- Support for dynamic and semi-static resource allocation

Random Access Channel (RACH)

- Supports transmission of limited control information
- Possible risk of collision

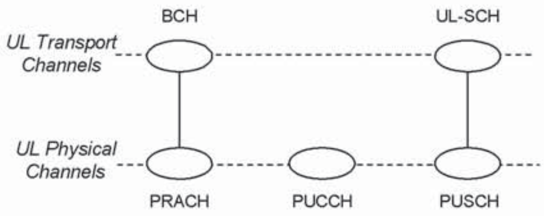
3.2.6 Mapping Uplink Physical Channels to Transport Channels

Transport channels are mapped to physical channels as shown in Figure 3.2.6-1.

3.2.7 Coding

The UL-SCH uses the same rate 1/3 turbo encoding scheme (two 8-state constituent encoders and one internal interleaver) as the DL-SCH.

Figure 3.2.6-1 Mapping of UL Transport Channels to UL Physical Channels



3.3 MB-SFN

Multimedia Broadcast Multicast Services (MBMS) are performed either in a single cell or multi-cell mode. In single cell transmissions, MBMS traffic is mapped to the DL-SCH. In multi-cell mode, transmissions from cells are carefully synchronized to form a Multicast/Broadcast – Single Frequency Network (MB-SFN).

MB-SFN is an elegant application of OFDM for cellular broadcast. The principle of operation is quite simple. Identical transmissions are broadcast from closely coordinated cells simultaneously on a common frequency. Signals from adjacent cells arrive at the receiver and are dealt with in the same manner as multipath delayed signals. In this manner, UE can combine the energy from multiple transmitters with no additional receiver complexity.

If the UE is at a cell boundary, the relative delay between the two signals is quite small. However, if the UE is close to one base station and relatively distant from a second base station, the amount of delay between the two signals can be quite large. For this reason, MB-SFN transmissions are supported using a 7.5 kHz subcarrier spacing and a longer CP. MB-SFN networks also use a common reference signal from all transmitters within the network to facilitate channel estimation.

As a consequence of the MB-SFN transmission scheme, UE can roam between cells with no handoff procedure required. Signals from various cells will vary in strength and in relative delay, but in aggregate the received signal is still dealt with in the same manner as a conventional single channel OFDM transmission.

4 Conclusions

Although incomplete, the LTE specifications do contain a great deal of useful information. It is entirely possible to construct a reasonably accurate picture of the LTE physical layer at this time. This discussion has hopefully provided the reader with a reasonably complete description of the LTE PHY. In some cases, material has been omitted for the sake of brevity. In other instances, the LTE specifications do not contain much detail at this time. As mentioned above, work on the 3GPP LTE specification is on going at this time and will not be complete before late this year or possibly early 2008.

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6 Acronyms and Abbreviations

16QAM	16 point quadrature amplitude modulation
3GPP	Third Generation Partnership Project
64QAM	64 point quadrature amplitude modulation
ACK	Acknowledgement
AGC	Automatic gain control
AP	Access point
ARQ	Automatic repeat request
BCH	Broadcast channel
BPSK	Binary phase shift keying
BW	Bandwidth
CCPCH	Common control physical channel
CDD	Cyclic delay diversity
CDMA	Code Division Multiple Access
CIR	Channel impulse response
CP	Cyclic prefix
CQI	Channel quality indication
CSMA	Carrier sense multiple access
DC	Direct current
DFT	Discrete Fourier transform
DL	Downlink
DL-SCH	Downlink-shared channel
DRX	Discontinuous receive
eNodeB	Enhanced Node B (enhanced base station)
FDD	Frequency division duplexing
FFT	Fast Fourier transform
GMSK	Gaussian minimum shift keying
GT	Guard time
HARQ	Hybrid automatic repeat request
HSDPA	High Speed Downlink Packet Access
HSUPA	High Speed Uplink Packet Access
ICI	Inter carrier interface
IDFT	Inverse discrete Fourier transform
IEEE	Institute of Electrical and Electronics Engineers
IFFT	Inverse fast Fourier transform
ISI	Inter symbol interface
LO	Local oscillator
LTE	Long Term Evolution
MBMS	Multimedia broadcast multicast service
MB-SFN	Multicast/broadcast – single frequency network
MCH	Multicast channel
MIMO	Multiple Input Multiple Output
MRC	Maximal ratio combining
NACK	Not acknowledgement
OFDM	Orthogonal Frequency Division Multiplexing
PAPR	Peak-to-average power ratio
PCH	Paging channel
PDCCH	Physical downlink control channel
PDSCH	Physical downlink shared channel
PHY	Physical layer
PRACH	Physical random access channel
PRB	Physical resource block
PRN	Pseudo random numerical sequence
PSK	Phase shift keying
PUCCH	Physical uplink control channel
PUSCH	Physical uplink shared channel
QAM	Quadrature amplitude modulation
QPSK	Quadrature phase shift keying
RACH	Random access channel
RFE	Radio front end
RFPA	Radio frequency power amplifier
S/P	Serial-to-parallel
SAP	Service access point
SC-FDMA	Single Carrier – Frequency Division Multiple Access
SNR	Signal-to-noise ratio
STA	Station
TDD	Time Division Duplexing
UE	User equipment
UL	Uplink
UL-SCH	Uplink – shared channel
XCVR	Transceiver

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