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Basics of LTE Technology

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Introduction:

LTE is the next generation of technology which is backward compatible with cellular technologies such as HSPA,GSM,CDMA etc. LTE means Long Term Evolution.LTE which is known as 4G technology is being specified in Release 8 and 9 of the 3GPP standard. Release 10 is referred as LTE-Advanced. The LTE radio transmission and reception specifications are documented in TS 36.101 for the UE (User Equipment) and TS 36.104 for the eNB (Evolved Node B). Downlink and uplink transmission in LTE are based on the use of multiple access technologies: specifically, orthogonal frequency division multiple access (OFDMA) for the downlink, and single-carrier frequency division multiple access (SC-FDMA) for the uplink. The work on the specifications is ongoing, and many of the technical documents are updated quarterly. The latest versions of the 36-series documents can be found at https://www.3gpp.org/ftp/specs/archive/36_series/ LTE Physical layer is described in TS36.211 and TS36.212 releases. 36.211 mentions physical channels and modulation while 36.212 mentions multiplexing and channel coding.

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LTE system basic parameters and LTE Frame structure:

Frame Size=10ms

No. of slots=20.

No of Slots per Sub frame =2.

Slot duration=0.5 ms

Sub frame duration=1 ms

Basic time unit T_s for BW of 20MHz, $(1/15000)*2048$ seconds equal to 32.55ns.

There are two types of frames in LTE;FDD and TDD.

Type 1, applicable to FDD- Here there are total 20 slots, each is 0.5ms. 2 slots constitute 1 sub frame.

Total Frame duration is 10ms.

Type 2, applicable to TDD- Here there are 10 sub frames, each is 1 ms,sub frame 0 and 5 are dedicated for downlink always while sub frames 1 and 6 are dedicated for control frame.Sub frames 2, 3, 4 and 7, 8, 9 depend on UL/DL configuration table defined in the standard.Frame has switch point periodicity of 5 ms.

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The key features of LTE physical layer are mentioned below.

Channel Bandwidth: 1.4/3/5/10/15/20 MHz

FFT size : 128/256/512/1024/1536/2048

Cyclic Prefix : Normal, Extended

DL multiple access: OFDMA

UL multiple access: SC-FDMA

Duplexing :FDD & TDD

Subcarrier mapping: Localized

Subcarrier hopping: Yes

Data Modulation : QPSK/16QAM/64QAM

Subcarrier spacing: 15KHz

Channel Coding : convolutional coding and turbo coding

MIMO :2 or 4 at transmit and 2 or 4 at receive side

HARQ :incremental redundancy

3GPP released documents of LTE and LTE-advanced are available at 3GPP web site-

<https://www.3gpp.org>

REFERENCES

1. TS 36.201- Evolved Universal Terrestrial Radio Access (E-UTRA); LTE physical layer; General description

2. TS 36.211- Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation
3. TS 36.212- Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding
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