

Joint RAN WG1 and RAN WG2 on LTE
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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 identities are needs to be further studied. However, we think that UE identities for idle and active mode would be different.

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 needed 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.

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 mode 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.