techniques, relevant channel models that capture the spatial properties is important. The SCM [7] and its extension to wider bandwidth SCME provide such models for system level evaluations. Here the corresponding link level models arc described.

4 different scenarios, SCM-A to D, are considered, see Table A.1.3-1, they represent a subset of "typical" antenna configurations and propagations scenarios.

Table A.1.3-1 – Representative cases

Name	Propagation scenario	BS arrangement	MS arrangement
SCM-A	Suburban Macro	3-sector, 0.5λ spacing	Handset, talk position
SCM-B	Urban Macro (low spread)	6-sector, 0.5λ spacing	Handset, data position
SCM-C	Urban Macro (high spread)	3-sector, 4λ spacing	Laptop
SCM-D	Urban Micro	6-sector, 4λ spacing	Laptop

Note that models SCM-C and SCM-D can also be used for evaluating laptops with two receive antennas. In this case, one should select the channel coefficients associated with one of the two dual-polarized antennas.

The multi-antenna channel model is a tapped delay line model with covariance matrices for describing the fast fading correlation and power distribution over transmit and receive antennas.

The total per-tap covariance matrix $\mathbf{R}_{tap}$ is obtained from the Kronecker product of the polarization covariance matrix $\mathbf{\Gamma}$ and the Node B and UE spatial correlation matrices **A** and **B**, further weighted by the antenna gains at Node B and UE:

$$\mathbf{R}_{tap} = p_{tap} \cdot g_{NodeB,tap} \cdot g_{UE,tap} \cdot \mathbf{A} \otimes \mathbf{\Gamma} \otimes \mathbf{B}$$

where p_{tap} is the relative power of the tap, $g_{NodeB,tap}$ is the effective antenna gain at the Node B, $g_{UE,tap}$ is the antenna gain at the UE, $\mathbf{A} = \begin{bmatrix} 1 & \alpha \\ \alpha^* & 1 \end{bmatrix}$ and $\mathbf{B} = \begin{bmatrix} 1 & \beta \\ \beta^* & 1 \end{bmatrix}$. $\otimes$ denotes Kronecker multiplication.

To determine $\mathbf{\Gamma}$ unambiguously, the antenna polarization combination matrix is vectorized as [$P1_{NodeB}P1_{UE}$, $P2_{NodeB}P1_{UE}$, $P1_{NodeB}P2_{UE}$, $P2_{NodeB}P2_{UE}$]. Note that P1 and P2 refer respectively to vertical and horizontal UE polarizations (nominal orientation) and ±45° Node B polarizations.

For the 4 selected scenarios, SCM-A, SCM-B, SCM-C and SCM-D, the effective tap power that includes the effective antenna gains at Node B and UE is tabulated below

Table A.1.3-2 SCM-A (Suburban Macro, 3-sector, 0.5λ spacing, Handset, talk position)

Tap/mid-path	Delay [ns]	Power, P_{tap} [dB]	Node B spatial correlation, α	Polarization covariance matrix, $\mathbf{\Gamma}$ [4x4]			
1/1	0.0	0.00	0.4783 + 0.8722i	0.5953	-0.0858	0	0.2534
1/2	12.5	-2.22		-0.0858	0.5953	0.2534	0
1/3	25.0	-3.98		0	0.2534	0.2976	0.0429
				0.2534	0	0.0429	0.2976
2/1	137.5	-8.50	0.4569 + 0.8836i	0.6174	0.1139	0	0.0745
2/2	150.0	-10.72		0.1139	0.6174	0.0745	0
2/3	162.5	-12.48		0	0.0745	0.3087	-0.0570
				0.0745	0	-0.0570	0.3087
3/1	62.5	-7.28	0.8407 + 0.5308i	0.6550	0.0172	0	0.1887
3/2	75.0	-9.50		0.0172	0.6550	0.1887	0
3/3	87.5	-11.26		0	0.1887	0.3275	-0.0086
				0.1887	0	-0.0086	0.3275
4/1	400.0	-8.45	0.8935 + 0.4359i	0.7153	-0.1054	0	0.1798
4/2	412.5	-10.67		-0.1054	0.7153	0.1798	0
4/3	425.0	-12.43		0	0.1798	0.3576	0.0527
				0.1798	0	0.0527	0.3576
5/1	1387.5	-14.65	0.9444 + 0.3103i	0.8460	-0.0531	0	0.0973
5/2	1400.0	-16.86		-0.0531	0.8460	0.0973	0
5/3	1412.5	-18.63		0	0.0973	0.4230	0.0265
				0.0973	0	0.0265	0.4230
6/1	2825.0	-26.43	0.9783 + 0.1763i	1	0	0	0
6/2	2837.5	-28.64		0	1	0	0
6/3	2850.0	-30.41		0	0	0.5	0
				0	0	0	0.5

Total per-tap covariance matrix: $\mathbf{R} = 10^{P_{tap}/10} \cdot \begin{bmatrix} 1 & \alpha^* \\ \alpha & 1 \end{bmatrix} \otimes \mathbf{\Gamma}$ where the symbol $\otimes$ denotes the Kronecker product.

Table A.1.3-3 SCM-B (Urban Macro (low spread), 6-sector, 0.5λ spacing, Handset, data position)

Tap/mid-path	Delay [ns]	Power, P_{tap} [dB]	Node B spatial correlation, α	Polarization covariance matrix, $\mathbf{\Gamma}$ [4x4]

1/1	0		0.4902 + 0.8656i	0.5953	0.1936	0	0.1831
1/2	12.5	0.00		0.1936	0.5953	0.1831	0
1/3	25.0	-2.22		0	0.1831	0.2976	-0.0968
		-3.98		0.1831	0	-0.0968	0.2976
2/1	362.5	-	0.5521 + 0.8274i	0.6134	0.2430	0	0.1106
2/2	375.0	1.17		0.2430	0.6134	0.1106	0
2/3	387.5	-3.39		0	0.1106	0.3067	-0.1215
		-5.15		0.1106	0	-0.1215	0.3067
3/1	250.0	-2.65	0.5902 + 0.8006i	0.6090	0.1197	0	0.2282
3/2	262.5	-4.86		0.1197	0.6090	0.2282	0
3/3	275.0	-6.62		0	0.2282	0.3045	-0.0598
				0.2282	0	-0.0598	0.3045
4/1	1037.5	-13.57	-0.2706 + 0.9587i	0.6430	0.2501	0	0.0514
4/2	1050.0	-15.79		0.2501	0.6430	0.0514	0
4/3	1062.5	-17.55		0	0.0514	0.3215	-0.1250
				0.0514	0	-0.1250	0.3215
5/1	2725.0	-22.40	-0.4100 + 0.9082i	0.6935	0.0778	0	-0.1912
5/2	2737.5	-24.62		0.0778	0.6935	-0.1912	0
5/3	2750.0	-26.38		0	-0.1912	0.3468	-0.0389
				-0.1912	0	-0.0389	0.3468
6/1	4600.0	-28.05	-0.5814 + 0.8099i	0.7535	0.1275	0	-0.1025
6/2	4612.5	-30.26		0.1275	0.7535	-0.1025	0
6/3	4625.0	-32.03		0	-0.1025	0.3768	-0.0638
				-0.1025	0	-0.0638	0.3768

Total per-tap covariance matrix: $\mathbf{R} = 10^{P_{tap}/10} \cdot \begin{bmatrix} 1 & \alpha^{*} \\ \alpha & 1 \end{bmatrix} \otimes \mathbf{\Gamma}$ where the symbol $\otimes$ denotes the Kronecker product

Table A.1.3-4 SCM-C (Urban Macro (high spread), 3-sector, 4λ spacing, Laptop)

Tap/mid-path	Delay [ns]	Power, P_{tap} [dB]	Node B spatial correlation α UE spatial correlation β	Polarization covariance matrix, Γ [4x4]			
1/1	0		-0.4616 + 0.5439i	0.5953	0.4047	0	0
1/2	12.5	0.00	0.0225 - 0.0595i	0.4047	0.5953	0	0
1/3	25.0	-2.22		0	0	0.5953	-0.4047
		-3.98		0	0	-0.4047	0.5953
2/1	362.5	-1.86	0.2806 + 0.6476i	0.6134	0.3866	0	0
2/2	375.0	-4.08	0.0088 + 0.0602i	0.3866	0.6134	0	0
2/3	387.5	-5.84		0	0	0.6134	-0.3866
				0	0	-0.3866	0.6134
3/1	250.0	-1.08	-0.1136 - 0.6818i	0.6090	0.3910	0	0
3/2	262.5	-3.30	0.0307 + 0.0555i	0.3910	0.6090	0	0
3/3	275.0	-5.06		0	0	0.6090	-0.3910
				0	0	-0.3910	0.6090
4/1	1037.5	-9.08	0.6944 + 0.5043i	0.6430	0.3570	0	0
4/2	1050.0	-11.30	-0.0244 - 0.0028i	0.3570	0.6430	0	0
4/3	1062.5	-13.06		0	0	0.6430	-0.3570
				0	0	-0.3570	0.6430
5/1	2725.0	-15.14	0.4072 + 0.5626i	0.6935	0.3065	0	0
5/2	2737.5	-17.36	0.0828 - 0.2378i	0.3065	0.6935	0	0
5/3	2750.0	-19.12		0	0	0.6935	-0.3065
				0	0	-0.3065	0.6935
6/1	4600.0	-20.64	-0.7753 + 0.1776i	0.7535	0.2465	0	0
6/2	4612.5	-22.85	0.4194 - 0.2429i	0.2465	0.7535	0	0

6/3	4625.0	-24.62		0	0	0.7535	-0.2465
				0	0	-0.2465	0.7535

1.

Total per-tap covariance matrix: $\mathbf{R} = 10^{P_{tap}/10} \cdot \begin{bmatrix} 1 & \alpha^* \\ \alpha & 1 \end{bmatrix} \otimes \mathbf{\Gamma} \otimes \begin{bmatrix} 1 & \beta^* \\ \beta & 1 \end{bmatrix}$ where the symbol $\otimes$ denotes the Kronecker product.

Table A.1.3-5 SCM-D (Urban Micro, 6-sector, 4λ spacing, Laptop)

Tap/mid-path	Delay [ns]	Power, P_{tap} [dB]	Node B spatial correlation α UE spatial correlation β	Polarization covariance matrix, Γ [4x4]			
1/1	0.0		-0.0907 + 0.1632i	0.5792	0.4208	0	0
1/2	12.5	0.00	0.0225 - 0.0595i	0.4208	0.5792	0	0
1/3	25.0	-2.22		0	0	0.5792	-0.4208
		-3.98		0	0	-0.4208	0.5792
2/1	287.5	-3.57	0.0301 - 0.1586i	0.5792	0.4208	0	0
2/2	300.0	-5.79	0.0061 - 0.0051i	0.4208	0.5792	0	0
2/3	312.5	-7.55		0	0	0.5792	-0.4208
				0	0	-0.4208	0.5792
3/1	200.0	-29.05	-0.5144 - 0.3812i	0.5792	0.4208	0	0
3/2	212.5	-31.27	0.0297 - 0.0078i	0.4208	0.5792	0	0
3/3	225.0	-33.03		0	0	0.5792	-0.4208
				0	0	-0.4208	0.5792
4/1	662.5	-20.94	0.1275 + 0.0979i	0.5792	0.4208	0	0
4/2	675.0	-23.15	-0.0244 + 0.0029i	0.4208	0.5792	0	0
4/3	687.5	-24.91		0	0	0.5792	-0.4208
				0	0	-0.4208	0.5792
5/1	812.5	-5.28	-0.0943 + 0.1609i	0.5792	0.4208	0	0
5/2	825.0	-7.50	-0.0010 - 0.0061i	0.4208	0.5792	0	0
5/3	837.5	-9.26		0	0	0.5792	-0.4208
				0	0	-0.4208	0.5792
6/1	925.0	-26.96	0.0505 + 0.2761i	0.5792	0.4208	0	0
6/2	937.5	-29.18	0.0080 - 0.0600i	0.4208	0.5792	0	0
6/3	950.0	-30.94		0	0	0.5792	-0.4208
				0	0	-0.4208	0.5792

Total per-tap covariance matrix: $\mathbf{R} = 10^{P_{tap}/10} \cdot \begin{bmatrix} 1 & \alpha^* \\ \alpha & 1 \end{bmatrix} \otimes \mathbf{\Gamma} \otimes \begin{bmatrix} 1 & \beta^* \\ \beta & 1 \end{bmatrix}$ where the symbol $\otimes$ denotes the Kronecker product.

A.2 System simulation scenario

A.2.1 System simulation assumptions

To facilitate evaluation of EUTRA and HSDPA/HSUPA (UTRA) the simulation assumptions are largely based on assumptions given in the previous HSDPA[2[2] and HSUPA [3[3] study items and reflect requirements in 25.913 [4[4]. Assumptions for reference system deployment and reference UE and Node-Bs along with channel and traffic models are given in the following sections. Scheduling and resource allocation as well as system and user performance metric assumptions are also included.

A.2.1.1 Reference system deployments

A.2.1.1.1 Cell dimensions

A Macro-cell reference system deployment type is considered sufficient to characterize UTRA and EUTRA performance. The system simulation baseline parameters for the Macro-cell deployment model are given in Table A.2.1.1-3. The minimum set of simulation cases using assumptions in Table A.2.1.1-3 are given in Table A.2.1.1-1 along with additional assumptions related to carrier frequency (CF), Inter-site distance (ISD), operating bandwidth (BW), penetration loss (PLoss) and UE speed. Note that 100% of the users for a given simulation case are assigned the same 'PLoss' and speed.

The system simulation parameters for the micro cell scenario used for initial MIMO system level simulations are given in Table A.2.1.1-4. The minimum set of micro cell simulation cases are given in Table A.2.1.1-2.

Table A.2.1.1-1 – UTRA and EUTRA simulation case minimum set

Simulation	CF	ISD	BW	PLoss	Speed
Cases	(GHz)	(meters)	(MHz)	(dB)	(km/h)
1	2.0	500	10	20	3
2	2.0	500	10	10	30
3	2.0	1732	10	20	3
4	0.9	1000	1.25	10	3

Other scenarios may, and higher velocities (e.g. 120km/h) shall be also verified.

Table A.2.1.1-2 EUTRA micro-cell simulation cases for MIMO

Simulation	CF	ISD	BW	PLoss	Speed
Cases	(GHz)	(meters)	(MHz)	(dB)	(km/h)
Outdoor-to-outdoor	2.0	130	10	Na	3/30
Outdoor-to-indoor	2.0	130	10	Na*	3

* Penetration loss is included in the distance dependent pathloss model

Table A.2.1.1-3 – Macro-cell system simulation baseline parameters

Parameter		Assumption
Cellular Layout		Hexagonal grid, 19 cell sites, 3 sectors per site
Inter-site distance		See Table A.2.1.1-1
Distance-dependent path loss		$L=I + 37.6\log_{10}(.R)$, R in kilometers I=128.1 – 2GHz, I=120.9 - 900MHz [5~~[5~~]
Lognormal Shadowing		Similar to UMTS 30.03, B 1.4.1.4 [6~~[6~~]
Shadowing standard deviation		8 dB
Correlation distance of Shadowing		50 m (See D,4 in UMTS 30.03)
Shadowing correlation	Between cells	0.5
	Between sectors	1.0
Penetration Loss		See Table A2.1.1-1[11~~[11~~][15~~[15~~]

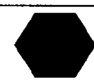
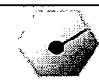
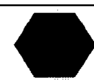
Antenna pattern [4] (horizontal) (For 3-sector cell sites with fixed antenna patterns)	$A(\theta) = -\min\left[12\left(\frac{\theta}{\theta_{3dB}}\right)^2, A_m\right]$ θ_{3dB} = 70 degrees, A_m = 20 dB
Carrier Frequency / Bandwidth	See Table A.2.1.1-1
Channel model	Typical Urban (TU) early simulations Spatial Channel Model (SCM) later simulations
UE speeds of interest	3km/h, 30km/h, 120km/h, 350km/h
Total BS TX power (Ptotal)	43dBm – 1.25, 5MHz carrier, 46dBm - 10MHz carrier
UE power class	21dBm (125mW). 24dBm (250mW)
Inter-cell Interference Modelling	UL: Explicit modelling (all cells occupied by UEs), DL: Explicit modelling else cell power = Ptotal
Antenna Bore-sight points toward flat side of cell (for 3-sector sites with fixed antenna patterns)	
Users dropped uniformly in entire cell	
Minimum distance between UE and cell	>= 35 meters [7[7]

Table A.2.1.1-4 Micro-cell system simulation parameters for initial or early MIMO simulation results

Parameter		Assumption	
		Outdoor to indoor	Out-door to outdoor
Cellular Layout		Hexagonal grid, 19 cell sites, 1 sectors per site	
Inter-site distance		See A.2.1.1-2	
Distance-dependent path loss		$L[dB] = 7 + 56\log_{10}(d[m])$	$L[dB] = \begin{cases} 39 + 20\log_{10}(d[m]) & 10m < d \le 45m \\ -39 + 67\log_{10}(d[m]) & d > 45m \end{cases}$
Lognormal Shadowing		Similar to UMTS 30.03, B 1.41.4 [6]	
Shadowing standard deviation		10 dB	10dB
Correlation distance of Shadowing		10 m	25 m
Shadowing correlation	Between cells	0.0	
	Between sectors	na	
Penetration Loss		Included in Distance dependent pathloss model	
Antenna pattern (horizontal) (For omni cell sites with fixed antenna patterns)		$A(\theta) = 1$	

Carrier Frequency	CF= 2GHz	
Channel model	According to Table A.2.1.2-1	
UE speeds of interest	3km/h	3km/h, 30km/h
Total BS TX power (Ptotal)	38 dBm – 10MHz carrier [7]	
UE power class	21dBm (125mW). 24dBm (250mW)	
Inter-cell Interference Modelling	UL: Explicit modelling (all cells occupied by Ues), DL: Explicit modelling else cell power = Ptotal	
BS prostitution in the middle of the hexagon		
Users dropped uniformly in entire cell		
Minimum distance between UE and cell	>= 10m (and minimum coupling loss of -53dB) The distance dependent pathloss + shadow fading is lower limited to free-space distance dependent pathloss	

A.2.1.1.2 Downlink and uplink numerology

TBD based on candidate technology.

A.2.1.2 Channel models

A.2.1.2.1 Multi-path channel models & early simulations

In order to simplify initial simulation work, and to facilitate the rapid generation of early results, the GSM Typical Urban channel model could represent a useful channel model. Alternatively, a set of ITU channel models could also be used. In order to keep the number of channel models to a minimum, the 6-ray Typical Urban channel model given first (1) [8[8, Section C.3.3] may be the best candidate for early simulations (see Table A.2.1.2-1) because of its larger delay spread. It is intended to use TU for early non-MIMO simulations for all bandwidth modes. Note for receiver/transmitter diversity and initial STC evaluation, there is less of a need for the SCM.

Table A.2.1.2-1 – Channel model for rapid generation of early simulations

Channel Model Target	Assumption
Channel model for initial or early simulations	Typical Urban (TU) for Micro, Macro cell
Channel model for initial or early simulations	Multi-Antenna Link level channel models (section A.1.3)

A.2.1.2.2 Spatial channel model (SCM)

In later detailed simulations (per the RAN EUTRA work schedule), to accurately address Multi-Antenna subsystem (MAS) performance for EUTRA, the Spatial Channel Model (SCM) [7[7] is needed (see Table A.2.1.2.-2). The SCM accounts for transmitter and receive antenna correlation and more accurately reflects the likelihood of formulating multiple streams (spatial sub-channels) for certain MIMO schemes. The SCM is also needed for Beamforming and SDMA (or Spatial Multiplexing).

A.2.1.2.2.1 SCM and extension to wider BW

The usage of SCM as currently defined in TR 25.996 for bandwidths above 5MHz is FFS. It is intended to use SCM for MIMO simulations up to 5MHz and use suitable channel models (e.g. SCM or modified SCM) for MIMO simulations for higher bandwidths.

Table A.2.1.2-2 – Channel model for later MIMO simulations in RAN1

Channel Model Target	Assumption
Channel model for later simulations in RAN1	

A.2.1.3 Traffic models

Proposed traffic models for evaluating EUTRA and UTRA performance are given in Table A.2.1.3-1. The traffic models are grouped in terms of Best Effort Packet Service type and Packet Service with Conversational Service (CS) like QoS type. It is expected to reuse HSDPA/HSUPA traffic models with detailed parameters FFS.

Table A.2.1.3-1 Traffic Models

Traffic Models	Model Applies to
Best Effort Packet Service	
FTP	DL or UL with TCP feedback
HTTP	DL with TCP feedback on UL
PS with CS like QoS	
VoIP	DL and UL
Streaming	DL and UL
Video Conferencing	DL and UL
Gaming	UL

A.2.1.3.1 Latency analysis

In order for latency to be fully and (parameters for latency evaluation) formally analyzed a UTRA and EUTRA delay model is needed. Such a model is needed for the ongoing work in RAN1 and RAN4. Also key protocol simulation models (e.g. TCP congestion, slow start, etc) should be detailed enough to reflect their impact on latency (e.g. modelling TCP ACKs on the uplink when modelling downlink packet transmissions).

A.2.1.4 System performance metrics

Performance metrics (user throughput, cell throughput, FER, etc) are described in [2[2] and [3[3] and can be reused for UTRA and EUTRA evaluation. It is important to ensure that SDMA and MIMO are properly handled in an uplink wrap around model. It is important to ensure that SDMA, MIMO, and macro-diversity schemes are properly handled for the downlink if only populating the centre cell site with users. Link budgets promote easier interpretation of system simulation results and it would be useful to include them along with simulation results and assumptions.

A.2.1.5 Reference Release 6 (UTRA) UE

Reference UTRA UE parameters are given in Table A.2.1.5-1. Note a differential offset from maximum UE transmit power equivalent to g=MAX(Cubic Metric - 1, 0) should be included in the system simulations for each uplink UTRA (HSUPA) transmitter configuration used. Cubic metric is defined in [9[9],[10[10].

Table A.2.1.5-1 –Reference UTRA UE parameters

Parameters	Model Assumptions
Receiver	Performance Type 1 (Rx Diversity)
Transmitter	1 Antenna
Antenna gain	0 dBi
Noise Figure	9dB
HSDPA UE Capability Category	14Mbps (15 codes) , Capability Category 10
HSUPA UE Capability Category	CC6: 2Mbps TTI=10ms, 5.76Mbps TTI=2ms
Multicast	S-CCPCH soft combining for multicast

A.2.1.6 Reference EUTRA UE

Reference EUTRA UE parameters are given in Table A.2.1.6-1. Note a differential offset from maximum UE transmit power equivalent to g=MAX(Cubic Metric - 1, 0) should be included in the system simulations for each transmitter configuration used for a given EUTRA MA scheme. Hence, for each transmitter configuration the Cubic Metric [9[9],[10[10] is computed and the maximum UE transmit power is reduced by g.

Table A.2.1.6-1 – Reference EUTRA UE parameters

Parameters	Model Assumptions
Receiver	2 Antennas
Transmitter	1 Antenna
Antenna gain	0 dBi
Noise Figure	9 dB
MIMO	support for 2x2 downlink MIMO
Peak to Average/Cubic Metric	Should be specified based on MA used

A.2.1.7 Reference Release 6 (UTRA) Node-B

Reference UTRA Node-B parameters are given in Table A.2.1.7-1.

Table A.2.1.7-1 – UTRA Reference Node-B

Parameters	Model Assumptions
Node-B Transmitter	1 Antenna
Node-B Receiver	2 Antennas – Rake, Ideal antenna de-correlation

	8 fingers assignable per UE
BS antenna gain plus cable loss	14 dBi for micro, macro cell case
Node-B HS-DSCH codes (N)	N = 15 – DPCH code overhead
Noise Figure	5 dB
Pilot channel power overhead (P_PILOT)	10% (CPICH)
Common channel power overhead (P_OVHD)	10% (SCH, P-CCPCH, S-CCPCH)
DL HSUPA channel power overhead (P_HSUPA)	[8]% (E-AGCH, E-RGCH, E-HICH)
Power available for HS-DSCH/HS-SCCH/DPCH	100% - P_PILOT - P_OVHD – P_HSUPA
HS-SCCH	Explicitly modelled else 5% power overhead
DL DPCH (F-DPCCH or Assoc.)	Explicitly modelled else 10% power overhead

A.2.1.8 Reference EUTRA Node-B

Reference UTRA Node-B parameters are given in Table A.2.1.8-1. Any additional support of number antennas beyond two (e.g. to support SDMA or Beamforming) at the Node-B is beyond what is given in the requirements document [4[4] and is FFS.

Table A.2.1.8-1 EUTRA Reference Node-B

Parameters	Model Assumptions
Node-B Transmitter	2 Antennas
Node-B Receiver	2 Antennas
Noise Figure	5 dB
BS antenna gain plus cable loss	14 dBi for micro,macro cell case 6 dBi for micro cell case with omni-antennas (with cable losses included)
Pilot channel overhead	Total time and/or power resources dependent on MA and numerology are given or accounted for in simulation.
Control channel overhead	Total time and/or power resources dependent on MA given or accounted for in simulation (includes sync, paging, L1/2 signaling, resource allocation, HARQ feedback, etc)

A.2.1.9 Scheduling & resource allocation

Various scheduling approaches will have performance and overhead impacts and will need to be aligned. Scheduling issues include support for conversational and streaming traffic and fairness in general.

A.2.1.9.1 Proportional fair or other scheduling

A description of scheduling and resource allocation schemes simulated should be provided. For frequency specific scheduling, the feedback approach, delay, and feedback error assumptions should also be indicated.

A.2.1.9.2 Fairness criteria

EUTRA and UTRA performance evaluation and comparison require that fairness be preserved or at least known in order to promote apple and apple (fair) comparisons. Fairness is defined as the normalized user packet call throughput CDF.

A.2.2 Multi-antenna subsystems

A.2.2.1 MIMO

In the evaluation of MIMO techniques for EUTRA MA candidates the following areas need to be aligned. It is necessary to provide non-MIMO performance as a benchmark before or along with MIMO performance. Specific MIMO schemes simulated for the work item phase should be accurately described.

Table A.2.2.1-1 – MIMO issues for achieving alignment

Issues	Details
Idealized generic MIMO model	
Non-ideal receiver issues	Non-ideal channel estimation, antennas (non-ideal patterns formed)
SNR estimation for LLR extraction	
MIMO antenna geometry	
MIMO feedback	Rate, delay, error
CQI feedback	Rate, delay, error
HARQ ACK/NACK	Error rates/probabilities

A.2.2.2 SDMA/Beamforming

More than 2 EUTRA Node-B antennas are likely needed to evaluate SDMA and Beamforming. Defining reference EUTRA Node-B with 4 or more antennas is TBD.

A.2.3 System configuration and performance topics

A.2.3.1 Frequency re-use assessment

It is important to properly account for effects of 1x1 and 1x3 frequency reuse[2] on data channel performance and control channel reliability. Improvements from 1x3 should be characterized in terms of transmit power, coding gain differences, other cell interference, and loading.

A.2.3.2 Frame signaling reliability [TBD]

A.2.3.3 Macro diversity performance

It is key that macro diversity gain in the context of the new E-UTRA air interface is reassessed. Effects of macro diversity techniques (soft handoff, fast cell selection, multicast) should be evaluated with each traffic type and account for mobility. For example, it is important to account for a user that is not always attached to the best coverage cell due to delays in cell reselection.

[2] Frequency reuse of a x b where 'a' is site reuse and 'b' is sector reuse.

A.2.3.4 Timing synchronization

Timing synchronization assumptions are important in determining guard interval requirements for unicast and broadcast modes. Such assumptions are FFS.

A.2.3.5 RACH channel performance [TBD]

A.2.4 Examples of Cell and User throughput evaluation

Two evaluation approaches are given. One approach is to load the UTRA and EUTRA systems to several different levels were at each level the 5% user throughput CDF value is computed. This allows the UTRA and EUTRA comparison based on two curves of load or sector throughput vs. 5% user t-put CDF. Another approach is to load each system up to a level corresponding to a user packet call throughput cdf outage (e.g. 2%) and then compare the corresponding 5% CDF user throughput values as well as the average cell and user throughputs.

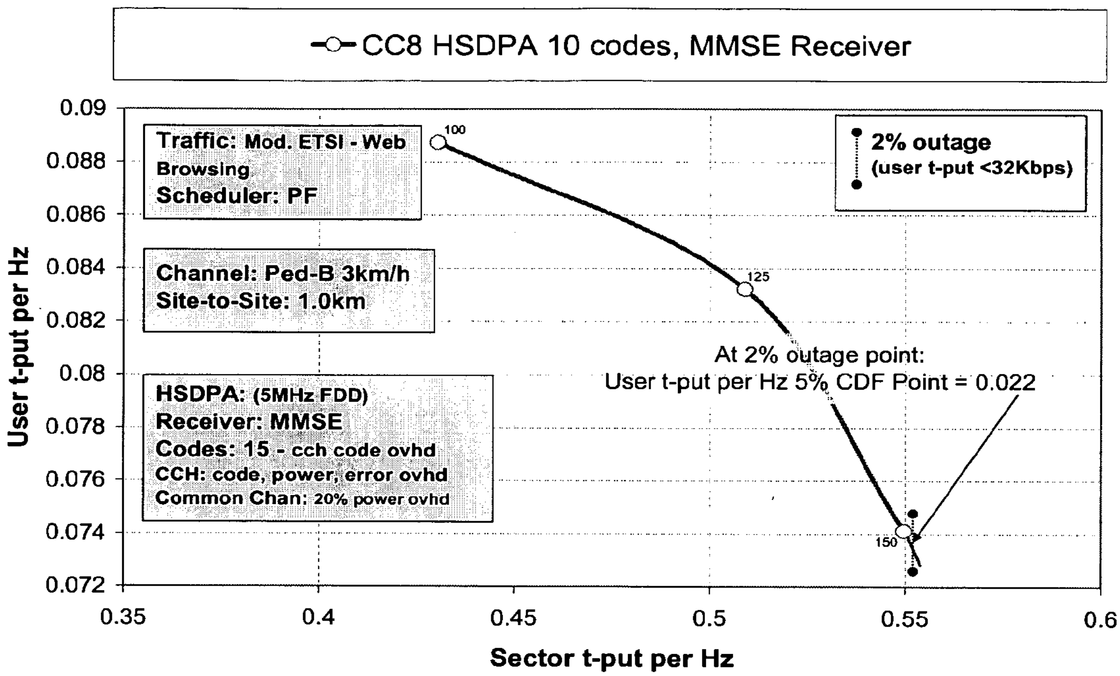


Figure A.2.4-1 – Example of User vs. Sector per Hz throughput with 5% CDF user throughput given at 2% outage point.

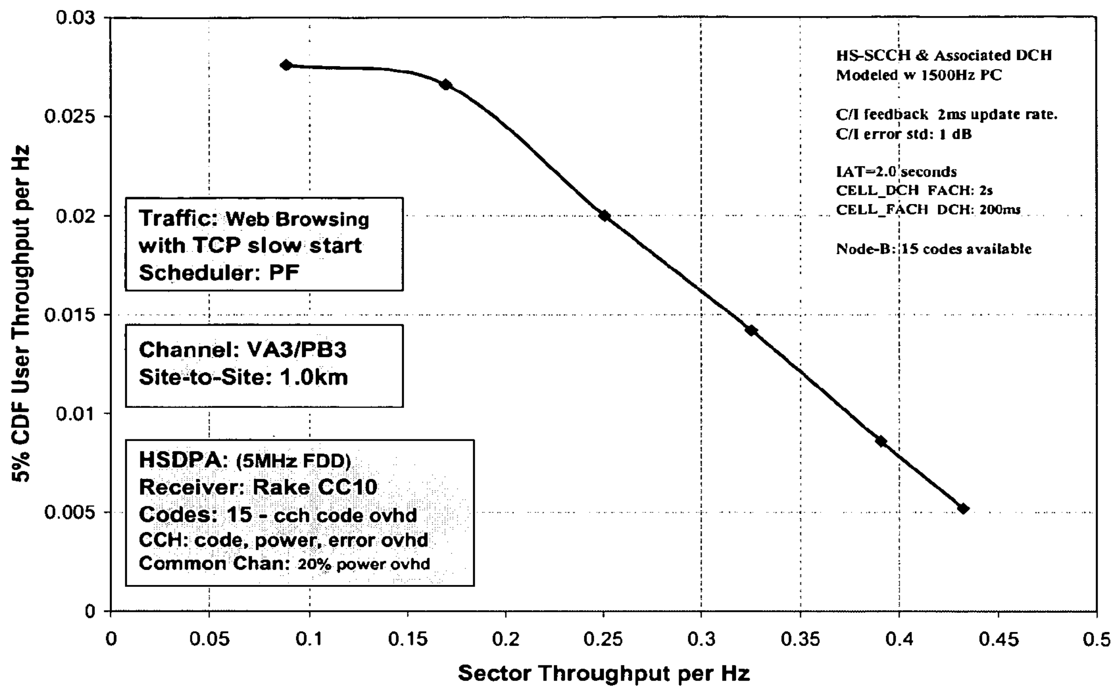


Figure A.2.4-2 – Example of 5% CDF User throughput vs. Sector throughput (per Hz)

ANNEX B: Change History

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
4-2005	RAN1 #40bis	R1-050372			Initial TR skeleton presented for approval		0.1.0
6-2005	RAN1 #adhoc	R1-050682			Basic transmission schemes and simulation assumption		0.1.1
8-2005	RAN1#42	R1-050698			Editorial correction	0.1.1	0.1.2
8-2005	RAN1#42	R1-050975			Raised to v0.2.0 following presentation of v0.1.2 at RAN1#42	0.1.2	0.2.0
10-2005	RAN1#42 bis	R1-051029			Basic transmission schemes	0.2.0	0.2.1
10-2005	RAN1#42 bis	R1-051252			Raised to v0.3.0 following presentation of v0.2.1 at RAN1#42bis	0.2.1	0.3.0
11-2005	RAN1#43	R1-051305			Duplexing, basic transmission schemes, multiplexing, enhanced modulation schemes	0.3.0	0.3.1
11-2005	RAN1#43	R1-051569			Raised to v0.4.0 following presentation of v0.3.1 at RAN1#43	0.3.1	0.4.0

11-2005	RAN1#43	R1-051623			Reference signal structure for OFDM, Basic scheme for MC-WCDMA, Initial simulation results, Multiplexing	0.4.0	0.4.1
11-2005	RAN1#43	R1-051264			MIMO	0.4.1	0.4.2
11-2005	RAN#30	RP-050729			Raised to v0.4.0 following presentation of v0.4.2 at RAN1#43	0.4.2	0.5.0
11-2005	RAN#30				Endorsed to v1.0.0	0.5.0	1.0.0
11-2005					Following by the decision in RAN#30 (RP-050909), scope is updated	1.0.0	1.0.1
2-2006					Reference signal structure, multiplexing. Scheduling, HARQ, Link adaptation is updated	1.0.1	1.0.2
2-2006	RAN1#44	R1-060363			Editorial correction	1.0.2	1.0.3
2-2006	RAN1#44	R1-060714			Raised to v1.1.0 following presentation of v1.0.0 at RAN1#42bis	1.0.3	1.1.0
2-2006	RAN1#44	R1-060763			Interference mitigation, Scheduling, HARQ, Link adaptation in UL, MIMO etc.	1.1.0	1.1.1
3-2006	RAN#31	RP-060178			Raised to v1.2.0 following presentation of v1.1.1 at RAN1#44	1.1.1	1.2.0

Agenda item: x.x

Source: LG Electronics Inc.

Title: Consideration on ARQ Signaling

Document for: Discussion, Decision

1. Introduction

In the last meeting in Athens, ARQ was discussed in detail. But agreed text includes many undecided points.

In this document, we discuss the FFS points in the 25.813.

2. Discussion

2.1 HARQ/ARQ interaction

Following was agreed to be included into section 6.3 of 25.813.

In HARQ assisted ARQ operation, ARQ uses knowledge obtained from the HARQ about the transmission/reception status of a TB e.g.:

- *If the HARQ transmitter detects a failed delivery of a TB due to e.g. maximum retransmission limit it is FFS if the relevant transmitting ARQ entities are notified;*
- *If the HARQ receiver is able to detect a NACK to ACK error it is FFS if the relevant transmitting ARQ entities are notified via explicit signalling;*

- *If the HARQ receiver is able to detect TB transmission failure it is FFS if the receiving ARQ entities are notified.*

In this section, we discuss above three example of HARQ/ARQ interaction.

Event 1: Detection of failed delivery of a TB by HARQ TX side:

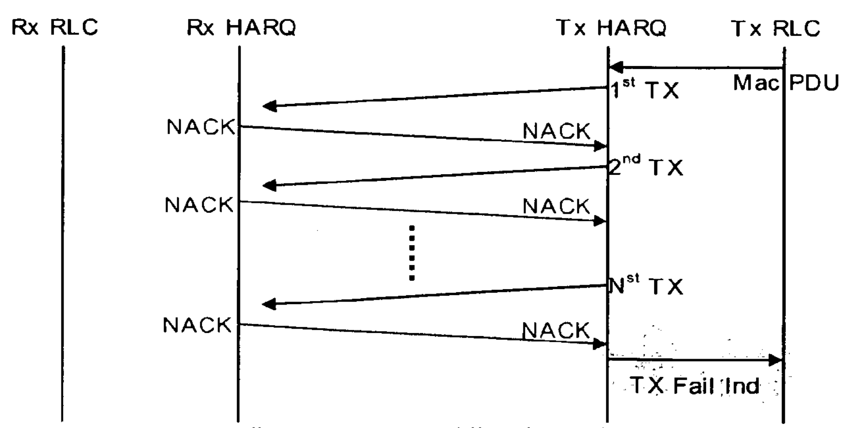


Fig 1 Indication of local TX failure (Normal case)

This event is used at the transmitting side. When transmitter receives HARQ NACK for the final trial of HARQ retransmission for a MAC PDU, this event can be used to trigger ARQ level retransmission. Accordingly, ARQ level

MAC PDU retransmission occurs faster than the case when the ARQ level retransmission is triggered by Status Report from peer entity.

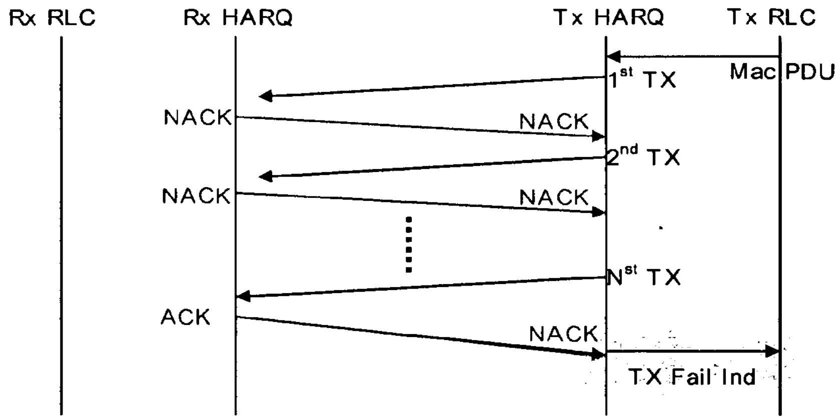


Fig 2 Indication of local TX failure (Error case)

For this event to be useful, first of all, HARQ transmitter's detection of this event should be reliable. It means that the ACK-to-NACK error ratio should be low enough. In fact, reaching the maximum allowed number of retransmission means that channel condition is not favourable. Though it is generally assumed that the target error ratio of ACK/NACK is designed to be low, the probability of NACK-to-ACK error at final retransmission can be higher than the other situation.

In fact, event 1 will not be the only available information. If complementary mechanism to cover the ACK/NACK error is used, then event 1 can be helpful information to ARQ entity. Nonetheless, the decision whether to use the event 1 or not and what to do with the information should be left to ARQ implementation.

Conclusion: HARQ transmitter notifies the detection of failed delivery to each relevant logical channel. How the notified entity will use this event is left further specified.

Event 2: Detection of NACK to ACK error by HARQ RX side:

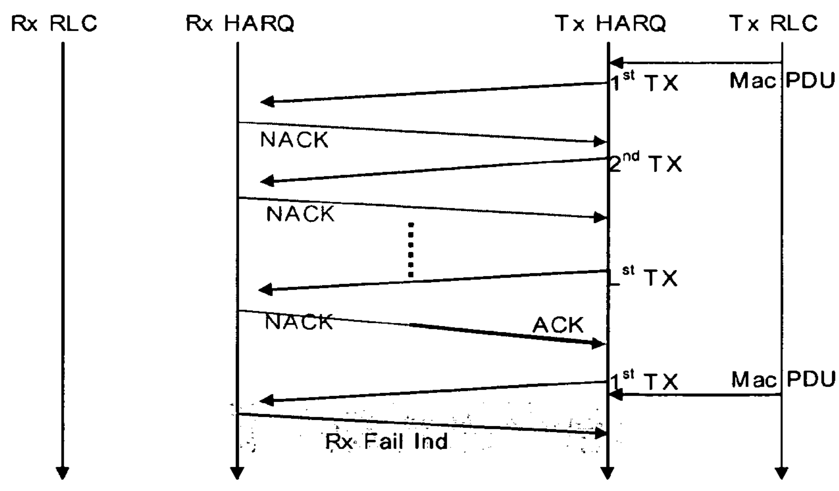


Fig 3 Indication of local RX failure (Normal case: N is Max Num of retransmission and L < N.)

Fig 3 shows the scenario. This event is detected at HARQ receiving side. Specifically, this event occurs when the HARQ receiver detects new HARQ transmission for a process. When this event is detected, the receiving side send failure indication to transmitting side. Transmitting side can use this indication to restart ARQ level retransmission.

But, because the HARQ receiver can not know what is included in the MAC PDU until it successfully decodes the MAC PDU, it does not know the maximum number of allowed HARQ retransmission for the ongoing HARQ process. Thus the only way for the HARQ receiver to know the occurrence of NACK to ACK error is when the HARQ receiver detects that new transmission has started for a HARQ process even when it has sent NACK for the latest HARQ reception of the process.

Thus, detection of NACK to ACK error is actually detection of new data transmission.

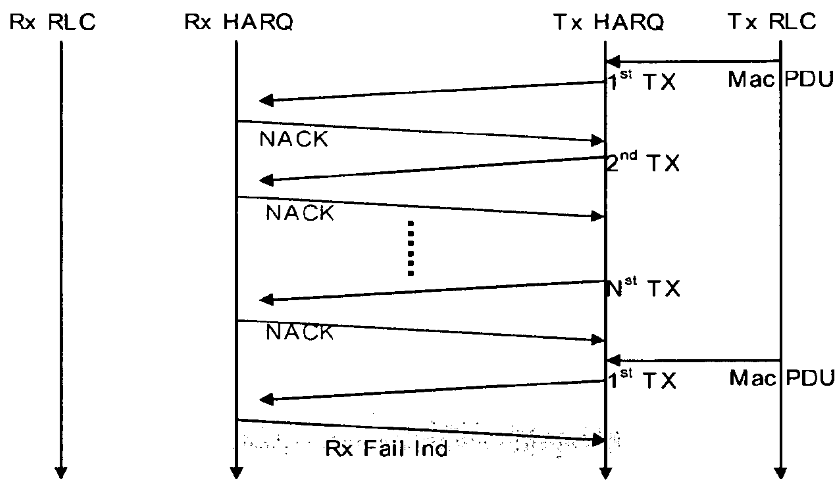


Fig 4 Indication of local RX failure (Error case: N is Max Num of retransmission.)

Care should be given to this detection of new data transmission. Due to the fact that HARQ receiver does not know the maximum number of retransmission for the HARQ process, the HARQ receiver can not discriminate the case where NACK is misinterpreted as ACK and the case where the HARQ retransmission has reached the allowed number of retransmission. I.e, the HARQ receiver can not discriminate the case of Fig 3 and the case of Fig.4. The indication in Fig 4 is useless and this is already known in transmitter by event 1.

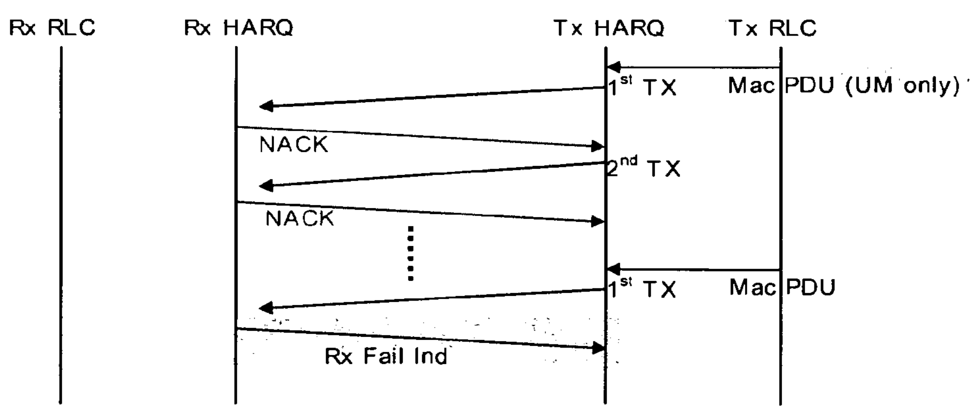


Fig 5. Indication of local RX failure (Error case: UM data does not require ARQ)

In addition, the HARQ receiver does not know whether the data in the HARQ process needs ARQ level retransmission or not as shown in Fig 5.

For example, the VoIP service or streaming service does not require ARQ level re-transmission. Then, it will be meaningless for the HARQ receiver to report this type of event to the transmitting side. Also the case when pre-emption is allowed for a process should be considered. The transmitting side may not want to receive feedback from HARQ receiver for the pre-empted process. Also the cost of radio resource for feedback should also be considered.

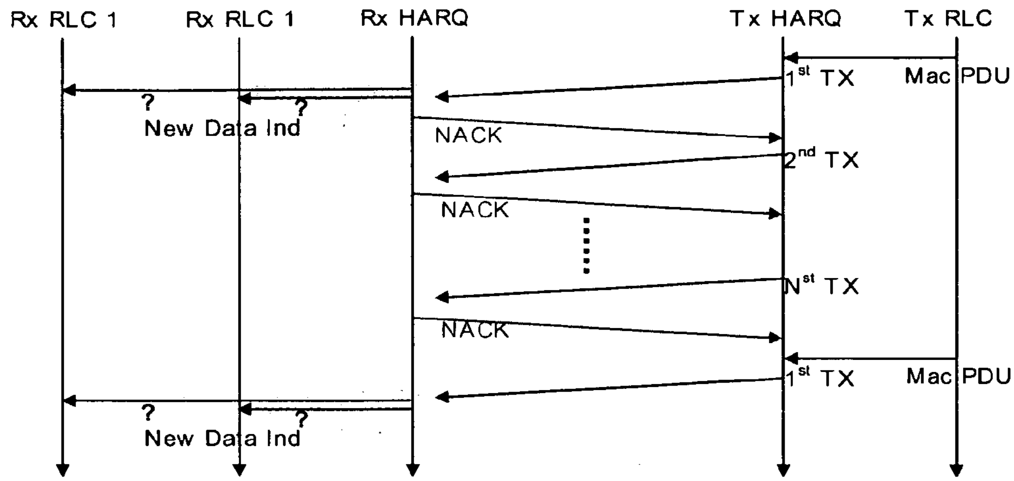


Fig 3. Indication of local RX failure (To which RLC Indication should be sent is unknown)

Furthermore, the HARQ receiver can not report this event to ARQ receiver. As said earlier, the HARQ receiver does not know what kind of data was included in the failed HARQ process. Accordingly, it does not know which logical channel or which ARQ entity should be notified of the event.

Conclusion: Detection of new data transmission by HARQ receiver is not notified to other entity.

2.2 Simplification of ARQ

In the section 6.2 of 25.813, following is agreed to be included.

- *ARQ retransmissions are based on:*
  - *RLC status reports (FFS);*
  - *HARQ/ARQ interactions (see subclause 6.3).*
- *The RLC transmitter can invoke a discard procedure (FFS);*
- *The RLC can invoke a reset procedure (FFS).*

In fact, these bullets are describing the mechanisms used in Rel-6 AM RLC. Though we agree that many functionality of Rel-6 AM RLC can be used also in RLC of LTE, the status reporting mechanism in R6 AM RLC is too complex. It seems to be better to adopt only essential functionality in LTE. Following points can be considered.

Reset Procedure

In WCDMA, causes for the occurrence of RESET procedure were out-of-sync security context or bad channel condition. Because security layer is above RLC, there is no need to consider out-of-sync security in RLC. Thus the possible cause for reset is just bad channel condition. I.e., if the transmitter does not receive acknowledgment after several retransmissions, the RLC will trigger RESET.

With fast link adaptation and fast resource scheduling by eNB and with HARQ, it seems to be very rare case that a RLC PDU fails a number of ARQ level retransmission. And if that situation really occurs, then it may be due to irrelevant configuration of radio parameter like HARQ parameter, timing, priority setting, etc. In this case, parameter reconfiguration or handover at RRC level can be right choice than using RESET procedure which just performs RLC context initialization. Actually, CELL UPDATE procedure was used in WCDMA to handle unrecoverable RLC error. Accordingly, it is proposed not to adopt RESET procedure and use RRC procedure to handle abnormal situation .

Discard Procedure

The typical procedure for discard in Rel-6 is MRW procedure. MRW procedure was used to exchange discard information between two peer entities. When a SDU or PDU is not successfully transmitted within a certain time period, the transmitter discards the SDU or PDU. In case of Acknowledge mode, the information about the discarded data should be exchanged. The typical reasons for this event are bad channel condition and lower priority.

, there were several periodic times like Timer_Poll_Prohibit, Timer_Poll_Periodic, Timer_Status_Prohibit, and Timer_Status_Periodic. These timers are used to guarantee missing PDUs or missing Status PDUs are received in peer entity.

But, for example, if the transmission timing of each status report can be known to the peer entity, then multiple reception of status report within round trip time will not automatically cause transmission of PDU more than necessary. Furthermore, as shown in [2], if the correct setting of timer is not done, the overall performance will be degraded. Thus, we need to re-examine the usability of these periodic timers.

SUFI in Control PDU

In R6, there are many different kinds of SUFIs for RLC AM. It seems that so much different kind of SUFI of R6 is not justified because the missing PDUs in layer 2 will be small by use of HARQ. Having more than one type of SUFI for the same purpose causes more testing and more implementation efforts.

Conclusion:

- Options used for ARQ information presentation is minimized

- ARQ simply process ACK/NACK information. Erroneous situation is handled in upper layer.

2.3 Additional point

Because ARQ entity is located where radio resource is controlled, it is possible to use fast radio resource for ARQ purpose. In fact, L1/L2 control information is quite robust and fast. Thus ARQ mechanism using this L1/L2 control information can be one approach to enhance ARQ performance. This will be quite beneficial at least for signalling message. Following examples can be thought as a starting point.

In the past, there were some proposals to correct a problem with regard to the "LAST PDU in the BUFFER" in R6. The problem occurs when the transmitting side transmit the last PDU in the buffer with polling bit but this PDU is lost over the air resulting long delay. One solution to solve this problem is to use L1/L2 control information. I.e., L1/L2 control information includes information like polling bit.

Or, receiving side can use L1/L2 information to tell about whether there is any missing MAC PDU or not within current receiving window or recent frames. Using this information, the transmitting side can estimate the TTI in which the HARQ transmission has failed. Then the transmitting side can immediately start ARQ level re-transmission for the data included in that TTI without receiving status report from MAC of receiving side.

Though L1/L2 control information content and delivery mechanism is not clear at this moment in RAN, it is clear that ARQ entity is located on the node where fast radio control occurs and L1/L2 control information is sent. Thus it is proposed to further investigate whether it is beneficial to include ARQ information in lower layer or not.

Conclusion:

Consider and further investigate of inclusion of ARQ information into L1/L2 control information.

3. Proposal

It is proposed to discuss and agree conclusions in each above sections.

4. Reference

[1] R2-060374, MAC functions: ARQ, Samsung

[2] R2-060428, Consideration of (H)ARQ layers for LTE, Philips

[3] R2-050095, RLC Status Reporting Enhancement, Qualcomm

Agenda item: 6.4

Source: LG Electronics Inc.

Title: Interaction of MAC and PDCP

Document for: Discussion, Decision

1. Introduction

After the joint meeting with SA3 in January, it was agreed that PDCP and ciphering functionality are located in aGW. And last Plenary decided that ARQ operation is in the eNB.

2. Discussion

In WCDMA, PDCP compresses and decompresses IP packet header and ARQ is used to guarantee delivery of data to peer entity. This is also true for the LTE.

But the difference is the location. In WCDMA, both PDCP and ARQ are located in the same network node, which is RNC. On the other hand in LTE, PDCP is located in aGW and ARQ is located in eNB. Accordingly, the interaction between ARQ and PDCP should be standardized due the physical separation. Following two can be considered:

Sequence Number Management

In WCDMA, PDCP should manage sequence number to support lossless relocation. This sequence number is exchanged between RNC and UE when RNS relocation occurs. But due to the fact that this sequence number is not explicitly included into the PDCP PDU, PDCP needs support from the lower layer, RLC.

When requested by upper layer, transmitting side RLC reports reception status of each PDCP SDU by the peer entity to PDCP. Without this information, the transmitting side PDCP and receiving side PDCP will keep different sequence number for the same PDCP PDU.

For the LTE case, the situation is different because aGW includes not only header compression/decompression functionality but also ciphering functionality. Though it is not decided whether PDCP entity include also ciphering function, it is clear that PDCP entity may get support from ciphering function due to co-location within aGW.

That support is sequence number used by ciphering function. Explicit sequence number included in the data packet is needed to perform ciphering and deciphering, If in-sequence delivery is guaranteed from MAC in eNB, then ciphering function can detect whether there is MAC SDU or PDCP SDU loss or not by checking only the sequence number. This internal information in aGW will ensure sequence number synchronization between PDCP.

Accordingly, primitive exchange on this aspect is not needed between MAC of eNB and PDCP of aGW.

Compression/Decompression Context

In WCDMA, RNC is in control of all the configuration of radio parameters. Thus even when only the parameters in Node-b change, the PDCP in RNC can know that there is some change in the Node-b. If PDCP knows the changes in lower entity, it is beneficial to PDCP.

For example, when MAC-hs reset occur, all the MAC PDUs in Node-b will be flushed. This is one of appropriate time for the PDCP to generate full header packet. Unless, the contexts between UE and RNC will be out of synchronization until next full header packet arrives in the UE. Another example is MRW procedure or Reset procedure. The occurrence of these procedures in RLC can be informed to PDCP to optimize PDCP operation.

But in LTE, because PDCP and MAC are not within same physical node, eNB can reconfigure radio parameter without involvement of aGW. Or, when the eNB changes serving cell within same eNB, aGW does not know about this because there is no path change between aGW and eNB. And, MAC ARQ status or event is also not available to aGW. If these events can be known to aGW, it will enhance and assist PDCP operation. Accordingly, some information or events in eNB should be delivered to aGW. Following can be options for the information delivery mechanism.

First possibility is to use control plane signalling. Whenever some event occurs in eNB, the eNB informs this event using, for example, NBAP. After informed by NBAP, the aGW takes appropriate actions like full header transmission.

Second possibility is to use in-band signalling. I.e., whenever some event occurs in eNB, then eNB informs this event by inserting control PDUs into the data stream from eNB to aGW. When the aGW receives this control PDU, it takes that information into account in controlling the PDCP operation. Using Frame header is also possibility.

At this moment, it seems early to compile all the events that should be informed to aGW. But it is beneficial to define supporting mechanism to inform aGW of events in eNB.

3. Conclusion

It is proposed to discuss and agree to:

- Provide signalling support between eNB and aGW about event such as reconfiguration and ARQ status, etc.

- Further investigate the events that are beneficial if indicated from eNB to aGW.

4. Reference

[1] R2-060xxx, xxxx, LG Electronics

Agenda item: 19

Source: LG Electronics Inc.

Title: Principle of Rel-7 Protocol Enhancement

Document for: Discussion, Decision

1. Introduction

Many aspects can be considered for the Rel-7 enhancement in RAN2 for Rel7. For example, RRC signalling optimization or L2 enhancement can be investigated.

In this document, we investigate how to enhance L2 protocol such as RLC, MAC and PDCP. Because this enhancement will be introduced into Rel-7 specification, we will look from the viewpoint of HSDPA and HSUPA.

2. Discussion

In fact, the scope of protocol enhancement for Rel-7 evolution has not yet been discussed. To what extend the change to current specification can be allowed is ambiguous.

Until current Rel-6, the basic principle is to add new feature without changing other entity. In other words, to raise the radio performance, add-on approach was used. An example of this add-on approach can be the introduction of MAC-hs and MAC-e into Node-b without impacting the RLC within RNC. This approach has not impacted other entities. But when we talk about the protocol enhancement, we don't need to confine ourselves to old approach.

But, note that the approach in protocol enhancement in Rel-7 should be different from the approach in LTE. In LTE, all the nodes are fresh and there is nothing that can be called legacy nodes. On the other hand, networks nodes of one release should support interfaces to network nodes of previous release in case of WCDMA.

Let's look at following figure 1.

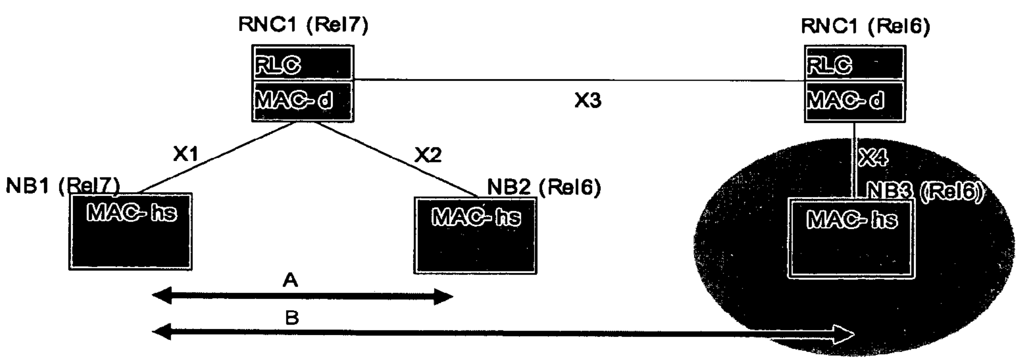


Figure 1

In this figure, two scenarios can be identified. First case is the handover from Rel-7 NB to Rel-6 NB. And the second scenario is the handover from Rel-7 RNC to Rel-6 RNC. Both scenario should be supported and should have minimal impact.

<u>Handover between Rel-7 NB and Rel-6 NB under Rel-7 RNC (Blue Line)</u>

Because NB2 is legacy NB which includes MAC-hs of Rel-6, the functionality performed by Rel-6 RLC and Rel-6 MAC-d should be retained in the RNC1. If RNC1 does not have two different stacks of RLC and MAC-d, then PDUs over X1 interface should have same format as PDUs over X2 interface. If this is the case, relocation of some functionality of RLC plus MAC-d into MAC-hs is impossible.

Of course, enhancing RLC and MAC-d in combination may be possible without impacting interface between MAC-d and MAC-hs. In this case, introduction of new feature into RLC and MAC-d in RNC may be possible. But the added feature will not automatically cause related change in MAC-hs in Node-b. And if the added feature in R7 RLC and MAC-d generates better performance only with corresponding changes in MAC-hs of R7 NB, RLC and MAC-d entities should be reconfigured and re-established whenever serving Node-b changes from R7 to R6 even if there is no SRNS relocation.

In fact, double protocol stack can be considered. But this will require double testing and double implementation effort. Furthermore, even if two protocol stacks are implemented in the RNC and different protocol stacks are used over X1 and X2 interfaces, data transmission will not be optimized. For example, if flexible size is used for RLC AM PDU over X1 interface or segmentation function is moved to Node-b, RLC should be flushed whenever serving Node-b changes from R7 to R6. This is because fixed PDU size is used for RLC AM entity and segmentation is done in RNC in legacy system. The sequence number ambiguity or ciphering aspect also make the system very complex.

Interface also should be considered. In LTE, many companies proposed that IP packet is directly delivered to Node-b. This approach can be considered also for WCDMA to perform optimal PDU segmentation in Node-b. But, according to the section 6.2.7.23 of TS25.435, the maximum MAC-d PDU size over legacy Iub is 5000 bit. Considering that MTU is normally 1500byte, current Iub does not allow IP packet is transferred over Iub without segmentation. Thus, dual protocol stacks requires also changes in Iub.

From the above reasoning, it seems to be better to keep current allocation of functionality between MAC and RLC also in R7. Accordingly, we believe that it is preferable to enhance each RLC and MAC separately under the requirement that the changes in one entity do not cause to corresponding changes in other entities.

Handover between Rel-7 RNC and Rel-6 RNC (Red Line)

In this scenario, the release of each RNC is different. In case SRNS relocation does not occur, the handover between eNBs under different RNCs will be similar to the case of previous scenario because CRNC can be bypassed. In case of SRNS relocation, anyway RLC will be re-established and the new Node-b needs configuration. Thus, in this case, any approach can be pursued for protocol enhancement.

Considering above scenarios, reshuffling of functionality of MAC and RLC or enhancement of functionality requiring changes in both entities seems to be inefficient and cause more testing and effort. Thus it seems to be favourable to enhance each entity separately.

3. Conclusion

As a basic principle for R7 protocol enhancement, it is proposed to agree:

- to enhance each RLC and MAC independently not in combination.

- not to relocate function of RLC and MAC.

- keep current interface between RNC and Node-b

CR-Form-v7.1

CHANGE REQUEST

⌘	25.331 CR -	⌘ rev -	⌘ Current version: 7.0.0 ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ [ ] ME [X] Radio Access Network [X] Core Network [ ]

Title:	⌘	Introduction of early IDT
Source:	⌘	LG Electronics Inc.
Work item code:	⌘	RANimp-DelayOpt — ***Date:*** ⌘
Category:	⌘	B — ***Release:*** ⌘ Rel-7

Use one of the following categories:
- ***F*** *(correction)*
- ***A*** *(corresponds to a correction in an earlier release)*
- ***B*** *(addition of feature),*
- ***C*** *(functional modification of feature)*
- ***D*** *(editorial modification)*

Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
- *Ph2 (GSM Phase 2)*
- *R96 (Release 1996)*
- *R97 (Release 1997)*
- *R98 (Release 1998)*
- *R99 (Release 1999)*
- *Rel-4 (Release 4)*
- *Rel-5 (Release 5)*
- *Rel-6 (Release 6)*
- *Rel-7 (Release 7)*

Reason for change:	⌘	
Summary of change:	⌘	
Consequences if not approved:	⌘	

		Y	N		
Clauses affected:	⌘				
Other specs affected:	⌘		X	Other core specifications	⌘
		X		Test specifications	
			X	O&M Specifications	
Other comments:	⌘				

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Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

8.1.8 Initial Direct transfer

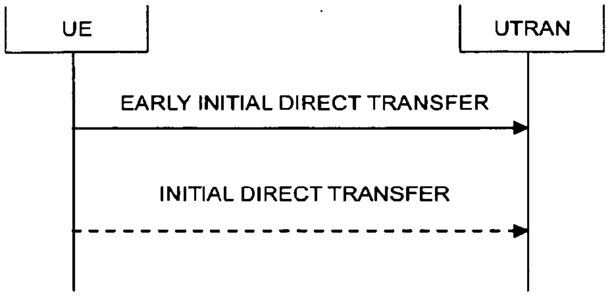

Figure 8.1.8-x: Initial Direct transfer in the uplink, normal flow

8.1.8.1 General

The initial direct transfer procedure is used in the uplink to establish a signalling connection. It is also used to carry an initial upper layer (NAS) message over the radio interface.

8.1.8.2 Initiation of Initial direct transfer procedure in the UE

In the UE, the initial direct transfer procedure shall be initiated, when the upper layers request establishment of a signalling connection. This request also includes a request for the transfer of a NAS message.

Upon initiation of the initial direct transfer procedure the UE shall:

1> set the variable ESTABLISHMENT_CAUSE to the cause for establishment indicated by upper layers.

Upon initiation of the initial direct transfer procedure when the UE is in idle mode, the UE shall:

1> perform an RRC connection establishment procedure, according to subclause 8.1.3;

1> in the RRC connection establishment procedure, whenever the MAC layer indicates successful transmission of an RRC CONNECTION REQUEST message according to subclause 8.1.3:

2> transmit an EARLY INITIAL DIRECT TRANSFER message according to subclause 8.1.8.x2.[Editor's NOTE: In this case, CN can find duplication NAS messages e.g. SERIVCE REQUEST message e.g. due to protocol error, cell re-selection, physical failure. It needs to be checked if this case can be treated in a similar manner to the existing case that the RRC connection is unintendedly released right after successfully transmitting the IDT on DCCH and then the UE establishes the RRC connection setup and send a new IDT to the same CN node.]

PFI: I think that each time a RRC Connection Setup message is sent as a response to a RRC Connection Request message a new RRC connection is supposed to be created. If an early IDT is forwarded to the Iu interface and an Iu connection is established then the Iu connection and the RRC connection are related. In the case that the RRC connection is released due to a RL failure the related Iu connection si released also by the RNC. Therefore there is no problem.

[Editor's NOTE: When the UE re-transmits the RRC CONNECTION REQUEST message after reception of RRC CONNECTION SETUP message with confirmation of the early IDT due to the cases in 8.1.3 e.g. protocol error, invalid message or physical failure, if the UE is still camping on the same cell, the UE may not need to re-transmit the early IDT again after the retransmission of the RRC CONNECTION REQUEST message because the early IDT previously transmitted was confirmed by the RRC CONNECTION SETUP message. This could be the subject to optimization of the early IDT procedure with RRC connection (also, with cell update).

However, if the UE performs cell re-selection before retransmission of RRC CONNECTION REQUEST message after the confirmation of the early IDT on the RRC CONNECTION SETUP message, the UE may need to re-transmit the early IDT again because UE does not know if the re-selected cell and the previous cell belong to the same RNC or not.]

PFI: Better to ignore this optimisation for the time being.

1> if the RRC connection establishment procedure was not successful:

2> if the establishment cause for the failed RRC connection establishment was set to "MBMS reception" and a different cause value is stored in the variable "ESTABLISHMENT_CAUSE":

3> UE-AS (RRC) initiates a new RRC connection establishment procedure, using the establishment cause as contained in the variable ESTABLISHMENT_CAUSE.

2> otherwise: /* indention changed*/

3> indicate failure to establish the signalling connection to upper layers and end the procedure.

1> when the RRC connection establishment procedure is completed successfully:

2> if IE "Early IDT Confirmation" of the received RRC CONNECTION SETUP message in the RRC connection establishment procedure is set to "Confirmed":

3> confirm the establishment of a signalling connection to upper layers; and

3> add the signalling connection with the identity indicated by the IE "CN domain identity" in the variable ESTABLISHED_SIGNALLING_CONNECTIONS.

3> the procedure ends.

2> otherwise:

3> continue with the initial direct transfer procedure according to subclause 8.1.8.y2.

Upon initiation of the initial direct transfer procedure when the UE is in CELL_PCH or URA_PCH state, the UE shall:

1> perform a cell update procedure, according to subclause 8.3.1, using the cause "uplink data transmission";

1> in the cell update procedure, whenever the MAC layer indicates successful transmission of a CELL UPDATE message according to subclause 8.3.1:

2> transmit an EARLY INITIAL DIRECT TRANSFER message according to subclause 8.1.8.x2.1> when the cell update procedure completed successfully:

2> if IE "Early IDT Confirmation" of the received CELL UPDATE CONFIRM message in the cell update procedure is set to "Confirmed":

3> confirm the establishment of a signalling connection to upper layers; and

3> add the signalling connection with the identity indicated by the IE "CN domain identity" in the variable ESTABLISHED_SIGNALLING_CONNECTIONS;

3> the procedure ends.

2> otherwise:

3> continue with the initial direct transfer procedure according to subclause 8.1.8.y2.

[Editor's NOTE: the sentences below move from 8.1.8.y2 of this CR without any modification only for replacement of the sentences.]

When not stated otherwise elsewhere, the UE may also initiate the initial direct transfer procedure when another procedure is ongoing, and in that case the state of the latter procedure shall not be affected.

A new signalling connection request may be received from upper layers during transition to idle mode. In those cases, from the time of the indication of release to upper layers until the UE has entered idle mode, any such upper layer request to establish a new signalling connection shall be queued. This request shall be processed after the UE has entered idle mode.

8.1.8.x1 EARLY INITIAL DIRECT TRANSFER message contents to set

The UE shall, in the EARLY INITIAL DIRECT TRANSFER message:

1> if an assigned U-RNTI is stored in the variable U_RNTI:

2> set the CHOICE "UE identity" to "U-RNTI" with the value of the variable U_RNTI.

1> otherwise:

2> set the CHOICE "UE identity" to "Initial UE identity" with the value of the variable INITIAL_UE_IDENTITY.

1> set the IE "NAS message" as received from upper layers; and

1> set the IE "CN domain identity" as indicated by the upper layers; and

1> set the IE "Intra Domain NAS Node Selector" as follows:

2> derive the IE "Intra Domain NAS Node Selector" from TMSI/PMTSI, IMSI, or IMEI; and

2> provide the coding of the IE "Intra Domain NAS Node Selector" according to the following priorities:

1. derive the routing parameter for IDNNS from TMSI (CS domain) or PTMSI (PS domain) whenever a valid TMSI/PTMSI is available;

2. base the routing parameter for IDNNS on IMSI when no valid TMSI/PTMSI is available;

3. base the routing parameter for IDNNS on IMEI only if no (U)SIM is inserted in the UE.

1> if the RRC connection exists:

2> if the UE, on the existing RRC connection, has received a dedicated RRC message containing the IE "Primary PLMN Identity" in the IE "CN Information Info":

3> set the IE "PLMN identity" in the INITIAL DIRECT TRANSFER message to the latest PLMN information received via dedicated RRC signalling. If NAS has indicated the PLMN towards which a signalling connection is requested, and this PLMN is not in agreement with the latest PLMN information received via dedicated RRC signalling, then the initial direct transfer procedure shall be aborted, and NAS shall be informed.

2> if the UE, on the existing RRC connection, has not received a dedicated RRC message containing the IE "CN Information Info" , and if the IE "Multiple PLMN List" was broadcast in the cell where the current RRC connection was established:

3> set the IE "PLMN identity" in the INITIAL DIRECT TRANSFER message to the PLMN chosen by higher layers [5, 25] amongst the PLMNs in the IE "Multiple PLMN List" broadcast in the cell where the RRC connection was established.

1> otherwise:

2> set the IE "PLMN identity" in the INITIAL DIRECT TRANSFER message to the PLMN chosen by higher layers [5, 25] amongst the PLMNs in the IE "Multiple PLMN List" broadcast in the cell where the RRC connection was established.

1> if the IE "Activated service list" within variable MBMS_ACTIVATED_SERVICES includes one or more MBMS services with the IE "Service type" set to "Multicast" and;

1> if the IE "CN domain identity" as indicated by the upper layers is set to "CS domain" and;

1> if the variable ESTABLISHED_SIGNALLING_CONNECTIONS does not include the CN domain identity 'PS domain':

2> include the IE "MBMS joined information";

2> include the IE "P-TMSI" within the IE "MBMS joined information" if a valid PTMSI is available.

8.1.8.x2 Transmission of EARLY INITIAL DIRECT TRANSFER message in the UE

The UE shall:

1> set the IEs in an EARLY INITIAL DIRECT TRANSFER message according to subclause 8.1.8.x1;

1> perform the mapping of the Access Class to an Access Service Class as specified in subclause 8.5.13 and apply the given Access Service Class when accessing the RACH;

1> submit the EARLY INITIAL DIRECT TRANSFER message to lower layers for transmission on the uplink CCCH.

8.1.8.y1 INITIAL DIRECT TRANSFER message contents to setThe UE shall, in the INITIAL DIRECT TRANSFER message:

1> set the IE "NAS message" as received from upper layers; and

1> set the IE "CN domain identity" as indicated by the upper layers; and

1> set the IE "Intra Domain NAS Node Selector" as follows:

2> derive the IE "Intra Domain NAS Node Selector" from TMSI/PMTSI, IMSI, or IMEI; and

2> provide the coding of the IE "Intra Domain NAS Node Selector" according to the following priorities:

1. derive the routing parameter for IDNNS from TMSI (CS domain) or PTMSI (PS domain) whenever a valid TMSI/PTMSI is available;

2. base the routing parameter for IDNNS on IMSI when no valid TMSI/PTMSI is available;

3. base the routing parameter for IDNNS on IMEI only if no (U)SIM is inserted in the UE.

1> if the UE, on the existing RRC connection, has received a dedicated RRC message containing the IE "Primary PLMN Identity" in the IE "CN Information Info":

2> set the IE "PLMN identity" in the INITIAL DIRECT TRANSFER message to the latest PLMN information received via dedicated RRC signalling. If NAS has indicated the PLMN towards which a signalling connection is requested, and this PLMN is not in agreement with the latest PLMN information received via dedicated RRC signalling, then the initial direct transfer procedure shall be aborted, and NAS shall be informed.

1> if the UE, on the existing RRC connection, has not received a dedicated RRC message containing the IE "CN Information Info" , and if the IE "Multiple PLMN List" was broadcast in the cell where the current RRC connection was established:

2> set the IE "PLMN identity" in the INITIAL DIRECT TRANSFER message to the PLMN chosen by higher layers [5, 25] amongst the PLMNs in the IE "Multiple PLMN List" broadcast in the cell where the RRC connection was established.

1> if the IE "Activated service list" within variable MBMS_ACTIVATED_SERVICES includes one or more MBMS services with the IE "Service type" set to "Multicast" and;

1> if the IE "CN domain identity" as indicated by the upper layers is set to "CS domain" and;

1> if the variable ESTABLISHED_SIGNALLING_CONNECTIONS does not include the CN domain identity 'PS domain':

2> include the IE "MBMS joined information";

2> include the IE "P-TMSI" within the IE "MBMS joined information" if a valid PTMSI is available.

1> if the variable ESTABLISHMENT_CAUSE_ is initialised:

2> set the IE "Establishment cause" to the value of the variable ESTABLISHMENT_CAUSE;

2> clear the variable ESTABLISHMENT_CAUSE.

1> calculate the START according to subclause 8.5.9 for the CN domain as set in the IE "CN Domain Identity"; and

1> include the calculated START value for that CN domain in the IE "START".

8.1.8.y2 Transmission of INITIAL DIRECT TRANSFER message in the UE

The UE shall:

1> transmit the INITIAL DIRECT TRANSFER message on the uplink DCCH using AM RLC on signalling radio bearer RB3;

1> when the INITIAL DIRECT TRANSFER message has been submitted to lower layers for transmission:

2> confirm the establishment of a signalling connection to upper layers; and

2> add the signalling connection with the identity indicated by the IE "CN domain identity" in the variable ESTABLISHED_SIGNALLING_CONNECTIONS.

1> when the successful delivery of the INITIAL DIRECT TRANSFER message has been confirmed by RLC:

2> the procedure ends.

8.1.8.2a RLC re-establishment or inter-RAT change

If a re-establishment of the transmitting side of the RLC entity on signalling radio bearer RB3 occurs before the successful delivery of the INITIAL DIRECT TRANSFER message has been confirmed by RLC, the UE shall:

1> retransmit the INITIAL DIRECT TRANSFER message on the uplink DCCH using AM RLC on signalling radio bearer RB3.

If an Inter-RAT handover from UTRAN procedure occurs after the RRC CONNECTION REJECT message was received, before the successful delivery of the EARLY INITIAL DIRECT TRANSFER message has been confirmed by the CELL UPDATE CONFIRM message or before the successful delivery of the INITIAL DIRECT TRANSFER message has been confirmed by RLC, for messages with the IE "CN domain identity" set to "CS domain", the UE shall:

1> retransmit the NAS message as specified in subclause 8.3.7.4.PFI: I think that it is possible to have a redirection when the RNC sends the RRC Connection Reject instead of the RRC Connection Setup message.

8.1.8.2ab Inter-RAT handover from UTRAN to GERAN *Iu mode*

If an Inter-RAT handover from UTRAN to GERAN *Iu mode* occurs after the RRC CONNECTION REJECT message was received, before the successful delivery of the EARLY INITIAL DIRECT TRANSFER message has been confirmed by the CELL UPDATE CONFIRM message or before the successful delivery of the INITIAL DIRECT TRANSFER message has been confirmed by RLC, for messages for all CN domains, the UE shall:

1> retransmit the NAS message as specified in subclause 8.3.7.4.8.1.8.2b Abortion of signalling connection establishment

If the UE receives a request from upper layers to release (abort) the signalling connection for the CN domain for which the initial direct transfer procedure is ongoing, the UE shall:

1> if the UE has not yet entered UTRA RRC connected mode:

2> abort the RRC connection establishment procedure as specified in subclause 8.1.3;

the procedure ends.

8.1.8.3 Reception of INITIAL DIRECT TRANSFER message by the UTRAN

On reception of the EARLY INITIAL DIRECT TRANSFER message, the UTRAN should:

1> in case that the EARLY INITIAL DIRECT TRANSFER message is received during the RRC connection establishment procedure:

2> if the RRC CONNECTION REQUEST message is received before the reception of the EARLY INITIAL DIRECT TRANSFER message and an RRC CONNECTION SETUP message will be transmitted in response to the RRC CONNECTION REQUEST message; and

[Editor's NOTE: If the early IDT arrived before the RRC CONNECTION REQUEST, the UTRAN may be able to buffer the early IDT before arrival of the RRC CONNECTION REQUEST. But, the UTRAN does not know when it finally receives the RRC CONNECTION REQUEST after the early IDT. If the RRC CONNECTION REQUEST doesn't ever arrive at the RNC, the RNC needs not to route the early IDT to CN. In addition, when the UTRAN receive the RRC CONNECTION REQUEST after the early IDT, if the UTRAN reject the RRC connection request, the UTRAN needs not to route the early IDT to CN either. Thus, in this case routing the early IDT to CN comes to an unnecessary action as well. Thus, it is recommended that the UTRAN waits until being ready to send the RRC CONNECTION SETUP message before routing the early IDT to CN. Anyway, this is UTRAN implementation dependent.]

PFI: In the way you describe it only in the case that te earcly IDT is received after the RRC Conn. Req. it is handled by the RNC. Thus there is no unambiguity. This looks ok.

2> if the value of IE "Initial UE identity" contained in the RRC CONNECTION REQUEST message is equal to the value of IE "Initial UE identity" contained in the the EARLY INITIAL DIRECT TRANSFER message:

3> routes the NAS message in EARLY INITIAL DIRECT TRANSFER message using the IE "CN Domain Identity". UTRAN may also use the IE "Intra Domain NAS Node Selector" and the IE "PLMN identity" for routing among the CN nodes for the addressed CN domain;

3> set the IE "Early IDT Confirmation" of the RRC CONNECTION SETUP message to "Confirmed";

3> transmit the RRC CONNECTION SETUP message according to subclause 8.1.3.

2> otherwise:

3> ignore the EARLY INITIAL DIRECT TRANSFER message;

3> if an RRC CONNECTION SETUP message will be transmitted in response to the RRC CONNECTION REQUEST message:

4> set the IE "Early IDT Confirmation" of the RRC CONNECTION SETUP message to "Not Confirmed" and transmit the RRC CONNECTION SETUP message according to subclause 8.1.3.

[Editor's NOTE: if the RRC connection request is rejected, no further action needs to be done.]

1> in case that the EARLY INITIAL DIRECT TRANSFER message is received during the cell update procedure:

2> if the CELL UPDATE message is received before the reception of the EARLY INITIAL DIRECT TRANSFER message and an CELL UPDATE CONFIRM message will be transmitted in response to the CELL UPDATE message; and

2> if the value of IE "U-RNTI" contained in the CELL UPDATE message is equal to the value of IE "U-RNTI" contained in the the EARLY INITIAL DIRECT TRANSFER message:

3> routes the NAS message in EARLY INITIAL DIRECT TRANSFER message using the IE "CN Domain Identity". UTRAN may also use the IE "Intra Domain NAS Node Selector" and the IE "PLMN identity" for routing among the CN nodes for the addressed CN domain;

3> set the IE "Early IDT Confirmation" of the CELL UPDATE CONFIRM message to "Confirmed";

3> transmit the CELL UPDATE CONFIRM message according to subclause 8.3.1.

2> otherwise:

3> ignore the EARLY INITIAL DIRECT TRANSFER message;

3> set the IE "Early IDT Confirmation" of the CELL UPDATE CONFIRM message to "Not Confirmed" and transmit the CELL UPDATE CONFIRM message according to subclause 8.3.1.

On reception of the INITIAL DIRECT TRANSFER message the NAS message should be routed using the IE "CN Domain Identity". UTRAN may also use the IE "Intra Domain NAS Node Selector" and the IE "PLMN identity" for routing among the CN nodes for the addressed CN domain.

If no signalling connection exists towards the chosen node, then a signalling connection is established.

When the UTRAN receives an EARLY INITIAL DIRECT TRANSFER message or an INITIAL DIRECT TRANSFER message, it shall not affect the state of any other ongoing RRC procedures, when not stated otherwise elsewhere.

The UTRAN should:

1> set the START value for the CN domain indicated in the IE "CN domain identity" to the value of the IE "START".

--- Omitted Sections ---

10.2.8 CELL UPDATE CONFIRM

This message confirms the cell update procedure and can be used to reallocate new RNTI information for the UE valid in the new cell.

RLC-SAP: UM

Logical channel: CCCH or DCCH

Direction: UTRAN→UE

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
Message Type	MP		Message Type		
UE Information Elements					
U-RNTI	CV-*CCCH*		U-RNTI 10.3.3.47		
RRC transaction identifier	MP		RRC transaction identifier 10.3.3.36		
Integrity check info	CH		Integrity check info 10.3.3.16		
Integrity protection mode info	OP		Integrity protection mode info 10.3.3.19	The UTRAN should not include this IE unless it is performing an SRNS relocation or a cell reselection from GERAN *Iu mode*	
Ciphering mode info	OP		Ciphering mode info 10.3.3.5	The UTRAN should not include this IE unless it is performing either an SRNS relocation or a cell reselection from GERAN *Iu mode*, and a change in ciphering algorithm.	
Activation time	MD		Activation time 10.3.3.1	Default value is "now"	
New U-RNTI	OP		U-RNTI 10.3.3.47		

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
New C-RNTI	OP		C-RNTI 10.3.3.8		
New DSCH-RNTI	OP		DSCH-RNTI 10.3.3.9a	Should not be set in FDD. If received, the UE should ignore it	
New H-RNTI	OP		H-RNTI 10.3.3.14a		REL-5
New Primary E-RNTI	OP		E-RNTI 10.3.3.10a		REL-6
New Secondary E-RNTI	OP		E-RNTI 10.3.3.10a		REL-6
RRC State Indicator	MP		RRC State Indicator 10.3.3.35a		
UTRAN DRX cycle length coefficient	OP		UTRAN DRX cycle length coefficient 10.3.3.49		
RLC re-establish indicator (RB2, RB3 and RB4)	MP		RLC re-establish indicator 10.3.3.35	Should not be set to TRUE if IE "Downlink counter synchronisation info" is included in message.	
RLC re-establish indicator (RB5 and upwards)	MP		RLC re-establish indicator 10.3.3.35	Should not be set to TRUE if IE "Downlink counter synchronisation info" is included in message.	
Early IDT Confirmation	MP		Enumerated (Confirmed, Not Confirmed)		REL-7
CN Information Elements					
CN Information info	OP		CN Information info 10.3.1.3		
UTRAN Information Elements					
URA identity	OP		URA identity 10.3.2.6		
RB information elements					
RB information to release list	OP	1 to <maxRB>			
>RB information to release	MP		RB information to release 10.3.4.19		
RB information to reconfigure list	OP	1 to <maxRB>			
>RB information to reconfigure	MP		RB information to reconfigure 10.3.4.18		
RB information to be affected list	OP	1 to <maxRB>			
>RB information to be affected	MP		RB information to be affected 10.3.4.17		
Downlink counter synchronisation info	OP				

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
>RB with PDCP information list	OP	1 to <maxRBallRABs>			
>>RB with PDCP information	MP		RB with PDCP information 10.3.4.22	This IE is needed for each RB having PDCP in the case of lossless SRNS relocation	
	OP				REL-5
>>PDCP context relocation info	OP		PDCP context relocation info 10.3.4.1a	This IE is needed for each RB having PDCP and performing PDCP context relocation	REL-5
PDCP ROHC target mode	OP		PDCP ROHC target mode 10.3.4.2a		REL-5
TrCH Information Elements					
Uplink transport channels					
UL Transport channel information common for all transport channels	OP		UL Transport channel information common for all transport channels 10.3.5.24		
Deleted TrCH information list	OP	1 to <maxTrCH>			
>Deleted UL TrCH information	MP		Deleted UL TrCH information 10.3.5.5		
Added or Reconfigured TrCH information list	OP	1 to <maxTrCH>			
>Added or Reconfigured UL TrCH information	MP		Added or Reconfigured UL TrCH information 10.3.5.2		
Downlink transport channels					
DL Transport channel information common for all transport channels	OP		DL Transport channel information common for all transport channels 10.3.5.6		
Deleted TrCH information list	OP	1 to <maxTrCH>			
>Deleted DL TrCH information	MP		Deleted DL TrCH information 10.3.5.4		
Added or Reconfigured TrCH information list	OP	1 to <maxTrCH>			
>Added or Reconfigured DL TrCH information	MP		Added or Reconfigured DL TrCH information 10.3.5.1		

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
PhyCH information elements					
Frequency info	OP		Frequency info 10.3.6.36		
Uplink radio resources					
Maximum allowed UL TX power	MD		Maximum allowed UL TX power 10.3.6.39	Default value is the existing maximum UL TX power	
Uplink DPCH info	OP		Uplink DPCH info 10.3.6.88.		
E-DCH Info	OP		E-DCH Info 10.3.6.97		REL-6
Downlink radio resources					
Downlink HS-PDSCH Information	OP		Downlink HS_PDSCH Information 10.3.6.23a		REL-5
Downlink information common for all radio links	OP		Downlink information common for all radio links 10.3.6.24		
Downlink information per radio link list	OP	1 to <maxRL>		Send downlink information for each radio link to be set-up	
>Downlink information for each radio link	MP		Downlink information for each radio link 10.3.6.27		
MBMS PL Service Restriction Information	OP		Enumerated (TRUE)	Absence means that on the MBMS Preferred Layer (PL) no restrictions apply concerning the use of non-MBMS services i.e. the PL is not congested	REL-6

Condition	Explanation
CCCH	This IE is mandatory present when CCCH is used and ciphering is not required and not needed otherwise.

--- **Omitted Sections** ---

10.2.x EARLY INITIAL DIRECT TRANSFER

This message is used to initiate a signalling connection immediately after the RRC CONNECTION SETUP message or the CELL_UPDATE message based on indication from the upper layers.

RLC-SAP: TM

Logical channel: CCCH

Direction: UE -> UTRAN

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
Message Type	MP		Message Type		REL-7
UE information elements					
CHOICE *UE identity*	MP				
>Initial UE identity			Initial UE identity 10.3.3.15	This IE is indentical with IE 'initial UE identity' in the RRC CONNECTION REQUEST message transmitted right before this message.	REL-7
>U-RNTI			U-RNTI 10.3.3.47	This IE is indentical with IE 'U-RNTI' in the CELL UPDATE message transmitted right before this message.	REL-7
PLMN identity	OP		PLMN identity 10.3.1.11	This IE indicates the PLMN to which the UE requests the signalling connection to be established.	REL-7
CN information elements					
CN domain identity	MP		CN domain identity 10.3.1.1		REL-7
Intra Domain NAS Node Selector	MP		Intra Domain NAS Node Selector 10.3.1.6		REL-7
NAS message	MP		NAS message 10.3.1.8		REL-7
MBMS joined information	OP				REL-7
>P-TMSI	OP		P-TMSI (GSM-MAP) 10.3.1.13		REL-7

--- **Omitted Sections** ---

10.2.40 RRC CONNECTION SETUP

This message is used by the network to accept the establishment of an RRC connection for a UE, including assignment of signalling link information, transport channel information and optionally physical channel information.

RLC-SAP: UM

Logical channel: CCCH

Direction: UTRAN → UE

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
Message Type	MP		Message Type		
UE Information Elements					
Initial UE identity	MP		Initial UE identity 10.3.3.15		
RRC transaction identifier	MP		RRC transaction identifier 10.3.3.36		
Activation time	MD		Activation time 10.3.3.1	Default value is "now"	
New U-RNTI	MP		U-RNTI 10.3.3.47		
New C-RNTI	OP		C-RNTI 10.3.3.8		
New H-RNTI	OP		H-RNTI 10.3.3.14a		REL-6
New Primary E-RNTI	OP		E-RNTI 10.3.3.10a		REL-6
New Secondary E-RNTI	OP		E-RNTI 10.3.3.10a		REL-6
RRC State Indicator	MP		RRC State Indicator 10.3.3.35a		
UTRAN DRX cycle length coefficient	MP		UTRAN DRX cycle length coefficient 10.3.3.49		
Capability update requirement	MD		Capability update requirement 10.3.3.2	Default value is defined in subclause 10.3.3.2	
Early IDT Confirmation	MP		Enumerated (Confirmed, Not Confirmed)		REL-77
CHOICE *specification mode*	MP				REL-5
>Complete specification					
RB Information Elements					
>>Signalling RB information to setup list	MP	3 to 4			
>>>Signalling RB information to setup	MP		Signalling RB information to setup 10.3.4.24		
TrCH Information Elements					
Uplink transport channels					
>>UL Transport channel information common for all transport channels	OP		UL Transport channel information common for all transport channels 10.3.5.24		

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
>>Added or Reconfigured TrCH information list	MP	1 to <maxTrCH>		Although this IE is not required when the IE "RRC state indicator" is set to "CELL_FACH", need is MP to align with ASN.1	
	OP				REL-4
>>>Added or Reconfigured UL TrCH information	MP		Added or Reconfigured UL TrCH information 10.3.5.2		
Downlink transport channels					
>>DL Transport channel information common for all transport channels	OP		DL Transport channel information common for all transport channels 10.3.5.6		
>>Added or Reconfigured TrCH information list	MP	1 to <maxTrCH>		Although this IE is not required when the IE "RRC state indicator" is set to "CELL_FACH", need is MP to align with ASN.1	
	OP				REL-4
>>>Added or Reconfigured DL TrCH information	MP		Added or Reconfigured DL TrCH information 10.3.5.1		
>Preconfiguration					REL-5
>>CHOICE *Preconfiguration mode*	MP				REL-5
>>>Predefined configuration identity	MP		Predefined configuration identity 10.3.4.5		REL-5
>>>Default configuration					REL-5
>>>>Default configuration mode	MP		Enumerated (FDD, TDD)	Indicates whether the FDD or TDD version of the default configuration shall be used	REL-5
>>>>Default configuration identity	MP		Default configuration identity 10.3.4.0		REL-5
PhyCH information elements					
Frequency info	OP		Frequency info 10.3.6.36		
Uplink radio resources					
Maximum allowed UL TX power	MD		Maximum allowed UL TX power 10.3.6.39	Default value is the existing maximum UL TX power	
Uplink DPCH info	OP		Uplink DPCH info 10.3.6.88		
E-DCH Info	OP		E-DCH Info		REL-6

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
			10.3.6.97		
Downlink radio resources					
Downlink HS-PDSCH Information	OP		Downlink HS-PDSCH information 10.3.6.23a		REL-6
Downlink information common for all radio links	OP		Downlink information common for all radio links 10.3.6.24		
Downlink information per radio link list	OP	1 to <MaxRL>		Send downlink information for each radio link to be set-up	
>Downlink information for each radio link	MP		Downlink information for each radio link 10.3.6.27		

-- Omitted Sections --

11 Message and Information element abstract syntax (with ASN.1))

11.1 General message structure

```
Class-definitions DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS

    ActiveSetUpdate,
    ActiveSetUpdateComplete,
    ActiveSetUpdateFailure,
    AssistanceDataDelivery,
    CellChangeOrderFromUTRAN,
    CellChangeOrderFromUTRANFailure,
    CellUpdate,
    CellUpdateConfirm-CCCH,
    CellUpdateConfirm,
    CounterCheck,
    CounterCheckResponse,
    DownlinkDirectTransfer,
    HandoverToUTRANComplete,
    InitialDirectTransfer,
    HandoverFromUTRANCommand-GERANIu,
    HandoverFromUTRANCommand-GSM,
    HandoverFromUTRANCommand-CDMA2000,
    HandoverFromUTRANFailure,
    MBMSAccessInformation,
    MBMSCommonPTMRBInformation,
    MBMSCurrentCellPTMRBInformation,
    MBMSGeneralInformation,
    MBMSModificationRequest,
    MBMSModifiedServicesInformation,
    MBMSNeighbouringCellPTMRBInformation,
    MBMSSchedulingInformation,
    MBMSUnmodifiedServicesInformation,
    MeasurementControl,
    MeasurementControlFailure,
    MeasurementReport,
    PagingType1,
    PagingType2,
    PhysicalChannelReconfiguration,
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    PhysicalChannelReconfigurationComplete,
    PhysicalChannelReconfigurationFailure,
    PhysicalSharedChannelAllocation,
    PUSCHCapacityRequest,
    RadioBearerReconfiguration,
    RadioBearerReconfigurationComplete,
    RadioBearerReconfigurationFailure,
    RadioBearerRelease,
    RadioBearerReleaseComplete,
    RadioBearerReleaseFailure,
    RadioBearerSetup,
    RadioBearerSetupComplete,
    RadioBearerSetupFailure,
    RRCConnectionReject,
    RRCConnectionRelease,
    RRCConnectionRelease-CCCH,
    RRCConnectionReleaseComplete,
    RRCConnectionRequest,
    RRCConnectionSetup,
    RRCConnectionSetupComplete,
    RRCStatus,
    SecurityModeCommand,
    SecurityModeComplete,
    SecurityModeFailure,
    SignallingConnectionRelease,
    SignallingConnectionReleaseIndication,
    SystemInformation-BCH,
    SystemInformation-FACH,
    SystemInformationChangeIndication,
    TransportChannelReconfiguration,
    TransportChannelReconfigurationComplete,
    TransportChannelReconfigurationFailure,
    TransportFormatCombinationControl,
    TransportFormatCombinationControlFailure,
    UECapabilityEnquiry,
    UECapabilityInformation,
    UECapabilityInformationConfirm,
    UplinkDirectTransfer,
    UplinkPhysicalChannelControl,
    URAUpdate,
    URAUpdateConfirm,
    URAUpdateConfirm-CCCH,
    UTRANMobilityInformation,
    UTRANMobilityInformationConfirm,
    UTRANMobilityInformationFailure
FROM PDU-definitions

-- User Equipment IEs :
    IntegrityCheckInfo
FROM InformationElements;

--**************************************************************
--
-- Downlink DCCH messages
--
--**************************************************************

DL-DCCH-Message ::= SEQUENCE {
    integrityCheckInfo      IntegrityCheckInfo      OPTIONAL,
    message                 DL-DCCH-MessageType
}

DL-DCCH-MessageType ::= CHOICE {
    activeSetUpdate                     ActiveSetUpdate,
    assistanceDataDelivery              AssistanceDataDelivery,
    cellChangeOrderFromUTRAN            CellChangeOrderFromUTRAN,
    cellUpdateConfirm                   CellUpdateConfirm,
    counterCheck                        CounterCheck,
    downlinkDirectTransfer              DownlinkDirectTransfer,
    handoverFromUTRANCommand-GSM        HandoverFromUTRANCommand-GSM,
    handoverFromUTRANCommand-CDMA2000   HandoverFromUTRANCommand-CDMA2000,
    measurementControl                  MeasurementControl,
    pagingType2                         PagingType2,
    physicalChannelReconfiguration      PhysicalChannelReconfiguration,
    physicalSharedChannelAllocation     PhysicalSharedChannelAllocation,
    radioBearerReconfiguration          RadioBearerReconfiguration,
    radioBearerRelease                  RadioBearerRelease,
    radioBearerSetup                    RadioBearerSetup,
```

```
    rrcConnectionRelease                    RRCConnectionRelease,
    securityModeCommand                     SecurityModeCommand,
    signallingConnectionRelease             SignallingConnectionRelease,
    transportChannelReconfiguration         TransportChannelReconfiguration,
    transportFormatCombinationControl       TransportFormatCombinationControl,
    ueCapabilityEnquiry                     UECapabilityEnquiry,
    ueCapabilityInformationConfirm          UECapabilityInformationConfirm,
    uplinkPhysicalChannelControl            UplinkPhysicalChannelControl,
    uraUpdateConfirm                        URAUpdateConfirm,
    utranMobilityInformation                UTRANMobilityInformation,
    handoverFromUTRANCommand-GERANIu        HandoverFromUTRANCommand-GERANIu,
    mbmsModifiedServicesInformation         MBMSModifiedServicesInformation,
    spare5                                  NULL,
    spare4                                  NULL,
    spare3                                  NULL,
    spare2                                  NULL,
    spare1                                  NULL
}

--***************************************************************
--
-- Uplink DCCH messages
--
--***************************************************************

UL-DCCH-Message ::= SEQUENCE {
    integrityCheckInfo        IntegrityCheckInfo        OPTIONAL,
    message                   UL-DCCH-MessageType
}

UL-DCCH-MessageType ::= CHOICE {
    activeSetUpdateComplete                 ActiveSetUpdateComplete,
    activeSetUpdateFailure                  ActiveSetUpdateFailure,
    cellChangeOrderFromUTRANFailure         CellChangeOrderFromUTRANFailure,
    counterCheckResponse                    CounterCheckResponse,
    handoverToUTRANComplete                 HandoverToUTRANComplete,
    initialDirectTransfer                   InitialDirectTransfer,
    handoverFromUTRANFailure                HandoverFromUTRANFailure,
    measurementControlFailure               MeasurementControlFailure,
    measurementReport                       MeasurementReport,
    physicalChannelReconfigurationComplete
                                            PhysicalChannelReconfigurationComplete,
    physicalChannelReconfigurationFailure
                                            PhysicalChannelReconfigurationFailure,
    radioBearerReconfigurationComplete      RadioBearerReconfigurationComplete,
    radioBearerReconfigurationFailure       RadioBearerReconfigurationFailure,
    radioBearerReleaseComplete              RadioBearerReleaseComplete,
    radioBearerReleaseFailure               RadioBearerReleaseFailure,
    radioBearerSetupComplete                RadioBearerSetupComplete,
    radioBearerSetupFailure                 RadioBearerSetupFailure,
    rrcConnectionReleaseComplete            RRCConnectionReleaseComplete,
    rrcConnectionSetupComplete              RRCConnectionSetupComplete,
    rrcStatus                               RRCStatus,
    securityModeComplete                    SecurityModeComplete,
    securityModeFailure                     SecurityModeFailure,
    signallingConnectionReleaseIndication
                                            SignallingConnectionReleaseIndication,
    transportChannelReconfigurationComplete
                                            TransportChannelReconfigurationComplete,
    transportChannelReconfigurationFailure
                                            TransportChannelReconfigurationFailure,
    transportFormatCombinationControlFailure
                                            TransportFormatCombinationControlFailure,
    ueCapabilityInformation                 UECapabilityInformation,
    uplinkDirectTransfer                    UplinkDirectTransfer,
    utranMobilityInformationConfirm         UTRANMobilityInformationConfirm,
    utranMobilityInformationFailure         UTRANMobilityInformationFailure,
    mbmsModificationRequest                 MBMSModificationRequest,
    spare1                                  NULL
}

--***************************************************************
--
-- Downlink CCCH messages
--
--***************************************************************

DL-CCCH-Message ::= SEQUENCE {
```

```
    integrityCheckInfo      IntegrityCheckInfo      OPTIONAL,
    message                 DL-CCCH-MessageType
}

DL-CCCH-MessageType ::= CHOICE {
    cellUpdateConfirm                   CellUpdateConfirm-CCCH,
    rrcConnectionReject                 RRCConnectionReject,
    rrcConnectionRelease                RRCConnectionRelease-CCCH,
    rrcConnectionSetup                  RRCConnectionSetup,
    uraUpdateConfirm                    URAUpdateConfirm-CCCH,
    spare3                              NULL,
    spare2                              NULL,
    spare1                              NULL
}

--***************************************************************
--
-- Uplink CCCH messages
--
--***************************************************************

UL-CCCH-Message ::= SEQUENCE {
    integrityCheckInfo      IntegrityCheckInfo      OPTIONAL,
    message                 UL-CCCH-MessageType
}

UL-CCCH-MessageType ::= CHOICE {
    cellUpdate                          CellUpdate,
    rrcConnectionRequest                RRCConnectionRequest,
    uraUpdate                           URAUpdate,
    spare                               NULL
}

--***************************************************************
--
-- PCCH messages
--
--***************************************************************

PCCH-Message ::= SEQUENCE {
    message             PCCH-MessageType
}

PCCH-MessageType ::= CHOICE {
    pagingType1                         PagingType1,
    spare                               NULL
}

--***************************************************************
--
-- Downlink SHCCH messages
--
--***************************************************************

DL-SHCCH-Message ::= SEQUENCE {
    message                 DL-SHCCH-MessageType
}

DL-SHCCH-MessageType ::= CHOICE {
    physicalSharedChannelAllocation     PhysicalSharedChannelAllocation,
    spare                               NULL
}

--***************************************************************
--
-- Uplink SHCCH messages
--
--***************************************************************

UL-SHCCH-Message ::= SEQUENCE {
    message                 UL-SHCCH-MessageType
}

UL-SHCCH-MessageType ::= CHOICE {
    puschCapacityRequest                PUSCHCapacityRequest,
    spare                               NULL
}
```

```
--**************************************************************
--
-- BCCH messages sent on FACH
--
--**************************************************************

BCCH-FACH-Message ::= SEQUENCE {
    message                 BCCH-FACH-MessageType
}

BCCH-FACH-MessageType ::= CHOICE {
    systemInformation                   SystemInformation-FACH,
    systemInformationChangeIndication   SystemInformationChangeIndication,
    spare2                              NULL,
    spare1                              NULL
}

--**************************************************************
--
-- BCCH messages sent on BCH
--
--**************************************************************

BCCH-BCH-Message ::= SEQUENCE {
    message                 SystemInformation-BCH
}

--**************************************************************
--
-- MCCH messages
--
--**************************************************************

MCCH-Message ::= SEQUENCE {
    message                 MCCH-MessageType
}

MCCH-MessageType ::= CHOICE {
    mbmsAccessInformation               MBMSAccessInformation,
    mbmsCommonPTMRBInformation          MBMSCommonPTMRBInformation,
    mbmsCurrentCellPTMRBInformation     MBMSCurrentCellPTMRBInformation,
    mbmsGeneralInformation              MBMSGeneralInformation,
    mbmsModifiedServicesInformation     MBMSModifiedServicesInformation,
    mbmsNeighbouringCellPTMRBInformation
                                        MBMSNeighbouringCellPTMRBInformation,
    mbmsUnmodifiedServicesInformation   MBMSUnmodifiedServicesInformation,
    spare9                              NULL,
    spare8                              NULL,
    spare7                              NULL,
    spare6                              NULL,
    spare5                              NULL,
    spare4                              NULL,
    spare3                              NULL,
    spare2                              NULL,
    spare1                              NULL
}

--**************************************************************
--
-- MSCH messages
--
--**************************************************************

MSCH-Message ::= SEQUENCE {
    message                 MSCH-MessageType
}

MSCH-MessageType ::= CHOICE {
    mbmsSchedulingInformation           MBMSSchedulingInformation,
    spare3                              NULL,
    spare2                              NULL,
    spare1                              NULL
}

END
```

11.2 PDU definitions

```
--**************************************************************
--
-- TABULAR: The message type and integrity check info are not
-- visible in this module as they are defined in the class module.
-- Also, all FDD/TDD specific choices have the FDD option first
-- and TDD second, just for consistency.
--
--**************************************************************

PDU-definitions DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

--**************************************************************
--
-- IE parameter types from other modules
--
--**************************************************************

IMPORTS

-- Core Network IEs :
    CN-DomainIdentity,
    CN-InformationInfo,
    CN-InformationInfo-r6,
    CN-InformationInfoFull,
    NAS-Message,
    PagingRecordTypeID,
    PLMN-Identity,
-- UTRAN Mobility IEs :
    CellIdentity,
    CellIdentity-PerRL-List,
    URA-Identity,
-- User Equipment IEs :
    UE-RadioAccessCapabilityComp-r7,
    UE-RadioAccessCapability-v7xyext,
    UE-RadioAccessCapabBandFDDList2,
    UE-RadioAccessCapabBandFDDList-ext,
    AccessStratumReleaseIndicator,
    ActivationTime,
    C-RNTI,
    CapabilityUpdateRequirement,
    CapabilityUpdateRequirement-r4,
    CapabilityUpdateRequirement-r4-ext,
    CapabilityUpdateRequirement-r5,
    CapabilityUpdateRequirement-r7-ext,
    CellUpdateCause,
    CellUpdateCause-ext,
CipheringAlgorithm,
    CipheringModeInfo,
        DelayRestrictionFlag,
    DSCH-RNTI,
    E-RNTI,
    EstablishmentCause,
    FailureCauseWithProtErr,
    FailureCauseWithProtErrTrId,
    GroupReleaseInformation,
    H-RNTI,
    UESpecificBehaviourInformation1idle,
    UESpecificBehaviourInformation1interRAT,
    InitialUE-Identity,
    IntegrityProtActivationInfo,
    IntegrityProtectionModeInfo,
    N-308,
    PagingCause,
    PagingRecordList,
    PagingRecord2List-r5,
    ProtocolErrorIndicator,
    ProtocolErrorIndicatorWithMoreInfo,
    RadioFrequencyBandTDDList,
    Rb-timer-indicator,
    RedirectionInfo,
    RedirectionInfo-r6,
    RejectionCause,
    ReleaseCause,
```

```
    RF-CapabilityComp,
    RRC-StateIndicator,
    RRC-TransactionIdentifier,
    SecurityCapability,
    START-Value,
    STARTList,
    SystemSpecificCapUpdateReq-v590ext,
    U-RNTI,
    U-RNTI-Short,
    UE-CapabilityContainer-IEs,
    UE-RadioAccessCapability,
    UE-RadioAccessCapability-v370ext,
    UE-RadioAccessCapability-v380ext,
    UE-RadioAccessCapability-v3a0ext,
    UE-RadioAccessCapability-v3g0ext,
    UE-RadioAccessCapability-v4b0ext,
    UE-RadioAccessCapability-v590ext,
    UE-RadioAccessCapability-v5c0ext,
    UE-RadioAccessCapability-v650ext,
    UE-RadioAccessCapability-v680ext,
    UE-RadioAccessCapabilityComp,
    UE-RadioAccessCapabilityComp-ext,
    UE-RadioAccessCapabilityComp2,
    DL-PhysChCapabilityFDD-v380ext,
    UE-ConnTimersAndConstants,
    UE-ConnTimersAndConstants-v3a0ext,
    UE-ConnTimersAndConstants-r5,
    UE-SecurityInformation,
    UE-SecurityInformation2,
    URA-UpdateCause,
    UTRAN-DRX-CycleLengthCoefficient,
    WaitTime,
-- Radio Bearer IEs :
    DefaultConfigIdentity,
    DefaultConfigIdentity-r4,
    DefaultConfigIdentity-r5,
    DefaultConfigIdentity-r6,
    DefaultConfigMode,
    DL-CounterSynchronisationInfo,
    DL-CounterSynchronisationInfo-r5,
    PDCP-ROHC-TargetMode,
    PredefinedConfigIdentity,
    PredefinedConfigStatusList,
    PredefinedConfigStatusListComp,
    PredefinedConfigSetWithDifferentValueTag,
    RAB-Info,
    RAB-Info-r6,
    RAB-Info-Post,
    RAB-InformationList,
    RAB-InformationList-r6,
    RAB-InformationReconfigList,
    RAB-InformationSetupList,
    RAB-InformationSetupList-r4,
    RAB-InformationSetupList-r5,
    RAB-InformationSetupList-r6-ext,
    RAB-InformationSetupList-r6,
RB-ActivationTimeInfoList,
    RB-COUNT-C-InformationList,
    RB-COUNT-C-MSB-InformationList,
    RB-IdentityList,
    RB-InformationAffectedList,
    RB-InformationAffectedList-r5,
    RB-InformationAffectedList-r6,
    RB-InformationChangedList-r6,
    RB-InformationReconfigList,
    RB-InformationReconfigList-r4,
    RB-InformationReconfigList-r5,
    RB-InformationReconfigList-r6,
    RB-InformationReleaseList,
    RB-PDCPContextRelocationList,
    SRB-InformationSetupList,
    SRB-InformationSetupList-r5,
    SRB-InformationSetupList-r6,
        SRB-InformationSetupList2,
    SRB-InformationSetupList2-r6,
    UL-CounterSynchronisationInfo,
-- Transport Channel IEs:
    CPCH-SetID,
```

```
    DL-AddReconfTransChInfo2List,
    DL-AddReconfTransChInfoList,
    DL-AddReconfTransChInfoList-r4,
    DL-AddReconfTransChInfoList-r5,
    DL-CommonTransChInfo,
    DL-CommonTransChInfo-r4,
    DL-DeletedTransChInfoList,
    DL-DeletedTransChInfoList-r5,
    DRAC-StaticInformationList,
    PowerOffsetInfoShort,
    TFC-Subset,
    TFCS-Identity,
    UL-AddReconfTransChInfoList,
    UL-AddReconfTransChInfoList-r6,
    UL-CommonTransChInfo,
    UL-CommonTransChInfo-r4,
    UL-DeletedTransChInfoList,
    UL-DeletedTransChInfoList-r6,
-- Physical Channel IEs :
    Alpha,
    BEACON-PL-Est,
    CCTrCH-PowerControlInfo,
    CCTrCH-PowerControlInfo-r4,
    CCTrCH-PowerControlInfo-r5,
    CCTrCH-PowerControlInfo-r7,
    ConstantValue,
    ConstantValueTdd,
    CPCH-SetInfo,
    DHS-Sync,
    DL-CommonInformation,
    DL-CommonInformation-r4,
    DL-CommonInformation-r5,
    DL-CommonInformation-r6,
    DL-CommonInformation-r7,
DL-CommonInformationPost,
        DL-HSPDSCH-Information,
    DL-HSPDSCH-Information-r6,
    DL-HSPDSCH-Information-r7,
    DL-InformationPerRL-List,
    DL-InformationPerRL-List-r4,
    DL-InformationPerRL-List-r5,
    DL-InformationPerRL-List-r5bis,
    DL-InformationPerRL-List-r6,
    DL-InformationPerRL-List-r7,
    DL-InformationPerRL-ListPostFDD,
    DL-InformationPerRL-PostTDD,
    DL-InformationPerRL-PostTDD-LCR-r4,
    DL-PDSCH-Information,
DL-TPC-PowerOffsetPerRL-List,
    DPC-Mode,
    DPCH-CompressedModeStatusInfo,
        DynamicPersistenceLevel,
    E-DCH-ReconfigurationInfo,
    FrequencyInfo,
    FrequencyInfoFDD,
    FrequencyInfoTDD,
    HARQ-Preamble-Mode,
    HS-SICH-Power-Control-Info-TDD384,
    HS-SICH-Power-Control-Info-TDD768,
    MaxAllowedUL-TX-Power,
    OpenLoopPowerControl-IPDL-TDD-r4,
    PDSCH-CapacityAllocationInfo,
    PDSCH-CapacityAllocationInfo-r4,
    PDSCH-CapacityAllocationInfo-r7,
    PDSCH-Identity,
    PrimaryCPICH-Info,
    PrimaryCCPCH-TX-Power,
    PUSCH-CapacityAllocationInfo,
    PUSCH-CapacityAllocationInfo-r4,
    PUSCH-CapacityAllocationInfo-r7,
    PUSCH-Identity,
PUSCH-SysInfoList-HCR-r5,
    PDSCH-SysInfoList-HCR-r5,
        RL-AdditionInformationList,
    RL-AdditionInformationList-r6,
    RL-RemovalInformationList,
    Serving-HSDSCH-CellInformation,
    SpecialBurstScheduling,
```

```
    SSDT-Information,
    SSDT-Information-r4,
    TFC-ControlDuration,
    SSDT-UL,
    TimingMaintainedSynchInd,
    TimeslotList,
    TimeslotList-r4,
    TX-DiversityMode,
    UL-ChannelRequirement,
    UL-ChannelRequirement-r4,
    UL-ChannelRequirement-r5,
    UL-ChannelRequirementWithCPCH-SetID,
    UL-ChannelRequirementWithCPCH-SetID-r4,
    UL-ChannelRequirementWithCPCH-SetID-r5,
    UL-DPCH-Info,
    UL-DPCH-Info-r4,
    UL-DPCH-Info-r5,
    UL-DPCH-Info-r6,
    UL-DPCH-Info-r7,
    UL-DPCH-InfoPostFDD,
    UL-DPCH-InfoPostTDD,
    UL-DPCH-InfoPostTDD-LCR-r4,
    UL-EDCH-Information-r6,
    UL-SynchronisationParameters-r4,
    UL-TimingAdvance,
    UL-TimingAdvanceControl,
    UL-TimingAdvanceControl-r4,
    UL-TimingAdvanceControl-r7,
    UL-TimingAdvance-VHCR,
-- Measurement IEs :
    AdditionalMeasurementID-List,
    DeltaRSCP,
    Frequency-Band,
    EventResults,
    Inter-FreqEventCriteriaList-v590ext,
    Intra-FreqEventCriteriaList-v590ext,
    IntraFreqReportingCriteria-1b-r5,
    IntraFreqEvent-1d-r5,
    IntraFreqCellID,
    InterFreqEventResults-LCR-r4-ext,
    InterRATCellInfoIndication,
    InterRAT-TargetCellDescription,
    MeasuredResults,
    MeasuredResults-v390ext,
    MeasuredResults-v590ext,
    MeasuredResultsList,
    MeasuredResultsList-LCR-r4-ext,
    MeasuredResultsOnRACH,
    MeasuredResultsOnRACHinterFreq,
    MeasurementCommand,
    MeasurementCommand-r4,
    MeasurementCommand-r6,
    MeasurementIdentity,
    MeasurementReportingMode,
    PrimaryCCPCH-RSCP,
    SFN-Offset-Validity,
    TimeslotListWithISCP,
    TrafficVolumeMeasuredResultsList,
    UE-Positioning-GPS-AssistanceData,
    UE-Positioning-Measurement-v390ext,
    UE-Positioning-Measurement-v7xyext,
    UE-Positioning-OTDOA-AssistanceData,
    UE-Positioning-OTDOA-AssistanceData-r4ext,
    UE-Positioning-OTDOA-AssistanceData-UEB,
    VelocityEstimate,
    UE-InternalMeasuredResults-r7,
-- Other IEs :
    BCCH-ModificationInfo,
    CDMA2000-MessageList,
    GSM-TargetCellInfoList,
    GERANIu-MessageList,
    GERAN-SystemInformation,
    GSM-MessageList,
    InterRAT-ChangeFailureCause,
    InterRAT-HO-FailureCause,
    InterRAT-UE-RadioAccessCapabilityList,
    InterRAT-UE-RadioAccessCapability-v590ext,
    InterRAT-UE-SecurityCapList,
```

```
    IntraDomainNasNodeSelector,
    ProtocolErrorMoreInformation,
    Rplmn-Information,
    Rplmn-Information-r4,
    SegCount,
    SegmentIndex,
    SFN-Prime,
    SIB-Data-fixed,
    SIB-Data-variable,
    SIB-Type,
-- MBMS IEs:
    MBMS-CellGroupIdentity-r6,
    MBMS-CommonRBInformationList-r6,
    MBMS-CurrentCell-SCCPCHList-r6,
    MBMS-JoinedInformation-r6,
    MBMS-MICHConfigurationInfo-r6,
    MBMS-MICHConfigurationInfo-r7,
    MBMS-ModifedServiceList-r6,
    MBMS-MSCH-ConfigurationInfo-r6,
    MBMS-NeighbouringCellSCCPCHList-r6,
    MBMS-NumberOfNeighbourCells-r6,
    MBMS-PhyChInformationList-r6,
    MBMS-PL-ServiceRestrictInfo-r6,
    MBMS-PreferredFreqRequest-r6,
    MBMS-PreferredFrequencyList-r6,
    MBMS-PTMActivationTime-r6,
    MBMS-ServiceAccessInfoList-r6,
    MBMS-ServiceIdentity-r6,
    MBMS-ServiceSchedulingInfoList-r6,
    MBMS-SIBType5-SCCPCHList-r6,
    MBMS-TimersAndCounters-r6,
    MBMS-TranspChInfoForEachCCTrCh-r6,
    MBMS-TranspChInfoForEachTrCh-r6,
    MBMS-UnmodifiedServiceList-r6
FROM InformationElements

    maxSIBperMsg,
    maxURNTI-Group
FROM Constant-definitions;

-- ***************************************************
--
-- ACTIVE SET UPDATE (FDD only)
--
-- ***************************************************

ActiveSetUpdate ::= CHOICE {
    r3                                  SEQUENCE {
        activeSetUpdate-r3                  ActiveSetUpdate-r3-IEs,
        laterNonCriticalExtensions          SEQUENCE {
            -- Container for additional R99 extensions
            activeSetUpdate-r3-add-ext          BIT STRING          OPTIONAL,
            v4b0NonCriticalExtensions           SEQUENCE {
                activeSetUpdate-v4b0ext         ActiveSetUpdate-v4b0ext-IEs,
                v590NonCriticalExtensions           SEQUENCE {
                    activeSetUpdate-v590ext             ActiveSetUpdate-v590ext-IEs,
                    v690NonCriticalExtensions           SEQUENCE {
                        activeSetUpdate-v690ext             ActiveSetUpdate-v690ext-IEs,
                        nonCriticalExtensions               SEQUENCE {} OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            } OPTIONAL
        } OPTIONAL
    },
    later-than-r3                       SEQUENCE {
        rrc-TransactionIdentifier           RRC-TransactionIdentifier,
        criticalExtensions                  CHOICE {
            r6                                  SEQUENCE {
                activeSetUpdate-r6                  ActiveSetUpdate-r6-IEs,
                activeSetUpdate-r6-add-ext          BIT STRING          OPTIONAL,
                nonCriticalExtensions               SEQUENCE {}         OPTIONAL
            },
            criticalExtensions                  SEQUENCE {}
        }
    }
}

ActiveSetUpdate-r3-IEs ::= SEQUENCE {
```

```
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        -- dummy and dummy2 are not used in this version of the specification, they should
        -- not be sent and if received they should be ignored.
        dummy                       IntegrityProtectionModeInfo         OPTIONAL,
        dummy2                      CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        newU-RNTI                       U-RNTI                              OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo                  OPTIONAL,
    -- Radio bearer IEs
        -- dummy3 is not used in this version of the specification, it should
        -- not be sent and if received it should be ignored.
        dummy3                      DL-CounterSynchronisationInfo       OPTIONAL,
    -- Physical channel IEs
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        rl-AdditionInformationList      RL-AdditionInformationList          OPTIONAL,
        rl-RemovalInformationList       RL-RemovalInformationList           OPTIONAL,
        tx-DiversityMode                TX-DiversityMode                    OPTIONAL,
        -- dummy4 is not used in this version of the specification, it should
        -- not be sent and if received it should be ignored.
        dummy4                          SSDT-Information                    OPTIONAL
}

ActiveSetUpdate-v4b0ext-IEs ::= SEQUENCE {
    -- Physical channel IEs
        -- dummy is not used in this version of the specification, it should
        -- not be sent and if received it should be ignored.
        dummy                               SSDT-UL                             OPTIONAL,
        -- The order of the RLs in IE cell-id-PerRL-List is the same as
        -- in IE RL-AdditionInformationList included in this message
        cell-id-PerRL-List                  CellIdentity-PerRL-List             OPTIONAL
}

ActiveSetUpdate-v590ext-IEs ::= SEQUENCE {
    -- Physical channel IEs
        dpc-Mode                            DPC-Mode,
        dl-TPC-PowerOffsetPerRL-List        DL-TPC-PowerOffsetPerRL-List            OPTIONAL
}

ActiveSetUpdate-v690ext-IEs ::= SEQUENCE {
    -- Core network IEs
        primary-plmn-Identity               PLMN-Identity                       OPTIONAL
}

ActiveSetUpdate-r6-IEs ::= SEQUENCE {
    -- User equipment IEs
        activationTime                      ActivationTime                      OPTIONAL,
        newU-RNTI                           U-RNTI                              OPTIONAL,
        newH-RNTI                           H-RNTI                              OPTIONAL,
        newPrimary-E-RNTI                   E-RNTI                              OPTIONAL,
        newSecondary-E-RNTI                 E-RNTI                              OPTIONAL,
    -- Core network IEs
        cn-InformationInfo                  CN-InformationInfo-r6               OPTIONAL,
    -- Physical channel IEs
        maxAllowedUL-TX-Power               MaxAllowedUL-TX-Power               OPTIONAL,
        rl-AdditionInformationList          RL-AdditionInformationList-r6       OPTIONAL,
        rl-RemovalInformationList           RL-RemovalInformationList           OPTIONAL,
        tx-DiversityMode                    TX-DiversityMode                    OPTIONAL,
        dpc-Mode                            DPC-Mode                            OPTIONAL,
        serving-HSDSCH-CellInformation      Serving-HSDSCH-CellInformation      OPTIONAL,
        e-dch-ReconfigurationInfo           E-DCH-ReconfigurationInfo           OPTIONAL
}

-- ***************************************************
--
-- ACTIVE SET UPDATE COMPLETE (FDD only)
--
-- ***************************************************

ActiveSetUpdateComplete ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        -- dummy is not used in this version of the specification, it should
        -- not be sent and if received it should be ignored.
        dummy                       IntegrityProtActivationInfo         OPTIONAL,
    -- Radio bearer IEs
        -- dummy2 and dummy3 are not used in this version of the specification, they should
```

```
        -- not be sent and if received they should be ignored.
        dummy2                      RB-ActivationTimeInfoList           OPTIONAL,
        dummy3                      UL-CounterSynchronisationInfo       OPTIONAL,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            activeSetUpdateComplete-r3-add-ext      BIT STRING      OPTIONAL,
            nonCriticalExtensions           SEQUENCE {} OPTIONAL
        }   OPTIONAL
}

-- ***************************************************
--
-- ACTIVE SET UPDATE FAILURE (FDD only)
--
-- ***************************************************

ActiveSetUpdateFailure ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        failureCause                    FailureCauseWithProtErr,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            activeSetUpdateFailure-r3-add-ext       BIT STRING      OPTIONAL,
            nonCriticalExtensions           SEQUENCE {} OPTIONAL
    }   OPTIONAL
}

-- ***************************************************
--
-- Assistance Data Delivery
--
-- ***************************************************

AssistanceDataDelivery ::= CHOICE {
    r3                              SEQUENCE {
        assistanceDataDelivery-r3       AssistanceDataDelivery-r3-IEs,
        v3a0NonCriticalExtensions       SEQUENCE {
            assistanceDataDelivery-v3a0ext  AssistanceDataDelivery-v3a0ext,
            laterNonCriticalExtensions      SEQUENCE {
                -- Container for additional R99 extensions
                assistanceDataDelivery-r3-add-ext       BIT STRING      OPTIONAL,
                v4b0NonCriticalExtensions       SEQUENCE {
                    assistanceDataDelivery-v4b0ext
                                            AssistanceDataDelivery-v4b0ext-IEs,
                    nonCriticalExtensions           SEQUENCE {}                 OPTIONAL
                }   OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
    },
    later-than-r3                   SEQUENCE {
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        criticalExtensions              SEQUENCE {}
    }
}

AssistanceDataDelivery-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
    rrc-TransactionIdentifier       RRC-TransactionIdentifier,
    -- Measurement Information Elements
    ue-positioning-GPS-AssistanceData           UE-Positioning-GPS-AssistanceData
    OPTIONAL,
    ue-positioning-OTDOA-AssistanceData-UEB     UE-Positioning-OTDOA-AssistanceData-UEB
    OPTIONAL
}

AssistanceDataDelivery-v3a0ext ::= SEQUENCE {
    sfn-Offset-Validity                 SFN-Offset-Validity     OPTIONAL
}

AssistanceDataDelivery-v4b0ext-IEs ::= SEQUENCE {
    ue-Positioning-OTDOA-AssistanceData-r4ext   UE-Positioning-OTDOA-AssistanceData-r4ext   OPTIONAL
}

-- ***************************************************
--
-- CELL CHANGE ORDER FROM UTRAN
--
-- ***************************************************
```

```
CellChangeOrderFromUTRAN ::= CHOICE {
    r3                                  SEQUENCE {
        cellChangeOrderFromUTRAN-IEs        CellChangeOrderFromUTRAN-r3-IEs,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            cellChangeOrderFromUTRAN-r3-add-ext     BIT STRING      OPTIONAL,
            v590NonCriticalExtensions           SEQUENCE {
                cellChangeOrderFromUTRAN-v590ext    CellChangeOrderFromUTRAN-v590ext-IEs,
                nonCriticalExtensions           SEQUENCE {} OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
    },
    later-than-r3                       SEQUENCE {
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        criticalExtensions              SEQUENCE {}
    }
}

CellChangeOrderFromUTRAN-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        -- dummy is not used in this version of the specification, it should
        -- not be sent and if received it should be ignored.
        dummy                           IntegrityProtectionModeInfo         OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        -- the IE rab-InformationList is not used in this version of the specification, it should
        -- not be sent and if received it should be ignored. The IE may be used in a later
        -- version of the protocol and hence it is not changed into a dummy
    rab-InformationList                 RAB-InformationList             OPTIONAL,
        interRAT-TargetCellDescription  InterRAT-TargetCellDescription
}

CellChangeOrderFromUTRAN-v590ext-IEs ::= SEQUENCE {
        geran-SystemInfoType                CHOICE  {
            sI                                  GERAN-SystemInformation,
            pSI                                 GERAN-SystemInformation
            }       OPTIONAL
}

-- ***************************************************
--
-- CELL CHANGE ORDER FROM UTRAN FAILURE
--
-- ***************************************************

CellChangeOrderFromUTRANFailure ::= CHOICE {
    r3                                  SEQUENCE {
        cellChangeOrderFromUTRANFailure-r3
                                        CellChangeOrderFromUTRANFailure-r3-IEs,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            cellChangeOrderFromUTRANFailure-r3-add-ext      BIT STRING  OPTIONAL,
            nonCriticalExtensions               SEQUENCE {} OPTIONAL
        }   OPTIONAL
    },
    -- dummy is not used in this version of the specification and it
    -- should be ignored.
    dummy                               SEQUENCE {
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        criticalExtensions              SEQUENCE {}
    }
}

CellChangeOrderFromUTRANFailure-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        -- dummy is not used in this version of the specification, it should
        -- not be sent and if received it should be ignored.
        dummy                           IntegrityProtectionModeInfo         OPTIONAL,
        interRAT-ChangeFailureCause     InterRAT-ChangeFailureCause
}

-- ***************************************************
--
-- CELL UPDATE
--
-- ***************************************************
```

```
CellUpdate ::= SEQUENCE {
    -- User equipment IEs
    u-RNTI                          U-RNTI,
        startList       STARTList,
            am-RLC-ErrorIndicationRb2-3or4      BOOLEAN,
        am-RLC-ErrorIndicationRb5orAbove    BOOLEAN,
        cellUpdateCause                 CellUpdateCause,
        -- TABULAR: RRC transaction identifier is nested in FailureCauseWithProtErrTrId
        failureCause                    FailureCauseWithProtErrTrId         OPTIONAL,
        rb-timer-indicator              Rb-timer-indicator,
    -- Measurement IEs
        measuredResultsOnRACH           MeasuredResultsOnRACH               OPTIONAL,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            cellUpdate-r3-add-ext           BIT STRING  OPTIONAL,
            v590NonCriticalExtensions   SEQUENCE {
                cellUpdate-v590ext  CellUpdate-v590ext,
                v690NonCriticalExtensions       SEQUENCE {
                    cellUpdate-v690ext              CellUpdate-v690ext-IEs,
                    nonCriticalExtensions           SEQUENCE {} OPTIONAL
                }       OPTIONAL
            }       OPTIONAL
        }   OPTIONAL
}

CellUpdate-v590ext ::= SEQUENCE {
    establishmentCause              EstablishmentCause  OPTIONAL
}

CellUpdate-v690ext-IEs ::=          SEQUENCE {
    -- User equipment IEs
        cellUpdateCause-ext             CellUpdateCause-ext                 OPTIONAL,
        trafficVolumeIndicator          ENUMERATED { true }                 OPTIONAL,
    -- Measurement IEs
        measuredResultsOnRACHinterFreq  MeasuredResultsOnRACHinterFreq      OPTIONAL,
        reconfigurationStatusIndicator  ENUMERATED { true }                 OPTIONAL
}

-- ***************************************************
--
-- CELL UPDATE CONFIRM
--
-- ***************************************************

CellUpdateConfirm ::= CHOICE {
    r3                              SEQUENCE {
        cellUpdateConfirm-r3            CellUpdateConfirm-r3-IEs,
        v3a0NonCriticalExtensions       SEQUENCE {
            cellUpdateConfirm-v3a0ext       CellUpdateConfirm-v3a0ext,
            laterNonCriticalExtensions      SEQUENCE {
                -- Container for additional R99 extensions
                cellUpdateConfirm-r3-add-ext    BIT STRING  OPTIONAL,
                v4b0NonCriticalExtensions       SEQUENCE {
                    cellUpdateConfirm-v4b0ext       CellUpdateConfirm-v4b0ext-IEs,
                    v590NonCriticalExtenstions      SEQUENCE {
                        cellUpdateConfirm-v590ext       CellUpdateConfirm-v590ext-IEs,
                        v5d0NonCriticalExtenstions      SEQUENCE {
                            cellUpdateConfirm-v5d0ext       CellUpdateConfirm-v5d0ext-IEs,
                            v690NonCriticalExtensions       SEQUENCE {
                                cellUpdateConfirm-v690ext       CellUpdateConfirm-v690ext-IEs,
                                nonCriticalExtensions           SEQUENCE {} OPTIONAL
                            }       OPTIONAL
                        }       OPTIONAL
                    }       OPTIONAL
                }       OPTIONAL
            }       OPTIONAL
        }       OPTIONAL
    },
    later-than-r3                   SEQUENCE {
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        criticalExtensions              CHOICE {
            r4                              SEQUENCE {
                cellUpdateConfirm-r4            CellUpdateConfirm-r4-IEs,
                v4d0NonCriticalExtensions       SEQUENCE {
                    -- Container for adding non critical extensions after freezing REL-5
                    cellUpdateConfirm-r4-add-ext    BIT STRING      OPTIONAL,
                    v590NonCriticalExtenstions      SEQUENCE {
```

```
                    cellUpdateConfirm-v590ext       CellUpdateConfirm-v590ext-IEs,
                    v5d0NonCriticalExtenstions      SEQUENCE {
                        cellUpdateConfirm-v5d0ext       CellUpdateConfirm-v5d0ext-IEs,
                        v690NonCriticalExtensions       SEQUENCE {
                            cellUpdateConfirm-v690ext       CellUpdateConfirm-v690ext-IEs,
                            nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                        }   OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            }   OPTIONAL
        },
        criticalExtensions              CHOICE {
            r5                              SEQUENCE {
                cellUpdateConfirm-r5            CellUpdateConfirm-r5-IEs,
                -- Container for adding non critical extensions after freezing REL-6
                cellUpdateConfirm-r5-add-ext    BIT STRING      OPTIONAL,
                v5d0NonCriticalExtenstions      SEQUENCE {
                    cellUpdateConfirm-v5d0ext       CellUpdateConfirm-v5d0ext-IEs,
                    v690NonCriticalExtensions       SEQUENCE {
                        cellUpdateConfirm-v690ext       CellUpdateConfirm-v690ext-IEs,
                        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            },
            criticalExtensions              CHOICE {
                r6                              SEQUENCE {
                    cellUpdateConfirm-r6            CellUpdateConfirm-r6-IEs,
                    -- Container for adding non critical extensions after freezing REL-7
                    cellUpdateConfirm-r6-add-ext    BIT STRING      OPTIONAL,
                    nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                },
                criticalExtensions              CHOICE {
                    r7                              SEQUENCE {
                        cellUpdateConfirm-r7            CellUpdateConfirm-r7-IEs,
                        -- Container for adding non critical extensions after freezing REL-8
                        cellUpdateConfirm-r7-add-ext    BIT STRING      OPTIONAL,
                        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                    },
                    criticalExtensions              SEQUENCE {}
                }
            }
        }
    }
  }
}

CellUpdateConfirm-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
        rlc-Re-establishIndicatorRb2-3or4       BOOLEAN,
        rlc-Re-establishIndicatorRb5orAbove     BOOLEAN,
    -- CN information elements
        cn-InformationInfo              CN-InformationInfo                  OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        rb-InformationReleaseList       RB-InformationReleaseList           OPTIONAL,
        rb-InformationReconfigList      RB-InformationReconfigList          OPTIONAL,
        rb-InformationAffectedList      RB-InformationAffectedList          OPTIONAL,
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo       OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo                OPTIONAL,
    ul-deletedTransChInfoList       UL-DeletedTransChInfoList           OPTIONAL,
            ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList         OPTIONAL,
        modeSpecificTransChInfo         CHOICE {
            fdd                             SEQUENCE {
                -- dummy and dummy2 are not used in this version of the specification, they should
                -- not be sent and if received they should be ignored.
                dummy                           CPCH-SetID                  OPTIONAL,
                dummy2                          DRAC-StaticInformationList  OPTIONAL
            },
```

```
        tdd                             NULL
    },
    dl-CommonTransChInfo            DL-CommonTransChInfo            OPTIONAL,
dl-DeletedTransChInfoList       DL-DeletedTransChInfoList       OPTIONAL,
        dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList     OPTIONAL,
-- Physical channel IEs
    frequencyInfo                   FrequencyInfo                   OPTIONAL,
    maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power           OPTIONAL,
    ul-ChannelRequirement           UL-ChannelRequirement           OPTIONAL,
    modeSpecificPhysChInfo          CHOICE {
        fdd                             SEQUENCE {
            -- dummy is not used in this version of specification, it should
            -- not be sent and if received it should be ignored.
            dummy                           DL-PDSCH-Information        OPTIONAL
        },
        tdd                             NULL
    },
    dl-CommonInformation            DL-CommonInformation            OPTIONAL,
    dl-InformationPerRL-List        DL-InformationPerRL-List        OPTIONAL
}

CellUpdateConfirm-v3a0ext ::= SEQUENCE {
    -- The IE "new-DSCH-RNTI" should not be included in FDD mode, and if received the UE behaviour
    -- is unspecified
    new-DSCH-RNTI               DSCH-RNTI                               OPTIONAL
}

CellUpdateConfirm-v4b0ext-IEs ::= SEQUENCE {
    -- Physical channel IEs
        -- dummy is not used in this version of the specification, it should
        -- not be sent and if received it should be ignored.
        dummy                           SSDT-UL                         OPTIONAL,
        -- The order of the RLs in IE cell-id-PerRL-List is the same as
        -- in IE DL-InformationPerRL-List included in this message
        cell-id-PerRL-List              CellIdentity-PerRL-List         OPTIONAL
}

CellUpdateConfirm-v590ext-IEs ::= SEQUENCE {
    -- Physical channel IEs
        dl-TPC-PowerOffsetPerRL-List    DL-TPC-PowerOffsetPerRL-List    OPTIONAL
}

CellUpdateConfirm-v5d0ext-IEs ::=  SEQUENCE {
    --Radio Bearer IEs
        pdcp-ROHC-TargetMode            PDCP-ROHC-TargetMode            OPTIONAL
}
CellUpdateConfirm-r4-IEs ::= SEQUENCE {
    -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo     OPTIONAL,
        cipheringModeInfo               CipheringModeInfo               OPTIONAL,
        activationTime                  ActivationTime                  OPTIONAL,
        new-U-RNTI                      U-RNTI                          OPTIONAL,
        new-C-RNTI                      C-RNTI                          OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode, and if received
        -- the UE behaviour is unspecified
        new-DSCH-RNTI                   DSCH-RNTI                       OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
        rlc-Re-establishIndicatorRb2-3or4       BOOLEAN,
        rlc-Re-establishIndicatorRb5orAbove BOOLEAN,
    -- CN information elements
        cn-InformationInfo              CN-InformationInfo              OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                    OPTIONAL,
    -- Radio bearer IEs
        rb-InformationReleaseList       RB-InformationReleaseList       OPTIONAL,
        rb-InformationReconfigList      RB-InformationReconfigList-r4   OPTIONAL,
        rb-InformationAffectedList      RB-InformationAffectedList      OPTIONAL,
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo   OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo-r4         OPTIONAL,
ul-deletedTransChInfoList       UL-DeletedTransChInfoList       OPTIONAL,
            ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList     OPTIONAL,
        modeSpecificTransChInfo         CHOICE {
            fdd                             SEQUENCE {
                -- dummy and dummy2 are not used in this version of the specification, they should
                -- not be sent and if received they should be ignored.
                dummy                           CPCH-SetID                  OPTIONAL,
```

```
                dummy2                          DRAC-StaticInformationList  OPTIONAL
            },
            tdd                             NULL
        },
        dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
    dl-DeletedTransChInfoList       DL-DeletedTransChInfoList           OPTIONAL,
            dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r4      OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-ChannelRequirement           UL-ChannelRequirement-r4            OPTIONAL,
        modeSpecificPhysChInfo          CHOICE {
            fdd                             SEQUENCE {
                -- dummy is not used in this version of specification, it should
                -- not be sent and if received it should be ignored.
                dummy                           DL-PDSCH-Information        OPTIONAL
            },
        tdd                             NULL
        },
        dl-CommonInformation            DL-CommonInformation-r4             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r4         OPTIONAL
}

CellUpdateConfirm-r5-IEs ::= SEQUENCE {
        -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode, and if received
        -- the UE behaviour is unspecified
        new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL,
        new-H-RNTI                      H-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
        rlc-Re-establishIndicatorRb2-3or4       BOOLEAN,
        rlc-Re-establishIndicatorRb5orAbove BOOLEAN,
    -- CN information elements
        cn-InformationInfo              CN-InformationInfo                  OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        rb-InformationReleaseList       RB-InformationReleaseList           OPTIONAL,
        rb-InformationReconfigList      RB-InformationReconfigList-r5       OPTIONAL,
        rb-InformationAffectedList      RB-InformationAffectedList-r5       OPTIONAL,
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo-r5    OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
    ul-deletedTransChInfoList       UL-DeletedTransChInfoList           OPTIONAL,
        ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList         OPTIONAL,
        modeSpecificTransChInfo         CHOICE {
            fdd                             SEQUENCE {
                -- dummy and dummy2 are not used in this version of the specification, they should
                -- not be sent and if received they should be ignored.
                dummy                           CPCH-SetID                  OPTIONAL,
                dummy2                          DRAC-StaticInformationList  OPTIONAL
            },
            tdd                             NULL
        },
        dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
        dl-DeletedTransChInfoList       DL-DeletedTransChInfoList-r5        OPTIONAL,
        dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r5      OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-ChannelRequirement           UL-ChannelRequirement-r5            OPTIONAL,
        modeSpecificPhysChInfo          CHOICE {
            fdd                             SEQUENCE {
                -- dummy is not used in this version of specification, it should
                -- not be sent and if received it should be ignored.
                dummy                           DL-PDSCH-Information        OPTIONAL
            },
            tdd                             NULL
        },
        dl-HSPDSCH-Information          DL-HSPDSCH-Information              OPTIONAL,
        dl-CommonInformation            DL-CommonInformation-r5             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r5         OPTIONAL
```

```
}

CellUpdateConfirm-r6-IEs ::= SEQUENCE {
    -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
            activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode,
        -- and if received the UE behaviour is unspecified
        new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL,
        new-H-RNTI                      H-RNTI                              OPTIONAL,
        newPrimary-E-RNTI               E-RNTI                              OPTIONAL,
        newSecondary-E-RNTI             E-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
        rlc-Re-establishIndicatorRb2-3or4       BOOLEAN,
        rlc-Re-establishIndicatorRb5orAbove     BOOLEAN,
    -- CN information elements
        cn-InformationInfo              CN-InformationInfo-r6               OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        rb-InformationReleaseList       RB-InformationReleaseList           OPTIONAL,
        rb-InformationReconfigList      RB-InformationReconfigList-r6       OPTIONAL,
        rb-InformationAffectedList      RB-InformationAffectedList-r6       OPTIONAL,
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo-r5    OPTIONAL,
        pdcp-ROHC-TargetMode            PDCP-ROHC-TargetMode                OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
    ul-deletedTransChInfoList       UL-DeletedTransChInfoList-r6        OPTIONAL,
            ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList-r6      OPTIONAL,
        dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
        dl-DeletedTransChInfoList       DL-DeletedTransChInfoList-r5        OPTIONAL,
        dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r5      OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-DPCH-Info                    UL-DPCH-Info-r6                     OPTIONAL,
        ul-EDCH-Information             UL-EDCH-Information-r6              OPTIONAL,
        dl-HSPDSCH-Information          DL-HSPDSCH-Information-r6           OPTIONAL,
        dl-CommonInformation            DL-CommonInformation-r6             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r6         OPTIONAL,
    -- MBMS IEs
        mbms-PL-ServiceRestrictInfo     MBMS-PL-ServiceRestrictInfo-r6      OPTIONAL
}

CellUpdateConfirm-v690ext-IEs ::=   SEQUENCE {
    -- Core network IEs
        primary-plmn-Identity           PLMN-Identity                       OPTIONAL,
    -- Physical channel IEs
        -- The IE harq-Preamble-Mode should not be used in the r3 and r4 versions of the message
        -- If included in the r3 or r4 version of the message, the UE should ignore the IE
        harq-Preamble-Mode              HARQ-Preamble-Mode                  OPTIONAL,
        beaconPLEst                     BEACON-PL-Est                       OPTIONAL,
        postVerificationPeriod          ENUMERATED { true }                 OPTIONAL,
        dhs-sync                        DHS-Sync                            OPTIONAL,
    -- MBMS IEs
        mbms-PL-ServiceRestrictInfo     MBMS-PL-ServiceRestrictInfo-r6      OPTIONAL
}

CellUpdateConfirm-r7-IEs ::= SEQUENCE {
    -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode,
        -- and if received the UE behaviour is unspecified
        new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL,
        new-H-RNTI                      H-RNTI                              OPTIONAL,
        newPrimary-E-RNTI               E-RNTI                              OPTIONAL,
        newSecondary-E-RNTI             E-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
        rlc-Re-establishIndicatorRb2-3or4       BOOLEAN,
```

```
        rlc-Re-establishIndicatorRb5orAbove     BOOLEAN,
    -- CN information elements
        cn-InformationInfo              CN-InformationInfo-r6               OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        rb-InformationReleaseList       RB-InformationReleaseList           OPTIONAL,
        rb-InformationReconfigList      RB-InformationReconfigList-r6       OPTIONAL,
        rb-InformationAffectedList      RB-InformationAffectedList-r6       OPTIONAL,
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo-r5    OPTIONAL,
        pdcp-ROHC-TargetMode            PDCP-ROHC-TargetMode                OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
    ul-deletedTransChInfoList       UL-DeletedTransChInfoList-r6        OPTIONAL,
            ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList-r6      OPTIONAL,
        dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
        dl-DeletedTransChInfoList       DL-DeletedTransChInfoList-r5        OPTIONAL,
        dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r5      OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-DPCH-Info                    UL-DPCH-Info-r7                     OPTIONAL,
        ul-EDCH-Information             UL-EDCH-Information-r6              OPTIONAL,       dl-
HSPDSCH-Information         DL-HSPDSCH-Information-r7           OPTIONAL,
            dl-CommonInformation            DL-CommonInformation-r7             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r7         OPTIONAL,
    -- MBMS IEs
        mbms-PL-ServiceRestrictInfo     MBMS-PL-ServiceRestrictInfo-r6      OPTIONAL
}

-- ***************************************************
--
-- CELL UPDATE CONFIRM for CCCH
--
-- ***************************************************

CellUpdateConfirm-CCCH ::= CHOICE {
    r3                              SEQUENCE {
        -- User equipment IEs
            u-RNTI                      U-RNTI,
        -- The rest of the message is identical to the one sent on DCCH.
            cellUpdateConfirm-r3                CellUpdateConfirm-r3-IEs,
            laterNonCriticalExtensions      SEQUENCE {
                -- Container for additional R99 extensions
                cellUpdateConfirm-CCCH-r3-add-ext           BIT STRING  OPTIONAL,
                v4b0NonCriticalExtensions           SEQUENCE {
                    cellUpdateConfirm-v4b0ext       CellUpdateConfirm-v4b0ext-IEs,
                    v590NonCriticalExtensions       SEQUENCE {
                        cellUpdateConfirm-v590ext       CellUpdateConfirm-v590ext-IEs,
                        v5d0NonCriticalExtenstions      SEQUENCE {
                            cellUpdateConfirm-v5d0ext       CellUpdateConfirm-v5d0ext-IEs,
                            v690NonCriticalExtensions       SEQUENCE {
                                cellUpdateConfirm-v690ext       CellUpdateConfirm-v690ext-IEs,
                                nonCriticalExtensions           SEQUENCE {} OPTIONAL
                            }   OPTIONAL
                        }   OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            }   OPTIONAL
    },
    later-than-r3                   SEQUENCE {
        u-RNTI                          U-RNTI,
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        criticalExtensions              CHOICE {
            r4                              SEQUENCE {
                -- The rest of the message is identical to the one sent on DCCH.
                cellUpdateConfirm-r4            CellUpdateConfirm-r4-IEs,
                v4d0NonCriticalExtensions           SEQUENCE {
                    -- Container for adding non critical extensions after freezing REL-5
                    cellUpdateConfirm-CCCH-r4-add-ext       BIT STRING      OPTIONAL,
                    v590NonCriticalExtensions       SEQUENCE {
                        cellUpdateConfirm-v590ext       CellUpdateConfirm-v590ext-IEs,
                        v5d0NonCriticalExtenstions      SEQUENCE {
                            cellUpdateConfirm-v5d0ext       CellUpdateConfirm-v5d0ext-IEs,
                            v690NonCriticalExtensions       SEQUENCE {
                                cellUpdateConfirm-v690ext       CellUpdateConfirm-v690ext-IEs,
                                nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                            }   OPTIONAL
```

```
                    }   OPTIONAL
                }   OPTIONAL
            }   OPTIONAL
        },
        criticalExtensions              CHOICE {
            r5                              SEQUENCE {
                cellUpdateConfirm-r5            CellUpdateConfirm-r5-IEs,
                cellUpdateConfirm-CCCH-r5-add-ext       BIT STRING      OPTIONAL,
                v5d0NonCriticalExtenstions      SEQUENCE {
                    cellUpdateConfirm-v5d0ext       CellUpdateConfirm-v5d0ext-IEs,
                    v690NonCriticalExtensions       SEQUENCE {
                        cellUpdateConfirm-v690ext       CellUpdateConfirm-v690ext-IEs,
                        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            },
            criticalExtensions              CHOICE {
                r6                              SEQUENCE {
                    cellUpdateConfirm-r6            CellUpdateConfirm-r6-IEs,
                    cellUpdateConfirm-r6-add-ext    BIT STRING      OPTIONAL,
                    nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                },
                criticalExtensions              CHOICE {
                    r7                              SEQUENCE {
                        cellUpdateConfirm-r7            CellUpdateConfirm-r7-IEs,
                        cellUpdateConfirm-r7-add-ext    BIT STRING      OPTIONAL,
                        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                    },
                    criticalExtensions              SEQUENCE {}
                }
            }
        }
    }
}
}

-- ***************************************************
--
-- COUNTER CHECK
--
-- ***************************************************

CounterCheck ::= CHOICE {
    r3                              SEQUENCE {
        counterCheck-r3                 CounterCheck-r3-IEs,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            counterCheck-r3-add-ext     BIT STRING  OPTIONAL,
            nonCriticalExtensions       SEQUENCE {} OPTIONAL
        }   OPTIONAL
    },
    later-than-r3                   SEQUENCE {
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        criticalExtensions              SEQUENCE {}
    }
}

CounterCheck-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
    -- Radio bearer IEs
        rb-COUNT-C-MSB-InformationList  RB-COUNT-C-MSB-InformationList
}

-- ***************************************************
--
-- COUNTER CHECK RESPONSE
--
-- ***************************************************

CounterCheckResponse ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
    -- Radio bearer IEs
        rb-COUNT-C-InformationList      RB-COUNT-C-InformationList          OPTIONAL,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            counterCheckResponse-r3-add-ext     BIT STRING  OPTIONAL,
```

```
            nonCriticalExtensions               SEQUENCE {} OPTIONAL
        }   OPTIONAL
}

-- ***************************************************
--
-- DOWNLINK DIRECT TRANSFER
--
-- ***************************************************

DownlinkDirectTransfer ::= CHOICE {
    r3                              SEQUENCE {
        downlinkDirectTransfer-r3       DownlinkDirectTransfer-r3-IEs,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            downlinkDirectTransfer-r3-add-ext       BIT STRING  OPTIONAL,
            nonCriticalExtensions           SEQUENCE {} OPTIONAL
        }   OPTIONAL
    },
    later-than-r3                   SEQUENCE {
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        criticalExtensions              SEQUENCE {}
    }
}

DownlinkDirectTransfer-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
    -- Core network IEs
        cn-DomainIdentity               CN-DomainIdentity,
        nas-Message                     NAS-Message
}

-- ***************************************************
--
-- HANDOVER TO UTRAN COMMAND
--
-- ***************************************************


HandoverToUTRANCommand ::= CHOICE {
    r3                              SEQUENCE {
        handoverToUTRANCommand-r3       HandoverToUTRANCommand-r3-IEs,
        nonCriticalExtensions           SEQUENCE {} OPTIONAL
    },
    criticalExtensions              CHOICE {
        r4                              SEQUENCE {
            handoverToUTRANCommand-r4       HandoverToUTRANCommand-r4-IEs,
            nonCriticalExtensions           SEQUENCE {}     OPTIONAL
        },
        criticalExtensions              CHOICE {
            r5                              SEQUENCE {
                handoverToUTRANCommand-r5       HandoverToUTRANCommand-r5-IEs,
                nonCriticalExtensions           SEQUENCE {}     OPTIONAL
            },
            criticalExtensions              CHOICE {
                r6                              SEQUENCE {
                    handoverToUTRANCommand-r6       HandoverToUTRANCommand-r6-IEs,
                    nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                },
                criticalExtensions              CHOICE {
                    r7                              SEQUENCE {
                        handoverToUTRANCommand-r7       HandoverToUTRANCommand-r7-IEs,
                        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                    },
                    criticalExtensions              SEQUENCE {}
                }
            }
        }
    }
}

HandoverToUTRANCommand-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
        new-U-RNTI                      U-RNTI-Short,
        -- dummy is not used in this version of specification, it should
        -- not be sent and if received it should be ignored.
        dummy                           ActivationTime                      OPTIONAL,
```

```
        cipheringAlgorithm              CipheringAlgorithm                  OPTIONAL,
    -- Radio bearer IEs
    -- Specification mode information
        specificationMode               CHOICE {
            complete                        SEQUENCE {
                srb-InformationSetupList        SRB-InformationSetupList,
                rab-InformationSetupList        RAB-InformationSetupList            OPTIONAL,
                ul-CommonTransChInfo            UL-CommonTransChInfo,
                ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList,
                dl-CommonTransChInfo            DL-CommonTransChInfo,
                dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList,
                ul-DPCH-Info                    UL-DPCH-Info,
                modeSpecificInfo                CHOICE {
                    fdd                             SEQUENCE {
                        -- dummy and dummy2 are not used in this version of specification,
                        -- they should not be sent and if received they should be ignored.
                        dummy                           DL-PDSCH-Information OPTIONAL,
                    dummy2                          CPCH-SetInfo        OPTIONAL
                    },
                    tdd                             NULL
                },
                    dl-CommonInformation            DL-CommonInformation,
                dl-InformationPerRL-List        DL-InformationPerRL-List,
                frequencyInfo                   FrequencyInfo
            },
            preconfiguration                SEQUENCE {
-- All IEs that include an FDD/TDD choice are split in two IEs for this message,
-- one for the FDD only elements and one for the TDD only elements, so that one
-- FDD/TDD choice in this level is sufficient.
                preConfigMode                   CHOICE {
                    predefinedConfigIdentity        PredefinedConfigIdentity,
                    defaultConfig                   SEQUENCE {
                        defaultConfigMode               DefaultConfigMode,
                        defaultConfigIdentity           DefaultConfigIdentity
                    }
                },
                rab-Info                        RAB-Info-Post       OPTIONAL,
                modeSpecificInfo                CHOICE {
                    fdd                             SEQUENCE {
                        ul-DPCH-Info                    UL-DPCH-InfoPostFDD,
                        dl-CommonInformationPost        DL-CommonInformationPost,
                        dl-InformationPerRL-List        DL-InformationPerRL-ListPostFDD,
                        frequencyInfo                   FrequencyInfoFDD
                    },
                    tdd                                 SEQUENCE {
                        ul-DPCH-Info                    UL-DPCH-InfoPostTDD,
                        dl-CommonInformationPost        DL-CommonInformationPost,
                        dl-InformationPerRL             DL-InformationPerRL-PostTDD,
                        frequencyInfo                   FrequencyInfoTDD,
                        primaryCCPCH-TX-Power           PrimaryCCPCH-TX-Power
                    }
                }
            }
        },
    -- Physical channel IEs
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power
}

HandoverToUTRANCommand-r4-IEs ::= SEQUENCE {
    -- User equipment IEs
        new-U-RNTI                      U-RNTI-Short,
        cipheringAlgorithm              CipheringAlgorithm                  OPTIONAL,
    -- Radio bearer IEs
    -- Specification mode information
        specificationMode               CHOICE {
            complete                        SEQUENCE {
                srb-InformationSetupList        SRB-InformationSetupList,
                rab-InformationSetupList        RAB-InformationSetupList-r4         OPTIONAL,
                ul-CommonTransChInfo            UL-CommonTransChInfo-r4,
                ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList,
                dl-CommonTransChInfo            DL-CommonTransChInfo-r4,
                dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r4,
                ul-DPCH-Info                    UL-DPCH-Info-r4,
                modeSpecificInfo                CHOICE {
                    fdd                             SEQUENCE {
                        -- dummy and dummy2 are not used in this version of specification,
                        -- they should not be sent and if received they should be ignored.
                        dummy                           DL-PDSCH-Information OPTIONAL,
```

```
                    dummy2                          CPCH-SetInfo        OPTIONAL
                    },
                    tdd                             NULL
                },
                    dl-CommonInformation            DL-CommonInformation-r4,
                dl-InformationPerRL-List        DL-InformationPerRL-List-r4,
                frequencyInfo                   FrequencyInfo
            },
            preconfiguration                SEQUENCE {
-- All IEs that include an FDD/TDD choice are split in two IEs for this message,
-- one for the FDD only elements and one for the TDD only elements, so that one
-- FDD/TDD choice in this level is sufficient.
                preConfigMode                   CHOICE {
                    predefinedConfigIdentity        PredefinedConfigIdentity,
                    defaultConfig                   SEQUENCE {
                        defaultConfigMode               DefaultConfigMode,
                        defaultConfigIdentity           DefaultConfigIdentity-r4
                    }
                },
                rab-Info                        RAB-Info-Post       OPTIONAL,
                modeSpecificInfo                CHOICE {
                    fdd                             SEQUENCE {
                        ul-DPCH-Info                    UL-DPCH-InfoPostFDD,
                        dl-CommonInformationPost        DL-CommonInformationPost,
                        dl-InformationPerRL-List        DL-InformationPerRL-ListPostFDD,
                        frequencyInfo                   FrequencyInfoFDD
                    },
                    tdd                             CHOICE {
                        tdd384                          SEQUENCE {
                            ul-DPCH-Info                    UL-DPCH-InfoPostTDD,
                        dl-InformationPerRL             DL-InformationPerRL-PostTDD,
                            frequencyInfo                   FrequencyInfoTDD,
                            primaryCCPCH-TX-Power           PrimaryCCPCH-TX-Power
                        },
                        tdd128                          SEQUENCE {
                            ul-DPCH-Info                    UL-DPCH-InfoPostTDD-LCR-r4,
                            dl-InformationPerRL             DL-InformationPerRL-PostTDD-LCR-r4,
                            frequencyInfo                   FrequencyInfoTDD,
                            primaryCCPCH-TX-Power           PrimaryCCPCH-TX-Power
                        }
                    }
                }
            }
        },
    -- Physical channel IEs
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power
}

HandoverToUTRANCommand-r5-IEs ::= SEQUENCE {
    -- User equipment IEs
        new-U-RNTI                      U-RNTI-Short,
        cipheringAlgorithm              CipheringAlgorithm                  OPTIONAL,
    -- Radio bearer IEs
    -- Specification mode information
        specificationMode               CHOICE {
            complete                        SEQUENCE {
                srb-InformationSetupList        SRB-InformationSetupList-r5,
                rab-InformationSetupList        RAB-InformationSetupList-r5         OPTIONAL,
                ul-CommonTransChInfo            UL-CommonTransChInfo-r4,
                ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList,
                dl-CommonTransChInfo            DL-CommonTransChInfo-r4,
                dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r5,
                ul-DPCH-Info                    UL-DPCH-Info-r5,
                modeSpecificInfo                CHOICE {
                    fdd                             SEQUENCE {
                        -- dummy and dummy2 are not used in this version of specification,
                        -- they should not be sent and if received they should be ignored.
                        dummy                           DL-PDSCH-Information OPTIONAL,
                        dummy2                          CPCH-SetInfo        OPTIONAL
                    },
                    tdd                             NULL
                },
                dl-CommonInformation            DL-CommonInformation-r4,
                dl-InformationPerRL-List        DL-InformationPerRL-List-r5,
                frequencyInfo                   FrequencyInfo
            },
            preconfiguration                SEQUENCE {
-- All IEs that include an FDD/TDD choice are split in two IEs for this message,
```

```
-- one for the FDD only elements and one for the TDD only elements, so that one
-- FDD/TDD choice in this level is sufficient.
                preConfigMode                       CHOICE {
                    predefinedConfigIdentity            PredefinedConfigIdentity,
                    defaultConfig                       SEQUENCE {
                        defaultConfigMode                   DefaultConfigMode,
                        defaultConfigIdentity               DefaultConfigIdentity-r5
                    }
                },
                rab-Info                            RAB-Info-Post       OPTIONAL,
                modeSpecificInfo                    CHOICE {
                    fdd                                 SEQUENCE {
                        ul-DPCH-Info                        UL-DPCH-InfoPostFDD,
                        dl-CommonInformationPost            DL-CommonInformationPost,
                        dl-InformationPerRL-List            DL-InformationPerRL-ListPostFDD,
                        frequencyInfo                       FrequencyInfoFDD
                    },
                    tdd                                 CHOICE {
                        tdd384                              SEQUENCE {
                            ul-DPCH-Info                        UL-DPCH-InfoPostTDD,
                            dl-InformationPerRL                 DL-InformationPerRL-PostTDD,
                                frequencyInfo                       FrequencyInfoTDD,
                            primaryCCPCH-TX-Power               PrimaryCCPCH-TX-Power
                        },
                        tdd128                              SEQUENCE {
                            ul-DPCH-Info                        UL-DPCH-InfoPostTDD-LCR-r4,
                        dl-InformationPerRL                 DL-InformationPerRL-PostTDD-LCR-r4,
                                frequencyInfo                       FrequencyInfoTDD,
                            primaryCCPCH-TX-Power               PrimaryCCPCH-TX-Power
                        }
                    }
                }
            }
        },
    -- Physical channel IEs
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power
}

HandoverToUTRANCommand-r6-IEs ::= SEQUENCE {
    -- User equipment IEs
        new-U-RNTI                      U-RNTI-Short,
        cipheringAlgorithm              CipheringAlgorithm                  OPTIONAL,
    -- Radio bearer IEs
    -- Specification mode information
        specificationMode               CHOICE {
            complete                        SEQUENCE {
                srb-InformationSetupList        SRB-InformationSetupList-r6,
                rab-InformationSetupList        RAB-InformationSetupList-r6     OPTIONAL,
                ul-CommonTransChInfo            UL-CommonTransChInfo-r4,
                ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList-r6,
                dl-CommonTransChInfo            DL-CommonTransChInfo-r4,
                dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r5,
                ul-DPCH-Info                    UL-DPCH-Info-r6,
                ul-EDCH-Information             UL-EDCH-Information-r6          OPTIONAL,
                dl-HSPDSCH-Information          DL-HSPDSCH-Information-r6       OPTIONAL,
                dl-CommonInformation            DL-CommonInformation-r6,
                dl-InformationPerRL-List        DL-InformationPerRL-List-r6,
                frequencyInfo                   FrequencyInfo
            },
            preconfiguration                SEQUENCE {
                -- All IEs that include an FDD/TDD choice are split in two IEs for this message,
                -- one for the FDD only elements and one for the TDD only elements, so that one
                -- FDD/TDD choice in this level is sufficient.
                preConfigMode                       CHOICE {
                    predefinedConfigIdentity            PredefinedConfigIdentity,
                    defaultConfig                       SEQUENCE {
                        defaultConfigMode                   DefaultConfigMode,
                        defaultConfigIdentity               DefaultConfigIdentity-r6
                    }
                },
                rab-Info                            RAB-Info-Post       OPTIONAL,
                modeSpecificInfo                    CHOICE {
                    fdd                                 SEQUENCE {
                        ul-DPCH-Info                        UL-DPCH-InfoPostFDD,
                        dl-CommonInformationPost            DL-CommonInformationPost,
                        dl-InformationPerRL-List            DL-InformationPerRL-ListPostFDD,
                        frequencyInfo                       FrequencyInfoFDD
                    },
```

```
                tdd                                 CHOICE {
                    tdd384                              SEQUENCE {
                        ul-DPCH-Info                        UL-DPCH-InfoPostTDD,
                    dl-InformationPerRL                 DL-InformationPerRL-PostTDD,
                            frequencyInfo                       FrequencyInfoTDD,
                        primaryCCPCH-TX-Power               PrimaryCCPCH-TX-Power
                    },
                    tdd128                              SEQUENCE {
                        ul-DPCH-Info                        UL-DPCH-InfoPostTDD-LCR-r4,
                    dl-InformationPerRL                 DL-InformationPerRL-PostTDD-LCR-r4,
                            frequencyInfo                       FrequencyInfoTDD,
                        primaryCCPCH-TX-Power               PrimaryCCPCH-TX-Power
                    }
                }
            }
        }
    },
    -- Physical channel IEs
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power
}

HandoverToUTRANCommand-r7-IEs ::= SEQUENCE {
    -- User equipment IEs
        new-U-RNTI                      U-RNTI-Short,
        cipheringAlgorithm              CipheringAlgorithm                      OPTIONAL,
    -- Radio bearer IEs
    -- Specification mode information
        specificationMode               CHOICE {
            complete                        SEQUENCE {
                srb-InformationSetupList        SRB-InformationSetupList-r6,
                rab-InformationSetupList        RAB-InformationSetupList-r6     OPTIONAL,
                ul-CommonTransChInfo            UL-CommonTransChInfo-r4,
                ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList-r6,
                dl-CommonTransChInfo            DL-CommonTransChInfo-r4,
                dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r5,
                ul-DPCH-Info                    UL-DPCH-Info-r7,
                dl-CommonInformation            DL-CommonInformation-r4,
                dl-InformationPerRL-List        DL-InformationPerRL-List-r7,
                frequencyInfo                   FrequencyInfo
            }
            -- For the 'preconfiguration' specificationMode the r5 message is used.
        },
    -- Physical channel IEs
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power
}

-- ***************************************************
--
-- HANDOVER TO UTRAN COMPLETE
--
-- ***************************************************

HandoverToUTRANComplete ::= SEQUENCE {
    --TABULAR: Integrity protection shall not be performed on this message.
    -- User equipment IEs
    -- TABULAR: startList is conditional on history.
        startList                       STARTList                           OPTIONAL,
    -- Radio bearer IEs
        count-C-ActivationTime          ActivationTime                      OPTIONAL,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            handoverToUTRANComplete-r3-add-ext      BIT STRING  OPTIONAL,
            nonCriticalExtensions           SEQUENCE {}     OPTIONAL
        }   OPTIONAL
}

-- ***************************************************
--
-- INITIAL DIRECT TRANSFER
--
-- ***************************************************

InitialDirectTransfer ::= SEQUENCE {
    -- Core network IEs
        cn-DomainIdentity               CN-DomainIdentity,
        intraDomainNasNodeSelector      IntraDomainNasNodeSelector,
        nas-Message                     NAS-Message,
    -- Measurement IEs
```

```
        measuredResultsOnRACH           MeasuredResultsOnRACH               OPTIONAL,
        v3a0NonCriticalExtensions       SEQUENCE {
        initialDirectTransfer-v3a0ext   InitialDirectTransfer-v3a0ext,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            initialDirectTransfer-r3-add-ext        BIT STRING  OPTIONAL,
                v590NonCriticalExtensions       SEQUENCE {
                    initialDirectTransfer-v590ext   InitialDirectTransfer-v590ext,
                    v690NonCriticalExtensions       SEQUENCE {
                        initialDirectTransfer-v690ext   InitialDirectTransfer-v690ext-IEs,
                        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                    }       OPTIONAL
                }       OPTIONAL
            }       OPTIONAL
        }   OPTIONAL
}

InitialDirectTransfer-v3a0ext ::= SEQUENCE {
    -- start-value shall always be included in this version of the protocol
    start-Value                     START-Value                         OPTIONAL
}
InitialDirectTransfer-v590ext ::= SEQUENCE {
    establishmentCause      EstablishmentCause  OPTIONAL
}

InitialDirectTransfer-v690ext-IEs ::= SEQUENCE {
    -- Core network IEs
        plmn-Identity                   PLMN-Identity                       OPTIONAL,
    -- Measurement IEs
        measuredResultsOnRACHinterFreq  MeasuredResultsOnRACHinterFreq      OPTIONAL,
    -- MBMS IEs
        mbms-JoinedInformation          MBMS-JoinedInformation-r6           OPTIONAL
}

-- ***************************************************
--
-- HANDOVER FROM UTRAN COMMAND
--
-- ***************************************************

HandoverFromUTRANCommand-GSM ::= CHOICE {
    r3                              SEQUENCE {
        handoverFromUTRANCommand-GSM-r3
                                        HandoverFromUTRANCommand-GSM-r3-IEs,
        -- UTRAN should not include the IE laterNonCriticalExtensions when it sets the IE
        -- gsm-message included in handoverFromUTRANCommand-GSM-r3 to single-GSM-Message. The UE
        -- behaviour upon receiving a message with this combination of IE values is unspecified.
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            handoverFromUTRANCommand-GSM-r3-add-ext     BIT STRING  OPTIONAL,
            -- UTRAN may apply the r3 version of the message to perform PS handover
            -- for a single RAB only
            v690NonCriticalExtensions       SEQUENCE {
                handoverFromUTRANCommand-GSM-v690ext    HandoverFromUTRANCommand-GSM-v690ext-IEs,
                nonCriticalExtensions           SEQUENCE {} OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
    },
    later-than-r3                   SEQUENCE {
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        criticalExtensions              CHOICE {
            r6                              SEQUENCE {
                handoverFromUTRANCommand-GSM-r6     HandoverFromUTRANCommand-GSM-r6-IEs,
                handoverFromUTRANCommand-GSM-r6-add-ext     BIT STRING  OPTIONAL,
                nonCriticalExtensions           SEQUENCE {} OPTIONAL
            },
            criticalExtensions              SEQUENCE {}
        }
    }
}

HandoverFromUTRANCommand-GSM-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        activationTime                  ActivationTime                      OPTIONAL,
    -- Radio bearer IEs
        toHandoverRAB-Info              RAB-Info                            OPTIONAL,
    -- Measurement IEs
```

```
        frequency-band                  Frequency-Band,
    -- Other IEs
        gsm-message                     CHOICE {
            -- In the single-GSM-Message case the following rules apply:
            -- 1> the GSM message directly follows the basic production; the final padding that
            --    results when PER encoding the abstract syntax value is removed prior to appending
            --    the GSM message.
            -- 2> the RRC message excluding the GSM part, does not contain a length determinant;
            --    there is no explicit parameter indicating the size of the included GSM message.
            -- 3> depending on need, final padding (all "0"s) is added to ensure the final result
            --    comprises a full number of octets
            single-GSM-Message              SEQUENCE {},
            gsm-MessageList                 SEQUENCE {
                gsm-Messages                    GSM-MessageList
            }
        }
}

HandoverFromUTRANCommand-GSM-r6-IEs ::= SEQUENCE {
    -- User equipment IEs
        activationTime                  ActivationTime                      OPTIONAL,
    -- Radio bearer IEs
        toHandoverRAB-Info              RAB-InformationList-r6              OPTIONAL,
    -- Measurement IEs
        frequency-band                  Frequency-Band,
    -- Other IEs
        gsm-message                     CHOICE {
            -- In the single-GSM-Message case the following rules apply:
            -- 1> the GSM message directly follows the basic production; the final padding that
            --    results when PER encoding the abstract syntax value is removed prior to appending
            --    the GSM message.
            -- 2> the RRC message excluding the GSM part, does not contain a length determinant;
            --    there is no explicit parameter indicating the size of the included GSM message.
            -- 3> depending on need, final padding (all "0"s) is added to ensure the final result
            --    comprises a full number of octets
        single-GSM-Message              SEQUENCE {},
            gsm-MessageList                 SEQUENCE {
                    gsm-Messages                    GSM-MessageList
            }
        },
        geran-SystemInfoType                CHOICE  {
            sI                                  GERAN-SystemInformation,
            pSI                                 GERAN-SystemInformation
    }       OPTIONAL
}

HandoverFromUTRANCommand-GSM-v690ext-IEs ::= SEQUENCE {
            geran-SystemInfoType                CHOICE  {
            sI                                  GERAN-SystemInformation,
            pSI                                 GERAN-SystemInformation
    }       OPTIONAL
}

HandoverFromUTRANCommand-GERANIu ::= SEQUENCE {
    rrc-TransactionIdentifier       RRC-TransactionIdentifier,
    handoverFromUTRANCommand-GERANIu    CHOICE {
        r5                                  SEQUENCE {
            handoverFromUTRANCommand-GERANIu-r5
                                                HandoverFromUTRANCommand-GERANIu-r5-IEs,
            -- UTRAN should not include the IE nonCriticalExtensions when it sets
            -- the IE geranIu-message included in handoverFromUTRANCommand-GERANIu-r5 to
            -- single-GERANIu-Message
            -- The UE behaviour upon receiving a message including this combination of IE values is
            -- not specified
            nonCriticalExtensions           SEQUENCE {} OPTIONAL
        },
        later-than-r5                   SEQUENCE {
            criticalExtensions              SEQUENCE {}
        }
    }
}

HandoverFromUTRANCommand-GERANIu-r5-IEs ::= SEQUENCE {
    -- User equipment IEs
        activationTime                  ActivationTime                      OPTIONAL,
    -- Measurement IEs
        frequency-Band                  Frequency-Band,
    -- Other IEs
```

```
        geranIu-Message                     CHOICE {
            -- In the single-GERANIu-Message case the following rules apply:
            -- 1> the GERAN Iu message directly follows the basic production; the final padding that
            --    results when PER encoding the abstract syntax value is removed prior to appending
            --    the GERAN Iu message.
            -- 2> the RRC message excluding the GERAN Iu part does not contain a length determinant;
--      there is no explicit parameter indicating the size of the included GERAN Iu
--      message.
            -- 3> depending on need, final padding (all "0"s) is added to ensure the final result
            --    comprises a full number of octets.
            single-GERANIu-Message          SEQUENCE {},
            geranIu-MessageList             SEQUENCE {
                geranIu-Messages                GERANIu-MessageList
            }
        }
}

HandoverFromUTRANCommand-CDMA2000 ::= CHOICE {
    r3                              SEQUENCE {
        handoverFromUTRANCommand-CDMA2000-r3
                                        HandoverFromUTRANCommand-CDMA2000-r3-IEs,
        laterNonCriticalExtensions          SEQUENCE {
            -- Container for additional R99 extensions
            handoverFromUTRANCommand-CDMA2000-r3-add-ext
                                            BIT STRING      OPTIONAL,
            nonCriticalExtensions           SEQUENCE {}     OPTIONAL
        }   OPTIONAL
    },
    later-than-r3                   SEQUENCE {
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        criticalExtensions              SEQUENCE {}
    }
}

HandoverFromUTRANCommand-CDMA2000-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        activationTime                  ActivationTime                      OPTIONAL,
    -- Radio bearer IEs
        toHandoverRAB-Info              RAB-Info                            OPTIONAL,
    -- Other IEs
        cdma2000-MessageList            CDMA2000-MessageList
}

-- ***************************************************
--
-- HANDOVER FROM UTRAN FAILURE
--
-- ***************************************************

HandoverFromUTRANFailure ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
    -- Other IEs
        interRAT-HO-FailureCause        InterRAT-HO-FailureCause            OPTIONAL,
        -- In case the interRATMessage to be transferred is for GERAN Iu mode, the
        -- message should be placed in the HandoverFromUtranFailure-v590ext-IEs
        -- non-critical extension container.
        interRATMessage                 CHOICE {
            gsm                             SEQUENCE {
                gsm-MessageList                 GSM-MessageList
            },
            cdma2000                        SEQUENCE {
                cdma2000-MessageList            CDMA2000-MessageList
            }
        }           OPTIONAL,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            handoverFromUTRANFailure-r3-add-ext     BIT STRING  OPTIONAL,
            v590NonCriticalExtensions           SEQUENCE {
                handoverFromUTRANFailure-v590ext    HandoverFromUtranFailure-v590ext-IEs,
                nonCriticalExtensions           SEQUENCE {}     OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
}

HandoverFromUtranFailure-v590ext-IEs ::= SEQUENCE {
    geranIu-MessageList                 GERANIu-MessageList         OPTIONAL
```

```
}

-- ***************************************************
--
-- INTER RAT HANDOVER INFO
--
-- ***************************************************

InterRATHandoverInfo ::= SEQUENCE {
    -- This structure is defined for historical reasons, backward compatibility with 44.018
    predefinedConfigStatusList      CHOICE {
        absent                          NULL,
        present                         PredefinedConfigStatusList
    },
    uE-SecurityInformation          CHOICE {
        absent                          NULL,
        present                         UE-SecurityInformation
    },
    ue-CapabilityContainer          CHOICE {
        absent                          NULL,
        -- present is an octet aligned string containing IE UE-RadioAccessCapabilityInfo
        present                         OCTET STRING (SIZE (0..63))
    },
    -- Non critical extensions
    v390NonCriticalExtensions       CHOICE {
        absent                          NULL,
        present                         SEQUENCE {
            interRATHandoverInfo-v390ext    InterRATHandoverInfo-v390ext-IEs,
            v3a0NonCriticalExtensions       SEQUENCE  {
                interRATHandoverInfo-v3a0ext    InterRATHandoverInfo-v3a0ext-IEs,
                laterNonCriticalExtensions      SEQUENCE {
                    interRATHandoverInfo-v3d0ext    InterRATHandoverInfo-v3d0ext-IEs,
                    -- Container for additional R99 extensions
                    interRATHandoverInfo-r3-add-ext     BIT STRING
                                (CONTAINING InterRATHandoverInfo-r3-add-ext-IEs)    OPTIONAL,
                    v3g0NonCriticalExtensions           SEQUENCE {
                        interRATHandoverInfo-v3g0ext    InterRATHandoverInfo-v3g0ext-IEs,
                        v4b0NonCriticalExtensions       SEQUENCE {
                            interRATHandoverInfo-v4b0ext    InterRATHandoverInfo-v4b0ext-IEs,
                            v4d0NonCriticalExtensions       SEQUENCE {
                                interRATHandoverInfo-v4d0ext    InterRATHandoverInfo-v4d0ext-IEs,
                                -- Reserved for future non critical extension
                                v590NonCriticalExtensions       SEQUENCE {
                                    interRATHandoverInfo-v590ext
                                                            InterRATHandoverInfo-v590ext-IEs,
                                    v690NonCriticalExtensions       SEQUENCE {
                                        interRATHandoverInfo-v690ext
                                                            InterRATHandoverInfo-v690ext-IEs,
                                        v7xyNonCriticalExtensions       SEQUENCE {
                                            interRATHandoverInfo-v7xyext
                                                            InterRATHandoverInfo-v7xyext-IEs,
                                            nonCriticalExtensions           SEQUENCE {} OPTIONAL
                                        }   OPTIONAL
                                    }   OPTIONAL
                                }   OPTIONAL
                            }   OPTIONAL
                        }   OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            }   OPTIONAL
        }
    }
}

InterRATHandoverInfo-v390ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        ue-RadioAccessCapability-v380ext    UE-RadioAccessCapability-v380ext        OPTIONAL,
        dl-PhysChCapabilityFDD-v380ext      DL-PhysChCapabilityFDD-v380ext
}

InterRATHandoverInfo-v3a0ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        ue-RadioAccessCapability-v3a0ext    UE-RadioAccessCapability-v3a0ext        OPTIONAL
}

InterRATHandoverInfo-v3d0ext-IEs ::= SEQUENCE {
    -- User equipment IEs
```

```
        uESpecificBehaviourInformation1interRAT     UESpecificBehaviourInformation1interRAT
    OPTIONAL
}

InterRATHandoverInfo-v3g0ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        ue-RadioAccessCapability-v3g0ext    UE-RadioAccessCapability-v3g0ext        OPTIONAL
}

InterRATHandoverInfo-r3-add-ext-IEs ::= SEQUENCE {
        interRATHandoverInfo-v690ext1       InterRATHandoverInfo-v690ext1-IEs,
        nonCriticalExtensions               SEQUENCE {}     OPTIONAL
}

InterRATHandoverInfo-v4b0ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        accessStratumReleaseIndicator       AccessStratumReleaseIndicator
}

InterRATHandoverInfo-v4d0ext-IEs ::= SEQUENCE {
    -- User equipment IEs
    tdd128-RF-Capability                RadioFrequencyBandTDDList       OPTIONAL
}

InterRATHandoverInfo-v590ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        predefinedConfigStatusListComp      PredefinedConfigStatusListComp          OPTIONAL,
        ue-RadioAccessCapabilityComp        UE-RadioAccessCapabilityComp            OPTIONAL
}

InterRATHandoverInfo-v690ext1-IEs ::= SEQUENCE {
    -- User equipment IEs
        ue-RadioAccessCapability-v650ext        UE-RadioAccessCapability-v650ext    OPTIONAL
}

InterRATHandoverInfo-v690ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        ue-SecurityInformation2             UE-SecurityInformation2                 OPTIONAL,
        ue-RadioAccessCapabilityComp        UE-RadioAccessCapabilityComp-ext        OPTIONAL,
        ue-RadioAccessCapabilityComp2       UE-RadioAccessCapabilityComp2
}

InterRATHandoverInfo-v7xyext-IEs ::= SEQUENCE {
        ue-RadioAccessCapability-v7xyext    UE-RadioAccessCapability-v7xyext        OPTIONAL,
        ue-RadioAccessCapabilityComp        UE-RadioAccessCapabilityComp-r7         OPTIONAL
}

-- ***************************************************
--
-- MEASUREMENT CONTROL
--
-- ***************************************************

MeasurementControl ::= CHOICE {
    -- The Rel-4 functionality of UE Positioning OTDOA AssistanceData TDD is only available
    -- in the later-than-r3 branch of this message (i.e. through the use of the IE
    -- ue-Positioning-OTDOA-AssistanceData-r4)
    r3                              SEQUENCE {
        measurementControl-r3           MeasurementControl-r3-IEs,
        v390nonCriticalExtensions       SEQUENCE {
            measurementControl-v390ext      MeasurementControl-v390ext,
            v3a0NonCriticalExtensions           SEQUENCE {
                measurementControl-v3a0ext          MeasurementControl-v3a0ext,
                laterNonCriticalExtensions      SEQUENCE {
                    -- Container for additional R99 extensions
                    measurementControl-r3-add-ext       BIT STRING  OPTIONAL,
                    v4b0NonCriticalExtensions           SEQUENCE{
                        -- The content of the v4b0 non-critical extension has been removed. If sent
                        -- to a UE of AS release 4, the UE behaviour is unspecified. A UE of AS
                        -- release 5 onward shall comply with the v4b0 and later extensions in this
                        -- branch of the message.
                        v590NonCriticalExtensions       SEQUENCE {
                            measurementControl-v590ext      MeasurementControl-v590ext-IEs,
                            v5b0NonCriticalExtensions       SEQUENCE {
                                measurementControl-v5b0ext      MeasurementControl-v5b0ext-IEs,
                                nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                            }                           OPTIONAL
                        }                           OPTIONAL
```

```
                    }                           OPTIONAL
                }                           OPTIONAL
            }                           OPTIONAL
        }                           OPTIONAL
    },
    later-than-r3                   SEQUENCE {
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        criticalExtensions              CHOICE {
            r4                              SEQUENCE {
                measurementControl-r4           MeasurementControl-r4-IEs,
                v4d0NonCriticalExtensions           SEQUENCE {
                    -- Container for adding non critical extensions after freezing REL-5
                    measurementControl-r4-add-ext       BIT STRING      OPTIONAL,
                    v590NonCriticalExtensions       SEQUENCE{
                        measurementControl-v590ext      MeasurementControl-v590ext-IEs,
                        v5b0NonCriticalExtensions       SEQUENCE {
                            measurementControl-v5b0ext      MeasurementControl-v5b0ext-IEs,

                            v7xyNonCriticalExtensions   SEQUENCE {
                                measurementControl-v7xy     MeasurementControl-v7xyext-IEs,
                                nonCriticalExtensions       SEQUENCE {}     OPTIONAL
                            }   OPTIONAL
                        }   OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            },
            -- Most significant part of "RRC transaction identifier" (MSP),
            -- "RRC transaction identifier" = rrc-TransactionIdentifier-MSP-r6-ext * 4 +
            -- rrc-TransactionIdentifier
            rrc-TransactionIdentifier-MSP-r6-ext        RRC-TransactionIdentifier,
            criticalExtensions              CHOICE {
                r6                              SEQUENCE {
                    measurementControl-r6           MeasurementControl-r6-IEs,
                    nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                },
                criticalExtensions              SEQUENCE {}
            }
        }
    }
}

MeasurementControl-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
    -- Measurement IEs
        measurementIdentity     MeasurementIdentity,
        -- TABULAR: The measurement type is included in MeasurementCommand.
        measurementCommand              MeasurementCommand,
        measurementReportingMode        MeasurementReportingMode            OPTIONAL,
        additionalMeasurementList       AdditionalMeasurementID-List        OPTIONAL,
    -- Physical channel IEs
        dpch-CompressedModeStatusInfo   DPCH-CompressedModeStatusInfo       OPTIONAL
}

MeasurementControl-v390ext ::= SEQUENCE {
        ue-Positioning-Measurement-v390ext      UE-Positioning-Measurement-v390ext  OPTIONAL
}

MeasurementControl-v3a0ext ::= SEQUENCE {
    sfn-Offset-Validity             SFN-Offset-Validity     OPTIONAL
}

MeasurementControl-r4-IEs ::= SEQUENCE {
    -- Measurement IEs
        measurementIdentity     MeasurementIdentity,
        -- TABULAR: The measurement type is included in measurementCommand.
        measurementCommand              MeasurementCommand-r4,
        measurementReportingMode        MeasurementReportingMode            OPTIONAL,
        additionalMeasurementList       AdditionalMeasurementID-List        OPTIONAL,
    -- Physical channel IEs
        dpch-CompressedModeStatusInfo   DPCH-CompressedModeStatusInfo       OPTIONAL
}

MeasurementControl-v590ext-IEs ::= SEQUENCE {
    measurementCommand-v590ext          CHOICE {
        -- the choice "intra-frequency" shall be used for the case of intra-frequency measurement,
        -- as well as when intra-frequency events are configured for inter-frequency measurement
        intra-frequency                     Intra-FreqEventCriteriaList-v590ext,
```

```
        inter-frequency                     Inter-FreqEventCriteriaList-v590ext
    }       OPTIONAL,
    intraFreqReportingCriteria-1b-r5        IntraFreqReportingCriteria-1b-r5    OPTIONAL,
    intraFreqEvent-1d-r5                    IntraFreqEvent-1d-r5                OPTIONAL,
    -- most significant part of "RRC transaction identifier" (MSP),
    -- "RRC transaction identifier" = rrc-TransactionIdentifier-MSP-v590ext * 4 +
    -- rrc-TransactionIdentifier
    rrc-TransactionIdentifier-MSP-v590ext   RRC-TransactionIdentifier
}

MeasurementControl-v5b0ext-IEs ::=  SEQUENCE {
    interRATCellInfoIndication          InterRATCellInfoIndication          OPTIONAL
}

MeasurementControl-r6-IEs ::= SEQUENCE {
    -- Measurement IEs
        measurementIdentity     MeasurementIdentity,
        -- TABULAR: The measurement type is included in measurementCommand.
        measurementCommand              MeasurementCommand-r6,
        measurementReportingMode        MeasurementReportingMode            OPTIONAL,
        additionalMeasurementList       AdditionalMeasurementID-List        OPTIONAL,
    -- Physical channel IEs
        dpch-CompressedModeStatusInfo   DPCH-CompressedModeStatusInfo       OPTIONAL
}

MeasurementControl-v7xyext-IEs ::=  SEQUENCE {
    ue-Positioning-Measurement-v7xyext      UE-Positioning-Measurement-v7xyext
}

-- ***************************************************
--
-- MEASUREMENT CONTROL FAILURE
--
-- ***************************************************

MeasurementControlFailure ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        failureCause                    FailureCauseWithProtErr,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            measurementControlFailure-r3-add-ext            BIT STRING      OPTIONAL,
            v590NonCriticalExtensions           SEQUENCE {
                measurementControlFailure-v590ext       MeasurementControlFailure-v590ext-IEs,
                nonCriticalExtensions           SEQUENCE {}     OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
}

MeasurementControlFailure-v590ext-IEs ::= SEQUENCE {
    -- most significant part of "RRC transaction identifier" (MSP),
    -- "RRC transaction identifier" = rrc-TransactionIdentifier-MSP-v590ext * 4 +
    -- rrc-TransactionIdentifier
    -- If the rrc-TransactionIdentifier-MSP-v590ext was not received in the MEASUREMENT CONTROL
    -- message, then the rrc-TransactionIdentifier-MSP-v590ext shall be set to zero
    rrc-TransactionIdentifier-MSP-v590ext   RRC-TransactionIdentifier
}

-- ***************************************************
--
-- MEASUREMENT REPORT
--
-- ***************************************************

MeasurementReport ::= SEQUENCE {
    -- Measurement IEs
        measurementIdentity     MeasurementIdentity,
        measuredResults                 MeasuredResults                     OPTIONAL,
        measuredResultsOnRACH           MeasuredResultsOnRACH               OPTIONAL,
        additionalMeasuredResults       MeasuredResultsList                 OPTIONAL,
        eventResults                    EventResults                        OPTIONAL,
    -- Non-critical extensions
        v390nonCriticalExtensions           SEQUENCE {
            measurementReport-v390ext       MeasurementReport-v390ext,
            laterNonCriticalExtensions      SEQUENCE {
                -- Container for additional R99 extensions
                measurementReport-r3-add-ext        BIT STRING      OPTIONAL,
                v4b0NonCriticalExtensions       SEQUENCE {
```

```
                    measurementReport-v4b0ext       MeasurementReport-v4b0ext-IEs,
                    -- Extension mechanism for non-Rel4 information
                    v590NonCriticalExtensions    SEQUENCE {
                        measurementReport-v590ext       MeasurementReport-v590ext-IEs,
                        v5b0NonCriticalExtensions       SEQUENCE {
                            measurementReport-v5b0ext       MeasurementReport-v5b0ext-IEs,
                            v690NonCriticalExtensions           SEQUENCE {
                                measurementReport-v690ext       MeasurementReport-v690ext-IEs,

                                v7xyNonCriticalExtensions       SEQUENCE {
                                    measurementReport-v7xyext       MeasurementReport-v7xyext-IEs,
                                    nonCriticalExtensions           SEQUENCE {}             OPTIONAL
                                }       OPTIONAL
                            }       OPTIONAL
                        }       OPTIONAL
                    }       OPTIONAL
                }       OPTIONAL
            }       OPTIONAL
        }       OPTIONAL
}

MeasurementReport-v390ext ::= SEQUENCE {
        measuredResults-v390ext         MeasuredResults-v390ext             OPTIONAL
}

MeasurementReport-v4b0ext-IEs ::= SEQUENCE {
    interFreqEventResults-LCR       InterFreqEventResults-LCR-r4-ext        OPTIONAL,
    -- additionalMeasuredResults-LCR shall contain measurement results and additional measurement
    -- results list.
    additionalMeasuredResults-LCR   MeasuredResultsList-LCR-r4-ext          OPTIONAL,
    gsmOTDreferenceCell             PrimaryCPICH-Info                       OPTIONAL
}

MeasurementReport-v590ext-IEs ::= SEQUENCE {
    measuredResults-v590ext             MeasuredResults-v590ext             OPTIONAL
}

MeasurementReport-v5b0ext-IEs ::=   SEQUENCE {
    interRATCellInfoIndication          InterRATCellInfoIndication          OPTIONAL
}

MeasurementReport-v690ext-IEs ::= SEQUENCE {
    measuredResultsOnRACHinterFreq      MeasuredResultsOnRACHinterFreq      OPTIONAL
}

MeasurementReport-v7xyext-IEs ::= SEQUENCE {
    velocityEstimate                    VelocityEstimate                    OPTIONAL,
    ue-InternalMeasuredResults          UE-InternalMeasuredResults-r7       OPTIONAL
}

-- ***************************************************
--
-- PAGING TYPE 1
--
-- ***************************************************

PagingType1 ::= SEQUENCE {
    -- User equipment IEs
        pagingRecordList                PagingRecordList                    OPTIONAL,
    -- Other IEs
        bcch-ModificationInfo           BCCH-ModificationInfo               OPTIONAL,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            pagingType1-r3-add-ext          BIT STRING      OPTIONAL,
            v590NonCriticalExtensions       SEQUENCE {
                pagingType1-v590ext             PagingType1-v590ext-IEs,
                nonCriticalExtensions           SEQUENCE {}     OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
}

PagingType1-v590ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        pagingRecord2List               PagingRecord2List-r5                OPTIONAL
}

-- ***************************************************
--
```

```
-- PAGING TYPE 2
--
-- ***************************************************

PagingType2 ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        pagingCause                     PagingCause,
    -- Core network IEs
        cn-DomainIdentity               CN-DomainIdentity,
        pagingRecordTypeID              PagingRecordTypeID,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            pagingType2-r3-add-ext          BIT STRING      OPTIONAL,
            nonCriticalExtensions           SEQUENCE {}     OPTIONAL
        }   OPTIONAL
}

-- ***************************************************
--
-- PHYSICAL CHANNEL RECONFIGURATION
--
-- ***************************************************

PhysicalChannelReconfiguration ::= CHOICE {
    r3                                  SEQUENCE {
        physicalChannelReconfiguration-r3
                                        PhysicalChannelReconfiguration-r3-IEs,
        v3a0NonCriticalExtensions           SEQUENCE {
            physicalChannelReconfiguration-v3a0ext      PhysicalChannelReconfiguration-v3a0ext,
            laterNonCriticalExtensions      SEQUENCE {
                -- Container for additional R99 extensions
                physicalChannelReconfiguration-r3-add-ext           BIT STRING      OPTIONAL,
                v4b0NonCriticalExtenstions          SEQUENCE {
                    physicalChannelReconfiguration-v4b0ext
                                                PhysicalChannelReconfiguration-v4b0ext-IEs,
                    v590NonCriticalExtenstions          SEQUENCE {
                        physicalChannelReconfiguration-v590ext
                                                    PhysicalChannelReconfiguration-v590ext-IEs,
                        v690NonCriticalExtensions       SEQUENCE {
                            physicalChannelReconfiguration-v690ext
                                                        PhysicalChannelReconfiguration-v690ext-IEs,
                            nonCriticalExtensions                   SEQUENCE {} OPTIONAL
                        }   OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
    },
    later-than-r3                       SEQUENCE {
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
            criticalExtensions              CHOICE {
            r4                              SEQUENCE {
                physicalChannelReconfiguration-r4
                                                PhysicalChannelReconfiguration-r4-IEs,
                v4d0NonCriticalExtensions           SEQUENCE {
                    -- Container for adding non critical extensions after freezing REL-5
                    physicalChannelReconfiguration-r4-add-ext       BIT STRING      OPTIONAL,
                    v590NonCriticalExtenstions          SEQUENCE {
                        physicalChannelReconfiguration-v590ext
                                                PhysicalChannelReconfiguration-v590ext-IEs,
                        v690NonCriticalExtensions       SEQUENCE {
                            physicalChannelReconfiguration-v690ext
                                                        PhysicalChannelReconfiguration-v690ext-IEs,
                            nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                        }   OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            },
            criticalExtensions              CHOICE {
                r5                              SEQUENCE {
                    physicalChannelReconfiguration-r5
                                                    PhysicalChannelReconfiguration-r5-IEs,
                    -- Container for adding non critical extensions after freezing REL-6
                    physicalChannelReconfiguration-r5-add-ext       BIT STRING      OPTIONAL,
                    v690NonCriticalExtensions           SEQUENCE {
                        physicalChannelReconfiguration-v690ext
                                                        PhysicalChannelReconfiguration-v690ext-IEs,
```

```
                    nonCriticalExtensions           SEQUENCE {}      OPTIONAL
                }   OPTIONAL
            },
            criticalExtensions              CHOICE {
                r6                                  SEQUENCE {
                    physicalChannelReconfiguration-r6
                                                        PhysicalChannelReconfiguration-r6-IEs,
                    -- Container for adding non critical extensions after freezing REL-7
                    physicalChannelReconfiguration-r6-add-ext       BIT STRING      OPTIONAL,
                    nonCriticalExtensions           SEQUENCE {}      OPTIONAL
                },
                criticalExtensions              CHOICE {
                    r7                                  SEQUENCE {
                        physicalChannelReconfiguration-r7
                                                        PhysicalChannelReconfiguration-r7-IEs,
                        -- Container for adding non critical extensions after freezing REL-8
                        physicalChannelReconfiguration-r7-add-ext   BIT STRING  OPTIONAL,
                        nonCriticalExtensions                       SEQUENCE {}      OPTIONAL
                    },
                    criticalExtensions              SEQUENCE {}
                }
            }
        }
    }
  }
}

PhysicalChannelReconfiguration-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo                  OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo       OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        -- Note: the reference to CPCH in the element name below is incorrect. The name is not
        -- changed to keep it aligned with R99.
        ul-ChannelRequirement           UL-ChannelRequirementWithCPCH-SetID     OPTIONAL,
        modeSpecificInfo                CHOICE {
            fdd                             SEQUENCE {
                -- dummy is not used in this version of specification, it should
                -- not be sent and if received it should be ignored.
                dummy                           DL-PDSCH-Information         OPTIONAL
            },
            tdd                             NULL
        },
        dl-CommonInformation            DL-CommonInformation                OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List            OPTIONAL
}

PhysicalChannelReconfiguration-v3a0ext ::= SEQUENCE {
    -- The IE "new-DSCH-RNTI" should not be included in FDD mode, and if received the UE behaviour
    -- is unspecified
    new-DSCH-RNTI                   DSCH-RNTI                               OPTIONAL
}

PhysicalChannelReconfiguration-v4b0ext-IEs ::= SEQUENCE {
    -- Physical channel IEs
        -- dummy is not used in this version of the specification, it should
        -- not be sent and if received it should be ignored.
        dummy                           SSDT-UL                                 OPTIONAL,
        -- The order of the RLs in IE cell-id-PerRL-List is the same as
        -- in IE DL-InformationPerRL-List included in this message
        cell-id-PerRL-List              CellIdentity-PerRL-List                 OPTIONAL
}

PhysicalChannelReconfiguration-v590ext-IEs ::= SEQUENCE {
```

```
    -- Physical channel IEs
        dl-TPC-PowerOffsetPerRL-List    DL-TPC-PowerOffsetPerRL-List        OPTIONAL
}

PhysicalChannelReconfiguration-r4-IEs ::= SEQUENCE {
    -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode, and if received
        -- the UE behaviour is unspecified
        new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo                  OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo       OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        -- Note: the reference to CPCH in the element name below is incorrect. The name is not
        -- changed to keep it aligned with R99.
        ul-ChannelRequirement           UL-ChannelRequirementWithCPCH-SetID-r4  OPTIONAL,
        modeSpecificInfo                CHOICE {
            fdd                             SEQUENCE {
                -- dummy is not used in this version of specification, it should
                -- not be sent and if received it should be ignored.
                dummy                           DL-PDSCH-Information        OPTIONAL
            },
            tdd                             NULL
        },
        dl-CommonInformation            DL-CommonInformation-r4             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r4         OPTIONAL
}

PhysicalChannelReconfiguration-r5-IEs ::= SEQUENCE {
    -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode, and if received
        -- the UE behaviour is unspecified
        new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL,
        new-H-RNTI                      H-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo                  OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo-r5    OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        -- Note: the reference to CPCH in the element name below is incorrect. The name is not
        -- changed to keep it aligned with R99.
        ul-ChannelRequirement           UL-ChannelRequirementWithCPCH-SetID-r5  OPTIONAL,
        modeSpecificInfo                CHOICE {
            fdd                             SEQUENCE {
                -- dummy is not used in this version of specification, it should
                -- not be sent and if received it should be ignored.
                dummy                           DL-PDSCH-Information        OPTIONAL
            },
            tdd                             NULL
        },
        dl-HSPDSCH-Information          DL-HSPDSCH-Information              OPTIONAL,
        dl-CommonInformation            DL-CommonInformation-r5             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r5         OPTIONAL
}
```

```
PhysicalChannelReconfiguration-r6-IEs ::= SEQUENCE {
    -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        delayRestrictionFlag            DelayRestrictionFlag                OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode,
        -- and if received the UE behaviour is unspecified
        new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL,
        new-H-RNTI                      H-RNTI                              OPTIONAL,
        newPrimary-E-RNTI               E-RNTI                              OPTIONAL,
        newSecondary-E-RNTI             E-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo-r6               OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo-r5    OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-DPCH-Info                    UL-DPCH-Info-r6                     OPTIONAL,
        ul-EDCH-Information             UL-EDCH-Information-r6              OPTIONAL,
        dl-HSPDSCH-Information          DL-HSPDSCH-Information-r6           OPTIONAL,
        dl-CommonInformation            DL-CommonInformation-r6             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r6         OPTIONAL,
    -- MBMS IEs
        mbms-PL-ServiceRestrictInfo     MBMS-PL-ServiceRestrictInfo-r6      OPTIONAL
}

PhysicalChannelReconfiguration-v690ext-IEs ::= SEQUENCE {
    -- User Equipment IEs
        delayRestrictionFlag            DelayRestrictionFlag                OPTIONAL,
    -- Core network IEs
        primary-plmn-Identity           PLMN-Identity                       OPTIONAL,
    -- Physical channel IEs
        -- The IE harq-Preamble-Mode should not be used in the r3 and r4 versions of the message
        -- If included in the r3 or r4 version of the message, the UE should ignore the IE
        harq-Preamble-Mode              HARQ-Preamble-Mode                  OPTIONAL,
        beaconPLEst                     BEACON-PL-Est                       OPTIONAL,
        postVerificationPeriod          ENUMERATED { true }                 OPTIONAL,
        dhs-sync                        DHS-Sync                            OPTIONAL,
        timingMaintainedSynchInd        TimingMaintainedSynchInd            OPTIONAL,
    -- MBMS IEs
        mbms-PL-ServiceRestrictInfo     MBMS-PL-ServiceRestrictInfo-r6      OPTIONAL
}

PhysicalChannelReconfiguration-r7-IEs ::= SEQUENCE {
    -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        delayRestrictionFlag            DelayRestrictionFlag                OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode,
        -- and if received the UE behaviour is unspecified
        new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL,
        new-H-RNTI                      H-RNTI                              OPTIONAL,
        newPrimary-E-RNTI               E-RNTI                              OPTIONAL,
        newSecondary-E-RNTI             E-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo-r6               OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo-r5    OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-DPCH-Info                    UL-DPCH-Info-r7                     OPTIONAL,
        ul-EDCH-Information             UL-EDCH-Information-r6              OPTIONAL,
```

```
        dl-HSPDSCH-Information           DL-HSPDSCH-Information-r7           OPTIONAL,
        dl-CommonInformation            DL-CommonInformation-r7             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r7         OPTIONAL,
    -- MBMS IEs
        mbms-PL-ServiceRestrictInfo     MBMS-PL-ServiceRestrictInfo-r6      OPTIONAL
}

-- ***************************************************
--
-- PHYSICAL CHANNEL RECONFIGURATION COMPLETE
--
-- ***************************************************

PhysicalChannelReconfigurationComplete ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        ul-IntegProtActivationInfo      IntegrityProtActivationInfo         OPTIONAL,
        -- TABULAR: UL-TimingAdvance is applicable for TDD mode only.
        ul-TimingAdvance                UL-TimingAdvance                    OPTIONAL,
    -- Radio bearer IEs
        count-C-ActivationTime          ActivationTime                      OPTIONAL,
        -- dummy is not used in this version of the specification and
        -- it should be ignored by the receiver.
        dummy                           RB-ActivationTimeInfoList           OPTIONAL,
        ul-CounterSynchronisationInfo   UL-CounterSynchronisationInfo       OPTIONAL,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            physicalChannelReconfigurationComplete-r3-add-ext       BIT STRING      OPTIONAL,
            v7xyNonCriticalExtensions       SEQUENCE {
                physicalChannelReconfigurationComplete-v7xyext
                                    PhysicalChannelReconfigurationComplete-v7xyext-IEs,
                nonCriticalExtensions           SEQUENCE {}     OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
}

PhysicalChannelReconfigurationComplete-v7xyext-IEs ::=  SEQUENCE {
        ul-TimingAdvance-VHCR           UL-TimingAdvance-VHCR               OPTIONAL
}

-- ***************************************************
--
-- PHYSICAL CHANNEL RECONFIGURATION FAILURE
--
-- ***************************************************

PhysicalChannelReconfigurationFailure ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier           OPTIONAL,
        failureCause                    FailureCauseWithProtErr,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            physicalChannelReconfigurationFailure-r3-add-ext        BIT STRING      OPTIONAL,
            nonCriticalExtensions           SEQUENCE {}     OPTIONAL
        }   OPTIONAL
}

-- ***************************************************
--
-- PHYSICAL SHARED CHANNEL ALLOCATION (TDD only)
--
-- ***************************************************

PhysicalSharedChannelAllocation ::= CHOICE {
    r3                              SEQUENCE {
        physicalSharedChannelAllocation-r3
                                        PhysicalSharedChannelAllocation-r3-IEs,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            physicalSharedChannelAllocation-r3-add-ext      BIT STRING      OPTIONAL,
            nonCriticalExtensions           SEQUENCE {} OPTIONAL
        }   OPTIONAL
    },
    later-than-r3                   SEQUENCE {
        dsch-RNTI                       DSCH-RNTI                           OPTIONAL,
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        criticalExtensions              CHOICE {
```

```
			r4								SEQUENCE {
				physicalSharedChannelAllocation-r4
													PhysicalSharedChannelAllocation-r4-IEs,
				v4d0NonCriticalExtensions		SEQUENCE {
					-- Container for adding non critical extensions after freezing REL-5
					physicalSharedChannelAllocation-r4-add-ext		BIT STRING		OPTIONAL,
					v690NonCriticalExtensions		SEQUENCE {
						physicalSharedChannelAllocation-v690ext
													PhysicalSharedChannelAllocation-v690ext-IEs,
						v7xyNonCriticalExtensions		SEQUENCE {
							physicalSharedChannelAllocation-v7xyext
													PhysicalSharedChannelAllocation-v7xyext-IEs,
							nonCriticalExtensions			SEQUENCE {}		OPTIONAL
						}		OPTIONAL
					}		OPTIONAL
				}		OPTIONAL
			},
			criticalExtensions				SEQUENCE {}
		}
	}
}

PhysicalSharedChannelAllocation-r3-IEs ::= SEQUENCE {
	-- TABULAR: Integrity protection shall not be performed on this message.
	-- User equipment IEs
		dsch-RNTI						DSCH-RNTI							OPTIONAL,
		rrc-TransactionIdentifier		RRC-TransactionIdentifier,
	-- Physical channel IEs
		ul-TimingAdvance				UL-TimingAdvanceControl				OPTIONAL,
		pusch-CapacityAllocationInfo	PUSCH-CapacityAllocationInfo		OPTIONAL,
		pdsch-CapacityAllocationInfo	PDSCH-CapacityAllocationInfo		OPTIONAL,
		-- TABULAR: If confirmRequest is not present, the default value "No Confirm"
		-- shall be used as specified in 10.2.25.
		confirmRequest					ENUMERATED {
											confirmPDSCH, confirmPUSCH }	OPTIONAL,
		trafficVolumeReportRequest		INTEGER (0..255)					OPTIONAL,
		iscpTimeslotList					TimeslotList						OPTIONAL,
		requestPCCPCHRSCP					BOOLEAN
}

PhysicalSharedChannelAllocation-r4-IEs ::= SEQUENCE {
	-- TABULAR: Integrity protection shall not be performed on this message.
	-- Physical channel IEs
		ul-TimingAdvance				UL-TimingAdvanceControl-r4			OPTIONAL,
		pusch-CapacityAllocationInfo	PUSCH-CapacityAllocationInfo-r4		OPTIONAL,
		pdsch-CapacityAllocationInfo	PDSCH-CapacityAllocationInfo-r4		OPTIONAL,
		-- TABULAR: If confirmRequest is not present, the default value "No Confirm"
		-- shall be used as specified in 10.2.25.
		confirmRequest					ENUMERATED {
											confirmPDSCH, confirmPUSCH }	OPTIONAL,
		trafficVolumeReportRequest		INTEGER (0..255)					OPTIONAL,
		iscpTimeslotList				TimeslotList-r4						OPTIONAL,
		requestPCCPCHRSCP				BOOLEAN
}

PhysicalSharedChannelAllocation-v690ext-IEs ::= SEQUENCE {
	-- Physical Channel IEs
		beaconPLEst						BEACON-PL-Est						OPTIONAL
}

PhysicalSharedChannelAllocation-v7xyext-IEs ::= SEQUENCE {
		ul-TimingAdvance				UL-TimingAdvanceControl-r7			OPTIONAL,
		pusch-CapacityAllocationInfo	PUSCH-CapacityAllocationInfo-r7		OPTIONAL,
		pdsch-CapacityAllocationInfo	PDSCH-CapacityAllocationInfo-r7		OPTIONAL
}

-- ***************************************************
--
-- PUSCH CAPACITY REQUEST (TDD only)
--
-- ***************************************************

PUSCHCapacityRequest ::= SEQUENCE {
	-- User equipment IEs
		dsch-RNTI						DSCH-RNTI							OPTIONAL,
	-- Measurement IEs
		trafficVolume					TrafficVolumeMeasuredResultsList	OPTIONAL,
		timeslotListWithISCP			TimeslotListWithISCP				OPTIONAL,
```

```
        primaryCCPCH-RSCP               PrimaryCCPCH-RSCP                   OPTIONAL,
        allocationConfirmation          CHOICE {
            pdschConfirmation               PDSCH-Identity,
            puschConfirmation               PUSCH-Identity
        }                                                                   OPTIONAL,
        protocolErrorIndicator          ProtocolErrorIndicatorWithMoreInfo,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            puschCapacityRequest-r3-add-ext     BIT STRING      OPTIONAL,
            v590NonCriticalExtensions       SEQUENCE {
                puschCapacityRequest-v590ext    PUSCHCapacityRequest-v590ext,
                nonCriticalExtensions           SEQUENCE {} OPTIONAL
            }       OPTIONAL
        }   OPTIONAL
}

PUSCHCapacityRequest-v590ext ::= SEQUENCE {
    primaryCCPCH-RSCP-delta             DeltaRSCP           OPTIONAL
}
-- ***************************************************
--
-- RADIO BEARER RECONFIGURATION
--
-- ***************************************************

RadioBearerReconfiguration ::= CHOICE {
    r3                              SEQUENCE {
        radioBearerReconfiguration-r3   RadioBearerReconfiguration-r3-IEs,
        -- Prefix "v3ao" is used (in one instance) to keep alignment with R99
        v3aoNonCriticalExtensions       SEQUENCE {
            radioBearerReconfiguration-v3a0ext  RadioBearerReconfiguration-v3a0ext,
            laterNonCriticalExtensions      SEQUENCE {
                -- Container for additional R99 extensions
                radioBearerReconfiguration-r3-add-ext       BIT STRING      OPTIONAL,
                v4b0NonCriticalExtensions           SEQUENCE {
                    radioBearerReconfiguration-v4b0ext
                                                    RadioBearerReconfiguration-v4b0ext-IEs,
                    v590NonCriticalExtensions           SEQUENCE {
                        radioBearerReconfiguration-v590ext
                                                        RadioBearerReconfiguration-v590ext-IEs,
                        v5d0NonCriticalExtenstions          SEQUENCE {
                            radioBearerReconfiguration-v5d0ext
                                                            RadioBearerReconfiguration-v5d0ext-IEs,
                            v690NonCriticalExtensions       SEQUENCE {
                                radioBearerReconfiguration-v690ext
                                                            RadioBearerReconfiguration-v690ext-IEs,
                                nonCriticalExtensions           SEQUENCE {} OPTIONAL
                            }   OPTIONAL
                        }   OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
    },
    later-than-r3                   SEQUENCE {
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        criticalExtensions              CHOICE {
            r4                              SEQUENCE {
                radioBearerReconfiguration-r4   RadioBearerReconfiguration-r4-IEs,
                v4d0NonCriticalExtensions           SEQUENCE {
                    -- Container for adding non critical extensions after freezing REL-5
                    radioBearerReconfiguration-r4-add-ext       BIT STRING      OPTIONAL,
                    v590NonCriticalExtensions           SEQUENCE {
                        radioBearerReconfiguration-v590ext
                                                    RadioBearerReconfiguration-v590ext-IEs,
                        v5d0NonCriticalExtenstions          SEQUENCE {
                            radioBearerReconfiguration-v5d0ext
                                                            RadioBearerReconfiguration-v5d0ext-IEs,
                            v690NonCriticalExtensions       SEQUENCE {
                                radioBearerReconfiguration-v690ext
                                                            RadioBearerReconfiguration-v690ext-IEs,
                                nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                            }   OPTIONAL
                        }   OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            },
            criticalExtensions              CHOICE {
```

```
            r5                                    SEQUENCE {
                radioBearerReconfiguration-r5         RadioBearerReconfiguration-r5-IEs,
                -- Container for adding non critical extensions after freezing REL-6
                radioBearerReconfiguration-r5-add-ext         BIT STRING        OPTIONAL,
                v5d0NonCriticalExtenstions            SEQUENCE {
                    radioBearerReconfiguration-v5d0ext  RadioBearerReconfiguration-v5d0ext-IEs,
                    v690NonCriticalExtensions             SEQUENCE {
                        radioBearerReconfiguration-v690ext
                                                          RadioBearerReconfiguration-v690ext-IEs,
                        nonCriticalExtensions                 SEQUENCE {}       OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            },
            criticalExtensions              CHOICE {
                r6                                    SEQUENCE {
                    radioBearerReconfiguration-r6         RadioBearerReconfiguration-r6-IEs,
                    -- Container for adding non critical extensions after freezing REL-7
                    radioBearerReconfiguration-r6-add-ext         BIT STRING        OPTIONAL,
                    nonCriticalExtensions                 SEQUENCE {}       OPTIONAL
                },
                criticalExtensions              CHOICE {
                    r7                                    SEQUENCE {
                        radioBearerReconfiguration-r7         RadioBearerReconfiguration-r7-IEs,
                        -- Container for adding non critical extensions after freezing REL-8
                        radioBearerReconfiguration-r7-add-ext         BIT STRING        OPTIONAL,
                        nonCriticalExtensions                 SEQUENCE {}       OPTIONAL
                    },
                    criticalExtensions              SEQUENCE {}
                }
            }
        }
    }
  }
}

RadioBearerReconfiguration-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo                  OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        rab-InformationReconfigList     RAB-InformationReconfigList         OPTIONAL,
        -- NOTE: IE rb-InformationReconfigList should be optional in later versions
        -- of this message
        rb-InformationReconfigList      RB-InformationReconfigList,
        rb-InformationAffectedList      RB-InformationAffectedList          OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo                OPTIONAL,
        ul-deletedTransChInfoList       UL-DeletedTransChInfoList           OPTIONAL,
        ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList         OPTIONAL,
        -- 'dummy', 'dummy1' and 'dummy2' are not used in this version of the specification,
        -- they should not be sent and if received they should be ignored.
        dummy                           CHOICE {
            fdd                             SEQUENCE {
                dummy1                          CPCH-SetID                  OPTIONAL,
                dummy2                          DRAC-StaticInformationList  OPTIONAL
            },
            tdd                             NULL
        }                                                                   OPTIONAL,
        dl-CommonTransChInfo            DL-CommonTransChInfo                OPTIONAL,
        dl-DeletedTransChInfoList       DL-DeletedTransChInfoList           OPTIONAL,
        dl-AddReconfTransChInfoList     DL-AddReconfTransChInfo2List        OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-ChannelRequirement           UL-ChannelRequirement               OPTIONAL,
        modeSpecificPhysChInfo          CHOICE {
            fdd                             SEQUENCE {
                -- dummy is not used in this version of specification, it should
```

```
                -- not be sent and if received it should be ignored.
                dummy                               DL-PDSCH-Information        OPTIONAL
            },
            tdd                             NULL
        },
        dl-CommonInformation            DL-CommonInformation                OPTIONAL,
        -- NOTE: IE dl-InformationPerRL-List is optional in later versions
        -- of this message
        dl-InformationPerRL-List        DL-InformationPerRL-List
}

RadioBearerReconfiguration-v3a0ext ::= SEQUENCE {
    -- The IE "new-DSCH-RNTI" should not be included in FDD mode, and if received the UE behaviour
    -- is unspecified
    new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL
}

RadioBearerReconfiguration-v4b0ext-IEs ::= SEQUENCE {
    -- Physical channel IEs
        -- dummy is not used in this version of the specification, it should
        -- not be sent and if received it should be ignored.
        dummy                               SSDT-UL                             OPTIONAL,
        -- The order of the RLs in IE cell-id-PerRL-List is the same as
        -- in IE DL-InformationPerRL-List included in this message
        cell-id-PerRL-List                  CellIdentity-PerRL-List             OPTIONAL
}

RadioBearerReconfiguration-v590ext-IEs ::= SEQUENCE {
    -- Physical channel IEs
        dl-TPC-PowerOffsetPerRL-List    DL-TPC-PowerOffsetPerRL-List        OPTIONAL
}

RadioBearerReconfiguration-v5d0ext-IEs ::= SEQUENCE {
    --Radio Bearer IEs
        pdcp-ROHC-TargetMode            PDCP-ROHC-TargetMode                OPTIONAL
}

RadioBearerReconfiguration-r4-IEs ::= SEQUENCE {
    -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode, and if received
        -- the UE behaviour is unspecified
        new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo                  OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        rab-InformationReconfigList     RAB-InformationReconfigList         OPTIONAL,
        rb-InformationReconfigList      RB-InformationReconfigList-r4       OPTIONAL,
        rb-InformationAffectedList      RB-InformationAffectedList          OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
        ul-deletedTransChInfoList       UL-DeletedTransChInfoList           OPTIONAL,
        ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList         OPTIONAL,
        -- 'dummy', 'dummy1' and 'dummy2' are not used in this version of the specification,
        -- they should not be sent and if received they should be ignored.
        dummy                           CHOICE {
            fdd                             SEQUENCE {
                dummy1                              CPCH-SetID                  OPTIONAL,
                dummy2                              DRAC-StaticInformationList  OPTIONAL
            },
            tdd                             NULL
        }                                                                   OPTIONAL,
        dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
        dl-DeletedTransChInfoList       DL-DeletedTransChInfoList           OPTIONAL,
        dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r4      OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-ChannelRequirement           UL-ChannelRequirement-r4            OPTIONAL,
        modeSpecificPhysChInfo          CHOICE {
```

```
          fdd                               SEQUENCE {
              -- dummy is not used in this version of specification, it should
              -- not be sent and if received it should be ignored.
              dummy                             DL-PDSCH-Information        OPTIONAL
          },
          tdd                               NULL
      },
      dl-CommonInformation            DL-CommonInformation-r4           OPTIONAL,
      dl-InformationPerRL-List        DL-InformationPerRL-List-r4       OPTIONAL
}

RadioBearerReconfiguration-r5-IEs ::= SEQUENCE {
    -- User equipment IEs
      integrityProtectionModeInfo     IntegrityProtectionModeInfo       OPTIONAL,
      cipheringModeInfo               CipheringModeInfo                 OPTIONAL,
      activationTime                  ActivationTime                    OPTIONAL,
      new-U-RNTI                      U-RNTI                            OPTIONAL,
      new-C-RNTI                      C-RNTI                            OPTIONAL,
      -- The IE "new-DSCH-RNTI" should not be included in FDD mode, and if received
      -- the UE behaviour is unspecified
      new-DSCH-RNTI                   DSCH-RNTI                         OPTIONAL,
      new-H-RNTI                      H-RNTI                            OPTIONAL,
      rrc-StateIndicator              RRC-StateIndicator,
      utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient  OPTIONAL,
    -- Core network IEs
      cn-InformationInfo              CN-InformationInfo                OPTIONAL,
    -- UTRAN mobility IEs
      ura-Identity                    URA-Identity                      OPTIONAL,
    -- Specification mode information
      specificationMode               CHOICE {
          complete                        SEQUENCE {
          -- Radio bearer IEs
              rab-InformationReconfigList     RAB-InformationReconfigList        OPTIONAL,
              rb-InformationReconfigList      RB-InformationReconfigList-r5      OPTIONAL,
              rb-InformationAffectedList      RB-InformationAffectedList-r5      OPTIONAL,
              rb-PDCPContextRelocationList    RB-PDCPContextRelocationList       OPTIONAL,
          -- Transport channel IEs
              ul-CommonTransChInfo            UL-CommonTransChInfo-r4            OPTIONAL,
              ul-deletedTransChInfoList       UL-DeletedTransChInfoList          OPTIONAL,
              ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList        OPTIONAL,
              -- 'dummy', 'dummy1' and 'dummy2' are not used in this version of the
              -- specification, they should not be sent and if received they should be ignored.
              dummy                           CHOICE {
                  fdd                             SEQUENCE {
                      dummy1                          CPCH-SetID                 OPTIONAL,
                      dummy2                          DRAC-StaticInformationList OPTIONAL
                  },
                  tdd                             NULL
              }                                                                  OPTIONAL,
              dl-CommonTransChInfo            DL-CommonTransChInfo-r4            OPTIONAL,
              dl-DeletedTransChInfoList       DL-DeletedTransChInfoList-r5       OPTIONAL,
              dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r5     OPTIONAL
          },
          preconfiguration                SEQUENCE {
          -- All IEs that include an FDD/TDD choice are split in two IEs for this message,
          -- one for the FDD only elements and one for the TDD only elements, so that one
          -- FDD/TDD choice in this level is sufficient.
              preConfigMode                   CHOICE {
                  predefinedConfigIdentity        PredefinedConfigIdentity,
                  defaultConfig                   SEQUENCE {
                      defaultConfigMode               DefaultConfigMode,
                      defaultConfigIdentity           DefaultConfigIdentity-r5
                  }
              }
          }
      },
    -- Physical channel IEs
      frequencyInfo                   FrequencyInfo                     OPTIONAL,
      maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power             OPTIONAL,
      ul-ChannelRequirement           UL-ChannelRequirement-r5          OPTIONAL,
      modeSpecificPhysChInfo          CHOICE {
          fdd                             SEQUENCE {
              -- dummy is not used in this version of specification, it should
              -- not be sent and if received it should be ignored.
              dummy                           DL-PDSCH-Information          OPTIONAL
          },
          tdd                             NULL
      },
```

```
        dl-HSPDSCH-Information          DL-HSPDSCH-Information              OPTIONAL,
        dl-CommonInformation            DL-CommonInformation-r5             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r5         OPTIONAL
}

RadioBearerReconfiguration-r6-IEs ::= SEQUENCE {
    -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        delayRestrictionFlag            DelayRestrictionFlag                OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode,
        -- and if received the UE behaviour is unspecified
        new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL,
        new-H-RNTI                      H-RNTI                              OPTIONAL,
        newPrimary-E-RNTI               E-RNTI                              OPTIONAL,
        newSecondary-E-RNTI             E-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo-r6               OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Specification mode information
        specificationMode               CHOICE {
            complete                        SEQUENCE {
            -- Radio bearer IEs
                rab-InformationReconfigList     RAB-InformationReconfigList         OPTIONAL,
                rb-InformationReconfigList      RB-InformationReconfigList-r6       OPTIONAL,
                rb-InformationAffectedList      RB-InformationAffectedList-r6       OPTIONAL,
                rb-PDCPContextRelocationList    RB-PDCPContextRelocationList        OPTIONAL,
                pdcp-ROHC-TargetMode            PDCP-ROHC-TargetMode                OPTIONAL,
            -- Transport channel IEs
                ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
                ul-deletedTransChInfoList       UL-DeletedTransChInfoList-r6        OPTIONAL,
                ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList-r6      OPTIONAL,
                dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
                dl-DeletedTransChInfoList       DL-DeletedTransChInfoList-r5        OPTIONAL,
                dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r5      OPTIONAL
            },
            preconfiguration                SEQUENCE {
            -- All IEs that include an FDD/TDD choice are split in two IEs for this message,
            -- one for the FDD only elements and one for the TDD only elements, so that one
            -- FDD/TDD choice in this level is sufficient.
                preConfigMode                   CHOICE {
                    predefinedConfigIdentity        PredefinedConfigIdentity,
                    defaultConfig                   SEQUENCE {
                        defaultConfigMode               DefaultConfigMode,
                        defaultConfigIdentity           DefaultConfigIdentity-r6
                    }
                }
            }
        },
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-DPCH-Info                    UL-DPCH-Info-r6                     OPTIONAL,
        ul-EDCH-Information             UL-EDCH-Information-r6              OPTIONAL,
        dl-HSPDSCH-Information          DL-HSPDSCH-Information-r6           OPTIONAL,
        dl-CommonInformation            DL-CommonInformation-r6             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r6         OPTIONAL,
    -- MBMS IEs
        mbms-PL-ServiceRestrictInfo     MBMS-PL-ServiceRestrictInfo-r6      OPTIONAL
}

RadioBearerReconfiguration-v690ext-IEs ::= SEQUENCE {
    -- User Equipment IEs
        delayRestrictionFlag            DelayRestrictionFlag                OPTIONAL,
    -- Core network IEs
        primary-plmn-Identity           PLMN-Identity                       OPTIONAL,
    -- Physical channel IEs
        -- The IE harq-Preamble-Mode should not be used in the r3 and r4 versions of the message
        -- If included in the r3 or r4 version of the message, the UE should ignore the IE
        harq-Preamble-Mode              HARQ-Preamble-Mode                  OPTIONAL,
        beaconPLEst                     BEACON-PL-Est                       OPTIONAL,
        postVerificationPeriod          ENUMERATED { true }                 OPTIONAL,
```

```
        dhs-sync                        DHS-Sync                            OPTIONAL,
        timingMaintainedSynchInd        TimingMaintainedSynchInd            OPTIONAL,
    -- MBMS IEs
        mbms-PL-ServiceRestrictInfo     MBMS-PL-ServiceRestrictInfo-r6      OPTIONAL
}

RadioBearerReconfiguration-r7-IEs ::= SEQUENCE {
    -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        delayRestrictionFlag            DelayRestrictionFlag                OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode,
        -- and if received the UE behaviour is unspecified
        new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL,
        new-H-RNTI                      H-RNTI                              OPTIONAL,
        newPrimary-E-RNTI               E-RNTI                              OPTIONAL,
        newSecondary-E-RNTI             E-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo-r6               OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Specification mode information
        specificationMode               CHOICE {
            complete                        SEQUENCE {
            -- Radio bearer IEs
                rab-InformationReconfigList     RAB-InformationReconfigList         OPTIONAL,
                rb-InformationReconfigList      RB-InformationReconfigList-r6       OPTIONAL,
                rb-InformationAffectedList      RB-InformationAffectedList-r6       OPTIONAL,
                rb-PDCPContextRelocationList    RB-PDCPContextRelocationList        OPTIONAL,
                pdcp-ROHC-TargetMode            PDCP-ROHC-TargetMode                OPTIONAL,
            -- Transport channel IEs
                ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
                ul-deletedTransChInfoList       UL-DeletedTransChInfoList-r6        OPTIONAL,
                ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList-r6      OPTIONAL,
                dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
                dl-DeletedTransChInfoList       DL-DeletedTransChInfoList-r5        OPTIONAL,
                dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r5      OPTIONAL
            },
            preconfiguration                SEQUENCE {
            -- All IEs that include an FDD/TDD choice are split in two IEs for this message,
            -- one for the FDD only elements and one for the TDD only elements, so that one
            -- FDD/TDD choice in this level is sufficient.
                preConfigMode                   CHOICE {
                    predefinedConfigIdentity        PredefinedConfigIdentity,
                    defaultConfig                   SEQUENCE {
                        defaultConfigMode               DefaultConfigMode,
                        defaultConfigIdentity           DefaultConfigIdentity-r5
                    }
                }
            }
        },
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-DPCH-Info                    UL-DPCH-Info-r7                     OPTIONAL,
        ul-EDCH-Information             UL-EDCH-Information-r6              OPTIONAL,
        dl-HSPDSCH-Information          DL-HSPDSCH-Information-r7           OPTIONAL,
        dl-CommonInformation            DL-CommonInformation-r7             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r7         OPTIONAL,
    -- MBMS IEs
        mbms-PL-ServiceRestrictInfo     MBMS-PL-ServiceRestrictInfo-r6      OPTIONAL
}

-- ***************************************************
--
-- RADIO BEARER RECONFIGURATION COMPLETE
--
-- ***************************************************

RadioBearerReconfigurationComplete ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        ul-IntegProtActivationInfo      IntegrityProtActivationInfo         OPTIONAL,
```

```
        -- TABULAR: UL-TimingAdvance is applicable for TDD mode only.
        ul-TimingAdvance                UL-TimingAdvance                    OPTIONAL,
    -- Radio bearer IEs
        count-C-ActivationTime          ActivationTime                      OPTIONAL,
        -- dummy is not used in this version of the specification and
        -- it should be ignored by the receiver.
        dummy                           RB-ActivationTimeInfoList           OPTIONAL,
        ul-CounterSynchronisationInfo   UL-CounterSynchronisationInfo       OPTIONAL,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            radioBearerReconfigurationComplete-r3-add-ext       BIT STRING      OPTIONAL,
            v7xyNonCriticalExtensions       SEQUENCE {
                radioBearerReconfigurationComplete-v7xyext
                                                RadioBearerReconfigurationComplete-v7xyext-IEs,
                nonCriticalExtensions           SEQUENCE {} OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
}

RadioBearerReconfigurationComplete-v7xyext-IEs ::= SEQUENCE {
        ul-TimingAdvance-VHCR           UL-TimingAdvance-VHCR               OPTIONAL
}

-- ***************************************************
--
-- RADIO BEARER RECONFIGURATION FAILURE
--
-- ***************************************************

RadioBearerReconfigurationFailure ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        failureCause                    FailureCauseWithProtErr,
    -- Radio bearer IEs
        potentiallySuccesfulBearerList  RB-IdentityList                     OPTIONAL,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            radioBearerReconfigurationFailure-r3-add-ext        BIT STRING      OPTIONAL,
            nonCriticalExtensions           SEQUENCE {} OPTIONAL
        }   OPTIONAL
}

-- ***************************************************
--
-- RADIO BEARER RELEASE
--
-- ***************************************************

RadioBearerRelease ::= CHOICE {
    r3                                  SEQUENCE {
        radioBearerRelease-r3           RadioBearerRelease-r3-IEs,
        v3a0NonCriticalExtensions       SEQUENCE {
            radioBearerRelease-v3a0ext      RadioBearerRelease-v3a0ext,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            radioBearerRelease-r3-add-ext       BIT STRING      OPTIONAL,
                v4b0NonCriticalExtensions       SEQUENCE {
                    radioBearerRelease-v4b0ext      RadioBearerRelease-v4b0ext-IEs,
                    v590NonCriticalExtensions       SEQUENCE {
                        radioBearerRelease-v590ext      RadioBearerRelease-v590ext-IEs,
                        v690NonCriticalExtensions       SEQUENCE {
                            radioBearerRelease-v690ext      RadioBearerRelease-v690ext-IEs,
                            nonCriticalExtensions           SEQUENCE {} OPTIONAL
                        }       OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
    },
    later-than-r3                       SEQUENCE {
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        criticalExtensions              CHOICE {
            r4                                  SEQUENCE {
                radioBearerRelease-r4           RadioBearerRelease-r4-IEs,
                v4d0NonCriticalExtensions           SEQUENCE {
                    -- Container for adding non critical extensions after freezing REL-5
                    radioBearerRelease-r4-add-ext       BIT STRING      OPTIONAL,
                    v590NonCriticalExtensions       SEQUENCE {
```

```
                    radioBearerRelease-v590ext      RadioBearerRelease-v590ext-IEs,
                    v690NonCriticalExtensions       SEQUENCE {
                        radioBearerRelease-v690ext      RadioBearerRelease-v690ext-IEs,
                        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            }   OPTIONAL
        },
        criticalExtensions              CHOICE {
            r5                              SEQUENCE {
                radioBearerRelease-r5           RadioBearerRelease-r5-IEs,
                -- Container for adding non critical extensions after freezing REL-6
                radioBearerRelease-r5-add-ext   BIT STRING      OPTIONAL,
                v690NonCriticalExtensions       SEQUENCE {
                    radioBearerRelease-v690ext      RadioBearerRelease-v690ext-IEs,
                    nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                }   OPTIONAL
            },
            criticalExtensions              CHOICE {
                r6                              SEQUENCE {
                    radioBearerRelease-r6           RadioBearerRelease-r6-IEs,
                    -- Container for adding non critical extensions after freezing REL-7
                    radioBearerRelease-r6-add-ext   BIT STRING      OPTIONAL,
                    nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                },
                criticalExtensions              CHOICE {
                    r7                              SEQUENCE {
                        radioBearerRelease-r7           RadioBearerRelease-r7-IEs,
                        -- Container for adding non critical extensions after freezing REL-8
                        radioBearerRelease-r7-add-ext   BIT STRING      OPTIONAL,
                        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                    },
                    criticalExtensions              SEQUENCE {}
                }
            }
        }
    }
}
}

RadioBearerRelease-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo                  OPTIONAL,
        signallingConnectionRelIndication   CN-DomainIdentity               OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        rab-InformationReconfigList     RAB-InformationReconfigList         OPTIONAL,
        rb-InformationReleaseList       RB-InformationReleaseList,
        rb-InformationAffectedList      RB-InformationAffectedList          OPTIONAL,
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo       OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo                OPTIONAL,
        ul-deletedTransChInfoList       UL-DeletedTransChInfoList           OPTIONAL,
        ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList         OPTIONAL,
        -- 'dummy', 'dummy1' and 'dummy2' are not used in this version of the specification,
        -- they should not be sent and if received they should be ignored.
        dummy                           CHOICE {
            fdd                             SEQUENCE {
                dummy1                          CPCH-SetID                  OPTIONAL,
                dummy2                          DRAC-StaticInformationList  OPTIONAL
            },
            tdd                             NULL
        }                                                                   OPTIONAL,
        dl-CommonTransChInfo            DL-CommonTransChInfo                OPTIONAL,
        dl-DeletedTransChInfoList       DL-DeletedTransChInfoList           OPTIONAL,
        dl-AddReconfTransChInfoList     DL-AddReconfTransChInfo2List        OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
```

```
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-ChannelRequirement           UL-ChannelRequirement               OPTIONAL,
        modeSpecificPhysChInfo          CHOICE {
            fdd                             SEQUENCE {
                -- dummy is not used in this version of specification, it should
                -- not be sent and if received it should be ignored.
                dummy                           DL-PDSCH-Information         OPTIONAL
            },
            tdd                         NULL
        },
        dl-CommonInformation            DL-CommonInformation                OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List            OPTIONAL
}

RadioBearerRelease-v3a0ext ::= SEQUENCE {
    -- The IE "new-DSCH-RNTI" should not be included in FDD mode, and if received the UE behaviour
    -- is unspecified
    new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL
}

RadioBearerRelease-v4b0ext-IEs ::= SEQUENCE {
    -- Physical channel IEs
        -- dummy is not used in this version of the specification, it should
        -- not be sent and if received it should be ignored.
        dummy                           SSDT-UL                             OPTIONAL,
        -- The order of the RLs in IE cell-id-PerRL-List is the same as
        --  in IE DL-InformationPerRL-List included in this message
        cell-id-PerRL-List              CellIdentity-PerRL-List             OPTIONAL
}

RadioBearerRelease-v590ext-IEs ::= SEQUENCE {
    -- Physical channel IEs
        dl-TPC-PowerOffsetPerRL-List    DL-TPC-PowerOffsetPerRL-List        OPTIONAL
}

RadioBearerRelease-r4-IEs ::= SEQUENCE {
    -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode, and if received
        -- the UE behaviour is unspecified
        new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo                  OPTIONAL,
        signallingConnectionRelIndication   CN-DomainIdentity               OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        rab-InformationReconfigList     RAB-InformationReconfigList         OPTIONAL,
        rb-InformationReleaseList       RB-InformationReleaseList,
        rb-InformationAffectedList      RB-InformationAffectedList          OPTIONAL,
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo       OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
        ul-deletedTransChInfoList       UL-DeletedTransChInfoList           OPTIONAL,
        ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList         OPTIONAL,
        -- 'dummy', 'dummy1' and 'dummy2' are not used in this version of the specification,
        -- they should not be sent and if received they should be ignored.
        dummy                           CHOICE {
            fdd                             SEQUENCE {
                dummy1                          CPCH-SetID                  OPTIONAL,
                dummy2                          DRAC-StaticInformationList  OPTIONAL
            },
            tdd                             NULL
        }                                                                   OPTIONAL,
        dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
        dl-DeletedTransChInfoList       DL-DeletedTransChInfoList           OPTIONAL,
        dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r4      OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-ChannelRequirement           UL-ChannelRequirement-r4            OPTIONAL,
        modeSpecificPhysChInfo          CHOICE {
```

```
          fdd                              SEQUENCE {
              -- dummy is not used in this version of specification, it should
              -- not be sent and if received it should be ignored.
              dummy                                DL-PDSCH-Information        OPTIONAL
          },
          tdd                          NULL
      },
      dl-CommonInformation             DL-CommonInformation-r4             OPTIONAL,
      dl-InformationPerRL-List         DL-InformationPerRL-List-r4         OPTIONAL
}

RadioBearerRelease-r5-IEs ::= SEQUENCE {
    -- User equipment IEs
      integrityProtectionModeInfo      IntegrityProtectionModeInfo         OPTIONAL,
      cipheringModeInfo                CipheringModeInfo                   OPTIONAL,
      activationTime                   ActivationTime                      OPTIONAL,
      new-U-RNTI                       U-RNTI                              OPTIONAL,
      new-C-RNTI                       C-RNTI                              OPTIONAL,
      -- The IE "new-DSCH-RNTI" should not be included in FDD mode,
      -- and if received the UE behaviour is unspecified
      new-DSCH-RNTI                    DSCH-RNTI                           OPTIONAL,
      new-H-RNTI                       H-RNTI                              OPTIONAL,
      rrc-StateIndicator               RRC-StateIndicator,
      utran-DRX-CycleLengthCoeff       UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- Core network IEs
      cn-InformationInfo               CN-InformationInfo                  OPTIONAL,
      signallingConnectionRelIndication   CN-DomainIdentity                OPTIONAL,
    -- UTRAN mobility IEs
      ura-Identity                     URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
      rab-InformationReconfigList      RAB-InformationReconfigList         OPTIONAL,
      rb-InformationReleaseList        RB-InformationReleaseList,
      rb-InformationAffectedList       RB-InformationAffectedList-r5       OPTIONAL,
      dl-CounterSynchronisationInfo    DL-CounterSynchronisationInfo-r5    OPTIONAL,
    -- Transport channel IEs
      ul-CommonTransChInfo             UL-CommonTransChInfo-r4             OPTIONAL,
      ul-deletedTransChInfoList        UL-DeletedTransChInfoList           OPTIONAL,
      ul-AddReconfTransChInfoList      UL-AddReconfTransChInfoList         OPTIONAL,
      -- 'dummy', 'dummy1' and 'dummy2' are not used in this version of the specification,
      -- they should not be sent and if received they should be ignored.
      dummy                            CHOICE {
          fdd                              SEQUENCE {
              dummy1                               CPCH-SetID                  OPTIONAL,
              dummy2                               DRAC-StaticInformationList  OPTIONAL
          },
          tdd                              NULL
      }                                                                    OPTIONAL,
      dl-CommonTransChInfo             DL-CommonTransChInfo-r4             OPTIONAL,
      dl-DeletedTransChInfoList        DL-DeletedTransChInfoList-r5        OPTIONAL,
      dl-AddReconfTransChInfoList      DL-AddReconfTransChInfoList-r5      OPTIONAL,
    -- Physical channel IEs
      frequencyInfo                    FrequencyInfo                       OPTIONAL,
      maxAllowedUL-TX-Power            MaxAllowedUL-TX-Power               OPTIONAL,
      ul-ChannelRequirement            UL-ChannelRequirement-r5            OPTIONAL,
      modeSpecificPhysChInfo           CHOICE {
          fdd                              SEQUENCE {
              -- dummy is not used in this version of specification, it should
              -- not be sent and if received it should be ignored.
              dummy                                DL-PDSCH-Information        OPTIONAL
          },
          tdd                          NULL
      },
      dl-HSPDSCH-Information           DL-HSPDSCH-Information              OPTIONAL,
      dl-CommonInformation             DL-CommonInformation-r5             OPTIONAL,
      dl-InformationPerRL-List         DL-InformationPerRL-List-r5         OPTIONAL
}

RadioBearerRelease-v690ext-IEs ::= SEQUENCE {
    -- Core network IEs
      primary-plmn-Identity            PLMN-Identity                       OPTIONAL,
    -- Physical channel IEs
      -- The IE harq-Preamble-Mode should not be used in the r3 and r4 versions of the message
      -- If included in the r3 or r4 version of the message, the UE should ignore the IE
      harq-Preamble-Mode               HARQ-Preamble-Mode                  OPTIONAL,
      beaconPLEst                      BEACON-PL-Est                       OPTIONAL,
      postVerificationPeriod           ENUMERATED { true }                 OPTIONAL,
      dhs-sync                         DHS-Sync                            OPTIONAL,
      timingMaintainedSynchInd         TimingMaintainedSynchInd            OPTIONAL,
```

```
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo-r5    OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
        ul-deletedTransChInfoList       UL-DeletedTransChInfoList-r6        OPTIONAL,
        ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList-r6      OPTIONAL,
        dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
        dl-DeletedTransChInfoList       DL-DeletedTransChInfoList-r5        OPTIONAL,
        dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r5      OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-DPCH-Info                    UL-DPCH-Info-r7                     OPTIONAL,
        ul-EDCH-Information             UL-EDCH-Information-r6              OPTIONAL,
        dl-HSPDSCH-Information          DL-HSPDSCH-Information-r7           OPTIONAL,
        dl-CommonInformation            DL-CommonInformation-r7             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r7         OPTIONAL,
    -- MBMS IEs
        mbms-PL-ServiceRestrictInfo     MBMS-PL-ServiceRestrictInfo-r6      OPTIONAL,
        mbms-RB-ListReleasedToChangeTransferMode
                                        RB-InformationReleaseList           OPTIONAL
}

-- ***************************************************
--
-- RADIO BEARER RELEASE COMPLETE
--
-- ***************************************************

RadioBearerReleaseComplete ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        ul-IntegProtActivationInfo      IntegrityProtActivationInfo         OPTIONAL,
        -- TABULAR: UL-TimingAdvance is applicable for TDD mode only.
        ul-TimingAdvance                UL-TimingAdvance                    OPTIONAL,
    -- Radio bearer IEs
        count-C-ActivationTime          ActivationTime                      OPTIONAL,
        -- dummy is not used in this version of the specification and
        -- it should be ignored by the receiver.
        dummy                           RB-ActivationTimeInfoList           OPTIONAL,
        ul-CounterSynchronisationInfo   UL-CounterSynchronisationInfo       OPTIONAL,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            radioBearerReleaseComplete-r3-add-ext       BIT STRING      OPTIONAL,
            v7xyNonCriticalExtensions       SEQUENCE {
                radioBearerReleaseComplete-v7xyext
                                                RadioBearerReleaseComplete-v7xyext-IEs,
                nonCriticalExtensions           SEQUENCE {}     OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
}

RadioBearerReleaseComplete-v7xyext-IEs ::= SEQUENCE {
        ul-TimingAdvance-VHCR           UL-TimingAdvance-VHCR               OPTIONAL
}

-- ***************************************************
--
-- RADIO BEARER RELEASE FAILURE
--
-- ***************************************************

RadioBearerReleaseFailure ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        failureCause                    FailureCauseWithProtErr,
    -- Radio bearer IEs
        potentiallySuccesfulBearerList  RB-IdentityList                     OPTIONAL,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            radioBearerReleaseFailure-r3-add-ext        BIT STRING      OPTIONAL,
            nonCriticalExtensions           SEQUENCE {}     OPTIONAL
        }   OPTIONAL
}

-- ***************************************************
--
-- RADIO BEARER SETUP
--
```

```
    -- MBMS IEs
        mbms-PL-ServiceRestrictInfo     MBMS-PL-ServiceRestrictInfo-r6      OPTIONAL,
        mbms-RB-ListReleasedToChangeTransferMode
                                        RB-InformationReleaseList           OPTIONAL
}

RadioBearerRelease-r6-IEs ::= SEQUENCE {
    -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode,
        -- and if received the UE behaviour is unspecified
        new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL,
        new-H-RNTI                      H-RNTI                              OPTIONAL,
        newPrimary-E-RNTI               E-RNTI                              OPTIONAL,
        newSecondary-E-RNTI             E-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo-r6               OPTIONAL,
        signallingConnectionRelIndication   CN-DomainIdentity               OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        rab-InformationReconfigList     RAB-InformationReconfigList         OPTIONAL,
        rb-InformationReleaseList       RB-InformationReleaseList,
        rb-InformationReconfigList      RB-InformationReconfigList-r6       OPTIONAL,
        rb-InformationAffectedList      RB-InformationAffectedList-r6       OPTIONAL,
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo-r5    OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
        ul-deletedTransChInfoList       UL-DeletedTransChInfoList-r6        OPTIONAL,
        ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList-r6      OPTIONAL,
        dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
        dl-DeletedTransChInfoList       DL-DeletedTransChInfoList-r5        OPTIONAL,
        dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r5      OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-DPCH-Info                    UL-DPCH-Info-r6                     OPTIONAL,
        ul-EDCH-Information             UL-EDCH-Information-r6              OPTIONAL,
        dl-HSPDSCH-Information          DL-HSPDSCH-Information-r6           OPTIONAL,
        dl-CommonInformation            DL-CommonInformation-r6             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r6         OPTIONAL,
    -- MBMS IEs
        mbms-PL-ServiceRestrictInfo     MBMS-PL-ServiceRestrictInfo-r6      OPTIONAL,
        mbms-RB-ListReleasedToChangeTransferMode
                                        RB-InformationReleaseList           OPTIONAL
}

RadioBearerRelease-r7-IEs ::= SEQUENCE {
    -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode,
        -- and if received the UE behaviour is unspecified
        new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL,
        new-H-RNTI                      H-RNTI                              OPTIONAL,
        newPrimary-E-RNTI               E-RNTI                              OPTIONAL,
        newSecondary-E-RNTI             E-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo-r6               OPTIONAL,
        signallingConnectionRelIndication   CN-DomainIdentity               OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        rab-InformationReconfigList     RAB-InformationReconfigList         OPTIONAL,
        rb-InformationReleaseList       RB-InformationReleaseList,
        rb-InformationReconfigList      RB-InformationReconfigList-r6       OPTIONAL,
        rb-InformationAffectedList      RB-InformationAffectedList-r6       OPTIONAL,
```

```
-- ***************************************************

RadioBearerSetup ::= CHOICE {
    r3                              SEQUENCE {
        radioBearerSetup-r3             RadioBearerSetup-r3-IEs,
        v3a0NonCriticalExtensions       SEQUENCE {
            radioBearerSetup-v3a0ext        RadioBearerSetup-v3a0ext,
            laterNonCriticalExtensions      SEQUENCE {
                -- Container for additional R99 extensions
                radioBearerSetup-r3-add-ext     BIT STRING      OPTIONAL,
                v4b0NonCriticalExtensions       SEQUENCE {
                    radioBearerSetup-v4b0ext        RadioBearerSetup-v4b0ext-IEs,
                    v590NonCriticalExtensions       SEQUENCE {
                        radioBearerSetup-v590ext        RadioBearerSetup-v590ext-IEs,
                        v5d0NonCriticalExtenstions      SEQUENCE {
                            radioBearerSetup-v5d0ext        RadioBearerSetup-v5d0ext-IEs,
                            v690NonCriticalExtensions       SEQUENCE {
                                radioBearerSetup-v690ext        RadioBearerSetup-v690ext-IEs,
                                nonCriticalExtensions           SEQUENCE {} OPTIONAL
                            }   OPTIONAL
                        }   OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
    },
    later-than-r3                   SEQUENCE {
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        criticalExtensions              CHOICE {
            r4                              SEQUENCE {
                radioBearerSetup-r4             RadioBearerSetup-r4-IEs,
                v4d0NonCriticalExtensions       SEQUENCE {
                    -- Container for adding non critical extensions after freezing REL-5
                    radioBearerSetup-r4-add-ext     BIT STRING      OPTIONAL,
                    v590NonCriticalExtensions       SEQUENCE {
                        radioBearerSetup-v590ext        RadioBearerSetup-v590ext-IEs,
                        v5d0NonCriticalExtenstions      SEQUENCE {
                            radioBearerSetup-v5d0ext        RadioBearerSetup-v5d0ext-IEs,
                            v690NonCriticalExtensions       SEQUENCE {
                                radioBearerSetup-v690ext        RadioBearerSetup-v690ext-IEs,
                                nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                            }   OPTIONAL
                        }   OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            },
            criticalExtensions              CHOICE {
                r5                              SEQUENCE {
                    radioBearerSetup-r5             RadioBearerSetup-r5-IEs,
                    -- Container for adding non critical extensions after freezing REL-6
                    radioBearerSetup-r5-add-ext     BIT STRING      OPTIONAL,
                    v5d0NonCriticalExtenstions      SEQUENCE {
                        radioBearerSetup-v5d0ext        RadioBearerSetup-v5d0ext-IEs,
                        v690NonCriticalExtensions       SEQUENCE {
                            radioBearerSetup-v690ext        RadioBearerSetup-v690ext-IEs,
                            nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                        }   OPTIONAL
                    }   OPTIONAL
                },
                criticalExtensions              CHOICE {
                    r6                              SEQUENCE {
                        radioBearerSetup-r6             RadioBearerSetup-r6-IEs,
                        -- Container for adding non critical extensions after freezing REL-7
                        radioBearerSetup-r6-add-ext     BIT STRING      OPTIONAL,
                        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                    },
                    criticalExtensions              CHOICE {
                        r7                              SEQUENCE {
                            radioBearerSetup-r7             RadioBearerSetup-r7-IEs,
                            -- Container for adding non critical extensions after freezing REL-8
                            radioBearerSetup-r7-add-ext     BIT STRING      OPTIONAL,
                            nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                        },
                        criticalExtensions              SEQUENCE {}
                    }
                }
            }
        }
```

```
    }
}

RadioBearerSetup-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo                  OPTIONAL,
    -- Radio bearer IEs
        srb-InformationSetupList        SRB-InformationSetupList            OPTIONAL,
        rab-InformationSetupList        RAB-InformationSetupList            OPTIONAL,
        rb-InformationAffectedList      RB-InformationAffectedList          OPTIONAL,
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo       OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo                OPTIONAL,
        ul-deletedTransChInfoList       UL-DeletedTransChInfoList           OPTIONAL,
        ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList         OPTIONAL,
        -- 'dummy', 'dummy1' and 'dummy2' are not used in this version of the specification,
        -- they should not be sent and if received they should be ignored.
        dummy                           CHOICE {
            fdd                             SEQUENCE {
                dummy1                          CPCH-SetID                  OPTIONAL,
                dummy2                          DRAC-StaticInformationList  OPTIONAL
            },
            tdd                             NULL
        }                                                                   OPTIONAL,
        dl-CommonTransChInfo            DL-CommonTransChInfo                OPTIONAL,
        dl-DeletedTransChInfoList       DL-DeletedTransChInfoList           OPTIONAL,
        dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList         OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-ChannelRequirement           UL-ChannelRequirement               OPTIONAL,
        modeSpecificPhysChInfo          CHOICE {
            fdd                             SEQUENCE {
                -- dummy is not used in this version of specification, it should
                -- not be sent and if received it should be ignored.
                dummy                           DL-PDSCH-Information        OPTIONAL
            },
            tdd                             NULL
        },
        dl-CommonInformation            DL-CommonInformation                OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List            OPTIONAL
}

RadioBearerSetup-v3a0ext ::= SEQUENCE {
    -- The IE "new-DSCH-RNTI" should not be included in FDD mode, and if received the UE behaviour
    -- is unspecified
    new-DSCH-RNTI                   DSCH-RNTI                               OPTIONAL
}

RadioBearerSetup-v4b0ext-IEs ::= SEQUENCE {
    -- Physical channel IEs
        -- dummy is not used in this version of the specification, it should
        -- not be sent and if received it should be ignored.
        dummy                               SSDT-UL                         OPTIONAL,
        -- The order of the RLs in IE cell-id-PerRL-List is the same as
        -- in IE DL-InformationPerRL-List included in this message
        cell-id-PerRL-List                  CellIdentity-PerRL-List         OPTIONAL
}

RadioBearerSetup-v590ext-IEs ::= SEQUENCE {
    -- Physical channel IEs
        dl-TPC-PowerOffsetPerRL-List    DL-TPC-PowerOffsetPerRL-List        OPTIONAL
}

RadioBearerSetup-v5d0ext-IEs ::=    SEQUENCE {
    --Radio Bearer IEs
        pdcp-ROHC-TargetMode            PDCP-ROHC-TargetMode                OPTIONAL
```

```
}

RadioBearerSetup-r4-IEs ::= SEQUENCE {
    -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode, and if received
        -- the UE behaviour is unspecified
        new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo                  OPTIONAL,
    -- Radio bearer IEs
        srb-InformationSetupList        SRB-InformationSetupList            OPTIONAL,
        rab-InformationSetupList        RAB-InformationSetupList-r4         OPTIONAL,
        rb-InformationAffectedList      RB-InformationAffectedList          OPTIONAL,
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo       OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
        ul-deletedTransChInfoList       UL-DeletedTransChInfoList           OPTIONAL,
        ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList         OPTIONAL,
        -- 'dummy', 'dummy1' and 'dummy2' are not used in this version of the specification,
        -- they should not be sent and if received they should be ignored.
        dummy                           CHOICE {
            fdd                             SEQUENCE {
                dummy1                          CPCH-SetID                  OPTIONAL,
                dummy2                          DRAC-StaticInformationList  OPTIONAL
            },
            tdd                             NULL
        }                                                                   OPTIONAL,
        dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
        dl-DeletedTransChInfoList       DL-DeletedTransChInfoList           OPTIONAL,
        dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r4      OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-ChannelRequirement           UL-ChannelRequirement-r4            OPTIONAL,
        modeSpecificPhysChInfo          CHOICE {
            fdd                             SEQUENCE {
                -- dummy is not used in this version of specification, it should
                -- not be sent and if received it should be ignored.
                dummy                           DL-PDSCH-Information        OPTIONAL
            },
            tdd                             NULL
        },
        dl-CommonInformation            DL-CommonInformation-r4             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r4         OPTIONAL
}

RadioBearerSetup-r5-IEs ::= SEQUENCE {
    -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode, and if received
        -- the UE behaviour is unspecified
        new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL,
        new-H-RNTI                      H-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo                  OPTIONAL,
    -- Radio bearer IEs
        srb-InformationSetupList        SRB-InformationSetupList-r5         OPTIONAL,
        rab-InformationSetupList        RAB-InformationSetupList-r5         OPTIONAL,
        rb-InformationAffectedList      RB-InformationAffectedList-r5       OPTIONAL,
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo-r5    OPTIONAL,
    -- Transport channel IEs
```

```
        ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
        ul-deletedTransChInfoList       UL-DeletedTransChInfoList           OPTIONAL,
        ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList         OPTIONAL,
        -- 'dummy', 'dummy1' and 'dummy2' are not used in this version of the specification,
        -- they should not be sent and if received they should be ignored.
        dummy                           CHOICE {
            fdd                             SEQUENCE {
                dummy1                          CPCH-SetID                  OPTIONAL,
                dummy2                          DRAC-StaticInformationList  OPTIONAL
            },
            tdd                             NULL
        }                                                                   OPTIONAL,
        dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
        dl-DeletedTransChInfoList       DL-DeletedTransChInfoList-r5        OPTIONAL,
        dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r5      OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-ChannelRequirement           UL-ChannelRequirement-r5            OPTIONAL,
        modeSpecificPhysChInfo          CHOICE {
            fdd                             SEQUENCE {
                -- dummy is not used in this version of specification, it should
                -- not be sent and if received it should be ignored.
                dummy                           DL-PDSCH-Information        OPTIONAL
            },
            tdd                             NULL
        },
        dl-HSPDSCH-Information          DL-HSPDSCH-Information              OPTIONAL,
        dl-CommonInformation            DL-CommonInformation-r5             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r5         OPTIONAL
}

RadioBearerSetup-v690ext-IEs ::= SEQUENCE {
    -- Core network IEs
        primary-plmn-Identity           PLMN-Identity                       OPTIONAL,
    -- Physical channel IEs
        -- The IE harq-Preamble-Mode should not be used in the r3 and r4 versions of the message
        -- If included in the r3 or r4 version of the message, the UE should ignore the IE
        harq-Preamble-Mode              HARQ-Preamble-Mode                  OPTIONAL,
        beaconPLEst                     BEACON-PL-Est                       OPTIONAL,
        postVerificationPeriod          ENUMERATED { true }                 OPTIONAL,
        dhs-sync                        DHS-Sync                            OPTIONAL,
        timingMaintainedSynchInd        TimingMaintainedSynchInd            OPTIONAL,
    -- Radio bearer IEs
        rab-InformationSetupList        RAB-InformationSetupList-r6-ext     OPTIONAL,
    -- MBMS IEs
        mbms-PL-ServiceRestrictInfo     MBMS-PL-ServiceRestrictInfo-r6      OPTIONAL
}

RadioBearerSetup-r6-IEs ::= SEQUENCE {
    -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode,
        -- and if received the UE behaviour is unspecified
        new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL,
        new-H-RNTI                      H-RNTI                              OPTIONAL,
        newPrimary-E-RNTI               E-RNTI                              OPTIONAL,
        newSecondary-E-RNTI             E-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo-r6               OPTIONAL,
        specificationMode               CHOICE {
            complete                        SEQUENCE {
            -- Radio bearer IEs
                srb-InformationSetupList        SRB-InformationSetupList-r6         OPTIONAL,
                rab-InformationSetupList        RAB-InformationSetupList-r6         OPTIONAL,
                rab-InformationReconfigList     RAB-InformationReconfigList         OPTIONAL,
                rb-InformationReconfigList      RB-InformationReconfigList-r6       OPTIONAL,
                rb-InformationAffectedList      RB-InformationAffectedList-r6       OPTIONAL,
                dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo-r5    OPTIONAL,
                pdcp-ROHC-TargetMode            PDCP-ROHC-TargetMode                OPTIONAL,
```

```
            -- Transport channel IEs
                ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
                ul-deletedTransChInfoList       UL-DeletedTransChInfoList-r6        OPTIONAL,
                ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList-r6      OPTIONAL,
                dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
                dl-DeletedTransChInfoList       DL-DeletedTransChInfoList-r5        OPTIONAL,
                dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r5      OPTIONAL
            },
            preconfiguration                SEQUENCE {
                rab-Info                        RAB-Info-r6,
                defaultConfigMode               DefaultConfigMode,
                defaultConfigIdentity           DefaultConfigIdentity-r6,
                rb-InformationChangedList       RB-InformationChangedList-r6        OPTIONAL,
                powerOffsetInfoShort            PowerOffsetInfoShort
            }
        },
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-DPCH-Info                    UL-DPCH-Info-r6                     OPTIONAL,
        ul-EDCH-Information             UL-EDCH-Information-r6              OPTIONAL,
        dl-HSPDSCH-Information          DL-HSPDSCH-Information-r6           OPTIONAL,
        dl-CommonInformation            DL-CommonInformation-r6             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r6         OPTIONAL,
    -- MBMS IEs
        mbms-PL-ServiceRestrictInfo     MBMS-PL-ServiceRestrictInfo-r6      OPTIONAL
}

RadioBearerSetup-r7-IEs ::= SEQUENCE {
    -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode,
        -- and if received the UE behaviour is unspecified
        new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL,
        new-H-RNTI                      H-RNTI                              OPTIONAL,
        newPrimary-E-RNTI               E-RNTI                              OPTIONAL,
        newSecondary-E-RNTI             E-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo-r6               OPTIONAL,
        specificationMode               CHOICE {
            complete                        SEQUENCE {
            -- Radio bearer IEs
                srb-InformationSetupList        SRB-InformationSetupList-r6         OPTIONAL,
                rab-InformationSetupList        RAB-InformationSetupList-r6         OPTIONAL,
                rb-InformationReconfigList      RB-InformationReconfigList-r6       OPTIONAL,
                rb-InformationAffectedList      RB-InformationAffectedList-r6       OPTIONAL,
                dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo-r5    OPTIONAL,
                pdcp-ROHC-TargetMode            PDCP-ROHC-TargetMode                OPTIONAL,
            -- Transport channel IEs
                ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
                ul-deletedTransChInfoList       UL-DeletedTransChInfoList-r6        OPTIONAL,
                ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList-r6      OPTIONAL,
                dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
                dl-DeletedTransChInfoList       DL-DeletedTransChInfoList-r5        OPTIONAL,
                dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r5      OPTIONAL
            },
            preconfiguration                SEQUENCE {
                rab-Info                        RAB-Info-r6,
                defaultConfigMode               DefaultConfigMode,
                defaultConfigIdentity           DefaultConfigIdentity-r5,
                rb-InformationChangedList       RB-InformationChangedList-r6        OPTIONAL,
                powerOffsetInfoShort            PowerOffsetInfoShort
            }
        },
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-DPCH-Info                    UL-DPCH-Info-r7                     OPTIONAL,
        ul-EDCH-Information             UL-EDCH-Information-r6              OPTIONAL,
        dl-HSPDSCH-Information          DL-HSPDSCH-Information-r7           OPTIONAL,
```

```
        dl-CommonInformation            DL-CommonInformation-r7             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r7         OPTIONAL,
    -- MBMS IEs
        mbms-PL-ServiceRestrictInfo     MBMS-PL-ServiceRestrictInfo-r6      OPTIONAL
}

-- ***************************************************
--
-- RADIO BEARER SETUP COMPLETE
--
-- ***************************************************

RadioBearerSetupComplete ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        ul-IntegProtActivationInfo      IntegrityProtActivationInfo         OPTIONAL,
        -- TABULAR: UL-TimingAdvance is applicable for TDD mode only.
        ul-TimingAdvance                UL-TimingAdvance                    OPTIONAL,
        start-Value             START-Value                                 OPTIONAL,
    -- Radio bearer IEs
        count-C-ActivationTime          ActivationTime                      OPTIONAL,
        -- dummy is not used in this version of the specification and
        -- it should be ignored by the receiver.
        dummy                           RB-ActivationTimeInfoList           OPTIONAL,
        ul-CounterSynchronisationInfo   UL-CounterSynchronisationInfo       OPTIONAL,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            radioBearerSetupComplete-r3-add-ext     BIT STRING      OPTIONAL,
            v7xyNonCriticalExtensions           SEQUENCE {
                radioBearerSetupComplete-v7xyext
                                                RadioBearerSetupComplete-v7xyext-IEs,
                nonCriticalExtensions           SEQUENCE {}     OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
}

RadioBearerSetupComplete-v7xyext-IEs ::= SEQUENCE {
        ul-TimingAdvance-VHCR           UL-TimingAdvance-VHCR               OPTIONAL
}

-- ***************************************************
--
-- RADIO BEARER SETUP FAILURE
--
-- ***************************************************

RadioBearerSetupFailure ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        failureCause                    FailureCauseWithProtErr,
    -- Radio bearer IEs
        potentiallySuccesfulBearerList  RB-IdentityList                     OPTIONAL,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            radioBearerSetupFailure-r3-add-ext      BIT STRING      OPTIONAL,
            nonCriticalExtensions               SEQUENCE {}     OPTIONAL
        }   OPTIONAL
}

-- ***************************************************
--
-- RRC CONNECTION REJECT
--
-- ***************************************************

RRCConnectionReject ::= CHOICE {
    r3                              SEQUENCE {
        rrcConnectionReject-r3          RRCConnectionReject-r3-IEs,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            rrcConnectionReject-r3-add-ext      BIT STRING      OPTIONAL,
            v690NonCriticalExtensions           SEQUENCE {
                rrcConnectionReject-v690ext     RRCConnectionReject-v690ext-IEs,
                nonCriticalExtensions           SEQUENCE {}     OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
    },
    later-than-r3                   SEQUENCE {
```

```
        initialUE-Identity                InitialUE-Identity,
        rrc-TransactionIdentifier         RRC-TransactionIdentifier,
        criticalExtensions                SEQUENCE {}
    }
}

RRCConnectionReject-r3-IEs ::= SEQUENCE {
    -- TABULAR: Integrity protection shall not be performed on this message.
    -- User equipment IEs
        initialUE-Identity                InitialUE-Identity,
        rrc-TransactionIdentifier         RRC-TransactionIdentifier,
        rejectionCause                    RejectionCause,
        waitTime                          WaitTime,
        redirectionInfo                   RedirectionInfo                  OPTIONAL
}

RRCConnectionReject-v690ext-IEs ::= SEQUENCE {
    redirectionInfo-v690ext              GSM-TargetCellInfoList          OPTIONAL
}

-- ***************************************************
--
-- RRC CONNECTION RELEASE
--
-- ***************************************************

RRCConnectionRelease ::= CHOICE {
    r3                                   SEQUENCE {
        rrcConnectionRelease-r3           RRCConnectionRelease-r3-IEs,
        laterNonCriticalExtensions        SEQUENCE {
            -- Container for additional R99 extensions
            rrcConnectionRelease-r3-add-ext      BIT STRING       OPTIONAL,
            v690NonCriticalExtensions            SEQUENCE {
                rrcConnectionRelease-v690ext     RRCConnectionRelease-v690ext-IEs,
                nonCriticalExtensions            SEQUENCE {}      OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
    },
    later-than-r3                        SEQUENCE {
        rrc-TransactionIdentifier         RRC-TransactionIdentifier,
        criticalExtensions                CHOICE {
            r4                                SEQUENCE {
                rrcConnectionRelease-r4           RRCConnectionRelease-r4-IEs,
                v4d0NonCriticalExtensions             SEQUENCE {
                    -- Container for adding non critical extensions after freezing REL-6
                    rrcConnectionRelease-r4-add-ext       BIT STRING       OPTIONAL,
                    v690NonCriticalExtensions             SEQUENCE {
                        rrcConnectionRelease-v690ext
                                                  RRCConnectionRelease-v690ext-IEs,
                        nonCriticalExtensions             SEQUENCE {}      OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            },
            criticalExtensions                SEQUENCE {}
        }
    }
}

RRCConnectionRelease-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier         RRC-TransactionIdentifier,
        -- n-308 is conditional on the UE state
        n-308                             N-308                            OPTIONAL,
        releaseCause                      ReleaseCause,
        rplmn-information                 Rplmn-Information                OPTIONAL
}

RRCConnectionRelease-r4-IEs ::= SEQUENCE {
    -- User equipment IEs
        -- n-308 is conditional on the UE state.
        n-308                             N-308                            OPTIONAL,
        releaseCause                      ReleaseCause,
        rplmn-information                 Rplmn-Information-r4             OPTIONAL
}

RRCConnectionRelease-v690ext-IEs ::= SEQUENCE {
    redirectionInfo-v690ext               RedirectionInfo-r6   OPTIONAL
}
```

```
-- ***************************************************
--
-- RRC CONNECTION RELEASE for CCCH
--
-- ***************************************************

RRCConnectionRelease-CCCH ::= CHOICE {
    r3                              SEQUENCE {
        rrcConnectionRelease-CCCH-r3     RRCConnectionRelease-CCCH-r3-IEs,
        laterNonCriticalExtensions       SEQUENCE {
            -- Container for additional R99 extensions
            rrcConnectionRelease-CCCH-r3-add-ext        BIT STRING      OPTIONAL,
            v690NonCriticalExtensions        SEQUENCE {
                rrcConnectionRelease-v690ext     RRCConnectionRelease-CCCH-v690ext-IEs,
                nonCriticalExtensions            SEQUENCE {} OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
    },
    later-than-r3                   SEQUENCE {
        u-RNTI                          U-RNTI,
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        criticalExtensions              CHOICE {
            r4                              SEQUENCE {
                rrcConnectionRelease-CCCH-r4    RRCConnectionRelease-CCCH-r4-IEs,
                v4d0NonCriticalExtensions           SEQUENCE {
                    -- Container for adding non critical extensions after freezing REL-5
                    rrcConnectionRelease-CCCH-r4-add-ext        BIT STRING      OPTIONAL,
                    v690NonCriticalExtensions       SEQUENCE {
                        rrcConnectionRelease-v690ext    RRCConnectionRelease-CCCH-v690ext-IEs,
                        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                    }   OPTIONAL
                }       OPTIONAL
            },
            criticalExtensions              SEQUENCE {
                -- TABULAR: CHOICE IdentityType (U-RNTI, GroupIdentity) is replaced with the
                -- optional element groupIdentity, since the U-RNTI is mandatory in ASN.1.
                -- In case CHOICE IdentityType is equal to GroupIdentity the value of the U-RNTI
                -- shall be ignored by a UE complying with this version of the message.
                groupIdentity       SEQUENCE ( SIZE (1 .. maxURNTI-Group) ) OF
                                        GroupReleaseInformation     OPTIONAL,
                criticalExtensions              CHOICE {
                    r5                              SEQUENCE {
                        rrcConnectionRelease-CCCH-r5    RRCConnectionRelease-CCCH-r5-IEs,
                        -- Container for adding non critical extensions after freezing REL-6
                        rrcConnectionRelease-r5-add-ext         BIT STRING      OPTIONAL,
                        v690NonCriticalExtensions       SEQUENCE {
                            rrcConnectionRelease-v690ext    RRCConnectionRelease-CCCH-v690ext-IEs,
                            nonCriticalExtensions           SEQUENCE {} OPTIONAL
                        }   OPTIONAL
                    },
                    criticalExtensions              SEQUENCE {}
                }
            }
        }
    }
}

RRCConnectionRelease-CCCH-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
        u-RNTI                          U-RNTI,
    -- The rest of the message is identical to the one sent on DCCH.
        rrcConnectionRelease            RRCConnectionRelease-r3-IEs
}

RRCConnectionRelease-CCCH-r4-IEs ::= SEQUENCE {
    -- The rest of the message is identical to the one sent on DCCH.
        rrcConnectionRelease            RRCConnectionRelease-r4-IEs
}

-- The R5 and R4 sequence of IEs are identical in this message
RRCConnectionRelease-CCCH-r5-IEs ::= RRCConnectionRelease-CCCH-r4-IEs

-- The R6 non-critical extension is identical to the one sent on DCCH.
RRCConnectionRelease-CCCH-v690ext-IEs ::= RRCConnectionRelease-v690ext-IEs

-- ***************************************************
--
```

```
-- RRC CONNECTION RELEASE COMPLETE
--
-- ***************************************************

RRCConnectionReleaseComplete ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        errorIndication                 FailureCauseWithProtErr             OPTIONAL,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            rrcConnectionReleaseComplete-r3-add-ext     BIT STRING      OPTIONAL,
            nonCriticalExtensions           SEQUENCE {}     OPTIONAL
        }   OPTIONAL
}

-- ***************************************************
--
-- RRC CONNECTION REQUEST
--
-- ***************************************************

RRCConnectionRequest ::= SEQUENCE {
    -- TABULAR: Integrity protection shall not be performed on this message.
    -- User equipment IEs
        initialUE-Identity              InitialUE-Identity,
        establishmentCause              EstablishmentCause,
        -- protocolErrorIndicator is MD, but for compactness reasons no default value
        -- has been assigned to it.
        protocolErrorIndicator          ProtocolErrorIndicator,
    -- Measurement IEs
        measuredResultsOnRACH           MeasuredResultsOnRACH               OPTIONAL,
    --  Non critical Extensions
        v3d0NonCriticalExtensions           SEQUENCE {
            rRCConnectionRequest-v3d0ext    RRCConnectionRequest-v3d0ext-IEs,
        -- Reserved for future non critical extension
            v4b0NonCriticalExtensions           SEQUENCE {
                rrcConnectionRequest-v4b0ext        RRCConnectionRequest-v4b0ext-IEs,
                v590NonCriticalExtensions           SEQUENCE {
                    rrcConnectionRequest-v590ext        RRCConnectionRequest-v590ext-IEs,
                    v690NonCriticalExtensions           SEQUENCE {
                        rrcConnectionRequest-v690ext    RRCConnectionRequest-v690ext-IEs,
                        -- Reserved for future non critical extension
                        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
}

RRCConnectionRequest-v3d0ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        uESpecificBehaviourInformation1idle     UESpecificBehaviourInformation1idle     OPTIONAL
}

RRCConnectionRequest-v4b0ext-IEs ::=    SEQUENCE {
    -- User equipment IEs
        accessStratumReleaseIndicator           AccessStratumReleaseIndicator
}

RRCConnectionRequest-v590ext-IEs ::=    SEQUENCE {
    -- User equipment IEs
        predefinedConfigStatusInfo          BOOLEAN
}

RRCConnectionRequest-v690ext-IEs ::=    SEQUENCE {
    -- User equipment IEs
        ueCapabilityIndication              ENUMERATED { hsdch, hsdch-edch }    OPTIONAL,
    -- Measurement IEs
        measuredResultsOnRACHinterFreq      MeasuredResultsOnRACHinterFreq          OPTIONAL,
        domainIndicator                     CHOICE {
            cs-domain                           SEQUENCE {
                csCallType                          ENUMERATED {speech, video, other, spare }
            },
            ps-domain                           NULL
        }
}

-- ***************************************************
```

```
--
-- RRC CONNECTION SETUP
--
-- **************************************************

RRCConnectionSetup ::= CHOICE {
    r3                                  SEQUENCE {
        rrcConnectionSetup-r3               RRCConnectionSetup-r3-IEs,
        laterNonCriticalExtensions          SEQUENCE {
            -- Container for additional R99 extensions
            rrcConnectionSetup-r3-add-ext       BIT STRING      OPTIONAL,
            v4b0NonCriticalExtensions           SEQUENCE {
                rrcConnectionSetup-v4b0ext          RRCConnectionSetup-v4b0ext-IEs,
                v590NonCriticalExtensions           SEQUENCE {
                    rrcConnectionSetup-v590ext          RRCConnectionSetup-v590ext-IEs,
                    v690NonCriticalExtensions           SEQUENCE {
                        rrcConnectionSetup-v690ext          RRCConnectionSetup-v690ext-IEs,
                        v7xyNonCriticalExtensions           SEQUENCE {
                            rrcConnectionSetup-v7xyext          RRCConnectionSetup-v7xyext-IEs,
                            nonCriticalExtensions               SEQUENCE {}     OPTIONAL
                        }   OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
    },
    later-than-r3                       SEQUENCE {
        initialUE-Identity                  InitialUE-Identity,
        rrc-TransactionIdentifier           RRC-TransactionIdentifier,
        criticalExtensions                  CHOICE {
            r4                                  SEQUENCE {
                rrcConnectionSetup-r4               RRCConnectionSetup-r4-IEs,
                v4d0NonCriticalExtensions           SEQUENCE {
                    -- Container for adding non critical extensions after freezing REL-5
                    rrcConnectionSetup-r4-add-ext   BIT STRING      OPTIONAL,
                    v590NonCriticalExtensions       SEQUENCE {
                        rrcConnectionSetup-v590ext      RRCConnectionSetup-v590ext-IEs,
                        v690NonCriticalExtensions       SEQUENCE {
                            rrcConnectionSetup-v690ext      RRCConnectionSetup-v690ext-IEs,
                            v7xyNonCriticalExtensions       SEQUENCE {
                                rrcConnectionSetup-v7xyext      RRCConnectionSetup-v7xyext-IEs,
                                nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                            }   OPTIONAL
                        }   OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            },
            criticalExtensions                  CHOICE {
                r5                                  SEQUENCE {
                    rrcConnectionSetup-r5               RRCConnectionSetup-r5-IEs,
                    -- Container for adding non critical extensions after freezing REL-6
                    rrcConnectionSetup-r5-add-ext   BIT STRING      OPTIONAL,
                    v690NonCriticalExtensions       SEQUENCE {
                        rrcConnectionSetup-v690ext      RRCConnectionSetup-v690ext-IEs,
                        v7xyNonCriticalExtensions       SEQUENCE {
                            rrcConnectionSetup-v7xyext      RRCConnectionSetup-v7xyext-IEs,
                            nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                        }   OPTIONAL
                    }   OPTIONAL
                },
                criticalExtensions              CHOICE {
                    r6                              SEQUENCE {
                        rrcConnectionSetup-r6           RRCConnectionSetup-r6-IEs,
                        -- Container for adding non critical extensions after freezing REL-7
                        rrcConnectionSetup-r6-add-ext   BIT STRING                  OPTIONAL,
                        v7xyNonCriticalExtensions       SEQUENCE {
                            rrcConnectionSetup-v7xyext      RRCConnectionSetup-v7xyext-IEs,
                            nonCriticalExtensions           SEQUENCE {}                 OPTIONAL
                        }   OPTIONAL
                    },
                    criticalExtensions              CHOICE {
                        r7                              SEQUENCE {
                            rrcConnectionSetup-r7           RRCConnectionSetup-r7-IEs,
                            -- Container for adding non critical extensions after freezing REL-8
                            rrcConnectionSetup-r7-add-ext   BIT STRING                  OPTIONAL,
                            nonCriticalExtensions           SEQUENCE {}                 OPTIONAL
                        },
                        criticalExtensions              SEQUENCE {}
```

```
                    }
                }
            }
        }
    }
}

RRCConnectionSetup-r3-IEs ::= SEQUENCE {
    -- TABULAR: Integrity protection shall not be performed on this message.
    -- User equipment IEs
        initialUE-Identity              InitialUE-Identity,
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI,
        new-c-RNTI                      C-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient,
        -- TABULAR: If capabilityUpdateRequirement is not present, the default value
        -- defined in 10.3.3.2 shall be used.
        capabilityUpdateRequirement     CapabilityUpdateRequirement         OPTIONAL,
    -- Radio bearer IEs
        srb-InformationSetupList        SRB-InformationSetupList2,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo                OPTIONAL,
        -- NOTE: ul-AddReconfTransChInfoList should be optional in later versions of
        -- this message
        ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList,
        dl-CommonTransChInfo            DL-CommonTransChInfo                OPTIONAL,
        -- NOTE: dl-AddReconfTransChInfoList should be optional in later versions
        -- of this message
        dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-ChannelRequirement           UL-ChannelRequirement               OPTIONAL,
        dl-CommonInformation            DL-CommonInformation                OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List            OPTIONAL
}

RRCConnectionSetup-v4b0ext-IEs ::= SEQUENCE {
        capabilityUpdateRequirement-r4-ext  CapabilityUpdateRequirement-r4-ext  OPTIONAL,
    -- Physical channel IEs
        -- dummy is not used in this version of the specification, it should
        -- not be sent and if received it should be ignored.
        dummy                               SSDT-UL                             OPTIONAL,
        -- The order of the RLs in IE cell-id-PerRL-List is the same as
        -- in IE DL-InformationPerRL-List included in this message
        cell-id-PerRL-List                  CellIdentity-PerRL-List             OPTIONAL
}

RRCConnectionSetup-v590ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        systemSpecificCapUpdateReq      SystemSpecificCapUpdateReq-v590ext      OPTIONAL,
    -- Physical channel IEs
        dl-TPC-PowerOffsetPerRL-List    DL-TPC-PowerOffsetPerRL-List        OPTIONAL
}

RRCConnectionSetup-r4-IEs ::= SEQUENCE {
    -- TABULAR: Integrity protection shall not be performed on this message.
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI,
        new-c-RNTI                      C-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient,
        -- TABULAR: If capabilityUpdateRequirement is not present, the default value
        -- defined in 10.3.3.2 shall be used.
        capabilityUpdateRequirement     CapabilityUpdateRequirement-r4      OPTIONAL,
    -- Radio bearer IEs
        srb-InformationSetupList        SRB-InformationSetupList2,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
        ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList         OPTIONAL,
        dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
        dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r4      OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-ChannelRequirement           UL-ChannelRequirement-r4            OPTIONAL,
```

```
        dl-CommonInformation            DL-CommonInformation-r4             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r4         OPTIONAL
}

RRCConnectionSetup-r5-IEs ::= SEQUENCE {
    -- TABULAR: Integrity protection shall not be performed on this message.
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI,
        new-c-RNTI                      C-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient,
        -- TABULAR: If capabilityUpdateRequirement is not present, the default value
        -- defined in 10.3.3.2 shall be used.
        capabilityUpdateRequirement     CapabilityUpdateRequirement-r5      OPTIONAL,
    -- Specification mode information
        specificationMode               CHOICE {
            complete                        SEQUENCE {
                -- Radio bearer IEs
                srb-InformationSetupList        SRB-InformationSetupList2,
                -- Transport channel IEs
                ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
                ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList         OPTIONAL,
                dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
                dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r4      OPTIONAL
            },
            preconfiguration                SEQUENCE {
                -- All IEs that include an FDD/TDD choice are split in two IEs for this message,
                -- one for the FDD only elements and one for the TDD only elements, so that one
                -- FDD/TDD choice in this level is sufficient.
                preConfigMode                   CHOICE {
                    predefinedConfigIdentity        PredefinedConfigIdentity,
                    defaultConfig                   SEQUENCE {
                        defaultConfigMode               DefaultConfigMode,
                        defaultConfigIdentity           DefaultConfigIdentity-r5
                    }
                }
            }
        },
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-ChannelRequirement           UL-ChannelRequirement-r4            OPTIONAL,
        dl-CommonInformation            DL-CommonInformation-r4             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r5bis      OPTIONAL
}

RRCConnectionSetup-v690ext-IEs ::= SEQUENCE {
    -- Physical Channel IEs
        beaconPLEst                     BEACON-PL-Est                       OPTIONAL,
        postVerificationPeriod          ENUMERATED { true }                 OPTIONAL
}

RRCConnectionSetup-r6-IEs ::= SEQUENCE {
    -- TABULAR: Integrity protection shall not be performed on this message.
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI,
        new-c-RNTI                      C-RNTI                              OPTIONAL,
        new-H-RNTI                      H-RNTI                              OPTIONAL,
        newPrimary-E-RNTI               E-RNTI                              OPTIONAL,
        newSecondary-E-RNTI             E-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient,
        -- TABULAR: If capabilityUpdateRequirement is not present, the default value
        -- defined in 10.3.3.2 shall be used.
        capabilityUpdateRequirement     CapabilityUpdateRequirement-r5      OPTIONAL,
    -- Specification mode information
        specificationMode               CHOICE {
            complete                        SEQUENCE {
                -- Radio bearer IEs
                srb-InformationSetupList        SRB-InformationSetupList2-r6,
                -- Transport channel IEs
                ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
                ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList-r6      OPTIONAL,
                dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
                dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r5      OPTIONAL
            },
            preconfiguration                SEQUENCE {
                -- All IEs that include an FDD/TDD choice are split in two IEs for this message,
```

```
                -- one for the FDD only elements and one for the TDD only elements, so that one
                -- FDD/TDD choice in this level is sufficient.
                preConfigMode                   CHOICE {
                    predefinedConfigIdentity        PredefinedConfigIdentity,
                    defaultConfig                   SEQUENCE {
                        defaultConfigMode               DefaultConfigMode,
                        defaultConfigIdentity           DefaultConfigIdentity-r6
                    }
                }
            }
        },
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-DPCH-Info                    UL-DPCH-Info-r6                     OPTIONAL,
        ul-EDCH-Information             UL-EDCH-Information-r6              OPTIONAL,
        dl-HSPDSCH-Information          DL-HSPDSCH-Information-r6           OPTIONAL,
        dl-CommonInformation            DL-CommonInformation-r6             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r6         OPTIONAL
}

RRCConnectionSetup-r7-IEs ::= SEQUENCE {
    -- TABULAR: Integrity protection shall not be performed on this message.
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI,
        new-c-RNTI                      C-RNTI                              OPTIONAL,
        new-H-RNTI                      H-RNTI                              OPTIONAL,
        newPrimary-E-RNTI               E-RNTI                              OPTIONAL,
        newSecondary-E-RNTI             E-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient,
        -- TABULAR: If capabilityUpdateRequirement is not present, the default value
        -- defined in 10.3.3.2 shall be used.
        capabilityUpdateRequirement     CapabilityUpdateRequirement-r5      OPTIONAL,
    -- Specification mode information
        specificationMode               CHOICE {
            complete                        SEQUENCE {
                -- Radio bearer IEs
                srb-InformationSetupList        SRB-InformationSetupList2-r6,
                -- Transport channel IEs
                ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
                ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList-r6      OPTIONAL,
                dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
                dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r5      OPTIONAL
            },
            preconfiguration                SEQUENCE {
                -- All IEs that include an FDD/TDD choice are split in two IEs for this message,
                -- one for the FDD only elements and one for the TDD only elements, so that one
                -- FDD/TDD choice in this level is sufficient.
                preConfigMode                   CHOICE {
                    predefinedConfigIdentity        PredefinedConfigIdentity,
                    defaultConfig                   SEQUENCE {
                        defaultConfigMode               DefaultConfigMode,
                        defaultConfigIdentity           DefaultConfigIdentity-r5
                    }
                }
            }
        },
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-DPCH-Info                    UL-DPCH-Info-r7                     OPTIONAL,
        ul-EDCH-Information             UL-EDCH-Information-r6              OPTIONAL,
        dl-HSPDSCH-Information          DL-HSPDSCH-Information-r7           OPTIONAL,
            dl-CommonInformation            DL-CommonInformation-r7             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r7         OPTIONAL
}

RRCConnectionSetup-v7xyext-IEs ::= SEQUENCE {
        capabilityUpdateRequirement-r7-ext  CapabilityUpdateRequirement-r7-ext      OPTIONAL
}

-- ***************************************************
--
-- RRC CONNECTION SETUP COMPLETE
--
-- ***************************************************
```

```
RRCConnectionSetupComplete ::= SEQUENCE {
    -- TABULAR: Integrity protection shall not be performed on this message.
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        startList                       STARTList,
        ue-RadioAccessCapability        UE-RadioAccessCapability            OPTIONAL,
    --  Other IEs
        ue-RATSpecificCapability        InterRAT-UE-RadioAccessCapabilityList   OPTIONAL,
    -- Non critical extensions
        v370NonCriticalExtensions           SEQUENCE {
            rrcConnectionSetupComplete-v370ext  RRCConnectionSetupComplete-v370ext,
            v380NonCriticalExtensions           SEQUENCE {
                rrcConnectionSetupComplete-v380ext  RRCConnectionSetupComplete-v380ext-IEs,
                -- Reserved for future non critical extension
                v3a0NonCriticalExtensions           SEQUENCE {
                    rrcConnectionSetupComplete-v3a0ext  RRCConnectionSetupComplete-v3a0ext-IEs,
                    laterNonCriticalExtensions          SEQUENCE {
                        -- Container for additional R99 extensions
                        rrcConnectionSetupComplete-r3-add-ext       BIT STRING
                                (CONTAINING RRCConnectionSetupComplete-r3-add-ext-IEs)  OPTIONAL,
                        v3g0NonCriticalExtensions           SEQUENCE {
                            rrcConnectionSetupComplete-v3g0ext  RRCConnectionSetupComplete-v3g0ext-IEs,
                            v4b0NonCriticalExtensions           SEQUENCE {
                                rrcConnectionSetupComplete-v4b0ext
                                                                RRCConnectionSetupComplete-v4b0ext-IEs,
                                v590NonCriticalExtensions           SEQUENCE {
                                    rrcConnectionSetupComplete-v590ext
                                                                RRCConnectionSetupComplete-v590ext-IEs,
                                    v5c0NonCriticalExtensions           SEQUENCE {
                                        rrcConnectionSetupComplete-v5c0ext
                                                                RRCConnectionSetupComplete-v5c0ext-IEs,
                                        v690NonCriticalExtensions           SEQUENCE {
                                            rrcConnectionSetupComplete-v690ext
                                                                RRCConnectionSetupComplete-v690ext-IEs,
                                            v7xyNonCriticalExtensions       SEQUENCE {
                                                rrcConectionSetupComplete-v7xyext
                                                                RRCConnectionSetupComplete-v7xyext-IEs,
                                                nonCriticalExtensions       SEQUENCE {}     OPTIONAL
                                            }       OPTIONAL
                                        }       OPTIONAL
                                    }       OPTIONAL
                                }       OPTIONAL
                            }       OPTIONAL
                        }       OPTIONAL
                    }       OPTIONAL
                }       OPTIONAL
            }       OPTIONAL
        }       OPTIONAL
}

RRCConnectionSetupComplete-v370ext ::= SEQUENCE {
    -- User equipment IEs
        ue-RadioAccessCapability-v370ext    UE-RadioAccessCapability-v370ext    OPTIONAL
}

RRCConnectionSetupComplete-v380ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        ue-RadioAccessCapability-v380ext    UE-RadioAccessCapability-v380ext        OPTIONAL,
        dl-PhysChCapabilityFDD-v380ext      DL-PhysChCapabilityFDD-v380ext
}

RRCConnectionSetupComplete-v3a0ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        ue-RadioAccessCapability-v3a0ext    UE-RadioAccessCapability-v3a0ext    OPTIONAL
}

RRCConnectionSetupComplete-v3g0ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        ue-RadioAccessCapability-v3g0ext    UE-RadioAccessCapability-v3g0ext    OPTIONAL
}

RRCConnectionSetupComplete-r3-add-ext-IEs ::= SEQUENCE {
        rrcConnectionSetupComplete-v650ext      RRCConnectionSetupComplete-v650ext-IEs  OPTIONAL,
        v680NonCriticalExtensions               SEQUENCE {
            rrcConnectionSetupComplete-v680ext      RRCConnectionSetupComplete-v680ext-IEs,
            nonCriticalExtensions                   SEQUENCE {}     OPTIONAL
        }       OPTIONAL
}
```

```
RRCConnectionSetupComplete-v4b0ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        ue-RadioAccessCapability-v4b0ext        UE-RadioAccessCapability-v4b0ext        OPTIONAL
}

RRCConnectionSetupComplete-v590ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        ue-RadioAccessCapability-v590ext        UE-RadioAccessCapability-v590ext        OPTIONAL,
    -- Other IEs
        ue-RATSpecificCapability-v590ext        InterRAT-UE-RadioAccessCapability-v590ext   OPTIONAL
}

RRCConnectionSetupComplete-v5c0ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        ue-RadioAccessCapability-v5c0ext        UE-RadioAccessCapability-v5c0ext        OPTIONAL
}

RRCConnectionSetupComplete-v650ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        ue-RadioAccessCapability-v650ext        UE-RadioAccessCapability-v650ext
}

RRCConnectionSetupComplete-v680ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        ue-RadioAccessCapability-v680ext        UE-RadioAccessCapability-v680ext
}

RRCConnectionSetupComplete-v690ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        ueCapabilityContainer                   BIT STRING
                                                    (CONTAINING UE-CapabilityContainer-IEs) OPTIONAL
}

RRCConnectionSetupComplete-v7xyext-IEs ::= SEQUENCE {
        ue-RadioAccessCapability-v7xyext    UE-RadioAccessCapability-v7xyext        OPTIONAL
}

-- ***************************************************
--
-- RRC FAILURE INFO
--
-- ***************************************************

RRC-FailureInfo ::= CHOICE {
    r3                                          SEQUENCE {
        rRC-FailureInfo-r3                              RRC-FailureInfo-r3-IEs,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            rrc-FailureInfo-r3-add-ext      BIT STRING      OPTIONAL,
            nonCriticalExtensions                       SEQUENCE {} OPTIONAL
        }   OPTIONAL
    },
    criticalExtensions                          SEQUENCE {}
}

RRC-FailureInfo-r3-IEs ::=      SEQUENCE {
    -- Non-RRC IEs
        failureCauseWithProtErr                         FailureCauseWithProtErr
}

-- ***************************************************
--
-- RRC STATUS
--
-- ***************************************************

RRCStatus ::= SEQUENCE {
    -- Other IEs
        -- TABULAR: Identification of received message is nested in
        -- ProtocolErrorMoreInformation
        protocolErrorInformation        ProtocolErrorMoreInformation,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            rrcStatus-r3-add-ext        BIT STRING      OPTIONAL,
            nonCriticalExtensions           SEQUENCE {}     OPTIONAL
        }   OPTIONAL
}
```

```
-- ***************************************************
--
-- SECURITY MODE COMMAND
--
-- ***************************************************

SecurityModeCommand ::= CHOICE {
    r3                                  SEQUENCE {
        securityModeCommand-r3              SecurityModeCommand-r3-IEs,
        laterNonCriticalExtensions          SEQUENCE {
            -- Container for additional R99 extensions
            securityModeCommand-r3-add-ext      BIT STRING      OPTIONAL,
            nonCriticalExtensions               SEQUENCE {}     OPTIONAL
        }   OPTIONAL
    },
    later-than-r3                       SEQUENCE {
        rrc-TransactionIdentifier           RRC-TransactionIdentifier,
        criticalExtensions                  SEQUENCE {}
    }
}

SecurityModeCommand-r3-IEs ::= SEQUENCE {
-- TABULAR: Integrity protection shall always be performed on this message.
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        securityCapability              SecurityCapability,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
    -- Core network IEs
        cn-DomainIdentity               CN-DomainIdentity,
    -- Other IEs
        ue-SystemSpecificSecurityCap    InterRAT-UE-SecurityCapList         OPTIONAL
}

-- ***************************************************
--
-- SECURITY MODE COMPLETE
--
-- ***************************************************

SecurityModeComplete ::= SEQUENCE {
-- TABULAR: Integrity protection shall always be performed on this message.

    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        ul-IntegProtActivationInfo      IntegrityProtActivationInfo         OPTIONAL,
    -- Radio bearer IEs
        rb-UL-CiphActivationTimeInfo    RB-ActivationTimeInfoList           OPTIONAL,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            securityModeComplete-r3-add-ext     BIT STRING      OPTIONAL,
            nonCriticalExtensions               SEQUENCE {}     OPTIONAL
        }   OPTIONAL
}

-- ***************************************************
--
-- SECURITY MODE FAILURE
--
-- ***************************************************

SecurityModeFailure ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        failureCause                    FailureCauseWithProtErr,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            securityModeFailure-r3-add-ext      BIT STRING      OPTIONAL,
            nonCriticalExtensions               SEQUENCE {}     OPTIONAL
        }   OPTIONAL
}

-- ***************************************************
--
-- SIGNALLING CONNECTION RELEASE
--
-- ***************************************************
```

```
SignallingConnectionRelease ::= CHOICE {
    r3                              SEQUENCE {
        signallingConnectionRelease-r3  SignallingConnectionRelease-r3-IEs,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            signallingConnectionRelease-r3-add-ext      BIT STRING      OPTIONAL,
            nonCriticalExtensions           SEQUENCE {}     OPTIONAL
        }   OPTIONAL
    },
    later-than-r3                   SEQUENCE {
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        criticalExtensions              SEQUENCE {}
    }
}

SignallingConnectionRelease-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
    -- Core network IEs
        cn-DomainIdentity               CN-DomainIdentity
}

-- ***************************************************
--
-- SIGNALLING CONNECTION RELEASE INDICATION
--
-- ***************************************************

SignallingConnectionReleaseIndication ::= SEQUENCE {
    -- Core network IEs
        cn-DomainIdentity               CN-DomainIdentity,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            signallingConnectionReleaseIndication-r3-add-ext        BIT STRING      OPTIONAL,
            nonCriticalExtensions           SEQUENCE {}     OPTIONAL
        }   OPTIONAL
}

-- ***************************************************
--
-- SYSTEM INFORMATION for BCH
--
-- ***************************************************

SystemInformation-BCH ::= SEQUENCE {
    -- Other information elements
        sfn-Prime                       SFN-Prime,
        payload                         CHOICE {
            noSegment                       NULL,
            firstSegment                    FirstSegment,
            subsequentSegment               SubsequentSegment,
            lastSegmentShort                        LastSegmentShort,
            lastAndFirst                    SEQUENCE {
                lastSegmentShort                LastSegmentShort,
                firstSegment                    FirstSegmentShort
            },
            lastAndComplete                 SEQUENCE {
                lastSegmentShort                LastSegmentShort,
                completeSIB-List                CompleteSIB-List
            },
            lastAndCompleteAndFirst         SEQUENCE {
                lastSegmentShort                LastSegmentShort,
                completeSIB-List                CompleteSIB-List,
                firstSegment                    FirstSegmentShort
            },
            completeSIB-List                CompleteSIB-List,
            completeAndFirst                SEQUENCE {
                completeSIB-List                CompleteSIB-List,
                firstSegment                    FirstSegmentShort
            },
            completeSIB                     CompleteSIB,
            lastSegment                     LastSegment,
            spare5                          NULL,
            spare4                          NULL,
            spare3                          NULL,
            spare2                          NULL,
            spare1                          NULL
```

```
        }
}

-- ***************************************************
--
-- SYSTEM INFORMATION for FACH
--
-- ***************************************************

SystemInformation-FACH ::= SEQUENCE {
    -- Other information elements
        payload                         CHOICE {
            noSegment                       NULL,
            firstSegment                    FirstSegment,
            subsequentSegment               SubsequentSegment,
            lastSegmentShort                LastSegmentShort,
            lastAndFirst                    SEQUENCE {
                lastSegmentShort                LastSegmentShort,
                firstSegment                    FirstSegmentShort
            },
            lastAndComplete                 SEQUENCE {
                lastSegmentShort                LastSegmentShort,
                completeSIB-List                CompleteSIB-List
            },
            lastAndCompleteAndFirst         SEQUENCE {
                lastSegmentShort                LastSegmentShort,
                completeSIB-List                CompleteSIB-List,
                firstSegment                    FirstSegmentShort
            },
            completeSIB-List                CompleteSIB-List,
            completeAndFirst                SEQUENCE {
                completeSIB-List                CompleteSIB-List,
                firstSegment                    FirstSegmentShort
            },
            completeSIB                     CompleteSIB,
            lastSegment                     LastSegment,
            spare5                          NULL,
            spare4                          NULL,
            spare3                          NULL,
            spare2                          NULL,
            spare1                          NULL
        }
}

-- ***************************************************
--
-- First segment
--
-- ***************************************************

FirstSegment ::=                    SEQUENCE {
    -- Other information elements
        sib-Type                        SIB-Type,
        seg-Count                       SegCount,
        sib-Data-fixed                  SIB-Data-fixed
}

-- ***************************************************
--
-- First segment (short)
--
-- ***************************************************

FirstSegmentShort ::=               SEQUENCE {
    -- Other information elements
        sib-Type                        SIB-Type,
        seg-Count                       SegCount,
        sib-Data-variable               SIB-Data-variable
}

-- ***************************************************
--
-- Subsequent segment
--
-- ***************************************************

SubsequentSegment ::=               SEQUENCE {
    -- Other information elements
```

```
		sib-Type					SIB-Type,
		segmentIndex				SegmentIndex,
		sib-Data-fixed				SIB-Data-fixed
}

-- ***************************************************
--
-- Last segment
--
-- ***************************************************

LastSegment ::=						SEQUENCE {
	-- Other information elements
		sib-Type					SIB-Type,
		segmentIndex				SegmentIndex,
		-- For sib-Data-fixed, in case the SIB data is less than 222 bits, padding
		-- shall be used. The same padding bits shall be used as defined in clause 12.1
		sib-Data-fixed				SIB-Data-fixed
}

LastSegmentShort ::=					SEQUENCE {
	-- Other information elements
		sib-Type					SIB-Type,
		segmentIndex				SegmentIndex,
		sib-Data-variable			SIB-Data-variable
}

-- ***************************************************
--
-- Complete SIB
--
-- ***************************************************

CompleteSIB-List ::=				SEQUENCE (SIZE (1..maxSIBperMsg)) OF
										CompleteSIBshort

CompleteSIB ::=						SEQUENCE {
	-- Other information elements
		sib-Type					SIB-Type,
		-- For sib-Data-fixed, in case the SIB data is less than 226 bits, padding
		-- shall be used. The same padding bits shall be used as defined in clause 12.1
		sib-Data-fixed				BIT STRING (SIZE (226))
}

CompleteSIBshort ::=					SEQUENCE {
	-- Other information elements
		sib-Type					SIB-Type,
		sib-Data-variable			SIB-Data-variable
}

-- ***************************************************
--
-- SYSTEM INFORMATION CHANGE INDICATION
--
-- ***************************************************

SystemInformationChangeIndication ::=	SEQUENCE {
	-- Other IEs
		bcch-ModificationInfo			BCCH-ModificationInfo,
		laterNonCriticalExtensions		SEQUENCE {
			-- Container for additional R99 extensions
			systemInformationChangeIndication-r3-add-ext		BIT STRING		OPTIONAL,
			nonCriticalExtensions		SEQUENCE {}		OPTIONAL
		}	OPTIONAL
}

-- ***************************************************
--
-- TRANSPORT CHANNEL RECONFIGURATION
--
-- ***************************************************

TransportChannelReconfiguration ::= CHOICE {
	r3								SEQUENCE {
		transportChannelReconfiguration-r3
									TransportChannelReconfiguration-r3-IEs,
		v3a0NonCriticalExtensions		SEQUENCE {
			transportChannelReconfiguration-v3a0ext
```

```
                                        TransportChannelReconfiguration-v3a0ext,
        laterNonCriticalExtensions              SEQUENCE {
            -- Container for additional R99 extensions
            transportChannelReconfiguration-r3-add-ext      BIT STRING      OPTIONAL,
            v4b0NonCriticalExtensions           SEQUENCE {
                transportChannelReconfiguration-v4b0ext
                                                    TransportChannelReconfiguration-v4b0ext-IEs,
                v590NonCriticalExtensions           SEQUENCE {
                    transportChannelReconfiguration-v590ext
                                                        TransportChannelReconfiguration-v590ext-IEs,
                    v690NonCriticalExtensions           SEQUENCE {
                        transportChannelReconfiguration-v690ext
                                                        TransportChannelReconfiguration-v690ext-IEs,
                        nonCriticalExtensions               SEQUENCE {}     OPTIONAL
                    }       OPTIONAL
                }       OPTIONAL
            }       OPTIONAL
        }       OPTIONAL
    }       OPTIONAL
},
later-than-r3                       SEQUENCE {
    rrc-TransactionIdentifier           RRC-TransactionIdentifier,
    criticalExtensions                  CHOICE {
        r4                                  SEQUENCE {
            transportChannelReconfiguration-r4
                                                TransportChannelReconfiguration-r4-IEs,
            v4d0NonCriticalExtensions           SEQUENCE {
                -- Container for adding non critical extensions after freezing REL-5
                transportChannelReconfiguration-r4-add-ext      BIT STRING      OPTIONAL,
                v590NonCriticalExtensions           SEQUENCE {
                    transportChannelReconfiguration-v590ext
                                                    TransportChannelReconfiguration-v590ext-IEs,
                    v690NonCriticalExtensions           SEQUENCE {
                        transportChannelReconfiguration-v690ext
                                                        TransportChannelReconfiguration-v690ext-IEs,
                        nonCriticalExtensions               SEQUENCE {}     OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            }   OPTIONAL
        },
        criticalExtensions                  CHOICE {
            r5                                  SEQUENCE {
                transportChannelReconfiguration-r5
                                                    TransportChannelReconfiguration-r5-IEs,
                -- Container for adding non critical extensions after freezing REL-6
                transportChannelReconfiguration-r5-add-ext      BIT STRING      OPTIONAL,
                v690NonCriticalExtensions           SEQUENCE {
                    transportChannelReconfiguration-v690ext
                                                        TransportChannelReconfiguration-v690ext-IEs,
                    nonCriticalExtensions               SEQUENCE {}     OPTIONAL
                }   OPTIONAL
            },
            criticalExtensions                  CHOICE {
                r6                                  SEQUENCE {
                    transportChannelReconfiguration-r6
                                                        TransportChannelReconfiguration-r6-IEs,
                    -- Container for adding non critical extensions after freezing REL-7
                    transportChannelReconfiguration-r6-add-ext      BIT STRING      OPTIONAL,
                    nonCriticalExtensions               SEQUENCE {}     OPTIONAL
                },
                criticalExtensions                  CHOICE {
                    r7                                  SEQUENCE {
                        transportChannelReconfiguration-r7
                                                        TransportChannelReconfiguration-r7-IEs,
                        -- Container for adding non critical extensions after freezing REL-8
                        transportChannelReconfiguration-r7-add-ext      BIT STRING  OPTIONAL,
                        nonCriticalExtensions               SEQUENCE {}     OPTIONAL
                    },
                    criticalExtensions                  SEQUENCE {}
                }
            }
        }
    }
}
}

TransportChannelReconfiguration-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
```

```
        rrc-TransactionIdentifier           RRC-TransactionIdentifier,
        integrityProtectionModeInfo         IntegrityProtectionModeInfo          OPTIONAL,
        cipheringModeInfo                   CipheringModeInfo                    OPTIONAL,
        activationTime                      ActivationTime                       OPTIONAL,
        new-U-RNTI                          U-RNTI                               OPTIONAL,
        new-C-RNTI                          C-RNTI                               OPTIONAL,
        rrc-StateIndicator                  RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff          UTRAN-DRX-CycleLengthCoefficient     OPTIONAL,
    -- Core network IEs
        cn-InformationInfo                  CN-InformationInfo                   OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                        URA-Identity                         OPTIONAL,
    -- Radio bearer IEs
        dl-CounterSynchronisationInfo       DL-CounterSynchronisationInfo        OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo                UL-CommonTransChInfo                 OPTIONAL,
        ul-AddReconfTransChInfoList         UL-AddReconfTransChInfoList          OPTIONAL,
        -- 'dummy', 'dummy1' and 'dummy2' are not used in this version of the specification,
        -- they should not be sent and if received they should be ignored.
        dummy                               CHOICE {
            fdd                                 SEQUENCE {
                dummy1                              CPCH-SetID                   OPTIONAL,
                dummy2                              DRAC-StaticInformationList   OPTIONAL
            },
            tdd                                 NULL
        }                                                                        OPTIONAL,
        dl-CommonTransChInfo                DL-CommonTransChInfo                 OPTIONAL,
        dl-AddReconfTransChInfoList         DL-AddReconfTransChInfoList          OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                       FrequencyInfo                        OPTIONAL,
        maxAllowedUL-TX-Power               MaxAllowedUL-TX-Power                OPTIONAL,
        ul-ChannelRequirement               UL-ChannelRequirement                OPTIONAL,
        modeSpecificPhysChInfo              CHOICE {
            fdd                                 SEQUENCE {
                -- dummy is not used in this version of specification, it should
                -- not be sent and if received it should be ignored.
                dummy                               DL-PDSCH-Information          OPTIONAL
            },
            tdd                             NULL
        },
        dl-CommonInformation                DL-CommonInformation                 OPTIONAL,
        dl-InformationPerRL-List            DL-InformationPerRL-List             OPTIONAL
}

TransportChannelReconfiguration-v3a0ext ::= SEQUENCE {
    -- The IE "new-DSCH-RNTI" should not be included in FDD mode, and if received
    -- the UE behaviour is unspecified
    new-DSCH-RNTI                       DSCH-RNTI                                OPTIONAL
}

TransportChannelReconfiguration-v4b0ext-IEs ::= SEQUENCE {
    -- Physical channel IEs
        -- dummy is not used in this version of the specification, it should
        -- not be sent and if received it should be ignored.
        dummy                               SSDT-UL                              OPTIONAL,
        -- The order of the RLs in IE cell-id-PerRL-List is the same as
        -- in IE DL-InformationPerRL-List included in this message
        cell-id-PerRL-List                  CellIdentity-PerRL-List              OPTIONAL
}

TransportChannelReconfiguration-v590ext-IEs ::= SEQUENCE {
    -- Physical channel IEs
        dl-TPC-PowerOffsetPerRL-List        DL-TPC-PowerOffsetPerRL-List         OPTIONAL
}

TransportChannelReconfiguration-r4-IEs ::= SEQUENCE {
    -- User equipment IEs
        integrityProtectionModeInfo         IntegrityProtectionModeInfo          OPTIONAL,
        cipheringModeInfo                   CipheringModeInfo                    OPTIONAL,
        activationTime                      ActivationTime                       OPTIONAL,
        new-U-RNTI                          U-RNTI                               OPTIONAL,
        new-C-RNTI                          C-RNTI                               OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode, and if received
        -- the UE behaviour is unspecified
        new-DSCH-RNTI                       DSCH-RNTI                            OPTIONAL,
        rrc-StateIndicator                  RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff          UTRAN-DRX-CycleLengthCoefficient     OPTIONAL,
    -- Core network IEs
```

```
        cn-InformationInfo              CN-InformationInfo                  OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo       OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
        ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList         OPTIONAL,
        -- 'dummy', 'dummy1' and 'dummy2' are not used in this version of the specification,
        -- they should not be sent and if received they should be ignored.
        dummy                           CHOICE {
            fdd                             SEQUENCE {
                dummy1                          CPCH-SetID                  OPTIONAL,
                dummy2                          DRAC-StaticInformationList  OPTIONAL
            },
            tdd                             NULL
        }                                                                   OPTIONAL,
        dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
        dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r4      OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-ChannelRequirement           UL-ChannelRequirement-r4            OPTIONAL,
        modeSpecificPhysChInfo          CHOICE {
            fdd                             SEQUENCE {
                -- dummy is not used in this version of specification, it should
                -- not be sent and if received it should be ignored.
                dummy                           DL-PDSCH-Information        OPTIONAL
            },
        tdd                         NULL
        },
        dl-CommonInformation            DL-CommonInformation-r4             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r4         OPTIONAL
}

TransportChannelReconfiguration-r5-IEs ::= SEQUENCE {
        -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode, and if received
        -- the UE behaviour is unspecified
        new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL,
        new-H-RNTI                      H-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo                  OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo-r5    OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
        ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList         OPTIONAL,
        -- 'dummy', 'dummy1' and 'dummy2' are not used in this version of the specification,
        -- they should not be sent and if received they should be ignored.
        dummy                           CHOICE {
            fdd                             SEQUENCE {
                dummy1                          CPCH-SetID                  OPTIONAL,
                dummy2                          DRAC-StaticInformationList  OPTIONAL
            },
            tdd                             NULL
        }                                                                   OPTIONAL,
        dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
        dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r5      OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-ChannelRequirement           UL-ChannelRequirement-r5            OPTIONAL,
        modeSpecificPhysChInfo          CHOICE {
            fdd                             SEQUENCE {
                -- dummy is not used in this version of specification, it should
                -- not be sent and if received it should be ignored.
                dummy                           DL-PDSCH-Information        OPTIONAL
            },
```

```
            tdd                         NULL
        },
        dl-HSPDSCH-Information          DL-HSPDSCH-Information              OPTIONAL,
    dl-CommonInformation            DL-CommonInformation-r5             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r5         OPTIONAL
}

TransportChannelReconfiguration-v690ext-IEs ::= SEQUENCE {
    -- User Equipment IEs
            delayRestrictionFlag            DelayRestrictionFlag                OPTIONAL,
    -- Core network IEs
        primary-plmn-Identity           PLMN-Identity                       OPTIONAL,
    -- Physical channel IEs
        -- The IE harq-Preamble-Mode should not be used in the r3 and r4 versions of the message
        -- If included in the r3 or r4 version of the message, the UE should ignore the IE
        harq-Preamble-Mode              HARQ-Preamble-Mode                  OPTIONAL,
        beaconPLEst                     BEACON-PL-Est                       OPTIONAL,
        postVerificationPeriod          ENUMERATED { true }                 OPTIONAL,
        dhs-sync                        DHS-Sync                            OPTIONAL,
        timingMaintainedSynchInd        TimingMaintainedSynchInd            OPTIONAL,
    -- MBMS IEs
        mbms-PL-ServiceRestrictInfo     MBMS-PL-ServiceRestrictInfo-r6      OPTIONAL
}

TransportChannelReconfiguration-r6-IEs ::= SEQUENCE {
    -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        delayRestrictionFlag            DelayRestrictionFlag                OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode,
        -- and if received the UE behaviour is unspecified
        new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL,
        new-H-RNTI                      H-RNTI                              OPTIONAL,
        newPrimary-E-RNTI               E-RNTI                              OPTIONAL,
        newSecondary-E-RNTI             E-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo-r6               OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo-r5    OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
        ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList-r6      OPTIONAL,
        dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
        dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r5      OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-DPCH-Info                    UL-DPCH-Info-r6                     OPTIONAL,
        ul-EDCH-Information             UL-EDCH-Information-r6              OPTIONAL,
        dl-HSPDSCH-Information          DL-HSPDSCH-Information-r6           OPTIONAL,
        dl-CommonInformation            DL-CommonInformation-r6             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r6         OPTIONAL,
    -- MBMS IEs
        mbms-PL-ServiceRestrictInfo     MBMS-PL-ServiceRestrictInfo-r6      OPTIONAL
}

TransportChannelReconfiguration-r7-IEs ::= SEQUENCE {
    -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        activationTime                  ActivationTime                      OPTIONAL,
        delayRestrictionFlag            DelayRestrictionFlag                OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        -- The IE "new-DSCH-RNTI" should not be included in FDD mode,
        -- and if received the UE behaviour is unspecified
        new-DSCH-RNTI                   DSCH-RNTI                           OPTIONAL,
        new-H-RNTI                      H-RNTI                              OPTIONAL,
        newPrimary-E-RNTI               E-RNTI                              OPTIONAL,
        newSecondary-E-RNTI             E-RNTI                              OPTIONAL,
        rrc-StateIndicator              RRC-StateIndicator,
```

```
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- Core network IEs
        cn-InformationInfo              CN-InformationInfo-r6               OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo-r5    OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
        ul-AddReconfTransChInfoList     UL-AddReconfTransChInfoList-r6      OPTIONAL,
        dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
        dl-AddReconfTransChInfoList     DL-AddReconfTransChInfoList-r5      OPTIONAL,
    -- Physical channel IEs
        frequencyInfo                   FrequencyInfo                       OPTIONAL,
        maxAllowedUL-TX-Power           MaxAllowedUL-TX-Power               OPTIONAL,
        ul-DPCH-Info                    UL-DPCH-Info-r7                     OPTIONAL,
        ul-EDCH-Information             UL-EDCH-Information-r6              OPTIONAL,        dl-
HSPDSCH-Information         DL-HSPDSCH-Information-r7           OPTIONAL,
            dl-CommonInformation            DL-CommonInformation-r7             OPTIONAL,
        dl-InformationPerRL-List        DL-InformationPerRL-List-r7         OPTIONAL,
    -- MBMS IEs
        mbms-PL-ServiceRestrictInfo     MBMS-PL-ServiceRestrictInfo-r6      OPTIONAL
}

-- ***************************************************
--
-- TRANSPORT CHANNEL RECONFIGURATION COMPLETE
--
-- ***************************************************

TransportChannelReconfigurationComplete ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        ul-IntegProtActivationInfo      IntegrityProtActivationInfo         OPTIONAL,
        -- TABULAR: UL-TimingAdvance is applicable for TDD mode only.
        ul-TimingAdvance                UL-TimingAdvance                    OPTIONAL,
    -- Radio bearer IEs
        count-C-ActivationTime          ActivationTime                      OPTIONAL,
        -- dummy is not used in this version of the specification and
        -- it should be ignored by the receiver.
        dummy                           RB-ActivationTimeInfoList           OPTIONAL,
        ul-CounterSynchronisationInfo   UL-CounterSynchronisationInfo       OPTIONAL,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            transportChannelReconfigurationComplete-r3-add-ext      BIT STRING      OPTIONAL,
            v7xyNonCriticalExtensions       SEQUENCE {
                transportChannelReconfigurationComplete-v7xyext
                                        TransportChannelReconfigurationComplete-v7xyext-IEs,
                nonCriticalExtensions           SEQUENCE {}     OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
}

TransportChannelReconfigurationComplete-v7xyext-IEs ::= SEQUENCE {
        ul-TimingAdvance-VHCR           UL-TimingAdvance-VHCR               OPTIONAL
}

-- ***************************************************
--
-- TRANSPORT CHANNEL RECONFIGURATION FAILURE
--
-- ***************************************************

TransportChannelReconfigurationFailure ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        failureCause                    FailureCauseWithProtErr,
        laterNonCriticalExtensions          SEQUENCE {
            -- Container for additional R99 extensions
            transportChannelReconfigurationFailure-r3-add-ext       BIT STRING      OPTIONAL,
            nonCriticalExtensions           SEQUENCE {}     OPTIONAL
        }   OPTIONAL
}

-- *******************************************************
--
-- TRANSPORT FORMAT COMBINATION CONTROL in AM or UM RLC mode
--
```

```
-- ***************************************************

TransportFormatCombinationControl ::= SEQUENCE {
        -- rrc-TransactionIdentifier is always included in this version of the specification
        rrc-TransactionIdentifier       RRC-TransactionIdentifier           OPTIONAL,
        modeSpecificInfo                    CHOICE {
            fdd                                 NULL,
            tdd                                 SEQUENCE {
                tfcs-ID                             TFCS-Identity   OPTIONAL
            }
        },
        dpch-TFCS-InUplink                  TFC-Subset,
        activationTimeForTFCSubset          ActivationTime                      OPTIONAL,
        tfc-ControlDuration                 TFC-ControlDuration                 OPTIONAL,
        laterNonCriticalExtensions          SEQUENCE {
            -- Container for additional R99 extensions
            transportFormatCombinationControl-r3-add-ext        BIT STRING      OPTIONAL,
                nonCriticalExtensions           SEQUENCE {}     OPTIONAL
        }   OPTIONAL
}

-- ***************************************************
--
-- TRANSPORT FORMAT COMBINATION CONTROL FAILURE
--
-- ***************************************************

TransportFormatCombinationControlFailure ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        failureCause                    FailureCauseWithProtErr,
        laterNonCriticalExtensions          SEQUENCE {
            -- Container for additional R99 extensions
            transportFormatCombinationControlFailure-r3-add-ext     BIT STRING      OPTIONAL,
            nonCriticalExtensions           SEQUENCE {}     OPTIONAL
        }   OPTIONAL
}

-- ***************************************************
--
-- UE CAPABILITY ENQUIRY
--
-- ***************************************************

UECapabilityEnquiry ::= CHOICE {
    r3                              SEQUENCE {
        ueCapabilityEnquiry-r3          UECapabilityEnquiry-r3-IEs,
        laterNonCriticalExtensions      SEQUENCE {
            -- Container for additional R99 extensions
            ueCapabilityEnquiry-r3-add-ext      BIT STRING      OPTIONAL,
            v4b0NonCriticalExtensions       SEQUENCE {
                ueCapabilityEnquiry-v4b0ext     UECapabilityEnquiry-v4b0ext-IEs,
                v590NonCriticalExtensions       SEQUENCE {
                    ueCapabilityEnquiry-v590ext     UECapabilityEnquiry-v590ext-IEs,
                    v7xyNonCriticalExtensions       SEQUENCE {
                        ueCapabilityEnquiry-v7xyext     UECapabilityEnquiry-v7xyext-IEs,
                        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
    },
    later-than-r3                   SEQUENCE {
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        criticalExtensions              SEQUENCE {}
    }
}

UECapabilityEnquiry-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        capabilityUpdateRequirement     CapabilityUpdateRequirement
}

UECapabilityEnquiry-v4b0ext-IEs ::= SEQUENCE {
        capabilityUpdateRequirement-r4-ext  CapabilityUpdateRequirement-r4-ext
}
```

```
UECapabilityEnquiry-v590ext-IEs ::= SEQUENCE {
        systemSpecificCapUpdateReq      SystemSpecificCapUpdateReq-v590ext
}

UECapabilityEnquiry-v7xyext-IEs ::= SEQUENCE {
        capabilityUpdateRequirement-r7-ext      CapabilityUpdateRequirement-r7-ext      OPTIONAL
}

-- ***************************************************
--
-- UE CAPABILITY INFORMATION
--
-- ***************************************************

UECapabilityInformation ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier           OPTIONAL,
        ue-RadioAccessCapability        UE-RadioAccessCapability            OPTIONAL,
    -- Other IEs
        ue-RATSpecificCapability        InterRAT-UE-RadioAccessCapabilityList       OPTIONAL,
        v370NonCriticalExtensions           SEQUENCE {
            ueCapabilityInformation-v370ext UECapabilityInformation-v370ext,
            v380NonCriticalExtensions           SEQUENCE {
                ueCapabilityInformation-v380ext     UECapabilityInformation-v380ext-IEs,
                v3a0NonCriticalExtensions           SEQUENCE {
                    ueCapabilityInformation-v3a0ext     UECapabilityInformation-v3a0ext-IEs,
                    laterNonCriticalExtensions          SEQUENCE {
                        -- Container for additional R99 extensions
                        ueCapabilityInformation-r3-add-ext      BIT STRING
                                (CONTAINING UECapabilityInformation-r3-add-ext-IEs) OPTIONAL,
                        -- Reserved for future non critical extension
                        v4b0NonCriticalExtensions           SEQUENCE {
                            ueCapabilityInformation-v4b0ext     UECapabilityInformation-v4b0ext,
                            v590NonCriticalExtensions           SEQUENCE {
                                ueCapabilityInformation-v590ext     UECapabilityInformation-v590ext,
                                v5c0NonCriticalExtensions           SEQUENCE {
                                    ueCapabilityInformation-v5c0ext
                                                                    UECapabilityInformation-v5c0ext,
                                    v690NonCriticalExtensions           SEQUENCE {
                                        ueCapabilityInformation-v690ext
                                                                    UECapabilityInformation-v690ext-IEs,
                                        v7xyNonCriticalExtensions           SEQUENCE {
                                            ueCapabilityInformation-v7xyext
                                                                    UECapabilityInformation-v7xyext-IEs,
                                            nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                                        }       OPTIONAL
                                    }       OPTIONAL
                                }       OPTIONAL
                            }       OPTIONAL
                        }       OPTIONAL
                    }       OPTIONAL
                }       OPTIONAL
            }       OPTIONAL
        }       OPTIONAL
}

UECapabilityInformation-v370ext ::= SEQUENCE {
    -- User equipment IEs
        ue-RadioAccessCapability-v370ext        UE-RadioAccessCapability-v370ext        OPTIONAL
}

UECapabilityInformation-v380ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        ue-RadioAccessCapability-v380ext        UE-RadioAccessCapability-v380ext        OPTIONAL,
        dl-PhysChCapabilityFDD-v380ext          DL-PhysChCapabilityFDD-v380ext
}

UECapabilityInformation-v3a0ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        ue-RadioAccessCapability-v3a0ext        UE-RadioAccessCapability-v3a0ext        OPTIONAL
}

UECapabilityInformation-r3-add-ext-IEs ::= SEQUENCE {
        ueCapabilityInformation-v650ext     UECapabilityInformation-v650ext-IEs     OPTIONAL,
        v680NonCriticalExtensions           SEQUENCE {
            ueCapabilityInformation-v680ext     UECapabilityInformation-v680ext-IEs,
            nonCriticalExtensions               SEQUENCE {}     OPTIONAL
        }       OPTIONAL
```

```
}

UECapabilityInformation-v4b0ext ::= SEQUENCE {
    -- User equipment IEs
        ue-RadioAccessCapability-v4b0ext        UE-RadioAccessCapability-v4b0ext        OPTIONAL
}

UECapabilityInformation-v590ext ::= SEQUENCE {
    -- User equipment IEs
        ue-RadioAccessCapability-v3g0ext        UE-RadioAccessCapability-v3g0ext        OPTIONAL,
        ue-RadioAccessCapability-v590ext        UE-RadioAccessCapability-v590ext        OPTIONAL,
    -- Other IEs
        ue-RATSpecificCapability-v590ext    InterRAT-UE-RadioAccessCapability-v590ext   OPTIONAL
}

UECapabilityInformation-v5c0ext ::= SEQUENCE {
    -- User equipment IEs
        ue-RadioAccessCapability-v5c0ext        UE-RadioAccessCapability-v5c0ext        OPTIONAL
}

UECapabilityInformation-v650ext-IEs ::= SEQUENCE {
        ue-RadioAccessCapability-v650ext        UE-RadioAccessCapability-v650ext
}

UECapabilityInformation-v680ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        ue-RadioAccessCapability-v680ext        UE-RadioAccessCapability-v680ext
}

UECapabilityInformation-v690ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        ueCapabilityContainer               BIT STRING
                                                (CONTAINING UE-CapabilityContainer-IEs) OPTIONAL
}

UECapabilityInformation-v7xyext-IEs ::= SEQUENCE {
        ue-RadioAccessCapability-v7xyext    UE-RadioAccessCapability-v7xyext        OPTIONAL
}

-- ***************************************************
--
-- UE CAPABILITY INFORMATION CONFIRM
--
-- ***************************************************

UECapabilityInformationConfirm ::= CHOICE {
    r3                              SEQUENCE {
        ueCapabilityInformationConfirm-r3
                                        UECapabilityInformationConfirm-r3-IEs,
        laterNonCriticalExtensions          SEQUENCE {
            -- Container for additional R99 extensions
            ueCapabilityInformationConfirm-r3-add-ext       BIT STRING      OPTIONAL,
            nonCriticalExtensions           SEQUENCE {}     OPTIONAL
        }   OPTIONAL
    },
    later-than-r3                   SEQUENCE {
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        criticalExtensions              SEQUENCE {}
    }
}

UECapabilityInformationConfirm-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier
}

-- ***************************************************
--
-- UPLINK DIRECT TRANSFER
--
-- ***************************************************

UplinkDirectTransfer ::= SEQUENCE {
    -- Core network IEs
        cn-DomainIdentity               CN-DomainIdentity,
        nas-Message                     NAS-Message,
    -- Measurement IEs
        measuredResultsOnRACH           MeasuredResultsOnRACH               OPTIONAL,
```

```
        laterNonCriticalExtensions          SEQUENCE {
            -- Container for additional R99 extensions
            uplinkDirectTransfer-r3-add-ext      BIT STRING      OPTIONAL,
            v690NonCriticalExtensions            SEQUENCE {
                uplinkDirectTransfer-v690ext        UplinkDirectTransfer-v690ext-IEs,
                nonCriticalExtensions               SEQUENCE {}     OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
}

UplinkDirectTransfer-v690ext-IEs ::= SEQUENCE {
    -- Measurement IEs
    measuredResultsOnRACHinterFreq      MeasuredResultsOnRACHinterFreq              OPTIONAL
}

-- ***************************************************
--
-- UPLINK PHYSICAL CHANNEL CONTROL
--
-- ***************************************************

UplinkPhysicalChannelControl ::= CHOICE {
    r3                              SEQUENCE {
        uplinkPhysicalChannelControl-r3 UplinkPhysicalChannelControl-r3-IEs,
        laterNonCriticalExtensions          SEQUENCE {
            -- Container for additional R99 extensions
            uplinkPhysicalChannelControl-r3-add-ext      BIT STRING      OPTIONAL,
            v4b0NonCriticalExtensions           SEQUENCE {
                uplinkPysicalChannelControl-v4b0ext     UplinkPhysicalChannelControl-v4b0ext-IEs,
                -- Extension mechanism for non-release 4 information
                noncriticalExtensions           SEQUENCE {}                 OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
    },
    later-than-r3                   SEQUENCE {
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        criticalExtensions              CHOICE {
            r4                              SEQUENCE {
                uplinkPhysicalChannelControl-r4 UplinkPhysicalChannelControl-r4-IEs,
                v4d0NonCriticalExtensions           SEQUENCE {
                    -- Container for adding non critical extensions after freezing REL-5
                    uplinkPhysicalChannelControl-r4-add-ext      BIT STRING      OPTIONAL,
                    v690NonCriticalExtensions           SEQUENCE {
                        uplinkPhysicalChannelControl-v690ext     UplinkPhysicalChannelControl-v690ext-IEs,
                        nonCriticalExtensions               SEQUENCE {} OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            },
            criticalExtensions              CHOICE {
                r5                              SEQUENCE {
                    uplinkPhysicalChannelControl-r5 UplinkPhysicalChannelControl-r5-IEs,
                    -- Container for adding non critical extensions after freezing REL-6
                    uplinkPhysicalChannelControl-r5-add-ext      BIT STRING      OPTIONAL,
                    v690NonCriticalExtensions           SEQUENCE {
                        uplinkPhysicalChannelControl-v690ext     UplinkPhysicalChannelControl-v690ext-IEs,
                        nonCriticalExtensions               SEQUENCE {} OPTIONAL
                    }   OPTIONAL
                },
                criticalExtensions              CHOICE {
                    r7                              SEQUENCE {
                        uplinkPhysicalChannelControl-r7 UplinkPhysicalChannelControl-r7-IEs,
                        -- Container for adding non critical extensions after freezing REL-8
                        uplinkPhysicalChannelControl-r7-add-ext      BIT STRING      OPTIONAL,
                        nonCriticalExtensions               SEQUENCE {}     OPTIONAL
                    },
                    criticalExtensions              SEQUENCE {}
                }
            }
        }
    }
}

UplinkPhysicalChannelControl-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
    -- Physical channel IEs
        ccTrCH-PowerControlInfo         CCTrCH-PowerControlInfo             OPTIONAL,
        timingAdvance                   UL-TimingAdvanceControl             OPTIONAL,
```

```
        alpha                           Alpha                             OPTIONAL,
        specialBurstScheduling          SpecialBurstScheduling            OPTIONAL,
        prach-ConstantValue             ConstantValueTdd                  OPTIONAL,
        pusch-ConstantValue             ConstantValueTdd                  OPTIONAL
}

UplinkPhysicalChannelControl-v4b0ext-IEs ::= SEQUENCE {
    -- In case of TDD, openLoopPowerControl-IPDL-TDD is included instead of IE
    -- up-IPDL-Parameters in up-OTDOA-AssistanceData
    openLoopPowerControl-IPDL-TDD   OpenLoopPowerControl-IPDL-TDD-r4    OPTIONAL
}

UplinkPhysicalChannelControl-r4-IEs ::= SEQUENCE {
    -- Physical channel IEs
        ccTrCH-PowerControlInfo         CCTrCH-PowerControlInfo-r4        OPTIONAL,
        specialBurstScheduling          SpecialBurstScheduling            OPTIONAL,
        tddOption                       CHOICE {
            tdd384                          SEQUENCE {
                timingAdvance                   UL-TimingAdvanceControl-r4  OPTIONAL,
                alpha                           Alpha                       OPTIONAL,
                prach-ConstantValue             ConstantValueTdd            OPTIONAL,
                pusch-ConstantValue             ConstantValueTdd            OPTIONAL,
                openLoopPowerControl-IPDL-TDD   OpenLoopPowerControl-IPDL-TDD-r4    OPTIONAL
            },
            tdd128                          SEQUENCE {
                ul-SynchronisationParameters    UL-SynchronisationParameters-r4 OPTIONAL
            }
        }
}

UplinkPhysicalChannelControl-r5-IEs ::= SEQUENCE {
    -- Physical channel IEs
        ccTrCH-PowerControlInfo         CCTrCH-PowerControlInfo-r5        OPTIONAL,
        specialBurstScheduling          SpecialBurstScheduling            OPTIONAL,
        tddOption                       CHOICE {
            tdd384                          SEQUENCE {
                timingAdvance                   UL-TimingAdvanceControl-r4  OPTIONAL,
                alpha                           Alpha                       OPTIONAL,
                prach-ConstantValue             ConstantValueTdd            OPTIONAL,
                pusch-ConstantValue             ConstantValueTdd            OPTIONAL,
                openLoopPowerControl-IPDL-TDD   OpenLoopPowerControl-IPDL-TDD-r4    OPTIONAL,
                hs-SICH-PowerControl            HS-SICH-Power-Control-Info-TDD384   OPTIONAL
            },
            tdd128                          SEQUENCE {
                ul-SynchronisationParameters    UL-SynchronisationParameters-r4 OPTIONAL
            }
        }
}

UplinkPhysicalChannelControl-v690ext-IEs ::= SEQUENCE {
    -- Physical Channel IEs
        beaconPLEst                     BEACON-PL-Est                     OPTIONAL
}

UplinkPhysicalChannelControl-r7-IEs ::= SEQUENCE {
    -- Physical channel IEs
        ccTrCH-PowerControlInfo         CCTrCH-PowerControlInfo-r7        OPTIONAL,
        specialBurstScheduling          SpecialBurstScheduling            OPTIONAL,
        tddOption                       CHOICE {
            tdd384                          SEQUENCE {
                timingAdvance                   UL-TimingAdvanceControl-r4  OPTIONAL,
                alpha                           Alpha                       OPTIONAL,
                prach-ConstantValue             ConstantValueTdd            OPTIONAL,
                pusch-ConstantValue             ConstantValueTdd            OPTIONAL,
                openLoopPowerControl-IPDL-TDD   OpenLoopPowerControl-IPDL-TDD-r4    OPTIONAL,
                hs-SICH-PowerControl            HS-SICH-Power-Control-Info-TDD384   OPTIONAL
            },
            tdd768                          SEQUENCE {
                timingAdvance                   UL-TimingAdvanceControl-r7  OPTIONAL,
                alpha                           Alpha                       OPTIONAL,
                prach-ConstantValue             ConstantValueTdd            OPTIONAL,
                pusch-ConstantValue             ConstantValueTdd            OPTIONAL,
                openLoopPowerControl-IPDL-TDD   OpenLoopPowerControl-IPDL-TDD-r4    OPTIONAL,
                hs-SICH-PowerControl            HS-SICH-Power-Control-Info-TDD768   OPTIONAL
            },
            tdd128                          SEQUENCE {
                ul-SynchronisationParameters    UL-SynchronisationParameters-r4 OPTIONAL
            }
```

```
		}
}

-- ***************************************************
--
-- URA UPDATE
--
-- ***************************************************

URAUpdate ::= SEQUENCE {
	-- User equipment IEs
		u-RNTI								U-RNTI,
		ura-UpdateCause						URA-UpdateCause,
		protocolErrorIndicator				ProtocolErrorIndicatorWithMoreInfo,
		laterNonCriticalExtensions				SEQUENCE {
			-- Container for additional R99 extensions
			uraUpdate-r3-add-ext			BIT STRING		OPTIONAL,
			nonCriticalExtensions				SEQUENCE {}		OPTIONAL
		}	OPTIONAL
}

-- ***************************************************
--
-- URA UPDATE CONFIRM
--
-- ***************************************************

URAUpdateConfirm ::= CHOICE {
	r3								SEQUENCE {
		uraUpdateConfirm-r3					URAUpdateConfirm-r3-IEs,
		laterNonCriticalExtensions				SEQUENCE {
			-- Container for additional R99 extensions
			uraUpdateConfirm-r3-add-ext		BIT STRING		OPTIONAL,
			v690NonCriticalExtensions			SEQUENCE {
				uraUpdateConfirm-v690ext			URAUpdateConfirm-v690ext-IEs,
				nonCriticalExtensions				SEQUENCE {}		OPTIONAL
			}	OPTIONAL
		}	OPTIONAL
	},
	later-than-r3							SEQUENCE {
		rrc-TransactionIdentifier				RRC-TransactionIdentifier,
		criticalExtensions					CHOICE {
			r5								SEQUENCE {
				uraUpdateConfirm-r5				URAUpdateConfirm-r5-IEs,
				v690NonCriticalExtensions		SEQUENCE {
					uraUpdateConfirm-v690ext		URAUpdateConfirm-v690ext-IEs,
					nonCriticalExtensions			SEQUENCE {}		OPTIONAL
				}	OPTIONAL
			},
			criticalExtensions					SEQUENCE {}
		}
	}
}

URAUpdateConfirm-r3-IEs ::= SEQUENCE {
	-- User equipment IEs
		rrc-TransactionIdentifier			RRC-TransactionIdentifier,
		integrityProtectionModeInfo			IntegrityProtectionModeInfo			OPTIONAL,
		cipheringModeInfo					CipheringModeInfo					OPTIONAL,
		new-U-RNTI							U-RNTI								OPTIONAL,
		new-C-RNTI							C-RNTI								OPTIONAL,
		rrc-StateIndicator					RRC-StateIndicator,
		utran-DRX-CycleLengthCoeff			UTRAN-DRX-CycleLengthCoefficient	OPTIONAL,
	-- CN information elements
		cn-InformationInfo					CN-InformationInfo					OPTIONAL,
	-- UTRAN mobility IEs
		ura-Identity						URA-Identity						OPTIONAL,
	-- Radio bearer IEs
		dl-CounterSynchronisationInfo		DL-CounterSynchronisationInfo		OPTIONAL
}

URAUpdateConfirm-r5-IEs ::= SEQUENCE {
	-- User equipment IEs
		integrityProtectionModeInfo			IntegrityProtectionModeInfo			OPTIONAL,
		cipheringModeInfo					CipheringModeInfo					OPTIONAL,
		new-U-RNTI							U-RNTI								OPTIONAL,
		new-C-RNTI							C-RNTI								OPTIONAL,
		rrc-StateIndicator					RRC-StateIndicator,
```

```
        utran-DRX-CycleLengthCoeff      UTRAN-DRX-CycleLengthCoefficient    OPTIONAL,
    -- CN information elements
        cn-InformationInfo              CN-InformationInfo                  OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo-r5    OPTIONAL
}

URAUpdateConfirm-v690ext-IEs ::= SEQUENCE {
    -- Core network IEs
        primary-plmn-Identity               PLMN-Identity                   OPTIONAL
}

-- ***************************************************
--
-- URA UPDATE CONFIRM for CCCH
--
-- ***************************************************

URAUpdateConfirm-CCCH ::= CHOICE {
    r3                                  SEQUENCE {
        uraUpdateConfirm-CCCH-r3        URAUpdateConfirm-CCCH-r3-IEs,
        laterNonCriticalExtensions          SEQUENCE {
            -- Container for additional R99 extensions
            uraUpdateConfirm-CCCH-r3-add-ext        BIT STRING      OPTIONAL,
            v690NonCriticalExtensions       SEQUENCE {
                uraUpdateConfirm-v690ext            URAUpdateConfirm-v690ext-IEs,
                nonCriticalExtensions           SEQUENCE {}     OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
    },
    later-than-r3                       SEQUENCE {
        u-RNTI                          U-RNTI,
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        criticalExtensions              SEQUENCE {}
    }
}

URAUpdateConfirm-CCCH-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
        u-RNTI                          U-RNTI,
    -- The rest of the message is identical to the one sent on DCCH.
        uraUpdateConfirm                URAUpdateConfirm-r3-IEs
}

-- ***************************************************
--
-- UTRAN MOBILITY INFORMATION
--
-- ***************************************************

UTRANMobilityInformation ::= CHOICE {
    r3                                  SEQUENCE {
        utranMobilityInformation-r3     UTRANMobilityInformation-r3-IEs,
        v3a0NonCriticalExtensions       SEQUENCE {
            utranMobilityInformation-v3a0ext    UTRANMobilityInformation-v3a0ext-IEs,
            laterNonCriticalExtensions          SEQUENCE {
                -- Container for additional R99 extensions
                utranMobilityInformation-r3-add-ext     BIT STRING      OPTIONAL,
                v690NonCriticalExtensions           SEQUENCE {
                    utranMobilityInformation-v690ext    UtranMobilityInformation-v690ext-IEs,
                    nonCriticalExtensions               SEQUENCE {}     OPTIONAL
                }       OPTIONAL
            }       OPTIONAL
        }       OPTIONAL
    },
    later-than-r3                       SEQUENCE {
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        criticalExtensions              CHOICE {
            r5                                  SEQUENCE {
                utranMobilityInformation-r5     UTRANMobilityInformation-r5-IEs,
                v690NonCriticalExtensions       SEQUENCE {
                    utranMobilityInformation-v690ext    UtranMobilityInformation-v690ext-IEs,
                    nonCriticalExtensions           SEQUENCE {}     OPTIONAL
                }   OPTIONAL
            },
            criticalExtensions              SEQUENCE {}
```

```
        }
    }
}

UTRANMobilityInformation-r3-IEs ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        ue-ConnTimersAndConstants       UE-ConnTimersAndConstants           OPTIONAL,
    -- CN information elements
        cn-InformationInfo              CN-InformationInfoFull              OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo       OPTIONAL,
    -- Extension mechanism for non- release99 information
        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
}

UTRANMobilityInformation-v3a0ext-IEs ::= SEQUENCE {
    ue-ConnTimersAndConstants-v3a0ext       UE-ConnTimersAndConstants-v3a0ext
}

UTRANMobilityInformation-r5-IEs ::= SEQUENCE {
    -- User equipment IEs
        integrityProtectionModeInfo     IntegrityProtectionModeInfo         OPTIONAL,
        cipheringModeInfo               CipheringModeInfo                   OPTIONAL,
        new-U-RNTI                      U-RNTI                              OPTIONAL,
        new-C-RNTI                      C-RNTI                              OPTIONAL,
        ue-ConnTimersAndConstants       UE-ConnTimersAndConstants-r5        OPTIONAL,
    -- CN information elements
        cn-InformationInfo              CN-InformationInfoFull              OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Radio bearer IEs
        dl-CounterSynchronisationInfo   DL-CounterSynchronisationInfo-r5    OPTIONAL
}

UtranMobilityInformation-v690ext-IEs ::= SEQUENCE {
    -- Core network IEs
        primary-plmn-Identity               PLMN-Identity                       OPTIONAL
}

-- ***************************************************
--
-- UTRAN MOBILITY INFORMATION CONFIRM
--
-- ***************************************************

UTRANMobilityInformationConfirm ::= SEQUENCE {
    -- User equipment IEs
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        ul-IntegProtActivationInfo      IntegrityProtActivationInfo         OPTIONAL,
    -- Radio bearer IEs
        count-C-ActivationTime          ActivationTime                      OPTIONAL,
        -- dummy is not used in this version of the specification and
        -- it should be ignored by the receiver.
        dummy                           RB-ActivationTimeInfoList           OPTIONAL,
        ul-CounterSynchronisationInfo   UL-CounterSynchronisationInfo       OPTIONAL,
        laterNonCriticalExtensions          SEQUENCE {
            -- Container for additional R99 extensions
            utranMobilityInformationConfirm-r3-add-ext      BIT STRING      OPTIONAL,
            nonCriticalExtensions           SEQUENCE {}     OPTIONAL
        }   OPTIONAL
}

-- ***************************************************
--
-- UTRAN MOBILITY INFORMATION FAILURE
--
-- ***************************************************

UTRANMobilityInformationFailure ::= SEQUENCE {
    -- UE information elements
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
```

```
        failureCause                    FailureCauseWithProtErr,
        laterNonCriticalExtensions            SEQUENCE {
            -- Container for additional R99 extensions
            utranMobilityInformationFailure-r3-add-ext      BIT STRING      OPTIONAL,
            nonCriticalExtensions             SEQUENCE {}     OPTIONAL
        }   OPTIONAL
}

-- ***************************************************
--
-- MBMS ACCESS INFORMATION
--
-- ***************************************************

MBMSAccessInformation ::= SEQUENCE {
    -- Access Information IEs
        mbms-ServiceAccessInfoList      MBMS-ServiceAccessInfoList-r6,
    -- Non critical extensions
        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
}

-- ***************************************************
--
-- MBMS COMMON PTM RB INFORMATION
--
-- ***************************************************

MBMSCommonPTMRBInformation ::= SEQUENCE {
    -- Common PTM RB Information IEs
        mbms-CommonRBInformationList    MBMS-CommonRBInformationList-r6,
        mbms-TranspChInfoForEachTrCh    MBMS-TranspChInfoForEachTrCh-r6,
        mbms-TranspChInfoForEachCCTrCh  MBMS-TranspChInfoForEachCCTrCh-r6   OPTIONAL,
        mbms-PhyChInformationList       MBMS-PhyChInformationList-r6,
    -- Non critical extensions
        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
}

-- ***************************************************
--
-- MBMS CURRENT CELL PTM RB INFORMATION
--
-- ***************************************************

MBMSCurrentCellPTMRBInformation ::= SEQUENCE {
    -- Current Cell PTM RB Information IEs
        mbms-CurrentCell-SCCPCHList     MBMS-CurrentCell-SCCPCHList-r6      OPTIONAL,
    mbms-SIBType5-SCCPCHList        MBMS-SIBType5-SCCPCHList-r6         OPTIONAL,
        -- Non critical extensions
        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
}

-- ***************************************************
--
-- MBMS GENERAL INFORMATION
--
-- ***************************************************

MBMSGeneralInformation ::= SEQUENCE {
    -- MBMS General Information IEs
        mbms-PreferredFrequencyInfo     MBMS-PreferredFrequencyList-r6      OPTIONAL,
        mbms-TimersAndCounters          MBMS-TimersAndCounters-r6,
        michConfigurationInfo           MBMS-MICHConfigurationInfo-r6,
        cellGroupIdentity               MBMS-CellGroupIdentity-r6,
        mschDefaultConfigurationInfo    MBMS-MSCH-ConfigurationInfo-r6      OPTIONAL,
    -- Non critical extensions
        v7xyNonCriticalExtensions       SEQUENCE {
            mbmsGenerAlInformation-v7xyext  MBMSGeneralInformation-v7xyext-IEs,
            nonCriticalExtensions           SEQUENCE {}     OPTIONAL
        }
}

MBMSGeneralInformation-v7xyext-IEs ::= SEQUENCE {
        mbmsMICHConfiguration-v7xyext   MBMS-MICHConfigurationInfo-r7       OPTIONAL
}

-- ***************************************************
--
-- MBMS MODIFICATION REQUEST
```

```
--
-- **************************************************

MBMSModificationRequest ::= SEQUENCE {
    -- MBMS Modification Request IEs
        mbms-PreferredFreqRequest       MBMS-ServiceIdentity-r6             OPTIONAL,
        rb-InformationReleaseList       RB-InformationReleaseList           OPTIONAL,
    -- Non critical extensions
        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
}

-- **************************************************
--
-- MBMS MODIFIED SERVICES INFORMATION
--
-- **************************************************

MBMSModifiedServicesInformation ::= SEQUENCE {
    -- MBMS Modified Services Information IEs
        modifedServiceList              MBMS-ModifedServiceList-r6          OPTIONAL,
        mbms-ReacquireMCCH              ENUMERATED { true }                 OPTIONAL,
        mbms-DynamicPersistenceLevel    DynamicPersistenceLevel             OPTIONAL,
        endOfModifiedMCCHInformation    INTEGER (1..16)                     OPTIONAL,
        mbmsNumberOfNeighbourCells      MBMS-NumberOfNeighbourCells-r6,
        mbms-AllUnmodifiedPTMServices   ENUMERATED { true }                 OPTIONAL,
        mbms-PTMActivationTime          MBMS-PTMActivationTime-r6           OPTIONAL,
    -- Non critical extensions
        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
}

-- **************************************************
--
-- MBMS NEIGHBOURING CELL PTM RB INFORMATION
--
-- **************************************************

MBMSNeighbouringCellPTMRBInformation ::= SEQUENCE {
    -- MBMS Neighbouring Cell PTM RB Information IEs
        neighbouringCellIdentity     IntraFreqCellID,
        neighbouringCellSCCPCHList      MBMS-NeighbouringCellSCCPCHList-r6,
    -- Non critical extensions
        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
}

-- **************************************************
--
-- MBMS SCHEDULING INFORMATION
--
-- **************************************************

MBMSSchedulingInformation ::= SEQUENCE {
    -- MBMS Scheduling Information IEs
        serviceSchedulingInfoList       MBMS-ServiceSchedulingInfoList-r6,
    -- Non critical extensions
        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
}

-- **************************************************
--
-- MBMS UNMODIFIED SERVICES INFORMATION
--
-- **************************************************

MBMSUnmodifiedServicesInformation ::= SEQUENCE {
    -- MBMS Unmodified Services Information IEs
        unmodifiedServiceList           MBMS-UnmodifiedServiceList-r6       OPTIONAL,
    -- Non critical extensions
        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
}

END
```

11.3 Information element definitions

```
InformationElements DEFINITIONS AUTOMATIC TAGS ::=

-- **************************************************
```

```
--
--      CORE NETWORK INFORMATION ELEMENTS (10.3.1)
--
-- ***************************************************

BEGIN

IMPORTS

    hiPDSCHidentities,
    hiPUSCHidentities,
    hiRM,
    maxAC,
    maxAdditionalMeas,
    maxASC,
    maxASCmap,
    maxASCpersist,
    maxCCTrCH,
    maxCellMeas,
    maxCellMeas-1,
    maxCNdomains,
    maxCPCHsets,
    maxDPCH-DLchan,
    maxDPDCH-UL,
    maxDRACclasses,
    maxE-DCHMACdFlow,
    maxE-DCHMACdFlow-1,
    maxFACHPCH,
    maxFreq,
    maxFreqBandsFDD,
    maxFreqBandsFDD-ext,
    maxFreqBandsTDD,
    maxFreqBandsGSM,
    maxGERAN-SI,
    maxHProcesses,
    maxHSDSCHTBIndex,
    maxHSDSCHTBIndex-tdd384,
    maxHSSCCHs,
    maxInterSysMessages,
    maxLoCHperRLC,
    maxMAC-d-PDUsizes,
    maxMBMS-CommonCCTrCh,
    maxMBMS-CommonPhyCh,
    maxMBMS-CommonRB,
    maxMBMS-CommonTrCh,
    maxMBMS-Freq,
    maxMBMS-L1CP,
    maxMBMSservCount,
    maxMBMSservModif,
    maxMBMSservSched,
    maxMBMSservUnmodif,
    maxMBMSTransmis,
    maxMeasEvent,
    maxMeasIntervals,
    maxMeasParEvent,
    maxNumCDMA2000Freqs,
    maxNumFDDFreqs,
    maxNumGSMFreqRanges,
    maxGSMTargetCells,
    maxNumTDDFreqs,
    maxOtherRAT,
    maxOtherRAT-16,
    maxPage1,
    maxPCPCH-APsig,
    maxPCPCH-APsubCh,
    maxPCPCH-CDsig,
    maxPCPCH-CDsubCh,
    maxPCPCH-SF,
    maxPCPCHs,
    maxPDCPAlgoType,
    maxPDSCH,
    maxPDSCH-TFCIgroups,
    maxPRACH,
    maxPRACH-FPACH,
    maxPredefConfig,
    maxPUSCH,
    maxQueueIDs,
    maxRABsetup,
```

```
    maxRAT,
    maxRB,
    maxRBallRABs,
    maxRBperTrCh,
    maxRBMuxOptions,
    maxRBperRAB,
    maxReportedGSMCells,
    maxRLCPDUsizePerLogChan,
    maxSRBsetup,
    maxRL,
    maxRL-1,
    maxEDCHRL,
    maxROHC-PacketSizes-r4,
    maxROHC-Profile-r4,
    maxSCCPCH,
    maxSat,
    maxSIB,
    maxSIB-FACH,
    maxSystemCapability,
    maxTF,
    maxTF-CPCH,
    maxTFC,
    maxTFCsub,
    maxTFCI-2-Combs,
    maxTGPS,
    maxTrCH,
    maxTrCHpreconf,
    maxTS,
    maxTS-1,
    maxTS-2,
    maxTS-LCR,
    maxTS-LCR-1,
    maxURA,
    maxURNTI-Group
FROM Constant-definitions;

Ansi-41-IDNNS ::=                       BIT STRING (SIZE (14))

CN-DomainIdentity ::=               ENUMERATED {
                                        cs-domain,
                                        ps-domain }

CN-DomainInformation ::=            SEQUENCE {
    cn-DomainIdentity                   CN-DomainIdentity,
    cn-DomainSpecificNAS-Info           NAS-SystemInformationGSM-MAP
}

CN-DomainInformationFull ::=        SEQUENCE {
    cn-DomainIdentity                   CN-DomainIdentity,
    cn-DomainSpecificNAS-Info           NAS-SystemInformationGSM-MAP,
    cn-DRX-CycleLengthCoeff             CN-DRX-CycleLengthCoefficient
}

CN-DomainInformationList ::=        SEQUENCE (SIZE (1..maxCNdomains)) OF
                                        CN-DomainInformation

CN-DomainInformationListFull ::=    SEQUENCE (SIZE (1..maxCNdomains)) OF
                                        CN-DomainInformationFull

CN-DomainSysInfo ::=                SEQUENCE {
    cn-DomainIdentity                   CN-DomainIdentity,
    cn-Type                             CHOICE {
        gsm-MAP                             NAS-SystemInformationGSM-MAP,
        ansi-41                             NAS-SystemInformationANSI-41
    },
    cn-DRX-CycleLengthCoeff             CN-DRX-CycleLengthCoefficient
}

CN-DomainSysInfoList ::=            SEQUENCE (SIZE (1..maxCNdomains)) OF
                                        CN-DomainSysInfo

CN-InformationInfo ::=              SEQUENCE {
    plmn-Identity                       PLMN-Identity                       OPTIONAL,
    cn-CommonGSM-MAP-NAS-SysInfo        NAS-SystemInformationGSM-MAP        OPTIONAL,
    cn-DomainInformationList            CN-DomainInformationList            OPTIONAL
}

CN-InformationInfo-r6 ::=           SEQUENCE {
```

```
    plmn-Identity                       PLMN-Identity                       OPTIONAL,
    cn-CommonGSM-MAP-NAS-SysInfo        NAS-SystemInformationGSM-MAP        OPTIONAL,
    cn-DomainInformationList            CN-DomainInformationList            OPTIONAL,
    primary-plmn-Identity               PLMN-Identity                       OPTIONAL
}

CN-InformationInfoFull ::=          SEQUENCE {
    plmn-Identity                       PLMN-Identity                       OPTIONAL,
    cn-CommonGSM-MAP-NAS-SysInfo        NAS-SystemInformationGSM-MAP        OPTIONAL,
    cn-DomainInformationListFull        CN-DomainInformationListFull        OPTIONAL
}

Digit ::=                           INTEGER (0..9)

Gsm-map-IDNNS ::=                           SEQUENCE {
    routingbasis                                    CHOICE {
        localPTMSI                                      SEQUENCE {
            routingparameter                                RoutingParameter
        },
        tMSIofsamePLMN                                  SEQUENCE {
            routingparameter                                RoutingParameter
        },
        tMSIofdifferentPLMN                             SEQUENCE {
            routingparameter                                RoutingParameter
        },
        iMSIresponsetopaging                            SEQUENCE {
            routingparameter                                RoutingParameter
        },
        iMSIcauseUEinitiatedEvent                       SEQUENCE {
            routingparameter                                RoutingParameter
        },
        iMEI                                            SEQUENCE {
            routingparameter                                RoutingParameter
        },
        spare2                                          SEQUENCE {
            routingparameter                                RoutingParameter
        },
        spare1                                          SEQUENCE {
            routingparameter                                RoutingParameter
        }
    },
    -- dummy is not used in this version of the specification and
    -- it should be ignored by the receiver.
    dummy                                   BOOLEAN
}

IMEI ::=                            SEQUENCE (SIZE (15)) OF
                                        IMEI-Digit

IMEI-Digit ::=                      INTEGER (0..15)

IMSI-GSM-MAP ::=                    SEQUENCE (SIZE (6..21)) OF
                                        Digit

IntraDomainNasNodeSelector ::=              SEQUENCE {
    version                                     CHOICE {
        release99                                   SEQUENCE {
            cn-Type                                     CHOICE {
                gsm-Map-IDNNS                               Gsm-map-IDNNS,
                ansi-41-IDNNS                               Ansi-41-IDNNS
            }
        },
        later                                       SEQUENCE {
            futurecoding                                BIT STRING (SIZE (15))
        }
    }
}

LAI ::=                             SEQUENCE {
    plmn-Identity                       PLMN-Identity,
    lac                                 BIT STRING (SIZE (16))
}

MCC ::=                             SEQUENCE (SIZE (3)) OF
                                        Digit

MNC ::=                             SEQUENCE (SIZE (2..3)) OF
                                        Digit
```

```
MultiplePLMN-List-r6 ::=            SEQUENCE {
    mibPLMN-Identity                    BOOLEAN,
    multiplePLMNs                       SEQUENCE (SIZE (1..5)) OF
                                            PLMN-IdentityWithOptionalMCC-r6
}

NAS-Message ::=                     OCTET STRING (SIZE (1..4095))

NAS-Synchronisation-Indicator ::=   BIT STRING(SIZE(4))

NAS-SystemInformationGSM-MAP ::=    OCTET STRING (SIZE (1..8))

P-TMSI-GSM-MAP ::=                  BIT STRING (SIZE (32))

PagingRecordTypeID ::=              ENUMERATED {
                                        imsi-GSM-MAP,
                                        tmsi-GSM-MAP-P-TMSI,
                                        imsi-DS-41,
                                        tmsi-DS-41 }

PLMN-Identity ::=                   SEQUENCE {
    mcc                                 MCC,
    mnc                                 MNC
}

PLMN-IdentityWithOptionalMCC-r6 ::= SEQUENCE {
    mcc                                 MCC                         OPTIONAL,
    mnc                                 MNC
}

PLMN-Type ::=                       CHOICE {
    gsm-MAP                             SEQUENCE {
        plmn-Identity                       PLMN-Identity
    },
    ansi-41                         SEQUENCE {
        p-REV                           P-REV,
        min-P-REV                       Min-P-REV,
        sid                             SID,
        nid                             NID
    },
    gsm-MAP-and-ANSI-41             SEQUENCE {
        plmn-Identity                   PLMN-Identity,
        p-REV                           P-REV,
        min-P-REV                       Min-P-REV,
        sid                             SID,
        nid                             NID
    },
    spare                           NULL
}

RAB-Identity ::=                    CHOICE {
    gsm-MAP-RAB-Identity                BIT STRING (SIZE (8)),
    ansi-41-RAB-Identity                BIT STRING (SIZE (8))
}

RAI ::=                             SEQUENCE {
    lai                                 LAI,
    rac                                 RoutingAreaCode
}

RoutingAreaCode ::=                 BIT STRING (SIZE (8))

RoutingParameter ::=                            BIT STRING (SIZE (10))

TMSI-GSM-MAP ::=                    BIT STRING (SIZE (32))

-- ***************************************************
--
--      UTRAN MOBILITY INFORMATION ELEMENTS (10.3.2)
--
-- ***************************************************

AccessClassBarred ::=               ENUMERATED {
                                        barred, notBarred }

AccessClassBarredList ::=           SEQUENCE (SIZE (maxAC)) OF
                                        AccessClassBarred
```

```
AllowedIndicator ::=                    ENUMERATED {
                                            allowed, notAllowed }

CellAccessRestriction ::=               SEQUENCE {
    cellBarred                              CellBarred,
    cellReservedForOperatorUse              ReservedIndicator,
    cellReservationExtension                ReservedIndicator,
    -- NOTE: IE accessClassBarredList should not be included if the IE CellAccessRestriction
    -- is included in the IE SysInfoType4
    accessClassBarredList                   AccessClassBarredList               OPTIONAL
}

CellBarred ::=                          CHOICE {
    barred                                  SEQUENCE {
        intraFreqCellReselectionInd             AllowedIndicator,
        t-Barred                                T-Barred
    },
    notBarred                               NULL
}

CellIdentity ::=                        BIT STRING (SIZE (28))

CellIdentity-PerRL-List ::=             SEQUENCE (SIZE (1..maxRL)) OF CellIdentity

CellSelectReselectInfoSIB-3-4 ::=       SEQUENCE {
    mappingInfo                             MappingInfo                         OPTIONAL,
    cellSelectQualityMeasure                CHOICE {
        cpich-Ec-N0                             SEQUENCE {
            -- Default value for q-HYST-2-S is q-HYST-1-S
            q-HYST-2-S                              Q-Hyst-S                    OPTIONAL
            -- Default value for q-HYST-2-S is q-HYST-1-S
        },
        cpich-RSCP                              NULL
    },
    modeSpecificInfo                        CHOICE {
        fdd                                     SEQUENCE {
            s-Intrasearch                           S-SearchQual                OPTIONAL,
            s-Intersearch                           S-SearchQual                OPTIONAL,
            s-SearchHCS                             S-SearchRXLEV               OPTIONAL,
            rat-List                                RAT-FDD-InfoList            OPTIONAL,
            q-QualMin                               Q-QualMin,
            q-RxlevMin                              Q-RxlevMin
        },
        tdd                                     SEQUENCE {
            s-Intrasearch                           S-SearchRXLEV               OPTIONAL,
            s-Intersearch                           S-SearchRXLEV               OPTIONAL,
            s-SearchHCS                             S-SearchRXLEV               OPTIONAL,
            rat-List                                RAT-TDD-InfoList            OPTIONAL,
            q-RxlevMin                              Q-RxlevMin
        }
    },
    q-Hyst-1-S                              Q-Hyst-S,
    t-Reselection-S                         T-Reselection-S,
    hcs-ServingCellInformation              HCS-ServingCellInformation          OPTIONAL,
    maxAllowedUL-TX-Power                   MaxAllowedUL-TX-Power
}

DomainSpecificAccessRestrictionForSharedNetwork-v670ext ::= CHOICE {
        domainSpecificAccessRestictionList                    DomainSpecificAccessRestrictionList-
v670ext,
        domainSpecificAccessRestictionParametersForAll       DomainSpecificAccessRestrictionParam-
v670ext
}

DomainSpecificAccessRestrictionList-v670ext ::= SEQUENCE {
        domainSpecificAccessRestrictionParametersForOperator1
                                    DomainSpecificAccessRestrictionParam-v670ext    OPTIONAL,
        domainSpecificAccessRestrictionParametersForOperator2
                                    DomainSpecificAccessRestrictionParam-v670ext    OPTIONAL,
        domainSpecificAccessRestrictionParametersForOperator3
                                    DomainSpecificAccessRestrictionParam-v670ext    OPTIONAL,
        domainSpecificAccessRestrictionParametersForOperator4
                                    DomainSpecificAccessRestrictionParam-v670ext    OPTIONAL,
        domainSpecificAccessRestrictionParametersForOperator5
                                    DomainSpecificAccessRestrictionParam-v670ext    OPTIONAL
}
```

```
DomainSpecificAccessRestrictionParam-v670ext ::= SEQUENCE {
        cSDomainSpecificAccessRestriction       DomainSpecificAccessRestriction-v670ext,
        pSDomainSpecificAccessRestriction       DomainSpecificAccessRestriction-v670ext
}

DomainSpecificAccessRestriction-v670ext ::= CHOICE {
        noRestriction       NULL,
        restriction         SEQUENCE {
            domainSpecficAccessClassBarredList      AccessClassBarredList   OPTIONAL
        }
}

MapParameter ::=                    INTEGER (0..99)

Mapping ::=                         SEQUENCE {
    rat                                 RAT,
    mappingFunctionParameterList        MappingFunctionParameterList
}

Mapping-LCR-r4 ::=                  SEQUENCE {
    mappingFunctionParameterList        MappingFunctionParameterList
}

MappingFunctionParameter ::=        SEQUENCE {
    functionType                        MappingFunctionType,
    mapParameter1                       MapParameter                    OPTIONAL,
    mapParameter2                       MapParameter,
    -- The presence of upperLimit is conditional on the number of repetition
    upperLimit                          UpperLimit                      OPTIONAL
}

MappingFunctionParameterList ::=    SEQUENCE (SIZE (1..maxMeasIntervals)) OF
                                        MappingFunctionParameter

MappingFunctionType ::=             ENUMERATED {
                                        linear,
                                        functionType2,
                                        functionType3,
                                        functionType4 }

-- In MappingInfo list, mapping for FDD and 3.84Mcps TDD is defined.
-- For 1.28Mcps TDD, Mapping-LCR-r4 is used instead.
MappingInfo ::=                     SEQUENCE (SIZE (1..maxRAT)) OF
                                        Mapping

-- Actual value Q-Hyst-S = IE value * 2
Q-Hyst-S ::=                        INTEGER (0..20)

Q-Hyst-S-Fine ::= INTEGER (0..40)

RAT ::=                             ENUMERATED {
                                        utra-FDD,
                                        utra-TDD,
                                        gsm,
                                        cdma2000 }

RAT-FDD-Info ::=                    SEQUENCE {
    rat-Identifier                      RAT-Identifier,
    s-SearchRAT                         S-SearchQual,
    s-HCS-RAT                           S-SearchRXLEV                       OPTIONAL,
    s-Limit-SearchRAT                   S-SearchQual
}

RAT-FDD-InfoList ::=                SEQUENCE (SIZE (1..maxOtherRAT)) OF
                                        RAT-FDD-Info

RAT-Identifier ::=                  ENUMERATED {
                                        gsm, cdma2000 }

RAT-TDD-Info ::=                    SEQUENCE {
    rat-Identifier                      RAT-Identifier,
    s-SearchRAT                         S-SearchRXLEV,
    s-HCS-RAT                           S-SearchRXLEV                   OPTIONAL,
    s-Limit-SearchRAT                   S-SearchRXLEV
}

RAT-TDD-InfoList ::=                SEQUENCE (SIZE (1..maxOtherRAT)) OF
                                        RAT-TDD-Info
```

```
ReservedIndicator ::=                ENUMERATED {
                                         reserved,
                                         notReserved }

-- Actual value S-SearchQual = IE value * 2
S-SearchQual ::=                         INTEGER (-16..10)

-- Actual value S-SearchRXLEV = (IE value * 2) + 1
S-SearchRXLEV ::=                        INTEGER (-53..45)

-- Actual value ScalingFactor = IE value * 0.1
SpeedDependentScalingFactor ::=      INTEGER (0..10)

T-Barred ::=                         ENUMERATED {
                                         s10, s20, s40, s80,
                                         s160, s320, s640, s1280 }

T-Reselection-S ::=                  INTEGER (0..31)

-- Actual value T-Reselection-S-Fine = IE value * 0.2
T-Reselection-S-Fine ::=             INTEGER (0..31)

-- Actual value ScalingFactor = IE value * 0.25
TreselectionScalingFactor ::=        INTEGER (4..19)

-- For UpperLimit, the used range depends on the RAT used.
UpperLimit ::=                       INTEGER (1..91)

URA-Identity ::=                     BIT STRING (SIZE (16))

URA-IdentityList ::=                 SEQUENCE (SIZE (1..maxURA)) OF
                                         URA-Identity

-- ***************************************************
--
--      USER EQUIPMENT INFORMATION ELEMENTS (10.3.3)
--
-- ***************************************************

AccessStratumReleaseIndicator ::=    ENUMERATED {
                                         rel-4, rel-5, rel-6, rel-7,
                                         spare12, spare11, spare10, spare9, spare8,
                                         spare7, spare6, spare5, spare4, spare3,
                                         spare2, spare1 }

-- TABULAR : for ActivationTime, value 'now' always appear as default, and is encoded
-- by absence of the field
ActivationTime ::=                   INTEGER (0..255)

BackoffControlParams ::=             SEQUENCE {
    n-AP-RetransMax                      N-AP-RetransMax,
    n-AccessFails                        N-AccessFails,
    nf-BO-NoAICH                         NF-BO-NoAICH,
    ns-BO-Busy                           NS-BO-Busy,
    nf-BO-AllBusy                        NF-BO-AllBusy,
    nf-BO-Mismatch                       NF-BO-Mismatch,
    t-CPCH                               T-CPCH
}

C-RNTI ::=                           BIT STRING (SIZE (16))

CapabilityUpdateRequirement ::=      SEQUENCE {
    ue-RadioCapabilityFDDUpdateRequirement  BOOLEAN,
    -- ue-RadioCapabilityTDDUpdateRequirement is for 3.84Mcps TDD update requirement
    ue-RadioCapabilityTDDUpdateRequirement  BOOLEAN,
    systemSpecificCapUpdateReqList       SystemSpecificCapUpdateReqList      OPTIONAL
}

CapabilityUpdateRequirement-r4-ext ::= SEQUENCE {
    ue-RadioCapabilityUpdateRequirement-TDD128  BOOLEAN
}

CapabilityUpdateRequirement-r4 ::=  SEQUENCE {
    ue-RadioCapabilityFDDUpdateRequirement-FDD  BOOLEAN,
    ue-RadioCapabilityTDDUpdateRequirement-TDD384   BOOLEAN,
    ue-RadioCapabilityTDDUpdateRequirement-TDD128   BOOLEAN,
    systemSpecificCapUpdateReqList       SystemSpecificCapUpdateReqList      OPTIONAL
```

```
}

CapabilityUpdateRequirement-r7-ext ::= SEQUENCE {
    ue-RadioCapabilityUpdateRequirement-TDD768  BOOLEAN
}

-- If the IE CellUpdateCause has the value 'cellUpdateCause-ext', the actual value is
-- defined in the IE CellUpdateCause-ext.
CellUpdateCause ::=                 ENUMERATED {
                                        cellReselection,
                                        periodicalCellUpdate,
                                        uplinkDataTransmission,
                                        utran-pagingResponse,
                                        re-enteredServiceArea,
                                        radiolinkFailure,
                                        rlc-unrecoverableError,
                                        cellUpdateCause-ext }

-- The IE CellUpdateCause-ext shall be present, if the IE CellUpdateCause has the
-- value 'cellUpdateCause-ext'.
CellUpdateCause-ext ::=             ENUMERATED {
                                        mbms-Reception,
                                        mbms-PTP-RB-Request, spare2, spare1 }

ChipRateCapability ::=              ENUMERATED {
                                        mcps3-84, mcps1-28 }

ChipRateCapability-r7 ::=               ENUMERATED {
                                        mcps3-84, mcps7-68, mcps1-28 }

CipheringAlgorithm ::=              ENUMERATED {
                                        uea0, uea1 }

CipheringModeCommand ::=            CHOICE {
    startRestart                            CipheringAlgorithm,
    dummy                       NULL
}

CipheringModeInfo ::=               SEQUENCE {
    -- TABULAR: The ciphering algorithm is included in the CipheringModeCommand.
    cipheringModeCommand                CipheringModeCommand,
    activationTimeForDPCH               ActivationTime                  OPTIONAL,
    rb-DL-CiphActivationTimeInfo        RB-ActivationTimeInfoList       OPTIONAL
}

CN-DRX-CycleLengthCoefficient ::=   INTEGER (6..9)

CN-PagedUE-Identity ::=             CHOICE {
    imsi-GSM-MAP                        IMSI-GSM-MAP,
    tmsi-GSM-MAP                        TMSI-GSM-MAP,
    p-TMSI-GSM-MAP                      P-TMSI-GSM-MAP,
    imsi-DS-41                          IMSI-DS-41,
    tmsi-DS-41                          TMSI-DS-41,
    spare3                              NULL,
    spare2                              NULL,
    spare1                              NULL
}

CompressedModeMeasCapability ::=    SEQUENCE {
    fdd-Measurements                    BOOLEAN,
    -- TABULAR: The IEs tdd-Measurements, gsm-Measurements and multiCarrierMeasurements
    -- are made optional since they are conditional based on another information element.
    -- Their absence corresponds to the case where the condition is not true.
    tdd-Measurements                    BOOLEAN                         OPTIONAL,
    gsm-Measurements                    GSM-Measurements                OPTIONAL,
    multiCarrierMeasurements            BOOLEAN                         OPTIONAL
}

CompressedModeMeasCapability-LCR-r4 ::= SEQUENCE {
    tdd128-Measurements                     BOOLEAN                     OPTIONAL
}

CompressedModeMeasCapabFDDList ::=  SEQUENCE (SIZE (1..maxFreqBandsFDD)) OF
                                        CompressedModeMeasCapabFDD

CompressedModeMeasCapabFDDList2 ::= SEQUENCE (SIZE (1..maxFreqBandsFDD)) OF
                                        CompressedModeMeasCapabFDD2
```

```
CompressedModeMeasCapabFDDList-ext ::= SEQUENCE (SIZE (1..maxFreqBandsFDD)) OF
                                            CompressedModeMeasCapabFDD-ext

CompressedModeMeasCapabFDD ::=      SEQUENCE {
    radioFrequencyBandFDD               RadioFrequencyBandFDD   OPTIONAL,
    dl-MeasurementsFDD                  BOOLEAN,
    ul-MeasurementsFDD                  BOOLEAN
}

CompressedModeMeasCapabFDD2 ::=     SEQUENCE {
    -- UE may omit both IEs if this IE indicates the compressed mode capability within the same
    -- frequency band. Otherwise, the UE shall include either one of the following OPTIONAL IEs.
    radioFrequencyBandFDD               RadioFrequencyBandFDD   OPTIONAL,
    radioFrequencyBandFDD2              RadioFrequencyBandFDD2  OPTIONAL,
    dl-MeasurementsFDD                  BOOLEAN,
    ul-MeasurementsFDD                  BOOLEAN
}

CompressedModeMeasCapabFDD-ext ::=      SEQUENCE {
    radioFrequencyBandFDD2              RadioFrequencyBandFDD2,
    dl-MeasurementsFDD                  BOOLEAN,
    ul-MeasurementsFDD                  BOOLEAN
}

CompressedModeMeasCapabTDDList ::=  SEQUENCE (SIZE (1..maxFreqBandsTDD)) OF
                                        CompressedModeMeasCapabTDD

CompressedModeMeasCapabTDD ::=      SEQUENCE {
    radioFrequencyBandTDD               RadioFrequencyBandTDD,
    dl-MeasurementsTDD                  BOOLEAN,
    ul-MeasurementsTDD                  BOOLEAN
}

CompressedModeMeasCapabGSMList ::=  SEQUENCE (SIZE (1..maxFreqBandsGSM)) OF
                                        CompressedModeMeasCapabGSM

CompressedModeMeasCapabGSM ::=      SEQUENCE {
    radioFrequencyBandGSM               RadioFrequencyBandGSM,
    dl-MeasurementsGSM                  BOOLEAN,
    ul-MeasurementsGSM                  BOOLEAN
}

CompressedModeMeasCapabMC ::=       SEQUENCE {
    dl-MeasurementsMC                   BOOLEAN,
    ul-MeasurementsMC                   BOOLEAN
}

CPCH-Parameters ::=                 SEQUENCE {
    initialPriorityDelayList            InitialPriorityDelayList            OPTIONAL,
    backoffControlParams                BackoffControlParams,
    -- TABULAR: TPC step size nested inside PowerControlAlgorithm
    powerControlAlgorithm               PowerControlAlgorithm,
    dl-DPCCH-BER                        DL-DPCCH-BER
}

DL-CapabilityWithSimultaneousHS-DSCHConfig ::=  ENUMERATED{kbps32, kbps64, kbps128, kbps384}

DL-DPCCH-BER ::=                    INTEGER (0..63)

DL-PhysChCapabilityFDD ::=          SEQUENCE {
    -- The IE "maxNoDPCH-PDSCH-Codes" only gives information on the maximum number of DPCH Codes.
    maxNoDPCH-PDSCH-Codes               INTEGER (1..8),
    maxNoPhysChBitsReceived             MaxNoPhysChBitsReceived,
    supportForSF-512                    BOOLEAN,
    -- dummy and dummy2 are not used in this version of the specification, they should not be sent
    -- and if received they should be ignored.
    dummy                               BOOLEAN,
    dummy2                              SimultaneousSCCPCH-DPCH-Reception
}

DL-PhysChCapabilityFDD-v380ext ::=          SEQUENCE {
    -- dummy is not used in this version of the specification, it should
    -- not be sent and if received it should be ignored.
    dummy                                       SupportOfDedicatedPilotsForChEstimation     OPTIONAL
}

SupportOfDedicatedPilotsForChEstimation ::=         ENUMERATED { true }
```

```
DL-PhysChCapabilityTDD ::=              SEQUENCE {
    maxTS-PerFrame                          MaxTS-PerFrame,
    maxPhysChPerFrame                       MaxPhysChPerFrame,
    minimumSF                               MinimumSF-DL,
    supportOfPDSCH                          BOOLEAN,
    maxPhysChPerTS                          MaxPhysChPerTS
}

DL-PhysChCapabilityTDD-LCR-r4 ::=       SEQUENCE {
    maxTS-PerSubFrame                       MaxTS-PerSubFrame-r4,
    maxPhysChPerFrame                       MaxPhysChPerSubFrame-r4,
    minimumSF                               MinimumSF-DL,
    supportOfPDSCH                          BOOLEAN,
    maxPhysChPerTS                          MaxPhysChPerTS,
    supportOf8PSK                           BOOLEAN
}

DL-PhysChCapabilityTDD-768 ::=          SEQUENCE {
    maxTS-PerFrame                          MaxTS-PerFrame,
    maxPhysChPerFrame                       MaxPhysChPerFrame-768,
    minimumSF                               MinimumSF-DL-768,
    supportOfPDSCH                          BOOLEAN,
    maxPhysChPerTS                          MaxPhysChPerTS-768
}

DL-TransChCapability ::=                SEQUENCE {
    maxNoBitsReceived                       MaxNoBits,
    maxConvCodeBitsReceived                 MaxNoBits,
    turboDecodingSupport                    TurboSupport,
    maxSimultaneousTransChs                 MaxSimultaneousTransChsDL,
    maxSimultaneousCCTrCH-Count             MaxSimultaneousCCTrCH-Count,
    maxReceivedTransportBlocks              MaxTransportBlocksDL,
    maxNumberOfTFC                          MaxNumberOfTFC-DL,
    maxNumberOfTF                           MaxNumberOfTF
}

DRAC-SysInfo ::=                        SEQUENCE {
    transmissionProbability                 TransmissionProbability,
    maximumBitRate                          MaximumBitRate
}

DRAC-SysInfoList ::=                    SEQUENCE (SIZE (1..maxDRACclasses)) OF
                                            DRAC-SysInfo

DSCH-RNTI ::=                           BIT STRING (SIZE (16))

DelayRestrictionFlag ::=                ENUMERATED { true }

E-RNTI ::=                              BIT STRING (SIZE (16))

ESN-DS-41 ::=                           BIT STRING (SIZE (32))

EstablishmentCause ::=                  ENUMERATED {
                                            originatingConversationalCall,
                                            originatingStreamingCall,
                                            originatingInteractiveCall,
                                            originatingBackgroundCall,
                                            originatingSubscribedTrafficCall,
                                            terminatingConversationalCall,
                                            terminatingStreamingCall,
                                            terminatingInteractiveCall,
                                            terminatingBackgroundCall,
                                            emergencyCall,
                                            interRAT-CellReselection,
                                            interRAT-CellChangeOrder,
                                            registration,
                                            detach,
                                            originatingHighPrioritySignalling,
                                            originatingLowPrioritySignalling,
                                            callRe-establishment,
                                            terminatingHighPrioritySignalling,
                                            terminatingLowPrioritySignalling,
                                            terminatingCauseUnknown,
                                            mbms-Reception,
                                            mbms-PTP-RB-Request,
                                            spare10,
                                            spare9,
                                            spare8,
```

```
                                        spare7,
                                        spare6,
                                        spare5,
                                        spare4,
                                        spare3,
                                        spare2,
                                        spare1 }

FailureCauseWithProtErr ::=          CHOICE {
    configurationUnsupported            NULL,
    physicalChannelFailure              NULL,
    incompatibleSimultaneousReconfiguration
                                        NULL,
    compressedModeRuntimeError          TGPSI,
    protocolError                       ProtocolErrorInformation,
    cellUpdateOccurred                  NULL,
    invalidConfiguration                NULL,
    configurationIncomplete             NULL,
    unsupportedMeasurement              NULL,
    mbmsSessionAlreadyReceivedCorrectly NULL,
    lowerPriorityMBMSService            NULL,
    spare5                              NULL,
    spare4                              NULL,
    spare3                              NULL,
    spare2                              NULL,
    spare1                              NULL
}

FailureCauseWithProtErrTrId ::=      SEQUENCE {
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        failureCause                    FailureCauseWithProtErr
}

GroupIdentityWithReleaseInformation ::=      SEQUENCE {
        rrc-ConnectionReleaseInformation        RRC-ConnectionReleaseInformation,
        groupReleaseInformation                 GroupReleaseInformation
    }

GroupReleaseInformation ::=          SEQUENCE {
    uRNTI-Group                         U-RNTI-Group
}

GSM-Measurements ::=                 SEQUENCE {
    gsm900                              BOOLEAN,
    dcs1800                             BOOLEAN,
    gsm1900                             BOOLEAN
}

H-RNTI ::=                           BIT STRING (SIZE (16))

HSDSCH-physical-layer-category ::=      INTEGER (1..64)

UESpecificBehaviourInformation1idle ::= BIT STRING (SIZE (4))

UESpecificBehaviourInformation1interRAT ::= BIT STRING (SIZE (8))


IMSI-and-ESN-DS-41 ::=               SEQUENCE {
    imsi-DS-41                          IMSI-DS-41,
    esn-DS-41                           ESN-DS-41
}

IMSI-DS-41 ::=                       OCTET STRING (SIZE (5..7))

InitialPriorityDelayList ::=         SEQUENCE (SIZE (1..maxASC)) OF
                                        NS-IP

InitialUE-Identity ::=               CHOICE {
    imsi                                IMSI-GSM-MAP,
    tmsi-and-LAI                        TMSI-and-LAI-GSM-MAP,
    p-TMSI-and-RAI                      P-TMSI-and-RAI-GSM-MAP,
    imei                                IMEI,
    esn-DS-41                           ESN-DS-41,
    imsi-DS-41                          IMSI-DS-41,
    imsi-and-ESN-DS-41                  IMSI-and-ESN-DS-41,
    tmsi-DS-41                          TMSI-DS-41
}
```

```
IntegrityCheckInfo ::=                  SEQUENCE {
    messageAuthenticationCode               MessageAuthenticationCode,
    rrc-MessageSequenceNumber               RRC-MessageSequenceNumber
}

IntegrityProtActivationInfo ::=         SEQUENCE {
    rrc-MessageSequenceNumberList           RRC-MessageSequenceNumberList
}

IntegrityProtectionAlgorithm ::=        ENUMERATED {
                                            uia1 }


IntegrityProtectionModeCommand ::=      CHOICE {
    startIntegrityProtection                SEQUENCE {
        integrityProtInitNumber                 IntegrityProtInitNumber
    },
    modify                                  SEQUENCE {
        dl-IntegrityProtActivationInfo          IntegrityProtActivationInfo
    }
}

IntegrityProtectionModeInfo ::=         SEQUENCE {
    -- TABULAR: DL integrity protection activation info and Integrity
    -- protection intialisation number have been nested inside
    -- IntegrityProtectionModeCommand.
    integrityProtectionModeCommand          IntegrityProtectionModeCommand,
    integrityProtectionAlgorithm            IntegrityProtectionAlgorithm        OPTIONAL
}

IntegrityProtInitNumber ::=             BIT STRING (SIZE (32))

-- dummy is not used in this version of the specification, it should
-- not be sent and if received it should be ignored.
MaxHcContextSpace ::=                       ENUMERATED  {
                                                dummy, by1024, by2048, by4096,
                                                by8192 }

MaxHcContextSpace-r5-ext ::=                ENUMERATED  {
                                                by16384, by32768, by65536, by131072 }


MaxROHC-ContextSessions-r4 ::=          ENUMERATED  {
                                                s2, s4, s8, s12, s16, s24, s32, s48,
                                                s64, s128, s256, s512, s1024, s16384 }
MaximumAM-EntityNumberRLC-Cap ::=       ENUMERATED {
                                                dummy, am4, am5, am6,
                                            am8, am16, am30 }

-- Actual value MaximumBitRate = IE value * 16
MaximumBitRate ::=                      INTEGER (0..32)

MaximumRLC-WindowSize ::=               ENUMERATED { mws2047, mws4095 }

MaxNoDPDCH-BitsTransmitted ::=          ENUMERATED {
                                            b600, b1200, b2400, b4800,
                                            b9600, b19200, b28800, b38400,
                                            b48000, b57600 }

MaxNoBits ::=                           ENUMERATED {
                                            b640, b1280, b2560, b3840, b5120,
                                            b6400, b7680, b8960, b10240,
                                            b20480, b40960, b81920, b163840 }

MaxNoPhysChBitsReceived ::=             ENUMERATED {
                                            dummy, b1200, b2400, b3600,
                                            b4800, b7200, b9600, b14400,
                                            b19200, b28800, b38400, b48000,
                                            b57600, b67200, b76800 }

MaxNoSCCPCH-RL ::=                      ENUMERATED {
                                            rl1 }

MaxNumberOfTF ::=                       ENUMERATED {
                                            tf32, tf64, tf128, tf256,
                                            tf512, tf1024 }

MaxNumberOfTFC-DL ::=                   ENUMERATED {
```

```
                                                tfc16, tfc32, tfc48, tfc64, tfc96,
                                                tfc128, tfc256, tfc512, tfc1024 }

MaxNumberOfTFC-UL ::=                   ENUMERATED {
                                            dummy1, dummy2, tfc16, tfc32, tfc48, tfc64,
                                            tfc96, tfc128, tfc256, tfc512, tfc1024 }

-- the values 1 …4 for MaxPhysChPerFrame are not used in this version of the protocol
MaxPhysChPerFrame ::=                   INTEGER (1..224)

MaxPhysChPerFrame-768 ::=               INTEGER (1..448)

MaxPhysChPerSubFrame-r4 ::=             INTEGER (1..96)

MaxPhysChPerTimeslot ::=                ENUMERATED {
                                            ts1, ts2 }

-- the values 1 …4 for MaxPhysChPerTS are not used in this version of the protocol
MaxPhysChPerTS ::=                      INTEGER (1..16)

MaxPhysChPerTS-768 ::=                  INTEGER (1..32)

MaxSimultaneousCCTrCH-Count ::=         INTEGER (1..8)

MaxSimultaneousTransChsDL ::=           ENUMERATED {
                                            e4, e8, e16, e32 }

MaxSimultaneousTransChsUL ::=           ENUMERATED {
                                            dummy, e4, e8, e16, e32 }

MaxTransportBlocksDL ::=                ENUMERATED {
                                            tb4, tb8, tb16, tb32, tb48,
                                            tb64, tb96, tb128, tb256, tb512 }

MaxTransportBlocksUL ::=                ENUMERATED {
                                            dummy, tb4, tb8, tb16, tb32, tb48,
                                            tb64, tb96, tb128, tb256, tb512 }

MaxTS-PerFrame ::=                      INTEGER (1..14)

MaxTS-PerSubFrame-r4 ::=                INTEGER (1..6)

-- TABULAR: MeasurementCapability contains dependencies to UE-MultiModeRAT-Capability,
-- the conditional fields have been left mandatory for now.
MeasurementCapability ::=               SEQUENCE {
    downlinkCompressedMode                  CompressedModeMeasCapability,
    uplinkCompressedMode                    CompressedModeMeasCapability
}

MeasurementCapabilityExt ::=            SEQUENCE{
    compressedModeMeasCapabFDDList          CompressedModeMeasCapabFDDList,
    compressedModeMeasCapabTDDList          CompressedModeMeasCapabTDDList  OPTIONAL,
    compressedModeMeasCapabGSMList          CompressedModeMeasCapabGSMList  OPTIONAL,
    compressedModeMeasCapabMC               CompressedModeMeasCapabMC       OPTIONAL
}

MeasurementCapabilityExt2 ::=           SEQUENCE{
    compressedModeMeasCapabFDDList          CompressedModeMeasCapabFDDList2,
    compressedModeMeasCapabTDDList          CompressedModeMeasCapabTDDList  OPTIONAL,
    compressedModeMeasCapabGSMList          CompressedModeMeasCapabGSMList  OPTIONAL,
    compressedModeMeasCapabMC               CompressedModeMeasCapabMC       OPTIONAL
}


MeasurementCapability-r4-ext ::=        SEQUENCE {
    downlinkCompressedMode-LCR              CompressedModeMeasCapability-LCR-r4,
    uplinkCompressedMode-LCR                CompressedModeMeasCapability-LCR-r4
}

MessageAuthenticationCode ::=           BIT STRING (SIZE (32))

MinimumSF-DL ::=                        ENUMERATED {
                                            sf1, sf16 }

MinimumSF-DL-768 ::=                    ENUMERATED {
                                            sf1, sf32 }

MinimumSF-UL ::=                        ENUMERATED {
```

```
                                  sf1, sf2, sf4, sf8, dummy }

MultiModeCapability ::=           ENUMERATED {
                                      tdd, fdd, fdd-tdd }

MultiRAT-Capability ::=           SEQUENCE {
    supportOfGSM                      BOOLEAN,
    supportOfMulticarrier             BOOLEAN
}

MultiModeRAT-Capability-v590ext ::= SEQUENCE {
    supportOfUTRAN-ToGERAN-NACC       BOOLEAN
}

MultiModeRAT-Capability-v680ext ::= SEQUENCE {
    supportOfHandoverToGAN            ENUMERATED { doesSupportHandoverToGAN }      OPTIONAL
}

N-300 ::=                         INTEGER (0..7)

N-301 ::=                         INTEGER (0..7)

N-302 ::=                         INTEGER (0..7)

N-304 ::=                         INTEGER (0..7)

N-308 ::=                         INTEGER (1..8)

N-310 ::=                         INTEGER (0..7)

N-312 ::=                         ENUMERATED {
                                      s1, s50, s100, s200, s400,
                                      s600, s800, s1000 }

N-312ext ::=                      ENUMERATED {
                                      s2, s4, s10, s20 }

N-312-r5 ::=                          ENUMERATED {
                                      s1, s2, s4, s10, s20,
                                      s50, s100, s200, s400,
                                      s600, s800, s1000 }

N-313 ::=                         ENUMERATED {
                                      s1, s2, s4, s10, s20,
                                       s50, s100, s200 }

N-315 ::=                         ENUMERATED {
                                      s1, s50, s100, s200, s400,
                                      s600, s800, s1000 }

N-315ext ::=                      ENUMERATED {
                                      s2, s4, s10, s20 }

N-315-r5 ::=                          ENUMERATED {
                                      s1, s2, s4, s10, s20,
                                      s50, s100, s200, s400,
                                      s600, s800, s1000 }


N-AccessFails ::=                 INTEGER (1..64)

N-AP-RetransMax ::=               INTEGER (1..64)

NetworkAssistedGPS-Supported ::=  ENUMERATED {
                                      networkBased,
                                      ue-Based,
                                      bothNetworkAndUE-Based,
                                      noNetworkAssistedGPS }

NF-BO-AllBusy ::=                 INTEGER (0..31)

NF-BO-NoAICH ::=                  INTEGER (0..31)

NF-BO-Mismatch ::=                INTEGER (0..127)

NS-BO-Busy ::=                    INTEGER (0..63)

NS-IP ::=                         INTEGER (0..28)
```

```
P-TMSI-and-RAI-GSM-MAP ::=          SEQUENCE {
    p-TMSI                              P-TMSI-GSM-MAP,
    rai                                 RAI
}

PagingCause ::=                     ENUMERATED {
                                        terminatingConversationalCall,
                                        terminatingStreamingCall,
                                        terminatingInteractiveCall,
                                        terminatingBackgroundCall,
                                        terminatingHighPrioritySignalling,
                                        terminatingLowPrioritySignalling,
                                        terminatingCauseUnknown,
                                        spare
 }

PagingRecord ::=                    CHOICE {
    cn-Identity                         SEQUENCE {
        pagingCause                         PagingCause,
        cn-DomainIdentity                   CN-DomainIdentity,
        cn-pagedUE-Identity                 CN-PagedUE-Identity
    },
    utran-Identity                      SEQUENCE {
        u-RNTI                              U-RNTI,
        cn-OriginatedPage-connectedMode-UE  SEQUENCE {
            pagingCause                         PagingCause,
            cn-DomainIdentity                   CN-DomainIdentity,
            pagingRecordTypeID                  PagingRecordTypeID
        }                                                                   OPTIONAL
    }
}

PagingRecord2-r5 ::=                CHOICE {
    utran-SingleUE-Identity             SEQUENCE {
        u-RNTI                              U-RNTI,
        cn-OriginatedPage-connectedMode-UE  SEQUENCE {
            pagingCause                         PagingCause,
            cn-DomainIdentity                   CN-DomainIdentity,
            pagingRecordTypeID                  PagingRecordTypeID
        }                                                                   OPTIONAL,
        rrc-ConnectionReleaseInformation    RRC-ConnectionReleaseInformation
    },
    utran-GroupIdentity                 SEQUENCE ( SIZE (1 .. maxURNTI-Group) ) OF
                                            GroupIdentityWithReleaseInformation
}

PagingRecordList ::=                SEQUENCE (SIZE (1..maxPage1)) OF
                                        PagingRecord

PagingRecord2List-r5 ::=            SEQUENCE (SIZE (1..maxPage1)) OF
                                        PagingRecord2-r5

PDCP-Capability ::=                 SEQUENCE {
    losslessSRNS-RelocationSupport      BOOLEAN,
    -- If present, the "maxHcContextSpace" in the IE "PDCP-Capability-r5-ext" overrides the
    -- "supported" value in this IE. The value in this IE may be used by a pre-REL-5 UTRAN.
    supportForRfc2507                   CHOICE {
        notSupported                        NULL,
        supported                           MaxHcContextSpace
    }
}

PDCP-Capability-r4-ext ::=          SEQUENCE {
    supportForRfc3095               CHOICE {
        notSupported                        NULL,
        supported                           SEQUENCE {
            maxROHC-ContextSessions             MaxROHC-ContextSessions-r4  DEFAULT s16,
            reverseCompressionDepth             INTEGER (0..65535)          DEFAULT 0
        }
    }
}

PDCP-Capability-r5-ext ::=          SEQUENCE {
    supportForRfc3095ContextRelocation      BOOLEAN,
    maxHcContextSpace                       MaxHcContextSpace-r5-ext    OPTIONAL
}
```

```
PDCP-Capability-r5-ext2 ::=          SEQUENCE {
    losslessDLRLC-PDUSizeChange          ENUMERATED { true }                    OPTIONAL
}

PhysicalChannelCapability ::=        SEQUENCE {
        fddPhysChCapability                  SEQUENCE {
            downlinkPhysChCapability             DL-PhysChCapabilityFDD,
            uplinkPhysChCapability               UL-PhysChCapabilityFDD
        }                                            OPTIONAL,
        -- tddPhysChCapability describes the 3.84Mcps TDD physical channel capability
        tddPhysChCapability                  SEQUENCE {
            downlinkPhysChCapability             DL-PhysChCapabilityTDD,
            uplinkPhysChCapability               UL-PhysChCapabilityTDD
        }                                            OPTIONAL
}

PhysicalChannelCapability-r7 ::=         SEQUENCE {
        fddPhysChCapability                  SEQUENCE {
            downlinkPhysChCapability             DL-PhysChCapabilityFDD,
            uplinkPhysChCapability               UL-PhysChCapabilityFDD
        }                                            OPTIONAL,
        -- tddPhysChCapability describes the 3.84Mcps TDD physical channel capability
        tddPhysChCapability                  SEQUENCE {
            downlinkPhysChCapability             DL-PhysChCapabilityTDD,
            uplinkPhysChCapability               UL-PhysChCapabilityTDD
        }                                            OPTIONAL,
        -- tddPhysicalChaCapability-768 describes the 7.68 TDD physical channel capability
        tddPhysChCapability-768              SEQUENCE {
            downlinkPhysChCapability             DL-PhysChCapabilityTDD-768,
            uplinkPhysChCapability               UL-PhysChCapabilityTDD
        }
}

-- PhysicalChannelCapability-LCR-r4 describes the 1.28Mcps TDD physical channel capability
PhysicalChannelCapability-LCR-r4 ::=         SEQUENCE {
        tdd128-PhysChCapability                  SEQUENCE {
            downlinkPhysChCapability             DL-PhysChCapabilityTDD-LCR-r4,
            uplinkPhysChCapability               UL-PhysChCapabilityTDD-LCR-r4
        }                                            OPTIONAL
}

-- PhysicalChannelCapability-hspdsch-r5 describes the HS-PDSCH physical channel capability
PhysicalChannelCapability-hspdsch-r5 ::=         SEQUENCE {
    fdd-hspdsch                                      CHOICE {
        supported                                        SEQUENCE {
            hsdsch-physical-layer-category                   HSDSCH-physical-layer-category,
            -- dummy and dummy2 are not used in this version of the specification, they should not
            -- be sent and if received they should be ignored.
            dummy                                            BOOLEAN,
            dummy2                                           BOOLEAN
        },
        unsupported                                      NULL
    },
    tdd384-hspdsch                                   CHOICE {
        supported                                        HSDSCH-physical-layer-category,
        unsupported                                      NULL
    },
    tdd128-hspdsch                                   CHOICE {
        supported                                        HSDSCH-physical-layer-category,
        unsupported                                      NULL
    }
}

PNBSCH-Allocation-r4 ::=                 SEQUENCE {
        numberOfRepetitionsPerSFNPeriod ENUMERATED {
                                             c2, c3, c4, c5, c6, c7, c8, c9, c10,
                                             c12, c14, c16, c18, c20, c24, c28, c32,
                                             c36, c40, c48, c56, c64, c72, c80  }
}

ProtocolErrorCause ::=               ENUMERATED {
                                         asn1-ViolationOrEncodingError,
                                         messageTypeNonexistent,
                                         messageNotCompatibleWithReceiverState,
                                         ie-ValueNotComprehended,
                                         informationElementMissing,
                                         messageExtensionNotComprehended,
                                         spare2, spare1 }
```

```
ProtocolErrorIndicator ::=          ENUMERATED {
                                        noError, errorOccurred }

ProtocolErrorIndicatorWithMoreInfo ::=
                                    CHOICE {
    noError                             NULL,
    errorOccurred                       SEQUENCE {
        rrc-TransactionIdentifier           RRC-TransactionIdentifier,
        protocolErrorInformation            ProtocolErrorInformation
    }
}

ProtocolErrorMoreInformation ::=    SEQUENCE {
    diagnosticsType                     CHOICE {
        type1                               CHOICE {
            asn1-ViolationOrEncodingError       NULL,
            messageTypeNonexistent              NULL,
            messageNotCompatibleWithReceiverState
                                                IdentificationOfReceivedMessage,
            ie-ValueNotComprehended             IdentificationOfReceivedMessage,
            conditionalInformationElementError  IdentificationOfReceivedMessage,
            messageExtensionNotComprehended     IdentificationOfReceivedMessage,
            spare1                              NULL,
            spare2                              NULL
        },
        spare                               NULL
    }
}

RadioFrequencyBandFDD ::=           ENUMERATED {
    -- fdd2100, fdd1900, fdd1800 correspond to Band I, Band II and Band III respectively
                                        fdd2100,
                                        fdd1900,
                                        fdd1800,
                                        bandVI,
                                        bandIV,
                                        bandV,
                                        bandVII,
                                        extension-indicator }

RadioFrequencyBandFDD2 ::=          ENUMERATED {
                                        bandVIII,
                                        bandIX,
                                        bandX,
                                        bandXI,
                                        bandXII,
                                        bandXIII,
                                        bandXIV,
                                        bandXV,
                                        bandXVI,
                                        bandXVII,
                                        bandXVIII,
                                        bandXIX,
                                        bandXX,
                                        bandXXI,
                                        bandXXII,
                                        extension-indicator }

RadioFrequencyBandTDDList ::=       ENUMERATED {
                                        a, b, c, ab, ac, bc, abc, spare }

RadioFrequencyBandTDD ::=           ENUMERATED {a, b, c, spare}

RadioFrequencyBandGSM ::=           ENUMERATED {
                                        gsm450,
                                        gsm480,
                                        gsm850,
                                        gsm900P,
                                        gsm900E,
                                        gsm1800,
                                        gsm1900,
                                        spare9, spare8, spare7, spare6, spare5,
                                        spare4, spare3, spare2, spare1}

Rb-timer-indicator ::=              SEQUENCE {
    t314-expired                        BOOLEAN,
    t315-expired                        BOOLEAN }
```

```
Re-EstablishmentTimer ::=          ENUMERATED {
                                       useT314, useT315
}

RedirectionInfo ::=                CHOICE {
    frequencyInfo                      FrequencyInfo,
    interRATInfo                       InterRATInfo
}

RedirectionInfo-r6 ::=             CHOICE {
    frequencyInfo                      FrequencyInfo,
    interRATInfo                       InterRATInfo-r6
}

RejectionCause ::=                 ENUMERATED {
                                       congestion,
                                       unspecified }

ReleaseCause ::=                   ENUMERATED {
                                       normalEvent,
                                       unspecified,
                                       pre-emptiveRelease,
                                       congestion,
                                       re-establishmentReject,
                                       directedsignallingconnectionre-establishment,
                                       userInactivity,
                                       spare }

RF-Capability ::=                  SEQUENCE {
        fddRF-Capability               SEQUENCE {
            ue-PowerClass                  UE-PowerClass,
            txRxFrequencySeparation        TxRxFrequencySeparation
        }                                  OPTIONAL,
        tddRF-Capability                           SEQUENCE {
            ue-PowerClass              UE-PowerClass,
            radioFrequencyTDDBandList  RadioFrequencyBandTDDList,
            chipRateCapability         ChipRateCapability
        }                                  OPTIONAL
}

RF-Capability-r4-ext ::=               SEQUENCE {
        tddRF-Capability                           SEQUENCE {
            ue-PowerClass              UE-PowerClass,
            radioFrequencyBandTDDList  RadioFrequencyBandTDDList,
            chipRateCapability         ChipRateCapability
        }                                  OPTIONAL
}

RF-Capability-r7 ::=               SEQUENCE {
        fddRF-Capability               SEQUENCE {
            ue-PowerClass                  UE-PowerClass,
            txRxFrequencySeparation        TxRxFrequencySeparation
        }                                  OPTIONAL,
        tddRF-Capability               SEQUENCE {
            ue-PowerClass                  UE-PowerClass,
            radioFrequencyTDDBandList      RadioFrequencyBandTDDList,
            chipRateCapability             ChipRateCapability-r7
        }   OPTIONAL
}

RLC-Capability ::=                 SEQUENCE {
    -- If present, the "totalRLC-AM-BufferSize" in the IE "RLC-Capability-r5-ext" overrides the
    -- corresponding value in this IE. The value in this IE may be used by a pre-REL-5 UTRAN.
    totalRLC-AM-BufferSize             TotalRLC-AM-BufferSize,
    maximumRLC-WindowSize              MaximumRLC-WindowSize,
    maximumAM-EntityNumber             MaximumAM-EntityNumberRLC-Cap
}

RLC-Capability-r5-ext ::=              SEQUENCE {
    totalRLC-AM-BufferSize             TotalRLC-AM-BufferSize-r5-ext       OPTIONAL
}

RRC-ConnectionReleaseInformation ::=   CHOICE {
    noRelease                              NULL,
    release                                SEQUENCE {
        releaseCause                           ReleaseCause
    }
```

```
}

RRC-MessageSequenceNumber ::=       INTEGER (0..15)


RRC-MessageSequenceNumberList ::=   SEQUENCE (SIZE (4..5)) OF
                                        RRC-MessageSequenceNumber

RRC-StateIndicator ::=              ENUMERATED {
                                        cell-DCH, cell-FACH, cell-PCH, ura-PCH }

RRC-TransactionIdentifier ::=       INTEGER (0..3)

S-RNTI ::=                          BIT STRING (SIZE (20))

S-RNTI-2 ::=                        BIT STRING (SIZE (10))

SecurityCapability ::=              SEQUENCE {
    cipheringAlgorithmCap               BIT STRING {
                                        -- For each bit value "0" means false/ not supported
                                            spare15(0),
                                            spare14(1),
                                            spare13(2),
                                            spare12(3),
                                            spare11(4),
                                            spare10(5),
                                            spare9(6),
                                            spare8(7),
                                            spare7(8),
                                            spare6(9),
                                            spare5(10),
                                            spare4(11),
                                            spare3(12),
                                            spare2(13),
                                            uea1(14),
                                            uea0(15)
                                            }   (SIZE (16)),
    integrityProtectionAlgorithmCap     BIT STRING {
                                        -- For each bit value "0" means false/ not supported
                                            spare15(0),
                                            spare14(1),
                                            spare13(2),
                                            spare12(3),
                                            spare11(4),
                                            spare10(5),
                                            spare9(6),
                                            spare8(7),
                                            spare7(8),
                                            spare6(9),
                                            spare5(10),
                                            spare4(11),
                                            spare3(12),
                                            spare2(13),
                                            uia1(14),
                                            spare0(15)
                                            }   (SIZE (16))
}

Serving-HSDSCH-CellInformation ::=      SEQUENCE {
    deltaACK                        DeltaACK                    OPTIONAL,
    deltaNACK                       DeltaNACK                   OPTIONAL,
    harq-Preamble-Mode              HARQ-Preamble-Mode,
    primaryCPICH-Info               PrimaryCPICH-Info           OPTIONAL,
    dl-hspdsch-Information          DL-HSPDSCH-Information      OPTIONAL,
    harqInfo                        HARQ-Info                   OPTIONAL,
    mac-hsResetIndicator            ENUMERATED { true }         OPTIONAL
}

SimultaneousSCCPCH-DPCH-Reception ::= CHOICE {
    notSupported                        NULL,
    supported                           SEQUENCE {
        maxNoSCCPCH-RL                      MaxNoSCCPCH-RL,
        -- simultaneousSCCPCH-DPCH-DPDCH-Reception is applicable only if
        -- the IE Support of PDSCH = TRUE
        -- Note: the reference to DPDCH in the element name below is incorrect (see tabular). The
        -- name is not changed, to keep it aligned with R99.
        simultaneousSCCPCH-DPCH-DPDCH-Reception     BOOLEAN
    }
```

```
}

SRNC-Identity ::=                BIT STRING (SIZE (12))


START-Value ::=                  BIT STRING (SIZE (20))

STARTList ::=                    SEQUENCE (SIZE (1..maxCNdomains)) OF
                                     STARTSingle

STARTSingle ::=                  SEQUENCE {
    cn-DomainIdentity                CN-DomainIdentity,
    start-Value                      START-Value
}

CapabilityUpdateRequirement-r5 ::= SEQUENCE {
    ue-RadioCapabilityFDDUpdateRequirement-FDD  BOOLEAN,
    ue-RadioCapabilityTDDUpdateRequirement-TDD384    BOOLEAN,
    ue-RadioCapabilityTDDUpdateRequirement-TDD128    BOOLEAN,
    systemSpecificCapUpdateReqList       SystemSpecificCapUpdateReqList-r5        OPTIONAL
}

SystemSpecificCapUpdateReq ::=   ENUMERATED {
                                     gsm }

SystemSpecificCapUpdateReq-v590ext ::=       ENUMERATED {
                                     geranIu }

SystemSpecificCapUpdateReq-r5 ::=        ENUMERATED {
                                     gsm, geranIu }

SystemSpecificCapUpdateReqList ::= SEQUENCE (SIZE (1..maxSystemCapability)) OF
                                     SystemSpecificCapUpdateReq

SystemSpecificCapUpdateReqList-r5 ::= SEQUENCE (SIZE (1..maxSystemCapability)) OF
                                     SystemSpecificCapUpdateReq-r5

T-300 ::=                        ENUMERATED {
                                     ms100, ms200, ms400, ms600, ms800,
                                     ms1000, ms1200, ms1400, ms1600,
                                     ms1800, ms2000, ms3000, ms4000,
                                     ms6000, ms8000 }

T-301 ::=                        ENUMERATED {
                                     ms100, ms200, ms400, ms600, ms800,
                                     ms1000, ms1200, ms1400, ms1600,
                                     ms1800, ms2000, ms3000, ms4000,
                                     ms6000, ms8000, spare }

T-302 ::=                        ENUMERATED {
                                     ms100, ms200, ms400, ms600, ms800,
                                     ms1000, ms1200, ms1400, ms1600,
                                     ms1800, ms2000, ms3000, ms4000,
                                     ms6000, ms8000, spare }

T-304 ::=                        ENUMERATED {
                                     ms100, ms200, ms400,
                                     ms1000, ms2000, spare3, spare2, spare1 }

T-305 ::=                        ENUMERATED {
                                     noUpdate, m5, m10, m30,
                                     m60, m120, m360, m720 }

T-307 ::=                        ENUMERATED {
                                     s5, s10, s15, s20,
                                     s30, s40, s50, spare }

T-308 ::=                        ENUMERATED {
                                     ms40, ms80, ms160, ms320 }

T-309 ::=                        INTEGER (1..8)
T-310 ::=                        ENUMERATED {
                                     ms40, ms80, ms120, ms160,
                                     ms200, ms240, ms280, ms320 }

T-311 ::=                        ENUMERATED {
                                     ms250, ms500, ms750, ms1000,
                                     ms1250, ms1500, ms1750, ms2000 }
```

```
-- The value 0 for T-312 is not used in this version of the specification
T-312 ::=                          INTEGER (0..15)

T-313 ::=                          INTEGER (0..15)

T-314 ::=                          ENUMERATED {
                                       s0, s2, s4, s6, s8,
                                       s12, s16, s20 }

T-315 ::=                          ENUMERATED {
                                       s0, s10, s30, s60, s180,
                                       s600, s1200, s1800 }

T-316 ::=                          ENUMERATED {
                                       s0, s10, s20, s30, s40,
                                       s50, s-inf, spare }

-- All the values are changed to "infinity" in Rel-5
T-317 ::=                          ENUMERATED {
                                       infinity0,  infinity1,  infinity2, infinity3, infinity4,
                                       infinity5, infinity6, infinity7}

T-318 ::=                          ENUMERATED {
                                       ms250, ms500, ms750, ms1000, ms1250, ms1500,
                                       ms1750, ms2000, ms3000, ms4000, ms6000, ms8000,
                                       ms10000, ms12000, ms16000 }

T-CPCH ::=                         ENUMERATED {
                                       ct0, ct1 }

TMSI-and-LAI-GSM-MAP ::=           SEQUENCE {
    tmsi                               TMSI-GSM-MAP,
    lai                                LAI
}

TMSI-DS-41 ::=                     OCTET STRING (SIZE (2..17))

TotalRLC-AM-BufferSize ::=         ENUMERATED {
                                       dummy, kb10, kb50, kb100,
                                       kb150, kb500, kb1000, spare }

TotalRLC-AM-BufferSize-r5-ext ::=  ENUMERATED {
                                       kb200, kb300, kb400, kb750 }

-- Actual value TransmissionProbability = IE value * 0.125
TransmissionProbability ::=        INTEGER (1..8)

TransportChannelCapability ::=     SEQUENCE {
    dl-TransChCapability               DL-TransChCapability,
    ul-TransChCapability               UL-TransChCapability
}

TurboSupport ::=                   CHOICE {
    notSupported                       NULL,
    supported                          MaxNoBits
}

-- Values defined as spare shall not be sent in this version of the protocol. If a spare value is
-- received, it should be interpreted as 'default-RxTX-sparation'.
TxRxFrequencySeparation ::=        ENUMERATED {
                                       default-TxRx-separation, spare2, spare1 }

U-RNTI ::=                         SEQUENCE {
    srnc-Identity                      SRNC-Identity,
    s-RNTI                             S-RNTI
}

U-RNTI-Group ::=                   CHOICE {
-- TABULAR: not following the tabular strictly, but this will most likely save bits
    all                                NULL,
    u-RNTI-BitMaskIndex-b1             BIT STRING (SIZE (31)),
    u-RNTI-BitMaskIndex-b2             BIT STRING (SIZE (30)),
    u-RNTI-BitMaskIndex-b3             BIT STRING (SIZE (29)),
    u-RNTI-BitMaskIndex-b4             BIT STRING (SIZE (28)),
    u-RNTI-BitMaskIndex-b5             BIT STRING (SIZE (27)),
    u-RNTI-BitMaskIndex-b6             BIT STRING (SIZE (26)),
```

```
    u-RNTI-BitMaskIndex-b7              BIT STRING (SIZE (25)),
    u-RNTI-BitMaskIndex-b8              BIT STRING (SIZE (24)),
    u-RNTI-BitMaskIndex-b9              BIT STRING (SIZE (23)),
    u-RNTI-BitMaskIndex-b10             BIT STRING (SIZE (22)),
    u-RNTI-BitMaskIndex-b11             BIT STRING (SIZE (21)),
    u-RNTI-BitMaskIndex-b12             BIT STRING (SIZE (20)),
    u-RNTI-BitMaskIndex-b13             BIT STRING (SIZE (19)),
    u-RNTI-BitMaskIndex-b14             BIT STRING (SIZE (18)),
    u-RNTI-BitMaskIndex-b15             BIT STRING (SIZE (17)),
    u-RNTI-BitMaskIndex-b16             BIT STRING (SIZE (16)),
    u-RNTI-BitMaskIndex-b17             BIT STRING (SIZE (15)),
    u-RNTI-BitMaskIndex-b18             BIT STRING (SIZE (14)),
    u-RNTI-BitMaskIndex-b19             BIT STRING (SIZE (13)),
    u-RNTI-BitMaskIndex-b20             BIT STRING (SIZE (12)),
    u-RNTI-BitMaskIndex-b21             BIT STRING (SIZE (11)),
    u-RNTI-BitMaskIndex-b22             BIT STRING (SIZE (10)),
    u-RNTI-BitMaskIndex-b23             BIT STRING (SIZE (9)),
    u-RNTI-BitMaskIndex-b24             BIT STRING (SIZE (8)),
    u-RNTI-BitMaskIndex-b25             BIT STRING (SIZE (7)),
    u-RNTI-BitMaskIndex-b26             BIT STRING (SIZE (6)),
    u-RNTI-BitMaskIndex-b27             BIT STRING (SIZE (5)),
    u-RNTI-BitMaskIndex-b28             BIT STRING (SIZE (4)),
    u-RNTI-BitMaskIndex-b29             BIT STRING (SIZE (3)),
    u-RNTI-BitMaskIndex-b30             BIT STRING (SIZE (2)),
    u-RNTI-BitMaskIndex-b31             BIT STRING (SIZE (1))
}

U-RNTI-Short ::=                    SEQUENCE {
    srnc-Identity                       SRNC-Identity,
    s-RNTI-2                            S-RNTI-2
}

UE-CapabilityContainer-IEs ::=          SEQUENCE {
-- Container for transparent transfer of capability information not related to
-- features for which early implementation is desired
        ue-RadioAccessCapability-v690ext    UE-RadioAccessCapability-v690ext,
        ue-RATSpecificCapability-v690ext    InterRAT-UE-RadioAccessCapability-v690ext   OPTIONAL,
        nonCriticalExtensions               SEQUENCE {}     OPTIONAL
}

UE-ConnTimersAndConstants ::=       SEQUENCE {
-- Optional is used also for parameters for which the default value is the last one read in SIB1
-- t-301 and n-301 should not be used by the UE in this version of the specification
    t-301                               T-301                                   DEFAULT ms2000,
    n-301                               N-301                                   DEFAULT 2,
    t-302                               T-302                                   DEFAULT ms4000,
    n-302                               N-302                                   DEFAULT 3,
    t-304                               T-304                                   DEFAULT ms2000,
    n-304                               N-304                                   DEFAULT 2,
    t-305                               T-305                                   DEFAULT m30,
    t-307                               T-307                                   DEFAULT s30,
    t-308                               T-308                                   DEFAULT ms160,
    t-309                               T-309                                   DEFAULT 5,
    t-310                               T-310                                   DEFAULT ms160,
    n-310                               N-310                                   DEFAULT 4,
    t-311                               T-311                                   DEFAULT ms2000,
    t-312                               T-312                                   DEFAULT 1,
    -- n-312 shall be ignored if n-312 in UE-ConnTimersAndConstants-v3a0ext is present, and the
    -- value of that element shall be used instead.
    n-312                               N-312                                   DEFAULT s1,
    t-313                               T-313                                   DEFAULT 3,
    n-313                               N-313                                   DEFAULT s20,
    t-314                               T-314                                   DEFAULT s12,
t-315                               T-315                                   DEFAULT s180,
        -- n-315 shall be ignored if n-315 in UE-ConnTimersAndConstants-v3a0ext is present, and the
    -- value of that element shall be used instead.
    n-315                               N-315                                   DEFAULT s1,
    t-316                               T-316                                   DEFAULT s30,
    t-317                               T-317                                   DEFAULT infinity4
}

UE-ConnTimersAndConstants-v3a0ext ::=       SEQUENCE {
    n-312                               N-312ext                                    OPTIONAL,
    n-315                               N-315ext                                    OPTIONAL
}

UE-ConnTimersAndConstants-r5 ::=        SEQUENCE {
-- Optional is used also for parameters for which the default value is the last one read in SIB1
```

```
-- t-301 and n-301 should not be used by the UE in this version of the specification
    t-301                               T-301                               DEFAULT ms2000,
    n-301                               N-301                               DEFAULT 2,
    t-302                               T-302                               DEFAULT ms4000,
    n-302                               N-302                               DEFAULT 3,
    t-304                               T-304                               DEFAULT ms2000,
    n-304                               N-304                               DEFAULT 2,
    t-305                               T-305                               DEFAULT m30,
    t-307                               T-307                               DEFAULT s30,
    t-308                               T-308                               DEFAULT ms160,
    t-309                               T-309                               DEFAULT 5,
    t-310                               T-310                               DEFAULT ms160,
    n-310                               N-310                               DEFAULT 4,
    t-311                               T-311                               DEFAULT ms2000,
    t-312                               T-312                               DEFAULT 1,
    n-312                               N-312-r5                            DEFAULT s1,
    t-313                               T-313                               DEFAULT 3,
    n-313                               N-313                               DEFAULT s20,
    t-314                               T-314                               DEFAULT s12,
    t-315                               T-315                               DEFAULT s180,
    n-315                               N-315-r5                            DEFAULT s1,
    t-316                               T-316                               DEFAULT s30,
    t-317                               T-317                               DEFAULT infinity4
}

UE-IdleTimersAndConstants ::=       SEQUENCE {
    t-300                               T-300,
    n-300                               N-300,
t-312                               T-312,
    -- n-312 shall be ignored if n-312 in UE-IdleTimersAndConstants-v3a0ext is present, and the
    -- value of that element shall be used instead.
    n-312                               N-312
}

UE-IdleTimersAndConstants-v3a0ext ::=       SEQUENCE {
    n-312                               N-312ext                                OPTIONAL
}

UE-MultiModeRAT-Capability ::=      SEQUENCE {
    multiRAT-CapabilityList             MultiRAT-Capability,
    multiModeCapability                 MultiModeCapability
}

UE-PowerClass ::=                   INTEGER (1..4)

UE-PowerClassExt ::=                ENUMERATED {class1, class2, class3, class4,
                                         spare4, spare3, spare2, spare1 }

UE-RadioAccessCapability ::=        SEQUENCE {
    -- UE-RadioAccessCapability is compatible with R99, although accessStratumReleaseIndicator
    -- is removed from this IE, since its encoding did not does in bits. The
    -- accessStratumReleaseIndicator is provided in the relevant REL-4 extension IEs.
    pdcp-Capability                     PDCP-Capability,
    rlc-Capability                      RLC-Capability,
    transportChannelCapability          TransportChannelCapability,
    rf-Capability                       RF-Capability,
    physicalChannelCapability           PhysicalChannelCapability,
    ue-MultiModeRAT-Capability          UE-MultiModeRAT-Capability,
    securityCapability                  SecurityCapability,
    ue-positioning-Capability           UE-Positioning-Capability,
    measurementCapability               MeasurementCapability       OPTIONAL
}

UE-RadioAccessCapabilityInfo ::=        SEQUENCE {
    ue-RadioAccessCapability            UE-RadioAccessCapability,
    ue-RadioAccessCapability-v370ext    UE-RadioAccessCapability-v370ext
}

UE-RadioAccessCapability-v370ext ::=    SEQUENCE {
    ue-RadioAccessCapabBandFDDList      UE-RadioAccessCapabBandFDDList
}

UE-RadioAccessCapability-v380ext ::=    SEQUENCE {
    ue-PositioningCapabilityExt-v380        UE-PositioningCapabilityExt-v380
}

UE-RadioAccessCapability-v3a0ext ::=    SEQUENCE {
    ue-PositioningCapabilityExt-v3a0        UE-PositioningCapabilityExt-v3a0
```

```
}

UE-RadioAccessCapability-v3g0ext ::=     SEQUENCE {
    ue-PositioningCapabilityExt-v3g0         UE-PositioningCapabilityExt-v3g0
}

UE-RadioAccessCapability-v650ext ::=     SEQUENCE {
    ue-RadioAccessCapabBandFDDList2      UE-RadioAccessCapabBandFDDList2,
    -- This IE shall be included if the UE also supports Band I-VII
    ue-RadioAccessCapabBandFDDList-ext  UE-RadioAccessCapabBandFDDList-ext  OPTIONAL
}

UE-RadioAccessCapability-v690ext ::= SEQUENCE {
        physicalchannelcapability-edch  PhysicalChannelCapability-edch-r6,
        -- TABULAR: deviceType is MD in tabular description
        -- Default value is 'doesBenefitFromBatteryConsumptionOptimisation'
        deviceType      ENUMERATED { doesNotBenefitFromBatteryConsumptionOptimisation } OPTIONAL
}

UE-RadioAccessCapability-v7xyext ::=         SEQUENCE {
    -- UE-RadioAccessCapability is compatible with R99, although accessStratumReleaseIndicator
    -- is removed from this IE, since its encoding did not does in bits. The
    -- accessStratumReleaseIndicator is provided in the relevant REL-4 extension IEs.
    pdcp-Capability                             PDCP-Capability,
    rlc-Capability                              RLC-Capability,
    transportChannelCapability                  TransportChannelCapability,
    rf-Capability                               RF-Capability-r7,
    physicalChannelCapability-r7                PhysicalChannelCapability-r7,
    ue-MultiModeRAT-Capability                  UE-MultiModeRAT-Capability,
    securityCapability                          SecurityCapability,
    ue-positioning-Capability                   UE-Positioning-Capability,
    measurementCapability                       MeasurementCapability       OPTIONAL
}

UE-RadioAccessCapabBandFDDList2 ::= SEQUENCE (SIZE (1..maxFreqBandsFDD)) OF
                                            UE-RadioAccessCapabBandFDD2

UE-RadioAccessCapabBandFDD2 ::= SEQUENCE {
    radioFrequencyBandFDD2              RadioFrequencyBandFDD2,
    fddRF-Capability                    SEQUENCE {
        ue-PowerClass                       UE-PowerClassExt,
        txRxFrequencySeparation             TxRxFrequencySeparation
    }       OPTIONAL,
    measurementCapability2              MeasurementCapabilityExt2
}


UE-PositioningCapabilityExt-v380 ::=     SEQUENCE {
    rx-tx-TimeDifferenceType2Capable         BOOLEAN
}

UE-PositioningCapabilityExt-v3a0 ::=     SEQUENCE {
    validity-CellPCH-UraPCH                  ENUMERATED { true }
}

UE-PositioningCapabilityExt-v3g0 ::=     SEQUENCE {
    sfn-sfnType2Capability               ENUMERATED { true }
}

UE-RadioAccessCapabBandFDDList ::=  SEQUENCE (SIZE (1..maxFreqBandsFDD)) OF
                                            UE-RadioAccessCapabBandFDD

UE-RadioAccessCapabBandFDDList-ext ::= SEQUENCE (SIZE (1..maxFreqBandsFDD)) OF
                                        UE-RadioAccessCapabBandFDD-ext

UE-RadioAccessCapabBandFDD ::=  SEQUENCE{
    radioFrequencyBandFDD               RadioFrequencyBandFDD,
    fddRF-Capability                    SEQUENCE {
        ue-PowerClass                       UE-PowerClassExt,
        txRxFrequencySeparation             TxRxFrequencySeparation
    }                                                            OPTIONAL,
    measurementCapability               MeasurementCapabilityExt
}

UE-RadioAccessCapabBandFDD-ext ::= SEQUENCE {
    radioFrequencyBandFDD               RadioFrequencyBandFDD,
    compressedModeMeasCapabFDDList-ext  CompressedModeMeasCapabFDDList-ext
}
```

```
UE-RadioAccessCapability-v4b0ext ::=    SEQUENCE {
    pdcp-Capability-r4-ext              PDCP-Capability-r4-ext,
    tdd-CapabilityExt                   SEQUENCE {
        rf-Capability                       RF-Capability-r4-ext,
        physicalChannelCapability-LCR       PhysicalChannelCapability-LCR-r4,
        measurementCapability-r4-ext        MeasurementCapability-r4-ext
    }                                           OPTIONAL,
    -- IE " AccessStratumReleaseIndicator" is not needed in RRC CONNECTION SETUP COMPLETE
    accessStratumReleaseIndicator               AccessStratumReleaseIndicator   OPTIONAL
}

UE-RadioAccessCapabilityComp ::= SEQUENCE {
    totalAM-RLCMemoryExceeds10kB            BOOLEAN,
    rf-CapabilityComp                       RF-CapabilityComp
}

UE-RadioAccessCapabilityComp-ext ::= SEQUENCE {
    rf-CapabilityFDDComp                RF-CapabBandListFDDComp-ext
}

UE-RadioAccessCapabilityComp-r7 ::= SEQUENCE {
    totalAM-RLCMemoryExceeds10kB            BOOLEAN,
    rf-CapabilityComp                       RF-CapabilityComp-r7
}

UE-RadioAccessCapabilityComp2 ::=       SEQUENCE {
    fddPhysicalChannelCapab-hspdsch-edch    SEQUENCE {
        dl-CapabilityWithSimultaneousHS-DSCHConfig
                                                DL-CapabilityWithSimultaneousHS-DSCHConfig
    OPTIONAL,
        physicalChannelCapabComp-hspdsch-r6     HSDSCH-physical-layer-category,
        physicalChannelCapability-edch-r6       PhysicalChannelCapability-edch-r6
    }       OPTIONAL
}

RF-CapabilityComp ::= SEQUENCE {
    fdd                     CHOICE {
        notSupported                    NULL,
        supported                       RF-CapabBandListFDDComp
    },
    tdd384-RF-Capability    CHOICE {
        notSupported                    NULL,
        supported                       RadioFrequencyBandTDDList
    },
    tdd128-RF-Capability    CHOICE {
        notSupported                    NULL,
        supported                       RadioFrequencyBandTDDList
    }
}

RF-CapabilityComp-r7 ::= SEQUENCE {
    fdd                     CHOICE {
        notSupported                    NULL,
        supported                       RF-CapabBandListFDDComp
    },
    tdd384-RF-Capability    CHOICE {
        notSupported                    NULL,
        supported                       RadioFrequencyBandTDDList
    },
    tdd768-RF-Capability    CHOICE  {
        notSupported                    NULL,
        supported                       RadioFrequencyBandTDDList
    },
    tdd128-RF-Capability    CHOICE {
        notSupported                    NULL,
        supported                       RadioFrequencyBandTDDList
    }
}

-- NOTE: This IE defines the supported TX/RX frequency separation for the respective supported
-- frequency band. Values defined as spare shall not be sent in this version of the protocol.
-- If a spare value is received, it should be interpreted as 'default-RxTX-sparation'.
RF-CapabBandFDDComp ::=             ENUMERATED { notSupported,
                                        default-TxRx-separation, spare2, spare1 }

RF-CapabBandListFDDComp ::=         SEQUENCE (SIZE (1..maxFreqBandsFDD)) OF
    -- The first entry corresponds with the first value of IE RadioFrequencyBandFDD,
```

```
    -- fdd2100, and so on. No more than seven entries should be included in this IE. The
    -- 8'th entry, if present, shall be ignored.
    -- An extension of this IE may be provided using the IE 'RF-CapabBandListFDDComp-ext'.
    RF-CapabBandFDDComp

RF-CapabBandListFDDComp-ext ::=     SEQUENCE (SIZE (1..maxFreqBandsFDD-ext)) OF
    -- The first entry corresponds with the first value of IE RadioFrequencyBandFDD2,
    -- bandVIII, and so on.
    RF-CapabBandFDDComp

UE-RadioAccessCapability-v590ext ::=    SEQUENCE {
    dl-CapabilityWithSimultaneousHS-DSCHConfig  DL-CapabilityWithSimultaneousHS-DSCHConfig
    OPTIONAL,
    pdcp-Capability-r5-ext              PDCP-Capability-r5-ext,
    rlc-Capability-r5-ext               RLC-Capability-r5-ext,
    physicalChannelCapability           PhysicalChannelCapability-hspdsch-r5,
    multiModeRAT-Capability-v590ext     MultiModeRAT-Capability-v590ext
}

UE-RadioAccessCapability-v5c0ext ::= SEQUENCE {
    pdcp-Capability-r5-ext2             PDCP-Capability-r5-ext2
}

UE-RadioAccessCapability-v680ext ::= SEQUENCE {
    multiModeRAT-Capability-v680ext     MultiModeRAT-Capability-v680ext
}

UL-PhysChCapabilityFDD ::=          SEQUENCE {
    maxNoDPDCH-BitsTransmitted          MaxNoDPDCH-BitsTransmitted,
    -- dummy is not used in this version of the specification and
    -- it should be ignored by the receiver.
    dummy                               BOOLEAN
}

UL-PhysChCapabilityFDD-r6 ::=           SEQUENCE {
    maxNoDPDCH-BitsTransmitted              MaxNoDPDCH-BitsTransmitted,
    physicalchannelcapability-edch          PhysicalChannelCapability-edch-r6
}

UL-PhysChCapabilityTDD ::=          SEQUENCE {
    maxTS-PerFrame                      MaxTS-PerFrame,
    maxPhysChPerTimeslot                MaxPhysChPerTimeslot,
    minimumSF                           MinimumSF-UL,
    supportOfPUSCH                      BOOLEAN
}

UL-PhysChCapabilityTDD-LCR-r4 ::=   SEQUENCE {
    maxTS-PerSubFrame                   MaxTS-PerSubFrame-r4,
    maxPhysChPerTimeslot                MaxPhysChPerTimeslot,
    minimumSF                           MinimumSF-UL,
    supportOfPUSCH                      BOOLEAN,
    supportOf8PSK                       BOOLEAN
}

PhysicalChannelCapability-edch-r6 ::=   SEQUENCE {
    fdd-edch                                CHOICE {
        supported                               SEQUENCE {
            edch-PhysicalLayerCategory              INTEGER (1..16)
        },
        unsupported                             NULL
    }
}

UL-TransChCapability ::=            SEQUENCE {
    maxNoBitsTransmitted                MaxNoBits,
    maxConvCodeBitsTransmitted          MaxNoBits,
    turboEncodingSupport                TurboSupport,
    maxSimultaneousTransChs             MaxSimultaneousTransChsUL,
    modeSpecificInfo                    CHOICE {
        fdd                                 NULL,
        tdd                                 SEQUENCE {
            maxSimultaneousCCTrCH-Count         MaxSimultaneousCCTrCH-Count
        }
    },
    maxTransmittedBlocks                MaxTransportBlocksUL,
    maxNumberOfTFC                      MaxNumberOfTFC-UL,
    maxNumberOfTF                       MaxNumberOfTF
}
```

```
UE-Positioning-Capability ::=       SEQUENCE {
    standaloneLocMethodsSupported           BOOLEAN,
    ue-BasedOTDOA-Supported                 BOOLEAN,
    networkAssistedGPS-Supported            NetworkAssistedGPS-Supported,
    supportForUE-GPS-TimingOfCellFrames     BOOLEAN,
    supportForIPDL                          BOOLEAN
}

UE-SecurityInformation ::=          SEQUENCE {
    start-CS                            START-Value
}

UE-SecurityInformation2 ::=         SEQUENCE {
    start-PS                            START-Value
}

URA-UpdateCause ::=                 ENUMERATED {
                                        changeOfURA,
                                        periodicURAUpdate,
                                        dummy,
                                        spare1 }

UTRAN-DRX-CycleLengthCoefficient ::= INTEGER (3..9)

WaitTime ::=                        INTEGER (0..15)

-- ***************************************************
--
--      RADIO BEARER INFORMATION ELEMENTS (10.3.4)
--
-- ***************************************************

AlgorithmSpecificInfo ::=           CHOICE {
    rfc2507-Info                        RFC2507-Info
}

AlgorithmSpecificInfo-r4 ::=        CHOICE {
    rfc2507-Info                        RFC2507-Info,
    rfc3095-Info                        RFC3095-Info-r4
}

CID-InclusionInfo-r4 ::=            ENUMERATED {
                                        pdcp-Header,
                                        rfc3095-PacketFormat }

-- Upper limit of COUNT-C is 2^32 - 1
COUNT-C ::=                         INTEGER (0..4294967295)

-- Upper limit of COUNT-C-MSB is 2^25 - 1
COUNT-C-MSB ::=                     INTEGER (0..33554431)

DefaultConfigIdentity ::=           INTEGER (0..10)

DefaultConfigIdentity-r4 ::=        INTEGER (0..12)

DefaultConfigIdentity-r5 ::=        INTEGER (0..13)

DefaultConfigIdentity-r6 ::=        INTEGER (0..31)

DefaultConfigMode ::=               ENUMERATED {
                                        fdd,
                                        tdd }

DDI ::=                             INTEGER (0..62)

DL-AM-RLC-Mode ::=                  SEQUENCE {
    inSequenceDelivery                  BOOLEAN,
    receivingWindowSize                 ReceivingWindowSize,
    dl-RLC-StatusInfo                   DL-RLC-StatusInfo
}

DL-AM-RLC-Mode-r5 ::=                   SEQUENCE {
    dl-RLC-PDU-size                     OctetModeRLC-SizeInfoType1,
    inSequenceDelivery                  BOOLEAN,
    receivingWindowSize                 ReceivingWindowSize,
    dl-RLC-StatusInfo                   DL-RLC-StatusInfo
}
```

```
DL-CounterSynchronisationInfo ::=        SEQUENCE {
    rB-WithPDCP-InfoList                     RB-WithPDCP-InfoList     OPTIONAL
}

DL-CounterSynchronisationInfo-r5 ::=     SEQUENCE {
    rb-WithPDCP-InfoList                     RB-WithPDCP-InfoList             OPTIONAL,
    rb-PDCPContextRelocationList             RB-PDCPContextRelocationList     OPTIONAL
}

DL-LogicalChannelMapping ::=         SEQUENCE {
    -- TABULAR: DL-TransportChannelType contains TransportChannelIdentity as well.
    dl-TransportChannelType              DL-TransportChannelType,
    logicalChannelIdentity               LogicalChannelIdentity             OPTIONAL
}

DL-LogicalChannelMapping-r5 ::=      SEQUENCE {
    -- TABULAR: DL-TransportChannelType contains TransportChannelIdentity as well.
    dl-TransportChannelType              DL-TransportChannelType-r5,
    logicalChannelIdentity               LogicalChannelIdentity             OPTIONAL
}

DL-LogicalChannelMappingList ::=     SEQUENCE (SIZE (1..maxLoCHperRLC)) OF
                                         DL-LogicalChannelMapping

DL-LogicalChannelMappingList-r5 ::= SEQUENCE (SIZE (1..maxLoCHperRLC)) OF
                                         DL-LogicalChannelMapping-r5

DL-Reception-Window-Size-r6 ::=      ENUMERATED { size32, size48, size64, size80, size96, size112 }

DL-RFC3095-r4 ::=                    SEQUENCE {
    cid-InclusionInfo                    CID-InclusionInfo-r4,
    max-CID                              INTEGER (1..16383)                 DEFAULT 15,
    reverseDecompressionDepth            INTEGER (0..65535)                 DEFAULT 0
}

DL-RLC-Mode ::=                      CHOICE {
    dl-AM-RLC-Mode                       DL-AM-RLC-Mode,
    dl-UM-RLC-Mode                       NULL,
    dl-TM-RLC-Mode                       DL-TM-RLC-Mode
}

DL-RLC-Mode-r5 ::=                   CHOICE {
    dl-AM-RLC-Mode                       DL-AM-RLC-Mode-r5,
    dl-UM-RLC-Mode                       DL-UM-RLC-Mode-r5,
    dl-TM-RLC-Mode                       DL-TM-RLC-Mode
}

DL-RLC-Mode-r6 ::=                   CHOICE {
    dl-AM-RLC-Mode                       DL-AM-RLC-Mode-r5,
    dl-UM-RLC-Mode                       DL-UM-RLC-Mode-r6,
    dl-TM-RLC-Mode                       DL-TM-RLC-Mode
}

DL-RLC-StatusInfo ::=                SEQUENCE {
    timerStatusProhibit                  TimerStatusProhibit                OPTIONAL,
    -- dummy is not used in this version of the specification, it should not be sent
    -- and if received they should be ignored.
    dummy                            TimerEPC                           OPTIONAL,
    missingPDU-Indicator                     BOOLEAN,
    timerStatusPeriodic                  TimerStatusPeriodic                OPTIONAL
}

DL-TM-RLC-Mode ::=                   SEQUENCE {
    segmentationIndication                   BOOLEAN
}

DL-TransportChannelType ::=          CHOICE {
    dch                                  TransportChannelIdentity,
    fach                                 NULL,
    -- The choice "dsch" should not be used in FDD mode, and if received
    -- the UE behaviour is unspecified.
    dsch                                 TransportChannelIdentity,
    -- The choice "dch-and-dsch" should not be used in FDD mode, and if received the UE
    -- behaviour is unspecified
    dch-and-dsch                         TransportChannelIdentityDCHandDSCH
}
```

```
DL-TransportChannelType-r5 ::=          CHOICE {
    dch                                 TransportChannelIdentity,
    fach                                NULL,
    -- The choice "dsch" should not be used in FDD mode, and if received
    -- the UE behaviour is unspecified.
    dsch                                TransportChannelIdentity,
    -- The choice "dch-and-dsch" should not be used in FDD mode, and if received the UE
    -- behaviour is unspecified
    dch-and-dsch                        TransportChannelIdentityDCHandDSCH,
    hsdsch                              MAC-d-FlowIdentity,
    dch-and-hsdsch                      MAC-d-FlowIdentityDCHandHSDSCH
}

DL-UM-RLC-LI-size ::=                   ENUMERATED {
                                        size7, size15 }

DL-UM-RLC-Mode-r5 ::=                   SEQUENCE {
    dl-UM-RLC-LI-size                   DL-UM-RLC-LI-size
}

DL-UM-RLC-Mode-r6 ::=               SEQUENCE {
    dl-UM-RLC-LI-size                   DL-UM-RLC-LI-size,
    dl-Reception-Window-Size            DL-Reception-Window-Size-r6         OPTIONAL
}

ExpectReordering ::=                ENUMERATED {
                                        reorderingNotExpected,
                                        reorderingExpected }

ExplicitDiscard ::=                 SEQUENCE {
    timerMRW                            TimerMRW,
    timerDiscard                        TimerDiscard,
    maxMRW                              MaxMRW
}

HeaderCompressionInfo ::=           SEQUENCE {
    algorithmSpecificInfo               AlgorithmSpecificInfo
}

HeaderCompressionInfoList ::=       SEQUENCE (SIZE (1..maxPDCPAlgoType)) OF
                                        HeaderCompressionInfo

HeaderCompressionInfo-r4 ::=        SEQUENCE {
    algorithmSpecificInfo               AlgorithmSpecificInfo-r4
}

HeaderCompressionInfoList-r4 ::=    SEQUENCE (SIZE (1..maxPDCPAlgoType)) OF
                                        HeaderCompressionInfo-r4

LogicalChannelIdentity ::=          INTEGER (1..15)

LosslessSRNS-RelocSupport ::=       CHOICE {
    supported                           MaxPDCP-SN-WindowSize,
    notSupported                        NULL
}

MAC-d-HFN-initial-value ::=         BIT STRING (SIZE (24))

MAC-LogicalChannelPriority ::=      INTEGER (1..8)

MaxDAT ::=                          ENUMERATED {
                                        dat1, dat2, dat3, dat4, dat5, dat6,
                                        dat7, dat8, dat9, dat10, dat15, dat20,
                                        dat25, dat30, dat35, dat40 }

MaxDAT-Retransmissions ::=          SEQUENCE {
    maxDAT                              MaxDAT,
    timerMRW                            TimerMRW,
    maxMRW                              MaxMRW
}

MaxMRW ::=                          ENUMERATED {
                                        mm1, mm4, mm6, mm8, mm12, mm16,
                                        mm24, mm32 }

MaxPDCP-SN-WindowSize ::=           ENUMERATED {
                                        sn255, sn65535 }
```

```
MaxRST ::=                          ENUMERATED {
                                        rst1, rst4, rst6, rst8, rst12,
                                        rst16, rst24, rst32 }

NoExplicitDiscard ::=               ENUMERATED {
                                        dt10, dt20, dt30, dt40, dt50,
                                        dt60, dt70, dt80, dt90, dt100 }

PDCP-Info ::=                       SEQUENCE {
    losslessSRNS-RelocSupport           LosslessSRNS-RelocSupport           OPTIONAL,
    -- TABULAR: pdcp-PDU-Header is MD in the tabular format and it can be encoded
    -- in one bit, so the OPTIONAL is removed for compactness.
    pdcp-PDU-Header                     PDCP-PDU-Header,
    headerCompressionInfoList           HeaderCompressionInfoList           OPTIONAL
}

PDCP-Info-r4 ::=                    SEQUENCE {
    losslessSRNS-RelocSupport           LosslessSRNS-RelocSupport           OPTIONAL,
    -- TABULAR: pdcp-PDU-Header is MD in the tabular format and it can be encoded
    -- in one bit, so the OPTIONAL is removed for compactness.
    pdcp-PDU-Header                     PDCP-PDU-Header,
    headerCompressionInfoList           HeaderCompressionInfoList-r4        OPTIONAL
}

PDCP-InfoReconfig ::=               SEQUENCE {
    pdcp-Info                           PDCP-Info,
    -- dummy is not used in this version of the specification and
    -- it should be ignored.
    dummy                               INTEGER (0..65535)
}

PDCP-InfoReconfig-r4 ::=            SEQUENCE {
    pdcp-Info                           PDCP-Info-r4
}

PDCP-PDU-Header ::=                 ENUMERATED {
                                        present, absent }

PDCP-ROHC-TargetMode ::=            ENUMERATED { o-Mode, r-Mode }

PDCP-SN-Info ::=                    INTEGER (0..65535)

Poll-PDU ::=                        ENUMERATED {
                                        pdu1, pdu2, pdu4, pdu8, pdu16,
                                        pdu32, pdu64, pdu128 }

Poll-SDU ::=                        ENUMERATED {
                                        sdu1, sdu4, sdu16, sdu64 }

PollingInfo ::=                     SEQUENCE {
    timerPollProhibit                   TimerPollProhibit                   OPTIONAL,
    timerPoll                           TimerPoll                           OPTIONAL,
    poll-PDU                            Poll-PDU                            OPTIONAL,
    poll-SDU                            Poll-SDU                            OPTIONAL,
    lastTransmissionPDU-Poll            BOOLEAN,
    lastRetransmissionPDU-Poll          BOOLEAN,
    pollWindow                          PollWindow                          OPTIONAL,
    timerPollPeriodic                   TimerPollPeriodic                   OPTIONAL
}

PollWindow ::=                      ENUMERATED {
                                        pw50, pw60, pw70, pw80, pw85,
                                        pw90, pw95, pw99 }

PredefinedConfigIdentity ::=        INTEGER (0..15)

PredefinedConfigValueTag ::=        INTEGER (0..15)

PredefinedRB-Configuration ::=      SEQUENCE {
    re-EstablishmentTimer               Re-EstablishmentTimer,
    srb-InformationList                 SRB-InformationSetupList,
    rb-InformationList                  RB-InformationSetupList
}

PreDefRadioConfiguration ::=        SEQUENCE {
    -- Radio bearer IEs
        predefinedRB-Configuration          PredefinedRB-Configuration,
    -- Transport channel IEs
```

```
        preDefTransChConfiguration          PreDefTransChConfiguration,
    -- Physical channel IEs
        preDefPhyChConfiguration            PreDefPhyChConfiguration
}

PredefinedConfigStatusList ::=              SEQUENCE (SIZE (maxPredefConfig)) OF
                                            PredefinedConfigStatusInfo

PredefinedConfigStatusInfo ::=      CHOICE {
    storedWithValueTagSameAsPrevius     NULL,
    other                               CHOICE {
        notStored                           NULL,
        storedWithDifferentValueTag         PredefinedConfigValueTag
    }
}

PredefinedConfigStatusListComp ::= SEQUENCE {
    setsWithDifferentValueTag           PredefinedConfigSetsWithDifferentValueTag,
    otherEntries                        PredefinedConfigStatusListVarSz             OPTIONAL
}

PredefinedConfigSetsWithDifferentValueTag ::= SEQUENCE (SIZE (1..2)) OF
                                                PredefinedConfigSetWithDifferentValueTag

PredefinedConfigSetWithDifferentValueTag ::= SEQUENCE {
    startPosition                               INTEGER (0..10)     DEFAULT 0,
    -- numberOfEntries                          INTEGER (6..16),
    -- numberOfEntries is covered by the size of the list in IE PredefinedConfigValueTagList
    valueTagList                                PredefinedConfigValueTagList
}


PredefinedConfigValueTagList ::=        SEQUENCE (SIZE (1..maxPredefConfig)) OF
                                            PredefinedConfigValueTag

PredefinedConfigStatusListVarSz ::=     SEQUENCE (SIZE (1..maxPredefConfig)) OF
                                            PredefinedConfigStatusInfo

RAB-Info ::=                        SEQUENCE {
    rab-Identity                        RAB-Identity,
    cn-DomainIdentity                   CN-DomainIdentity,
    nas-Synchronisation-Indicator       NAS-Synchronisation-Indicator   OPTIONAL,
    re-EstablishmentTimer               Re-EstablishmentTimer
}

RAB-Info-r6-ext ::=                 SEQUENCE {
    mbms-SessionIdentity                MBMS-SessionIdentity                OPTIONAL
}

RAB-Info-r6 ::=                     SEQUENCE {
    rab-Identity                        RAB-Identity,
    mbms-SessionIdentity                MBMS-SessionIdentity                OPTIONAL,
    cn-DomainIdentity                   CN-DomainIdentity,
    nas-Synchronisation-Indicator       NAS-Synchronisation-Indicator       OPTIONAL,
    re-EstablishmentTimer               Re-EstablishmentTimer
}

RAB-InformationList ::=             SEQUENCE (SIZE (1..maxRABsetup)) OF
                                        RAB-Info

RAB-InformationList-r6 ::=          SEQUENCE (SIZE (1..maxRABsetup)) OF
                                        RAB-Info-r6

RAB-InformationReconfigList ::=     SEQUENCE (SIZE (1.. maxRABsetup)) OF
                                        RAB-InformationReconfig

RAB-InformationReconfig ::=         SEQUENCE {
    rab-Identity                        RAB-Identity,
    cn-DomainIdentity                   CN-DomainIdentity,
    nas-Synchronisation-Indicator       NAS-Synchronisation-Indicator
}

RAB-Info-Post ::=                       SEQUENCE {
    rab-Identity                        RAB-Identity,
    cn-DomainIdentity                   CN-DomainIdentity,
    nas-Synchronisation-Indicator       NAS-Synchronisation-Indicator   OPTIONAL
}
```

```
RAB-InformationSetup ::=            SEQUENCE {
    rab-Info                            RAB-Info,
    rb-InformationSetupList             RB-InformationSetupList
}

RAB-InformationSetup-r4 ::=         SEQUENCE {
    rab-Info                            RAB-Info,
    rb-InformationSetupList             RB-InformationSetupList-r4
}

RAB-InformationSetup-r5 ::=         SEQUENCE {
    rab-Info                            RAB-Info,
    rb-InformationSetupList             RB-InformationSetupList-r5
}

RAB-InformationSetup-r6-ext ::=     SEQUENCE {
    rab-Info-r6-ext                     RAB-Info-r6-ext
}

RAB-InformationSetup-r6 ::=         SEQUENCE {
    rab-Info                            RAB-Info-r6,
    rb-InformationSetupList             RB-InformationSetupList-r6
}

RAB-InformationSetupList ::=        SEQUENCE (SIZE (1..maxRABsetup)) OF
                                        RAB-InformationSetup

RAB-InformationSetupList-r4 ::=     SEQUENCE (SIZE (1..maxRABsetup)) OF
                                        RAB-InformationSetup-r4

RAB-InformationSetupList-r5 ::=     SEQUENCE (SIZE (1..maxRABsetup)) OF
                                        RAB-InformationSetup-r5

RAB-InformationSetupList-r6 ::=     SEQUENCE (SIZE (1..maxRABsetup)) OF
                                        RAB-InformationSetup-r6

-- The IE 'RAB-InformationSetupList-r6-ext' provides elements of extension information, which
-- are added to the corresponding elements of the IE 'RAB-InformationSetupList/-r4/-r5'.
RAB-InformationSetupList-r6-ext ::= SEQUENCE (SIZE (1..maxRABsetup)) OF
                                        RAB-InformationSetup-r6-ext

RB-ActivationTimeInfo ::=           SEQUENCE {
    rb-Identity                         RB-Identity,
    rlc-SequenceNumber                  RLC-SequenceNumber
}

RB-ActivationTimeInfoList ::=       SEQUENCE (SIZE (1..maxRB)) OF
                                        RB-ActivationTimeInfo

RB-COUNT-C-Information ::=          SEQUENCE {
    rb-Identity                         RB-Identity,
    count-C-UL                          COUNT-C,
    count-C-DL                          COUNT-C
}

RB-COUNT-C-InformationList ::=      SEQUENCE (SIZE (1..maxRBallRABs)) OF
                                        RB-COUNT-C-Information

RB-COUNT-C-MSB-Information ::=      SEQUENCE {
    rb-Identity                         RB-Identity,
    count-C-MSB-UL                      COUNT-C-MSB,
    count-C-MSB-DL                      COUNT-C-MSB
}

RB-COUNT-C-MSB-InformationList ::=  SEQUENCE (SIZE (1..maxRBallRABs)) OF
                                        RB-COUNT-C-MSB-Information

RB-Identity ::=                     INTEGER (1..32)

RB-IdentityList ::=                 SEQUENCE (SIZE (1..maxRB)) OF
                                        RB-Identity

RB-InformationAffected ::=          SEQUENCE {
    rb-Identity                         RB-Identity,
    rb-MappingInfo                      RB-MappingInfo
}

RB-InformationAffected-r5 ::=       SEQUENCE {
```

```
    rb-Identity                         RB-Identity,
    rb-MappingInfo                      RB-MappingInfo-r5
}

RB-InformationAffected-r6 ::=       SEQUENCE {
    rb-Identity                         RB-Identity,
    rb-MappingInfo                      RB-MappingInfo-r6
}

RB-InformationAffectedList ::=      SEQUENCE (SIZE (1..maxRB)) OF
                                        RB-InformationAffected

RB-InformationAffectedList-r5 ::=   SEQUENCE (SIZE (1..maxRB)) OF
                                        RB-InformationAffected-r5

RB-InformationAffectedList-r6 ::=   SEQUENCE (SIZE (1..maxRB)) OF
                                        RB-InformationAffected-r6

RB-InformationChanged-r6 ::=        SEQUENCE {
    rb-Identity                         RB-Identity,
    rb-Change                           CHOICE {
        release                             NULL,
        re-mapToDefaultRb                   RB-Identity
    }
}

RB-InformationChangedList-r6 ::=        SEQUENCE (SIZE (1..maxRB)) OF
                                            RB-InformationChanged-r6

RB-InformationReconfig ::=          SEQUENCE {
    rb-Identity                         RB-Identity,
    pdcp-Info                           PDCP-InfoReconfig                   OPTIONAL,
    pdcp-SN-Info                        PDCP-SN-Info                        OPTIONAL,
    rlc-Info                            RLC-Info                            OPTIONAL,
    rb-MappingInfo                      RB-MappingInfo                      OPTIONAL,
    rb-StopContinue                     RB-StopContinue                     OPTIONAL
}

RB-InformationReconfig-r4 ::=       SEQUENCE {
    rb-Identity                         RB-Identity,
    pdcp-Info                           PDCP-InfoReconfig-r4                OPTIONAL,
    pdcp-SN-Info                        PDCP-SN-Info                        OPTIONAL,
    rlc-Info                            RLC-Info                            OPTIONAL,
    rb-MappingInfo                      RB-MappingInfo                      OPTIONAL,
    rb-StopContinue                     RB-StopContinue                     OPTIONAL
}

RB-InformationReconfig-r5 ::=       SEQUENCE {
    rb-Identity                         RB-Identity,
    pdcp-Info                           PDCP-InfoReconfig-r4                OPTIONAL,
    pdcp-SN-Info                        PDCP-SN-Info                        OPTIONAL,
    rlc-Info                            RLC-Info-r5                         OPTIONAL,
    rb-MappingInfo                      RB-MappingInfo-r5                   OPTIONAL,
    rb-StopContinue                     RB-StopContinue                     OPTIONAL
}

RB-InformationReconfig-r6 ::=       SEQUENCE {
    rb-Identity                         RB-Identity,
    pdcp-Info                           PDCP-InfoReconfig-r4                OPTIONAL,
    pdcp-SN-Info                        PDCP-SN-Info                        OPTIONAL,
    rlc-Info                            RLC-Info-r6                         OPTIONAL,
    rb-MappingInfo                      RB-MappingInfo-r6                   OPTIONAL,
    rb-StopContinue                     RB-StopContinue                     OPTIONAL
}

RB-InformationReconfigList ::=      SEQUENCE (SIZE (1..maxRB)) OF
                                        RB-InformationReconfig

RB-InformationReconfigList-r4 ::=   SEQUENCE (SIZE (1..maxRB)) OF
                                        RB-InformationReconfig-r4

RB-InformationReconfigList-r5 ::=   SEQUENCE (SIZE (1..maxRB)) OF
                                        RB-InformationReconfig-r5

RB-InformationReconfigList-r6 ::=   SEQUENCE (SIZE (1..maxRB)) OF
                                        RB-InformationReconfig-r6

RB-InformationReleaseList ::=       SEQUENCE (SIZE (1..maxRB)) OF
```

```
                                        RB-Identity

RB-InformationSetup ::=                 SEQUENCE {
    rb-Identity                             RB-Identity,
    pdcp-Info                               PDCP-Info                           OPTIONAL,
    rlc-InfoChoice                          RLC-InfoChoice,
    rb-MappingInfo                          RB-MappingInfo
}

RB-InformationSetup-r4 ::=              SEQUENCE {
    rb-Identity                             RB-Identity,
    pdcp-Info                               PDCP-Info-r4                        OPTIONAL,
    rlc-InfoChoice                          RLC-InfoChoice,
    rb-MappingInfo                          RB-MappingInfo
}

RB-InformationSetup-r5 ::=              SEQUENCE {
    rb-Identity                             RB-Identity,
    pdcp-Info                               PDCP-Info-r4                        OPTIONAL,
    rlc-InfoChoice                          RLC-InfoChoice-r5,
    rb-MappingInfo                          RB-MappingInfo-r5
}

RB-InformationSetup-r6 ::=              SEQUENCE {
    rb-Identity                             RB-Identity,
    pdcp-Info                               PDCP-Info-r4                        OPTIONAL,
    rlc-InfoChoice                          RLC-InfoChoice-r6,
    rb-MappingInfo                          RB-MappingInfo-r6
}

RB-InformationSetupList ::=             SEQUENCE (SIZE (1..maxRBperRAB)) OF
                                            RB-InformationSetup

RB-InformationSetupList-r4 ::=          SEQUENCE (SIZE (1..maxRBperRAB)) OF
                                            RB-InformationSetup-r4

RB-InformationSetupList-r5 ::=          SEQUENCE (SIZE (1..maxRBperRAB)) OF
                                            RB-InformationSetup-r5

RB-InformationSetupList-r6 ::=          SEQUENCE (SIZE (1..maxRBperRAB)) OF
                                            RB-InformationSetup-r6

RB-MappingInfo ::=                      SEQUENCE (SIZE (1..maxRBMuxOptions)) OF
                                            RB-MappingOption

RB-MappingInfo-r5 ::=                       SEQUENCE (SIZE (1..maxRBMuxOptions)) OF
                                            RB-MappingOption-r5

RB-MappingInfo-r6 ::=                       SEQUENCE (SIZE (1..maxRBMuxOptions)) OF
                                            RB-MappingOption-r6

RB-MappingOption ::=                    SEQUENCE {
    ul-LogicalChannelMappings               UL-LogicalChannelMappings           OPTIONAL,
    dl-LogicalChannelMappingList            DL-LogicalChannelMappingList        OPTIONAL
}

RB-MappingOption-r5 ::=                     SEQUENCE {
    ul-LogicalChannelMappings               UL-LogicalChannelMappings           OPTIONAL,
    dl-LogicalChannelMappingList            DL-LogicalChannelMappingList-r5     OPTIONAL
}

RB-MappingOption-r6 ::=                     SEQUENCE {
    ul-LogicalChannelMappings               UL-LogicalChannelMappings-r6        OPTIONAL,
    dl-LogicalChannelMappingList            DL-LogicalChannelMappingList-r5     OPTIONAL
}

RB-PDCPContextRelocation ::=                SEQUENCE {
    rb-Identity                                 RB-Identity,
    dl-RFC3095-Context-Relocation               BOOLEAN,
    ul-RFC3095-Context-Relocation               BOOLEAN
}

RB-PDCPContextRelocationList ::=                SEQUENCE (SIZE (1..maxRBallRABs)) OF
                                                RB-PDCPContextRelocation

RB-StopContinue ::=                     ENUMERATED {
                                            stopRB, continueRB }
```

```
RB-WithPDCP-Info ::=                SEQUENCE {
    rb-Identity                         RB-Identity,
    pdcp-SN-Info                        PDCP-SN-Info
}

RB-WithPDCP-InfoList ::=            SEQUENCE (SIZE (1..maxRBallRABs)) OF
                                        RB-WithPDCP-Info

ReceivingWindowSize ::=             ENUMERATED {
                                        rw1, rw8, rw16, rw32, rw64, rw128, rw256,
                                        rw512, rw768, rw1024, rw1536, rw2047,
                                        rw2560, rw3072, rw3584, rw4095 }

RFC2507-Info ::=                    SEQUENCE {
    f-MAX-PERIOD                        INTEGER (1..65535)              DEFAULT 256,
    f-MAX-TIME                          INTEGER (1..255)                DEFAULT 5,
    max-HEADER                          INTEGER (60..65535)             DEFAULT 168,
    tcp-SPACE                           INTEGER (3..255)                DEFAULT 15,
    non-TCP-SPACE                       INTEGER (3..65535)              DEFAULT 15,
    -- TABULAR: expectReordering has only two possible values, so using Optional or Default
    -- would be wasteful
    expectReordering                    ExpectReordering
}

RFC3095-Info-r4 ::=             SEQUENCE {
    rohcProfileList                     ROHC-ProfileList-r4,
    ul-RFC3095                          UL-RFC3095-r4                   OPTIONAL,
    dl-RFC3095                          DL-RFC3095-r4                   OPTIONAL
}

RLC-Info ::=                        SEQUENCE {
    ul-RLC-Mode                         UL-RLC-Mode                     OPTIONAL,
    dl-RLC-Mode                         DL-RLC-Mode                     OPTIONAL
}

RLC-Info-r5 ::=                     SEQUENCE {
    ul-RLC-Mode                         UL-RLC-Mode                     OPTIONAL,
    dl-RLC-Mode                         DL-RLC-Mode-r5                  OPTIONAL,
    rlc-OneSidedReEst                   BOOLEAN
}

RLC-Info-r6 ::=                     SEQUENCE {
    ul-RLC-Mode                         UL-RLC-Mode                     OPTIONAL,
    dl-RLC-Mode                         DL-RLC-Mode-r6                  OPTIONAL,
    rlc-OneSidedReEst                   BOOLEAN,
    altE-bitInterpretation              ENUMERATED { true }             OPTIONAL
}

RLC-Info-MCCH-r6 ::=                SEQUENCE {
    dl-UM-RLC-LI-size                   DL-UM-RLC-LI-size,
    dl-UM-RLC-OutOSeqDelivery-Info      UM-RLC-OutOSeqDelivery-Info-r6  OPTIONAL
}

RLC-Info-MSCH-r6 ::=                SEQUENCE {
    dl-UM-RLC-LI-size                   DL-UM-RLC-LI-size
}

RLC-Info-MTCH-r6 ::=                SEQUENCE {
    dl-UM-RLC-LI-size                   DL-UM-RLC-LI-size,
    dl-UM-RLC-DuplAvoid-Reord-Info      UM-RLC-DuplAvoid-Reord-Info-r6  OPTIONAL
}

RLC-InfoChoice ::=                  CHOICE {
    rlc-Info                            RLC-Info,
    same-as-RB                          RB-Identity
}

RLC-InfoChoice-r5 ::=               CHOICE {
    rlc-Info                            RLC-Info-r5,
    same-as-RB                          RB-Identity
}

RLC-InfoChoice-r6 ::=               CHOICE {
    rlc-Info                            RLC-Info-r6,
    same-as-RB                          RB-Identity
}

RLC-PDU-Size ::=                    OctetModeRLC-SizeInfoType1
```

```
RLC-PDU-SizeList ::=                SEQUENCE (SIZE (1..maxRLCPDUsizePerLogChan)) OF
                                        RLC-PDU-Size

RLC-SequenceNumber ::=              INTEGER (0..4095)

RLC-SizeInfo ::=                    SEQUENCE {
    rlc-SizeIndex                       INTEGER (1..maxTF)
}

RLC-SizeExplicitList ::=            SEQUENCE (SIZE  (1..maxTF)) OF
                                        RLC-SizeInfo

ROHC-Profile-r4 ::=                 INTEGER (1..3)

ROHC-ProfileList-r4 ::=             SEQUENCE (SIZE  (1..maxROHC-Profile-r4))     OF
                                        ROHC-Profile-r4

ROHC-PacketSize-r4 ::=              INTEGER (2..1500)

ROHC-PacketSizeList-r4 ::=          SEQUENCE (SIZE  (1..maxROHC-PacketSizes-r4))     OF
                                        ROHC-PacketSize-r4

SRB-InformationSetup ::=            SEQUENCE {
    -- The default value for rb-Identity is the smallest value not used yet.
    rb-Identity                         RB-Identity                         OPTIONAL,
    rlc-InfoChoice                      RLC-InfoChoice,
    rb-MappingInfo                      RB-MappingInfo
}

SRB-InformationSetup-r5 ::=         SEQUENCE {
    -- The default value for rb-Identity is the smallest value not used yet.
    rb-Identity                         RB-Identity                         OPTIONAL,
    rlc-InfoChoice                      RLC-InfoChoice-r5,
    rb-MappingInfo                      RB-MappingInfo-r5
}

SRB-InformationSetup-r6 ::=         SEQUENCE {
    -- The default value for rb-Identity is the smallest value not used yet.
    rb-Identity                         RB-Identity                         OPTIONAL,
    rlc-InfoChoice                      RLC-InfoChoice-r6,
    rb-MappingInfo                      RB-MappingInfo-r6
}

SRB-InformationSetupList ::=        SEQUENCE (SIZE (1..maxSRBsetup)) OF
                                        SRB-InformationSetup

SRB-InformationSetupList-r5 ::=     SEQUENCE (SIZE (1..maxSRBsetup)) OF
                                        SRB-InformationSetup-r5

SRB-InformationSetupList-r6 ::=     SEQUENCE (SIZE (1..maxSRBsetup)) OF
                                        SRB-InformationSetup-r6

SRB-InformationSetupList2 ::=       SEQUENCE (SIZE (3..4)) OF
                                        SRB-InformationSetup

SRB-InformationSetupList2-r6 ::=    SEQUENCE (SIZE (3..4)) OF
                                        SRB-InformationSetup-r6

TimerDAR-r6 ::=                     ENUMERATED {
                                        ms40, ms80, ms120, ms160, ms240, ms320, ms480, ms640,
                                        ms960, ms1280, ms1920, ms2560, ms3840, ms5120 }

TimerDiscard ::=                    ENUMERATED {
                                        td0-1, td0-25, td0-5, td0-75,
                                        td1, td1-25, td1-5, td1-75,
                                        td2, td2-5, td3, td3-5, td4,
                                        td4-5, td5, td7-5 }

TimerEPC ::=                        ENUMERATED {
                                        te50, te60, te70, te80, te90,
                                        te100, te120, te140, te160, te180,
                                        te200, te300, te400, te500, te700,
                                        te900 }

TimerMRW ::=                        ENUMERATED {
                                        te50, te60, te70, te80, te90, te100,
                                        te120, te140, te160, te180, te200,
```

```
                                    te300, te400, te500, te700, te900 }

TimerOSD-r6 ::=                 ENUMERATED {
                                    ms40, ms80, ms120, ms160, ms240, ms320, ms480, ms640,
                                    ms960, ms1280, ms1920, ms2560, ms3840, ms5120 }

TimerPoll ::=                   ENUMERATED {
                                    tp10, tp20, tp30, tp40, tp50,
                                    tp60, tp70, tp80, tp90, tp100,
                                    tp110, tp120, tp130, tp140, tp150,
                                    tp160, tp170, tp180, tp190, tp200,
                                    tp210, tp220, tp230, tp240, tp250,
                                    tp260, tp270, tp280, tp290, tp300,
                                    tp310, tp320, tp330, tp340, tp350,
                                    tp360, tp370, tp380, tp390, tp400,
                                    tp410, tp420, tp430, tp440, tp450,
                                    tp460, tp470, tp480, tp490, tp500,
                                    tp510, tp520, tp530, tp540, tp550,
                                    tp600, tp650, tp700, tp750, tp800,
                                    tp850, tp900, tp950, tp1000 }

TimerPollPeriodic ::=           ENUMERATED {
                                    tper100, tper200, tper300, tper400,
                                    tper500, tper750, tper1000, tper2000 }

TimerPollProhibit ::=           ENUMERATED {
                                    tpp10, tpp20, tpp30, tpp40, tpp50,
                                    tpp60, tpp70, tpp80, tpp90, tpp100,
                                    tpp110, tpp120, tpp130, tpp140, tpp150,
                                    tpp160, tpp170, tpp180, tpp190, tpp200,
                                    tpp210, tpp220, tpp230, tpp240, tpp250,
                                    tpp260, tpp270, tpp280, tpp290, tpp300,
                                    tpp310, tpp320, tpp330, tpp340, tpp350,
                                    tpp360, tpp370, tpp380, tpp390, tpp400,
                                    tpp410, tpp420, tpp430, tpp440, tpp450,
                                    tpp460, tpp470, tpp480, tpp490, tpp500,
                                    tpp510, tpp520, tpp530, tpp540, tpp550,
                                    tpp600, tpp650, tpp700, tpp750, tpp800,
                                    tpp850, tpp900, tpp950, tpp1000 }

TimerRST ::=                    ENUMERATED {
                                    tr50, tr100, tr150, tr200, tr250, tr300,
                                    tr350, tr400, tr450, tr500, tr550,
                                    tr600, tr700, tr800, tr900, tr1000 }

TimerStatusPeriodic ::=         ENUMERATED {
                                    tsp100, tsp200, tsp300, tsp400, tsp500,
                                    tsp750, tsp1000, tsp2000 }

TimerStatusProhibit ::=         ENUMERATED {
                                    tsp10,tsp20,tsp30,tsp40,tsp50,
                                    tsp60,tsp70,tsp80,tsp90,tsp100,
                                    tsp110,tsp120,tsp130,tsp140,tsp150,
                                    tsp160,tsp170,tsp180,tsp190,tsp200,
                                    tsp210,tsp220,tsp230,tsp240,tsp250,
                                    tsp260,tsp270,tsp280,tsp290,tsp300,
                                    tsp310,tsp320,tsp330,tsp340,tsp350,
                                    tsp360,tsp370,tsp380,tsp390,tsp400,
                                    tsp410,tsp420,tsp430,tsp440,tsp450,
                                    tsp460,tsp470,tsp480,tsp490,tsp500,
                                    tsp510,tsp520,tsp530,tsp540,tsp550,
                                    tsp600,tsp650,tsp700,tsp750,tsp800,
                                    tsp850,tsp900,tsp950,tsp1000 }

TransmissionRLC-Discard ::=     CHOICE {
    timerBasedExplicit              ExplicitDiscard,
    timerBasedNoExplicit            NoExplicitDiscard,
    maxDAT-Retransmissions          MaxDAT-Retransmissions,
    noDiscard                       MaxDAT
}

TransmissionWindowSize ::=      ENUMERATED {
                                    tw1, tw8, tw16, tw32, tw64, tw128, tw256,
                                    tw512, tw768, tw1024, tw1536, tw2047,
                                    tw2560, tw3072, tw3584, tw4095 }

UL-AM-RLC-Mode ::=              SEQUENCE {
    transmissionRLC-Discard         TransmissionRLC-Discard,
```

```
    transmissionWindowSize              TransmissionWindowSize,
    timerRST                            TimerRST,
    max-RST                             MaxRST,
    pollingInfo                         PollingInfo                     OPTIONAL
}

UL-CounterSynchronisationInfo ::=       SEQUENCE {
    rB-WithPDCP-InfoList                    RB-WithPDCP-InfoList    OPTIONAL,
    startList                               STARTList
}

UL-LogicalChannelMapping ::=        SEQUENCE {
    -- TABULAR: UL-TransportChannelType contains TransportChannelIdentity as well.
    ul-TransportChannelType             UL-TransportChannelType,
    logicalChannelIdentity              LogicalChannelIdentity          OPTIONAL,
    rlc-SizeList                        CHOICE {
        allSizes                            NULL,
        configured                          NULL,
        explicitList                        RLC-SizeExplicitList
    },
    mac-LogicalChannelPriority          MAC-LogicalChannelPriority
}

UL-LogicalChannelMapping-r6 ::=     SEQUENCE {
    ul-TrCH-Type                        CHOICE {
        dch-rach-usch                       SEQUENCE {
            -- TABULAR: UL-TransportChannelType contains TransportChannelIdentity as well.
            ul-TransportChannelType             UL-TransportChannelType,
            logicalChannelIdentity              LogicalChannelIdentity          OPTIONAL,
            rlc-SizeList                        CHOICE {
                allSizes                            NULL,
                configured                          NULL,
                explicitList                        RLC-SizeExplicitList
            }
        },
        e-dch                               SEQUENCE {
            logicalChannelIdentity              LogicalChannelIdentity,
            e-DCH-MAC-d-FlowIdentity            E-DCH-MAC-d-FlowIdentity,
            ddi                                 DDI,
            rlc-PDU-SizeList                    RLC-PDU-SizeList,
            includeInSchedulingInfo             BOOLEAN
        }
    },
    mac-LogicalChannelPriority          MAC-LogicalChannelPriority
}

UL-LogicalChannelMappingList ::=    SEQUENCE {
    -- rlc-LogicalChannelMappingIndicator shall be set to TRUE in this version
    -- of the specification
    rlc-LogicalChannelMappingIndicator  BOOLEAN,
    ul-LogicalChannelMapping            SEQUENCE (SIZE (maxLoCHperRLC)) OF
                                        UL-LogicalChannelMapping
}

UL-LogicalChannelMappingList-r6 ::= SEQUENCE {
    -- rlc-LogicalChannelMappingIndicator shall be set to TRUE in this version
    -- of the specification
    rlc-LogicalChannelMappingIndicator  BOOLEAN,
    ul-LogicalChannelMapping            SEQUENCE (SIZE (maxLoCHperRLC)) OF
                                            UL-LogicalChannelMapping-r6
}

UL-LogicalChannelMappings ::=       CHOICE {
    oneLogicalChannel                   UL-LogicalChannelMapping,
    twoLogicalChannels                  UL-LogicalChannelMappingList
}

UL-LogicalChannelMappings-r6 ::=    CHOICE {
    oneLogicalChannel                   UL-LogicalChannelMapping-r6,
    twoLogicalChannels                  UL-LogicalChannelMappingList-r6
}

UL-RFC3095-r4 ::=                   SEQUENCE {
    cid-InclusionInfo                   CID-InclusionInfo-r4,
    max-CID                             INTEGER (1..16383)              DEFAULT 15,
    rohcPacketSizeList                  ROHC-PacketSizeList-r4
}
```

```
UL-RLC-Mode ::=                     CHOICE {
    ul-AM-RLC-Mode                      UL-AM-RLC-Mode,
    ul-UM-RLC-Mode                      UL-UM-RLC-Mode,
    ul-TM-RLC-Mode                      UL-TM-RLC-Mode,
    spare                               NULL
}

UL-TM-RLC-Mode ::=                  SEQUENCE {
    transmissionRLC-Discard             TransmissionRLC-Discard             OPTIONAL,
    segmentationIndication              BOOLEAN
}

UL-UM-RLC-Mode ::=                  SEQUENCE {
    transmissionRLC-Discard             TransmissionRLC-Discard             OPTIONAL
}

UL-TransportChannelType ::=         CHOICE {
    dch                                 TransportChannelIdentity,
    rach                                NULL,
    -- dummy is not used in this version of the specification and
    -- if received the UE behaviour is not specified.
    dummy                               NULL,
    usch                                TransportChannelIdentity
}

UM-RLC-DuplAvoid-Reord-Info-r6 ::=  SEQUENCE {
    timer-DAR                           TimerDAR-r6,
    widowSize-DAR                       WindowSizeDAR-r6
}

UM-RLC-OutOSeqDelivery-Info-r6 ::=  SEQUENCE {
    timer-OSD                           TimerOSD-r6                         OPTIONAL,
    windowSize-OSD                      WindowSizeOSD-r6
}

WindowSizeDAR-r6 ::=                ENUMERATED {
                                        ws4, ws8, ws16, ws32, ws40, ws48,
                                        ws56, ws64 }

WindowSizeOSD-r6 ::=                ENUMERATED {
                                        ws8, ws16, ws32, ws40, ws48,
                                        ws56, ws64 }

-- ***************************************************
--
--      TRANSPORT CHANNEL INFORMATION ELEMENTS (10.3.5)
--
-- ***************************************************

AddOrReconfMAC-dFlow ::=            SEQUENCE {
    mac-hs-AddReconfQueue-List                  MAC-hs-AddReconfQueue-List  OPTIONAL,
    mac-hs-DelQueue-List                        MAC-hs-DelQueue-List    OPTIONAL
}

AllowedTFC-List ::=                 SEQUENCE (SIZE (1..maxTFC)) OF
                                        TFC-Value

AllowedTFI-List ::=                 SEQUENCE (SIZE (1..maxTF)) OF
                                        INTEGER (0..31)

BitModeRLC-SizeInfo ::=             CHOICE {
    sizeType1                           INTEGER (0..127),
    -- Actual value sizeType2 = (part1 * 8) + 128 + part2
    sizeType2                           SEQUENCE {
        part1                               INTEGER (0..15),
        part2                               INTEGER (1..7)                  OPTIONAL
    },
    -- Actual value sizeType3 = (part1 * 16) + 256 + part2
    sizeType3                           SEQUENCE {
        part1                               INTEGER (0..47),
        part2                               INTEGER (1..15)                 OPTIONAL
    },
    -- Actual value sizeType4 = (part1 * 64) + 1024 + part2
    sizeType4                           SEQUENCE {
        part1                               INTEGER (0..62),
        part2                               INTEGER (1..63)                 OPTIONAL
    }
}
```

```
-- Actual value BLER-QualityValue = IE value * 0.1
BLER-QualityValue ::=                INTEGER (-63..0)

ChannelCodingType ::=                CHOICE {
    -- noCoding is only used for TDD in this version of the specification,
    -- otherwise it should be ignored
    noCoding                             NULL,
    convolutional                        CodingRate,
    turbo                                NULL
}

CodingRate ::=                       ENUMERATED {
                                         half,
                                         third }

CommonDynamicTF-Info ::=             SEQUENCE {
    rlc-Size                             CHOICE {
        fdd                                  SEQUENCE {
            octetModeRLC-SizeInfoType2           OctetModeRLC-SizeInfoType2
        },
        tdd                                  SEQUENCE {
            commonTDD-Choice                     CHOICE {
                bitModeRLC-SizeInfo                  BitModeRLC-SizeInfo,
                octetModeRLC-SizeInfoType1           OctetModeRLC-SizeInfoType1
            }
        }
    },
    numberOfTbSizeList               SEQUENCE (SIZE (1..maxTF)) OF
                                             NumberOfTransportBlocks,
    logicalChannelList               LogicalChannelList
}

CommonDynamicTF-Info-DynamicTTI ::= SEQUENCE {
    commonTDD-Choice                     CHOICE {
        bitModeRLC-SizeInfo                  BitModeRLC-SizeInfo,
        octetModeRLC-SizeInfoType1           OctetModeRLC-SizeInfoType1
    },
    numberOfTbSizeAndTTIList             NumberOfTbSizeAndTTIList,
    logicalChannelList                   LogicalChannelList
}

CommonDynamicTF-InfoList ::=         SEQUENCE (SIZE (1..maxTF)) OF
                                         CommonDynamicTF-Info

CommonDynamicTF-InfoList-DynamicTTI ::= SEQUENCE (SIZE (1..maxTF)) OF
                                         CommonDynamicTF-Info-DynamicTTI

CommonTransChTFS ::=                 SEQUENCE {
    tti                                  CHOICE {
        tti10                                CommonDynamicTF-InfoList,
        tti20                                CommonDynamicTF-InfoList,
        tti40                                CommonDynamicTF-InfoList,
        tti80                                CommonDynamicTF-InfoList,
        dynamic                              CommonDynamicTF-InfoList-DynamicTTI
    },
    semistaticTF-Information             SemistaticTF-Information
}

CommonTransChTFS-LCR ::=                 SEQUENCE {
    tti                                  CHOICE {
        tti5                                 CommonDynamicTF-InfoList,
        tti10                                CommonDynamicTF-InfoList,
        tti20                                CommonDynamicTF-InfoList,
        tti40                                CommonDynamicTF-InfoList,
        tti80                                CommonDynamicTF-InfoList,
        dynamic                              CommonDynamicTF-InfoList-DynamicTTI
    },
    semistaticTF-Information             SemistaticTF-Information
}

CPCH-SetID ::=                       INTEGER (1..maxCPCHsets)

CRC-Size ::=                         ENUMERATED {
                                         crc0, crc8, crc12, crc16, crc24 }

DedicatedDynamicTF-Info ::=          SEQUENCE {
    rlc-Size                             CHOICE {
```

```
        bitMode                             BitModeRLC-SizeInfo,
        octetModeType1                      OctetModeRLC-SizeInfoType1
    },
    numberOfTbSizeList              SEQUENCE (SIZE (1..maxTF)) OF
    NumberOfTransportBlocks,
    logicalChannelList              LogicalChannelList
}

DedicatedDynamicTF-Info-DynamicTTI ::= SEQUENCE {
    rlc-Size                            CHOICE {
        bitMode                             BitModeRLC-SizeInfo,
        octetModeType1                      OctetModeRLC-SizeInfoType1
    },
    numberOfTbSizeAndTTIList            NumberOfTbSizeAndTTIList,
    logicalChannelList              LogicalChannelList
}

DedicatedDynamicTF-InfoList ::=     SEQUENCE (SIZE (1..maxTF)) OF
                                        DedicatedDynamicTF-Info

DedicatedDynamicTF-InfoList-DynamicTTI ::= SEQUENCE (SIZE (1..maxTF)) OF
                                        DedicatedDynamicTF-Info-DynamicTTI

DedicatedTransChTFS ::=             SEQUENCE {
    tti                                 CHOICE {
        tti10                               DedicatedDynamicTF-InfoList,
        tti20                               DedicatedDynamicTF-InfoList,
        tti40                               DedicatedDynamicTF-InfoList,
        tti80                               DedicatedDynamicTF-InfoList,
        dynamic                             DedicatedDynamicTF-InfoList-DynamicTTI
    },
    semistaticTF-Information            SemistaticTF-Information
}

-- The maximum allowed size of DL-AddReconfTransChInfo2List sequence is 16
DL-AddReconfTransChInfo2List ::=    SEQUENCE (SIZE (1..maxTrCHpreconf)) OF
                                        DL-AddReconfTransChInformation2

-- The maximum allowed size of DL-AddReconfTransChInfoList sequence is 16
DL-AddReconfTransChInfoList ::=     SEQUENCE (SIZE (1..maxTrCHpreconf)) OF
                                        DL-AddReconfTransChInformation

-- The maximum allowed size of DL-AddReconfTransChInfoList-r4 sequence is 16
DL-AddReconfTransChInfoList-r4 ::=  SEQUENCE (SIZE (1..maxTrCHpreconf)) OF
                                        DL-AddReconfTransChInformation-r4

-- The maximum allowed size of DL-AddReconfTransChInfoList-r5 sequence is 16
DL-AddReconfTransChInfoList-r5 ::=  SEQUENCE (SIZE (1..maxTrCHpreconf)) OF
                                        DL-AddReconfTransChInformation-r5

-- ASN.1 for IE "Added or Reconfigured DL TrCH information"
-- in case of messages other than: Radio Bearer Release message and
-- Radio Bearer Reconfiguration message
DL-AddReconfTransChInformation ::=  SEQUENCE {
    dl-TransportChannelType             DL-TrCH-Type,
    dl-transportChannelIdentity         TransportChannelIdentity,
    tfs-SignallingMode                  CHOICE {
        explicit-config                     TransportFormatSet,
        sameAsULTrCH                        UL-TransportChannelIdentity
    },
    dch-QualityTarget                   QualityTarget                   OPTIONAL,
    -- dummy is not used in this version of the specification, it should
    -- not be sent and if received it should be ignored.
    dummy                               TM-SignallingInfo               OPTIONAL
}

DL-AddReconfTransChInformation-r4 ::=   SEQUENCE {
    dl-TransportChannelType             DL-TrCH-Type,
    dl-transportChannelIdentity         TransportChannelIdentity,
    tfs-SignallingMode                  CHOICE {
        explicit-config                     TransportFormatSet,
        sameAsULTrCH                        UL-TransportChannelIdentity
    },
    dch-QualityTarget                   QualityTarget                   OPTIONAL
}

DL-AddReconfTransChInformation-r5 ::=   SEQUENCE {
    dl-TransportChannelType             DL-TrCH-TypeId1-r5,
```

```
    tfs-SignallingMode                  CHOICE {
        explicit-config                     TransportFormatSet,
        sameAsULTrCH                        UL-TransportChannelIdentity,
        hsdsch                              HSDSCH-Info
    },
    dch-QualityTarget                   QualityTarget                       OPTIONAL
}

-- ASN.1 for IE "Added or Reconfigured DL TrCH information"
-- in case of Radio Bearer Release message and
-- Radio Bearer Reconfiguration message
DL-AddReconfTransChInformation2 ::= SEQUENCE {
    dl-TransportChannelType             DL-TrCH-Type,
    transportChannelIdentity            TransportChannelIdentity,
    tfs-SignallingMode                  CHOICE {
        explicit-config                     TransportFormatSet,
        sameAsULTrCH                        UL-TransportChannelIdentity
    },
    qualityTarget                       QualityTarget                       OPTIONAL
}

DL-CommonTransChInfo ::=            SEQUENCE {
    sccpch-TFCS                         TFCS                                OPTIONAL,
    -- modeSpecificInfo should be optional. A new version of this IE should be defined
    -- to be used in later versions of messages using this IE
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            dl-Parameters                       CHOICE {
                dl-DCH-TFCS                         TFCS,
                sameAsUL                            NULL
            }                                                               OPTIONAL
        },
        tdd                                 SEQUENCE {
            individualDL-CCTrCH-InfoList        IndividualDL-CCTrCH-InfoList
                                                                            OPTIONAL
        }
    }
}

DL-CommonTransChInfo-r4 ::=         SEQUENCE {
    sccpch-TFCS                         TFCS                                OPTIONAL,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            dl-Parameters                       CHOICE {
                dl-DCH-TFCS                         SEQUENCE {
                    tfcs                                TFCS                OPTIONAL
                },
                sameAsUL                            NULL
            }                                                               OPTIONAL
        },
        tdd                                 SEQUENCE {
            individualDL-CCTrCH-InfoList        IndividualDL-CCTrCH-InfoList
                                                                            OPTIONAL
        }
    }   OPTIONAL
}

DL-DeletedTransChInfoList ::=       SEQUENCE (SIZE (1..maxTrCH)) OF
                                        DL-TransportChannelIdentity

DL-DeletedTransChInfoList-r5 ::=    SEQUENCE (SIZE (1..maxTrCH)) OF
                                        DL-TransportChannelIdentity-r5

DL-TransportChannelIdentity ::=         SEQUENCE {
    dl-TransportChannelType             DL-TrCH-Type,
    dl-TransportChannelIdentity         TransportChannelIdentity
}

DL-TransportChannelIdentity-r5 ::=      SEQUENCE {
    dl-TransportChannelType             DL-TrCH-TypeId2-r5
}

-- The choice "dsch" should not be used in FDD mode, and if received the UE behaviour is unspecified
DL-TrCH-Type ::=                    ENUMERATED {dch, dsch}

DL-TrCH-TypeId1-r5 ::=              CHOICE {
    dch                                 TransportChannelIdentity,
    -- The choice "dsch" should not be used in FDD mode, and if received
```

```
    -- the UE behaviour is unspecified.
    dsch                                TransportChannelIdentity,
    hsdsch                              NULL
}

DL-TrCH-TypeId2-r5 ::=              CHOICE {
    dch                                 TransportChannelIdentity,
    -- The choice "dsch" should not be used in FDD mode, and if received
    -- the UE behaviour is unspecified.
    dsch                                TransportChannelIdentity,
    hsdsch                              MAC-d-FlowIdentity
}

DRAC-ClassIdentity ::=              INTEGER (1..maxDRACclasses)

DRAC-StaticInformation ::=          SEQUENCE {
    transmissionTimeValidity            TransmissionTimeValidity,
    timeDurationBeforeRetry             TimeDurationBeforeRetry,
    drac-ClassIdentity                  DRAC-ClassIdentity
}

DRAC-StaticInformationList ::=      SEQUENCE (SIZE (1..maxTrCH)) OF
                                        DRAC-StaticInformation

E-DCH-AddReconf-MAC-d-Flow ::=      SEQUENCE {
    mac-d-FlowIdentity                  E-DCH-MAC-d-FlowIdentity,
    mac-d-FlowPowerOffset               E-DCH-MAC-d-FlowPowerOffset         OPTIONAL,
    mac-d-FlowMaxRetrans                E-DCH-MAC-d-FlowMaxRetrans          OPTIONAL,
    mac-d-FlowMultiplexingList          E-DCH-MAC-d-FlowMultiplexingList    OPTIONAL,
    transmissionGrantType               CHOICE {
        non-ScheduledTransGrantInfo         SEQUENCE {
            maxMAC-e-PDUContents                INTEGER (1..19982),
            ms2-NonSchedTransmGrantHARQAlloc    BIT STRING (SIZE (8))       OPTIONAL
        },
        scheduledTransmissionGrantInfo      NULL
    }   OPTIONAL
}

E-DCH-AddReconf-MAC-d-FlowList ::=  SEQUENCE (SIZE (1..maxE-DCHMACdFlow)) OF
                            E-DCH-AddReconf-MAC-d-Flow

E-DCH-MAC-d-FlowIdentity ::=        INTEGER (0..maxE-DCHMACdFlow-1)

E-DCH-MAC-d-FlowMaxRetrans ::=      INTEGER (0..15)

E-DCH-MAC-d-FlowMultiplexingList ::= BIT STRING (SIZE (maxE-DCHMACdFlow))

E-DCH-MAC-d-FlowPowerOffset ::=     INTEGER (0..6)

E-DCH-TTI ::=                       ENUMERATED { tti2, tti10 }

ExplicitTFCS-Configuration ::=      CHOICE {
    complete                            TFCS-ReconfAdd,
    addition                            TFCS-ReconfAdd,
    removal                             TFCS-RemovalList,
    replacement                         SEQUENCE {
        tfcsRemoval                         TFCS-RemovalList,
        tfcsAdd                             TFCS-ReconfAdd
    }
}

GainFactor ::=                      INTEGER (0..15)

GainFactorInformation ::=           CHOICE {
    signalledGainFactors                SignalledGainFactors,
    computedGainFactors                 ReferenceTFC-ID
}

HSDSCH-Info ::=                     SEQUENCE {
    harqInfo                            HARQ-Info               OPTIONAL,
    addOrReconfMAC-dFlow                AddOrReconfMAC-dFlow    OPTIONAL
}

HARQ-Info ::=                       SEQUENCE {
    numberOfProcesses                   INTEGER (1..8),
    memoryPartitioning                  CHOICE {
        implicit                            NULL,
        explicit                            SEQUENCE (SIZE (1..maxHProcesses)) OF
```

```
                                                HARQMemorySize
    }
}

HARQMemorySize ::=                  ENUMERATED {
                                        hms800, hms1600, hms2400, hms3200, hms4000,
                                        hms4800, hms5600, hms6400, hms7200, hms8000,
                                        hms8800, hms9600, hms10400, hms11200, hms12000,
                                        hms12800, hms13600, hms14400, hms15200, hms16000,
                                        hms17600, hms19200, hms20800, hms22400, hms24000,
                                        hms25600, hms27200, hms28800, hms30400, hms32000,
                                        hms36000, hms40000, hms44000, hms48000, hms52000,
                                        hms56000, hms60000, hms64000, hms68000, hms72000,
                                        hms76000, hms80000, hms88000, hms96000, hms104000,
                                        hms112000, hms120000, hms128000, hms136000, hms144000,
                                        hms152000, hms160000, hms176000, hms192000, hms208000,
                                        hms224000, hms240000, hms256000, hms272000, hms288000,
                                        hms304000 }

IndividualDL-CCTrCH-Info ::=        SEQUENCE {
    dl-TFCS-Identity                    TFCS-Identity,
    tfcs-SignallingMode                 CHOICE {
        explicit-config                     TFCS,
        sameAsUL                            TFCS-Identity
    }
}

IndividualDL-CCTrCH-InfoList ::=    SEQUENCE (SIZE (1..maxCCTrCH)) OF
                                        IndividualDL-CCTrCH-Info

IndividualUL-CCTrCH-Info ::=        SEQUENCE {
    ul-TFCS-Identity                    TFCS-Identity,
    ul-TFCS                             TFCS ,
    tfc-Subset                          TFC-Subset
}

IndividualUL-CCTrCH-InfoList ::=    SEQUENCE (SIZE (1..maxCCTrCH)) OF
                                        IndividualUL-CCTrCH-Info

LogicalChannelByRB ::=              SEQUENCE {
    rb-Identity                         RB-Identity,
    logChOfRb                           INTEGER (0..1)              OPTIONAL
}

LogicalChannelList ::=              CHOICE {
        allSizes                            NULL,
        configured                          NULL,
        explicitList                        SEQUENCE (SIZE (1..15)) OF
                                                LogicalChannelByRB
}

MAC-d-FlowIdentityDCHandHSDSCH ::=  SEQUENCE {
    dch-transport-ch-id                 TransportChannelIdentity,
    hsdsch-mac-d-flow-id                MAC-d-FlowIdentity
}

MAC-d-FlowIdentity ::=              INTEGER (0..7)

MAC-d-PDU-SizeInfo-List ::=         SEQUENCE (SIZE(1.. maxMAC-d-PDUsizes)) OF
                                        MAC-d-PDUsizeInfo

--MAC-d-Pdu sizes need to be defined
MAC-d-PDUsizeInfo ::=               SEQUENCE{
    mac-d-PDU-Size                      INTEGER (1..5000),
    mac-d-PDU-Index                     INTEGER(0..7)
}

MAC-hs-AddReconfQueue-List ::=          SEQUENCE (SIZE(1..maxQueueIDs)) OF
                                        MAC-hs-AddReconfQueue

MAC-hs-AddReconfQueue ::=           SEQUENCE {
    mac-hsQueueId                       INTEGER(0..7),
    mac-dFlowId                         MAC-d-FlowIdentity,
    reorderingReleaseTimer              T1-ReleaseTimer,
    mac-hsWindowSize                    MAC-hs-WindowSize,
    mac-d-PDU-SizeInfo-List             MAC-d-PDU-SizeInfo-List     OPTIONAL
}
```

```
MAC-hs-DelQueue-List ::=              SEQUENCE (SIZE(1..maxQueueIDs)) OF
                                          MAC-hs-DelQueue

MAC-hs-DelQueue ::=                   SEQUENCE {
    mac-hsQueueId                         INTEGER(0..7)
}

MAC-hs-WindowSize ::=                 ENUMERATED {
                                          mws4, mws6, mws8, mws12, mws16, mws24, mws32 }

NumberOfTbSizeAndTTIList ::=          SEQUENCE (SIZE (1..maxTF)) OF SEQUENCE {
        numberOfTransportBlocks               NumberOfTransportBlocks,
        transmissionTimeInterval              TransmissionTimeInterval
}

MessType ::=                          ENUMERATED {
                                          transportFormatCombinationControl }

Non-allowedTFC-List ::=               SEQUENCE (SIZE (1..maxTFC)) OF
                                          TFC-Value

NumberOfTransportBlocks ::=           CHOICE {
    zero                                  NULL,
    one                                   NULL,
    small                                 INTEGER (2..17),
    large                                 INTEGER (18..512)
}

OctetModeRLC-SizeInfoType1 ::=        CHOICE {
    -- Actual size = (8 * sizeType1) + 16
    sizeType1                             INTEGER (0..31),
    sizeType2                             SEQUENCE {
        -- Actual size = (32 * part1) + 272 + (part2 * 8)
        part1                                 INTEGER (0..23),
        part2                                 INTEGER (1..3)                  OPTIONAL
    },
    sizeType3                             SEQUENCE {
        -- Actual size = (64 * part1) + 1040 + (part2 * 8)
        part1                                 INTEGER (0..61),
        part2                                 INTEGER (1..7)                  OPTIONAL
    }
}

OctetModeRLC-SizeInfoType2 ::=        CHOICE {
    -- Actual size = (sizeType1 * 8) + 48
    sizeType1                             INTEGER (0..31),
    -- Actual size = (sizeType2 * 16) + 312
    sizeType2                             INTEGER (0..63),
    -- Actual size = (sizeType3 *64) + 1384
    sizeType3                             INTEGER (0..56)
}

PowerOffsetInfoShort ::=              SEQUENCE {
    referenceTFC                          TFC-Value,
    modeSpecificInfo                      CHOICE {
        fdd                                   SEQUENCE {
            gainFactorBetaC                       GainFactor
        },
        tdd                                   NULL
    },
    gainFactorBetaD                       GainFactor
}

PowerOffsetInformation ::=            SEQUENCE {
    gainFactorInformation                 GainFactorInformation,
    -- PowerOffsetPp-m is always absent in TDD
    powerOffsetPp-m                       PowerOffsetPp-m                     OPTIONAL
}

PowerOffsetPp-m ::=                   INTEGER (-5..10)

PreDefTransChConfiguration ::=        SEQUENCE {
    ul-CommonTransChInfo                  UL-CommonTransChInfo,
    ul-AddReconfTrChInfoList              UL-AddReconfTransChInfoList,
    dl-CommonTransChInfo                  DL-CommonTransChInfo,
    dl-TrChInfoList                       DL-AddReconfTransChInfoList
}
```

```
QualityTarget ::=                   SEQUENCE {
    bler-QualityValue                   BLER-QualityValue
}

RateMatchingAttribute ::=           INTEGER (1..hiRM)


ReferenceTFC-ID ::=                 INTEGER (0..3)

RestrictedTrChInfo ::=              SEQUENCE {
    ul-TransportChannelType             UL-TrCH-Type,
    restrictedTrChIdentity              TransportChannelIdentity,
    allowedTFI-List                     AllowedTFI-List                     OPTIONAL
}

RestrictedTrChInfoList ::=          SEQUENCE (SIZE (1..maxTrCH)) OF
                                        RestrictedTrChInfo

SemistaticTF-Information ::=        SEQUENCE {
    -- TABULAR: Transmission time interval has been included in the IE CommonTransChTFS.
    channelCodingType                   ChannelCodingType,
    rateMatchingAttribute               RateMatchingAttribute,
    crc-Size                            CRC-Size
}

SignalledGainFactors ::=            SEQUENCE {
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            gainFactorBetaC                     GainFactor
        },
        tdd                                 NULL
    },
    gainFactorBetaD                     GainFactor,
    referenceTFC-ID                     ReferenceTFC-ID                     OPTIONAL
}

SplitTFCI-Signalling ::=            SEQUENCE {
    splitType                           SplitType                       OPTIONAL,
    tfci-Field2-Length                  INTEGER (1..10)                 OPTIONAL,
    tfci-Field1-Information             ExplicitTFCS-Configuration      OPTIONAL,
    tfci-Field2-Information             TFCI-Field2-Information         OPTIONAL
}

SplitType ::=                       ENUMERATED {
                                        hardSplit, logicalSplit }

T1-ReleaseTimer ::=                 ENUMERATED {
                                        rt10, rt20, rt30, rt40, rt50,
                                        rt60, rt70, rt80, rt90, rt100,
                                        rt120, rt140, rt160, rt200, rt300,
                                        rt400 }


TFC-Subset ::=                      CHOICE {
    minimumAllowedTFC-Number            TFC-Value,
    allowedTFC-List                     AllowedTFC-List,
    non-allowedTFC-List                 Non-allowedTFC-List,
    restrictedTrChInfoList              RestrictedTrChInfoList,
    fullTFCS                            NULL
}

TFC-SubsetList ::=                  SEQUENCE (SIZE (1.. maxTFCsub)) OF SEQUENCE {
    modeSpecificInfo                    CHOICE {
        fdd                                 NULL,
        tdd                                 SEQUENCE {
            tfcs-ID                             TFCS-Identity               OPTIONAL
        }
    },
    tfc-Subset                          TFC-Subset
}

TFC-Value ::=                       INTEGER (0..1023)

TFCI-Field2-Information ::=         CHOICE {
    tfci-Range                          TFCI-RangeList,
    explicit-config                     ExplicitTFCS-Configuration
}

TFCI-Range ::=                      SEQUENCE {
```

```
    maxTFCIField2Value                  INTEGER (1..1023),
    tfcs-InfoForDSCH                    TFCS-InfoForDSCH
}

TFCI-RangeList ::=                  SEQUENCE (SIZE (1..maxPDSCH-TFCIgroups)) OF
                                        TFCI-Range

TFCS ::=                            CHOICE {
    normalTFCI-Signalling               ExplicitTFCS-Configuration,
    -- dummy is not used in this version of specification, it should
    -- not be sent and if received it should be ignored.
    dummy                               SplitTFCI-Signalling
}

TFCS-Identity ::=                   SEQUENCE {
    tfcs-ID                             TFCS-IdentityPlain                  DEFAULT 1,
    sharedChannelIndicator              BOOLEAN
}

TFCS-IdentityPlain ::=              INTEGER (1..8)

TFCS-InfoForDSCH ::=                CHOICE {
    ctfc2bit                            INTEGER (0..3),
    ctfc4bit                            INTEGER (0..15),
    ctfc6bit                            INTEGER (0..63),
    ctfc8bit                            INTEGER (0..255),
    ctfc12bit                           INTEGER (0..4095),
    ctfc16bit                           INTEGER (0..65535),
    ctfc24bit                           INTEGER (0..16777215)
}

TFCS-ReconfAdd ::=                  SEQUENCE{
    ctfcSize                            CHOICE{
        ctfc2Bit                            SEQUENCE (SIZE (1..maxTFC)) OF SEQUENCE {
            ctfc2                               INTEGER (0..3),
            powerOffsetInformation              PowerOffsetInformation          OPTIONAL
        },
        ctfc4Bit                            SEQUENCE (SIZE (1..maxTFC)) OF SEQUENCE {
            ctfc4                               INTEGER (0..15),
            powerOffsetInformation              PowerOffsetInformation          OPTIONAL
        },
        ctfc6Bit                            SEQUENCE (SIZE (1..maxTFC)) OF SEQUENCE {
            ctfc6                               INTEGER (0..63),
            powerOffsetInformation              PowerOffsetInformation          OPTIONAL
        },
        ctfc8Bit                            SEQUENCE (SIZE (1..maxTFC)) OF SEQUENCE {
            ctfc8                               INTEGER (0..255),
            powerOffsetInformation              PowerOffsetInformation          OPTIONAL
        },
        ctfc12Bit                           SEQUENCE (SIZE(1..maxTFC)) OF SEQUENCE {
            ctfc12                              INTEGER (0..4095),
            powerOffsetInformation              PowerOffsetInformation          OPTIONAL
        },
        ctfc16Bit                           SEQUENCE (SIZE (1..maxTFC)) OF SEQUENCE {
            ctfc16                              INTEGER(0..65535),
            powerOffsetInformation              PowerOffsetInformation          OPTIONAL
        },
        ctfc24Bit                           SEQUENCE (SIZE (1..maxTFC)) OF SEQUENCE {
            ctfc24                              INTEGER(0..16777215),
            powerOffsetInformation              PowerOffsetInformation          OPTIONAL
        }
    }
}

TFCS-Removal ::=                    SEQUENCE {
    tfci                                INTEGER (0..1023)
}

TFCS-RemovalList ::=                SEQUENCE (SIZE (1..maxTFC)) OF
                                        TFCS-Removal

TimeDurationBeforeRetry ::=         INTEGER (1..256)

TM-SignallingInfo ::=               SEQUENCE {
    messType                            MessType,
    tm-SignallingMode                   CHOICE {
        mode1                               NULL,
        mode2                               SEQUENCE {
```

```
            -- in ul-controlledTrChList, TrCH-Type is always DCH
            ul-controlledTrChList              UL-ControlledTrChList
        }
    }
}

TransmissionTimeInterval ::=        ENUMERATED {
                                        tti10, tti20, tti40, tti80 }

TransmissionTimeValidity ::=        INTEGER (1..256)

TransportChannelIdentity ::=        INTEGER (1..32)

TransportChannelIdentityDCHandDSCH ::=  SEQUENCE {
    dch-transport-ch-id             TransportChannelIdentity,
    dsch-transport-ch-id            TransportChannelIdentity
}


TransportFormatSet ::=              CHOICE {
    dedicatedTransChTFS                 DedicatedTransChTFS,
    commonTransChTFS                    CommonTransChTFS
}

TransportFormatSet-LCR ::=              CHOICE {
    dedicatedTransChTFS                 DedicatedTransChTFS,
    commonTransChTFS-LCR                CommonTransChTFS-LCR
}

-- The maximum allowed size of UL-AddReconfTransChInfoList sequence is 16
UL-AddReconfTransChInfoList ::=     SEQUENCE (SIZE (1..maxTrCHpreconf)) OF
                                        UL-AddReconfTransChInformation

-- The maximum allowed size of UL-AddReconfTransChInfoList-r6 sequence is 32
UL-AddReconfTransChInfoList-r6 ::=  SEQUENCE (SIZE (1..maxTrCH)) OF
                                        UL-AddReconfTransChInformation-r6

UL-AddReconfTransChInformation ::= SEQUENCE {
    ul-TransportChannelType             UL-TrCH-Type,
    transportChannelIdentity            TransportChannelIdentity,
    transportFormatSet                  TransportFormatSet
}

UL-AddReconfTransChInformation-r6 ::= CHOICE {
    dch-usch                            SEQUENCE {
        ul-TransportChannelType             UL-TrCH-Type,
        transportChannelIdentity            TransportChannelIdentity,
        transportFormatSet                  TransportFormatSet
    },
    e-dch                               SEQUENCE {
        tti                                 E-DCH-TTI,
        harq-Info                           ENUMERATED { rv0, rvtable },
        addReconf-MAC-d-FlowList            E-DCH-AddReconf-MAC-d-FlowList  OPTIONAL
    }
}

UL-CommonTransChInfo ::=            SEQUENCE {
    -- TABULAR: tfc-subset is applicable to FDD only, TDD specifies tfc-subset in individual
    -- CCTrCH Info.
    tfc-Subset                          TFC-Subset                          OPTIONAL,
    prach-TFCS                          TFCS                                OPTIONAL,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            ul-TFCS                             TFCS
        },
        tdd                                 SEQUENCE {

            individualUL-CCTrCH-InfoList        IndividualUL-CCTrCH-InfoList
                                                                            OPTIONAL
        }
    }                                                                       OPTIONAL
}

UL-CommonTransChInfo-r4 ::=         SEQUENCE {
    -- TABULAR: tfc-subset is applicable to FDD only, TDD specifies tfc-subset in individual
    -- CCTrCH Info.
    tfc-Subset                          TFC-Subset                          OPTIONAL,
    prach-TFCS                          TFCS                                OPTIONAL,
```

```
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            ul-TFCS                             TFCS
        },
        tdd                                 SEQUENCE {
            individualUL-CCTrCH-InfoList        IndividualUL-CCTrCH-InfoList        OPTIONAL
        }
    }                                                                       OPTIONAL,
    tfc-SubsetList                      TFC-SubsetList                      OPTIONAL
}

-- In UL-ControlledTrChList, TrCH-Type is always DCH
UL-ControlledTrChList ::=           SEQUENCE (SIZE (1..maxTrCH)) OF
                                        TransportChannelIdentity

UL-DeletedTransChInfoList ::=       SEQUENCE (SIZE (1..maxTrCH)) OF
                                        UL-TransportChannelIdentity

UL-DeletedTransChInfoList-r6 ::=    SEQUENCE (SIZE (1..maxTrCH)) OF
                                        UL-TransportChannelIdentity-r6

UL-TransportChannelIdentity ::=     SEQUENCE {
    ul-TransportChannelType             UL-TrCH-Type,
    ul-TransportChannelIdentity         TransportChannelIdentity
}

UL-TransportChannelIdentity-r6 ::=  CHOICE {
    dch-usch                            SEQUENCE {
        ul-TransportChannelType             UL-TrCH-Type,
        ul-TransportChannelIdentity         TransportChannelIdentity
    },
    e-dch                               E-DCH-MAC-d-FlowIdentity
}

UL-TrCH-Type ::=                    ENUMERATED {dch, usch}

USCH-TransportChannelsInfo ::=      SEQUENCE (SIZE (1..maxTrCH)) OF
                                        SEQUENCE {
    usch-TransportChannelIdentity           TransportChannelIdentity,
    usch-TFS                                TransportFormatSet
}
-- ***************************************************
--
--      PHYSICAL CHANNEL INFORMATION ELEMENTS (10.3.6)
--
-- ***************************************************

ACK-NACK-repetitionFactor ::=       INTEGER(1..4)

AC-To-ASC-Mapping ::=               INTEGER (0..7)

AC-To-ASC-MappingTable ::=          SEQUENCE (SIZE (maxASCmap)) OF
                                        AC-To-ASC-Mapping

AccessServiceClass-FDD ::=          SEQUENCE {
    availableSignatureStartIndex        INTEGER (0..15),
    availableSignatureEndIndex          INTEGER (0..15),

    assignedSubChannelNumber            BIT STRING {
                                            b3(0),
                                            b2(1),
                                            b1(2),
                                            b0(3)
                                            }   (SIZE(4))
}

AccessServiceClass-TDD ::=          SEQUENCE {
    channelisationCodeIndices           BIT STRING  {
                                            chCodeIndex7(0),
                                            chCodeIndex6(1),
                                            chCodeIndex5(2),
                                            chCodeIndex4(3),
                                            chCodeIndex3(4),
                                            chCodeIndex2(5),
                                            chCodeIndex1(6),
                                            chCodeIndex0(7)
                                            } (SIZE(8))             OPTIONAL,
    subchannelSize                      CHOICE {
```

```
        size1                               NULL,
        size2                               SEQUENCE {
            -- subch0 means bitstring '01' in the tabular, subch1 means bitsring '10'
            subchannels                         ENUMERATED  { subch0, subch1 }  OPTIONAL
        },
        size4                               SEQUENCE {
            subchannels                         BIT STRING  {
                                                    subCh3(0),
                                                    subCh2(1),
                                                    subCh1(2),
                                                    subCh0(3)
                                                    } (SIZE(4))     OPTIONAL
        },
        size8                               SEQUENCE {
            subchannels                         BIT STRING  {
                                                    subCh7(0),
                                                    subCh6(1),
                                                    subCh5(2),
                                                    subCh4(3),
                                                    subCh3(4),
                                                    subCh2(5),
                                                    subCh1(6),
                                                    subCh0(7)
                                                    } (SIZE(8))     OPTIONAL
        }
    }
}

AccessServiceClass-TDD-r7 ::=           SEQUENCE {
    channelisationCodeIndices           BIT STRING  {
                                            chCodeIndex15(0),
                                            chCodeIndex14(1),
                                            chCodeIndex13(2),
                                            chCodeIndex12(3),
                                            chCodeIndex11(4),
                                            chCodeIndex10(5),
                                            chCodeIndex9(6),
                                            chCodeIndex8(7),
                                            chCodeIndex7(8),
                                            chCodeIndex6(9),
                                            chCodeIndex5(10),
                                            chCodeIndex4(11),
                                            chCodeIndex3(12),
                                            chCodeIndex2(13),
                                            chCodeIndex1(14),
                                            chCodeIndex0(15)
                                            } (SIZE(16))                OPTIONAL,
    subchannelSize                      CHOICE {
        size1                               NULL,
        size2                               SEQUENCE {
            -- subch0 means bitstring '01' in the tabular, subch1 means bitsring '10'
            subchannels                         ENUMERATED  { subch0, subch1 }  OPTIONAL
        },
        size4                               SEQUENCE {
            subchannels                         BIT STRING  {
                                                    subCh3(0),
                                                    subCh2(1),
                                                    subCh1(2),
                                                    subCh0(3)
                                                    } (SIZE(4))     OPTIONAL
        },
        size8                               SEQUENCE {
            subchannels                         BIT STRING  {
                                                    subCh7(0),
                                                    subCh6(1),
                                                    subCh5(2),
                                                    subCh4(3),
                                                    subCh3(4),
                                                    subCh2(5),
                                                    subCh1(6),
                                                    subCh0(7)
                                                    } (SIZE(8))     OPTIONAL
        },
        size16                              SEQUENCE {
            subchannels                         BIT STRING  {
                                                    subCh15(0),
                                                    subCh14(1),
                                                    subCh13(2),
```

```
                                                            subCh12(3),
                                                            subCh11(4),
                                                            subCh10(5),
                                                            subCh9(6),
                                                            subCh8(7),
                                                            subCh7(8),
                                                            subCh6(9),
                                                            subCh5(10),
                                                            subCh4(11),
                                                            subCh3(12),
                                                            subCh2(13),
                                                            subCh1(14),
                                                            subCh0(15)
                                                            } (SIZE(16))        OPTIONAL
        }
    }
}

AccessServiceClass-TDD-LCR-r4 ::=   SEQUENCE {
    availableSYNC-UlCodesIndics         BIT STRING {
                                            sulCodeIndex7(0),
                                            sulCodeIndex6(1),
                                            sulCodeIndex5(2),
                                            sulCodeIndex4(3),
                                            sulCodeIndex3(4),
                                            sulCodeIndex2(5),
                                            sulCodeIndex1(6),
                                            sulCodeIndex0(7)
                                            } (SIZE(8))             OPTIONAL,
    subchannelSize                      CHOICE {
        size1                               NULL,
        size2                               SEQUENCE {
            -- subch0 means bitstring '01' in the tabular, subch1 means bitsring '10'.
            subchannels                         ENUMERATED  { subch0, subch1 }  OPTIONAL
        },
        size4                               SEQUENCE {
            subchannels                         BIT STRING  {
                                                    subCh3(0),
                                                    subCh2(1),
                                                    subCh1(2),
                                                    subCh0(3)
                                                    } (SIZE(4))         OPTIONAL
        },
        size8                               SEQUENCE {
            subchannels                         BIT STRING  {
                                                    subCh7(0),
                                                    subCh6(1),
                                                    subCh5(2),
                                                    subCh4(3),
                                                    subCh3(4),
                                                    subCh2(5),
                                                    subCh1(6),
                                                    subCh0(7)
                                                    } (SIZE(8))         OPTIONAL
        }
    }

}

AdditionalPRACH-TF-and-TFCS-CCCH-IEs ::= SEQUENCE {
    powerOffsetInformation              PowerOffsetInformation,
    dynamicTFInformationCCCH            DynamicTFInformationCCCH
}

AdditionalPRACH-TF-and-TFCS-CCCH ::=    SEQUENCE {
    additionalPRACH-TF-and-TFCS-CCCH-IEs    AdditionalPRACH-TF-and-TFCS-CCCH-IEs    OPTIONAL
}

-- The order is the same as in the PRACH-SystemInformationList
AdditionalPRACH-TF-and-TFCS-CCCH-List ::=   SEQUENCE (SIZE (1..maxPRACH)) OF
                                        AdditionalPRACH-TF-and-TFCS-CCCH

AICH-Info ::=                       SEQUENCE {
    channelisationCode256               ChannelisationCode256,
    sttd-Indicator                      BOOLEAN,
    aich-TransmissionTiming             AICH-TransmissionTiming
}
```

```
AICH-PowerOffset ::=                INTEGER (-22..5)

AICH-TransmissionTiming ::=         ENUMERATED {
                                        e0, e1 }

AllocationPeriodInfo ::=            SEQUENCE {
    allocationActivationTime            INTEGER (0..255),
    allocationDuration                  INTEGER (1..256)
}

-- Actual value Alpha = IE value * 0.125
Alpha ::=                           INTEGER (0..8)

AP-AICH-ChannelisationCode ::=      INTEGER (0..255)

AP-PreambleScramblingCode ::=       INTEGER (0..79)

AP-Signature ::=                    INTEGER (0..15)

AP-Signature-VCAM ::=               SEQUENCE {
    ap-Signature                        AP-Signature,
    availableAP-SubchannelList          AvailableAP-SubchannelList OPTIONAL
}

AP-Subchannel ::=                   INTEGER (0..11)

ASCSetting-FDD ::=                      SEQUENCE {
    -- TABULAR: accessServiceClass-FDD is MD in tabular description
    -- Default value is previous ASC
    -- If this is the first ASC, the default value is all available signature and sub-channels
    accessServiceClass-FDD                  AccessServiceClass-FDD  OPTIONAL
}

ASCSetting-TDD ::=                      SEQUENCE {
    -- TABULAR: accessServiceClass-TDD is MD in tabular description
    -- Default value is previous ASC
    -- If this is the first ASC, the default value is all available channelisation codes and
    -- all available sub-channels with subchannelSize=size1.
    accessServiceClass-TDD                  AccessServiceClass-TDD  OPTIONAL
}

ASCSetting-TDD-r7 ::=                       SEQUENCE {
    -- TABULAR: accessServiceClass-TDD is MD in tabular description
    -- Default value is previous ASC
    -- If this is the first ASC, the default value is all available channelisation codes and
    -- all available sub-channels with subchannelSize=size1.
    accessServiceClass-TDD                      AccessServiceClass-TDD-r7   OPTIONAL
}

ASCSetting-TDD-LCR-r4 ::=                       SEQUENCE {
    -- TABULAR: accessServiceClass-TDD-LCR is MD in tabular description
    -- Default value is previous ASC
    -- If this is the first ASC, the default value is all available SYNC_UL codes and
    -- all available sub-channels with subchannelSize=size1.
    accessServiceClass-TDD-LCR                  AccessServiceClass-TDD-LCR-r4   OPTIONAL
}

AvailableAP-Signature-VCAMList ::=  SEQUENCE (SIZE (1..maxPCPCH-APsig)) OF
                                        AP-Signature-VCAM

AvailableAP-SignatureList ::=       SEQUENCE (SIZE (1..maxPCPCH-APsig)) OF
                                        AP-Signature

AvailableAP-SubchannelList ::=      SEQUENCE (SIZE (1..maxPCPCH-APsubCh)) OF
                                        AP-Subchannel

AvailableMinimumSF-ListVCAM ::=     SEQUENCE (SIZE (1..maxPCPCH-SF)) OF
                                        AvailableMinimumSF-VCAM

AvailableMinimumSF-VCAM ::=         SEQUENCE {
    minimumSpreadingFactor              MinimumSpreadingFactor,
    nf-Max                              NF-Max,
    maxAvailablePCPCH-Number            MaxAvailablePCPCH-Number,
    availableAP-Signature-VCAMList      AvailableAP-Signature-VCAMList
}

AvailableSignatures ::=         BIT STRING {
                                    signature15(0),
```

```
                                        signature14(1),
                                        signature13(2),
                                        signature12(3),
                                        signature11(4),
                                        signature10(5),
                                        signature9(6),
                                        signature8(7),
                                        signature7(8),
                                        signature6(9),
                                        signature5(10),
                                        signature4(11),
                                        signature3(12),
                                        signature2(13),
                                        signature1(14),
                                        signature0(15)
                                        }     (SIZE(16))

AvailableSubChannelNumbers ::=          BIT STRING {
                                            subCh11(0),
                                            subCh10(1),
                                            subCh9(2),
                                            subCh8(3),
                                            subCh7(4),
                                            subCh6(5),
                                            subCh5(6),
                                            subCh4(7),
                                            subCh3(8),
                                            subCh2(9),
                                            subCh1(10),
                                            subCh0(11)
                                            }     (SIZE(12))

BEACON-PL-Est ::=                       ENUMERATED { true }

BurstType ::=                           ENUMERATED {
                                            type1, type2 }

-- Actual value Bler-Target = IE value * 0.05
Bler-Target ::=                         INTEGER (-63..0)

CCTrCH-PowerControlInfo ::=             SEQUENCE {
    tfcs-Identity                           TFCS-Identity                       OPTIONAL,
    ul-DPCH-PowerControlInfo                UL-DPCH-PowerControlInfo
}

CCTrCH-PowerControlInfo-r4 ::=          SEQUENCE {
    tfcs-Identity                           TFCS-Identity                       OPTIONAL,
    ul-DPCH-PowerControlInfo                UL-DPCH-PowerControlInfo-r4
}

CCTrCH-PowerControlInfo-r5 ::=          SEQUENCE {
    tfcs-Identity                           TFCS-Identity                       OPTIONAL,
    ul-DPCH-PowerControlInfo                UL-DPCH-PowerControlInfo-r5
}

CCTrCH-PowerControlInfo-r7 ::=          SEQUENCE {
    tfcs-Identity                           TFCS-Identity                       OPTIONAL,
    ul-DPCH-PowerControlInfo                UL-DPCH-PowerControlInfo-r7
}

CD-AccessSlotSubchannel ::=             INTEGER (0..11)

CD-AccessSlotSubchannelList ::=         SEQUENCE (SIZE (1..maxPCPCH-CDsubCh)) OF
                                            CD-AccessSlotSubchannel

CD-CA-ICH-ChannelisationCode ::=        INTEGER (0..255)

CD-PreambleScramblingCode ::=           INTEGER (0..79)

CD-SignatureCode ::=                    INTEGER (0..15)

CD-SignatureCodeList ::=                SEQUENCE (SIZE (1..maxPCPCH-CDsig)) OF
                                            CD-SignatureCode

CellAndChannelIdentity ::=              SEQUENCE {
    -- burstType may be set to either value and should be ignored by the receiver for 1.28 Mcps TDD.
    burstType                               BurstType,
    midambleShift                           MidambleShiftLong,
```

```
    timeslot                            TimeslotNumber,
    cellParametersID                    CellParametersID
    }

CellParametersID ::=                INTEGER (0..127)

Cfntargetsfnframeoffset ::=             INTEGER(0..255)

ChannelAssignmentActive ::=         CHOICE {
    notActive                           NULL,
    isActive                            AvailableMinimumSF-ListVCAM
}

ChannelisationCode256 ::=           INTEGER (0..255)

ChannelReqParamsForUCSM ::=         SEQUENCE {
    availableAP-SignatureList           AvailableAP-SignatureList,
    availableAP-SubchannelList          AvailableAP-SubchannelList          OPTIONAL
}

ClosedLoopTimingAdjMode ::=         ENUMERATED {
                                        slot1, slot2 }

CodeNumberDSCH ::=                  INTEGER (0..255)

CodeRange ::=                       SEQUENCE {
    pdsch-CodeMapList                   PDSCH-CodeMapList
}

CodeWordSet ::=                     ENUMERATED {
                                        longCWS,
                                        mediumCWS,
                                        shortCWS,
                                        ssdtOff }

CommonTimeslotInfo ::=              SEQUENCE {
    -- TABULAR: secondInterleavingMode is MD, but since it can be encoded in a single
    -- bit it is not defined as OPTIONAL.
    secondInterleavingMode              SecondInterleavingMode,
    tfci-Coding                         TFCI-Coding                         OPTIONAL,
    puncturingLimit                     PuncturingLimit,
    repetitionPeriodAndLength           RepetitionPeriodAndLength           OPTIONAL
}

CommonTimeslotInfoSCCPCH ::=        SEQUENCE {
    -- TABULAR: secondInterleavingMode is MD, but since it can be encoded in a single
    -- bit it is not defined as OPTIONAL.
    secondInterleavingMode              SecondInterleavingMode,
    tfci-Coding                         TFCI-Coding                         OPTIONAL,
    puncturingLimit                     PuncturingLimit,
    repetitionPeriodLengthAndOffset     RepetitionPeriodLengthAndOffset     OPTIONAL
}

ConstantValue ::=                   INTEGER (-35..-10)

ConstantValueTdd ::=                INTEGER (-35..10)

CPCH-PersistenceLevels ::=          SEQUENCE {
    cpch-SetID                          CPCH-SetID,
    dynamicPersistenceLevelTF-List      DynamicPersistenceLevelTF-List
}

CPCH-PersistenceLevelsList ::=      SEQUENCE (SIZE (1..maxCPCHsets)) OF
                                        CPCH-PersistenceLevels

CPCH-SetInfo ::=                    SEQUENCE {
    cpch-SetID                          CPCH-SetID,
    transportFormatSet                  TransportFormatSet,
    tfcs                                TFCS,
    ap-PreambleScramblingCode           AP-PreambleScramblingCode,
    ap-AICH-ChannelisationCode          AP-AICH-ChannelisationCode,
    cd-PreambleScramblingCode           CD-PreambleScramblingCode,
    cd-CA-ICH-ChannelisationCode        CD-CA-ICH-ChannelisationCode,
    cd-AccessSlotSubchannelList         CD-AccessSlotSubchannelList         OPTIONAL,
    cd-SignatureCodeList                CD-SignatureCodeList                OPTIONAL,
    deltaPp-m                           DeltaPp-m,
    ul-DPCCH-SlotFormat                 UL-DPCCH-SlotFormat,
    n-StartMessage                      N-StartMessage,
```

```
    n-EOT                               N-EOT,
    -- TABULAR: VCAM info has been nested inside ChannelAssignmentActive,
    -- which in turn is mandatory since it's only a binary choice.
    channelAssignmentActive             ChannelAssignmentActive,
    cpch-StatusIndicationMode           CPCH-StatusIndicationMode,
    pcpch-ChannelInfoList               PCPCH-ChannelInfoList
}

CPCH-SetInfoList ::=                SEQUENCE (SIZE (1..maxCPCHsets)) OF
                                        CPCH-SetInfo

CPCH-StatusIndicationMode ::=       ENUMERATED {
                                        pa-mode,
                                        pamsf-mode }

CQI-RepetitionFactor ::=            INTEGER(1..4)

CSICH-PowerOffset ::=               INTEGER (-10..5)

-- DefaultDPCH-OffsetValueFDD and DefaultDPCH-OffsetValueTDD corresponds to
-- IE "Default DPCH Offset Value" depending on the mode.
-- Actual value DefaultDPCH-OffsetValueFDD = IE value * 512
DefaultDPCH-OffsetValueFDD ::=      INTEGER (0..599)

DefaultDPCH-OffsetValueTDD ::=      INTEGER (0..7)

DeltaPp-m ::=                       INTEGER (-10..10)

DeltaCQI ::=                        INTEGER (0..8)

DeltaNACK ::=                       INTEGER (0..8)

DeltaACK ::=                        INTEGER (0..8)

-- Actual value DeltaSIR = IE value * 0.1
DeltaSIR ::=                        INTEGER (0..30)

DHS-Sync ::=                        INTEGER (-20..10)

DL-CCTrCh ::=                       SEQUENCE {
    tfcs-ID                             TFCS-IdentityPlain              DEFAULT 1,
    timeInfo                            TimeInfo,
    commonTimeslotInfo                  CommonTimeslotInfo              OPTIONAL,
    dl-CCTrCH-TimeslotsCodes            DownlinkTimeslotsCodes          OPTIONAL,
    ul-CCTrChTPCList                    UL-CCTrChTPCList                OPTIONAL
}

DL-CCTrCh-r4 ::=                    SEQUENCE {
    tfcs-ID                             TFCS-IdentityPlain              DEFAULT 1,
    timeInfo                            TimeInfo,
    commonTimeslotInfo                  CommonTimeslotInfo              OPTIONAL,
    tddOption                           CHOICE {
        tdd384                              SEQUENCE {
            dl-CCTrCH-TimeslotsCodes            DownlinkTimeslotsCodes  OPTIONAL
        },
        tdd128                              SEQUENCE {
            dl-CCTrCH-TimeslotsCodes            DownlinkTimeslotsCodes-LCR-r4   OPTIONAL
        }
    },
    ul-CCTrChTPCList                    UL-CCTrChTPCList        OPTIONAL
}

DL-CCTrCh-r7 ::=                    SEQUENCE {
    tfcs-ID                             TFCS-IdentityPlain              DEFAULT 1,
    timeInfo                            TimeInfo,
    commonTimeslotInfo                  CommonTimeslotInfo              OPTIONAL,
    tddOption                           CHOICE {
        tdd384                              SEQUENCE {
            dl-CCTrCH-TimeslotsCodes            DownlinkTimeslotsCodes  OPTIONAL
        },
        tdd768                              SEQUENCE {
            dl-CCTrCH-TimeslotsCodes            DownlinkTimeslotsCodes-VHCR     OPTIONAL
        },
        tdd128                              SEQUENCE {
            dl-CCTrCH-TimeslotsCodes            DownlinkTimeslotsCodes-LCR-r4   OPTIONAL
        }
    },
    ul-CCTrChTPCList                    UL-CCTrChTPCList        OPTIONAL
```

```
}

DL-CCTrChList ::=                   SEQUENCE (SIZE (1..maxCCTrCH)) OF
                                        DL-CCTrCh

DL-CCTrChList-r7 ::=                SEQUENCE (SIZE (1..maxCCTrCH)) OF
                                        DL-CCTrCh-r7

DL-CCTrChList-r4 ::=                SEQUENCE (SIZE (1..maxCCTrCH)) OF
                                        DL-CCTrCh-r4

DL-CCTrChListToRemove ::=           SEQUENCE (SIZE (1..maxCCTrCH)) OF
                                        TFCS-IdentityPlain

DL-CCTrChTPCList ::=                SEQUENCE (SIZE (0..maxCCTrCH)) OF
                                            TFCS-Identity

DL-ChannelisationCode ::=           SEQUENCE {
    secondaryScramblingCode             SecondaryScramblingCode         OPTIONAL,
    sf-AndCodeNumber                    SF512-AndCodeNumber,
    scramblingCodeChange                ScramblingCodeChange            OPTIONAL
}

DL-ChannelisationCodeList ::=       SEQUENCE (SIZE (1..maxDPCH-DLchan)) OF
                                        DL-ChannelisationCode

DL-CommonInformation ::=            SEQUENCE {
    dl-DPCH-InfoCommon                  DL-DPCH-InfoCommon          OPTIONAL,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            defaultDPCH-OffsetValue             DefaultDPCH-OffsetValueFDD  OPTIONAL,
            dpch-CompressedModeInfo             DPCH-CompressedModeInfo     OPTIONAL,
            tx-DiversityMode                    TX-DiversityMode            OPTIONAL,
            -- dummy is not used in this version of the specification, it should
            -- not be sent and if received it should be ignored.
            dummy                               SSDT-Information            OPTIONAL
        },
        tdd                                 SEQUENCE {
            defaultDPCH-OffsetValue             DefaultDPCH-OffsetValueTDD  OPTIONAL
        }
    }
}

DL-CommonInformation-r4 ::=         SEQUENCE {
    dl-DPCH-InfoCommon                  DL-DPCH-InfoCommon-r4       OPTIONAL,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            defaultDPCH-OffsetValue             DefaultDPCH-OffsetValueFDD  OPTIONAL,
            dpch-CompressedModeInfo             DPCH-CompressedModeInfo     OPTIONAL,
            tx-DiversityMode                    TX-DiversityMode            OPTIONAL,
            -- dummy is not used in this version of the specification, it should
            -- not be sent and if received it should be ignored.
            dummy                               SSDT-Information-r4         OPTIONAL
        },
        tdd                                 SEQUENCE {
            tddOption                           CHOICE {
                tdd384                              NULL,
                tdd128                              SEQUENCE {
                    tstd-Indicator                      BOOLEAN
                }
            },
            defaultDPCH-OffsetValue             DefaultDPCH-OffsetValueTDD  OPTIONAL
        }
    }
}


DL-CommonInformation-r5 ::=         SEQUENCE {
    dl-DPCH-InfoCommon                  DL-DPCH-InfoCommon-r4           OPTIONAL,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            defaultDPCH-OffsetValue             DefaultDPCH-OffsetValueFDD  OPTIONAL,
            dpch-CompressedModeInfo             DPCH-CompressedModeInfo     OPTIONAL,
            tx-DiversityMode                    TX-DiversityMode            OPTIONAL,
            -- dummy is not used in this version of the specification, it should
            -- not be sent and if received it should be ignored.
            dummy                               SSDT-Information-r4         OPTIONAL
        },
```

```
        tdd                                 SEQUENCE {
            tddOption                           CHOICE {
                tdd384                              NULL,
                tdd128                              SEQUENCE {
                    tstd-Indicator                      BOOLEAN
                }
            },
            defaultDPCH-OffsetValue             DefaultDPCH-OffsetValueTDD  OPTIONAL
        }
    },
    mac-hsResetIndicator                ENUMERATED { true }         OPTIONAL
}

DL-CommonInformation-r6 ::=         SEQUENCE {
    dl-dpchInfoCommon                   CHOICE {
        dl-DPCH-InfoCommon                  DL-DPCH-InfoCommon-r6,
        dl-FDPCH-InfoCommon                 DL-FDPCH-InfoCommon-r6
    }                                                               OPTIONAL,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            defaultDPCH-OffsetValue             DefaultDPCH-OffsetValueFDD  OPTIONAL,
            dpch-CompressedModeInfo             DPCH-CompressedModeInfo     OPTIONAL,
            tx-DiversityMode                    TX-DiversityMode            OPTIONAL
        },
        tdd                                 SEQUENCE {
            tddOption                           CHOICE {
                tdd384                              NULL,
                tdd128                              SEQUENCE {
                    tstd-Indicator                      BOOLEAN
                }
            },
            defaultDPCH-OffsetValue             DefaultDPCH-OffsetValueTDD  OPTIONAL
        }
    },
    mac-hsResetIndicator                ENUMERATED { true }         OPTIONAL,
    postVerificationPeriod              ENUMERATED { true }         OPTIONAL
}

DL-CommonInformation-r7 ::=         SEQUENCE {
    dl-dpchInfoCommon                   CHOICE {
        dl-DPCH-InfoCommon                  DL-DPCH-InfoCommon-r6,
        dl-FDPCH-InfoCommon                 DL-FDPCH-InfoCommon-r6
    }                                                               OPTIONAL,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            defaultDPCH-OffsetValue             DefaultDPCH-OffsetValueFDD  OPTIONAL,
            dpch-CompressedModeInfo             DPCH-CompressedModeInfo     OPTIONAL,
            tx-DiversityMode                    TX-DiversityMode            OPTIONAL
        },
        tdd                                 SEQUENCE {
            tddOption                           CHOICE {
                tdd384                              NULL,
                tdd768                              NULL,
                tdd128                              SEQUENCE {
                    tstd-Indicator                      BOOLEAN
                }
            },
            defaultDPCH-OffsetValue             DefaultDPCH-OffsetValueTDD  OPTIONAL
        }
    },
    mac-hsResetIndicator                ENUMERATED { true }         OPTIONAL,
    postVerificationPeriod              ENUMERATED { true }         OPTIONAL
}

DL-CommonInformationPost ::=        SEQUENCE {
    dl-DPCH-InfoCommon                  DL-DPCH-InfoCommonPost
}

DL-CommonInformationPredef ::=      SEQUENCE {
    dl-DPCH-InfoCommon                  DL-DPCH-InfoCommonPredef    OPTIONAL
}

DL-CompressedModeMethod ::=         ENUMERATED {
        -- dummy is not used in this version of the specification, it should
        -- not be sent and if received it should be ignored.
                                        dummy, sf-2,
                                        higherLayerScheduling }
```

```
DL-DPCH-InfoCommon ::=                  SEQUENCE {
    cfnHandling                             CHOICE {
        maintain                                NULL,
        initialise                              SEQUENCE {
            -- IE dummy is not used in this version of the specification
            -- The IE should not be sent and if received it should be ignored
            dummy                                   Cfntargetsfnframeoffset             OPTIONAL
        }
    },
    modeSpecificInfo                        CHOICE {
        fdd                                     SEQUENCE {
            dl-DPCH-PowerControlInfo                DL-DPCH-PowerControlInfo            OPTIONAL,
            powerOffsetPilot-pdpdch                 PowerOffsetPilot-pdpdch,
            dl-rate-matching-restriction            Dl-rate-matching-restriction        OPTIONAL,
            -- TABULAR: The number of pilot bits is nested inside the spreading factor.
            spreadingFactorAndPilot                 SF512-AndPilot,
            positionFixedOrFlexible                 PositionFixedOrFlexible,
            tfci-Existence                          BOOLEAN
        },
        tdd                                     SEQUENCE {
            dl-DPCH-PowerControlInfo                DL-DPCH-PowerControlInfo            OPTIONAL
        }
    }
}

DL-DPCH-InfoCommon-r4 ::=               SEQUENCE {
    cfnHandling                             CHOICE {
        maintain                                NULL,
        initialise                              SEQUENCE {
            -- IE dummy is not used in this version of the specification
            -- The IE should not be sent and if received it should be ignored
            dummy                                   Cfntargetsfnframeoffset             OPTIONAL
        }
    },
    modeSpecificInfo                        CHOICE {
        fdd                                     SEQUENCE {
            dl-DPCH-PowerControlInfo                DL-DPCH-PowerControlInfo            OPTIONAL,
            powerOffsetPilot-pdpdch                 PowerOffsetPilot-pdpdch,
            dl-rate-matching-restriction            Dl-rate-matching-restriction        OPTIONAL,
            -- TABULAR: The number of pilot bits is nested inside the spreading factor.
            spreadingFactorAndPilot                 SF512-AndPilot,
            positionFixedOrFlexible                 PositionFixedOrFlexible,
            tfci-Existence                          BOOLEAN
        },
        tdd                                     SEQUENCE {
            dl-DPCH-PowerControlInfo                DL-DPCH-PowerControlInfo            OPTIONAL
        }
    },
-- The IE mac-d-HFN-initial-value should be absent in the RRCConnectionSetup-r4-IEs or
-- RRCConnectionSetup-r5-IEs or HandoverToUTRANCommand-r4-IEs or HandoverToUTRANCommand-r5-IEs and
-- if the IE is included, the general error handling for conditional IEs applies.
    mac-d-HFN-initial-value                 MAC-d-HFN-initial-value             OPTIONAL

}

DL-DPCH-InfoCommon-r6 ::=                   SEQUENCE {
    cfnHandling                                 CHOICE {
        maintain                                    SEQUENCE {
            timingmaintainedsynchind                    TimingMaintainedSynchInd            OPTIONAL
        },
        initialise                                  NULL
    },
    modeSpecificInfo                            CHOICE {
        fdd                                         SEQUENCE {
            dl-DPCH-PowerControlInfo                    DL-DPCH-PowerControlInfo            OPTIONAL,
            powerOffsetPilot-pdpdch                     PowerOffsetPilot-pdpdch,
            dl-rate-matching-restriction                Dl-rate-matching-restriction        OPTIONAL,
            -- TABULAR: The number of pilot bits is nested inside the spreading factor.
            spreadingFactorAndPilot                     SF512-AndPilot,
            positionFixedOrFlexible                     PositionFixedOrFlexible,
            tfci-Existence                              BOOLEAN
        },
        tdd                                     SEQUENCE {
            dl-DPCH-PowerControlInfo                DL-DPCH-PowerControlInfo            OPTIONAL
        }
    },
    -- The IE mac-d-HFN-initial-value should be absent in the RRCConnectionSetup and the
    -- HandoverToUTRANCommand messages. If the IE is included, the general error handling
```

```
    -- for conditional IEs applies.
    mac-d-HFN-initial-value             MAC-d-HFN-initial-value             OPTIONAL
}

DL-DPCH-InfoCommonPost ::=          SEQUENCE {
    dl-DPCH-PowerControlInfo            DL-DPCH-PowerControlInfo                OPTIONAL
}

DL-DPCH-InfoCommonPredef ::=        SEQUENCE {
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            -- TABULAR: The number of pilot bits is nested inside the spreading factor.
            spreadingFactorAndPilot             SF512-AndPilot,
            positionFixedOrFlexible             PositionFixedOrFlexible,
            tfci-Existence                      BOOLEAN
        },
        tdd                                 SEQUENCE {
            commonTimeslotInfo                  CommonTimeslotInfo
        }
    }
}

DL-DPCH-InfoPerRL ::=               CHOICE {
    fdd                                 SEQUENCE {
        pCPICH-UsageForChannelEst           PCPICH-UsageForChannelEst,
        dpch-FrameOffset                    DPCH-FrameOffset,
        secondaryCPICH-Info                 SecondaryCPICH-Info             OPTIONAL,
        dl-ChannelisationCodeList           DL-ChannelisationCodeList,
        tpc-CombinationIndex                TPC-CombinationIndex,
        -- dummy is not used in this version of the specification, it should
        -- not be sent and if received it should be ignored.
        dummy                               SSDT-CellIdentity               OPTIONAL,
        closedLoopTimingAdjMode             ClosedLoopTimingAdjMode         OPTIONAL
    },
    tdd                                 SEQUENCE {
        dl-CCTrChListToEstablish            DL-CCTrChList                   OPTIONAL,
        dl-CCTrChListToRemove               DL-CCTrChListToRemove           OPTIONAL
    }
}

DL-DPCH-InfoPerRL-r4 ::=            CHOICE {
    fdd                                 SEQUENCE {
        pCPICH-UsageForChannelEst           PCPICH-UsageForChannelEst,
        dpch-FrameOffset                    DPCH-FrameOffset,
        secondaryCPICH-Info                 SecondaryCPICH-Info             OPTIONAL,
        dl-ChannelisationCodeList           DL-ChannelisationCodeList,
        tpc-CombinationIndex                TPC-CombinationIndex,
        -- dummy is not used in this version of the specification, it should
        -- not be sent and if received it should be ignored.
        dummy                               SSDT-CellIdentity               OPTIONAL,
        closedLoopTimingAdjMode             ClosedLoopTimingAdjMode         OPTIONAL
    },
    tdd                                 SEQUENCE {
        dl-CCTrChListToEstablish            DL-CCTrChList-r4                OPTIONAL,
        dl-CCTrChListToRemove               DL-CCTrChListToRemove           OPTIONAL
    }
}

DL-DPCH-InfoPerRL-r5 ::=            CHOICE {
    fdd                                 SEQUENCE {
        pCPICH-UsageForChannelEst           PCPICH-UsageForChannelEst,
        dpch-FrameOffset                    DPCH-FrameOffset,
        secondaryCPICH-Info                 SecondaryCPICH-Info             OPTIONAL,
        dl-ChannelisationCodeList           DL-ChannelisationCodeList,
        tpc-CombinationIndex                TPC-CombinationIndex,
        powerOffsetTPC-pdpdch               PowerOffsetTPC-pdpdch           OPTIONAL,
        -- dummy is not used in this version of the specification, it should
        -- not be sent and if received it should be ignored.
        dummy                               SSDT-CellIdentity               OPTIONAL,
        closedLoopTimingAdjMode             ClosedLoopTimingAdjMode         OPTIONAL
    },
    tdd                                 SEQUENCE {
        dl-CCTrChListToEstablish            DL-CCTrChList-r4                OPTIONAL,
        dl-CCTrChListToRemove               DL-CCTrChListToRemove           OPTIONAL
    }
}

DL-DPCH-InfoPerRL-r6 ::=            CHOICE {
```

```
    fdd                                 SEQUENCE {
        pCPICH-UsageForChannelEst           PCPICH-UsageForChannelEst,
        dpch-FrameOffset                    DPCH-FrameOffset,
        secondaryCPICH-Info                 SecondaryCPICH-Info             OPTIONAL,
        dl-ChannelisationCodeList           DL-ChannelisationCodeList,
        tpc-CombinationIndex                TPC-CombinationIndex,
        powerOffsetTPC-pdpdch               PowerOffsetTPC-pdpdch           OPTIONAL,
        closedLoopTimingAdjMode             ClosedLoopTimingAdjMode         OPTIONAL
    },
    tdd                                 SEQUENCE {
        dl-CCTrChListToEstablish            DL-CCTrChList-r4                OPTIONAL,
        dl-CCTrChListToRemove               DL-CCTrChListToRemove           OPTIONAL
    }
}

DL-DPCH-InfoPerRL-r7 ::=            CHOICE {
    fdd                                 SEQUENCE {
        pCPICH-UsageForChannelEst           PCPICH-UsageForChannelEst,
        dpch-FrameOffset                    DPCH-FrameOffset,
        secondaryCPICH-Info                 SecondaryCPICH-Info             OPTIONAL,
        dl-ChannelisationCodeList           DL-ChannelisationCodeList,
        tpc-CombinationIndex                TPC-CombinationIndex,
        powerOffsetTPC-pdpdch               PowerOffsetTPC-pdpdch           OPTIONAL,
        closedLoopTimingAdjMode             ClosedLoopTimingAdjMode         OPTIONAL
    },
    tdd                                 SEQUENCE {
        dl-CCTrChListToEstablish            DL-CCTrChList-r7                OPTIONAL,
        dl-CCTrChListToRemove               DL-CCTrChListToRemove           OPTIONAL
    }
}

DL-FDPCH-InfoPerRL-r6 ::=           SEQUENCE {
    pCPICH-UsageForChannelEst           PCPICH-UsageForChannelEst,
    fdpch-FrameOffset                   DPCH-FrameOffset,
    secondaryCPICH-Info                 SecondaryCPICH-Info             OPTIONAL,
    secondaryScramblingCode             SecondaryScramblingCode         OPTIONAL,
    dl-ChannelisationCode               INTEGER (0..255),
    tpc-CombinationIndex                TPC-CombinationIndex
}

DL-DPCH-InfoPerRL-PostFDD ::=                           SEQUENCE {
        pCPICH-UsageForChannelEst           PCPICH-UsageForChannelEst,
        dl-ChannelisationCode               DL-ChannelisationCode,
        tpc-CombinationIndex                TPC-CombinationIndex
}

DL-DPCH-InfoPerRL-PostTDD ::=           SEQUENCE {
    dl-DPCH-TimeslotsCodes                  DownlinkTimeslotsCodes
}

DL-DPCH-InfoPerRL-PostTDD-LCR-r4 ::=    SEQUENCE {
    dl-CCTrCH-TimeslotsCodes                DownlinkTimeslotsCodes-LCR-r4
}

DL-DPCH-PowerControlInfo ::=        SEQUENCE {
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            dpc-Mode                            DPC-Mode
        },
        tdd                                 SEQUENCE {
            tpc-StepSizeTDD                     TPC-StepSizeTDD             OPTIONAL
        }
    }
}

DL-FDPCH-InfoCommon-r6 ::=          SEQUENCE {
    cfnHandling                         CHOICE {
        maintain                            SEQUENCE {
            timingmaintainedsynchind            TimingMaintainedSynchInd            OPTIONAL
        },
        initialise                          NULL
    },
    dl-FDPCH-PowerControlInfo           DL-DPCH-PowerControlInfo            OPTIONAL,
-- Actual value dl-FDPCH-TPCcommandErrorRate = IE value * 0.01
-- dl-FDPCH-TPCcommandErrorRate values 11..16 are spare and shall not be used in this version of
-- the protocol
    dl-FDPCH-TPCcommandErrorRate        INTEGER (1..16)     OPTIONAL
}
```

```
DL-FrameType ::=                        ENUMERATED {
                                            dl-FrameTypeA, dl-FrameTypeB }

DL-HSPDSCH-Information ::=              SEQUENCE {
    hs-scch-Info                        HS-SCCH-Info     OPTIONAL,
    measurement-feedback-Info           Measurement-Feedback-Info    OPTIONAL,
    modeSpecificInfo                    CHOICE {
    tdd                                 CHOICE{
            tdd384                              SEQUENCE {
                dl-HSPDSCH-TS-Configuration DL-HSPDSCH-TS-Configuration      OPTIONAL
            },
            tdd128                              SEQUENCE {
                hs-PDSCH-Midamble-Configuration-tdd128
                        HS-PDSCH-Midamble-Configuration-TDD128               OPTIONAL
            }
        },
        fdd                             NULL
    }
}

DL-HSPDSCH-Information-r6 ::=   SEQUENCE {
    hs-scch-Info                        HS-SCCH-Info-r6                      OPTIONAL,
    measurement-feedback-Info           Measurement-Feedback-Info            OPTIONAL,
    modeSpecificInfo                    CHOICE {
        tdd                                 CHOICE {
            tdd384                              SEQUENCE {
                dl-HSPDSCH-TS-Configuration     DL-HSPDSCH-TS-Configuration OPTIONAL
            },
            tdd128                              SEQUENCE {
                hs-PDSCH-Midamble-Configuration-tdd128
                        HS-PDSCH-Midamble-Configuration-TDD128               OPTIONAL
            }
        },
        fdd                             NULL
    }
}

DL-HSPDSCH-Information-r7 ::=   SEQUENCE {
    hs-scch-Info                        HS-SCCH-Info-r7                      OPTIONAL,
    measurement-feedback-Info           Measurement-Feedback-Info            OPTIONAL,
    modeSpecificInfo                    CHOICE {
        tdd                                 CHOICE {
            tdd384                              SEQUENCE {
                dl-HSPDSCH-TS-Configuration     DL-HSPDSCH-TS-Configuration OPTIONAL
            },
            tdd768                              SEQUENCE {
                dl-HSPDSCH-TS-Configuration     DL-HSPDSCH-TS-Configuration-VHCR    OPTIONAL
            },
            tdd128                              SEQUENCE {
                hs-PDSCH-Midamble-Configuration-tdd128
                        HS-PDSCH-Midamble-Configuration-TDD128                      OPTIONAL
            }
        },
        fdd                             NULL
    }
}

-- The IE 'DL-HSPDSCH-TS-Configuration' applies to tdd-384 REL-5 onward
DL-HSPDSCH-TS-Configuration ::=     SEQUENCE (SIZE (1..maxTS-1)) OF
                                        SEQUENCE {
    timeslot                                TimeslotNumber,
    midambleShiftAndBurstType               MidambleShiftAndBurstType-DL
}

-- The IE 'DL-HSPDSCH-TS-Configuration-VHCR' applies to tdd-768 REL-7 onward
DL-HSPDSCH-TS-Configuration-VHCR ::= SEQUENCE (SIZE (1..maxTS-1)) OF
                                        SEQUENCE {
    timeslot                                TimeslotNumber,
    midambleShiftAndBurstType               MidambleShiftAndBurstType-DL-VHCR
}

DL-InformationPerRL ::=             SEQUENCE {
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            primaryCPICH-Info                   PrimaryCPICH-Info,
            -- dummy1 and dummy 2 are not used in this version of specification, they should
            -- not be sent and if received they should be ignored.
```

```
            dummy1                              PDSCH-SHO-DCH-Info          OPTIONAL,
            dummy2                              PDSCH-CodeMapping           OPTIONAL
        },
        tdd                                 PrimaryCCPCH-Info
    },
    dl-DPCH-InfoPerRL                   DL-DPCH-InfoPerRL                   OPTIONAL,
    -- dummy is not used in this version of the specification, it should
    -- not be sent and if received it should be ignored.
    dummy                               SCCPCH-InfoForFACH                  OPTIONAL
}

DL-InformationPerRL-r4 ::=          SEQUENCE {
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            primaryCPICH-Info                   PrimaryCPICH-Info,
            -- dummy1 and dummy 2 are not used in this version of specification, they should
            -- not be sent and if received they should be ignored.
            dummy1                              PDSCH-SHO-DCH-Info          OPTIONAL,
            dummy2                              PDSCH-CodeMapping           OPTIONAL
        },
        tdd                                 PrimaryCCPCH-Info-r4
    },
    dl-DPCH-InfoPerRL                   DL-DPCH-InfoPerRL-r4                OPTIONAL,
    -- dummy is not used in this version of the specification, it should
    -- not be sent and if received it should be ignored.
    dummy                               SCCPCH-InfoForFACH-r4               OPTIONAL,
    cell-id                             CellIdentity                        OPTIONAL
}

DL-InformationPerRL-r5 ::=          SEQUENCE {
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            primaryCPICH-Info                   PrimaryCPICH-Info,
            -- dummy1 and dummy 2 are not used in this version of specification, they should
            -- not be sent and if received they should be ignored.
            dummy1                              PDSCH-SHO-DCH-Info          OPTIONAL,
            dummy2                              PDSCH-CodeMapping           OPTIONAL,
            servingHSDSCH-RL-indicator          BOOLEAN
        },
        tdd                                 PrimaryCCPCH-Info-r4
    },
    dl-DPCH-InfoPerRL                   DL-DPCH-InfoPerRL-r5                OPTIONAL,
    -- dummy is not used in this version of the specification, it should
    -- not be sent and if received it should be ignored.
    dummy                               SCCPCH-InfoForFACH-r4               OPTIONAL,
    cell-id                             CellIdentity                        OPTIONAL
}

DL-InformationPerRL-r5bis ::=       SEQUENCE {
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            primaryCPICH-Info                   PrimaryCPICH-Info,
            -- dummy1 and dummy 2 are not used in this version of specification, they should
            -- not be sent and if received they should be ignored.
            dummy1                              PDSCH-SHO-DCH-Info          OPTIONAL,
            dummy2                              PDSCH-CodeMapping           OPTIONAL
        },
        tdd                                 PrimaryCCPCH-Info-r4
    },
    dl-DPCH-InfoPerRL                   DL-DPCH-InfoPerRL-r5                OPTIONAL,
    -- dummy is not used in this version of the specification, it should
    -- not be sent and if received it should be ignored.
    dummy                               SCCPCH-InfoForFACH-r4               OPTIONAL,
    cell-id                             CellIdentity                        OPTIONAL
}

DL-InformationPerRL-r6 ::=          SEQUENCE {
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            primaryCPICH-Info                   PrimaryCPICH-Info,
            servingHSDSCH-RL-indicator          BOOLEAN,
            servingEDCH-RL-indicator            BOOLEAN
        },
        tdd                                 PrimaryCCPCH-Info-r4
    },
    dl-dpchInfo                         CHOICE {
        dl-DPCH-InfoPerRL                   DL-DPCH-InfoPerRL-r6,
        dl-FDPCH-InfoPerRL                  DL-FDPCH-InfoPerRL-r6
```

```
	}																OPTIONAL,
	e-AGCH-Information					E-AGCH-Information			OPTIONAL,
	e-HICH-Info							CHOICE	{
		e-HICH-Information					E-HICH-Information,
		releaseIndicator					NULL
	}	OPTIONAL,
	e-RGCH-Info							CHOICE	{
		e-RGCH-Information					E-RGCH-Information,
		releaseIndicator					NULL
	}	OPTIONAL,
	cell-id								CellIdentity				OPTIONAL
}

DL-InformationPerRL-r7 ::=			SEQUENCE {
	modeSpecificInfo					CHOICE {
		fdd									SEQUENCE {
			primaryCPICH-Info					PrimaryCPICH-Info,
			servingHSDSCH-RL-indicator			BOOLEAN,
			servingEDCH-RL-indicator			BOOLEAN
		},
		tdd									PrimaryCCPCH-Info-r7
	},
	dl-dpchInfo							CHOICE {
		dl-DPCH-InfoPerRL					DL-DPCH-InfoPerRL-r7,
		dl-FDPCH-InfoPerRL					DL-FDPCH-InfoPerRL-r6
	}																OPTIONAL,
	e-AGCH-Information					E-AGCH-Information			OPTIONAL,
	e-HICH-Info							CHOICE	{
		e-HICH-Information					E-HICH-Information,
		releaseIndicator					NULL
	}	OPTIONAL,
	e-RGCH-Info							CHOICE	{
		e-RGCH-Information					E-RGCH-Information,
		releaseIndicator					NULL
	}	OPTIONAL,
	cell-id								CellIdentity				OPTIONAL
}

DL-InformationPerRL-List ::=		SEQUENCE (SIZE (1..maxRL)) OF
										DL-InformationPerRL

DL-InformationPerRL-List-r4 ::=		SEQUENCE (SIZE (1..maxRL)) OF
										DL-InformationPerRL-r4

DL-InformationPerRL-List-r5 ::=		SEQUENCE (SIZE (1..maxRL)) OF
										DL-InformationPerRL-r5

DL-InformationPerRL-List-r6 ::=		SEQUENCE (SIZE (1..maxRL)) OF
										DL-InformationPerRL-r6

DL-InformationPerRL-List-r5bis ::=		SEQUENCE (SIZE (1..maxRL)) OF
											DL-InformationPerRL-r5bis

DL-InformationPerRL-List-r7 ::=		SEQUENCE (SIZE (1..maxRL)) OF
										DL-InformationPerRL-r7

DL-InformationPerRL-ListPostFDD ::= SEQUENCE (SIZE (1..maxRL)) OF
										DL-InformationPerRL-PostFDD

DL-InformationPerRL-PostFDD ::=		SEQUENCE {
			primaryCPICH-Info					PrimaryCPICH-Info,
	dl-DPCH-InfoPerRL					DL-DPCH-InfoPerRL-PostFDD
}

DL-InformationPerRL-PostTDD ::=		SEQUENCE {
	primaryCCPCH-Info					PrimaryCCPCH-InfoPost,
	dl-DPCH-InfoPerRL					DL-DPCH-InfoPerRL-PostTDD
}

DL-InformationPerRL-PostTDD-LCR-r4 ::=	SEQUENCE {
	primaryCCPCH-Info					PrimaryCCPCH-InfoPostTDD-LCR-r4,
	dl-DPCH-InfoPerRL					DL-DPCH-InfoPerRL-PostTDD-LCR-r4
}

DL-PDSCH-Information ::=			SEQUENCE {
	-- dummy1 and dummy 2 are not used in this version of specification, it should
	-- not be sent and if received it should be ignored.
	dummy1								PDSCH-SHO-DCH-Info			OPTIONAL,
```

```
    dummy2                              PDSCH-CodeMapping                   OPTIONAL
}

Dl-rate-matching-restriction ::=    SEQUENCE {
    restrictedTrCH-InfoList             RestrictedTrCH-InfoList             OPTIONAL
}

DL-TPC-PowerOffsetPerRL ::=     SEQUENCE {
        powerOffsetTPC-pdpdch               PowerOffsetTPC-pdpdch           OPTIONAL
}

-- NOTE: The radio links in the following list have a one-to-one mapping with the
-- radio links in the message.
DL-TPC-PowerOffsetPerRL-List ::=    SEQUENCE (SIZE (1..maxRL)) OF
                                        DL-TPC-PowerOffsetPerRL

DL-TS-ChannelisationCode ::=        ENUMERATED {
                                        cc16-1, cc16-2, cc16-3, cc16-4,
                                        cc16-5, cc16-6, cc16-7, cc16-8,
                                        cc16-9, cc16-10, cc16-11, cc16-12,
                                        cc16-13, cc16-14, cc16-15, cc16-16 }

DL-TS-ChannelisationCode-VHCR ::=   ENUMERATED {
                                        cc32-1, cc32-2, cc32-3, cc32-4,
                                        cc132-5, cc32-6, cc32-7, cc32-8,
                                        cc32-9, cc32-10, cc32-11, cc32-12,
                                        cc32-13, cc32-14, cc32-15, cc32-16,
                                        cc32-17, cc32-18, cc32-19, cc32-20,
                                        cc32-21, cc32-22, cc32-23, cc32-24,
                                        cc32-25, cc32-26, cc32-27, cc32-28,
                                        cc32-29, cc32-30, cc32-31, cc32-32 }

DL-TS-ChannelisationCodesShort ::=  SEQUENCE {
    codesRepresentation                 CHOICE {
        consecutive                         SEQUENCE {
            firstChannelisationCode             DL-TS-ChannelisationCode,
            lastChannelisationCode              DL-TS-ChannelisationCode
        },
        bitmap                              BIT STRING {
                                                chCode16-SF16(0),
                                                chCode15-SF16(1),
                                                chCode14-SF16(2),
                                                chCode13-SF16(3),
                                                chCode12-SF16(4),
                                                chCode11-SF16(5),
                                                chCode10-SF16(6),
                                                chCode9-SF16(7),
                                                chCode8-SF16(8),
                                                chCode7-SF16(9),
                                                chCode6-SF16(10),
                                                chCode5-SF16(11),
                                                chCode4-SF16(12),
                                                chCode3-SF16(13),
                                                chCode2-SF16(14),
                                                chCode1-SF16(15)
                                                }   (SIZE (16))
    }
}

DL-TS-ChannelisationCodesShort-VHCR ::= SEQUENCE {
    codesRepresentation                 CHOICE {
        consecutive                         SEQUENCE {
            firstChannelisationCode             DL-TS-ChannelisationCode-VHCR,
            lastChannelisationCode              DL-TS-ChannelisationCode-VHCR
        },
        bitmap                              BIT STRING {
                                                chCode32-SF32(0),
                                                chCode31-SF32(1),
                                                chCode30-SF32(2),
                                                chCode29-SF32(3),
                                                chCode28-SF32(4),
                                                chCode27-SF32(5),
                                                chCode26-SF32(6),
                                                chCode25-SF32(7),
                                                chCode24-SF32(8),
                                                chCode23-SF32(9),
                                                chCode22-SF32(10),
                                                chCode21-SF32(11),
```

```
                                                    chCode20-SF32(12),
                                                    chCode19-SF32(13),
                                                    chCode18-SF32(14),
                                                    chCode17-SF32(15),
                                                    chCode16-SF32(16),
                                                    chCode15-SF32(17),
                                                    chCode14-SF32(18),
                                                    chCode13-SF32(19),
                                                    chCode12-SF32(20),
                                                    chCode11-SF32(21),
                                                    chCode10-SF32(22),
                                                    chCode9-SF32(23),
                                                    chCode8-SF32(24),
                                                    chCode7-SF32(25),
                                                    chCode6-SF32(26),
                                                    chCode5-SF32(27),
                                                    chCode4-SF32(28),
                                                    chCode3-SF32(29),
                                                    chCode2-SF32(30),
                                                    chCode1-SF32(31)
                                                    }   (SIZE (32))
    }
}

DownlinkAdditionalTimeslots ::=     SEQUENCE {
    parameters                          CHOICE {
        sameAsLast                          SEQUENCE {
            timeslotNumber                      TimeslotNumber
        },
        newParameters                       SEQUENCE {
            individualTimeslotInfo              IndividualTimeslotInfo,
            dl-TS-ChannelisationCodesShort      DL-TS-ChannelisationCodesShort
        }
    }
}

DownlinkAdditionalTimeslots-VHCR ::= SEQUENCE {
    parameters                          CHOICE {
        sameAsLast                          SEQUENCE {
            timeslotNumber                      TimeslotNumber
        },
        newParameters                       SEQUENCE {
            individualTimeslotInfo              IndividualTimeslotInfo-VHCR,
            dl-TS-ChannelisationCodesShort      DL-TS-ChannelisationCodesShort-VHCR
        }
    }
}

DownlinkAdditionalTimeslots-LCR-r4 ::=  SEQUENCE {
    parameters                          CHOICE {
        sameAsLast                          SEQUENCE {
            timeslotNumber                      TimeslotNumber-LCR-r4
        },
        newParameters                       SEQUENCE {
            individualTimeslotInfo              IndividualTimeslotInfo-LCR-r4,
            dl-TS-ChannelisationCodesShort      DL-TS-ChannelisationCodesShort
        }
    }
}

DownlinkTimeslotsCodes ::=      SEQUENCE {
    firstIndividualTimeslotInfo         IndividualTimeslotInfo,
    dl-TS-ChannelisationCodesShort      DL-TS-ChannelisationCodesShort,
    moreTimeslots                       CHOICE {
        noMore                              NULL,
        additionalTimeslots                 CHOICE {
            consecutive                         INTEGER (1..maxTS-1),
            timeslotList                        SEQUENCE (SIZE (1..maxTS-1)) OF
                                                    DownlinkAdditionalTimeslots
        }
    }
}

DownlinkTimeslotsCodes-VHCR ::=     SEQUENCE {
    firstIndividualTimeslotInfo         IndividualTimeslotInfo-VHCR,
    dl-TS-ChannelisationCodesShort      DL-TS-ChannelisationCodesShort,
    moreTimeslots                       CHOICE {
        noMore                              NULL,
```

```
        additionalTimeslots                     CHOICE {
            consecutive                             INTEGER (1..maxTS-1),
            timeslotList                            SEQUENCE (SIZE (1..maxTS-1)) OF
                                                        DownlinkAdditionalTimeslots-VHCR
        }
    }
}

DownlinkTimeslotsCodes-LCR-r4 ::=   SEQUENCE {
    firstIndividualTimeslotInfo         IndividualTimeslotInfo-LCR-r4,
    dl-TS-ChannelisationCodesShort      DL-TS-ChannelisationCodesShort,
    moreTimeslots                       CHOICE {
        noMore                              NULL,
        additionalTimeslots                 CHOICE {
            consecutive                         INTEGER (1..maxTS-LCR-1),
            timeslotList                        SEQUENCE (SIZE (1..maxTS-LCR-1)) OF
                                                    DownlinkAdditionalTimeslots-LCR-r4
        }
    }
}

DPC-Mode ::=                        ENUMERATED {
                                        singleTPC,
                                        tpcTripletInSoft }

-- Actual value DPCCH-PowerOffset = IE value * 2
DPCCH-PowerOffset ::=               INTEGER (-82..-3)

-- Actual value DPCCH-PowerOffset2 = 2 + (IE value * 4)
DPCCH-PowerOffset2 ::=              INTEGER (-28..-13)

DPCH-CompressedModeInfo ::=         SEQUENCE {
    tgp-SequenceList                    TGP-SequenceList
}

DPCH-CompressedModeStatusInfo ::=   SEQUENCE {
    tgps-Reconfiguration-CFN            TGPS-Reconfiguration-CFN,
    tgp-SequenceShortList                   SEQUENCE (SIZE (1..maxTGPS)) OF
                                            TGP-SequenceShort
}

-- Actual value DPCH-FrameOffset = IE value * 256
DPCH-FrameOffset::=                 INTEGER (0..149)

DSCH-Mapping ::=                    SEQUENCE {
    maxTFCI-Field2Value                 MaxTFCI-Field2Value,
    spreadingFactor                     SF-PDSCH,
    codeNumber                          CodeNumberDSCH,
    multiCodeInfo                       MultiCodeInfo
}

DSCH-MappingList ::=                SEQUENCE (SIZE (1..maxPDSCH-TFCIgroups)) OF
                                        DSCH-Mapping

DSCH-RadioLinkIdentifier ::=        INTEGER (0..511)

DSCH-TransportChannelsInfo ::=      SEQUENCE (SIZE (1..maxTrCH)) OF
                                        SEQUENCE {
    dsch-transport-channel-identity         TransportChannelIdentity,
    dsch-TFS                                TransportFormatSet
}
DurationTimeInfo ::=                INTEGER (1..4096)

DynamicPersistenceLevel ::=         INTEGER (1..8)

DynamicPersistenceLevelList ::=     SEQUENCE (SIZE (1..maxPRACH)) OF
                                        DynamicPersistenceLevel

DynamicPersistenceLevelTF-List ::= SEQUENCE (SIZE (1..maxTF-CPCH)) OF
                                        DynamicPersistenceLevel

DynamicTFInformationCCCH ::=        SEQUENCE {
    octetModeRLC-SizeInfoType2          OctetModeRLC-SizeInfoType2
}

E-AGCH-ChannelisationCode ::=       INTEGER (0..255)

E-AGCH-Information ::=              SEQUENCE {
```

```
    e-AGCH-ChannelisationCode           E-AGCH-ChannelisationCode
}

E-DCH-MinimumSet-E-TFCI ::=         INTEGER (0..127)

E-DCH-ReconfigurationInfo ::=   SEQUENCE {
    e-DCH-RL-InfoNewServingCell         E-DCH-RL-InfoNewServingCell             OPTIONAL,
    e-DCH-RL-InfoOtherCellList          SEQUENCE (SIZE (1..maxEDCHRL)) OF
                                            E-DCH-RL-InfoOtherCell              OPTIONAL
}

E-DCH-RL-InfoNewServingCell ::=     SEQUENCE {
    primaryCPICH-Info                   PrimaryCPICH-Info,
    e-AGCH-Information                  E-AGCH-Information,
    servingGrant                        SEQUENCE {
        value                               INTEGER (0..38)                     OPTIONAL,
        primary-Secondary-GrantSelector     ENUMERATED { primary, secondary }
    }   OPTIONAL,
    e-DPCCH-DPCCH-PowerOffset           E-DPCCH-DPCCH-PowerOffset               OPTIONAL,
    reference-E-TFCIs                   E-DPDCH-Reference-E-TFCIList            OPTIONAL,
    powerOffsetForSchedInfo             INTEGER (0..6)                          OPTIONAL,
    threeIndexStepThreshold             INTEGER (0..37)                         OPTIONAL,
    twoIndexStepThreshold               INTEGER (0..37)                         OPTIONAL,
    e-HICH-Information                  E-HICH-Information      OPTIONAL,
    e-RGCH-Info                         CHOICE  {
        e-RGCH-Information                  E-RGCH-Information,
        releaseIndicator                    NULL
    }   OPTIONAL
}

E-DCH-RL-InfoOtherCell ::=          SEQUENCE {
    primaryCPICH-Info                   PrimaryCPICH-Info,
    e-HICH-Info                         CHOICE {
        e-HICH-Information                  E-HICH-Information,
        releaseIndicator                    NULL
    }   OPTIONAL,
    e-RGCH-Info                         CHOICE {
        e-RGCH-Information                  E-RGCH-Information,
        releaseIndicator                    NULL
    }   OPTIONAL
}

E-DPCCH-Info ::=                    SEQUENCE {
    e-DPCCH-DPCCH-PowerOffset           E-DPCCH-DPCCH-PowerOffset,
    happyBit-DelayCondition             HappyBit-DelayCondition
}

E-DPCCH-DPCCH-PowerOffset ::=       INTEGER (0..8)

E-DPDCH-Info ::=                    SEQUENCE {
    e-TFCI-TableIndex                   E-TFCI-TableIndex,
    e-DCH-MinimumSet-E-TFCI             E-DCH-MinimumSet-E-TFCI             OPTIONAL,
    reference-E-TFCIs                   E-DPDCH-Reference-E-TFCIList,
    maxChannelisationCodes              E-DPDCH-MaxChannelisationCodes,
    pl-NonMax                           E-DPDCH-PL-NonMax,
    schedulingInfoConfiguration         E-DPDCH-SchedulingInfoConfiguration,
    threeIndexStepThreshold             INTEGER (0..37)                     OPTIONAL,
    twoIndexStepThreshold               INTEGER (0..37)                     OPTIONAL
}

E-DPDCH-PeriodicyOfSchedInfo ::=    ENUMERATED {
                                        everyEDCHTTI, ms4, ms10, ms20, ms50, ms100, ms200, ms500,
                                        ms1000 }

-- The actual value of E-DPDCH-PL-NonMax is: IE value * 0.04
E-DPDCH-PL-NonMax ::=               INTEGER (11..25)

E-DPDCH-Reference-E-TFCI ::=        SEQUENCE {
    reference-E-TFCI                    INTEGER (0..127),
    reference-E-TFCI-PO                 INTEGER (0..29)
}

E-DPDCH-Reference-E-TFCIList ::=    SEQUENCE (SIZE (1..8)) OF E-DPDCH-Reference-E-TFCI

E-DPDCH-SchedulingInfoConfiguration ::= SEQUENCE {
    periodicityOfSchedInfo-NoGrant      E-DPDCH-PeriodicyOfSchedInfo        OPTIONAL,
    periodicityOfSchedInfo-Grant        E-DPDCH-PeriodicyOfSchedInfo        OPTIONAL,
    powerOffsetForSchedInfo             INTEGER (0..6)
```

```
}

E-DPDCH-SchedulingTransmConfiguration ::= SEQUENCE {
    ms2-SchedTransmGrantHARQAlloc       BIT STRING (SIZE (8))            OPTIONAL,
    servingGrant                        SEQUENCE {
        value                               INTEGER (0..38),
        primary-Secondary-GrantSelector     ENUMERATED { primary, secondary }
    }       OPTIONAL
}

E-DPDCH-MaxChannelisationCodes ::=  ENUMERATED {
                                        sf256, sf128, sf64, sf32, sf16, sf8, sf4, sf4x2, sf2x2,
sf4x2-and-sf2x2 }

E-HICH-ChannelisationCode ::=       INTEGER (0..127)

E-HICH-Information ::=              SEQUENCE {
    channelisationCode                  E-HICH-ChannelisationCode,
    signatureSequence                   E-HICH-RGCH-SignatureSequence
}

E-HICH-RGCH-SignatureSequence ::=   INTEGER (0..39)

E-RGCH-CombinationIndex ::=         INTEGER (0..5)

E-RGCH-Information ::=              SEQUENCE {
    signatureSequence                   E-HICH-RGCH-SignatureSequence,
    rg-CombinationIndex                 E-RGCH-CombinationIndex
}

E-TFCI-TableIndex ::=               INTEGER (0..1)

FACH-PCH-Information ::=            SEQUENCE {
    transportFormatSet                  TransportFormatSet,
    transportChannelIdentity            TransportChannelIdentity,
    ctch-Indicator                      BOOLEAN
}

FACH-PCH-InformationList ::=        SEQUENCE (SIZE (1..maxFACHPCH)) OF
                                        FACH-PCH-Information

Feedback-cycle ::=                  ENUMERATED {
                                        fc0, fc2, fc4, fc8, fc10, fc20, fc40, fc80, fc160}

FPACH-Info-r4 ::=                       SEQUENCE {
    timeslot                            TimeslotNumber-LCR-r4,
    channelisationCode                  TDD-FPACH-CCode16-r4,
    midambleShiftAndBurstType           MidambleShiftAndBurstType-LCR-r4,
    wi                                  Wi-LCR
}

FrequencyInfo ::=                   SEQUENCE {
    modeSpecificInfo                    CHOICE {
        fdd                                 FrequencyInfoFDD,
        tdd                                 FrequencyInfoTDD    }
}

FrequencyInfoFDD ::=                SEQUENCE {
    uarfcn-UL                           UARFCN              OPTIONAL,
    uarfcn-DL                           UARFCN
}

FrequencyInfoTDD ::=                SEQUENCE {
    uarfcn-Nt                           UARFCN
}

HappyBit-DelayCondition ::=         ENUMERATED {
                                        ms2, ms10, ms20, ms50, ms100, ms200, ms500, ms1000 }

HARQ-Preamble-Mode ::=              INTEGER (0..1)

HS-ChannelisationCode-LCR ::=       ENUMERATED {
                                        cc16-1, cc16-2, cc16-3, cc16-4,
                                        cc16-5, cc16-6, cc16-7, cc16-8,
                                        cc16-9, cc16-10, cc16-11, cc16-12,
                                        cc16-13, cc16-14, cc16-15, cc16-16 }

HS-PDSCH-Midamble-Configuration-TDD128 ::=  SEQUENCE {
```

```
    midambleAllocationMode              CHOICE{
        defaultMidamble                     NULL,
        commonMidamble                      NULL,
        ueSpecificMidamble                  INTEGER (0..15)
    },
    -- Actual value midambleConfiguration = IE value * 2
    midambleConfiguration               INTEGER (1..8)
}

HS-SCCH-Info ::=                    SEQUENCE {
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            hS-SCCHChannelisationCodeInfo       SEQUENCE (SIZE (1..maxHSSCCHs)) OF
                                                    HS-SCCH-Codes,
            dl-ScramblingCode                   SecondaryScramblingCode     OPTIONAL
        },
        tdd                                 CHOICE {
            tdd384                              SEQUENCE {
                nack-ack-power-offset               INTEGER (-7..8),
                hs-SICH-PowerControl-Info           HS-SICH-Power-Control-Info-TDD384,
                hS-SCCH-SetConfiguration            SEQUENCE (SIZE (1..maxHSSCCHs)) OF
                        HS-SCCH-TDD384
                },
            tdd128                              SEQUENCE (SIZE (1..maxHSSCCHs)) OF
                                                    HS-SCCH-TDD128
        }
    }
}

HS-SCCH-Info-r6 ::=                 SEQUENCE {
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            hS-SCCHChannelisationCodeInfo       SEQUENCE (SIZE (1..maxHSSCCHs)) OF
                                                    HS-SCCH-Codes,
            dl-ScramblingCode                   SecondaryScramblingCode         OPTIONAL
        },
        tdd                                 CHOICE {
            tdd384                              SEQUENCE {
                nack-ack-power-offset               INTEGER (-7..8),
                hs-SICH-PowerControl-Info           HS-SICH-Power-Control-Info-TDD384,
                dhs-sync                            DHS-Sync                    OPTIONAL,
                hS-SCCH-SetConfiguration            SEQUENCE (SIZE (1..maxHSSCCHs)) OF
                                                        HS-SCCH-TDD384
                },
            tdd128                              SEQUENCE (SIZE (1..maxHSSCCHs)) OF
                                                    HS-SCCH-TDD128
        }
    }
}

HS-SCCH-Info-r7 ::=                 SEQUENCE {
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            hS-SCCHChannelisationCodeInfo       SEQUENCE (SIZE (1..maxHSSCCHs)) OF
                                                    HS-SCCH-Codes,
            dl-ScramblingCode                   SecondaryScramblingCode         OPTIONAL
        },
        tdd                                 CHOICE {
            tdd384                              SEQUENCE {
                nack-ack-power-offset               INTEGER (-7..8),
                hs-SICH-PowerControl-Info           HS-SICH-Power-Control-Info-TDD384,
                dhs-sync                            DHS-Sync                    OPTIONAL,
                hS-SCCH-SetConfiguration            SEQUENCE (SIZE (1..maxHSSCCHs)) OF
                                                        HS-SCCH-TDD384
                },
            tdd768                              SEQUENCE {
                nack-ack-power-offset               INTEGER (-7..8),
                hs-SICH-PowerControl-Info           HS-SICH-Power-Control-Info-TDD768,
                dhs-sync                            DHS-Sync                    OPTIONAL,
                hS-SCCH-SetConfiguration            SEQUENCE (SIZE (1..maxHSSCCHs)) OF
                                                        HS-SCCH-TDD768
                },
            tdd128                              SEQUENCE (SIZE (1..maxHSSCCHs)) OF
                                                    HS-SCCH-TDD128
        }
    }
}
```

```
HS-SCCH-Codes ::=                   INTEGER (0..127)

HS-SCCH-TDD128 ::=              SEQUENCE {
    timeslotNumber                      TimeslotNumber-LCR-r4,
    firstChannelisationCode             HS-ChannelisationCode-LCR,
    secondChannelisationCode            HS-ChannelisationCode-LCR,
    midambleAllocationMode              CHOICE {
        defaultMidamble                     NULL,
        commonMidamble                      NULL,
        ueSpecificMidamble                  INTEGER(0..15)
    },
    -- Actual value midambleConfiguration = IE value * 2
    midambleConfiguration               INTEGER (1..8),
    bler-target                         Bler-Target,
    hs-sich-configuration               HS-SICH-Configuration-TDD128
}

HS-SICH-Configuration-TDD128 ::=    SEQUENCE {
    timeslotNumber                      TimeslotNumber-LCR-r4,
    channelisationCode                  HS-ChannelisationCode-LCR,
    midambleAllocationMode              CHOICE {
        defaultMidamble                     NULL,
        ueSpecificMidamble                  SEQUENCE {
            midambleShift                       MidambleShiftLong
        }
    },
    -- Actual value midambleConfiguration = IE value * 2
    midambleConfiguration               INTEGER (1..8),
    nack-ack-power-offset               INTEGER (-7..8),
    power-level-HSSICH                  INTEGER (-120..-58),
    tpc-step-size                       ENUMERATED { s1, s2, s3 , spare1}
}



HS-SCCH-TDD384 ::=              SEQUENCE {
    timeslotNumber                      TimeslotNumber,
    channelisationCode                  DL-TS-ChannelisationCode,
    midambleAllocationMode              CHOICE {
        defaultMidamble                     NULL,
        commonMidamble                      NULL,
        ueSpecificMidamble                  SEQUENCE {
            midambleShift                       MidambleShiftLong
        }
    },
    midambleconfiguration               MidambleConfigurationBurstType1and3,
    bler-target                         Bler-Target,
    hs-sich-configuration               HS-SICH-Configuration-TDD384
}

HS-SCCH-TDD768 ::=              SEQUENCE {
    timeslotNumber                      TimeslotNumber,
    channelisationCode                  DL-TS-ChannelisationCode-VHCR,
    midambleAllocationMode              CHOICE {
        defaultMidamble                     NULL,
        commonMidamble                      NULL,
        ueSpecificMidamble                  SEQUENCE {
            midambleShift                       MidambleShiftLong
        }
    },
    midambleconfiguration               MidambleConfigurationBurstType1and3,
    bler-target                         Bler-Target,
    hs-sich-configuration               HS-SICH-Configuration-TDD768
}

HS-SICH-Configuration-TDD384 ::=    SEQUENCE {
    timeslotNumber                      TimeslotNumber,
    channelisationCode                  DL-TS-ChannelisationCode,
    midambleAllocationMode              CHOICE {
        defaultMidamble                     NULL,
        ueSpecificMidamble                  SEQUENCE {
            midambleShift                       MidambleShiftLong
        }
    },
    midambleconfiguration               MidambleConfigurationBurstType1and3
}

HS-SICH-Configuration-TDD768 ::=    SEQUENCE {
```

```
    timeslotNumber                      TimeslotNumber,
    channelisationCode                  DL-TS-ChannelisationCode-VHCR,
    midambleAllocationMode              CHOICE {
        defaultMidamble                     NULL,
        ueSpecificMidamble                  SEQUENCE {
            midambleShift                       MidambleShiftLong
        }
    },
    midambleconfiguration               MidambleConfigurationBurstType1and3
}

HS-SICH-Power-Control-Info-TDD384 ::= SEQUENCE {
    -- Actual value ul-target-SIR = IE value * 0.5
    ul-target-SIR                       INTEGER (-22..40),
    hs-sich-ConstantValue               ConstantValue
}

HS-SICH-Power-Control-Info-TDD768 ::= SEQUENCE {
    -- Actual value ul-target-SIR = IE value * 0.5
    ul-target-SIR                       INTEGER (-22..40),
    hs-sich-ConstantValue               ConstantValue
}

IndividualTimeslotInfo ::=          SEQUENCE {
    timeslotNumber                      TimeslotNumber,
    tfci-Existence                      BOOLEAN,
    midambleShiftAndBurstType           MidambleShiftAndBurstType
}

IndividualTimeslotInfo-VHCR ::=         SEQUENCE {
    timeslotNumber                      TimeslotNumber,
    tfci-Existence                      BOOLEAN,
    midambleShiftAndBurstType-VHCR      MidambleShiftAndBurstType-VHCR
}

IndividualTimeslotInfo-LCR-r4 ::=   SEQUENCE {
    timeslotNumber                      TimeslotNumber-LCR-r4,
    tfci-Existence                      BOOLEAN,
    midambleShiftAndBurstType           MidambleShiftAndBurstType-LCR-r4,
    modulation                          ENUMERATED { mod-QPSK, mod-8PSK },
    ss-TPC-Symbols                      ENUMERATED { zero, one, sixteenOverSF },
    additionalSS-TPC-Symbols            INTEGER(1..15)      OPTIONAL
}

IndividualTimeslotInfo-LCR-r4-ext ::=       SEQUENCE {
-- timeslotNumber and tfci-Existence is taken from IndividualTimeslotInfo.
-- midambleShiftAndBurstType in IndividualTimeslotInfo shall be ignored.
    midambleShiftAndBurstType           MidambleShiftAndBurstType-LCR-r4,
    modulation                          ENUMERATED { mod-QPSK, mod-8PSK },
    ss-TPC-Symbols                      ENUMERATED { zero, one, sixteenOverSF }
}

IndividualTS-Interference ::=       SEQUENCE {
    timeslot                            TimeslotNumber,
    ul-TimeslotInterference             TDD-UL-Interference
}

IndividualTS-InterferenceList ::=   SEQUENCE (SIZE (1..maxTS)) OF
                                        IndividualTS-Interference

ITP ::=                             ENUMERATED {
                                        mode0, mode1 }

NidentifyAbort ::=  INTEGER (1..128)

MaxAllowedUL-TX-Power ::=           INTEGER (-50..33)

MaxAvailablePCPCH-Number ::=        INTEGER (1..64)
MaxPowerIncrease-r4 ::=             INTEGER (0..3)

MaxTFCI-Field2Value ::=             INTEGER (1..1023)

Measurement-Feedback-Info ::=       SEQUENCE {
    modeSpecificInfo                CHOICE {
        fdd                             SEQUENCE {
            measurementPowerOffset          MeasurementPowerOffset,
            feedback-cycle                  Feedback-cycle,
            cqi-RepetitionFactor            CQI-RepetitionFactor,
```

```
            deltaCQI                                DeltaCQI
        },
        tdd                                     NULL
    }
}


MidambleConfigurationBurstType1and3 ::= ENUMERATED {ms4, ms8, ms16}

MidambleConfigurationBurstType2 ::=     ENUMERATED {ms3, ms6}

MidambleConfigurationBurstType2-VHCR ::=        ENUMERATED {ms4, ms8}

MidambleShiftAndBurstType ::=       SEQUENCE {
    burstType                               CHOICE {
        type1                                   SEQUENCE {
            midambleConfigurationBurstType1and3 MidambleConfigurationBurstType1and3,
            midambleAllocationMode              CHOICE {
                defaultMidamble                     NULL,
                commonMidamble                      NULL,
                ueSpecificMidamble                  SEQUENCE {
                    midambleShift                       MidambleShiftLong
                }
            }
        },
        type2                                   SEQUENCE {
            midambleConfigurationBurstType2     MidambleConfigurationBurstType2,
            midambleAllocationMode              CHOICE {
                defaultMidamble                     NULL,
                commonMidamble                      NULL,
                ueSpecificMidamble                  SEQUENCE {
                    midambleShift                       MidambleShiftShort
                }
            }
        },
        type3                                   SEQUENCE {
            midambleConfigurationBurstType1and3 MidambleConfigurationBurstType1and3,
            midambleAllocationMode              CHOICE {
                defaultMidamble                     NULL,
                ueSpecificMidamble                  SEQUENCE {
                    midambleShift                       MidambleShiftLong
                }
            }
        }
    }
}

MidambleShiftAndBurstType-VHCR ::=  SEQUENCE {
    burstType                               CHOICE {
        type1                                   SEQUENCE {
            midambleConfigurationBurstType1and3 MidambleConfigurationBurstType1and3,
            midambleAllocationMode              CHOICE {
                defaultMidamble                     NULL,
                commonMidamble                      NULL,
                ueSpecificMidamble                  SEQUENCE {
                    midambleShift                       MidambleShiftLong
                }
            }
        },
        type2                                   SEQUENCE {
            midambleConfigurationBurstType2     MidambleConfigurationBurstType2-VHCR,
            midambleAllocationMode              CHOICE {
                defaultMidamble                     NULL,
                commonMidamble                      NULL,
                ueSpecificMidamble                  SEQUENCE {
                    midambleShift                       MidambleShiftShort-VHCR
                }
            }
        },
        type3                                   SEQUENCE {
            midambleConfigurationBurstType1and3 MidambleConfigurationBurstType1and3,
            midambleAllocationMode              CHOICE {
                defaultMidamble                     NULL,
                ueSpecificMidamble                  SEQUENCE {
                    midambleShift                       MidambleShiftLong
                }
            }
        }
```

```
    }
}

MidambleShiftAndBurstType-DL ::=         SEQUENCE {
    burstType                            CHOICE {
        type1                                SEQUENCE {
            midambleConfigurationBurstType1and3 MidambleConfigurationBurstType1and3,
            midambleAllocationMode               CHOICE {
                defaultMidamble                      NULL,
                commonMidamble                       NULL,
                ueSpecificMidamble                   SEQUENCE {
                    midambleShift                        MidambleShiftLong
                }
            }
        },
        type2                                SEQUENCE {
            midambleConfigurationBurstType2      MidambleConfigurationBurstType2,
            midambleAllocationMode               CHOICE {
                defaultMidamble                      NULL,
                commonMidamble                       NULL,
                ueSpecificMidamble                   SEQUENCE {
                    midambleShift                        MidambleShiftShort
                }
            }
        }
    }
}

MidambleShiftAndBurstType-DL-VHCR ::= SEQUENCE {
    burstType                            CHOICE {
        type1                                SEQUENCE {
            midambleConfigurationBurstType1and3 MidambleConfigurationBurstType1and3,
            midambleAllocationMode               CHOICE {
                defaultMidamble                      NULL,
                commonMidamble                       NULL,
                ueSpecificMidamble                   SEQUENCE {
                    midambleShift                        MidambleShiftLong
                }
            }
        },
        type2                                SEQUENCE {
            midambleConfigurationBurstType2      MidambleConfigurationBurstType2-VHCR,
            midambleAllocationMode               CHOICE {
                defaultMidamble                      NULL,
                commonMidamble                       NULL,
                ueSpecificMidamble                   SEQUENCE {
                    midambleShift                        MidambleShiftShort-VHCR
                }
            }
        }
    }
}

MidambleShiftAndBurstType-LCR-r4 ::=     SEQUENCE {
    midambleAllocationMode               CHOICE {
        defaultMidamble                      NULL,
        commonMidamble                       NULL,
        ueSpecificMidamble                   SEQUENCE {
            midambleShift                        INTEGER (0..15)
        }
    },
    -- Actual value midambleConfiguration = IE value * 2
    midambleConfiguration                INTEGER (1..8)
}

MidambleShiftLong ::=                INTEGER (0..15)


MidambleShiftShort ::=               INTEGER (0..5)

MidambleShiftShort-VHCR ::=          INTEGER (0..7)

MinimumSpreadingFactor ::=           ENUMERATED {
                                         sf4, sf8, sf16, sf32,
                                         sf64, sf128, sf256 }

MultiCodeInfo ::=                    INTEGER (1..16)
```

```
N-EOT ::=                           INTEGER (0..7)

N-GAP ::=                           ENUMERATED {
                                        f2, f4, f8 }

N-PCH ::=                           INTEGER (1..8)

N-StartMessage ::=                  INTEGER (1..8)

NB01 ::=                            INTEGER (0..50)

NF-Max ::=                          INTEGER (1..64)

NumberOfDPDCH ::=                   INTEGER (1..maxDPDCH-UL)

NumberOfFBI-Bits ::=                INTEGER (1..2)

OpenLoopPowerControl-TDD ::=        SEQUENCE {
    primaryCCPCH-TX-Power               PrimaryCCPCH-TX-Power,
    -- alpha, prach-ConstantValue, dpch-ConstantValue and pusch-ConstantValue
    -- shall be ignored in 1.28Mcps TDD mode.
    alpha                               Alpha                       OPTIONAL,
    prach-ConstantValue                 ConstantValueTdd,
    dpch-ConstantValue                  ConstantValueTdd,
    pusch-ConstantValue                 ConstantValueTdd            OPTIONAL
}

OpenLoopPowerControl-IPDL-TDD-r4 ::=    SEQUENCE {
    ipdl-alpha                          Alpha,
    maxPowerIncrease                    MaxPowerIncrease-r4
}

PagingIndicatorLength ::=           ENUMERATED {
                                        pi4, pi8, pi16 }

PC-Preamble ::=                     INTEGER (0..7)

PCP-Length ::=                      ENUMERATED {
                                        as0, as8 }

PCPCH-ChannelInfo ::=               SEQUENCE {
    pcpch-UL-ScramblingCode             INTEGER (0..79),
    pcpch-DL-ChannelisationCode         INTEGER (0..511),
    pcpch-DL-ScramblingCode             SecondaryScramblingCode         OPTIONAL,
    pcp-Length                          PCP-Length,
    ucsm-Info                           UCSM-Info                       OPTIONAL
}

PCPCH-ChannelInfoList ::=           SEQUENCE (SIZE (1..maxPCPCHs)) OF
                                        PCPCH-ChannelInfo

PCPICH-UsageForChannelEst ::=       ENUMERATED {
                                        mayBeUsed,
                                        shallNotBeUsed }

PDSCH-CapacityAllocationInfo ::=    SEQUENCE {
    -- pdsch-PowerControlInfo is conditional on new-configuration branch below, if this
    -- selected the IE is OPTIONAL otherwise it should not be sent
    pdsch-PowerControlInfo              PDSCH-PowerControlInfo          OPTIONAL,
    pdsch-AllocationPeriodInfo          AllocationPeriodInfo,
    configuration                       CHOICE {
        old-Configuration                   SEQUENCE {
            tfcs-ID                             TFCS-IdentityPlain              DEFAULT 1,
            pdsch-Identity                      PDSCH-Identity
        },
        new-Configuration                   SEQUENCE {
            pdsch-Info                          PDSCH-Info,
            pdsch-Identity                      PDSCH-Identity          OPTIONAL
        }
    }
}

PDSCH-CapacityAllocationInfo-r4 ::= SEQUENCE {
    pdsch-AllocationPeriodInfo          AllocationPeriodInfo,
    configuration                       CHOICE {
        old-Configuration                   SEQUENCE {
            tfcs-ID                             TFCS-IdentityPlain              DEFAULT 1,
```

```
            pdsch-Identity                      PDSCH-Identity
        },
        new-Configuration                   SEQUENCE {
            pdsch-Info                          PDSCH-Info-r4,
            pdsch-Identity                      PDSCH-Identity              OPTIONAL,
            pdsch-PowerControlInfo              PDSCH-PowerControlInfo      OPTIONAL
        }
    }
}

PDSCH-CapacityAllocationInfo-r7 ::= SEQUENCE {
    pdsch-AllocationPeriodInfo          AllocationPeriodInfo,
    configuration                       CHOICE {
        old-Configuration                   SEQUENCE {
            tfcs-ID                             TFCS-IdentityPlain                  DEFAULT 1,
            pdsch-Identity                      PDSCH-Identity
        },
        new-Configuration                   SEQUENCE {
            pdsch-Info                          PDSCH-Info-r7,
            pdsch-Identity                      PDSCH-Identity              OPTIONAL,
            pdsch-PowerControlInfo              PDSCH-PowerControlInfo      OPTIONAL
        }
    }
}

PDSCH-CodeInfo ::=                  SEQUENCE {
    spreadingFactor                     SF-PDSCH,
    codeNumber                          CodeNumberDSCH,
    multiCodeInfo                       MultiCodeInfo
}

PDSCH-CodeInfoList ::=              SEQUENCE (SIZE (1..maxTFCI-2-Combs)) OF
                                        PDSCH-CodeInfo

PDSCH-CodeMap ::=                   SEQUENCE {
    spreadingFactor                     SF-PDSCH,
    multiCodeInfo                       MultiCodeInfo,
    codeNumberStart                     CodeNumberDSCH,
    codeNumberStop                      CodeNumberDSCH
}

PDSCH-CodeMapList ::=               SEQUENCE (SIZE (1..maxPDSCH-TFCIgroups)) OF
                                        PDSCH-CodeMap

PDSCH-CodeMapping ::=               SEQUENCE {
    dl-ScramblingCode                   SecondaryScramblingCode             OPTIONAL,
    signallingMethod                    CHOICE {
        codeRange                           CodeRange,
        tfci-Range                          DSCH-MappingList,
        explicit-config                     PDSCH-CodeInfoList,
        replace                             ReplacedPDSCH-CodeInfoList
    }
}

PDSCH-Identity ::=                  INTEGER (1..hiPDSCHidentities)


PDSCH-Info ::=                      SEQUENCE {
    tfcs-ID                             TFCS-IdentityPlain                  DEFAULT 1,
    commonTimeslotInfo                  CommonTimeslotInfo                  OPTIONAL,
    pdsch-TimeslotsCodes                DownlinkTimeslotsCodes              OPTIONAL
}

PDSCH-Info-r4 ::=                       SEQUENCE {
    tfcs-ID                             TFCS-IdentityPlain                  DEFAULT 1,
    commonTimeslotInfo                  CommonTimeslotInfo                  OPTIONAL,
    tddOption                           CHOICE {
        tdd384                              SEQUENCE {
            pdsch-TimeslotsCodes                DownlinkTimeslotsCodes      OPTIONAL
        },
        tdd128                              SEQUENCE {
            pdsch-TimeslotsCodes                DownlinkTimeslotsCodes-LCR-r4   OPTIONAL
        }
    }
}

PDSCH-Info-r7 ::=                       SEQUENCE {
    tfcs-ID                             TFCS-IdentityPlain                  DEFAULT 1,
```

```
    commonTimeslotInfo                  CommonTimeslotInfo                  OPTIONAL,
    tddOption                           CHOICE {
        tdd384                              SEQUENCE {
            pdsch-TimeslotsCodes                DownlinkTimeslotsCodes          OPTIONAL
        },
        tdd768                              SEQUENCE {
            pdsch-TimeslotsCodes                DownlinkTimeslotsCodes-VHCR         OPTIONAL
        },
        tdd128                              SEQUENCE {
            pdsch-TimeslotsCodes                DownlinkTimeslotsCodes-LCR-r4   OPTIONAL
        }
    }
}

PDSCH-Info-LCR-r4 ::=               SEQUENCE {
    tfcs-ID                             TFCS-IdentityPlain                  DEFAULT 1,
    commonTimeslotInfo                  CommonTimeslotInfo                  OPTIONAL,
    pdsch-TimeslotsCodes                DownlinkTimeslotsCodes-LCR-r4       OPTIONAL
}

PDSCH-PowerControlInfo ::=          SEQUENCE {
    tpc-StepSizeTDD                     TPC-StepSizeTDD                     OPTIONAL,
    ul-CCTrChTPCList                    UL-CCTrChTPCList                    OPTIONAL
}

PDSCH-SHO-DCH-Info ::=              SEQUENCE {
    dsch-RadioLinkIdentifier            DSCH-RadioLinkIdentifier,
    rl-IdentifierList                   RL-IdentifierList                   OPTIONAL
}

PDSCH-SysInfo ::=                   SEQUENCE {
    pdsch-Identity                      PDSCH-Identity,
    pdsch-Info                          PDSCH-Info,
    dsch-TFS                            TransportFormatSet                  OPTIONAL,
    dsch-TFCS                           TFCS                                OPTIONAL
}

PDSCH-SysInfo-r7 ::=                SEQUENCE {
    pdsch-Identity                      PDSCH-Identity,
    pdsch-Info                          PDSCH-Info-r7,
    dsch-TransportChannelsInfo          DSCH-TransportChannelsInfo          OPTIONAL,
    dsch-TFCS                           TFCS                                OPTIONAL
}

PDSCH-SysInfo-HCR-r5 ::=                SEQUENCE {
    pdsch-Identity                      PDSCH-Identity,
    pdsch-Info                          PDSCH-Info,
    dsch-TransportChannelsInfo          DSCH-TransportChannelsInfo          OPTIONAL,
    dsch-TFCS                           TFCS                                OPTIONAL
}

PDSCH-SysInfo-LCR-r4 ::=            SEQUENCE {
    pdsch-Identity                      PDSCH-Identity,
    pdsch-Info                          PDSCH-Info-LCR-r4,
    dsch-TFS                            TransportFormatSet                  OPTIONAL,
    dsch-TFCS                           TFCS                                OPTIONAL
}

PDSCH-SysInfoList ::=               SEQUENCE (SIZE (1..maxPDSCH)) OF
                                        PDSCH-SysInfo

PDSCH-SysInfoList-r7 ::=            SEQUENCE (SIZE (1..maxPDSCH)) OF PDSCH-SysInfo-r7

PDSCH-SysInfoList-HCR-r5 ::=            SEQUENCE (SIZE (1..maxPDSCH)) OF PDSCH-SysInfo-HCR-r5

PDSCH-SysInfoList-LCR-r4 ::=        SEQUENCE (SIZE (1..maxPDSCH)) OF
                                        PDSCH-SysInfo-LCR-r4

PDSCH-SysInfoList-SFN ::=           SEQUENCE (SIZE (1..maxPDSCH)) OF
                                        SEQUENCE {
    pdsch-SysInfo                           PDSCH-SysInfo,
    sfn-TimeInfo                            SFN-TimeInfo                    OPTIONAL
}

PDSCH-SysInfoList-SFN-HCR-r5 ::=            SEQUENCE (SIZE (1..maxPDSCH)) OF
                                        SEQUENCE {
    pdsch-SysInfo                           PDSCH-SysInfo-HCR-r5,
    sfn-TimeInfo                            SFN-TimeInfo                    OPTIONAL
```

```
}

PDSCH-SysInfoList-SFN-LCR-r4 ::=    SEQUENCE (SIZE (1..maxPDSCH)) OF
                                        SEQUENCE {
    pdsch-SysInfo                           PDSCH-SysInfo-LCR-r4,
    sfn-TimeInfo                            SFN-TimeInfo                OPTIONAL
}

PersistenceScalingFactor ::=        ENUMERATED {
                                        psf0-9, psf0-8, psf0-7, psf0-6,
                                        psf0-5, psf0-4, psf0-3, psf0-2 }

PersistenceScalingFactorList ::=    SEQUENCE (SIZE (1..maxASCpersist)) OF
                                        PersistenceScalingFactor

PI-CountPerFrame ::=                ENUMERATED {
                                        e18, e36, e72, e144 }

PichChannelisationCodeList-LCR-r4 ::=   SEQUENCE (SIZE (1..2)) OF
                                            DL-TS-ChannelisationCode

PICH-Info ::=                       CHOICE {
    fdd                                 SEQUENCE {
        channelisationCode256               ChannelisationCode256,
        pi-CountPerFrame                    PI-CountPerFrame,
        sttd-Indicator                      BOOLEAN
    },
    tdd                                 SEQUENCE {
        channelisationCode                  TDD-PICH-CCode              OPTIONAL,
        timeslot                            TimeslotNumber              OPTIONAL,
        midambleShiftAndBurstType           MidambleShiftAndBurstType,
        repetitionPeriodLengthOffset        RepPerLengthOffset-PICH     OPTIONAL,
        pagingIndicatorLength               PagingIndicatorLength       DEFAULT pi4,
        n-GAP                               N-GAP                       DEFAULT f4,
        n-PCH                               N-PCH                       DEFAULT 2
    }
}

PICH-Info-r7 ::=                    CHOICE {
    fdd                                 SEQUENCE {
        channelisationCode256               ChannelisationCode256,
        pi-CountPerFrame                    PI-CountPerFrame,
        sttd-Indicator                      BOOLEAN
    },
    tdd384                                  SEQUENCE {
        channelisationCode                  TDD-PICH-CCode              OPTIONAL,
        timeslot                            TimeslotNumber              OPTIONAL,
        midambleShiftAndBurstType           MidambleShiftAndBurstType,
        repetitionPeriodLengthOffset        RepPerLengthOffset-PICH     OPTIONAL,
        pagingIndicatorLength               PagingIndicatorLength       DEFAULT pi4,
        n-GAP                               N-GAP                       DEFAULT f4,
        n-PCH                               N-PCH                       DEFAULT 2
    },
    tdd768                                  SEQUENCE {
        channelisationCode                  TDD768-PICH-CCode           OPTIONAL,
        timeslot                            TimeslotNumber              OPTIONAL,
        midambleShiftAndBurstType           MidambleShiftAndBurstType,
        repetitionPeriodLengthOffset        RepPerLengthOffset-PICH     OPTIONAL,
        pagingIndicatorLength               PagingIndicatorLength       DEFAULT pi4,
        n-GAP                               N-GAP                       DEFAULT f4,
        n-PCH                               N-PCH                       DEFAULT 2
    }
}

PICH-Info-LCR-r4 ::=                SEQUENCE {
    timeslot                            TimeslotNumber-LCR-r4           OPTIONAL,
    pichChannelisationCodeList-LCR-r4   PichChannelisationCodeList-LCR-r4,
    midambleShiftAndBurstType           MidambleShiftAndBurstType-LCR-r4,
    repetitionPeriodLengthOffset        RepPerLengthOffset-PICH         OPTIONAL,
    pagingIndicatorLength               PagingIndicatorLength       DEFAULT pi4,
    n-GAP                               N-GAP                       DEFAULT f4,
    n-PCH                               N-PCH                       DEFAULT 2
}

PICH-PowerOffset ::=                INTEGER (-10..5)

PilotBits128 ::=                    ENUMERATED {
                                        pb4, pb8 }
```

```
PilotBits256 ::=                    ENUMERATED {
                                        pb2, pb4, pb8 }

    -- Actual measurement power offset value = IE value * 0.5
MeasurementPowerOffset ::=          INTEGER (-12..26)

PLCCH-Info       ::=                SEQUENCE {
    plcchSequenceNumber             INTEGER(1..17),
    timeslotNumber                  TimeslotNumber-LCR-r4,
    channelisationCode              DL-TS-ChannelisationCode,
    tpcCommandTargetRate            TPC-CommandTargetRate
}

PositionFixedOrFlexible ::=         ENUMERATED {
                                        fixed,
                                        flexible }

PowerControlAlgorithm ::=           CHOICE {
    algorithm1                          TPC-StepSizeFDD,
    algorithm2                          NULL
}

PowerOffsetPilot-pdpdch ::=         INTEGER (0..24)

PowerOffsetTPC-pdpdch ::=           INTEGER (0..24)

PowerRampStep ::=                   INTEGER (1..8)

PRACH-ChanCodes-LCR-r4 ::=          SEQUENCE (SIZE (1..4)) OF
                                        TDD-PRACH-CCode-LCR-r4

PRACH-Definition-LCR-r4 ::=         SEQUENCE {
    timeslot                            TimeslotNumber-PRACH-LCR-r4,
    prach-ChanCodes-LCR                 PRACH-ChanCodes-LCR-r4,
    midambleShiftAndBurstType           MidambleShiftAndBurstType-LCR-r4,
    fpach-Info                          FPACH-Info-r4
}

PRACH-Midamble ::=                  ENUMERATED {
                                        direct,
                                        direct-Inverted }

PRACH-Partitioning ::=              CHOICE {
    fdd                                 SEQUENCE (SIZE (1..maxASC)) OF
    -- TABULAR: If only "NumASC+1" (with, NumASC+1 < maxASC) ASCSetting-FDD are listed,
    -- the remaining (NumASC+2 through maxASC) ASCs are unspecified.
                                            ASCSetting-FDD,
    tdd                                 SEQUENCE (SIZE (1..maxASC)) OF
    -- TABULAR: If only "NumASC+1" (with, NumASC+1 < maxASC) ASCSetting-TDD are listed,
    -- the remaining (NumASC+2 through maxASC) ASCs are unspecified.
                                            ASCSetting-TDD
}

PRACH-Partitioning-r7 ::=           CHOICE {
    fdd                                 SEQUENCE (SIZE (1..maxASC)) OF
    -- TABULAR: If only "NumASC+1" (with, NumASC+1 < maxASC) ASCSetting-FDD are listed,
    -- the remaining (NumASC+2 through maxASC) ASCs are unspecified.
                                            ASCSetting-FDD,
    tdd                                 SEQUENCE (SIZE (1..maxASC)) OF
    -- TABULAR: If only "NumASC+1" (with, NumASC+1 < maxASC) ASCSetting-TDD are listed,
    -- the remaining (NumASC+2 through maxASC) ASCs are unspecified.
                                            ASCSetting-TDD-r7
}

PRACH-Partitioning-LCR-r4 ::=       SEQUENCE (SIZE (1..maxASC)) OF
    -- TABULAR: If only "NumASC+1" (with, NumASC+1 < maxASC) ASCSetting-TDD-LCR-r4 are listed,
    -- the remaining (NumASC+2 through maxASC) ASCs are unspecified.
                                            ASCSetting-TDD-LCR-r4

PRACH-PowerOffset ::=               SEQUENCE {
    powerRampStep                       PowerRampStep,
    preambleRetransMax                  PreambleRetransMax
}

PRACH-RACH-Info ::=                 SEQUENCE {
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
```

```
            availableSignatures                 AvailableSignatures,
            availableSF                         SF-PRACH,
            preambleScramblingCodeWordNumber    PreambleScramblingCodeWordNumber,
            puncturingLimit                     PuncturingLimit,
            availableSubChannelNumbers          AvailableSubChannelNumbers
        },
        tdd                                 SEQUENCE {
            timeslot                            TimeslotNumber,
            channelisationCodeList              TDD-PRACH-CCodeList,
            prach-Midamble                      PRACH-Midamble
        }
    }
}

PRACH-RACH-Info-r7 ::=              SEQUENCE {
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            availableSignatures                 AvailableSignatures,
            availableSF                         SF-PRACH,
            preambleScramblingCodeWordNumber    PreambleScramblingCodeWordNumber,
            puncturingLimit                     PuncturingLimit,
            availableSubChannelNumbers          AvailableSubChannelNumbers
        },
        tdd384                              SEQUENCE {
            timeslot                            TimeslotNumber,
            channelisationCodeList              TDD-PRACH-CCodeList,
            prach-Midamble                      PRACH-Midamble
        },
        tdd768                              SEQUENCE {
            timeslot                            TimeslotNumber,
            channelisationCodeList              TDD768-PRACH-CCodeList,
            prach-Midamble                      PRACH-Midamble
        }
    }
}

PRACH-RACH-Info-LCR-r4 ::=          SEQUENCE {
    sync-UL-Info                        SYNC-UL-Info-r4,
    prach-DefinitionList                SEQUENCE (SIZE (1..maxPRACH-FPACH)) OF
                                            PRACH-Definition-LCR-r4
}

PRACH-SystemInformation ::=         SEQUENCE {
    prach-RACH-Info                     PRACH-RACH-Info,
    transportChannelIdentity            TransportChannelIdentity,
    rach-TransportFormatSet             TransportFormatSet                  OPTIONAL,
    rach-TFCS                           TFCS                                OPTIONAL,
    prach-Partitioning                  PRACH-Partitioning                  OPTIONAL,
    persistenceScalingFactorList        PersistenceScalingFactorList        OPTIONAL,
    ac-To-ASC-MappingTable              AC-To-ASC-MappingTable              OPTIONAL,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            primaryCPICH-TX-Power               PrimaryCPICH-TX-Power       OPTIONAL,
            constantValue                       ConstantValue               OPTIONAL,
            prach-PowerOffset                   PRACH-PowerOffset           OPTIONAL,
            rach-TransmissionParameters         RACH-TransmissionParameters OPTIONAL,
            aich-Info                           AICH-Info                   OPTIONAL
        },
        tdd                                 NULL
    }
}

PRACH-SystemInformation-r7 ::=      SEQUENCE {
    prach-RACH-Info                     PRACH-RACH-Info-r7,
    transportChannelIdentity            TransportChannelIdentity,
    rach-TransportFormatSet             TransportFormatSet                  OPTIONAL,
    rach-TFCS                           TFCS                                OPTIONAL,
    prach-Partitioning                  PRACH-Partitioning-r7               OPTIONAL,
    persistenceScalingFactorList        PersistenceScalingFactorList        OPTIONAL,
    ac-To-ASC-MappingTable              AC-To-ASC-MappingTable              OPTIONAL,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            primaryCPICH-TX-Power               PrimaryCPICH-TX-Power       OPTIONAL,
            constantValue                       ConstantValue               OPTIONAL,
            prach-PowerOffset                   PRACH-PowerOffset           OPTIONAL,
            rach-TransmissionParameters         RACH-TransmissionParameters OPTIONAL,
            aich-Info                           AICH-Info                   OPTIONAL
        },
```

```
        tdd                                     NULL
    }
}

PRACH-SystemInformation-LCR-r4 ::=  SEQUENCE {
    prach-RACH-Info-LCR                 PRACH-RACH-Info-LCR-r4,
    rach-TransportFormatSet-LCR         TransportFormatSet-LCR          OPTIONAL,
    prach-Partitioning-LCR              PRACH-Partitioning-LCR-r4       OPTIONAL
}

PRACH-SystemInformationList ::=     SEQUENCE (SIZE (1..maxPRACH)) OF
                                        PRACH-SystemInformation

PRACH-SystemInformationList-r7 ::=  SEQUENCE (SIZE (1..maxPRACH)) OF
                                        PRACH-SystemInformation-r7

PRACH-SystemInformationList-LCR-r4 ::=  SEQUENCE (SIZE (1..maxPRACH)) OF
                                            PRACH-SystemInformation-LCR-r4

PreambleRetransMax ::=              INTEGER (1..64)

PreambleScramblingCodeWordNumber ::=    INTEGER (0..15)

PreDefPhyChConfiguration ::=        SEQUENCE {
    ul-DPCH-InfoPredef                  UL-DPCH-InfoPredef,
    dl-CommonInformationPredef          DL-CommonInformationPredef  OPTIONAL
}

PrimaryCCPCH-Info ::=               CHOICE {
    fdd                                 SEQUENCE {
        tx-DiversityIndicator               BOOLEAN
    },
    tdd                                 SEQUENCE {
        -- syncCase should be ignored for 1.28Mcps TDD mode
        syncCase                            CHOICE {
            syncCase1                           SEQUENCE {
                timeslot                            TimeslotNumber
            },
            syncCase2                           SEQUENCE {
                timeslotSync2                       TimeslotSync2
            }
        }                                                                   OPTIONAL,
        cellParametersID                    CellParametersID                OPTIONAL,
        sctd-Indicator                      BOOLEAN
    }
}

PrimaryCCPCH-Info-r4 ::=            CHOICE {
    fdd                                 SEQUENCE {
        tx-DiversityIndicator               BOOLEAN
    },
    tdd                                 SEQUENCE {
        tddOption                           CHOICE {
            tdd384                              SEQUENCE {
                syncCase                            CHOICE {
                    syncCase1                           SEQUENCE {
                        timeslot                            TimeslotNumber
                    },
                    syncCase2                           SEQUENCE {
                        timeslotSync2                       TimeslotSync2
                    }
                }                                                           OPTIONAL
            },
            tdd128                              SEQUENCE {
                tstd-Indicator                      BOOLEAN
            }
        },
        cellParametersID                    CellParametersID                OPTIONAL,
        sctd-Indicator                      BOOLEAN
    }
}

PrimaryCCPCH-Info-r7 ::=            CHOICE {
    fdd                                 SEQUENCE {
        tx-DiversityIndicator               BOOLEAN
    },
    tdd                                 SEQUENCE {
        tddOption                           CHOICE {
```

```
			tdd384							SEQUENCE {
				syncCase						CHOICE {
					syncCase1						SEQUENCE {
						timeslot						TimeslotNumber
					},
					syncCase2						SEQUENCE {
						timeslotSync2					TimeslotSync2
					}
				}												OPTIONAL
			},
			tdd768						SEQUENCE {
				syncCase					CHOICE {
					syncCase1					SEQUENCE {
						timeslot					TimeslotNumber
					},
					syncCase2						SEQUENCE {
						timeslotSync2					TimeslotSync2
					}
				}												OPTIONAL
			},
			tdd128							SEQUENCE {
				tstd-Indicator					BOOLEAN
			}
		},
		cellParametersID				CellParametersID				OPTIONAL,
		sctd-Indicator					BOOLEAN
	}
}

PrimaryCCPCH-Info-LCR-r4 ::=		SEQUENCE {
	tstd-Indicator						BOOLEAN,
	cellParametersID					CellParametersID			OPTIONAL,
	sctd-Indicator						BOOLEAN
}

-- For 1.28Mcps TDD, the following IE includes elements for the PCCPCH Info additional to those
-- in PrimaryCCPCH-Info
PrimaryCCPCH-Info-LCR-r4-ext ::=	SEQUENCE {
	tstd-Indicator						BOOLEAN
}

PrimaryCCPCH-InfoPost ::=			SEQUENCE {
	syncCase							CHOICE {
		syncCase1							SEQUENCE {
			timeslot							TimeslotNumber
		},
		syncCase2							SEQUENCE {
			timeslotSync2						TimeslotSync2
		}
	},
	cellParametersID					CellParametersID,
	sctd-Indicator						BOOLEAN
}

PrimaryCCPCH-InfoPostTDD-LCR-r4 ::= SEQUENCE {
	tstd-Indicator						BOOLEAN,
	cellParametersID					CellParametersID,
	sctd-Indicator						BOOLEAN
}

PrimaryCCPCH-TX-Power ::=			INTEGER (6..43)

PrimaryCPICH-Info ::=				SEQUENCE {
	primaryScramblingCode				PrimaryScramblingCode
}

PrimaryCPICH-TX-Power ::=			INTEGER (-10..50)

PrimaryScramblingCode ::=			INTEGER (0..511)

PuncturingLimit ::=					ENUMERATED {
										pl0-40, pl0-44, pl0-48, pl0-52, pl0-56,
										pl0-60, pl0-64, pl0-68, pl0-72, pl0-76,
										pl0-80, pl0-84, pl0-88, pl0-92, pl0-96, pl1 }

PUSCH-CapacityAllocationInfo ::=	SEQUENCE {
	pusch-Allocation					CHOICE {
		pusch-AllocationPending				NULL,
```

```
        pusch-AllocationAssignment          SEQUENCE {
            pusch-AllocationPeriodInfo          AllocationPeriodInfo,
            pusch-PowerControlInfo              UL-TargetSIR                OPTIONAL,
            configuration                       CHOICE {
                old-Configuration                   SEQUENCE {
                    tfcs-ID                             TFCS-IdentityPlain          DEFAULT 1,
                    pusch-Identity                      PUSCH-Identity
                },
                new-Configuration                   SEQUENCE {
                    pusch-Info                          PUSCH-Info,
                    pusch-Identity                      PUSCH-Identity      OPTIONAL
                }
            }
        }
    }
}

PUSCH-CapacityAllocationInfo-r4 ::= SEQUENCE {
    pusch-Allocation                    CHOICE {
        pusch-AllocationPending             NULL,
        pusch-AllocationAssignment          SEQUENCE {
            pusch-AllocationPeriodInfo          AllocationPeriodInfo,
            pusch-PowerControlInfo              PUSCH-PowerControlInfo-r4   OPTIONAL,
            configuration                       CHOICE {
                old-Configuration                   SEQUENCE {
                    tfcs-ID                             TFCS-IdentityPlain          DEFAULT 1,
                    pusch-Identity                      PUSCH-Identity
                },
                new-Configuration                   SEQUENCE {
                    pusch-Info                          PUSCH-Info-r4,
                    pusch-Identity                      PUSCH-Identity      OPTIONAL
                }
            }
        }
    }
}

PUSCH-CapacityAllocationInfo-r7 ::= SEQUENCE {
    pusch-Allocation                    CHOICE {
        pusch-AllocationPending             NULL,
        pusch-AllocationAssignment          SEQUENCE {
            pusch-AllocationPeriodInfo          AllocationPeriodInfo,
            pusch-PowerControlInfo              PUSCH-PowerControlInfo-r7   OPTIONAL,
            configuration                       CHOICE {
                old-Configuration                   SEQUENCE {
                    tfcs-ID                             TFCS-IdentityPlain          DEFAULT 1,
                    pusch-Identity                      PUSCH-Identity
                },
                new-Configuration                   SEQUENCE {
                    pusch-Info                          PUSCH-Info-VHCR,
                    pusch-Identity                      PUSCH-Identity      OPTIONAL
                }
            }
        }
    }
}

PUSCH-Identity ::=                  INTEGER (1..hiPUSCHidentities)

PUSCH-Info ::=                      SEQUENCE {
    tfcs-ID                             TFCS-IdentityPlain              DEFAULT 1,
    commonTimeslotInfo                  CommonTimeslotInfo              OPTIONAL,
    pusch-TimeslotsCodes                UplinkTimeslotsCodes            OPTIONAL
}

PUSCH-Info-r4 ::=                   SEQUENCE {
    tfcs-ID                             TFCS-IdentityPlain              DEFAULT 1,
    commonTimeslotInfo                  CommonTimeslotInfo              OPTIONAL,
    tddOption                           CHOICE {
        tdd384                              SEQUENCE {
            pusch-TimeslotsCodes                UplinkTimeslotsCodes        OPTIONAL
        },
        tdd128                              SEQUENCE {
            pusch-TimeslotsCodes                UplinkTimeslotsCodes-LCR-r4 OPTIONAL
        }
    }
}
```

```
PUSCH-Info-VHCR ::=                 SEQUENCE {
    tfcs-ID                             TFCS-IdentityPlain                  DEFAULT 1,
    commonTimeslotInfo                  CommonTimeslotInfo                  OPTIONAL,
    pusch-TimeslotsCodes-VHCR           UplinkTimeslotsCodes-VHCR           OPTIONAL
}

PUSCH-Info-LCR-r4 ::=               SEQUENCE {
    tfcs-ID                             TFCS-IdentityPlain                  DEFAULT 1,

    commonTimeslotInfo                  CommonTimeslotInfo                  OPTIONAL,
    pusch-TimeslotsCodes                UplinkTimeslotsCodes-LCR-r4         OPTIONAL
}

PUSCH-PowerControlInfo-r4 ::=       SEQUENCE {
    -- The IE ul-TargetSIR corresponds to PRX-PUSCHdes for 1.28Mcps TDD
    -- Actual value PRX-PUSCHdes = (value of IE "ul-TargetSIR" - 120)
    ul-TargetSIR                        UL-TargetSIR,
    tddOption                           CHOICE {
        tdd384                              NULL,
        tdd128                              SEQUENCE {
            tpc-StepSize                        TPC-StepSizeTDD                 OPTIONAL
        }
    }
}

PUSCH-PowerControlInfo-r7 ::=       SEQUENCE {
    -- The IE ul-TargetSIR corresponds to PRX-PUSCHdes for 1.28Mcps TDD
    -- Actual value PRX-PUSCHdes = (value of IE "ul-TargetSIR" - 120)
    ul-TargetSIR                        UL-TargetSIR,
    tddOption                           CHOICE {
        tdd384                              NULL,
        tdd768                              NULL,
        tdd128                              SEQUENCE {
            tpc-StepSize                        TPC-StepSizeTDD                 OPTIONAL
        }
    }
}

PUSCH-SysInfo ::=                   SEQUENCE {
    pusch-Identity                      PUSCH-Identity,
    pusch-Info                          PUSCH-Info,
    usch-TFS                            TransportFormatSet                  OPTIONAL,
    usch-TFCS                           TFCS                                OPTIONAL
}

PUSCH-SysInfo-VHCR ::=                  SEQUENCE {
    pusch-Identity                      PUSCH-Identity,
    pusch-Info-VHCR                     PUSCH-Info-VHCR,
    usch-TransportChannelsInfo          USCH-TransportChannelsInfo          OPTIONAL,
    usch-TFCS                           TFCS                                OPTIONAL
}

PUSCH-SysInfo-HCR-r5 ::=                    SEQUENCE {
    pusch-Identity                      PUSCH-Identity,
    pusch-Info                          PUSCH-Info,
    usch-TransportChannelsInfo          USCH-TransportChannelsInfo          OPTIONAL,
    usch-TFCS                           TFCS                                OPTIONAL
}

PUSCH-SysInfo-LCR-r4 ::=            SEQUENCE {
    pusch-Identity                      PUSCH-Identity,
    pusch-Info                          PUSCH-Info-LCR-r4,
    usch-TFS                            TransportFormatSet                  OPTIONAL,
    usch-TFCS                           TFCS                                OPTIONAL
}

PUSCH-SysInfoList ::=               SEQUENCE (SIZE (1..maxPUSCH)) OF
                                        PUSCH-SysInfo

PUSCH-SysInfoList-HCR-r5 ::=            SEQUENCE (SIZE (1..maxPUSCH)) OF PUSCH-SysInfo-HCR-r5

PUSCH-SysInfoList-LCR-r4 ::=        SEQUENCE (SIZE (1..maxPUSCH)) OF
                                        PUSCH-SysInfo-LCR-r4

PUSCH-SysInfoList-SFN ::=           SEQUENCE (SIZE (1..maxPUSCH)) OF
                                        SEQUENCE {
    pusch-SysInfo                           PUSCH-SysInfo,
    sfn-TimeInfo                            SFN-TimeInfo                    OPTIONAL
```

```
}

PUSCH-SysInfoList-SFN-HCR-r5 ::=          SEQUENCE (SIZE (1..maxPUSCH)) OF
                                       SEQUENCE {
    pusch-SysInfo                          PUSCH-SysInfo-HCR-r5,
    sfn-TimeInfo                           SFN-TimeInfo                    OPTIONAL
}

PUSCH-SysInfoList-SFN-LCR-r4 ::=       SEQUENCE (SIZE (1..maxPUSCH)) OF
                                       SEQUENCE {
    pusch-SysInfo                          PUSCH-SysInfo-LCR-r4,
    sfn-TimeInfo                           SFN-TimeInfo                    OPTIONAL
}

PUSCH-SysInfoList-SFN-VHCR ::=     SEQUENCE (SIZE (1..maxPUSCH)) OF
                                       SEQUENCE {
    pusch-SysInfo-VHCR                     PUSCH-SysInfo-VHCR,
    sfn-TimeInfo                           SFN-TimeInfo                    OPTIONAL
}

RACH-TransmissionParameters ::=    SEQUENCE {
    mmax                               INTEGER (1..32),
    nb01Min                            NB01,
    nb01Max                            NB01
}

ReducedScramblingCodeNumber ::=    INTEGER (0..8191)

RepetitionPeriodAndLength ::=      CHOICE {
    repetitionPeriod1                  NULL,
    -- repetitionPeriod2 could just as well be NULL also.
    repetitionPeriod2                  INTEGER (1..1),
    repetitionPeriod4                  INTEGER (1..3),
    repetitionPeriod8                  INTEGER (1..7),
    repetitionPeriod16                 INTEGER (1..15),
    repetitionPeriod32                 INTEGER (1..31),
    repetitionPeriod64                 INTEGER (1..63)
}

RepetitionPeriodLengthAndOffset ::= CHOICE {
    repetitionPeriod1                  NULL,
    repetitionPeriod2                  SEQUENCE {
        length                             NULL,
        offset                             INTEGER (0..1)
    },
    repetitionPeriod4                  SEQUENCE {
        length                             INTEGER (1..3),
        offset                             INTEGER (0..3)
    },
    repetitionPeriod8                  SEQUENCE {
        length                             INTEGER (1..7),
        offset                             INTEGER (0..7)
    },
    repetitionPeriod16                 SEQUENCE {
        length                             INTEGER (1..15),
        offset                             INTEGER (0..15)
    },
    repetitionPeriod32                 SEQUENCE {
        length                             INTEGER (1..31),
        offset                             INTEGER (0..31)
    },
    repetitionPeriod64                 SEQUENCE {
        length                             INTEGER (1..63),
        offset                             INTEGER (0..63)
    }
}

ReplacedPDSCH-CodeInfo ::=         SEQUENCE {
    tfci-Field2                        MaxTFCI-Field2Value,
    spreadingFactor                    SF-PDSCH,
    codeNumber                         CodeNumberDSCH,
    multiCodeInfo                      MultiCodeInfo
}

ReplacedPDSCH-CodeInfoList ::=     SEQUENCE (SIZE (1..maxTFCI-2-Combs)) OF
                                       ReplacedPDSCH-CodeInfo

RepPerLengthOffset-PICH ::=        CHOICE {
```

```
    rpp4-2                              INTEGER (0..3),
    rpp8-2                              INTEGER (0..7),
    rpp8-4                              INTEGER (0..7),
    rpp16-2                             INTEGER (0..15),
    rpp16-4                             INTEGER (0..15),
    rpp32-2                             INTEGER (0..31),
    rpp32-4                             INTEGER (0..31),
    rpp64-2                             INTEGER (0..63),
    rpp64-4                             INTEGER (0..63)
}

RepPerLengthOffset-MICH ::=         CHOICE {
    rpp4-2                              INTEGER (0..3),
    rpp8-2                              INTEGER (0..7),
    rpp8-4                              INTEGER (0..7),
    rpp16-2                             INTEGER (0..15),
    rpp16-4                             INTEGER (0..15),
    rpp32-2                             INTEGER (0..31),
    rpp32-4                             INTEGER (0..31),
    rpp64-2                             INTEGER (0..63),
    rpp64-4                             INTEGER (0..63)
}

RestrictedTrCH ::=                  SEQUENCE {
    dl-restrictedTrCh-Type              DL-TrCH-Type,
    restrictedDL-TrCH-Identity          TransportChannelIdentity,
    allowedTFIList                      AllowedTFI-List
}

RestrictedTrCH-InfoList ::=         SEQUENCE (SIZE(1..maxTrCH)) OF
                                        RestrictedTrCH

RL-AdditionInformation ::=          SEQUENCE {
    primaryCPICH-Info                   PrimaryCPICH-Info,
    dl-DPCH-InfoPerRL                   DL-DPCH-InfoPerRL,
    -- dummy and dummy2 are not used in this version of specification
    -- and the IEs should be ignored.
    dummy                               BOOLEAN,
    dummy2                              SCCPCH-InfoForFACH                  OPTIONAL
}

RL-AdditionInformation-r6 ::=       SEQUENCE {
    primaryCPICH-Info                   PrimaryCPICH-Info,
    cell-Id                             CellIdentity                        OPTIONAL,
    dl-dpchInfo                         CHOICE {
        dl-DPCH-InfoPerRL                   DL-DPCH-InfoPerRL-r5,
        dl-FDPCH-InfoPerRL                  DL-FDPCH-InfoPerRL-r6
    },
    e-HICH-Information                  E-HICH-Information                  OPTIONAL,
    e-RGCH-Information                  E-RGCH-Information                  OPTIONAL
}

RL-AdditionInformationList ::=      SEQUENCE (SIZE (1..maxRL-1)) OF
                                        RL-AdditionInformation

RL-AdditionInformationList-r6 ::=   SEQUENCE (SIZE (1..maxRL-1)) OF
                                        RL-AdditionInformation-r6

RL-IdentifierList ::=               SEQUENCE (SIZE (1..maxRL)) OF
                                        PrimaryCPICH-Info

RL-RemovalInformationList ::=       SEQUENCE (SIZE (1..maxRL)) OF
                                        PrimaryCPICH-Info

RPP ::=                             ENUMERATED {
                                        mode0, mode1 }

S-Field ::=                         ENUMERATED {
                                        e1bit, e2bits }

SCCPCH-ChannelisationCode ::=       ENUMERATED {
                                        cc16-1, cc16-2, cc16-3, cc16-4,
                                        cc16-5, cc16-6, cc16-7, cc16-8,
                                        cc16-9, cc16-10, cc16-11, cc16-12,
                                        cc16-13, cc16-14, cc16-15, cc16-16 }

SCCPCH-ChannelisationCode-VHCR ::=  ENUMERATED {
                                        cc32-1, cc32-2, cc32-3, cc32-4,
```

```
                                        cc32-5, cc32-6, cc32-7, cc32-8,
                                        cc32-9, cc32-10, cc32-11, cc32-12,
                                        cc32-13, cc32-14, cc32-15, cc32-16,
                                        cc32-17, cc32-18, cc32-19, cc32-20,
                                        cc32-21, cc32-22, cc32-23, cc32-24,
                                        cc32-25, cc32-26, cc32-27, cc32-28,
                                        cc32-29, cc32-30, cc32-31, cc32-32 }

SCCPCH-ChannelisationCodeList ::=   SEQUENCE (SIZE (1..16)) OF
                                        SCCPCH-ChannelisationCode

SCCPCH-ChannelisationCodeList-VHCR ::= SEQUENCE (SIZE (1..32)) OF
                                        SCCPCH-ChannelisationCode-VHCR

SCCPCH-InfoForFACH ::=              SEQUENCE {
    secondaryCCPCH-Info                 SecondaryCCPCH-Info,
    tfcs                                TFCS,
    modeSpecificInfo                CHOICE {
        fdd                             SEQUENCE {
            fach-PCH-InformationList            FACH-PCH-InformationList,
            sib-ReferenceListFACH               SIB-ReferenceListFACH
        },
        tdd                             SEQUENCE {
            fach-PCH-InformationList            FACH-PCH-InformationList
        }
    }
}

SCCPCH-InfoForFACH-r4 ::=               SEQUENCE {
    secondaryCCPCH-Info                 SecondaryCCPCH-Info-r4,
    tfcs                                TFCS,
    fach-PCH-InformationList            FACH-PCH-InformationList,
    modeSpecificInfo                CHOICE {
        fdd                             SEQUENCE {
            sib-ReferenceListFACH           SIB-ReferenceListFACH
        },
        tdd                             NULL
    }
}

SCCPCH-SystemInformation ::=        SEQUENCE {
    secondaryCCPCH-Info                 SecondaryCCPCH-Info,
    tfcs                                TFCS                                OPTIONAL,
    fach-PCH-InformationList            FACH-PCH-InformationList            OPTIONAL,
    pich-Info                           PICH-Info                           OPTIONAL
}

SCCPCH-SystemInformation-LCR-r4-ext ::= SEQUENCE {
    secondaryCCPCH-LCR-Extensions   SecondaryCCPCH-Info-LCR-r4-ext,
    -- pich-Info in the SCCPCH-SystemInformation IE shall be absent,
    -- and instead the following used.
    pich-Info                       PICH-Info-LCR-r4                        OPTIONAL
}

SCCPCH-SystemInformation-r7 ::=     SEQUENCE {
    secondaryCCPCH-Info                 SecondaryCCPCH-Info-r7,
    tfcs                                TFCS                                OPTIONAL,
    fach-PCH-InformationList            FACH-PCH-InformationList            OPTIONAL,
    pich-Info                           PICH-Info-r7                        OPTIONAL
}

SCCPCH-SystemInformationList ::=    SEQUENCE (SIZE (1..maxSCCPCH)) OF
                                        SCCPCH-SystemInformation

SCCPCH-SystemInformationList-r7 ::= SEQUENCE (SIZE (1..maxSCCPCH)) OF
                                        SCCPCH-SystemInformation-r7

-- SCCPCH-SystemInformationList-LCR-r4-ext includes elements additional to those in
-- SCCPCH-SystemInformationList for the 1.28Mcps TDD. The order of the IEs
-- indicates which SCCPCH-SystemInformation-LCR-r4-ext IE extends which
-- SCCPCH-SystemInformation IE.
SCCPCH-SystemInformationList-LCR-r4-ext ::= SEQUENCE (SIZE (1..maxSCCPCH)) OF
                                                SCCPCH-SystemInformation-LCR-r4-ext

-- The SCCPCH-SystemInformation-MBMS-r6 is used for an S-CCPCH dedicated for MBMS purposes.
SCCPCH-SystemInformation-MBMS-r6 ::= SEQUENCE {
    secondaryCCPCHInfo-MBMS             SecondaryCCPCHInfo-MBMS-r6,
    transportFormatCombinationSet       TFCS,
```

```
    fachCarryingMCCH                    SEQUENCE {
        mcch-transportFormatSet             TransportFormatSet,
        mcch-ConfigurationInfo              MBMS-MCCH-ConfigurationInfo-r6
    },
    fachCarryingMTCH-List               MBMS-FACHCarryingMTCH-List          OPTIONAL,
    -- If schedulingInformation is provided
    fachCarryingMSCH                    SEQUENCE {
        msch-transportFormatSet             TransportFormatSet,
        msch-ConfigurationInfo              MBMS-MSCH-ConfigurationInfo-r6
    }       OPTIONAL
}

-- The SCCPCH-SystemInformation-MBMS-r7 is used for an S-CCPCH dedicated for MBMS purposes.
SCCPCH-SystemInformation-MBMS-r7 ::= SEQUENCE {
    secondaryCCPCHInfo-MBMS             SecondaryCCPCHInfo-MBMS-r7,
    transportFormatCombinationSet       TFCS,
    fachCarryingMCCH                    SEQUENCE {
        mcch-transportFormatSet             TransportFormatSet,
        mcch-ConfigurationInfo              MBMS-MCCH-ConfigurationInfo-r6
    },
    fachCarryingMTCH-List               MBMS-FACHCarryingMTCH-List          OPTIONAL,
    -- If schedulingInformation is provided
    fachCarryingMSCH                    SEQUENCE {
        msch-transportFormatSet             TransportFormatSet,
        msch-ConfigurationInfo              MBMS-MSCH-ConfigurationInfo-r6
    }       OPTIONAL
}

ScramblingCodeChange ::=            ENUMERATED {
                                        codeChange, noCodeChange }

ScramblingCodeType ::=              ENUMERATED {
                                        shortSC,
                                        longSC }

SecondaryCCPCH-Info ::=             SEQUENCE {
    modeSpecificInfo                CHOICE {
        fdd                             SEQUENCE {
            -- dummy1 is not used in this version of the specification and should be ignored.
            dummy1                          PCPICH-UsageForChannelEst,
            -- dummy2 is not used in this version of the specification.  It should not
            -- be sent and if received it should be ignored.
            dummy2                          SecondaryCPICH-Info             OPTIONAL,
            secondaryScramblingCode         SecondaryScramblingCode         OPTIONAL,
            sttd-Indicator                  BOOLEAN,
            sf-AndCodeNumber                SF256-AndCodeNumber,
            pilotSymbolExistence            BOOLEAN,
            tfci-Existence                  BOOLEAN,
            positionFixedOrFlexible         PositionFixedOrFlexible,
            timingOffset                    TimingOffset                    DEFAULT 0
        },
        tdd                             SEQUENCE {
            -- TABULAR: the offset is included in CommonTimeslotInfoSCCPCH
            commonTimeslotInfo              CommonTimeslotInfoSCCPCH,
            individualTimeslotInfo          IndividualTimeslotInfo,
            channelisationCode              SCCPCH-ChannelisationCodeList
        }
    }
}

SecondaryCCPCH-Info-r4 ::=      SEQUENCE {
    modeSpecificInfo                CHOICE {
        fdd                             SEQUENCE {
            secondaryScramblingCode         SecondaryScramblingCode         OPTIONAL,
            sttd-Indicator                  BOOLEAN,
            sf-AndCodeNumber                SF256-AndCodeNumber,
            pilotSymbolExistence            BOOLEAN,
            tfci-Existence                  BOOLEAN,
            positionFixedOrFlexible         PositionFixedOrFlexible,
            timingOffset                    TimingOffset                    DEFAULT 0
        },
        tdd                             SEQUENCE {
            -- TABULAR: the offset is included in CommonTimeslotInfoSCCPCH
            commonTimeslotInfo              CommonTimeslotInfoSCCPCH,
            tddOption                       CHOICE {
                tdd384                          SEQUENCE {
                    individualTimeslotInfo          IndividualTimeslotInfo
                },
```

```
                tdd128                          SEQUENCE {
                    individualTimeslotInfo          IndividualTimeslotInfo-LCR-r4
                }
            },
            channelisationCode              SCCPCH-ChannelisationCodeList
        }
    }
}

SecondaryCCPCH-Info-r7 ::=      SEQUENCE {
    modeSpecificInfo                CHOICE {
        fdd                             SEQUENCE {
            secondaryScramblingCode         SecondaryScramblingCode         OPTIONAL,
            sttd-Indicator                  BOOLEAN,
            sf-AndCodeNumber                SF256-AndCodeNumber,
            pilotSymbolExistence            BOOLEAN,
            tfci-Existence                  BOOLEAN,
            positionFixedOrFlexible         PositionFixedOrFlexible,
            timingOffset                    TimingOffset                    DEFAULT 0
        },
        tdd                             SEQUENCE {
            -- TABULAR: the offset is included in CommonTimeslotInfoSCCPCH
            commonTimeslotInfo              CommonTimeslotInfoSCCPCH,
            tddOption                       CHOICE {
                tdd384                          SEQUENCE {
                    individualTimeslotInfo          IndividualTimeslotInfo,
                    channelisationCode              SCCPCH-ChannelisationCodeList
                },
                tdd768                          SEQUENCE {
                    individualTimeslotInfo          IndividualTimeslotInfo-VHCR,
                    channelisationCode              SCCPCH-ChannelisationCodeList-VHCR
                },
                tdd128                          SEQUENCE {
                    individualTimeslotInfo          IndividualTimeslotInfo-LCR-r4,
                    channelisationCode              SCCPCH-ChannelisationCodeList
                }
            }
        }
    }
}

SecondaryCCPCH-Info-LCR-r4-ext ::=  SEQUENCE {
    individualTimeslotLCR-Ext           IndividualTimeslotInfo-LCR-r4-ext
}

SecondaryCCPCHInfo-MBMS-r6 ::=      SEQUENCE {
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            secondaryScramblingCode             SecondaryScramblingCode         OPTIONAL,
            sttd-Indicator                      BOOLEAN,
            sf-AndCodeNumber                    SF256-AndCodeNumber,
            timingOffset                        TimingOffset                    DEFAULT 0
        },
        tdd384                              DownlinkTimeslotsCodes,
        tdd128                              DownlinkTimeslotsCodes-LCR-r4
    }
}

SecondaryCCPCHInfo-MBMS-r7 ::=      SEQUENCE {
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            secondaryScramblingCode             SecondaryScramblingCode         OPTIONAL,
            sttd-Indicator                      BOOLEAN,
            sf-AndCodeNumber                    SF256-AndCodeNumber,
            timingOffset                        TimingOffset                    DEFAULT 0
        },
        tdd384                              DownlinkTimeslotsCodes,
        tdd768                              DownlinkTimeslotsCodes-VHCR,
        tdd128                              DownlinkTimeslotsCodes-LCR-r4
    }
}

SecondaryCPICH-Info ::=             SEQUENCE {
    secondaryDL-ScramblingCode          SecondaryScramblingCode         OPTIONAL,
    channelisationCode                  ChannelisationCode256
}

SecondaryScramblingCode ::=         INTEGER (1..15)
```

```
SecondInterleavingMode ::=          ENUMERATED {
                                        frameRelated, timeslotRelated }

-- SF256-AndCodeNumber encodes both "Spreading factor" and "Code Number"
SF256-AndCodeNumber ::=             CHOICE {
    sf4                                 INTEGER (0..3),
    sf8                                 INTEGER (0..7),
    sf16                                INTEGER (0..15),
    sf32                                INTEGER (0..31),
    sf64                                INTEGER (0..63),
    sf128                               INTEGER (0..127),
    sf256                               INTEGER (0..255)
}

-- SF512-AndCodeNumber encodes both "Spreading factor" and "Code Number"
SF512-AndCodeNumber ::=             CHOICE {
    sf4                                 INTEGER (0..3),
    sf8                                 INTEGER (0..7),
    sf16                                INTEGER (0..15),
    sf32                                INTEGER (0..31),
    sf64                                INTEGER (0..63),
    sf128                               INTEGER (0..127),
    sf256                               INTEGER (0..255),
    sf512                               INTEGER (0..511)
}

-- SF512-AndPilot encodes both "Spreading factor" and "Number of bits for Pilot bits"
SF512-AndPilot ::=                  CHOICE {
    sfd4                                NULL,
    sfd8                                NULL,
    sfd16                               NULL,
    sfd32                               NULL,
    sfd64                               NULL,
    sfd128                              PilotBits128,
    sfd256                              PilotBits256,
    sfd512                              NULL
}
SF-PDSCH ::=                        ENUMERATED {
                                        sfp4, sfp8, sfp16, sfp32,
                                        sfp64, sfp128, sfp256 }

SF-PRACH ::=                        ENUMERATED {
                                        sfpr32, sfpr64, sfpr128, sfpr256 }

SFN-TimeInfo ::=                    SEQUENCE {
    activationTimeSFN                   INTEGER (0..4095),
    physChDuration                  DurationTimeInfo
}

-- actual scheduling value = 2^(signalled value +1) and is the periodicity of sending special burst frames
SpecialBurstScheduling ::=              INTEGER (0..7)

SpreadingFactor ::=                 ENUMERATED {
                                        sf4, sf8, sf16, sf32,
                                        sf64, sf128, sf256 }

SRB-delay ::=                       INTEGER (0..7)

SSDT-CellIdentity ::=               ENUMERATED {
                                        ssdt-id-a, ssdt-id-b, ssdt-id-c,
                                        ssdt-id-d, ssdt-id-e, ssdt-id-f,
                                        ssdt-id-g, ssdt-id-h }

SSDT-Information ::=                SEQUENCE {
    s-Field                             S-Field,
    codeWordSet                         CodeWordSet
}

SSDT-Information-r4 ::=             SEQUENCE {
    s-Field                             S-Field,
    codeWordSet                         CodeWordSet,
    ssdt-UL-r4                          SSDT-UL                             OPTIONAL
}

SSDT-UL ::=                         ENUMERATED {
                                        ul, ul-AndDL }
```

```
SynchronisationParameters-r4 ::=    SEQUENCE {
    sync-UL-CodesBitmap                 BIT STRING {
                                            code7(0),
                                            code6(1),
                                            code5(2),
                                            code4(3),
                                            code3(4),
                                            code2(5),
                                            code1(6),
                                            code0(7)
                                            } (SIZE (8)),
    fpach-Info                          FPACH-Info-r4,
    -- Actual value prxUpPCHdes = IE value - 120
    prxUpPCHdes                         INTEGER (0..62),
    sync-UL-Procedure                   SYNC-UL-Procedure-r4                OPTIONAL
}

SYNC-UL-Procedure-r4 ::=            SEQUENCE {
    max-SYNC-UL-Transmissions           ENUMERATED { tr1, tr2, tr4, tr8 },
    powerRampStep                       INTEGER (0..3)
}

SYNC-UL-Info-r4 ::=                 SEQUENCE {
    sync-UL-Codes-Bitmap                BIT STRING {
                                            code7(0),
                                            code6(1),
                                            code5(2),
                                            code4(3),
                                            code3(4),
                                            code2(5),
                                            code1(6),
                                            code0(7)
                                            } ( SIZE (8)),
    -- Actual value prxUpPCHdes = IE value - 120
    prxUpPCHdes                         INTEGER (0..62),
    powerRampStep                       INTEGER (0..3),
    max-SYNC-UL-Transmissions           ENUMERATED { tr1, tr2, tr4, tr8 } ,
    mmax                                INTEGER(1..32)
}

TDD-FPACH-CCode16-r4 ::=            ENUMERATED {
                                        cc16-1, cc16-2, cc16-3, cc16-4,
                                        cc16-5, cc16-6, cc16-7, cc16-8,
                                        cc16-9, cc16-10, cc16-11, cc16-12,
                                        cc16-13, cc16-14, cc16-15, cc16-16 }

TDD-UL-Interference ::=             INTEGER (-110..-52)

TDD-PICH-CCode ::=                  ENUMERATED {
                                        cc16-1, cc16-2, cc16-3, cc16-4,
                                        cc16-5, cc16-6, cc16-7, cc16-8,
                                        cc16-9, cc16-10, cc16-11, cc16-12,
                                        cc16-13, cc16-14, cc16-15, cc16-16 }

TDD768-PICH-CCode ::=               ENUMERATED {
                                        cc32-1, cc32-2, cc32-3, cc32-4,
                                        cc32-5, cc32-6, cc32-7, cc32-8,
                                        cc32-9, cc32-10, cc32-11, cc32-12,
                                        cc32-13, cc32-14, cc32-15, cc32-16,
                                        cc32-17, cc32-18, cc32-19, cc32-20,
                                        cc32-21, cc32-22, cc32-23, cc32-24,
                                        cc32-25, cc32-26, cc32-27, cc32-28,
                                        cc32-29, cc32-30, cc32-31, cc32-32 }

TDD-PRACH-CCode8 ::=                ENUMERATED {
                                        cc8-1, cc8-2, cc8-3, cc8-4,
                                        cc8-5, cc8-6, cc8-7, cc8-8 }

TDD-PRACH-CCode16 ::=               ENUMERATED {
                                        cc16-1, cc16-2, cc16-3, cc16-4,
                                        cc16-5, cc16-6, cc16-7, cc16-8,
                                        cc16-9, cc16-10, cc16-11, cc16-12,
                                        cc16-13, cc16-14, cc16-15, cc16-16 }

TDD-PRACH-CCode-LCR-r4 ::=          ENUMERATED {
                                        cc4-1, cc4-2, cc4-3, cc4-4,
                                        cc8-1, cc8-2, cc8-3, cc8-4,
                                        cc8-5, cc8-6, cc8-7, cc8-8,
```

```
                                        cc16-1, cc16-2, cc16-3, cc16-4,
                                        cc16-5, cc16-6, cc16-7, cc16-8,
                                        cc16-9, cc16-10, cc16-11, cc16-12,
                                        cc16-13, cc16-14, cc16-15, cc16-16 }

TDD-PRACH-CCodeList ::=             CHOICE {
    sf8                                 SEQUENCE (SIZE (1..8)) OF
                                            TDD-PRACH-CCode8,
-- Channelisation codes cc16-9, cc16-10, cc16-11, cc16-12, cc16-13, cc16-14,
-- cc16-15 and cc16-16 shall not be used
    sf16                                SEQUENCE (SIZE (1..8)) OF
                                            TDD-PRACH-CCode16
}

TDD768-PRACH-CCode8 ::=             ENUMERATED {
                                        cc8-1, cc8-2, cc8-3, cc8-4,
                                        cc8-5, cc8-6, cc8-7, cc8-8 }

TDD768-PRACH-CCode16 ::=                ENUMERATED {
                                        cc16-1, cc16-2, cc16-3, cc16-4,
                                        cc16-5, cc16-6, cc16-7, cc16-8,
                                        cc16-9, cc16-10, cc16-11, cc16-12,
                                        cc16-13, cc16-14, cc16-15, cc16-16 }

TDD768-PRACH-CCode32 ::=                ENUMERATED {
                                        cc32-1, cc32-2, cc32-3, cc32-4,
                                        cc32-5, cc32-6, cc32-7, cc32-8,
                                        cc32-9, cc32-10, cc32-11, cc32-12,
                                        cc32-13, cc32-14, cc32-15, cc32-16 }

TDD768-PRACH-CCodeList ::=          CHOICE {
    sf32                                SEQUENCE (SIZE (1..16)) OF
                                            TDD768-PRACH-CCode32,
-- Channelisation codes cc32-17, cc32-18, cc32-19, cc32-20, cc32-21, cc32-22,
-- cc32-23, cc32-24, cc32-25, cc32-26, cc32-27, cc32-28, cc32-29, cc32-30, cc32-31
-- and cc32-32 shall not be used
    sf16                                SEQUENCE (SIZE (1..16)) OF
                                            TDD768-PRACH-CCode16,
    sf8                                 SEQUENCE (SIZE (1..8)) OF
                                            TDD768-PRACH-CCode8
}

TFC-ControlDuration ::=             ENUMERATED {
                                        tfc-cd1, tfc-cd2, tfc-cd4, tfc-cd8,
                                        tfc-cd16, tfc-cd24, tfc-cd32,
                                        tfc-cd48, tfc-cd64, tfc-cd128,
                                        tfc-cd192, tfc-cd256, tfc-cd512 }

TFCI-Coding ::=                     ENUMERATED {
                                        tfci-bits-4, tfci-bits-8,
                                        tfci-bits-16, tfci-bits-32 }

TGCFN ::=                           INTEGER (0..255)

-- In TGD, value 270 represents "undefined" in the tabular description.
TGD ::=                             INTEGER (15..270)

TGL ::=                             INTEGER (1..14)

TGMP ::=                            ENUMERATED {
                                        tdd-Measurement, fdd-Measurement,
                                        gsm-CarrierRSSIMeasurement,
                                        gsm-initialBSICIdentification, gsmBSICReconfirmation,
                                        multi-carrier }

TGP-Sequence ::=                    SEQUENCE {
    tgpsi                               TGPSI,
    tgps-Status                         CHOICE {
        activate                            SEQUENCE {
            tgcfn                               TGCFN
        },
        deactivate                          NULL
    },
    tgps-ConfigurationParams            TGPS-ConfigurationParams            OPTIONAL
}

TGPS-Reconfiguration-CFN ::=        INTEGER (0..255)
```

```
TGP-SequenceList ::=                SEQUENCE (SIZE (1..maxTGPS)) OF
                                        TGP-Sequence

TGP-SequenceShort ::=               SEQUENCE {
    tgpsi                               TGPSI,
    tgps-Status                         CHOICE {
        activate                            SEQUENCE {
            tgcfn                               TGCFN
        },
        deactivate                          NULL
    }
}

TGPL ::=                            INTEGER (1..144)

-- TABULAR: In TGPRC, value 0 represents "infinity" in the tabular description.
TGPRC ::=                           INTEGER (0..511)

TGPS-ConfigurationParams ::=        SEQUENCE {
    tgmp                                TGMP,
    tgprc                               TGPRC,
    tgsn                                TGSN,
    tgl1                                TGL,
    tgl2                                TGL                                 OPTIONAL,
    tgd                                 TGD,
    tgpl1                               TGPL,
    -- dummy is not used in this version of the specification, it should
    -- not be sent and if received it shall be ignored.
    dummy                           TGPL                                OPTIONAL,
    rpp                                 RPP,
    itp                                 ITP,
    -- TABULAR: Compressed mode method is nested inside UL-DL-Mode
    ul-DL-Mode                          UL-DL-Mode,
    dl-FrameType                        DL-FrameType,
    deltaSIR1                           DeltaSIR,
    deltaSIRAfter1                      DeltaSIR,
    deltaSIR2                           DeltaSIR                            OPTIONAL,
    deltaSIRAfter2                      DeltaSIR                            OPTIONAL,
    nidentifyAbort                      NidentifyAbort                      OPTIONAL,
    treconfirmAbort                     TreconfirmAbort                     OPTIONAL
}

TGPSI ::=                           INTEGER (1..maxTGPS)

TGSN ::=                            INTEGER (0..14)

TimeInfo ::=                        SEQUENCE {
    activationTime                      ActivationTime                      OPTIONAL,
    durationTimeInfo                    DurationTimeInfo                    OPTIONAL
}

TimeslotList ::=                    SEQUENCE (SIZE (1..maxTS)) OF
                                        TimeslotNumber

TimeslotList-r4 ::=                 CHOICE {
-- the choice for 7.68 Mcps TDD is as for 3.84 Mcps TDD  --
    tdd384                              SEQUENCE (SIZE (1..maxTS)) OF
                                            TimeslotNumber,
    tdd128                              SEQUENCE (SIZE (1..maxTS-LCR)) OF
                                            TimeslotNumber-LCR-r4
}

-- If TimeslotNumber is included for a 1.28Mcps TDD description, it shall take values from 0..6
TimeslotNumber ::=                      INTEGER (0..14)

TimeslotNumber-LCR-r4 ::=               INTEGER (0..6)

TimeslotNumber-PRACH-LCR-r4 ::=     INTEGER (1..6)

TimeslotSync2 ::=               INTEGER (0..6)

-- Actual value TimingOffset = IE value * 256
TimingOffset ::=                    INTEGER (0..149)

TimingMaintainedSynchInd ::=        ENUMERATED { false }

TPC-CombinationIndex ::=            INTEGER (0..5)
```

```
TPC-CommandTargetRate ::=           ENUMERATED  {
                                        zerop01, zerop02, zerop03, zerop04, zerop05,
                                        zerop06, zerop07, zerop08, zerop09, zerop10 }

-- Actual value TPC-StepSizeFDD = IE value + 1
TPC-StepSizeFDD ::=                 INTEGER (0..1)

TPC-StepSizeTDD ::=                 INTEGER (1..3)

-- Actual value TreconfirmAbort = IE value * 0.5 seconds
TreconfirmAbort ::= INTEGER (1..20)

TX-DiversityMode ::=                ENUMERATED {
                                        noDiversity,
                                        sttd,
                                        closedLoopModel,
        -- dummy is not used in this version of the specification, it should
        -- not be sent and if received it should be ignored.
                                        dummy }

UARFCN ::=                      INTEGER (0..16383)

UCSM-Info ::=                       SEQUENCE {
    minimumSpreadingFactor              MinimumSpreadingFactor,
    nf-Max                              NF-Max,
    channelReqParamsForUCSM             ChannelReqParamsForUCSM
}

UL-CCTrCH ::=                       SEQUENCE {
    tfcs-ID                             TFCS-IdentityPlain                  DEFAULT 1,
    ul-TargetSIR                        UL-TargetSIR,
    timeInfo                            TimeInfo,
    commonTimeslotInfo                  CommonTimeslotInfo                  OPTIONAL,
    ul-CCTrCH-TimeslotsCodes            UplinkTimeslotsCodes                OPTIONAL
}

UL-CCTrCH-r4 ::=                    SEQUENCE {
    tfcs-ID                             TFCS-IdentityPlain                  DEFAULT 1,
    -- The IE ul-TargetSIR corresponds to PRX-DPCHdes for 1.28Mcps TDD
    -- Actual value PRX-DPCHdes = (value of IE "ul-TargetSIR" - 120)
    ul-TargetSIR                        UL-TargetSIR,
    timeInfo                            TimeInfo,
    commonTimeslotInfo                  CommonTimeslotInfo                  OPTIONAL,
    tddOption                           CHOICE {
        tdd384                              SEQUENCE {
            ul-CCTrCH-TimeslotsCodes            UplinkTimeslotsCodes        OPTIONAL
        },
        tdd128                              SEQUENCE {
            ul-CCTrCH-TimeslotsCodes            UplinkTimeslotsCodes-LCR-r4 OPTIONAL
        }
    }
}

UL-CCTrCH-r7 ::=                    SEQUENCE {
    tfcs-ID                             TFCS-IdentityPlain                  DEFAULT 1,
    -- The IE ul-TargetSIR corresponds to PRX-DPCHdes for 1.28Mcps TDD
    -- Actual value PRX-DPCHdes = (value of IE "ul-TargetSIR" - 120)
    ul-TargetSIR                        UL-TargetSIR,
    timeInfo                            TimeInfo,
    commonTimeslotInfo                  CommonTimeslotInfo                  OPTIONAL,
    tddOption                           CHOICE {
        tdd384                              SEQUENCE {
            ul-CCTrCH-TimeslotsCodes            UplinkTimeslotsCodes        OPTIONAL
        },
        tdd768                              SEQUENCE {
            ul-CCTrCH-TimeslotsCodes            UplinkTimeslotsCodes-VHCR   OPTIONAL
        },
        tdd128                              SEQUENCE {
            ul-CCTrCH-TimeslotsCodes            UplinkTimeslotsCodes-LCR-r7 OPTIONAL
        }
    }
}

UL-CCTrCHList ::=                   SEQUENCE (SIZE (1..maxCCTrCH)) OF
                                        UL-CCTrCH

UL-CCTrCHList-r4 ::=                SEQUENCE (SIZE (1..maxCCTrCH)) OF
                                        UL-CCTrCH-r4
```

```
UL-CCTrCHList-r7 ::=                SEQUENCE (SIZE (1..maxCCTrCH)) OF
                                        UL-CCTrCH-r7

UL-CCTrCHListToRemove ::=           SEQUENCE (SIZE (1..maxCCTrCH)) OF
                                        TFCS-IdentityPlain

UL-CCTrChTPCList ::=                SEQUENCE (SIZE (0..maxCCTrCH)) OF
                                            TFCS-Identity

UL-ChannelRequirement ::=           CHOICE {
    ul-DPCH-Info                        UL-DPCH-Info,
    -- dummy is not used in this version of the specification, it should
    -- not be sent and if received the UE behaviour is not specified.
    dummy                               CPCH-SetInfo
}

UL-ChannelRequirement-r4 ::=        CHOICE {
    ul-DPCH-Info                        UL-DPCH-Info-r4,
    -- dummy is not used in this version of the specification, it should
    -- not be sent and if received the UE behaviour is not specified.
    dummy                               CPCH-SetInfo
}

UL-ChannelRequirement-r5 ::=        CHOICE {
    ul-DPCH-Info                        UL-DPCH-Info-r5,
    -- dummy is not used in this version of the specification, it should
    -- not be sent and if received the UE behaviour is not specified.
    dummy                               CPCH-SetInfo
}

-- Note: the reference to CPCH in the element name below is incorrect. The name is not
-- changed to keep it aligned with R99.
UL-ChannelRequirementWithCPCH-SetID ::= CHOICE {
    ul-DPCH-Info                        UL-DPCH-Info,
    -- dummy1 and dummy 2 are not used in this version of the specification, they should
    -- not be sent and if received the UE behaviour is not specified.
    dummy1                              CPCH-SetInfo,
    dummy2                              CPCH-SetID
}

-- Note: the reference to CPCH in the element name below is incorrect. The name is not
-- changed to keep it aligned with R99.
UL-ChannelRequirementWithCPCH-SetID-r4 ::=  CHOICE {
    ul-DPCH-Info                        UL-DPCH-Info-r4,
    -- dummy1 and dummy2 are not used in this version of the specification, they
    -- should not be sent and if received the UE behaviour is not specified.
    dummy1                              CPCH-SetInfo,
    dummy2                              CPCH-SetID
}

-- Note: the reference to CPCH in the element name below is incorrect. The name is not
-- changed to keep it aligned with R99.
UL-ChannelRequirementWithCPCH-SetID-r5 ::=  CHOICE {
    ul-DPCH-Info                        UL-DPCH-Info-r5,
    -- dummy1 and dummy2 are not used in this version of the specification, they should
    -- not be sent and if received the UE behaviour is not specified.
    dummy1                              CPCH-SetInfo,
    dummy2                              CPCH-SetID
}

UL-CompressedModeMethod ::=         ENUMERATED {
                                        sf-2,
                                        higherLayerScheduling }

UL-DL-Mode ::=                      CHOICE {
    ul                                  UL-CompressedModeMethod,
    dl                                  DL-CompressedModeMethod,
    ul-and-dl                               SEQUENCE {
        ul                                  UL-CompressedModeMethod,
        dl                                  DL-CompressedModeMethod
    }}

UL-DPCCH-SlotFormat ::=             ENUMERATED {
                                        slf0, slf1, slf2 }

UL-DPCH-Info ::=                    SEQUENCE {
    ul-DPCH-PowerControlInfo            UL-DPCH-PowerControlInfo            OPTIONAL,
```

```
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            scramblingCodeType                  ScramblingCodeType,
            scramblingCode                      UL-ScramblingCode,
            numberOfDPDCH                       NumberOfDPDCH               DEFAULT 1,
            spreadingFactor                     SpreadingFactor,
            tfci-Existence                      BOOLEAN,
            -- numberOfFBI-Bits is conditional based on history
            numberOfFBI-Bits                    NumberOfFBI-Bits            OPTIONAL,
            puncturingLimit                     PuncturingLimit
        },
        tdd                                 SEQUENCE {
            ul-TimingAdvance                    UL-TimingAdvanceControl     OPTIONAL,
            ul-CCTrCHList                       UL-CCTrCHList               OPTIONAL,
            ul-CCTrCHListToRemove               UL-CCTrCHListToRemove       OPTIONAL
        }
    }
}

UL-DPCH-Info-r4 ::=                 SEQUENCE {
    ul-DPCH-PowerControlInfo            UL-DPCH-PowerControlInfo-r4         OPTIONAL,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            scramblingCodeType                  ScramblingCodeType,
            scramblingCode                      UL-ScramblingCode,
            numberOfDPDCH                       NumberOfDPDCH               DEFAULT 1,
            spreadingFactor                     SpreadingFactor,
            tfci-Existence                      BOOLEAN,
            -- numberOfFBI-Bits is conditional based on history
            numberOfFBI-Bits                    NumberOfFBI-Bits            OPTIONAL,
            puncturingLimit                     PuncturingLimit
        },
        tdd                                 SEQUENCE {
            ul-TimingAdvance                    UL-TimingAdvanceControl-r4  OPTIONAL,
            ul-CCTrCHList                       UL-CCTrCHList-r4            OPTIONAL,
            ul-CCTrCHListToRemove               UL-CCTrCHListToRemove       OPTIONAL
        }
    }
}

UL-DPCH-Info-r5 ::=                 SEQUENCE {
    ul-DPCH-PowerControlInfo            UL-DPCH-PowerControlInfo-r5         OPTIONAL,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            scramblingCodeType                  ScramblingCodeType,
            scramblingCode                      UL-ScramblingCode,
            numberOfDPDCH                       NumberOfDPDCH               DEFAULT 1,
            spreadingFactor                     SpreadingFactor,
            tfci-Existence                      BOOLEAN,
            -- numberOfFBI-Bits is conditional based on history
            numberOfFBI-Bits                    NumberOfFBI-Bits            OPTIONAL,
            puncturingLimit                     PuncturingLimit
        },
        tdd                                 SEQUENCE {
            ul-TimingAdvance                    UL-TimingAdvanceControl-r4  OPTIONAL,
            ul-CCTrCHList                       UL-CCTrCHList-r4            OPTIONAL,
            ul-CCTrCHListToRemove               UL-CCTrCHListToRemove       OPTIONAL
        }
    }
}

UL-DPCH-Info-r6 ::=                 SEQUENCE {
    ul-DPCH-PowerControlInfo            UL-DPCH-PowerControlInfo-r6         OPTIONAL,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            scramblingCodeType                  ScramblingCodeType,
            scramblingCode                      UL-ScramblingCode,
            dpdchPresence                       CHOICE {
                present                             SEQUENCE {
                    numberOfDPDCH                       NumberOfDPDCH               DEFAULT 1,
                    spreadingFactor                     SpreadingFactor,
                    tfci-Existence                      BOOLEAN,
                    -- numberOfFBI-Bits is conditional based on history
                    numberOfFBI-Bits                    NumberOfFBI-Bits            OPTIONAL,
                    puncturingLimit                     PuncturingLimit
                },
                notPresent                          SEQUENCE {
                    tfci-Existence                      BOOLEAN,
```

```
                    -- numberOfFBI-Bits is conditional based on history
                    numberOfFBI-Bits                    NumberOfFBI-Bits            OPTIONAL
                }
            }
        },
        tdd                                 SEQUENCE {
            ul-TimingAdvance                    UL-TimingAdvanceControl-r4  OPTIONAL,
            ul-CCTrCHList                       UL-CCTrCHList-r4            OPTIONAL,
            ul-CCTrCHListToRemove               UL-CCTrCHListToRemove       OPTIONAL
        }
    }
}

UL-DPCH-Info-r7 ::=                 SEQUENCE {
    ul-DPCH-PowerControlInfo            UL-DPCH-PowerControlInfo-r6         OPTIONAL,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            scramblingCodeType                  ScramblingCodeType,
            scramblingCode                      UL-ScramblingCode,
            dpdchPresence                       CHOICE {
                present                             SEQUENCE {
                    numberOfDPDCH                       NumberOfDPDCH               DEFAULT 1,
                    spreadingFactor                     SpreadingFactor,
                    tfci-Existence                      BOOLEAN,
                    -- numberOfFBI-Bits is conditional based on history
                    numberOfFBI-Bits                    NumberOfFBI-Bits            OPTIONAL,
                    puncturingLimit                     PuncturingLimit
                        },
                notPresent                          SEQUENCE {
                    tfci-Existence                      BOOLEAN,
                    -- numberOfFBI-Bits is conditional based on history
                    numberOfFBI-Bits                    NumberOfFBI-Bits            OPTIONAL
                }
            }
        },
        tdd                                 SEQUENCE {
            ul-TimingAdvance                    UL-TimingAdvanceControl-r7  OPTIONAL,
            ul-CCTrCHList                       UL-CCTrCHList-r7            OPTIONAL,
            ul-CCTrCHListToRemove               UL-CCTrCHListToRemove       OPTIONAL
        }
    }
}

UL-DPCH-InfoPostFDD ::=             SEQUENCE {
    ul-DPCH-PowerControlInfo            UL-DPCH-PowerControlInfoPostFDD,
            scramblingCodeType                  ScramblingCodeType,
            reducedScramblingCodeNumber         ReducedScramblingCodeNumber,
            spreadingFactor                     SpreadingFactor

}

UL-DPCH-InfoPostTDD ::=             SEQUENCE {
    ul-DPCH-PowerControlInfo            UL-DPCH-PowerControlInfoPostTDD,
    ul-TimingAdvance                    UL-TimingAdvanceControl                 OPTIONAL,
    ul-CCTrCH-TimeslotsCodes            UplinkTimeslotsCodes
}

UL-DPCH-InfoPostTDD-LCR-r4 ::=      SEQUENCE {
    ul-DPCH-PowerControlInfo            UL-DPCH-PowerControlInfoPostTDD-LCR-r4,
    ul-TimingAdvance                    UL-TimingAdvanceControl-LCR-r4              OPTIONAL,
    ul-CCTrCH-TimeslotsCodes            UplinkTimeslotsCodes-LCR-r4
}

UL-DPCH-InfoPredef ::=              SEQUENCE {
    ul-DPCH-PowerControlInfo            UL-DPCH-PowerControlInfoPredef,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            tfci-Existence                      BOOLEAN,
            puncturingLimit                     PuncturingLimit
        },
        tdd                                 SEQUENCE {
            commonTimeslotInfo                  CommonTimeslotInfo
        }
    }
}

UL-DPCH-PowerControlInfo ::=        CHOICE {
    fdd                                 SEQUENCE {
```

```
        dpcch-PowerOffset                   DPCCH-PowerOffset,
        pc-Preamble                         PC-Preamble,
        sRB-delay                           SRB-delay,
        -- TABULAR: TPC step size nested inside PowerControlAlgorithm
        powerControlAlgorithm               PowerControlAlgorithm
    },
    tdd                                 SEQUENCE {
        ul-TargetSIR                        UL-TargetSIR                OPTIONAL,
        ul-OL-PC-Signalling                 CHOICE {
            broadcast-UL-OL-PC-info             NULL,
            individuallySignalled               SEQUENCE {
                individualTS-InterferenceList       IndividualTS-InterferenceList,
                dpch-ConstantValue                  ConstantValueTdd,
                primaryCCPCH-TX-Power               PrimaryCCPCH-TX-Power
            }
        }                                                               OPTIONAL
    }
}

UL-DPCH-PowerControlInfo-r4 ::=     CHOICE {
    fdd                                 SEQUENCE {
        dpcch-PowerOffset                   DPCCH-PowerOffset,
        pc-Preamble                         PC-Preamble,
        sRB-delay                           SRB-delay,
        -- TABULAR: TPC step size nested inside PowerControlAlgorithm
        powerControlAlgorithm               PowerControlAlgorithm
    },
    tdd                                 SEQUENCE {
        -- The IE ul-TargetSIR corresponds to PRX-DPCHdes for 1.28Mcps TDD
        -- Actual value PRX-DPCHdes = (value of IE "ul-TargetSIR" - 120)
        ul-TargetSIR                        UL-TargetSIR                OPTIONAL,
        ul-OL-PC-Signalling                 CHOICE {
            broadcast-UL-OL-PC-info             NULL,
            individuallySignalled               SEQUENCE {
                tddOption                           CHOICE {
                    tdd384                              SEQUENCE {
                        individualTS-InterferenceList       IndividualTS-InterferenceList,
                        dpch-ConstantValue                  ConstantValue
                    },
                    tdd128                              SEQUENCE {
                        tpc-StepSize                        TPC-StepSizeTDD
                    }
                },
                primaryCCPCH-TX-Power               PrimaryCCPCH-TX-Power
            }
        }
    }
}

UL-DPCH-PowerControlInfo-r5 ::=     CHOICE {
    fdd                                 SEQUENCE {
        dpcch-PowerOffset                   DPCCH-PowerOffset,
        pc-Preamble                         PC-Preamble,
        sRB-delay                           SRB-delay,
        -- TABULAR: TPC step size nested inside PowerControlAlgorithm
        powerControlAlgorithm               PowerControlAlgorithm,
        deltaACK                            DeltaACK    OPTIONAL,
        deltaNACK                           DeltaNACK   OPTIONAL,
        ack-NACK-repetition-factor          ACK-NACK-repetitionFactor   OPTIONAL
    },
    tdd                                 SEQUENCE {
        -- The IE ul-TargetSIR corresponds to PRX-DPCHdes for 1.28Mcps TDD
        -- Actual value PRX-DPCHdes = (value of IE "ul-TargetSIR" - 120)
        ul-TargetSIR                        UL-TargetSIR                OPTIONAL,
        ul-OL-PC-Signalling                 CHOICE {
            broadcast-UL-OL-PC-info             NULL,
            individuallySignalled               SEQUENCE {
                tddOption                           CHOICE {
                    tdd384                              SEQUENCE {
                        individualTS-InterferenceList       IndividualTS-InterferenceList,
                        dpch-ConstantValue                  ConstantValue
                    },
                    tdd128                              SEQUENCE {
                        tpc-StepSize                        TPC-StepSizeTDD
                    }
                },
                primaryCCPCH-TX-Power               PrimaryCCPCH-TX-Power
            }
```

```
            }
        }
}

UL-DPCH-PowerControlInfo-r6 ::=         CHOICE {
    fdd                                     SEQUENCE {
        dpcch-PowerOffset                       DPCCH-PowerOffset,
        pc-Preamble                             PC-Preamble,
        sRB-delay                               SRB-delay,
        -- TABULAR: TPC step size nested inside PowerControlAlgorithm
        powerControlAlgorithm                   PowerControlAlgorithm,
        deltaACK                                DeltaACK    OPTIONAL,
        deltaNACK                               DeltaNACK   OPTIONAL,
        ack-NACK-repetition-factor              ACK-NACK-repetitionFactor   OPTIONAL,
        harq-Preamble-Mode                      HARQ-Preamble-Mode
    },
    tdd                                     SEQUENCE {
        -- The IE ul-TargetSIR corresponds to PRX-DPCHdes for 1.28Mcps TDD
        -- Actual value PRX-DPCHdes = (value of IE "ul-TargetSIR" - 120)
        ul-TargetSIR                            UL-TargetSIR                OPTIONAL,
        ul-OL-PC-Signalling                     CHOICE {
            broadcast-UL-OL-PC-info                 NULL,
            individuallySignalled                   SEQUENCE {
                tddOption                               CHOICE {
                    tdd384                                  SEQUENCE {
                        individualTS-InterferenceList       IndividualTS-InterferenceList,
                        dpch-ConstantValue                  ConstantValue
                    },
                    tdd128                                  SEQUENCE {
                        beaconPLEst                         BEACON-PL-Est       OPTIONAL,
                        tpc-StepSize                        TPC-StepSizeTDD
                    }
                },
                primaryCCPCH-TX-Power                   PrimaryCCPCH-TX-Power
            }
        }
    }
}

UL-DPCH-PowerControlInfo-r7 ::=         CHOICE {
    fdd                                     SEQUENCE {
        dpcch-PowerOffset                       DPCCH-PowerOffset,
        pc-Preamble                             PC-Preamble,
        sRB-delay                               SRB-delay,
        -- TABULAR: TPC step size nested inside PowerControlAlgorithm
        powerControlAlgorithm                   PowerControlAlgorithm,
        deltaACK                                DeltaACK    OPTIONAL,
        deltaNACK                               DeltaNACK   OPTIONAL,
        ack-NACK-repetition-factor              ACK-NACK-repetitionFactor   OPTIONAL,
        harq-Preamble-Mode                      HARQ-Preamble-Mode
    },
    tdd                                     SEQUENCE {
        -- The IE ul-TargetSIR corresponds to PRX-DPCHdes for 1.28Mcps TDD
        -- Actual value PRX-DPCHdes = (value of IE "ul-TargetSIR" - 120)
        ul-TargetSIR                            UL-TargetSIR                OPTIONAL,
        ul-OL-PC-Signalling                     CHOICE {
            broadcast-UL-OL-PC-info                 NULL,
            individuallySignalled                   SEQUENCE {
                tddOption                               CHOICE {
                    tdd384                                  SEQUENCE {
                        individualTS-InterferenceList       IndividualTS-InterferenceList,
                        dpch-ConstantValue                  ConstantValue
                    },
                    tdd768                                  SEQUENCE {
                        individualTS-InterferenceList       IndividualTS-InterferenceList,
                        dpch-ConstantValue                  ConstantValue
                    },
                    tdd128                                  SEQUENCE {
                        beaconPLEst                         BEACON-PL-Est       OPTIONAL,
                        tpc-StepSize                        TPC-StepSizeTDD
                    }
                },
                primaryCCPCH-TX-Power                   PrimaryCCPCH-TX-Power
            }
        }
    }
}
```

```
UL-DPCH-PowerControlInfoPostFDD ::= SEQUENCE {
    -- DPCCH-PowerOffset2 has a smaller range to save bits
    dpcch-PowerOffset                   DPCCH-PowerOffset2,
    pc-Preamble                         PC-Preamble,
    sRB-delay                           SRB-delay
}

UL-DPCH-PowerControlInfoPostTDD ::= SEQUENCE {
    ul-TargetSIR                        UL-TargetSIR,
    ul-TimeslotInterference             TDD-UL-Interference
}

UL-DPCH-PowerControlInfoPostTDD-LCR-r4 ::=  SEQUENCE {
    -- The IE ul-TargetSIR corresponds to PRX-DPCHdes for 1.28Mcps TDD
    -- Actual value PRX-DPCHdes = (value of IE "ul-TargetSIR" - 120)
    ul-TargetSIR                        UL-TargetSIR
}

UL-DPCH-PowerControlInfoPredef ::=      CHOICE {
    fdd                                 SEQUENCE {
        -- TABULAR: TPC step size nested inside PowerControlAlgorithm
        powerControlAlgorithm               PowerControlAlgorithm
    },
    tdd                                 SEQUENCE {
        -- dpch-ConstantValue shall be ignored if in 1.28Mcps TDD mode.
        dpch-ConstantValue                  ConstantValueTdd
    }
}

UL-EDCH-Information-r6 ::=          SEQUENCE {
    mac-es-e-resetIndicator             ENUMERATED { true }                     OPTIONAL,
    e-DPCCH-Info                        E-DPCCH-Info                            OPTIONAL,
    e-DPDCH-Info                        E-DPDCH-Info                            OPTIONAL,
    schedulingTransmConfiguration       E-DPDCH-SchedulingTransmConfiguration   OPTIONAL
}

UL-Interference ::=                 INTEGER (-110..-70)

UL-ScramblingCode ::=               INTEGER (0..16777215)


UL-SynchronisationParameters-r4 ::= SEQUENCE {
    stepSize                            INTEGER (1..8),
    frequency                           INTEGER (1..8)
}

-- Actual value UL-TargetSIR = (IE value * 0.5) - 11
UL-TargetSIR ::=                    INTEGER (0..62)

UL-TimingAdvance ::=                INTEGER (0..63)

UL-TimingAdvance-VHCR ::=           INTEGER (0..127)

UL-TimingAdvanceControl ::=         CHOICE {
    disabled                            NULL,
    enabled                             SEQUENCE {
        ul-TimingAdvance                    UL-TimingAdvance                OPTIONAL,
        activationTime                      ActivationTime                  OPTIONAL
    }
}

UL-TimingAdvanceControl-r4 ::=      CHOICE {
    disabled                            NULL,
    enabled                             SEQUENCE {
        tddOption                           CHOICE {
            tdd384                              SEQUENCE {
                ul-TimingAdvance                    UL-TimingAdvance                OPTIONAL,
                activationTime                      ActivationTime                  OPTIONAL
            },
            tdd128                              SEQUENCE {
                ul-SynchronisationParameters        UL-SynchronisationParameters-r4 OPTIONAL,
                synchronisationParameters           SynchronisationParameters-r4    OPTIONAL
            }
        }
    }
}

UL-TimingAdvanceControl-r7 ::=      CHOICE {
```

```
    disabled                                NULL,
    enabled                                 SEQUENCE {
        tddOption                               CHOICE {
            tdd384                                  SEQUENCE {
                ul-TimingAdvance                        UL-TimingAdvance                OPTIONAL,
                activationTime                          ActivationTime                  OPTIONAL
            },
            tdd768                                  SEQUENCE {
                ul-TimingAdvance                        UL-TimingAdvance-VHCR           OPTIONAL,
                activationTime                          ActivationTime                  OPTIONAL
            },
            tdd128                                  SEQUENCE {
                ul-SynchronisationParameters            UL-SynchronisationParameters-r4 OPTIONAL,
                synchronisationParameters               SynchronisationParameters-r4    OPTIONAL
            }
        }
    }
}

UL-TimingAdvanceControl-LCR-r4 ::=  CHOICE {
    disabled                                NULL,
    enabled                                 SEQUENCE {
        ul-SynchronisationParameters            UL-SynchronisationParameters-r4 OPTIONAL,
        synchronisationParameters               SynchronisationParameters-r4    OPTIONAL
    }
}

UL-TS-ChannelisationCode ::=        ENUMERATED {
                                        cc1-1, cc2-1, cc2-2,
                                        cc4-1, cc4-2, cc4-3, cc4-4,
                                        cc8-1, cc8-2, cc8-3, cc8-4,
                                        cc8-5, cc8-6, cc8-7, cc8-8,
                                        cc16-1, cc16-2, cc16-3, cc16-4,
                                        cc16-5, cc16-6, cc16-7, cc16-8,
                                        cc16-9, cc16-10, cc16-11, cc16-12,
                                        cc16-13, cc16-14, cc16-15, cc16-16 }

UL-TS-ChannelisationCodeList ::=    SEQUENCE (SIZE (1..2)) OF
                                        UL-TS-ChannelisationCode

UL-TS-ChannelisationCodeList-r7 ::=     SEQUENCE (SIZE (1..2)) OF
                                            SEQUENCE {
        ul-TS-Channelisation-Code                   UL-TS-ChannelisationCode,
        plcch-info                                  PLCCH-Info      OPTIONAL
}

UL-TS-ChannelisationCode-VHCR ::=       ENUMERATED {
                                        cc1-1, cc2-1, cc2-2,
                                        cc4-1, cc4-2, cc4-3, cc4-4,
                                        cc8-1, cc8-2, cc8-3, cc8-4,
                                        cc8-5, cc8-6, cc8-7, cc8-8,
                                        cc16-1, cc16-2, cc16-3, cc16-4,
                                        cc16-5, cc16-6, cc16-7, cc16-8,
                                        cc16-9, cc16-10, cc16-11, cc16-12,
                                        cc16-13, cc16-14, cc16-15, cc16-16,
                                        cc32-1, cc32-2, cc32-3, cc32-4,
                                        cc32-5, cc32-6, cc32-7, cc32-8,
                                        cc32-9, cc32-10, cc32-11, cc32-12,
                                        cc32-13, cc32-14, cc32-15, cc32-16,
                                        cc32-17, cc32-18, cc32-19, cc32-20,
                                        cc32-21, cc32-22, cc32-23, cc32-24,
                                        cc32-25, cc32-26, cc32-27, cc32-28,
                                        cc32-29, cc32-30, cc32-31, cc32-32 }

UL-TS-ChannelisationCodeList-VHCR ::=   SEQUENCE (SIZE (1..2)) OF
                                            UL-TS-ChannelisationCode-VHCR

UplinkAdditionalTimeslots ::=       SEQUENCE {
    parameters                              CHOICE {
        sameAsLast                              SEQUENCE {
            timeslotNumber                          TimeslotNumber
        },
        newParameters                           SEQUENCE {
            individualTimeslotInfo                      IndividualTimeslotInfo,
            ul-TS-ChannelisationCodeList                UL-TS-ChannelisationCodeList
        }
    }
}
```

```
UplinkAdditionalTimeslots-LCR-r4 ::=     SEQUENCE {
    parameters                           CHOICE {
        sameAsLast                           SEQUENCE {
            timeslotNumber                       TimeslotNumber
        },
        newParameters                        SEQUENCE {
            individualTimeslotInfo                       IndividualTimeslotInfo-LCR-r4,
            ul-TS-ChannelisationCodeList                 UL-TS-ChannelisationCodeList
        }
    }
}

UplinkAdditionalTimeslots-LCR-r7 ::=     SEQUENCE {
    parameters                           CHOICE {
        sameAsLast                           SEQUENCE {
            timeslotNumber                       TimeslotNumber
            -- plcch-info assigned as previously defined slot
        },
        newParameters                        SEQUENCE {
            individualTimeslotInfo               IndividualTimeslotInfo-LCR-r4,
            ul-TS-ChannelisationCodeList         UL-TS-ChannelisationCodeList-r7
        }
    }
}

UplinkTimeslotsCodes ::=             SEQUENCE {
    dynamicSFusage                       BOOLEAN,
    firstIndividualTimeslotInfo          IndividualTimeslotInfo,
    ul-TS-ChannelisationCodeList         UL-TS-ChannelisationCodeList,
    moreTimeslots                        CHOICE {
        noMore                               NULL,
        additionalTimeslots                  CHOICE {
            consecutive                          SEQUENCE {
                numAdditionalTimeslots               INTEGER (1..maxTS-1)
            },
            timeslotList                         SEQUENCE (SIZE (1..maxTS-1)) OF
                                                     UplinkAdditionalTimeslots
        }
    }
}

UplinkTimeslotsCodes-VHCR ::=        SEQUENCE {
    dynamicSFusage                       BOOLEAN,
    firstIndividualTimeslotInfo          IndividualTimeslotInfo-VHCR,
    ul-TS-ChannelisationCodeList         UL-TS-ChannelisationCodeList-VHCR,
    moreTimeslots                        CHOICE {
        noMore                               NULL,
        additionalTimeslots                  CHOICE {
            consecutive                          SEQUENCE {
                numAdditionalTimeslots               INTEGER (1..maxTS-1)
            },
            timeslotList                         SEQUENCE (SIZE (1..maxTS-1)) OF
                                                     UplinkAdditionalTimeslots
        }
    }
}

UplinkTimeslotsCodes-LCR-r4 ::=      SEQUENCE {
    dynamicSFusage                       BOOLEAN,
    firstIndividualTimeslotInfo          IndividualTimeslotInfo-LCR-r4,
    ul-TS-ChannelisationCodeList         UL-TS-ChannelisationCodeList,
    moreTimeslots                        CHOICE {
        noMore                               NULL,
        additionalTimeslots                  CHOICE {
            consecutive                          SEQUENCE {
                numAdditionalTimeslots               INTEGER (1..maxTS-LCR-1)
            },
            timeslotList                         SEQUENCE (SIZE (1..maxTS-LCR-1)) OF
                                                     UplinkAdditionalTimeslots-LCR-r4
        }
    }
}

UplinkTimeslotsCodes-LCR-r7 ::=      SEQUENCE {
    dynamicSFusage                       BOOLEAN,
    firstIndividualTimeslotInfo          IndividualTimeslotInfo-LCR-r4,
    ul-TS-ChannelisationCodeList         UL-TS-ChannelisationCodeList-r7,
```

```
    moreTimeslots                       CHOICE {
        noMore                              NULL,
        additionalTimeslots                 CHOICE {
            consecutive                         SEQUENCE {
            -- the choice of 'consecutive' is not needed because there is only 1 option.
                numAdditionalTimeslots              INTEGER (1..maxTS-LCR-1)
            },
            timeslotList                        SEQUENCE (SIZE (1..maxTS-LCR-1)) OF
                                                    UplinkAdditionalTimeslots-LCR-r7
        }
    }
}

Wi-LCR ::=                                                                      INTEGER(1..4)

-- ***************************************************
--
--      MEASUREMENT INFORMATION ELEMENTS (10.3.7)
--
-- ***************************************************

AcquisitionSatInfo ::=              SEQUENCE {
    satID                               SatID,
    -- Actual value dopplerOthOrder = IE value * 2.5
    doppler0thOrder                     INTEGER (-2048..2047),
    extraDopplerInfo                    ExtraDopplerInfo                    OPTIONAL,
    codePhase                           INTEGER (0..1022),
    integerCodePhase                    INTEGER (0..19),
    gps-BitNumber                       INTEGER (0..3),
    codePhaseSearchWindow               CodePhaseSearchWindow,
    azimuthAndElevation                 AzimuthAndElevation                 OPTIONAL
}

AcquisitionSatInfoList ::=          SEQUENCE (SIZE (1..maxSat)) OF
                                        AcquisitionSatInfo


AdditionalMeasurementID-List ::=    SEQUENCE (SIZE (1..maxAdditionalMeas)) OF
                                        MeasurementIdentity

AlmanacSatInfo ::=                  SEQUENCE {
    dataID                              INTEGER (0..3),
    satID                               SatID,
    e                                   BIT STRING (SIZE (16)),
    t-oa                                BIT STRING (SIZE (8)),
    deltaI                              BIT STRING (SIZE (16)),
    omegaDot                            BIT STRING (SIZE (16)),
    satHealth                           BIT STRING (SIZE (8)),
    a-Sqrt                              BIT STRING (SIZE (24)),
    omega0                              BIT STRING (SIZE (24)),
    m0                                  BIT STRING (SIZE (24)),
    omega                               BIT STRING (SIZE (24)),
    af0                                 BIT STRING (SIZE (11)),
    af1                                 BIT STRING (SIZE (11))
}

AlmanacSatInfoList ::=              SEQUENCE (SIZE (1..maxSat)) OF
                                        AlmanacSatInfo

AverageRLC-BufferPayload ::=        ENUMERATED {
                                        pla0, pla4, pla8, pla16, pla32,
                                        pla64, pla128, pla256, pla512,
                                        pla1024, pla2k, pla4k, pla8k, pla16k,
                                        pla32k, pla64k, pla128k, pla256k,
                                        pla512k, pla1024k, spare12, spare11,
                                        spare10, spare9, spare8, spare7, spare6,
                                        spare5, spare4, spare3, spare2, spare1 }

AzimuthAndElevation ::=             SEQUENCE {
    -- Actual value azimuth = IE value * 11.25
    azimuth                             INTEGER (0..31),
    -- Actual value elevation = IE value * 11.25
    elevation                           INTEGER (0..7)
}

BadSatList ::=                      SEQUENCE (SIZE (1..maxSat)) OF
                                        INTEGER (0..63)
```

```
Frequency-Band ::=                  ENUMERATED {
                                        dcs1800BandUsed, pcs1900BandUsed }

BCCH-ARFCN ::=                      INTEGER (0..1023)

BLER-MeasurementResults ::=         SEQUENCE {
    transportChannelIdentity            TransportChannelIdentity,
    dl-TransportChannelBLER             DL-TransportChannelBLER             OPTIONAL
}

BLER-MeasurementResultsList ::=     SEQUENCE (SIZE (1..maxTrCH)) OF
                                        BLER-MeasurementResults

BLER-TransChIdList ::=              SEQUENCE (SIZE (1..maxTrCH)) OF
                                        TransportChannelIdentity

BSIC-VerificationRequired ::=       ENUMERATED {
                                        required, notRequired }

BSICReported ::=                    CHOICE {
    -- Value maxCellMeas is not allowed for verifiedBSIC
    verifiedBSIC                        INTEGER (0..maxCellMeas),
    nonVerifiedBSIC                     BCCH-ARFCN
}

BurstModeParameters ::=             SEQUENCE {
    burstStart                          INTEGER (0..15),
    burstLength                         INTEGER (10..25),
    burstFreq                           INTEGER (1..16)
}

CellDCH-ReportCriteria ::=          CHOICE {
    intraFreqReportingCriteria          IntraFreqReportingCriteria,
    periodicalReportingCriteria         PeriodicalReportingCriteria
}

CellDCH-ReportCriteria-LCR-r4 ::=   CHOICE {
    intraFreqReportingCriteria          IntraFreqReportingCriteria-LCR-r4,
    periodicalReportingCriteria         PeriodicalReportingCriteria
}

-- Actual value CellIndividualOffset = IE value * 0.5
CellIndividualOffset ::=            INTEGER (-20..20)


CellInfo ::=                        SEQUENCE {
    cellIndividualOffset                CellIndividualOffset                DEFAULT 0,
    referenceTimeDifferenceToCell       ReferenceTimeDifferenceToCell       OPTIONAL,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            primaryCPICH-Info                   PrimaryCPICH-Info           OPTIONAL,
            primaryCPICH-TX-Power               PrimaryCPICH-TX-Power       OPTIONAL,
            readSFN-Indicator                   BOOLEAN,
            tx-DiversityIndicator               BOOLEAN
        },
        tdd                                 SEQUENCE {
            primaryCCPCH-Info                   PrimaryCCPCH-Info,
            primaryCCPCH-TX-Power               PrimaryCCPCH-TX-Power       OPTIONAL,
            timeslotInfoList                    TimeslotInfoList            OPTIONAL,
            readSFN-Indicator                   BOOLEAN
        }
    }
}

CellInfo-r4 ::=                     SEQUENCE {
    cellIndividualOffset                CellIndividualOffset                DEFAULT 0,
    referenceTimeDifferenceToCell       ReferenceTimeDifferenceToCell       OPTIONAL,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            primaryCPICH-Info                   PrimaryCPICH-Info           OPTIONAL,
            primaryCPICH-TX-Power               PrimaryCPICH-TX-Power       OPTIONAL,
            readSFN-Indicator                   BOOLEAN,
            tx-DiversityIndicator               BOOLEAN
        },
        tdd                                 SEQUENCE {
            primaryCCPCH-Info                   PrimaryCCPCH-Info-r4,
            primaryCCPCH-TX-Power               PrimaryCCPCH-TX-Power       OPTIONAL,
            timeslotInfoList                    TimeslotInfoList-r4         OPTIONAL,
```

```
            readSFN-Indicator                   BOOLEAN
        }
    }
}

CellInfoSI-RSCP ::=                     SEQUENCE {
    cellIndividualOffset                    CellIndividualOffset                DEFAULT 0,
    referenceTimeDifferenceToCell           ReferenceTimeDifferenceToCell       OPTIONAL,
    modeSpecificInfo                        CHOICE {
        fdd                                     SEQUENCE {
            primaryCPICH-Info                       PrimaryCPICH-Info           OPTIONAL,
            primaryCPICH-TX-Power                   PrimaryCPICH-TX-Power       OPTIONAL,
            readSFN-Indicator                       BOOLEAN,
            tx-DiversityIndicator                   BOOLEAN
        },
        tdd                                     SEQUENCE {
            primaryCCPCH-Info                       PrimaryCCPCH-Info,
            primaryCCPCH-TX-Power                   PrimaryCCPCH-TX-Power       OPTIONAL,
            timeslotInfoList                        TimeslotInfoList            OPTIONAL,
            readSFN-Indicator                       BOOLEAN
        }
    },
    cellSelectionReselectionInfo            CellSelectReselectInfoSIB-11-12-RSCP        OPTIONAL
}

CellInfoSI-RSCP-LCR-r4 ::=              SEQUENCE {
    cellIndividualOffset                    CellIndividualOffset                DEFAULT 0,
    referenceTimeDifferenceToCell           ReferenceTimeDifferenceToCell       OPTIONAL,
    primaryCCPCH-Info                       PrimaryCCPCH-Info-LCR-r4,
    primaryCCPCH-TX-Power                   PrimaryCCPCH-TX-Power               OPTIONAL,
    timeslotInfoList                        TimeslotInfoList-LCR-r4             OPTIONAL,
    readSFN-Indicator                       BOOLEAN,
    cellSelectionReselectionInfo            CellSelectReselectInfoSIB-11-12-RSCP        OPTIONAL
}

CellInfoSI-ECN0 ::=                     SEQUENCE {
    cellIndividualOffset                    CellIndividualOffset                DEFAULT 0,
    referenceTimeDifferenceToCell           ReferenceTimeDifferenceToCell       OPTIONAL,
    modeSpecificInfo                        CHOICE {
        fdd                                     SEQUENCE {
            primaryCPICH-Info                       PrimaryCPICH-Info           OPTIONAL,
            primaryCPICH-TX-Power                   PrimaryCPICH-TX-Power       OPTIONAL,
            readSFN-Indicator                       BOOLEAN,
            tx-DiversityIndicator                   BOOLEAN
        },
        tdd                                     SEQUENCE {
            primaryCCPCH-Info                       PrimaryCCPCH-Info,
            primaryCCPCH-TX-Power                   PrimaryCCPCH-TX-Power       OPTIONAL,
            timeslotInfoList                        TimeslotInfoList            OPTIONAL,
            readSFN-Indicator                       BOOLEAN
        }
    },
    cellSelectionReselectionInfo            CellSelectReselectInfoSIB-11-12-ECN0    OPTIONAL
}

CellInfoSI-ECN0-LCR-r4 ::=              SEQUENCE {
    cellIndividualOffset                    CellIndividualOffset                DEFAULT 0,
    referenceTimeDifferenceToCell           ReferenceTimeDifferenceToCell       OPTIONAL,
    primaryCCPCH-Info                       PrimaryCCPCH-Info-LCR-r4,
    primaryCCPCH-TX-Power                   PrimaryCCPCH-TX-Power               OPTIONAL,
    timeslotInfoList                        TimeslotInfoList-LCR-r4             OPTIONAL,
    readSFN-Indicator                       BOOLEAN,
    cellSelectionReselectionInfo            CellSelectReselectInfoSIB-11-12-ECN0    OPTIONAL
}

CellInfoSI-HCS-RSCP ::=                 SEQUENCE {
    cellIndividualOffset                    CellIndividualOffset                DEFAULT 0,
    referenceTimeDifferenceToCell           ReferenceTimeDifferenceToCell       OPTIONAL,
    modeSpecificInfo                        CHOICE {
        fdd                                     SEQUENCE {
            primaryCPICH-Info                       PrimaryCPICH-Info           OPTIONAL,
            primaryCPICH-TX-Power                   PrimaryCPICH-TX-Power       OPTIONAL,
            readSFN-Indicator                       BOOLEAN,
            tx-DiversityIndicator                   BOOLEAN
        },
        tdd                                     SEQUENCE {
            primaryCCPCH-Info                       PrimaryCCPCH-Info,
```

```
            primaryCCPCH-TX-Power                PrimaryCCPCH-TX-Power       OPTIONAL,
            timeslotInfoList                     TimeslotInfoList            OPTIONAL,
            readSFN-Indicator                    BOOLEAN
        }
    },
    cellSelectionReselectionInfo        CellSelectReselectInfoSIB-11-12-HCS-RSCP    OPTIONAL
}

CellInfoSI-HCS-RSCP-LCR-r4 ::=      SEQUENCE {
    cellIndividualOffset                CellIndividualOffset                DEFAULT 0,
    referenceTimeDifferenceToCell       ReferenceTimeDifferenceToCell       OPTIONAL,
    primaryCCPCH-Info                   PrimaryCCPCH-Info-LCR-r4,
    primaryCCPCH-TX-Power               PrimaryCCPCH-TX-Power               OPTIONAL,
    timeslotInfoList                    TimeslotInfoList-LCR-r4             OPTIONAL,
    readSFN-Indicator                   BOOLEAN,
    cellSelectionReselectionInfo        CellSelectReselectInfoSIB-11-12-HCS-RSCP    OPTIONAL
}

CellInfoSI-HCS-ECN0 ::=             SEQUENCE {
    cellIndividualOffset                CellIndividualOffset                DEFAULT 0,
    referenceTimeDifferenceToCell       ReferenceTimeDifferenceToCell       OPTIONAL,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            primaryCPICH-Info                   PrimaryCPICH-Info           OPTIONAL,
            primaryCPICH-TX-Power               PrimaryCPICH-TX-Power       OPTIONAL,
            readSFN-Indicator                   BOOLEAN,
            tx-DiversityIndicator               BOOLEAN
        },
        tdd                                 SEQUENCE {
            primaryCCPCH-Info                   PrimaryCCPCH-Info,
            primaryCCPCH-TX-Power               PrimaryCCPCH-TX-Power       OPTIONAL,
            timeslotInfoList                    TimeslotInfoList            OPTIONAL,
            readSFN-Indicator                   BOOLEAN
        }
    },
    cellSelectionReselectionInfo        CellSelectReselectInfoSIB-11-12-HCS-ECN0    OPTIONAL
}

CellInfoSI-HCS-ECN0-LCR-r4 ::=      SEQUENCE {
    cellIndividualOffset                CellIndividualOffset                DEFAULT 0,
    referenceTimeDifferenceToCell       ReferenceTimeDifferenceToCell       OPTIONAL,
    primaryCCPCH-Info                   PrimaryCCPCH-Info-LCR-r4,
    primaryCCPCH-TX-Power               PrimaryCCPCH-TX-Power               OPTIONAL,
    timeslotInfoList                    TimeslotInfoList-LCR-r4             OPTIONAL,
    readSFN-Indicator                   BOOLEAN,
    cellSelectionReselectionInfo        CellSelectReselectInfoSIB-11-12-HCS-ECN0    OPTIONAL
}

CellMeasuredResults ::=             SEQUENCE {
    cellIdentity                        CellIdentity                        OPTIONAL,
    -- dummy is not used in this version of the specification, it should
    -- not be sent and if received it should be ignored.
    dummy               SFN-SFN-ObsTimeDifference           OPTIONAL,
    cellSynchronisationInfo         CellSynchronisationInfo         OPTIONAL,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            primaryCPICH-Info                   PrimaryCPICH-Info,
            cpich-Ec-N0                         CPICH-Ec-N0                 OPTIONAL,
            cpich-RSCP                          CPICH-RSCP                  OPTIONAL,
            pathloss                            Pathloss                    OPTIONAL
        },
        tdd                                 SEQUENCE {
            cellParametersID                    CellParametersID,
            proposedTGSN                        TGSN                        OPTIONAL,
            primaryCCPCH-RSCP                   PrimaryCCPCH-RSCP           OPTIONAL,
            pathloss                            Pathloss                    OPTIONAL,
            timeslotISCP-List                   TimeslotISCP-List           OPTIONAL
        }
    }
}

CellMeasurementEventResults ::=     CHOICE {
    fdd                                 SEQUENCE (SIZE (1..maxCellMeas)) OF
                                            PrimaryCPICH-Info,
    tdd                                 SEQUENCE (SIZE (1..maxCellMeas)) OF
                                            PrimaryCCPCH-Info
}
```

```
CellMeasurementEventResults-LCR-r4 ::=  SEQUENCE (SIZE (1..maxCellMeas)) OF
                                            PrimaryCCPCH-Info-LCR-r4

CellReportingQuantities ::=         SEQUENCE {
    -- dummy is not used in this version of the specification, it should
    -- not be sent and if received it should be ignored.
    dummy                       SFN-SFN-OTD-Type,
    cellIdentity-reportingIndicator                     BOOLEAN,
    cellSynchronisationInfoReportingIndicator           BOOLEAN,
    modeSpecificInfo                        CHOICE {
        fdd                                     SEQUENCE {
            cpich-Ec-N0-reportingIndicator                          BOOLEAN,
            cpich-RSCP-reportingIndicator                           BOOLEAN,
            pathloss-reportingIndicator                         BOOLEAN
        },
        tdd                                     SEQUENCE {
            timeslotISCP-reportingIndicator                     BOOLEAN,
            proposedTGSN-ReportingRequired                      BOOLEAN,
            primaryCCPCH-RSCP-reportingIndicator                    BOOLEAN,
            pathloss-reportingIndicator                         BOOLEAN
        }
    }
}

CellSelectReselectInfoSIB-11-12 ::= SEQUENCE {
    q-Offset1S-N                            Q-OffsetS-N                         DEFAULT 0,
    q-Offset2S-N                            Q-OffsetS-N                         OPTIONAL,
    maxAllowedUL-TX-Power                   MaxAllowedUL-TX-Power               OPTIONAL,
    hcs-NeighbouringCellInformation-RSCP        HCS-NeighbouringCellInformation-RSCP
    OPTIONAL,
    modeSpecificInfo                        CHOICE {
        fdd                                     SEQUENCE {
            q-QualMin                               Q-QualMin                   OPTIONAL,
            q-RxlevMin                              Q-RxlevMin                  OPTIONAL
        },
        tdd                                     SEQUENCE {
            q-RxlevMin                              Q-RxlevMin                  OPTIONAL
        },
        gsm                                     SEQUENCE {
            q-RxlevMin                              Q-RxlevMin                  OPTIONAL
        }
    }
}

CellSelectReselectInfoSIB-11-12-RSCP ::=    SEQUENCE {
    q-OffsetS-N                         Q-OffsetS-N                     DEFAULT 0,
    maxAllowedUL-TX-Power                   MaxAllowedUL-TX-Power               OPTIONAL,
    modeSpecificInfo                        CHOICE {
        fdd                                     SEQUENCE {
            q-QualMin                               Q-QualMin                   OPTIONAL,
            q-RxlevMin                              Q-RxlevMin                  OPTIONAL
        },
        tdd                                     SEQUENCE {
            q-RxlevMin                              Q-RxlevMin                  OPTIONAL
        },
        gsm                                     SEQUENCE {
            q-RxlevMin                              Q-RxlevMin                  OPTIONAL
        }
    }
}

CellSelectReselectInfoSIB-11-12-ECN0 ::=    SEQUENCE {
    q-Offset1S-N                            Q-OffsetS-N                     DEFAULT 0,
    q-Offset2S-N                            Q-OffsetS-N                     DEFAULT 0,
    maxAllowedUL-TX-Power                   MaxAllowedUL-TX-Power               OPTIONAL,
    modeSpecificInfo                        CHOICE {
        fdd                                     SEQUENCE {
            q-QualMin                               Q-QualMin                   OPTIONAL,
            q-RxlevMin                              Q-RxlevMin                  OPTIONAL
        },
        tdd                                     SEQUENCE {
            q-RxlevMin                              Q-RxlevMin                  OPTIONAL
        },
        gsm                                     SEQUENCE {
            q-RxlevMin                              Q-RxlevMin                  OPTIONAL
        }
    }
}
```

```
CellSelectReselectInfoSIB-11-12-HCS-RSCP ::=     SEQUENCE {
    q-OffsetS-N                         Q-OffsetS-N                     DEFAULT 0,
    maxAllowedUL-TX-Power                   MaxAllowedUL-TX-Power               OPTIONAL,
    hcs-NeighbouringCellInformation-RSCP        HCS-NeighbouringCellInformation-RSCP
    OPTIONAL,
    modeSpecificInfo                        CHOICE {
        fdd                                     SEQUENCE {
            q-QualMin                               Q-QualMin                   OPTIONAL,
            q-RxlevMin                              Q-RxlevMin                  OPTIONAL
        },
        tdd                                     SEQUENCE {
            q-RxlevMin                              Q-RxlevMin                  OPTIONAL
        },
        gsm                                     SEQUENCE {
            q-RxlevMin                              Q-RxlevMin                  OPTIONAL
        }
    }
}

CellSelectReselectInfoSIB-11-12-HCS-ECN0 ::=     SEQUENCE {
    q-Offset1S-N                            Q-OffsetS-N                     DEFAULT 0,
    q-Offset2S-N                            Q-OffsetS-N                     DEFAULT 0,
    maxAllowedUL-TX-Power                   MaxAllowedUL-TX-Power               OPTIONAL,
    hcs-NeighbouringCellInformation-ECN0        HCS-NeighbouringCellInformation-ECN0
    OPTIONAL,
    modeSpecificInfo                        CHOICE {
        fdd                                     SEQUENCE {
            q-QualMin                               Q-QualMin                   OPTIONAL,
            q-RxlevMin                              Q-RxlevMin                  OPTIONAL
        },
        tdd                                     SEQUENCE {
            q-RxlevMin                              Q-RxlevMin                  OPTIONAL
        },
        gsm                                     SEQUENCE {
            q-RxlevMin                              Q-RxlevMin                  OPTIONAL
        }
    }
}

CellSelectReselectInfo-v590ext ::= SEQUENCE {
    deltaQrxlevmin                      DeltaQrxlevmin                  OPTIONAL,
    deltaQhcs                           DeltaRSCP                       OPTIONAL
}

CellSelectReselectInfoPCHFACH-v5b0ext ::= SEQUENCE {
    q-Hyst-l-S-PCH                  Q-Hyst-S-Fine                       OPTIONAL,
    q-Hyst-l-S-FACH                 Q-Hyst-S-Fine                       OPTIONAL,
    q-Hyst-2-S-PCH                  Q-Hyst-S-Fine                       OPTIONAL,
    q-Hyst-2-S-FACH                 Q-Hyst-S-Fine                       OPTIONAL,
    t-Reselection-S-PCH             T-Reselection-S                     OPTIONAL,
    t-Reselection-S-FACH            T-Reselection-S-Fine                OPTIONAL
}

CellSelectReselectInfoTreselectionScaling-v5c0ext ::= SEQUENCE {
    -- For speed detection, the same HCS parameters are utilised
    non-HCS-t-CR-Max                            T-CRMax                             OPTIONAL,
    speedDependentScalingFactor                 SpeedDependentScalingFactor         OPTIONAL,
    interFrequencyTreselectionScalingFactor     TreselectionScalingFactor           OPTIONAL,
    interRATTreselectionScalingFactor           TreselectionScalingFactor           OPTIONAL
}

CellsForInterFreqMeasList ::=       SEQUENCE (SIZE  (1..maxCellMeas)) OF
                                        InterFreqCellID
CellsForInterRATMeasList ::=            SEQUENCE (SIZE  (1..maxCellMeas)) OF
                                        InterRATCellID
CellsForIntraFreqMeasList ::=       SEQUENCE (SIZE  (1..maxCellMeas)) OF
                                        IntraFreqCellID

CellSynchronisationInfo ::=         SEQUENCE {
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            countC-SFN-Frame-difference         CountC-SFN-Frame-difference     OPTIONAL,
            tm                                  INTEGER(0..38399)
        },
        tdd                                 SEQUENCE {
            countC-SFN-Frame-difference         CountC-SFN-Frame-difference     OPTIONAL
        }
```

```
    }
}

CellToReport ::=                SEQUENCE {
    bsicReported                    BSICReported
}

CellToReportList ::=            SEQUENCE (SIZE (1..maxCellMeas)) OF
                                    CellToReport

CodePhaseSearchWindow ::=       ENUMERATED {
                                    w1023, w1, w2, w3, w4, w6, w8,
                                    w12, w16, w24, w32, w48, w64,
                                    w96, w128, w192 }

CountC-SFN-Frame-difference ::= SEQUENCE {
    -- Actual value countC-SFN-High = IE value * 256
    countC-SFN-High                 INTEGER(0..15),
    off                             INTEGER(0..255)
}

-- SPARE: CPICH-Ec-No, Max = 49
-- Values above Max are spare
CPICH-Ec-N0 ::=                 INTEGER (0..63)

-- SPARE: CPICH- RSCP, Max = 91
-- Values above Max are spare
CPICH-RSCP ::=                  INTEGER (0..127)


DeltaPRC ::=                    INTEGER (-127..127)

--Actual value DeltaQrxlevmin = IE value * 2
DeltaQrxlevmin ::= INTEGER (-2..-1)

DeltaRSCP ::= INTEGER (-5..-1)

DeltaRSCPPerCell ::= SEQUENCE {
    deltaRSCP                       DeltaRSCP   OPTIONAL
}

-- Actual value DeltaRRC = IE value * 0.032
DeltaRRC ::=                    INTEGER (-7..7)

DGPS-CorrectionSatInfo ::=      SEQUENCE {
    satID                           SatID,
    iode                            IODE,
    udre                            UDRE,
    prc                             PRC,
    rrc                             RRC,
-- dummy1 and dummy2 are not used in this version of the specification and should be ignored.
    dummy1                          DeltaPRC,
    dummy2                          DeltaRRC,
    -- dummy3 and dummy4 are not used in this version of the specification. They should not
    -- be sent and if received they should be ignored.
    dummy3                          DeltaPRC            OPTIONAL,
    dummy4                          DeltaRRC            OPTIONAL
}

DGPS-CorrectionSatInfoList ::=  SEQUENCE (SIZE (1..maxSat)) OF
                                    DGPS-CorrectionSatInfo

DiffCorrectionStatus ::=        ENUMERATED {
                                    udre-1-0, udre-0-75, udre-0-5, udre-0-3,
                                    udre-0-2, udre-0-1, noData, invalidData }

DL-TransportChannelBLER ::=     INTEGER (0..63)

DopplerUncertainty ::=          ENUMERATED {
                                    hz12-5, hz25, hz50, hz100, hz200,
                                    spare3, spare2, spare1 }

EllipsoidPoint ::=              SEQUENCE {
    latitudeSign            ENUMERATED { north, south },
    latitude                INTEGER (0..8388607),
    longitude               INTEGER (-8388608..8388607)
}
```

```
EllipsoidPointAltitude ::=          SEQUENCE {
    latitudeSign        ENUMERATED { north, south },
    latitude            INTEGER (0..8388607),
    longitude           INTEGER (-8388608..8388607),
    altitudeDirection   ENUMERATED {height, depth},
    altitude            INTEGER (0..32767)
}

EllipsoidPointAltitudeEllipsoide ::=    SEQUENCE {
    latitudeSign            ENUMERATED { north, south },
    latitude                INTEGER (0..8388607),
    longitude               INTEGER (-8388608..8388607),
    altitudeDirection       ENUMERATED {height, depth},
    altitude                INTEGER (0..32767),
    uncertaintySemiMajor    INTEGER (0..127),
    uncertaintySemiMinor    INTEGER (0..127),
    -- Actual value orientationMajorAxis = IE value * 2
    orientationMajorAxis    INTEGER (0..89),
    uncertaintyAltitude     INTEGER (0..127),
    confidence              INTEGER (0..100)
}

EllipsoidPointUncertCircle ::=      SEQUENCE {
    latitudeSign            ENUMERATED { north, south },
    latitude                INTEGER (0..8388607),
    longitude               INTEGER (-8388608..8388607),
    uncertaintyCode         INTEGER (0..127)
}

EllipsoidPointUncertEllipse ::=     SEQUENCE {
    latitudeSign            ENUMERATED { north, south },
    latitude                INTEGER (0..8388607),
    longitude               INTEGER (-8388608..8388607),
    uncertaintySemiMajor    INTEGER (0..127),
    uncertaintySemiMinor    INTEGER (0..127),
    -- Actual value orientationMajorAxis = IE value * 2
    orientationMajorAxis    INTEGER (0..89),
    confidence              INTEGER (0..100)
}

EnvironmentCharacterisation ::=     ENUMERATED {
                                        possibleHeavyMultipathNLOS,
                                        lightMultipathLOS,
                                        notDefined,
                                        spare }

Event1a ::=                         SEQUENCE {
    triggeringCondition                 TriggeringCondition2,
    reportingRange                      ReportingRange,
    forbiddenAffectCellList             ForbiddenAffectCellList             OPTIONAL,
    w                                   W,
    reportDeactivationThreshold         ReportDeactivationThreshold,
    reportingAmount                     ReportingAmount,
    reportingInterval                   ReportingInterval
}

Event1a-r4 ::=                      SEQUENCE {
    triggeringCondition                 TriggeringCondition2,
    reportingRange                      ReportingRange,
    forbiddenAffectCellList             ForbiddenAffectCellList-r4          OPTIONAL,
    w                                   W,
    reportDeactivationThreshold         ReportDeactivationThreshold,
    reportingAmount                     ReportingAmount,
    reportingInterval                   ReportingInterval
}

Event1a-LCR-r4 ::=                  SEQUENCE {
    triggeringCondition                 TriggeringCondition2,
    reportingRange                      ReportingRange,
    forbiddenAffectCellList             ForbiddenAffectCellList-LCR-r4          OPTIONAL,
    w                                   W,
    reportDeactivationThreshold         ReportDeactivationThreshold,
    reportingAmount                     ReportingAmount,
```

```
    reportingInterval                  ReportingInterval
}

Event1b ::=                        SEQUENCE {
    triggeringCondition                TriggeringCondition1,
    reportingRange                     ReportingRange,
    forbiddenAffectCellList            ForbiddenAffectCellList           OPTIONAL,
    w                                  W
}

Event1b-r4 ::=                     SEQUENCE {
    triggeringCondition                TriggeringCondition1,
    reportingRange                     ReportingRange,
    forbiddenAffectCellList            ForbiddenAffectCellList-r4        OPTIONAL,
    w                                  W
}

Event1b-r6 ::=                     SEQUENCE {
    triggeringCondition                TriggeringCondition1,
    reportingRange                     ReportingRange,
    forbiddenAffectCellList            ForbiddenAffectCellList-r4        OPTIONAL,
    w                                  W,
    -- The IE periodicReportingInfo should not be included in case the IE is
    -- included in the IE InterFreqReportCriteria
    periodicReportingInfo              PeriodicReportingInfo-1b
}

Event1b-LCR-r4 ::=                 SEQUENCE {
    triggeringCondition                TriggeringCondition1,
    reportingRange                     ReportingRange,
    forbiddenAffectCellList            ForbiddenAffectCellList-LCR-r4        OPTIONAL,
    w                                  W
}

Event1c ::=                        SEQUENCE {
    replacementActivationThreshold     ReplacementActivationThreshold,
    reportingAmount                    ReportingAmount,
    reportingInterval                  ReportingInterval
}

Event1d ::=                        SEQUENCE {
    triggeringCondition                TriggeringCondition2    OPTIONAL,
    useCIO                             BOOLEAN                 OPTIONAL
}

Event1e ::=                    SEQUENCE {
    triggeringCondition                TriggeringCondition2,
    thresholdUsedFrequency             ThresholdUsedFrequency
}

Event1e-r6 ::=                 SEQUENCE {
    triggeringCondition                TriggeringCondition2,
    thresholdUsedFrequency             ThresholdUsedFrequency-r6
}

Event1f ::=                    SEQUENCE {
    triggeringCondition                TriggeringCondition1,
    thresholdUsedFrequency             ThresholdUsedFrequency
}

Event1f-r6 ::=                 SEQUENCE {
    triggeringCondition                TriggeringCondition1,
    thresholdUsedFrequency             ThresholdUsedFrequency-r6
}

Event1j-r6 ::=                 SEQUENCE {
    replacementActivationThreshold     ReplacementActivationThreshold,
    reportingAmount                    ReportingAmount,
    reportingInterval                  ReportingInterval
}

Event2a ::=                        SEQUENCE {
    -- dummy is not used in this version of the specification and should be ignored
    dummy                              Threshold,
    usedFreqW                          W,
    hysteresis                         HysteresisInterFreq,
    timeToTrigger                      TimeToTrigger,
    reportingCellStatus                ReportingCellStatus               OPTIONAL,
```

```
    nonUsedFreqParameterList            NonUsedFreqParameterList            OPTIONAL
}

Event2a-r6 ::=                      SEQUENCE {
    usedFreqW                           W,
    hysteresis                          HysteresisInterFreq,
    timeToTrigger                       TimeToTrigger,
    reportingCellStatus                 ReportingCellStatus                 OPTIONAL,
    nonUsedFreqParameterList            NonUsedFreqWList-r6                 OPTIONAL
}

Event2b ::=                         SEQUENCE {
    usedFreqThreshold                   Threshold,
    usedFreqW                           W,
    hysteresis                          HysteresisInterFreq,
    timeToTrigger                       TimeToTrigger,
    reportingCellStatus                 ReportingCellStatus                 OPTIONAL,
    nonUsedFreqParameterList            NonUsedFreqParameterList            OPTIONAL
}

Event2b-r6 ::=                      SEQUENCE {
    usedFreqThreshold                   Threshold-r6,
    usedFreqW                           W,
    hysteresis                          HysteresisInterFreq,
    timeToTrigger                       TimeToTrigger,
    reportingCellStatus                 ReportingCellStatus                 OPTIONAL,
    nonUsedFreqParameterList            NonUsedFreqParameterList-r6         OPTIONAL
}

Event2c ::=                         SEQUENCE {
    hysteresis                          HysteresisInterFreq,
    timeToTrigger                       TimeToTrigger,
    reportingCellStatus                 ReportingCellStatus                 OPTIONAL,
    nonUsedFreqParameterList            NonUsedFreqParameterList            OPTIONAL
}

Event2c-r6 ::=                      SEQUENCE {
    hysteresis                          HysteresisInterFreq,
    timeToTrigger                       TimeToTrigger,
    reportingCellStatus                 ReportingCellStatus                 OPTIONAL,
    nonUsedFreqParameterList            NonUsedFreqParameterList-r6         OPTIONAL
}

Event2d ::=                         SEQUENCE {
    usedFreqThreshold                   Threshold,
    usedFreqW                           W,
    hysteresis                          HysteresisInterFreq,
    timeToTrigger                       TimeToTrigger,
    reportingCellStatus                 ReportingCellStatus                 OPTIONAL
}

Event2d-r6 ::=                      SEQUENCE {
    usedFreqThreshold                   Threshold-r6,
    usedFreqW                           W,
    hysteresis                          HysteresisInterFreq,
    timeToTrigger                       TimeToTrigger,
    reportingCellStatus                 ReportingCellStatus                 OPTIONAL
}

Event2e ::=                         SEQUENCE {
    hysteresis                          HysteresisInterFreq,
    timeToTrigger                       TimeToTrigger,
    reportingCellStatus                 ReportingCellStatus                 OPTIONAL,
    nonUsedFreqParameterList            NonUsedFreqParameterList            OPTIONAL
}

Event2e-r6 ::=                      SEQUENCE {
    hysteresis                          HysteresisInterFreq,
    timeToTrigger                       TimeToTrigger,
    reportingCellStatus                 ReportingCellStatus                 OPTIONAL,
    nonUsedFreqParameterList            NonUsedFreqParameterList-r6         OPTIONAL
}

Event2f ::=                         SEQUENCE {
    usedFreqThreshold                   Threshold,
    usedFreqW                           W,
    hysteresis                          HysteresisInterFreq,
    timeToTrigger                       TimeToTrigger,
```

```
	reportingCellStatus				ReportingCellStatus				OPTIONAL
}

Event2f-r6 ::=						SEQUENCE {
	usedFreqThreshold					Threshold-r6,
	usedFreqW							W,
	hysteresis							HysteresisInterFreq,
	timeToTrigger						TimeToTrigger,
	reportingCellStatus				ReportingCellStatus				OPTIONAL
}

Event3a ::=							SEQUENCE {
	thresholdOwnSystem					Threshold,
	w									W,
	thresholdOtherSystem				Threshold,
	hysteresis							Hysteresis,
	timeToTrigger						TimeToTrigger,
	reportingCellStatus				ReportingCellStatus				OPTIONAL
}

Event3b ::=							SEQUENCE {
	thresholdOtherSystem				Threshold,
	hysteresis							Hysteresis,
	timeToTrigger						TimeToTrigger,
	reportingCellStatus				ReportingCellStatus				OPTIONAL

}

Event3c ::=							SEQUENCE {
	thresholdOtherSystem				Threshold,
	hysteresis							Hysteresis,
	timeToTrigger						TimeToTrigger,
	reportingCellStatus				ReportingCellStatus				OPTIONAL
}

Event3d ::=							SEQUENCE {
	hysteresis							Hysteresis,
	timeToTrigger						TimeToTrigger,
	reportingCellStatus				ReportingCellStatus				OPTIONAL
}

EventIDInterFreq ::=				ENUMERATED {
										e2a, e2b, e2c, e2d, e2e, e2f, spare2, spare1 }

EventIDInterRAT ::=					ENUMERATED {
										e3a, e3b, e3c, e3d }

EventIDIntraFreq ::=				ENUMERATED {
										e1a, e1b, e1c, e1d, e1e,
										e1f, e1g, e1h, e1i, e1j,
										spare6, spare5, spare4, spare3, spare2,
										spare1 }

EventResults ::=					CHOICE {
	intraFreqEventResults				IntraFreqEventResults,
	interFreqEventResults				InterFreqEventResults,
	interRATEventResults				InterRATEventResults,
	trafficVolumeEventResults			TrafficVolumeEventResults,
	qualityEventResults					QualityEventResults,
	ue-InternalEventResults				UE-InternalEventResults,
	ue-positioning-MeasurementEventResults		UE-Positioning-MeasurementEventResults,
	spare								NULL
}

ExtraDopplerInfo ::=				SEQUENCE {
	-- Actual value doppler1stOrder = IE value * 0.023
	doppler1stOrder						INTEGER (-42..21),
	dopplerUncertainty					DopplerUncertainty
}

FACH-MeasurementOccasionInfo ::=	SEQUENCE {
	fACH-meas-occasion-coeff			INTEGER (1..12)					OPTIONAL,
	inter-freq-FDD-meas-ind				BOOLEAN,
	-- inter-freq-TDD-meas-ind is for 3.84Mcps TDD and 7.68 Mcps TDD. For 1.28Mcps TDD, the IE in
	-- FACH-MeasurementOccasionInfo-LCR-r4-ext is used.
	inter-freq-TDD-meas-ind				BOOLEAN,
	inter-RAT-meas-ind					SEQUENCE (SIZE (1..maxOtherRAT)) OF
											RAT-Type					OPTIONAL
```

```
}

FACH-MeasurementOccasionInfo-LCR-r4-ext ::= SEQUENCE {
    inter-freq-TDD128-meas-ind                  BOOLEAN
}

FilterCoefficient ::=                   ENUMERATED {
                                            fc0, fc1, fc2, fc3, fc4, fc5,
                                            fc6, fc7, fc8, fc9, fc11, fc13,
                                            fc15, fc17, fc19, spare1 }

-- Actual value FineSFN-SFN = IE value * 0.0625
FineSFN-SFN ::=                         INTEGER (0..15)

ForbiddenAffectCell ::=                 CHOICE {
    fdd                                     PrimaryCPICH-Info,
    tdd                                     PrimaryCCPCH-Info
}

ForbiddenAffectCell-r4 ::=              CHOICE {
    fdd                                     PrimaryCPICH-Info,
    tdd                                     PrimaryCCPCH-Info-r4
}

ForbiddenAffectCell-LCR-r4 ::=          SEQUENCE {
    tdd                                     PrimaryCCPCH-Info-LCR-r4
}

ForbiddenAffectCellList ::=             SEQUENCE (SIZE (1..maxCellMeas)) OF
                                            ForbiddenAffectCell

ForbiddenAffectCellList-r4 ::=              SEQUENCE (SIZE (1..maxCellMeas)) OF
                                            ForbiddenAffectCell-r4

ForbiddenAffectCellList-LCR-r4 ::=      SEQUENCE (SIZE (1..maxCellMeas)) OF
                                            ForbiddenAffectCell-LCR-r4

FreqQualityEstimateQuantity-FDD ::=     ENUMERATED {
                                            cpich-Ec-N0,
                                            cpich-RSCP }

FreqQualityEstimateQuantity-TDD ::=     ENUMERATED {
                                            primaryCCPCH-RSCP }

GPS-MeasurementParam ::=                SEQUENCE {
    satelliteID                             INTEGER (0..63),
    c-N0                                    INTEGER (0..63),
    doppler                                 INTEGER (-32768..32768),
    wholeGPS-Chips                          INTEGER (0..1022),
    fractionalGPS-Chips                     INTEGER (0..1023),
    multipathIndicator                      MultipathIndicator,
    pseudorangeRMS-Error                    INTEGER (0..63)
}

GPS-MeasurementParamList ::=            SEQUENCE (SIZE (1..maxSat)) OF
                                            GPS-MeasurementParam

GSM-CarrierRSSI ::=                     BIT STRING (SIZE (6))


GSM-MeasuredResults ::=                 SEQUENCE {
    gsm-CarrierRSSI                         GSM-CarrierRSSI                 OPTIONAL,
    -- dummy is not used in this version of the specification, it should
    -- not be sent and if received it should be ignored.
    dummy                                   INTEGER (46..173)               OPTIONAL,
    bsicReported                            BSICReported,
    -- dummy2 is not used in this version of the specification, it should
    -- not be sent and if received it should be ignored.
    dummy2                                  ObservedTimeDifferenceToGSM     OPTIONAL
}

GSM-MeasuredResultsList ::=             SEQUENCE (SIZE (1..maxReportedGSMCells)) OF
                                            GSM-MeasuredResults

GPS-TOW-1msec ::=                       INTEGER (0..604799999)

GPS-TOW-Assist ::=                      SEQUENCE {
    satID                                   SatID,
```

```
    tlm-Message                          BIT STRING (SIZE (14)),
    tlm-Reserved                         BIT STRING (SIZE (2)),
    alert                                BOOLEAN,
    antiSpoof                            BOOLEAN
}

GPS-TOW-AssistList ::=               SEQUENCE (SIZE (1..maxSat)) OF
                                         GPS-TOW-Assist

HCS-CellReselectInformation-RSCP ::=         SEQUENCE {
    -- TABULAR: The default value for penaltyTime is "notUsed"
    -- Temporary offset is nested inside PenaltyTime-RSCP
    penaltyTime                                  PenaltyTime-RSCP
}

HCS-CellReselectInformation-ECN0 ::=         SEQUENCE {
    -- TABULAR: The default value for penaltyTime is "notUsed"
    -- Temporary offset is nested inside PenaltyTime-ECN0
    penaltyTime                          PenaltyTime-ECN0
}

HCS-NeighbouringCellInformation-RSCP ::= SEQUENCE {
    hcs-PRIO                             HCS-PRIO                             DEFAULT 0,
    q-HCS                                Q-HCS                                DEFAULT 0,
    hcs-CellReselectInformation          HCS-CellReselectInformation-RSCP
}

HCS-NeighbouringCellInformation-ECN0 ::= SEQUENCE {
    hcs-PRIO                             HCS-PRIO                             DEFAULT 0,
    q-HCS                                Q-HCS                                DEFAULT 0,
    hcs-CellReselectInformation          HCS-CellReselectInformation-ECN0
}

HCS-PRIO ::=                         INTEGER (0..7)

HCS-ServingCellInformation ::=       SEQUENCE {
    hcs-PRIO                             HCS-PRIO                             DEFAULT 0,
    q-HCS                                Q-HCS                                DEFAULT 0,
    t-CR-Max                             T-CRMax                              OPTIONAL
}

HorizontalVelocity ::=               SEQUENCE {
    bearing                              INTEGER (0..359),
    horizontalSpeed                      INTEGER (0..2047)
    }

HorizontalWithVerticalVelocity ::=   SEQUENCE {
    verticalSpeedDirection               ENUMERATED { upward, downward },
    bearing                              INTEGER (0..359),
    horizontalSpeed                      INTEGER (0..2047),
    verticalSpeed                        INTEGER (0..255)
}

HorizontalVelocityWithUncertainty ::=    SEQUENCE {
    bearing                              INTEGER (0..359),
    horizontalSpeed                      INTEGER (0..2047),
    horizontalSpeedUncertainty           INTEGER (0..255)
}

HorizontalWithVerticalVelocityAndUncertainty ::=    SEQUENCE {
    verticalSpeedDirection               ENUMERATED { upward, downward },
    bearing                              INTEGER (0..359),
    horizontalSpeed                      INTEGER (0..2047),
    verticalSpeed                        INTEGER (0..255),
    horizontalSpeedUncertainty           INTEGER (0..255)
}

-- Actual value Hysteresis = IE value * 0.5
Hysteresis ::=                       INTEGER (0..15)

-- Actual value HysteresisInterFreq = IE value * 0.5
HysteresisInterFreq ::=              INTEGER (0..29)

InterFreqCell ::=                    SEQUENCE {
    frequencyInfo                        FrequencyInfo,
    nonFreqRelatedEventResults           CellMeasurementEventResults
}
```

```
InterFreqCell-LCR-r4 ::=            SEQUENCE {
    frequencyInfo                       FrequencyInfo,
    nonFreqRelatedEventResults          CellMeasurementEventResults-LCR-r4
}

InterFreqCellID ::=                 INTEGER (0..maxCellMeas-1)

InterFreqCellInfoList ::=           SEQUENCE {
    removedInterFreqCellList            RemovedInterFreqCellList            OPTIONAL,
    newInterFreqCellList                NewInterFreqCellList                OPTIONAL,
    cellsForInterFreqMeasList           CellsForInterFreqMeasList           OPTIONAL
}

InterFreqCellInfoList-r4 ::=        SEQUENCE {
    removedInterFreqCellList            RemovedInterFreqCellList            OPTIONAL,
    newInterFreqCellList                NewInterFreqCellList-r4             OPTIONAL,
    cellsForInterFreqMeasList           CellsForInterFreqMeasList           OPTIONAL
}

InterFreqCellInfoSI-List-RSCP ::=       SEQUENCE {
    removedInterFreqCellList            RemovedInterFreqCellList            OPTIONAL,
    newInterFreqCellList                NewInterFreqCellSI-List-RSCP        OPTIONAL
}

InterFreqCellInfoSI-List-ECN0 ::=       SEQUENCE {
    removedInterFreqCellList            RemovedInterFreqCellList            OPTIONAL,
    newInterFreqCellList                NewInterFreqCellSI-List-ECN0        OPTIONAL
}

InterFreqCellInfoSI-List-HCS-RSCP ::=       SEQUENCE {
    removedInterFreqCellList            RemovedInterFreqCellList            OPTIONAL,
    newInterFreqCellList                NewInterFreqCellSI-List-HCS-RSCP    OPTIONAL
}
InterFreqCellInfoSI-List-HCS-ECN0 ::=       SEQUENCE {
    removedInterFreqCellList            RemovedInterFreqCellList            OPTIONAL,
    newInterFreqCellList                NewInterFreqCellSI-List-HCS-ECN0    OPTIONAL
}

InterFreqCellInfoSI-List-RSCP-LCR ::=       SEQUENCE {
    removedInterFreqCellList            RemovedInterFreqCellList            OPTIONAL,
    newInterFreqCellList                NewInterFreqCellSI-List-RSCP-LCR-r4     OPTIONAL
}

InterFreqCellInfoSI-List-ECN0-LCR ::=       SEQUENCE {
    removedInterFreqCellList            RemovedInterFreqCellList            OPTIONAL,
    newInterFreqCellList                NewInterFreqCellSI-List-ECN0-LCR-r4     OPTIONAL
}

InterFreqCellInfoSI-List-HCS-RSCP-LCR ::=       SEQUENCE {
    removedInterFreqCellList            RemovedInterFreqCellList            OPTIONAL,
    newInterFreqCellList                NewInterFreqCellSI-List-HCS-RSCP-LCR-r4 OPTIONAL
}
InterFreqCellInfoSI-List-HCS-ECN0-LCR ::=       SEQUENCE {
    removedInterFreqCellList            RemovedInterFreqCellList            OPTIONAL,
    newInterFreqCellList                NewInterFreqCellSI-List-HCS-ECN0-LCR-r4 OPTIONAL
}

InterFreqCellList ::=               SEQUENCE (SIZE (1..maxFreq)) OF
                                        InterFreqCell

InterFreqCellList-LCR-r4-ext ::=    SEQUENCE (SIZE (1..maxFreq)) OF
                                        InterFreqCell-LCR-r4

InterFreqCellMeasuredResultsList ::= SEQUENCE (SIZE (1..maxCellMeas)) OF
                                        CellMeasuredResults

InterFreqEvent ::=                  CHOICE {
    event2a                             Event2a,
    event2b                             Event2b,
    event2c                             Event2c,
    event2d                             Event2d,
    event2e                             Event2e,
    event2f                             Event2f
}

InterFreqEvent-r6 ::=               CHOICE {
    event2a                             Event2a-r6,
    event2b                             Event2b-r6,
```

```
    event2c                             Event2c-r6,
    event2d                             Event2d-r6,
    event2e                             Event2e-r6,
    event2f                             Event2f-r6
}

InterFreqEventList ::=              SEQUENCE (SIZE (1..maxMeasEvent)) OF
                                        InterFreqEvent

InterFreqEventList-r6 ::=           SEQUENCE (SIZE (1..maxMeasEvent)) OF
                                        InterFreqEvent-r6

--Following IE shall be used regardless of CPICH RSCP(FDD) or Primary CCPCH RSCP(TDD)
--The order of the list corresponds to the order of the cells in InterFrequencyMeasuredResultsList
--The IE is only used for measured results and not for additional measured results.
InterFrequencyMeasuredResultsList-v590ext ::= SEQUENCE (SIZE (1..maxCellMeas)) OF
                                                DeltaRSCPPerCell

Inter-FreqEventCriteria-v590ext ::= SEQUENCE {
    threholdUsedFrequency-delta             DeltaRSCP,
    threholdNonUsedFrequency-deltaList      ThreholdNonUsedFrequency-deltaList      OPTIONAL
}

--The order of the list corresponds to the order of the events in Inter-FreqEventList
Inter-FreqEventCriteriaList-v590ext ::= SEQUENCE (SIZE (1..maxMeasEvent)) OF
                                            Inter-FreqEventCriteria-v590ext

--The order of the list corresponds to the order of relevant events in Intra-FreqEventCriteriaList
--i.e. the first element of the list corresponds to the first occurance of event 1e, 1f, 1h, 1i,
--the second element of the list corresponds to the second occurance of event 1e, 1f, 1h, 1i
Intra-FreqEventCriteriaList-v590ext ::= SEQUENCE (SIZE (1..maxMeasEvent)) OF
                                            DeltaRSCP

--Following IE shall be used regardless of CPICH RSCP(FDD) or Primary CCPCH RSCP(TDD)
--The order of the list corresponds to the order of the cells in IntraFrequencyMeasuredResultsList
--The IE is only used for measured results and not for additional measured results.
IntraFrequencyMeasuredResultsList-v590ext ::= SEQUENCE (SIZE (1..maxCellMeas)) OF
                                                DeltaRSCPPerCell

IntraFreqReportingCriteria-1b-r5 ::= SEQUENCE {
    periodicReportingInfo-1b            PeriodicReportingInfo-1b
}

PeriodicReportingInfo-1b ::= SEQUENCE {
    reportingAmount                     ReportingAmount,
    reportingInterval                   ReportingInterval
}

InterFreqEventResults ::=           SEQUENCE {
    eventID                             EventIDInterFreq,
    interFreqCellList                   InterFreqCellList                   OPTIONAL
}

InterFreqEventResults-LCR-r4-ext ::=    SEQUENCE {
    eventID                             EventIDInterFreq,
    interFreqCellList                   InterFreqCellList-LCR-r4-ext        OPTIONAL
}

InterFreqMeasQuantity ::=           SEQUENCE {
    reportingCriteria                   CHOICE {
        intraFreqReportingCriteria          SEQUENCE {
            intraFreqMeasQuantity               IntraFreqMeasQuantity
        },
        interFreqReportingCriteria          SEQUENCE {
            filterCoefficient                   FilterCoefficient           DEFAULT fc0,
            modeSpecificInfo                    CHOICE {
                fdd                                 SEQUENCE {
                    freqQualityEstimateQuantity-FDD     FreqQualityEstimateQuantity-FDD
                },
                tdd                                 SEQUENCE {
                    freqQualityEstimateQuantity-TDD     FreqQualityEstimateQuantity-TDD
                }
            }
        }
    }
}

InterFreqMeasuredResults ::=        SEQUENCE {
```

```
    frequencyInfo                         FrequencyInfo                         OPTIONAL,
    utra-CarrierRSSI                      UTRA-CarrierRSSI                      OPTIONAL,
    interFreqCellMeasuredResultsList      InterFreqCellMeasuredResultsList      OPTIONAL
}

InterFreqMeasuredResultsList ::=      SEQUENCE (SIZE (1..maxFreq)) OF
                                          InterFreqMeasuredResults


InterFreqMeasurementSysInfo-RSCP ::=      SEQUENCE {
    interFreqCellInfoSI-List                  InterFreqCellInfoSI-List-RSCP         OPTIONAL
}

InterFreqMeasurementSysInfo-ECN0 ::=          SEQUENCE {
    interFreqCellInfoSI-List              InterFreqCellInfoSI-List-ECN0         OPTIONAL
}

InterFreqMeasurementSysInfo-HCS-RSCP ::=          SEQUENCE {
    interFreqCellInfoSI-List              InterFreqCellInfoSI-List-HCS-RSCP     OPTIONAL
}

InterFreqMeasurementSysInfo-HCS-ECN0 ::=          SEQUENCE {
    interFreqCellInfoSI-List              InterFreqCellInfoSI-List-HCS-ECN0     OPTIONAL
}

InterFreqMeasurementSysInfo-RSCP-LCR-r4 ::= SEQUENCE {
    interFreqCellInfoSI-List                  InterFreqCellInfoSI-List-RSCP-LCR         OPTIONAL
}

InterFreqMeasurementSysInfo-ECN0-LCR-r4 ::=       SEQUENCE {
    interFreqCellInfoSI-List              InterFreqCellInfoSI-List-ECN0-LCR         OPTIONAL
}

InterFreqMeasurementSysInfo-HCS-RSCP-LCR-r4 ::=       SEQUENCE {
    interFreqCellInfoSI-List              InterFreqCellInfoSI-List-HCS-RSCP-LCR     OPTIONAL
}

InterFreqMeasurementSysInfo-HCS-ECN0-LCR-r4 ::=       SEQUENCE {
    interFreqCellInfoSI-List              InterFreqCellInfoSI-List-HCS-ECN0-LCR     OPTIONAL
}

InterFreqRACHRepCellsList ::=             SEQUENCE (SIZE (1..maxFreq)) OF
InterFreqCellID

InterFreqRACHReportingInfo ::= SEQUENCE {
    modeSpecificInfo                      CHOICE {
        fdd                                   SEQUENCE {
            interFreqRepQuantityRACH-FDD          InterFreqRepQuantityRACH-FDD
        },
        tdd                                   SEQUENCE {
            interFreqRepQuantityRACH-TDDList      InterFreqRepQuantityRACH-TDDList
        },
    interFreqRACHReportingThreshold       Threshold,
    maxReportedCellsOnRACHinterFreq       MaxReportedCellsOnRACHinterFreq
    }
}

InterFreqReportCriteria ::=           CHOICE {
    intraFreqReportingCriteria            IntraFreqReportingCriteria,
    interFreqReportingCriteria            InterFreqReportingCriteria,
    periodicalReportingCriteria           PeriodicalWithReportingCellStatus,
    noReporting                           ReportingCellStatusOpt
}

InterFreqReportCriteria-r4 ::=        CHOICE {
    intraFreqReportingCriteria            IntraFreqReportingCriteria-r4,
    interFreqReportingCriteria            InterFreqReportingCriteria,
    periodicalReportingCriteria           PeriodicalWithReportingCellStatus,
    noReporting                           ReportingCellStatusOpt
}

InterFreqReportCriteria-r6 ::=        CHOICE {
    intraFreqReportingCriteria            IntraFreqReportingCriteria-r6,
    interFreqReportingCriteria            InterFreqReportingCriteria-r6,
    periodicalReportingCriteria           PeriodicalWithReportingCellStatus,
    noReporting                           ReportingCellStatusOpt
}
```

```
InterFreqReportingCriteria ::=      SEQUENCE {
    interFreqEventList                  InterFreqEventList                  OPTIONAL
}

InterFreqReportingCriteria-r6 ::=   SEQUENCE {
    interFreqEventList                  InterFreqEventList-r6               OPTIONAL
}

InterFreqReportingQuantity ::=      SEQUENCE {
    utra-Carrier-RSSI                   BOOLEAN,
    frequencyQualityEstimate            BOOLEAN,
    nonFreqRelatedQuantities            CellReportingQuantities
}

InterFreqRepQuantityRACH-FDD ::=    ENUMERATED {
                                        cpich-EcN0, cpich-RSCP }

InterFreqRepQuantityRACH-TDD ::=    ENUMERATED {
                                        timeslotISCP,
                                        primaryCCPCH-RSCP }

InterFreqRepQuantityRACH-TDDList ::= SEQUENCE (SIZE (1..2)) OF
                                        InterFreqRepQuantityRACH-TDD

InterFrequencyMeasurement ::=       SEQUENCE {
    interFreqCellInfoList               InterFreqCellInfoList,
    interFreqMeasQuantity               InterFreqMeasQuantity               OPTIONAL,
    interFreqReportingQuantity          InterFreqReportingQuantity          OPTIONAL,
    measurementValidity                 MeasurementValidity                 OPTIONAL,
    interFreqSetUpdate                  UE-AutonomousUpdateMode             OPTIONAL,
    reportCriteria                      InterFreqReportCriteria
}

InterFrequencyMeasurement-r4 ::=    SEQUENCE {
    interFreqCellInfoList               InterFreqCellInfoList-r4,
    interFreqMeasQuantity               InterFreqMeasQuantity               OPTIONAL,
    interFreqReportingQuantity          InterFreqReportingQuantity          OPTIONAL,
    measurementValidity                 MeasurementValidity                 OPTIONAL,
    interFreqSetUpdate                  UE-AutonomousUpdateMode             OPTIONAL,
    reportCriteria                      InterFreqReportCriteria-r4
}

InterFrequencyMeasurement-r6 ::=    SEQUENCE {
    interFreqCellInfoList               InterFreqCellInfoList-r4,
    interFreqMeasQuantity               InterFreqMeasQuantity               OPTIONAL,
    interFreqReportingQuantity          InterFreqReportingQuantity          OPTIONAL,
    measurementValidity                 MeasurementValidity                 OPTIONAL,
    interFreqSetUpdate                  UE-AutonomousUpdateMode             OPTIONAL,
    reportCriteria                      InterFreqReportCriteria-r6
}

InterRAT-TargetCellDescription ::=  SEQUENCE {
    technologySpecificInfo              CHOICE {
        gsm                                 SEQUENCE {
            bsic                                BSIC,
            frequency-band                      Frequency-Band,
            bcch-ARFCN                          BCCH-ARFCN,
            ncMode                              NC-Mode             OPTIONAL
        },
        is-2000                             NULL,
        spare2                              NULL,
        spare1                              NULL
    }
}

InterRATCellID ::=              INTEGER (0..maxCellMeas-1)

InterRATCellInfoIndication ::=      INTEGER (0..3)

InterRATCellInfoList ::=            SEQUENCE {
    removedInterRATCellList         RemovedInterRATCellList,
    -- NOTE: Future revisions of dedicated messages including IE newInterRATCellList
    -- should use a corrected version of this IE
    newInterRATCellList             NewInterRATCellList,
    cellsForInterRATMeasList            CellsForInterRATMeasList            OPTIONAL
}

InterRATCellInfoList-B ::=          SEQUENCE {
```

```
    removedInterRATCellList         RemovedInterRATCellList,
    -- NOTE: IE newInterRATCellList should be optional.  However, system information
    -- does not support message versions.  Hence, this can not be corrected
    newInterRATCellList             NewInterRATCellList-B
}

InterRATCellInfoList-r4 ::=         SEQUENCE {
    removedInterRATCellList                 RemovedInterRATCellList,
    newInterRATCellList                     NewInterRATCellList             OPTIONAL,
    cellsForInterRATMeasList                CellsForInterRATMeasList        OPTIONAL
}

InterRATCellInfoList-r6 ::=         SEQUENCE {
    removedInterRATCellList                 RemovedInterRATCellList,
    newInterRATCellList                     NewInterRATCellList             OPTIONAL,
    cellsForInterRATMeasList                CellsForInterRATMeasList        OPTIONAL,
    interRATCellInfoIndication-r6           InterRATCellInfoIndication      OPTIONAL
}

InterRATCellIndividualOffset ::=            INTEGER (-50..50)

InterRATEvent ::=                   CHOICE {
    event3a                             Event3a,
    event3b                             Event3b,
    event3c                             Event3c,
    event3d                             Event3d
}

InterRATEventList ::=               SEQUENCE (SIZE (1..maxMeasEvent)) OF
                                        InterRATEvent

InterRATEventResults ::=            SEQUENCE {
    eventID                             EventIDInterRAT,
    cellToReportList                    CellToReportList
}

InterRATInfo ::=                    ENUMERATED {
                                        gsm }

InterRATInfo-r6 ::=                 SEQUENCE {
    rat                                 InterRATInfo,
    gsm-TargetCellInfoList              GSM-TargetCellInfoList          OPTIONAL
}

InterRATMeasQuantity ::=                SEQUENCE {
    measQuantityUTRAN-QualityEstimate       IntraFreqMeasQuantity           OPTIONAL,
    ratSpecificInfo                     CHOICE {
        gsm                                     SEQUENCE {
            measurementQuantity                     MeasurementQuantityGSM,
            filterCoefficient                       FilterCoefficient       DEFAULT fc0,
            bsic-VerificationRequired               BSIC-VerificationRequired
        },
        is-2000                                 SEQUENCE {
            tadd-EcIo                               INTEGER (0..63),
            tcomp-EcIo                              INTEGER (0..15),
            softSlope                               INTEGER (0..63)         OPTIONAL,
            addIntercept                            INTEGER (0..63)         OPTIONAL
        }
    }
}

InterRATMeasuredResults ::=         CHOICE {
    gsm                                 GSM-MeasuredResultsList,
    spare                               NULL
}

InterRATMeasuredResultsList ::= SEQUENCE (SIZE (1..maxOtherRAT-16)) OF
                                        InterRATMeasuredResults

InterRATMeasurement ::=             SEQUENCE {
    interRATCellInfoList                InterRATCellInfoList            OPTIONAL,
    interRATMeasQuantity                InterRATMeasQuantity            OPTIONAL,
    interRATReportingQuantity           InterRATReportingQuantity       OPTIONAL,
    reportCriteria                      InterRATReportCriteria
}

InterRATMeasurement-r4 ::=          SEQUENCE {
    interRATCellInfoList                InterRATCellInfoList-r4         OPTIONAL,
```

```
    interRATMeasQuantity                InterRATMeasQuantity               OPTIONAL,
    interRATReportingQuantity           InterRATReportingQuantity      OPTIONAL,
    reportCriteria                      InterRATReportCriteria
}

InterRATMeasurement-r6 ::=          SEQUENCE {
    interRATCellInfoList                InterRATCellInfoList-r6            OPTIONAL,
    interRATMeasQuantity                InterRATMeasQuantity               OPTIONAL,
    interRATReportingQuantity           InterRATReportingQuantity      OPTIONAL,
    reportCriteria                      InterRATReportCriteria
}

InterRATMeasurementSysInfo ::=  SEQUENCE {
    interRATCellInfoList                InterRATCellInfoList               OPTIONAL
}

InterRATMeasurementSysInfo-B ::=    SEQUENCE {
    interRATCellInfoList                InterRATCellInfoList-B         OPTIONAL
}

InterRATReportCriteria ::=      CHOICE {
    interRATReportingCriteria           InterRATReportingCriteria,
    periodicalReportingCriteria         PeriodicalWithReportingCellStatus,
    noReporting                         ReportingCellStatusOpt
}

InterRATReportingCriteria ::=   SEQUENCE {
    interRATEventList               InterRATEventList              OPTIONAL
}

InterRATReportingQuantity ::=   SEQUENCE {
    utran-EstimatedQuality              BOOLEAN,
    ratSpecificInfo                 CHOICE {
        gsm                                 SEQUENCE {
            -- dummy and dummy2 are not used in this version of the specification
            -- and when received they should be ignored.
            dummy                               BOOLEAN,
            dummy2                              BOOLEAN,
            gsm-Carrier-RSSI                    BOOLEAN
        }
    }
}

IntraFreqCellID ::=                 INTEGER (0..maxCellMeas-1)

IntraFreqCellInfoList ::=           SEQUENCE {
    removedIntraFreqCellList            RemovedIntraFreqCellList           OPTIONAL,
    newIntraFreqCellList                NewIntraFreqCellList               OPTIONAL,
    cellsForIntraFreqMeasList           CellsForIntraFreqMeasList          OPTIONAL
}

IntraFreqCellInfoList-r4 ::=        SEQUENCE {
    removedIntraFreqCellList            RemovedIntraFreqCellList           OPTIONAL,
    newIntraFreqCellList                NewIntraFreqCellList-r4            OPTIONAL,
    cellsForIntraFreqMeasList           CellsForIntraFreqMeasList          OPTIONAL
}

IntraFreqCellInfoSI-List-RSCP ::=   SEQUENCE {
    removedIntraFreqCellList            RemovedIntraFreqCellList           OPTIONAL,
    newIntraFreqCellList                NewIntraFreqCellSI-List-RSCP
}

IntraFreqCellInfoSI-List-ECN0 ::=       SEQUENCE {
    removedIntraFreqCellList            RemovedIntraFreqCellList           OPTIONAL,
    newIntraFreqCellList                NewIntraFreqCellSI-List-ECN0
}

IntraFreqCellInfoSI-List-HCS-RSCP ::=       SEQUENCE {
    removedIntraFreqCellList            RemovedIntraFreqCellList           OPTIONAL,
    newIntraFreqCellList                NewIntraFreqCellSI-List-HCS-RSCP
}

IntraFreqCellInfoSI-List-HCS-ECN0 ::=       SEQUENCE {
    removedIntraFreqCellList            RemovedIntraFreqCellList           OPTIONAL,
    newIntraFreqCellList                NewIntraFreqCellSI-List-HCS-ECN0
}

IntraFreqCellInfoSI-List-RSCP-LCR-r4 ::=    SEQUENCE {
```

```
    removedIntraFreqCellList            RemovedIntraFreqCellList            OPTIONAL,
    newIntraFreqCellList                NewIntraFreqCellSI-List-RSCP-LCR-r4
}

IntraFreqCellInfoSI-List-ECN0-LCR-r4 ::=        SEQUENCE {
    removedIntraFreqCellList            RemovedIntraFreqCellList            OPTIONAL,
    newIntraFreqCellList                NewIntraFreqCellSI-List-ECN0-LCR-r4
}

IntraFreqCellInfoSI-List-HCS-RSCP-LCR-r4 ::=        SEQUENCE {
    removedIntraFreqCellList            RemovedIntraFreqCellList            OPTIONAL,
    newIntraFreqCellList                NewIntraFreqCellSI-List-HCS-RSCP-LCR-r4
}

IntraFreqCellInfoSI-List-HCS-ECN0-LCR-r4 ::=        SEQUENCE {
    removedIntraFreqCellList            RemovedIntraFreqCellList            OPTIONAL,
    newIntraFreqCellList                NewIntraFreqCellSI-List-HCS-ECN0-LCR-r4
}

IntraFreqEvent ::=                  CHOICE {
    e1a                                 Event1a,
    e1b                                 Event1b,
    e1c                                 Event1c,
    e1d                                 NULL,
    e1e                                 Event1e,
    e1f                                 Event1f,
    e1g                                 NULL,
    e1h                                 ThresholdUsedFrequency,
    e1i                                 ThresholdUsedFrequency
}

IntraFreqEvent-r4 ::=               CHOICE {
    e1a                                 Event1a-r4,
    e1b                                 Event1b-r4,
    e1c                                 Event1c,
    e1d                                 NULL,
    e1e                                 Event1e,
    e1f                                 Event1f,
    e1g                                 NULL,
    e1h                                 ThresholdUsedFrequency,
    e1i                                 ThresholdUsedFrequency
}

IntraFreqEvent-LCR-r4 ::=           CHOICE {
    e1a                                 Event1a-LCR-r4,
    e1b                                 Event1b-LCR-r4,
    e1c                                 Event1c,
    e1d                                 NULL,
    e1e                                 Event1e,
    e1f                                 Event1f,
    e1g                                 NULL,
    e1h                                 ThresholdUsedFrequency,
    e1i                                 ThresholdUsedFrequency
}

IntraFreqEvent-r6 ::=               CHOICE {
    e1a                                 Event1a-r4,
    e1b                                 Event1b-r4,
    e1c                                 Event1c,
    e1d                                 Event1d,
    e1e                                 Event1e-r6,
    e1f                                 Event1f-r6,
    e1g                                 NULL,
    e1h                                 ThresholdUsedFrequency-r6,
    e1i                                 ThresholdUsedFrequency-r6,
    e1j                                 Event1j-r6
}

IntraFreqEvent-1d-r5 ::=        SEQUENCE {
    triggeringCondition                 TriggeringCondition2    OPTIONAL,
    useCIO                              BOOLEAN                 OPTIONAL
}

IntraFreqEventCriteria ::=          SEQUENCE {
    event                               IntraFreqEvent,
    hysteresis                          Hysteresis,
    timeToTrigger                       TimeToTrigger,
    reportingCellStatus                 ReportingCellStatus                 OPTIONAL
```

```
}

IntraFreqEventCriteria-r4 ::=          SEQUENCE {
    event                                  IntraFreqEvent-r4,
    hysteresis                             Hysteresis,
    timeToTrigger                          TimeToTrigger,
    reportingCellStatus                    ReportingCellStatus              OPTIONAL
}

IntraFreqEventCriteria-LCR-r4 ::=      SEQUENCE {
    event                                  IntraFreqEvent-LCR-r4,
    hysteresis                             Hysteresis,
    timeToTrigger                          TimeToTrigger,
    reportingCellStatus                    ReportingCellStatus              OPTIONAL
}

IntraFreqEventCriteria-r6 ::=      SEQUENCE {
    event                                  IntraFreqEvent-r6,
    hysteresis                             Hysteresis,
    timeToTrigger                          TimeToTrigger,
    reportingCellStatus                    ReportingCellStatus              OPTIONAL
}

IntraFreqEventCriteriaList ::=         SEQUENCE (SIZE (1..maxMeasEvent)) OF
                                           IntraFreqEventCriteria

IntraFreqEventCriteriaList-r4 ::=      SEQUENCE (SIZE (1..maxMeasEvent)) OF
                                           IntraFreqEventCriteria-r4

IntraFreqEventCriteriaList-LCR-r4 ::=      SEQUENCE (SIZE (1..maxMeasEvent)) OF
                                           IntraFreqEventCriteria-LCR-r4

IntraFreqEventCriteriaList-r6 ::=          SEQUENCE (SIZE (1..maxMeasEvent)) OF
                                           IntraFreqEventCriteria-r6

IntraFreqEventResults ::=              SEQUENCE {
    eventID                                EventIDIntraFreq,
    cellMeasurementEventResults            CellMeasurementEventResults
}

IntraFreqMeasQuantity ::=              SEQUENCE {
    filterCoefficient                      FilterCoefficient                DEFAULT fc0,
    modeSpecificInfo                       CHOICE {
        fdd                                SEQUENCE {
            intraFreqMeasQuantity-FDD          IntraFreqMeasQuantity-FDD
        },
        tdd                                SEQUENCE {
            intraFreqMeasQuantity-TDDList      IntraFreqMeasQuantity-TDDList
        }
    }
}

-- If IntraFreqMeasQuantity-FDD is used in InterRATMeasQuantity, then only
-- cpich-Ec-N0 and cpich-RSCP are allowed.
-- dummy is not used in this version of the specification, it should
-- not be sent and if received it should be ignored.
IntraFreqMeasQuantity-FDD ::=          ENUMERATED {
                                           cpich-Ec-N0,
                                           cpich-RSCP,
                                           pathloss,
                                           dummy }

-- dummy is not used in this version of the specification, it should
-- not be sent and if received it should be ignored.
IntraFreqMeasQuantity-TDD ::=          ENUMERATED {
                                           primaryCCPCH-RSCP,
                                           pathloss,
                                           timeslotISCP,
                                           dummy }

IntraFreqMeasQuantity-TDDList ::=      SEQUENCE (SIZE (1..4)) OF
                                           IntraFreqMeasQuantity-TDD

IntraFreqMeasuredResultsList ::=       SEQUENCE (SIZE (1..maxCellMeas)) OF
                                           CellMeasuredResults

IntraFreqMeasurementSysInfo-RSCP ::=       SEQUENCE {
    intraFreqMeasurementID                 MeasurementIdentity          DEFAULT 1,
```

```
    intraFreqCellInfoSI-List              IntraFreqCellInfoSI-List-RSCP        OPTIONAL,
    intraFreqMeasQuantity                 IntraFreqMeasQuantity                OPTIONAL,
    intraFreqReportingQuantityForRACH     IntraFreqReportingQuantityForRACH    OPTIONAL,
    maxReportedCellsOnRACH                MaxReportedCellsOnRACH               OPTIONAL,
    reportingInfoForCellDCH               ReportingInfoForCellDCH              OPTIONAL
}

IntraFreqMeasurementSysInfo-ECN0 ::=        SEQUENCE {
    intraFreqMeasurementID                MeasurementIdentity         DEFAULT 1,
    intraFreqCellInfoSI-List              IntraFreqCellInfoSI-List-ECN0        OPTIONAL,
    intraFreqMeasQuantity                 IntraFreqMeasQuantity                OPTIONAL,
    intraFreqReportingQuantityForRACH     IntraFreqReportingQuantityForRACH    OPTIONAL,
    maxReportedCellsOnRACH                MaxReportedCellsOnRACH               OPTIONAL,
    reportingInfoForCellDCH               ReportingInfoForCellDCH              OPTIONAL
}

IntraFreqMeasurementSysInfo-HCS-RSCP ::=    SEQUENCE {
    intraFreqMeasurementID                MeasurementIdentity         DEFAULT 1,
    intraFreqCellInfoSI-List              IntraFreqCellInfoSI-List-HCS-RSCP    OPTIONAL,
    intraFreqMeasQuantity                 IntraFreqMeasQuantity                OPTIONAL,
    intraFreqReportingQuantityForRACH     IntraFreqReportingQuantityForRACH    OPTIONAL,
    maxReportedCellsOnRACH                MaxReportedCellsOnRACH               OPTIONAL,
    reportingInfoForCellDCH               ReportingInfoForCellDCH              OPTIONAL
}

IntraFreqMeasurementSysInfo-HCS-ECN0 ::=    SEQUENCE {
    intraFreqMeasurementID                MeasurementIdentity         DEFAULT 1,
    intraFreqCellInfoSI-List              IntraFreqCellInfoSI-List-HCS-ECN0    OPTIONAL,
    intraFreqMeasQuantity                 IntraFreqMeasQuantity                OPTIONAL,
    intraFreqReportingQuantityForRACH     IntraFreqReportingQuantityForRACH    OPTIONAL,
    maxReportedCellsOnRACH                MaxReportedCellsOnRACH               OPTIONAL,
    reportingInfoForCellDCH               ReportingInfoForCellDCH              OPTIONAL
}

IntraFreqMeasurementSysInfo-RSCP-LCR-r4 ::= SEQUENCE {
    intraFreqMeasurementID                MeasurementIdentity         DEFAULT 1,
    intraFreqCellInfoSI-List              IntraFreqCellInfoSI-List-RSCP-LCR-r4     OPTIONAL,
    intraFreqMeasQuantity                 IntraFreqMeasQuantity                OPTIONAL,
    intraFreqReportingQuantityForRACH     IntraFreqReportingQuantityForRACH    OPTIONAL,
    maxReportedCellsOnRACH                MaxReportedCellsOnRACH               OPTIONAL,
    reportingInfoForCellDCH               ReportingInfoForCellDCH-LCR-r4       OPTIONAL
}

IntraFreqMeasurementSysInfo-ECN0-LCR-r4 ::=     SEQUENCE {
    intraFreqMeasurementID                MeasurementIdentity         DEFAULT 1,
    intraFreqCellInfoSI-List              IntraFreqCellInfoSI-List-ECN0-LCR-r4     OPTIONAL,
    intraFreqMeasQuantity                 IntraFreqMeasQuantity                OPTIONAL,
    intraFreqReportingQuantityForRACH     IntraFreqReportingQuantityForRACH    OPTIONAL,
    maxReportedCellsOnRACH                MaxReportedCellsOnRACH               OPTIONAL,
    reportingInfoForCellDCH               ReportingInfoForCellDCH-LCR-r4       OPTIONAL
}

IntraFreqMeasurementSysInfo-HCS-RSCP-LCR-r4 ::= SEQUENCE {
    intraFreqMeasurementID                MeasurementIdentity         DEFAULT 1,
    intraFreqCellInfoSI-List              IntraFreqCellInfoSI-List-HCS-RSCP-LCR-r4     OPTIONAL,
    intraFreqMeasQuantity                 IntraFreqMeasQuantity                OPTIONAL,
    intraFreqReportingQuantityForRACH     IntraFreqReportingQuantityForRACH    OPTIONAL,
    maxReportedCellsOnRACH                MaxReportedCellsOnRACH               OPTIONAL,
    reportingInfoForCellDCH               ReportingInfoForCellDCH-LCR-r4       OPTIONAL
}

IntraFreqMeasurementSysInfo-HCS-ECN0-LCR-r4 ::= SEQUENCE {
    intraFreqMeasurementID                MeasurementIdentity         DEFAULT 1,
    intraFreqCellInfoSI-List              IntraFreqCellInfoSI-List-HCS-ECN0-LCR-r4     OPTIONAL,
    intraFreqMeasQuantity                 IntraFreqMeasQuantity                OPTIONAL,
    intraFreqReportingQuantityForRACH     IntraFreqReportingQuantityForRACH    OPTIONAL,
    maxReportedCellsOnRACH                MaxReportedCellsOnRACH               OPTIONAL,
    reportingInfoForCellDCH               ReportingInfoForCellDCH-LCR-r4       OPTIONAL
}

IntraFreqReportCriteria ::=          CHOICE {
    intraFreqReportingCriteria            IntraFreqReportingCriteria,
    periodicalReportingCriteria           PeriodicalWithReportingCellStatus,
    noReporting                           ReportingCellStatusOpt
}

IntraFreqReportCriteria-r4 ::=       CHOICE {
    intraFreqReportingCriteria            IntraFreqReportingCriteria-r4,
```

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    periodicalReportingCriteria         PeriodicalWithReportingCellStatus,
    noReporting                         ReportingCellStatusOpt
}

IntraFreqReportCriteria-r6 ::=      CHOICE {
    intraFreqReportingCriteria          IntraFreqReportingCriteria-r6,
    periodicalReportingCriteria         PeriodicalWithReportingCellStatus,
    noReporting                         ReportingCellStatusOpt
}

IntraFreqReportingCriteria ::=      SEQUENCE {
    eventCriteriaList                   IntraFreqEventCriteriaList      OPTIONAL
}

IntraFreqReportingCriteria-r4 ::=   SEQUENCE {
    eventCriteriaList                   IntraFreqEventCriteriaList-r4   OPTIONAL
}

IntraFreqReportingCriteria-LCR-r4 ::=   SEQUENCE {
    eventCriteriaList                   IntraFreqEventCriteriaList-LCR-r4   OPTIONAL
}

IntraFreqReportingCriteria-r6 ::= SEQUENCE {
    eventCriteriaList                   IntraFreqEventCriteriaList-r6   OPTIONAL
}

IntraFreqReportingQuantity ::=      SEQUENCE {
    activeSetReportingQuantities        CellReportingQuantities,
    monitoredSetReportingQuantities     CellReportingQuantities,
    detectedSetReportingQuantities      CellReportingQuantities             OPTIONAL
}

IntraFreqReportingQuantityForRACH ::= SEQUENCE {
    sfn-SFN-OTD-Type                    SFN-SFN-OTD-Type,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            intraFreqRepQuantityRACH-FDD        IntraFreqRepQuantityRACH-FDD
        },
        tdd                                 SEQUENCE {
            intraFreqRepQuantityRACH-TDDList    IntraFreqRepQuantityRACH-TDDList
        }
    }
}

IntraFreqRepQuantityRACH-FDD ::=    ENUMERATED {
                                        cpich-EcN0, cpich-RSCP,
                                        pathloss, noReport }

IntraFreqRepQuantityRACH-TDD ::=    ENUMERATED {
                                        timeslotISCP,
                                        primaryCCPCH-RSCP,
                                        noReport }

IntraFreqRepQuantityRACH-TDDList ::= SEQUENCE (SIZE (1..2)) OF
                                        IntraFreqRepQuantityRACH-TDD

IntraFrequencyMeasurement ::=       SEQUENCE {
    intraFreqCellInfoList               IntraFreqCellInfoList               OPTIONAL,
    intraFreqMeasQuantity               IntraFreqMeasQuantity               OPTIONAL,
    intraFreqReportingQuantity          IntraFreqReportingQuantity          OPTIONAL,
    measurementValidity                 MeasurementValidity                 OPTIONAL,
    reportCriteria                      IntraFreqReportCriteria             OPTIONAL
}

IntraFrequencyMeasurement-r4 ::=    SEQUENCE {
    intraFreqCellInfoList               IntraFreqCellInfoList-r4            OPTIONAL,
    intraFreqMeasQuantity               IntraFreqMeasQuantity               OPTIONAL,
    intraFreqReportingQuantity          IntraFreqReportingQuantity          OPTIONAL,
    measurementValidity                 MeasurementValidity                 OPTIONAL,
    reportCriteria                      IntraFreqReportCriteria-r4          OPTIONAL
}

IntraFrequencyMeasurement-r6 ::=        SEQUENCE {
    intraFreqCellInfoList               IntraFreqCellInfoList-r4            OPTIONAL,
    intraFreqMeasQuantity               IntraFreqMeasQuantity               OPTIONAL,
    intraFreqReportingQuantity          IntraFreqReportingQuantity          OPTIONAL,
    measurementValidity                 MeasurementValidity                 OPTIONAL,
    reportCriteria                      IntraFreqReportCriteria-r6
```

```
}

IODE ::=                            INTEGER (0..255)

IP-Length ::=                       ENUMERATED {
                                        ipl5, ipl10 }

IP-PCCPCH-r4 ::=                    BOOLEAN

IP-Spacing ::=                      ENUMERATED {
                                        e5, e7, e10, e15, e20,
                                        e30, e40, e50 }

IP-Spacing-TDD ::=                      ENUMERATED {
                                        e30, e40, e50, e70, e100}

IS-2000SpecificMeasInfo ::=         ENUMERATED {
                                        frequency, timeslot, colourcode,
                                        outputpower, pn-Offset }

MaxNumberOfReportingCellsType1 ::=  ENUMERATED {
                                        e1, e2, e3, e4, e5, e6}

MaxNumberOfReportingCellsType2 ::=  ENUMERATED {
                                        e1, e2, e3, e4, e5, e6, e7, e8, e9, e10, e11, e12}

MaxNumberOfReportingCellsType3 ::=  ENUMERATED {
                                        viactCellsPlus1,
                                        viactCellsPlus2,
                                        viactCellsPlus3,
                                        viactCellsPlus4,
                                        viactCellsPlus5,
                                        viactCellsPlus6 }

MaxReportedCellsOnRACH ::=          ENUMERATED {
                                        noReport,
                                        currentCell,
                                        currentAnd-1-BestNeighbour,
                                        currentAnd-2-BestNeighbour,
                                        currentAnd-3-BestNeighbour,
                                        currentAnd-4-BestNeighbour,
                                        currentAnd-5-BestNeighbour,
                                        currentAnd-6-BestNeighbour }

MaxReportedCellsOnRACHinterFreq ::=     INTEGER (1..8)

MeasuredResults ::=                 CHOICE {
    intraFreqMeasuredResultsList        IntraFreqMeasuredResultsList,
    interFreqMeasuredResultsList        InterFreqMeasuredResultsList,
    interRATMeasuredResultsList     InterRATMeasuredResultsList,
    trafficVolumeMeasuredResultsList    TrafficVolumeMeasuredResultsList,
    qualityMeasuredResults              QualityMeasuredResults,
    ue-InternalMeasuredResults          UE-InternalMeasuredResults,
    ue-positioning-MeasuredResults      UE-Positioning-MeasuredResults,
    spare                               NULL
}

MeasuredResults-v390ext ::=                 SEQUENCE {
    ue-positioning-MeasuredResults-v390ext                  UE-Positioning-MeasuredResults-v390ext
}


MeasuredResults-v590ext ::= CHOICE {
    intraFrequencyMeasuredResultsList       IntraFrequencyMeasuredResultsList-v590ext,
    interFrequencyMeasuredResultsList       InterFrequencyMeasuredResultsList-v590ext
}

MeasuredResults-v7xyext ::= CHOICE {
    ueInternalMeasuredResults       UE-InternalMeasuredResults-r7
}

MeasuredResults-LCR-r4 ::=          CHOICE {
    intraFreqMeasuredResultsList        IntraFreqMeasuredResultsList,
    interFreqMeasuredResultsList        InterFreqMeasuredResultsList,
    interRATMeasuredResultsList     InterRATMeasuredResultsList,
    trafficVolumeMeasuredResultsList    TrafficVolumeMeasuredResultsList,
    qualityMeasuredResults              QualityMeasuredResults,
    ue-InternalMeasuredResults          UE-InternalMeasuredResults-LCR-r4,
```

```
    ue-positioniing-MeasuredResults     UE-Positioning-MeasuredResults,
    spare                               NULL
}

MeasuredResultsList ::=             SEQUENCE (SIZE (1..maxAdditionalMeas)) OF
                                        MeasuredResults

MeasuredResultsList-LCR-r4-ext ::=  SEQUENCE (SIZE (1..maxAdditionalMeas)) OF
                                        MeasuredResults-LCR-r4

MeasuredResultsOnRACH ::=           SEQUENCE {
    currentCell                         SEQUENCE {
        modeSpecificInfo                    CHOICE {
            fdd                                 SEQUENCE {
                measurementQuantity                 CHOICE {
                    cpich-Ec-N0                         CPICH-Ec-N0,
                    cpich-RSCP                          CPICH-RSCP,
                    pathloss                            Pathloss,
                    spare                               NULL
                }
            },
            tdd                                 SEQUENCE {
                -- For 3.84 Mcps and 7.68 Mcps TDD  --
                timeslotISCP                        TimeslotISCP-List       OPTIONAL,
                primaryCCPCH-RSCP                   PrimaryCCPCH-RSCP       OPTIONAL
            }
        }
    },
    monitoredCells                      MonitoredCellRACH-List          OPTIONAL
}

MeasuredResultsOnRACHinterFreq ::=      SEQUENCE {
    interFreqCellIndication-SIB11           INTEGER (0..1),
    interFreqCellIndication-SIB12           INTEGER (0..1),
    interFreqRACHRepCellsList               InterFreqRACHRepCellsList
}

MeasurementCommand ::=              CHOICE {
    setup                               MeasurementType,
    modify                              SEQUENCE {
        measurementType                     MeasurementType                 OPTIONAL
    },
    release                             NULL
}

MeasurementCommand-r4 ::=           CHOICE {
    setup                               MeasurementType-r4,
    modify                              SEQUENCE {
        measurementType                     MeasurementType-r4              OPTIONAL
    },
    release                             NULL
}

MeasurementCommand-r6 ::=           CHOICE {
    setup                               MeasurementType-r6,
    modify                              SEQUENCE {
        measurementType                     MeasurementType-r6              OPTIONAL
    },
    release                             NULL
}

MeasurementControlSysInfo ::=       SEQUENCE {
    -- CHOICE cellSelectQualityMeasure represents PCCPCH-RSCP in TDD mode.
    use-of-HCS                          CHOICE  {
        hcs-not-used                        SEQUENCE    {
            cellSelectQualityMeasure        CHOICE  {
                cpich-RSCP                  SEQUENCE    {
                    intraFreqMeasurementSysInfo         IntraFreqMeasurementSysInfo-RSCP
    OPTIONAL,
                    interFreqMeasurementSysInfo         InterFreqMeasurementSysInfo-RSCP    OPTIONAL
                },
                cpich-Ec-N0                 SEQUENCE    {
                    intraFreqMeasurementSysInfo         IntraFreqMeasurementSysInfo-ECN0
    OPTIONAL,
                    interFreqMeasurementSysInfo         InterFreqMeasurementSysInfo-ECN0    OPTIONAL
                }
            },
            interRATMeasurementSysInfo      InterRATMeasurementSysInfo-B        OPTIONAL
```

```
        },
        hcs-used                        SEQUENCE     {
            cellSelectQualityMeasure    CHOICE  {
                cpich-RSCP              SEQUENCE     {
                    intraFreqMeasurementSysInfo         IntraFreqMeasurementSysInfo-HCS-RSCP
    OPTIONAL,
                    interFreqMeasurementSysInfo         InterFreqMeasurementSysInfo-HCS-RSCP
    OPTIONAL
                },
                cpich-Ec-N0             SEQUENCE     {
                    intraFreqMeasurementSysInfo         IntraFreqMeasurementSysInfo-HCS-ECN0
    OPTIONAL,
                    interFreqMeasurementSysInfo         InterFreqMeasurementSysInfo-HCS-ECN0
    OPTIONAL                }
            },
            interRATMeasurementSysInfo      InterRATMeasurementSysInfo      OPTIONAL
        }
    },

    trafficVolumeMeasSysInfo            TrafficVolumeMeasSysInfo            OPTIONAL,
    -- dummy is not used in this version of specification and it shall be ignored by the UE.
    dummy       UE-InternalMeasurementSysInfo       OPTIONAL
}

MeasurementControlSysInfo-LCR-r4-ext ::=    SEQUENCE {
    -- CHOICE use-of-HCS shall have the same value as the use-of-HCS
    -- in MeasurementControlSysInfo
    -- CHOICE cellSelectQualityMeasure represents PCCPCH-RSCP in TDD mode.
    use-of-HCS                          CHOICE  {
        hcs-not-used                    SEQUENCE     {
            -- CHOICE cellSelectQualityMeasure shall have the same value as the
            -- cellSelectQualityMeasure in MeasurementControlSysInfo
            cellSelectQualityMeasure    CHOICE  {
                cpich-RSCP              SEQUENCE     {
                    intraFreqMeasurementSysInfo IntraFreqMeasurementSysInfo-RSCP-LCR-r4 OPTIONAL,
                    interFreqMeasurementSysInfo InterFreqMeasurementSysInfo-RSCP-LCR-r4 OPTIONAL
                },
                cpich-Ec-N0             SEQUENCE     {
                    intraFreqMeasurementSysInfo IntraFreqMeasurementSysInfo-ECN0-LCR-r4 OPTIONAL,
                    interFreqMeasurementSysInfo InterFreqMeasurementSysInfo-ECN0-LCR-r4 OPTIONAL
                }
            }
        },
        hcs-used                        SEQUENCE     {
            -- CHOICE cellSelectQualityMeasure shall have the same value as the
            -- cellSelectQualityMeasure in MeasurementControlSysInfo
            cellSelectQualityMeasure    CHOICE  {
                cpich-RSCP              SEQUENCE     {
                    intraFreqMeasurementSysInfo IntraFreqMeasurementSysInfo-HCS-RSCP-LCR-r4
    OPTIONAL,
                    interFreqMeasurementSysInfo InterFreqMeasurementSysInfo-HCS-RSCP-LCR-r4 OPTIONAL
                },
                cpich-Ec-N0             SEQUENCE     {
                    intraFreqMeasurementSysInfo IntraFreqMeasurementSysInfo-HCS-ECN0-LCR-r4
    OPTIONAL,
                    interFreqMeasurementSysInfo InterFreqMeasurementSysInfo-HCS-ECN0-LCR-r4 OPTIONAL
                }
            }
        }
    }
}

MeasurementIdentity ::=     INTEGER (1..16)

MeasurementQuantityGSM ::=          ENUMERATED {
                                        gsm-CarrierRSSI,
                                        dummy }

MeasurementReportingMode ::=        SEQUENCE {
    measurementReportTransferMode       TransferMode,
    periodicalOrEventTrigger            PeriodicalOrEventTrigger
}

MeasurementType ::=                 CHOICE {
    intraFrequencyMeasurement           IntraFrequencyMeasurement,
    interFrequencyMeasurement           InterFrequencyMeasurement,
    interRATMeasurement                 InterRATMeasurement,
    ue-positioning-Measurement          UE-Positioning-Measurement,
```

```
    trafficVolumeMeasurement            TrafficVolumeMeasurement,
    qualityMeasurement                  QualityMeasurement,
    ue-InternalMeasurement              UE-InternalMeasurement
}

MeasurementType-r4 ::=              CHOICE {
    intraFrequencyMeasurement           IntraFrequencyMeasurement-r4,
    interFrequencyMeasurement           InterFrequencyMeasurement-r4,
    interRATMeasurement                 InterRATMeasurement-r4,
    up-Measurement                      UE-Positioning-Measurement-r4,
    trafficVolumeMeasurement            TrafficVolumeMeasurement,
    qualityMeasurement                  QualityMeasurement,
    ue-InternalMeasurement              UE-InternalMeasurement-r4
}

MeasurementType-r6 ::=              CHOICE {
    intraFrequencyMeasurement           IntraFrequencyMeasurement-r6,
    interFrequencyMeasurement           InterFrequencyMeasurement-r6,
    interRATMeasurement                 InterRATMeasurement-r6,
    up-Measurement                      UE-Positioning-Measurement-r4,
    trafficVolumeMeasurement            TrafficVolumeMeasurement,
    qualityMeasurement                  QualityMeasurement,
    ue-InternalMeasurement              UE-InternalMeasurement-r4
}

MeasurementValidity ::=             SEQUENCE {
    ue-State                            ENUMERATED {
                                            cell-DCH, all-But-Cell-DCH, all-States }
}

MonitoredCellRACH-List ::=          SEQUENCE (SIZE (1..8)) OF
                                        MonitoredCellRACH-Result

MonitoredCellRACH-Result ::=        SEQUENCE {
    sfn-SFN-ObsTimeDifference           SFN-SFN-ObsTimeDifference           OPTIONAL,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            primaryCPICH-Info                   PrimaryCPICH-Info,
            measurementQuantity                 CHOICE {
                cpich-Ec-N0                         CPICH-Ec-N0,
                cpich-RSCP                          CPICH-RSCP,
                pathloss                            Pathloss,
                spare                               NULL
            }                                                               OPTIONAL
        },
        tdd                                 SEQUENCE {
            cellParametersID                    CellParametersID,
            primaryCCPCH-RSCP                   PrimaryCCPCH-RSCP
        }
    }
}

MultipathIndicator ::=              ENUMERATED {
                                        nm,
                                        low,
                                        medium,
                                        high }

N-CR-T-CRMaxHyst ::=                SEQUENCE {
    n-CR                                INTEGER (1..16)                     DEFAULT 8,
    t-CRMaxHyst                         T-CRMaxHyst

}

NavigationModelSatInfo ::=          SEQUENCE {
    satID                               SatID,
    satelliteStatus                     SatelliteStatus,
    ephemerisParameter                  EphemerisParameter      OPTIONAL
}

NavigationModelSatInfoList ::=      SEQUENCE (SIZE (1..maxSat)) OF
                                        NavigationModelSatInfo

EphemerisParameter ::=                  SEQUENCE {
    codeOnL2                            BIT STRING (SIZE (2)),
    uraIndex                            BIT STRING (SIZE (4)),
    satHealth                           BIT STRING (SIZE (6)),
    iodc                                BIT STRING (SIZE (10)),
```

```
    l2Pflag                             BIT STRING (SIZE (1)),
    sf1Revd                             SubFrame1Reserved,
    t-GD                                BIT STRING (SIZE (8)),
    t-oc                                BIT STRING (SIZE (16)),
    af2                                 BIT STRING (SIZE (8)),
    af1                                 BIT STRING (SIZE (16)),
    af0                                 BIT STRING (SIZE (22)),
    c-rs                                BIT STRING (SIZE (16)),
    delta-n                             BIT STRING (SIZE (16)),
    m0                                  BIT STRING (SIZE (32)),
    c-uc                                BIT STRING (SIZE (16)),
    e                                   BIT STRING (SIZE (32)),
    c-us                                BIT STRING (SIZE (16)),
    a-Sqrt                              BIT STRING (SIZE (32)),
    t-oe                                BIT STRING (SIZE (16)),
    fitInterval                         BIT STRING (SIZE (1)),
    aodo                                BIT STRING (SIZE (5)),
    c-ic                                BIT STRING (SIZE (16)),
    omega0                              BIT STRING (SIZE (32)),
    c-is                                BIT STRING (SIZE (16)),
    i0                                  BIT STRING (SIZE (32)),
    c-rc                                BIT STRING (SIZE (16)),
    omega                               BIT STRING (SIZE (32)),
    omegaDot                            BIT STRING (SIZE (24)),
    iDot                                BIT STRING (SIZE (14))
}
NC-Mode ::=                         BIT STRING (SIZE (3))

Neighbour ::=                       SEQUENCE {
    modeSpecificInfo                CHOICE {
        fdd                             SEQUENCE {
            neighbourIdentity                   PrimaryCPICH-Info                   OPTIONAL,
            uE-RX-TX-TimeDifferenceType2Info    UE-RX-TX-TimeDifferenceType2Info    OPTIONAL
        },
        tdd                             SEQUENCE {
            neighbourAndChannelIdentity     CellAndChannelIdentity              OPTIONAL
        }
    },
    neighbourQuality                    NeighbourQuality,
    sfn-SFN-ObsTimeDifference2          SFN-SFN-ObsTimeDifference2}

Neighbour-v390ext ::=                   SEQUENCE {
    modeSpecificInfo                CHOICE {
        fdd                             SEQUENCE {
            frequencyInfo                       FrequencyInfo
        },
        tdd                             NULL
    }
}

NeighbourList ::=                   SEQUENCE (SIZE (1..maxCellMeas)) OF
                                        Neighbour

-- The order of the cells in IE NeighbourList-v390ext shall be the
-- same as the order in IE NeighbourList
NeighbourList-v390ext ::=               SEQUENCE (SIZE (1..maxCellMeas)) OF
                                        Neighbour-v390ext

NeighbourQuality ::=                SEQUENCE {
    ue-Positioning-OTDOA-Quality        UE-Positioning-OTDOA-Quality
}

NewInterFreqCell ::=                SEQUENCE {
    interFreqCellID                     InterFreqCellID                 OPTIONAL,
    frequencyInfo                       FrequencyInfo                   OPTIONAL,
    cellInfo                            CellInfo
}

NewInterFreqCell-r4 ::=             SEQUENCE {
    interFreqCellID                     InterFreqCellID                 OPTIONAL,
    frequencyInfo                       FrequencyInfo                   OPTIONAL,
    cellInfo                            CellInfo-r4
}

NewInterFreqCellList ::=            SEQUENCE (SIZE (1..maxCellMeas)) OF
                                        NewInterFreqCell

NewInterFreqCellList-r4 ::=         SEQUENCE (SIZE (1..maxCellMeas)) OF
```

```
                                                NewInterFreqCell-r4

NewInterFreqCellSI-RSCP ::=                     SEQUENCE {
    interFreqCellID                             InterFreqCellID                 OPTIONAL,
    frequencyInfo                               FrequencyInfo                   OPTIONAL,
    cellInfo                                    CellInfoSI-RSCP
}

NewInterFreqCellSI-ECN0 ::=                     SEQUENCE {
    interFreqCellID                             InterFreqCellID                 OPTIONAL,
    frequencyInfo                               FrequencyInfo                   OPTIONAL,
    cellInfo                                    CellInfoSI-ECN0
}

NewInterFreqCellSI-HCS-RSCP ::=                     SEQUENCE {
    interFreqCellID                             InterFreqCellID                 OPTIONAL,
    frequencyInfo                               FrequencyInfo                   OPTIONAL,
    cellInfo                                    CellInfoSI-HCS-RSCP
}

NewInterFreqCellSI-HCS-ECN0 ::=                     SEQUENCE {
    interFreqCellID                             InterFreqCellID                 OPTIONAL,
    frequencyInfo                               FrequencyInfo                   OPTIONAL,
    cellInfo                                    CellInfoSI-HCS-ECN0
}

NewInterFreqCellSI-RSCP-LCR-r4 ::=                  SEQUENCE {
    interFreqCellID                             InterFreqCellID                 OPTIONAL,
    frequencyInfo                               FrequencyInfo                   OPTIONAL,
    cellInfo                                    CellInfoSI-RSCP-LCR-r4
}

NewInterFreqCellSI-ECN0-LCR-r4 ::=                  SEQUENCE {
    interFreqCellID                             InterFreqCellID                 OPTIONAL,
    frequencyInfo                               FrequencyInfo                   OPTIONAL,
    cellInfo                                    CellInfoSI-ECN0-LCR-r4
}

NewInterFreqCellSI-HCS-RSCP-LCR-r4 ::=              SEQUENCE {
    interFreqCellID                             InterFreqCellID                 OPTIONAL,
    frequencyInfo                               FrequencyInfo                   OPTIONAL,
    cellInfo                                    CellInfoSI-HCS-RSCP-LCR-r4
}

NewInterFreqCellSI-HCS-ECN0-LCR-r4 ::=              SEQUENCE {
    interFreqCellID                             InterFreqCellID                 OPTIONAL,
    frequencyInfo                               FrequencyInfo                   OPTIONAL,
    cellInfo                                    CellInfoSI-HCS-ECN0-LCR-r4
}

NewInterFreqCellSI-List-ECN0 ::=                    SEQUENCE (SIZE (1..maxCellMeas)) OF
                                                NewInterFreqCellSI-ECN0

NewInterFreqCellSI-List-HCS-RSCP ::=                    SEQUENCE (SIZE (1..maxCellMeas)) OF
                                                NewInterFreqCellSI-HCS-RSCP

NewInterFreqCellSI-List-HCS-ECN0 ::=                    SEQUENCE (SIZE (1..maxCellMeas)) OF
                                                NewInterFreqCellSI-HCS-ECN0

NewInterFreqCellSI-List-RSCP ::=                SEQUENCE (SIZE (1..maxCellMeas)) OF
                                                NewInterFreqCellSI-RSCP

NewInterFreqCellSI-List-ECN0-LCR-r4 ::=             SEQUENCE (SIZE (1..maxCellMeas)) OF
                                                NewInterFreqCellSI-ECN0-LCR-r4

NewInterFreqCellSI-List-HCS-RSCP-LCR-r4 ::= SEQUENCE (SIZE (1..maxCellMeas)) OF
                                                NewInterFreqCellSI-HCS-RSCP-LCR-r4

NewInterFreqCellSI-List-HCS-ECN0-LCR-r4 ::= SEQUENCE (SIZE (1..maxCellMeas)) OF
                                                NewInterFreqCellSI-HCS-ECN0-LCR-r4

NewInterFreqCellSI-List-RSCP-LCR-r4 ::=             SEQUENCE (SIZE (1..maxCellMeas)) OF
                                                NewInterFreqCellSI-RSCP-LCR-r4

NewInterRATCell ::=                     SEQUENCE {
    interRATCellID                              InterRATCellID          OPTIONAL,
    technologySpecificInfo                      CHOICE {
        gsm                                         SEQUENCE {
```

```
            cellSelectionReselectionInfo        CellSelectReselectInfoSIB-11-12     OPTIONAL,
            interRATCellIndividualOffset        InterRATCellIndividualOffset,
            bsic                                BSIC,
            frequency-band                      Frequency-Band,
            bcch-ARFCN                          BCCH-ARFCN,
            -- dummy is not used in this version of the specification, it should
            -- not be sent and if received it should be ignored.
            dummy                               NULL                OPTIONAL
        },
        is-2000                             SEQUENCE {
            is-2000SpecificMeasInfo             IS-2000SpecificMeasInfo
        },
        -- ASN.1 inconsistency: NewInterRATCellList should be optional within
        -- InterRATCellInfoList. The UE shall consider IE NewInterRATCell with
        -- technologySpecificInfo set to "absent" as valid and handle the
        -- message as if the IE NewInterRATCell was absent
        absent                              NULL,
        spare1                              NULL
    }
}

NewInterRATCell-B ::=               SEQUENCE {
    interRATCellID                      InterRATCellID              OPTIONAL,
    technologySpecificInfo              CHOICE {
        gsm                                 SEQUENCE {
            cellSelectionReselectionInfo        CellSelectReselectInfoSIB-11-12     OPTIONAL,
            interRATCellIndividualOffset        InterRATCellIndividualOffset,
            bsic                                BSIC,
            frequency-band                      Frequency-Band,
            bcch-ARFCN                          BCCH-ARFCN,
            -- dummy is not used in this version of the specification, it should
            -- not be sent and if received it should be ignored.
            dummy                               NULL                OPTIONAL
        },
        is-2000                             SEQUENCE {
            is-2000SpecificMeasInfo             IS-2000SpecificMeasInfo
        },
        -- ASN.1 inconsistency: NewInterRATCellList-B should be optional within
        -- InterRATCellInfoList-B. The UE shall consider IE NewInterRATCell-B with
        -- technologySpecificInfo set to "absent" as valid and handle the
        -- message as if the IE NewInterRATCell-B was absent
        absent                              NULL,
        spare1                              NULL
    }
}

NewInterRATCellList ::=         SEQUENCE (SIZE (1..maxCellMeas)) OF
                                    NewInterRATCell

NewInterRATCellList-B ::=           SEQUENCE (SIZE (1..maxCellMeas)) OF
                                        NewInterRATCell-B

NewIntraFreqCell ::=                SEQUENCE {
    intraFreqCellID                     IntraFreqCellID                 OPTIONAL,
    cellInfo                            CellInfo
}

NewIntraFreqCell-r4 ::=             SEQUENCE {
    intraFreqCellID                     IntraFreqCellID                 OPTIONAL,
    cellInfo                            CellInfo-r4
}

NewIntraFreqCellList ::=            SEQUENCE (SIZE (1..maxCellMeas)) OF
                                        NewIntraFreqCell

NewIntraFreqCellList-r4 ::=         SEQUENCE (SIZE (1..maxCellMeas)) OF
                                        NewIntraFreqCell-r4

NewIntraFreqCellSI-RSCP ::=             SEQUENCE {
    intraFreqCellID                     IntraFreqCellID                 OPTIONAL,
    cellInfo                            CellInfoSI-RSCP
}

NewIntraFreqCellSI-ECN0 ::=         SEQUENCE {
    intraFreqCellID                     IntraFreqCellID                 OPTIONAL,
    cellInfo                            CellInfoSI-ECN0
}
NewIntraFreqCellSI-HCS-RSCP ::=     SEQUENCE {
```

```
    intraFreqCellID                      IntraFreqCellID                      OPTIONAL,
    cellInfo                             CellInfoSI-HCS-RSCP
}

NewIntraFreqCellSI-HCS-ECN0 ::=      SEQUENCE {
    intraFreqCellID                      IntraFreqCellID                      OPTIONAL,
    cellInfo                             CellInfoSI-HCS-ECN0
}

NewIntraFreqCellSI-RSCP-LCR-r4 ::=       SEQUENCE {
    intraFreqCellID                      IntraFreqCellID                      OPTIONAL,
    cellInfo                             CellInfoSI-RSCP-LCR-r4
}

NewIntraFreqCellSI-ECN0-LCR-r4 ::=       SEQUENCE {
    intraFreqCellID                      IntraFreqCellID                      OPTIONAL,
    cellInfo                             CellInfoSI-ECN0-LCR-r4
}
NewIntraFreqCellSI-HCS-RSCP-LCR-r4 ::=   SEQUENCE {
    intraFreqCellID                      IntraFreqCellID                      OPTIONAL,
    cellInfo                             CellInfoSI-HCS-RSCP-LCR-r4
}

NewIntraFreqCellSI-HCS-ECN0-LCR-r4 ::=   SEQUENCE {
    intraFreqCellID                      IntraFreqCellID                      OPTIONAL,
    cellInfo                             CellInfoSI-HCS-ECN0-LCR-r4
}

NewIntraFreqCellSI-List-RSCP ::=         SEQUENCE (SIZE (1..maxCellMeas)) OF
                                             NewIntraFreqCellSI-RSCP

NewIntraFreqCellSI-List-ECN0 ::=         SEQUENCE (SIZE (1..maxCellMeas)) OF
                                         NewIntraFreqCellSI-ECN0

NewIntraFreqCellSI-List-HCS-RSCP ::=     SEQUENCE (SIZE (1..maxCellMeas)) OF
                                         NewIntraFreqCellSI-HCS-RSCP

NewIntraFreqCellSI-List-HCS-ECN0 ::=     SEQUENCE (SIZE (1..maxCellMeas)) OF
                                         NewIntraFreqCellSI-HCS-ECN0

NewIntraFreqCellSI-List-RSCP-LCR-r4 ::=      SEQUENCE (SIZE (1..maxCellMeas)) OF
                                             NewIntraFreqCellSI-RSCP-LCR-r4

NewIntraFreqCellSI-List-ECN0-LCR-r4 ::=      SEQUENCE (SIZE (1..maxCellMeas)) OF
                                         NewIntraFreqCellSI-ECN0-LCR-r4

NewIntraFreqCellSI-List-HCS-RSCP-LCR-r4 ::= SEQUENCE (SIZE (1..maxCellMeas)) OF
                                         NewIntraFreqCellSI-HCS-RSCP-LCR-r4

NewIntraFreqCellSI-List-HCS-ECN0-LCR-r4 ::= SEQUENCE (SIZE (1..maxCellMeas)) OF
                                         NewIntraFreqCellSI-HCS-ECN0-LCR-r4

    -- IE "nonUsedFreqThreshold" is not needed in case of event 2a
    -- In case of event 2a UTRAN should include value 0 within IE "nonUsedFreqThreshold"
    -- In case of event 2a, the UE shall be ignore IE "nonUsedFreqThreshold"
    -- In later versions of the message including this IE, a special version of
    -- IE "NonUsedFreqParameterList" may be defined for event 2a, namely a
    -- version not including IE "nonUsedFreqThreshold"
NonUsedFreqParameter ::=             SEQUENCE {
    nonUsedFreqThreshold                 Threshold,
    nonUsedFreqW                         W
}

NonUsedFreqParameter-r6 ::=          SEQUENCE {
    nonUsedFreqThreshold                 Threshold-r6,
    nonUsedFreqW                         W
}

NonUsedFreqParameterList ::=         SEQUENCE (SIZE (1..maxFreq)) OF
                                         NonUsedFreqParameter

NonUsedFreqParameterList-r6 ::=      SEQUENCE (SIZE (1..maxFreq)) OF
                                         NonUsedFreqParameter-r6

NonUsedFreqWList-r6 ::=      SEQUENCE (SIZE (1..maxFreq)) OF W

ObservedTimeDifferenceToGSM ::=      INTEGER (0..4095)
```

```
OTDOA-SearchWindowSize ::=          ENUMERATED {
                                        c20, c40, c80, c160, c320,
                                        c640, c1280, moreThan1280 }

-- SPARE: Pathloss, Max = 158
-- Values above Max are spare
Pathloss ::=                        INTEGER (46..173)

PenaltyTime-RSCP ::=                CHOICE {
    notUsed                             NULL,
    pt10                                TemporaryOffset1,
    pt20                                TemporaryOffset1,
    pt30                                TemporaryOffset1,
    pt40                                TemporaryOffset1,
    pt50                                TemporaryOffset1,
    pt60                                TemporaryOffset1
}

PenaltyTime-ECN0 ::=                CHOICE {
    notUsed                             NULL,
    pt10                                TemporaryOffsetList,
    pt20                                TemporaryOffsetList,
    pt30                                TemporaryOffsetList,
    pt40                                TemporaryOffsetList,
    pt50                                TemporaryOffsetList,
    pt60                                TemporaryOffsetList
}

PendingTimeAfterTrigger ::=         ENUMERATED {
                                        ptat0-25, ptat0-5, ptat1,
                                        ptat2, ptat4, ptat8, ptat16 }

PeriodicalOrEventTrigger ::=        ENUMERATED {
                                        periodical,
                                        eventTrigger }

PeriodicalReportingCriteria ::=     SEQUENCE {
    reportingAmount                     ReportingAmount                 DEFAULT ra-Infinity,
    reportingInterval                   ReportingIntervalLong
}

PeriodicalWithReportingCellStatus ::= SEQUENCE {
    periodicalReportingCriteria         PeriodicalReportingCriteria,
    reportingCellStatus                 ReportingCellStatus                 OPTIONAL
}

PLMNIdentitiesOfNeighbourCells ::=  SEQUENCE {
        plmnsOfIntraFreqCellsList       PLMNsOfIntraFreqCellsList           OPTIONAL,
        plmnsOfInterFreqCellsList       PLMNsOfInterFreqCellsList           OPTIONAL,
        plmnsOfInterRATCellsList        PLMNsOfInterRATCellsList            OPTIONAL
}

PLMNsOfInterFreqCellsList ::=           SEQUENCE (SIZE (1..maxCellMeas)) OF
                                            SEQUENCE {
    plmn-Identity                               PLMN-Identity               OPTIONAL
}

PLMNsOfIntraFreqCellsList ::=           SEQUENCE (SIZE (1..maxCellMeas)) OF
                                            SEQUENCE {
    plmn-Identity                               PLMN-Identity               OPTIONAL
}

PLMNsOfInterRATCellsList ::=            SEQUENCE (SIZE (1..maxCellMeas)) OF
                                            SEQUENCE {
    plmn-Identity                               PLMN-Identity               OPTIONAL
}

PositionEstimate ::=                CHOICE {
    ellipsoidPoint                      EllipsoidPoint,
    ellipsoidPointUncertCircle          EllipsoidPointUncertCircle,
    ellipsoidPointUncertEllipse         EllipsoidPointUncertEllipse,
    ellipsoidPointAltitude              EllipsoidPointAltitude,
    ellipsoidPointAltitudeEllipse       EllipsoidPointAltitudeEllipsoide
}

PositioningMethod ::=               ENUMERATED {
                                        otdoa,
                                        gps,
```

```
                                    otdoaOrGPS, cellID }

-- Actual value PRC = IE value * 0.32
PRC ::=                             INTEGER (-2047..2047)

-- SPARE: PrimaryCCPCH-RSCP, Max = 91
-- Values above Max are spare
PrimaryCCPCH-RSCP ::=               INTEGER (0..127)

Q-HCS ::=                           INTEGER (0..99)

Q-OffsetS-N ::=                     INTEGER (-50..50)

Q-QualMin ::=                       INTEGER (-24..0)

-- Actual value Q-RxlevMin = (IE value * 2) + 1
Q-RxlevMin ::=                      INTEGER (-58..-13)

QualityEventResults ::=             SEQUENCE (SIZE (1..maxTrCH)) OF
                                        TransportChannelIdentity

QualityMeasuredResults ::=          SEQUENCE {
    blerMeasurementResultsList          BLER-MeasurementResultsList         OPTIONAL,
    modeSpecificInfo                    CHOICE {
        fdd                                 NULL,
        tdd                                 SEQUENCE {
            sir-MeasurementResults              SIR-MeasurementList         OPTIONAL
        }
    }
}

QualityMeasurement ::=              SEQUENCE {
    qualityReportingQuantity            QualityReportingQuantity            OPTIONAL,
    reportCriteria                      QualityReportCriteria
}

QualityReportCriteria ::=           CHOICE {
    qualityReportingCriteria            QualityReportingCriteria,
    periodicalReportingCriteria         PeriodicalReportingCriteria,
    noReporting                         NULL
}

QualityReportingCriteria ::=        SEQUENCE (SIZE (1..maxTrCH)) OF
                                        QualityReportingCriteriaSingle

QualityReportingCriteriaSingle ::=  SEQUENCE {
    transportChannelIdentity            TransportChannelIdentity,
    totalCRC                            INTEGER (1..512),
    badCRC                              INTEGER (1..512),
    pendingAfterTrigger                 INTEGER (1..512)
}

QualityReportingQuantity ::=        SEQUENCE {
    dl-TransChBLER                      BOOLEAN,
    bler-dl-TransChIdList               BLER-TransChIdList                  OPTIONAL,
    modeSpecificInfo                    CHOICE {
        fdd                                 NULL,
        tdd                                 SEQUENCE {
            sir-TFCS-List                       SIR-TFCS-List               OPTIONAL
        }
    }
}

RAT-Type ::=                        ENUMERATED {
                                        gsm, is2000 }

ReferenceCellPosition ::=           CHOICE {
    ellipsoidPoint                      EllipsoidPoint,
    ellipsoidPointWithAltitude          EllipsoidPointAltitude
}

-- ReferenceLocation, as defined in 23.032
ReferenceLocation ::=           SEQUENCE {
    ellipsoidPointAltitudeEllipsoide        EllipsoidPointAltitudeEllipsoide
}

ReferenceTimeDifferenceToCell ::=   CHOICE {
    -- Actual value accuracy40 = IE value * 40
```

```
    accuracy40                          INTEGER (0..960),
    -- Actual value accuracy256 = IE value * 256
    accuracy256                         INTEGER (0..150),
    -- Actual value accuracy2560 = IE value * 2560
    accuracy2560                        INTEGER (0..15)
}

RemovedInterFreqCellList ::=        CHOICE {
    removeAllInterFreqCells             NULL,
    removeSomeInterFreqCells            SEQUENCE (SIZE (1..maxCellMeas)) OF
                                            InterFreqCellID,
    removeNoInterFreqCells              NULL
}

RemovedInterRATCellList ::=     CHOICE {
    removeAllInterRATCells          NULL,
    removeSomeInterRATCells         SEQUENCE (SIZE (1..maxCellMeas)) OF
                                            InterRATCellID,
    removeNoInterRATCells           NULL
}

RemovedIntraFreqCellList ::=        CHOICE {
    removeAllIntraFreqCells             NULL,
    removeSomeIntraFreqCells            SEQUENCE (SIZE (1..maxCellMeas)) OF
                                            IntraFreqCellID,
    removeNoIntraFreqCells              NULL
}

ReplacementActivationThreshold ::=  ENUMERATED {
                                        notApplicable, t1, t2,
                                        t3, t4, t5, t6, t7 }

ReportDeactivationThreshold ::=     ENUMERATED {
                                        notApplicable, t1, t2,
                                        t3, t4, t5, t6, t7 }

ReportingAmount ::=                 ENUMERATED {
                                        ra1, ra2, ra4, ra8, ra16, ra32,
                                        ra64, ra-Infinity }

ReportingCellStatus ::=             CHOICE{
    withinActiveSet                     MaxNumberOfReportingCellsType1,
    withinMonitoredSetUsedFreq          MaxNumberOfReportingCellsType1,
    withinActiveAndOrMonitoredUsedFreq  MaxNumberOfReportingCellsType1,
    withinDetectedSetUsedFreq           MaxNumberOfReportingCellsType1,
    withinMonitoredAndOrDetectedUsedFreq
                                        MaxNumberOfReportingCellsType1,
    allActiveplusMonitoredSet           MaxNumberOfReportingCellsType3,
    allActivePlusDetectedSet            MaxNumberOfReportingCellsType3,
    allActivePlusMonitoredAndOrDetectedSet
                                        MaxNumberOfReportingCellsType3,
    withinVirtualActSet             MaxNumberOfReportingCellsType1,
    withinMonitoredSetNonUsedFreq       MaxNumberOfReportingCellsType1,
    withinMonitoredAndOrVirtualActiveSetNonUsedFreq
                                        MaxNumberOfReportingCellsType1,
    allVirtualActSetplusMonitoredSetNonUsedFreq
                                        MaxNumberOfReportingCellsType3,
    withinActSetOrVirtualActSet-InterRATcells
                                        MaxNumberOfReportingCellsType2,
    withinActSetAndOrMonitoredUsedFreqOrVirtualActSetAndOrMonitoredNonUsedFreq
                                        MaxNumberOfReportingCellsType2
}

ReportingCellStatusOpt ::=          SEQUENCE {
    reportingCellStatus                 ReportingCellStatus                 OPTIONAL
}


ReportingInfoForCellDCH ::=         SEQUENCE {
    intraFreqReportingQuantity          IntraFreqReportingQuantity,
    measurementReportingMode            MeasurementReportingMode,
    reportCriteria                      CellDCH-ReportCriteria
}

ReportingInfoForCellDCH-LCR-r4 ::=  SEQUENCE {
    intraFreqReportingQuantity          IntraFreqReportingQuantity,
    measurementReportingMode            MeasurementReportingMode,
    reportCriteria                      CellDCH-ReportCriteria-LCR-r4
```

```
}

ReportingInterval ::=               ENUMERATED {
                                        noPeriodicalreporting, ri0-25,
                                        ri0-5, ri1, ri2, ri4, ri8, ri16 }

ReportingIntervalLong ::=           ENUMERATED {
                                        ril0, ril0-25, ril0-5, ril1,
                                        ril2, ril3, ril4, ril6, ril8,
                                        ril12, ril16, ril20, ril24,
                                        ril28, ril32, ril64 }
                                    -- When the value "ril0" is used, the UE behaviour is not
                                    -- defined.

-- Actual value ReportingRange = IE value * 0.5
ReportingRange ::=                  INTEGER (0..29)

RL-AdditionInfoList ::=             SEQUENCE (SIZE (1..maxRL)) OF
                                        PrimaryCPICH-Info

RL-InformationLists ::=             SEQUENCE {
    rl-AdditionInfoList                 RL-AdditionInfoList                 OPTIONAL,
    rL-RemovalInformationList           RL-RemovalInformationList           OPTIONAL
}

RLC-BuffersPayload ::=              ENUMERATED {
                                        pl0, pl4, pl8, pl16, pl32,
                                        pl64, pl128, pl256, pl512, pl1024,
                                        pl2k, pl4k, pl8k, pl16k, pl32k,
                                        pl64k, pl128k, pl256k, pl512k, pl1024k,
                                        spare12, spare11, spare10, spare9, spare8,
                                        spare7, spare6, spare5, spare4, spare3,
                                        spare2, spare1 }

-- Actual value RRC = IE value * 0.032
RRC ::=                             INTEGER (-127..127)

SatData ::=                         SEQUENCE{
    satID                               SatID,
    iode                                IODE
}

SatDataList ::=                     SEQUENCE (SIZE (0..maxSat)) OF
                                        SatData

SatelliteStatus ::=                 ENUMERATED {
                                        ns-NN-U,
                                        es-SN,
                                        es-NN-U,
                                        rev2,
                                        rev }

-- Identifies the satellite and is equal to (SV ID No - 1) where SV ID No is defined in [12].
SatID ::=                           INTEGER (0..63)

SFN-Offset-Validity ::=         ENUMERATED { false }

SFN-SFN-Drift ::=                   ENUMERATED {
                                        sfnsfndrift0, sfnsfndrift1, sfnsfndrift2,
                                        sfnsfndrift3, sfnsfndrift4, sfnsfndrift5,
                                        sfnsfndrift8, sfnsfndrift10, sfnsfndrift15,
                                        sfnsfndrift25, sfnsfndrift35, sfnsfndrift50,
                                        sfnsfndrift65, sfnsfndrift80, sfnsfndrift100,
                                        sfnsfndrift-1, sfnsfndrift-2, sfnsfndrift-3,
                                        sfnsfndrift-4, sfnsfndrift-5, sfnsfndrift-8,
                                        sfnsfndrift-10, sfnsfndrift-15, sfnsfndrift-25,
                                        sfnsfndrift-35, sfnsfndrift-50, sfnsfndrift-65,
                                        sfnsfndrift-80, sfnsfndrift-100}

SFN-SFN-ObsTimeDifference ::=       CHOICE {
    type1                               SFN-SFN-ObsTimeDifference1,
    type2                               SFN-SFN-ObsTimeDifference2
}

-- SPARE: SFN-SFN-ObsTimeDifference1, Max = 9830399
-- For 1.28Mcps TDD, Max value of SFN-SFN-ObsTimeDifference1 is 3276799.
-- Values above Max are spare
SFN-SFN-ObsTimeDifference1 ::=      INTEGER (0..16777215)
```

```
-- SPARE: SFN-SFN-ObsTimeDifference2, Max = 40961
-- For 1.28Mcps TDD, Max value of SFN-SFN-ObsTimeDifference2 is 27649.
-- Values above Max are spare
SFN-SFN-ObsTimeDifference2 ::=      INTEGER (0..65535)

SFN-SFN-OTD-Type ::=                ENUMERATED {
                                        noReport,
                                        type1,
                                        type2 }

SFN-SFN-RelTimeDifference1 ::=      SEQUENCE {
    sfn-Offset                          INTEGER (0 .. 4095),
    sfn-sfn-Reltimedifference           INTEGER (0.. 38399)
}

SFN-TOW-Uncertainty ::=             ENUMERATED {
                                        lessThan10,
                                        moreThan10 }


SIR ::=                             INTEGER (0..63)


SIR-MeasurementList ::=             SEQUENCE (SIZE (1..maxCCTrCH)) OF
                                        SIR-MeasurementResults


SIR-MeasurementResults ::=          SEQUENCE {
    tfcs-ID                             TFCS-IdentityPlain,
    sir-TimeslotList                    SIR-TimeslotList
}

SIR-TFCS ::=                        TFCS-IdentityPlain


SIR-TFCS-List ::=                   SEQUENCE (SIZE (1..maxCCTrCH)) OF
                                        SIR-TFCS

SIR-TimeslotList ::=                SEQUENCE (SIZE (1..maxTS)) OF
                                        SIR

-- SubFrame1Reserved, reserved bits in subframe 1 of the GPS navigation message
SubFrame1Reserved ::=               SEQUENCE {
    reserved1                           BIT STRING (SIZE (23)),
    reserved2                           BIT STRING (SIZE (24)),
    reserved3                           BIT STRING (SIZE (24)),
    reserved4                           BIT STRING (SIZE (16))
}

T-ADVinfo ::=                       SEQUENCE {
                t-ADV                   INTEGER(0..2047),
                sfn                     INTEGER(0..4095)
}

T-CRMax ::=                         CHOICE {
    notUsed                             NULL,
    t30                                 N-CR-T-CRMaxHyst,
    t60                                 N-CR-T-CRMaxHyst,
    t120                                N-CR-T-CRMaxHyst,
    t180                                N-CR-T-CRMaxHyst,
    t240                                N-CR-T-CRMaxHyst
}

T-CRMaxHyst ::=                     ENUMERATED {
                                        notUsed, t10, t20, t30,
                                        t40, t50, t60, t70 }

TemporaryOffset1 ::=                ENUMERATED {
                                        to3, to6, to9, to12, to15,
                                        to18, to21, infinite }

TemporaryOffset2 ::=                ENUMERATED {
                                        to2, to3, to4, to6, to8,
                                        to10, to12, infinite }

TemporaryOffsetList ::=             SEQUENCE    {
        temporaryOffset1                TemporaryOffset1,
```

```
        temporaryOffset2                TemporaryOffset2
}

Threshold ::=                       INTEGER (-115..0)

Threshold-r6 ::=                            INTEGER (-120..0)

-- The order of the list corresponds to the order of frequency defined in Inter-FreqEventCriteria
ThreholdNonUsedFrequency-deltaList ::= SEQUENCE (SIZE (1..maxFreq)) OF
                                            DeltaRSCPPerCell

ThresholdPositionChange ::=         ENUMERATED {
                                        pc10, pc20, pc30, pc40, pc50,
                                        pc100, pc200, pc300, pc500,
                                        pc1000, pc2000, pc5000, pc10000,
                                        pc20000, pc50000, pc100000 }

ThresholdSFN-GPS-TOW ::=            ENUMERATED {
                                        ms1, ms2, ms3, ms5, ms10,
                                        ms20, ms50, ms100 }

ThresholdSFN-SFN-Change ::=         ENUMERATED {
                                        c0-25, c0-5, c1, c2, c3, c4, c5,
                                        c10, c20, c50, c100, c200, c500,
                                        c1000, c2000, c5000 }

ThresholdUsedFrequency ::=          INTEGER (-115..165)

ThresholdUsedFrequency-r6 ::=       INTEGER (-120..165)

-- Actual value TimeInterval = IE value * 20.
TimeInterval ::=                    INTEGER (1..13)


TimeslotInfo ::=                    SEQUENCE {
    timeslotNumber                      TimeslotNumber,
    burstType                           BurstType
}

TimeslotInfo-LCR-r4 ::=             SEQUENCE {
    timeslotNumber                      TimeslotNumber-LCR-r4
}

TimeslotInfoList ::=                SEQUENCE (SIZE (1..maxTS)) OF
                                        TimeslotInfo

TimeslotInfoList-LCR-r4 ::=         SEQUENCE (SIZE (1..maxTS-LCR)) OF
                                        TimeslotInfo-LCR-r4

TimeslotInfoList-r4 ::=             CHOICE {
    -- the choice for 7.68 Mcps TDD is the same as for 3.84 Mcps TDD --
    tdd384                              SEQUENCE (SIZE (1..maxTS)) OF
                                            TimeslotInfo,
    tdd128                              SEQUENCE (SIZE (1..maxTS-LCR)) OF
                                            TimeslotInfo-LCR-r4
}

-- SPARE: TimeslotISCP, Max = 91
-- Values above Max are spare
TimeslotISCP ::=                    INTEGER (0..127)


-- TimeslotISCP-List shall not include more than 6 elements in 1.28Mcps TDD mode.
TimeslotISCP-List ::=               SEQUENCE (SIZE (1..maxTS)) OF
                                        TimeslotISCP

TimeslotListWithISCP ::=            SEQUENCE (SIZE (1..maxTS)) OF
                                        TimeslotWithISCP

TimeslotWithISCP ::=                SEQUENCE {
    timeslot                            TimeslotNumber,
    timeslotISCP                        TimeslotISCP
}

TimeToTrigger ::=                   ENUMERATED {
                                        ttt0, ttt10, ttt20, ttt40, ttt60,
                                        ttt80, ttt100, ttt120, ttt160,
                                        ttt200, ttt240, tt320, ttt640,
```

```
                                    ttt1280, ttt2560, ttt5000 }

TrafficVolumeEventParam ::=         SEQUENCE {
    eventID                             TrafficVolumeEventType,
    reportingThreshold                  TrafficVolumeThreshold,
    timeToTrigger                       TimeToTrigger                       OPTIONAL,
    pendingTimeAfterTrigger             PendingTimeAfterTrigger             OPTIONAL,
    tx-InterruptionAfterTrigger         TX-InterruptionAfterTrigger         OPTIONAL
}

TrafficVolumeEventResults ::=       SEQUENCE {
    ul-transportChannelCausingEvent     UL-TrCH-Identity,
    trafficVolumeEventIdentity          TrafficVolumeEventType
}

TrafficVolumeEventType ::=          ENUMERATED {
                                        e4a,
                                        e4b }

TrafficVolumeMeasQuantity ::=       CHOICE {
    rlc-BufferPayload                   NULL,
    averageRLC-BufferPayload            TimeInterval,
    varianceOfRLC-BufferPayload         TimeInterval
}

TrafficVolumeMeasSysInfo ::=        SEQUENCE {
    trafficVolumeMeasurementID          MeasurementIdentity         DEFAULT 4,
    trafficVolumeMeasurementObjectList  TrafficVolumeMeasurementObjectList  OPTIONAL,
    trafficVolumeMeasQuantity           TrafficVolumeMeasQuantity           OPTIONAL,
    trafficVolumeReportingQuantity      TrafficVolumeReportingQuantity      OPTIONAL,
    -- dummy is not used in this version of specification, it should
    -- not be sent and if received it should be ignored.
    dummy                               TrafficVolumeReportingCriteria      OPTIONAL,
    measurementValidity                 MeasurementValidity                 OPTIONAL,
    measurementReportingMode            MeasurementReportingMode,
    reportCriteriaSysInf                TrafficVolumeReportCriteriaSysInfo

}

TrafficVolumeMeasuredResults ::=    SEQUENCE {
    rb-Identity                         RB-Identity,
    rlc-BuffersPayload                  RLC-BuffersPayload                  OPTIONAL,
    averageRLC-BufferPayload            AverageRLC-BufferPayload            OPTIONAL,
    varianceOfRLC-BufferPayload         VarianceOfRLC-BufferPayload         OPTIONAL
}

TrafficVolumeMeasuredResultsList ::= SEQUENCE (SIZE (1..maxRB)) OF
                                        TrafficVolumeMeasuredResults

TrafficVolumeMeasurement ::=        SEQUENCE {
    trafficVolumeMeasurementObjectList  TrafficVolumeMeasurementObjectList  OPTIONAL,
    trafficVolumeMeasQuantity           TrafficVolumeMeasQuantity           OPTIONAL,
    trafficVolumeReportingQuantity      TrafficVolumeReportingQuantity      OPTIONAL,
    measurementValidity                 MeasurementValidity                 OPTIONAL,
    reportCriteria                      TrafficVolumeReportCriteria
}

TrafficVolumeMeasurementObjectList ::= SEQUENCE (SIZE (1..maxTrCH)) OF
                                            UL-TrCH-Identity

TrafficVolumeReportCriteria ::=     CHOICE {
    trafficVolumeReportingCriteria      TrafficVolumeReportingCriteria,
    periodicalReportingCriteria         PeriodicalReportingCriteria,
    noReporting                         NULL
}

TrafficVolumeReportCriteriaSysInfo ::=  CHOICE {
    trafficVolumeReportingCriteria      TrafficVolumeReportingCriteria,
    periodicalReportingCriteria         PeriodicalReportingCriteria
}

TrafficVolumeReportingCriteria ::= SEQUENCE {
    -- NOTE: transChCriteriaList should be mandatory in later versions of this message
    transChCriteriaList                 TransChCriteriaList                 OPTIONAL
}

TrafficVolumeReportingQuantity ::= SEQUENCE {
    rlc-RB-BufferPayload                BOOLEAN,
```

```
    rlc-RB-BufferPayloadAverage          BOOLEAN,
    rlc-RB-BufferPayloadVariance         BOOLEAN
}

TrafficVolumeThreshold ::=           ENUMERATED {
                                         th8, th16, th32, th64, th128,
                                         th256, th512, th1024, th2k, th3k,
                                         th4k, th6k, th8k, th12k, th16k,
                                         th24k, th32k, th48k, th64k, th96k,
                                         th128k, th192k, th256k, th384k,
                                         th512k, th768k }

TransChCriteria ::=                  SEQUENCE {
    ul-transportChannelID                UL-TrCH-Identity                    OPTIONAL,
    eventSpecificParameters              SEQUENCE (SIZE (1..maxMeasParEvent)) OF
                                             TrafficVolumeEventParam         OPTIONAL
}

TransChCriteriaList ::=          SEQUENCE (SIZE (1..maxTrCH)) OF
                                         TransChCriteria

TransferMode ::=                     ENUMERATED {
                                         acknowledgedModeRLC,
                                         unacknowledgedModeRLC }

TransmittedPowerThreshold ::=        INTEGER (-50..33)

TriggeringCondition1 ::=             ENUMERATED {
                                         activeSetCellsOnly,
                                         monitoredSetCellsOnly,
                                         activeSetAndMonitoredSetCells }

TriggeringCondition2 ::=             ENUMERATED {
                                         activeSetCellsOnly,
                                         monitoredSetCellsOnly,
                                         activeSetAndMonitoredSetCells,
                                         detectedSetCellsOnly,
                                         detectedSetAndMonitoredSetCells }

TX-InterruptionAfterTrigger ::=      ENUMERATED {
                                         txiat0-25, txiat0-5, txiat1,
                                         txiat2, txiat4, txiat8, txiat16 }

UDRE ::=                             ENUMERATED {
                                         lessThan1,
                                         between1-and-4,
                                         between4-and-8,
                                         over8 }

UE-6AB-Event ::=                     SEQUENCE {
    timeToTrigger                        TimeToTrigger,
    transmittedPowerThreshold            TransmittedPowerThreshold
}

UE-6FG-Event ::=                     SEQUENCE {
    timeToTrigger                        TimeToTrigger,
    -- in 1.28 Mcps TDD ue-RX-TX-TimeDifferenceThreshold corresponds to TADV Threshold
    ue-RX-TX-TimeDifferenceThreshold     UE-RX-TX-TimeDifferenceThreshold
}

-- dummy and dummy2 are not used in this version of the specification, they should
-- not be sent and if received the UE behaviour is not specified.
UE-AutonomousUpdateMode ::=          CHOICE {
    dummy                                NULL,
    onWithNoReporting                    NULL,
    dummy2                               RL-InformationLists
}

UE-InternalEventParam ::=            CHOICE {
    event6a                              UE-6AB-Event,
    event6b                              UE-6AB-Event,
    event6c                              TimeToTrigger,
    event6d                              TimeToTrigger,
    event6e                              TimeToTrigger,
    event6f                              UE-6FG-Event,
    event6g                              UE-6FG-Event
}
```

```
UE-InternalEventParamList ::=       SEQUENCE (SIZE (1..maxMeasEvent)) OF
                                        UE-InternalEventParam

UE-InternalEventResults ::=         CHOICE {
    event6a                             NULL,
    event6b                             NULL,
    event6c                             NULL,
    event6d                             NULL,
    event6e                             NULL,
    event6f                             PrimaryCPICH-Info,
    event6g                             PrimaryCPICH-Info,
    spare                               NULL
}

UE-InternalMeasQuantity ::=         SEQUENCE {
    measurementQuantity                 UE-MeasurementQuantity,
    filterCoefficient                   FilterCoefficient               DEFAULT fc0
}

UE-InternalMeasuredResults ::=      SEQUENCE {
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            ue-TransmittedPowerFDD              UE-TransmittedPower         OPTIONAL,
            ue-RX-TX-ReportEntryList            UE-RX-TX-ReportEntryList    OPTIONAL
        },
        tdd                                 SEQUENCE {
            ue-TransmittedPowerTDD-List         UE-TransmittedPowerTDD-List OPTIONAL,
            appliedTA                           UL-TimingAdvance            OPTIONAL
        }
    }
}

UE-InternalMeasuredResults-r7 ::=       SEQUENCE {
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            ue-TransmittedPowerFDD              UE-TransmittedPower         OPTIONAL,
            ue-RX-TX-ReportEntryList            UE-RX-TX-ReportEntryList    OPTIONAL
        },
        tdd                                 SEQUENCE {
            ue-TransmittedPowerTDD-List         UE-TransmittedPowerTDD-List OPTIONAL,
            appliedTA                           UL-TimingAdvance-VHCR       OPTIONAL
        }
    }
}

UE-InternalMeasuredResults-LCR-r4 ::=   SEQUENCE {
        ue-TransmittedPowerTDD-List         UE-TransmittedPowerTDD-List     OPTIONAL,
        t-ADVinfo                           T-ADVinfo                       OPTIONAL
}

UE-InternalMeasurement ::=          SEQUENCE {
    ue-InternalMeasQuantity             UE-InternalMeasQuantity             OPTIONAL,
    ue-InternalReportingQuantity        UE-InternalReportingQuantity        OPTIONAL,
    reportCriteria                      UE-InternalReportCriteria
}

UE-InternalMeasurement-r4 ::=       SEQUENCE {
    ue-InternalMeasQuantity             UE-InternalMeasQuantity             OPTIONAL,
    ue-InternalReportingQuantity        UE-InternalReportingQuantity-r4     OPTIONAL,
    reportCriteria                      UE-InternalReportCriteria
}

UE-InternalMeasurementSysInfo ::=   SEQUENCE {
    ue-InternalMeasurementID            MeasurementIdentity         DEFAULT 5,
    ue-InternalMeasQuantity             UE-InternalMeasQuantity
}

UE-InternalReportCriteria ::=       CHOICE {
    ue-InternalReportingCriteria        UE-InternalReportingCriteria,
    periodicalReportingCriteria         PeriodicalReportingCriteria,
    noReporting                         NULL
}

UE-InternalReportingCriteria ::=    SEQUENCE {
    ue-InternalEventParamList           UE-InternalEventParamList           OPTIONAL
}

UE-InternalReportingQuantity ::=    SEQUENCE {
```

```
    ue-TransmittedPower                 BOOLEAN,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            ue-RX-TX-TimeDifference             BOOLEAN
        },
        tdd                                 SEQUENCE {
            appliedTA                           BOOLEAN
        }
    }
}

UE-InternalReportingQuantity-r4 ::= SEQUENCE {
    ue-TransmittedPower                 BOOLEAN,
    modeSpecificInfo                    CHOICE {
        fdd                                 SEQUENCE {
            ue-RX-TX-TimeDifference             BOOLEAN
        },
        tdd                                 SEQUENCE {
            tddOption                           CHOICE {
            -- appliedTA applies to both 3.84 Mcps TDD and to 7.68 Mcps TDD.
            -- Therefore, no additional choice of TDD mode is necessary
                tdd384                              SEQUENCE {
                    appliedTA                           BOOLEAN
                },
                tdd128                              SEQUENCE {
                    t-ADVinfo                           BOOLEAN
                }
            }
        }
    }
}

-- TABULAR: UE-MeasurementQuantity, for 3.84 Mcps TDD only the first two values
-- ue-TransmittedPower and utra-Carrier-RSSI are used.
-- For 1.28 Mcps TDD ue-RX-TX-TimeDifference corresponds to T-ADV in the tabular
UE-MeasurementQuantity ::=          ENUMERATED {
                                        ue-TransmittedPower,
                                        utra-Carrier-RSSI,
                                        ue-RX-TX-TimeDifference }

UE-RX-TX-ReportEntry ::=            SEQUENCE {
    primaryCPICH-Info                   PrimaryCPICH-Info,
    ue-RX-TX-TimeDifferenceType1        UE-RX-TX-TimeDifferenceType1
}

UE-RX-TX-ReportEntryList ::=        SEQUENCE (SIZE (1..maxRL)) OF
                                        UE-RX-TX-ReportEntry

-- SPARE: UE-RX-TX-TimeDifferenceType1, Max = 1280
-- Values above Max are spare
UE-RX-TX-TimeDifferenceType1 ::=            INTEGER (768..1791)


UE-RX-TX-TimeDifferenceType2 ::=    INTEGER (0..8191)

UE-RX-TX-TimeDifferenceType2Info ::=    SEQUENCE {
    ue-RX-TX-TimeDifferenceType2            UE-RX-TX-TimeDifferenceType2,
    neighbourQuality                        NeighbourQuality
}

-- In 1.28 Mcps TDD, actual value for
-- T-ADV Threshold = (UE-RX-TX-TimeDifferenceThreshold - 768) * 0.125
UE-RX-TX-TimeDifferenceThreshold ::= INTEGER (768..1280)

UE-TransmittedPower ::=             INTEGER (0..104)

UE-TransmittedPowerTDD-List ::=     SEQUENCE (SIZE (1..maxTS)) OF
                                        UE-TransmittedPower

UL-TrCH-Identity ::=                    CHOICE{
    dch                                 TransportChannelIdentity,
    -- Note: the reference to CPCH in the element name below is incorrect. The name is not changed
    -- to keep it aligned with R99.
    rachorcpch                          NULL,
    usch                                TransportChannelIdentity
}

UE-Positioning-Accuracy ::=                 BIT STRING (SIZE (7))
```

```
UE-Positioning-CipherParameters ::=         SEQUENCE {
    cipheringKeyFlag                        BIT STRING (SIZE (1)),
    cipheringSerialNumber                   INTEGER (0..65535)
}

UE-Positioning-Error ::=                            SEQUENCE {
    errorReason                             UE-Positioning-ErrorCause,
    ue-positioning-GPS-additionalAssistanceDataRequest          UE-Positioning-GPS-
AdditionalAssistanceDataRequest OPTIONAL
}

UE-Positioning-ErrorCause ::=                       ENUMERATED {
                                            notEnoughOTDOA-Cells,
                                            notEnoughGPS-Satellites,
                                            assistanceDataMissing,
                                            notAccomplishedGPS-TimingOfCellFrames,
                                            undefinedError,
                                            requestDeniedByUser,
                                            notProcessedAndTimeout,
                                            referenceCellNotServingCell }

UE-Positioning-EventParam ::=                       SEQUENCE {
    reportingAmount                         ReportingAmount,
    reportFirstFix                          BOOLEAN,
    measurementInterval                     UE-Positioning-MeasurementInterval,
    eventSpecificInfo                       UE-Positioning-EventSpecificInfo
}

UE-Positioning-EventParamList ::=                   SEQUENCE (SIZE (1..maxMeasEvent)) OF
                                            UE-Positioning-EventParam

UE-Positioning-EventSpecificInfo ::=                CHOICE {
    e7a                                     ThresholdPositionChange,
    e7b                                     ThresholdSFN-SFN-Change,
    e7c                                     ThresholdSFN-GPS-TOW
}

UE-Positioning-GPS-AcquisitionAssistance ::=    SEQUENCE {
    gps-ReferenceTime                       INTEGER (0..604799999),
    utran-GPSReferenceTime                  UTRAN-GPSReferenceTime          OPTIONAL,
    satelliteInformationList                AcquisitionSatInfoList
}

UE-Positioning-GPS-AdditionalAssistanceDataRequest ::=      SEQUENCE {
    almanacRequest                          BOOLEAN,
    utcModelRequest                         BOOLEAN,
    ionosphericModelRequest                 BOOLEAN,
    navigationModelRequest                  BOOLEAN,
    dgpsCorrectionsRequest                  BOOLEAN,
    referenceLocationRequest                BOOLEAN,
    referenceTimeRequest                    BOOLEAN,
    aquisitionAssistanceRequest             BOOLEAN,
    realTimeIntegrityRequest                BOOLEAN,
    navModelAddDataRequest                  UE-Positioning-GPS-NavModelAddDataReq       OPTIONAL
}

UE-Positioning-GPS-Almanac ::=                      SEQUENCE {
    wn-a                                    BIT STRING (SIZE (8)),
    almanacSatInfoList                      AlmanacSatInfoList,
    sv-GlobalHealth                         BIT STRING (SIZE (364))         OPTIONAL
}

UE-Positioning-GPS-AssistanceData ::=               SEQUENCE {
    ue-positioning-GPS-ReferenceTime                    UE-Positioning-GPS-ReferenceTime
    OPTIONAL,
    ue-positioning-GPS-ReferenceLocation                ReferenceLocation               OPTIONAL,
    ue-positioning-GPS-DGPS-Corrections                 UE-Positioning-GPS-DGPS-Corrections
    OPTIONAL,
    ue-positioning-GPS-NavigationModel                  UE-Positioning-GPS-NavigationModel
    OPTIONAL,
    ue-positioning-GPS-IonosphericModel                 UE-Positioning-GPS-IonosphericModel
    OPTIONAL,
    ue-positioning-GPS-UTC-Model                        UE-Positioning-GPS-UTC-Model
    OPTIONAL,
    ue-positioning-GPS-Almanac                          UE-Positioning-GPS-Almanac
    OPTIONAL,
```

```
    ue-positioning-GPS-AcquisitionAssistance        UE-Positioning-GPS-AcquisitionAssistance
    OPTIONAL,
    ue-positioning-GPS-Real-timeIntegrity           BadSatList                          OPTIONAL,
    -- dummy is not used in this version of the specification, it should
    -- not be sent and if received it should be ignored.
    dummy           UE-Positioning-GPS-ReferenceCellInfo        OPTIONAL
}

UE-Positioning-GPS-DGPS-Corrections ::=     SEQUENCE {
    gps-TOW                             INTEGER (0..604799),
    statusHealth                        DiffCorrectionStatus,
    dgps-CorrectionSatInfoList          DGPS-CorrectionSatInfoList
}

UE-Positioning-GPS-IonosphericModel ::=     SEQUENCE {
    alfa0                               BIT STRING (SIZE (8)),
    alfa1                               BIT STRING (SIZE (8)),
    alfa2                               BIT STRING (SIZE (8)),
    alfa3                               BIT STRING (SIZE (8)),
    beta0                               BIT STRING (SIZE (8)),
    beta1                               BIT STRING (SIZE (8)),
    beta2                               BIT STRING (SIZE (8)),
    beta3                               BIT STRING (SIZE (8))
}

UE-Positioning-GPS-MeasurementResults ::=       SEQUENCE {
    referenceTime                       CHOICE {
        utran-GPSReferenceTimeResult        UTRAN-GPSReferenceTimeResult,
        gps-ReferenceTimeOnly               INTEGER (0..604799999)
    },
    gps-MeasurementParamList            GPS-MeasurementParamList
}

UE-Positioning-GPS-NavigationModel ::=          SEQUENCE {
    navigationModelSatInfoList          NavigationModelSatInfoList
}

UE-Positioning-GPS-NavModelAddDataReq ::=       SEQUENCE {
    gps-Week                            INTEGER (0..1023),
    -- SPARE: gps-Toe, Max = 167
    -- Values above Max are spare
    gps-Toe                             INTEGER (0..255),
    -- SPARE: tToeLimit, Max = 10
    -- Values above Max are spare
    tToeLimit                           INTEGER (0..15),
    satDataList                         SatDataList
}

UE-Positioning-GPS-ReferenceCellInfo ::=        SEQUENCE{
    modeSpecificInfo                CHOICE {
        fdd                             SEQUENCE {
            referenceIdentity               PrimaryCPICH-Info
        },
        tdd                             SEQUENCE {
            referenceIdentity               CellParametersID
        }
    }
}

UE-Positioning-GPS-ReferenceTime ::=            SEQUENCE {
    gps-Week                            INTEGER (0..1023),
    gps-tow-1msec                       GPS-TOW-1msec,  utran-GPSReferenceTime          UTRAN-
GPSReferenceTime                OPTIONAL,
    sfn-tow-Uncertainty                 SFN-TOW-Uncertainty             OPTIONAL,
    utran-GPS-DriftRate                 UTRAN-GPS-DriftRate             OPTIONAL,
    gps-TOW-AssistList                  GPS-TOW-AssistList              OPTIONAL
}

UE-Positioning-GPS-UTC-Model ::=                SEQUENCE {
    a1                                  BIT STRING (SIZE (24)),
    a0                                  BIT STRING (SIZE (32)),
    t-ot                                BIT STRING (SIZE (8)),
    wn-t                                BIT STRING (SIZE (8)),
    delta-t-LS                          BIT STRING (SIZE (8)),
    wn-lsf                              BIT STRING (SIZE (8)),
    dn                                  BIT STRING (SIZE (8)),
    delta-t-LSF                         BIT STRING (SIZE (8))
}
```

```
UE-Positioning-IPDL-Parameters ::=              SEQUENCE {
    ip-Spacing                                  IP-Spacing,
    ip-Length                                   IP-Length,
    ip-Offset                                   INTEGER (0..9),
    seed                                        INTEGER (0..63),
    burstModeParameters                         BurstModeParameters         OPTIONAL
}

UE-Positioning-IPDL-Parameters-r4 ::=           SEQUENCE {
    modeSpecificInfo                            CHOICE {
        fdd                                         SEQUENCE {
            ip-Spacing                                  IP-Spacing,
            ip-Length                                   IP-Length,
            ip-Offset                                   INTEGER (0..9),
            seed                                        INTEGER (0..63)
        },
        tdd                                         SEQUENCE {
            ip-Spacing-TDD                              IP-Spacing-TDD,
            ip-slot                                     INTEGER (0..14),
            ip-Start                                    INTEGER (0..4095),
            ip-PCCPCG                                   IP-PCCPCH-r4            OPTIONAL
        }
    },
    burstModeParameters                         BurstModeParameters             OPTIONAL
}

UE-Positioning-IPDL-Parameters-TDD-r4-ext ::=   SEQUENCE {
    ip-Spacing                                  IP-Spacing-TDD,
    ip-slot                                     INTEGER (0..14),
    ip-Start                                    INTEGER (0..4095),
    ip-PCCPCG                                   IP-PCCPCH-r4                    OPTIONAL,
    burstModeParameters                         BurstModeParameters
}

UE-Positioning-MeasuredResults ::=              SEQUENCE {
    ue-positioning-OTDOA-Measurement                UE-Positioning-OTDOA-Measurement
    OPTIONAL,
    ue-positioning-PositionEstimateInfo             UE-Positioning-PositionEstimateInfo
        OPTIONAL,
    ue-positioning-GPS-Measurement                  UE-Positioning-GPS-MeasurementResults
        OPTIONAL,
    ue-positioning-Error                            UE-Positioning-Error
    OPTIONAL
}

UE-Positioning-MeasuredResults-v390ext ::=      SEQUENCE {
    ue-Positioning-OTDOA-Measurement-v390ext        UE-Positioning-OTDOA-Measurement-v390ext
}

UE-Positioning-Measurement ::=                  SEQUENCE {
    ue-positioning-ReportingQuantity                UE-Positioning-ReportingQuantity,
    reportCriteria                              UE-Positioning-ReportCriteria,
    ue-positioning-OTDOA-AssistanceData         UE-Positioning-OTDOA-AssistanceData
    OPTIONAL,
    ue-positioning-GPS-AssistanceData               UE-Positioning-GPS-AssistanceData
    OPTIONAL
}

UE-Positioning-Measurement-v390ext ::=          SEQUENCE {
    ue-positioning-ReportingQuantity-v390ext        UE-Positioning-ReportingQuantity-v390ext
    OPTIONAL,
    measurementValidity                         MeasurementValidity                 OPTIONAL,
    ue-positioning-OTDOA-AssistanceData-UEB         UE-Positioning-OTDOA-AssistanceData-UEB
    OPTIONAL
}

UE-Positioning-Measurement-r4 ::=               SEQUENCE {
    ue-positioning-ReportingQuantity                UE-Positioning-ReportingQuantity-r4,
    measurementValidity                             MeasurementValidity
    OPTIONAL,
    reportCriteria                                  UE-Positioning-ReportCriteria,
    ue-positioning-OTDOA-AssistanceData             UE-Positioning-OTDOA-AssistanceData-r4
    OPTIONAL,
    ue-positioning-GPS-AssistanceData               UE-Positioning-GPS-AssistanceData
    OPTIONAL
}
```

```
UE-Positioning-Measurement-v7xyext ::=          SEQUENCE {
    ue-positioning-ReportingQuantity                UE-Positioning-ReportingQuantity-v7xyext,
    measurementValidity                             MeasurementValidity                OPTIONAL,
    reportCriteria                                  UE-Positioning-ReportCriteria,
    ue-positioning-OTDOA-AssistanceData             UE-Positioning-OTDOA-AssistanceData-r4
    OPTIONAL,
    ue-positioning-GPS-AssistanceData               UE-Positioning-GPS-AssistanceData        OPTIONAL
}

UE-Positioning-MeasurementEventResults ::=      CHOICE {
    event7a                             UE-Positioning-PositionEstimateInfo,
    event7b                             UE-Positioning-OTDOA-Measurement,
    event7c                             UE-Positioning-GPS-MeasurementResults,
    spare                               NULL
}

UE-Positioning-MeasurementInterval ::=          ENUMERATED {
                                        e5, e15, e60, e300,
                                        e900, e1800, e3600, e7200 }

UE-Positioning-MethodType ::=                   ENUMERATED {
                                        ue-Assisted,
                                        ue-Based,
                                        ue-BasedPreferred,
                                        ue-AssistedPreferred }

UE-Positioning-OTDOA-AssistanceData ::=     SEQUENCE {
    ue-positioning-OTDOA-ReferenceCellInfo          UE-Positioning-OTDOA-ReferenceCellInfo
    OPTIONAL,
    ue-positioning-OTDOA-NeighbourCellList              UE-Positioning-OTDOA-NeighbourCellList
        OPTIONAL
}

UE-Positioning-OTDOA-AssistanceData-r4 ::=  SEQUENCE {
    ue-positioning-OTDOA-ReferenceCellInfo          UE-Positioning-OTDOA-ReferenceCellInfo-r4
        OPTIONAL,
    ue-positioning-OTDOA-NeighbourCellList          UE-Positioning-OTDOA-NeighbourCellList-r4
        OPTIONAL
}

UE-Positioning-OTDOA-AssistanceData-r4ext ::= SEQUENCE {
    -- In case of TDD these IPDL parameters shall be used for the reference cell instead of
    -- IPDL Parameters in IE UE-Positioning-OTDOA-ReferenceCellInfo
    ue-Positioning-IPDL-Parameters-TDD-r4-ext       UE-Positioning-IPDL-Parameters-TDD-r4-ext
    OPTIONAL,
    -- These IPDL parameters shall be used for the neighbour cells in case of TDD instead of
    -- IPDL Parameters in IE UE-Positioning-OTDOA-NeighbourCellInfoList. The cells shall be
    -- listed in the same order as in IE UE-Positioning-OTDOA-NeighbourCellInfoList
    ue-Positioning-IPDL-Parameters-TDDList-r4-ext   UE-Positioning-IPDL-Parameters-TDDList-r4-ext
    OPTIONAL
}

UE-Positioning-OTDOA-AssistanceData-UEB ::=     SEQUENCE {
    ue-positioning-OTDOA-ReferenceCellInfo-UEB          UE-Positioning-OTDOA-ReferenceCellInfo-UEB
            OPTIONAL,
    ue-positioning-OTDOA-NeighbourCellList-UEB              UE-Positioning-OTDOA-NeighbourCellList-
UEB             OPTIONAL
}

UE-Positioning-IPDL-Parameters-TDDList-r4-ext ::=   SEQUENCE (SIZE (1..maxCellMeas)) OF
                                        UE-Positioning-IPDL-Parameters-TDD-r4-ext

UE-Positioning-OTDOA-Measurement ::=            SEQUENCE {
    sfn                                 INTEGER (0..4095),
    modeSpecificInfo                CHOICE {
        fdd                             SEQUENCE {
            referenceCellIDentity               PrimaryCPICH-Info,
            ue-RX-TX-TimeDifferenceType2Info    UE-RX-TX-TimeDifferenceType2Info
        },
        tdd                                 SEQUENCE {
            referenceCellIdentity           CellParametersID
        }
    },
    neighbourList                       NeighbourList                       OPTIONAL
}

UE-Positioning-OTDOA-Measurement-v390ext ::=            SEQUENCE {
    neighbourList-v390ext                   NeighbourList-v390ext
```

```
}

UE-Positioning-OTDOA-NeighbourCellInfo ::= SEQUENCE {
    modeSpecificInfo      CHOICE   {
        fdd                                 SEQUENCE {
            primaryCPICH-Info                       PrimaryCPICH-Info
        },
        tdd                                 SEQUENCE{
            cellAndChannelIdentity                  CellAndChannelIdentity
        }
    },
    frequencyInfo                           FrequencyInfo                        OPTIONAL,
    ue-positioning-IPDL-Paremeters                  UE-Positioning-IPDL-Parameters
    OPTIONAL,
    sfn-SFN-RelTimeDifference               SFN-SFN-RelTimeDifference1,
    sfn-SFN-Drift                           SFN-SFN-Drift                        OPTIONAL,
    searchWindowSize                        OTDOA-SearchWindowSize,
    positioningMode       CHOICE{
        ueBased                                     SEQUENCE {},
        ueAssisted                                  SEQUENCE {}
    }
}

UE-Positioning-OTDOA-NeighbourCellInfo-r4 ::= SEQUENCE {
    modeSpecificInfo      CHOICE   {
        fdd                                 SEQUENCE {
            primaryCPICH-Info                       PrimaryCPICH-Info
        },
        tdd                                 SEQUENCE{
            cellAndChannelIdentity                  CellAndChannelIdentity
        }
    },
    frequencyInfo                           FrequencyInfo                        OPTIONAL,
    ue-positioning-IPDL-Paremeters          UE-Positioning-IPDL-Parameters-r4    OPTIONAL,
    sfn-SFN-RelTimeDifference               SFN-SFN-RelTimeDifference1,
    sfn-Offset-Validity                     SFN-Offset-Validity                  OPTIONAL,
    sfn-SFN-Drift                           SFN-SFN-Drift                        OPTIONAL,
    searchWindowSize                        OTDOA-SearchWindowSize,
    positioningMode       CHOICE {
        ueBased                                     SEQUENCE {
            relativeNorth                           INTEGER (-20000..20000)              OPTIONAL,
            relativeEast                            INTEGER (-20000..20000)              OPTIONAL,
            relativeAltitude                        INTEGER (-4000..4000)                OPTIONAL,
            fineSFN-SFN                             FineSFN-SFN                          OPTIONAL,
            -- actual value roundTripTime = (IE value * 0.0625) + 876
            roundTripTime                           INTEGER (0.. 32766)                  OPTIONAL
        },
        ueAssisted                                  SEQUENCE {}
    }
}

UE-Positioning-OTDOA-NeighbourCellInfo-UEB ::= SEQUENCE {
    modeSpecificInfo      CHOICE   {
        fdd                                 SEQUENCE {
            primaryCPICH-Info                       PrimaryCPICH-Info
        },
        tdd                                 SEQUENCE{
            cellAndChannelIdentity                  CellAndChannelIdentity
        }
    },
    frequencyInfo                           FrequencyInfo                        OPTIONAL,
    ue-positioning-IPDL-Paremeters          UE-Positioning-IPDL-Parameters       OPTIONAL,
    sfn-SFN-RelTimeDifference               SFN-SFN-RelTimeDifference1,
    sfn-SFN-Drift                           SFN-SFN-Drift                        OPTIONAL,
    searchWindowSize                        OTDOA-SearchWindowSize,
    relativeNorth                           INTEGER (-20000..20000)              OPTIONAL,
    relativeEast                            INTEGER (-20000..20000)              OPTIONAL,
    relativeAltitude                        INTEGER (-4000..4000)                OPTIONAL,
    fineSFN-SFN                             FineSFN-SFN,
    -- actual value roundTripTime = (IE value * 0.0625) + 876
    roundTripTime                           INTEGER (0..32766)                   OPTIONAL
}

UE-Positioning-OTDOA-NeighbourCellList ::= SEQUENCE (SIZE (1..maxCellMeas)) OF
                                            UE-Positioning-OTDOA-NeighbourCellInfo

UE-Positioning-OTDOA-NeighbourCellList-r4 ::= SEQUENCE (SIZE (1..maxCellMeas)) OF
                                            UE-Positioning-OTDOA-NeighbourCellInfo-r4
```

```
UE-Positioning-OTDOA-NeighbourCellList-UEB ::= SEQUENCE (SIZE (1..maxCellMeas)) OF
                                              UE-Positioning-OTDOA-NeighbourCellInfo-UEB

UE-Positioning-OTDOA-Quality ::=              SEQUENCE {
    stdResolution                         BIT STRING (SIZE (2)),
    numberOfOTDOA-Measurements            BIT STRING (SIZE (3)),
    stdOfOTDOA-Measurements               BIT STRING (SIZE (5))
}

UE-Positioning-OTDOA-ReferenceCellInfo ::=        SEQUENCE {
    sfn                                   INTEGER (0..4095)
    OPTIONAL,
    modeSpecificInfo CHOICE {
        fdd                                   SEQUENCE {
            primaryCPICH-Info                 PrimaryCPICH-Info
        },
        tdd                                   SEQUENCE{
            cellAndChannelIdentity            CellAndChannelIdentity
        }
    },
    frequencyInfo                         FrequencyInfo                         OPTIONAL,
    positioningMode CHOICE {
        ueBased                               SEQUENCE {},
        ueAssisted                            SEQUENCE {}
    },
    ue-positioning-IPDL-Paremeters            UE-Positioning-IPDL-Parameters  OPTIONAL
}

UE-Positioning-OTDOA-ReferenceCellInfo-r4 ::=   SEQUENCE {
    sfn                                   INTEGER (0..4095)
    OPTIONAL,
    modeSpecificInfo CHOICE {
        fdd                                   SEQUENCE {
            primaryCPICH-Info                 PrimaryCPICH-Info
        },
        tdd                                   SEQUENCE{
            cellAndChannelIdentity            CellAndChannelIdentity
        }
    },
    frequencyInfo                         FrequencyInfo                         OPTIONAL,
    positioningMode CHOICE {
        ueBased                               SEQUENCE {
            cellPosition                              ReferenceCellPosition   OPTIONAL,
            -- actual value roundTripTime = (IE value * 0.0625) + 876
            roundTripTime                     INTEGER (0..32766)              OPTIONAL
        },
        ueAssisted                            SEQUENCE {}
    },
    ue-positioning-IPDL-Paremeters            UE-Positioning-IPDL-Parameters-r4   OPTIONAL
}

UE-Positioning-OTDOA-ReferenceCellInfo-UEB ::=        SEQUENCE {
    sfn                                   INTEGER (0..4095)                     OPTIONAL,
    modeSpecificInfo CHOICE {
        fdd                                   SEQUENCE {
            primaryCPICH-Info                 PrimaryCPICH-Info
        },
        tdd                                   SEQUENCE{
            cellAndChannelIdentity            CellAndChannelIdentity
        }
    },
    frequencyInfo                         FrequencyInfo                         OPTIONAL,
    cellPosition                          ReferenceCellPosition                 OPTIONAL,
    -- actual value roundTripTime = (IE value * 0.0625) + 876
    roundTripTime                         INTEGER (0..32766)                    OPTIONAL,
    ue-positioning-IPDL-Paremeters        UE-Positioning-IPDL-Parameters        OPTIONAL
}

UE-Positioning-PositionEstimateInfo ::=               SEQUENCE {
    referenceTime                     CHOICE {
        utran-GPSReferenceTimeResult          UTRAN-GPSReferenceTimeResult,
        gps-ReferenceTimeOnly                 INTEGER (0..604799999),
        cell-Timing                           SEQUENCE {
            sfn                                       INTEGER (0..4095),
            modeSpecificInfo                  CHOICE {
                fdd                                   SEQUENCE {
                    primaryCPICH-Info                         PrimaryCPICH-Info
```

```
            },
            tdd                                 SEQUENCE{
                cellAndChannelIdentity              CellAndChannelIdentity
            }
        }
    }
    },
    positionEstimate                    PositionEstimate
}

UE-Positioning-ReportCriteria ::=               CHOICE {
    ue-positioning-ReportingCriteria                UE-Positioning-EventParamList,
    periodicalReportingCriteria         PeriodicalReportingCriteria,
    noReporting                         NULL
}

UE-Positioning-ReportingQuantity ::=            SEQUENCE {
    methodType                          UE-Positioning-MethodType,
    positioningMethod                   PositioningMethod,
    -- dummy1 is not used in this version of specification and it should
    -- be ignored.
    dummy1                              UE-Positioning-ResponseTime,
    horizontal-Accuracy                 UE-Positioning-Accuracy          OPTIONAL,
    gps-TimingOfCellWanted              BOOLEAN,
    -- dummy2 is not used in this version of specification and it should
    -- be ignored.
    dummy2                              BOOLEAN,
    additionalAssistanceDataRequest     BOOLEAN,
    environmentCharacterisation         EnvironmentCharacterisation      OPTIONAL
}

UE-Positioning-ReportingQuantity-v390ext ::=        SEQUENCE {
    vertical-Accuracy                           UE-Positioning-Accuracy
}

UE-Positioning-ReportingQuantity-r4 ::=         SEQUENCE {
    methodType                          UE-Positioning-MethodType,
    positioningMethod                   PositioningMethod,
    horizontalAccuracy                  UE-Positioning-Accuracy          OPTIONAL,
    verticalAccuracy                    UE-Positioning-Accuracy          OPTIONAL,
    gps-TimingOfCellWanted              BOOLEAN,
    additionalAssistanceDataReq         BOOLEAN,
    environmentCharacterisation         EnvironmentCharacterisation      OPTIONAL
}

UE-Positioning-ReportingQuantity-v7xyext ::=    SEQUENCE {
    methodType                          UE-Positioning-MethodType,
    positioningMethod                   PositioningMethod,
    horizontalAccuracy                  UE-Positioning-Accuracy          OPTIONAL,
    verticalAccuracy                    UE-Positioning-Accuracy          OPTIONAL,
    gps-TimingOfCellWanted              BOOLEAN,
    additionalAssistanceDataReq         BOOLEAN,
    environmentCharacterisation         EnvironmentCharacterisation      OPTIONAL,
    velocityRequested                   ENUMERATED { true }              OPTIONAL
}

UE-Positioning-ResponseTime ::=             ENUMERATED {
                                        s1, s2, s4, s8, s16,
                                        s32, s64, s128 }

-- SPARE: UTRA-CarrierRSSI, Max = 76
-- Values above Max are spare
UTRA-CarrierRSSI ::=                INTEGER (0..127)

UTRAN-GPS-DriftRate ::=             ENUMERATED {
                                    utran-GPSDrift0, utran-GPSDrift1, utran-GPSDrift2,
                                    utran-GPSDrift5, utran-GPSDrift10, utran-GPSDrift15,
                                    utran-GPSDrift25, utran-GPSDrift50, utran-GPSDrift-1,
                                    utran-GPSDrift-2, utran-GPSDrift-5, utran-GPSDrift-10,
                                    utran-GPSDrift-15, utran-GPSDrift-25, utran-GPSDrift-50}

UTRAN-GPSReferenceTime ::=              SEQUENCE {
    -- For utran-GPSTimingOfCell values above 2322431999999 are not
    -- used in this version of the specification
    -- Actual value utran-GPSTimingOfCell = (ms-part * 4294967296) + ls-part
    utran-GPSTimingOfCell           SEQUENCE {
        ms-part                         INTEGER (0..1023),
        ls-part                         INTEGER (0..4294967295)
```

```
    },
    modeSpecificInfo                CHOICE {
        fdd                             SEQUENCE {
            referenceIdentity               PrimaryCPICH-Info
        },
        tdd                             SEQUENCE {
            referenceIdentity               CellParametersID
        }
    }               OPTIONAL,
    sfn                             INTEGER (0..4095)
}

UTRAN-GPSReferenceTimeResult ::=            SEQUENCE {
    -- For ue-GPSTimingOfCell values above 37158911999999 are not
    -- used in this version of the specification
    -- Actual value ue-GPSTimingOfCell = (ms-part * 4294967296) + ls-part
    ue-GPSTimingOfCell          SEQUENCE {
        ms-part                         INTEGER (0.. 16383),
        ls-part                         INTEGER (0..4294967295)
    },
    modeSpecificInfo                CHOICE {
        fdd                             SEQUENCE {
            referenceIdentity               PrimaryCPICH-Info
        },
        tdd                             SEQUENCE {
            referenceIdentity               CellParametersID
        }
    },
    sfn                             INTEGER (0..4095)
}

VarianceOfRLC-BufferPayload ::=     ENUMERATED {
                                        plv0, plv4, plv8, plv16, plv32, plv64,
                                        plv128, plv256, plv512, plv1024,
                                        plv2k, plv4k, plv8k, plv16k, spare2, spare1 }

VelocityEstimate    ::=             CHOICE {
    horizontalVelocity                              HorizontalVelocity,
    horizontalWithVerticalVelocity                  HorizontalWithVerticalVelocity,
    horizontalVelocityWithUncertainty               HorizontalVelocityWithUncertainty,
    horizontalWithVerticalVelocityAndUncertainty    HorizontalWithVerticalVelocityAndUncertainty
}

-- Actual value W = IE value * 0.1
W ::=                               INTEGER (0..20)

-- ***************************************************
--
--      OTHER INFORMATION ELEMENTS (10.3.8)
--
-- ***************************************************

BCC ::=                             INTEGER (0..7)

BCCH-ModificationInfo ::=           SEQUENCE {
    mib-ValueTag                        MIB-ValueTag,
    bcch-ModificationTime               BCCH-ModificationTime                   OPTIONAL
}

-- Actual value BCCH-ModificationTime = IE value * 8
BCCH-ModificationTime ::=           INTEGER (0..511)

BSIC ::=                            SEQUENCE {
    ncc                                 NCC,
    bcc                                 BCC
}

CBS-DRX-Level1Information ::=       SEQUENCE {
    ctch-AllocationPeriod               INTEGER (1..256),
    cbs-FrameOffset                     INTEGER (0..255)
}

CBS-DRX-Level1Information-extension-r6 ::=  ENUMERATED {p8, p16, p32, p64, p128, p256}

CDMA2000-Message ::=                SEQUENCE {
    msg-Type                            BIT STRING (SIZE (8)),
    payload                             BIT STRING (SIZE (1..512))
}
```

```
CDMA2000-MessageList ::=                SEQUENCE (SIZE (1..maxInterSysMessages)) OF
                                            CDMA2000-Message

CDMA2000-UMTS-Frequency-List ::=        SEQUENCE (SIZE (1..maxNumCDMA2000Freqs)) OF
                                            FrequencyInfoCDMA2000

CellValueTag ::=                        INTEGER (1..4)

--Actual value = 2^(IE value)
ExpirationTimeFactor ::=                INTEGER (1..8)

FDD-UMTS-Frequency-List ::=             SEQUENCE (SIZE (1..maxNumFDDFreqs)) OF
                                            FrequencyInfoFDD

FrequencyInfoCDMA2000 ::=               SEQUENCE {
                                            band-Class          BIT STRING (SIZE (5)),
                                            cdma-Freq           BIT STRING (SIZE(11))
}

GERAN-SystemInfoBlock ::=               OCTET STRING (SIZE (1..23))

GERAN-SystemInformation ::=             SEQUENCE (SIZE (1..maxGERAN-SI)) OF GERAN-SystemInfoBlock

GSM-BA-Range ::=                        SEQUENCE {
                                            gsmLowRangeUARFCN           UARFCN,
                                            gsmUpRangeUARFCN            UARFCN
}

GSM-BA-Range-List ::=                   SEQUENCE (SIZE (1..maxNumGSMFreqRanges)) OF
                                            GSM-BA-Range

-- This IE is formatted as 'TLV' and is coded in the same way as the Mobile Station Classmark 2
-- information element in [5]. The first octet is the Mobile station classmark 2 IEI and its value
-- shall be set to 33H. The second octet is the Length of mobile station classmark 2 and its value
-- shall be set to 3. The octet 3 contains the first octet of the value part of the Mobile Station
-- Classmark 2 information element, the octet 4 contains the second octet of the value part of the
-- Mobile Station Classmark 2 information element and so on. For each of these octets, the first/
-- leftmost/ most significant bit of the octet contains b8 of the corresponding octet of the Mobile
-- Station Classmark 2.
GSM-Classmark2 ::=                  OCTET STRING (SIZE (5))

-- This IE is formatted as 'V' and is coded in the same way as the value part in the Mobile station
-- classmark 3 information element in [5]
-- The value part is specified by means of CSN.1, which encoding results in a bit string, to which
-- final padding may be appended upto the next octet boundary [5]. The first/ leftmost bit of the
-- CSN.1 bit string is placed in the first/ leftmost/ most significant bit of the first
-- octet. This continues until the last bit of the CSN.1 bit string, which is placed in the last/
-- rightmost/ least significant bit of the last octet.
GSM-Classmark3 ::=                  OCTET STRING (SIZE (1..32))

GSM-MessageList ::=                 SEQUENCE (SIZE (1..maxInterSysMessages)) OF
                                        BIT STRING (SIZE (1..512))

GSM-MS-RadioAccessCapability ::=    OCTET STRING (SIZE (1..64))

GsmSecurityCapability ::=           BIT STRING {
                                        -- For each bit value "0" means false/ not supported
                                        a5-7(0),
                                        a5-6(1),
                                        a5-5(2),
                                        a5-4(3),
                                        a5-3(4),
                                        a5-2(5),
                                        a5-1(6)
                                        }   (SIZE (7))

GSM-TargetCellInfoList ::=      SEQUENCE (SIZE (1..maxGSMTargetCells)) OF
                                            GSM-TargetCellInfo


GSM-TargetCellInfo ::=              SEQUENCE {
    bcch-ARFCN                          BCCH-ARFCN,
    frequency-band                      Frequency-Band,
    bsic                                BSIC                OPTIONAL
}
```

```
IdentificationOfReceivedMessage ::= SEQUENCE {
        rrc-TransactionIdentifier       RRC-TransactionIdentifier,
        receivedMessageType             ReceivedMessageType
}

InterRAT-ChangeFailureCause ::=     CHOICE {
    configurationUnacceptable           NULL,
    physicalChannelFailure              NULL,
    protocolError                       ProtocolErrorInformation,
    unspecified                         NULL,
    spare4                              NULL,
    spare3                              NULL,
    spare2                              NULL,
    spare1                              NULL
}

GERANIu-MessageList ::=             SEQUENCE (SIZE (1..maxInterSysMessages)) OF
                                        BIT STRING (SIZE (1..32768))

GERANIu-RadioAccessCapability ::=   BIT STRING (SIZE (1..170))

InterRAT-UE-RadioAccessCapability ::= CHOICE {
    gsm                                 SEQUENCE {
        gsm-Classmark2                      GSM-Classmark2,
        gsm-Classmark3                      GSM-Classmark3
    },
    cdma2000                            SEQUENCE {
        cdma2000-MessageList                CDMA2000-MessageList
    }
}

InterRAT-UE-RadioAccessCapabilityList ::=   SEQUENCE (SIZE(1..maxInterSysMessages)) OF
                                            InterRAT-UE-RadioAccessCapability

InterRAT-UE-RadioAccessCapability-v590ext ::= SEQUENCE {
    geranIu-RadioAccessCapability       GERANIu-RadioAccessCapability
}

InterRAT-UE-RadioAccessCapability-v690ext ::= SEQUENCE {
    supportOfInter-RAT-PS-Handover      ENUMERATED { doesSupporInter-RAT-PS-Handover }  OPTIONAL,
    gsm-MS-RadioAccessCapability        GSM-MS-RadioAccessCapability
}

InterRAT-UE-SecurityCapability ::= CHOICE {
    gsm                                 SEQUENCE {
        gsmSecurityCapability           GsmSecurityCapability
    }
}

InterRAT-UE-SecurityCapList ::=     SEQUENCE (SIZE(1..maxInterSysMessages)) OF
                                        InterRAT-UE-SecurityCapability

InterRAT-HO-FailureCause ::=        CHOICE {
    configurationUnacceptable           NULL,
    physicalChannelFailure              NULL,
    protocolError                       ProtocolErrorInformation,
    interRAT-ProtocolError              NULL,
    unspecified                         NULL,
    spare11                             NULL,
    spare10                             NULL,
    spare9                              NULL,
    spare8                              NULL,
    spare7                              NULL,
    spare6                              NULL,
    spare5                              NULL,
    spare4                              NULL,
    spare3                              NULL,
    spare2                              NULL,
    spare1                              NULL
}

MasterInformationBlock ::=          SEQUENCE {
        mib-ValueTag                        MIB-ValueTag,
        -- TABULAR: The PLMN identity and ANSI-41 core network information
        -- are included in PLMN-Type.
        plmn-Type                           PLMN-Type,
        sibSb-ReferenceList                 SIBSb-ReferenceList,
    -- Extension mechanism for non- release99 information
```

```
        v690NonCriticalExtensions            SEQUENCE {
            masterInformationBlock-v690ext       MasterInformationBlock-v690ext,
            nonCriticalExtensions                SEQUENCE {}                          OPTIONAL
        }   OPTIONAL
}

MasterInformationBlock-v690ext ::=  SEQUENCE {
    multiplePLMN-List                   MultiplePLMN-List-r6            OPTIONAL
}

MIB-ValueTag ::=                    INTEGER (1..8)

NCC ::=                             INTEGER (0..7)

PLMN-ValueTag ::=                   INTEGER (1..256)


PredefinedConfigIdentityAndValueTag ::= SEQUENCE {
    predefinedConfigIdentity                PredefinedConfigIdentity,
    predefinedConfigValueTag                PredefinedConfigValueTag
}

ProtocolErrorInformation ::=        SEQUENCE {
    diagnosticsType                     CHOICE {
        type1                               SEQUENCE {
            protocolErrorCause                  ProtocolErrorCause
        },
        spare                               NULL
    }
}

ReceivedMessageType ::=             ENUMERATED {
                                        activeSetUpdate,
                                        cellChangeOrderFromUTRAN,
                                        cellUpdateConfirm,
                                        counterCheck,
                                        downlinkDirectTransfer,
                                        interRATHandoverCommand,
                                        measurementControl,
                                        pagingType2,
                                        physicalChannelReconfiguration,
                                        physicalSharedChannelAllocation,
                                        radioBearerReconfiguration,
                                        radioBearerRelease,
                                        radioBearerSetup,
                                        rrcConnectionRelease,
                                        rrcConnectionReject,
                                        rrcConnectionSetup,
                                        securityModeCommand,
                                        signallingConnectionRelease,
                                        transportChannelReconfiguration,
                                        transportFormatCombinationControl,
                                        ueCapabilityEnquiry,
                                        ueCapabilityInformationConfirm,
                                        uplinkPhysicalChannelControl,
                                        uraUpdateConfirm,
                                        utranMobilityInformation,
                                        assistanceDataDelivery,
                                        spare6, spare5, spare4, spare3, spare2,
                                        spare1
}

Rplmn-Information ::=                   SEQUENCE {
                                            gsm-BA-Range-List       GSM-BA-Range-List   OPTIONAL,
                                            fdd-UMTS-Frequency-List FDD-UMTS-Frequency-List
    OPTIONAL,
                                            tdd-UMTS-Frequency-List TDD-UMTS-Frequency-List
    OPTIONAL,
                                            cdma2000-UMTS-Frequency-List     CDMA2000-UMTS-Frequency-
List    OPTIONAL
}

Rplmn-Information-r4 ::=        SEQUENCE {
    gsm-BA-Range-List               GSM-BA-Range-List                       OPTIONAL,
    fdd-UMTS-Frequency-List         FDD-UMTS-Frequency-List                 OPTIONAL,
    -- the option is the same for 7.68 Mcps TDD as for 3.84 Mcps TDD
    -- i.e. TDD-UMTS-Frequency-List applies
    tdd384-UMTS-Frequency-List      TDD-UMTS-Frequency-List                 OPTIONAL,
```

```
    tdd128-UMTS-Frequency-List       TDD-UMTS-Frequency-List              OPTIONAL,
    cdma2000-UMTS-Frequency-List     CDMA2000-UMTS-Frequency-List         OPTIONAL
}

SchedulingInformation ::=            SEQUENCE {
    scheduling                           SEQUENCE {
        segCount                             SegCount                     DEFAULT 1,
        sib-Pos                              CHOICE {
            -- The element name indicates the repetition period and the value
            -- (multiplied by two) indicates the position of the first segment.
            rep4                                 INTEGER (0..1),
            rep8                                 INTEGER (0..3),
            rep16                                INTEGER (0..7),
            rep32                                INTEGER (0..15),
            rep64                                INTEGER (0..31),
            rep128                               INTEGER (0..63),
            rep256                               INTEGER (0..127),
            rep512                               INTEGER (0..255),
            rep1024                              INTEGER (0..511),
            rep2048                              INTEGER (0..1023),
            rep4096                              INTEGER (0..2047)
        },
        sib-PosOffsetInfo                    SibOFF-List                  OPTIONAL
    }
}

SchedulingInformationSIB ::=         SEQUENCE {
    sib-Type                             SIB-TypeAndTag,
    scheduling                           SchedulingInformation
}

SchedulingInformationSIBSb ::=       SEQUENCE {
    sibSb-Type                           SIBSb-TypeAndTag,
    scheduling                           SchedulingInformation
}

SegCount ::=                         INTEGER (1..16)

SegmentIndex ::=                     INTEGER (1..15)

-- Actual value SFN-Prime = 2 * IE value
SFN-Prime ::=                        INTEGER (0..2047)


SIB-Data-fixed ::=                   BIT STRING (SIZE (222))


SIB-Data-variable ::=                BIT STRING (SIZE (1..214))

SIBOccurIdentity ::=             INTEGER (0..15)

SIBOccurrenceIdentityAndValueTag ::=    SEQUENCE {
    sibOccurIdentity                 SIBOccurIdentity,
    sibOccurValueTag                 SIBOccurValueTag
}

SIBOccurValueTag ::=             INTEGER (0..15)

SIB-ReferenceList ::=                SEQUENCE (SIZE (1..maxSIB)) OF
                                         SchedulingInformationSIB

SIBSb-ReferenceList ::=              SEQUENCE (SIZE (1..maxSIB)) OF
                                         SchedulingInformationSIBSb

SIB-ReferenceListFACH ::=            SEQUENCE (SIZE (1..maxSIB-FACH)) OF
                                         SchedulingInformationSIB

SIB-Type ::=                         ENUMERATED {
                                         masterInformationBlock,
                                         systemInformationBlockType1,
                                         systemInformationBlockType2,
                                         systemInformationBlockType3,
                                         systemInformationBlockType4,
                                         systemInformationBlockType5,
                                         systemInformationBlockType6,
                                         systemInformationBlockType7,
        -- dummy, dummy2 and dummy3 are not used in this version of the specification,
        -- they should not be sent. If they are received they should be ignored
```

```
                                            dummy,
                                            dummy2,
                                            dummy3,
                                            systemInformationBlockType11,
                                            systemInformationBlockType12,
                                            systemInformationBlockType13,
                                            systemInformationBlockType13-1,
                                            systemInformationBlockType13-2,
                                            systemInformationBlockType13-3,
                                            systemInformationBlockType13-4,
                                            systemInformationBlockType14,
                                            systemInformationBlockType15,
                                            systemInformationBlockType15-1,
                                            systemInformationBlockType15-2,
                                            systemInformationBlockType15-3,
                                            systemInformationBlockType16,
                                            systemInformationBlockType17,
                                            systemInformationBlockType15-4,
                                            systemInformationBlockType18,
                                            schedulingBlock1,
                                            schedulingBlock2,
                                            systemInformationBlockType15-5,
                                            systemInformationBlockType5bis,
                                            spare1 }

SIB-TypeAndTag ::=                      CHOICE {
    sysInfoType1                            PLMN-ValueTag,
    sysInfoType2                            CellValueTag,
    sysInfoType3                            CellValueTag,
    sysInfoType4                            CellValueTag,
    sysInfoType5                            CellValueTag,
    sysInfoType6                            CellValueTag,
    sysInfoType7                            NULL,
    -- dummy, dummy2 and dummy3 are not used in this version of the specification,
    -- they should not be sent. If they are received they should be ignored
    dummy                                   CellValueTag,
    dummy2                                  NULL,
    dummy3                                  NULL,
    sysInfoType11                           CellValueTag,
    sysInfoType12                           CellValueTag,
    sysInfoType13                           CellValueTag,
    sysInfoType13-1                         CellValueTag,
    sysInfoType13-2                         CellValueTag,
    sysInfoType13-3                         CellValueTag,
    sysInfoType13-4                         CellValueTag,
    sysInfoType14                           NULL,
    sysInfoType15                           CellValueTag,
    sysInfoType16                           PredefinedConfigIdentityAndValueTag,
    sysInfoType17                           NULL,
    sysInfoType15-1                         CellValueTag,
    sysInfoType15-2                         SIBOccurrenceIdentityAndValueTag,
    sysInfoType15-3                         SIBOccurrenceIdentityAndValueTag,
    sysInfoType15-4                         CellValueTag,
    sysInfoType18                           CellValueTag,
    sysInfoType15-5                         CellValueTag,
    sysInfoType5bis                         CellValueTag,
    spare4                                  NULL,
    spare3                                  NULL,
    spare2                                  NULL,
    spare1                                  NULL
}

SIBSb-TypeAndTag ::=                        CHOICE {
    sysInfoType1                            PLMN-ValueTag,
    sysInfoType2                            CellValueTag,
    sysInfoType3                            CellValueTag,
    sysInfoType4                            CellValueTag,
    sysInfoType5                            CellValueTag,
    sysInfoType6                            CellValueTag,
    sysInfoType7                            NULL,
    -- dummy, dummy2 and dummy3 are not used in this version of the specification,
    -- they should not be sent. If they are received they should be ignored
    dummy                                   CellValueTag,
    dummy2                                  NULL,
    dummy3                                  NULL,
    sysInfoType11                           CellValueTag,
    sysInfoType12                           CellValueTag,
    sysInfoType13                           CellValueTag,
```

```
	sysInfoType13-1				CellValueTag,
	sysInfoType13-2				CellValueTag,
	sysInfoType13-3				CellValueTag,
	sysInfoType13-4				CellValueTag,
	sysInfoType14				NULL,
	sysInfoType15				CellValueTag,
	sysInfoType16				PredefinedConfigIdentityAndValueTag,
	sysInfoType17				NULL,
	sysInfoTypeSB1				CellValueTag,
	sysInfoTypeSB2				CellValueTag,
	sysInfoType15-1				CellValueTag,
	sysInfoType15-2				SIBOccurrenceIdentityAndValueTag,
	sysInfoType15-3				SIBOccurrenceIdentityAndValueTag,
	sysInfoType15-4				CellValueTag,
	sysInfoType18				CellValueTag,
	sysInfoType15-5				CellValueTag,
	sysInfoType5bis				CellValueTag,
	spare2					NULL,
	spare1					NULL
}

SibOFF ::=				ENUMERATED {
						so2, so4, so6, so8, so10,
						so12, so14, so16, so18,
						so20, so22, so24, so26,
						so28, so30, so32 }

SibOFF-List ::=				SEQUENCE (SIZE (1..15)) OF
						SibOFF

SysInfoType1 ::=			SEQUENCE {
	-- Core network IEs
		cn-CommonGSM-MAP-NAS-SysInfo	NAS-SystemInformationGSM-MAP,
		cn-DomainSysInfoList		CN-DomainSysInfoList,
	-- User equipment IEs
		ue-ConnTimersAndConstants	UE-ConnTimersAndConstants		OPTIONAL,
		ue-IdleTimersAndConstants	UE-IdleTimersAndConstants		OPTIONAL,
	-- Extension mechanism for non- release99 information
		v3a0NonCriticalExtensions	SEQUENCE {
			sysInfoType1-v3a0ext	SysInfoType1-v3a0ext-IEs,
			nonCriticalExtensions	SEQUENCE {} OPTIONAL
		}				OPTIONAL
}

SysInfoType1-v3a0ext-IEs ::= SEQUENCE {
	ue-ConnTimersAndConstants-v3a0ext	UE-ConnTimersAndConstants-v3a0ext,
	ue-IdleTimersAndConstants-v3a0ext	UE-IdleTimersAndConstants-v3a0ext
}

SysInfoType2 ::=			SEQUENCE {
	-- UTRAN mobility IEs
		ura-IdentityList		URA-IdentityList,
	-- Extension mechanism for non- release99 information
		nonCriticalExtensions		SEQUENCE {}				OPTIONAL
}

SysInfoType3 ::=			SEQUENCE {
		sib4indicator			BOOLEAN,
	-- UTRAN mobility IEs
		cellIdentity			CellIdentity,
		cellSelectReselectInfo		CellSelectReselectInfoSIB-3-4,
		cellAccessRestriction		CellAccessRestriction,
	-- Extension mechanism for non- release99 information
		v4b0NonCriticalExtensions	SEQUENCE {
			sysInfoType3-v4b0ext		SysInfoType3-v4b0ext-IEs,
			v590NonCriticalExtension	SEQUENCE {
				sysInfoType3-v590ext		SysInfoType3-v590ext,
				v5c0NoncriticalExtension	SEQUENCE {
					sysInfoType3-v5c0ext		SysInfoType3-v5c0ext-IEs,
					v670NonCriticalExtension	SEQUENCE {
						sysInfoType3-v670ext		SysInfoType3-v670ext,
						nonCriticalExtensions		SEQUENCE {}		OPTIONAL
					}				OPTIONAL
				}				OPTIONAL
			}				OPTIONAL
		}				OPTIONAL
}
```

```
SysInfoType3-v4b0ext-IEs ::= SEQUENCE {
    mapping-LCR                     Mapping-LCR-r4                          OPTIONAL
}

SysInfoType3-v590ext ::= SEQUENCE {
    cellSelectReselectInfo-v590ext      CellSelectReselectInfo-v590ext      OPTIONAL
}

SysInfoType3-v5c0ext-IEs ::= SEQUENCE {
    cellSelectReselectInfoTreselectionScaling-v5c0ext
                                        CellSelectReselectInfoTreselectionScaling-v5c0ext   OPTIONAL
}

SysInfoType3-v670ext ::= SEQUENCE {
        domainSpecificAccessRestrictionParametersForPLMNOfMIB
                                    DomainSpecificAccessRestrictionParam-v670ext    OPTIONAL,
        domainSpecificAccessRestictionForSharedNetwork
                                    DomainSpecificAccessRestrictionForSharedNetwork-v670ext OPTIONAL
}

SysInfoType4 ::=                    SEQUENCE {
    -- UTRAN mobility IEs
        cellIdentity                    CellIdentity,
        cellSelectReselectInfo          CellSelectReselectInfoSIB-3-4,
        cellAccessRestriction           CellAccessRestriction,
    -- Extension mechanism for non- release99 information
        v4b0NonCriticalExtensions       SEQUENCE {
            sysInfoType4-v4b0ext            SysInfoType4-v4b0ext-IEs,
            v590NonCriticalExtension        SEQUENCE {
                sysInfoType4-v590ext            SysInfoType4-v590ext,
                v5b0NonCriticalExtension        SEQUENCE {
                    sysInfoType4-v5b0ext            SysInfoType4-v5b0ext-IEs,
                    v5c0NonCriticalExtension            SEQUENCE {
                        sysInfoType4-v5c0ext                SysInfoType4-v5c0ext-IEs,
                        nonCriticalExtensions           SEQUENCE {}                 OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
}

SysInfoType4-v4b0ext-IEs ::= SEQUENCE {
    mapping-LCR                     Mapping-LCR-r4                          OPTIONAL
}


SysInfoType4-v590ext ::= SEQUENCE {
    cellSelectReselectInfo-v590ext      CellSelectReselectInfo-v590ext      OPTIONAL
}

SysInfoType4-v5b0ext-IEs ::= SEQUENCE {
    cellSelectReselectInfoPCHFACH-v5b0ext   CellSelectReselectInfoPCHFACH-v5b0ext       OPTIONAL
}

SysInfoType4-v5c0ext-IEs ::= SEQUENCE {
    cellSelectReselectInfoTreselectionScaling-v5c0ext
                                        CellSelectReselectInfoTreselectionScaling-v5c0ext   OPTIONAL
}

SysInfoType5 ::=                    SEQUENCE {
        sib6indicator                   BOOLEAN,
    -- Physical channel IEs
        pich-PowerOffset                PICH-PowerOffset,
        modeSpecificInfo                CHOICE {
            fdd                             SEQUENCE {
                aich-PowerOffset                AICH-PowerOffset
            },
            tdd                             SEQUENCE {
    -- If PDSCH/PUSCH is configured for 1.28Mcps TDD, the following IEs should be absent
    --   and the info included in the tdd128SpecificInfo instead.
    -- If PDSCH/PUSCH is configured for 3.84Mcps TDD in R5, HCR-r5-SpecificInfo should also be
    -- included.
                pusch-SysInfoList-SFN           PUSCH-SysInfoList-SFN       OPTIONAL,
                pdsch-SysInfoList-SFN           PDSCH-SysInfoList-SFN       OPTIONAL,
                openLoopPowerControl-TDD        OpenLoopPowerControl-TDD
            }
        },
        primaryCCPCH-Info               PrimaryCCPCH-Info                   OPTIONAL,
```

```
        prach-SystemInformationList         PRACH-SystemInformationList,
        sCCPCH-SystemInformationList        SCCPCH-SystemInformationList,
        -- cbs-DRX-Level1Information is conditional on any of the CTCH indicator IEs in
        -- sCCPCH-SystemInformationList
        cbs-DRX-Level1Information           CBS-DRX-Level1Information           OPTIONAL,
    -- Extension mechanism for non- release99 information
        v4b0NonCriticalExtensions           SEQUENCE {
            sysInfoType5-v4b0ext                SysInfoType5-v4b0ext-IEs        OPTIONAL,
        -- Extension mechanism for non- rel-4 information
            v590NonCriticalExtensions           SEQUENCE {
                sysInfoType5-v590ext                SysInfoType5-v590ext-IEs        OPTIONAL,
                v650NonCriticalExtensions           SEQUENCE {
                    sysInfoType5-v650ext                SysInfoType5-v650ext-IES        OPTIONAL,
                    v680NonCriticalExtensions           SEQUENCE {
                        sysInfoType5-v680ext                SysInfoType5-v680ext-IEs        OPTIONAL,
                        v690NonCriticalExtensions           SEQUENCE {
                            sysInfoType5-v690ext                SysInfoType5-v690ext-IEs,
                            v7xyNonCriticalExtensions           SEQUENCE {
                                sysInfoType5-v7xyext                SysInfoType5-v7xyext-IEs,
                                nonCriticalExtensions               SEQUENCE {}         OPTIONAL
                            }       OPTIONAL
                        }       OPTIONAL
                    }       OPTIONAL
                }       OPTIONAL
            }       OPTIONAL
        }       OPTIONAL
}

SysInfoType5-v4b0ext-IEs ::= SEQUENCE {
    --The following IE PNBSCH-Allocation-r4 shall be used for 3.84Mcps TDD only.
    pNBSCH-Allocation-r4                PNBSCH-Allocation-r4            OPTIONAL,
    -- In case of TDD, the following IE is included instead of the
    -- IE up-IPDL-Parameter in up-OTDOA-AssistanceData.
    openLoopPowerControl-IPDL-TDD   OpenLoopPowerControl-IPDL-TDD-r4    OPTIONAL,
-- If SysInfoType5 is sent to describe a 1.28Mcps TDD cell, the IE PRACH-RACH-Info included in
-- PRACH-SystemInformationList shall be ignored, the IE PRACH-Partitioning and the
-- IE rach-TransportFormatSet shall be absent and the corresponding IE in the following
-- PRACH-SystemInformationList-LCR-r4 shall be used
    prach-SystemInformationList-LCR-r4  PRACH-SystemInformationList-LCR-r4  OPTIONAL,
    tdd128SpecificInfo                  SEQUENCE {
        pusch-SysInfoList-SFN               PUSCH-SysInfoList-SFN-LCR-r4    OPTIONAL,
        pdsch-SysInfoList-SFN               PDSCH-SysInfoList-SFN-LCR-r4    OPTIONAL,
        pCCPCH-LCR-Extensions               PrimaryCCPCH-Info-LCR-r4-ext    OPTIONAL,
        sCCPCH-LCR-ExtensionsList           SCCPCH-SystemInformationList-LCR-r4-ext
    }                                                                   OPTIONAL,
    frequencyBandIndicator              RadioFrequencyBandFDD           OPTIONAL
}

SysInfoType5-v590ext-IEs ::= SEQUENCE {
    hcr-r5-SpecificInfo                 SEQUENCE {
        pusch-SysInfoList-SFN               PUSCH-SysInfoList-SFN-HCR-r5    OPTIONAL,
        pdsch-SysInfoList-SFN               PDSCH-SysInfoList-SFN-HCR-r5    OPTIONAL
    }                                                                   OPTIONAL
}

SysInfoType5-v650ext-IEs ::= SEQUENCE {
    frequencyBandIndicator2             RadioFrequencyBandFDD2
}

SysInfoType5-v680ext-IEs ::= SEQUENCE {
    -- TABULAR: HSDPA Cell Indicator is MD in tabular description
    -- Default value is 'HSDPA Capability not indicated'
    hsdpa-CellIndicator         ENUMERATED { hsdpa-CapableCell }            OPTIONAL
}

SysInfoType5-v690ext-IEs ::=            SEQUENCE {
    -- TABULAR: E-DCH Cell Indicator is MD in tabular description
    -- Default value is 'E-DCH Capability not indicated'
    edch-CellIndicator                  ENUMERATED { edch-CapableCell }     OPTIONAL,
    sccpch-SystemInformation-MBMS       CHOICE {
        mcchOnSCCPCHusedForNonMBMS          MBMS-MCCH-ConfigurationInfo-r6,
        mcchOnSCCPCHusedOnlyForMBMS         SCCPCH-SystemInformation-MBMS-r6
    }       OPTIONAL,
    additionalPRACH-TF-and-TFCS-CCCH-List   AdditionalPRACH-TF-and-TFCS-CCCH-List   OPTIONAL,
    cBS-DRX-Level1Information-extension     CBS-DRX-Level1Information-extension-r6  OPTIONAL
}

SysInfoType5-v7xyext-IEs ::=            SEQUENCE {
```

```
    pusch-SysInfoList-SFN-VHCR          PUSCH-SysInfoList-SFN-VHCR      OPTIONAL,
    prach-SystemInformationList-r7      PRACH-SystemInformationList-r7  OPTIONAL,
    pdsch-SysInfoList-SFN-r7            PDSCH-SysInfoList-r7            OPTIONAL,
    sccpch-SystemInformation-MBMS       CHOICE {
        mcchOnSCCPCHusedForNonMBMS          MBMS-MCCH-ConfigurationInfo-r6,
        mcchOnSCCPCHusedOnlyForMBMS         SCCPCH-SystemInformation-MBMS-r7
    }       OPTIONAL,
    sCCPCH-SystemInformationList-r7     SCCPCH-SystemInformationList-r7 OPTIONAL
}


-- SysInfoType5bis uses the same structure as SysInfoType5
SysInfoType5bis ::= SysInfoType5

SysInfoType6 ::=                    SEQUENCE {
    -- Physical channel IEs
        pich-PowerOffset                PICH-PowerOffset,
        modeSpecificInfo                CHOICE {
            fdd                             SEQUENCE {
                aich-PowerOffset                AICH-PowerOffset,
                -- dummy is not used in this version of specification, it should
                -- not be sent and if received it should be ignored.
                dummy                           CSICH-PowerOffset           OPTIONAL
            },
            tdd                             SEQUENCE {
                -- If PDSCH/PUSCH is configured for 1.28Mcps TDD, pusch-SysInfoList-SFN,
                -- pdsch-SysInfoList-SFN and openLoopPowerControl-TDD should be absent
                -- and the info included in the tdd128SpecificInfo instead.
                -- If PDSCH/PUSCH is configured for 3.84Mcps TDD in R5, HCR-r5-SpecificInfo should
                -- also be included.
                pusch-SysInfoList-SFN           PUSCH-SysInfoList-SFN       OPTIONAL,
                pdsch-SysInfoList-SFN           PDSCH-SysInfoList-SFN       OPTIONAL,
                openLoopPowerControl-TDD        OpenLoopPowerControl-TDD
            }
        },
        primaryCCPCH-Info               PrimaryCCPCH-Info                   OPTIONAL,
        prach-SystemInformationList     PRACH-SystemInformationList         OPTIONAL,
        sCCPCH-SystemInformationList    SCCPCH-SystemInformationList        OPTIONAL,
        cbs-DRX-Level1Information       CBS-DRX-Level1Information           OPTIONAL,
        -- Conditional on any of the CTCH indicator IEs in
        -- sCCPCH-SystemInformationList
    -- Extension mechanism for non- release99 information
        v4b0NonCriticalExtensions       SEQUENCE {
            sysInfoType6-v4b0ext            SysInfoType6-v4b0ext-IEs        OPTIONAL,
        -- Extension mechanism for non- rel-4 information
            v590NonCriticalExtensions   SEQUENCE {
                sysInfoType6-v590ext            SysInfoType6-v590ext-IEs        OPTIONAL,
                v650nonCriticalExtensions       SEQUENCE {
                    sysInfoType6-v650ext            SysInfoType6-v650ext-IEs        OPTIONAL,
                    v690nonCriticalExtensions       SEQUENCE {
                        sysInfoType6-v690ext            SysInfoType6-v690ext-IEs,
                        v7xyNonCriticalExtensions       SEQUENCE {
                            sysInfoType6-v7xyext            SysInfoType6-v7xyext-IEs,
                            nonCriticalExtensions           SEQUENCE {}             OPTIONAL
                        }   OPTIONAL
                    }                           OPTIONAL
                }                           OPTIONAL
            }                           OPTIONAL
        }                           OPTIONAL
}

SysInfoType6-v4b0ext-IEs ::= SEQUENCE {
    -- openLoopPowerControl-IPDL-TDD is present only if IPDLs are applied for TDD
    openLoopPowerControl-IPDL-TDD   OpenLoopPowerControl-IPDL-TDD-r4    OPTIONAL,
    -- If SysInfoType6 is sent to describe a 1.28Mcps TDD cell, the IE PRACH-RACH-Info included
    -- in PRACH-SystemInformationList shall be ignored, the IE PRACH-Partitioning and the
    -- IE rach-TransportFormatSet shall be absent and the corresponding IEs in the following
    -- PRACH-SystemInformationList-LCR-r4 shall be used
    prach-SystemInformationList-LCR-r4  PRACH-SystemInformationList-LCR-r4  OPTIONAL,
    tdd128SpecificInfo              SEQUENCE {
        pusch-SysInfoList-SFN           PUSCH-SysInfoList-SFN-LCR-r4    OPTIONAL,
        pdsch-SysInfoList-SFN           PDSCH-SysInfoList-SFN-LCR-r4    OPTIONAL,
        pCCPCH-LCR-Extensions           PrimaryCCPCH-Info-LCR-r4-ext    OPTIONAL,
        sCCPCH-LCR-ExtensionsList       SCCPCH-SystemInformationList-LCR-r4-ext OPTIONAL
    }                                                               OPTIONAL,
    frequencyBandIndicator          RadioFrequencyBandFDD           OPTIONAL
}
```

```
SysInfoType6-v590ext-IEs ::= SEQUENCE {
    hcr-r5-SpecificInfo             SEQUENCE {
        pusch-SysInfoList-SFN           PUSCH-SysInfoList-SFN-HCR-r5    OPTIONAL,
        pdsch-SysInfoList-SFN           PDSCH-SysInfoList-SFN-HCR-r5    OPTIONAL
    }                                                                   OPTIONAL
}

SysInfoType6-v650ext-IEs ::= SEQUENCE {
    frequencyBandIndicator2         RadioFrequencyBandFDD2
}

SysInfoType6-v690ext-IEs ::= SEQUENCE {
    additionalPRACH-TF-and-TFCS-CCCH-List   AdditionalPRACH-TF-and-TFCS-CCCH-List   OPTIONAL
}

SysInfoType6-v7xyext-IEs ::=        SEQUENCE {
    pusch-SysInfoList-SFN-VHCR          PUSCH-SysInfoList-SFN-VHCR      OPTIONAL,
    pdsch-SysInfoList-SFN-r7            PDSCH-SysInfoList-r7            OPTIONAL,
    prach-SystemInformationList-r7      PRACH-SystemInformationList-r7  OPTIONAL,
    sCCPCH-SystemInformationList-r7     SCCPCH-SystemInformationList-r7 OPTIONAL
}

SysInfoType7 ::=                    SEQUENCE {
    -- Physical channel IEs
        modeSpecificInfo                CHOICE {
            fdd                             SEQUENCE {
                ul-Interference                 UL-Interference
            },
            tdd                             NULL
        },
        prach-Information-SIB5-List     DynamicPersistenceLevelList,
        prach-Information-SIB6-List     DynamicPersistenceLevelList         OPTIONAL,
        expirationTimeFactor            ExpirationTimeFactor                OPTIONAL,
    -- Extension mechanism for non- release99 information
        nonCriticalExtensions           SEQUENCE {}                         OPTIONAL
}

-- This IE is not used in this version of the specification.
-- It was kept only for backwards compatibility reasons
SysInfoType8 ::=                    SEQUENCE {
    -- User equipment IEs
        -- dummy1, dummy2, dummy3 are not used in this version of the specification and
        -- they should be ignored by the receiver.
        dummy1                          CPCH-Parameters,
    -- Physical channel IEs
        dummy2                          CPCH-SetInfoList,
        dummy3                          CSICH-PowerOffset,
    -- Extension mechanism for non- release99 information
        nonCriticalExtensions           SEQUENCE {}                         OPTIONAL
}

-- This IE is not used in this version of the specification.
-- It was kept only for backwards compatibility reasons
SysInfoType9 ::=                    SEQUENCE {
    -- Physical channel IEs
        -- dummy is not used in this version of the specification and
        -- it should be ignored by the receiver.
        dummy                           CPCH-PersistenceLevelsList,
    -- Extension mechanism for non- release99 information
        nonCriticalExtensions           SEQUENCE {}                         OPTIONAL
}

-- This IE is not used in this version of the specification.
-- It was kept only for backwards compatibility reasons
SysInfoType10 ::=                   SEQUENCE {
    -- User equipment IEs
        -- dummy is not used in this version of the specification, it should
        -- not be sent and if received it should be ignored.
        dummy                           DRAC-SysInfoList,
    -- Extension mechanism for non- release99 information
        nonCriticalExtensions           SEQUENCE {}                         OPTIONAL
}

SysInfoType11 ::=                   SEQUENCE {
        sib12indicator                  BOOLEAN,
    -- Measurement IEs
        fach-MeasurementOccasionInfo    FACH-MeasurementOccasionInfo        OPTIONAL,
        measurementControlSysInfo       MeasurementControlSysInfo,
```

```
    -- Extension mechanism for non- release99 information
        v4b0NonCriticalExtensions           SEQUENCE {
            sysInfoType11-v4b0ext               SysInfoType11-v4b0ext-IEs           OPTIONAL,
            v590NonCriticalExtension            SEQUENCE {
                sysInfoType11-v590ext               SysInfoType11-v590ext-IEs,
                v690NonCriticalExtensions               SEQUENCE {
                    sysInfoType11-v690ext               SysInfoType11-v690ext-IEs,
                    nonCriticalExtensions               SEQUENCE {}                         OPTIONAL
                }                                   OPTIONAL
            }                                   OPTIONAL
        }                                   OPTIONAL
}

SysInfoType11-v4b0ext-IEs ::= SEQUENCE {
    fach-MeasurementOccasionInfo-LCR-Ext    FACH-MeasurementOccasionInfo-LCR-r4-ext OPTIONAL,
    measurementControlSysInfo-LCR           MeasurementControlSysInfo-LCR-r4-ext
}

SysInfoType11-v590ext-IEs ::= SEQUENCE {
    --The order of the list corresponds to the order of cell in newIntraFrequencyCellInfoList
    newIntraFrequencyCellInfoList-v590ext   SEQUENCE (SIZE (1..maxCellMeas)) OF
                                                CellSelectReselectInfo-v590ext  OPTIONAL,
    --The order of the list corresponds to the order of cell in newInterFrequencyCellInfoList
    newInterFrequencyCellInfoList-v590ext   SEQUENCE (SIZE (1..maxCellMeas)) OF
                                                CellSelectReselectInfo-v590ext  OPTIONAL,
    --The order of the list corresponds to the order of cell in newInterRATCellInfoList
    newInterRATCellInfoList-v590ext         SEQUENCE (SIZE (1..maxCellMeas)) OF
                                                CellSelectReselectInfo-v590ext  OPTIONAL,
    intraFreqEventCriteriaList-v590ext      Intra-FreqEventCriteriaList-v590ext     OPTIONAL,
    intraFreqReportingCriteria-1b-r5        IntraFreqReportingCriteria-1b-r5    OPTIONAL,
    intraFreqEvent-1d-r5                    IntraFreqEvent-1d-r5                OPTIONAL
}

SysInfoType11-v690ext-IEs ::= SEQUENCE {
    -- Measurement IEs
    interFreqRACHReportingInfo          InterFreqRACHReportingInfo          OPTIONAL
}

SysInfoType12 ::=                   SEQUENCE {
    -- Measurement IEs
        fach-MeasurementOccasionInfo    FACH-MeasurementOccasionInfo        OPTIONAL,
        measurementControlSysInfo       MeasurementControlSysInfo,
    -- Extension mechanism for non- release99 information
        v4b0NonCriticalExtensions           SEQUENCE {
            sysInfoType12-v4b0ext               SysInfoType12-v4b0ext-IEs           OPTIONAL,
            v590NonCriticalExtension            SEQUENCE {
                sysInfoType12-v590ext               SysInfoType12-v590ext-IEs,
                v690NonCriticalExtensions               SEQUENCE {
                    sysInfoType12-v690ext               SysInfoType12-v690ext-IEs,
                    nonCriticalExtensions               SEQUENCE {}                         OPTIONAL
                }                                   OPTIONAL
            }                                   OPTIONAL
        }                                   OPTIONAL
}

SysInfoType12-v4b0ext-IEs ::= SEQUENCE {
    fach-MeasurementOccasionInfo-LCR-Ext    FACH-MeasurementOccasionInfo-LCR-r4-ext OPTIONAL,
    measurementControlSysInfo-LCR           MeasurementControlSysInfo-LCR-r4-ext
}

SysInfoType12-v590ext-IEs ::= SEQUENCE {
    --The order of the list corresponds to the order of cell in newIntraFrequencyCellInfoList
    newIntraFrequencyCellInfoList-v590ext   SEQUENCE (SIZE (1..maxCellMeas)) OF
                                                CellSelectReselectInfo-v590ext  OPTIONAL,
    --The order of the list corresponds to the order of cell in newInterFrequencyCellInfoList
    newInterFrequencyCellInfoList-v590ext   SEQUENCE (SIZE (1..maxCellMeas)) OF
                                                CellSelectReselectInfo-v590ext  OPTIONAL,
    --The order of the list corresponds to the order of cell in newInterRATCellInfoList
    newInterRATCellInfoList-v590ext         SEQUENCE (SIZE (1..maxCellMeas)) OF
                                                CellSelectReselectInfo-v590ext  OPTIONAL,
    intraFreqEventCriteriaList-v590ext      Intra-FreqEventCriteriaList-v590ext     OPTIONAL,
    intraFreqReportingCriteria-1b-r5        IntraFreqReportingCriteria-1b-r5    OPTIONAL,
    intraFreqEvent-1d-r5                    IntraFreqEvent-1d-r5                OPTIONAL
}

SysInfoType12-v690ext-IEs ::= SEQUENCE {
    -- Measurement IEs
    interFreqRACHReportingInfo          InterFreqRACHReportingInfo          OPTIONAL
```

```
}

SysInfoType13 ::=                   SEQUENCE {
    -- Core network IEs
        cn-DomainSysInfoList            CN-DomainSysInfoList,
    -- User equipment IEs
        ue-IdleTimersAndConstants       UE-IdleTimersAndConstants           OPTIONAL,
        capabilityUpdateRequirement     CapabilityUpdateRequirement         OPTIONAL,
    -- Extension mechanism for non- release99 information
        v3a0NonCriticalExtensions           SEQUENCE {
            sysInfoType13-v3a0ext           SysInfoType13-v3a0ext-IEs,
            v4b0NonCriticalExtensions       SEQUENCE {
                sysInfoType13-v4b0ext           SysInfoType13-v4b0ext-IEs,
            -- Extension mechanism for non- release99 information
                v7xyNonCriticalExtensions       SEQUENCE {
                    sysInfoType13-v7xyext           SysInfoType13-v7xyext-IEs,
                    nonCriticalExtensions           SEQUENCE {}                 OPTIONAL
                }                               OPTIONAL
            }                               OPTIONAL
        }                               OPTIONAL
}

SysInfoType13-v3a0ext-IEs ::= SEQUENCE {
    ue-IdleTimersAndConstants-v3a0ext       UE-IdleTimersAndConstants-v3a0ext
}

SysInfoType13-v4b0ext-IEs ::= SEQUENCE {
    capabilityUpdateRequirement-r4Ext   CapabilityUpdateRequirement-r4-ext  OPTIONAL
}

SysInfoType13-v7xyext-IEs ::= SEQUENCE {
    capabilityUpdateRequirement-r7Ext   CapabilityUpdateRequirement-r7-ext  OPTIONAL
}

SysInfoType13-1 ::=                 SEQUENCE {
    -- ANSI-41 IEs
        ansi-41-RAND-Information        ANSI-41-RAND-Information,
    -- Extension mechanism for non- release99 information
        nonCriticalExtensions           SEQUENCE {}                         OPTIONAL
}

SysInfoType13-2 ::=                 SEQUENCE {
    -- ANSI-41 IEs
        ansi-41-UserZoneID-Information  ANSI-41-UserZoneID-Information,
    -- Extension mechanism for non- release99 information
        nonCriticalExtensions           SEQUENCE {}                         OPTIONAL
}

SysInfoType13-3 ::=                 SEQUENCE {
    -- ANSI-41 IEs
        ansi-41-PrivateNeighbourListInfo ANSI-41-PrivateNeighbourListInfo,
    -- Extension mechanism for non- release99 information
        nonCriticalExtensions           SEQUENCE {}                         OPTIONAL
}

SysInfoType13-4 ::=                 SEQUENCE {
    -- ANSI-41 IEs
        ansi-41-GlobalServiceRedirectInfo
                                        ANSI-41-GlobalServiceRedirectInfo,
    -- Extension mechanism for non- release99 information
        nonCriticalExtensions           SEQUENCE {}                         OPTIONAL
}

SysInfoType14 ::=                   SEQUENCE {
    -- Physical channel IEs
        individualTS-InterferenceList   IndividualTS-InterferenceList,
        expirationTimeFactor            ExpirationTimeFactor                OPTIONAL,
    -- Extension mechanism for non- release99 information
        nonCriticalExtensions           SEQUENCE {}                         OPTIONAL
}

SysInfoType15 ::=                   SEQUENCE {
    -- Measurement IEs

        ue-positioning-GPS-CipherParameters     UE-Positioning-CipherParameters     OPTIONAL,
        ue-positioning-GPS-ReferenceLocation    ReferenceLocation,
        ue-positioning-GPS-ReferenceTime        UE-Positioning-GPS-ReferenceTime,
```

```
        ue-positioning-GPS-Real-timeIntegrity       BadSatList                          OPTIONAL,
    -- Extension mechanism for non- release99 information
        v4b0NonCriticalExtensions               SEQUENCE {
            sysInfoType15-v4b0ext                   SysInfoType15-v4b0ext-IEs,
        -- Extension mechanism for non- release4 information
            nonCriticalExtensions                   SEQUENCE {}             OPTIONAL
        }   OPTIONAL
}

SysInfoType15-v4b0ext-IEs ::= SEQUENCE {
    up-Ipdl-Parameters-TDD          UE-Positioning-IPDL-Parameters-TDD-r4-ext   OPTIONAL
}

SysInfoType15-1 ::=                 SEQUENCE {
    -- DGPS corrections
        ue-positioning-GPS-DGPS-Corrections         UE-Positioning-GPS-DGPS-Corrections,

    -- Extension mechanism for non- release99 information
        nonCriticalExtensions           SEQUENCE {}             OPTIONAL
}

SysInfoType15-2 ::=                 SEQUENCE {
    -- Ephemeris and clock corrections
        transmissionTOW                 INTEGER (0..604799),
        satID                           SatID,
        ephemerisParameter              EphemerisParameter,

    -- Extension mechanism for non- release99 information
        nonCriticalExtensions           SEQUENCE {}         OPTIONAL
}

SysInfoType15-3 ::=                 SEQUENCE {
    -- Almanac and other data
        transmissionTOW                 INTEGER (0.. 604799),
        ue-positioning-GPS-Almanac                  UE-Positioning-GPS-Almanac
    OPTIONAL,
        ue-positioning-GPS-IonosphericModel         UE-Positioning-GPS-IonosphericModel
    OPTIONAL,
        ue-positioning-GPS-UTC-Model                UE-Positioning-GPS-UTC-Model
    OPTIONAL,
        satMask                         BIT STRING (SIZE (1..32))   OPTIONAL,
        lsbTOW                          BIT STRING (SIZE (8))       OPTIONAL,
    -- Extension mechanism for non- release99 information
        nonCriticalExtensions           SEQUENCE {}                 OPTIONAL
}

SysInfoType15-4 ::=                 SEQUENCE {
    -- Measurement IEs
        ue-positioning-OTDOA-CipherParameters   UE-Positioning-CipherParameters         OPTIONAL,
        ue-positioning-OTDOA-AssistanceData     UE-Positioning-OTDOA-AssistanceData,
        v3a0NonCriticalExtensions               SEQUENCE {
            sysInfoType15-4-v3a0ext                 SysInfoType15-4-v3a0ext,
        -- Extension mechanism for non- release99 information
            v4b0NonCriticalExtensions               SEQUENCE {
                sysInfoType15-4-v4b0ext                 SysInfoType15-4-v4b0ext,
                nonCriticalExtensions                   SEQUENCE {}     OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
}

SysInfoType15-4-v3a0ext ::= SEQUENCE {
    sfn-Offset-Validity             SFN-Offset-Validity     OPTIONAL
}

SysInfoType15-4-v4b0ext ::= SEQUENCE {
    ue-Positioning-OTDOA-AssistanceData-r4ext   UE-Positioning-OTDOA-AssistanceData-r4ext   OPTIONAL
}

SysInfoType15-5 ::=                 SEQUENCE {
    -- Measurement IEs
        ue-positioning-OTDOA-AssistanceData-UEB     UE-Positioning-OTDOA-AssistanceData-UEB,
        v3a0NonCriticalExtensions               SEQUENCE {
            sysInfoType15-5-v3a0ext                 SysInfoType15-5-v3a0ext,
        -- Extension mechanism for non- release99 information
            nonCriticalExtensions                   SEQUENCE {}     OPTIONAL
        }   OPTIONAL
}
```

```
SysInfoType15-5-v3a0ext ::= SEQUENCE {
    sfn-Offset-Validity         SFN-Offset-Validity     OPTIONAL
}

SysInfoType16 ::=                   SEQUENCE {
    -- Radio bearer IEs
        preDefinedRadioConfiguration    PreDefRadioConfiguration,
    -- Extension mechanism for non- release99 information
        nonCriticalExtensions           SEQUENCE {}                     OPTIONAL
}

SysInfoType17 ::=                   SEQUENCE {
    -- Physical channel IEs
        -- If PDSCH/PUSCH is configured for 1.28Mcps TDD, pusch-SysInfoList and
        -- pdsch-SysInfoList should be absent and the info included in the
        -- tdd128SpecificInfo instead.
        -- If PDSCH/PUSCH is configured for 3.84Mcps TDD in R5, HCR-r5-SpecificInfo should also be
        -- included.
        pusch-SysInfoList               PUSCH-SysInfoList               OPTIONAL,
        pdsch-SysInfoList               PDSCH-SysInfoList               OPTIONAL,
    -- Extension mechanism for non- release99 information
        v4b0NonCriticalExtensions       SEQUENCE {
            sysInfoType17-v4b0ext           SysInfoType17-v4b0ext-IEs,
            v590NonCriticalExtensions   SEQUENCE {
                sysInfoType17-v590ext       SysInfoType17-v590ext-IEs       OPTIONAL,
                v7xyNonCriticalExtensions       SEQUENCE {
                    sysInfoType17-v7xyext       SysInfoType17-v7xyext-IEs,
                    nonCriticalExtensions       SEQUENCE {}             OPTIONAL
                }                               OPTIONAL
            }                           OPTIONAL
        }                           OPTIONAL
}

SysInfoType17-v4b0ext-IEs ::= SEQUENCE {
    tdd128SpecificInfo              SEQUENCE {
        pusch-SysInfoList               PUSCH-SysInfoList-LCR-r4        OPTIONAL,
        pdsch-SysInfoList               PDSCH-SysInfoList-LCR-r4        OPTIONAL
    }                                                                   OPTIONAL
}

SysInfoType17-v590ext-IEs ::= SEQUENCE {
    hcr-r5-SpecificInfo             SEQUENCE {
        pusch-SysInfoList           PUSCH-SysInfoList-HCR-r5    OPTIONAL,
        pdsch-SysInfoList           PDSCH-SysInfoList-HCR-r5    OPTIONAL
    }                                                           OPTIONAL
}

SysInfoType17-v7xyext-IEs ::=       SEQUENCE {
    pusch-SysInfoList-SFN-VHCR          PUSCH-SysInfoList-SFN-VHCR      OPTIONAL,
    pdsch-SysInfoList-r7                PDSCH-SysInfoList-r7            OPTIONAL
}

SysInfoType18 ::=                       SEQUENCE {
        idleModePLMNIdentities          PLMNIdentitiesOfNeighbourCells      OPTIONAL,
        connectedModePLMNIdentities PLMNIdentitiesOfNeighbourCells      OPTIONAL,
    -- Extension mechanism for non- release99 information
        nonCriticalExtensions           SEQUENCE {}     OPTIONAL
}

SysInfoTypeSB1 ::=                  SEQUENCE {
    -- Other IEs
        sib-ReferenceList               SIB-ReferenceList,
    -- Extension mechanism for non- release99 information
        nonCriticalExtensions           SEQUENCE {}                     OPTIONAL
}

SysInfoTypeSB2 ::=                  SEQUENCE {
    -- Other IEs
        sib-ReferenceList               SIB-ReferenceList,
    -- Extension mechanism for non- release99 information
        nonCriticalExtensions           SEQUENCE {}                     OPTIONAL
}

TDD-UMTS-Frequency-List ::=             SEQUENCE (SIZE (1..maxNumTDDFreqs)) OF
                                            FrequencyInfoTDD

-- ***************************************************
--
```

```
--     ANSI-41 INFORMATION ELEMENTS (10.3.9)
--
-- **************************************************

ANSI-41-GlobalServiceRedirectInfo ::=  ANSI-41-NAS-Parameter
ANSI-41-PrivateNeighbourListInfo ::=   ANSI-41-NAS-Parameter
ANSI-41-RAND-Information ::=           ANSI-41-NAS-Parameter
ANSI-41-UserZoneID-Information ::=     ANSI-41-NAS-Parameter
ANSI-41-NAS-Parameter ::=              BIT STRING (SIZE (1..2048))

Min-P-REV ::=                          BIT STRING (SIZE (8))

NAS-SystemInformationANSI-41 ::=       ANSI-41-NAS-Parameter
NID ::=                                BIT STRING (SIZE (16))

P-REV ::=                              BIT STRING (SIZE (8))

SID ::=                                BIT STRING (SIZE (15))

-- **************************************************
--
--     MBMS INFORMATION ELEMENTS (10.3.9a)
--
-- **************************************************

MBMS-AccessProbabilityFactor ::=    ENUMERATED {
                                        apf0, apf32, apf64, apf96, apf128, apf160, apf192,
                                        apf224, apf256, apf288, apf320, apf352, apf384, apf416,
                                        apf448, apf480, apf512, apf544, apf576, apf608, apf640,
                                        apf672, apf704, apf736, apf768, apf800, apf832, apf864,
                                        apf896, apf928, apf960, apf1000 }

MBMS-CellGroupIdentity-r6 ::=       BIT STRING (SIZE (12))

MBMS-CommonCCTrChIdentity ::=       INTEGER (1..32)

MBMS-CommonPhyChIdentity ::=        INTEGER (1..32)

MBMS-CommonRBIdentity ::=           INTEGER (1..32)

MBMS-CommonRBInformation-r6 ::=     SEQUENCE {
    commonRBIdentity                    MBMS-CommonRBIdentity,
    pdcp-Info                           PDCP-Info-r4,
    rlc-Info                            RLC-Info-MTCH-r6
}

MBMS-CommonRBInformationList-r6 ::= SEQUENCE (SIZE (1..maxMBMS-CommonRB)) OF
                                        MBMS-CommonRBInformation-r6

MBMS-CommonTrChIdentity ::=         INTEGER (1..32)

MBMS-ConnectedModeCountingScope ::= SEQUENCE {
    countingForUraPCH                               BOOLEAN,
    countingForCellPCH                              BOOLEAN,
    countingForCellFACH                             BOOLEAN
}

MBMS-CurrentCell-SCCPCH-r6 ::=      SEQUENCE {
    sccpchIdentity                      MBMS-SCCPCHIdentity                 OPTIONAL,
    secondaryCCPCH-Info                 MBMS-CommonPhyChIdentity,
    softComb-TimingOffset               MBMS-SoftComb-TimingOffset          OPTIONAL,
    -- If the IE transpCh-InfoCommonForAllTrCh is absent, the default TFCS as specified
    -- in 14.10.1 applies
    transpCh-InfoCommonForAllTrCh       MBMS-CommonCCTrChIdentity           OPTIONAL,
    transpCHInformation                 MBMS-TrCHInformation-CurrList
}

MBMS-CurrentCell-SCCPCHList-r6 ::=  SEQUENCE (SIZE (1..maxSCCPCH)) OF
                                        MBMS-CurrentCell-SCCPCH-r6

MBMS-FACHCarryingMTCH-List ::=      SEQUENCE (SIZE (1..maxFACHPCH)) OF
                                            TransportFormatSet

MBMS-JoinedInformation-r6 ::=       SEQUENCE {
    p-TMSI                              P-TMSI-GSM-MAP                      OPTIONAL
}

MBMS-L1CombiningSchedule-32 ::=     SEQUENCE {
```

```
    -- Actual L1 combining schedule values (offset, start, duration) = IE value * 4
    cycleOffset                         INTEGER (0..7)                      OPTIONAL,
    mtch-L1CombiningPeriodList          SEQUENCE (SIZE (1..maxMBMS-L1CP)) OF SEQUENCE {
        periodStart                         INTEGER (0..7),
        periodDuration                      INTEGER (1..8)
    }
}

MBMS-L1CombiningSchedule-64 ::=     SEQUENCE {
    -- Actual L1 combining schedule values (offset, start, duration) = IE value * 4
    cycleOffset                         INTEGER (0..15)                     OPTIONAL,
    mtch-L1CombiningPeriodList          SEQUENCE (SIZE (1..maxMBMS-L1CP)) OF SEQUENCE {
        periodStart                         INTEGER (0..15),
        periodDuration                      INTEGER (1..16)
    }
}

MBMS-L1CombiningSchedule-128 ::=    SEQUENCE {
    -- Actual L1 combining schedule values (offset, start, duration) = IE value * 4
    cycleOffset                         INTEGER (0..31)                     OPTIONAL,
    mtch-L1CombiningPeriodList          SEQUENCE (SIZE (1..maxMBMS-L1CP)) OF SEQUENCE {
        periodStart                         INTEGER (0..31),
        periodDuration                      INTEGER (1..32)
    }
}

MBMS-L1CombiningSchedule-256 ::=    SEQUENCE {
    -- Actual L1 combining schedule values (offset, start, duration) = IE value * 4
    cycleOffset                         INTEGER (0..63)                     OPTIONAL,
    mtch-L1CombiningPeriodList          SEQUENCE (SIZE (1..maxMBMS-L1CP)) OF SEQUENCE {
        periodStart                         INTEGER (0..63),
        periodDuration                      INTEGER (1..64)
    }
}

MBMS-L1CombiningSchedule-512 ::=    SEQUENCE {
    -- Actual L1 combining schedule values (offset, start, duration) = IE value * 4
    cycleOffset                         INTEGER (0..127)                        OPTIONAL,
    mtch-L1CombiningPeriodList          SEQUENCE (SIZE (1..maxMBMS-L1CP)) OF SEQUENCE {
        periodStart                         INTEGER (0..127),
        periodDuration                      INTEGER (1..128)
    }
}

MBMS-L1CombiningSchedule-1024 ::=   SEQUENCE {
    -- Actual L1 combining schedule values (offset, start, duration) = IE value * 4
    cycleOffset                         INTEGER (0..255)                        OPTIONAL,
    mtch-L1CombiningPeriodList          SEQUENCE (SIZE (1..maxMBMS-L1CP)) OF SEQUENCE {
        periodStart                         INTEGER (0..255),
        periodDuration                      INTEGER (1..256)
    }
}

MBMS-L1CombiningSchedule ::=        CHOICE {
    cycleLength-32                      MBMS-L1CombiningSchedule-32,
    cycleLength-64                      MBMS-L1CombiningSchedule-64,
    cycleLength-128                     MBMS-L1CombiningSchedule-128,
    cycleLength-256                     MBMS-L1CombiningSchedule-256,
    cycleLength-512                     MBMS-L1CombiningSchedule-512,
    cycleLength-1024                    MBMS-L1CombiningSchedule-1024
}

MBMS-L1CombiningTransmTimeDiff ::=  INTEGER (0..3)

MBMS-L23Configuration ::=           CHOICE {
    sameAsCurrent                       SEQUENCE {
        currentCell-SCCPCH                  MBMS-SCCPCHIdentity,
        msch-ConfigurationInfo              MBMS-MSCH-ConfigurationInfo-r6      OPTIONAL
    },
    different                           SEQUENCE {
        -- If the IE transpCh-InfoCommonForAllTrCh is absent, the default TFCS as specified
        -- in 14.10.1 applies
        transpCh-InfoCommonForAllTrCh       MBMS-CommonCCTrChIdentity           OPTIONAL,
        transpCHInformation                 MBMS-TrCHInformation-NeighbList
    }
}

MBMS-LogicalChIdentity ::=          INTEGER (1..15)
```

```
MBMS-MCCH-ConfigurationInfo-r6 ::=  SEQUENCE {
    accessInfoPeriodCoefficient         INTEGER (0..3),
    repetitionPeriodCoefficient         INTEGER (0..3),
    modificationPeriodCoefficient       INTEGER (7..10),
    rlc-Info                            RLC-Info-MCCH-r6,
    tctf-Presence                       MBMS-TCTF-Presence                  OPTIONAL
}

MBMS-MICHConfigurationInfo-r6 ::=   SEQUENCE {
    michPowerOffset                     MBMS-MICHPowerOffset,
    mode                                CHOICE {
        fdd                                 SEQUENCE {
            channelisationCode256               ChannelisationCode256,
            ni-CountPerFrame                    MBMS-NI-CountPerFrame,
            sttd-Indicator                      BOOLEAN
        },
        tdd384                              SEQUENCE {
            timeslot                            TimeslotNumber,
            midambleShiftAndBurstType           MidambleShiftAndBurstType,
            channelisationCode                  DL-TS-ChannelisationCode,
            repetitionPeriodLengthOffset        RepPerLengthOffset-MICH     OPTIONAL,
            mbmsNotificationIndLength           MBMS-MICHNotificationIndLength  DEFAULT mn4
        },
        tdd128                              SEQUENCE {
            timeslot                            TimeslotNumber-LCR-r4,
            midambleShiftAndBurstType           MidambleShiftAndBurstType-LCR-r4,
            channelisationCodeList              SEQUENCE (SIZE (1..2)) OF
                                                    DL-TS-ChannelisationCode,
            repetitionPeriodLengthOffset        RepPerLengthOffset-MICH     OPTIONAL,
            mbmsNotificationIndLength           MBMS-MICHNotificationIndLength  DEFAULT mn4
        }
    }
}

MBMS-MICHConfigurationInfo-r7 ::=   SEQUENCE {
    michPowerOffset                     MBMS-MICHPowerOffset,
    mode                                CHOICE {
        fdd                                 SEQUENCE {
            channelisationCode256               ChannelisationCode256,
            ni-CountPerFrame                    MBMS-NI-CountPerFrame,
            sttd-Indicator                      BOOLEAN
        },
        tdd384                              SEQUENCE {
            timeslot                            TimeslotNumber,
            midambleShiftAndBurstType           MidambleShiftAndBurstType,
            channelisationCode                  DL-TS-ChannelisationCode,
            repetitionPeriodLengthOffset        RepPerLengthOffset-MICH     OPTIONAL,
            mbmsNotificationIndLength           MBMS-MICHNotificationIndLength  DEFAULT mn4
        },
        tdd768                              SEQUENCE {
            timeslot                            TimeslotNumber,
            midambleShiftAndBurstType           MidambleShiftAndBurstType-VHCR,
            channelisationCode                  DL-TS-ChannelisationCode,
            repetitionPeriodLengthOffset        RepPerLengthOffset-MICH     OPTIONAL,
            mbmsNotificationIndLength           MBMS-MICHNotificationIndLength  DEFAULT mn4
        },
        tdd128                              SEQUENCE {
            timeslot                            TimeslotNumber-LCR-r4,
            midambleShiftAndBurstType           MidambleShiftAndBurstType-LCR-r4,
            channelisationCodeList              SEQUENCE (SIZE (1..2)) OF
                                                    DL-TS-ChannelisationCode,
            repetitionPeriodLengthOffset        RepPerLengthOffset-MICH     OPTIONAL,
            mbmsNotificationIndLength           MBMS-MICHNotificationIndLength  DEFAULT mn4
        }
    }
}

MBMS-MICHNotificationIndLength ::=  ENUMERATED { mn4, mn8, mn16 }

MBMS-MICHPowerOffset ::=            INTEGER (-10..5)

MBMS-ModifedService-r6 ::=          SEQUENCE {
    mbms-TransmissionIdentity           MBMS-TransmissionIdentity,
    mbms-RequiredUEAction               MBMS-RequiredUEAction-Mod,
    mbms-PreferredFrequency             CHOICE {
        mcch                                MBMS-PFLIndex,
        dcch                                MBMS-PFLInfo
```

```
    }       OPTIONAL,
    mbms-DispersionIndicator            ENUMERATED { true }                 OPTIONAL,
    continueMCCHReading                 BOOLEAN
}

MBMS-ModifedServiceList-r6 ::=      SEQUENCE (SIZE (1..maxMBMSservModif)) OF
                                        MBMS-ModifedService-r6

MBMS-MSCH-ConfigurationInfo-r6 ::=  SEQUENCE {
    mschShedulingInfo                   MBMS-MSCHSchedulingInfo             OPTIONAL,
    rlc-Info                            RLC-Info-MSCH-r6                    OPTIONAL,
    tctf-Presence                       MBMS-TCTF-Presence                  OPTIONAL
}

MBMS-MSCHSchedulingInfo ::=         CHOICE {
    schedulingPeriod-32-Offset          INTEGER (0..31),
    schedulingPeriod-64-Offset          INTEGER (0..63),
    schedulingPeriod-128-Offset         INTEGER (0..127),
    schedulingPeriod-256-Offset         INTEGER (0..255),
    schedulingPeriod-512-Offset         INTEGER (0..511),
    schedulingPeriod-1024-Offset        INTEGER (0..1023)
}

MBMS-NeighbouringCellSCCPCH-r6 ::=  SEQUENCE {
    secondaryCCPCH-Info                 MBMS-CommonPhyChIdentity,
    secondaryCCPCHPwrOffsetDiff         MBMS-SCCPCHPwrOffsetDiff            OPTIONAL,
    layer1Combining                     CHOICE {
        fdd                                 SEQUENCE {
            softComb-TimingOffset               MBMS-SoftComb-TimingOffset,
            mbms-L1CombiningTransmTimeDiff      MBMS-L1CombiningTransmTimeDiff,
            mbms-L1CombiningSchedule            MBMS-L1CombiningSchedule    OPTIONAL
        },
        tdd                                 NULL
    }       OPTIONAL,
    mbms-L23Configuration               MBMS-L23Configuration
}

MBMS-NeighbouringCellSCCPCHList-r6 ::= SEQUENCE (SIZE (1..maxSCCPCH)) OF
                                        MBMS-NeighbouringCellSCCPCH-r6

MBMS-NI-CountPerFrame ::=           ENUMERATED { ni18, ni36, ni72, ni144 }

MBMS-NumberOfNeighbourCells-r6 ::=      INTEGER (0..32)

MBMS-PFLIndex ::=                   INTEGER (1..maxMBMS-Freq)

MBMS-PFLInfo ::=                    FrequencyInfo

MBMS-PhyChInformation-r6 ::=        SEQUENCE {
    mbms-CommonPhyChIdentity            MBMS-CommonPhyChIdentity,
    secondaryCCPCHInfo-MBMS             SecondaryCCPCHInfo-MBMS-r6
}

MBMS-PhyChInformationList-r6 ::=    SEQUENCE (SIZE (1..maxMBMS-CommonPhyCh)) OF
                                        MBMS-PhyChInformation-r6

MBMS-PL-ServiceRestrictInfo-r6 ::=  ENUMERATED { true }

MBMS-PreferredFreqRequest-r6 ::=    SEQUENCE {
    preferredFreqRequest                FrequencyInfo
}

MBMS-PreferredFrequencyInfo-r6 ::=  SEQUENCE {
    mbmsPreferredFrequency              INTEGER (1..maxMBMS-Freq)           OPTIONAL,
    layerConvergenceInformation         CHOICE {
        mbms-Qoffset                        MBMS-Qoffset,
        mbms-HCSoffset                      INTEGER (0..7)
    },
    mbms-PL-ServiceRestrictInfo         MBMS-PL-ServiceRestrictInfo-r6      OPTIONAL
}

MBMS-PreferredFrequencyList-r6 ::=  SEQUENCE (SIZE (1..maxMBMS-Freq)) OF
                                        MBMS-PreferredFrequencyInfo-r6

MBMS-PTMActivationTime-r6 ::=       INTEGER (0..2047)

MBMS-PTM-RBInformation-C ::=        SEQUENCE {
    rbInformation                       MBMS-CommonRBIdentity,
```

```
    shortTransmissionID                 MBMS-ShortTransmissionID,
    logicalChIdentity                   MBMS-LogicalChIdentity
}

MBMS-PTM-RBInformation-CList ::=    SEQUENCE (SIZE (1..maxRBperTrCh)) OF
                                        MBMS-PTM-RBInformation-C

MBMS-PTM-RBInformation-N ::=        SEQUENCE {
    shortTransmissionID                 MBMS-ShortTransmissionID,
    logicalChIdentity                   MBMS-LogicalChIdentity,
    layer1-CombiningStatus              BOOLEAN}

MBMS-PTM-RBInformation-NList ::=    SEQUENCE (SIZE (1..maxRBperTrCh)) OF
                                        MBMS-PTM-RBInformation-N

MBMS-Qoffset ::=                    ENUMERATED { q4, q8, q12, q16, q20, q30, q40, qInfinity }

MBMS-RequiredUEAction-Mod ::=       ENUMERATED {
                                        none,
                                        acquireCountingInfo,
                                        acquireCountingInfoPTM-RBsUnmodified,
                                        acquirePTM-RBInfo,
                                        requestPTPRB,
                                        releasePTM-RB }

MBMS-RequiredUEAction-UMod ::=      ENUMERATED {
                                        none,
                                        acquirePTM-RBInfo,
                                        requestPTPRB }

MBMS-SCCPCHIdentity ::=             INTEGER (1..maxSCCPCH)

MBMS-SCCPCHPwrOffsetDiff ::=        ENUMERATED { mcpo-minus6, mcpo-minus3, mcpo-plus3, mcpo-plus6 }

MBMS-ServiceAccessInfo-r6 ::=       SEQUENCE {
    shortTransmissionID                 MBMS-ShortTransmissionID,
    accessprobabilityFactor-Idle        MBMS-AccessProbabilityFactor,
    accessprobabilityFactor-UraPCH      MBMS-AccessProbabilityFactor        OPTIONAL,
    mbms-ConnectedModeCountingScope     MBMS-ConnectedModeCountingScope
}

MBMS-ServiceAccessInfoList-r6 ::=   SEQUENCE (SIZE (1..maxMBMSservCount)) OF
                                        MBMS-ServiceAccessInfo-r6

MBMS-ServiceIdentity-r6 ::=         SEQUENCE {
    serviceIdentity                     OCTET STRING (SIZE (3)),
    plmn-Identity                       CHOICE {
        -- The 'sameAsMIB-PLMN-Id' choice refers to the 'PLMN Identity' (R99) in MIB.
        sameAsMIB-PLMN-Id                   NULL,
        other                               CHOICE {
            -- The 'sameAsMIB-MultiPLMN-Id' choice refers to one of the (1..5) PLMN Identities
            -- provided in the 'Multiple PLMN List' (REL-6) in MIB.
            sameAsMIB-MultiPLMN-Id              INTEGER (1..5),
            explicitPLMN-Id                     PLMN-Identity
        }
    }
}

MBMS-ServiceSchedulingInfo-r6 ::=   SEQUENCE {
    mbms-TransmissionIdentity           MBMS-TransmissionIdentity,
    mbms-ServiceTransmInfoList          MBMS-ServiceTransmInfoList          OPTIONAL,
    nextSchedulingperiod                INTEGER (0..31)
}

MBMS-ServiceSchedulingInfoList-r6 ::= SEQUENCE (SIZE (1..maxMBMSservSched)) OF
                                        MBMS-ServiceSchedulingInfo-r6

MBMS-ServiceTransmInfo ::=          SEQUENCE {
    -- Actual values (start, duration) = IE values * 4
    start                               INTEGER (0..255),
    duration                            INTEGER (1..256)
}

MBMS-ServiceTransmInfoList ::=      SEQUENCE (SIZE (1..maxMBMSTransmis)) OF
                                        MBMS-ServiceTransmInfo

MBMS-SessionIdentity ::=            OCTET STRING (SIZE (1))
```

```
MBMS-ShortTransmissionID ::=        INTEGER (1..maxMBMSservUnmodif)

MBMS-SIBType5-SCCPCH-r6 ::=         SEQUENCE {
    sccpchIdentity                      MBMS-SCCPCHIdentity,
    transpCHInformation                 MBMS-TrCHInformation-SIB5List
}

MBMS-SIBType5-SCCPCHList-r6 ::=     SEQUENCE (SIZE (1..maxSCCPCH)) OF
                                        MBMS-SIBType5-SCCPCH-r6

MBMS-SoftComb-TimingOffset ::=      ENUMERATED { ms0, ms10, ms20, ms40 }

MBMS-TCTF-Presence ::=              ENUMERATED { false }

MBMS-TimersAndCounters-r6 ::=       SEQUENCE {
    t-318                               T-318                       DEFAULT ms1000
}

MBMS-TransmissionIdentity ::=       SEQUENCE {
    mbms-ServiceIdentity                MBMS-ServiceIdentity-r6,
    mbms-SessionIdentity                MBMS-SessionIdentity        OPTIONAL
}

MBMS-TranspChInfoForCCTrCh-r6 ::=   SEQUENCE {
    commonCCTrChIdentity                MBMS-CommonCCTrChIdentity,
    transportFormatCombinationSet       TFCS
}


MBMS-TranspChInfoForEachCCTrCh-r6 ::= SEQUENCE (SIZE (1..maxMBMS-CommonCCTrCh)) OF
                                        MBMS-TranspChInfoForCCTrCh-r6

MBMS-TranspChInfoForEachTrCh-r6 ::= SEQUENCE (SIZE (1..maxMBMS-CommonTrCh)) OF
                                        MBMS-TranspChInfoForTrCh-r6

MBMS-TranspChInfoForTrCh-r6 ::=     SEQUENCE {
    commonTrChIdentity                  MBMS-CommonTrChIdentity,
    transportFormatSet                  TransportFormatSet
}

MBMS-TrCHInformation-Curr ::=       SEQUENCE {
    transpCh-Info                       MBMS-CommonTrChIdentity,
    rbInformation                       MBMS-PTM-RBInformation-CList    OPTIONAL,
    msch-ConfigurationInfo              MBMS-MSCH-ConfigurationInfo-r6  OPTIONAL
}

MBMS-TrCHInformation-CurrList ::=   SEQUENCE (SIZE (1..maxFACHPCH)) OF
                                        MBMS-TrCHInformation-Curr

MBMS-TrCHInformation-Neighb ::=     SEQUENCE {
    transpCh-Info                       MBMS-CommonTrChIdentity,
    transpCh-CombiningStatus            BOOLEAN,
    rbInformation                       MBMS-PTM-RBInformation-NList    OPTIONAL,
    msch-ConfigurationInfo              MBMS-MSCH-ConfigurationInfo-r6  OPTIONAL
}

MBMS-TrCHInformation-NeighbList ::= SEQUENCE (SIZE (1..maxFACHPCH)) OF
                                        MBMS-TrCHInformation-Neighb

MBMS-TrCHInformation-SIB5 ::=       SEQUENCE {
    transpCh-Identity                   INTEGER (1..maxFACHPCH),
    rbInformation                       MBMS-PTM-RBInformation-CList    OPTIONAL,
    msch-ConfigurationInfo              MBMS-MSCH-ConfigurationInfo-r6  OPTIONAL
}

MBMS-TrCHInformation-SIB5List ::=   SEQUENCE (SIZE (1..maxFACHPCH)) OF
                                        MBMS-TrCHInformation-SIB5

MBMS-UnmodifiedService-r6 ::=       SEQUENCE {
    mbms-TransmissionIdentity           MBMS-TransmissionIdentity,
    mbms-RequiredUEAction               MBMS-RequiredUEAction-UMod,
    mbms-PreferredFrequency             MBMS-PFLIndex               OPTIONAL
}

MBMS-UnmodifiedServiceList-r6 ::=   SEQUENCE (SIZE (1..maxMBMSservUnmodif)) OF
                                        MBMS-UnmodifiedService-r6

END
```

11.4 Constant definitions

```
Constant-definitions DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

hiPDSCHidentities            INTEGER ::= 64
hiPUSCHidentities            INTEGER ::= 64
hiRM                         INTEGER ::= 256
maxAC                        INTEGER ::= 16
maxAdditionalMeas            INTEGER ::= 4
maxASC                       INTEGER ::= 8
maxASCmap                    INTEGER ::= 7
maxASCpersist                INTEGER ::= 6
maxCCTrCH                    INTEGER ::= 8
maxCellMeas                  INTEGER ::= 32
maxCellMeas-1                INTEGER ::= 31
maxCNdomains                 INTEGER ::= 4
maxCPCHsets                  INTEGER ::= 16
maxDPCH-DLchan               INTEGER ::= 8
maxDPDCH-UL                  INTEGER ::= 6
maxDRACclasses               INTEGER ::= 8
maxE-DCHMACdFlow             INTEGER ::= 8
maxE-DCHMACdFlow-1           INTEGER ::= 7
maxEDCHRL                    INTEGER ::= 4
maxFACHPCH                   INTEGER ::= 8
maxFreq                      INTEGER ::= 8
maxFreqBandsFDD              INTEGER ::= 8
maxFreqBandsFDD-ext          INTEGER ::= 15   -- maxFreqBandsFDD-ext ::= 22 - (maxFreqBandsFDD - 1)
maxFreqBandsTDD              INTEGER ::= 4
maxFreqBandsGSM              INTEGER ::= 16
maxGERAN-SI                  INTEGER ::= 8
maxGSMTargetCells            INTEGER ::= 32
maxHProcesses                INTEGER ::= 8
maxHSDSCHTBIndex             INTEGER ::= 64
maxHSDSCHTBIndex-tdd384      INTEGER ::= 512
maxHSSCCHs                   INTEGER ::= 4
maxInterSysMessages          INTEGER ::= 4
maxLoCHperRLC                INTEGER ::= 2
maxMAC-d-PDUsizes            INTEGER ::= 8
maxMBMS-CommonCCTrCh         INTEGER ::= 32
maxMBMS-CommonPhyCh          INTEGER ::= 32
maxMBMS-CommonRB             INTEGER ::= 32
maxMBMS-CommonTrCh           INTEGER ::= 32
maxMBMS-Freq                 INTEGER ::= 4
maxMBMS-L1CP                 INTEGER ::= 4
maxMBMSservCount             INTEGER ::= 8
maxMBMSservModif             INTEGER ::= 32
maxMBMSservSched             INTEGER ::= 16
maxMBMSservUnmodif           INTEGER ::= 64
maxMBMSTransmis              INTEGER ::= 4
maxMeasEvent                 INTEGER ::= 8
maxMeasIntervals             INTEGER ::= 3
maxMeasParEvent              INTEGER ::= 2
maxNumCDMA2000Freqs          INTEGER ::=  8
maxNumGSMFreqRanges          INTEGER ::= 32
maxNumFDDFreqs               INTEGER ::=  8
maxNumTDDFreqs               INTEGER ::=  8
maxNoOfMeas                  INTEGER ::= 16
maxOtherRAT                  INTEGER ::= 15
maxOtherRAT-16               INTEGER ::= 16
maxPage1                     INTEGER ::= 8
maxPCPCH-APsig               INTEGER ::= 16
maxPCPCH-APsubCh             INTEGER ::= 12
maxPCPCH-CDsig               INTEGER ::= 16
maxPCPCH-CDsubCh             INTEGER ::= 12
maxPCPCH-SF                  INTEGER ::= 7
maxPCPCHs                    INTEGER ::= 64
maxPDCPAlgoType              INTEGER ::= 8
maxPDSCH                     INTEGER ::= 8
maxPDSCH-TFCIgroups          INTEGER ::= 256
maxPRACH                     INTEGER ::= 16
maxPRACH-FPACH               INTEGER ::= 8
maxPredefConfig              INTEGER ::= 16
maxPUSCH                     INTEGER ::= 8
maxQueueIDs                  INTEGER ::= 8
maxRABsetup                  INTEGER ::= 16
```

```
maxRAT                       INTEGER ::= 16
maxRB                        INTEGER ::= 32
maxRBallRABs                 INTEGER ::= 27
maxRBMuxOptions              INTEGER ::= 8
maxRBperRAB                  INTEGER ::= 8
maxRBperTrCh                 INTEGER ::= 16
maxReportedGSMCells          INTEGER ::= 8
maxRL                        INTEGER ::= 8
maxRL-1                      INTEGER ::= 7
maxRLCPDUsizePerLogChan      INTEGER ::= 32
maxRFC3095-CID               INTEGER ::= 16384
maxROHC-PacketSizes-r4       INTEGER ::= 16
maxROHC-Profile-r4           INTEGER ::= 8
maxSat                       INTEGER ::= 16
maxSCCPCH                    INTEGER ::= 16
maxSIB                       INTEGER ::= 32
maxSIB-FACH                  INTEGER ::= 8
maxSIBperMsg                 INTEGER ::= 16
maxSRBsetup                  INTEGER ::= 8
maxSystemCapability          INTEGER ::= 16
maxTF                        INTEGER ::= 32
maxTF-CPCH                   INTEGER ::= 16
maxTFC                       INTEGER ::= 1024
maxTFCsub                    INTEGER ::= 1024
maxTFCI-2-Combs              INTEGER ::= 512
maxTGPS                      INTEGER ::= 6
maxTrCH                      INTEGER ::= 32
-- maxTrCHpreconf should be 16 but has been set to 32 for compatibility
maxTrCHpreconf               INTEGER ::= 32
maxTS                        INTEGER ::= 14
maxTS-1                      INTEGER ::= 13
maxTS-2                      INTEGER ::= 12
maxTS-LCR                    INTEGER ::= 6
maxTS-LCR-1                  INTEGER ::= 5
maxURA                       INTEGER ::= 8
maxURNTI-Group               INTEGER ::= 8

END
```

11.5 RRC information between network nodes

```
Internode-definitions DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS

    HandoverToUTRANCommand,
    MeasurementReport,
    PhysicalChannelReconfiguration,
    RadioBearerReconfiguration,
    RadioBearerRelease,
    RadioBearerSetup,
    RRCConnectionSetupComplete-r3-add-ext-IEs,
    RRC-FailureInfo,
    TransportChannelReconfiguration,
    UECapabilityInformation-r3-add-ext-IEs
FROM PDU-definitions

-- Core Network IEs :
    CN-DomainIdentity,
    CN-DomainInformationList,
    CN-DomainInformationListFull,
    CN-DRX-CycleLengthCoefficient,
    NAS-SystemInformationGSM-MAP,
-- UTRAN Mobility IEs :
    CellIdentity,
    URA-Identity,
-- User Equipment IEs :
    AccessStratumReleaseIndicator,
    C-RNTI,
    ChipRateCapability,
    DL-CapabilityWithSimultaneousHS-DSCHConfig,
    DL-PhysChCapabilityFDD-v380ext,
    DL-PhysChCapabilityTDD,
    DL-PhysChCapabilityTDD-LCR-r4,
    GSM-Measurements,
```

```
    HSDSCH-physical-layer-category,
    FailureCauseWithProtErr,
    MaxHcContextSpace,
    MaximumAM-EntityNumberRLC-Cap,
    MaximumRLC-WindowSize,
    MaxNoPhysChBitsReceived,
    MaxNoDPDCH-BitsTransmitted,
    MaxPhysChPerFrame,
    MaxPhysChPerSubFrame-r4,
    MaxPhysChPerTS,
    MaxROHC-ContextSessions-r4,
    MaxTS-PerFrame,
    MaxTS-PerSubFrame-r4,
    MinimumSF-DL,
    MultiModeCapability,
    MultiRAT-Capability,
    NetworkAssistedGPS-Supported,
    PhysicalChannelCapability-edch-r6,
    RadioFrequencyBandTDDList,
    RLC-Capability,
    RRC-MessageSequenceNumber,
    SecurityCapability,
    SimultaneousSCCPCH-DPCH-Reception,
    STARTList,
    STARTSingle,
    START-Value,
    SupportOfDedicatedPilotsForChEstimation,
    TransportChannelCapability,
    TxRxFrequencySeparation,
    U-RNTI,
    UE-CapabilityContainer-IEs,
    UE-MultiModeRAT-Capability,
    UE-PowerClassExt,
    UE-RadioAccessCapabBandFDDList,
    UE-RadioAccessCapabBandFDDList2,
    UE-RadioAccessCapabBandFDDList-ext,
    UE-RadioAccessCapability,
    UE-RadioAccessCapability-v370ext,
    UE-RadioAccessCapability-v380ext,
    UE-RadioAccessCapability-v3a0ext,
    UE-RadioAccessCapability-v3g0ext,
    UE-RadioAccessCapability-v4b0ext,
    UE-RadioAccessCapability-v590ext,
    UE-RadioAccessCapability-v5c0ext,
    UE-RadioAccessCapability-v7xyext,
    UL-PhysChCapabilityFDD,
    UL-PhysChCapabilityFDD-r6,
    UL-PhysChCapabilityTDD,
    UL-PhysChCapabilityTDD-LCR-r4,
-- Radio Bearer IEs :
    PredefinedConfigStatusList,
    PredefinedConfigValueTag,
    RAB-InformationSetupList,
    RAB-InformationSetupList-r4,
    RAB-InformationSetupList-r5,
    RAB-InformationSetupList-r6-ext,
    RAB-InformationSetupList-r6,
    RB-Identity,
    SRB-InformationSetupList,
    SRB-InformationSetupList-r5,
    SRB-InformationSetupList-r6,
-- Transport Channel IEs :
    CPCH-SetID,
    DL-CommonTransChInfo,
    DL-CommonTransChInfo-r4,
    DL-AddReconfTransChInfoList,
    DL-AddReconfTransChInfoList-r4,
    DL-AddReconfTransChInfoList-r5,
    DRAC-StaticInformationList,
    UL-CommonTransChInfo,
    UL-CommonTransChInfo-r4,
    UL-AddReconfTransChInfoList,
    UL-AddReconfTransChInfoList-r6,
-- Physical Channel IEs :
    PrimaryCPICH-Info,
    TPC-CombinationIndex,
    ScramblingCodeChange,
    TGCFN,
```

```
    TGPSI,
    TGPS-ConfigurationParams,
-- Measurement IEs :
    Event1j-r6,
    Hysteresis,
    Inter-FreqEventCriteriaList-v590ext,
    Intra-FreqEventCriteriaList-v590ext,
    IntraFreqEvent-1d-r5,
    IntraFreqReportingCriteria-1b-r5,
    InterRATCellInfoIndication,
    MeasuredResultsOnRACHinterFreq,
    MeasurementIdentity,
    MeasurementReportingMode,
    MeasurementType,
    MeasurementType-r4,
    MeasurementType-r6,
    AdditionalMeasurementID-List,
    PositionEstimate,
    ReportingCellStatus,
    TimeToTrigger,
-- MBMS IEs :
    MBMS-JoinedInformation-r6,
-- Other IEs :
    GERANIu-RadioAccessCapability,
    GSM-MS-RadioAccessCapability,
    InterRAT-UE-RadioAccessCapabilityList,
    InterRAT-UE-RadioAccessCapability-v590ext,
    InterRAT-UE-RadioAccessCapability-v690ext,
    UESpecificBehaviourInformation1idle,
    UESpecificBehaviourInformation1interRAT

FROM InformationElements

    maxCNdomains,
    maxNoOfMeas,

    maxRB,
    maxRBallRABs,
    maxRFC3095-CID,
    maxSRBsetup,
    maxRL,
    maxTGPS
FROM Constant-definitions
;

-- Part 1: Class definitions similar to what has been defined in 11.1 for RRC messages
-- Information that is tranferred in the same direction and across the same path is grouped

-- ***************************************************
--
-- RRC information, to target RNC
--
-- ***************************************************
-- RRC Information to target RNC sent either from source RNC or from another RAT

ToTargetRNC-Container ::= CHOICE {
    interRATHandoverInfo                InterRATHandoverInfoWithInterRATCapabilities-r3,
    srncRelocation                      SRNC-RelocationInfo-r3,
    rfc3095-ContextInfo                 RFC3095-ContextInfo-r5,
    extension                           NULL
}

-- ***************************************************
--
-- RRC information, target RNC to source RNC
--
-- ***************************************************


TargetRNC-ToSourceRNC-Container ::= CHOICE {
    radioBearerSetup                    RadioBearerSetup,
    radioBearerReconfiguration          RadioBearerReconfiguration,
    radioBearerRelease                  RadioBearerRelease,
    transportChannelReconfiguration     TransportChannelReconfiguration,
    physicalChannelReconfiguration      PhysicalChannelReconfiguration,
    rrc-FailureInfo                     RRC-FailureInfo,
    -- IE dl-DCCHmessage consists of an octet string that includes the IE DL-DCCH-Message
    dL-DCCHmessage                      OCTET STRING,
```

```
    extension                           NULL
}

-- Part 2: Container definitions, similar to the PDU definitions in 11.2 for RRC messages
-- In alphabetical order


-- ***************************************************
--
-- Handover to UTRAN information
--
-- ***************************************************

InterRATHandoverInfoWithInterRATCapabilities-r3 ::= CHOICE {
    r3                                  SEQUENCE {
        -- IE InterRATHandoverInfoWithInterRATCapabilities-r3-IEs also
        -- includes non critical extensions
        interRATHandoverInfo-r3         InterRATHandoverInfoWithInterRATCapabilities-r3-IEs,
        v390NonCriticalExtensions       SEQUENCE {
            interRATHandoverInfoWithInterRATCapabilities-v390ext
                                        InterRATHandoverInfoWithInterRATCapabilities-v390ext-IEs,
            -- Reserved for future non critical extension
            v690NonCriticalExtensions       SEQUENCE {
                interRATHandoverInfoWithInterRATCapabilities-v690ext
                                        InterRATHandoverInfoWithInterRATCapabilities-v690ext-IEs,
                nonCriticalExtensions           SEQUENCE {} OPTIONAL
            }       OPTIONAL
        }       OPTIONAL
    },
    criticalExtensions                  SEQUENCE {}
}

InterRATHandoverInfoWithInterRATCapabilities-r3-IEs ::=     SEQUENCE {
        -- The order of the IEs may not reflect the tabular format
        --  but has been chosen to simplify the handling of the information in the BSC
    --  Other IEs
        ue-RATSpecificCapability        InterRAT-UE-RadioAccessCapabilityList   OPTIONAL,
        -- interRATHandoverInfo, Octet string is used to obtain 8 bit length field prior to
        -- actual information.  This makes it possible for BSS to transparently handle information
        -- received via GSM air interface even when it includes non critical extensions.
        -- The octet string shall include the InterRATHandoverInfo information
        -- The BSS can re-use the 44.018 length field received from the MS
        interRATHandoverInfo            OCTET STRING (SIZE (0..255))
}

InterRATHandoverInfoWithInterRATCapabilities-v390ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        failureCauseWithProtErr             FailureCauseWithProtErr                 OPTIONAL
}

InterRATHandoverInfoWithInterRATCapabilities-v690ext-IEs ::= SEQUENCE {
    -- Other IEs
        ue-RATSpecificCapability-v690ext    InterRAT-UE-RadioAccessCapability-v690ext   OPTIONAL
}

-- ***************************************************
--
-- RFC3095 context, source RNC to target RNC
--
-- ***************************************************

RFC3095-ContextInfo-r5 ::= CHOICE {
    r5                                  SEQUENCE {
        rFC3095-ContextInfoList-r5      RFC3095-ContextInfoList-r5,
        -- Reserved for future non critical extension
        nonCriticalExtensions           SEQUENCE {} OPTIONAL
    },
    criticalExtensions                  SEQUENCE {}
}

RFC3095-ContextInfoList-r5 ::=          SEQUENCE (SIZE (1..maxRBallRABs)) OF
                                        RFC3095-ContextInfo


-- ***************************************************
--
-- SRNC Relocation information
--
```

```
-- ***************************************************

SRNC-RelocationInfo-r3 ::= CHOICE {
    r3                              SEQUENCE {
        sRNC-RelocationInfo-r3          SRNC-RelocationInfo-r3-IEs,
        v380NonCriticalExtensions           SEQUENCE {
            sRNC-RelocationInfo-v380ext SRNC-RelocationInfo-v380ext-IEs,
            -- Reserved for future non critical extension
            v390NonCriticalExtensions           SEQUENCE {
                sRNC-RelocationInfo-v390ext         SRNC-RelocationInfo-v390ext-IEs,
                v3a0NonCriticalExtensions           SEQUENCE {
                    sRNC-RelocationInfo-v3a0ext         SRNC-RelocationInfo-v3a0ext-IEs,
                    v3b0NonCriticalExtensions           SEQUENCE {
                        sRNC-RelocationInfo-v3b0ext         SRNC-RelocationInfo-v3b0ext-IEs,
                        v3c0NonCriticalExtensions           SEQUENCE {
                            sRNC-RelocationInfo-v3c0ext         SRNC-RelocationInfo-v3c0ext-IEs,
                            laterNonCriticalExtensions          SEQUENCE {
                                sRNC-RelocationInfo-v3d0ext         SRNC-RelocationInfo-v3d0ext-IEs,
                                -- Container for additional R99 extensions
                                sRNC-RelocationInfo-r3-add-ext      BIT STRING
                                        (CONTAINING SRNC-RelocationInfo-v3h0ext-IEs)      OPTIONAL,
                                v3g0NonCriticalExtensions           SEQUENCE {
                                    sRNC-RelocationInfo-v3g0ext         SRNC-RelocationInfo-v3g0ext-IEs,
                                    v4b0NonCriticalExtensions           SEQUENCE {
                                        sRNC-RelocationInfo-v4b0ext         SRNC-RelocationInfo-v4b0ext-IEs,
                                        v590NonCriticalExtensions           SEQUENCE {
                                            sRNC-RelocationInfo-v590ext
                                                                    SRNC-RelocationInfo-v590ext-IEs,
                                            v5a0NonCriticalExtensions           SEQUENCE {
                                                sRNC-RelocationInfo-v5a0ext
                                                                    SRNC-RelocationInfo-v5a0ext-IEs,
                                                v5b0NonCriticalExtensions           SEQUENCE {
                                                    sRNC-RelocationInfo-v5b0ext
                                                                    SRNC-RelocationInfo-v5b0ext-IEs,
                                                    v5c0NonCriticalExtensions           SEQUENCE {
                                                        sRNC-RelocationInfo-v5c0ext
                                                                    SRNC-RelocationInfo-v5c0ext-IEs,
                                                        v690NonCriticalExtensions       SEQUENCE {
                                                            sRNC-RelocationInfo-v690ext
                                                                    SRNC-RelocationInfo-v690ext-IEs,
                                                            v7xyNonCriticalExtensions SEQUENCE {
                                                                sRNC-RelocationInfo-v7xyext
                                                                    SRNC-RelocationInfo-v7xyext-IEs,
                                                                -- Reserved for future non critical extension
                                                                nonCriticalExtensions   SEQUENCE {} OPTIONAL
                                                            }       OPTIONAL
                                                        }       OPTIONAL
                                                    }       OPTIONAL
                                                }       OPTIONAL
                                            }       OPTIONAL
                                        }       OPTIONAL
                                    }       OPTIONAL
                                }       OPTIONAL
                            }       OPTIONAL
                        }       OPTIONAL
                    }       OPTIONAL
                }       OPTIONAL
            }       OPTIONAL
        }       OPTIONAL
    },
    later-than-r3                   CHOICE {
        r4                              SEQUENCE {
            sRNC-RelocationInfo-r4          SRNC-RelocationInfo-r4-IEs,
            v4d0NonCriticalExtensions       SEQUENCE {
                sRNC-RelocationInfo-v4d0ext     SRNC-RelocationInfo-v4d0ext-IEs,
                -- Container for adding non critical extensions after freezing REL-5
                sRNC-RelocationInfo-r4-add-ext      BIT STRING      OPTIONAL,
                v590NonCriticalExtensions           SEQUENCE {
                    sRNC-RelocationInfo-v590ext         SRNC-RelocationInfo-v590ext-IEs,
                    v5a0NonCriticalExtensions           SEQUENCE {
                        sRNC-RelocationInfo-v5a0ext         SRNC-RelocationInfo-v5a0ext-IEs,
                        v5b0NonCriticalExtensions           SEQUENCE {
                            sRNC-RelocationInfo-v5b0ext         SRNC-RelocationInfo-v5b0ext-IEs,
                            v5c0NonCriticalExtensions           SEQUENCE {
                                sRNC-RelocationInfo-v5c0ext         SRNC-RelocationInfo-v5c0ext-IEs,
                                v690NonCriticalExtensions           SEQUENCE {
                                    sRNC-RelocationInfo-v690ext
                                                SRNC-RelocationInfo-v690ext-IEs,
```

```
                                nonCriticalExtensions               SEQUENCE {} OPTIONAL
                            }   OPTIONAL
                        }   OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            }   OPTIONAL
        }   OPTIONAL
    },
    criticalExtensions              CHOICE {
        r5                              SEQUENCE {
            sRNC-RelocationInfo-r5          SRNC-RelocationInfo-r5-IEs,
            sRNC-RelocationInfo-r5-add-ext  BIT STRING      OPTIONAL,
            v5a0NonCriticalExtensions       SEQUENCE {
                sRNC-RelocationInfo-v5a0ext     SRNC-RelocationInfo-v5a0ext-IEs,
                v5b0NonCriticalExtensions       SEQUENCE {
                    sRNC-RelocationInfo-v5b0ext     SRNC-RelocationInfo-v5b0ext-IEs,
                    v5c0NonCriticalExtensions           SEQUENCE {
                        sRNC-RelocationInfo-v5c0ext         SRNC-RelocationInfo-v5c0ext-IEs,
                        v690NonCriticalExtensions           SEQUENCE {
                            sRNC-RelocationInfo-v690ext         SRNC-RelocationInfo-v690ext-IEs,
                            nonCriticalExtensions               SEQUENCE {}     OPTIONAL
                        }   OPTIONAL
                    }   OPTIONAL
                }   OPTIONAL
            }   OPTIONAL
        },
        criticalExtensions              CHOICE {
            r6                              SEQUENCE {
                sRNC-RelocationInfo-r6          SRNC-RelocationInfo-r6-IEs,
                sRNC-RelocationInfo-r6-add-ext  BIT STRING      OPTIONAL,
                nonCriticalExtensions           SEQUENCE {}     OPTIONAL
            },
            criticalExtensions              SEQUENCE {}
        }
    }
  }
}

SRNC-RelocationInfo-r3-IEs ::=      SEQUENCE {
    -- Non-RRC IEs
        stateOfRRC                      StateOfRRC,
        stateOfRRC-Procedure            StateOfRRC-Procedure,
    -- Ciphering related information IEs
    -- If the extension v380 is included use the extension for the ciphering status per CN domain
        cipheringStatus                 CipheringStatus,
        -- If ciphering status is started and the IE latestConfiguredCN-Domain should be included,
        -- the IE cn-DomainIdentity (in SRNC-RelocationInfo-v380ext-IEs) shall be used instead.
        calculationTimeForCiphering     CalculationTimeForCiphering         OPTIONAL,
        -- The order of occurrence in the IE cipheringInfoPerRB-List is the
        -- same as the RBs in SRB-InformationSetupList in RAB-InformationSetupList.
        -- The signalling RBs are supposed to be listed
        -- first. Only UM and AM RBs that are ciphered are listed here
        cipheringInfoPerRB-List         CipheringInfoPerRB-List             OPTIONAL,
        count-C-List                    COUNT-C-List                        OPTIONAL,
        integrityProtectionStatus       IntegrityProtectionStatus,
        -- In the IE srb-SpecificIntegrityProtInfo, the first information listed corresponds to
      -- signalling radio bearer RB0 and after the order of occurrence is the same as the SRBs in
     -- SRB-InformationSetupList
        -- The target RNC may ignore the IE srb-SpecificIntegrityProtInfo if the
        -- IE integrityProtectionStatus has the value "not started".
        srb-SpecificIntegrityProtInfo   SRB-SpecificIntegrityProtInfoList,
        implementationSpecificParams    ImplementationSpecificParams        OPTIONAL,
    -- User equipment IEs
        u-RNTI                          U-RNTI,
        c-RNTI                          C-RNTI                              OPTIONAL,
        ue-RadioAccessCapability        UE-RadioAccessCapability,
        ue-Positioning-LastKnownPos     UE-Positioning-LastKnownPos         OPTIONAL,
    -- Other IEs
        ue-RATSpecificCapability        InterRAT-UE-RadioAccessCapabilityList   OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Core network IEs
        cn-CommonGSM-MAP-NAS-SysInfo    NAS-SystemInformationGSM-MAP,
        cn-DomainInformationList        CN-DomainInformationList            OPTIONAL,
    -- Measurement IEs
        ongoingMeasRepList              OngoingMeasRepList                  OPTIONAL,
    -- Radio bearer IEs
        predefinedConfigStatusList      PredefinedConfigStatusList,
```

```
        srb-InformationList             SRB-InformationSetupList,
        rab-InformationList             RAB-InformationSetupList            OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo                OPTIONAL,
        ul-TransChInfoList              UL-AddReconfTransChInfoList         OPTIONAL,
        modeSpecificInfo                CHOICE {
            fdd                             SEQUENCE {
                -- dummy and dummy2 are not used in this version of the specification, they should
                -- not be sent and if received they should be ignored.
                dummy                           CPCH-SetID                  OPTIONAL,
                dummy2                          DRAC-StaticInformationList  OPTIONAL
            },
            tdd                             NULL
        },
        dl-CommonTransChInfo            DL-CommonTransChInfo                OPTIONAL,
        dl-TransChInfoList              DL-AddReconfTransChInfoList         OPTIONAL,
    -- Measurement report
        measurementReport               MeasurementReport                   OPTIONAL
}

SRNC-RelocationInfo-v380ext-IEs ::= SEQUENCE {
    -- Ciphering related information IEs
        -- In the SRNC-RelocationInfo-r3-IEs, the IE 'cn-DomainIdentity' is used to represent the
        -- IE 'Latest configured CN domain' in the tabular.
        cn-DomainIdentity                   CN-DomainIdentity,
        cipheringStatusList                 CipheringStatusList
}

SRNC-RelocationInfo-v390ext-IEs ::= SEQUENCE {
        cn-DomainInformationList-v390ext    CN-DomainInformationList-v390ext        OPTIONAL,
        ue-RadioAccessCapability-v370ext    UE-RadioAccessCapability-v370ext        OPTIONAL,
        ue-RadioAccessCapability-v380ext    UE-RadioAccessCapability-v380ext        OPTIONAL,
        dl-PhysChCapabilityFDD-v380ext      DL-PhysChCapabilityFDD-v380ext,
        failureCauseWithProtErr             FailureCauseWithProtErr                 OPTIONAL
}

SRNC-RelocationInfo-v3a0ext-IEs ::= SEQUENCE {
        cipheringInfoForSRB1-v3a0ext        CipheringInfoPerRB-List-v3a0ext,
        ue-RadioAccessCapability-v3a0ext    UE-RadioAccessCapability-v3a0ext        OPTIONAL,
        -- cn-domain identity for IE startValueForCiphering-v3a0ext is specified
        -- in subsequent extension (SRNC-RelocationInfo-v3b0ext-IEs)
        startValueForCiphering-v3a0ext      START-Value
}

SRNC-RelocationInfo-v3b0ext-IEs ::= SEQUENCE {
        -- cn-domain identity for IE startValueForCiphering-v3a0ext included in previous extension
        cn-DomainIdentity               CN-DomainIdentity,
        -- the IE startValueForCiphering-v3b0ext contains the start values for each CN Domain. The
        -- value of start indicated by the IE startValueForCiphering-v3a0ext should be set to the
        -- same value as the start-Value for the corresponding cn-DomainIdentity in the IE
        -- startValueForCiphering-v3b0ext
        startValueForCiphering-v3b0ext      STARTList2                              OPTIONAL
}

SRNC-RelocationInfo-v3c0ext-IEs ::= SEQUENCE {
        -- IE rb-IdentityForHOMessage includes the identity of the RB used by the source SRNC
        -- to send the message contained in the IE "TargetRNC-ToSourceRNC-Container".
        -- Only included if type is "UE involved"
        rb-IdentityForHOMessage             RB-Identity         OPTIONAL
}

SRNC-RelocationInfo-v3d0ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        uESpecificBehaviourInformation1idle     UESpecificBehaviourInformation1idle     OPTIONAL,
        uESpecificBehaviourInformation1interRAT     UESpecificBehaviourInformation1interRAT
    OPTIONAL
}

SRNC-RelocationInfo-v3g0ext-IEs ::= SEQUENCE {
        ue-RadioAccessCapability-v3g0ext    UE-RadioAccessCapability-v3g0ext        OPTIONAL
}

SRNC-RelocationInfo-v3h0ext-IEs ::= SEQUENCE {
        tpc-CombinationInfoList         TPC-CombinationInfoList     OPTIONAL,
        nonCriticalExtension                SEQUENCE {}             OPTIONAL
}

SRNC-RelocationInfo-v4d0ext-IEs ::= SEQUENCE {
```

```
        tpc-CombinationInfoList      TPC-CombinationInfoList      OPTIONAL
}

TPC-CombinationInfoList ::= SEQUENCE (SIZE (1..maxRL)) OF
        TPC-Combination-Info

STARTList2 ::=                    SEQUENCE (SIZE (2..maxCNdomains)) OF
                                      STARTSingle

SRNC-RelocationInfo-v4b0ext-IEs ::= SEQUENCE {
        ue-RadioAccessCapability-v4b0ext     UE-RadioAccessCapability-v4b0ext        OPTIONAL
}

SRNC-RelocationInfo-v590ext-IEs ::= SEQUENCE {
        ue-RadioAccessCapability-v590ext     UE-RadioAccessCapability-v590ext        OPTIONAL,
        ue-RATSpecificCapability-v590ext     InterRAT-UE-RadioAccessCapability-v590ext   OPTIONAL
}

SRNC-RelocationInfo-v5a0ext-IEs ::= SEQUENCE {
        storedCompressedModeInfo        StoredCompressedModeInfo     OPTIONAL
}

SRNC-RelocationInfo-v5b0ext-IEs ::= SEQUENCE {
    interRATCellInfoIndication          InterRATCellInfoIndication          OPTIONAL
}

SRNC-RelocationInfo-v5c0ext-IEs ::= SEQUENCE {
        ue-RadioAccessCapability-v5c0ext     UE-RadioAccessCapability-v5c0ext        OPTIONAL
}

SRNC-RelocationInfo-v7xyext-IEs ::= SEQUENCE {
        ue-RadioAccessCapability-v7xyext     UE-RadioAccessCapability-v7xyext        OPTIONAL
}

CipheringInfoPerRB-List-v3a0ext ::= SEQUENCE {
        dl-UM-SN                            BIT STRING (SIZE (7))
}

CipheringStatusList ::=         SEQUENCE (SIZE (1..maxCNdomains)) OF
                                    CipheringStatusCNdomain

CipheringStatusCNdomain ::=             SEQUENCE {
        cn-DomainIdentity               CN-DomainIdentity,
        cipheringStatus                 CipheringStatus
}

CodeChangeStatusList ::= SEQUENCE (SIZE (1..maxRL)) OF
        CodeChangeStatus

CodeChangeStatus ::= SEQUENCE {
        primaryCPICH-Info                   PrimaryCPICH-Info,
        scramblingCodeChange                ScramblingCodeChange
}

StoredCompressedModeInfo ::= SEQUENCE {
        storedTGP-SequenceList       StoredTGP-SequenceList,
        codeChangeStatusList         CodeChangeStatusList     OPTIONAL
}

StoredTGP-SequenceList ::=          SEQUENCE (SIZE (1..maxTGPS)) OF
                                        StoredTGP-Sequence

StoredTGP-Sequence ::=              SEQUENCE {
    tgpsi                               TGPSI,
    current-tgps-Status                 CHOICE {
        active                              SEQUENCE {
            tgcfn                               TGCFN
        },
        inactive                            NULL
    },
    tgps-ConfigurationParams            TGPS-ConfigurationParams            OPTIONAL
}

SRNC-RelocationInfo-r4-IEs ::=          SEQUENCE {
    -- Non-RRC IEs
        -- IE rb-IdentityForHOMessage includes the identity of the RB used by the source SRNC
        -- to send the message contained in the IE "TargetRNC-ToSourceRNC-Container".
        -- Only included if type is "UE involved"
```

```
        rb-IdentityForHOMessage         RB-Identity                         OPTIONAL,
        stateOfRRC                      StateOfRRC,
        stateOfRRC-Procedure            StateOfRRC-Procedure,
    -- Ciphering related information IEs
        cipheringStatusList             CipheringStatusList-r4,
        latestConfiguredCN-Domain       CN-DomainIdentity,
        calculationTimeForCiphering     CalculationTimeForCiphering         OPTIONAL,
        count-C-List                    COUNT-C-List                        OPTIONAL,
        cipheringInfoPerRB-List         CipheringInfoPerRB-List-r4          OPTIONAL,
    -- Integrity protection related information IEs
        integrityProtectionStatus       IntegrityProtectionStatus,
        -- The target RNC may ignore the IE srb-SpecificIntegrityProtInfo if the
        -- IE integrityProtectionStatus has the value "not started".
        srb-SpecificIntegrityProtInfo   SRB-SpecificIntegrityProtInfoList,
        implementationSpecificParams    ImplementationSpecificParams        OPTIONAL,
    -- User equipment IEs
        u-RNTI                          U-RNTI,
        c-RNTI                          C-RNTI                              OPTIONAL,
        ue-RadioAccessCapability        UE-RadioAccessCapability-r4,
        ue-RadioAccessCapability-ext    UE-RadioAccessCapabBandFDDList      OPTIONAL,
        ue-Positioning-LastKnownPos     UE-Positioning-LastKnownPos         OPTIONAL,
        uESpecificBehaviourInformation1idle     UESpecificBehaviourInformation1idle     OPTIONAL,
        uESpecificBehaviourInformation1interRAT     UESpecificBehaviourInformation1interRAT
    OPTIONAL,
    -- Other IEs
        ue-RATSpecificCapability        InterRAT-UE-RadioAccessCapabilityList   OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Core network IEs
        cn-CommonGSM-MAP-NAS-SysInfo    NAS-SystemInformationGSM-MAP,
        cn-DomainInformationList        CN-DomainInformationListFull        OPTIONAL,
    -- Measurement IEs
        ongoingMeasRepList              OngoingMeasRepList-r4               OPTIONAL,
    -- Radio bearer IEs
        predefinedConfigStatusList      PredefinedConfigStatusList,
        srb-InformationList             SRB-InformationSetupList,
        rab-InformationList             RAB-InformationSetupList-r4         OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
        ul-TransChInfoList              UL-AddReconfTransChInfoList         OPTIONAL,
        -- 'dummy', 'dummy1' and 'dummy2' are not used in this version of the specification,
        -- they should not be sent and if received they should be ignored.
        dummy                           CHOICE {
            fdd                             SEQUENCE {
                dummy1                          CPCH-SetID                  OPTIONAL,
                dummy2                          DRAC-StaticInformationList  OPTIONAL
            },
            tdd                             NULL
        }                                                                   OPTIONAL,
        dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
        dl-TransChInfoList              DL-AddReconfTransChInfoList-r4      OPTIONAL,
    -- Measurement report
        measurementReport               MeasurementReport                   OPTIONAL,
        failureCause                    FailureCauseWithProtErr             OPTIONAL
}

SRNC-RelocationInfo-r5-IEs ::=          SEQUENCE {
    -- Non-RRC IEs
        -- IE rb-IdentityForHOMessage includes the identity of the RB used by the source SRNC
        -- to send the message contained in the IE "TargetRNC-ToSourceRNC-Container".
        -- Only included if type is "UE involved"
        rb-IdentityForHOMessage         RB-Identity                         OPTIONAL,
        stateOfRRC                      StateOfRRC,
        stateOfRRC-Procedure            StateOfRRC-Procedure,
    -- Ciphering related information IEs
        cipheringStatusList             CipheringStatusList-r4,
        latestConfiguredCN-Domain       CN-DomainIdentity,
        calculationTimeForCiphering     CalculationTimeForCiphering         OPTIONAL,
        count-C-List                    COUNT-C-List                        OPTIONAL,
        cipheringInfoPerRB-List         CipheringInfoPerRB-List-r4          OPTIONAL,
    -- Integrity protection related information IEs
        integrityProtectionStatus       IntegrityProtectionStatus,
        srb-SpecificIntegrityProtInfo   SRB-SpecificIntegrityProtInfoList   OPTIONAL,
        implementationSpecificParams    ImplementationSpecificParams        OPTIONAL,
    -- User equipment IEs
        u-RNTI                          U-RNTI,
        c-RNTI                          C-RNTI                              OPTIONAL,
        ue-RadioAccessCapability        UE-RadioAccessCapability-r5,
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        ue-RadioAccessCapability-ext    UE-RadioAccessCapabBandFDDList      OPTIONAL,
        ue-Positioning-LastKnownPos     UE-Positioning-LastKnownPos         OPTIONAL,
        uESpecificBehaviourInformation1idle
                                        UESpecificBehaviourInformation1idle     OPTIONAL,
        uESpecificBehaviourInformation1interRAT
                                        UESpecificBehaviourInformation1interRAT     OPTIONAL,
    -- Other IEs
        ue-RATSpecificCapability        InterRAT-UE-RadioAccessCapabilityList-r5    OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Core network IEs
        cn-CommonGSM-MAP-NAS-SysInfo    NAS-SystemInformationGSM-MAP,
        cn-DomainInformationList        CN-DomainInformationListFull        OPTIONAL,
    -- Measurement IEs
        ongoingMeasRepList              OngoingMeasRepList-r5               OPTIONAL,
    -- Radio bearer IEs
        predefinedConfigStatusList      PredefinedConfigStatusList,
        srb-InformationList             SRB-InformationSetupList-r5,
        rab-InformationList             RAB-InformationSetupList-r5         OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
        ul-TransChInfoList              UL-AddReconfTransChInfoList         OPTIONAL,
        -- 'dummy', 'dummy1' and 'dummy2' are not used in this version of the specification,
        -- they should not be sent and if received they should be ignored.
        dummy                           CHOICE {
            fdd                             SEQUENCE {
                dummy1                          CPCH-SetID                  OPTIONAL,
                dummy2                          DRAC-StaticInformationList  OPTIONAL
            },
            tdd                             NULL
        }                                                                   OPTIONAL,
        dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
        dl-TransChInfoList              DL-AddReconfTransChInfoList-r5      OPTIONAL,
    -- PhyCH IEs
        tpc-CombinationInfoList         TPC-CombinationInfoList             OPTIONAL,
    -- Measurement report
        measurementReport               MeasurementReport                   OPTIONAL,
    -- Other IEs
        failureCause                    FailureCauseWithProtErr             OPTIONAL
}

SRNC-RelocationInfo-v690ext-IEs ::= SEQUENCE {
    -- User equipment IEs
        -- IE ueCapabilityContainer is used for the transparent transfer of capability information
        -- received from the UE
        ueCapabilityContainer           BIT STRING
                                            (CONTAINING UE-CapabilityContainer-IEs) OPTIONAL,
        -- IE ueCapabilityContainer-RSC and IE ueCapabilityContainer-UCI are used for the
        -- transparent transfer of capability information received from the UE that was introduced
        -- in a release independent manner, i.e., transferred within a VLEC. These UE capabilities
        -- are included both in the RRC CONNECTION SETUP COMPLETE and the UE CAPABILITY INFORMATION
        -- messages. Only the VLEC of one message needs to be included i.e. the one from these
        -- messages that was last received.
        -- Case 1: If the last received message was a RRC CONNECTION SETUP COMPLETE (RSC)
        ueCapabilityContainer-RSC       BIT STRING
                            (CONTAINING RRCConnectionSetupComplete-r3-add-ext-IEs)  OPTIONAL,
        -- Case 2: If the last received message was a UE CAPABILITY INFORMATION (UCI)
        ueCapabilityContainer-UCI       BIT STRING
                            (CONTAINING UECapabilityInformation-r3-add-ext-IEs)     OPTIONAL,
    -- Radio bearer IEs
        rab-InformationSetupList        RAB-InformationSetupList-r6-ext     OPTIONAL,
    -- Measurement report
        measuredResultsOnRACHinterFreq  MeasuredResultsOnRACHinterFreq      OPTIONAL,
    -- MBMS IEs
        mbms-JoinedInformation          MBMS-JoinedInformation-r6           OPTIONAL,
    -- Measurement IEs
        intraFreqReportingCriteria      IntraFreqReportingCriteria-r6-ext       OPTIONAL
}

SRNC-RelocationInfo-r6-IEs ::=          SEQUENCE {
    -- Non-RRC IEs
        -- IE rb-IdentityForHOMessage includes the identity of the RB used by the source SRNC
        -- to send the message contained in the IE "TargetRNC-ToSourceRNC-Container".
        -- Only included if type is "UE involved"
        rb-IdentityForHOMessage         RB-Identity                         OPTIONAL,
        stateOfRRC                      StateOfRRC,
        stateOfRRC-Procedure            StateOfRRC-Procedure,
    -- Ciphering related information IEs
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        cipheringStatusList             CipheringStatusList-r4,
        latestConfiguredCN-Domain       CN-DomainIdentity,
        calculationTimeForCiphering     CalculationTimeForCiphering         OPTIONAL,
        count-C-List                    COUNT-C-List                        OPTIONAL,
        cipheringInfoPerRB-List         CipheringInfoPerRB-List-r4          OPTIONAL,
    -- Integrity protection related information IEs
        integrityProtectionStatus       IntegrityProtectionStatus,
        srb-SpecificIntegrityProtInfo   SRB-SpecificIntegrityProtInfoList   OPTIONAL,
        implementationSpecificParams    ImplementationSpecificParams        OPTIONAL,
    -- User equipment IEs
        u-RNTI                          U-RNTI,
        c-RNTI                          C-RNTI                              OPTIONAL,
        ue-RadioAccessCapability        UE-RadioAccessCapability-r6,
        ue-RadioAccessCapability-ext    UE-RadioAccessCapabBandFDDList      OPTIONAL,
        ue-Positioning-LastKnownPos     UE-Positioning-LastKnownPos         OPTIONAL,
        uESpecificBehaviourInformation1idle
                                        UESpecificBehaviourInformation1idle     OPTIONAL,
        uESpecificBehaviourInformation1interRAT
                                        UESpecificBehaviourInformation1interRAT     OPTIONAL,
        -- IE ueCapabilityContainer is used for the transparent transfer of capability information
        -- received from the UE
        ueCapabilityContainer           BIT STRING
                                            (CONTAINING UE-CapabilityContainer-IEs) OPTIONAL,
        -- IE ueCapabilityContainer-RSC and IE ueCapabilityContainer-UCI are used for the
        -- transparent transfer of capability information received from the UE that was introduced
        -- in a release independent manner, i.e., transferred within a VLEC. These UE capabilities
        -- are included both in the RRC CONNECTION SETUP COMPLETE and the UE CAPABILITY INFORMATION
        -- messages. Only the VLEC of one message needs to be included i.e. the one from these
        -- messages that was last received.
        -- Case 1: If the last received message was a RRC CONNECTION SETUP COMPLETE (RSC)
        ueCapabilityContainer-RSC       BIT STRING
                            (CONTAINING RRCConnectionSetupComplete-r3-add-ext-IEs)  OPTIONAL,
        -- Case 2: If the last received message was a UE CAPABILITY INFORMATION (UCI)
        ueCapabilityContainer-UCI       BIT STRING
                            (CONTAINING UECapabilityInformation-r3-add-ext-IEs)     OPTIONAL,
    -- Other IEs
        ue-RATSpecificCapability        InterRAT-UE-RadioAccessCapabilityList-r5    OPTIONAL,
    -- UTRAN mobility IEs
        ura-Identity                    URA-Identity                        OPTIONAL,
    -- Core network IEs
        cn-CommonGSM-MAP-NAS-SysInfo    NAS-SystemInformationGSM-MAP,
        cn-DomainInformationList        CN-DomainInformationListFull        OPTIONAL,
    -- Measurement IEs
        ongoingMeasRepList              OngoingMeasRepList-r6               OPTIONAL,
        interRATCellInfoIndication      InterRATCellInfoIndication          OPTIONAL,
    -- Radio bearer IEs
        predefinedConfigStatusList      PredefinedConfigStatusList,
        srb-InformationList             SRB-InformationSetupList-r6,
        rab-InformationList             RAB-InformationSetupList-r6         OPTIONAL,
    -- Transport channel IEs
        ul-CommonTransChInfo            UL-CommonTransChInfo-r4             OPTIONAL,
        ul-TransChInfoList              UL-AddReconfTransChInfoList-r6      OPTIONAL,
        dl-CommonTransChInfo            DL-CommonTransChInfo-r4             OPTIONAL,
        dl-TransChInfoList              DL-AddReconfTransChInfoList-r5      OPTIONAL,
    -- PhyCH IEs
        tpc-CombinationInfoList         TPC-CombinationInfoList             OPTIONAL,
        storedCompressedModeInfo        StoredCompressedModeInfo            OPTIONAL,
    -- Measurement report
        measurementReport               MeasurementReport                   OPTIONAL,
    -- Other IEs
        failureCause                    FailureCauseWithProtErr             OPTIONAL,
    -- MBMS IEs
        mbms-JoinedInformation          MBMS-JoinedInformation-r6           OPTIONAL
}

-- IE definitions

CalculationTimeForCiphering ::=     SEQUENCE {
    cell-Id                             CellIdentity,
    sfn                                 INTEGER (0..4095)
}

CipheringInfoPerRB ::=              SEQUENCE {
    dl-HFN                              BIT STRING (SIZE (20..25)),
    ul-HFN                              BIT STRING (SIZE (20..25))
}

CipheringInfoPerRB-r4 ::=           SEQUENCE {
```

```
    rb-Identity                             RB-Identity,
    dl-HFN                                  BIT STRING (SIZE (20..25)),
    dl-UM-SN                                BIT STRING (SIZE (7))               OPTIONAL,
    ul-HFN                                  BIT STRING (SIZE (20..25))
}

-- TABULAR: CipheringInfoPerRB-List, multiplicity value numberOfRadioBearers
-- has been replaced with maxRB.
CipheringInfoPerRB-List ::=             SEQUENCE (SIZE (1..maxRB)) OF
                                            CipheringInfoPerRB

CipheringInfoPerRB-List-r4 ::=          SEQUENCE (SIZE (1..maxRB)) OF
                                            CipheringInfoPerRB-r4


CipheringStatus ::=                     ENUMERATED {
                                            started, notStarted }

CipheringStatusList-r4 ::=              SEQUENCE (SIZE (1..maxCNdomains)) OF
                                            CipheringStatusCNdomain-r4

CipheringStatusCNdomain-r4 ::=          SEQUENCE {
        cn-DomainIdentity                   CN-DomainIdentity,
        cipheringStatus                     CipheringStatus,
        start-Value                         START-Value
}

CN-DomainInformation-v390ext ::=            SEQUENCE {
    cn-DRX-CycleLengthCoeff                 CN-DRX-CycleLengthCoefficient
}

CN-DomainInformationList-v390ext ::=    SEQUENCE (SIZE (1..maxCNdomains)) OF
                                            CN-DomainInformation-v390ext

CompressedModeMeasCapability-r4 ::= SEQUENCE {
    fdd-Measurements                        BOOLEAN,
    -- TABULAR: The IEs tdd-Measurements, gsm-Measurements and multiCarrierMeasurements
    -- are made optional since they are conditional based on another information element.
    -- Their absence corresponds to the case where the condition is not true.
    tdd384-Measurements                     BOOLEAN                             OPTIONAL,
    tdd128-Measurements                     BOOLEAN                             OPTIONAL,
    gsm-Measurements                        GSM-Measurements                    OPTIONAL,
    multiCarrierMeasurements                BOOLEAN                             OPTIONAL
}

COUNT-C-List ::=                            SEQUENCE (SIZE (1..maxCNdomains)) OF
                                            COUNT-CSingle

COUNT-CSingle ::=                           SEQUENCE {
    cn-DomainIdentity                       CN-DomainIdentity,
    count-C                                 BIT STRING (SIZE (32))
}

DL-PhysChCapabilityFDD-r4 ::=           SEQUENCE {
    -- The IE "maxNoDPCH-PDSCH-Codes" only gives information on the maximum number of DPCH Codes.
    maxNoDPCH-PDSCH-Codes                   INTEGER (1..8),
    maxNoPhysChBitsReceived                 MaxNoPhysChBitsReceived,
    supportForSF-512                        BOOLEAN,
    -- dummy, dummy2 and dummy3 are not used in this version of the specification,
    -- they should not be sent and if received they should be ignored.
    dummy                                   BOOLEAN,
    dummy2                                  SimultaneousSCCPCH-DPCH-Reception,
    dummy3                                  SupportOfDedicatedPilotsForChEstimation     OPTIONAL
}

DL-PhysChCapabilityFDD-r5 ::=           SEQUENCE {
    -- The IE "maxNoDPCH-PDSCH-Codes" only gives information on the maximum number of DPCH Codes.
    maxNoDPCH-PDSCH-Codes                   INTEGER (1..8),
    maxNoPhysChBitsReceived                 MaxNoPhysChBitsReceived,
    supportForSF-512                        BOOLEAN,
    -- dummy, dumy2 and dummy3 are not used in this version of the specification,
    -- they should not be sent and if received they should be ignored.
    dummy                                   BOOLEAN,
    dummy2                                  SimultaneousSCCPCH-DPCH-Reception,
    dummy3                                  SupportOfDedicatedPilotsForChEstimation     OPTIONAL,
    fdd-hspdsch                             CHOICE {
        supported                               SEQUENCE {
            hsdsch-physical-layer-category          HSDSCH-physical-layer-category,
```

```
            -- dummy and dummy2 are not used in this version of the specification
            -- they should not be sent and if received they should be ignored.
            dummy                                   BOOLEAN,
            dummy2                                  BOOLEAN
        },
        unsupported                         NULL
    }
}

DL-PhysChCapabilityTDD-r5 ::=       SEQUENCE {
    maxTS-PerFrame                      MaxTS-PerFrame,
    maxPhysChPerFrame                   MaxPhysChPerFrame,
    minimumSF                           MinimumSF-DL,
    supportOfPDSCH                      BOOLEAN,
    maxPhysChPerTS                      MaxPhysChPerTS,
    tdd384-hspdsch                      CHOICE {
        supported                           HSDSCH-physical-layer-category,
        unsupported                         NULL
    }
}

DL-PhysChCapabilityTDD-LCR-r5 ::=   SEQUENCE {
    maxTS-PerSubFrame                   MaxTS-PerSubFrame-r4,
    maxPhysChPerFrame                   MaxPhysChPerSubFrame-r4,
    minimumSF                           MinimumSF-DL,
    supportOfPDSCH                      BOOLEAN,
    maxPhysChPerTS                      MaxPhysChPerTS,
    supportOf8PSK                       BOOLEAN,
    tdd128-hspdsch                      CHOICE {
        supported                           HSDSCH-physical-layer-category,
        unsupported                         NULL
    }
}

DL-RFC3095-Context ::=              SEQUENCE {
    rfc3095-Context-Identity            INTEGER (0..16383),
    dl-mode                             ENUMERATED {u, o, r},
    dl-ref-ir                           OCTET STRING ( SIZE (1..3000)),
    dl-ref-time                         INTEGER (0..4294967295)     OPTIONAL,
    dl-curr-time                        INTEGER (0..4294967295)     OPTIONAL,
    dl-syn-offset-id                    INTEGER (0..65535)          OPTIONAL,
    dl-syn-slope-ts                     INTEGER (0..4294967295)     OPTIONAL,
    dl-dyn-changed                      BOOLEAN
}

ImplementationSpecificParams ::=    BIT STRING (SIZE (1..512))


IntegrityProtectionStatus ::=       ENUMERATED {
                                        started, notStarted }

InterRAT-UE-RadioAccessCapabilityList-r5 ::=    SEQUENCE {
    interRAT-UE-RadioAccessCapability   InterRAT-UE-RadioAccessCapabilityList,
    geranIu-RadioAccessCapability       GERANIu-RadioAccessCapability               OPTIONAL
}

IntraFreqReportingCriteria-r6-ext ::= SEQUENCE {
    -- The content of the v690 non-critical extension should be
    -- considered as an extension of IE IntraFreqEventCriteriaList
    event                               Event1j-r6,
    hysteresis                          Hysteresis,
    timeToTrigger                       TimeToTrigger,
    reportingCellStatus                 ReportingCellStatus                 OPTIONAL
}

-- dummy is not used in this version of the specification, it should
-- not be sent and if received it should be ignored.
MaxHcContextSpace-r5 ::=                ENUMERATED {
                                            dummy, by1024, by2048, by4096, by8192,
                                            by16384, by32768, by65536, by131072 }

MeasurementCapability-r4 ::=        SEQUENCE {
    downlinkCompressedMode              CompressedModeMeasCapability-r4,
    uplinkCompressedMode                CompressedModeMeasCapability-r4
}

MeasurementCommandWithType ::=      CHOICE {
    setup                               MeasurementType,
```

```
    modify                              NULL,
    release                             NULL
}

MeasurementCommandWithType-r4 ::=   CHOICE {
    setup                               MeasurementType-r4,
    modify                              NULL,
    release                             NULL
}

MeasurementCommandWithType-r6 ::=   CHOICE {
    setup                               MeasurementType-r6,
    modify                              NULL,
    release                             NULL
}

OngoingMeasRep ::=                  SEQUENCE {
    measurementIdentity                 MeasurementIdentity,
    -- TABULAR: The CHOICE Measurement in the tabular description is included
    -- in MeasurementCommandWithType
    measurementCommandWithType          MeasurementCommandWithType,
    measurementReportingMode            MeasurementReportingMode            OPTIONAL,
    additionalMeasurementID-List        AdditionalMeasurementID-List        OPTIONAL
}

OngoingMeasRep-r4 ::=               SEQUENCE {
    measurementIdentity                 MeasurementIdentity,
    -- TABULAR: The CHOICE Measurement in the tabular description is included
    -- in MeasurementCommandWithType-r4.
    measurementCommandWithType          MeasurementCommandWithType-r4,
    measurementReportingMode            MeasurementReportingMode            OPTIONAL,
    additionalMeasurementID-List        AdditionalMeasurementID-List        OPTIONAL
}

OngoingMeasRep-r5 ::=               SEQUENCE {
    measurementIdentity                 MeasurementIdentity,
    -- TABULAR: The CHOICE Measurement in the tabular description is included
    -- in MeasurementCommandWithType-r4.
    measurementCommandWithType          MeasurementCommandWithType-r4,
    measurementReportingMode            MeasurementReportingMode            OPTIONAL,
    additionalMeasurementID-List        AdditionalMeasurementID-List        OPTIONAL,
    measurementCommand-v590ext          CHOICE {
        -- the choice "intra-frequency" shall be used for the case of intra-frequency measurement,
        -- as well as when intra-frequency events are configured for inter-frequency measurement
        intra-frequency                     Intra-FreqEventCriteriaList-v590ext,
        inter-frequency                     Inter-FreqEventCriteriaList-v590ext
    }       OPTIONAL,
    intraFreqReportingCriteria-1b-r5        IntraFreqReportingCriteria-1b-r5    OPTIONAL,
    intraFreqEvent-1d-r5                    IntraFreqEvent-1d-r5                OPTIONAL
}

OngoingMeasRep-r6 ::=               SEQUENCE {
    measurementIdentity                 MeasurementIdentity,
    measurementCommandWithType          MeasurementCommandWithType-r6,
    measurementReportingMode            MeasurementReportingMode            OPTIONAL,
    additionalMeasurementID-List        AdditionalMeasurementID-List        OPTIONAL
}

OngoingMeasRepList ::=              SEQUENCE (SIZE (1..maxNoOfMeas)) OF
                                        OngoingMeasRep

OngoingMeasRepList-r4 ::=           SEQUENCE (SIZE (1..maxNoOfMeas)) OF
                                        OngoingMeasRep-r4

OngoingMeasRepList-r5 ::=           SEQUENCE (SIZE (1..maxNoOfMeas)) OF
                                        OngoingMeasRep-r5

OngoingMeasRepList-r6 ::=           SEQUENCE (SIZE (1..maxNoOfMeas)) OF
                                        OngoingMeasRep-r6

PDCP-Capability-r4 ::=              SEQUENCE {
    losslessSRNS-RelocationSupport      BOOLEAN,
    supportForRfc2507                   CHOICE {
        notSupported                        NULL,
        supported                           MaxHcContextSpace
    },
    supportForRfc3095                   CHOICE {
        notSupported                        NULL,
```

```
        supported                           SEQUENCE {
            maxROHC-ContextSessions             MaxROHC-ContextSessions-r4  DEFAULT s16,
            reverseCompressionDepth             INTEGER (0..65535)          DEFAULT 0
        }
    }
}

PDCP-Capability-r5 ::=              SEQUENCE {
    losslessSRNS-RelocationSupport      BOOLEAN,
    supportForRfc2507                   CHOICE {
        notSupported                        NULL,
        supported                           MaxHcContextSpace-r5
    },
    supportForRfc3095                   CHOICE {
        notSupported                        NULL,
        supported                           SEQUENCE {
            maxROHC-ContextSessions             MaxROHC-ContextSessions-r4  DEFAULT s16,
            reverseCompressionDepth             INTEGER (0..65535)          DEFAULT 0,
            supportForRfc3095ContextRelocation  BOOLEAN
        }
    }
}

PDCP-Capability-r6 ::=              SEQUENCE {
    losslessSRNS-RelocationSupport      BOOLEAN,
    losslessDLRLC-PDUSizeChange         ENUMERATED { true }                 OPTIONAL,
    supportForRfc2507                   CHOICE {
        notSupported                        NULL,
        supported                           MaxHcContextSpace-r5
    },
    supportForRfc3095                   CHOICE {
        notSupported                        NULL,
        supported                           SEQUENCE {
            maxROHC-ContextSessions             MaxROHC-ContextSessions-r4  DEFAULT s16,
            reverseCompressionDepth             INTEGER (0..65535)          DEFAULT 0,
            supportForRfc3095ContextRelocation  BOOLEAN
        }
    }
}

PhysicalChannelCapability-r4 ::=        SEQUENCE {
        fddPhysChCapability                 SEQUENCE {
            downlinkPhysChCapability            DL-PhysChCapabilityFDD-r4,
            uplinkPhysChCapability              UL-PhysChCapabilityFDD
        }                                           OPTIONAL,
        tdd384-PhysChCapability             SEQUENCE {
            downlinkPhysChCapability            DL-PhysChCapabilityTDD,
            uplinkPhysChCapability              UL-PhysChCapabilityTDD
        }                                           OPTIONAL,
        tdd128-PhysChCapability             SEQUENCE {
            downlinkPhysChCapability            DL-PhysChCapabilityTDD-LCR-r4,
            uplinkPhysChCapability              UL-PhysChCapabilityTDD-LCR-r4
        }                                           OPTIONAL
}

PhysicalChannelCapability-r5 ::=        SEQUENCE {
        fddPhysChCapability                 SEQUENCE {
            downlinkPhysChCapability            DL-PhysChCapabilityFDD-r5,
            uplinkPhysChCapability              UL-PhysChCapabilityFDD
        }                                           OPTIONAL,
        tdd384-PhysChCapability             SEQUENCE {
            downlinkPhysChCapability            DL-PhysChCapabilityTDD-r5,
            uplinkPhysChCapability              UL-PhysChCapabilityTDD
        }                                           OPTIONAL,
        tdd128-PhysChCapability             SEQUENCE {
            downlinkPhysChCapability            DL-PhysChCapabilityTDD-LCR-r5,
            uplinkPhysChCapability              UL-PhysChCapabilityTDD-LCR-r4
        }                                           OPTIONAL
}

RF-Capability-r4 ::=                SEQUENCE {
        fddRF-Capability                    SEQUENCE {
            ue-PowerClass                       UE-PowerClassExt,
            txRxFrequencySeparation             TxRxFrequencySeparation
        }                                                               OPTIONAL,
        tdd384-RF-Capability                SEQUENCE {
            ue-PowerClass                       UE-PowerClassExt,
            radioFrequencyBandTDDList           RadioFrequencyBandTDDList,
```

```
            chipRateCapability              ChipRateCapability
        }                                                                       OPTIONAL,
        tdd128-RF-Capability            SEQUENCE {
            ue-PowerClass                   UE-PowerClassExt,
            radioFrequencyBandTDDList       RadioFrequencyBandTDDList,
            chipRateCapability              ChipRateCapability
        }                                                                       OPTIONAL
}

RFC3095-ContextInfo ::=             SEQUENCE {
    rb-Identity                         RB-Identity,
    rfc3095-Context-List                RFC3095-Context-List
}

RFC3095-Context-List ::=            SEQUENCE (SIZE (1..maxRFC3095-CID)) OF SEQUENCE {
    dl-RFC3095-Context                  DL-RFC3095-Context      OPTIONAL,
    ul-RFC3095-Context                  UL-RFC3095-Context      OPTIONAL
}

RLC-Capability-r5 ::=               SEQUENCE {
    totalRLC-AM-BufferSize              TotalRLC-AM-BufferSize-r5,
    maximumRLC-WindowSize               MaximumRLC-WindowSize,
    maximumAM-EntityNumber              MaximumAM-EntityNumberRLC-Cap
}


SRB-SpecificIntegrityProtInfo ::=   SEQUENCE {
    ul-RRC-HFN                          BIT STRING (SIZE (28)),
    dl-RRC-HFN                          BIT STRING (SIZE (28)),
    ul-RRC-SequenceNumber               RRC-MessageSequenceNumber,
    dl-RRC-SequenceNumber               RRC-MessageSequenceNumber
}

SRB-SpecificIntegrityProtInfoList ::= SEQUENCE (SIZE (4..maxSRBsetup)) OF
                                        SRB-SpecificIntegrityProtInfo

StateOfRRC ::=                      ENUMERATED {
                                        cell-DCH, cell-FACH,
                                        cell-PCH, ura-PCH }

StateOfRRC-Procedure ::=            ENUMERATED {
                                        awaitNoRRC-Message,
                                        awaitRB-ReleaseComplete,
                                        awaitRB-SetupComplete,
                                        awaitRB-ReconfigurationComplete,
                                        awaitTransportCH-ReconfigurationComplete,
                                        awaitPhysicalCH-ReconfigurationComplete,
                                        awaitActiveSetUpdateComplete,
                                        awaitHandoverComplete,
                                        sendCellUpdateConfirm,
                                        sendUraUpdateConfirm,
                                        -- dummy is not used in this version of specification
                                        -- It should not be sent
                                        dummy,
                                        otherStates
}

TotalRLC-AM-BufferSize-r5 ::=       ENUMERATED {
                                        kb10, kb50, kb100, kb150, kb200,
                                        kb300, kb400, kb500, kb750, kb1000 }

TPC-Combination-Info ::= SEQUENCE {
        primaryCPICH-Info                   PrimaryCPICH-Info,
        tpc-CombinationIndex                TPC-CombinationIndex
}

UE-MultiModeRAT-Capability-r5 ::=   SEQUENCE {
    multiRAT-CapabilityList             MultiRAT-Capability,
    multiModeCapability                 MultiModeCapability,
    supportOfUTRAN-ToGERAN-NACC         BOOLEAN
}

UE-Positioning-Capability-r4 ::=    SEQUENCE {
    standaloneLocMethodsSupported           BOOLEAN,
    ue-BasedOTDOA-Supported                 BOOLEAN,
    networkAssistedGPS-Supported            NetworkAssistedGPS-Supported,
    supportForUE-GPS-TimingOfCellFrames     BOOLEAN,
    supportForIPDL                          BOOLEAN,
```

```
    rx-tx-TimeDifferenceType2Capable        BOOLEAN,
    validity-CellPCH-UraPCH                 ENUMERATED { true }       OPTIONAL,
    sfn-sfnType2Capability                  ENUMERATED { true }           OPTIONAL
}

UE-Positioning-LastKnownPos ::=         SEQUENCE {
        sfn                                 INTEGER (0..4095),
        cell-id                             CellIdentity,
        positionEstimate                    PositionEstimate
}

UE-RadioAccessCapability-r4 ::=         SEQUENCE {
    accessStratumReleaseIndicator           AccessStratumReleaseIndicator,
    pdcp-Capability                         PDCP-Capability-r4,
    rlc-Capability                          RLC-Capability,
    transportChannelCapability              TransportChannelCapability,
    rf-Capability                           RF-Capability-r4,
    physicalChannelCapability               PhysicalChannelCapability-r4,
    ue-MultiModeRAT-Capability              UE-MultiModeRAT-Capability,
    securityCapability                      SecurityCapability,
    ue-positioning-Capability               UE-Positioning-Capability-r4,
    measurementCapability                   MeasurementCapability-r4        OPTIONAL
}

UE-RadioAccessCapability-r5 ::=         SEQUENCE {
    accessStratumReleaseIndicator           AccessStratumReleaseIndicator,
    dl-CapabilityWithSimultaneousHS-DSCHConfig
                                            DL-CapabilityWithSimultaneousHS-DSCHConfig  OPTIONAL,
    pdcp-Capability                         PDCP-Capability-r5,
    rlc-Capability                          RLC-Capability-r5,
    transportChannelCapability              TransportChannelCapability,
    rf-Capability                           RF-Capability-r4,
    physicalChannelCapability               PhysicalChannelCapability-r5,
    ue-MultiModeRAT-Capability              UE-MultiModeRAT-Capability-r5,
    securityCapability                      SecurityCapability,
    ue-positioning-Capability               UE-Positioning-Capability-r4,
    measurementCapability                   MeasurementCapability-r4        OPTIONAL
}

UE-RadioAccessCapability-r6 ::=         SEQUENCE {
    accessStratumReleaseIndicator           AccessStratumReleaseIndicator,
    dl-CapabilityWithSimultaneousHS-DSCHConfig
                                            DL-CapabilityWithSimultaneousHS-DSCHConfig  OPTIONAL,
    pdcp-Capability                         PDCP-Capability-r6,
    rlc-Capability                          RLC-Capability-r5,
    transportChannelCapability              TransportChannelCapability,
    rf-Capability                           RF-Capability-r4,
    physicalChannelCapability               PhysicalChannelCapability-r5,
    ue-MultiModeRAT-Capability              UE-MultiModeRAT-Capability-r5,
    securityCapability                      SecurityCapability,
    ue-positioning-Capability               UE-Positioning-Capability-r4,
    measurementCapability                   MeasurementCapability-r4        OPTIONAL
}

UL-RFC3095-Context ::=                  SEQUENCE {
    rfc3095-Context-Identity                INTEGER (0..16383),
    ul-mode                                 ENUMERATED {u, o, r},
    ul-ref-ir                               OCTET STRING ( SIZE (1..3000)),
    ul-ref-time                             INTEGER (0..4294967295)     OPTIONAL,
    ul-curr-time                            INTEGER (0..4294967295)     OPTIONAL,
    ul-syn-offset-id                        INTEGER (0..65535)          OPTIONAL,
    ul-syn-slope-ts                         INTEGER (0..4294967295)     OPTIONAL,
    ul-ref-sn-1                             INTEGER (0..65535)          OPTIONAL
}

END
```

Source: LG Electronics

Title: Dual Receiver for MBMS

Agenda Item: 16

Document for: Discussion & Decision

Introduction

In RAN2#51 the proposal to use dual receiver UEs has been brought to the attention of group and has been discussed in a first time. This document proposes to add some more details for clarification on the proposals and gives a text proposal for the SI on Improvement of MBMS.

Proposal

Definition of the dual receiver UE

In our view a dual receiver UE should be capable of simultaneously receiving dedicated services and MBMS PtP / PtM services on one frequency A plus MBMS services sent on PtM bearers on a separate frequency B e.g.:

- Frequency A (FDD or TDD) (dedicated services + MBMS):
  - Channels necessary independent from MBMS
  - MICH or MCCH independently from the MBMS services on frequency B
  - MTCH, possibly depending on the reception of MBMS services with the dual receiver
- Frequency B (FDD or TDD) (additional MBMS capabilities):
  - MICH or MCCH independently from the reception of MBMS services or dedicated services on frequency B
  - MTCH, possibly depending on the reception of MBMS services with the dual receiver

Detailed capabilities should be decided during the WI phase.

Scenarios

Dual receiver UEs can be useful for different scenarios.

- MBMS multicarrier Rel-6 network:
  - Rel-6 frequency convergence and counting used for transmission in only one frequency
  - Rel-7 rules for dual receiver UEs without network impact allow to receive dedicated and MBMS services with no restriction
- MBMS multicarrier Rel-6 network + optimisations for Rel-7 dual receiver UEs
  - Rel-6 frequency convergence and counting used for transmission in only one frequency
  - Rel-7 rules for dual receiver UEs without network impact allow to receive dedicated and MBMS services with no restriction
  - Rel-7 mechanisms for dual receiver UEs allow resource optimization to receive dedicated and MBMS services with no restriction

- Rel-6 network (single carrier or multicarrier) + separate independent MBMS downlink only frequency for Rel-7 dual receiver UEs (FDD/TDD)
    - Mechanisms for paging on the Rel 6 network which allows to activate the dual receiver for reception of MBMS services

Support of dual receiver UEs in a Rel-6 MBMS multicarrier network:

The first proposal is to define the behaviour of a dual receiver UE in a Rel-6 MBMS network with two frequency layers as shown in Figure 3.

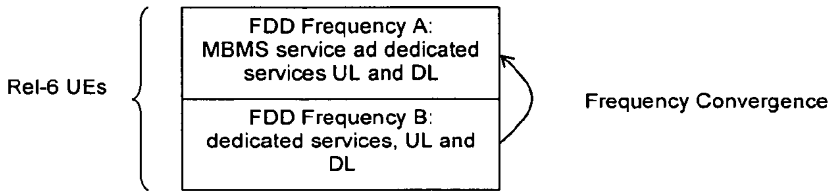


Figure 1: FDD MBMS multicarrier network in Rel6 with Rel-7 dual receiver UEs

In this scenario an operator has deployed a multicarrier network with more than one 5MHz frequency. In order to allow to build UEs with a dual receiver several issues in the Rel-6 specification need to be clarified as listed below, and as already highlighted in [1].

Impacted functionalities

- **Counting:**
  Since according to the proposed UE capabilities there is no capability for uplink transmission, and in order not to impact the behaviour of the network the UE is only allowed to respond to counting on the corresponding uplink frequency where counting is indicated in the MCCH.
  ➔ in the specification it should be clarified that the RRC Connection Request / Cell Update as answer to counting should only be performed on the corresponding uplink frequency where the MCCH is sent in the DL, i.e. the UE would respond only if it is camping on the uplink frequency corresponding to the MCCH on which the counting indication has been sent..

- **PtP establishment:**
  Today when the UE initiates a RRC Connection setup / Cell Update message in order to respond to PtP bearer establishment request there is no indication of the related services. Therefore a network in Rel-6 should never expect a request for a MBMS PtP bearer on which it has not initiated a PtP bearer establishment. Therefore a dual receiver should today only respond to the PtP bearer establishment indication on the corresponding uplink frequency where PtP bearer establishment is indicated in the MCCH
  ➔ in the specification it should be clarified that the RRC Connection Request / Cell Update as answer to the PtP bearer establishment should only be performed on the corresponding uplink frequency where the MCCH is sent in the DL, i.e. the UE would respond only if it is camping on the uplink frequency corresponding to the MCCH on which the PtP establishment indication has been sent..

- **Frequency convergence:**
    - **Idle / Cell/URA_PCH / CELL_FACH state procedure**
      Frequency convergence is today performed in order to allow that UEs that are camping on a frequency on which a MBMS service is not broadcast to select to the frequency on which the service is broadcast. A dual receiver UE as defined above does in principle not need to select to the frequency on which the MBMS service it is interested in in the case that the service is sent on a PtM bearer. However the network could perform re-counting, or switch to PtP bearer at any time. In those cases the UE should answer always on the same frequency as the frequency on which it as received the indication.
      Therefore we propose that the UE would only reselect to the preferred frequency on which counting or PtP establishment needs to be performed once that a the network needs to be contacted e.g. for

counting or for PtP establishment.
Alternatives that are not our preferred choice are that:

- the dual receiver UE should always follow the Rel-6 rules as if the UE would not have any dual receiver capabilities, including the priorization
- or the UE does not follow frequency convergence unless it is incapable of receiving a prioritized service. In that case the UE could either:
    - perform frequency convergence in the case it should respond to counting or PtP establishment, or it would not perform frequency convergence in the case it should respond to counting or MBMS PtP establishment. Different behaviour could be imagined for the case of counting and MBMS PtP bearer establishment.

➔ in the specification it should be clarified that the UE should perform frequency convergence in the case that it should answer to counting.

CELL_DCH procedure
According to the Rel-6 specifications the UE should indicate to the network if its preferred frequency is different from the frequency that is currently used for dedicated services. However for a dual receiver UE, even if the priorized service is sent on a different frequency on a PtM bearer there is no real problem for this UE, and indicating to the network the wish to change frequency would have more drawbacks than advantages.
Therefore we propose that the UE should not use the MBMS modification request message in the case that it is capable of receiving all wanted services and the priorized service is sent on a different frequency.
➔in the specification it should be clarified that the UE should not indicate to the network the priorized service / frequency or RBs to be released as long as it is able to receive all priorized services including via the dual receiver capabilities.

Proposed UE behaviour

The proposed UE behaviour is shown in Figure 2. The UE is initially camping on the frequency B, and receiving the MICH in modification period 0 as shown by yellow color. Upon detection of the MICH the UE starts reading of the MCCH, and receives the frequency convergence information in modification period 1. Since the UE is a dual receiver UE it will then activate the second receiver and start receiving the MCCH of frequency A. We consider that the UE does not need to receive the MICH on frequency B, but the UE could optionally restart reception of MICH or MCCH on frequency B.

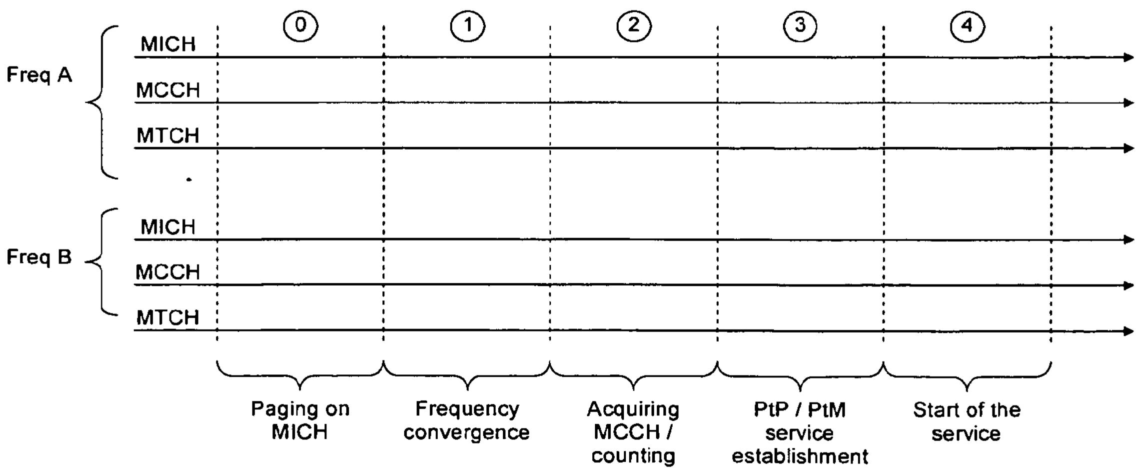


Figure 2: FDD MBMS multicarrier network in Rel6 with Rel-7 dual receiver UEs

In Figure 2 the case where the service is sent on MTCH is shown. In the case that the MBMS service would start on the a PtP bearer the UE should perform frequency convergence in period 3 / 4 and request a PtP bearer.

MBMS cell selection:

In the case that a Rel-6 UE is performing frequency convergence it will follow the Rel-6 inter frequency cell selection rules. For a dual receiver UE there is today no explication on how it should select on which it would best receive MBMS MTCH using its dual receiver capabilities. One way of doing so could be to mandate the dual receiver UEs to follow also the inter frequency cell reselection rules, and to read the BCCH on the frequency for MBMS reception.

Advantages for the dual receiver UE:

In the above scenario a UE with the above mentioned dual receiver capabilities will always be able to receive the MBMS service it has subscribed. However in order to perform counting and PtP request the UE would still need to perform frequency convergence. The allowed UE behaviour in this case should be clarified in the specifications.

Rel-7 enhancements for dual receiver UEs in a Rel-6 compatible MBMS multicarrier network:

In order to optimize the usage of the capabilities of a dual receiver UE it would be necessary that the some specific optimizations are done on top of the clarifications as described above.

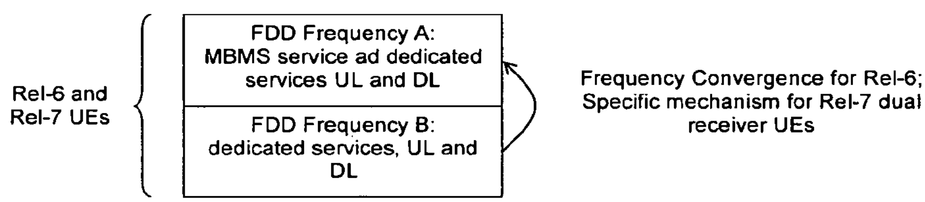


Figure 3: MBMS multicarrier Rel-6 network + optimisations for Rel-7 dual receiver UEs

Additional information on the BCCH / MCCH:

In order to remove the drawbacks as mentioned above it is necessary that the UE can respond to the counting / MBMS PtP establishment on a different frequency / cell compared to the cell on which the UE is informed about the counting. In order to indicate to the UE that this is allowed some information would need to be sent to the UE either on the BCCH or the MCCH. This could be an implicit information, such as the Frequency convergencec information in the MBMS general info message, i.e. in the case that a neighbouring frequency is indicated then the UE would be allowed to respond to counting for any MCCH received in that given neighbouring frequency. However as shown e.g. in Figure 4 this could mean that a UE camping in Cell 6 might respond to cocunting in Cell 7. This would be a useless information, since the RNC I does not control Cell 7. Therefore it would be better to introduce an explicit indication. This explicit indication sent on frequency B would include e.g in cell 5 for which cells from frequency A the counting responses/ MBMS PtP bearer requests are allowed to be sent, or vice versa, i.e. for cells of frequency A an indication from which cells from frequency B counting responses can be sent. This is due to the fact that the RNC would only be able to interpret the counting responses/ MBMS PtP bearer requests if the cell that the UE is camping on and the cell from which the UE reads the MCCH are controlled by the same RNC, as shown in Figure 4. In the case that it is not indicated that the UE can respond on a counting / PtP establishment indicated in the MCCH of frequency A on the cell on which the UE is camping in the frequency B the UE might still need to follow frequency convergencec in that case. However this should be considered as a rare case and it should be possible that the UE is allowed to not follow Counting and PtP establishment in that case.

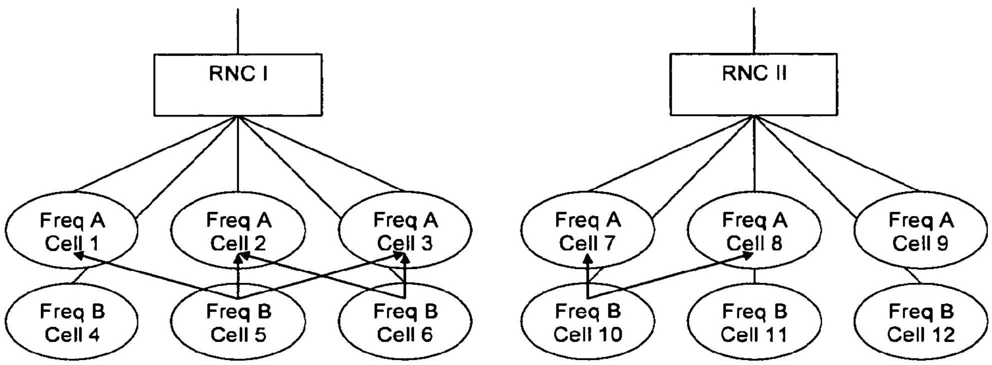


Figure 4: Indication for cells from which the UE is allowed to act on the MCCH.

In order to minimize the impact for counting a separate counting indicator for dual receiver UEs could be introduced similarly to the way that this is already done for idle / connected mode access probability factor and the counting scope. Thus a dual receiver UE would send a response on a frequency different from the frequency on which the MCCH is sent only in the case that this is indicated to be allowed and in the case that the specific access probability factor / counting scope is included. This method would also allow to perform the counting / PtP establishment on a different frequency on which the MTCH is sent, i.e. in the case that MBMS MTCH would be sent on frequency A counting / PtP establishment would be performed on frequency B only for the UEs with dual receiver capabilities, and counting / PtP establishment for Rel-6 UEs would be performed only on frequency A. If this mechanism is necessary then the UE in Figure 2 would be required to continue to read the MCCH on frequency B during the ongoing service in order to be able to respond to counting / PtP establishment.

Linking of counting response / PtP bearer request:

Also in order to make sure that the RNC can link the counting response / PtP establishment request it is necessary that a UE with dual receiver capabilities that responds to messages received on a MCCH sent on a different cell compared to the cell that the UE is camping on includes some additional information to the message sent to the network e.g.:

- indication of the related services
- the cell on which the MCCH has been received
- the frequency on which the MCCH has been received.

Dual receiver capability indication:

A UE with dual receiver capabilities for UMTS is able to efficiently receive MBMS services and dedicated services in parallel. However in Rel-6 the network has no information on the limitations of a UE, or the extra freedom that the UE has in order to receive MBMS services. In the case that the UE is able to receive MTCH on a different frequency than the dedicated services we believe that it is important to inform the network of this capability, e.g. at RRC connection establishment or any other occasion.

MBMS cell selection

One additional possibility to facilitate the dual receiver operation would be to link the MBMS cell to the cell that the UE is camping on. In this way for each cell that the UE is camping on frequency B and indication would be given which cell or set of cells in frequency A is collocated, and thus restrict the number of cells from which the UE needs to choose for the reception of MBMS services.

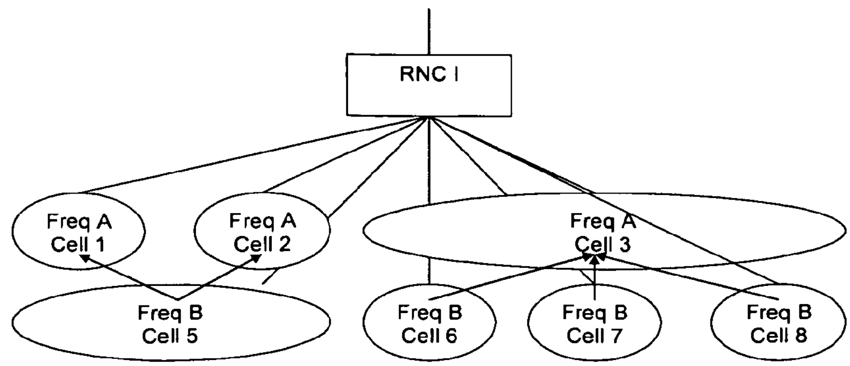


Figure 5: Indication for cells from which the UE should try to receive the MCCH / MTCH.

As shown in Figure 5 it is usefull to point the UE camping on frequency B to the cell or set of cells in frequency A that have the same coverage. This reduces the complexity of the dual receiver UEs and allows to reduce the information on cell reselection that would need to be sent on the MBMS frequency, especially in the case that the frequency is used as MBMS only frequency.

Configuration information

In a further step it could even be possible that parts of the configuration, e.g. MCCH, MTCH, MSCH and or radio bearer configuration of the cells and services in the frequency A would be broadcast on the frequency B, such that a UE would only need to receive MTCH / MSCH on the frequency A, but neither BCCH nor MCCH.

Advantages for the dual receiver UE:

In the above scenario a UE with the above mentioned dual receiver capabilities will always be able to receive the MBMS service it has subscribed, without having any impact from MBMS services any more. This allows that the UE does not need to follow frequency convergence for any case, and thus there is no more impact for the UE for the case of simultaneous reception of dedicated and MBMS data.

Separate independent MBMS downlink only frequency for Rel-7 dual receiver UEs (FDD/TDD)

As shown above a dual receiver UE does in the normal case not need to transmit on the frequency A where MBMS services are sent. However due to the backwards capability requirement with Rel-6 it is always possible that a Rel-6 UE would camp on this frequency, and thus it is possible that a UE might access the network. Therefore the network equipment always needs to be equipped both with a transmitter and a receiver.

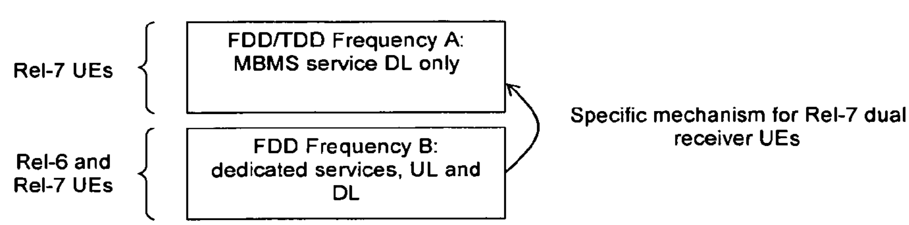


Figure 6: Rel-6 network (single carrier or multicarrier) + separate independent MBMS downlink only frequency for Rel-7 dual receiver UEs (FDD/TDD)

In order to allow to have a DL only carrier without receiver equipment we propose to introduce for Rel-7 DL only MBMS carriers. In order to prevent Rel-6 UEs from reselecting to this DL only MBMS carrier it would be necessary that on this carrier some relevant SIBs are not sent, that they are blocked for operator use or any other possibility that prevents Rel-6 and earlier UEs to select this carrier. In addition a specific indication is needed that Rel-7 UEs with dual receiver recognize the cells in this frequency as cells providing regular MBMS service.

In order to allow Rel-7 dual receiver MBMS UEs to select those carriers it is necessary to give a specific indication in a Rel-7 extension on BCCH or MCCH, e.g. a Rel-7 MBMS inter-frequency dual receiver cell info list. Also we believe that it should be possible to add inter frequency FDD as well as TDD cells. Apart from this the above sections cover the necessary extensions in order to allow to access dual receiver UEs.

Advantages:

Compared to the above scenarios this scenario does not really bring an advantage for the UE but rather for the network operation. This allows to deploy only the necessary elements for MBMS and allows therefore cost reductions for the deployment of MBMS. In the case that TDD is used this allows to use the asymmetric spectrum for MBMS.

Although it would in principle be possible that UEs without dual receivers could receive MBMS services on a MBMS DL only spectrum (e.g. by moving to the frequency as soon as the UE receives paging messages on the MBMS DL only frequency or when the UE wants to initiate a call) there would be big limitations e.g. in terms of counting, and PtP establishment. Therefore we don't believe that a Ue without dual receiver capability should be allowed to receive a MBMS DL only cell.

Conclusion

In summary we propose the following different scenarios, for which it is necessary to include some enhancements in the Rel-7 specifications:

Scenario	**Necessary enhancements**
Support of dual receiver UEs in a Rel-6 MBMS multicarrier network:	• Clarify UE behaviour for counting • Clarify UE behaviour for PtP establishment • Clarify frequency convergence and MBMS modification request • Clarify selection of MBMS serving cell in the case MBMS is received on a different frequency compared to the frequency the UE is camping on / is using for dedicated services.
Rel-7 enhancements for dual receiver UEs in a Rel-6 compatible MBMS multicarrier network	• Allow counting on different frequency than the MTCH reception • Allow PtP establishment on a different frequency than MTCH reception • Indicate cells with similar coverage • Configuration information of the MBMS channels in the neighbouring cell. • Indicate the dual receiver capability to the network
Separate independent MBMS downlink only frequency for Rel-7 dual receiver UEs (FDD/TDD)	• Specific configuration such that Rel-6 UEs do not attempt to camp on this frequency • Indication that MBMS service is broadcast on the hidden frequency • Indication of the MBMS DL only frequency in the normal frequencies used for dedicated service.

We propose to discuss the above proposal and to include it in the TR on MBMS improvements.

Annex:

[1] R2-060582, MBMS dual receiver, LG Electronics

Agenda Item : 11.4.1

Source : LG Electronics

Title : [DRAFT] in-sequence delivery handling in handover

Document for : Discussion and Decision

1 Introduction

Recently, there were discussions on the support of the lossless handover. RAN3 decided that for reducing the degradation of the performance, in-sequence delivery should be supported and the data forwarding scheme would be only scheme for transferring data packets during inter-eNodeB handover. However, there was no decision on how to and which entities should be involved for supporting the in-sequcne delivery. In this contribution, we propose in-sequence delivery considerations for handover.

2. Mobility support in LTE

Following figure1 shows the E-UTRAN architecture and mobility. AGW has PDCP function for header compression/decompression and ciphering function for user plane. eNodeB has the MAC, outer ARQ(RLC) and RRC function.

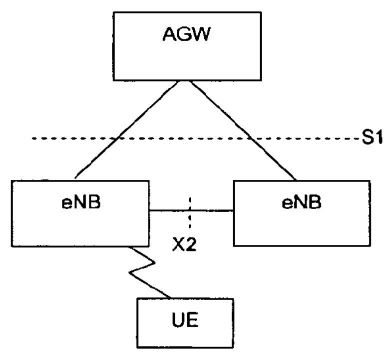


Figure1. E-UTRAN architecture

For NRT services, packet loss or duplication during handover should be minimized not to impact on the upper layer protocol (e.g. TCP) and not to suffer the performance degradation.. In case of data forwarding scheme, AGW would not send same packets to source eNodeB and target eNodeB at the same time. Thus, it may not need to consider the packet duplication. We would focus on the packet loss and reordering for in-sequence delivery. It is not clear whether the reordering between eNodeBs (X2 interface) should be independantly considered or not[to be deleted]

Downlink packet in-sequence delivery

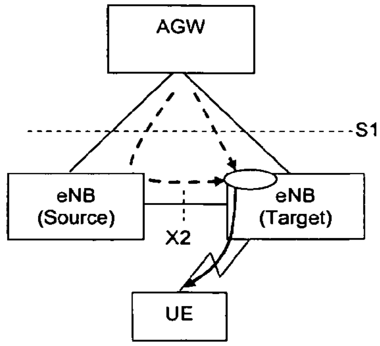


Figure2. Downlink packet transmission (inter-eNodeB handover case)

Considering the agreed E-UTRAN architecture, the Outer ARQ should be located in the eNodeB. Thus, there would be no gurantee of the in-sequence delivery between AGW and eNodeB. It is because the packets from the AGW to eNodeB via S1 interface could be out-of-sequence.

Furthermore, during handover, the packets from AGW should be converged in the target eNodeB(circle point in figure2) regardless of the transmission path that include source eNodeB or not (direct to target eNodeB). In this case, it could not make sure that the target eNodeB receives the incoming packets as in-sequence. Due to the network topology, the possibility of the out of sequence delivery could be high. In contrast with UTRAN, this case would happen so frequently during handover.

We assume that the packet sequence numbering could be happened in the AGW for the downlink packet transmission. And then, it is possible for eNodeB to see that sequence number and check whether the packets are received in the in-sequence state or not. After checking the sequence number of the packets, eNodeB reorders the received packets. The eNodeB send the packets according to the reordered sequence. The UE receive the packets from eNodeB. If there are out-of-sequence in the received packets, the outer ARQ of the UE would reorder the packets. The received packets from the outer ARQ of the UE would send to the PDCP. In that time, the PDCP receives the packets according to the sequence that are generated in the AGW.

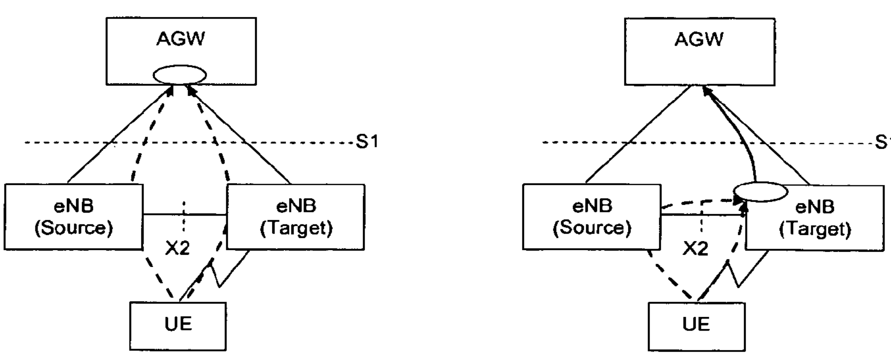
If there is no reordering function in the eNodeB level, there would be no way to detect out of sequence delivery between AGW and the UE before the packets arriving the UE. And after receiving the packets, the upper layer function of the outer ARQ in the UE should buffer that packets before receiving the packets for in-sequence. In the UE side, it should be minimize the impact from the out of sequence packets in the network. As described in the above, that could be evitable if the network side reordering is used.

Conclusion: for downlink in-sequence packet transmission, we propose the followings.

- The sequence numbering in the AGW should be supported for downlink packet transmission

- For minimizing the impact on UE, the reordering of downlink packets from AGW should be in the eNodeB before sending to UE.

<u>Uplink packet in-sequence delivery</u>



Alternative A Alternative B

Figure3. Uplink packet transmission

Regarding the uplink packet transmission, there are two possibilities to support in-sequence delivery during inter - eNodeB handover. In downlink packet transmission, it is impossible to send packets from source eNodeB to UE after sending handover command. However, in uplink packet transmission, the packets from UE before UE receiveing handover command could be sent from source eNodeB via target eNodeB to AGW or from source eNodeB to AGW directly. The route path of the uplink packet from source eNodeB to AGW is available before target eNodeB send handover complete message to AGW. Above figure 3 shows the two alternatives. In both cases, the UE should support sequence numbering for in-sequence delivery.

In alternative A, the packets from UE would be converged into the AGW, not in eNodeB (Alt A: circle point in figure3). The reordering of uplink packets from the UE would be in the AGW. There would be no reordering function in eNodeB to reduce time delay from the reordering buffer. The outer ARQ in eNodeB only check packet receiving states and request retransmission of the packets to the UE if there are missing packets.

Using the alternative A, the packet transmission route could be optimized and there would be no need to make data forwarding from source eNodeB to target eNodeB via X2 interface. Data forwarding in case of uplink packets also cause context transmission from source eNodeB to target eNodeB.

In alternative B, the uplink packets from UE would be converged into the target eNodeB, not in AGW (Alt B: circle point in figure3). The reordering of the uplink packet from the UE would be in the target eNodeB. In this case, if there would be no gurantee that the packet from the target eNodeB are transferred to the AGW as in-sequence, the AGW may need the reordering of the uplink packets from the target eNodeB to AGW[FFS]

Source eNodeB should forward packets received from UE to target eNodeB at PDU or SDU type after sending the handover command. Target eNodeB could check the sequence number of packets from source eNodeB. After that, target eNodeB reorders the received packets and sends to the AGW according to the packet sequence.

Using alternative B, the packet transmission from the source eNodeB to target eNodeB should be supported. That could make the reordering of the uplink packets in the eNodeB before sending to AGW. There would be no need to reorder the packets from the target eNodeB. However, for this, the in-sequence delivery between eNodeB and AGW should be guranteed. If there is no gurantee, the reordering of the upling packets between eNodeB and AGW should be supported in AGW. And then, the packet forwarding from the source eNodeB to target eNodeB may be reduandant.

We thinks that if both of two alternaties need to support reordering function in the AGW level, it is better to limit the reordering function in the AGW level. Thus, our preference is alternative 1 for reducing the reordering function only in AGW.

Conclusion: for uplink in-sequence packet transmission, we propose the followings.

- The sequence numbering in the UE should be supported for uplink packet transmission

- Due to the difference between uplink and downlink, we should discuss the need for the uplink packet forwarding from source eNodeB to target eNodeB.

- If in-sequence delivery between eNodeB and AGW is not guranteed, it is more reasonable to reorder the uplink packets in the AGW.

3. Conclusion

In this contribution, we proposed the some consideration point for the in-sequence delivery suppor for inter-eNodeB handover. For downlink packet transmission, we need to consider the impact on the UE and take the way to minimize the impact. For uplink packet transmission, it is different with the downlink packet transmission. If there is no gurantee of in-sequence delivery between eNodeB and AGW, the reordering in AGW may be better approach than in eNodeB.

References

[1]

Agenda Item : 11.8

Source : LG Electronics

Title : Discussion on LTE multicast & broadcast

Document for : Discussion and Decision

1 Introduction

We discuss and propose several aspects of LTE multicast/broadcast in this document.

2 Bandwidth scenarios for multicast/broadcast

Minimum UE bandwidth was decided to be 10 Mhz. However, minimum UE bandwidth with multicast/broadcast is not clear. Decision on this would impact on specification of LTE multicast/broadcast.

In case of 20 Mhz cell, we could imagine either that an upper 10 Mhz carries a unicast service and a lower 10 Mhz carries a multicast/broadcast service or that central 10 Mhz carries a multicast/broadcast service and outside of the central 10 Mhz carries a unicast service.

In this case, if minimum UE capability for multicast/broadcast is 10 Mhz, the UE could indicate need for reception of multicast/broadcast service to eNode B because eNode B may not know UE reception of multicast/broadcast service. With this indication, eNode B could move the unicast service on the other 10 Mhz to help the UE receive both services. eNode B could do so easiler than R6 MBMS because RRC is located at eNode B together with a scheduler.

However, sometimes eNode B could not help the UE. So, the UE may need to select which service it should receive between unicast and multicast/broadcast. Also, if a interesting multicast/broadcast service is provided on different layer (cell), UE may need to perform frequency layer convergence and divergence discussed in R6 MBMS with the service prioritization.

On the other hand, if multicast/broadcast services are provided on a multicast/broadcast specific carrier which is different from a carrier for unitcast services [1], UE may perform service prioritization between both carriers. However, if every LTE UE supporting multicast/broadcast has a dual receiver. multicast/broadcast procedure would be simpler because UE with dual receiver can receive both unicast services and multicast/broadcast services on different carriers. With dual receiver, the UE could also receive a 20 Mhz cell carrying both unicast and multicast/broadcast services without any data loss. Therefore, it should be decided if the dual receiver is mandated to a UE supporting multicast/broadcast or not.

In summary, it is proposed that:

- The service prioritization and FLC/FLD procedures need to be studied.
    - Considering limited UE capability, scheduling, cell bandwidths, and dedicated carriers to multicast/broadcast.
- A UE with the dual receiver can be considered for carriers dedicated to multicast/broadcast
    - if the dual receiver is mandatory in the UE, multicast/broadcast procedures could be simpler.
    - Thus, it should be decided if the dual receiver is mandated to a UE or not.

3 UE capability for multicast/broadcast

It has already been discussed earlier that e.g. the capability to receive HS-DSCH could be updated by the UE based on whether the UE would receive MBMS service in parallel or not. However this had been abandoned since the overhead due to the L3 signalling and the fact that this would require a (slow) reconfiguration.

However, in LTE RRC is terminated at eNode B with the scheduler of DL SCH channel. Thus, UE capability could be dynamically updated by signalling between UE and eNode B. Since eNode B may not know which multicast/broadcast service UE intends to receive, UE could calculate the available processing and reception resources based on the resources that the broadcast channel would occupy. The resources to be exchanged between the UE and the Scheduler could thus contain number of subcarriers, number of processes etc for a unicast service.

In summary, it is proposed that:

- UE capability is dynamically updated by signalling from UE to eNode B.
  - e.g. when UE receive a multicast/broadcast service with a unicast service
  - The scheduler considers the updated UE capability to schedule a unicast service for the UE.

4 Multicast/broadcast service scenarios

Discussion on the RAN and RAN1 reflector before this meeting show there are two types of service scenarios for multicast/broadcast: cell specific contents and cell group contents. The cell specific contents could be R99 CBS-like service i.e. message distribution, which are a single cell transmission. The cell group contents could be TV broadcasting services, which is a multi-cell transmission.

We think multi-cell transmission should use a L1 combining technique. Therefore, a central node is needed as a source of multi-cell transmission and the cell group concept in R6 can be re-used in LTE. On the other hand, single cell transmission cannot be combined across eNode B because single cell transmission covers only one cell or one eNode B. If possible, single cell transmission can be combined only within the same eNode B. Thus, the central node may not be needed for single cell transmission.

Since aGW would be the source of multi-cell transmission, aGW needs to schedule multi-cell transmission for a group of cells. The aGW needs to apply semi-static scheduling to multi-cell transmissions because scheduling should be applied to a group of cells. Such scheduling information could be provided by in-band signalling like R6 MSCH signalling mapped to the same physical channel carrying MTCH.

However, in case of single cell transmission, if necessary, eNode B can dynamically schedule the single cell transmission in consideration with scheduling of unitcast and other common channels. That is because it is eNode B who schedules unitcast and other common channels. Thus, eNode B could schedule unitcast data based on dedicated CQI and then schedule single cell transmission with DL resources not scheduled for unitcast data. In this manner, such scheduling information is provided on L1/2 control information used for DL SCH which may include MBMS service identity as well as UE identity.

As discussed above, eNode B would handle multi-cell and single cell transmissions in different manners, in terms of scheduling and combining. Thus, it is suggested that multi-cell and single cell transmissions use different types of channels. Single cell transmission can be provided on DL Shared Channel and multi-cell transmission on a different channel that is L1 combinable. In this case, L1/2 at eNode B could be differently optimized for multi-cell and single cell transmissions.

In summary, it is proposed that:

- single cell transmission is provided on DL Shared Channel and multi-cell transmission on a different channel that is L1 combinable, i.e. MCH.
- single cell transmission is scheduled by eNode B and multi-cell transmission by aGW.
  - For multi-cell transmission, scheduling information is provided by in-band signalling like R6 MSCH signalling.
  - For single cell transmission, scheduling information is provided by L1/2 control information used for DL SCH.
- aGW is a source of multi-cell transmission and manages cell groups for multi-cell transmissions.

5 Point-to-point and point-to-multipoint RB

As we know, R6 MBMS provided a point to point RB and a point to multipoint RB for a service with the counting procedure. Thus, UTRAN can determine a RB type e.g. based on the number of MBMS users in a cell.

We think that PTP RB cannot be applied to multi-cell transmissions because L1 combining seems to be a baseline of this transmission option. In this case different cells cannot have different types of RB and so PTM RB is assumed to be used for all cells. Thus, the counting procedure seems to be not useful and therefore multi-cell service like TV broadcasting will be transmitted every cell.

On the other hand, PTP RB could be applied to single cell transmissions. However, if single cell transmission is carried on DL SCH(Shared Channel), we may not need PTP RB because if necessary, DL SCH could consider AMC and HARQ for small number of users receiving a multicast service. Also, a complex counting procedure may need to be applied to transition between PTP RB and PTM RB as we have seen in R6 MBMS. Thus, we don't see any benefit of PTP RB. However, detecting only existence of a user interested in a service could be interesting to avoid unnecessary transmission in a cell.

In summary, it is proposed that:

- PTP RB is not needed for a multicast/broadcast service.
    - PTM RB mapped to DL SCH can replace PTP RB.
- Complex counting procedure is not needed for simple specification
    - But, detecting only existence of a user interested in a specific service in a cell is needed to to avoid unnecessary cell transmission.

6 Protocol Architecture for multicast/broadcast

It is felt that most of companies seems to prefer to share one common architecture between multicast/broadcast and unitcast services. In this case, PDCP is placed at aGW and RRC/MAC at eNode B for ptm bearer service.

Discussion on Layer 2

Locating PDCP at aGW is similar to R6 MBMS architecture. Thus, as R6 MBMS, it could be specified that there is one PDCP entity per cell group managed by aGW for one service.

In MAC, we have only one big MAC at eNode B. In this sense, we don't need any multicast/broadcast specific MAC entity like R6 MAC-m. Functions of MAC at eNode B for multicast/broadcast are channel mapping between logical channel and transport channel and multiplexing of logical channels into transport channel.

In addition, if a text message distribution like R99 CBS is supported, it is questionable whether a L2 entity like a BMC entity is needed or not. R99 BMC did storing, formatting, scheduling, transmitting and repeating CBS messages. In case of single cell transmission, we think that if DL SCH carries MTCH, ARQ (or HARQ) could be used in a fixed manner without ACK/NACK, instead of the MBMS repairing taking a long time. In this case, it can be one possibility that number of retransmissions is fixed e.g. 2 or 3 times and retransmission on DL SCH is synchronous to reduce length of signalling.

However, retransmission of multicast/broadcast data in L2 seems to be not useful for multi-cell transmissions e.g. TV broadcasting. We think that retransmission at eNode B is beneficial only for single cell transmission of message distribution services, not all sorts of services.

Discussion on Layer 3

Currently we agreed that RRC is terminated at eNode B. That means there is no RRC layer at aGW. However, aGW need to control multicast/broadcast, at least for multi-cell transmissions. Thus, someone could say that such control funcation at aGW could be part of RRC.

We think that one common architecture needs to be applied to both multicast/broadcast and unitcast services. So, to avoid putting RRC on aGW, it is suggested that aGW transfers control information of multi-cell transmissions i.e. scheduling/combining to eNode B to control multi-cell transmissions. Then, eNode B transmits some of control information received from aGW on either MCCH or MSCH. Thus, there is no RRC layer in aGW and no direct communication with RRC signalling between UE and aGW. RRC at eNode B controls multicast/broadcast transmissions with the control information received from aGW.

In summary, it is proposed that the agreed architecture of unicast RB is applied to multicast/broadcast RB as well:

- PDCP at aGW performs header compression of multicast/broadcast services.
  - There is one PDCP entity per cell group for one service like PDCP of R6 MBMS
- MAC at eNode B performs channel mapping from logical to transport channel and multiplexing of logical channels.
  - In MAC, ARQ (or HARQ) can be studied without ACK/NACK for single cell transmission of message distribution.
- RRC at eNode B control multicast/broadcast transmissions based on the control information given from aGW.
  - Some of the control information given from aGW can be transferred to UE on MCCH or MSCH by eNode B.

It is noted that there are no RRC and RLC/MAC at aGW even for multicast/broadcast.

7 Control Channel/Information for multicast/broadcast

Since single cell transmission is considered for multicast/broadcast, it is assumed that multicast/broadcast will contain cell specific information. For example, if cells are different, service information, RB information and scheduling information can be different due to single cell transmissions. Thus, MCCH should be configured for each cell like R6 MBMS.

MCCH needs to provide service information that lists all of available service in a cell and then information of PTM RBs on DL SCH and MCH for each service. Based on MCCH information, UE can know how to configure PTM RB on DL SCH without L1 combinig or PTM RB on MCH with L1 combining for an interesting service. We think that R6 MCCH messages could be a baseline of LTE MCCH messages.

In R6 MBMS, UE needs to receive System Information on BCH and then MCCH to acquire MBMS information, so that it took at least one cycle of SIB transmission on BCH e.g. 640 ms to acquire MBMS information. To reduce this time, we propose that MCCH configuration is provided by the like of BCCH MIB (Master Information Block) or SB (Scheduling Block) i.e. Primary System Information in [2]. Therefore, a UE could read MCCH immediately after reading Sychronization Channel and Primary System Information on BCH if it wishes. It is noted that we propose BCCH is carried on BCH & DL SCH and configuration of BCCH on DL-SCH is informed by BCCH on BCH [2]. Thus, configuration of MCCH could be broadcast together with configuration of BCCH on DL SCH.

In addition, it is proposed that MCCH is mapped to DL SCH. It is assumed that MCH transmits soft combined data with a long cyclic prefix and so one sub-frame of MCH would be one symbol smaller than one sub-frame of DL SCH. On the other hand, MCCH information would not be soft combinable due to the fact that different cells would have different lists of available services. For those reasons, DL SCH is preferred for MCCH because DL SCH can transmit more MCCH information than MCH and soft combining would not be applied to MCCH.

For multi-cell transmission, it seems to be better to transmit semi-static scheduling of MBMS services by in-band signalling on MCH. In this case, in-band signalling can be also L1 combined and is orginiated from aGW. The in-band signalling on MCH may contain time/frequency allocation and if necessary, MCS info, etc.

For single cell transmission, we think that the in-band signalling is not needed. Since DL-SCH is proposed for this transmission, L1/2 control information can be used instead of MSCH. L1/2 control information could also control UE DRX of DL-SCH for single cell transmission of multicast/broadcast.

In summary, it is proposed that

- R6 MCCH messages are the baseline of LTE MCCH messages.
- MCCH is mapped to DL SCH.
  - The configuration of MCCH on DL SCH is broadcast on Primary System Information on BCH [2].

- For multi-cell transmission, in-band signaling is transmitted on MCH with L1 combining and is used for carrying multicast/broadcast scheduling information which may be semi-static.
- For single cell transmission, L1/2 control information for DL-SCH is used for carrying multicast/broadcast scheduling information which is relatively dynamic.

8 Conclusion

In this document, we propose to agree to the points proposed above.

References

[1] RP-060215, "Introduction of specfic requirements for support of Broadcast mode in MBMS in LTE", Orange

[2] R2-06xxxx, "LTE system information", LG Electronics

Agenda Item : 11.9

Source : LG Electronics

Title : LTE System Information

Document for : Discussion and Decision

1. Introduction

This document dicusses how to transfer system information on BCCH.

2. Primary and Secondary System Information

2.1 UTRA System Information

Table 1 shows what kind of system information is provided in UTRA for discussion.

MIB	• Value tag • PLMN type • PLMN identity
SB1/2	• References to other SIBs
SIB1	• (CN domain) NAS system information • UE timers and counters to be used in idle mode and in connected mode
SIB2	URA identity
SIB3	Parameters for cell selection and re-selection - Cell identity - Q values and S values - Etc.
SIB4	Parameters for cell selection and re-selection in CONNECTED MODE
SIB5	Parameters for the configuration of the common physical channels - PRACH - SCCPCH - PICH etc.
SIB5bis	Used in networks that use Band IV instead of SIB5
SIB6	Parameters for the configuration of the common physical channels in CONNECTED MODE
SIB7	Fast changing parameters - UL interference - PRACH Dynamic persistence level.
SIB11	Measurement control information to be used in the cell - FACH measurement occasion info - Measurement control system information (for intra/inter frequency, inter-RAT, TVM info)
SIB12	Measurement control information to be used in the cell in CONNECTED MODE
SIB13	ANSI-41 system information
SIB14	TDD parameters for common and dedicated physical channel uplink outer loop power control information to be used in both idle and connected mode. - Individual Timeslot interference
SIB15	Information useful for UE-based or UE-assisted positioning methods
SIB16	Pre-defined Configurations
SIB17	TDD fast changing parameters only for PDSCH/PUSCH - TFS

	- Codes - Time slots
SIB18	PLMN identities of neighbouring cells to be considered in idle mode as well as in connected mode.

Table 1. System Information in UTRA

2.2 E-UTRA System Information

2.2.1 Categorization of System Information

We think that system information similar to UTRA would be used for LTE. The system information blocks listed in Table 1 could be categorized as in Table 2. The categorized information in Table 2 could be a starting point of LTE system information. Each information in Table 2 would be realized by one or several information blocks i.e. SIB.

Primary System Information		• PLMN information (e.g. MIB) • Scheduling information of BCCH blocks, i.e. Secondary system information blocks (e.g. R6 MIB or SB)
Cell-level Secondary System Information	Semi-static	• Cell selection/re-selection information (e.g. R6 SIB3) • Semi-staic common channel information (e.g. R6 SIB5/6) • Measurement control information (e.g. R6 SIB11/12) • Cell-level Location Service information (e.g. R6 SIB15 except SIB15.3) • Information on PLMN identities of neighbouring cells (e.g. SIB18)
	Dynamic	• Dynamic common channel information (e.g. R6 SIB7, SIB14, SIB17)
PLMN-level Secondary System Information		• NAS system information (e.g. R6 SIB1) • Information on UE timers/counters (e.g. R6 SIB1) • PLMN-level Location Service information (e.g. R6 SIB15.3) • Pre-defined Configurations (e.g. R6 SIB16)

Table 2. Potential LTE system information in E-UTRA

2.2.2 Primary System Information

When a UE camps on a cell, the UE read the Primary System Information in Table 2 immediately after Sychronization Channel. The Primary System Information is cell specific and semi-static. The information contains scheduling of the Secondary System Information blocks. Thus, after reading the Primary System Information, the UE is able to read a Secondary System Information block on a scheduled time and frequency.

2.2.3 Cell-level Secondary System Information

The Cell-level Secondary System Information in Table 2 is cell-specific. Thus, if a UE moves to a new cell, the UE should read the Cell-level Secondary System Information in the new cell, regardless of reading of the Cell-level Secondary System Information in a previous cell.

Dynamic Cell-level Secondary System Information

The Dynamic Cell-level Secondary System Information in Table 2 includes fast changing parameters such as interference. It would be used for a common channel such as Random Access Channel.

Semi-static Cell-level Secondary System Information

Except the Dynamic Cell-level Secondary System Information, it is assumed that all of System Information in Table 2 are semi-static i.e. slower changing.

2.2.4 PLMN-level Secondary System Information

The PLMN-level Secondary System Information in Table 2 is not cell-specific, but common to multiple cells in PLMN area. Thus, if a UE that has read the PLMN-level Secondary System Information in a previous cell moves to a new cell and the PLMN-level Secondary System Information is not modified, the UE does not need to read the same PLMN-level Secondary System Information in a new cell. The information is semi-static.

3. Transfer of System Information on BCCH

3.1 Transmissions of Primary and Secondary System Information

As explained in [1], BCH channel should have a globally fixed configuration for UEs to decode without any control information. Thus, it is proposed that the Primary System Information is broadcast on BCH. On the other hand, if system information is broadcast on DL SCH, there are several benefits such as easy SIB extension, power saving and so on. Thus, it is proposed that the Seconary System Information is broadcast on DL SCH. In this case, configuration of BCCH on DL SCH should be carried on the Primary System Information on BCH.

Layer 2 may be able to differently handle transmissions of Primary & Secondary System Information e.g. segmentation/concatenation. Therefore, different BCCH logical channels may be configured for Primary & Secondary System Information, which needs to be further studied based on L2 design.

3.2 Transmission of PLMN-level System Information

As seen above, SIB1, SIB15.3 and SIB16 are across several cells in PLMN area. SIB1 contains NAS system information and UE timer/counter, SIB15.3 Location Service information and SIB16 pre-defined configurations. Apart from Location Service, the likes of SIB1 and SIB16 would be still needed in LTE. If they are broadcast on LTE BCCH, a combining technique across several cells could be considered to transfer of NAS system information, UE timer/counter and pre-defined configurations.

Typically, soft combining or selective combining were used in UTRA as a combining technique. However, they have some problems as discussed below.

3.2.1 Possibility of Soft Combining of PLMN-level System Information

In terms of performance, soft combining is better than selective combining. However, if soft combining is applied to the likes of SIB1 and SIB16 in LTE, L1 would provide a specific common pilot and probably long cyclic prefix for them. Thus, a sub-frame of soft combined system information would be physically different from a sub-frame of non-soft combined system information.

In addition, in this case, synchronous time/frequency transmission of the specific system information between cells needs to be provided. Thus, this could not be applied to various scalable BW scenarios e.g. 10 Mhz and 20 Mhz neighboring cells.

3.2.2 Possibility of Selective Combining of PLMN-level System Information

If selective combining is applied to the likes of SIB1 ans SIB16 in LTE, L1 does not need to consider the specific sommon pilots, the length of cyclic prefix and synchronous transmissions. However, a UE should decode multiple cells to selectively combine BCCH channels of multiple cells.

Moreover, the UE should apply duplication avoidance function in L2. For this function, aGW may need to provide sequence numbers of this PLMN-level system information.

3.3 Segmentation/Concetanation and Re-assembly of System Information

BCCH information and MCCH information are similar in that they are repeatedly broadcast and indicate update of information when they are modified. In R99, segmentation/concetanation and re-assembly for BCCH information were done in RRC, not L2. On the other hand, in R6, similar processes for MCCH information were done in RLC.

It is expected that both BCCH and MCCH will be still part of LTE. Also, we could find out another information similar to BCCH and MCCH information. Thus, to increase commonality of features and simplify specifications, it could be considered that segmentation/concetanation and re-assembly of BCCH information are performed by L2, not by L3. L2 needs to support the like of R6 RLC UM mode. It is noted that this is also proposed for MCCH information.

4. Conclusion

In this document, the following points are proposed to be captured in TR 25.813:

1. Table 2 and related description are a starting point of LTE system information.
2. The Primary System Information is broadcast on BCH and the Secondary System Information on DL SCH.
3. If combining is applied to BCCH, the PLMN-level System Information can be combined between cells e.g. by soft or selective combining. However, further study is needed to know if they have a real benefit.
4. Segmentation/concetanation and re-assembly of BCCH information are performed by L2

References

[1] R2-060903, Considerations on BCH and 20 MHz system BW, LG Electronic Inc.

Agenda Item : 11.9
Source : LG Electronics
Title : LTE System Information
Document for : Discussion and Decision

1. Introduction

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The Cell-level Secondary System Information in Table 2 is cell-specific. Thus, if a UE moves to a new cell, the UE should read the Cell-level Secondary System Information in the new cell, regardless of reading of the Cell-level Secondary System Information in a previous cell.

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Except the Dynamic Cell-level Secondary System Information, it is assumed that all of System Information in Table 2 are semi-static i.e. slower changing.

2.2.4 PLMN-level Secondary System Information

The PLMN-level Secondary System Information in Table 2 is not cell-specific, but common to multiple cells in PLMN area. Thus, if a UE that has read the PLMN-level Secondary System Information in a previous cell moves to a new cell and the PLMN-level Secondary System Information is not modified, the UE does not need to read the same PLMN-level Secondary System Information in a new cell. The information is semi-static.

3. Transfer of System Information on BCCH

3.1 Transmissions of Primary and Secondary System Information

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Typically, soft combining or selective combining were used in UTRA as a combining technique. However, they have some problems as discussed below.

3.2.1 Possibility of Soft Combining of PLMN-level System Information

In terms of performance, soft combining is better than selective combining. However, if soft combining is applied to the likes of SIB1 and SIB16 in LTE, L1 would provide a specific common pilot and probably long cyclic prefix for them. Thus, a sub-frame of soft combined system information would be physically different from a sub-frame of non-soft combined system information.

In addition, in this case, synchronous time/frequency transmission of the specific system information between cells needs to be provided. Thus, this could not be applied to various scalable BW scenarios e.g. 10 Mhz and 20 Mhz neighboring cells.

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Moreover, the UE should apply duplication avoidance function in L2. For this function, aGW may need to provide sequence numbers of this PLMN-level system information.

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4. Conclusion

In this document, the following points are proposed to be captured in TR 25.813:

1. Table 2 and related description are a starting point of LTE system information.
2. The Primary System Information is broadcast on BCH and the Secondary System Information on DL SCH.
3. If combining is applied to BCCH, the PLMN-level System Information can be combined between cells e.g. by soft or selective combining. However, further study is needed to know if they have a real benefit.
4. Segmentation/concetanation and re-assembly of BCCH information are performed by L2

References

[1] R2-060903, Considerations on BCH and 20 MHz system BW, LG Electronic Inc.

Agenda Item : 11.10
Source : LG Electronics
Title : Discussion on Initial Access to LTE Cell
Document for : Discussion and Decision

1. Introduction

This document dicusses initial access procedures to a LTE cell.

2. Network/UE-originated Initial Access Procedure

The network originated initial access procedure is started with a paging message. When a UE receives its own paging message, the UE tries to access a cell. On the other hand, the UE originated initial access procedure is started without a paging message. The procedures are shown in the figure 1.

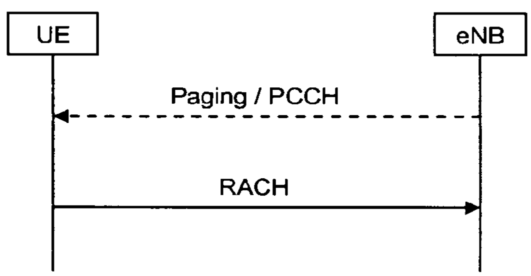

Figure 1. Network/UE-originated Initial Access Procedure

2.1 Paging

In the figure 1, the same paging message will be transmitted across multiple cells over the same Tracking Area. Thus, PCH channel could be optimized with a combining scheme from multi cells because it is assumed that pagings may not be cell specific.

2.1.1 Soft Combining of PCH Channel

As the combining scheme, soft combining or selective combining could be considered. The soft combining is better than selective combining in terms of performance. However, in case of soft combining PCH should be statically mapped to a specific frequency and time in all cells over the same Tracking Area. i.e. when scalable cell bandwidths are applied to multiple cells over the same Tracking Area, e.g. 10 Mhz and 20 Mhz cells on the same Tracking Area, this static resource mapping could not be always possible.

Also, it is noted that PCH can be mapped to physical resources which can be used dynamically also for traffic/other control channels according to 25.813. However, soft combining could not be applied to physical resources which can be used dynamically also for traffic/other control channels because soft combined sub-frames would have a long cyclic prefix and however DL SCH sub-frames a short cyclic prefix.

But, if soft combining of PCH is applied only to intra-Node case, such drawbacks may be not a big deal.

2.1.2 Selective Combining of PCH Channel

Selective combining could be broadly used over the same Tracking Area and be applied to various scalable cell bandwidth scenarios e.g. neighboring 10 Mhz and 20 Mhz cells. Also, selective combining could be applied to physical resources which can be used dynamically also for traffic/other control channels. However, a UE should decode multiple cells to selectively combine PCH channels of multiple cells. It is noted that timing of paging would be aligned among cells based on a UE DRX cycle, even with selective combining.

2.1.3 Support for More than one Tracking Area on a Cell

In the case of combining, either soft or selective combining, Since a cell can be placed in more than one Tracking Area, different cells could have different combinations of Tracking Areas. Due to this, it may be difficult to combine PCH channels from different cells over one Tracking Area. To solve this problem, multiple PCCH or PCH channels may need to be supported for one cell and each PCCH or PCH channel is configured for each Tracking Area.

In particular, in case of selective combining, L2 sequence numbers of PCH need to be provided by aGW to support selective combining in L2. Thus, different sequence numbering may need to be done for different Tracking Area.

2.2 Preamble Resource Allocation

2.2.1 RACH preamble resource allocated by Paging

RACH preamble resource could be allocated by PCH channel. In that case, a paged UE would access a cell by RACH without collision. However, since it is assumed that a paging is transmitted at multiple cells over a Tracking Area, all cells except one paging cell will wastefully allocate RACH preamble resources.

Thus, it is not preferred to allocate RACH preamble by PCH channel.

2.2.2 Random Selection of RACH preamble resource

This is similar to R99 RACH preamble. The cell broadcasts one or more sets of RACH preamble resources e.g. according to ASC. The RACH preamble resource can be randomly selected within one set of RACH preamble resources by the UE. It is proposed to use this scheme for Network/UE-originated Initial Access Procedures.

It is noted that in case of handover, the UE may be able to send a RACH preamble in a target cell with a resource allocated from a source cell.

2.3 Information for initial access

When a UE initially accesses a cell, the UE needs to indicate the following points to the network either explicitly or implicitly:

- Cell identification i.e. which cell the UE wish to access
- UE identification e.g. random UE id

In addition, When a UE initially accesses a cell, if the following information is carried on RACH, it would be helpful:

- a priority e.g. Access Service Class, Logical Channel Priority
- a cause value. e.g. Establishment Cause

2.3.1 Cell Identification

If different cells share the same UL band, the cell identifier should be included in the preamble. In this case, a cell should broadcast a short cell identifier which needs to be short enough to be carried on one RACH preamble. On the other hand, if different cell uses different radio resource e.g. time, frequency, a cell can be identified by the different radio resource without any identifier in the RACH preamble.

2.3.2 UE Identification

If a RACH preamble carries a sequence, the sequence may be able to differentiate UEs. However, there would be only a limited number of sequences on RACH preamble. Thus, clear UE identification needs to be done by RACH preamble or Scheduled Transmission after the RACH preamble to reduce collision due to RACH access.

2.3.2.1 Use of Allocated UE identity on Scheduled Transmission

In case of intial access, if the RACH preamble or the Scheduled Transmission carries a NAS related UE identity such as TMSI, there will be no collision. However, it is felt that the RACH preamble is not capable of carrying the long identity.

Thus, this method is lack of ability to reduce collision of the RACH preamble. Collision would be solved after RACH preamble.

2.3.2.2 Use of a random UE identity on RACH preamble

A UE can generate random number for a UE identity to be transmitted on RACH preamble. This method can reduce collision of the RACH preamble. However, it is not totally free from collision.

2.3.2.3 Use of UE identity on RACH preamble driven from Paging

In case of the network-originated initial access procedure, the UE can avoid collision during the RACH preamble by using a number drived from a received paging. Paging messages are transmitted based on UE DRX cycles. Thus, each paging message would have its own sub-carrier and sub-frame. In this case, when a UE responds to its own paging message received on a specific sub-frame Ti and a resource block Rj, if the UE generates a temporary UE identity with Ti and Rj, RACH transmission from the UE would be free from collision.

For example, if Ti = [0001001] and Rj = [010], a UE receive its own paging message on 9th sub-frame within sub-frames allocated for PCH during one DRX cycle and 2nd resource block within a set of resource blocks allocated for PCH during the 9th sub-frame and. In this case, the UE sends RACH with a UE id [Ti:Rj] = [0001001 010]. If a UE identity on RACH is numbered by this way, we could avoid collision on RACH. In this case, the length of UE identity depends on how many resources are allocated for PCH in a cell and how long a UE DRX cycle is.

In addition, the UE identity generated by this scheme for the network-originated initial access procedure needs to be set apart from UE identities used for the UE-originated initial access procedure. For this, these network/UE-originated procedures can be separated by different RACH resources or by insertion of addition 1 bit into the UE identity.

2.3.3 Priority

In R99, when a UE sends RACH preamble, the UE needs to perform ASC selection in MAC layer. During the procedure, the UE needs to use ASC mapped to AC and LoCH priority. It is felt that such RACH prioritization can be realized in LTE RACH by the following ways:

- Like R99, RACH priority is indicated by a UL radio resource allocated to the RACH preamble.
- RACH priority is indicated by a priority bit carried on the RACH preamble.

When the network responds to an initial access of a UE, the network needs to consider this priority. Thus, this information needs to be indicated by the preamble, not by the scheduled transmission.

2.3.4 Cause Value

In R99, when a UE initially requests a RRC connection, the initial message includes 'Establishment Cause'. This information is included not in the RACH preamble, but in the RACH message. Thus, detailed causes like 'Establishment Cause' could be carried on the scheduled transmission after the RACH preamble.

However, simple RACH causes such as initial access, handover, synchronization maintanence could be considered to help the cell to responds the RACH access.

This simple cause value also can be indicated:

- by a UL radio resource allocated to the RACH preamble; or
- by a cause bit carried on the RACH preamble.

2.4 Default/Pre-defined Configurations

By using the RACH preamble or the scheduled transmission after the RACH preamble, a UE could indicates to the network which kinds of service(s) needs to be supported for the UE. In this case, an indication 'index indication' can be included in the RACH preamble or the scheduled transmission. The index indication on UL helps the network to determine which RB configuration should be done for the UE.

For example, if the UE wish to transmit/receive VoIP traffic, the UE can indicate to the network by the index indication on RACH preamble or the scheduled transmission that the UE wishes to be configured by a RB configuration of VoIP traffic. For this, RB configuration information including several RB configurations for several types of services can be broadcast on system information. When the UE indicate by the index indication, the UE can choose one of the RB configurations broadcast on system information.

If the network receives the index indication from the UE, the network will configure the UE by a RB configuration mapped to the index indication. For this, eNB can indicate the RB configuration on ACK of the RACH preamble or another DL message. Thus, if ACK is received by the UE, the RB configuration should be done in the UE.

3. Conclusion

It is proposed in this document that:

- Soft or selective combining need to be considered for PCH channel.
- In case of initial access, a RACH preamble resource is randomly selected among a set of RACH preamble resources by a UE.
    - In case of handover, a RACH preamble resource used in a target cell can be allocated to a UE by source cell.
- Which cell a UE try to access, a priority and a simple cause value are indicated by a UL resource used for a RACH preamble or by bits inserted in a RACH preamble.

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2. Network/UE-originated Initial Access Procedure

The network originated initial access procedure is started with a paging message. When a UE receives its own paging message, the UE tries to access a cell. On the other hand, the UE originated initial access procedure is started without a paging message. The procedures are shown in the figure 1.

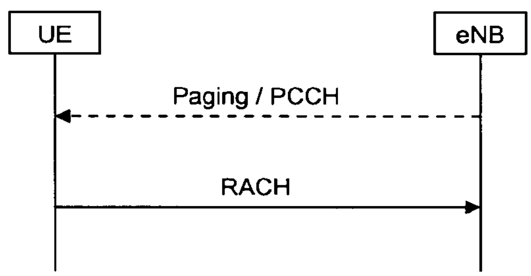


Figure 1. Network/UE-originated Initial Access Procedure

2.1 Paging

In the figure 1, the same paging message will be transmitted across multiple cells over the same Tracking Area. Thus, PCH channel could be optimized with a combining scheme from multi cells because it is assumed that pagings may not be cell specific.

2.1.1 Soft Combining of PCH Channel

As the combining scheme, soft combining or selective combining could be considered. The soft combining is better than selective combining in terms of performance. However, in case of soft combining PCH should be statically mapped to a specific frequency and time in all cells over the same Tracking Area. i.e. when scalable cell bandwidths are applied to multiple cells over the same Tracking Area, e.g. 10 Mhz and 20 Mhz cells on the same Tracking Area, this static resource mapping could not be always possible.

Also, it is noted that PCH can be mapped to physical resources which can be used dynamically also for traffic/other control channels according to 25.813. However, soft combining could not be applied to physical resources which can be used dynamically also for traffic/other control channels because soft combined sub-frames would have a long cyclic prefix and however DL SCH sub-frames a short cyclic prefix.

But, if soft combining of PCH is applied only to intra-Node case, such drawbacks may be not a big deal.

2.1.2 Selective Combining of PCH Channel

Selective combining could be broadly used over the same Tracking Area and be applied to various scalable cell bandwidth scenarios e.g. neighboring 10 Mhz and 20 Mhz cells. Also, selective combining could be applied to physical resources which can be used dynamically also for traffic/other control channels. However, a UE should decode multiple cells to selectively combine PCH channels of multiple cells. It is noted that timing of paging would be aligned among cells based on a UE DRX cycle, even with selective combining.

2.1.3 Support for Multiple Tracking Areas on a Cell

In the case of combining, either soft or selective combining, Since a cell can have multiple Tracking Areas, different cells could have different combination of Tracking Areas. Due to this, it would be difficult to combine PCH channels from different cells. To solve this problem, multiple PCCH or PCH may need to be supported. In this case, each PCCH or PCH is configured for each Tracking Area.

In particular, in case of selective combining, L2 sequence numbers of PCH need to be provided by aGW to support selective combining in L2. Thus, different sequence numbering may need to be done for different Tracking Area.

2.2 Preamble Resource Allocation

2.2.1 RACH preamble resource allocated by Paging

RACH preamble resource could be allocated by PCH channel. In that case, a paged UE would access a cell by RACH without collision. However, since it is assumed that a paging is transmitted at multiple cells over a Tracking Area, all cells except one paging cell will wastefully allocate RACH preamble resources.

Thus, it is not preferred to allocate RACH preamble by PCH channel.

2.2.2 Random Selection of RACH preamble resource

This is similar to R99 RACH preamble. The cell broadcasts the set of RACH preamble resources. The RACH preamble resource can be randomly selected within a set of RACH preamble resources by the UE.

It is proposed to use this scheme for Network/UE-originated Initial Access Procedures. It is noted that in case of handover, the UE may be able to send a RACH preamble in a target cell with a resource allocated from a source cell.

2.3 Information for initial access

When a UE initially accesses a cell, the UE needs to indicate the following points to the network either explicitly or implicitly:

- Cell identification i.e. which cell the UE wish to access
- UE identification e.g. random UE id

In addition, When a UE initially accesses a cell, if the following information is carried on RACH, it would be helpful:

- a priority e.g. Access Service Class, Logical Channel Priority
- a cause value. e.g. Establishment Cause

2.3.1 Cell Identification

If different cells share the same UL band, the cell identifier should be included in the preamble. In this case, a cell should broadcast a short cell identifier which needs to be short enough to be carried on one RACH preamble. On the other hand, if different cell uses different radio resource e.g. time, frequency, a cell can be identified by the different radio resource without any identifier in the RACH preamble.

2.3.2 UE Identification

If a RACH preamble carries a sequence, the sequence may be able to differentiate UEs. However, there would be only a limited number of sequences on RACH preamble. Thus, clear UE identification needs to be done by RACH preamble or Scheduled Transmission after the RACH preamble to reduce collision due to RACH access.

2.3.2.1 Use of Allocated UE identity on Scheduled Transmission

In case of intial access, if the RACH preamble or the Scheduled Transmission carries a NAS related UE identity such as TMSI, there will be no collision. However, it is felt that the RACH preamble is not capable of carrying the long identity.

Thus, this method is lack of ability to reduce collision of the RACH preamble. Collision would be solved after RACH preamble.

2.3.2.2 Use of a random UE identity on RACH preamble

A UE can generate random number for a UE identity to be transmitted on RACH preamble. This method can reduce collision of the RACH preamble. However, it is not totally free from collision.

2.3.2.3 Use of UE identity on RACH preamble driven from Paging

In case of the network-originated initial access procedure, the UE can avoid collision during the RACH preamble by using a number drived from a received paging. Paging messages are transmitted based on UE DRX cycles. Thus, each paging message would have its own sub-carrier and sub-frame. In this case, when a UE responds to its own paging message received on a specific sub-frame Ti and a resource block Rj, if the UE generates a temporary UE identity with Ti and Rj, RACH transmission from the UE would be free from collision.

For example, if Ti = [0001001] and Rj = [010], a UE receive its own paging message on 9^{th} sub-frame within sub-frames allocated for PCH during one DRX cycle and 2^{nd} resource block within a set of resource blocks allocated for PCH during the 9^{th} sub-frame and. In this case, the UE sends RACH with a UE id [Ti:Rj] = [0001001 010]. If a UE identity on RACH is numbered by this way, we could avoid collision on RACH. In this case, the length of UE identity depends on how many resources are allocated for PCH in a cell and how long a UE DRX cycle is.

In addition, the UE identity generated by this scheme for the network-originated initial access procedure needs to be set apart from UE identities used for the UE-originated initial access procedure. For this, these network/UE-originated procedures can be separated by different RACH resources or by insertion of addition 1 bit into the UE identity.

2.3.3 Priority

In R99, when a UE sends RACH preamble, the UE needs to perform ASC selection in MAC layer. During the procedure, the UE needs to use ASC mapped to AC and LoCH priority. It is felt that such RACH prioritization can be realized in LTE RACH by the following ways:

- Like R99, RACH priority is indicated by a UL radio resource allocated to the RACH preamble.
- RACH priority is indicated by a priority bit carried on the RACH preamble.

When the network responds to an initial access of a UE, the network needs to consider this priority. Thus, this information needs to be indicated by the preamble, not by the scheduled transmission.

2.3.4 Cause Value

In R99, when a UE initially requests a RRC connection, the initial message includes 'Establishment Cause'. This information is included not in the RACH preamble, but in the RACH message. Thus, detailed causes like 'Establishment Cause' could be carried on the scheduled transmission after the RACH preamble.

However, simple RACH causes such as initial access, handover, synchronization maintanence could be considered to help the cell to responds the RACH access.

This simple cause value also can be indicated:

- by a UL radio resource allocated to the RACH preamble; or
- by a cause bit carried on the RACH preamble.

3. Conclusion

It is proposed in this document that:

- if PCH combining is needed, soft combining could be used only for the intra-Node B case or selective combining for all cases.
- In case of initial access, a RACH preamble resource is randomly selected by a UE.
    - In case of handover, a RACH preamble resource used in a target cell can be allocated to a UE by source cell.

• Which cell a UE try to access, a priority and a simple cause value are indicated by a UL resource used for a RACH preamble or by bits inserted in a RACH preamble.

Agenda item: 6.4

Source: LG Electronics Inc.

Title: Framing in the MAC entity

Document for: Discussion, Decision

1. Introduction

In the last plenary, it was decided that ARQ operation is in the eNB. And basic MAC architecture was also agreed in the last RAN2 meeting in Denver.

Still, it is not clear how upper layer data, i.e. MAC SDU, is constructed into MAC PDU and how ARQ information is included into MAC PDU. In this document, we discuss further details of the framing.

2. Discussion

2.1 Framing

To optimize data throughput, it is essential to reduce unused bit in the MAC PDU. To this purpose, several logical channels or MAC-d flows will be multiplexed into same MAC PDU to reduce padding bits. In fact, in the section 5.3.1 of 25.813 it is stated that *"The MAC layer performs multiplexing of logical channels on the same HARQ process."* The amount of data of each logical channel that is included into MAC PDU will be different according to the decision of scheduler. Accordingly, it is necessary for the MAC PDU to include information indicating each included logical channel identity and the amount of included data of each logical channel.

And if each channel processes its data segment, then the processing load for combined MAC PDU will be reduced. In order words, dedicated entity of each channel assembles/dissembles its MAC-I (MAC internal) PDU and this MAC-I PDU are assembled into or dissembled out of one MAC PDU. This will enable stepwise processing.

Following is one example of framing.

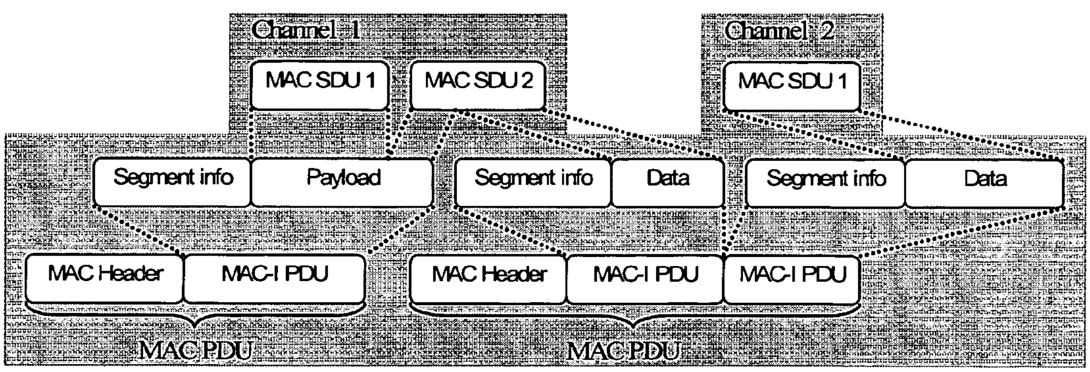


Figure 1 Example of Framing

In this example, each MAC-I (MAC Internal) PDU is composed of MAC SDUs from only one logical channel and MAC PDU is composed of several MAC-I PDU.

MAC Header indicates the length and the channel ID of each included MAC-I PDUs. Using this information, the receiver can decompose the MAC PDU into MAC-I PDUs, and then distribute them to the appropriate channel for further processing. When control information like Status Report is included, this can be indicated as MAC-I PDU of special channel ID [FFS]. Inclusion of control information into MAC-I PDU also can be option.

Segment info indicates how to reassemble the payloads into MAC SDUs. This information will include the boundary information of SDUs and the sequence information to tell the position of Payload part. The detailed example of Segment info is shown in section 2.2

2.2 SubFraming

When a MAC-I PDU is needed to be retransmitted due to ARQ status report, it can happen that the channel quality and the traffic situation have degraded. Therefore the original size of the MAC-I PDU can not be supported over the air.

In this section, we show one example to perform SubFraming. SubFraming is used to segment MAC-I PDUs that are reported missing by the receiving side. Without SubFraming, when one MAC-I PDU is missing in the receiver and the MAC-I PDU size exceeds the available resources of the scheduler, the transmission should be started again from MAC SDU level.

It is FFS whether SubFraming is used only for uplink direction. Because cell resource scheduler is located in the Node-b, the frequency and time resource for the MAC PDU in Downlink might be adjusted according channel characteristic. Therefore the cases where the, original size of MAC PDU can not be supported should be rare. But for Uplink direction, due to power limitation and UE capability, more frequency and time resource allocation may not be useful for transmission of original MAC-I PDU. Thus in this case, SubFraming is useful.

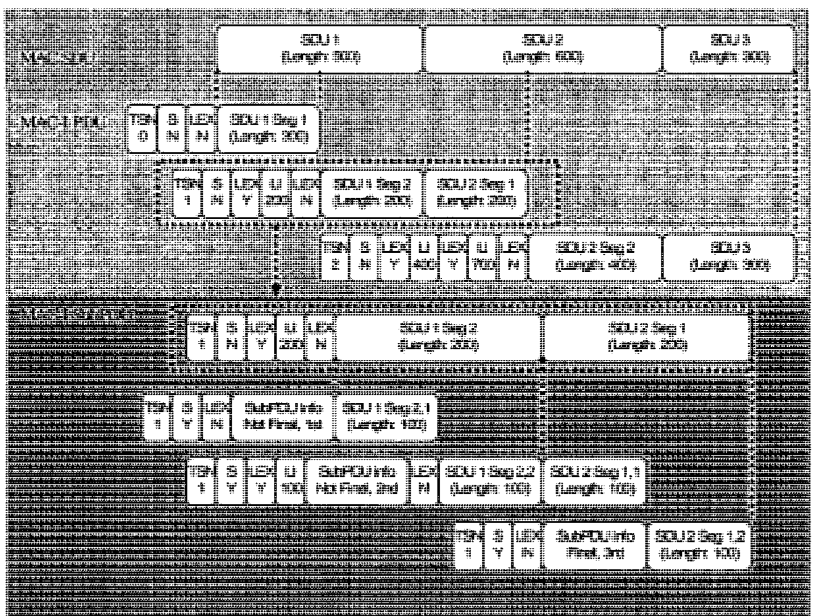


Figure 2 Example of SubFraming

Above figure 2 shows an example on how subframing can be done. For simplicity reason, only one logical channel is considered. Following is description for the above figure.

Blue box:

In the blue box, three IP packets are shown. From MAC entity point of view, this IP packet is actually MAC SDU. In this example, the length of each IP Packet is 500,600,300 bit.

Yellow box:

In the yellow box, how MAC-I PDUs are composed from original IP packets (MAC SDUs) is shown. The size of each MAC-I PDU is decided by the scheduler. In this example, the allowed sizes of MAC-I PDUs are 300,400 and 700 bit. This is size that is used before re-transmission is requested.

MAC-I PDU includes several header fields.

- TSN (Transmission sequence number): This is used for re-ordering and ARQ purpose. Whenever new MAC-I PDU is generated, the TSN is incremented. TSN uniquely identifies the order of MAC-I PDUs. It is FFS whether TSN is same as SN of MAC SDU.
- LI: (Length Indicator): This is used to indicate the boundary of MAC SDUs within a MAC-I PDU. Without LI, the receiving side does not know how to reassemble MAC PDUs into MAC SDUs.
- S: (SubFraming Indicator): This is used to indicate that the concerned MAC-I PDU is sub-framed MAC-I PDU of original MAC-I PDU.
- LEX: (LEngth eXtension Indicator): This is used to indicate that there is additional length indicator in the MAC-I PDU header.
- SubPDU info: This is used to re-order MAC-I SubPDUs. This field include the order of this MAC-I SubPDU within SubPDUs and whether this is the final MAC-I SubPDU or not for the concerned MAC-I PDU.

Green Box:

In the green box it is shown how MAC-I SubPDUs are composed from original MAC-I PDU. When upper ARQ indicates that a MAC-I PDU is missing in the receiving side, the MAC-I PDU needs to be retransmitted. If the allocated resources are not big enough for the size of the original MAC-I PDU at the moment of ARQ retransmission, the MAC-I PDU should be sub-divided into MAC-I SubPDUs.

In above figure, it is assumed that the second MAC-I PDU in the yellow box is divided into MAC-I SubPDUs. The available size of MAC-I SubPDU is assumed to be 100, 200 and 100 bit in this figure.

To discriminate MAC-I SubPDUs from MAC PDUs, a "S" field is used. When the receiving side finds "S" field set to "Yes" in MAC-I PDU, it treats this MAC-I PDU as MAC-I SubPDU. To identify the original MAC-I PDU, the TSN field of MAC-I SubPDU is set to the TSN of the original MAC-I PDU.

To identify the order of the MAC-I SubPDU for one MAC-I PDU, "SubPDU info" field is inserted immediately after the special LI. This field tells two things: Whether this MAC SubPDU is the last segment of MAC-I PDU, the position of this MAC-I SubPDU within all the MAC-I SubPDUs. So in above figure, the "SubPDU info" of third MAC-I SubPDU is set to 'Final' and '3rd'. This indicates that the MAC-I SubPDU is the final segment of a MAC-I PDU and the SubPDU is third in position. Accordingly, the receiving side knows that there is 3 MAC-I SubPDUs.

In case that a transmission of MAC-I SubPDU would fail, the handling, i.e., whether the MAC-I SubPDU would be segmented further or not is FFS. In that case, one more indicator bit can be inserted after "S" bit.

One possibility is to set lower target error ratio for MAC-I SubPDU or the amount of data in MAC-I SubPDU is minimized. In fact, the probability of loss of both MAC PDU and its MAC SubPDU will be very small. If this is true, then there will be maximum one level of subframing.

Conclusion:

Consider above SubFraming mechanism as candidate segmentation mechanism for re-transmission.

3. Conclusion

It is proposed to discuss and agree to:

- Consider and include mechanism in section 2 for Framing/SubFraming mechanism in the LTE TR.

4. Reference

[1] R2-060xxx, xx, xx

Agenda item: x

Source: LG Electronics Inc.

Title: Data handling at Handover

Document for: Discussion, Decision

1. Introduction

In the last meeting in Athens, following is agreed to be added into section 9.1.7 of TS 25.813.

> *When the eNB changes at handover, pending downlink RLC SDUs or PDUs (TBD) may be retransmitted in the target eNB. In the uplink, if in-order delivery of RLC SDUs is required at the decompressor in PDCP, either:*
>
> - *The PDCP sublayer includes a reordering buffer of RLC SDUs before security/decompressor; or*
> - *The uplink RLC SDUs or PDUs which were not delivered to PDCP have to be provided to the target eNB for re-ordering.*

But as shown in the text above, whether to retransmit RLC PDU or RLC SDU in the new cell is not decided yet.

2. Discussion

While every cell has equal spectrum allocation in WCDMA FDD mode, the spectrum allocation of each cell can be different in LTE. Because of this scalable bandwidth, handover between cells of different bandwidth can occur. But in most case, the cell bandwidth will be almost same within network of one operator.

Currently, there are two approaches data forwarding in inter-eNB handover. First approach is SDU based relocation in which not only the SDU which has never been transmitted but also SDU which has not been completely acknowledged are relocated to new eNB. Second approach is PDU based relocation in which all the unacknowledged PDUs are relocated to new eNB in addition to the SDU which has never been transmitted. This is illustrated in the following figure 1.

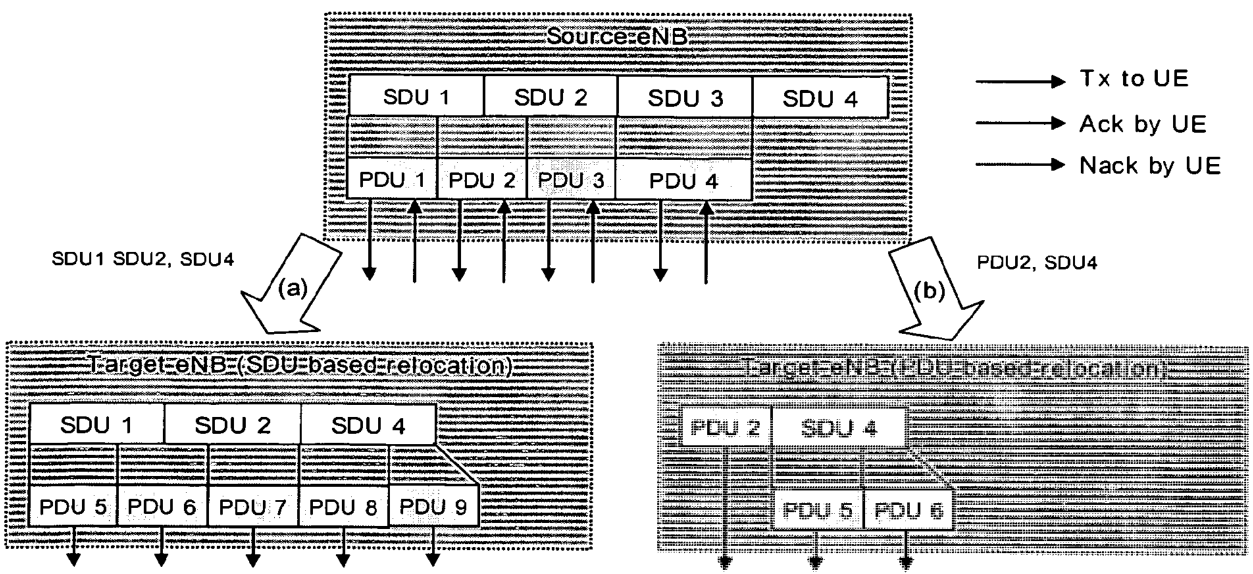


Fig. 1 Inter-eNB Handover (a) SDU based (b) PDU based

In deciding which approach to use, we can consider the available resources in each cell. Depending on the number of UE and the traffic activity, cells can be classified into congested cell and sparse cell. For example, in the figure 2, we can assume cell D as congested cell and cell C as sparse cell.

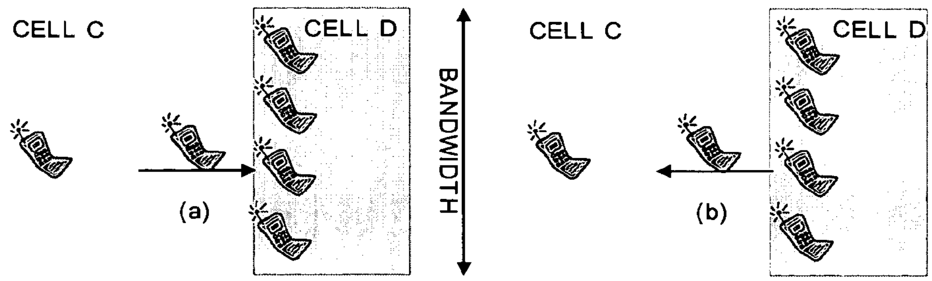


Fig. 1 Handover between same BW (a) Into congested cell (b) Into sparse cell

In For example, we can assume an old cell with 20 MHz and a new cell with 1.25 MHz. In simple calculation, for the same

<u>Handover from a cell of larger bandwidth to a cell of smaller bandwidth</u>

For example, we can assume an old cell with 20 MHz and a new cell with 1.25 MHz. In simple calculation, for the same amount of data, 1.25 MHz cell may require more time to transmit than the 20 MHz cell. Accordingly, to meet the QoS target of UEs in the cell, the need for utilizing radio resource as efficient as possible is critical in the cell with small bandwidth.

In fact, to transmit data over the radio means to schedule radio resources for some UE. If the transmission is used to deliver data already available in the receiving side, the radio resource for that transmission is just wasted without adding any value. If the cell has much resource such as wide bandwidth, this may not impact much. But for the small bandwidth cell, the ratio of efficiency and the delay induced to other traffic by that will be significant.

Furthermore, if the spectrum allocation is small, the allocated resources of backhaul network also will be small. It seems not to make much sense to reserve much larger bandwidth between network nodes when the achievable data rate over the radio is quite small. Then, the transferring of data between a network node of smaller bandwidth and other network node should be optimized also.

Considering above things, it seems to be beneficial for new cell to transmit RLC PDUs which is not acknowledged by UE and not to transmit RLC PDUs which is acknowledged by UE. In other words, if all the data of one RLC SDU is not acknowledged, then only the data segment which is not acknowledged should be retransmitted by new cell. This will not only increase radio efficiency but also reduce load on the backhaul network because only necessary part of RLC SDU is exchanged.

<u>Handover from a cell of smaller bandwidth to a cell of larger bandwidth</u>

This is the other way around of above case. In this case, a UE is handed over from a cell of 1.25 MHz to a cell of 20 MHz. Unlike scenario above, the available resources of new cell for backhaul and radio may be much bigger than the old cell. Because the bandwidth is wider, the maximum data rate over the radio is bigger in the new cell. Thus the traffic can be transmitted in shorter time and much larger capacity is needed into or out of this network node.

Due to the much more capacity, the limitation in the old cell in terms of maximum achievable throughput and QoS does not apply any more. In other words, efficiency of resource utilization can be sacrificed to simple buffer relocation or management.

Then, retransmitting the data that is already received by UE may not be much problem. Because of big radio resources, the time to transmit whole RLC SDU may be not so different from the time to transmit some RLC PDUs of that RLC SDU. Thus, simply forwarding RLC SDU from old eNB to new eNB can be a solution in this scenario. This will make the context relocation simple and will reduce the target eNB's load in understanding the context delivered from old eNB.

But as shown in above analysis, the data handling approach that should be used in inter-eNB handover should be different depending on the handover situation. There is trade-off between resource usage efficiency and complexity. In other words, when usable resource is larger in the new cell, SDU based relocation seems preferable in eNB change. On the other hand, when usable resource for the UE in new cell is smaller than the resource in the old cell, PDU based relocation seems better. Then, it is proposed to adopt both SDU based relocation and PDU based relocation in LTE because both approaches bring benefit.

But deciding which approach should be used is not straight forward. Not only actual bandwidth but also the average usable radio resource for each priority should be considered. In fact, it is assumed that the initial message from source eNB to target eNB may include the snapshot of the UE's status such as buffer information, GBR, etc. Based on the status of resource usage of the cell and the information from the source eNB, the target eNB may be able to decide whether SDU based or PDU based relocation is desirable. And this decision can be feedback to source eNB and UE to prepare relocation.

3. Conclusion

It is proposed to discuss and agree to:

- Both SDU based relocation and PDU based relocation are supported for inter-eNB relocation
- Target eNB decides which one of the two relocation methods should be used.

CR-Form-v8

CHANGE REQUEST

⌘ **25.321 CR CRNum** ⌘**rev - ** ⌘ Current version: **7.0.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ [ ] ME [X] Radio Access Network [X] Core Network [ ]

Title:	⌘ Correction on SI reporting and Psuedo-Code for E-TFC selection		
Source:	⌘ LG Electronics Inc.		
Work item code:	⌘ EDCH-L23	***Date:*** ⌘	
Category:	⌘ **F** *Use one of the following categories:* ***F*** *(correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.	***Release:*** ⌘	Rel-6 *Use one of the following releases:* *Ph2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *Rel-4 (Release 4)* *Rel-5 (Release 5)* *Rel-6 (Release 6)* *Rel-7 (Release 7)* *Rel-8 (Release 8)*

Reason for change: ⌘	Regarding a SI Reporting, when SG <> "Zero_Grant" and at least one proccess is activated, the SI is triggred in following situations. - when an E-DCH serving cell change occurs and if the new E-DCH serving cell was not part of the previous Serving E-DCH RLS. - when T_SIG expires However, for algorithm to insert SI into MAC-e PDU, it is specified that if the padding allows a SI to be sent, add it to the MAC-e PDU. Therefore, In order to avoid unnecessarily transmit a SI, that should affect timer "T_SIG" to be restartd as well. In Pseudo-Code for E-TFC Selection, when a SI is sent alone, to set maximum number of retransmission is not specified.
Summary of change: ⌘	It is clarifed that timer "T_SIG" is restarted when the padding in MAC-e PDU allows a SI to be sent. It is specified that maximum number of retransmission is set to 8 in case when a SI is sent alone.
Consequences if not approved: ⌘	Timer "T_SIG" can not be restarted when there is the SI transmission. It is not clear whether or not the maximum number of retransmission is set when the SI is snet aonle..

Clauses affected: ⌘	11.8.1.6.2, Annex C

		Y	N		
Other specs affected:	⌘	X		Other core specifications	⌘
				Test specifications	
				O&M Specifications	
Other comments:	⌘				

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

11.8.1.6.2 Report Triggering when SG <> "Zero_Grant" and at least one process is activated

If an E-DCH serving cell change occurs and if the new E-DCH serving cell was not part of the previous Serving E-DCH RLS or the padding in MAC-e PDU allows a Scheduling Information to be sent, the transmission of a Scheduling Information shall be triggered.

RRC can configure MAC with periodic triggering also for the case when the variable Serving_Grant <> "Zero_Grant" and at least one process is activated. The periodic trigger timer T_SIG (Timer Scheduling Information – different from "Zero_Grant") can be configured to a different value than T_SING.

T_SIG shall be started once the Serving_Grant variable becomes <> "Zero_Grant" and at least one process is activated.

When T_SIG expires, the transmission of a new Scheduling Information shall be triggered.

T_SIG shall be stopped and reset once the Serving_Grant variable in the Serving Grant Update function becomes equal to "Zero_Grant" or all processes are deactivated.

T_SIG shall be restarted when the transmission of a Scheduling Information is triggered.

Once the Serving_Grant variable in the Serving Grant Update function becomes equal to "Zero_Grant" or all processes are deactivated and Total E-DCH Buffer Status is larger than zero, the transmission of a Scheduling Information shall be triggered.

Annex C (informative): Pseudo-Code for E-TFC Selection

The pseudo-code below describes one possible implementation of the E-TFC Selection as described in subclause 11.8.1.4:

1> determine whether to take the scheduled and non-scheduled grants into account in the upcoming transmission.

1> if scheduled and/or non-scheduled data can be transmited:

2> select a MAC-d flow that allows highest-priority data to be transmitted (when more than one MAC-d flow allows data of the same highest priority to be transmitted, it is left to implementation to select which MAC-d flow to prefer);

2> based on this MAC-d flow, identify the MAC-d flow(s) that can be sent according to their multiplexing list and ignore the one(s) that cannot.

2> based on the HARQ profile of this MAC-d flow, identify the power offset to use;

2> based on this power offset and the E-TFC restriction procedure, determine the maximum supported payload (i.e. maximum MAC-e PDU size or E-TFC) that can be sent by the UE during the upcoming transmission;

2> set "Remaining Available Payload" to the maximum supported payload;

2> if the upcoming transmission overlaps with a compressed mode gap on 10ms TTI, scale down the current serving grant (SG);

2> set "Scheduled Grant Payload" to the highest payload that could be transmitted according to SG and selected power offset;

2> for each MAC-d flow with a non-scheduled grant, set the "Remaining Non-scheduled Payload" to the value of the grant;

2> set "Non scheduled Payload" to sum of MIN ("Remaining Non-scheduled Payload", non-scheduled available payload) for all non scheduled MAC-d flow(s);

2> if Scheduling Information needs to be transmitted:

3> if "Remaining Available Payload" > "Scheduled Grant Payload" + "Non-scheduled Payload" + size of the Scheduling Information:

4> quantize the sum of the "Scheduled Grant Payload" + "Non-scheduled Payload"+ size of the Scheduling Information to the next smaller supported E-TFC;

4> set the "Scheduled Grant Payload" to the quantized sum minus "Non-scheduled Payload" + size of the Scheduling Information.

3> substract the size of the Scheduling Information from "Remaining Available Payload".

2> else:

3> if "Remaining Available Payload" > "Scheduled Grant Payload" + "Non-scheduled Payload":

4> quantize the sum of the "Scheduled Grant Payload" + "Non-scheduled Payload" to the next smaller supported E-TFC;

4> set the "Scheduled Grant Payload" to the quantized sum minus "Non-scheduled Payload".

2> perform the following loop for each logical channel, in the order of their priorities:

3> if this logical channel belongs to a MAC-d flow with a non-scheduled grant, then:

4> consider the "Remaining Non-scheduled Payload" corresponding to the MAC-d flow on which this logical channel is mapped;

4> fill the MAC-e PDU with SDU(s) from this logical channel up to MIN("Remaining Non-scheduled Payload", Available Data for this logical channel, "Remaining Available Payload");

4> subtract the corresponding bits if any from "Remaining Available Payload" and "Remaining Non-scheduled Payload" taking into account the MAC-e headers.

3> else:

4> fill the MACe PDU with SDU(s) from this logical channel up to MIN("Scheduled Grant Payload", Available Data for this logical channel, "Remaining Available Payload");

4> subtract the corresponding bits if any from "Remaining Available Payload" and "Scheduled Grant Payload" taking into account the MAC-e headers.

2> if Scheduling Information needs to be transmitted:

3> add Scheduling Information to the MAC-e PDU;

3> determine the smallest E-TFC that can carry the resulting MAC-e PDU;

2> else:

3> determine the smallest E-TFC that can carry the resulting MAC-e PDU;

3> if the padding allows a Scheduling Information to be sent, add it to the MAC-e PDU;

2> set the maximum number of HARQ transmissions to the maximum among the maximum number of HARQ transmissions of the HARQ profiles of the MAC-d flows selected for transmissions.

1> else if Scheduling Information needs to be transmitted:

2> select the "control-only" HARQ profile;

2> fill the MAC-e PDU with the scheduling information;

2> select the smallest E-TFC.

2> set the maximum number of HARQ transmissions to 8.

Agenda item: 5.4

Source: LG Electronics Inc.

Title: Unit of ARQ

Document for: Discussion, Decision

1. Introduction

In the last meeting in Athens, following is agreed to be included into 25.813.

- *It is FFS whether the ARQ retransmits RLC SDUs or RLC PDUs (segments);*

In this document, we discuss on this point.

2. Discussion

2.1 Comparison on ARQ Unit

ARQ functionality is located in the RLC layer. The main function would be the lossless delivery if necessary, and segmentation and re-assembly in order to adapt the MAC-SDUs to the size required by the scheduler. Detection of Duplication and In-sequence delivery should also be included as functionality.

In Rel-6 the RLC PDU size in case of AM-RLC was fixed. This was due to the fact that fast channel type switching was required whilst maintaining the RLC context. But in LTE, general assumption in RAN2 is that the RLC PDUs would be of variable size depending on the size requested by the scheduler.

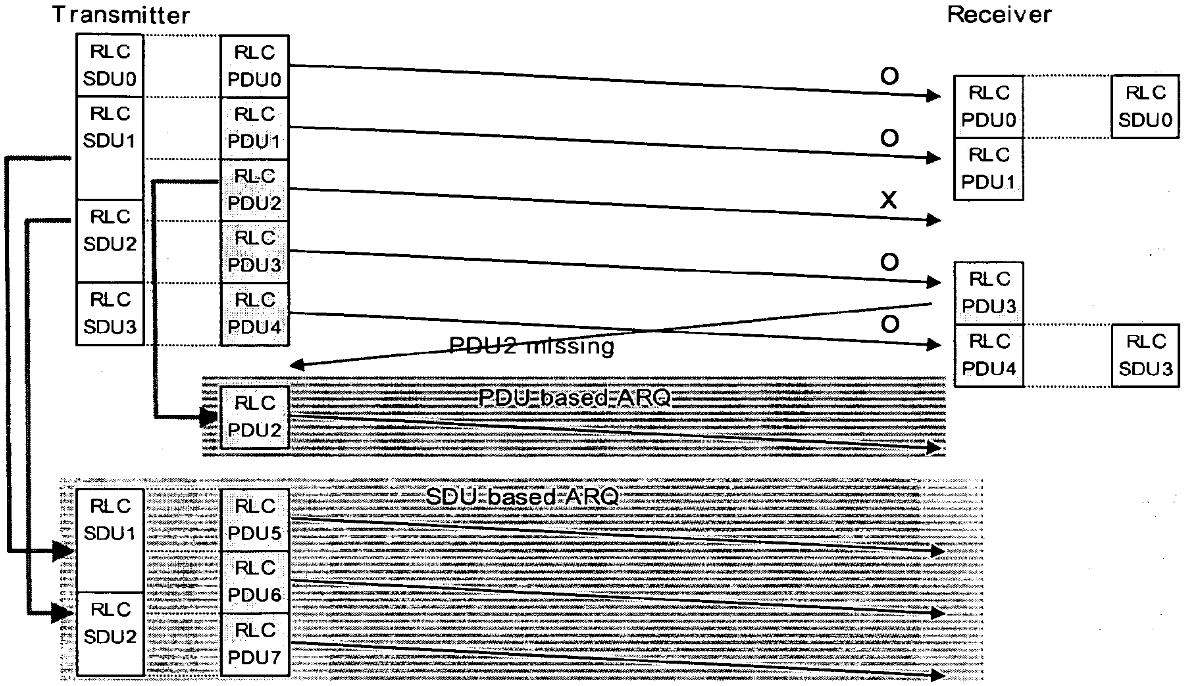


Fig 1 PDU and SDU based ARQ

Above figure 1 shows the difference between PDU based ARQ and SDU based ARQ. For the RLC SDU received from upper layer, the RLC will segment the RLC SDUs into RLC PDUs of size indicated by scheduler. Each RLC PDU is transmitted using HARQ to the receiving side. The receiving RLC checks whether there is a missing RLC PDU or not, by looking at the sequence number of the received RLC PDU. In the example of figure 1, after receiving RLC PDU3, the receiver detects that RLC PDU 3 is missing. This information is delivered to the transmitting side. But the retransmission is different between the two approaches. While the SDUs related to the RLC PDU 2 is retransmitted in SDU based approach, only the PDU 2 is retransmitted in the PDU based approach.

In short, all the related SDUs for unacknowledged PDUs are retransmitted in SDU based approach and only unacknowledged PDUs are retransmitted in PDU based approach.

Based on the figure and description above, following is a brief comparison table for the two mechanisms.

	PDU based ARQ	SDU based ARQ
Pros	When HARQ transmission fails, only MAC PDUs are retransmitted. This will enable the optimized and efficient usage of radio resources. Also the required time is short. The amount of buffering is optimized RLC SDU which is formatted into RLC PDU can be deleted. Only RLC PDU remains in the buffer until receiving ACK.	When RLC SDU is retransmitted, RLC PDUs are newly generated. This will give more scheduling flexibility.
Cons	If re-framing is not used, retransmission of RLC PDU will limit scheduler's flexibility. If re-framing is used, the header structure of RLC PDU will be complex.	When transmission of a RLC PDU fails, all the RLC SDU related to the RLC PDU are retransmitted. For example, when one MAC PDU includes more than one MAC SDU and the size of

		SDU is as long as 1500 bytes, this will be huge waste of resources. The requirement of buffer is big. Until ACK is received for the all RLC PDUs for an RLC SDU, the RLC has to buffer RLC SDUs even if they are segmented into RLC PDUs. PDU sequence number handling If sequence number is used for identification of each PDU, when RLC SDU is retransmitted, the sequence number of constructed RLC PDUs should be different from that of the previous RLC PDUs.

In case, NACK-based ARQ reporting is used, the amount of bit for statue report from receiving RLC to transmitting RLC will be the same for both approaches. For NACK based ARQ, PDUs or SDUs that are not received will be reported to the receiving side. To detect the missing data, the receiver will rely on the sequence number check. For example in figure 1, as soon as the receiver receives the RLC PDU 3, it knows that RLC PDU 2 is missing. Thus, the receiver in both approaches knows that RLC PDU 2 is missing at the same time. Because the receiver does not know the relationship between SDUs and the missing PDU, it may just report only the sequence number of missing PDU. Thus the amount of bit is same in both SDU based ARQ and PDU based ARQ.

Conclusion:

Within one cell, the unit of ARQ operation is MAC PDU.

3. Conclusion

It is proposed to discuss and agree to:

- ARQ retransmits RLC PDU in one cell.

CR-Form-v8

CHANGE REQUEST

⌘	25.302 CR CRNum	⌘ rev	-	⌘	Current version:	6.5.0	⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ [ ]   ME [X] Radio Access Network [X] Core Network [ ]

Title:	⌘	Removal of FFS regarding E-DCH
Source:	⌘	LG Electronics Inc.
Work item code:	⌘	EDCH-L23
Date:	⌘	
Category:	⌘	F
Release:	⌘	Rel-6

Use one of the following categories:
- ***F*** *(correction)*
- ***A*** *(corresponds to a correction in an earlier release)*
- ***B*** *(addition of feature),*
- ***C*** *(functional modification of feature)*
- ***D*** *(editorial modification)*

Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
- *Ph2 (GSM Phase 2)*
- *R96 (Release 1996)*
- *R97 (Release 1997)*
- *R98 (Release 1998)*
- *R99 (Release 1999)*
- *Rel-4 (Release 4)*
- *Rel-5 (Release 5)*
- *Rel-6 (Release 6)*
- *Rel-7 (Release 7)*
- *Rel-8 (Release 8)*

Reason for change:	⌘	Most issues related to E-DCH was closed. And stage 2 and stage 3 E-DCH is almost done. But there are still some sentences with FFS in 25.302.
Summary of change:	⌘	- Scheduling information over physical channel is clarified - Relationship between serving E-DCH cell and seving HSDPA cell is clarified - Redundancy version is clarified. - Sentences that are not applicable are deleted
Consequences if not approved:	⌘	FFSs still remains in the specification for the concluded issues.

Clauses affected:	⌘	6.1, 6.2, 7.1.13, 8.1, 9.2, 9.3, 10.3.5.24, 10.3.5.27, 10.3.528, 10.3.6. Annes A			
		Y	N		
Other specs affected:	⌘		X	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘				

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be

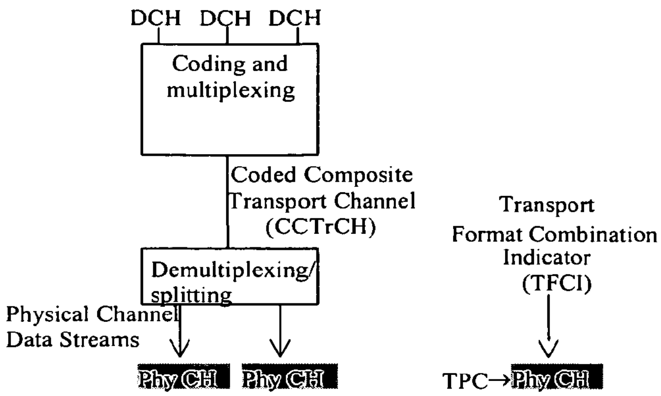
downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

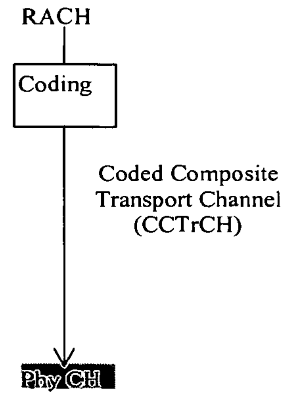
6.1 Uplink models

Figure 2 shows models of the UE's physical layer in the uplink for both FDD and TDD mode. It shows the models for DCH, RACH, E-DCH (FDD only), and USCH (TDD only). Some restriction exist for the use of different types of transport channel at the same time, these restrictions are described in the clause "UE Simultaneous Physical Channel combinations". More details can be found in [3] and [4].

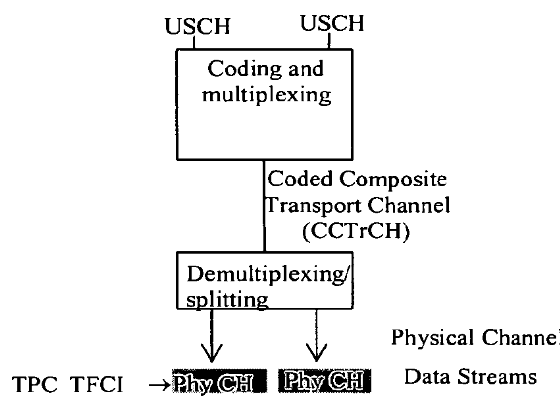
DCH model



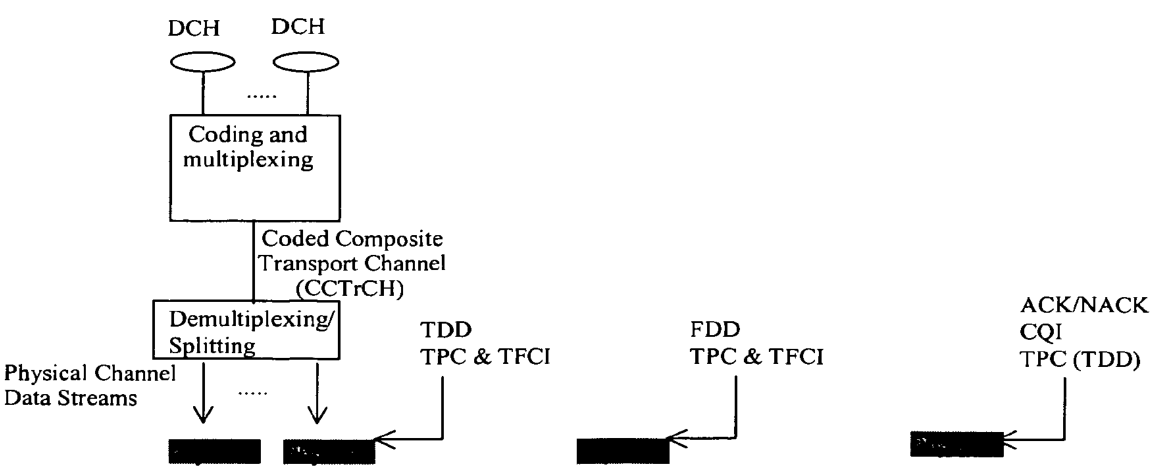
RACH model



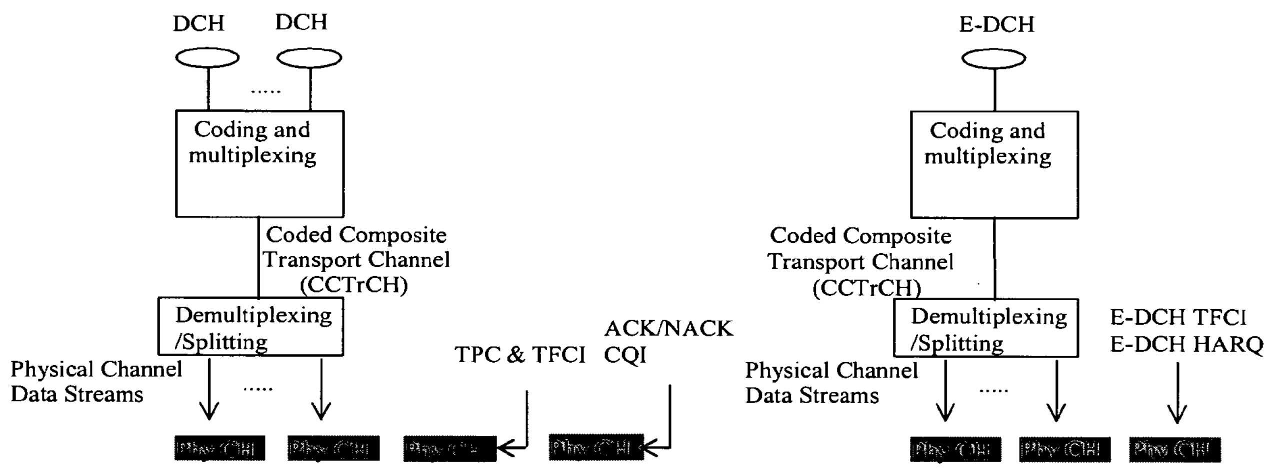
USCH model



DCH model with HS-DSCH support



DCH and E-DCH model with HS-DSCH support



NOTE 1: USCH is for TDD only.

NOTE 2: E-DCH is for FDD only.

Figure 2: Model of the UE's physical layer – uplink

The DCH model shows that one or several DCHs can be processed and multiplexed together by the same coding and multiplexing unit. The detailed functions of the coding and multiplexing unit are not defined in the present document but in [3] and [4]. The single output data stream from the coding and multiplexing unit is denoted *Coded Composite Transport Channel (CCTrCH)*.

The bits on a CCTrCH Data Stream can be mapped on the same Physical Channel and should have the same C/I requirement.

On the downlink, multiple CCTrCH can be used simultaneously with one UE. In the case of FDD, only one fast power control loop is necessary for these different CCtrCH, but the different CCtrCH can have different C/I requirements to provide different QoS on the mapped Transport Channels. In the case of TDD, different power control loops can be applied for different CCTrCH. One physical channel can only have bits coming from the same CCTrCH.

On the uplink and in the case of FDD, when E-DCH is not configured, only one CCTrCH can be used simultaneously. On the uplink and in the case of TDD, multiple CCTrCH can be used simultaneously.

On the uplink and in case of FDD, two CCTrCHs are used simultaneously when the E-DCH Transport Channel is configured.

When multiple CCTrCH are used by one UE, one or several TFCI can be used, but each CCTrCH has only zero or one corresponding TFCI. In the case of FDD, these different words are mapped on the same DPCCH. In the case of TDD, these different TFCIs can be mapped on different DPCH.

The data stream of the CCTrCH is fed to a data demultiplexing/splitting unit that demultiplexes/splits the CCTrCH's data stream onto one or several *Physical Channel Data Streams*.

The current configuration of the coding and multiplexing unit is either signalled to, or optionally blindly detected by, the network for each 10 ms frame. If the configuration is signalled, it is represented by the *Transport Format Combination Indicator (TFCI)* bits. Note that the TFCI signalling only consists of pointing out the current transport format combination within the already configured transport format combination set. In the uplink there is only one TFCI representing the current transport formats on all DCHs of one CCTrCH simultaneously. In FDD mode, the physical channel data stream carrying the TFCI is mapped onto the physical channel carrying the power control bits and the pilot. In TDD mode the TFCI is time multiplexed onto the same physical channel(s) as the DCHs. The exact locations and coding of the TFCI are signalled by higher layers.

The DCH and USCH have the possibility to perform Timing Advance in TDD mode.

The model for the RACH case shows that RACH is a common type transport channel in the uplink. RACHs are always mapped one-to-one onto physical channels (PRACHs), i.e. there is no physical layer multiplexing of RACHs, and there can only be one RACH TrCH and no other TrCH in a RACH CCTrCH. Service multiplexing is handled by the MAC layer. In one cell several RACHs/PRACHs may be configured. If more than one PRACH is configured in a cell, the UE performs PRACH selection as specified in [4].

In FDD, the RACHs mapped to the PRACHs may all employ the same Transport Format and Transport Format Combination Sets, respectively. It is however also possible that individual RACH Transport Format Sets are applied on each available RACH/PRACH.

In TDD, there is no TFCI transmitted in the burst, and therefore each RACH is configured with a single transport format within its TFS. The RACHs mapped to the PRACHs may all employ the same Transport Format. It is however also possible that individual RACH Transport Formats are applied on each available RACH/PRACH combination.

The available pairs of RACH and PRACHs and their parameters are indicated in system information. In FDD mode, the various PRACHs are distinguished either by employing different preamble scrambling codes, or by using a common scrambling code but distinct (non-overlapping) partitions of available signatures and available subchannels. In TDD mode, the various PRACHs are distinguished either by employing different timeslots, or by using a common timeslot but distinct (non-overlapping) partitions of available channelisation codes and available subchannels. Examples of RACH/PRACH configurations are given in [6].

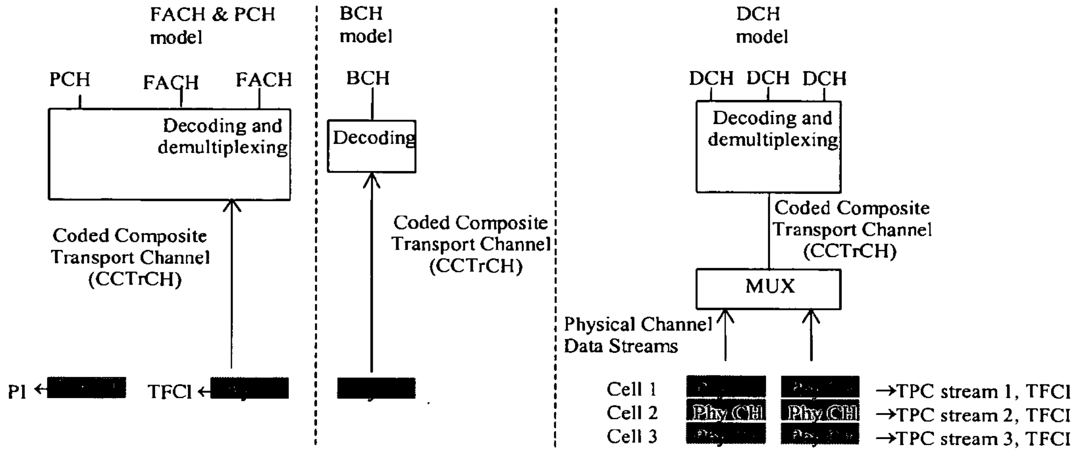
In FDD in case of a configured HS-DSCH one physical channel (HS-DPCCH) is configured for the reporting of HS-DSCH transport block acknowledgement / negative acknowledgement and channel quality indicator. In TDD in case of a configured HS-DSCH a shared physical channel (HS-SICH) is configured for the reporting of HS-DSCH transport block acknowledgement / negative acknowledgement, channel quality indicator and transmit power control symbols.

The E-DCH is applicable to the FDD mode only. There can only be one E-DCH TrCH and no other TrCH in a E-DCH CCTrCH. The E-DCH CCTrCH is carried on E-DPDCH(s) physical channel(s). E-DCH TFCI and E-DCH HARQ information are carried on a E-DPCCH physical channel. A single bit on a E-DPCCH physical channel is used to indicate whether the UE could use more resources or not.

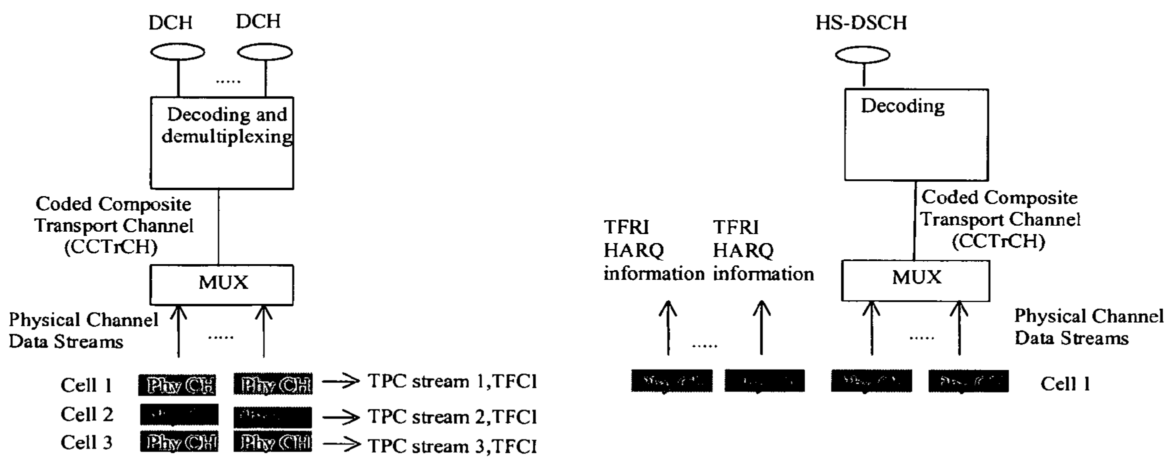
*** NEXT modified Section ***

6.2 Downlink models

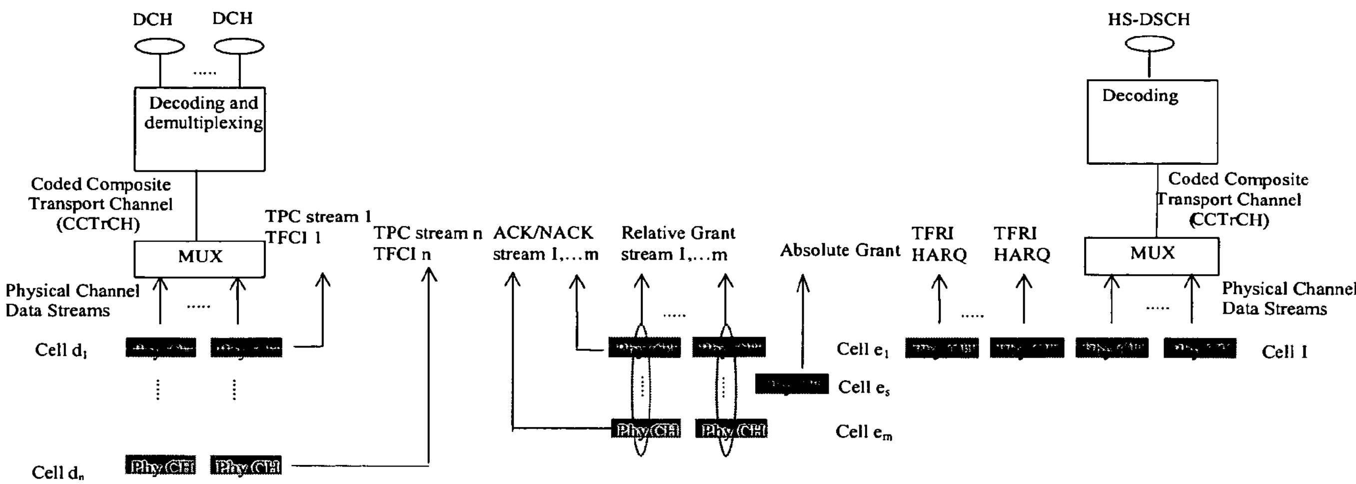
Figure 3 and figure 4 show the model of the UE's physical layer for the downlink in FDD and TDD mode, respectively. Note that there is a different model for each transport channel type.



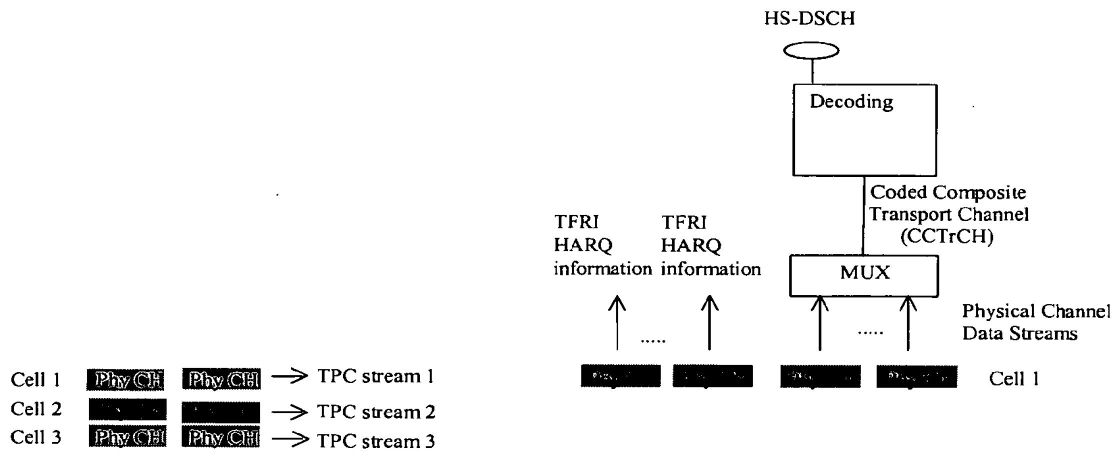
DCH model with HS-DSCH(s)



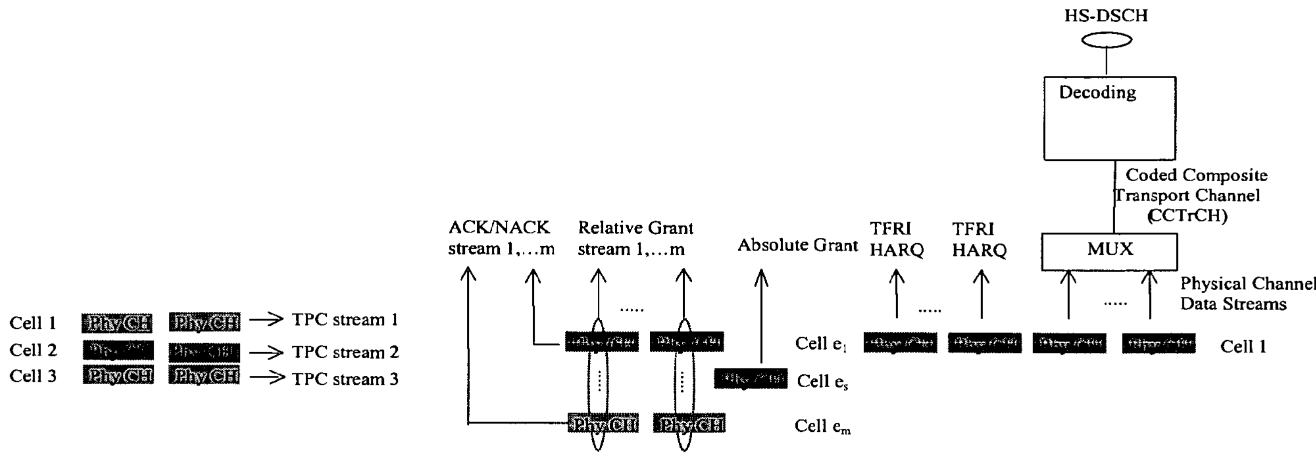
DCH and HS-DSCH model with E-DCH support



HS-DSCH(s) with F-DPCH model



HS-DSCH with F-DPCH model and E-DCH support



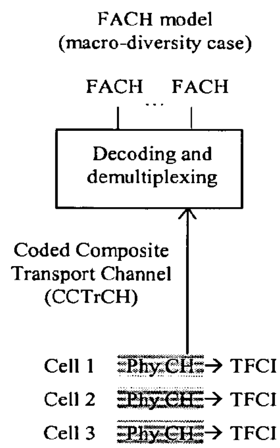
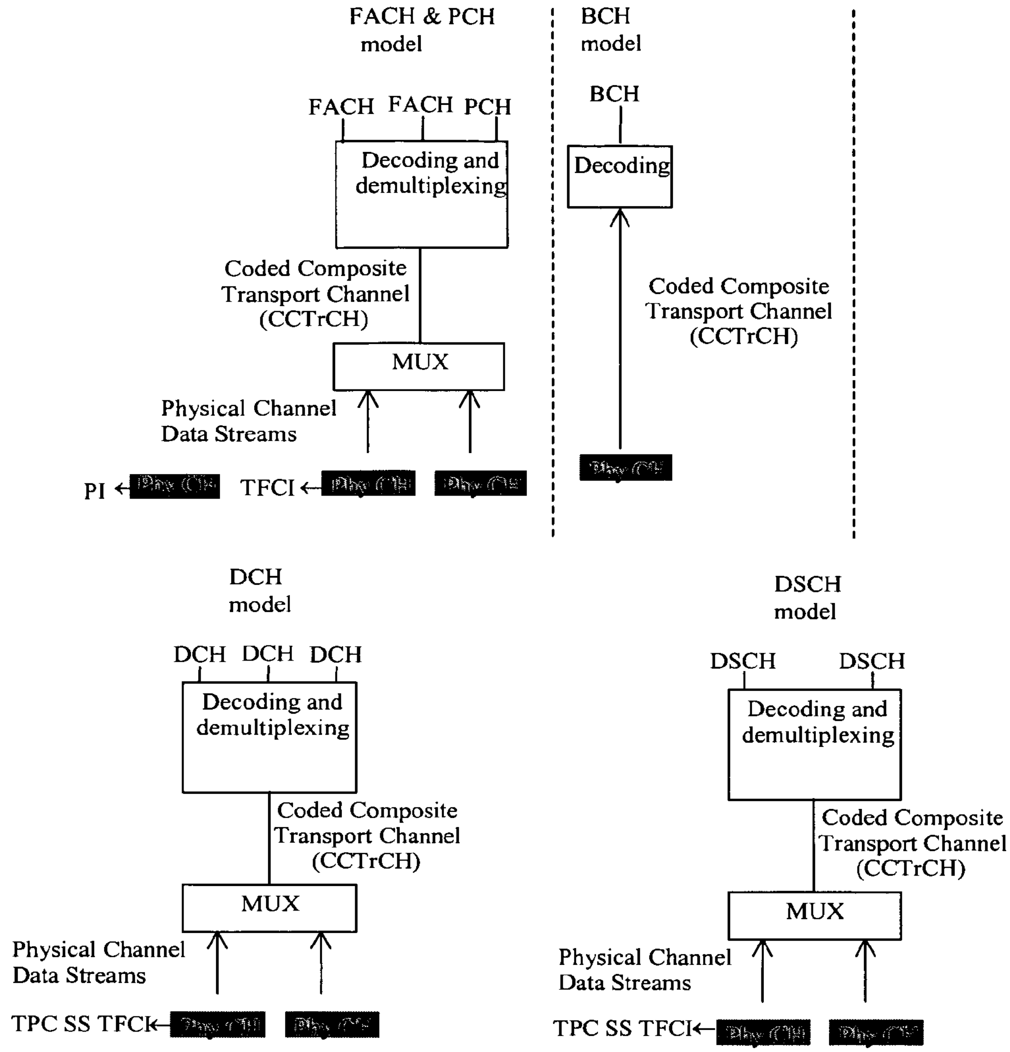
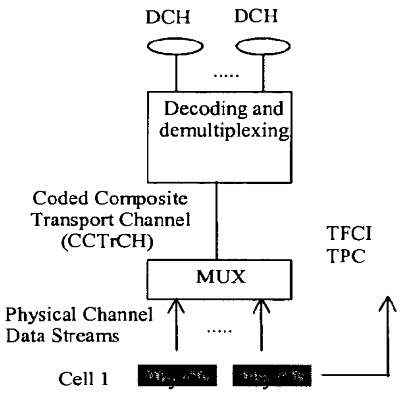
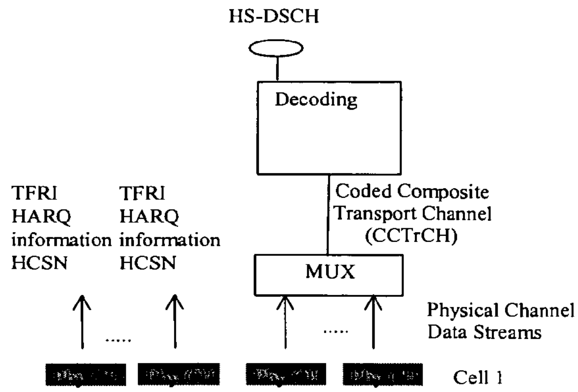


Figure 3: Model of the UE's physical layer - downlink FDD mode

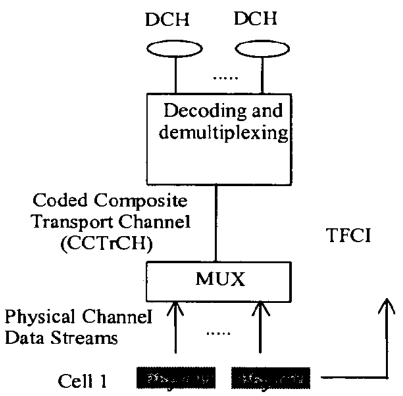

FACH & PCH model
BCH model
FACH FACH PCH
BCH
Decoding and demultiplexing
Decoding
Coded Composite Transport Channel (CCTrCH)
Coded Composite Transport Channel (CCTrCH)
MUX
Physical Channel Data Streams
PI
Phy CH
TFCI
Phy CH
Phy CH
Phy CH
DCH model
DSCH model
DCH DCH DCH
DSCH DSCH
Decoding and demultiplexing
Decoding and demultiplexing
Coded Composite Transport Channel (CCTrCH)
Coded Composite Transport Channel (CCTrCH)
MUX
MUX
Physical Channel Data Streams
Physical Channel Data Streams
TPC SS TFCI
Phy CH
Phy CH
TPC SS TFCI
Phy CH
Phy CH

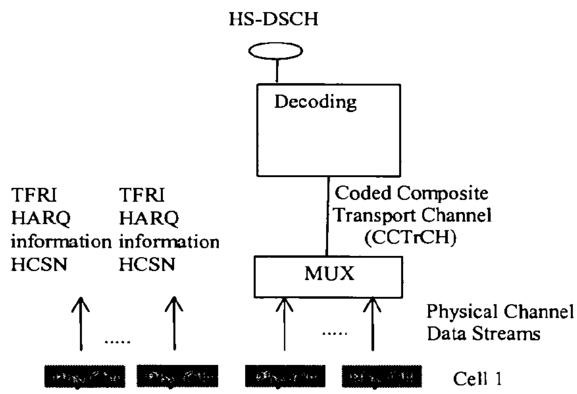
DCH model with HS-DSCH(s)
for 3.84 Mcps TDD



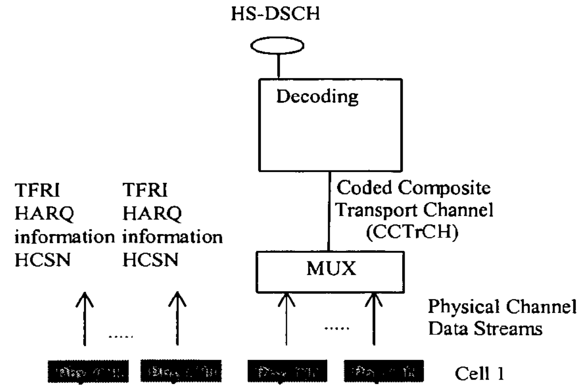


HS-DSCH(s) for 3.84 Mcps
TDD with DL DPCH

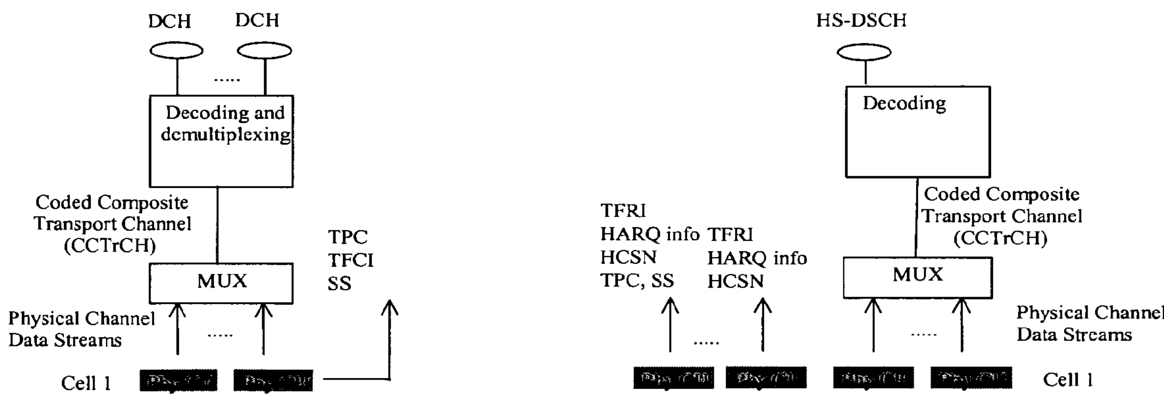




HS-DSCH(s) for 3.84 Mcps
TDD without DL DPCH



DCH model with HS-DSCH(s)
for 1.28 Mcps TDD



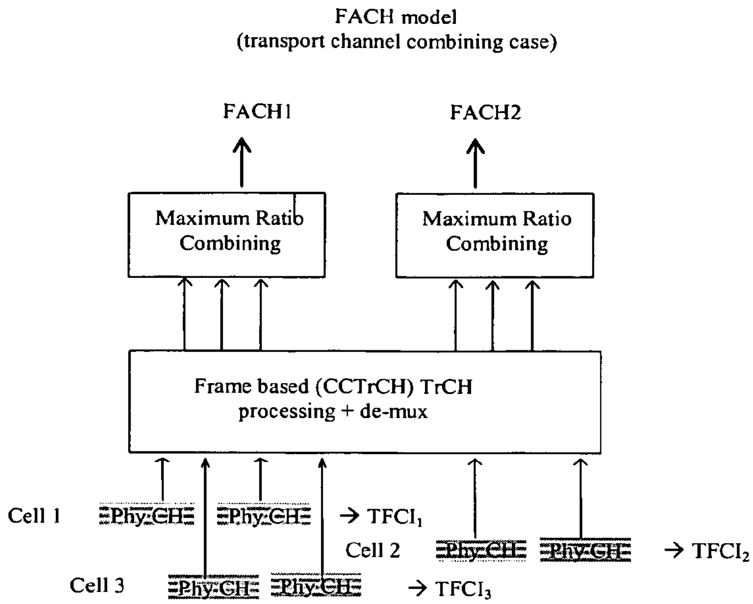


Figure 4: Model of the UE's physical layer - downlink TDD mode

For the DCH case, the mapping between DCHs and physical channel data streams works in the same way as for the uplink. Note however, that the number of DCHs, the coding and multiplexing etc. may be different in uplink and downlink.

In the FDD mode, the differences are mainly due to the soft and softer handover. Further, the pilot, TPC bits and TFCI are time multiplexed onto the same physical channel(s) as the DCHs, in case of HS-DSCH(s) without a DCH in the DL TPC bits are carried onto F-DPCH(s). Further, the definition of physical channel data stream is somewhat different from the uplink. In TDD mode the TFCI is time multiplexed onto the same physical channel(s) as the DCHs. The exact locations and coding of the TFCI are signalled by higher layers.

Note that it is logically one and the same physical data stream in the active set of cells, even though physically there is one stream for each cell. The same processing and multiplexing is done in each cell. The only difference between the cells is the actual codes, and these codes correspond to the same spreading factor.

The physical channels carrying the same physical channel data stream are combined in the UE receiver, excluding the pilot, and in some cases the TPC bits. TPC bits received on certain physical channels may be combined provided that UTRAN has informed the UE that the TPC information on these channels is identical.

A PCH and one or several FACH can be encoded and multiplexed together forming a CCTrCH. Similarly as in the DCH model there is one TFCI for each CCTrCH for indication of the transport formats used on each PCH and FACH. The PCH is associated with a separate physical channel carrying page indicators (PIs) which are used to trigger UE reception of the physical channel that carries PCH. A FACH or a PCH can also be individually mapped onto a separate physical channel. The BCH is always mapped onto one physical channel without any multiplexing with other transport channels, and there can only be one BCH TrCH and no other TrCH in a BCH CCTrCH.

For point-to-multipoint transmission [14], FACH can be distributed on a set of physical layer combinable CCTrCHs, i.e., for macro-diversity combining: soft combining (FDD and TDD) or transport channel combining (TDD only). The physical layer combinable CCTrCHs shall have the same TFC during the TTIs in which soft combining can be used. The physical layer combinable CCTrCHs need not have the same TFC during the TTIs in which transport channel combining can be used. The possibility of performing macro-diversity combining (either soft combining or transport channel combining) shall be signalled to the UE.

In the TDD mode a CCTrCh carrying PCH and one or several FACH can be multiplexed onto one or several physical channel data streams.

For each HS-DSCH TTI, each HS-SCCH carries HS-DSCH-related downlink signalling for one UE. The following information is carried on the HS-SCCH:

- Transport Format and Resource Indicator (TFRI);
- Hybrid-ARQ-related Information (HARQ information);
- UE Identity via a UE specific CRC;
- HS-SCCH Cyclic Sequence Number (HCSN) for TDD.

In addition, for the case of 1.28 Mcps TDD, the HS-SCCH also carries Transmit Power Control and Synchronisation Shift symbols.

In the case of 3.84 Mcps TDD, HS-DSCH operation is supported without an associated DL DPCH.

In FDD mode, the E-DCH active set can be identical or a subset of the DCH active set.

The E-DCH ACK/NACKs are transmitted by each cell of the E-DCH active set on a physical channel called E-HICH. The E-HICHs of the cells belonging to the same RLS (same MAC-e entity i.e. same Node B) shall have the same content and be combined by the UE. The set of cells transmitting identical ACK/NACK information is the same as the set of cells sending identical TPC bits (excluding the cells which are not in the E-DCH active set).

The E-DCH Absolute Grant is transmitted by a single cell, the Serving E-DCH cell (Cell e_s on figure 4) on a physical channel called E-AGCH. The Serving E-DCH cell and the HS-DSCH Serving cell are identical.

The E-DCH Relative Grants can be transmitted by each cell of the E-DCH active set on a physical channel called E-RGCH. The E-RGCHs of the cells belonging to the same serving E-DCH RLS shall have the same content and be combined by the UE. There is one Serving E-DCH RLS (containing the Serving E-DCH cell) and optionally one or several Non-serving E-DCH RL(s).

*** NEXT modified Section ***

7.1.13 HARQ information

Hybrid ARQ is defined for HS-DSCH and E-DCH. For HS-DSCH with the help of the HARQ information the UE is enabled to identify the process being used for the transport block that is received on the HS-DSCH For E-DCH the HARQ process is derived in an implicit way. For both HS-DSCH and E-DCH the HARQ information also includes information that indicates whether a new data block is transmitted for the first time or a retransmission. Furthermore it is used to decode the received data correctly.The redundancy version is either explicitly indicated as part of the HARQ information (for the HS-DSCH) or is derived from the retransmission indicator (RSN) and the CFN and in case of 2ms TTI additionally from sub-frame number (for the E-DCH).

*** NEXT modified Section ***

8.1 FDD Uplink

The table describes the possible combinations of FDD physical channels that can be supported in the uplink on the same frequency by one UE simultaneously.

Table 1: FDD Uplink

	Physical Channel Combination	Transport Channel Combination	Mandatory or dependent on UE radio access capabilities	Comment
1	PRACH	RACH	Mandatory	The PRACH physical channel includes the preambles and the message.
2	(Void)			
3	DPCCH+DPDCH	One or more DCH coded into a single CCTrCH	Mandatory	The maximum number of DCHs and the maximum channel bit rate are dependent on UE radio access capabilities.
4	DPCCH+ more than one DPDCH	One or more DCH coded into a single CCTrCH	Depending on UE radio access capabilities	The maximum number of DCHs and the maximum channel bit rate are dependent on UE radio access capabilities.
5	DPCCH+one or more DPDCH+ HS-DPCCH	One or more DCH coded into a single CCTrCH	Depending on UE radio access capabilities	The maximum number of DCHs and the maximum bit rate are dependent on UE radio access capabilities. In this combination HS-DSCH(s) are configured in downlink.
6	DPCCH+one or more DPDCH+E-DPCCH+one or more E-DPDCH	One or more DCH coded into a single CCTrCH + One E-DCH	Depending on UE radio access capabilities	The maximum number of DCHs and the maximum channel bit rate are dependent on UE radio access capabilities.
7	DPCCH+one or more DPDCH+ HS-DPCCH+E-DPCCH+ one or more E-DPDCH	One or more DCH coded into a single CCTrCH + One E-DCH	Depending on UE radio access capabilities	The maximum number of DCHs and the maximum bit rate are dependent on UE radio access capabilities. In this combination HS-DSCH(s) are configured in downlink.
8	DPCCH+HS-DPCCH+E-DPCCH+ one or more E-DPDCH	One E-DCH	Depending on UE radio access capabilities	The maximum bit rate are dependent on UE radio access capabilities. In this combination HS-DSCH(s) are configured in downlink.

*** NEXT modified Section ***

9.2 UE Measurements

For definitions of the measurements, see [6] and [11].

*** NEXT modified Section ***

9.3 UTRAN Measurements

*** NEXT modified Section ***

10.3.5.24 E-AGCH (FDD only)

- Scrambling code.
- Channelisation code.

- Tx diversity mode.

*** NEXT modified Section ***

10.3.5.27 E-HICH (FDD only)

- Scrambling code.
- Channelisation code.
- Hadamard sequence

*** NEXT modified Section ***

10.3.5.28 E-RGCH (FDD only)

- Scrambling code.
- Channelisation code.
- Hadamard sequence.

*** NEXT modified Section ***

10.3.6 Feedback information

- Quality indication (HS-DSCH ~~and E-DCH only FFS~~).
- HARQ Status (HS-DSCH and E-DCH only).

~~Additional content of the Feedback information for the E-DCH is FFS.~~

Annex A (normative): Description of Transport Formats

The following table describes the characterisation of a Transport Format.

Table A.1: Characterisation of Transport Format

		Attribute values	BCH	PCH	FACH	RACH
Dynamic part	Transport Block Size	0 to 5 000 1 bit granularity	246	1 to 5000 1 bit granularity	0 to 5 000 1 bit granularity	0 to 5 000 1 bit granularity
	Transport Block Set Size	0 to 200 000 1 bit granularity	246	1 to 200 000 1 bit granularity	0 to 200 000 1 bit granularity	0 to 200 000 1 bit granularity
	Transmission Time Interval (option for TDD only)	10, 20 ms, 40 and 80 ms				
Semi-static part	Transmission Time Interval (FDD, option for TDD NRT bearers)	10, 20 ms, 40 and 80 ms	20 ms	10ms for FDD, 20ms for TDD	10, 20 ms, 40 and 80 ms	10 ms and 20 ms for FDD, 10 ms for 3.84 Mcps TDD 5ms, 10ms and 20ms for 1.28 Mcps TDD
	Type of channel coding	No Coding (TDD only) Turbo coding Convolutional coding	Convolutional coding	Convolutional coding	No coding (TDD only) Turbo coding Convolutional coding	Convolutional coding
	Code rates	1/2, 1/3	1/2 for FDD and 3.84 Mcps TDD 1/3 for 1.28 Mcps TDD	1/2 for FDD and 3.84 Mcps TDD 1/2, 1/3 for 1.28 Mcps TDD	1/2, 1/3	1/2
	CRC size	0, 8, 12, 16, 24	16	0, 8, 12, 16, 24	0, 8, 12, 16, 24	0, 8, 12, 16, 24
	Resulting ratio after static rate matching	0,5 to 4				

		Attribute values	DCH	DSCH	USCH
Dynamic part	Transport Block Size	0 to 5 000 1 bit granularity	0 to 5 000 1 bit granularity	0 to 5 000 1 bit granularity	0 to 5 000 1 bit granularity
	Transport Block Set Size	0 to 200 000 1 bit granularity	0 to 200 000 1 bit granularity	0 to 200 000 1 bit granularity	0 to 200 000 1 bit granularity
	Transmission Time Interval (option for TDD only)	10, 20 ms, 40 and 80 ms	10, 20 ms, 40 and 80 ms	10, 20 ms, 40 and 80 ms	10, 20 ms, 40 and 80 ms
Semi-static part	Transmission Time Interval (FDD, option for TDD NRT bearers)	10, 20 ms, 40 and 80 ms	10, 20 ms, 40 and 80 ms	10, 20 ms, 40 and 80 ms	10, 20 ms, 40 and 80 ms
	Type of channel coding	No coding (TDD only) Turbo coding Convolutional coding	No coding (TDD only) Turbo coding Convolutional coding	No coding (TDD only) Turbo coding Convolutional coding	No coding (TDD only) Turbo coding Convolutiona l coding
	code rates (in case of convolutional coding)	1/2, 1/3	1/2, 1/3	1/2, 1/3	1/2, 1/3
	CRC size	0, 8, 12, 16, 24	0, 8, 12, 16, 24	0, 8, 12, 16, 24	0, 8, 12, 16, 24
	Resulting ratio after static rate matching	0,5 to 4			

		HS-DSCH
Dynamic part	Transport Block Size	1 to 200 000 8 bit granularity
	Transport Block Set Size	1 to 200 000 8 bit granularity
	Modulation scheme	QPSK, 16 QAM
	Redundancy version/Conste llation	1 to 8
Static part	Transmission Time Interval	2ms for FDD 5 ms for 1.28 Mcps TDD 10 ms for 3.84 Mcps TDD
	Type of channel coding	Turbo coding
	Code rates	1/3
	CRC size	24

		E-DCH
Dynamic part	Transport Block Size	1 to 200 000 18 bit granularity FFS 2
	Transport Block Set Size	1 to 200 000 18 bit granularity FFS 2
	Redundancy version	0 to 3
Semi-static part	Transmission Time Interval	2ms, 10ms
Static part	Type of channel coding	Turbo coding
	Code rates	1/3
	CRC size	24

NOTE 1: The maximum size of the Transport Block has been chosen so as to avoid any need for segmentation in the physical layer into sub-blocks (segmentation should be avoided in the physical layer).

NOTE 2: Code rate is fixed to 1/3 in case of Turbo coding.

NOTE 3: All channels using the same resources as the BCH (i.e. the same timeslot and code, e.g. in a multiframe pattern) have to use different Transport Formats than the BCH to allow the identification of the BCH channel by physical layer parameters. Due to the differing parameters, decoding of other transport channels than BCH will result in an erroneous CRC.

CR-Form-v8

CHANGE REQUEST

⌘	25.321 CR CRNum	⌘ rev	-	⌘	Current version:	6.8.0	⌘

For ***HELP*** *on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ [ ] ME [X] Radio Access Network [X] Core Network [ ]

Title:	⌘	Miscellaneous corrections for E-DCH	
Source:	⌘	LG Electronics Inc.	
Work item code:	⌘	EDCH-L23	***Date:*** ⌘
Category:	⌘	**F**	***Release:*** ⌘ Rel-6
		Use one of the following categories: **F** *(correction)* **A** *(corresponds to a correction in an earlier release)* **B** *(addition of feature),* **C** *(functional modification of feature)* **D** *(editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.	*Use one of the following releases:* *Ph2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *Rel-4 (Release 4)* *Rel-5 (Release 5)* *Rel-6 (Release 6)* *Rel-7 (Release 7)* *Rel-8 (Release 8)*

Reason for change: ⌘

- In section 4.2.3.4, it is written that E-TFC entity is responsible for E-TFC selection according to the scheduling information (Relative Grants and Absolute Grants) received from UTRAN via L1. However, at start of E-DCH transmission, serving cell change and TTI change the serving grant value is signalled through RRC. Hence, E-TFC entity can select E-TFC according to these RRC configurations as well.
- Section 8.3 describes primitives between MAC and RRC. Tables 8.3.1.1 shows primities and related parameters between MAC and RRC. Through parameter "E-DCH configuration elements" are described in section 8.3.2, this parameter is not shown in the table.
- In section 11.8.1.4, the criteria of SI reporting according to E-DCH buffer status is not alinged to section 11.8.1.6.
- In Pseudo-Code for E-TFC Selection, when a SI is sent alone, to set maximum number of retransmission is not specified.

Summary of change: ⌘

- It is clarifed that E-TFC entity can also select according to Serving Grant value signalled through RRC.
- Parameter "E-DCH configuration elements" is added in the table 8.3.1.1
- It is referred to as section 11.8.1.6
- It is specified that maximum number of retransmission is set to 8 in case when a SI is sent alone.

Consequences if ⌘ If not approved, ambiguities remain in current specification.

not approved:			

Clauses affected:	⌘	4.2.3.4, 8.3.1, 11.8.1.4, Annex C			
		Y	N		
Other specs affected:	⌘	X		Other core specifications	⌘
				Test specifications	
				O&M Specifications	
Other comments:	⌘				

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2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

4.2.3.4 MAC-e/es entity – UE Side

The MAC-es/e handles the E-DCH specific functions. The split between MAC-e and MAC-es in the UE is not detailed. In the model below the MAC-e/es comprises the following entities:

- HARQ:
  The HARQ entity is responsible for handling the MAC functions relating to the HARQ protocol. It is responsible for storing MAC-e payloads and re-transmitting them. The detailed configuration of the hybrid ARQ protocol is provided by RRC over the MAC-Control SAP. The HARQ entity provides the E-TFC, the retransmission sequence number (RSN), and the power offset to be used by L1. Redundancy version (RV) of the HARQ transmission is derived by L1 from RSN, CFN and in case of 2 ms TTI from the sub-frame number.

- Multiplexing and TSN setting:
  The multiplexing and TSN setting entity is responsible for concatenating multiple MAC-d PDUs into MAC-es PDUs, and to multiplex one or multiple MAC-es PDUs into a single MAC-e PDU, to be transmitted in the next TTI, as instructed by the E-TFC selection function. It is also responsible for managing and setting the TSN per logical channel for each MAC-es PDU.

- E-TFC selection:
  This entity is responsible for E-TFC selection according to the scheduling information (Relative Grants and Absolute Grants) received from UTRAN via L1, and for arbitration among the different flows mapped on the E-DCH. The detailed configuration of the E-TFC entity is provided by RRC over the MAC-Control SAP. The E-TFC selection function controls the multiplexing function.

*** NEXT modified Section ***

8.3 Primitives between MAC and RRC

8.3.1 Primitives

The primitives between MAC and RRC are shown in table 8.3.1.1.

Table 8.3.1.1: Primitives between MAC sub-layer and RRC

Generic Name	Parameter			
	Request	Indication	Response	Confirm
CMAC-CONFIG	UE information elements, RB information elements, TrCH information elements, RACH transmission control elements, Ciphering elements, MBMS information elements E-DCH configuration elements			
CMAC-MEASUREMENT	Measurement information elements	Measurement result		
CMAC-STATUS		Status info		

CMAC-CONFIG-Req:

- CMAC-CONFIG-Req is used to request for setup, release and configuration of a logical channel, e.g. RNTI allocation, switching the connection between logical channels and transport channels, TFCS update or scheduling priority of logical channel.

CMAC-MEASUREMENT-Req/Ind:

- CMAC-MEASUREMENT-Req is used by RRC to request MAC to perform measurements, e.g. traffic volume measurements;

- CMAC-MEASUREMENT-Ind is used to notify RRC of the measurement result.

CMAC-STATUS-Ind:

- CMAC-STATUS-Ind primitive notifies RRC of status information.

8.3.2 Parameters

See [7] for a detailed description of the UE, RB and TrCH information elements.

a) UE information elements
S-RNTI
SRNC identity
C-RNTI
Activation time
Primary E-RNTI configured
Secondary E-RNTI configured

b) RB information elements
RB multiplexing info (Transport channel identity, Logical channel identity, MAC logical channel priority)
DDI mapping table for E-DCH transmission
Indication whether the Logical channel is considered when the Scheduling Information is generated

c) TrCH information elements
Transport Format Combination Set
MAC-hs reset indicator
MAC-es/e reset indicator
Re-ordering release timer (T1)
HARQ Profile parameters (power offset, maximum number of re-transmissions)
E-DCH TTI duration
Allowed combinations for multiplexing of MAC-d flows into MAC-e PDUs
E-DCH grant type of MAC-d flows (scheduled or non-scheduled)
List of HARQ processes on which non-scheduled grants are allowed (if the grant type is non-scheduled and the E-DCH TTI duration is 2ms)

d) Measurement information elements
Reporting Quantity identifiers
Time interval to take an average or a variance (applicable when Average or Variance is Reporting Quantity)

e) Measurement result
Reporting Quantity

f) Status info
when set to value "transmission unsuccessful" this parameter indicates to RRC that transmission of a TM RLC PDU failed (due to e.g. Maximum number of preamble ramping cycles reached for RACH in FDD), when set to value "transmission successful" this parameter indicates to RRC that the requested TM RLC PDU(s) has been submitted for transmission by the physical layer.

g) RACH transmission control elements
Set of ASC parameters (identifier for PRACH partitions, persistence values)
Maximum number of preamble ramping cycles (FDD) or synchronisation attempts (1.28 Mcps TDD) M_{max}
Minimum and maximum number of time units between two preamble ramping cycles, N_{BO1min} and N_{BO1max} (FDD only)
ASC for RRC CONNECTION REQUEST message

h) Ciphering elements
Ciphering mode
Ciphering key
Ciphering sequence number

i) (Void)

j) MBMS information elements
MBMS Id

k) E-DCH configuration elements
E-DPCCH to DPCCH power offset
Happy bit delay condition
E-TFCI table index
minimum set E-TFCI
Reference E-TFCI
Periodicities for Scheduling Information with and without grant
Scheduling Information power offset
List of HARQ processes on which scheduled grants are allowed (if the E-DCH TTI duration is 2ms)
Initial Serving Grant value and type

*** NEXT modified Section ***

11.8.1.4 E-TFC Selection

In FDD mode, the rules for E-TFC selection provided below shall apply to UEs in CELL_DCH state with an E-DCH transport channel configured. These UEs shall apply the E-TFC selection procedure when invoked by the HARQ entity (see subclause 11.8.1.1.1). In the case where a 2ms TTI is configured, E-TFC selection shall not be performed for TTIs that overlap with an uplink compressed mode gap. The E-TFC restriction procedure described in [12] shall always be applied before the E-TFC selection process below. Furthermore, for UEs that are also configured with a DCH transport channel on uplink, the TFC selection procedure shall be applied before either of these.

For each MAC-d flow, RRC configures MAC with a HARQ profile and a multiplexing list. Additionally, RRC configures MAC with a power offset for "Control-only" transmissions. This power offset and a maximum number of HARQ transmissions of 8 will be used to define a HARQ profile for "Control-only" transmissions which will be used, in case the Scheduling Information needs to be transmitted without any higher-layer data. The HARQ profile includes the power offset and maximum number of HARQ transmissions to use for this MAC-d flow. The multiplexing list identifies for each MAC-d flow(s), the other MAC-d flows from which data can be multiplexed in a transmission that uses the power offset included in its HARQ profile.

RRC can control the scheduling of uplink data by giving each logical channel a priority between 1 and 8, where 1 is the highest priority and 8 the lowest. E-TFC selection in the UE shall be done in accordance with the priorities indicated by RRC. Logical channels have absolute priority, i.e. the UE shall maximise the transmission of higher priority data.

RRC can allocate non-scheduled transmission grants to individual MAC-d flows in order to reduce the transmission delays. When a 2ms TTI is configured each non-scheduled grant is applicable to the specific set of HARQ processes indicated by RRC. The applicability of scheduled grants can be also restricted to a specific set of HARQ processes when a 2ms TTI is configured. HARQ process restriction and reservation is under the control of the serving cell Node B and indicated to the UE by RRC.

For each configured MAC-d flow, a given E-TFC can be in any of the following states:

- Supported state;
- Blocked state.

At each TTI boundary, UEs in CELL_DCH state with an E-DCH transport channel configured shall determine the state of each E-TFC for every MAC-d flow configured based on its required transmit power versus the maximum UE transmit power (see [7] and [12]). If no DCH transport channel is configured or if a DCH transport channel is configured and the selected TFC is "empty" (see [3]), the UE shall consider that E-TFCs included in the minimum set of E-TFCs are always in supported state (see [7]).

At every TTI boundary for which a new transmission is requested by the HARQ entity (see subclause 11.8.1.1.1), the UE shall perform the operations described below. UEs configured both with DCH and E-DCH transport channels shall perform TFC selection before performing E-TFC selection.

The Serving Grant Update function provides the E-TFC selection function with the maximum E-DPDCH to DPCCH power ratio that the UE is allowed to allocate for the upcoming transmission for scheduled data (held in the Serving Grant state variable – see subclause 11.8.1.3).

The HARQ process ID for the upcoming transmission is determined using the following formulae:

- For 2ms TTI: CURRENT_HARQ_PROCESS_ID = [5*CFN + subframe number] **mod** HARQ_RTT
- For 10ms TTI: CURRENT_HARQ_PROCESS_ID = [CFN] **mod** HARQ_RTT

Based on this current HARQ process ID and the RRC configuration, the UE shall determine whether to take the scheduled and non-scheduled grants into account in the upcoming transmission. If they are not supposed to be taken into account, then the corresponding grant shall be assumed to not exist. If the variable Serving_Grant has the value "Zero_Grant" after the Serving Grant Update, then the Serving Grant shall not be taken into account in the upcoming transmission.

When Scheduling Information is triggered per subclause 11.8.1.6, the E-TFC selection and data-allocation process shall assume that a non-scheduled grant is available for its transmission and that Scheduling Information has a priority higher then any other logical channel. Furthermore the HARQ process used for the upcoming transmission shall be assumed to be active and not L3 restricted for the transmission of the Scheduling Information, i.e. transmission of Scheduling Information can take place on this process.

The transmission format and data allocation shall follow the requirements below:

- Only E-TFCs from the configured E-TFCS shall be considered for the transmission;
- For all logical channels, if the logical channel belongs to a non-scheduled MAC-d flow, its data shall be considered as available up to the corresponding non-scheduled grant, if the logical channel does not belong to a non-scheduled MAC-d flow, its data shall be considered as available up to the Serving Grant;
- The power offset for the transmission is the one from the HARQ profile of the MAC-d flow that allows highest-priority data to be transmitted. If more than one MAC-d flow allows data of the same highest priority to be transmitted, it is left to implementation to select which MAC-d flow to prefer);
- In case the variable Serving_Grant has the value "Zero_Grant" after the Serving Grant Update function and there is no data available for MAC-d flows for which non-scheduled grants were configured and the transmission of Scheduling Information has been triggered, the "Control-only" HARQ profile configured by the higher layers shall be used.
- The Nominal Power Offset shall be set to the power offset included in the transmission HARQ profile;
- The data allocation shall maximize the transmission of higher priority data;
- The amount of data from MAC-d flows for which non-scheduled grants were configured shall not exceed the value of the non-scheduled grant;
- If a 10ms TTI is configured and the TTI for the upcoming transmission overlaps with a compressed mode gap, the Serving_Grant provided by the Serving Grant Update function shall be scaled back as follows:

  $$SG' = SG * (\frac{N_C}{15})$$

  where SG' represents the modified serving grant considered by the E-TFC selection algorithm and N_C represents the number of non DTX slots in the compressed TTI;
- When not in a power limited condition the maximum amount of data from MAC-d flows for which no non-scheduled grants were configured shall be quantized to the next smaller supported E-TFC based on the Serving Grant (after adjustment for compressed frames), the power offset from the selected HARQ profile, the non-scheduled grants (if any) and Scheduling Information (if any); In the case a 2ms TTI is configured and the HARQ process is inactive, the UE shall not include any such data in the transmission;
- The Scheduling Information is always sent when triggered (see subclause 11.8.1.6);
- Only E-TFCs in supported state shall be considered;
- The E-TFC resulting in the smallest amount of padding for the selected MAC-es PDUs and corresponding MAC-e/es headers, shall be selected including the case when the Scheduling Information needs to be transmitted.

Once an appropriate E-TFC and data allocation are found according to the rules above, the "Multiplexing and TSN Setting" entity shall generate the corresponding MAC-e PDU.

The E-TFC selection function shall provide this MAC-e PDU and transmission HARQ profile to the HARQ entity. The maximum number of HARQ transmissions and the power offset in this profile, shall be set respectively to the maximum of the Max Number of HARQ Transmissions of the HARQ profiles from all the MAC-d flows from which data is multiplexed into the transmission and to the Nominal Power Offset. The HARQ entity shall also be informed of whether the transmission includes Scheduling Information and whether this information is sent by itself or with higher-layer data.

11.8.1.6 Scheduling Information reporting

Scheduling information reports will be triggered differently depending on the value of the variable Serving_Grant after the Serving Grant Update function. The triggering of a report shall be indicated to the E-TFC selection function at the first new transmission opportunity (this process may be delayed in case the HARQ processes are occupied with re-transmissions).

Even if multiple events are triggered by the time a new transmission can take place, only a single scheduling information header will be included in the payload.

The Scheduling Information shall not be transmitted if the Total E-DCH Buffer Status is zero, even if it was triggered by one of the configured triggering mechanisms.

The transmission of Scheduling Information can take place on every HARQ process, even on those processes for which transmission is restricted according to RRC or deactivated by absolute grants, i.e. processes on which scheduled and/or non-scheduled transmission can not take place.

The description of the behaviour in the two cases is provided below.

Annex C (informative): Pseudo-Code for E-TFC Selection

The pseudo-code below describes one possible implementation of the E-TFC Selection as described in subclause 11.8.1.4:

1> determine whether to take the scheduled and non-scheduled grants into account in the upcoming transmission.

1> if scheduled and/or non-scheduled data can be transmited:

  2> select a MAC-d flow that allows highest-priority data to be transmitted (when more than one MAC-d flow allows data of the same highest priority to be transmitted, it is left to implementation to select which MAC-d flow to prefer);

  2> based on this MAC-d flow, identify the MAC-d flow(s) that can be sent according to their multiplexing list and ignore the one(s) that cannot.

  2> based on the HARQ profile of this MAC-d flow, identify the power offset to use;

  2> based on this power offset and the E-TFC restriction procedure, determine the maximum supported payload (i.e. maximum MAC-e PDU size or E-TFC) that can be sent by the UE during the upcoming transmission;

  2> set "Remaining Available Payload" to the maximum supported payload;

  2> if the upcoming transmission overlaps with a compressed mode gap on 10ms TTI, scale down the current serving grant (SG);

  2> set "Scheduled Grant Payload" to the highest payload that could be transmitted according to SG and selected power offset;

  2> for each MAC-d flow with a non-scheduled grant, set the "Remaining Non-scheduled Payload" to the value of the grant;

2> set "Non scheduled Payload" to sum of MIN ("Remaining Non-scheduled Payload", non-scheduled available payload) for all non scheduled MAC-d flow(s);

2> if Scheduling Information needs to be transmitted:

3> if "Remaining Available Payload" > "Scheduled Grant Payload" + "Non-scheduled Payload" + size of the Scheduling Information:

4> quantize the sum of the "Scheduled Grant Payload" + "Non-scheduled Payload"+ size of the Scheduling Information to the next smaller supported E-TFC;

4> set the "Scheduled Grant Payload" to the quantized sum minus "Non-scheduled Payload" + size of the Scheduling Information.

3> substract the size of the Scheduling Information from "Remaining Available Payload".

2> else:

3> if "Remaining Available Payload" > "Scheduled Grant Payload" + "Non-scheduled Payload":

4> quantize the sum of the "Scheduled Grant Payload" + "Non-scheduled Payload" to the next smaller supported E-TFC;

4> set the "Scheduled Grant Payload" to the quantized sum minus "Non-scheduled Payload".

2> perform the following loop for each logical channel, in the order of their priorities:

3> if this logical channel belongs to a MAC-d flow with a non-scheduled grant, then:

4> consider the "Remaining Non-scheduled Payload" corresponding to the MAC-d flow on which this logical channel is mapped;

4> fill the MAC-e PDU with SDU(s) from this logical channel up to MIN("Remaining Non-scheduled Payload", Available Data for this logical channel, "Remaining Available Payload");

4> subtract the corresponding bits if any from "Remaining Available Payload" and "Remaining Non-scheduled Payload" taking into account the MAC-e headers.

3> else:

4> fill the MACe PDU with SDU(s) from this logical channel up to MIN("Scheduled Grant Payload", Available Data for this logical channel, "Remaining Available Payload");

4> subtract the corresponding bits if any from "Remaining Available Payload" and "Scheduled Grant Payload" taking into account the MAC-e headers.

2> if Scheduling Information needs to be transmitted:

3> add Scheduling Information to the MAC-e PDU;

3> determine the smallest E-TFC that can carry the resulting MAC-e PDU;

2> else:

3> determine the smallest E-TFC that can carry the resulting MAC-e PDU;

3> if the padding allows a Scheduling Information to be sent, add it to the MAC-e PDU;

2> set the maximum number of HARQ transmissions to the maximum among the maximum number of HARQ transmissions of the HARQ profiles of the MAC-d flows selected for transmissions.

1> else if Scheduling Information needs to be transmitted:

2> select the "control-only" HARQ profile;

2> fill the MAC-e PDU with the scheduling information;

2> select the smallest E-TFC.

2> set the maximum number of HARQ transmissions to 8.

CR-Form-v8

CHANGE REQUEST

⌘	25.321 CR CRNum	⌘ rev	-	⌘	Current version:	6.8.0	⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ [ ] ME [X] Radio Access Network [X] Core Network [ ]

Title:	⌘	Correction to handling of same priority logical channels	
Source:	⌘	LG Electronics Inc.	
Work item code:	⌘	EDCH-L23	***Date:*** ⌘
Category:	⌘	**F** *Use one of the following categories:* ***F** (correction)* ***A** (corresponds to a correction in an earlier release)* ***B** (addition of feature),* ***C** (functional modification of feature)* ***D** (editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.	***Release:*** ⌘ Rel-6 *Use one of the following releases:* *Ph2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *Rel-4 (Release 4)* *Rel-5 (Release 5)* *Rel-6 (Release 6)* *Rel-7 (Release 7)* *Rel-8 (Release 8)*

Reason for change:	⌘	Several sections describes handling of data of same priority. Section 9.2.5.3.2 state how to perform Scheduling Information reporting when multiple logical channels with data have same priority. Section 11.8.1.4 state how to select HARQ profile when multiple MAC-d flows have data for the highest priority. But in E-TFC selection, it's not specified how to handle multiple logical channels with same priority.
Summary of change:	⌘	In E-TFC selection, when there are more than one logical channels with data for the same priority: - For the logical channels of different MAC-d flows, logical channels of selected MAC-d flow are considered first. - For the logical channels of same MAC-d flows, logical channel with highest buffer occupancy is considered first.
Consequences if not approved:	⌘	The UE behaviour is unclear how to behave when multiple logical channels with data have same priority.

Clauses affected:	⌘	11.8.1.4, Annex C			
		Y	N		
Other specs affected:	⌘		X	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘				

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

9.2.5.3.2 Scheduling Information

The Scheduling Information is located at the end of the MAC-e PDU and is used to provide the serving Node B with a better view of the amount of system resources needed by the UE and the amount of resources it can actually make use of. The transmission of this information will be initiated due to the quantization of the transport block sizes that can be supported or based on the triggers defined in subclause 11.8.1.6. When a Scheduling Information is transmitted, its contents shall always be updated in new transmissions with the buffer status after application of the E-TFC selection procedure described in subclause 11.8.1.4. The logical channels for which a non-scheduled grant is configured shall never be taken into account when putting together this information. In addition, the RRC may restrict applicability for logical channels for which no non-scheduled grant was configured.

This information includes the following fields:

- Highest priority Logical channel ID (HLID):
  The HLID field identifies unambiguously the highest priority logical channel with available data. If multiple logical channels exist with the highest priority, the one corresponding to the highest buffer occupancy will be reported. The length of the HLID is 4 bits. In case the TEBS is indicating index 0 (0 byte), the HLID shall indicate the value "0000".

- Fields related to amount of available data:

- Total E-DCH Buffer Status (TEBS):
  The TEBS field identifies the total amount of data available across all logical channels for which reporting has been requested by the RRC and indicates the amount of data in number of bytes that is available for transmission and retransmission in RLC layer. When MAC is connected to an AM RLC entity, control PDUs to be transmitted and RLC PDUs outside the RLC Tx window shall also be included in the TEBS. RLC PDUs that have been transmitted but not negatively acknowledged by the peer entity shall not be included in the TEBS.

The length of this field is 5 bits. The values taken by TEBS are shown in Table 9.2.5.3.2.1.

Table 9.2.5.3.2-1: TEBS Values

Index	TEBS Value (bytes)

0	TEBS = 0
1	0 < TEBS ≤10
2	10 < TEBS ≤14
3	14 < TEBS ≤18
4	18 < TEBS ≤24
5	24 < TEBS ≤32
6	32 < TEBS ≤42
7	42 < TEBS ≤55
8	55 < TEBS ≤73
9	73 < TEBS ≤97
10	97 < TEBS ≤129
11	129 < TEBS ≤171
12	171 < TEBS ≤228
13	228 < TEBS ≤302
14	302 < TEBS ≤401
15	401 < TEBS ≤533
16	533 < TEBS ≤708
17	708 < TEBS ≤940
18	940 < TEBS ≤1248
19	1248 < TEBS ≤1658
20	1658 < TEBS ≤2202
21	2202 < TEBS ≤2925
22	2925 < TEBS ≤3884
23	3884 < TEBS ≤5160
24	5160 < TEBS ≤6853
25	6853 < TEBS ≤9103
26	9103 < TEBS ≤12092
27	12092 < TEBS ≤16062
28	16062 < TEBS ≤21335
29	21335 < TEBS ≤28339
30	28339 < TEBS ≤37642
31	37642 < TEBS

- Highest priority Logical channel Buffer Status (HLBS):
  The HLBS field indicates the amount of data available from the logical channel identified by HLID, relative to the highest value of the buffer size range reported by TEBS when the reported TEBS index is not 31, and relative to 50000 bytes when the reported TEBS index is 31. The length of HLBS is 4 bits. The values taken by HLBS are shown in table 9.2.5.3.2.2. In case the TEBS field is indicating index 0 (0 byte), the HLBS field shall indicate index 0.

Table 9.2.5.3.2-2: HLBS Values

Index	HLBS values (%)

0	0 < HLBS ≤4
1	4 < HLBS ≤6
2	6 < HLBS ≤8
3	8 < HLBS ≤10
4	10 < HLBS ≤12
5	12 < HLBS ≤14
6	14 < HLBS ≤17
7	17 < HLBS ≤21
8	21 < HLBS ≤25
9	25 < HLBS ≤31
10	31 < HLBS ≤37
11	37 < HLBS ≤45
12	45 < HLBS ≤55
13	55 < HLBS ≤68
14	68 < HLBS ≤82
15	82 < HLBS ≤100

- UE Power Headroom (UPH):
  The UPH field indicates the ratio of the maximum UE transmission power and the corresponding DPCCH code power defined in [17]. The length of UPH is 5 bits.

The Scheduling Information message is represented in figure 9.2.5.3.2-1 where for each field, the LSB is the rightmost bit in the figure and the MSB is the leftmost bit.

UPH (5bits)	TEBS (5bits)	HLBS (4bits)	HLID (4bits)

Figure 9.2.5.3.2-1: Scheduling Information format

11.8.1.4 E-TFC Selection

In FDD mode, the rules for E-TFC selection provided below shall apply to UEs in CELL_DCH state with an E-DCH transport channel configured. These UEs shall apply the E-TFC selection procedure when invoked by the HARQ entity (see subclause 11.8.1.1.1). In the case where a 2ms TTI is configured, E-TFC selection shall not be performed for TTIs that overlap with an uplink compressed mode gap. The E-TFC restriction procedure described in [12] shall always be applied before the E-TFC selection process below. Furthermore, for UEs that are also configured with a DCH transport channel on uplink, the TFC selection procedure shall be applied before either of these.

For each MAC-d flow, RRC configures MAC with a HARQ profile and a multiplexing list. Additionally, RRC configures MAC with a power offset for "Control-only" transmissions. This power offset and a maximum number of HARQ transmissions of 8 will be used to define a HARQ profile for "Control-only" transmissions which will be used, in case the Scheduling Information needs to be transmitted without any higher-layer data. The HARQ profile includes the power offset and maximum number of HARQ transmissions to use for this MAC-d flow. The multiplexing list identifies for each MAC-d flow(s), the other MAC-d flows from which data can be multiplexed in a transmission that uses the power offset included in its HARQ profile.

RRC can control the scheduling of uplink data by giving each logical channel a priority between 1 and 8, where 1 is the highest priority and 8 the lowest. E-TFC selection in the UE shall be done in accordance with the priorities indicated by RRC. Logical channels have absolute priority, i.e. the UE shall maximise the transmission of higher priority data.

RRC can allocate non-scheduled transmission grants to individual MAC-d flows in order to reduce the transmission delays. When a 2ms TTI is configured each non-scheduled grant is applicable to the specific set of HARQ processes indicated by RRC. The applicability of scheduled grants can be also restricted to a specific set of HARQ processes when a 2ms TTI is configured. HARQ process restriction and reservation is under the control of the serving cell Node B and indicated to the UE by RRC.

For each configured MAC-d flow, a given E-TFC can be in any of the following states:

- Supported state;

- Blocked state.

At each TTI boundary, UEs in CELL_DCH state with an E-DCH transport channel configured shall determine the state of each E-TFC for every MAC-d flow configured based on its required transmit power versus the maximum UE transmit power (see [7] and [12]). If no DCH transport channel is configured or if a DCH transport channel is configured and the selected TFC is "empty" (see [3]), the UE shall consider that E-TFCs included in the minimum set of E-TFCs are always in supported state (see [7]).

At every TTI boundary for which a new transmission is requested by the HARQ entity (see subclause 11.8.1.1.1), the UE shall perform the operations described below. UEs configured both with DCH and E-DCH transport channels shall perform TFC selection before performing E-TFC selection.

The Serving Grant Update function provides the E-TFC selection function with the maximum E-DPDCH to DPCCH power ratio that the UE is allowed to allocate for the upcoming transmission for scheduled data (held in the Serving Grant state variable – see subclause 11.8.1.3).

The HARQ process ID for the upcoming transmission is determined using the following formulae:

- For 2ms TTI: CURRENT_HARQ_PROCESS_ID = [5*CFN + subframe number] **mod** HARQ_RTT
- For 10ms TTI: CURRENT_HARQ_PROCESS_ID = [CFN] **mod** HARQ_RTT

Based on this current HARQ process ID and the RRC configuration, the UE shall determine whether to take the scheduled and non-scheduled grants into account in the upcoming transmission. If they are not supposed to be taken into account, then the corresponding grant shall be assumed to not exist. If the variable Serving_Grant has the value "Zero_Grant" after the Serving Grant Update, then the Serving Grant shall not be taken into account in the upcoming transmission.

When Scheduling Information is triggered per subclause 11.8.1.6, the E-TFC selection and data-allocation process shall assume that a non-scheduled grant is available for its transmission and that Scheduling Information has a priority higher then any other logical channel. Furthermore the HARQ process used for the upcoming transmission shall be assumed to be active and not L3 restricted for the transmission of the Scheduling Information, i.e. transmission of Scheduling Information can take place on this process.

The transmission format and data allocation shall follow the requirements below:

- Only E-TFCs from the configured E-TFCS shall be considered for the transmission;
- For all logical channels, if the logical channel belongs to a non-scheduled MAC-d flow, its data shall be considered as available up to the corresponding non-scheduled grant, if the logical channel does not belong to a non-scheduled MAC-d flow, its data shall be considered as available up to the Serving Grant;
- The power offset for the transmission is the one from the HARQ profile of the MAC-d flow that allows highest-priority data to be transmitted. If more than one MAC-d flow allows data of the same highest priority to be transmitted, it is left to implementation to select which MAC-d flow to prefer;
- If there are multiple logical channels with data for the same priority, the logical channels which belong to the MAC-d flow of selected HARQ profile are considered prior to the logical channels of other MAC-d flows. And if there are multiple logical channels with data for the same priority within a MAC-d flow, logical channels are considered according to the buffer occupancy in descending order.

[SJ]

- If there are multiple logical channels with data for the same priority, the logical channels which belong to the MAC-d flow of selected HARQ profile are considered prior to the logical channels of other MAC-d flows. For considering other logical channels within other MAC-d flows, next MAC-d flow is randomly selected among other MAC-d flows. And if there are multiple logical channels with data for the same priority within a MAC-d flow, logical channels are considered according to the buffer occupancy in descending order. And if the buffer occupancies of the logical channels with same priority are same, the logical channels are randomly condisered.
- If there are multiple logical channels with data for the same priority, the logical channels are considered according to the buffer occupancy in decending order. And if the buffer occupancies of the logical channels with same priority are same, the logical channels are randomly considered or it is left to implementation which logical channel to prefer.

- If there are multiple logical channels with data for the same priority, the logical channels which belong to the MAC-d flow of selected HARQ profile are considered prior to the logical channels of other MAC-d flows. The logical channels within other MAC-d flows are considered according to the buffer occupancy in decending order. And if the buffer occupancies of the lgocial channels with same priority are same, the logical channels are randomly condisered or it is left to implementation which logical channel to prefer.

- If there are multiple logical channels with data for the same priority, the logical channels are randomly condisered.

If there are multiple logical channels with data for the same priority, it is left to implementation which logical channel to prefer.- In case the variable Serving_Grant has the value "Zero_Grant" after the Serving Grant Update function and there is no data available for MAC-d flows for which non-scheduled grants were configured and the transmission of Scheduling Information has been triggered, the "Control-only" HARQ profile configured by the higher layers shall be used.

- The Nominal Power Offset shall be set to the power offset included in the transmission HARQ profile;

- The data allocation shall maximize the transmission of higher priority data;

- The amount of data from MAC-d flows for which non-scheduled grants were configured shall not exceed the value of the non-scheduled grant;

- If a 10ms TTI is configured and the TTI for the upcoming transmission overlaps with a compressed mode gap, the Serving_Grant provided by the Serving Grant Update function shall be scaled back as follows:

$$SG' = SG * (\frac{N_C}{15})$$

where SG' represents the modified serving grant considered by the E-TFC selection algorithm and N_C represents the number of non DTX slots in the compressed TTI;

- When not in a power limited condition the maximum amount of data from MAC-d flows for which no non-scheduled grants were configured shall be quantized to the next smaller supported E-TFC based on the Serving Grant (after adjustment for compressed frames), the power offset from the selected HARQ profile, the non-scheduled grants (if any) and Scheduling Information (if any); In the case a 2ms TTI is configured and the HARQ process is inactive, the UE shall not include any such data in the transmission;

- The Scheduling Information is always sent when triggered;

- Only E-TFCs in supported state shall be considered;

- The E-TFC resulting in the smallest amount of padding for the selected MAC-es PDUs and corresponding MAC-e/es headers, shall be selected including the case when the Scheduling Information needs to be transmitted.

Once an appropriate E-TFC and data allocation are found according to the rules above, the "Multiplexing and TSN Setting" entity shall generate the corresponding MAC-e PDU.

The E-TFC selection function shall provide this MAC-e PDU and transmission HARQ profile to the HARQ entity. The maximum number of HARQ transmissions and the power offset in this profile, shall be set respectively to the maximum of the Max Number of HARQ Transmissions of the HARQ profiles from all the MAC-d flows from which data is multiplexed into the transmission and to the Nominal Power Offset. The HARQ entity shall also be informed of whether the transmission includes Scheduling Information and whether this information is sent by itself or with higher-layer data.

Annex C (informative): Pseudo-Code for E-TFC Selection

The pseudo-code below describes one possible implementation of the E-TFC Selection as described in subclause 11.8.1.4:

1> determine whether to take the scheduled and non-scheduled grants into account in the upcoming transmission.

1> if scheduled and/or non-scheduled data can be transmited:

2> select a MAC-d flow that allows highest-priority data to be transmitted (when more than one MAC-d flow allows data of the same highest priority to be transmitted, it is left to implementation to select which MAC-d flow to prefer);

2> based on this MAC-d flow, identify the MAC-d flow(s) that can be sent according to their multiplexing list and ignore the one(s) that cannot.

2> based on the HARQ profile of this MAC-d flow, identify the power offset to use;

2> based on this power offset and the E-TFC restriction procedure, determine the maximum supported payload (i.e. maximum MAC-e PDU size or E-TFC) that can be sent by the UE during the upcoming transmission;

2> set "Remaining Available Payload" to the maximum supported payload;

2> if the upcoming transmission overlaps with a compressed mode gap on 10ms TTI, scale down the current serving grant (SG);

2> set "Scheduled Grant Payload" to the highest payload that could be transmitted according to SG and selected power offset;

2> for each MAC-d flow with a non-scheduled grant, set the "Remaining Non-scheduled Payload" to the value of the grant;

2> set "Non scheduled Payload" to sum of MIN ("Remaining Non-scheduled Payload", non-scheduled available payload) for all non scheduled MAC-d flow(s);

2> if Scheduling Information needs to be transmitted:

3> if "Remaining Available Payload" > "Scheduled Grant Payload" + "Non-scheduled Payload" + size of the Scheduling Information:

4> quantize the sum of the "Scheduled Grant Payload" + "Non-scheduled Payload"+ size of the Scheduling Information to the next smaller supported E-TFC;

4> set the "Scheduled Grant Payload" to the quantized sum minus "Non-scheduled Payload" + size of the Scheduling Information.

3> substract the size of the Scheduling Information from "Remaining Available Payload".

2> else:

3> if "Remaining Available Payload" > "Scheduled Grant Payload" + "Non-scheduled Payload":

4> quantize the sum of the "Scheduled Grant Payload" + "Non-scheduled Payload" to the next smaller supported E-TFC;

4> set the "Scheduled Grant Payload" to the quantized sum minus "Non-scheduled Payload".

perform the following loop for each logical channel, in the order of their priorities (when more than one logical channel with data exists for the same priority, the logical channels within the MAC-d flow of selected HARQ and the logical channels with higher buffer occupancy are considered prior to other logical channels or If there are multiple logical channels with data for the same priority, the logical channels which belong to the MAC-d flow of selected HARQ profile are considered prior to the logical channels of other MAC-d flows. For considering other logical channels within other MAC-d flows, next MAC-d flow is randomly selected among other MAC-d flows. And if there are multiple logical channels with data for the same priority within a MAC-d flow, logical channels are considered according to the buffer occupancy in descending order. And if the buffer occupancies of the logical channels with same priority are same, the logical channels are randomly condisered. Or if there are multiple logical channels with data for the same priority, the logical channels are considered according to the buffer occupancy in decending order. And if the buffer occupancies of the logical channels with same priority are same, the logical channels are randomly considered or it is left to implementation which logical channel to prefer. Or if there are multiple logical channels with data for the same priority, the logical channels which belong to the MAC-d flow of selected HARQ profile are considered prior to the logical channels of other MAC-d flows. The logical channels within other MAC-d flows are considered according to the buffer occupancy in decending order. And if the buffer occupancies of the lgocial channels with same priority are same, the logical channels are randomly condisered or it is left to implementation which logical channel to prefer. Or if there are multiple logical channels with data for the same priority, the logical channels are randomly condisered. Or if there are multiple logical channels with data for the same priority, it is left to implementation which logical channel to prefer.):

3> if this logical channel belongs to a MAC-d flow with a non-scheduled grant, then:

4> consider the "Remaining Non-scheduled Payload" corresponding to the MAC-d flow on which this logical channel is mapped;

4> fill the MAC-e PDU with SDU(s) from this logical channel up to MIN("Remaining Non-scheduled Payload", Available Data for this logical channel, "Remaining Available Payload");

4> subtract the corresponding bits if any from "Remaining Available Payload" and "Remaining Non-scheduled Payload" taking into account the MAC-e headers.

3> else:

4> fill the MACe PDU with SDU(s) from this logical channel up to MIN("Scheduled Grant Payload", Available Data for this logical channel, "Remaining Available Payload");

4> subtract the corresponding bits if any from "Remaining Available Payload" and "Scheduled Grant Payload" taking into account the MAC-e headers.

2> if Scheduling Information needs to be transmitted:

3> add Scheduling Information to the MAC-e PDU;

3> determine the smallest E-TFC that can carry the resulting MAC-e PDU;

2> else:

3> determine the smallest E-TFC that can carry the resulting MAC-e PDU;

3> if the padding allows a Scheduling Information to be sent, add it to the MAC-e PDU;

2> set the maximum number of HARQ transmissions to the maximum among the maximum number of HARQ transmissions of the HARQ profiles of the MAC-d flows selected for transmissions.

1> else if Scheduling Information needs to be transmitted:

2> select the "control-only" HARQ profile;

2> fill the MAC-e PDU with the scheduling information;

2> select the smallest E-TFC.

Agenda Item : 12
Source : LG Electronics
Title : Discussion on Early Transmission of IDT
Document for : Discussion and Decision

1. Introduction

In Denver, early transmission of IDT was discussed and captured in TR25.815 [1]. This document proposes additional decription of handling of the early IDT message to TR25.815.

2. Early Transmission of Initial Direct Transfer

2.1 Early Transmission of Initial Direct Transfer

One of the most critical parts in call setup is the time between UE call initiation and UE signaling connection establishment. RRC connection between UE and RNC is established by RRC connection procedure and a signaling connection between MSC (SGSN) and UE is established when NAS message is sent over INITIAL DIRECT TRANSFER to MSC (SGSN) via RNC. Currently IDT is sent to MSC (SGSN) only when RRC connection is established. i.e, signaling connection establishment procedure is subsequent to RRC connection, not concurrent. We think that if the UE is allowed to transmit two consecutive RRC messages over RACH, we could reduce call setup time. That means if RRC connection request and IDT transfer concurrently occur, we could decrease initial call setup time.

The figure 1 below shows the successful case of the proposed initial call setup procedure with early transmission of IDT. In this figure, RRC connection is requested before IDT transfer as usual. But, IDT is transferred on CCCH immediately after the RRC Connection Request message is sent from UE. By this early IDT on CCCH, NAS procedures will be initiated ealier than before. A subsequent NAS message, e.g. Authentication Request, could be sent to the UE right after the RRC connection setup complete. Thus, we could reduce call setup time.

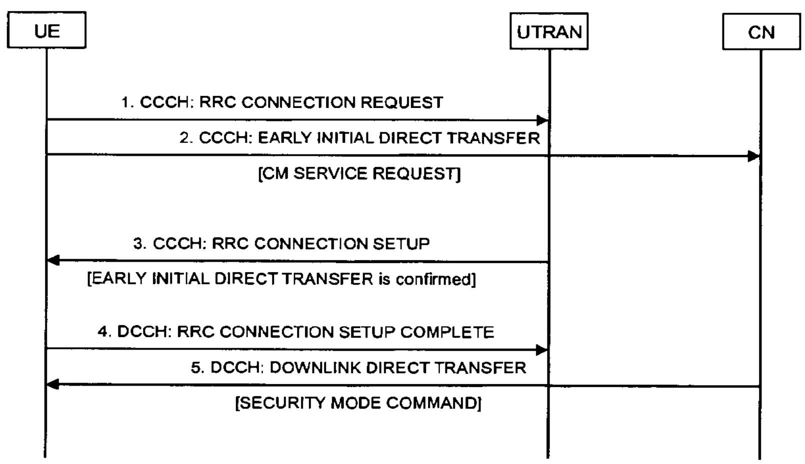

Figure 1. The proposed initial call setup procedure: Successful

In most configurations the RRC Connection Setup message contains information in order to indicate to the UE a CELL_DCH configuration. Hence the delay between the transmission of the RRC Connection Request message and the transmission of the RRC Connection Setup message is quite large due to the need of the allocation of the resources between the RNC and the NodeB.

Because in step 2 in figure 1 there is no DCCH available today the only new aspect compared to today's behaviour would be that the Initial Direct Transfer would be able to be mapped to CCCH as well. In order to allow the RNC to link the Initial direct transfer message to the RRC Connection Request message it is necessary to include the same initial UE identity in the new CCCH message as in the RRC Connection Request message.

2.2 Routing NAS message in Early IDT to CN

If the early IDT arrived before the RRC CONNECTION REQUEST, the UTRAN may be able to buffer the early IDT before arrival of the RRC CONNECTION REQUEST. But, the UTRAN does not know when it finally receives the RRC CONNECTION REQUEST after the early IDT. If the RRC CONNECTION REQUEST doesn't ever arrive at the RNC, the RNC needs not to route the early IDT to CN.

In addition, when the UTRAN receive the RRC CONNECTION REQUEST after the early IDT, if the UTRAN reject the RRC connection request, the UTRAN needs not to route the early IDT to CN, either. Thus, in this case routing the early IDT to CN comes to an unnecessary action as well.

Thus, it is recommended that the UTRAN waits until being ready to send the RRC CONNECTION SETUP message before routing the early IDT to CN.

2.3 Unsuccessful Early Transmission of IDT

The confirmation in the RRC Connection Setup message is also used to handle unsuccessful transmission of this early IDT on CCCH and to transmit the normal IDT on DCCH as shown in figure 2. In this figure, UTRAN does not receive the IDT on CCCH before sending RRC CONNECTION SETUP. In this case, UTRAN indicates to the UE that the IDT on CCCH was not correctly received so that the the UE sends the conventional IDT on DCCH after the RRC CONNECTION SETUP COMPLETE message.

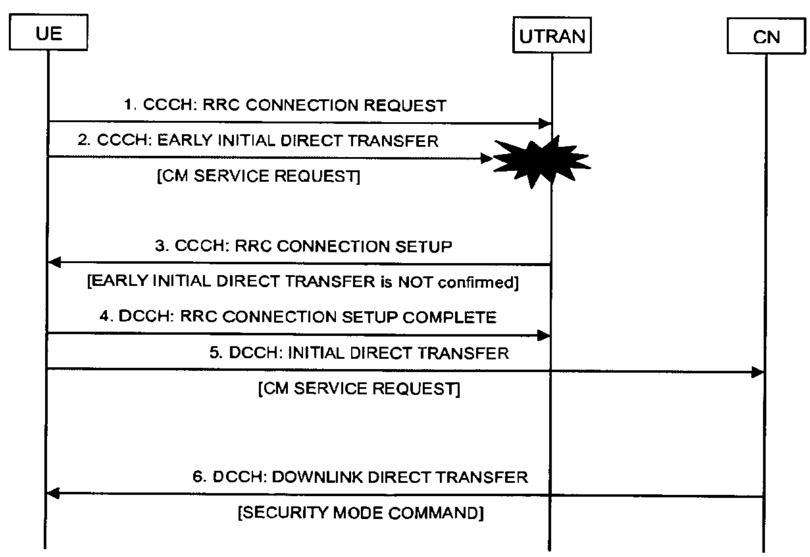

Figure 2. The proposed initial call setup procedure: Unsuccessful

The UE shall not transmit an early IDT after reception of the RRC CONNETION SETUP message. Thus, if UTRAN does not receive the early IDT on CCCH before sending RRC CONNECTION SETUP, the UTRAN indicates by using the RRC CONNECTION SETUP that the early IDT is not confirmed.

In this procedure, since the early IDT failed, call setup delay cannot be reduced by the early IDT. However, there is no additional delay occurred by transmission of the early IDT as well because the early IDT is not transmitted after reception of the RRC CONNETION SETUP message.

2.4 Transmission of Early IDT after Unsuccessful Transmission of RRC CONNECTION REQUEST

2.4.1 In case of timer expiry

If RRC CONNECTION REQUEST is unsuccessfully transmitted and Early IDT is successfully transmitted, the UE will send RRC CONNECTION REQUEST again after T300 expiry. In this case, it is proposed that the UE shall send RRC CONNECTION REQUEST and the early IDT again regardless of successful transfer of the previous early IDT. Thus, UTRAN should ignore the early IDT received before successfully receiving RRC CONNECTION REQUEST.

Furthermore, if both RRC CONNECTION REQUEST and early IDT are unsuccessfully transmitted, the UE shall send RRC CONNECTION REQUEST and the early IDT again after T300 expiry.

Thus, it is proposed whenever a UE sends an RRC CONNECTION REQUEST message, the UE sends an early IDT immediately after sending the RRC CONNECTION REQUEST message.

2.4.1 In case of cell re-selection

If UE preforms cell re-selection after sending RRC CONNECTION REQUEST, UE is required to send the RRC CONNECTION REQUEST again. This UE operation is also applied to the case that the UE preforms cell re-selection after successfully sending RRC CONNECTION REQUEST and the subsequent early IDT.

That means that if the UE preforms cell re-selection after sending RRC CONNECTION REQUEST and the subsequent early IDT, the UE shall send RRC CONNECTION REQUEST and the early IDT again because UE cannot know whether both messages are successfully transmitted or not.

2.5 Handling of Duplicated Early IDT messages

2.5.1 In case of cell-reselection or timer expiry

If the IDT is early transmitted before completion of the RRC connection establishment, whenever an RRC CONNECTION REQUEST message is transmitted due to cell re-selection or timer expiry i.e. the MAC layer indicates successful transmission of an RRC CONNECTION REQUEST message, an early IDT will be transmitted again. In this case, CN may receive duplicated NAS messages e.g. SERIVCE REQUEST message.

However, as sugguested above, if the UTRAN waits until being ready to send the RRC CONNECTION SETUP message before routing the early IDT to CN, duplication of similar Early IDT messages cannot happen before sending the RRC CONNECTION SETUP.

2.5.2 In case of physical failures and invalid messages

After the RRC CONNECTION SETUP message is transmitted, a UE could find out a RL failure of the RRC connection. Also, a UE could receive an invalid RRC CONNECTION SETUP or RRC CONNECTION REJECT message. In this case, the UE will re-try to request a RRC connetion. Thus, an early IDT message will be transmitted again and so the NAS message in the early IDT may be routed to the CN. The CN may be able to found out duplication of the NAS message.

From our perspective, each time a RRC CONNECTION SETUP message is sent as a response to a RRC CONNECTION REQUEST message, a new RRC connection is supposed to be created. If an early IDT is forwarded to the Iu interface and an Iu connection is established, then the Iu connection and the RRC connection are related. In this case, when the RRC connection is released due to a RL failure, the related Iu connection is released also by the RNC.

Therefore, if a new early IDT message is transmitted again due to a physical failure, it is recommended that CN/UTRAN release the previous Iu/RRC connection and then are going to re-establish the Iu/RRC connection according to the new early IDT message transmitted again.

In addition, when the UE will re-try to request a RRC connetion due to reception of an invalid RRC CONNECTION SETUP or RRC CONNECTION REJECT message, an early IDT message will be re-transmitted. However, there is no duplicatin of early IDT message because the Iu connection and the RRC connection are related. That means the network will release an old connection and establish a new connection with a new RRC CONNECTION REQUEST and a subsequent early IDT message. Accordingly, there is no problem.

2.6 Rejection of RRC Connection Request

The UTRAN can reject the RRC Connection Request from the UE. In this case, the UTRAN does not to route the early IDT to CN. Thus, there is no signalling problem.

It is noted that if the UE re-sends an RRC CONNECTION REQUEST message after rejection, then the UE will re-transmit an early IDT.

2.7 Handling of Early IDT in legacy RNC

From a backwards compatibility point of view, the use of the new initial direct transfer message on CCCH on RACH is ignored by any legacy RNC and the conventional Initial Direct transfer message is sent after the transmission of the RRC CONNECTION SETUP COMPLETE message.

The transmission of the conventional Initial direct transfer message will be suppressed by a corresponding indication from the RNC in the RRC Connection Setup message that confirms the correct reception of the Early Initial direct transfer message on the CCCH.

2.8 CS Call Establishment in CELL_PCH and URA_PCH

The early initial direct transfer can be transmitted on CCCH on RACH as well when a CS call establishment is initiated in CELL_PCH or URA_PCH state. In that case Step 1 in figure 1 would contain the Cell Update message, step 3 would contain the Cell Update Confirm message, and step 4 one of the the Radio Bearer Control complete messages.

Instead of using the initial UE identity the U-RNTI will then be used in order to link the Initial direct transfer message sent on the CCCH to the Cell Update message.

3. Structure of the Early IDT message on CCCH

There are some variations of the size of the new Early IDT message depending on which IEs are included in the new IDT on CCCH. If all of optional IEs of the conventional IDT on DCCH are included in the new IDT message on CCCH, the message length could be too large to be transmitted on one RACH message. Since this new IDT is transmitted very earlier than before, some of IEs included in the existing IDT on DCCH could be omitted. We think that the following IEs do not need to be included in new IDT on CCCH any more:

(1) IE 'integrity check info', 'START' & 'Establishment Cause': They do not need to be included in the proposed early IDT message. It is noted that IE 'START' is included in RRC CONNECTION SETUP COMPLETE message or the Cell Update message and IE 'Establishment Cause' is included in RRC CONNECTION REQUEST message and the Cell Update message.

(2) IE 'Measured results on RACH': It does not need to be included in the proposed early IDT message because RRC CONNECTION REQUEST message also includes this IE and the early IDT on CCCH is immediately following RRC CONNECTION REQUEST message or the Cell Update message.

In addition, in order to allow the RNC to link the Early IDT message to the RRC Connection Request message it is necessary to include the same initial UE identity in the Early IDT as in the RRC Connection Request message. It is because the new IDT is transmitted on CCCH, not DCCH. To include the initial UE identity in the Early IDT, there are two options as follow:

Option A: Additional RRC IE 'initial UE identity':

In this case, the UE RRC includes an additional IE 'initial UE identity' in the new IDT message. Thus, RNC identifies the UE sending new IDT on CCCH by checking the RRC IE 'initial UE identity' included in RRC IDT message.

Option B: Use of NAS IE 'mobilty identity'

RNC could identify the UE sending a new Early IDT on CCCH by checking NAS IE 'mobilty identity' of CM SERVICE REQEUST included in the new Early IDT. Thus, the new early IDT does not need to include the additional IE 'initial UE identity' in the new IDT message. However, in this case RNC needs to decode the CN message. It should be also assumed that IE 'Initial UE identity' in RRC CONNECTION REQUEST is always similar to IE 'mobilty identity' in the new IDT on CCCH.

We think that some of IEs existing in the current IDT on DCCH are not so necessary in the new IDT on CCCH. Thus, removing (1) and (2) listed above seems to be good for the new IDT message. And if the assumptions of the option B is agreeable, the new IDT message can be further optimized. It is noted that in case of the option A, a new larger TB size on RACH than 240 bits needs to be defined.

The new Early IDT based on the sugguestion above is shown below.

10.2.x EARLY INITIAL DIRECT TRANSFER

This message is used to initiate a signalling connection immediately after the RRC CONNECTION SETUP message or the CELL_UPDATE message based on indication from the upper layers.

RLC-SAP: TM

Logical channel: CCCH

Direction: UE -> UTRAN

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
Message Type	MP		Message Type		REL-7
UE information elements					
CHOICE *UE identity*	MP				
>Initial UE identity			Initial UE identity 10.3.3.15	This IE is indentical with IE 'initial UE identity' in the RRC CONNECTION REQUEST message transmitted right before this message.	REL-7
>U-RNTI			U-RNTI 10.3.3.47	This IE is indentical with IE 'U-RNTI' in the CELL UPDATE message transmitted right before this message.	REL-7
PLMN identity	OP		PLMN identity 10.3.1.11	This IE indicates the PLMN to which the UE requests the signalling connection to be established.	REL-7
CN information elements					
CN domain identity	MP		CN domain identity 10.3.1.1		REL-7
Intra Domain NAS Node Selector	MP		Intra Domain NAS Node Selector 10.3.1.6		REL-7
NAS message	MP		NAS message 10.3.1.8		REL-7
MBMS joined information	OP				REL-7
>P-TMSI	OP		P-TMSI (GSM-MAP) 10.3.1.13		REL-7

4. Analysis of Improved Call Setup Delay

According to Tables in [1], cumulative delay of the current CS Voice call setup from SIB reading to reception of response of CM SERVICE REQUEST seems to be 810 ms for CELL_DCH UE and 470 ms for CELL_FACH UE. In [1], delay between transmission of RRC CONNECTION REQUEST and reception of RRC CONNECTION SETUP takes 200 ms for CELL_DCH UE and 60 ms for CELL_FACH UE. Since T300 timer is set to 4 sec in 34.108, after sending RRC CONNECTION REQUEST, in the worst case UE may have to wait for max. 4 sec until receiving RRC CONNECTION SETUP.

Since transmission of RRC CONNECTION REQUEST on RACH takes 40 ms in Table 1, it is assumed that transmission of the proposed Early IDT on RACH also takes about 40 ms. If it's true, in the normal case UE can successfully transmit the Early IDT in the gap between sending RRC CONNECTION REQUEST and receiving RRC CONNECTION SETUP.

It is noted that if the UE successfully received RRC CONNECTION SETUP before sending the Early IDT on RACH, the UE will immediately abort RACH transmission of the Early IDT and starts transmission of RRC CONNECTION SETUP COMPLETE on DCCH. In this case, since UE failed to transmit the Early IDT on CCCH, the UE will start transmission of the normal IDT on DCCH as usual after RRC CONNECTION SETUP COMPLETE.

If UE transmitted the Early IDT including CM SERVICE REQUEST and the network successfully received it on CCCH, then CN will send a first NAS message to the UE. According to Table 3/4, delay between transmission of CM SERVICE REQUEST and reception of the first NAS message from CN would take 200 ms. If the Early IDT is applied, the interval between transmission of CM SERVICE REQUEST and reception of the first NAS message from CN will be overlapped in time with the interval between transmission of RRC CONNECTION REQUEST and reception of RRC CONNECTION SETUP. Thus, the Early IDT can save about 200 ms according to Tables below.

It is noted that if the UTRAN earlier receives the first NAS message from CN, e.g. Security mode command or Authentication Request, than receiving RRC CONNECTION SETUP COMPLETE, UTRAN could delay transferring the first NAS message to UE until successful reception of RRC CONNECTION SETUP COMPLETE.

Table 1: RRC connection establishment in CELL_DCH state [1]

Message/procedure	Sender/receiver	Delay	Cumulative Delay	Comments	Reference time point in Figure 6.1.1-1
SIB7 reading time	NA	70 ms	70 ms	Highly depending on UTRAN SIB7 scheduling	t_0
RRC connection request	UE/RNC	40 ms	110 ms		
RRC connection setup	RNC/UE	200 ms	310 ms	Includes network RL setup delays, no predefined/default configuration	t_1
RRC connection completed	UE/RNC	300 ms	610 ms	Includes synchronisation delay, reduced in Rel6	t_2
RRC Connection setup in Total			610 ms		T_0-t_2

Table 2: RRC connection establishment in CELL_FACH state [1]

Message/procedure	Sender/receiver	Delay	Cumulative Delay	Comments	Reference time point in Figure 6.1.1-2
SIB7 reading time	NA	70 ms	70 ms	Highly depending on UTRAN SIB7 scheduling	t_0
RRC connection request	UE/RNC	40 ms	110 ms		
RRC connection setup	RNC/UE	60 ms	170 ms	no predefined/default configuration	t_1
RRC connection completed	UE/RNC	100 ms	270 ms		t_2
RRC Connection setup in Total			270 ms		T_0-t_2

Table 3: CS Voice call setup, UE in CELL_DCH state in the current scheme (3.4kbps for SRBs) [1]

Message/procedure	Sender/receiver	Delay	Cumulative Delay	Comments	Reference time point in Figure 6.2.1-1
CM service request	UE/CS CN	200 ms	200 ms	Includes authentication delays	t_2
Security mode command	RNC/UE	100 ms	300 ms		t_3
Security mode Command Completed	UE/RNC	200 ms	500 ms		t_3
Setup	UE/CS CN	150 ms	650 ms		t_4
Call proceeding	CS CN/UE	100 ms	750 ms		t_7
Radio bearer setup	RNC/UE	200 ms	950 ms	UTRAN resource reservation and, RL reconfiguration delays	t_8
Radio bearer setup completed	UE/RNC	400 ms	1350 ms	Synchronous reconfiguration	t_9
Alerting	CS CN/UE	250 ms	1600 ms		t_{10}
CS voice Call setup delay			1600 ms		T_1-t_2
Total from Idle			2210 ms		T_1-T_0

Table 4: CS Voice call setup, UE in CELL_FACH state in the current scheme [1]

Message/procedure	Sender/receiver	Delay	Cumulative Delay	Comments	Reference time point in Figure 6.2.1-1
CM service request	UE/CS CN	200 ms	200 ms	Includes authentication delays	t2
Security mode command	RNC/UE	100 ms	300 ms		t3
Security mode Command Completed	UE/RNC	200 ms	500 ms		t3
Setup	UE/CS CN	150 ms	650 ms		t4
Call proceeding	CS CN/UE	100 ms	750 ms		t7
Radio bearer setup	RNC/UE	200 ms	950 ms	UTRAN resource reservation and, RL reconfiguration delays	t8
Radio bearer setup completed	UE/RNC	300 ms	1250 ms	asynchronous reconfiguration	t9
Alerting	CS CN/UE	250 ms	1500 ms		t10
CS voice Call setup delay			1500 ms		T_1-t_2

Total from Idle			1770 ms		T_1-T_0

5. Conclusion

It is proposed that section 2 above is captured in TR 25.815 [1]. In addition, a CR to 25.331 [2] is proposed to be agreed for R7.

Reference

[1] 3GPP TR 25.815: Signalling enhancements for Circuit-Switched (CS) and Packet-Switched (PS) Connections; Analyses and Recommendations

[2] R2-061318, Proposed CR on 25.331 on Introduction of Early IDT, LG Electronics Inc.

Agenda Item : 12

Source : LG Electronics

Title : Discussion on Early Transmission of IDT

Document for : Discussion and Decision

1. Introduction

In Denver, early transmission of IDT was discussed and captured in TR25.815 [1]. This document proposes additional decription of handling of the early IDT message to TR25.815.

2. Early Transmission of Initial Direct Transfer

2.1 Early Transmission of Initial Direct Transfer

One of the most critical parts in call setup is the time between UE call initiation and UE signaling connection establishment. RRC connection between UE and RNC is established by RRC connection procedure and a signaling connection between MSC (SGSN) and UE is established when NAS message is sent over INITIAL DIRECT TRANSFER to MSC (SGSN) via RNC. Currently IDT is sent to MSC (SGSN) only when RRC connection is established. i.e, signaling connection establishment procedure is subsequent to RRC connection, not concurrent. We think that if the UE is allowed to transmit two consecutive RRC messages over RACH, we could reduce call setup time. That means if RRC connection request and IDT transfer concurrently occur, we could decrease initial call setup time.

The figure 1 below shows the successful case of the proposed initial call setup procedure with early transmission of IDT. In this figure, RRC connection is requested before IDT transfer as usual. But, IDT is transferred on CCCH immediately after the RRC Connection Request message is sent from UE. By this early IDT on CCCH, NAS procedures will be initiated ealier than before. A subsequent NAS message, e.g. Authcntication Request, could be sent to the UE right after the RRC connection setup complete. Thus, we could reduce call setup time.

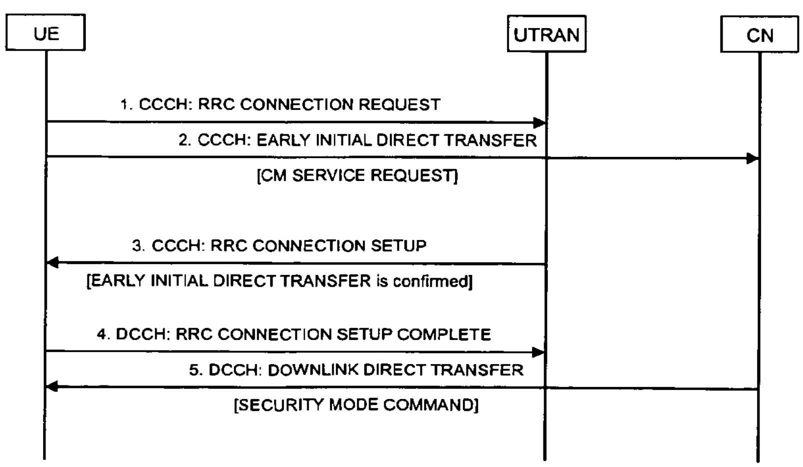

Figure 1. The proposed initial call setup procedure: Successful

In most configurations the RRC Connection Setup message contains information in order to indicate to the UE a CELL_DCH configuration. Hence the delay between the transmission of the RRC Connection Request message and the transmission of the RRC Connection Setup message is quite large due to the need of the allocation of the resources between the RNC and the NodeB.

Because in step 2 in figure 1 there is no DCCH available today the only new aspect compared to today's behaviour would be that the Initial Direct Transfer would be able to be mapped to CCCH as well. In order to allow the RNC to link the Initial direct transfer message to the RRC Connection Request message it is necessary to include the same initial UE identity in the new CCCH message as in the RRC Connection Request message.

2.2 Routing NAS message in Early IDT to CN

If the early IDT arrived before the RRC CONNECTION REQUEST, the UTRAN may be able to buffer the early IDT before arrival of the RRC CONNECTION REQUEST. But, the UTRAN does not know when it finally receives the RRC CONNECTION REQUEST after the early IDT. If the RRC CONNECTION REQUEST doesn't ever arrive at the RNC, the RNC needs not to route the early IDT to CN.

In addition, when the UTRAN receive the RRC CONNECTION REQUEST after the early IDT, if the UTRAN reject the RRC connection request, the UTRAN needs not to route the early IDT to CN, either. Thus, in this case routing the early IDT to CN comes to an unnecessary action as well.

Thus, it is recommended that the UTRAN waits until being ready to send the RRC CONNECTION SETUP message before routing the early IDT to CN.

2.3 Unsuccessful Early Transmission of IDT

The confirmation in the RRC Connection Setup message is also used to handle unsuccessful transmission of this early IDT on CCCH and to transmit the normal IDT on DCCH as shown in figure 2. In this figure, UTRAN does not receive the IDT on CCCH before sending RRC CONNECTION SETUP. In this case, UTRAN indicates to the UE that the IDT on CCCH was not correctly received so that the the UE sends the conventional IDT on DCCH after the RRC CONNECTION SETUP COMPLETE message.

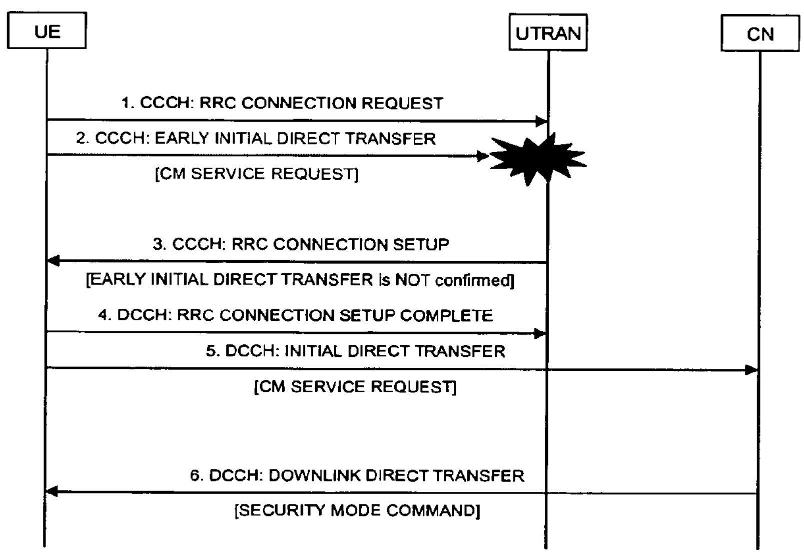

Figure 2. The proposed initial call setup procedure: Unsuccessful

The UE shall not transmit an early IDT after reception of the RRC CONNETION SETUP message. Thus, if UTRAN does not receive the early IDT on CCCH before sending RRC CONNECTION SETUP, the UTRAN indicates by using the RRC CONNECTION SETUP that the early IDT is not confirmed.

In this procedure, since the early IDT failed, call setup delay cannot be reduced by the early IDT. However, there is no additional delay occurred by transmission of the early IDT as well because the early IDT is not transmitted after reception of the RRC CONNETION SETUP message.

2.4 Transmission of Early IDT after Unsuccessful Transmission of RRC CONNECTION REQUEST

2.4.1 In case of timer expiry

If RRC CONNECTION REQUEST is unsuccessfully transmitted and Early IDT is successfully transmitted, the UE will send RRC CONNECTION REQUEST again after T300 expiry. In this case, it is proposed that the UE shall send RRC CONNECTION REQUEST and the early IDT again regardless of successful transfer of the previous early IDT. Thus, UTRAN should ignore the early IDT received before successfully receiving RRC CONNECTION REQUEST.

Furthermore, if both RRC CONNECTION REQUEST and early IDT are unsuccessfully transmitted, the UE shall send RRC CONNECTION REQUEST and the early IDT again after T300 expiry.

Thus, it is proposed whenever a UE sends an RRC CONNECTION REQUEST message, the UE sends an early IDT immediately after sending the RRC CONNECTION REQUEST message.

2.4.1 In case of cell re-selection

If UE preforms cell re-selection after sending RRC CONNECTION REQUEST, UE is required to send the RRC CONNECTION REQUEST again. This UE operation is also applied to the case that the UE preforms cell re-selection after successfully sending RRC CONNECTION REQUEST and the subsequent early IDT.

That means that if the UE preforms cell re-selection after sending RRC CONNECTION REQUEST and the subsequent early IDT, the UE shall send RRC CONNECTION REQUEST and the early IDT again because UE cannot know whether both messages are successfully transmitted or not.

2.5 Handling of Duplicated Early IDT messages

2.5.1 In case of cell-reselection or timer expiry

If the IDT is early transmitted before completion of the RRC connection establishment, whenever an RRC CONNECTION REQUEST message is transmitted due to cell re-selection or timer expiry i.e. the MAC layer indicates successful transmission of an RRC CONNECTION REQUEST message, an early IDT will be transmitted again. In this case, CN may receive duplicated NAS messages e.g. SERIVCE REQUEST message.

However, as sugguested above, if the UTRAN waits until being ready to send the RRC CONNECTION SETUP message before routing the early IDT to CN, duplication of similar Early IDT messages cannot happen before sending the RRC CONNECTION SETUP.

2.5.2 In case of physical failures and invalid messages

After the RRC CONNECTION SETUP message is transmitted, a UE could find out a RL failure of the RRC connection. Also, a UE could receive an invalid RRC CONNECTION SETUP or RRC CONNECTION REJECT message. In this case, the UE will re-try to request a RRC connetion. Thus, an early IDT message will be transmitted again and so the NAS message in the early IDT may be routed to the CN. The CN may be able to found out duplication of the NAS message.

From our perspective, each time a RRC CONNECTION SETUP message is sent as a response to a RRC CONNECTION REQUEST message, a new RRC connection is supposed to be created. If an early IDT is forwarded to the Iu interface and an Iu connection is established, then the Iu connection and the RRC connection are related. In this case, when the RRC connection is released due to a RL failure, the related Iu connection is released also by the RNC.

Therefore, if a new early IDT message is transmitted again due to a physical failure, it is recommended that CN/UTRAN release the previous Iu/RRC connection and then are going to re-establish the Iu/RRC connection according to the new early IDT message transmitted again.

In addition, when the UE will re-try to request a RRC connetion due to reception of an invalid RRC CONNECTION SETUP or RRC CONNECTION REJECT message, an early IDT message will be re-transmitted. However, there is no duplicatin of early IDT message because the Iu connection and the RRC connection are related. That means the network will release an old connection and establish a new connection with a new RRC CONNECTION REQUEST and a subsequent early IDT message. Accordingly, there is no problem.

2.6 Rejection of RRC Connection Request

The UTRAN can reject the RRC Connection Request from the UE. In this case, the UTRAN does not to route the early IDT to CN. Thus, there is no signalling problem.

It is noted that if the UE re-sends an RRC CONNECTION REQUEST message after rejection, then the UE will re-transmit an early IDT.

2.7 Handling of Early IDT in legacy RNC

From a backwards compatibility point of view, the use of the new initial direct transfer message on CCCH on RACH is ignored by any legacy RNC and the conventional Initial Direct transfer message is sent after the transmission of the RRC CONNECTION SETUP COMPLETE message.

The transmission of the conventional Initial direct transfer message will be suppressed by a corresponding indication from the RNC in the RRC Connection Setup message that confirms the correct reception of the Early Initial direct transfer message on the CCCH.

2.8 CS Call Establishment in CELL_PCH and URA_PCH

The early initial direct transfer can be transmitted on CCCH on RACH as well when a CS call establishment is initiated in CELL_PCH or URA_PCH state. In that case Step 1 in figure 1 would contain the Cell Update message, step 3 would contain the Cell Update Confirm message, and step 4 one of the the Radio Bearer Control complete messages.

Instead of using the initial UE identity the U-RNTI will then be used in order to link the Initial direct transfer message sent on the CCCH to the Cell Update message.

3. Structure of the Early IDT message on CCCH

There are some variations of the size of the new Early IDT message depending on which IEs are included in the new IDT on CCCH. If all of optional IEs of the conventional IDT on DCCH are included in the new IDT message on CCCH, the message length could be too large to be transmitted on one RACH message. Since this new IDT is transmitted very earlier than before, some of IEs included in the existing IDT on DCCH could be omitted. We think that the following IEs do not need to be included in new IDT on CCCH any more:

(1) IE 'integrity check info', 'START' & 'Establishment Cause': They do not need to be included in the proposed early IDT message. It is noted that IE 'START' is included in RRC CONNECTION SETUP COMPLETE message or the Cell Update message and IE 'Establishment Cause' is included in RRC CONNECTION REQUEST message and the Cell Update message.

(2) IE 'Measured results on RACH': It does not need to be included in the proposed early IDT message because RRC CONNECTION REQUEST message also includes this IE and the early IDT on CCCH is immediately following RRC CONNECTION REQUEST message or the Cell Update message.

In addition, in order to allow the RNC to link the Early IDT message to the RRC Connection Request message it is necessary to include the same initial UE identity in the Early IDT as in the RRC Connection Request message. It is because the new IDT is transmitted on CCCH, not DCCH. To include the initial UE identity in the Early IDT, there are two options as follow:

Option A: Additional RRC IE 'initial UE identity':

In this case, the UE RRC includes an additional IE 'initial UE identity' in the new IDT message. Thus, RNC identifies the UE sending new IDT on CCCH by checking the RRC IE 'initial UE identity' included in RRC IDT message.

Option B: Use of NAS IE 'mobilty identity'

RNC could identify the UE sending a new Early IDT on CCCH by checking NAS IE 'mobilty identity' of CM SERVICE REQEUST included in the new Early IDT. Thus, the new early IDT does not need to include the additional IE 'initial UE identity' in the new IDT message. However, in this case RNC needs to decode the CN message. It should be also assumed that IE 'Initial UE identity' in RRC CONNECTION REQUEST is always similar to IE 'mobilty identity' in the new IDT on CCCH.

We think that some of IEs existing in the current IDT on DCCH are not so necessary in the new IDT on CCCH. Thus, removing (1) and (2) listed above seems to be good for the new IDT message. And if the assumptions of the option B is agreeable, the new IDT message can be further optimized. It is noted that in case of the option A, a new larger TB size on RACH than 240 bits needs to be defined.

The new Early IDT based on the sugguestion above is shown below.

10.2.x EARLY INITIAL DIRECT TRANSFER

This message is used to initiate a signalling connection immediately after the RRC CONNECTION SETUP message or the CELL_UPDATE message based on indication from the upper layers.

RLC-SAP: TM

Logical channel: CCCH

Direction: UE -> UTRAN

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
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>Initial UE identity			Initial UE identity 10.3.3.15	This IE is indentical with IE 'initial UE identity' in the RRC CONNECTION REQUEST message transmitted right before this message.	REL-7
>U-RNTI			U-RNTI 10.3.3.47	This IE is indentical with IE 'U-RNTI' in the CELL UPDATE message transmitted right before this message.	REL-7
PLMN identity	OP		PLMN identity 10.3.1.11	This IE indicates the PLMN to which the UE requests the signalling connection to be established.	REL-7
CN information elements					
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Intra Domain NAS Node Selector	MP		Intra Domain NAS Node Selector 10.3.1.6		REL-7
NAS message	MP		NAS message 10.3.1.8		REL-7
MBMS joined information	OP				REL-7
>P-TMSI	OP		P-TMSI (GSM-MAP) 10.3.1.13		REL-7

4. Analysis of Improved Call Setup Delay

According to Tables in [1], cumulative delay of the current CS Voice call setup from SIB reading to reception of response of CM SERVICE REQUEST seems to be 810 ms for CELL_DCH UE and 470 ms for CELL_FACH UE. In [1], delay between transmission of RRC CONNECTION REQUEST and reception of RRC CONNECTION SETUP takes 200 ms for CELL_DCH UE and 60 ms for CELL_FACH UE. Since T300 timer is set to 4 sec in 34.108, after sending RRC CONNECTION REQUEST, in the worst case UE may have to wait for max. 4 sec until receiving RRC CONNECTION SETUP.

Since transmission of RRC CONNECTION REQUEST on RACH takes 40 ms in Table 1, it is assumed that transmission of the proposed Early IDT on RACH also takes about 40 ms. If it's true, in the normal case UE can successfully transmit the Early IDT in the gap between sending RRC CONNECTION REQUEST and receiving RRC CONNECTION SETUP.

It is noted that if the UE successfully received RRC CONNECTION SETUP before sending the Early IDT on RACH, the UE will immediately abort RACH transmission of the Early IDT and starts transmission of RRC CONNECTION SETUP COMPLETE on DCCH. In this case, since UE failed to transmit the Early IDT on CCCH, the UE will start transmission of the normal IDT on DCCH as usual after RRC CONNECTION SETUP COMPLETE.

If UE transmitted the Early IDT including CM SERVICE REQUEST and the network successfully received it on CCCH, then CN will send a first NAS message to the UE. According to Table 3/4, delay between transmission of CM SERVICE REQUEST and reception of the first NAS message from CN would take 200 ms. If the Early IDT is applied, the interval between transmission of CM SERVICE REQUEST and reception of the first NAS message from CN will be overlapped in time with the interval between transmission of RRC CONNECTION REQUEST and reception of RRC CONNECTION SETUP. Thus, the Early IDT can save about 200 ms according to Tables below.

It is noted that if the UTRAN earlier receives the first NAS message from CN, e.g. Security mode command or Authentication Request, than receiving RRC CONNECTION SETUP COMPLETE, UTRAN could delay transferring the first NAS message to UE until successful reception of RRC CONNECTION SETUP COMPLETE.

Table 1: RRC connection establishment in CELL_DCH state [1]

Message/procedure	Sender/receiver	Delay	Cumulative Delay	Comments	Reference time point in Figure 6.1.1-1
SIB7 reading time	NA	70 ms	70 ms	Highly depending on UTRAN SIB7 scheduling	t_0
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RRC connection completed	UE/RNC	300 ms	610 ms	Includes synchronisation delay, reduced in Rel6	t_2
RRC Connection setup in Total			610 ms		T_0-t_2

Table 2: RRC connection establishment in CELL_FACH state [1]

Message/procedure	Sender/receiver	Delay	Cumulative Delay	Comments	Reference time point in Figure 6.1.1-2
SIB7 reading time	NA	70 ms	70 ms	Highly depending on UTRAN SIB7 scheduling	t_0
RRC connection request	UE/RNC	40 ms	110 ms		
RRC connection setup	RNC/UE	60 ms	170 ms	no predefined/default configuration	t_1
RRC connection completed	UE/RNC	100 ms	270 ms		t_2
RRC Connection setup in Total			270 ms		T_0-t_2

Table 3: CS Voice call setup, UE in CELL_DCH state in the current scheme (3.4kbps for SRBs) [1]

Message/procedure	Sender/receiver	Delay	Cumulative Delay	Comments	Reference time point in Figure 6.2.1-1
CM service request	UE/CS CN	200 ms	200 ms	Includes authentication delays	t_2
Security mode command	RNC/UE	100 ms	300 ms		t_3
Security mode Command Completed	UE/RNC	200 ms	500 ms		t_3
Setup	UE/CS CN	150 ms	650 ms		t_4
Call proceeding	CS CN/UE	100 ms	750 ms		t_7
Radio bearer setup	RNC/UE	200 ms	950 ms	UTRAN resource reservation and, RL reconfiguration delays	t_8
Radio bearer setup completed	UE/RNC	400 ms	1350 ms	Synchronous reconfiguration	t_9
Alerting	CS CN/UE	250 ms	1600 ms		t_{10}
CS voice Call setup delay			1600 ms		T_1-t_2
Total from Idle			2210 ms		T_1-T_0

Table 4: CS Voice call setup, UE in CELL_FACH state in the current scheme [1]

Message/procedure	Sender/receiver	Delay	Cumulative Delay	Comments	Reference time point in Figure 6.2.1-1
CM service request	UE/CS CN	200 ms	200 ms	Includes authentication delays	t2
Security mode command	RNC/UE	100 ms	300 ms		t3
Security mode Command Completed	UE/RNC	200 ms	500 ms		t3
Setup	UE/CS CN	150 ms	650 ms		t4
Call proceeding	CS CN/UE	100 ms	750 ms		t7
Radio bearer setup	RNC/UE	200 ms	950 ms	UTRAN resource reservation and, RL reconfiguration delays	t8
Radio bearer setup completed	UE/RNC	300 ms	1250 ms	asynchronous reconfiguration	t9
Alerting	CS CN/UE	250 ms	1500 ms		t10
CS voice Call setup delay			1500 ms		T_1-t_2

Total from Idle			1770 ms		T_1-T_0

5. Conclusion

It is proposed that section 2 above is captured in TR 25.815 [1]. In addition, a CR to 25.331 [2] is proposed to be agreed for R7.

Reference

[1] 3GPP TR 25.815: Signalling enhancements for Circuit-Switched (CS) and Packet-Switched (PS) Connections; Analyses and Recommendations

[2] R2-061318, Proposed CR on 25.331 on Introduction of Early IDT, LG Electronics Inc.

CR-Form-v7.1

CHANGE REQUEST

⌘	25.331 CR -	⌘ rev -	⌘	Current version:	7.0.0	⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: | UICC apps⌘ [ ] ME [X] Radio Access Network [X] Core Network [ ]

Title:	⌘ Introduction of early IDT		
Source:	⌘ LG Electronics Inc.		
Work item code:	⌘ RANimp-DelayOpt	***Date:*** ⌘	
Category:	⌘ **B**	***Release:*** ⌘	Rel-7
	Use <u>one</u> of the following categories: ***F** (correction)* ***A** (corresponds to a correction in an earlier release)* ***B** (addition of feature),* ***C** (functional modification of feature)* ***D** (editorial modification)* Detailed explanations of the above categories can be found in 3GPP <u>TR 21.900</u>.	*Use <u>one</u> of the following releases:* *Ph2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *Rel-4 (Release 4)* *Rel-5 (Release 5)* *Rel-6 (Release 6)* *Rel-7 (Release 7)*	

Reason for change:	⌘
Summary of change:	⌘
Consequences if not approved:	⌘

		Y	N		
Clauses affected:	⌘				
Other specs affected:	⌘		X	Other core specifications	⌘
		X		Test specifications	
			X	O&M Specifications	
Other comments:	⌘				

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at <u>http://www.3gpp.org/specs/CR.htm</u>. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under <u>ftp://ftp.3gpp.org/specs/</u> For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

8.1.8 Initial Direct transfer

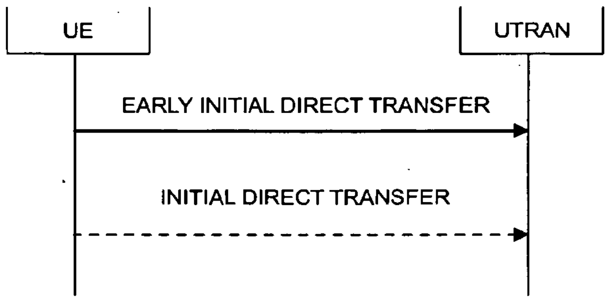

Figure 8.1.8-x: Initial Direct transfer in the uplink, normal flow

8.1.8.1 General

The initial direct transfer procedure is used in the uplink to establish a signalling connection. It is also used to carry an initial upper layer (NAS) message over the radio interface.

8.1.8.2 Initiation of Initial direct transfer procedure in the UE

In the UE, the initial direct transfer procedure shall be initiated, when the upper layers request establishment of a signalling connection. This request also includes a request for the transfer of a NAS message.

Upon initiation of the initial direct transfer procedure the UE shall:

1> set the variable ESTABLISHMENT_CAUSE to the cause for establishment indicated by upper layers.

Upon initiation of the initial direct transfer procedure when the UE is in idle mode, the UE shall:

1> perform an RRC connection establishment procedure, according to subclause 8.1.3;

1> in the RRC connection establishment procedure, whenever the MAC layer indicates successful transmission of an RRC CONNECTION REQUEST message according to subclause 8.1.3:

2> transmit an EARLY INITIAL DIRECT TRANSFER message according to subclause 8.1.8.x2.

1> if the RRC connection establishment procedure was not successful:

2> if the establishment cause for the failed RRC connection establishment was set to "MBMS reception" and a different cause value is stored in the variable "ESTABLISHMENT_CAUSE":

3> UE-AS (RRC) initiates a new RRC connection establishment procedure, using the establishment cause as contained in the variable ESTABLISHMENT_CAUSE.

2> otherwise: /* indention changed*/

3> indicate failure to establish the signalling connection to upper layers and end the procedure.

1> when the RRC connection establishment procedure is completed successfully:

2> if IE "Early IDT Confirmation" of the received RRC CONNECTION SETUP message in the RRC connection establishment procedure is set to "Confirmed":

3> confirm the establishment of a signalling connection to upper layers; and

3> add the signalling connection with the identity indicated by the IE "CN domain identity" in the variable ESTABLISHED_SIGNALLING_CONNECTIONS.

3> the procedure ends.

2> otherwise:

3> continue with the initial direct transfer procedure according to subclause 8.1.8.y2.

Upon initiation of the initial direct transfer procedure when the UE is in CELL_PCH or URA_PCH state, the UE shall:

1> perform a cell update procedure, according to subclause 8.3.1, using the cause "uplink data transmission";

1> in the cell update procedure, whenever the MAC layer indicates successful transmission of a CELL UPDATE message according to subclause 8.3.1:

2> transmit an EARLY INITIAL DIRECT TRANSFER message according to subclause 8.1.8.x2.1> when the cell update procedure completed successfully:

2> if IE "Early IDT Confirmation" of the received CELL UPDATE CONFIRM message in the cell update procedure is set to "Confirmed":

3> confirm the establishment of a signalling connection to upper layers; and

3> add the signalling connection with the identity indicated by the IE "CN domain identity" in the variable ESTABLISHED_SIGNALLING_CONNECTIONS;

3> the procedure ends.

2> otherwise:

3> continue with the initial direct transfer procedure according to subclause 8.1.8.y2.

[Editor's NOTE: the sentences below move from 8.1.8.y2 of this CR without any modification only for replacement of the sentences.]

When not stated otherwise elsewhere, the UE may also initiate the initial direct transfer procedure when another procedure is ongoing, and in that case the state of the latter procedure shall not be affected.

A new signalling connection request may be received from upper layers during transition to idle mode. In those cases, from the time of the indication of release to upper layers until the UE has entered idle mode, any such upper layer request to establish a new signalling connection shall be queued. This request shall be processed after the UE has entered idle mode.

8.1.8.x1 EARLY INITIAL DIRECT TRANSFER message contents to set

The UE shall, in the EARLY INITIAL DIRECT TRANSFER message:

1> if an assigned U-RNTI is stored in the variable U_RNTI:

2> set the CHOICE "UE identity" to "U-RNTI" with the value of the variable U_RNTI.

1> otherwise:

2> set the CHOICE "UE identity" to "Initial UE identity" with the value of the variable INITIAL_UE_IDENTITY.

1> set the IE "NAS message" as received from upper layers; and

1> set the IE "CN domain identity" as indicated by the upper layers; and

1> set the IE "Intra Domain NAS Node Selector" as follows:

2> derive the IE "Intra Domain NAS Node Selector" from TMSI/PMTSI, IMSI, or IMEI; and

2> provide the coding of the IE "Intra Domain NAS Node Selector" according to the following priorities:

1. derive the routing parameter for IDNNS from TMSI (CS domain) or PTMSI (PS domain) whenever a valid TMSI/PTMSI is available;
2. base the routing parameter for IDNNS on IMSI when no valid TMSI/PTMSI is available;

3. base the routing parameter for IDNNS on IMEI only if no (U)SIM is inserted in the UE.

1> if the RRC connection exists:

2> if the UE, on the existing RRC connection, has received a dedicated RRC message containing the IE "Primary PLMN Identity" in the IE "CN Information Info":

3> set the IE "PLMN identity" in the INITIAL DIRECT TRANSFER message to the latest PLMN information received via dedicated RRC signalling. If NAS has indicated the PLMN towards which a signalling connection is requested, and this PLMN is not in agreement with the latest PLMN information received via dedicated RRC signalling, then the initial direct transfer procedure shall be aborted, and NAS shall be informed.

2> if the UE, on the existing RRC connection, has not received a dedicated RRC message containing the IE "CN Information Info" , and if the IE "Multiple PLMN List" was broadcast in the cell where the current RRC connection was established:

3> set the IE "PLMN identity" in the INITIAL DIRECT TRANSFER message to the PLMN chosen by higher layers [5, 25] amongst the PLMNs in the IE "Multiple PLMN List" broadcast in the cell where the RRC connection was established.

1> otherwise:

2> set the IE "PLMN identity" in the INITIAL DIRECT TRANSFER message to the PLMN chosen by higher layers [5, 25] amongst the PLMNs in the IE "Multiple PLMN List" broadcast in the cell where the RRC connection was established.

1> if the IE "Activated service list" within variable MBMS_ACTIVATED_SERVICES includes one or more MBMS services with the IE "Service type" set to "Multicast" and;

1> if the IE "CN domain identity" as indicated by the upper layers is set to "CS domain" and;

1> if the variable ESTABLISHED_SIGNALLING_CONNECTIONS does not include the CN domain identity 'PS domain':

2> include the IE "MBMS joined information";

2> include the IE "P-TMSI" within the IE "MBMS joined information" if a valid PTMSI is available.

8.1.8.x2 Transmission of EARLY INITIAL DIRECT TRANSFER message in the UE

The UE shall:

1> set the IEs in an EARLY INITIAL DIRECT TRANSFER message according to subclause 8.1.8.x1;

1> perform the mapping of the Access Class to an Access Service Class as specified in subclause 8.5.13 and apply the given Access Service Class when accessing the RACH;

1> submit the EARLY INITIAL DIRECT TRANSFER message to lower layers for transmission on the uplink CCCH.

8.1.8.y1 INITIAL DIRECT TRANSFER message contents to setThe UE shall, in the INITIAL DIRECT TRANSFER message:

1> set the IE "NAS message" as received from upper layers; and

1> set the IE "CN domain identity" as indicated by the upper layers; and

1> set the IE "Intra Domain NAS Node Selector" as follows:

2> derive the IE "Intra Domain NAS Node Selector" from TMSI/PMTSI, IMSI, or IMEI; and

2> provide the coding of the IE "Intra Domain NAS Node Selector" according to the following priorities:

1. derive the routing parameter for IDNNS from TMSI (CS domain) or PTMSI (PS domain) whenever a valid TMSI/PTMSI is available;

2. base the routing parameter for IDNNS on IMSI when no valid TMSI/PTMSI is available;

3. base the routing parameter for IDNNS on IMEI only if no (U)SIM is inserted in the UE.

1> if the UE, on the existing RRC connection, has received a dedicated RRC message containing the IE "Primary PLMN Identity" in the IE "CN Information Info":

2> set the IE "PLMN identity" in the INITIAL DIRECT TRANSFER message to the latest PLMN information received via dedicated RRC signalling. If NAS has indicated the PLMN towards which a signalling connection is requested, and this PLMN is not in agreement with the latest PLMN information received via dedicated RRC signalling, then the initial direct transfer procedure shall be aborted, and NAS shall be informed.

1> if the UE, on the existing RRC connection, has not received a dedicated RRC message containing the IE "CN Information Info" , and if the IE "Multiple PLMN List" was broadcast in the cell where the current RRC connection was established:

2> set the IE "PLMN identity" in the INITIAL DIRECT TRANSFER message to the PLMN chosen by higher layers [5, 25] amongst the PLMNs in the IE "Multiple PLMN List" broadcast in the cell where the RRC connection was established.

1> if the IE "Activated service list" within variable MBMS_ACTIVATED_SERVICES includes one or more MBMS services with the IE "Service type" set to "Multicast" and;

1> if the IE "CN domain identity" as indicated by the upper layers is set to "CS domain" and;

1> if the variable ESTABLISHED_SIGNALLING_CONNECTIONS does not include the CN domain identity 'PS domain':

2> include the IE "MBMS joined information";

2> include the IE "P-TMSI" within the IE "MBMS joined information" if a valid PTMSI is available.

1> if the variable ESTABLISHMENT_CAUSE_ is initialised:

2> set the IE "Establishment cause" to the value of the variable ESTABLISHMENT_CAUSE;

2> clear the variable ESTABLISHMENT_CAUSE.

1> calculate the START according to subclause 8.5.9 for the CN domain as set in the IE "CN Domain Identity"; and

1> include the calculated START value for that CN domain in the IE "START".

8.1.8.y2 Transmission of INITIAL DIRECT TRANSFER message in the UE

The UE shall:

1> transmit the INITIAL DIRECT TRANSFER message on the uplink DCCH using AM RLC on signalling radio bearer RB3;

1> when the INITIAL DIRECT TRANSFER message has been submitted to lower layers for transmission:

2> confirm the establishment of a signalling connection to upper layers; and

2> add the signalling connection with the identity indicated by the IE "CN domain identity" in the variable ESTABLISHED_SIGNALLING_CONNECTIONS.

1> when the successful delivery of the INITIAL DIRECT TRANSFER message has been confirmed by RLC:

2> the procedure ends.

8.1.8.2a RLC re-establishment or inter-RAT change

If a re-establishment of the transmitting side of the RLC entity on signalling radio bearer RB3 occurs before the successful delivery of the INITIAL DIRECT TRANSFER message has been confirmed by RLC, the UE shall:

1> retransmit the INITIAL DIRECT TRANSFER message on the uplink DCCH using AM RLC on signalling radio bearer RB3.

If an Inter-RAT handover from UTRAN procedure occurs after the RRC CONNECTION REJECT message was received, before the successful delivery of the EARLY INITIAL DIRECT TRANSFER message has been confirmed by the CELL UPDATE CONFIRM message or before the successful delivery of the INITIAL DIRECT TRANSFER message has been confirmed by RLC, for messages with the IE "CN domain identity" set to "CS domain", the UE shall:

1> retransmit the NAS message as specified in subclause 8.3.7.4.8.1.8.2ab Inter-RAT handover from UTRAN to GERAN *Iu mode*

If an Inter-RAT handover from UTRAN to GERAN *Iu mode* occurs after the RRC CONNECTION REJECT message was received, before the successful delivery of the EARLY INITIAL DIRECT TRANSFER message has been confirmed by the CELL UPDATE CONFIRM message or before the successful delivery of the INITIAL DIRECT TRANSFER message has been confirmed by RLC, for messages for all CN domains, the UE shall:

1> retransmit the NAS message as specified in subclause 8.3.7.4.8.1.8.2b Abortion of signalling connection establishment

If the UE receives a request from upper layers to release (abort) the signalling connection for the CN domain for which the initial direct transfer procedure is ongoing, the UE shall:

1> if the UE has not yet entered UTRA RRC connected mode:

2> abort the RRC connection establishment procedure as specified in subclause 8.1.3;

the procedure ends.

8.1.8.3 Reception of INITIAL DIRECT TRANSFER message by the UTRAN

On reception of the EARLY INITIAL DIRECT TRANSFER message, the UTRAN should:

1> in case that the EARLY INITIAL DIRECT TRANSFER message is received during the RRC connection establishment procedure:

2> if the RRC CONNECTION REQUEST message is received before the reception of the EARLY INITIAL DIRECT TRANSFER message and an RRC CONNECTION SETUP message will be transmitted in response to the RRC CONNECTION REQUEST message; and

2> if the value of IE "Initial UE identity" contained in the RRC CONNECTION REQUEST message is equal to the value of IE "Initial UE identity" contained in the the EARLY INITIAL DIRECT TRANSFER message:

3> routes the NAS message in EARLY INITIAL DIRECT TRANSFER message using the IE "CN Domain Identity". UTRAN may also use the IE "Intra Domain NAS Node Selector" and the IE "PLMN identity" for routing among the CN nodes for the addressed CN domain;

3> set the IE "Early IDT Confirmation" of the RRC CONNECTION SETUP message to "Confirmed";

3> transmit the RRC CONNECTION SETUP message according to subclause 8.1.3.

2> otherwise:

3> ignore the EARLY INITIAL DIRECT TRANSFER message;

3> if an RRC CONNECTION SETUP message will be transmitted in response to the RRC CONNECTION REQUEST message:

4> set the IE "Early IDT Confirmation" of the RRC CONNECTION SETUP message to "Not Confirmed" and transmit the RRC CONNECTION SETUP message according to subclause 8.1.3.

1> in case that the EARLY INITIAL DIRECT TRANSFER message is received during the cell update procedure:

2> if the CELL UPDATE message is received before the reception of the EARLY INITIAL DIRECT TRANSFER message and an CELL UPDATE CONFIRM message will be transmitted in response to the CELL UPDATE message; and

2> if the value of IE "U-RNTI" contained in the CELL UPDATE message is equal to the value of IE "U-RNTI" contained in the the EARLY INITIAL DIRECT TRANSFER message:

3> routes the NAS message in EARLY INITIAL DIRECT TRANSFER message using the IE "CN Domain Identity". UTRAN may also use the IE "Intra Domain NAS Node Selector" and the IE "PLMN identity" for routing among the CN nodes for the addressed CN domain;

3> set the IE "Early IDT Confirmation" of the CELL UPDATE CONFIRM message to "Confirmed";

3> transmit the CELL UPDATE CONFIRM message according to subclause 8.3.1.

2> otherwise:

3> ignore the EARLY INITIAL DIRECT TRANSFER message;

3> set the IE "Early IDT Confirmation" of the CELL UPDATE CONFIRM message to "Not Confirmed" and transmit the CELL UPDATE CONFIRM message according to subclause 8.3.1.

On reception of the INITIAL DIRECT TRANSFER message the NAS message should be routed using the IE "CN Domain Identity". UTRAN may also use the IE "Intra Domain NAS Node Selector" and the IE "PLMN identity" for routing among the CN nodes for the addressed CN domain.

If no signalling connection exists towards the chosen node, then a signalling connection is established.

When the UTRAN receives an EARLY INITIAL DIRECT TRANSFER message or an INITIAL DIRECT TRANSFER message, it shall not affect the state of any other ongoing RRC procedures, when not stated otherwise elsewhere.

The UTRAN should:

1> set the START value for the CN domain indicated in the IE "CN domain identity" to the value of the IE "START".

--- Omitted Sections ---

10.2.8 CELL UPDATE CONFIRM

This message confirms the cell update procedure and can be used to reallocate new RNTI information for the UE valid in the new cell.

RLC-SAP: UM

Logical channel: CCCH or DCCH

Direction: UTRAN→UE

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
Message Type	MP		Message Type		
UE Information Elements					
U-RNTI	CV-*CCCH*		U-RNTI 10.3.3.47		
RRC transaction identifier	MP		RRC transaction identifier 10.3.3.36		
Integrity check info	CH		Integrity check info 10.3.3.16		
Integrity protection mode info	OP		Integrity protection mode info	The UTRAN should not include this IE unless it is	

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
			10.3.3.19	performing an SRNS relocation or a cell reselection from GERAN *Iu mode*	
Ciphering mode info	OP		Ciphering mode info 10.3.3.5	The UTRAN should not include this IE unless it is performing either an SRNS relocation or a cell reselection from GERAN *Iu mode*, and a change in ciphering algorithm.	
Activation time	MD		Activation time 10.3.3.1	Default value is "now"	
New U-RNTI	OP		U-RNTI 10.3.3.47		
New C-RNTI	OP		C-RNTI 10.3.3.8		
New DSCH-RNTI	OP		DSCH-RNTI 10.3.3.9a	Should not be set in FDD. If received, the UE should ignore it	
New H-RNTI	OP		H-RNTI 10.3.3.14a		REL-5
New Primary E-RNTI	OP		E-RNTI 10.3.3.10a		REL-6
New Secondary E-RNTI	OP		E-RNTI 10.3.3.10a		REL-6
RRC State Indicator	MP		RRC State Indicator 10.3.3.35a		
UTRAN DRX cycle length coefficient	OP		UTRAN DRX cycle length coefficient 10.3.3.49		
RLC re-establish indicator (RB2, RB3 and RB4)	MP		RLC re-establish indicator 10.3.3.35	Should not be set to TRUE if IE "Downlink counter synchronisation info" is included in message.	
RLC re-establish indicator (RB5 and upwards)	MP		RLC re-establish indicator 10.3.3.35	Should not be set to TRUE if IE "Downlink counter synchronisation info" is included in message.	
Early IDT Confirmation	MP		Enumerated (Confirmed, Not Confirmed)		REL-7
CN Information Elements					
CN Information info	OP		CN Information info 10.3.1.3		
UTRAN Information Elements					
URA identity	OP		URA identity 10.3.2.6		
RB information elements					
RB information to release list	OP	1 to <maxRB>			

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
>RB information to release	MP		RB information to release 10.3.4.19		
RB information to reconfigure list	OP	1 to <maxRB>			
>RB information to reconfigure	MP		RB information to reconfigure 10.3.4.18		
RB information to be affected list	OP	1 to <maxRB>			
>RB information to be affected	MP		RB information to be affected 10.3.4.17		
Downlink counter synchronisation info	OP				
>RB with PDCP information list	OP	1 to <maxRBallRABs>			
>>RB with PDCP information	MP		RB with PDCP information 10.3.4.22	This IE is needed for each RB having PDCP in the case of lossless SRNS relocation	
	OP				REL-5
>>PDCP context relocation info	OP		PDCP context relocation info 10.3.4.1a	This IE is needed for each RB having PDCP and performing PDCP context relocation	REL-5
PDCP ROHC target mode	OP		PDCP ROHC target mode 10.3.4.2a		REL-5
TrCH Information Elements					
Uplink transport channels					
UL Transport channel information common for all transport channels	OP		UL Transport channel information common for all transport channels 10.3.5.24		
Deleted TrCH information list	OP	1 to <maxTrCH>			
>Deleted UL TrCH information	MP		Deleted UL TrCH information 10.3.5.5		
Added or Reconfigured TrCH information list	OP	1 to <maxTrCH>			
>Added or Reconfigured UL TrCH information	MP		Added or Reconfigured UL TrCH information 10.3.5.2		
Downlink transport channels					
DL Transport channel	OP		DL Transport		

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
information common for all transport channels			channel information common for all transport channels 10.3.5.6		
Deleted TrCH information list	OP	1 to <maxTrCH>			
>Deleted DL TrCH information	MP		Deleted DL TrCH information 10.3.5.4		
Added or Reconfigured TrCH information list	OP	1 to <maxTrCH>			
>Added or Reconfigured DL TrCH information	MP		Added or Reconfigured DL TrCH information 10.3.5.1		
PhyCH information elements					
Frequency info	OP		Frequency info 10.3.6.36		
Uplink radio resources					
Maximum allowed UL TX power	MD		Maximum allowed UL TX power 10.3.6.39	Default value is the existing maximum UL TX power	
Uplink DPCH info	OP		Uplink DPCH info 10.3.6.88.		
E-DCH Info	OP		E-DCH Info 10.3.6.97		REL-6
Downlink radio resources					
Downlink HS-PDSCH Information	OP		Downlink HS_PDSCH Information 10.3.6.23a		REL-5
Downlink information common for all radio links	OP		Downlink information common for all radio links 10.3.6.24		
Downlink information per radio link list	OP	1 to <maxRL>		Send downlink information for each radio link to be set-up	
>Downlink information for each radio link	MP		Downlink information for each radio link 10.3.6.27		
MBMS PL Service Restriction Information	OP		Enumerated (TRUE)	Absence means that on the MBMS Preferred Layer (PL) no restrictions apply concerning the use of non-MBMS services i.e. the PL is not congested	REL-6

Condition	Explanation
CCCH	This IE is mandatory present when CCCH is used and ciphering is not required and not needed otherwise.

--- **Omitted Sections** ---

10.2.x EARLY INITIAL DIRECT TRANSFER

This message is used to initiate a signalling connection immediately after the RRC CONNECTION SETUP message or the CELL_UPDATE message based on indication from the upper layers.

RLC-SAP: TM

Logical channel: CCCH

Direction: UE -> UTRAN

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
Message Type	MP		Message Type		REL-7
UE information elements					
CHOICE *UE identity*	MP				
>Initial UE identity			Initial UE identity 10.3.3.15	This IE is indentical with IE 'initial UE identity' in the RRC CONNECTION REQUEST message transmitted right before this message.	REL-7
>U-RNTI			U-RNTI 10.3.3.47	This IE is indentical with IE 'U-RNTI' in the CELL UPDATE message transmitted right before this message.	REL-7
PLMN identity	OP		PLMN identity 10.3.1.11	This IE indicates the PLMN to which the UE requests the signalling connection to be established.	REL-7
CN information elements					
CN domain identity	MP		CN domain identity 10.3.1.1		REL-7
Intra Domain NAS Node Selector	MP		Intra Domain NAS Node Selector 10.3.1.6		REL-7
NAS message	MP		NAS message 10.3.1.8		REL-7
MBMS joined information	OP				REL-7
>P-TMSI	OP		P-TMSI (GSM-MAP) 10.3.1.13		REL-7

--- **Omitted Sections** ---

10.2.40 RRC CONNECTION SETUP

This message is used by the network to accept the establishment of an RRC connection for a UE, including assignment of signalling link information, transport channel information and optionally physical channel information.

RLC-SAP: UM

Logical channel: CCCH

Direction: UTRAN → UE

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
Message Type	MP		Message Type		
UE Information Elements					
Initial UE identity	MP		Initial UE identity 10.3.3.15		
RRC transaction identifier	MP		RRC transaction identifier 10.3.3.36		
Activation time	MD		Activation time 10.3.3.1	Default value is "now"	
New U-RNTI	MP		U-RNTI 10.3.3.47		
New C-RNTI	OP		C-RNTI 10.3.3.8		
New H-RNTI	OP		H-RNTI 10.3.3.14a		REL-6
New Primary E-RNTI	OP		E-RNTI 10.3.3.10a		REL-6
New Secondary E-RNTI	OP		E-RNTI 10.3.3.10a		REL-6
RRC State Indicator	MP		RRC State Indicator 10.3.3.35a		
UTRAN DRX cycle length coefficient	MP		UTRAN DRX cycle length coefficient 10.3.3.49		
Capability update requirement	MD		Capability update requirement 10.3.3.2	Default value is defined in subclause 10.3.3.2	
Early IDT Confirmation	MP		Enumerated (Confirmed, Not Confirmed)		REL-77
CHOICE *specification mode*	MP				REL-5
>Complete specification					
RB Information Elements					
>>Signalling RB information to setup list	MP	3 to 4			
>>>Signalling RB information to setup	MP		Signalling RB information to setup 10.3.4.24		
TrCH Information Elements					
Uplink transport channels					
>>UL Transport channel information common for all transport channels	OP		UL Transport channel information common for all transport		

05451

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
			channels 10.3.5.24		
>>Added or Reconfigured TrCH information list	MP	1 to <maxTrCH>		Although this IE is not required when the IE "RRC state indicator" is set to "CELL_FACH", need is MP to align with ASN.1	
	OP				REL-4
>>>Added or Reconfigured UL TrCH information	MP		Added or Reconfigured UL TrCH information 10.3.5.2		
Downlink transport channels					
>>DL Transport channel information common for all transport channels	OP		DL Transport channel information common for all transport channels 10.3.5.6		
>>Added or Reconfigured TrCH information list	MP	1 to <maxTrCH>		Although this IE is not required when the IE "RRC state indicator" is set to "CELL_FACH", need is MP to align with ASN.1	
	OP				REL-4
>>>Added or Reconfigured DL TrCH information	MP		Added or Reconfigured DL TrCH information 10.3.5.1		
>Preconfiguration					REL-5
>>CHOICE *Preconfiguration mode*	MP				REL-5
>>>Predefined configuration identity	MP		Predefined configuration identity 10.3.4.5		REL-5
>>>Default configuration					REL-5
>>>>Default configuration mode	MP		Enumerated (FDD, TDD)	Indicates whether the FDD or TDD version of the default configuration shall be used	REL-5
>>>>Default configuration identity	MP		Default configuration identity 10.3.4.0		REL-5
PhyCH information elements					
Frequency info	OP		Frequency info 10.3.6.36		
Uplink radio resources					
Maximum allowed UL TX power	MD		Maximum allowed UL TX power 10.3.6.39	Default value is the existing maximum UL TX power	
Uplink DPCH info	OP		Uplink DPCH info		

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
			10.3.6.88		
E-DCH Info	OP		E-DCH Info 10.3.6.97		REL-6
Downlink radio resources					
Downlink HS-PDSCH Information	OP		Downlink HS-PDSCH information 10.3.6.23a		REL-6
Downlink information common for all radio links	OP		Downlink information common for all radio links 10.3.6.24		
Downlink information per radio link list	OP	1 to <MaxRL>		Send downlink information for each radio link to be set-up	
>Downlink information for each radio link	MP		Downlink information for each radio link 10.3.6.27		

CR-Form-v7.1

CHANGE REQUEST

⌘	25.331 CR -	⌘ rev	-	⌘	Current version:	7.0.0	⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ [ ] ME [X] Radio Access Network [X] Core Network [ ]

Title:	⌘ Introduction of early IDT		
Source:	⌘ LG Electronics Inc.		
Work item code:	⌘ RANimp-DelayOpt	***Date:*** ⌘	
Category:	⌘ **B**	***Release:*** ⌘	Rel-7
	Use one of the following categories: ***F*** *(correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.	*Use one of the following releases:* *Ph2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *Rel-4 (Release 4)* *Rel-5 (Release 5)* *Rel-6 (Release 6)* *Rel-7 (Release 7)*	

Reason for change:	⌘
Summary of change:	⌘
Consequences if not approved:	⌘

Clauses affected:	⌘				
		Y	N		
Other specs affected:	⌘		X	Other core specifications	⌘
		X		Test specifications	
			X	O&M Specifications	
Other comments:	⌘				

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

8.1.8 Initial Direct transfer

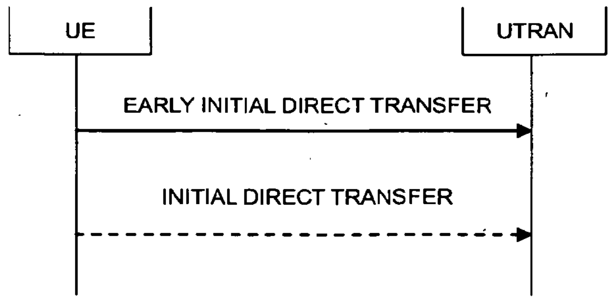

Figure 8.1.8-x: Initial Direct transfer in the uplink, normal flow

8.1.8.1 General

The initial direct transfer procedure is used in the uplink to establish a signalling connection. It is also used to carry an initial upper layer (NAS) message over the radio interface.

8.1.8.2 Initiation of Initial direct transfer procedure in the UE

In the UE, the initial direct transfer procedure shall be initiated, when the upper layers request establishment of a signalling connection. This request also includes a request for the transfer of a NAS message.

Upon initiation of the initial direct transfer procedure the UE shall:

1> set the variable ESTABLISHMENT_CAUSE to the cause for establishment indicated by upper layers.

Upon initiation of the initial direct transfer procedure when the UE is in idle mode, the UE shall:

1> perform an RRC connection establishment procedure, according to subclause 8.1.3;

1> in the RRC connection establishment procedure, whenever the MAC layer indicates successful transmission of an RRC CONNECTION REQUEST message according to subclause 8.1.3:

2> transmit an EARLY INITIAL DIRECT TRANSFER message according to subclause 8.1.8.x2.

1> if the RRC connection establishment procedure was not successful:

2> if the establishment cause for the failed RRC connection establishment was set to "MBMS reception" and a different cause value is stored in the variable "ESTABLISHMENT_CAUSE":

3> UE-AS (RRC) initiates a new RRC connection establishment procedure, using the establishment cause as contained in the variable ESTABLISHMENT_CAUSE.

2> otherwise: /* indention changed*/

3> indicate failure to establish the signalling connection to upper layers and end the procedure.

1> when the RRC connection establishment procedure is completed successfully:

2> if IE "Early IDT Confirmation" of the received RRC CONNECTION SETUP message in the RRC connection establishment procedure is set to "Confirmed":

3> confirm the establishment of a signalling connection to upper layers; and

3> add the signalling connection with the identity indicated by the IE "CN domain identity" in the variable ESTABLISHED_SIGNALLING_CONNECTIONS.

3> the procedure ends.

2> otherwise:

3> continue with the initial direct transfer procedure according to subclause 8.1.8.y2.

Upon initiation of the initial direct transfer procedure when the UE is in CELL_PCH or URA_PCH state, the UE shall:

1> perform a cell update procedure, according to subclause 8.3.1, using the cause "uplink data transmission";

1> in the cell update procedure, whenever the MAC layer indicates successful transmission of a CELL UPDATE message according to subclause 8.3.1:

2> transmit an EARLY INITIAL DIRECT TRANSFER message according to subclause 8.1.8.x2.1> when the cell update procedure completed successfully:

2> if IE "Early IDT Confirmation" of the received CELL UPDATE CONFIRM message in the cell update procedure is set to "Confirmed":

3> confirm the establishment of a signalling connection to upper layers; and

3> add the signalling connection with the identity indicated by the IE "CN domain identity" in the variable ESTABLISHED_SIGNALLING_CONNECTIONS;

3> the procedure ends.

2> otherwise:

3> continue with the initial direct transfer procedure according to subclause 8.1.8.y2.

[Editor's NOTE: the sentences below move from 8.1.8.y2 of this CR without any modification only for replacement of the sentences.]

When not stated otherwise elsewhere, the UE may also initiate the initial direct transfer procedure when another procedure is ongoing, and in that case the state of the latter procedure shall not be affected.

A new signalling connection request may be received from upper layers during transition to idle mode. In those cases, from the time of the indication of release to upper layers until the UE has entered idle mode, any such upper layer request to establish a new signalling connection shall be queued. This request shall be processed after the UE has entered idle mode.

8.1.8.x1 EARLY INITIAL DIRECT TRANSFER message contents to set

The UE shall, in the EARLY INITIAL DIRECT TRANSFER message:

1> if an assigned U-RNTI is stored in the variable U_RNTI:

2> set the CHOICE "UE identity" to "U-RNTI" with the value of the variable U_RNTI.

1> otherwise:

2> set the CHOICE "UE identity" to "Initial UE identity" with the value of the variable INITIAL_UE_IDENTITY.

1> set the IE "NAS message" as received from upper layers; and

1> set the IE "CN domain identity" as indicated by the upper layers; and

1> set the IE "Intra Domain NAS Node Selector" as follows:

2> derive the IE "Intra Domain NAS Node Selector" from TMSI/PMTSI, IMSI, or IMEI; and

2> provide the coding of the IE "Intra Domain NAS Node Selector" according to the following priorities:

1. derive the routing parameter for IDNNS from TMSI (CS domain) or PTMSI (PS domain) whenever a valid TMSI/PTMSI is available;

2. base the routing parameter for IDNNS on IMSI when no valid TMSI/PTMSI is available;

3. base the routing parameter for IDNNS on IMEI only if no (U)SIM is inserted in the UE.

1> if the RRC connection exists:

2> if the UE, on the existing RRC connection, has received a dedicated RRC message containing the IE "Primary PLMN Identity" in the IE "CN Information Info":

3> set the IE "PLMN identity" in the INITIAL DIRECT TRANSFER message to the latest PLMN information received via dedicated RRC signalling. If NAS has indicated the PLMN towards which a signalling connection is requested, and this PLMN is not in agreement with the latest PLMN information received via dedicated RRC signalling, then the initial direct transfer procedure shall be aborted, and NAS shall be informed.

2> if the UE, on the existing RRC connection, has not received a dedicated RRC message containing the IE "CN Information Info" , and if the IE "Multiple PLMN List" was broadcast in the cell where the current RRC connection was established:

3> set the IE "PLMN identity" in the INITIAL DIRECT TRANSFER message to the PLMN chosen by higher layers [5, 25] amongst the PLMNs in the IE "Multiple PLMN List" broadcast in the cell where the RRC connection was established.

1> otherwise:

2> set the IE "PLMN identity" in the INITIAL DIRECT TRANSFER message to the PLMN chosen by higher layers [5, 25] amongst the PLMNs in the IE "Multiple PLMN List" broadcast in the cell where the RRC connection was established.

1> if the IE "Activated service list" within variable MBMS_ACTIVATED_SERVICES includes one or more MBMS services with the IE "Service type" set to "Multicast" and;

1> if the IE "CN domain identity" as indicated by the upper layers is set to "CS domain" and;

1> if the variable ESTABLISHED_SIGNALLING_CONNECTIONS does not include the CN domain identity 'PS domain':

2> include the IE "MBMS joined information";

2> include the IE "P-TMSI" within the IE "MBMS joined information" if a valid PTMSI is available.

8.1.8.x2 Transmission of EARLY INITIAL DIRECT TRANSFER message in the UE

The UE shall:

1> set the IEs in an EARLY INITIAL DIRECT TRANSFER message according to subclause 8.1.8.x1;

1> perform the mapping of the Access Class to an Access Service Class as specified in subclause 8.5.13 and apply the given Access Service Class when accessing the RACH;

1> submit the EARLY INITIAL DIRECT TRANSFER message to lower layers for transmission on the uplink CCCH.

8.1.8.y1 INITIAL DIRECT TRANSFER message contents to setThe UE shall, in the INITIAL DIRECT TRANSFER message:

1> set the IE "NAS message" as received from upper layers; and

1> set the IE "CN domain identity" as indicated by the upper layers; and

1> set the IE "Intra Domain NAS Node Selector" as follows:

2> derive the IE "Intra Domain NAS Node Selector" from TMSI/PMTSI, IMSI, or IMEI; and

2> provide the coding of the IE "Intra Domain NAS Node Selector" according to the following priorities:

1. derive the routing parameter for IDNNS from TMSI (CS domain) or PTMSI (PS domain) whenever a valid TMSI/PTMSI is available;

2. base the routing parameter for IDNNS on IMSI when no valid TMSI/PTMSI is available;

3. base the routing parameter for IDNNS on IMEI only if no (U)SIM is inserted in the UE.

1> if the UE, on the existing RRC connection, has received a dedicated RRC message containing the IE "Primary PLMN Identity" in the IE "CN Information Info":

2> set the IE "PLMN identity" in the INITIAL DIRECT TRANSFER message to the latest PLMN information received via dedicated RRC signalling. If NAS has indicated the PLMN towards which a signalling connection is requested, and this PLMN is not in agreement with the latest PLMN information received via dedicated RRC signalling, then the initial direct transfer procedure shall be aborted, and NAS shall be informed.

1> if the UE, on the existing RRC connection, has not received a dedicated RRC message containing the IE "CN Information Info" , and if the IE "Multiple PLMN List" was broadcast in the cell where the current RRC connection was established:

2> set the IE "PLMN identity" in the INITIAL DIRECT TRANSFER message to the PLMN chosen by higher layers [5, 25] amongst the PLMNs in the IE "Multiple PLMN List" broadcast in the cell where the RRC connection was established.

1> if the IE "Activated service list" within variable MBMS_ACTIVATED_SERVICES includes one or more MBMS services with the IE "Service type" set to "Multicast" and;

1> if the IE "CN domain identity" as indicated by the upper layers is set to "CS domain" and;

1> if the variable ESTABLISHED_SIGNALLING_CONNECTIONS does not include the CN domain identity 'PS domain':

2> include the IE "MBMS joined information";

2> include the IE "P-TMSI" within the IE "MBMS joined information" if a valid PTMSI is available.

1> if the variable ESTABLISHMENT_CAUSE_ is initialised:

2> set the IE "Establishment cause" to the value of the variable ESTABLISHMENT_CAUSE;

2> clear the variable ESTABLISHMENT_CAUSE.

1> calculate the START according to subclause 8.5.9 for the CN domain as set in the IE "CN Domain Identity"; and

1> include the calculated START value for that CN domain in the IE "START".

8.1.8.y2 Transmission of INITIAL DIRECT TRANSFER message in the UE

The UE shall:

1> transmit the INITIAL DIRECT TRANSFER message on the uplink DCCH using AM RLC on signalling radio bearer RB3;

1> when the INITIAL DIRECT TRANSFER message has been submitted to lower layers for transmission:

2> confirm the establishment of a signalling connection to upper layers; and

2> add the signalling connection with the identity indicated by the IE "CN domain identity" in the variable ESTABLISHED_SIGNALLING_CONNECTIONS.

1> when the successful delivery of the INITIAL DIRECT TRANSFER message has been confirmed by RLC:

2> the procedure ends.

8.1.8.2a RLC re-establishment or inter-RAT change

If a re-establishment of the transmitting side of the RLC entity on signalling radio bearer RB3 occurs before the successful delivery of the INITIAL DIRECT TRANSFER message has been confirmed by RLC, the UE shall:

1> retransmit the INITIAL DIRECT TRANSFER message on the uplink DCCH using AM RLC on signalling radio bearer RB3.

If an Inter-RAT handover from UTRAN procedure occurs after the RRC CONNECTION REJECT message was received, before the successful delivery of the EARLY INITIAL DIRECT TRANSFER message has been confirmed by the CELL UPDATE CONFIRM message or before the successful delivery of the INITIAL DIRECT TRANSFER message has been confirmed by RLC, for messages with the IE "CN domain identity" set to "CS domain", the UE shall:

1> retransmit the NAS message as specified in subclause 8.3.7.4.8.1.8.2ab Inter-RAT handover from UTRAN to GERAN *Iu mode*

If an Inter-RAT handover from UTRAN to GERAN *Iu mode* occurs after the RRC CONNECTION REJECT message was received, before the successful delivery of the EARLY INITIAL DIRECT TRANSFER message has been confirmed by the CELL UPDATE CONFIRM message or before the successful delivery of the INITIAL DIRECT TRANSFER message has been confirmed by RLC, for messages for all CN domains, the UE shall:

1> retransmit the NAS message as specified in subclause 8.3.7.4.8.1.8.2b Abortion of signalling connection establishment

If the UE receives a request from upper layers to release (abort) the signalling connection for the CN domain for which the initial direct transfer procedure is ongoing, the UE shall:

1> if the UE has not yet entered UTRA RRC connected mode:

2> abort the RRC connection establishment procedure as specified in subclause 8.1.3;

the procedure ends.

8.1.8.3 Reception of INITIAL DIRECT TRANSFER message by the UTRAN

On reception of the EARLY INITIAL DIRECT TRANSFER message, the UTRAN should:

1> in case that the EARLY INITIAL DIRECT TRANSFER message is received during the RRC connection establishment procedure:

2> if the RRC CONNECTION REQUEST message is received before the reception of the EARLY INITIAL DIRECT TRANSFER message and an RRC CONNECTION SETUP message will be transmitted in response to the RRC CONNECTION REQUEST message; and

2> if the value of IE "Initial UE identity" contained in the RRC CONNECTION REQUEST message is equal to the value of IE "Initial UE identity" contained in the the EARLY INITIAL DIRECT TRANSFER message:

3> routes the NAS message in EARLY INITIAL DIRECT TRANSFER message using the IE "CN Domain Identity". UTRAN may also use the IE "Intra Domain NAS Node Selector" and the IE "PLMN identity" for routing among the CN nodes for the addressed CN domain;

3> set the IE "Early IDT Confirmation" of the RRC CONNECTION SETUP message to "Confirmed";

3> transmit the RRC CONNECTION SETUP message according to subclause 8.1.3.

2> otherwise:

3> ignore the EARLY INITIAL DIRECT TRANSFER message;

3> if an RRC CONNECTION SETUP message will be transmitted in response to the RRC CONNECTION REQUEST message:

4> set the IE "Early IDT Confirmation" of the RRC CONNECTION SETUP message to "Not Confirmed" and transmit the RRC CONNECTION SETUP message according to subclause 8.1.3.

1> in case that the EARLY INITIAL DIRECT TRANSFER message is received during the cell update procedure:

2> if the CELL UPDATE message is received before the reception of the EARLY INITIAL DIRECT TRANSFER message and an CELL UPDATE CONFIRM message will be transmitted in response to the CELL UPDATE message; and

2> if the value of IE "U-RNTI" contained in the CELL UPDATE message is equal to the value of IE "U-RNTI" contained in the the EARLY INITIAL DIRECT TRANSFER message:

3> routes the NAS message in EARLY INITIAL DIRECT TRANSFER message using the IE "CN Domain Identity". UTRAN may also use the IE "Intra Domain NAS Node Selector" and the IE "PLMN identity" for routing among the CN nodes for the addressed CN domain;

3> set the IE "Early IDT Confirmation" of the CELL UPDATE CONFIRM message to "Confirmed";

3> transmit the CELL UPDATE CONFIRM message according to subclause 8.3.1.

2> otherwise:

3> ignore the EARLY INITIAL DIRECT TRANSFER message;

3> set the IE "Early IDT Confirmation" of the CELL UPDATE CONFIRM message to "Not Confirmed" and transmit the CELL UPDATE CONFIRM message according to subclause 8.3.1.

On reception of the INITIAL DIRECT TRANSFER message the NAS message should be routed using the IE "CN Domain Identity". UTRAN may also use the IE "Intra Domain NAS Node Selector" and the IE "PLMN identity" for routing among the CN nodes for the addressed CN domain.

If no signalling connection exists towards the chosen node, then a signalling connection is established.

When the UTRAN receives an EARLY INITIAL DIRECT TRANSFER message or an INITIAL DIRECT TRANSFER message, it shall not affect the state of any other ongoing RRC procedures, when not stated otherwise elsewhere.

The UTRAN should:

1> set the START value for the CN domain indicated in the IE "CN domain identity" to the value of the IE "START".

-- Omitted Sections --

10.2.8 CELL UPDATE CONFIRM

This message confirms the cell update procedure and can be used to reallocate new RNTI information for the UE valid in the new cell.

RLC-SAP: UM

Logical channel: CCCH or DCCH

Direction: UTRAN→UE

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
Message Type	MP		Message Type		
UE Information Elements					
U-RNTI	CV-*CCCH*		U-RNTI 10.3.3.47		
RRC transaction identifier	MP		RRC transaction identifier 10.3.3.36		
Integrity check info	CH		Integrity check info 10.3.3.16		
Integrity protection mode info	OP		Integrity protection mode info	The UTRAN should not include this IE unless it is	

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
			10.3.3.19	performing an SRNS relocation or a cell reselection from GERAN *Iu mode*	
Ciphering mode info	OP		Ciphering mode info 10.3.3.5	The UTRAN should not include this IE unless it is performing either an SRNS relocation or a cell reselection from GERAN *Iu mode*, and a change in ciphering algorithm.	
Activation time	MD		Activation time 10.3.3.1	Default value is "now"	
New U-RNTI	OP		U-RNTI 10.3.3.47		
New C-RNTI	OP		C-RNTI 10.3.3.8		
New DSCH-RNTI	OP		DSCH-RNTI 10.3.3.9a	Should not be set in FDD. If received, the UE should ignore it	
New H-RNTI	OP		H-RNTI 10.3.3.14a		REL-5
New Primary E-RNTI	OP		E-RNTI 10.3.3.10a		REL-6
New Secondary E-RNTI	OP		E-RNTI 10.3.3.10a		REL-6
RRC State Indicator	MP		RRC State Indicator 10.3.3.35a		
UTRAN DRX cycle length coefficient	OP		UTRAN DRX cycle length coefficient 10.3.3.49		
RLC re-establish indicator (RB2, RB3 and RB4)	MP		RLC re-establish indicator 10.3.3.35	Should not be set to TRUE if IE "Downlink counter synchronisation info" is included in message.	
RLC re-establish indicator (RB5 and upwards)	MP		RLC re-establish indicator 10.3.3.35	Should not be set to TRUE if IE "Downlink counter synchronisation info" is included in message.	
Early IDT Confirmation	MP		Enumerated (Confirmed, Not Confirmed)		REL-7
CN Information Elements					
CN Information info	OP		CN Information info 10.3.1.3		
UTRAN Information Elements					
URA identity	OP		URA identity 10.3.2.6		
RB information elements					
RB information to release list	OP	1 to <maxRB>			

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
>RB information to release	MP		RB information to release 10.3.4.19		
RB information to reconfigure list	OP	1 to <maxRB>			
>RB information to reconfigure	MP		RB information to reconfigure 10.3.4.18		
RB information to be affected list	OP	1 to <maxRB>			
>RB information to be affected	MP		RB information to be affected 10.3.4.17		
Downlink counter synchronisation info	OP				
>RB with PDCP information list	OP	1 to <maxRBallRABs>			
>>RB with PDCP information	MP		RB with PDCP information 10.3.4.22	This IE is needed for each RB having PDCP in the case of lossless SRNS relocation	
	OP				REL-5
>>PDCP context relocation info	OP		PDCP context relocation info 10.3.4.1a	This IE is needed for each RB having PDCP and performing PDCP context relocation	REL-5
PDCP ROHC target mode	OP		PDCP ROHC target mode 10.3.4.2a		REL-5
TrCH Information Elements					
Uplink transport channels					
UL Transport channel information common for all transport channels	OP		UL Transport channel information common for all transport channels 10.3.5.24		
Deleted TrCH information list	OP	1 to <maxTrCH>			
>Deleted UL TrCH information	MP		Deleted UL TrCH information 10.3.5.5		
Added or Reconfigured TrCH information list	OP	1 to <maxTrCH>			
>Added or Reconfigured UL TrCH information	MP		Added or Reconfigured UL TrCH information 10.3.5.2		
Downlink transport channels					
DL Transport channel	OP		DL Transport		

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
information common for all transport channels			channel information common for all transport channels 10.3.5.6		
Deleted TrCH information list	OP	1 to <maxTrCH>			
>Deleted DL TrCH information	MP		Deleted DL TrCH information 10.3.5.4		
Added or Reconfigured TrCH information list	OP	1 to <maxTrCH>			
>Added or Reconfigured DL TrCH information	MP		Added or Reconfigured DL TrCH information 10.3.5.1		
PhyCH information elements					
Frequency info	OP		Frequency info 10.3.6.36		
Uplink radio resources					
Maximum allowed UL TX power	MD		Maximum allowed UL TX power 10.3.6.39	Default value is the existing maximum UL TX power	
Uplink DPCH info	OP		Uplink DPCH info 10.3.6.88.		
E-DCH Info	OP		E-DCH Info 10.3.6.97		REL-6
Downlink radio resources					
Downlink HS-PDSCH Information	OP		Downlink HS_PDSCH Information 10.3.6.23a		REL-5
Downlink information common for all radio links	OP		Downlink information common for all radio links 10.3.6.24		
Downlink information per radio link list	OP	1 to <maxRL>		Send downlink information for each radio link to be set-up	
>Downlink information for each radio link	MP		Downlink information for each radio link 10.3.6.27		
MBMS PL Service Restriction Information	OP		Enumerated (TRUE)	Absence means that on the MBMS Preferred Layer (PL) no restrictions apply concerning the use of non-MBMS services i.e. the PL is not congested	REL-6

Condition	Explanation
CCCH	This IE is mandatory present when CCCH is used and ciphering is not required and not needed otherwise.

--- **Omitted Sections** ---

10.2.x EARLY INITIAL DIRECT TRANSFER

This message is used to initiate a signalling connection immediately after the RRC CONNECTION SETUP message or the CELL_UPDATE message based on indication from the upper layers.

RLC-SAP: TM

Logical channel: CCCH

Direction: UE -> UTRAN

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
Message Type	MP		Message Type		REL-7
UE information elements					
CHOICE *UE identity*	MP				
>Initial UE identity			Initial UE identity 10.3.3.15	This IE is indentical with IE 'initial UE identity' in the RRC CONNECTION REQUEST message transmitted right before this message.	REL-7
>U-RNTI			U-RNTI 10.3.3.47	This IE is indentical with IE 'U-RNTI' in the CELL UPDATE message transmitted right before this message.	REL-7
PLMN identity	OP		PLMN identity 10.3.1.11	This IE indicates the PLMN to which the UE requests the signalling connection to be established.	REL-7
CN information elements					
CN domain identity	MP		CN domain identity 10.3.1.1		REL-7
Intra Domain NAS Node Selector	MP		Intra Domain NAS Node Selector 10.3.1.6		REL-7
NAS message	MP		NAS message 10.3.1.8		REL-7
MBMS joined information	OP				REL-7
>P-TMSI	OP		P-TMSI (GSM-MAP) 10.3.1.13		REL-7

--- **Omitted Sections** ---

10.2.40 RRC CONNECTION SETUP

This message is used by the network to accept the establishment of an RRC connection for a UE, including assignment of signalling link information, transport channel information and optionally physical channel information.

RLC-SAP: UM

Logical channel: CCCH

Direction: UTRAN → UE

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
Message Type	MP		Message Type		
UE Information Elements					
Initial UE identity	MP		Initial UE identity 10.3.3.15		
RRC transaction identifier	MP		RRC transaction identifier 10.3.3.36		
Activation time	MD		Activation time 10.3.3.1	Default value is "now"	
New U-RNTI	MP		U-RNTI 10.3.3.47		
New C-RNTI	OP		C-RNTI 10.3.3.8		
New H-RNTI	OP		H-RNTI 10.3.3.14a		REL-6
New Primary E-RNTI	OP		E-RNTI 10.3.3.10a		REL-6
New Secondary E-RNTI	OP		E-RNTI 10.3.3.10a		REL-6
RRC State Indicator	MP		RRC State Indicator 10.3.3.35a		
UTRAN DRX cycle length coefficient	MP		UTRAN DRX cycle length coefficient 10.3.3.49		
Capability update requirement	MD		Capability update requirement 10.3.3.2	Default value is defined in subclause 10.3.3.2	
Early IDT Confirmation	MP		Enumerated (Confirmed, Not Confirmed)		REL-77
CHOICE *specification mode*	MP				REL-5
>Complete specification					
RB Information Elements					
>>Signalling RB information to setup list	MP	3 to 4			
>>>Signalling RB information to setup	MP		Signalling RB information to setup 10.3.4.24		
TrCH Information Elements					
Uplink transport channels					
>>UL Transport channel information common for all transport channels	OP		UL Transport channel information common for all transport		

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
			channels 10.3.5.24		
>>Added or Reconfigured TrCH information list	MP	1 to <maxTrCH>		Although this IE is not required when the IE "RRC state indicator" is set to "CELL_FACH", need is MP to align with ASN.1	
	OP				REL-4
>>>Added or Reconfigured UL TrCH information	MP		Added or Reconfigured UL TrCH information 10.3.5.2		
Downlink transport channels					
>>DL Transport channel information common for all transport channels	OP		DL Transport channel information common for all transport channels 10.3.5.6		
>>Added or Reconfigured TrCH information list	MP	1 to <maxTrCH>		Although this IE is not required when the IE "RRC state indicator" is set to "CELL_FACH", need is MP to align with ASN.1	
	OP				REL-4
>>>Added or Reconfigured DL TrCH information	MP		Added or Reconfigured DL TrCH information 10.3.5.1		
>Preconfiguration					REL-5
>>CHOICE *Preconfiguration mode*	MP				REL-5
>>>Predefined configuration identity	MP		Predefined configuration identity 10.3.4.5		REL-5
>>>Default configuration					REL-5
>>>>Default configuration mode	MP		Enumerated (FDD, TDD)	Indicates whether the FDD or TDD version of the default configuration shall be used	REL-5
>>>>Default configuration identity	MP		Default configuration identity 10.3.4.0		REL-5
PhyCH information elements					
Frequency info	OP		Frequency info 10.3.6.36		
Uplink radio resources					
Maximum allowed UL TX power	MD		Maximum allowed UL TX power 10.3.6.39	Default value is the existing maximum UL TX power	
Uplink DPCH info	OP		Uplink DPCH info		

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
·			10.3.6.88		
E-DCH Info	OP		E-DCH Info 10.3.6.97		REL-6
Downlink radio resources					
Downlink HS-PDSCH Information	OP		Downlink HS-PDSCH information 10.3.6.23a		REL-6
Downlink information common for all radio links	OP		Downlink information common for all radio links 10.3.6.24		
Downlink information per radio link list	OP	1 to <MaxRL>		Send downlink information for each radio link to be set-up	
>Downlink information for each radio link	MP		Downlink information for each radio link 10.3.6.27		

Agenda Item : 11.8

Source : LG Electronics

Title : Discussion on LTE multicast & broadcast

Document for : Discussion and Decision

1 Introduction

We discuss and propose several aspects of LTE multicast/broadcast in this document.

2 Bandwidth scenarios for multicast/broadcast

Minimum UE bandwidth was decided to be 10 Mhz. However, minimum UE bandwidth with multicast/broadcast is not clear. Decision on this would impact on specification of LTE multicast/broadcast.

In case of 20 Mhz cell, we could imagine either that an upper 10 Mhz carries a unicast service and a lower 10 Mhz carries a multicast/broadcast service or that central 10 Mhz carries a multicast/broadcast service and outside of the central 10 Mhz carries a unicast service.

In this case, if minimum UE capability for multicast/broadcast is 10 Mhz, the UE could indicate need for reception of multicast/broadcast service to eNode B because eNode B may not know UE reception of multicast/broadcast service. With this indication, eNode B could move the unicast service on the other 10 Mhz to help the UE receive both services. eNode B could do so easiler than R6 MBMS because RRC is located at eNode B together with a scheduler.

However, sometimes eNode B could not help the UE. So, the UE may need to select which service it should receive between unicast and multicast/broadcast. Also, if a interesting multicast/broadcast service is provided on different layer (cell), UE may need to perform frequency layer convergence and divergence discussed in R6 MBMS with the service prioritization.

On the other hand, if multicast/broadcast services are provided on a multicast/broadcast specific carrier which is different from a carrier for unitcast services.[1], UE may perform service prioritization between both carriers. However, if every LTE UE supporting multicast/broadcast has a dual receiver. multicast/broadcast procedure would be simpler because UE with dual receiver can receive both unicast services and multicast/broadcast services on different carriers. With dual receiver, thc UE could also receive a 20 Mhz cell carrying both unicast and multicast/broadcast services without any data loss. Therefore, it should be decided if the dual receiver is mandated to a UE supporting multicast/broadcast or not.

In summary, it is proposed that:

- The service prioritization and FLC/FLD procedures need to be studied.
  - Considering limited UE capability, scheduling, cell bandwidths, and dedicated carriers to multicast/broadcast.
- A UE with the dual receiver can be considered for carriers dedicated to multicast/broadcast
  - if the dual receiver is mandatory in the UE, multicast/broadcast procedures could be simpler.
  - Thus, it should be decided if the dual receiver is mandated to a UE or not.

3 UE capability for multicast/broadcast

It has already been discussed earlier that e.g. the capability to receive HS-DSCH could be updated by the UE based on whether the UE would receive MBMS service in parallel or not. However this had been abandoned since the overhead due to the L3 signalling and the fact that this would require a (slow) reconfiguration.

However, in LTE RRC is terminated at eNode B with the scheduler of DL SCH channel. Thus, UE capability could be dynamically updated by signalling between UE and eNode B. Since eNode B may not know which multicast/broadcast service UE intends to receive, UE could calculate the available processing and reception resources based on the resources that the broadcast channel would occupy. The resources to be exchanged between the UE and the Scheduler could thus contain number of subcarriers, number of processes etc for a unicast service.

In summary, it is proposed that:

- UE capability is dynamically updated by signalling from UE to eNode B.
    - e.g. when UE receive a multicast/broadcast service with a unicast service
    - The scheduler considers the updated UE capability to schedule a unicast service for the UE.

4 Multicast/broadcast service scenarios

Discussion on the RAN and RAN1 reflector before this meeting show there are two types of service scenarios for multicast/broadcast: cell specific contents and cell group contents. The cell specific contents could be R99 CBS-like service i.e. message distribution, which are a single cell transmission. The cell group contents could be TV broadcasting services, which is a multi-cell transmission.

We think multi-cell transmission should use a L1 combining technique. Therefore, a central node is needed as a source of multi-cell transmission and the cell group concept in R6 can be re-used in LTE. On the other hand, single cell transmission cannot be combined across eNode B because single cell transmission covers only one cell or one eNode B. If possible, single cell transmission can be combined only within the same eNode B. Thus, the central node may not be needed for single cell transmission.

Since aGW would be the source of multi-cell transmission, aGW needs to schedule multi-cell transmission for a group of cells. The aGW needs to apply semi-static scheduling to multi-cell transmissions because scheduling should be applied to a group of cells. Such scheduling information could be provided by in-band signalling like R6 MSCH signalling mapped to the same physical channel carrying MTCH.

However, in case of single cell transmission, if necessary, eNode B can dynamically schedule the single cell transmission in consideration with scheduling of unitcast and other common channels. That is because it is eNode B who schedules unitcast and other common channels. Thus, eNode B could schedule unitcast data based on dedicated CQI and then schedule single cell transmission with DL resources not scheduled for unitcast data. In this manner, such scheduling information is provided on L1/2 control information used for DL SCH which may include MBMS service identity as well as UE identity.

As discussed above, eNode B would handle multi-cell and single cell transmissions in different manners, in terms of scheduling and combining. Thus, it is suggested that multi-cell and single cell transmissions use different types of channels. Single cell transmission can be provided on DL Shared Channel and multi-cell transmission on a different channel that is L1 combinable. In this case, L1/2 at eNode B could be differently optimized for multi-cell and single cell transmissions.

In summary, it is proposed that:

- single cell transmission is provided on DL Shared Channel and multi-cell transmission on a different channel that is L1 combinable, i.e. MCH.
- single cell transmission is scheduled by eNode B and multi-cell transmission by aGW.
    - For multi-cell transmission, scheduling information is provided by in-band signalling like R6 MSCH signalling.
    - For single cell transmission, scheduling information is provided by L1/2 control information used for DL SCH.
- aGW is a source of multi-cell transmission and manages cell groups for multi-cell transmissions.

5 Point-to-point and point-to-multipoint RB

As we know, R6 MBMS provided a point to point RB and a point to multipoint RB for a service with the counting procedure. Thus, UTRAN can determine a RB type e.g. based on the number of MBMS users in a cell.

We think that PTP RB cannot be applied to multi-cell transmissions because L1 combining seems to be a baseline of this transmission option. In this case different cells cannot have different types of RB and so PTM RB is assumed to be used for all cells. Thus, the counting procedure seems to be not useful and therefore multi-cell service like TV broadcasting will be transmitted every cell.

On the other hand, PTP RB could be applied to single cell transmissions. However, if single cell transmission is carried on DL SCH(Shared Channel), we may not need PTP RB because if necessary, DL SCH could consider AMC and HARQ for small number of users receiving a multicast service. Also, a complex counting procedure may need to be applied to transition between PTP RB and PTM RB as we have seen in R6 MBMS. Thus, we don't see any benefit of PTP RB. However, detecting only existence of a user interested in a service could be interesting to avoid unnecessary transmission in a cell.

In summary, it is proposed that:

- PTP RB is not needed for a multicast/broadcast service.
  - PTM RB mapped to DL SCH can replace PTP RB.
- Complex counting procedure is not needed for simple specification
  - But, detecting only existence of a user interested in a specific service in a cell is needed to to avoid unnecessary cell transmission.

6 Protocol Architecture for multicast/broadcast

It is felt that most of companies seems to prefer to share one common architecture between multicast/broadcast and unitcast services. In this case, PDCP is placed at aGW and RRC/MAC at eNode B for ptm bearer service.

Discussion on Layer 2

Locating PDCP at aGW is similar to R6 MBMS architecture. Thus, as R6 MBMS, it could be specified that there is one PDCP entity per cell group managed by aGW for one service.

In MAC, we have only one big MAC at eNode B. In this sense, we don't need any multicast/broadcast specific MAC entity like R6 MAC-m. Functions of MAC at eNode B for multicast/broadcast are channel mapping between logical channel and transport channel and multiplexing of logical channels into transport channel.

In addition, if a text message distribution like R99 CBS is supported, it is questionable whether a L2 entity likc a BMC entity is needed or not. R99 BMC did storing, formatting, scheduling, transmitting and repeating CBS messages. In case of single cell transmission, we think that if DL SCH carries MTCH, ARQ (or HARQ) could be used in a fixed manner without ACK/NACK, instead of the MBMS repairing taking a long time. In this case, it can be one possibility that number of retransmissions is fixed e.g. 2 or 3 times and retransmission on DL SCH is synchronous to reduce length of signalling.

However, retransmission of multicast/broadcast data in L2 seems to be not useful for multi-cell transmissions e.g. TV broadcasting. We think that retransmission at eNode B is beneficial only for single cell transmission of message distribution services, not all sorts of services.

Discussion on Layer 3

Currently we agreed that RRC is terminated at eNode B. That means there is no RRC layer at aGW. However, aGW need to control multicast/broadcast, at least for multi-cell transmissions. Thus, someone could say that such control funcation at aGW could be part of RRC.

We think that one common architecture needs to be applied to both multicast/broadcast and unitcast services. So, to avoid putting RRC on aGW, it is suggested that aGW transfers control information of multi-cell transmissions i.e. scheduling/combining to eNode B to control multi-cell transmissions. Then, eNode B transmits some of control information received from aGW on either MCCH or MSCH. Thus, there is no RRC layer in aGW and no direct communication with RRC signalling between UE and aGW. RRC at eNode B controls multicast/broadcast transmissions with the control information received from aGW.

In summary, it is proposed that the agreed architecture of unicast RB is applied to multicast/broadcast RB as well:

- PDCP at aGW performs header compression of multicast/broadcast services.
    - There is one PDCP entity per cell group for one service like PDCP of R6 MBMS
- MAC at eNode B performs channel mapping from logical to transport channel and multiplexing of logical channels.
    - In MAC, ARQ (or HARQ) can be studied without ACK/NACK for single cell transmission of message distribution.
- RRC at eNode B control multicast/broadcast transmissions based on the control information given from aGW.
    - Some of the control information given from aGW can be transferred to UE on MCCH or MSCH by eNode B.

It is noted that there are no RRC and RLC/MAC at aGW even for multicast/broadcast.

7 Control Channel/Information for multicast/broadcast

Since single cell transmission is considered for multicast/broadcast, it is assumed that multicast/broadcast will contain cell specific information. For example, if cells are different, service information, RB information and scheduling information can be different due to single cell transmissions. Thus, MCCH should be configured for each cell like R6 MBMS.

MCCH needs to provide service information that lists all of available service in a cell and then information of PTM RBs on DL SCH and MCH for each service. Based on MCCH information, UE can know how to configure PTM RB on DL SCH without L1 combinig or PTM RB on MCH with L1 combining for an interesting service. We think that R6 MCCH messages could be a baseline of LTE MCCH messages.

In R6 MBMS, UE needs to receive System Information on BCH and then MCCH to acquire MBMS information, so that it took at least one cycle of SIB transmission on BCH e.g. 640 ms to acquire MBMS information. To reduce this time, we propose that MCCH configuration is provided by the like of BCCH MIB (Master Information Block) or SB (Scheduling Block) i.e. Primary System Information in [2]. Therefore, a UE could read MCCH immediately after reading Sychronization Channel and Primary System Information on BCH if it wishes. It is noted that we propose BCCH is carried on BCH & DL SCH and configuration of BCCH on DL-SCH is informed by BCCH on BCH [2]. Thus, configuration of MCCH could be broadcast together with configuration of BCCH on DL SCH.

In addition, it is proposed that MCCH is mapped to DL SCH. It is assumed that MCH transmits soft combined data with a long cyclic prefix and so one sub-frame of MCH would be one symbol smaller than one sub-frame of DL SCH. On the other hand, MCCH information would not be soft combinable due to the fact that different cells would have different lists of available services. For those reasons, DL SCH is preferred for MCCH because DL SCH can transmit more MCCH information than MCH and soft combining would not be applied to MCCH.

For multi-cell transmission, it seems to be better to transmit semi-static scheduling of MBMS services by in-band signalling on MCH. In this case, in-band signalling can be also L1 combined and is orginiated from aGW. The in-band signalling on MCH may contain time/frequency allocation and if necessary, MCS info, etc.

For single cell transmission, we think that the in-band signalling is not needed. Since DL-SCH is proposed for this transmission, L1/2 control information can be used instead of MSCH. L1/2 control information could also control UE DRX of DL-SCH for single cell transmission of multicast/broadcast.

In summary, it is proposed that

- R6 MCCH messages are the baseline of LTE MCCH messages.
- MCCH is mapped to DL SCH.
    - The configuration of MCCH on DL SCH is broadcast on Primary System Information on BCH [2].

- For multi-cell transmission, in-band signaling is transmitted on MCH with L1 combining and is used for carrying multicast/broadcast scheduling information which may be semi-static.
- For single cell transmission, L1/2 control information for DL-SCH is used for carrying multicast/broadcast scheduling information which is relatively dynamic.

8 Conclusion

In this document, we propose to agree to the points proposed above.

References

[1] RP-060215, "Introduction of specfic requirements for support of Broadcast mode in MBMS in LTE", Orange

[2] R2-06xxxx, "LTE system information", LG Electronics

Agenda Item : 11.8

Source : LG Electronics

Title : Text Proposal for LTE MBMS

Document for : Discussion and Decision

1. Introduction

To complete TR 25.813, LTE MBMS needs to be captured in the TR. However, TR 25.813 does not fully capture LTE MBMS. Thus, this document proposes the text proposal for LTE MBMS to be captured in TR 25.813 as below.

2. Proposal

This text proposal was written based on the following assumptions:

- The SAE/LTE protocol architecture agreed for dedicated services needs to be the baseline of MBMS protocol architecture. Thus, even for MBMS, RRC/RLC/MAC are placed on eNB and PDCP placed on aGW. RRC in eNB controls MBMS based on information given from aGW.
- MBMS is allowed to be provided on MCH (Multicast Channel) or DL-SCH (DL Shared Channel), depending on support of L1 combining. To transmit MBMS, MCH provides L1 combining and a long cylic prefix and however DL-SCH cannot provide L1 comibing and a long cylic prefix.

Most of MBMS features were proposed to be described in section 11 'MBMS' with MBMS principles, functions and transmissions in new sub-sections. Specific topics related to MBMS related channels and MBMS identities were proposed to be captured in section 5.2/5.3 and section 5.6 respectively.

Text Proposal for TR 25.813

------------------------------------ The Beginning of Text Proposal ------------------------------------

5 Protocol architecture

5.1 Overall protocol architecture

The E-UTRAN consists of eNBs, providing the E-UTRA user plane (RLC/MAC/PHY) and control plane (RRC) protocol terminations towards the UE. The eNBs interface to the aGW via the S1.

Figure 5.1 below gives an overview of the E-UTRAN architecture where:

- It remains FFS whether the aGW is split into U- and C-plane;
- Logical Nodes depicted as yellow-shaded boxes with solid frame are agreed;
- Logical Nodes depicted as yellow-shaded boxes with dashed frame are not yet agreed;
- White boxes depict the functional entities of the control plane and blue boxes depict the functional entities of the user plane:
    - Those, where an agreement on their association with logical nodes has been achieved are depicted inside this logical node;
    - Those, where an agreement on their association with logical nodes has not yet been achieved, are depicted outside logical nodes and their possible locations are indicated by arrows;

- Those, where an agreement on their existence has been achieved are depicted with solid frames;
- Those, where an agreement on their existence has not been achieved are depicted with dashed frames.

The MBMS related functions in eNB and aGW are described in section 11.2.

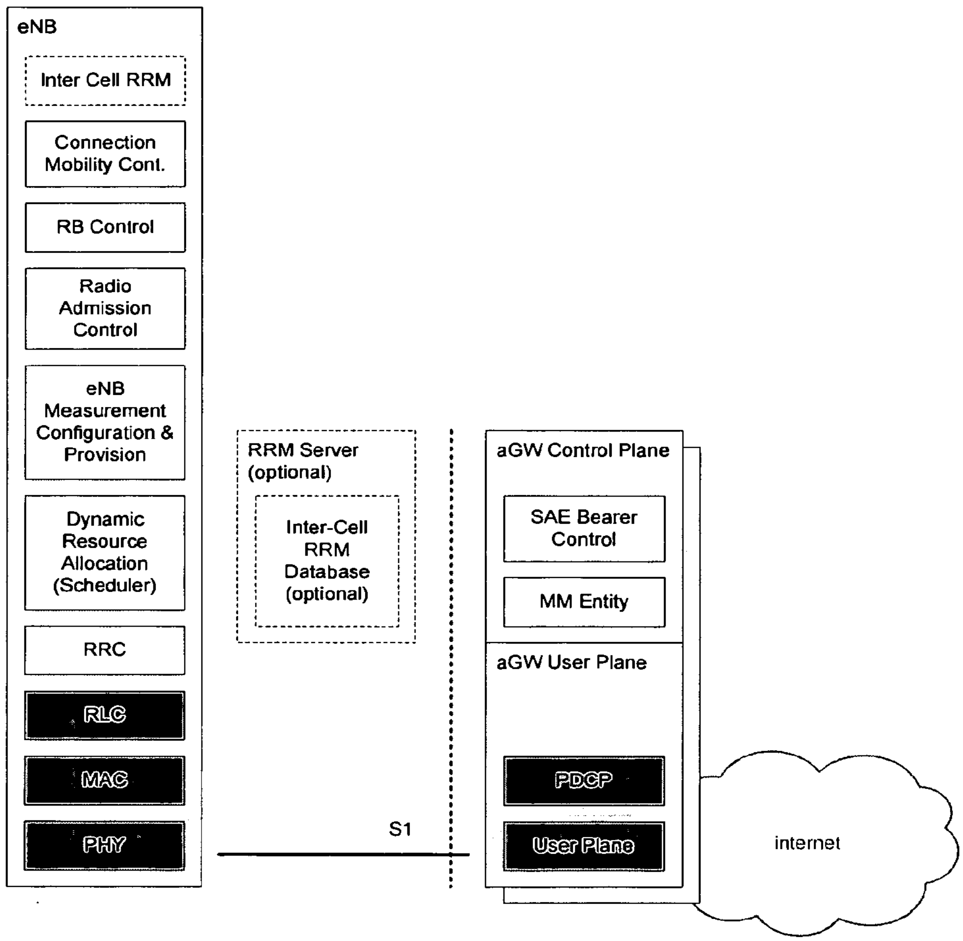

Figure 5.1: E-UTRAN Architecture

The functions agreed to be hosted by the eNB are:

- Selection of aGW at attachment;
- Routing towards aGW at RRC activation;
- Scheduling and transmission of paging messages;
- Scheduling and transmission of BCCH information;
- Dynamic allocation of resources to UEs in both uplink and downlink;
- The configuration and provision of eNB measurements;
- Radio Bearer Control;
- Radio Admission Control;
- Connection Mobility Control in LTE_ACTIVE state.

The functions agreed to be hosted by the aGW are:

- Paging origination;
- LTE_IDLE state management;
- Ciphering of the user plane;
- PDCP;
- SAE Bearer Control (see 3GPP TR 23.882 [6]);
- Ciphering and integrity protection of NAS signalling.

5.1.1 User plane

Figure 5.1.1 below shows the user-plane protocol stack for E-UTRAN, where:

- RLC and MAC sublayers (terminated in eNB on the network side) perform the functions listed in section 5.3, e.g.:
  - Scheduling;
  - ARQ;
  - HARQ;
- Security sublayer (terminated in aGW on the network side) performs:
  - Ciphering;
  - Integrity protection (FFS);
- PDCP sublayer (terminated in aGW on the network side) performs the functions listed in section 5.3, e.g.:
  - Header Compression.

NOTE: It is FFS if there is a separate security sublayer or if it is part of PDCP.

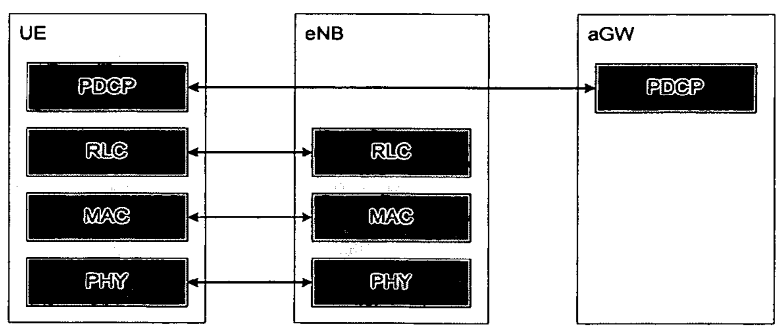

Figure 5.1.1: User-plane protocol stack

5.1.2 Control plane

Figure 5.1.2 below shows the control-plane protocol stack for E-UTRAN. The following working assumptions apply:

- RLC and MAC sublayers (terminated in eNB on the network side) perform the same functions as for the user plane;
- RRC (terminated in eNB on the network side) performs the functions listed in section 5.4.2, e.g.:

  - Broadcast;
  - Paging;
  - RRC connection management;
  - RB control;
  - Mobility functions;
  - UE measurement reporting and control.
- NAS (terminated in aGW on the network side) performs among other things:
  - SAE bearer management;
  - Authentication;
  - Idle mode mobility handling;
  - Paging origination in LTE_IDLE;
  - Security control for the signalling between aGW and UE, and for the user plane.

NOTE: the NAS control protocol is not covered by the scope of this TR and is only mentioned for information.

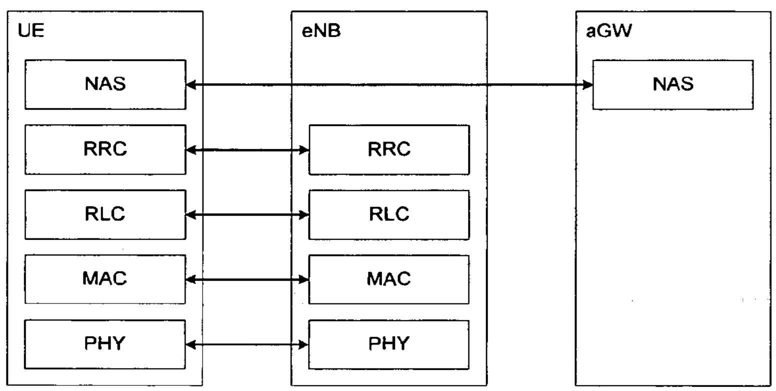

Figure 5.1.2: Control-plane protocol stack

5.2 Layer 1

Note: This section will summarize the Layer 1 in terms of services, functions and transport channels offered to Layer 2 (input from WG1 and 25.814).

5.2.1 Services and functions

The physical layer offers information transfer services to MAC and higher layers. The physical layer transport services are described by *how* and with what characteristics data are transferred over the radio interface. An adequate term for this is "Transport Channel".

NOTE: This should be clearly separated from the classification of *what* is transported, which relates to the concept of logical channels at MAC sublayer.

5.2.2 Transport channels

Downlink transport channel types are:

1. **Broadcast Channel (BCH)** characterised by:
   - fixed, pre-defined transport format;
   - requirement to be broadcast in the entire coverage area of the cell.
2. **Downlink Shared Channel (DL-SCH)** characterised by:
   - support for HARQ;
   - support for dynamic link adaptation by varying the modulation, coding and transmit power;
   - possibility to be broadcast in the entire cell;
   - possibility to use beamforming;
   - support for both dynamic and semi-static resource allocation;
   - support for UE discontinuous reception (DRX) to enable UE power saving.
   - support for MBMS transmission on a single cellNOTE: the possibility to use slow power control depends on the physical layer.
3. **Paging Channel (PCH)** characterised by:
   - support for UE discontinuous reception (DRX) to enable UE power saving (DRX cycle is indicated by the network to the UE);
   - requirement to be broadcast in the entire coverage area of the cell;
   - mapped to physical resources which can be used dynamically also for traffic/other control channels.

It is FFS, whether a NCH is included. If yes, it would be characterised by the following attributes:

4. **Notification Channel (NCH)** characterised by:
   - support of UE power saving;
   - requirement to be broadcast in the entire coverage area of the cell.
5. **Multicast Channel (MCH)** characterised by:
   - requirement to be broadcast in the entire coverage area of the cell;
   - support for L1 combining of MBMS transmission on multiple cells;
   - support for semi-static resource allocation e.g. with a time frame of a long cylic prefix;

Uplink transport channel types are:

1. **Uplink Shared Channel (UL-SCH)** characterised by:
   - possibility to use beamforming; (likely no impact on specifications)
   - support for dynamic link adaptation by varying the transmit power and potentially modulation and coding;
   - support for HARQ;
   - support for both dynamic and semi-static resource allocation; (Note: new attribute, FFS on whether there would be two types of UL-SCH)

NOTE: the possibility to use uplink synchronisation and timing advance depend on the physical layer.

It is FFS, whether a RACH is included. If yes, it would be characterised by the following attributes:

2. **Random Access Channel(s) (RACH)** characterised by:
   - limited data field (FFS);

- collision risk;

NOTE: the possibility to use open loop power control depends on the physical layer solution.

5.3 Layer 2

Layer 2 is split into the following sublayers: Medium Access Control (MAC), Radio Link Control (RLC) and Packet Data Convergence Protocol (PDCP).

This section gives a high level description of the Layer 2 sub-layers in terms of services and functions. Figure 5.3a and Figure 5.3b below depicts the PDCP/RLC/MAC architecture for downlink and uplink respectively, where:

- Service Access Points (SAP) for peer-to-peer communication are marked with circles at the interface between sublayers. The SAP between the physical layer and the MAC sublayer provides the transport channels. The SAPs between the MAC sublayer and the RLC sublayer provide the logical channels. The SAPs between the RLC sublayer and the PDCP sublayer provide the radio bearers.
- The multiplexing of several logical channels on the same transport channel is possible;
- The multiplexing of radio bearers with the same QoS onto the same priority queue is FFS. If there is no multiplexing of radio bearers onto priority queues, there is only one level of multiplexing in the RLC and MAC sublayers;
- In the uplink, only one transport block is generated per TTI in the non-MIMO case;
- In the downlink, the number of transport block is FFS.

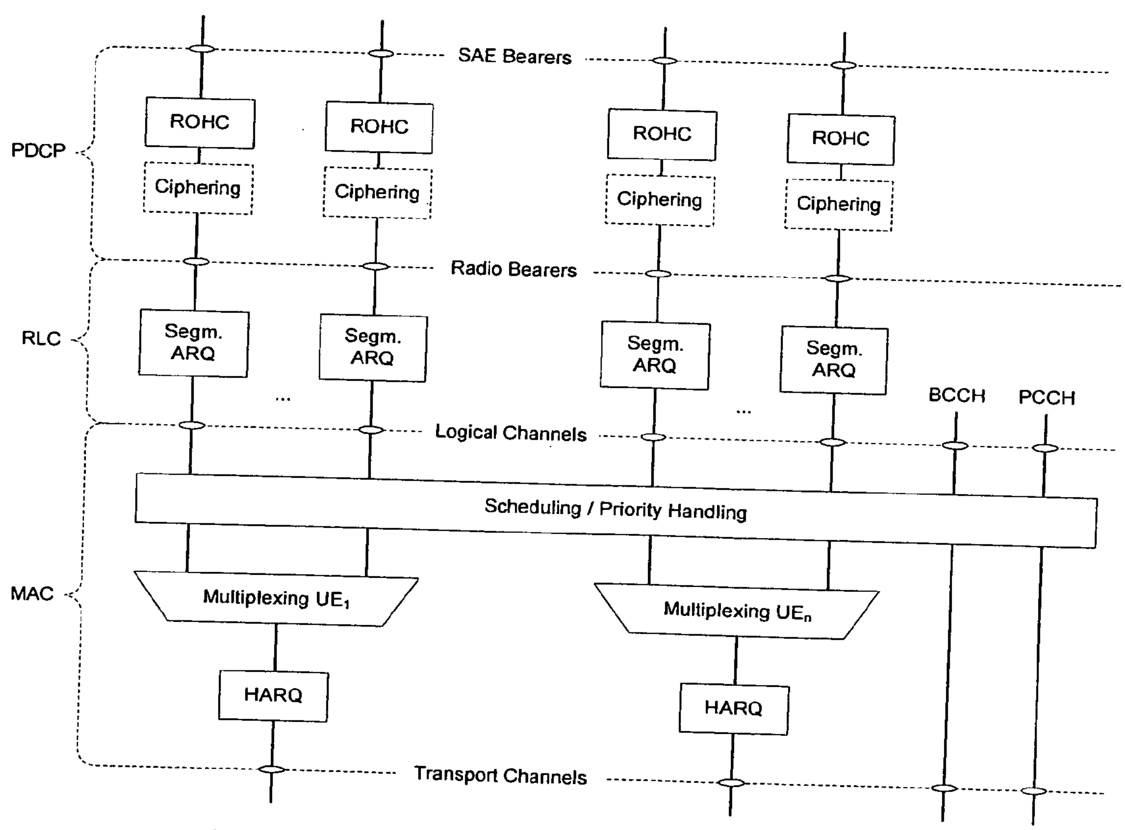

Figure 5.3a: Layer 2 Structure for DL in eNB and aGW

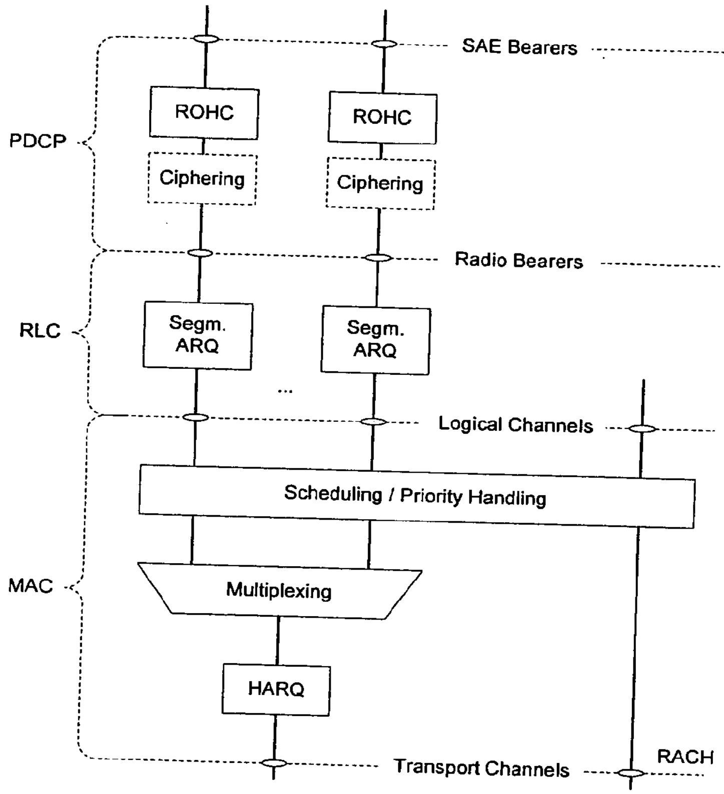

Figure 5.3.b: Layer 2 Structure for UL in UE

5.3.1 MAC Sublayer

This subclause provides an overview on services and functions provided by the MAC sublayer.

5.3.1.1 Services and Functions

The main services and functions of the MAC sublayer include:

- Mapping between logical channels and transport channels;
- Multiplexing/demultiplexing of RLC PDUs belonging to one or different radio bearers into/from transport blocks (TB) delivered to/from the physical layer on transport channels;
- Traffic volume measurement reporting;
- Error correction through HARQ;
- Priority handling between logical channels of one UE;
- Priority handling between UEs by means of dynamic scheduling;
- Transport format selection;
- Mapping of Access Classes to Access Service Classes (FFS for RACH);
- Padding (FFS);
- In-sequence delivery of RLC PDUs if RLC cannot handle the out of sequence delivery caused by HARQ (FFS).

NOTE: How the multiplexing relates to the QoS of the multiplexed logical channels is FFS.

5.3.1.2 Logical Channels

The MAC sublayer provides data transfer services on logical channels. A set of logical channel types is defined for different kinds of data transfer services as offered by MAC. Each logical channel type is defined by what type of information is transferred.

A general classification of logical channels is into two groups:

- Control Channels (for the transfer of control plane information);
- Traffic Channels (for the transfer of user plane information).

There is one MAC entity per cell. MAC generally consists of several function blocks (transmission scheduling functions, per UE functions, MBMS functions, MAC control functions, transport block generation…). Transparent Mode is only applied to BCCH (FFS) and PCCH.

5.3.1.2.1 Control Channels

Control channels are used for transfer of control plane information only. The control channels offered by MAC are:

- **Broadcast Control Channel (BCCH)**

  A downlink channel for broadcasting system control information.

- **Paging (and Notification) Control Channel (P(N)CCH)**

  A downlink channel that transfers paging information (and also notifications for MBMS FFS). This channel is used when the network does not know the location cell of the UE.

- **Common Control Channel (CCCH)**

  FFS: this channel is used by the UEs having no RRC connection with the network (need is FFS depending on whether the access mechanism is contained in L1. If RACH is visible as a transport channel, CCCH would be used by the UEs when accessing a new cell or after cell reselection).

- **Multicast Control Channel (MCCH)**

  FFS whether it is distinct from CCCH: a point-to-multipoint downlink channel used for transmitting MBMS scheduling and control information from the network to the UE, for one or several MTCHs. After establishing RRC connection this channel is only used by UEs that receive MBMS.

- **Dedicated Control Channel (DCCH)**

  A point-to-point bi-directional channel that transmits dedicated control information between a UE and the network. Used by UEs having an RRC connection.

5.3.1.2.2 Traffic Channels

Traffic channels are used for the transfer of user plane information only. The traffic channels offered by MAC are:

- **Dedicated Traffic Channel (DTCH)**

  A Dedicated Traffic Channel (DTCH) is a point-to-point channel, dedicated to one UE, for the transfer of user information. A DTCH can exist in both uplink and downlink.

- **Multicast Traffic Channel (MTCH)**

  A point-to-multipoint downlink channel for transmitting traffic data from the network to the UE.

5.3.1.3 Mapping between logical channels and transport channels

The figure below depicts the mapping between logical and transport channels (in grey the items for FFS):

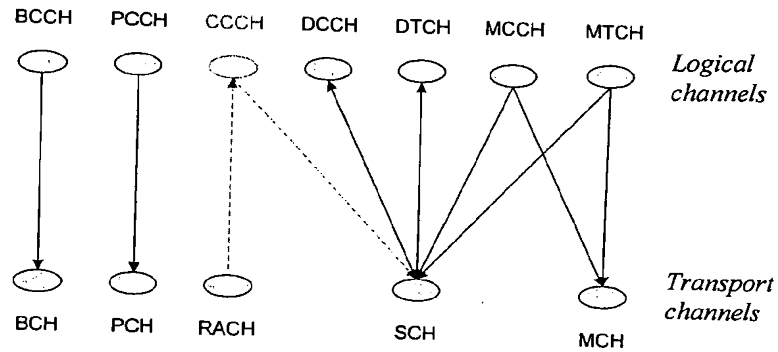

Figure 5.3.1.3: Mapping between logical channels and transport channels

5.3.1.3.1 Mapping in Uplink

In Uplink, the following connections between logical channels and transport channels exist:

- CCCH can be mapped to RACH: FFS if access procedure is not contained within L1;
- CCCH can be mapped to Uplink SCH: FFS if just a transient (random) ID is assigned for the resource request, the actual e.g. RRC Connection Request message has still to contain a UE identifier and therefore such message is considered to be a CCCH message, even if it's transported on the UL-SCH, since the UE is not in RRC_CONNECTED state at this stage;
- DCCH can be mapped to UL- SCH;
- DTCH can be mapped to UL-SCH.

5.3.1.3.2 Mapping in Downlink

In Downlink, the following connections between logical channels and transport channels exist:

- BCCH can be mapped to BCH;
- BCCH can be mapped to DL-SCH: FFS;
- PCCH can be mapped to PCH;
- CCCH can be mapped to DL-SCH: FFS if CCCH exists;
- DCCH can be mapped to DL-SCH;
- DTCH can be mapped to DL-SCH;
- MTCH can be mapped to MCH or DL-SCH;
- MCCH can be mapped to DL-SCH.

5.3.2 RLC Sublayer

This subclause provides an overview on services and functions provided by the RLC sublayer.

5.3.2.1 Services and Functions

The main services and functions of the RLC sublayer include:

- Transfer of upper layer PDUs supporting AM, UM or TM data transfer (FFS);
- Error Correction through ARQ;

- Segmentation according to the size of the TB;
- Resegmentation when necessary (e.g. when the radio quality, i.e. the supported TB size changes) (FFS if it takes place at PDU or SDU level);
- Concatenation of SDUs for the same radio bearer is FFS;
- In-sequence delivery of upper layer PDUs;
- Duplicate Detection;
- Protocol error detection and recovery;
- Flow Control (FFS between aGW and eNB);
- SDU discard (FFS);
- Reset (FFS).

5.3.3 PDCP Sublayer

This subclause provides an overview on services and functions provided by the PDCP sublayer.

5.3.3.1 Services and Functions

The main services and functions of the PDCP sublayer include:

- Header compression and decompression: ROHC only;
- Transfer of user data: transmission of user data means that PDCP receives PDCP SDU from the NAS and forwards it to the RLC layer and vice versa;
- Security: ciphering of user plane data (FFS).

NOTE: When compared to UTRAN, the *lossless DL RLC PDU size change* is not required.

5.3.4 Data flows through Layer 2

Note: Different flows for different transport channels, logical channels and transfer mode.

5.4 RRC

This subclause provides an overview on services and functions provided by the RRC sublayer.

5.4.1 Services and Functions

The main services and functions of the RRC sublayer include:

- Broadcast of System Information related to the non-access stratum (NAS);
- Broadcast of System Information related to the access stratum (AS);
- Paging;
- Establishment, maintenance and release of an RRC connection between the UE and E-UTRAN including:
  - Allocation of temporary identifiers between UE and E-UTRAN;
  - Configuration of radio resources for RRC connection.
- Security functions including integrity protection for RRC messages (FFS);

- Establishment, maintenance and release of point to point Radio Bearers including configuration of radio resources for the Radio Bearers;
- Mobility functions including:
  - UE measurement reporting and control of the reporting for inter-cell and inter-RAT mobility;
  - Inter-cell handover;
  - UE cell selection and reselection and control of cell selection and reselection;
  - Context transfer between eNBs.
- Notification for multicast/broadcast services (FFS);
- Establishment, maintenance and release of Radio Bearers for multicast/broadcast services, including configuration of the Radio Bearers (FFS);
- QoS management functions (FFS is spread across multiple layers);
- UE measurement reporting and control of the reporting;
- MBMS control;
- NAS direct message transfer to/from NAS from/to UE (FFS).

5.4.2 RRC protocol states & state transitions

RRC uses the following states:

- **RRC_IDLE**:
  - DRX;
  - Broadcast of system information;
  - Paging;
  - Cell re-selection mobility;
  - The UE shall have been allocated an id which uniquely identifies the UE in a tracking area;
  - No RRC context stored in the eNB.
- **RRC_CONNECTED**:
  - UE has an E-UTRAN-RRC connection;
  - UE has context in E-UTRAN;
  - E-UTRAN knows the cell which the UE belongs to;
  - Network can transmit and/or receive data to/from UE;
  - Network controlled mobility (handover);
  - Neighbour cell measurements;
  - At RLC/MAC level:
    - UE can transmit and/or receive data to/from network;
    - UE monitors control signalling channel for shared data channel to see if any transmission over the shared data channel has been allocated to the UE;
    - UE also reports channel quality information and feedback information to eNB;

- DRX/DTX period can be configured according to UE activity level for UE power saving and efficient resource utilization. This is under control of the eNB.

5.5 NAS control protocol

This subclause provides an overview on services and functions provided by the NAS control protocol.

NOTE: the NAS control protocol is not covered by the scope of this TR and is only mentioned for information.

5.5.1 Services and Functions

The main services and functions of the NAS sublayer include:

- SAE Bearer control (see 3GPP TR 23.882 [6]);
- LTE_IDLE mobility handling;
- Paging origination;
- Configuration and control of PDCP;
- Configuration and control of Security.

5.5.2 NAS protocol states & state transitions

The NAS control protocol uses the following states:

- **LTE_DETACHED**:
  - No RRC entity.
- **LTE_IDLE**:
  - RRC_IDLE State;
  - Some information is stored in the UE and in the network:
    - IP address, etc;
    - Security association (keys, etc);
    - UE capability information (FFS);
    - Radio Bearers (FFS);
  - State transition decided in eNB or aGW (FFS);
- **LTE_ACTIVE**:
  - RRC_CONNECTED State;
  - State transition decided in eNB or aGW (FFS);

The following figure reflects how the NAS states relate to the RRC:

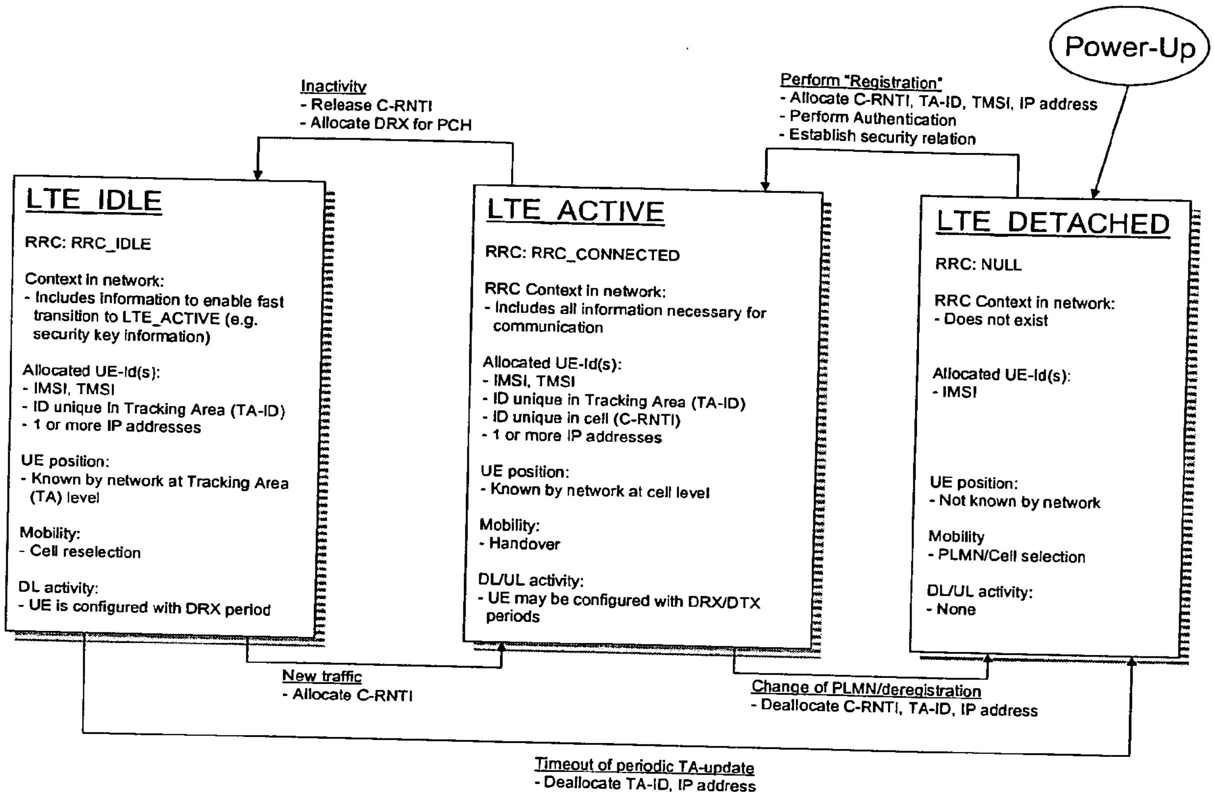

Figure 5.5.2: E-UTRAN RRC protocol states

NOTE: The applicability of the ID unique in Tracking Area (TAID) in LTE_DETACHED is FFS.

The UE context in the aGW will discriminate the 3 states. The UE context in the eNB will only exist in the LTE_ACTIVE state.

5.6 Identities used over the E-UTRAN radio interface

5.6.1 NAS related UE identities

NAS related UE identities used in E-UTRAN are assumed to be similar to the NAS identities used in 2G or 3G:

a) IMSI/IMEI;

b) TMSI for MME:

- Temporary identity allocated by the MME. The scope of the TMSI for MME is FFS.

c) TMSI for UPE (FFS):

- Temporary identity allocated by the UPE.

5.6.2 E-UTRAN related UE identities

The following E-UTRAN related UE identities are used:

a) C-RNTI:

- The C-RNTI provides a unique UE identification at the cell level;

- It is assumed that this identity is used for scheduling unless the cost would turn out to be too high and the introduction of a separate MAC identity would be required.

b) Random value for contention resolution:

- During some transient states, the UE is temporarily identified with a random value for contention resolution purposes.

5.6.3 Network entity related Identities

The following identities are used in E-UTRAN for identifying a specific network entity:

a) MME identity:

- It is agreed that a UE in LTE_IDLE establishing an RRC connection has to provide a unique identification of its current MME to the eNB when the connection establishment is initially related to NAS signalling;
- It is FFS whether this MME identity is also provided when the RRC connection is initially intended for user plane traffic;
- It is FFS whether this MME identity is provided by the UE to the eNB as a separate identity, or whether this MME identity is included in the TMSI for MME.

b) eNB identity or cell identity (FFS):

- The signalling sequence to be followed in case a UE in LTE_ACTIVE accesses a cell in which no UE context has been established yet (kind of "cell update") is currently not agreed. Identified options are:
  1) In order to obtain the UE context/data from the old eNB, the new eNB directly contacts the old eNB without consulting the aGW;
  2) In order to obtain the UE context/data from the old eNB, the new eNB consults the aGW to obtain the identity of the old eNB;
  3) In order to obtain a UE context, the new eNB contacts the aGW.
- If it is required for the new eNB to be able to contact the old eNB without involving the aGW (case 1 above), the UE has to provide a network entity related identification that enables the new eNB to contact the old eNB, and that enables the old eNB to uniquely identify the UE for retrieving the correct UE context. For this purpose either an eNB identity or cell identity could be used.

c) UPE identity (FFS):

- The signalling sequence to be followed when a UE in LTE_IDLE wants to establish an RRC connection initially intended for user plane traffic is not agreed yet. If it is required to support user plane data transport before the UE context is retrieved from the aGW, the UE might have to provide a UPE identity to the eNB thus enabling the new eNB to contact the UPE directly.

d) Tracking Area identity (FFS):

- Unique identification of a Tracking Area in a PLMN.

The following identities are broadcast in every E-UTRAN cell:

a) Cell identity:

- Uniquely identifying the cell in the area (size of area is FFS).

b) One or more Tracking Area identities (FFS):

- Tracking Area (s) this cell belongs to.

c) One or more PLMNs:

- PLMN (s) for which this cell is providing radio access.

5.6.4 MBMS related Identities

The following E-UTRAN related MBMS identity is used:

a) MBMS Id:

- The MBMS Id provides a unique identification of an MBMS bearer service.

---------- Omitted Sections ----------

11 MBMS

Note: A separate chapter might be needed to deal with MBMS specific issues.

Note: From R2-051759: The following issues have to be discussed: need for selective combining within E-UTRA, possibility to perform selective combining between E-UTRA and UTRA; need for L1 combining (simpler with OFDM); FLC across UTRA and E-UTRA, all new requirements of MBMS for LTE...

11.1 MBMS E-UTRA/E-UTRAN principles

1. The E-UTRA/E-UTRAN protocol architecture agreed for dedicated services is the baseline protocol architecture of the E-UTRA/E-UTRAN MBMS.
2. The MBMS should permit simultaneous, tightly integrated and efficient provisioning of dedicated and MBMS services to the user. The simultaneous reception of several MBMS services should not be optimized with high priority.
3. An MBMS service is distributed to a group of cells by the aGW. In case of multi-cell transmission, the network should provide synchronous transmission of an MBMS service from the cells.
4. Only a point-to-multipoint radio bearer is supported for MBMS. Therefore, the network does not need to count the number of MBMS users in a cell. Whether the network should detect the existence of MBMS users to avoid unnecessary MBMS transmission in a cell where there is no MBMS user is FFS.
5. The RRC layer in eNB controls MBMS transmissions based on information given from aGW e.g. QoS parameters, semi-static scheduling information.
6. The PDCP layer in aGW performs header compression of multicast/broadcast services. There is one PDCP entity per cell group for one service in the aGW.
7. UEs in RRC IDLE and CONNECTED mode is allowed to receive an activated MBMS service.
8. The MBMS should support diverse deployment scenarios with scalable bandwidth. The network is allowed to provide an MBMS service on a carrier dedicated to MBMS as well as on a carrier with a dedicated service.

11.2 MBMS E-UTRA/E-UTRAN functions

The functions hosted by the eNB are:

- Scheduling and transmission of notification messages;
- Scheduling and transmission of MBMS control information;
- Scheduling of single-cell MBMS services;
- Transmission of single-cell and multi-cell MBMS services;
- Point-to-multipoint radio bearer control.

The functions hosted by the aGW are:

- Distribution of MBMS services

- MBMS SAE bearer control;
- Scheduling of multi-cell MBMS services;
- PDCP.

Additional functions related to MBMS may be added to eNB and aGW.

11.3 MBMS E-UTRA/E-UTRAN transmission

There are two types of MBMS transmissions:

a) Single-cell transmission
   - An MBMS service, e.g. group message distribution, is transmitted only on the coverage of a specific cell;
   - An MBMS service is transmitted on DL-SCH by scheduling done by eNB;
   - L1 combining is not supported;

b) Multi-cell transmission
   - An MBMS service, e.g. TV broadcasting, is transmitted on the coverage of a group of cells;
   - An MBMS service can be transmitted on MCH by scheduling done by aGW;

-L1 combining is supported;------------------------------ **The End of Text Proposal** ------------------------------

Agenda Item	**:**	**16**
Source	**:**	**LG Electronics**
Title	**:**	**Proposed Skeleton TR for Improvement of MBMS**
Document for	**:**	**Discussion and Decision**

3GPP TR 25.xxx V0.0.0 (2006-05)

Technical Report

3rd Generation Partnership Project;
Technical Specification Group Radio Access Network;
Improvement of the Multimedia Broadcast Multicast Service (MBMS) in UTRAN
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Keywords

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Contents

Foreword

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x the first digit:

1 presented to TSG for information;

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3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

Editor's notes: This section describes the scope of this study item. The scope of this study item defined in [1] may be narrowed down.

The present document summarizes the work done under the study item "Improvement of the Multimedia Broadcast Multicast Service (MBMS) in UTRAN" defined in [1] by listing technical concepts addressing the objectives of the study item, analysing these technical concepts and recommending a way forward of the study item.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] 3GPP TD RP-050746: "Proposed Study Item on Improvement of the Multimedia Broadcast Multicast Service (MBMS) in UTRAN".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply.

<defined term>: <definition>.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

<symbol> <Explanation>

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

UMTS	Universal Mobile Telecommunications System
UTRAN	UMTS Terrestrial Radio Access Network
MBMS	Multimedia Broadcast Multicast Service

4 Overview of Proposed Improvements

Editor's notes: This section describes and analyses the technical schemes proposed for MBMS improvements in the scope of this study item.

5 Conclusions and Recommendations

Editor's notes: This section concludes this feasibility study and describes which technical schemes of section 4 are recommended to further enhance MBMS in the scope of this study item.

5.1 Conclusions

5.2 Recommendations

Annex A: Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
2006-05	RAN2#53	R2-05xxxx			Proposed Skeleton TR		0.0.0

Agenda Item : 11.11

Source : LG Electronics

Title : Resource request in Synchronized Case

Document for : Discussion and Decision

Introduction

The purpose of this paper is to clarify how a UE requests uplink resource in synchronized case.

Discussion

According to the TP on RACH, the synchronized random access is used when a UE uplink is time synchronized by the node B. And the purpose is for the UE to request resource for uplink data transmission.

According to our understanding, when uplink data to be transmitted arrive to buffer of a UE, the UE would request resource including synchronized random access if it does not have valid uplink resource. Therefore, we are assuming that new data arrive to the UE's buffer in below cases in this paper.

However, in addition to synchronized random access, there may be several resource request mechanism for uplink synchronized UE depending on its data transmission status on uplink and downlink.

We describe possible cases in synchronization as follows.

Case 1. when a UE transmits uplink data frequently

In this case, the synchronized RACH procedure may not be necessary since RR (Resource Request) can be sent over in-band signaling on uplink data.

Case 2. when a UE does not transmit uplink data frequently but the UE is receiving downlink data from network.

In this case, uplink resource can be allocated to send data non-associated control signals such as CQI or ACK/NACK. Thus, RR indicator [1] to request resource for UL data could be embedded into CQI or ACK/NACK signaling, e.g., as 1 additional bit on CQI. However, if period of CQI and ACK/NACK transmission is not frequent enough to support an efficient RR on uplink, then the UE could use the synchronized RACH procedure to request resource for uplink data.

And since the radio resource for non-scheduled transmission may be periodically assigned to the UE, RR can be sent over in-band signaling on uplink non-scheduled data. In that case, the synchronized RACH procedure may not be necessary.

Case 3. when a UE does not transmit uplink data frequently and the UE is not receiving downlink data from network

In this case, UE may transmit CQI intermittently in order to help Node B initiate downlink scheduling whenever necessary. Or else, UE may transmit only uplink pilot signal to maintain the uplink synchronization. In the first case, RR indicator on CQI may be still applicable depending on the frequency of CQI transmission. In the second case, UE should use synchronized RACH procedure for RR in uplink.

And since the radio resource for non-scheduled transmission may be periodically assigned to the UE, RR can be sent over in-band signaling on uplink non-scheduled data. In that case, the synchronized RACH procedure may not be necessary.

As discussed above, in-band signaling on uplink data transmission or synchronized RACH would be a basic procedure for uplink RR since those two procedures cover all the cases mentioned above. However, RR indication on data non-associated control signaling, such as 1 bit RR on CQI, should also be considered since RR on uplink by synchronized RACH procedure may not be efficient because it takes more uplink resources and involves contention and collision resulting in more latency. This scheme should be employed as a compensation on top of the basic procedures for uplink RR since it can be applicable only for certain UEs which transmit data non-associated control signaling in uplink.

Conclusion

We propose to discuss methods of resource request in synchronized case and to capture the agreeable parts in the TR.

Reference

[1] R1-060922 Uplink resource request for uplink scheduling, LG Electronics

Agenda Item : 11.10
Source : LG Electronics
Title : Discussion on Initial Access to LTE Cell
Document for : Discussion and Decision

1. Introduction

This document dicusses initial access procedures to a LTE cell.

2. Network/UE-originated Initial Access Procedure

The network originated initial access procedure is started with a paging message. When a UE receives its own paging message, the UE tries to access a cell. On the other hand, the UE originated initial access procedure is started without a paging message. The procedures are shown in the figure 1.

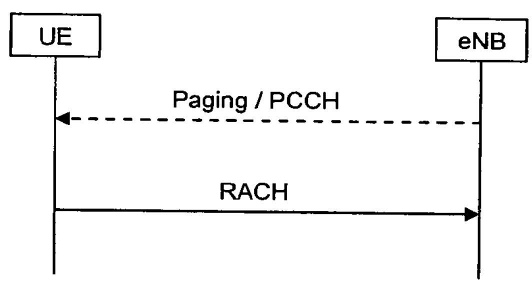

Figure 1. Network/UE-originated Initial Access Procedure

2.1 Paging

In the figure 1, the same paging message will be transmitted across multiple cells over the same Tracking Area. Thus, PCH channel could be optimized with a combining scheme from multi cells because it is assumed that pagings may not be cell specific.

2.1.1 Soft Combining of PCH Channel

As the combining scheme, soft combining or selective combining could be considered. The soft combining is better than selective combining in terms of performance. However, in case of soft combining PCH should be statically mapped to a specific frequency and time in all cells over the same Tracking Area. i.e. when scalable cell bandwidths are applied to multiple cells over the same Tracking Area, e.g. 10 Mhz and 20 Mhz cells on the same Tracking Area, this static resource mapping could not be always possible.

Also, it is noted that PCH can be mapped to physical resources which can be used dynamically also for traffic/other control channels according to 25.813. However, soft combining could not be applied to physical resources which can be used dynamically also for traffic/other control channels because soft combined sub-frames would have a long cyclic prefix and however DL SCH sub-frames a short cyclic prefix.

But, if soft combining of PCH is applied only to intra-Node case, such drawbacks may be not a big deal.

2.1.2 Selective Combining of PCH Channel

Selective combining could be broadly used over the same Tracking Area and be applied to various scalable cell bandwidth scenarios e.g. neighboring 10 Mhz and 20 Mhz cells. Also, selective combining could be applied to physical resources which can be used dynamically also for traffic/other control channels. However, a UE should decode multiple cells to selectively combine PCH channels of multiple cells. It is noted that timing of paging would be aligned among cells based on a UE DRX cycle, even with selective combining.

2.1.3 Support for More than one Tracking Area on a Cell

In the case of combining, either soft or selective combining, Since a cell can be placed in more than one Tracking Area, different cells could have different combinations of Tracking Areas. Due to this, it may be difficult to combine PCH channels from different cells over one Tracking Area. To solve this problem, multiple PCCH or PCH channels may need to be supported for one cell and each PCCH or PCH channel is configured for each Tracking Area.

In particular, in case of selective combining, L2 sequence numbers of PCH need to be provided by aGW to support selective combining in L2. Thus, different sequence numbering may need to be done for different Tracking Area.

2.2 Preamble Resource Allocation

2.2.1 RACH preamble resource allocated by Paging

RACH preamble resource could be allocated by PCH channel. In that case, a paged UE would access a cell by RACH without collision. However, since it is assumed that a paging is transmitted at multiple cells over a Tracking Area, all cells except one paging cell will wastefully allocate RACH preamble resources.

Thus, it is not preferred to allocate RACH preamble by PCH channel.

2.2.2 Random Selection of RACH preamble resource

This is similar to R99 RACH preamble. The cell broadcasts one or more sets of RACH preamble resources e.g. according to ASC. The RACH preamble resource can be randomly selected within one set of RACH preamble resources by the UE. It is proposed to use this scheme for Network/UE-originated Initial Access Procedures.

It is noted that in case of handover, the UE may be able to send a RACH preamble in a target cell with a resource allocated from a source cell.

2.3 Information sent on UL for initial access

When a UE initially accesses a cell, the UE needs to indicate the following points to the network either explicitly or implicitly:

- Cell identification i.e. which cell the UE wish to access
- UE identification e.g. random UE id

In addition, When a UE initially accesses a cell, if the following information is carried on RACH, it would be helpful:

- a priority e.g. Access Service Class, Logical Channel Priority
- a cause value. e.g. Establishment Cause

2.3.1 Cell Identification

If different cells share the same UL band, the cell identifier should be included in the preamble. In this case, a cell should broadcast a short cell identifier which needs to be short enough to be carried on one RACH preamble. On the other hand, if different cell uses different radio resource e.g. time, frequency, a cell can be identified by the different radio resource without any identifier in the RACH preamble.

2.3.2 UE Identification

If a RACH preamble carries a sequence, the sequence may be able to differentiate UEs. However, there would be only a limited number of sequences on RACH preamble. Thus, clear UE identification needs to be done by RACH preamble or Scheduled Transmission after the RACH preamble to reduce collision due to RACH access.

2.3.2.1 Use of Allocated UE identity on Scheduled Transmission

In case of intial access, if the RACH preamble or the Scheduled Transmission carries a NAS related UE identity such as TMSI, there will be no collision. However, it is felt that the RACH preamble is not capable of carrying the long identity. Thus, this method cannot reduce collision of the RACH preamble. Collision would be solved after RACH preamble.

2.3.2.2 Use of a random UE identity on RACH preamble

A UE can generate random number for a UE identity to be transmitted on RACH preamble. This method can reduce collision of the RACH preamble. However, it is not totally free from collision.

2.3.3 Priority

In R99, when a UE sends RACH preamble, the UE needs to perform ASC selection in MAC layer. During the procedure, the UE needs to use ASC mapped to AC and LoCH priority. It is felt that such RACH prioritization can be realized in LTE RACH by the following ways:

- Like R99, RACH priority is indicated by a UL radio resource allocated to the RACH preamble.
- RACH priority is indicated by a priority bit carried on the RACH preamble.

When the network responds to an initial access of a UE, the network needs to consider this priority. Thus, this information needs to be indicated by the preamble, not by the scheduled transmission.

2.3.4 Cause Value

In R99, when a UE initially requests a RRC connection, the initial message includes 'Establishment Cause'. This information is included not in the RACH preamble, but in the RACH message. Thus, detailed causes like 'Establishment Cause' could be carried on the scheduled transmission after the RACH preamble.

However, simple RACH causes such as initial access, handover, synchronization maintanence could be considered to help the cell to responds the RACH access.

This simple cause value also can be indicated:

- by a UL radio resource allocated to the RACH preamble; or
- by a cause bit carried on the RACH preamble.

3. Conclusion

It is proposed in this document that:

- Soft or selective combining need to be considered for PCH channel.
- In case of initial access, a RACH preamble resource is randomly selected among a set of RACH preamble resources by a UE.
    - In case of handover, a RACH preamble resource used in a target cell can be allocated to a UE by source cell.
- Which cell a UE try to access, a priority and a simple cause value are indicated by a UL resource used for a RACH preamble or by bits inserted in a RACH preamble.

3GPP TR 25.912 V0.1.3 (2006-5)

Technical Report

3rd Generation Partnership Project;
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y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

This present document is the technical report for the study item "Evolved UTRA and UTRAN" [1]. The objective of the study item is to develop a framework for the evolution of the 3GPP radio-access technology towards a high-data-rate, low-latency and packet-optimized radio access technology.

2 References

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[1] 3GPP TD RP-040461: "Proposed Study Item on Evolved UTRA and UTRAN".

[2] 3GPP TR 25.814: "Physical Layer Aspects for Evolved UTRA"

[3] 3GPP TR 23.882: "3GPP System Architecture Evolution: Report on Technical Options and Conclusions"

[4] 3GPP TR 25.913: "Requirements for Evolved UTRA (E-UTRA) and Evolved UTRAN (E-UTRAN)"

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply.

<defined term>: <definition>.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

<symbol> <Explanation>

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

4 Introduction

At the 3GPP TSG RAN #26 meeting, the SI description on "Evolved UTRA and UTRAN" was approved [1].

The justification of the study item was, that with enhancements such as HSDPA and Enhanced Uplink, the 3GPP radio-access technology will be highly competitive for several years. However, to ensure competitiveness in an even longer time frame, i.e. for the next 10 years and beyond, a long-term evolution of the 3GPP radio-access technology needs to be considered.

Important parts of such a long-term evolution include reduced latency, higher user data rates, improved system capacity and coverage, and reduced cost for the operator. In order to achieve this, an evolution of the radio interface as well as the radio network architecture should be considered.

Considering a desire for even higher data rates and also taking into account future additional 3G spectrum allocations the long-term 3GPP evolution should include an evolution towards support for wider transmission bandwidth than 5 MHz. At the same time, support for transmission bandwidths of 5MHz and less than 5MHz should be investigated in order to allow for more flexibility in whichever frequency bands the system may be deployed

5 Deployment Scenario

Editor's notes: This chapter will capture NW deployment scenarios and results of evaluations on its system concept. Responsible WG is RAN3.

6 Radio Interface Protocol Architecture for evolved UTRA

Editor's notes: This chapter will capture the overall protocol architecture for evolved UTRA.

7 Physical Layer for evolved UTRA

Editor's notes: This chapter will capture physical layer specific solutions to meet requirements for evolved UTRA and UTRAN.

7.1 Downlink Transmission Scheme

For both FDD and TDD, the downlink transmission scheme is based on OFDM. Each 10 ms radio frame is divided into 20 equally sized sub-frames. In addition, for coexistence with LCR-TDD, a frame structure according to [2], section 6.2.1.1.1, is also supported when operating E-UTRA in TDD mode. Channel-dependent scheduling and link adaptation can operate on a sub-frame level.

7.2 Uplink Transmission Scheme

For both FDD and TDD, the basic uplink transmission scheme is based on low-PAPR single-carrier transmission (SC-FDMA) with cyclic prefix to achieve uplink inter-user orthogonality and to enable efficient frequency-domain equalization at the receiver side. Each 10 ms radio frame is divided into 20 equally sized sub-frames and scheduling can operate on a sub-frame level. In addition, for coexistence with LCR-TDD, a frame structure according to [2], section 6.2.1.1.1, is also supported when operating E-UTRA in TDD mode. To allow for multi-user MIMO reception at the Node B, transmission of orthogonal pilot patterns from single Tx-antenna UEs is part of the baseline uplink transmission scheme.

8 Layer 2 and RRC Evolution for evolved UTRA

Editor's notes: This chapter will capture specific solutions of layer 2 and RRC to meet requirements for evolved UTRA and UTRAN.

9 Architecture for evolved UTRAN

9.1 RAN-CN functional split

Editor's notes: This chapter will capture agreed RAN-CN functional split with SA2.

9.2 System migration scenario

Editor's notes: This chapter will capture possible UTRAN internal and RAN-CN system migration scenario.

9.3 Evolved UTRAN Architecture

Editor's notes: This chapter will capture specific solutions of UTRAN internal architecture to meet requirements for evolved UTRA and UTRAN.

9.3.1 Description of evolved UTRAN Architecture

This chapter describes the definition of an evolved UTRAN Architecture in terms of logical nodes, each node hosting a set of functions and the related physical interfaces.

9.3.2 Solution for evolved UTRAN Architecture

The evolved UTRAN consists of eNodeBs, providing the evolved UTRA user plane (PHY/MAC) and control plane (RRC) protocol terminations towards the UE. An eNodeB hosts the following functions: Radio Bearer Control, Radio Admission Control, Connection Mobility Control, Dynamic Resource Allocation (scheduling). The EUTRAN architecture is illustrated in Figure 9.3.2-1.

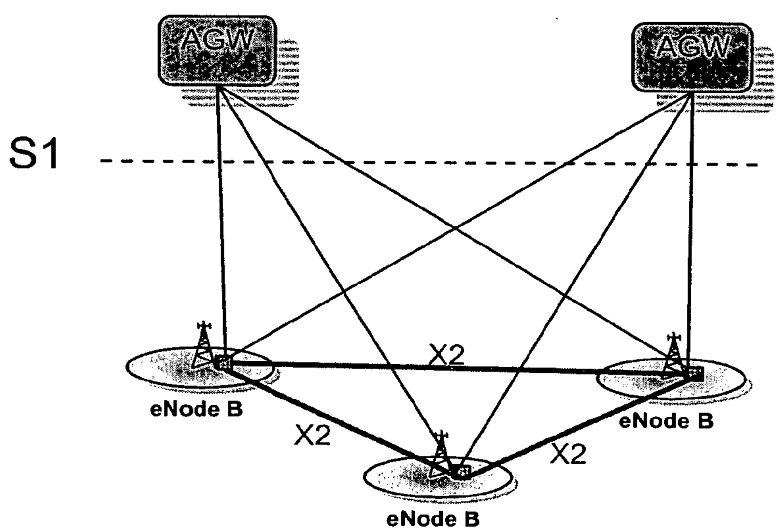

Figure 9.3.2-1: EUTRAN Architecture

The eNodeBs are interconnected with each other by means of the X2 interface in a meshed way. It is assumed that there always exists an X2 interface between the eNodeBs that need to communicate with each other, e.g. for support of handover of UEs in LTE_Active.

The eNodeBs are also connected by means of the S1 interface to the Access Gateway (this term used as a synonym for MME/UPE/inter-Access Mobility Anchor). The S1 interface support a many-to-many relation between AGWs and eNodeBs.

The location of inter-cell RRM (interference management & load management) will reside either in the eNodeBs (de-centralised approach) or in a node external to the eNodeBs (centralised approach, "RRM Server")

IP Header Compression and encryption of user data streams reside in the Access Gateway.

Termination of UP packets for paging reasons and paging initiation is performed in the Access Gateway.

9.3.3 Impact on the baseline CN Architecture

Editors Note: It is FFS whether there is any particular impact.

9.3.4 Impact on the baseline RAN Architecture

Editors Note: It is FFS whether there is any particular impact.

9.3.5 Impact on terminals used in the existing architecture

Editors Note: It is FFS whether there is any particular terminal impact.

9.4 Intra-LTE-Access-System Mobility

9.4.1 Intra-LTE-Access-System Mobility Support for UE in LTE_IDLE

Refer to section 7.7 in [3].

9.4.2 Intra LTE-Access-System Mobility Support for UE in LTE_ACTIVE

9.4.2.1 Description of Intra-LTE-Access Mobility Support for UEs in LTE_ACTIVE

The Intra-LTE-Access Mobility Support for UEs in LTE_ACTIVE handles all necessary steps already known from state of the art relocation/handover procedures, like processes that precedes the final HO decision on the source network side (control and evaluation of UE and "PHY/MAC control" measurements taking into account certain UE specific area restrictions), preparation of resources on the target network side, commanding the UE to the new radio resources and finally releasing resources on the (old) source network side. It contains mechanisms to transfer context data between evolved nodes, and to update node relations on C- and U-plane.

9.4.2.2 Solution for Intra-LTE-Access Mobility Support for UEs in LTE_ACTIVE

9.4.2.2.1 C-plane handling:

The HO procedure is performed without MME/UPE involvement, i.e. preparation messages are directly exchanged between the eNodeBs. The release of the resources at the source side during the HO completion phase is triggered by the eNodeB entity.

The HO procedure comprises the following steps:

UEs in LTE_ACTIVE are still controlled by the eNodeB, responsible for the UE's radio link quality and configuring neighbour-cell measurements in UL and DL as well as the "PHY/MAC" to provide corresponding UL measurements. Additional information like load and interference states in neighbours is beneficial, the provision is FFS.

Typically, the source eNodeB entity triggers the HO process after it has made a definite decision to serve the user in another cell.

After the target eNodeB has received the final confirmation from the UE on HO completion it starts to trigger the release source-cell and related transport/context resources.

Note 1: The functional entity "RRC" and "PHY/MAC" are located in the eNodeB.

Note 2: The MME/UPE is co-located in one functional entity for simplicity reasons; however it is FFS in SA2.

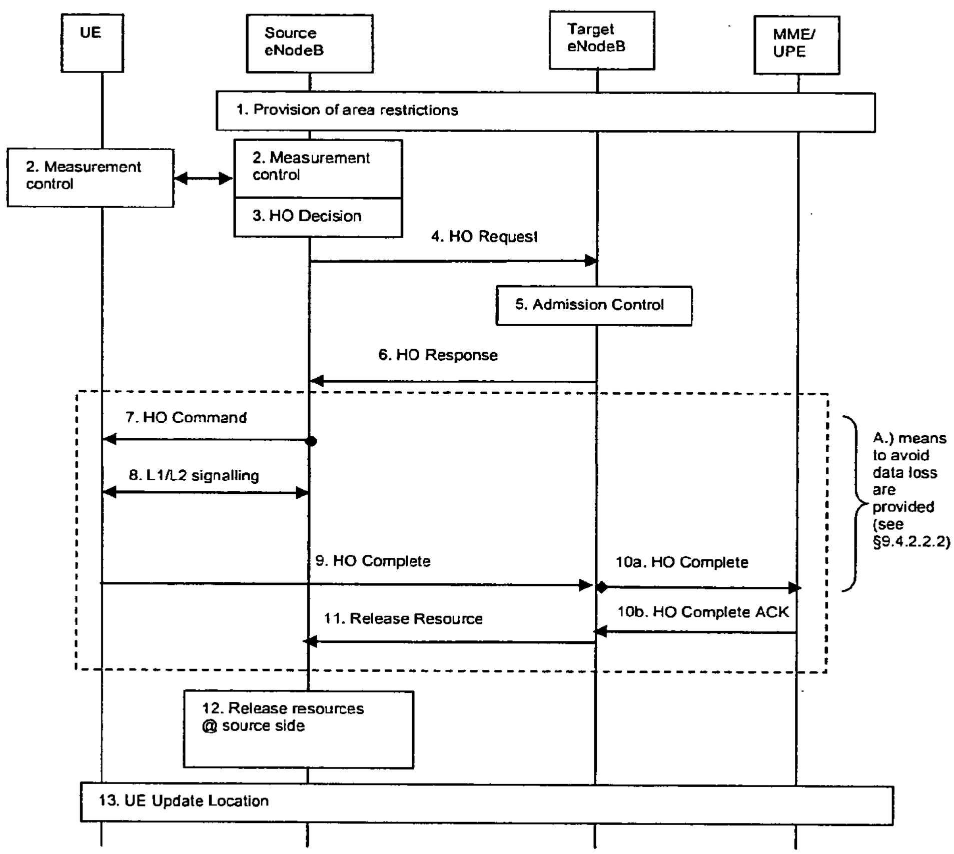

Figure 9.4.2-1: Information flow for Intra-LTE-Access Mobility Support

1) The UE context within the source eNodeB contains information regarding roaming restrictions which where provided either at connection establishment or at the last TA update.

2) The source eNodeB entity configures the UE measurement procedures according to the area restriction information. Measurements provided by the source eNodeB entity may assist the function controlling the UE's connection mobility.

3) Based on measurement results from the UE and the source eNodeB, probably assisted by additional RRM specific information, the source eNodeB decides to handover the UE to a cell controlled by the target eNodeB.

4) The source eNodeB issues a HO Request to the target eNodeB entity passing necessary information to prepare the HO at the target side. The target eNodeB configures the required resources.

5) Admission Control is performed by the target eNodeB to increase the likelihood of a successful HO, if the resources can be granted by target eNodeB.

6) The HO preparation is finished at the target side, information for the UE to reconfigure the radio path towards the target side is passed to the source eNodeB.

A) from step 7) until 11a) means to avoid data loss during HO are provided and are detailed in §9.4.2.2.2.

7) The UE is commanded by the source eNodeB entity to perform the HO, target side radio resource information is contained.

8) The UE gains synchronisation at the target side.

9) Once the UE has successfully accessed the cell, it sends an indication to the target eNodeB that the handover is completed.

10) The MME/UPE is informed that the UEs data path has to be switched to the target side and TNL resources towards the source side can be released. The MME/UPE confirms the HO Complete message with the HO Complete ACK message.

11) After the reception of the HO Complete ACK message the target eNodeB triggers the release of resources at the source side.

12) The source eNodeB entity releases radio, context and TNL resources.

13) If the new cell is member of a new Tracking Area, the UE needs to register with the MME/UPE which in turn updates the area restriction information on the target side.

9.4.2.2.2 User plane handling

Note 1: The MME/UPE is co-located in one functional entity for simplicity reasons; however this is ffs in SA2.

Note 2: Further details wrt to UP handling are FFS; dependant on the input received from SA4.

The U-plane handling during the Intra-LTE-Access mobility activity for UEs in LTE_ACTIVE takes the following principles into account to avoid data loss during HO and hence to support seamless/lossless service provision:

- During HO preparation a user plane tunnel is established between the source eNodeB and the target eNodeB.
- During HO execution, user data may be forwarded from the source eNodeB to the target eNodeB. The forwarding may take place in a service dependent and implementation specific way.

  Forwarding of user data from the source to the target eNodeB should take place as long as packets are received at the source eNodeB from the UPE.
- During HO completion:
  - After the MME/UPE was informed by the target eNodeB that the UE has gained access at the target eNodeB by the HO Complete message, the user plane path is switched by the MME/UPE from the source eNodeB to the target eNodeB.
- The source eNodeB shall continue forwarding of user plane data as long as packets are received at the source eNodeB from the UPE.

9.4.2.3 Impact on the baseline CN Architecture

Editors Note: It is FFS whether there is any particular impact

9.4.2.4 Impact on the baseline RAN Architecture

Editors Note: It is FFS whether there is any particular impact

9.4.2.5 Impact on terminals used in the existing architecture

Editors Note: It is FFS whether there is any particular terminal impact.

9.5 Inter 3GPP Access System Mobility

9.5.1 Inter 3GPP Access System Mobility in Idle State

Refer to section 7.5 in [3].

9.5.2 Inter 3GPP Access System Mobility Handover

Refer to section 7.8.2 in [3].

9.6 Resource Establishment and QoS Signalling

9.6.1 QoS Concept and Bearer Service Architecture

Refer to section 7.12.2 and 7.12.3 in [3].

9.6.2 Description of Resource Establishment and QoS Signalling

The key issue on Resource Establishment and QoS signalling encompasses the following aspects:

- Means for providing enhanced QoS for services that require QoS or policies beyond what the default IP Access service provides including the provisioning of QoS/policy information to the network entities that control radio/network resources;
- Signalling of QoS profiles and signalling for Resource Establishment or Resource Reservation, including the direction of such signalling procedures (i.e. Network initiated / UE initiated);

9.6.3 Solution for Resource Establishment and QoS Signalling

Resource Establishment and QoS Signalling handle the provisioning of QoS/policy information to the network entities that control radio/network resources. Radio/network resources are controlled applying information about the users' subscription, the UE's and the radio/network capabilities, the availability of radio/network resources and certain operator policies.

It is assumed that resources can always be granted even though the requested QoS may not, i.e. the QoS can be downgraded by the network/radio. It is FFS to which extent a negotiation/re-negotiation of requested network resources shall be possible.

Resource Establishment and QoS Signalling for resources with different QoS than for default IP Access service assume a preceding signalling of QoS requirements. This could be performed either by application signalling (e.g. IMS) or by other TBD means. It is FFS if this will lead to the establishment of additional IP Access services (comparable to UMTS PS bearers).

Signalling of QoS requirements takes place on the already established resources of the default IP Access service. An application function performs the negotiation with the UE on media components and their characteristics. The media information is translated (e.g. by the PCRF) into the necessary Policy/QoS information which is contained in the resource request triggering the Resource Establishment.

The Resource Establishment function contains both, the functions that are needed to setup network and radio resources and the respective signalling towards the UE to link the radio resources with the application layer and provide it with the authorised QoS.

The MME/UPE checks whether the granted resources correspond to the limits defined in the subscription profile of the user and initiates a resource assignment towards the radio part of the network.

The responsible radio function checks the availability of resources and sets up the required resources and finally informs the UE on the radio resource configuration for the service and which resources are bound to which IP or session flows.

In the information flow below MME and UPE are shown together for simplicity reasons. This does not preclude a separation of the two, which would however require the definition of an interface between both entities. Further the radio functions are depicted in the functional entities "PHY/MAC control" comprising PHY/MAC functions and "RRC" comprising RRC termination and possible access to inter-cell RRM functions (to be further detailed).

Note that allocation of radio functions to logical entities needs to be further discussed within RAN WGs

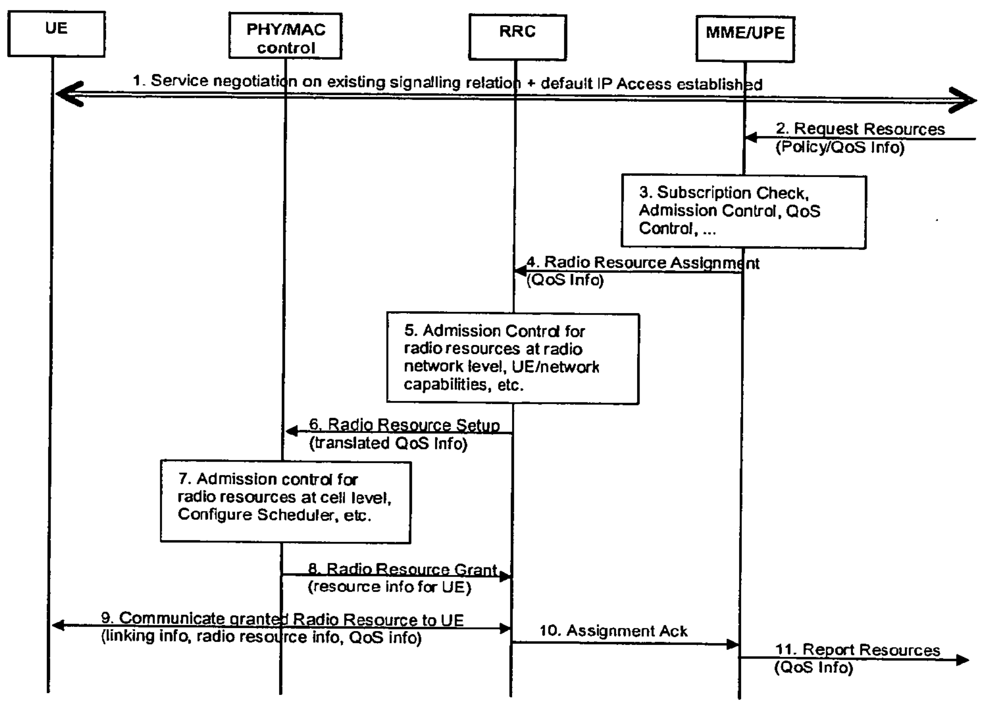

Figure 1: Information flow for Resource Establishment in the Radio Network for application level signalling

1) The UE has a signalling relation established with the network which relies on the default IP Access service.

2) The MME/UPE is triggered by a resource request which contains Policy/QoS Information corresponding to the requested service.

3) The MME/UPE checks the UE's subscription, performs admission control according to the received Policy/QoS information and applies the received policy information.

   Note: The location of the policy enforcement point is FFS, it might be located in the (inter-access-) mobility anchor).

4) MME/UPE initiates the Resource Establishment towards the responsible radio functions.

5) The "RRC" entity performs admission control for radio resources at radio network level, and translates the received QoS information for the "PHY/MAC control" entity and triggers the allocation of radio resources.

6) The "PHY/MAC control" receives the QoS information from the "RRC".

7) The "PHY/MAC control" uses this information to perform admission control for radio and processing resources at cell level and to generate the relevant HARQ entities and also to perform any mapping of logical channel to

resource identifier configures the scheduler according to the received QoS information and allocates resources according to the received QoS information.

8) The "PHY/MAC control" returns the relevant configuration information (e.g. HARQ configuration, air interface identifiers, channel mapping etc) to the "RRC" entity. Details of the information provided is FFS

9) The UE is provided with information about the radio configuration necessary for the service and related information to link radio resources with IP or session flows.

   Note, that the "RRC" entity does not grant the resource for the UE in a cell, but only provides the information required for the "PHY/MAC control" to grant the physical resource in the cell.

10) The MME/UPE is informed about the successful outcome of the resource establishment.

11) The MME/UPE reports the outcome of the resource establishment together with the negotiated QoS. Renegotiation is FFS.

9.6.4 Impact on the baseline CN Architecture

Editors Note: It is FFS whether there is any particular impact

9.6.5 Impact on the baseline RAN Architecture

Editors Note: It is FFS whether there is any particular impact

9.6.6 Impact on terminals used in the existing architecture

Editors Note: It is FFS whether there is any particular terminal impact.

9.7 Paging and C-plane establishment

Refer to section 7.14 in [3].

9.X Evaluations on for E-UTRAN architecture and migration

Editor's notes: As the system concept evaluations, relevant system concept or features should be clarified to show the requirements specified in chapter 9 of [4] can be satisfied. Responsible WG is RAN3

10 RF Related aspects of evolved UTRA

Editor's notes: This chapter will capture RF related specific solutions to meet requirements for evolved UTRA and UTRAN. Results of the system concept evaluations on section 8.2 Spectrum flexibility and 8.3 Spectrum deployments in [4] will be also captured. Requirements on co-existence and co-location of networks specified in section 8.4 of [4] should be addressed in terms of RF related aspects, also. Responsible WG is RAN4.

11 Radio Resource Management Aspects of evolved UTRA

Editor's notes: This chapter will capture solution of the RRM aspect, e.g. inter-RAT support. As the system concept evaluations, relevant concept of e.g. eUTRAN architecture, inter-cell interference control, QoS control should be clarified to show requirements in chapter 10 in [4] can be satisfied. Responsible WG is RAN3.

12 System and Terminal Complexity

Editor's notes: This chapter will capture study results on system and terminal complexity. As the system concept evaluations, relevant concept, e.g. UE capabilities, UE types, complexity study results, should be clarified to show requirements in chapter 11 of [4] can be satisfied.

12.1 Over all system complexity

Editor's notes: Responsible WG is RAN2.

12.2 UE complexity

Editor's notes: Responsible WG is RAN4.

13 Performance Assessments

Editor's notes: This chapter will capture assumptions for the study and study results on spectrum efficiency, data rate, latency, etc.

13.1 Peak Data Rate

Editor's notes: As the system concept evaluations, peak data rate calculated by agreed radio transmission schemes, e.g. modulation scheme, TTI length, the number of data stream per antenna, coding rate, should be clarified and compared with requirements in section 6.1 of [4]. Responsible WG is RAN1.

13.2 C-Plane Latency

Editor's notes: As the system concept evaluations, estimated C-plane latency should be clarified taking into account e.g. physical layer structure, signalling procedures and expected processing delay in each node. The estimated results should be compared with requirements in section 6.2.1 of [4]. Responsible WG is RAN2

13.3 U-Plane Latency

Editor's notes: As the system concept evaluations, estimated U-plane latency should be clarified taking into account e.g. physical layer structure, U-Plane data transmission process, expected processing delay in each node. And the estimated results should be compared with requirements in section 6.2.2 of [4]. Responsible WG is RAN2

13.4 User Throughput

Editor's notes: As the system concept evaluations, estimated performances of user throughput should be clarified according to e.g. simulation results. The estimated results should be compared with requirements in section 7.1 of [4]. Responsible WG is RAN1

13.5 Spectrum Efficiency

Editor's notes: As the system concept evaluations, estimated performances of spectrum efficiency should be clarified according to e.g. simulation results, and the estimated results should be compared with requirements in section 7.2 of [4]. Responsible WG is RAN1

13.6 Mobility

Editor's notes: As the system concept evaluations, relevant system concept or features should be clarified to show the requirement specified in section 7.3 of [4] can be satisfied. Responsible WG is RAN2

13.7 Coverage

Editor's notes: As the system concept evaluations, estimated performances of coverage should be clarified according to e.g. simulation results. The estimated results should be compared with requirements in section 7.4 of [4] to show the requirements can be satisfied. Responsible WG is RAN1

13.8 Further Enhanced MBMS

Editor's notes: As the system concept evaluations, estimated performances of further enhanced MBMS should be clarified according to e.g. simulation results. The estimated results should be compared with requirements in section 7.5 of [4] to show the requirement can be satisfied. Responsible WG is RAN1

13.9 Network Synchronisation

Editor's notes: As the system concept evaluations, estimated performance or gain in case of employing network synchronization should be clarified according to e.g. simulation results, and the estimated results should be compared with requirements in section 7.6 of [4] to show the requirement can be satisfied. Responsible WG is RAN1

13.10 Co-existence and Inter-working with 3GPP RAT

Editor's note: Concerning requirements on interruption time (see bullet c to f in 8.4 of [4]), estimated performance should be clarified and compared with the requirements as the system concept evaluations. Concerning requirements other than those of interruption time, relevant system concept, e.g. overall architecture, inter-RAT measurements & HO signalling procedures, should be clarified to show these requirements can be satisfied. Responsible WG is RAN3

13.11 General requirements

Editor's notes: As the system concept evaluations, relevant system concept or features should be clarified to show the requirements specified in chapter 12 of [4] can be satisfied. The rapporteur should be responsible for this requirement. All WGs should support the general requirements

14 Conclusions and Recommendations

14.1 Conclusions

14.2 Recommendations

15 Change History

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
2005-12	RAN#30				Text proposals approved in RAN#30 were added in section 7 and 9	0.0.0	0.0.2
2005-12					Reference [2] added	0.0.2	0.0.3
2006-3	RAN#31				Text agreed in the RAN2-RAN3-SA2 joint meeting was added in section 9	0.0.3	0.0.4
2006-3	RAN#31				RP-060122 and RP-060171 were captured according to agreements in RAN#31	0.0.4	0.1.0
2006-3					A sentence in 9.3.2 was deleted according to decision in RAN#31. Note 1 in section 9.4.2.2.1 was corrected for alignment with the RAN#31 decision on the RRC termination point.	0.1.0	0.1.1
2006-3					Editorial corrections. New sections are added for system concept evaluations. Responsible WGs are clarified.	0.1.1	0.1.2
2006-5					R3-060512, R3-060516 and R3-060519 were captured according to agreements in RAN3#51bis.	0.1.2	0.1.3

3GPP TR 25.813 V0.8.3 (2006-04)

Technical Report

3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Radio interface protocol aspects (Release 7)

Keywords

Evolved UTRA and UTRAN

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Contents

Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

Introduction

With enhancements such as HSDPA and Enhanced Uplink, the 3GPP radio-access technology will remain highly competitive for several years to come. However, to ensure competitiveness in an even longer time frame, the long-term evolution of the 3GPP radio-access technology is under study. Important parts of such a long-term evolution include reduced latency, higher user data rates, optimised support for packet services, improved system capacity and coverage, and reduced cost for the operator, while also reducing system complexity. In order to achieve this, evolutions of the radio interface as well as the radio network architecture are considered in the study item "Evolved UTRA and UTRAN" [1]. This document covers the Radio Interface Protocol Aspects of the study item.

1 Scope

The purpose of this TR is to help TSG RAN WG2 to define and describe the radio interface protocol evolution under consideration for Evolved UTRA and UTRAN [1]. This activity involves the Radio Access Network work area of the 3GPP studies for evolution and has impacts both on the Mobile Equipment and Access Network of the 3GPP systems. This document is intended to gather the agreements rather than comparing different solutions.

NOTE: this document is a living document, i.e. it is permanently updated and presented to TSG-RAN meetings.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] TD RP-040461: "Proposed Study Item on Evolved UTRA and UTRAN".

[2] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[3] 3GPP TR 25.913: "Requirements for Evolved UTRA and UTRAN".

[4] 3GPP TR 25.912; "Feasibility Study for Evolved UTRA and UTRAN".

[5] 3GPP TR 25.814: "Physical Layer Aspects for Evolved UTRA".

[6] 3GPP TR 23.882, "System architecture evolution (SAE): Report on technical options and conclusions".

[7] 3GPP TS 25.133, "Requirements for support of radio resource management".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply.

<defined term>: <definition>.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

<symbol> <Explanation>

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

aGW	E-UTRAN Access Gateway
ARQ	Automatic Repeat Request
AS	Access Stratum
DL	Downlink
eNB	E-UTRAN NodeB
E-UTRA	Evolved Universal Terrestrial Radio Access
E-UTRAN	Evolved Universal Terrestrial Radio Access Network
HARQ	Hybrid Automatic Repeat Request
HO	Handover
L1	Layer 1 (physical layer)
L2	Layer 2 (data link layer)
L3	Layer 3 (network layer)
MAC	Medium Access Control
NAS	Non-Access Stratum
PDCP	Packet Data Convergence Protocol
PDU	Protocol Data Unit
RLC	Radio Link Control
RRC	Radio Resource Control
SAE	System Architecture Evolution
SDU	Service Data Unit
TCH	Traffic Channel
UE	User Equipment
UL	Uplink
UMTS	Universal Mobile Telecommunications System
UTRA	Universal Terrestrial Radio Access
UTRAN	Universal Terrestrial Radio Access Network

Other abbreviations used in the present document are listed in 3GPP TR 21.905 [2].

4 Objectives and requirements

Simplification of the UTRAN protocol architecture and actual protocols is expected. The overall requirements on the E-UTRAN are described in 3GPP TR 25.913 [3].

4.1 Complexity

A key requirement of E-UTRAN is to maintain the complexity at a reasonable level. In this respect the following decisions apply:

- The number of transport channels is reduced compared to UTRAN, by making use of shared channels and not supporting dedicated transport channels.
- The number of different MAC entities is reduced compared to UTRAN (e.g. MAC-d not needed in the absence of dedicated transport channels).
- The BMC layer and the CTCH of UTRAN are not needed in E-UTRAN i.e. all data broadcast is on MBMS and on e.g. MTCH.
- There is no SHO in the downlink (as currently supported for Rel-6 dedicated channels in UTRAN) for the shared channel, in case of unicast transmissions. Note that this does not preclude the potential support of other schemes such as fast cell selection, bi-casting, "softer HO" (L1 combining) for intra-site cases, etc.
- Compressed mode as defined for UTRAN is not supported. If some transmission/reception gaps for measurement purpose have to be provided to the UE, this will be based on scheduling gaps.

- Only one receiver structure will be assumed for defining the measurements and their requirements.
- RRC is simplified by e.g. reducing the number of RRC states compared to UTRAN (e.g. removal of UTRAN CELL_FACH is agreed).

4.2 Performance

Note: From R2-051759: U-Plane Latency < 5msec; C-Plane Latency < 100msec (from Inactive to Active); optimisation of User Plane for high bit rates; hide breaks from application; shorter transitions (state transitions, handover within UTRA?); support "always-on" efficiently.

5 Protocol architecture

5.1 Overall protocol architecture

The E-UTRAN consists of eNBs, providing the E-UTRA user plane (RLC/MAC/PHY) and control plane (RRC) protocol terminations towards the UE. The eNBs interface to the aGW via the S1.

Figure 5.1 below gives an overview of the E-UTRAN architecture where:

- It remains FFS whether the aGW is split into U- and C-plane;
- Logical Nodes depicted as yellow-shaded boxes with solid frame are agreed;
- Logical Nodes depicted as yellow-shaded boxes with dashed frame are not yet agreed;
- White boxes depict the functional entities of the control plane and blue boxes depict the functional entities of the user plane:
    - Those, where an agreement on their association with logical nodes has been achieved are depicted inside this logical node;
    - Those, where an agreement on their association with logical nodes has not yet been achieved, are depicted outside logical nodes and their possible locations are indicated by arrows;
    - Those, where an agreement on their existence has been achieved are depicted with solid frames;
    - Those, where an agreement on their existence has not been achieved are depicted with dashed frames.

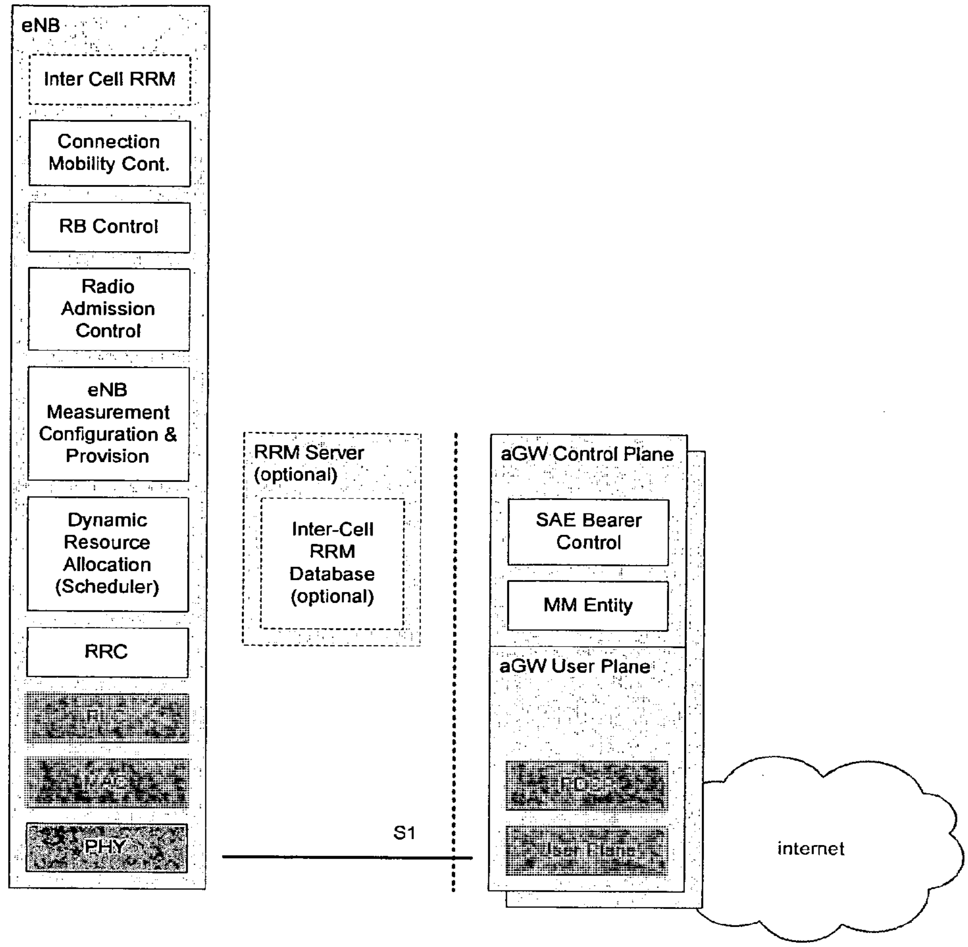

Figure 5.1: E-UTRAN Architecture

The functions agreed to be hosted by the eNB are:

- Selection of aGW at attachment;
- Routing towards aGW at RRC activation;
- Scheduling and transmission of paging messages;
- Scheduling and transmission of BCCH information;
- Dynamic allocation of resources to UEs in both uplink and downlink;
- The configuration and provision of eNB measurements;
- Radio Bearer Control;
- Radio Admission Control;
- Connection Mobility Control in LTE_ACTIVE state.

The functions agreed to be hosted by the aGW are:

- Paging origination;
- LTE_IDLE state management;

- Ciphering of the user plane;
- PDCP;
- SAE Bearer Control (see 3GPP TR 23.882 [6]);
- Ciphering and integrity protection of NAS signalling.

5.1.1 User plane

Figure 5.1.1 below shows the user-plane protocol stack for E-UTRAN, where:

- RLC and MAC sublayers (terminated in eNB on the network side) perform the functions listed in section 5.3, e.g.:
  - Scheduling;
  - ARQ;
  - HARQ;
- Security sublayer (terminated in aGW on the network side) performs:
  - Ciphering;
  - Integrity protection (FFS);
- PDCP sublayer (terminated in aGW on the network side) performs the functions listed in section 5.3, e.g.:
  - Header Compression.

NOTE: It is FFS if there is a separate security sublayer or if it is part of PDCP.

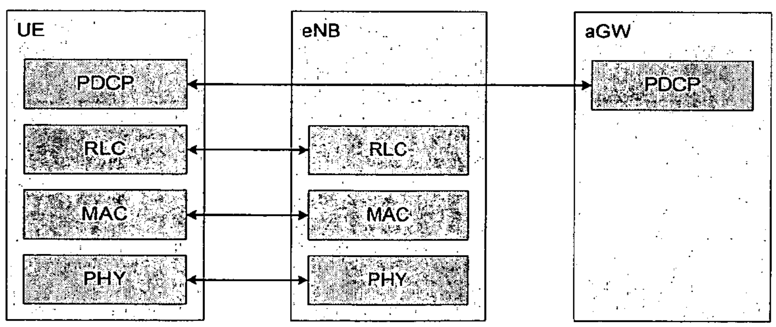

Figure 5.1.1: User-plane protocol stack

5.1.2 Control plane

Figure 5.1.2 below shows the control-plane protocol stack for E-UTRAN. The following working assumptions apply:

- RLC and MAC sublayers (terminated in eNB on the network side) perform the same functions as for the user plane;
- RRC (terminated in eNB on the network side) performs the functions listed in section 5.4.2, e.g.:
  - Broadcast;
  - Paging;
  - RRC connection management;

- RB control;
- Mobility functions;
- UE measurement reporting and control.

- NAS (terminated in aGW on the network side) performs among other things:
  - SAE bearer management;
  - Authentication;
  - Idle mode mobility handling;
  - Paging origination in LTE_IDLE;
  - Security control for the signalling between aGW and UE, and for the user plane.

NOTE: the NAS control protocol is not covered by the scope of this TR and is only mentioned for information.

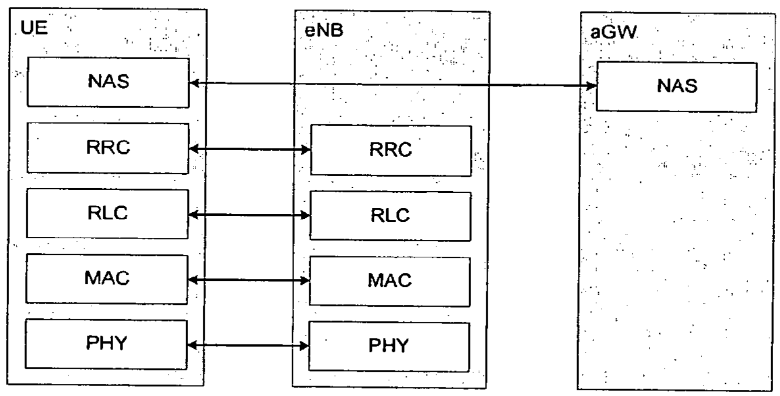

Figure 5.1.2: Control-plane protocol stack

5.2 Layer 1

Note: This section will summarize the Layer 1 in terms of services, functions and transport channels offered to Layer 2 (input from WG1 and 25.814).

5.2.1 Services and functions

The physical layer offers information transfer services to MAC and higher layers. The physical layer transport services are described by *how* and with what characteristics data are transferred over the radio interface. An adequate term for this is "Transport Channel".

NOTE: This should be clearly separated from the classification of *what* is transported, which relates to the concept of logical channels at MAC sublayer.

5.2.2 Transport channels

Downlink transport channel types are:

1. **Broadcast Channel (BCH)** characterised by:
   - fixed, pre-defined transport format;
   - requirement to be broadcast in the entire coverage area of the cell.

2. **Downlink Shared Channel (DL-SCH)** characterised by:

   - support for HARQ;
   - support for dynamic link adaptation by varying the modulation, coding and transmit power;
   - possibility to be broadcast in the entire cell;
   - possibility to use beamforming;
   - support for both dynamic and semi-static resource allocation;
   - support for UE discontinuous reception (DRX) to enable UE power saving.

NOTE: the possibility to use slow power control depends on the physical layer.

3. **Paging Channel (PCH)** characterised by:

   - support for UE discontinuous reception (DRX) to enable UE power saving (DRX cycle is indicated by the network to the UE);
   - requirement to be broadcast in the entire coverage area of the cell;
   - mapped to physical resources which can be used dynamically also for traffic/other control channels.

It is FFS, whether a NCH is included. If yes, it would be characterised by the following attributes:

4. **Notification Channel (NCH)** characterised by:

   - support of UE power saving;
   - requirement to be broadcast in the entire coverage area of the cell.

It is FFS whether a separate **Multicast Channel (MCH)** would exist or if additional attributes will be added to the DL-SCH.

Uplink transport channel types are:

1. **Uplink Shared Channel (UL-SCH)** characterised by:

   - possibility to use beamforming; (likely no impact on specifications)
   - support for dynamic link adaptation by varying the transmit power and potentially modulation and coding;
   - support for HARQ;
   - support for both dynamic and semi-static resource allocation; (Note: new attribute, FFS on whether there would be two types of UL-SCH)

NOTE: the possibility to use uplink synchronisation and timing advance depend on the physical layer.

It is FFS, whether a RACH is included. If yes, it would be characterised by the following attributes:

2. **Random Access Channel(s) (RACH)** characterised by:

   - limited data field (FFS);
   - collision risk;

NOTE: the possibility to use open loop power control depends on the physical layer solution.

5.3 Layer 2

Layer 2 is split into the following sublayers: Medium Access Control (MAC), Radio Link Control (RLC) and Packet Data Convergence Protocol (PDCP).

This section gives a high level description of the Layer 2 sub-layers in terms of services and functions. Figure 5.3a and Figure 5.3b below depicts the PDCP/RLC/MAC architecture for downlink and uplink respectively, where:

- Service Access Points (SAP) for peer-to-peer communication are marked with circles at the interface between sublayers. The SAP between the physical layer and the MAC sublayer provides the transport channels. The SAPs between the MAC sublayer and the RLC sublayer provide the logical channels. The SAPs between the RLC sublayer and the PDCP sublayer provide the radio bearers.
- The multiplexing of several logical channels on the same transport channel is possible;
- The multiplexing of radio bearers with the same QoS onto the same priority queue is FFS. If there is no multiplexing of radio bearers onto priority queues, there is only one level of multiplexing in the RLC and MAC sublayers;
- In the uplink, only one transport block is generated per TTI in the non-MIMO case;
- In the downlink, the number of transport block is FFS.

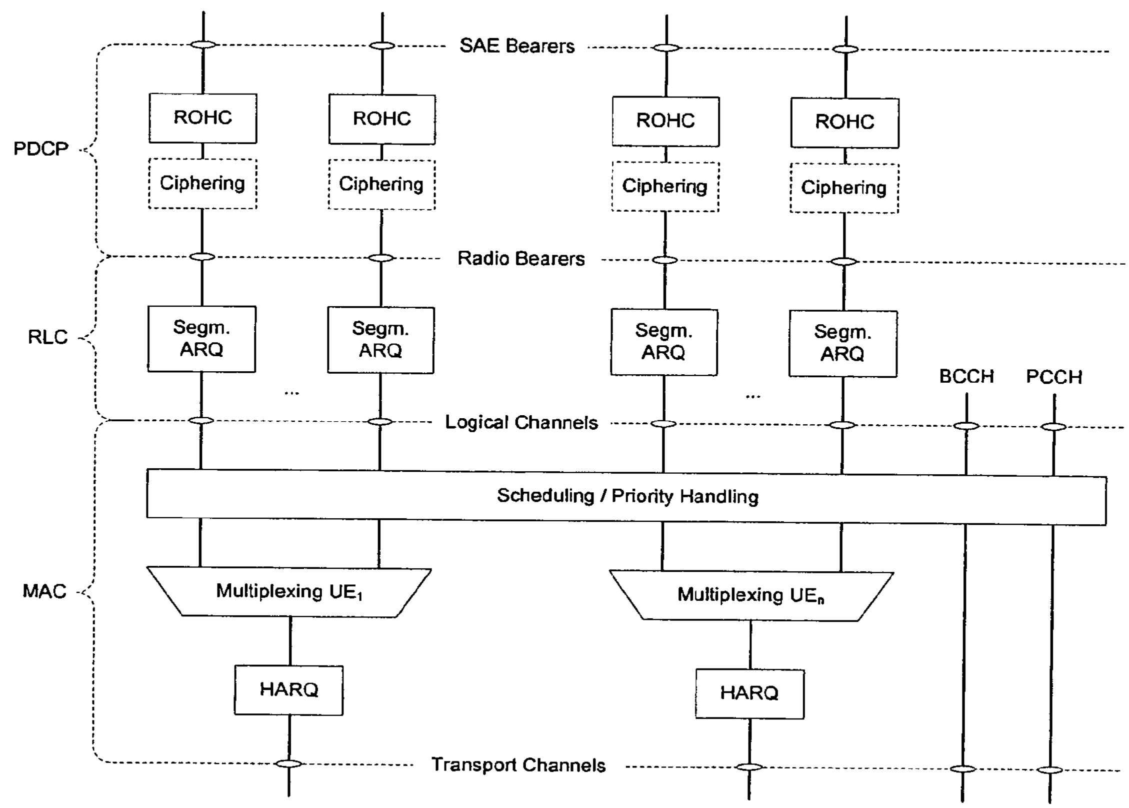

Figure 5.3a: Layer 2 Structure for DL in eNB and aGW

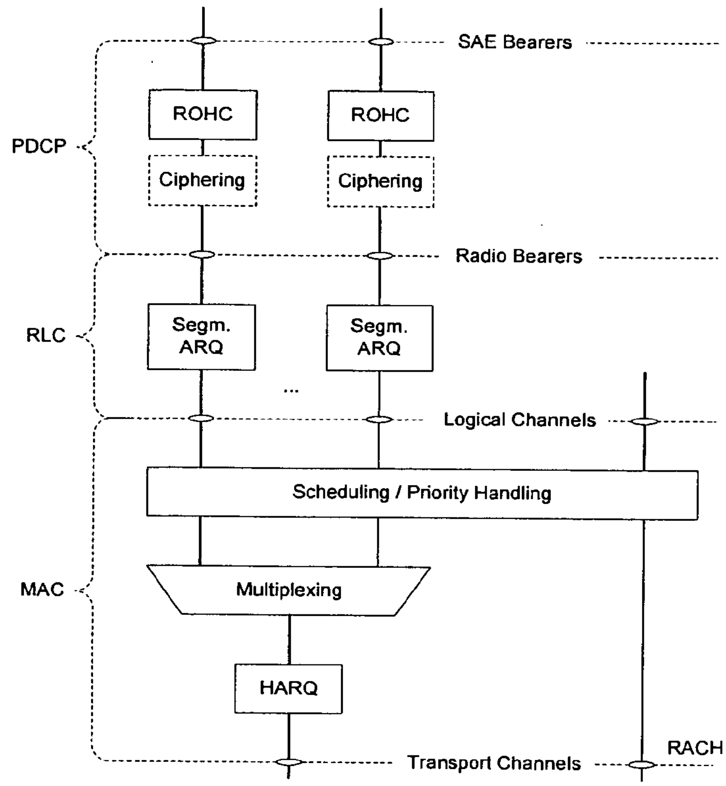

Figure 5.3.b: Layer 2 Structure for UL in UE

5.3.1 MAC Sublayer

This subclause provides an overview on services and functions provided by the MAC sublayer.

5.3.1.1 Services and Functions

The main services and functions of the MAC sublayer include:

- Mapping between logical channels and transport channels;
- Multiplexing/demultiplexing of RLC PDUs belonging to one or different radio bearers into/from transport blocks (TB) delivered to/from the physical layer on transport channels;
- Traffic volume measurement reporting;
- Error correction through HARQ;
- Priority handling between logical channels of one UE;
- Priority handling between UEs by means of dynamic scheduling;
- Transport format selection;
- Mapping of Access Classes to Access Service Classes (FFS for RACH);
- Padding (FFS);
- In-sequence delivery of RLC PDUs if RLC cannot handle the out of sequence delivery caused by HARQ (FFS).

NOTE: How the multiplexing relates to the QoS of the multiplexed logical channels is FFS.

5.3.1.2 Logical Channels

The MAC sublayer provides data transfer services on logical channels. A set of logical channel types is defined for different kinds of data transfer services as offered by MAC. Each logical channel type is defined by what type of information is transferred.

A general classification of logical channels is into two groups:

- Control Channels (for the transfer of control plane information);
- Traffic Channels (for the transfer of user plane information).

There is one MAC entity per cell. MAC generally consists of several function blocks (transmission scheduling functions, per UE functions, MBMS functions, MAC control functions, transport block generation…). Transparent Mode is only applied to BCCH (FFS) and PCCH.

5.3.1.2.1 Control Channels

Control channels are used for transfer of control plane information only. The control channels offered by MAC are:

- **Broadcast Control Channel (BCCH)**

  A downlink channel for broadcasting system control information.

- **Paging (and Notification) Control Channel (P(N)CCH)**

  A downlink channel that transfers paging information (and also notifications for MBMS FFS). This channel is used when the network does not know the location cell of the UE.

- **Common Control Channel (CCCH)**

  FFS: this channel is used by the UEs having no RRC connection with the network (need is FFS depending on whether the access mechanism is contained in L1. If RACH is visible as a transport channel, CCCH would be used by the UEs when accessing a new cell or after cell reselection).

- **Multicast Control Channel (MCCH)**

  FFS whether it is distinct from CCCH: a point-to-multipoint downlink channel used for transmitting MBMS scheduling and control information from the network to the UE, for one or several MTCHs. After establishing RRC connection this channel is only used by UEs that receive MBMS.

- **Dedicated Control Channel (DCCH)**

  A point-to-point bi-directional channel that transmits dedicated control information between a UE and the network. Used by UEs having an RRC connection.

5.3.1.2.2 Traffic Channels

Traffic channels are used for the transfer of user plane information only. The traffic channels offered by MAC are:

- **Dedicated Traffic Channel (DTCH)**

  A Dedicated Traffic Channel (DTCH) is a point-to-point channel, dedicated to one UE, for the transfer of user information. A DTCH can exist in both uplink and downlink.

- **Multicast Traffic Channel (MTCH)**

  A point-to-multipoint downlink channel for transmitting traffic data from the network to the UE.

5.3.1.3 Mapping between logical channels and transport channels

The figure below depicts the mapping between logical and transport channels (in grey the items for FFS):

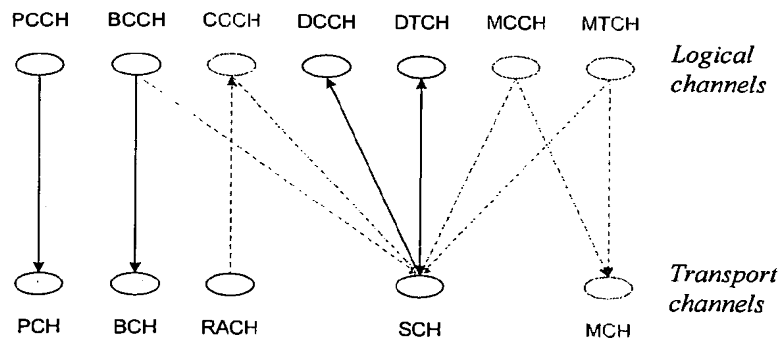

Figure 5.3.1.3: Mapping between logical channels and transport channels

5.3.1.3.1 Mapping in Uplink

In Uplink, the following connections between logical channels and transport channels exist:

- CCCH can be mapped to RACH: FFS if access procedure is not contained within L1;
- CCCH can be mapped to Uplink SCH: FFS if just a transient (random) ID is assigned for the resource request, the actual e.g. RRC Connection Request message has still to contain a UE identifier and therefore such message is considered to be a CCCH message, even if it's transported on the UL-SCH, since the UE is not in RRC_CONNECTED state at this stage;
- DCCH can be mapped to UL- SCH;
- DTCH can be mapped to UL-SCH.

5.3.1.3.2 Mapping in Downlink

In Downlink, the following connections between logical channels and transport channels exist:

- BCCH can be mapped to BCH;
- BCCH can be mapped to DL-SCH: FFS;
- PCCH can be mapped to PCH;
- CCCH can be mapped to DL-SCH: FFS if CCCH exists;
- DCCH can be mapped to DL-SCH;
- DTCH can be mapped to DL-SCH;
- MTCH can be mapped to DL-SCH: FFS if a separate MCH does not exist;
- MTCH can be mapped to MCH: FFS if a separate MCH exists;
- MCCH can be mapped to DL-SCH: FFS if a separate MCCH exist;
- MCCH can be mapped to MCH: FFS if a separate MCCH and MCH exist.

5.3.2 RLC Sublayer

This subclause provides an overview on services and functions provided by the RLC sublayer.

5.3.2.1 Services and Functions

The main services and functions of the RLC sublayer include:

- Transfer of upper layer PDUs supporting AM, UM or TM data transfer (FFS);
- Error Correction through ARQ;
- Segmentation according to the size of the TB;
- Resegmentation when necessary (e.g. when the radio quality, i.e. the supported TB size changes) (FFS if it takes place at PDU or SDU level);
- Concatenation of SDUs for the same radio bearer is FFS;
- In-sequence delivery of upper layer PDUs;
- Duplicate Detection;
- Protocol error detection and recovery;
- Flow Control (FFS between aGW and eNB);
- SDU discard (FFS);
- Reset (FFS).

5.3.3 PDCP Sublayer

This subclause provides an overview on services and functions provided by the PDCP sublayer.

5.3.3.1 Services and Functions

The main services and functions of the PDCP sublayer include:

- Header compression and decompression: ROHC only;
- Transfer of user data: transmission of user data means that PDCP receives PDCP SDU from the NAS and forwards it to the RLC layer and vice versa;
- Security: ciphering of user plane data (FFS).

NOTE: When compared to UTRAN, the *lossless DL RLC PDU size change* is not required.

5.3.4 Data flows through Layer 2

Note: Different flows for different transport channels, logical channels and transfer mode.

5.4 RRC

This subclause provides an overview on services and functions provided by the RRC sublayer.

5.4.1 Services and Functions

The main services and functions of the RRC sublayer include:

- Broadcast of System Information related to the non-access stratum (NAS);
- Broadcast of System Information related to the access stratum (AS);
- Paging;
- Establishment, maintenance and release of an RRC connection between the UE and E-UTRAN including:
  - Allocation of temporary identifiers between UE and E-UTRAN;
  - Configuration of radio resources for RRC connection.

- Security functions including integrity protection for RRC messages (FFS);
- Establishment, maintenance and release of point to point Radio Bearers including configuration of radio resources for the Radio Bearers;
- Mobility functions including:
  - UE measurement reporting and control of the reporting for inter-cell and inter-RAT mobility;
  - Inter-cell handover;
  - UE cell selection and reselection and control of cell selection and reselection;
  - Context transfer between eNBs.
- Notification for multicast/broadcast services (FFS);
- Establishment, maintenance and release of Radio Bearers for multicast/broadcast services, including configuration of the Radio Bearers (FFS);
- QoS management functions (FFS is spread across multiple layers);
- UE measurement reporting and control of the reporting;
- NAS direct message transfer to/from NAS from/to UE (FFS).

5.4.2 RRC protocol states & state transitions

RRC uses the following states:

- **RRC_IDLE**:
  - DRX;
  - Broadcast of system information;
  - Paging;
  - Cell re-selection mobility;
  - The UE shall have been allocated an id which uniquely identifies the UE in a tracking area;
  - No RRC context stored in the eNB.
- **RRC_CONNECTED**:
  - UE has an E-UTRAN-RRC connection;
  - UE has context in E-UTRAN;
  - E-UTRAN knows the cell which the UE belongs to;
  - Network can transmit and/or receive data to/from UE;
  - Network controlled mobility (handover);
  - Neighbour cell measurements;
  - At RLC/MAC level:
    - UE can transmit and/or receive data to/from network;
    - UE monitors control signalling channel for shared data channel to see if any transmission over the shared data channel has been allocated to the UE;
    - UE also reports channel quality information and feedback information to eNB;

- DRX/DTX period can be configured according to UE activity level for UE power saving and efficient resource utilization. This is under control of the eNB.

5.5 NAS control protocol

This subclause provides an overview on services and functions provided by the NAS control protocol.

NOTE: the NAS control protocol is not covered by the scope of this TR and is only mentioned for information.

5.5.1 Services and Functions

The main services and functions of the NAS sublayer include:

- SAE Bearer control (see 3GPP TR 23.882 [6]);
- LTE_IDLE mobility handling;
- Paging origination;
- Configuration and control of PDCP;
- Configuration and control of Security.

5.5.2 NAS protocol states & state transitions

The NAS control protocol uses the following states:

- **LTE_DETACHED**:
  - No RRC entity.
- **LTE_IDLE**:
  - RRC_IDLE State;
  - Some information is stored in the UE and in the network:
    - IP address, etc;
    - Security association (keys, etc);
    - UE capability information (FFS);
    - Radio Bearers (FFS);
  - State transition decided in eNB or aGW (FFS);
- **LTE_ACTIVE**:
  - RRC_CONNECTED State;
  - State transition decided in eNB or aGW (FFS);

The following figure reflects how the NAS states relate to the RRC:

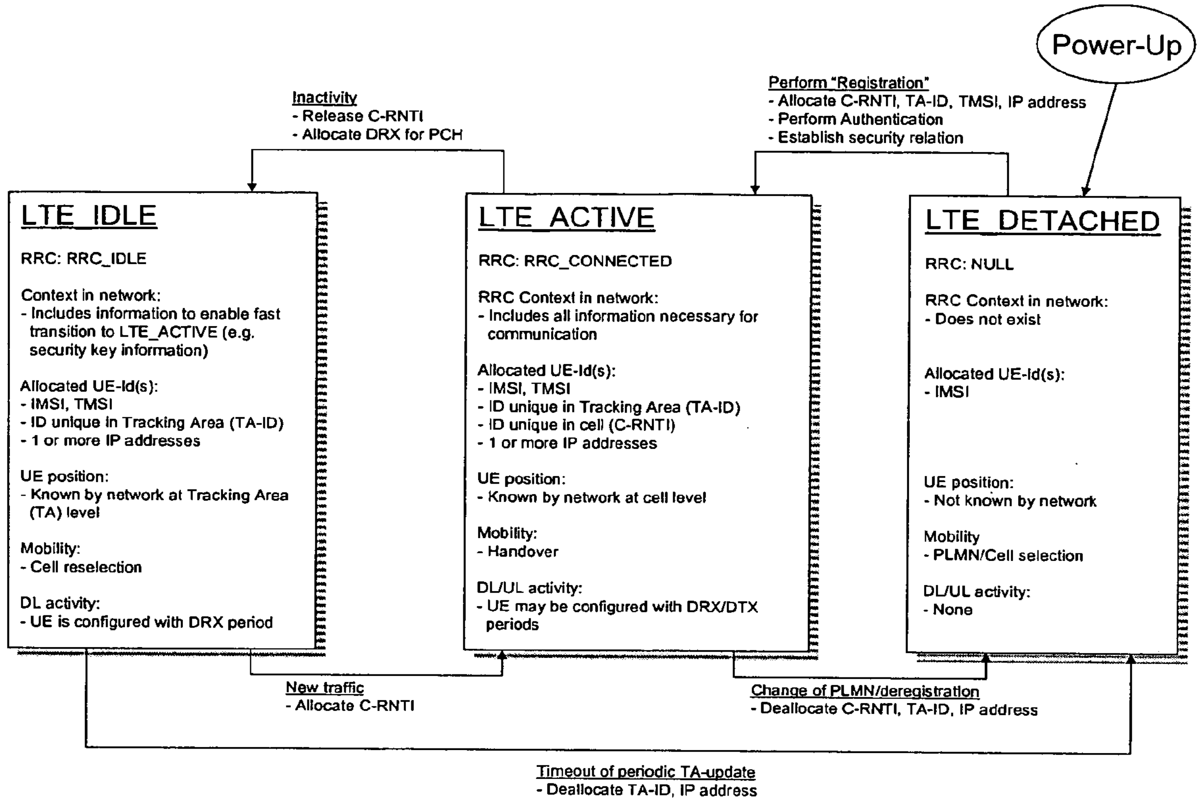

Figure 5.5.2: E-UTRAN RRC protocol states

NOTE: The applicability of the ID unique in Tracking Area (TAID) in LTE_DETACHED is FFS.

The UE context in the aGW will discriminate the 3 states. The UE context in the eNB will only exist in the LTE_ACTIVE state.

5.6 Identities used over the E-UTRAN radio interface

5.6.1 NAS related UE identities

NAS related UE identities used in E-UTRAN are assumed to be similar to the NAS identities used in 2G or 3G:

a) IMSI/IMEI;

b) TMSI for MME:

- Temporary identity allocated by the MME. The scope of the TMSI for MME is FFS.

c) TMSI for UPE (FFS):

- Temporary identity allocated by the UPE.

5.6.2 E-UTRAN related UE identities

The following E-UTRAN related UE identities are used:

a) C-RNTI:

- The C-RNTI provides a unique UE identification at the cell level;

- It is assumed that this identity is used for scheduling unless the cost would turn out to be too high and the introduction of a separate MAC identity would be required.

b) Random value for contention resolution:

- During some transient states, the UE is temporarily identified with a random value for contention resolution purposes.

5.6.3 Network entity related Identities

The following identities are used in E-UTRAN for identifying a specific network entity:

a) MME identity:

- It is agreed that a UE in LTE_IDLE establishing an RRC connection has to provide a unique identification of its current MME to the eNB when the connection establishment is initially related to NAS signalling;

- It is FFS whether this MME identity is also provided when the RRC connection is initially intended for user plane traffic;

- It is FFS whether this MME identity is provided by the UE to the eNB as a separate identity, or whether this MME identity is included in the TMSI for MME.

b) eNB identity or cell identity (FFS):

- The signalling sequence to be followed in case a UE in LTE_ACTIVE accesses a cell in which no UE context has been established yet (kind of "cell update") is currently not agreed. Identified options are:

  1) In order to obtain the UE context/data from the old eNB, the new eNB directly contacts the old eNB without consulting the aGW;

  2) In order to obtain the UE context/data from the old eNB, the new eNB consults the aGW to obtain the identity of the old eNB;

  3) In order to obtain a UE context, the new eNB contacts the aGW.

- If it is required for the new eNB to be able to contact the old eNB without involving the aGW (case 1 above), the UE has to provide a network entity related identification that enables the new eNB to contact the old eNB, and that enables the old eNB to uniquely identify the UE for retrieving the correct UE context. For this purpose either an eNB identity or cell identity could be used.

c) UPE identity (FFS):

- The signalling sequence to be followed when a UE in LTE_IDLE wants to establish an RRC connection initially intended for user plane traffic is not agreed yet. If it is required to support user plane data transport before the UE context is retrieved from the aGW, the UE might have to provide a UPE identity to the eNB thus enabling the new eNB to contact the UPE directly.

d) Tracking Area identity (FFS):

- Unique identification of a Tracking Area in a PLMN.

The following identities are broadcast in every E-UTRAN cell:

a) Cell identity:

- Uniquely identifying the cell in the area (size of area is FFS).

b) One or more Tracking Area identities (FFS):

- Tracking Area (s) this cell belongs to.

c) One or more PLMNs:

- PLMN (s) for which this cell is providing radio access.

6 ARQ and HARQ

E-UTRAN provides ARQ and HARQ functionalities. The ARQ functionality provides error correction by retransmissions in acknowledged mode at Layer 2. The HARQ functionality ensures delivery between peer entities at Layer 1.

6.1 HARQ principles

The HARQ within the MAC sublayer has the following characteristics:

- N-process Stop-And-Wait HARQ is used;
- The HARQ is based on ACK/NACKs;
- In the downlink:
  - Asynchronous retransmissions with adaptive transmission parameters are supported;
  - Additional optimisations (e.g. less adaptive/synchronous) are FFS.
- In the uplink:
  - HARQ is based on synchronous retransmissions;
  - Whether resource allocation and modulation and coding scheme can be adapted for retransmissions is FFS.
- The HARQ transmits and retransmits TBs;

6.2 ARQ principles

The ARQ within the RLC sublayer has the following characteristics:

- It is FFS whether the ARQ retransmits RLC SDUs or RLC PDUs (segments);
- ARQ retransmissions are based on:
  - RLC status reports (FFS);
  - HARQ/ARQ interactions (see subclause 6.3).
- The RLC transmitter can invoke a discard procedure (FFS);
- The RLC can invoke a reset procedure (FFS).

6.3 HARQ/ARQ interactions

In HARQ assisted ARQ operation, ARQ uses knowledge obtained from the HARQ about the transmission/reception status of a TB e.g.:

- If the HARQ transmitter detects a failed delivery of a TB due to e.g. maximum retransmission limit it is FFS if the relevant transmitting ARQ entities are notified;
- If the HARQ receiver is able to detect a NACK to ACK error it is FFS if the relevant transmitting ARQ entities are notified via explicit signalling;
- If the HARQ receiver is able to detect TB transmission failure it is FFS if the receiving ARQ entities are notified.

7 Scheduling

In order to utilise the SCH resources efficiently, a scheduling function is used in MAC. In this subclause, an overview of the scheduler is given in terms of scheduler operation, signalling of scheduler decisions, and measurements to support scheduler operation.

Scheduler Operation:

- MAC in eNB includes dynamic resource schedulers that allocate physical layer resources for the DL-SCH and UL-SCH transport channels. Different schedulers operate for the DL-SCH and UL-SCH.
- Taking account the traffic volume and the QoS requirements of each UE and associated radio bearers, schedulers assign resources between UEs and potentially also between different radio bearers associated with a single UE (FFS).
- Schedulers may assign resources taking account the radio conditions at the UE identified through measurements made at the eNB and/or reported by the UE.
- Radio resource allocations can be valid for one or multiple TTIs.
- Resource assignment consists of radio resources (resource blocks). Allocations for time periods longer than one TTI might also require additional information (allocation time, allocation repetition factor...).

Signalling of Scheduler Decisions:

- UEs identify whether resources are assigned to them by receiving a scheduling (resource assignment) channel. There may be separate scheduling channels for uplink and downlink resource assignment.
- Scheduling decisions are signalled via MAC messages. It is FFS whether resources can be assigned by other means e.g. MAC headers or RRC signalling.

Measurements to Support Scheduler Operation:

- Measurement reports are required to enable the scheduler to operate in both uplink and downlink. These include transport volume and measurements of a UEs radio environment. The time and frequency granularity of the UE radio environment measurement reports is FFS.
- Uplink buffer status reports are needed to provide support for QoS-aware packet scheduling. Uplink buffer status reports refer to the data that is buffered in the logical channel queues in the UE MAC. The uplink packet scheduler in the eNB is located at MAC level. Uplink buffer status reports may be transmitted using MAC signalling (e.g. as a specific type of MAC control PDU). A way to separately signal buffer status reports for different QoS classes may be used. To define the exact content of buffer status reports and the possible use of physical layer signalling are FFS.
- The buffer reporting scheme used in uplink should be flexible in order to support different types of data services. The buffer reporting criteria are setup and reconfigured on a per user basis or per radio bearer basis (FFS) using RRC or MAC signalling (FFS). The use of System Information should also be considered for the initial setup of default buffer reporting criteria (on a per cell basis). Constraints on how often uplink buffer reports are signalled from the UEs can be specified by the network to limit the overhead from sending the reports in the uplink.
- It is FFS whether additional measurement information is required to support the classification of UEs between localised and distributed resource allocation.
- It is FFS whether additional measurement information is required to support cell center / cell-edge resource subdivision.

8 QoS Control

Note: This section will describe how QoS is managed.

9 Mobility

In E-UTRAN RRC_CONNECTED state, network controlled UE assisted handovers are performed and various DRX/DTX cycles are supported:

- UE performs neighbour cell measurements based on measurement control and neighbour cell information from the network;
- Network signals reporting criteria for event-triggered and possibly periodical (FFS) reporting.

Following defines the handover support within E-UTRAN:

- The intra E-UTRAN HO in RRC_CONNECTED state is UE assisted NW controlled HO with HO preparation signalling in E-UTRAN.
- In E-UTRAN RRC_IDLE state, cell reselections are performed and DRX is supported.

9.1 Intra E-UTRAN

9.1.1 Variable bandwidth scenarios

The Figure below shows a number of scenarios for adjacent cells with different transmission bandwidths and UEs with different receiver bandwidths. Measurements, reselection and handover need to be considered for these different scenarios.

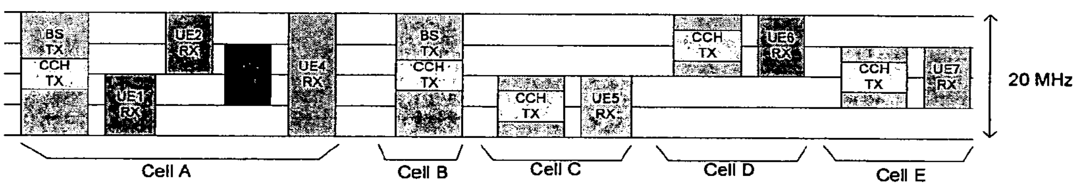

Figure 9.1.1: Variable bandwidth scenarios

1) A cell transmits one set of common channel information. This information must be contained in a bandwidth equal than or less than the UE minimum bandwidth capability (assumed to be 10MHz). This ensures all UEs in RRC_IDLE are capable of receiving the common channels irrespective of UE capability. The need to replicate some control information is FFS.
2) The term handover is used for the procedure that changes the serving cell of a UE in RRC_CONNECTED. A frequency reconfiguration within the same serving cell is not a handover. A frequency reconfiguration is used to move the UE reception bandwidth within the cell transmission bandwidth.
3) Neighbour cell lists on which the network requests the UEs to perform measurements for handover and cell reselection do not classify cells as intra-frequency or inter-frequency (i.e. there are no intra-frequency cells and inter-frequency cells)
4) A non gap assisted measurement (for handover) is a measurement on a cell from the neighbour list that does not require transmission/reception gaps to allow the measurement to be performed.
5) A gap assisted measurement (for handover) is a measurement on a cell from the neighbour list that does require transmission/reception gaps to allow the measurement to be performed.

6) Whether a measurement (for handover) is non gap assisted or gap assisted depends on the UE's capability and current operating frequency. The UE determines whether a particular cell measurement needs to be performed in a transmission/reception gap and the scheduler needs to know whether gaps are needed. The exact scenarios that require gaps assisted measurements are FFS.

9.1.2 Cell selection

9.1.3 Cell reselection

9.1.4 Paging

Note: From R2-051759: Several proposals 1) paging channel; 2) DRX on shared channel instead of paging channel. URA concept retained. Common with UTRA or specific to E-UTRA always? No need for NAS paging if some NAS/AS functionality merge (PMM with RRC) take place (e.g. if Idle mode is removed).

9.1.5 Handover

Note: From R2-051759: should depend on the RRC state and can be of intra-frequency or inter-frequency. Network controlled proposed to be primary method, and UE controlled only for RL failure case. UE controlled (like cell re-selection) for active state also proposed to be studied.

9.1.6 Measurements

Measurements to be performed by a UE for intra/inter-frequency mobility can be controlled by E-UTRAN, using broadcast or dedicated control. In RRC_IDLE state, a UE shall follow the measurement parameters defined for cell reselection specified by the E-UTRAN broadcast (as in UTRAN SIB). The use of dedicated measurement control in cell reselection is FFS. In RRC_CONNECTED state, a UE shall follow the measurement parameters specified by RRC or MAC commands (FFS) directed from the E-UTRAN (e.g. as in UTRAN MEASUREMENT_CONTROL).

Usage of dedicated control for RRC_IDLE state is FFS.

9.1.6.1 Intra-frequency

In a system with frequency reuse = 1, intra-frequency mobility is preponderant. Good intra-frequency measurements are needed in order to ensure good mobility support and easy network deployment. Search of intra-frequency neighbour cells from the neighbour list, and measurements of the relevant quantities for identified cells is needed.

NOTE: To avoid UE activity outside the DRX/DTX cycle, the reporting criteria for intra frequency measurements should match the used DRX/DTX cycle.

9.1.6.2 Inter-frequency

Regarding inter-frequency mobility, UE performs neighbour cell measurements during DL/UL idle periods that are provided by DRX/DTX or packet scheduling, if necessary.

NOTE: How the gaps are controlled, as well as how the scheduler knows the gaps required by the UE, is FFS.

9.1.7 Network aspects

When the eNB changes at handover, pending downlink RLC SDUs or PDUs (TBD) may be retransmitted in the target eNB. In the uplink, if in-order delivery of RLC SDUs is required at the decompressor in PDCP, either:

- The PDCP sublayer includes a reordering buffer of RLC SDUs before security/decompressor; or
- The uplink RLC SDUs or PDUs which were not delivered to PDCP have to be provided to the target eNB for re-ordering.

9.2 Inter RAT

The following list defines the mobility support between E-UTRAN and UTRAN (see Figure 9.2), with mobility support between E-UTRAN and GERAN being FFS.

1) The HO from E-UTRAN RRC_CONNECTED state to UTRAN CELL_DCH state is supported with UE assisted NW controlled manner including HO preparation signalling. From UTRAN CELL_DCH state to E-UTRAN RRC_CONNECTED state mobility is supported. The utilisation of the HO with preparation signalling or relying on Network Assistant Cell Change (NACC) is FFS.

2) When a UE in CELL_FACH state in the UTRAN goes out-of-service it may reselect to E-UTRAN. If the UE camps on E-UTRAN coverage the UE completes the Tracking Area update procedure to the MME. In this case the UE stores the UTRAN MM configuration.

3) The transition between UTRAN CELL/URA_PCH and E-UTRAN RRC_IDLE is completed by UE controlled cell reselection. The support of signalling-free transition between UTRAN CELL/URA_PCH and E-UTRAN RRC_IDLE states requires the UTRAN RRC Connection configuration to be stored by the UE whilst in E-UTRAN RRC_IDLE state (including the Last RRC State). The storage of the UTRAN context is indicated in the figure by the "UTRAN RRC Connected Configuration Stored".

   If, when reselecting from E-UTRAN to UTRAN the UE has a valid UTRAN RRC Connection Configuration Stored, it shall automatically enter the Last RRC State indicated in the UTRAN Stored Configuration.

   If, when changing between E-UTRAN and UTRAN the UE has moved out of its mobility area (e.g. Cell, URA, TA) then the UE initiates the normal mobility update procedure (e.g. Cell Update, URA update or Tracking Area Update procedures), but the completion of a Tracking Area Update in the E-UTRAN does not affect the stored UTRAN configurations, and the UTRAN RRC connection for the UE is maintained.

   If the timer relating to the periodic CELL/URA Update of UTRAN has expired when the UE is in E-UTRAN coverage, then the UE can delete the stored UTRAN RRC Connected configuration.

4) The transition between UTRAN IDLE and E-UTRAN RRC_IDLE is completed by UE controlled cell reselection. The UTRAN MM configuration is stored after completing the state transition to LTE_IDLE state, and the LTE_IDLE configuration is stored when reselecting from E-UTRAN RRC_IDLE to UTRAN IDLE.

NOTE: The handling in the E-UTRAN RRC_IDLE state is independent of the stored UTRAN configuration.

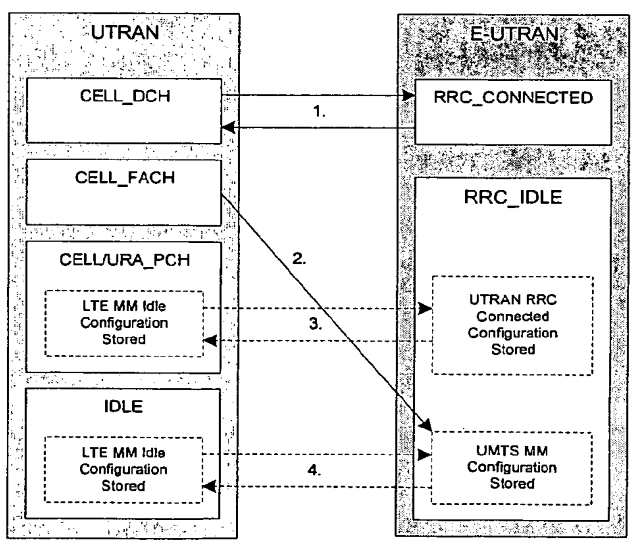

Figure 9.2: Handovers between E-UTRAN and UTRAN

9.2.1 Cell reselection

9.2.2 Handover

9.2.3 Measurements

9.2.3.1 Inter-RAT handovers from E-UTRAN

Measurements to be performed by a UE for inter-RAT mobility can be controlled by E-UTRAN, using broadcast or dedicated control. In RRC_CONNECTED state, a UE shall follow the measurement parameters specified by RRC or MAC commands (FFS) directed from the E-UTRAN (e.g. as in UTRAN MEASUREMENT_CONTROL).

UE performs inter-RAT neighbour cell measurements during DL/UL idle periods that are provided by the network through suitable DRX/DTX period or packet scheduling if necessary.

NOTE: How the gaps are controlled, as well as how the scheduler knows the gaps required by the UE, is FFS.

9.2.3.2 Inter-RAT Handovers to E-UTRAN

From UTRAN, UE performs E-UTRAN measurements by using idle periods created by compressed mode (CELL_DCH), FACH measurement occasions (CELL_FACH - FFS), or DRX (other states).

From GERAN, E-UTRAN measurements are performed in the same way as WCDMA measurements for handover to UTRAN: E-UTRAN measurements are performed in GSM idle frames in a time multiplexed manner. However, it should be discussed with GERAN how to ensure that inter-RAT measurements do not take too much measurement time, while the requested 3GPP inter-RAT measurements can be performed well enough.

Design constraints of 3GPP inter-RAT measurements should be considered when L1 details of E-UTRAN concept are defined.

9.2.3.3 Inter-RAT cell reselection from E-UTRAN

In RRC_IDLE state, a UE shall follow the measurement parameters specified by the E-UTRAN broadcast (as in UTRAN SIB). The use of dedicated measurement control is FFS.

9.2.3.4 Limiting measurement load at UE

Introduction of E-UTRA implies co-existence of various UE capabilities. Each UE may support different combinations of RATs, e.g., E-UTRA, UTRA, GSM, and non-3GPP RATs, and different combinations of frequency bands, e.g., 800 MHz, 1.7 GHz, 2 GHZ, etc. Moreover, some UEs may support the full E-UTRA spectrum bandwidth of 20 MHz, whereas some UEs may support only a part of 20 MHz. Despite such heterogeneous environment, the measurement load at UE should be minimised. To limit the measurement load and the associated control load:

- E-UTRAN can configure the RATs to be measured by UE;
- The number of measurement criteria (event and periodic reporting criteria) should be limited (as in TS 25.133 section 8.3.2 [7]);
- E-UTRAN should be aware of the UE capabilities for efficient measurement control, to prevent unnecessary waking up of the measurement entity;
- The UE capabilities should be categorised to prevent diversion of capabilities and conformance test scenarios, FFS;
- Support for blind HO (i.e., HO without measurement reports from UE) is FFS.

9.2.4 Network Aspects

9.3 Timing Advance

The timing advance is a signal derived from the time synchronisation of the UL sequence and sent by the eNB to the UE which the UE uses to advance its timings of transmissions to the eNB so as to compensate for propagation delay and thus time align the transmissions from different UEs with the receiver window of the eNB. By avoiding the overlapping of uplink transmissions, timing advance allows time domain multiplexing in the uplink.

In RRC_CONNECTED, it remains FFS whether the timing advance is permanently maintained or not. If not, MAC knows if the L1 is synchronised and which procedure to use to start transmitting in the uplink (FFS for RRC).

Cases where the UL synchronisation status may move from "synchronised" to "non-synchronised" include:

- Expiration of a timer;
- Non-synchronised handover;
- Explicit request by MAC or RRC in the eNB;

10 Security

10.1 Security Termination Points

The table below describes the security termination points.

Table 10.1 Security Termination Points

	Ciphering	Integrity Protection
NAS Signalling	Required and terminated above eNB (NOTE 1)	Required and terminated above eNB (NOTE 1)
U-Plane Data	Required and terminated in aGW (NOTE 2)	Need is FFS
RRC Signalling (AS)	Need is FFS	Required an terminated in eNB (NOTE 3)
MAC Signalling (AS)	Need is FFS	Need is FFS
NOTE 1: "Above eNB" means that the termination point is in either the aGW or above (FFS) and that the activation/deactivation is not controlled by the eNB. NOTE 2: The protocol stack layer in which the ciphering takes place is FFS. The activation/deactivation of ciphering of the U-Plane is not controlled by the eNB NOTE 3: Key set for RRC protection cannot be used to derive NAS and user-plane keys.		

11 MBMS

Note: A separate chapter might be needed to deal with MBMS specific issues.

Note: From R2-051759: The following issues have to be discussed: need for selective combining within E-UTRA, possibility to perform selective combining between E-UTRA and UTRA; need for L1 combining (simpler with OFDM); FLC across UTRA and E-UTRA, all new requirements of MBMS for LTE...

12 Migration and compatibility

Note: This section will have a closer look at the evolution in terms of migration scenario and interaction with previous releases. It will summarize what will be described in 25.912 and 25.913 from a protocol architecture viewpoint. SA1 and SA2 should lead the way.

Note: From R2-051759: concept of having two stacks in the UE with a legacy stack connecting to legacy CN via Iu, and a new stack. where E-RRC replaces NAS+RRC. Dual IP addresses.

12.1 Migration scenario

12.2 Interaction with previous releases

12.3 Interoperability

13 UE capabilities

Note: This section will deal with the UE capabilities from a RAN2 viewpoint (e.g. signalling support).

Note: From R2-051759: Mandating dual Receiver should be discussed early (different views, UE manufacturers prefer single receiver; dual-receiver likely to be an optimisation (UE cap?). Possibility to have separate capability for 20MHz. Will need signalling support of capabilities.

14 Impact on specifications

14.1 Specification methodology

14.2 Affected specifications

Note: This section will list the specifications that affected – if any.

14.3 New specifications

Note: This section will list the specifications that affected – if any.

Annex A: Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
2005-08	RAN2#48	R2-051787			Proposed Skeleton for RAN2#48		0.0.0
2005-08	RAN2#48	R2-052241			Proposed Skeleton for RAN2#48	0.0.0	0.0.1
2005-10	RAN2#49	R2-052730			Transport channels and Logical Channels added in Section 5	0.0.1	0.0.2
2005-11	RAN2#49	R2-053071			Presence of both HARQ and ARQ Overview of the E-UTRAN Architecture added	0.0.2	0.1.0
2006-01	RAN2#50	R2-060128			Editorship updated for MBMS section	0.1.0	0.1.1
2006-01	RAN2#50	R2-060133			Descriptive text for Handovers added in Section 9; Update of the transport channels in Section 5; Annex added to reflect agreements on RACH; Function for MAC, RRC and RLC listed in section 5; Termination points for security captured in section 10.1; Figure of logical channels to transport channels added in section 5. RRC States described in section 5.	0.1.1	0.2.0
2006-01	RAN2#50	R2-060146			Various editorial changes and clarifications	0.2.0	0.3.0
2006-02	RAN2#51	R2-060309			Update of the Nomenclature and removal of some editor's notes	0.3.0	0.3.1
2006-02	RAN2#51	R2-060760			Inclusion of the agreed MAC architecture	0.3.1	0.4.0
2006-02	RAN2#51	R2-060798			Editorial Corrections	0.4.0	0.4.1
2006-02	RAN2#51	R2-060803			Addition of the Chairman Notes of RAN2#51 in Annex C	0.4.1	0.5.0
2006-03	RAN#31	RP-060176			Agreement on the state names reflected throughout the document	0.5.0	0.5.1
2006-03	RAN2#52	RP-060825			Agreements of RAN#31 and from RP-060122 + SRJ-060059 included: ARQ and RRC in eNB, SAE Bearer + Radio Bearer	0.5.1	0.6.0
2006-03	RAN2#53	R2-061062			Section 5 updated to keep ARQ as a sublayer	0.6.0	0.6.1
2006-03	RAN2#53	R2-061063			Miscellaneous clarifications and updates	0.6.1	0.6.2
2006-03	RAN2#53	R2-061070			RLC introduced as a sublayer of layer 2 Agreements on ARQ, HARQ and their interaction captured State names updated for RRC: connected and idle	0.6.2	0.7.0
2006-03	RAN2#53	R2-061085			Generic description of the scheduler added Miscellaneous clarifications and corrections	0.7.0	0.7.1
2006-03	RAN2#53	R2-061092			Miscellaneous clarifications	0.7.1	0.7.2
2006-03	RAN2#53	R2-061099			Agreed text proposals on bandwidth scenario (R2-061098), ARQ/HARQ (R2-061098), UE identities (R2-061094) and handover scenarios (R2-061089) included	0.7.2	0.8.0
2006-03	RAN2#53	R2-061102			Minor updates following email review	0.8.0	0.8.1
2006-03	RAN2#53	R2-061103			Table of content updated. Reordering at MAC layer added as FFS in section 5.3.1.1.	0.8.1	0.8.2
2006-04	RAN2#54	R2-061xxx			Editorial corrections and clean up.	0.8.2	0.8.3

Annex B: RACH and Contention Resolution

The contention channel i.e. RACH, allows achieving the following:

- Synchronising the L1 timing (timing advance);
- Transmission of a X bits message towards the network MAC e.g. 16 bits;
- RAN1 should combine both if possible to gain time.

The X bits may have a different content depending on the case where the RACH is used. This is TBD:

- Some information on UL resources needed, priority, establishment cause, and random ID to assist in contention resolution;
- UE ID already allocated by the network to the UE.

In the case of the initial access, means for the network to prioritise the various requests should be possible.

After the X bits have been received by the network, the network is responsible to send to the UE:

- If necessary, timing advance information to be used on the UL SCH;
- If necessary, C-RNTI;
- Allocation of UL resources on UL SCH.

Contention resolution takes place using the UL/DL-SCH.

The RACH L1 channel may have multiple signatures in UL (to help resolving collisions). To be checked with RAN1.

Transmission of L3 messages, MAC data or control PDU, only takes place on the UL-SCH, possibly after the RACH procedure used to get an uplink allocation.

Resources for RACH are indicated by the network.

The RACH procedure can be used for (exact list TBD, details of its use/content of X bits TBD):

- Initial access to get UL SCH resources to send RRC connection request;
- To obtain L1 synchronisation;
- To request resources when no UL resources are available;
- In case of mobility.

Annex C: Architecture Progress

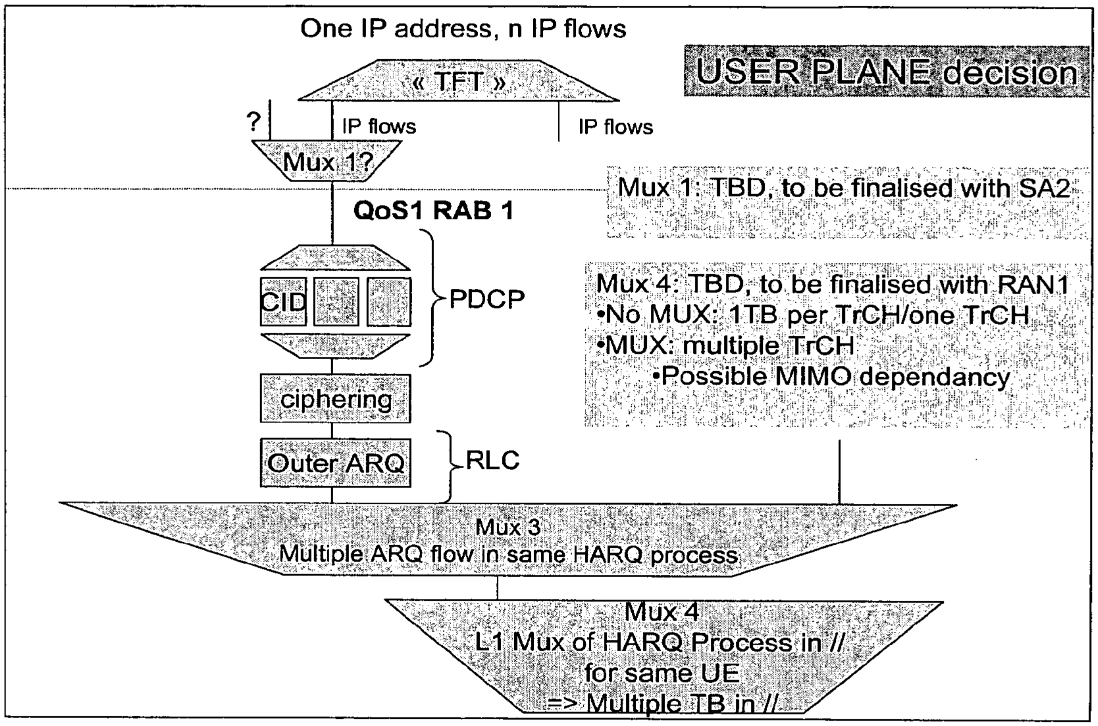

Figure C1: User Plane

Table C1: Location of Control Plane Functions

Function	eNB	aGW	Comment
Broadcast	+		Originated from aGW or O&M
Paging	+		Originated from aGW
aGW connection handling		+	NAS
Security control		+	
Mobility handling for LTE_ACTIVE state	+		
Measurement configuration and reporting for mobility	+		
Mobility handling for LTE_IDLE state		+	NAS
RAB/QoS control		+	NAS
Node-B level configuration	+		
Assignment of radio resources	+		
Identification and mapping of logical channels	+		
Scheduling for all channels incl BCH and PCH	+		
Measurements for scheduling	+		

Annex D: Editorship

In addition to the rapporteur (Benoist Sébire - Nokia), an editor was nominated for each section of the TR as described in Table B below.

Table B. Editorship

Section	Company	Name	email
1. Scope	Nokia	Benoist Sébire	benoist.sebire@nokia.com
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4. Objectives and requirements	Nokia	Benoist Sébire	benoist.sebire@nokia.com
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14. Impact on specifications	Motorola	Agnes Revel	agnes.revel@motorola.com
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3GPP TR 25.813 V0.8.3 (2006-04)

Technical Report

3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Radio interface protocol aspects (Release 7)

Keywords

Evolved UTRA and UTRAN

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Contents

Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

Introduction

With enhancements such as HSDPA and Enhanced Uplink, the 3GPP radio-access technology will remain highly competitive for several years to come. However, to ensure competitiveness in an even longer time frame, the long-term evolution of the 3GPP radio-access technology is under study. Important parts of such a long-term evolution include reduced latency, higher user data rates, optimised support for packet services, improved system capacity and coverage, and reduced cost for the operator, while also reducing system complexity. In order to achieve this, evolutions of the radio interface as well as the radio network architecture are considered in the study item "Evolved UTRA and UTRAN" [1]. This document covers the Radio Interface Protocol Aspects of the study item.

1 Scope

The purpose of this TR is to help TSG RAN WG2 to define and describe the radio interface protocol evolution under consideration for Evolved UTRA and UTRAN [1]. This activity involves the Radio Access Network work area of the 3GPP studies for evolution and has impacts both on the Mobile Equipment and Access Network of the 3GPP systems. This document is intended to gather the agreements rather than comparing different solutions.

NOTE: this document is a living document, i.e. it is permanently updated and presented to TSG-RAN meetings.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] TD RP-040461: "Proposed Study Item on Evolved UTRA and UTRAN".

[2] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[3] 3GPP TR 25.913: "Requirements for Evolved UTRA and UTRAN".

[4] 3GPP TR 25.912; "Feasibility Study for Evolved UTRA and UTRAN".

[5] 3GPP TR 25.814: "Physical Layer Aspects for Evolved UTRA".

[6] 3GPP TR 23.882, "System architecture evolution (SAE): Report on technical options and conclusions".

[7] 3GPP TS 25.133, "Requirements for support of radio resource management".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply.

<defined term>: <definition>.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

<symbol> <Explanation>

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

aGW	E-UTRAN Access Gateway
ARQ	Automatic Repeat Request
AS	Access Stratum
DL	Downlink
eNB	E-UTRAN NodeB
E-UTRA	Evolved Universal Terrestrial Radio Access
E-UTRAN	Evolved Universal Terrestrial Radio Access Network
HARQ	Hybrid Automatic Repeat Request
HO	Handover
L1	Layer 1 (physical layer)
L2	Layer 2 (data link layer)
L3	Layer 3 (network layer)
MAC	Medium Access Control
NAS	Non-Access Stratum
PDCP	Packet Data Convergence Protocol
PDU	Protocol Data Unit
RLC	Radio Link Control
RRC	Radio Resource Control
SAE	System Architecture Evolution
SDU	Service Data Unit
TCH	Traffic Channel
UE	User Equipment
UL	Uplink
UMTS	Universal Mobile Telecommunications System
UTRA	Universal Terrestrial Radio Access
UTRAN	Universal Terrestrial Radio Access Network

Other abbreviations used in the present document are listed in 3GPP TR 21.905 [2].

4 Objectives and requirements

Simplification of the UTRAN protocol architecture and actual protocols is expected. The overall requirements on the E-UTRAN are described in 3GPP TR 25.913 [3].

4.1 Complexity

A key requirement of E-UTRAN is to maintain the complexity at a reasonable level. In this respect the following decisions apply:

- The number of transport channels is reduced compared to UTRAN, by making use of shared channels and not supporting dedicated transport channels.
- The number of different MAC entities is reduced compared to UTRAN (e.g. MAC-d not needed in the absence of dedicated transport channels).
- The BMC layer and the CTCH of UTRAN are not needed in E-UTRAN i.e. all data broadcast is on MBMS and on e.g. MTCH.
- There is no SHO in the downlink (as currently supported for Rel-6 dedicated channels in UTRAN) for the shared channel, in case of unicast transmissions. Note that this does not preclude the potential support of other schemes such as fast cell selection, bi-casting, "softer HO" (L1 combining) for intra-site cases, etc.
- Compressed mode as defined for UTRAN is not supported. If some transmission/reception gaps for measurement purpose have to be provided to the UE, this will be based on scheduling gaps.

- Only one receiver structure will be assumed for defining the measurements and their requirements.
- RRC is simplified by e.g. reducing the number of RRC states compared to UTRAN (e.g. removal of UTRAN CELL_FACH is agreed).

4.2 Performance

Note: From R2-051759: U-Plane Latency < 5msec; C-Plane Latency < 100msec (from Inactive to Active); optimisation of User Plane for high bit rates; hide breaks from application; shorter transitions (state transitions, handover within UTRA?); support "always-on" efficiently.

5 Protocol architecture

5.1 Overall protocol architecture

The E-UTRAN consists of eNBs, providing the E-UTRA user plane (RLC/MAC/PHY) and control plane (RRC) protocol terminations towards the UE. The eNBs interface to the aGW via the S1.

Figure 5.1 below gives an overview of the E-UTRAN architecture where:

- It remains FFS whether the aGW is split into U- and C-plane;
- Logical Nodes depicted as yellow-shaded boxes with solid frame are agreed;
- Logical Nodes depicted as yellow-shaded boxes with dashed frame are not yet agreed;
- White boxes depict the functional entities of the control plane and blue boxes depict the functional entities of the user plane:
  - Those, where an agreement on their association with logical nodes has been achieved are depicted inside this logical node;
  - Those, where an agreement on their association with logical nodes has not yet been achieved, are depicted outside logical nodes and their possible locations are indicated by arrows;
  - Those, where an agreement on their existence has been achieved are depicted with solid frames;
  - Those, where an agreement on their existence has not been achieved are depicted with dashed frames.

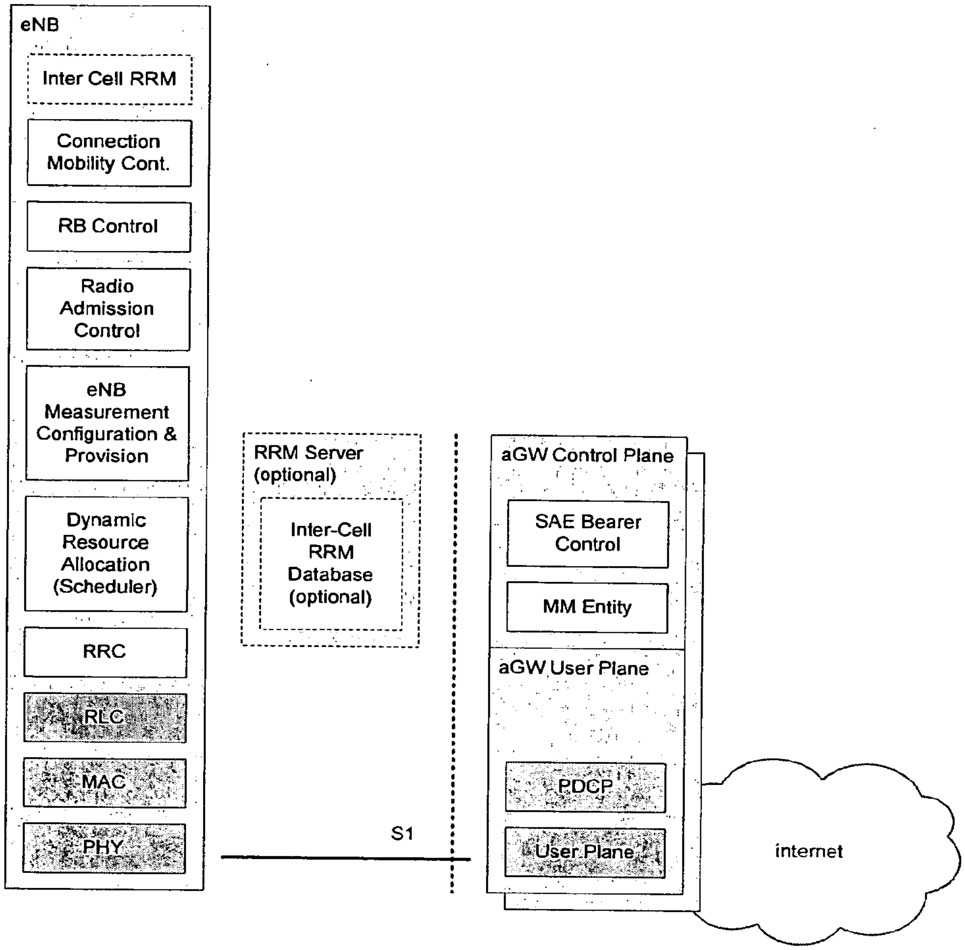

Figure 5.1: E-UTRAN Architecture

The functions agreed to be hosted by the eNB are:

- Selection of aGW at attachment;
- Routing towards aGW at RRC activation;
- Scheduling and transmission of paging messages;
- Scheduling and transmission of BCCH information;
- Dynamic allocation of resources to UEs in both uplink and downlink;
- The configuration and provision of eNB measurements;
- Radio Bearer Control;
- Radio Admission Control;
- Connection Mobility Control in LTE_ACTIVE state.

The functions agreed to be hosted by the aGW are:

- Paging origination;
- LTE_IDLE state management;

- Ciphering of the user plane;
- PDCP;
- SAE Bearer Control (see 3GPP TR 23.882 [6]);
- Ciphering and integrity protection of NAS signalling.

5.1.1 User plane

Figure 5.1.1 below shows the user-plane protocol stack for E-UTRAN, where:

- RLC and MAC sublayers (terminated in eNB on the network side) perform the functions listed in section 5.3, e.g.:
  - Scheduling;
  - ARQ;
  - HARQ;
- Security sublayer (terminated in aGW on the network side) performs:
  - Ciphering;
  - Integrity protection (FFS);
- PDCP sublayer (terminated in aGW on the network side) performs the functions listed in section 5.3, e.g.:
  - Header Compression.

NOTE: It is FFS if there is a separate security sublayer or if it is part of PDCP.

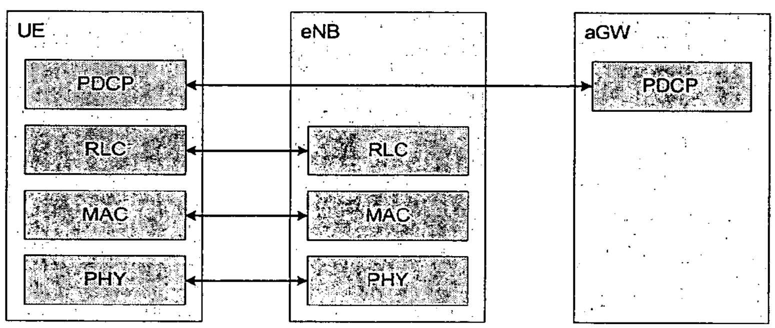

Figure 5.1.1: User-plane protocol stack

5.1.2 Control plane

Figure 5.1.2 below shows the control-plane protocol stack for E-UTRAN. The following working assumptions apply:

- RLC and MAC sublayers (terminated in eNB on the network side) perform the same functions as for the user plane;
- RRC (terminated in eNB on the network side) performs the functions listed in section 5.4.2, e.g.:
  - Broadcast;
  - Paging;
  - RRC connection management;

- RB control;
- Mobility functions;
- UE measurement reporting and control.
- NAS (terminated in aGW on the network side) performs among other things:
  - SAE bearer management;
  - Authentication;
  - Idle mode mobility handling;
  - Paging origination in LTE_IDLE;
  - Security control for the signalling between aGW and UE, and for the user plane.

NOTE: the NAS control protocol is not covered by the scope of this TR and is only mentioned for information.

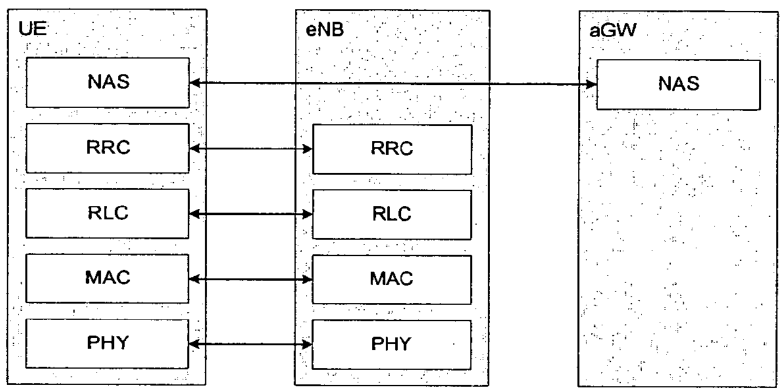

Figure 5.1.2: Control-plane protocol stack

5.2 Layer 1

Note: This section will summarize the Layer 1 in terms of services, functions and transport channels offered to Layer 2 (input from WG1 and 25.814).

5.2.1 Services and functions

The physical layer offers information transfer services to MAC and higher layers. The physical layer transport services are described by *how* and with what characteristics data are transferred over the radio interface. An adequate term for this is "Transport Channel".

NOTE: This should be clearly separated from the classification of *what* is transported, which relates to the concept of logical channels at MAC sublayer.

5.2.2 Transport channels

Downlink transport channel types are:

1. **Broadcast Channel (BCH)** characterised by:
   - fixed, pre-defined transport format;
   - requirement to be broadcast in the entire coverage area of the cell.

2. **Downlink Shared Channel (DL-SCH)** characterised by:
   - support for HARQ;
   - support for dynamic link adaptation by varying the modulation, coding and transmit power;
   - possibility to be broadcast in the entire cell;
   - possibility to use beamforming;
   - support for both dynamic and semi-static resource allocation;
   - support for UE discontinuous reception (DRX) to enable UE power saving.

NOTE: the possibility to use slow power control depends on the physical layer.

3. **Paging Channel (PCH)** characterised by:
   - support for UE discontinuous reception (DRX) to enable UE power saving (DRX cycle is indicated by the network to the UE);
   - requirement to be broadcast in the entire coverage area of the cell;
   - mapped to physical resources which can be used dynamically also for traffic/other control channels.

It is FFS, whether a NCH is included. If yes, it would be characterised by the following attributes:

4. **Notification Channel (NCH)** characterised by:
   - support of UE power saving;
   - requirement to be broadcast in the entire coverage area of the cell.

It is FFS whether a separate **Multicast Channel (MCH)** would exist or if additional attributes will be added to the DL-SCH.

Uplink transport channel types are:

1. **Uplink Shared Channel (UL-SCH)** characterised by:
   - possibility to use beamforming; (likely no impact on specifications)
   - support for dynamic link adaptation by varying the transmit power and potentially modulation and coding;
   - support for HARQ;
   - support for both dynamic and semi-static resource allocation; (Note: new attribute, FFS on whether there would be two types of UL-SCH)

NOTE: the possibility to use uplink synchronisation and timing advance depend on the physical layer.

It is FFS, whether a RACH is included. If yes, it would be characterised by the following attributes:

2. **Random Access Channel(s) (RACH)** characterised by:
   - limited data field (FFS);
   - collision risk;

NOTE: the possibility to use open loop power control depends on the physical layer solution.

5.3 Layer 2

Layer 2 is split into the following sublayers: Medium Access Control (MAC), Radio Link Control (RLC) and Packet Data Convergence Protocol (PDCP).

This section gives a high level description of the Layer 2 sub-layers in terms of services and functions. Figure 5.3a and Figure 5.3b below depicts the PDCP/RLC/MAC architecture for downlink and uplink respectively, where:

- Service Access Points (SAP) for peer-to-peer communication are marked with circles at the interface between sublayers. The SAP between the physical layer and the MAC sublayer provides the transport channels. The SAPs between the MAC sublayer and the RLC sublayer provide the logical channels. The SAPs between the RLC sublayer and the PDCP sublayer provide the radio bearers.
- The multiplexing of several logical channels on the same transport channel is possible;
- The multiplexing of radio bearers with the same QoS onto the same priority queue is FFS. If there is no multiplexing of radio bearers onto priority queues, there is only one level of multiplexing in the RLC and MAC sublayers;
- In the uplink, only one transport block is generated per TTI in the non-MIMO case;
- In the downlink, the number of transport block is FFS.

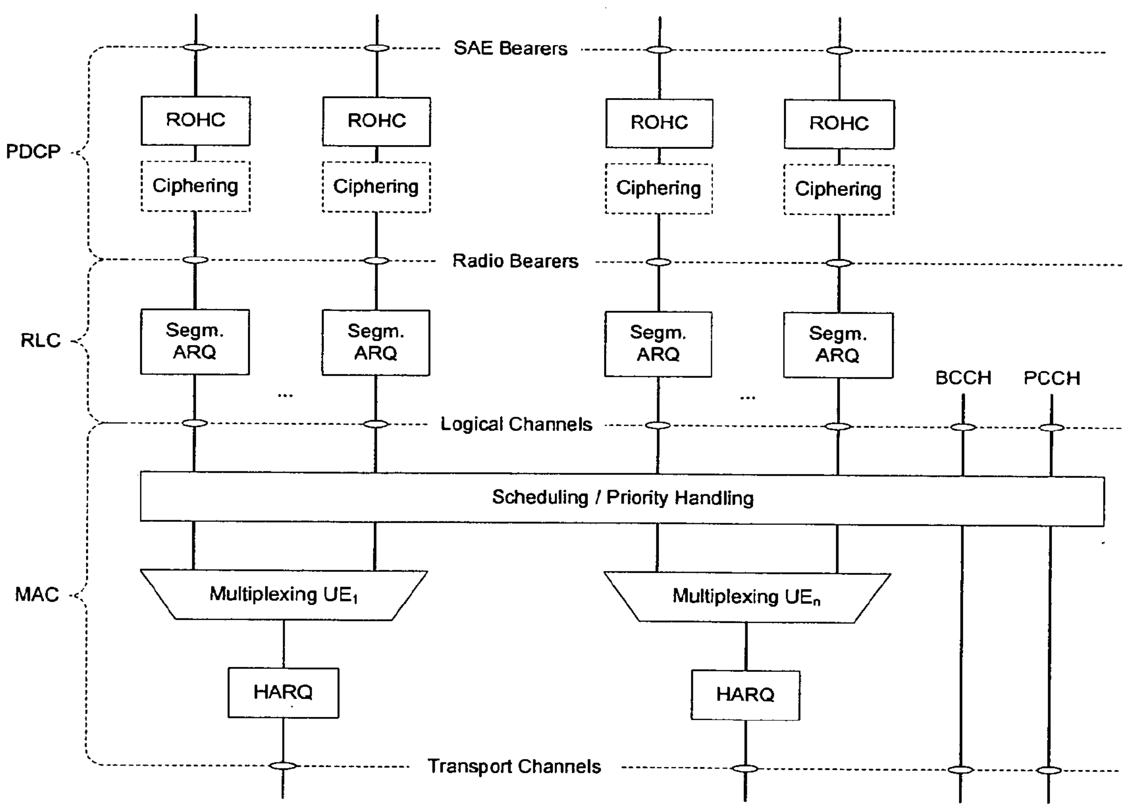

Figure 5.3a: Layer 2 Structure for DL in eNB and aGW

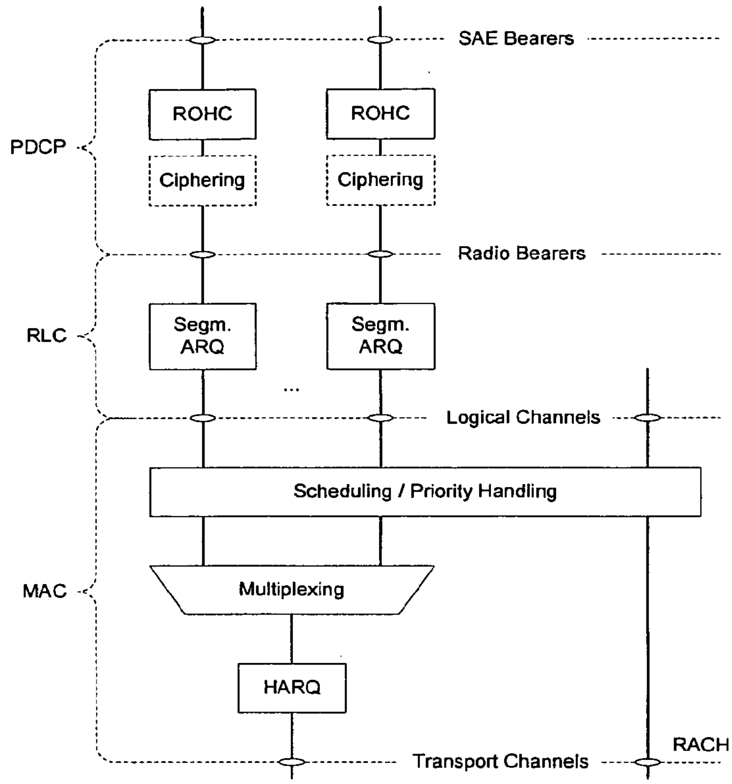

Figure 5.3.b: Layer 2 Structure for UL in UE

5.3.1 MAC Sublayer

This subclause provides an overview on services and functions provided by the MAC sublayer.

5.3.1.1 Services and Functions

The main services and functions of the MAC sublayer include:

- Mapping between logical channels and transport channels;
- Multiplexing/demultiplexing of RLC PDUs belonging to one or different radio bearers into/from transport blocks (TB) delivered to/from the physical layer on transport channels;
- Traffic volume measurement reporting;
- Error correction through HARQ;
- Priority handling between logical channels of one UE;
- Priority handling between UEs by means of dynamic scheduling;
- Transport format selection;
- Mapping of Access Classes to Access Service Classes (FFS for RACH);
- Padding (FFS);
- In-sequence delivery of RLC PDUs if RLC cannot handle the out of sequence delivery caused by HARQ (FFS).

NOTE: How the multiplexing relates to the QoS of the multiplexed logical channels is FFS.

5.3.1.2 Logical Channels

The MAC sublayer provides data transfer services on logical channels. A set of logical channel types is defined for different kinds of data transfer services as offered by MAC. Each logical channel type is defined by what type of information is transferred.

A general classification of logical channels is into two groups:

- Control Channels (for the transfer of control plane information);
- Traffic Channels (for the transfer of user plane information).

There is one MAC entity per cell. MAC generally consists of several function blocks (transmission scheduling functions, per UE functions, MBMS functions, MAC control functions, transport block generation…). Transparent Mode is only applied to BCCH (FFS) and PCCH.

5.3.1.2.1 Control Channels

Control channels are used for transfer of control plane information only. The control channels offered by MAC are:

- **Broadcast Control Channel (BCCH)**

  A downlink channel for broadcasting system control information.

- **Paging (and Notification) Control Channel (P(N)CCH)**

  A downlink channel that transfers paging information (and also notifications for MBMS FFS). This channel is used when the network does not know the location cell of the UE.

- **Common Control Channel (CCCH)**

  FFS: this channel is used by the UEs having no RRC connection with the network (need is FFS depending on whether the access mechanism is contained in L1. If RACH is visible as a transport channel, CCCH would be used by the UEs when accessing a new cell or after cell reselection).

- **Multicast Control Channel (MCCH)**

  FFS whether it is distinct from CCCH: a point-to-multipoint downlink channel used for transmitting MBMS scheduling and control information from the network to the UE, for one or several MTCHs. After establishing RRC connection this channel is only used by UEs that receive MBMS.

- **Dedicated Control Channel (DCCH)**

  A point-to-point bi-directional channel that transmits dedicated control information between a UE and the network. Used by UEs having an RRC connection.

5.3.1.2.2 Traffic Channels

Traffic channels are used for the transfer of user plane information only. The traffic channels offered by MAC are:

- **Dedicated Traffic Channel (DTCH)**

  A Dedicated Traffic Channel (DTCH) is a point-to-point channel, dedicated to one UE, for the transfer of user information. A DTCH can exist in both uplink and downlink.

- **Multicast Traffic Channel (MTCH)**

  A point-to-multipoint downlink channel for transmitting traffic data from the network to the UE.

5.3.1.3 Mapping between logical channels and transport channels

The figure below depicts the mapping between logical and transport channels (in grey the items for FFS):

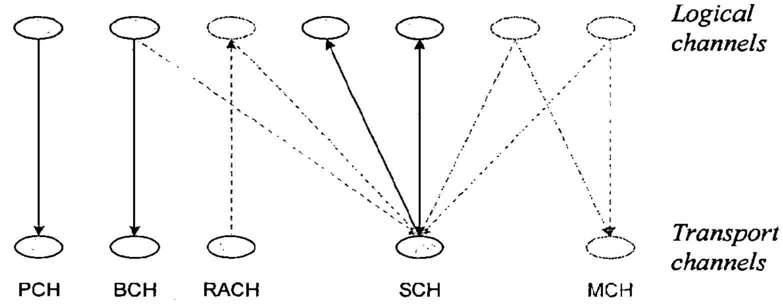

Figure 5.3.1.3: Mapping between logical channels and transport channels

5.3.1.3.1 Mapping in Uplink

In Uplink, the following connections between logical channels and transport channels exist:

- CCCH can be mapped to RACH: FFS if access procedure is not contained within L1;
- CCCH can be mapped to Uplink SCH: FFS if just a transient (random) ID is assigned for the resource request, the actual e.g. RRC Connection Request message has still to contain a UE identifier and therefore such message is considered to be a CCCH message, even if it's transported on the UL-SCH, since the UE is not in RRC_CONNECTED state at this stage;
- DCCH can be mapped to UL- SCH;
- DTCH can be mapped to UL-SCH.

5.3.1.3.2 Mapping in Downlink

In Downlink, the following connections between logical channels and transport channels exist:

- BCCH can be mapped to BCH;
- BCCH can be mapped to DL-SCH: FFS;
- PCCH can be mapped to PCH;
- CCCH can be mapped to DL-SCH: FFS if CCCH exists;
- DCCH can be mapped to DL-SCH;
- DTCH can be mapped to DL-SCH;
- MTCH can be mapped to DL-SCH: FFS if a separate MCH does not exist;
- MTCH can be mapped to MCH: FFS if a separate MCH exists;
- MCCH can be mapped to DL-SCH: FFS if a separate MCCH exist;
- MCCH can be mapped to MCH: FFS if a separate MCCH and MCH exist.

5.3.2 RLC Sublayer

This subclause provides an overview on services and functions provided by the RLC sublayer.

5.3.2.1 Services and Functions

The main services and functions of the RLC sublayer include:

- Transfer of upper layer PDUs supporting AM, UM or TM data transfer (FFS);
- Error Correction through ARQ;
- Segmentation according to the size of the TB;
- Resegmentation when necessary (e.g. when the radio quality, i.e. the supported TB size changes) (FFS if it takes place at PDU or SDU level);
- Concatenation of SDUs for the same radio bearer is FFS;
- In-sequence delivery of upper layer PDUs;
- Duplicate Detection;
- Protocol error detection and recovery;
- Flow Control (FFS between aGW and eNB);
- SDU discard (FFS);
- Reset (FFS).

5.3.3 PDCP Sublayer

This subclause provides an overview on services and functions provided by the PDCP sublayer.

5.3.3.1 Services and Functions

The main services and functions of the PDCP sublayer include:

- Header compression and decompression: ROHC only;
- Transfer of user data: transmission of user data means that PDCP receives PDCP SDU from the NAS and forwards it to the RLC layer and vice versa;
- Security: ciphering of user plane data (FFS).

NOTE: When compared to UTRAN, the *lossless DL RLC PDU size change* is not required.

5.3.4 Data flows through Layer 2

Note: Different flows for different transport channels, logical channels and transfer mode.

5.4 RRC

This subclause provides an overview on services and functions provided by the RRC sublayer.

5.4.1 Services and Functions

The main services and functions of the RRC sublayer include:

- Broadcast of System Information related to the non-access stratum (NAS);
- Broadcast of System Information related to the access stratum (AS);
- Paging;
- Establishment, maintenance and release of an RRC connection between the UE and E-UTRAN including:
  - Allocation of temporary identifiers between UE and E-UTRAN;
  - Configuration of radio resources for RRC connection.

- Security functions including integrity protection for RRC messages (FFS);
- Establishment, maintenance and release of point to point Radio Bearers including configuration of radio resources for the Radio Bearers;
- Mobility functions including:
  - UE measurement reporting and control of the reporting for inter-cell and inter-RAT mobility;
  - Inter-cell handover;
  - UE cell selection and reselection and control of cell selection and reselection;
  - Context transfer between eNBs.
- Notification for multicast/broadcast services (FFS);
- Establishment, maintenance and release of Radio Bearers for multicast/broadcast services, including configuration of the Radio Bearers (FFS);
- QoS management functions (FFS is spread across multiple layers);
- UE measurement reporting and control of the reporting;
- NAS direct message transfer to/from NAS from/to UE (FFS).

5.4.2 RRC protocol states & state transitions

RRC uses the following states:

- **RRC_IDLE**:
  - DRX;
  - Broadcast of system information;
  - Paging;
  - Cell re-selection mobility;
  - The UE shall have been allocated an id which uniquely identifies the UE in a tracking area;
  - No RRC context stored in the eNB.
- **RRC_CONNECTED**:
  - UE has an E-UTRAN-RRC connection;
  - UE has context in E-UTRAN;
  - E-UTRAN knows the cell which the UE belongs to;
  - Network can transmit and/or receive data to/from UE;
  - Network controlled mobility (handover);
  - Neighbour cell measurements;
  - At RLC/MAC level:
    - UE can transmit and/or receive data to/from network;
    - UE monitors control signalling channel for shared data channel to see if any transmission over the shared data channel has been allocated to the UE;
    - UE also reports channel quality information and feedback information to eNB;

- DRX/DTX period can be configured according to UE activity level for UE power saving and efficient resource utilization. This is under control of the eNB.

5.5 NAS control protocol

This subclause provides an overview on services and functions provided by the NAS control protocol.

NOTE: the NAS control protocol is not covered by the scope of this TR and is only mentioned for information.

5.5.1 Services and Functions

The main services and functions of the NAS sublayer include:

- SAE Bearer control (see 3GPP TR 23.882 [6]);
- LTE_IDLE mobility handling;
- Paging origination;
- Configuration and control of PDCP;
- Configuration and control of Security.

5.5.2 NAS protocol states & state transitions

The NAS control protocol uses the following states:

- **LTE_DETACHED**:
  - No RRC entity.
- **LTE_IDLE**:
  - RRC_IDLE State;
  - Some information is stored in the UE and in the network:
    - IP address, etc;
    - Security association (keys, etc);
    - UE capability information (FFS);
    - Radio Bearers (FFS);
  - State transition decided in eNB or aGW (FFS);
- **LTE_ACTIVE**:
  - RRC_CONNECTED State;
  - State transition decided in eNB or aGW (FFS);

The following figure reflects how the NAS states relate to the RRC:

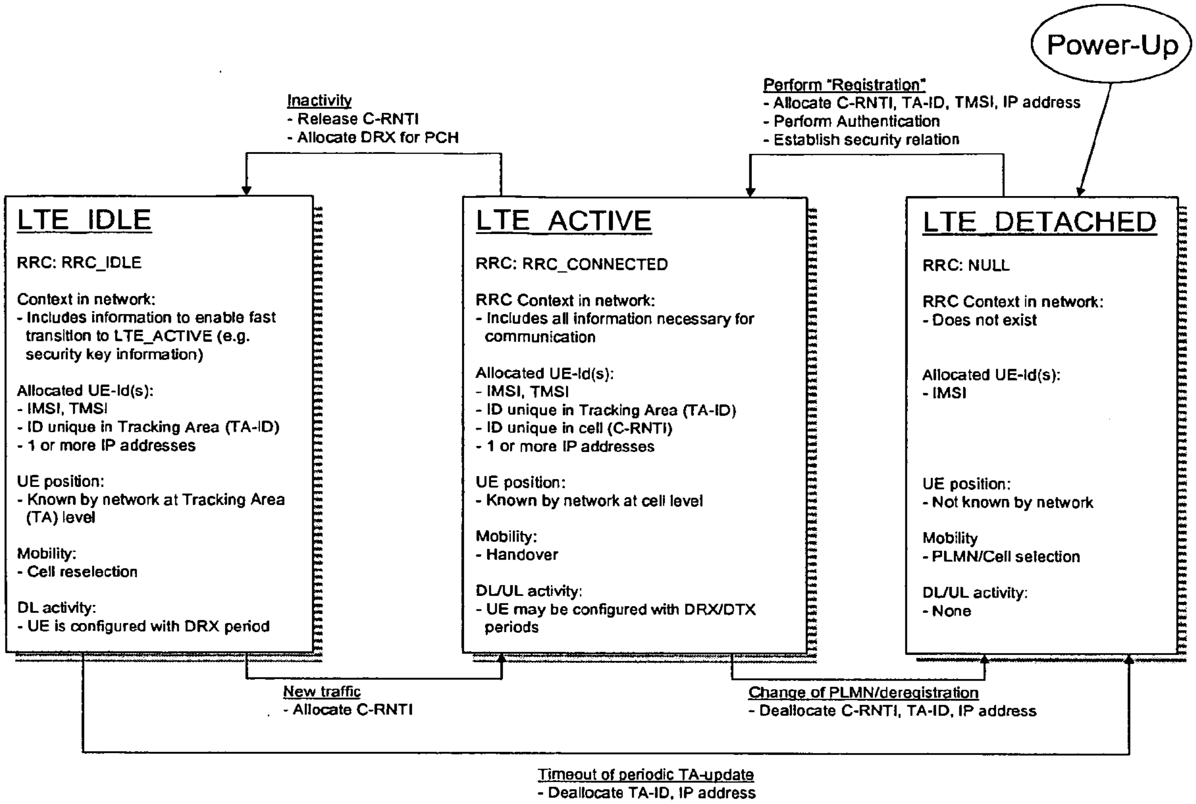

Figure 5.5.2: E-UTRAN RRC protocol states

NOTE: The applicability of the ID unique in Tracking Area (TAID) in LTE_DETACHED is FFS.

The UE context in the aGW will discriminate the 3 states. The UE context in the eNB will only exist in the LTE_ACTIVE state.

5.6 Identities used over the E-UTRAN radio interface

5.6.1 NAS related UE identities

NAS related UE identities used in E-UTRAN are assumed to be similar to the NAS identities used in 2G or 3G:

a) IMSI/IMEI;

b) TMSI for MME:

- Temporary identity allocated by the MME. The scope of the TMSI for MME is FFS.

c) TMSI for UPE (FFS):

- Temporary identity allocated by the UPE.

5.6.2 E-UTRAN related UE identities

The following E-UTRAN related UE identities are used:

a) C-RNTI:

- The C-RNTI provides a unique UE identification at the cell level;

- It is assumed that this identity is used for scheduling unless the cost would turn out to be too high and the introduction of a separate MAC identity would be required.

b) Random value for contention resolution:

- During some transient states, the UE is temporarily identified with a random value for contention resolution purposes.

5.6.3 Network entity related Identities

The following identities are used in E-UTRAN for identifying a specific network entity:

a) MME identity:

- It is agreed that a UE in LTE_IDLE establishing an RRC connection has to provide a unique identification of its current MME to the eNB when the connection establishment is initially related to NAS signalling;

- It is FFS whether this MME identity is also provided when the RRC connection is initially intended for user plane traffic;

- It is FFS whether this MME identity is provided by the UE to the eNB as a separate identity, or whether this MME identity is included in the TMSI for MME.

b) eNB identity or cell identity (FFS):

- The signalling sequence to be followed in case a UE in LTE_ACTIVE accesses a cell in which no UE context has been established yet (kind of "cell update") is currently not agreed. Identified options are:

  1) In order to obtain the UE context/data from the old eNB, the new eNB directly contacts the old eNB without consulting the aGW;

  2) In order to obtain the UE context/data from the old eNB, the new eNB consults the aGW to obtain the identity of the old eNB;

  3) In order to obtain a UE context, the new eNB contacts the aGW.

- If it is required for the new eNB to be able to contact the old eNB without involving the aGW (case 1 above), the UE has to provide a network entity related identification that enables the new eNB to contact the old eNB, and that enables the old eNB to uniquely identify the UE for retrieving the correct UE context. For this purpose either an eNB identity or cell identity could be used.

c) UPE identity (FFS):

- The signalling sequence to be followed when a UE in LTE_IDLE wants to establish an RRC connection initially intended for user plane traffic is not agreed yet. If it is required to support user plane data transport before the UE context is retrieved from the aGW, the UE might have to provide a UPE identity to the eNB thus enabling the new eNB to contact the UPE directly.

d) Tracking Area identity (FFS):

- Unique identification of a Tracking Area in a PLMN.

The following identities are broadcast in every E-UTRAN cell:

a) Cell identity:

- Uniquely identifying the cell in the area (size of area is FFS).

b) One or more Tracking Area identities (FFS):

- Tracking Area (s) this cell belongs to.

c) One or more PLMNs:

- PLMN (s) for which this cell is providing radio access.

6 ARQ and HARQ

E-UTRAN provides ARQ and HARQ functionalities. The ARQ functionality provides error correction by retransmissions in acknowledged mode at Layer 2. The HARQ functionality ensures delivery between peer entities at Layer 1.

6.1 HARQ principles

The HARQ within the MAC sublayer has the following characteristics:

- N-process Stop-And-Wait HARQ is used;
- The HARQ is based on ACK/NACKs;
- In the downlink:
  - Asynchronous retransmissions with adaptive transmission parameters are supported;
  - Additional optimisations (e.g. less adaptive/synchronous) are FFS.
- In the uplink:
  - HARQ is based on synchronous retransmissions;
  - Whether resource allocation and modulation and coding scheme can be adapted for retransmissions is FFS.
- The HARQ transmits and retransmits TBs;

6.2 ARQ principles

The ARQ within the RLC sublayer has the following characteristics:

- It is FFS whether the ARQ retransmits RLC SDUs or RLC PDUs (segments);
- ARQ retransmissions are based on:
  - RLC status reports (FFS);
  - HARQ/ARQ interactions (see subclause 6.3).
- The RLC transmitter can invoke a discard procedure (FFS);
- The RLC can invoke a reset procedure (FFS).

6.3 HARQ/ARQ interactions

In HARQ assisted ARQ operation, ARQ uses knowledge obtained from the HARQ about the transmission/reception status of a TB e.g.:

- If the HARQ transmitter detects a failed delivery of a TB due to e.g. maximum retransmission limit it is FFS if the relevant transmitting ARQ entities are notified;
- If the HARQ receiver is able to detect a NACK to ACK error it is FFS if the relevant transmitting ARQ entities are notified via explicit signalling;
- If the HARQ receiver is able to detect TB transmission failure it is FFS if the receiving ARQ entities are notified.

7 Scheduling

In order to utilise the SCH resources efficiently, a scheduling function is used in MAC. In this subclause, an overview of the scheduler is given in terms of scheduler operation, signalling of scheduler decisions, and measurements to support scheduler operation.

Scheduler Operation:

- MAC in eNB includes dynamic resource schedulers that allocate physical layer resources for the DL-SCH and UL-SCH transport channels. Different schedulers operate for the DL-SCH and UL-SCH.
- Taking account the traffic volume and the QoS requirements of each UE and associated radio bearers, schedulers assign resources between UEs and potentially also between different radio bearers associated with a single UE (FFS).
- Schedulers may assign resources taking account the radio conditions at the UE identified through measurements made at the eNB and/or reported by the UE.
- Radio resource allocations can be valid for one or multiple TTIs.
- Resource assignment consists of radio resources (resource blocks). Allocations for time periods longer than one TTI might also require additional information (allocation time, allocation repetition factor…).

Signalling of Scheduler Decisions:

- UEs identify whether resources are assigned to them by receiving a scheduling (resource assignment) channel. There may be separate scheduling channels for uplink and downlink resource assignment.
- Scheduling decisions are signalled via MAC messages. It is FFS whether resources can be assigned by other means e.g. MAC headers or RRC signalling.

Measurements to Support Scheduler Operation:

- Measurement reports are required to enable the scheduler to operate in both uplink and downlink. These include transport volume and measurements of a UEs radio environment. The time and frequency granularity of the UE radio environment measurement reports is FFS.
- Uplink buffer status reports are needed to provide support for QoS-aware packet scheduling. Uplink buffer status reports refer to the data that is buffered in the logical channel queues in the UE MAC. The uplink packet scheduler in the eNB is located at MAC level. Uplink buffer status reports may be transmitted using MAC signalling (e.g. as a specific type of MAC control PDU). A way to separately signal buffer status reports for different QoS classes may be used. To define the exact content of buffer status reports and the possible use of physical layer signalling are FFS.
- The buffer reporting scheme used in uplink should be flexible in order to support different types of data services. The buffer reporting criteria are setup and reconfigured on a per user basis or per radio bearer basis (FFS) using RRC or MAC signalling (FFS). The use of System Information should also be considered for the initial setup of default buffer reporting criteria (on a per cell basis). Constraints on how often uplink buffer reports are signalled from the UEs can be specified by the network to limit the overhead from sending the reports in the uplink.
- It is FFS whether additional measurement information is required to support the classification of UEs between localised and distributed resource allocation.
- It is FFS whether additional measurement information is required to support cell center / cell-edge resource subdivision.

8 QoS Control

Note: This section will describe how QoS is managed.

9 Mobility

In E-UTRAN RRC_CONNECTED state, network controlled UE assisted handovers are performed and various DRX/DTX cycles are supported:

- UE performs neighbour cell measurements based on measurement control and neighbour cell information from the network;
- Network signals reporting criteria for event-triggered and possibly periodical (FFS) reporting.

Following defines the handover support within E-UTRAN:

- The intra E-UTRAN HO in RRC_CONNECTED state is UE assisted NW controlled HO with HO preparation signalling in E-UTRAN.
- In E-UTRAN RRC_IDLE state, cell reselections are performed and DRX is supported.

9.1 Intra E-UTRAN

9.1.1 Variable bandwidth scenarios

The Figure below shows a number of scenarios for adjacent cells with different transmission bandwidths and UEs with different receiver bandwidths. Measurements, reselection and handover need to be considered for these different scenarios.

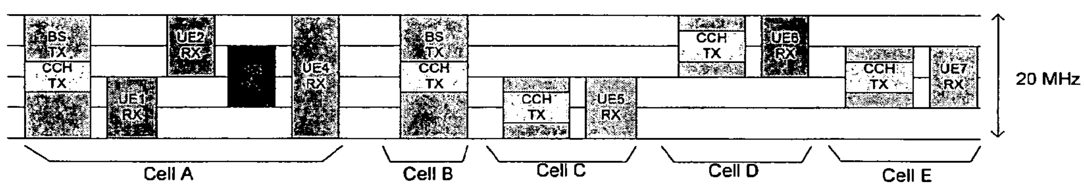

Figure 9.1.1: Variable bandwidth scenarios

1) A cell transmits one set of common channel information. This information must be contained in a bandwidth equal than or less than the UE minimum bandwidth capability (assumed to be 10MHz). This ensures all UEs in RRC_IDLE are capable of receiving the common channels irrespective of UE capability. The need to replicate some control information is FFS.
2) The term handover is used for the procedure that changes the serving cell of a UE in RRC_CONNECTED. A frequency reconfiguration within the same serving cell is not a handover. A frequency reconfiguration is used to move the UE reception bandwidth within the cell transmission bandwidth.
3) Neighbour cell lists on which the network requests the UEs to perform measurements for handover and cell reselection do not classify cells as intra-frequency or inter-frequency (i.e. there are no intra-frequency cells and inter-frequency cells)
4) A non gap assisted measurement (for handover) is a measurement on a cell from the neighbour list that does not require transmission/reception gaps to allow the measurement to be performed.
5) A gap assisted measurement (for handover) is a measurement on a cell from the neighbour list that does require transmission/reception gaps to allow the measurement to be performed.

6) Whether a measurement (for handover) is non gap assisted or gap assisted depends on the UE's capability and current operating frequency. The UE determines whether a particular cell measurement needs to be performed in a transmission/reception gap and the scheduler needs to know whether gaps are needed. The exact scenarios that require gaps assisted measurements are FFS.

9.1.2 Cell selection

9.1.3 Cell reselection

9.1.4 Paging

Note: From R2-051759: Several proposals 1) paging channel; 2) DRX on shared channel instead of paging channel. URA concept retained. Common with UTRA or specific to E-UTRA always? No need for NAS paging if some NAS/AS functionality merge (PMM with RRC) take place (e.g. if Idle mode is removed).

9.1.5 Handover

Note: From R2-051759: should depend on the RRC state and can be of intra-frequency or inter-frequency. Network controlled proposed to be primary method, and UE controlled only for RL failure case. UE controlled (like cell re-selection) for active state also proposed to be studied.

9.1.6 Measurements

Measurements to be performed by a UE for intra/inter-frequency mobility can be controlled by E-UTRAN, using broadcast or dedicated control. In RRC_IDLE state, a UE shall follow the measurement parameters defined for cell reselection specified by the E-UTRAN broadcast (as in UTRAN SIB). The use of dedicated measurement control in cell reselection is FFS. In RRC_CONNECTED state, a UE shall follow the measurement parameters specified by RRC or MAC commands (FFS) directed from the E-UTRAN (e.g. as in UTRAN MEASUREMENT_CONTROL).

Usage of dedicated control for RRC_IDLE state is FFS.

9.1.6.1 Intra-frequency

In a system with frequency reuse = 1, intra-frequency mobility is preponderant. Good intra-frequency measurements are needed in order to ensure good mobility support and easy network deployment. Search of intra-frequency neighbour cells from the neighbour list, and measurements of the relevant quantities for identified cells is needed.

NOTE: To avoid UE activity outside the DRX/DTX cycle, the reporting criteria for intra frequency measurements should match the used DRX/DTX cycle.

9.1.6.2 Inter-frequency

Regarding inter-frequency mobility, UE performs neighbour cell measurements during DL/UL idle periods that are provided by DRX/DTX or packet scheduling, if necessary.

NOTE: How the gaps are controlled, as well as how the scheduler knows the gaps required by the UE, is FFS.

9.1.7 Network aspects

When the eNB changes at handover, pending downlink RLC SDUs or PDUs (TBD) may be retransmitted in the target eNB. In the uplink, if in-order delivery of RLC SDUs is required at the decompressor in PDCP, either:

- The PDCP sublayer includes a reordering buffer of RLC SDUs before security/decompressor; or
- The uplink RLC SDUs or PDUs which were not delivered to PDCP have to be provided to the target eNB for re-ordering.

9.2 Inter RAT

The following list defines the mobility support between E-UTRAN and UTRAN (see Figure 9.2), with mobility support between E-UTRAN and GERAN being FFS.

1) The HO from E-UTRAN RRC_CONNECTED state to UTRAN CELL_DCH state is supported with UE assisted NW controlled manner including HO preparation signalling. From UTRAN CELL_DCH state to E-UTRAN RRC_CONNECTED state mobility is supported. The utilisation of the HO with preparation signalling or relying on Network Assistant Cell Change (NACC) is FFS.

2) When a UE in CELL_FACH state in the UTRAN goes out-of-service it may reselect to E-UTRAN. If the UE camps on E-UTRAN coverage the UE completes the Tracking Area update procedure to the MME. In this case the UE stores the UTRAN MM configuration.

3) The transition between UTRAN CELL/URA_PCH and E-UTRAN RRC_IDLE is completed by UE controlled cell reselection. The support of signalling-free transition between UTRAN CELL/URA_PCH and E-UTRAN RRC_IDLE states requires the UTRAN RRC Connection configuration to be stored by the UE whilst in E-UTRAN RRC_IDLE state (including the Last RRC State). The storage of the UTRAN context is indicated in the figure by the "UTRAN RRC Connected Configuration Stored".

   If, when reselecting from E-UTRAN to UTRAN the UE has a valid UTRAN RRC Connection Configuration Stored, it shall automatically enter the Last RRC State indicated in the UTRAN Stored Configuration.

   If, when changing between E-UTRAN and UTRAN the UE has moved out of its mobility area (e.g. Cell, URA, TA) then the UE initiates the normal mobility update procedure (e.g. Cell Update, URA update or Tracking Area Update procedures), but the completion of a Tracking Area Update in the E-UTRAN does not affect the stored UTRAN configurations, and the UTRAN RRC connection for the UE is maintained.

   If the timer relating to the periodic CELL/URA Update of UTRAN has expired when the UE is in E-UTRAN coverage, then the UE can delete the stored UTRAN RRC Connected configuration.

4) The transition between UTRAN IDLE and E-UTRAN RRC_IDLE is completed by UE controlled cell reselection. The UTRAN MM configuration is stored after completing the state transition to LTE_IDLE state, and the LTE_IDLE configuration is stored when reselecting from E-UTRAN RRC_IDLE to UTRAN IDLE.

NOTE: The handling in the E-UTRAN RRC_IDLE state is independent of the stored UTRAN configuration.

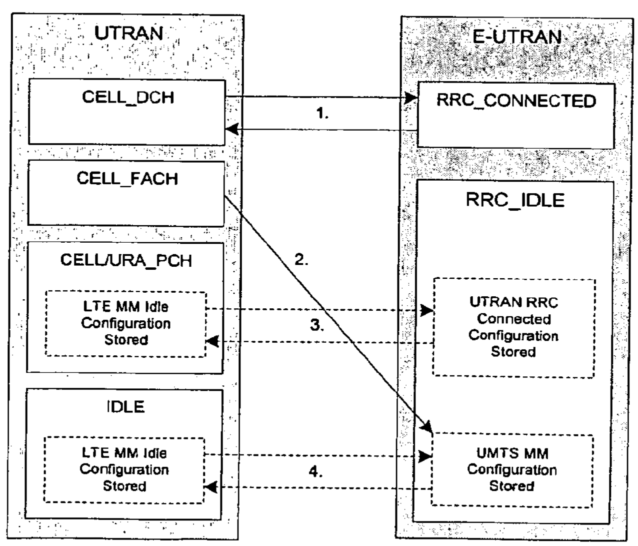

Figure 9.2: Handovers between E-UTRAN and UTRAN

9.2.1 Cell reselection

9.2.2 Handover

9.2.3 Measurements

9.2.3.1 Inter-RAT handovers from E-UTRAN

Measurements to be performed by a UE for inter-RAT mobility can be controlled by E-UTRAN, using broadcast or dedicated control. In RRC_CONNECTED state, a UE shall follow the measurement parameters specified by RRC or MAC commands (FFS) directed from the E-UTRAN (e.g. as in UTRAN MEASUREMENT_CONTROL).

UE performs inter-RAT neighbour cell measurements during DL/UL idle periods that are provided by the network through suitable DRX/DTX period or packet scheduling if necessary.

NOTE: How the gaps are controlled, as well as how the scheduler knows the gaps required by the UE, is FFS.

9.2.3.2 Inter-RAT Handovers to E-UTRAN

From UTRAN, UE performs E-UTRAN measurements by using idle periods created by compressed mode (CELL_DCH), FACH measurement occasions (CELL_FACH - FFS), or DRX (other states).

From GERAN, E-UTRAN measurements are performed in the same way as WCDMA measurements for handover to UTRAN: E-UTRAN measurements are performed in GSM idle frames in a time multiplexed manner. However, it should be discussed with GERAN how to ensure that inter-RAT measurements do not take too much measurement time, while the requested 3GPP inter-RAT measurements can be performed well enough.

Design constraints of 3GPP inter-RAT measurements should be considered when L1 details of E-UTRAN concept are defined.

9.2.3.3 Inter-RAT cell reselection from E-UTRAN

In RRC_IDLE state, a UE shall follow the measurement parameters specified by the E-UTRAN broadcast (as in UTRAN SIB). The use of dedicated measurement control is FFS.

9.2.3.4 Limiting measurement load at UE

Introduction of E-UTRA implies co-existence of various UE capabilities. Each UE may support different combinations of RATs, e.g., E-UTRA, UTRA, GSM, and non-3GPP RATs, and different combinations of frequency bands, e.g., 800 MHz, 1.7 GHz, 2 GHZ, etc. Moreover, some UEs may support the full E-UTRA spectrum bandwidth of 20 MHz, whereas some UEs may support only a part of 20 MHz. Despite such heterogeneous environment, the measurement load at UE should be minimised. To limit the measurement load and the associated control load:

- E-UTRAN can configure the RATs to be measured by UE;
- The number of measurement criteria (event and periodic reporting criteria) should be limited (as in TS 25.133 section 8.3.2 [7]);
- E-UTRAN should be aware of the UE capabilities for efficient measurement control, to prevent unnecessary waking up of the measurement entity;
- The UE capabilities should be categorised to prevent diversion of capabilities and conformance test scenarios, FFS;
- Support for blind HO (i.e., HO without measurement reports from UE) is FFS.

9.2.4 Network Aspects

9.3 Timing Advance

The timing advance is a signal derived from the time synchronisation of the UL sequence and sent by the eNB to the UE which the UE uses to advance its timings of transmissions to the eNB so as to compensate for propagation delay and thus time align the transmissions from different UEs with the receiver window of the eNB. By avoiding the overlapping of uplink transmissions, timing advance allows time domain multiplexing in the uplink.

In RRC_CONNECTED, it remains FFS whether the timing advance is permanently maintained or not. If not, MAC knows if the L1 is synchronised and which procedure to use to start transmitting in the uplink (FFS for RRC).

Cases where the UL synchronisation status may move from "synchronised" to "non-synchronised" include:

- Expiration of a timer;
- Non-synchronised handover;
- Explicit request by MAC or RRC in the eNB;

10 Security

10.1 Security Termination Points

The table below describes the security termination points.

Table 10.1 Security Termination Points

	Ciphering	Integrity Protection
NAS Signalling	Required and terminated above eNB (NOTE 1)	Required and terminated above eNB (NOTE 1)
U-Plane Data	Required and terminated in aGW (NOTE 2)	Need is FFS
RRC Signalling (AS)	Need is FFS	Required an terminated in eNB (NOTE 3)
MAC Signalling (AS)	Need is FFS	Need is FFS

NOTE 1: "Above eNB" means that the termination point is in either the aGW or above (FFS) and that the activation/deactivation is not controlled by the eNB.
NOTE 2: The protocol stack layer in which the ciphering takes place is FFS. The activation/deactivation of ciphering of the U-Plane is not controlled by the eNB
NOTE 3: Key set for RRC protection cannot be used to derive NAS and user-plane keys.

11 MBMS

Note: A separate chapter might be needed to deal with MBMS specific issues.

Note: From R2-051759: The following issues have to be discussed: need for selective combining within E-UTRA, possibility to perform selective combining between E-UTRA and UTRA; need for L1 combining (simpler with OFDM); FLC across UTRA and E-UTRA, all new requirements of MBMS for LTE...

12 Migration and compatibility

Note: This section will have a closer look at the evolution in terms of migration scenario and interaction with previous releases. It will summarize what will be described in 25.912 and 25.913 from a protocol architecture viewpoint. SA1 and SA2 should lead the way.

Note: From R2-051759: concept of having two stacks in the UE with a legacy stack connecting to legacy CN via Iu, and a new stack. where E-RRC replaces NAS+RRC. Dual IP addresses.

12.1 Migration scenario

12.2 Interaction with previous releases

12.3 Interoperability

13 UE capabilities

Note: This section will deal with the UE capabilities from a RAN2 viewpoint (e.g. signalling support).

Note: From R2-051759: Mandating dual Receiver should be discussed early (different views. UE manufacturers prefer single receiver; dual-receiver likely to be an optimisation (UE cap?). Possibility to have separate capability for 20MHz. Will need signalling support of capabilities.

14 Impact on specifications

14.1 Specification methodology

14.2 Affected specifications

Note: This section will list the specifications that affected – if any.

14.3 New specifications

Note: This section will list the specifications that affected – if any.

Annex A:
Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2005-08	RAN2#48	R2-051787			Proposed Skeleton for RAN2#48		0.0.0
2005-08	RAN2#48	R2-052241			Proposed Skeleton for RAN2#48	0.0.0	0.0.1
2005-10	RAN2#49	R2-052730			Transport channels and Logical Channels added in Section 5	0.0.1	0.0.2
2005-11	RAN2#49	R2-053071			Presence of both HARQ and ARQ Overview of the E-UTRAN Architecture added	0.0.2	0.1.0
2006-01	RAN2#50	R2-060128			Editorship updated for MBMS section	0.1.0	0.1.1
2006-01	RAN2#50	R2-060133			Descriptive text for Handovers added in Section 9; Update of the transport channels in Section 5; Annex added to reflect agreements on RACH; Function for MAC, RRC and RLC listed in section 5; Termination points for security captured in section 10.1; Figure of logical channels to transport channels added in section 5. RRC States described in section 5.	0.1.1	0.2.0
2006-01	RAN2#50	R2-060146			Various editorial changes and clarifications	0.2.0	0.3.0
2006-02	RAN2#51	R2-060309			Update of the Nomenclature and removal of some editor's notes	0.3.0	0.3.1
2006-02	RAN2#51	R2-060760			Inclusion of the agreed MAC architecture	0.3.1	0.4.0
2006-02	RAN2#51	R2-060798			Editorial Corrections	0.4.0	0.4.1
2006-02	RAN2#51	R2-060803			Addition of the Chairman Notes of RAN2#51 in Annex C	0.4.1	0.5.0
2006-03	RAN#31	RP-060176			Agreement on the state names reflected throughout the document	0.5.0	0.5.1
2006-03	RAN2#52	RP-060825			Agreements of RAN#31 and from RP-060122 + SRJ-060059 included: ARQ and RRC in eNB, SAE Bearer + Radio Bearer	0.5.1	0.6.0
2006-03	RAN2#53	R2-061062			Section 5 updated to keep ARQ as a sublayer	0.6.0	0.6.1
2006-03	RAN2#53	R2-061063			Miscellaneous clarifications and updates	0.6.1	0.6.2
2006-03	RAN2#53	R2-061070			RLC introduced as a sublayer of layer 2 Agreements on ARQ, HARQ and their interaction captured State names updated for RRC: connected and idle	0.6.2	0.7.0
2006-03	RAN2#53	R2-061085			Generic description of the scheduler added Miscellaneous clarifications and corrections	0.7.0	0.7.1
2006-03	RAN2#53	R2-061092			Miscellaneous clarifications	0.7.1	0.7.2
2006-03	RAN2#53	R2-061099			Agreed text proposals on bandwidth scenario (R2-061098), ARQ/HARQ (R2-061098), UE identities (R2-061094) and handover scenarios (R2-061089) included	0.7.2	0.8.0
2006-03	RAN2#53	R2-061102			Minor updates following email review	0.8.0	0.8.1
2006-03	RAN2#53	R2-061103			Table of content updated. Reordering at MAC layer added as FFS in section 5.3.1.1.	0.8.1	0.8.2
2006-04	RAN2#54	R2-061xxx			Editorial corrections and clean up.	0.8.2	0.8.3

Annex B: RACH and Contention Resolution

The contention channel i.e. RACH, allows achieving the following:

- Synchronising the L1 timing (timing advance);
- Transmission of a X bits message towards the network MAC e.g. 16 bits;
- RAN1 should combine both if possible to gain time.

The X bits may have a different content depending on the case where the RACH is used. This is TBD:

- Some information on UL resources needed, priority, establishment cause, and random ID to assist in contention resolution;
- UE ID already allocated by the network to the UE.

In the case of the initial access, means for the network to prioritise the various requests should be possible.

After the X bits have been received by the network, the network is responsible to send to the UE:

- If necessary, timing advance information to be used on the UL SCH;
- If necessary, C-RNTI;
- Allocation of UL resources on UL SCH.

Contention resolution takes place using the UL/DL-SCH.

The RACH L1 channel may have multiple signatures in UL (to help resolving collisions). To be checked with RAN1.

Transmission of L3 messages, MAC data or control PDU, only takes place on the UL-SCH, possibly after the RACH procedure used to get an uplink allocation.

Resources for RACH are indicated by the network.

The RACH procedure can be used for (exact list TBD, details of its use/content of X bits TBD):

- Initial access to get UL SCH resources to send RRC connection request;
- To obtain L1 synchronisation;
- To request resources when no UL resources are available;
- In case of mobility.

Annex C:
Architecture Progress

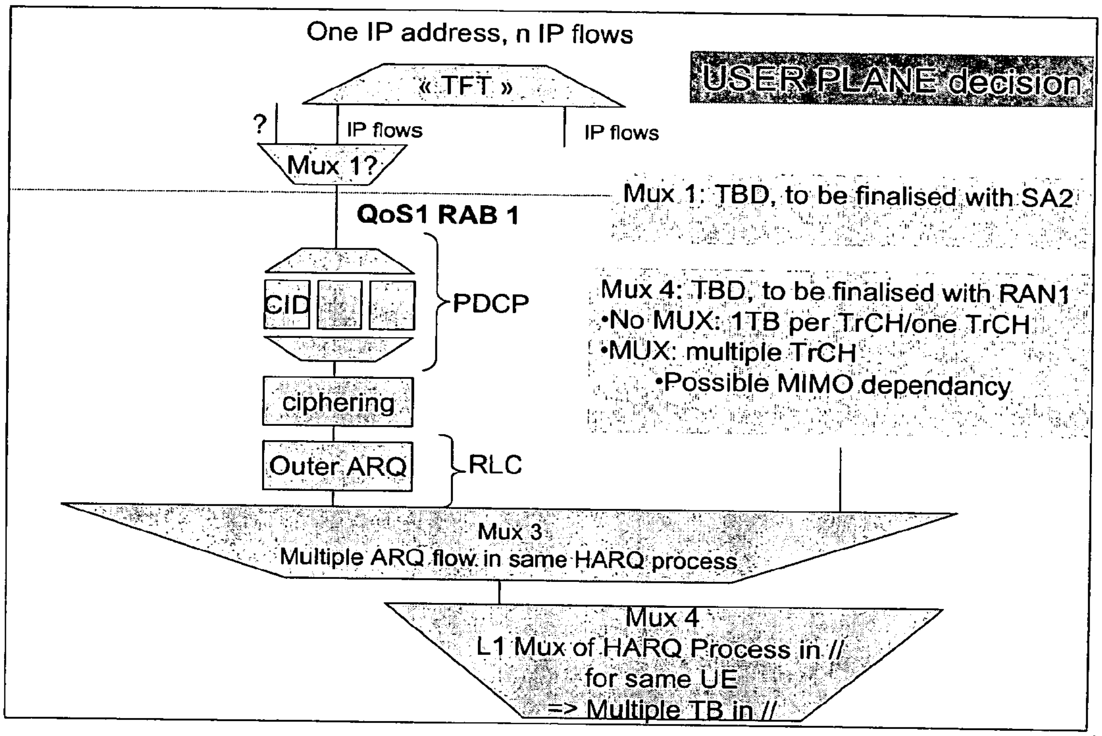

Figure C1: User Plane

Table C1: Location of Control Plane Functions

Function	eNB	aGW	Comment
Broadcast	+		Originated from aGW or O&M
Paging	+		Originated from aGW
aGW connection handling		+	NAS
Security control		+	
Mobility handling for LTE_ACTIVE state	+		
Measurement configuration and reporting for mobility	+		
Mobility handling for LTE_IDLE state		+	NAS
RAB/QoS control		+	NAS
Node-B level configuration	+		
Assignment of radio resources	+		
Identification and mapping of logical channels	+		
Scheduling for all channels incl BCH and PCH	+		
Measurements for scheduling	+		

Annex D: Editorship

In addition to the rapporteur (Benoist Sébire - Nokia), an editor was nominated for each section of the TR as described in Table B below.

Table B. Editorship

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4. Objectives and requirements	Nokia	Benoist Sébire	benoist.sebire@nokia.com
5. Protocol architecture	Nokia	Benoist Sébire	benoist.sebire@nokia.com
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