ISO 9001 : 2008

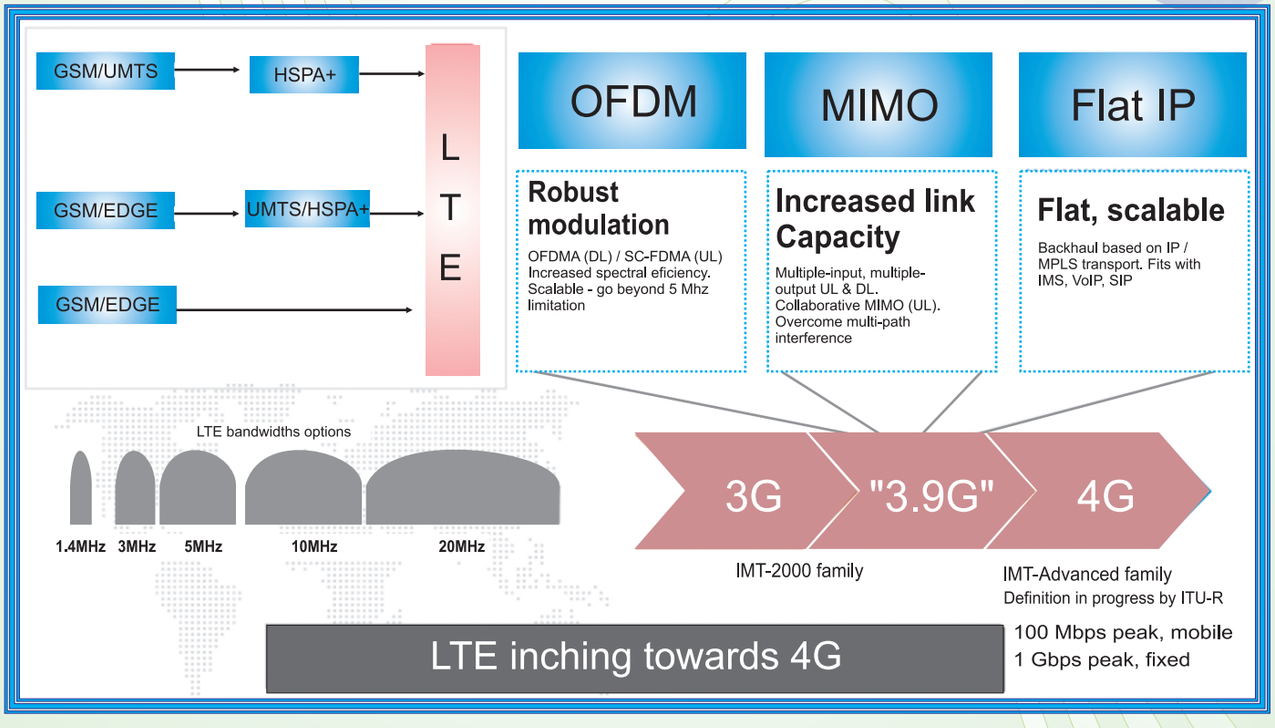
TEC

टी ई सी संचारिका

NEWSLETTER

VOL 15 OCTOBER 2011 ISSUE 4

# LONG TERM EVOLUTION (LTE)




ISO 9001:2008
TELECOMMUNICATION ENGINEERING CENTRE

## IN THIS ISSUE

## 1.0 LTE :

Long Term Evolution (LTE) is the standardisation work by the Third Generation Partnership Project (3GPP) which defines a new high-speed radio access method for mobile communications systems.

LTE is the enhancement of the 3GPP family of cellular systems that include GSM, GPRS and EDGE as well as WCDMA and now HSPA (High Speed Packet Access), which offers a smooth evolutionary path to higher speeds and lower latency. Besides providing the efficient use of operators' finite spectrum assets, LTE offers richer mobile service environment.

Realization of full potential offered by advanced new radio interface of LTE, requires an evolution from present hybrid packet/circuit switched networks to all-IP (Internet Protocol) environment. From the Network operator's perspective, LTE facilitates reduced delivery costs for rich, blended applications combining voice, video and data services and simplified interworking with other fixed and wireless networks.

## 2. Key Features :

### 2.1 Enhanced air interface allows increased data rates:

LTE is built on an all-new radio access network based on OFDM (Orthogonal Frequency-Division Multiplexing) technology. Specified in 3GPP Release 8, the air interface for LTE combines OFDMA-based modulation (64 QAM) and multiple access schemes for the downlink, together with SC-FDMA (Single Carrier FDMA) for the uplink.

The result of these radio interface features is significantly improved radio performance, yielding up to five times the average throughput of HSPA. Downlink peak data rates are extended up to a theoretical maximum of 300 Mbit/s per 20 MHz of spectrum. Similarly, LTE theoretical uplink rates can reach 75 Mbit/s per 20 MHz of spectrum, with theoretical support for at least 200 active users per cell in 5 MHz.

### 2.2 High spectral efficiency :

3 times the current standards

### 2.3 Reduced latency :

reducing round-trip times to 10ms or even less compared with 40–50ms for HSPA.

### 2.4 Flexible radio planning :

To achieve effective performance and mobility, careful radio planning needs to be performed. LTE is very flexible i.e. it can be deployed in various frequency bands using a mixture of channel bandwidth.

### 2.5 An all-IP environment :

One of the most significant features of LTE is its transition to a 'flat', all-IP based core network with a simplified architecture and open interfaces.

### 2.6 Spectrum Flexibility :

LTE networks could be rolled out in any of the bands already harmonized for use by 3GPP systems. These include IMT-2000 core frequency bands (1.9-2 GHz) and extension bands (2.5 GHz), as well as at 850-900 MHz, 1800 MHz, AWS spectrum (1.7 GHz-2.1 GHz) and portions of the UHF band recently identified at the World Radio communication Conference (WRC-07) for mobile services in some parts of the world.

## 3. LTE Standardisation Target :

In December 2004, 3GPP launched a feasibility study in order "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". The objective was to develop specifications for a radio access network (RAN) capable of supporting the broadband Internet user experience we already enjoy in today's fixed networks – with the addition of

full mobility to enable possibilities for exciting new services.

Today, specifications for LTE are encapsulated in 3GPP Release 8, the newest set of standards that defines the technical evolution of 3GPP mobile network systems. Release 8 succeeds the previous iteration of 3G standards – Release 7 – that includes specifications for HSPA+, the 'missing link' between HSPA and LTE. Defined in 3GPP Releases 7 and 8, HSPA+ allows the introduction of a simpler, 'flat', IP-oriented network architecture while bypassing many of the legacy equipment requirements of UMTS/HSPA.

## 4. LTE Technology :

Two key enabling technologies viz. OFDM & MIMO will help the industry meet and exceed the LTE performance objectives.

### 4.1 Orthogonal Frequency Division Multiplexing (OFDM) :

It is intrinsically able to handle the most common radio frequency (RF) distortions without the need for complex equalization techniques, and scales easily to fit different bandwidth requirements (upto 20 MHz). LTE uses OFDM for the downlink, that is, from the base station to the terminal. In the uplink, LTE uses a pre-coded version of OFDM called Single Carrier Frequency Division Multiple Access (SC-FDMA).

### 4.2 Advance Antenna Solutions :

Advanced antenna solutions introduced in HSPA Evolution are also used by LTE. Solutions incorporating multiple antennas meet next generation mobile broadband network requirements for high peak data rates, extended coverage and high capacity. Advanced multi-antenna solutions are vital to achieving these targets. There is not one single antenna solution that addresses every scenario. Consequently, a family of antenna solutions is available for specific deployment scenarios. For example, high peak data rates can be achieved with multi-layer antenna solutions such as 2x2 or 4x4 **Multiple Input, Multiple Output (MIMO),** and extended coverage can be achieved with beam-forming.

MIMO increases peak throughput by transmitting and receiving multiple streams of information within the same spectrum. It exploits the multi-path effects typical in wireless environments.

The combined use of OFDM and MIMO will improve the spectral efficiency and capacity of the wireless network, and will prove to be a very valuable asset in maximizing usage of scarce spectrum typically controlled by regulatory bodies.

## 5. Frequency bands for LTE :

LTE can be used in both paired (FDD) and unpaired (TDD) spectrum. Leading suppliers' first product releases will support both duplex schemes. In general, FDD is more efficient and represents higher device and infrastructure volumes, but TDD is a good complement, for example, in spectrum center gaps. Because LTE hardware is the same for FDD and TDD, except for the radio unit, TDD operators will for the first time be able to enjoy the economies of scale that come with broadly supported FDD products.

### 5.1 Transmission bandwidth :

| Channel bandwidth [MHz] | 1.4 | 3 | 5 | 10 | 15 | 20 |
|---|---|---|---|---|---|---|
| Transmission bandwidth bit rate | 6 | 15 | 25 | 50 | 75 | 100 |

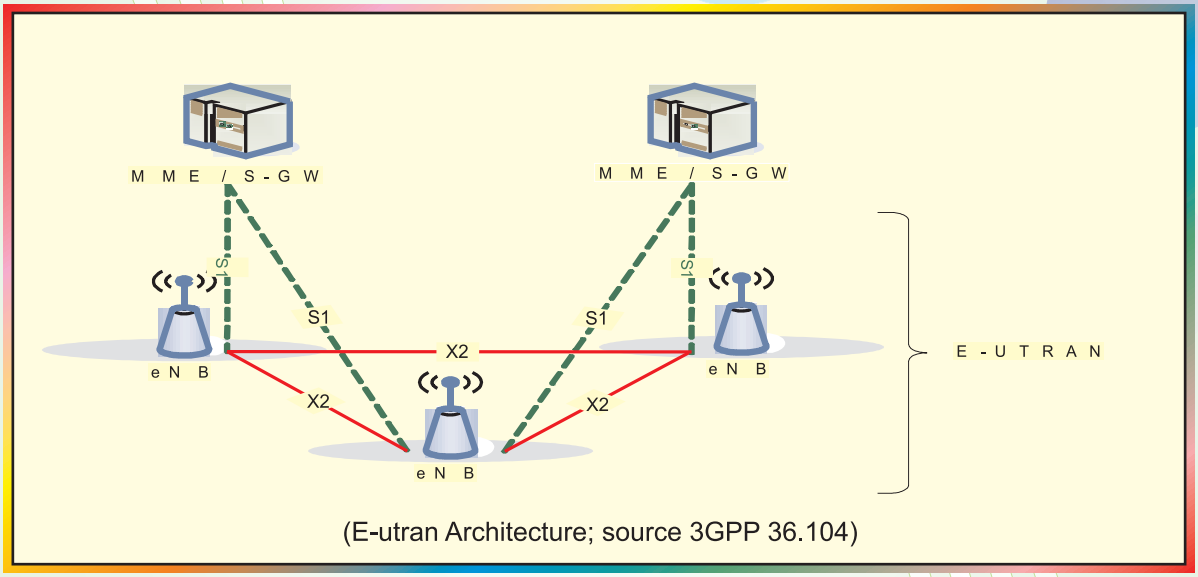
(Source 3GPP 36.104)

### 5.2 Architecture of LTE :

The E-UTRAN consists of eNBs, providing the E-UTRA user plane PDCP/RLC/MAC/PHY) and control plane (RRC) protocol terminations towards the UE. The eNBs are interconnected with each other by means of the X2 interface. The eNBs are

also connected by means of the S1 interface to the EPC (Evolved Packet Core), more specifically to the MME (Mobility Management Entity) by means of the S1-MME and to the Serving Gateway (S-GW) by means of the S1-U. The S1 interface supports a many-to-many relation between MMEs / Serving Gateways and eNBs.

The E-UTRAN architecture is illustrated in figure below.




(E-utran Architecture; source 3GPP 36.104)

## 6. Terminals, modules and fixed wireless terminals :

The LTE network's powerful support for mobile multimedia data applications is the determining push towards the mobile multimedia direction as compared to voice centric functionality.

Initially LTE terminals will only support data applications leaving voice centric function to underlying 3G and GERAN networks. Voice will eventually be viewed as just another data application. (through mobile VoIP) and it is expected that in due course, the LTE network will assume responsibility for overall subscriber connectivity.

## 7. Conclusion :

LTE can meet the requirements of next-generation mobile networks, both for existing 3GPP/3GPP2 operators. Operators will be able to reap the benefits of LTE like high-performance, mobile broadband services, through a combination of high bit-rates and system throughput, in both the uplink and downlink and with low latency. LTE infrastructure is designed to be simple to deploy and operate, that can be deployed in a wide variety of frequency bands.

LTE provides scalable bandwidths, from 1.4 MHz up to 20 MHz, together with support for both FDD paired and TDD unpaired spectrum. The LTE–SAE architecture reduces the number of nodes, supports flexible network configurations and provides a high level of service availability. LTE–SAE will also inter-operate with GSM, WCDMA/ HSPA, TD-SCDMA and CDMA. Besides next generation mobile phones, LTE will be available in devices like notebooks, ultra-portables, cameras and other devices that benefit from mobile broadband.

## Special Events

Release of compendium on "Rural Communications" by Advisor (T) DoT Sh J.Gopal at TEC on 30/09/2011. The compendium aims to focus attention of all

Left to right : Sh J.Gopal Advisor (T) DoT, Sh N.K. Srivastava Sr DDG TEC

the four stakeholders i.e. Government, manufacturers, service providers and users, on issues essential for telecom services in the rural areas. The compendium also covers the USOF's initiative on rural broadband. Technical papers on broadband over VSAT systems in rural India, broadband connectivity using WiMax, NGN as facilitator, IPv6 based applications, etc .have been included. It also covers the case study on rural telephony.

## Other Activities

- TEC participated at Busan, South Korea in discussion on PROP-100 proposal regarding reservation of IPv6 allocation blocks economy wise in APNIC-32 meeting.
- TEC and WPC prepared a contribution for the 5th Asia Pacific Preparatory Group (APG-5) meeting in Busan, on High Altitude Platform Station (HAPS). The paper requests World Radiocommunication Conference (WRC) studies leading to technical, regulatory and operational recommendations to decide on the use of HAPS in the mobile service, anywhere within the country, using the frequency bands identified for HAPS in the Radio Regulations. At present such a use of HAPS is not permitted.
- Contribution on Vocabulary terms and definitions was submitted by TEC in ITU – R WP5D meeting at Waikoloa, Hawaii, USA
- Contribution paper on Question 22 of Study Group5 of ITU-T on Requirements for rural Setting up a low cost sustainable telecommunication infrastructure for rural communications in developing countries as an input to the handbook being prepared on the subject
- हिन्दी ग्रह पत्रिका टी ई सी संचारिका 2011 का प्रकाशन

## 5.4 हिंदी कार्यशाला

दूरसंचार इंजीनियरिंग केन्द्र द्वारा 9 सितम्बर 2011 को मानक वर्तनी के प्रयोग के सबन्ध मे जानकारी विषय में कार्यशाला का आयोजन किया गया। डॉ. आर सी शर्मा, संयुक्त निदेशक (राजभाषा) दूरसंचार विभाग द्वारा इस कार्यशाला में व्याख्यान दिया गया तथा वर्तनी के मूल सिद्धांतों एवं दैनिक व्यवहार में किस तरह हिन्दी को त्रुटि रहित लिखा एवं बोला जाए एस पर प्रकाश डाला। यह कार्यशाला हिंदी में काम करने की दृष्टि से बहुत ही उपयोगी सिद्ध हुई।


कार्यशाला में में भाग लेते हुए अधिकारी एवं कर्मचारीगण

## हिन्दी पखवाड़ा 2011 की झलकियाँ

दूरसंचार इंजीनियरिंग केन्द्र द्वारा दिनांक 14 से 28 सितम्बर तक हिन्दी पखवाड़ा समारोह पूर्वक मनाया गया। हिंदी के प्रचार प्रसार के अंतर्गत कुल 9 प्रतियोगिताओं का आयोजन किया गया जिसमें टी ई सी परिवार के सदस्यों ने बढ़ चढ़ कर हिस्सा लिया। 29 सितम्बर को समापन समारोह वरिष्ठ उप महा निदेशक की अध्यक्षता में आयोजित किया गया। समारोह में विभिन्न प्रतियोगिताओं के विजेताओं को अध्यक्ष महोदय ने नकद पुरस्कार एवं प्रशस्ति पत्र से सम्मानित किया

समापन समारोह में भाग लेते हुए अधिकारी एवं कर्मचारीगण

वरिष्ठ उप महा निदेशक श्री एन के श्रीवास्तव दीप प्रज्वलित कर हिंदी पखवाड़े का शुभारंभ करते हुए।

राष्ट्रीय दूरसंचार संस्थान में हिंदी प्रशन्नोतरी में भाग लेते हुए प्रशिक्षणार्थी

वंदना द्वारा माँ सरस्वती का आवाहन

समारोह का राष्ट्रीय गान के साथ समापन

## Approvals from 1st July 2011 to 30th September 2011

| Company/Product | |
|---|---|
| 1 | Alcatel Lucent India (P) Limited |
| 1.1 | OMNI PCX Enterprise, IP PABX |
| 2 | Avaya India Private Limited |
| 2.1 | Avaya B5800 Branch Gateway PABX for PSTN connectivity. |
| 3 | BPL Telecom |
| 3.1 | Electronic Tele Instrument,MN-6390 |
| 4 | Hewlett Packard India Sales(P) Ltd. |
| 4.1 | G3 FAX Machine, SDGOB-1053 |
| 4.2 | Router, HPA-MSR 20-21 |
| 4.3 | Router HPA-MSR 20-20 |
| 4.4 | Router, HPA-MSR 20-40 |
| 4.5 | Router HPA-MSR-30-10 |
| 4.6 | Router, HP A-MSR 30-20 |
| 5 | Kadevi Industries Limited, Hyderabad |
| 5.1 | GSM Base Station Panel antenna,KE1721X6518-DE10 |
| 5.2 | High Performance Parabolic Antenna,KEH03-144S |
| 6. | Laser Telesystems (P) Ltd. |
| 6.1 | FAX Machine, KX-MB772CX |
| 7 | Motorola Mobility India (P) Ltd. |
| 7.1 | Motorola EX-109,DQ4-4411F11 |
| 7.2 | Motorola Ex-119,DQ44411J11 |
| 7.3 | Motorola EX-212,DC4-41H11 |
| 7.4 | GSM Mobile Phone, Motorola XT311,DYQ6-334411A11 |
| 7.5 | GSM MOBILE PHONE,XT530,DVQ7-334411A11 |
| 7.6 | GSM Mobile phone, Motorola Defy+MB-526, MWQ7-334411A11 |
| 8 | NEC India (P) Limited |
| 8.1 | Indoor Unit(IDU) for Point to Point MW System, MDP-400MB-1B |
| 8.2 | PABX for PSTN Connectivity, SL 1000 |
| 9 | Nokia India Private Limited |
| 9.1 | Nokia Blue Tooth Head Set, BH-905i |
| 9.2 | GSM Mobile phone, Nokia C3-01.5(RM-776) |
| 9.3 | GSM Mobile phone, Nokia X3-02.5(RM-775) |
| 9.4 | GSM Mobile phone, Nokia C2-02(RM-692) |
| 9.5 | GSM Mobile phone, Nokia C2-03 (RM-702) |
| 9.6 | GSM Mobile phone, Nokia C2-063 (RM-702) |
| 9.7 | GSM Mobile phone, Nokia 100 (RH-130) |
| 9.8 | GSM Mobile phone, Nokia N9 (RM-696) |
| 9.9 | GSM Mobile phone, Nokia 701 (RM-774) |
| 9.10 | GSM Mobile phone, Nokia 700 (RM-670) |
| 9.11 | GSM Mobile phone, Nokia 600 (RM-701) |
| 9.12 | GSM Mobile phone, Nokia 101 (RM-769) |
| 9.13 | GSM Mobile phone, Nokia 500 (RM-750) |
| 9.14 | GSM Mobile phone, Nokia 300 (RM-781) |
| 9.15 | Blue Tooth Head Set, BH-111 |
| 10 | Otis Elevator Company (I) (P) Ltd |
| 10.1 | V.90 Modem (Analog),ACA 26800 ARH |
| 11 | Polycom |
| 11.1 | ISDN CPE, HDX 7000 HD |
| 11.2 | ISDN CPE, HDX 7000 |
| 11.3 | ISDN CPE, HDX 8000 |
| 11.4 | ISDN CPE, HDX 8000 HD |
| 12 | Seven Hills Optocommunication Ltd |
| 12.1 | Optical Fibre Splicing Machine, TCW-505 |
| 13 | Sharp Business Systems(I)(P) Ltd |
| 13.1 | Sharp FAX Expansion KIT,MX-FX12 |
| 14 | Sunren Technical Solutions (P) Ltd |
| 14.1 | V-90 Modem (analog) |
| 14.2 | G-3 FAX Machine, |
| 14.3 | Mediant 1000 MSBG-Media Gateway, PABX for PSTN connectivity |
| 14.4 | G-3 FAX Card, CLX-FAX 250 |
| 14.5 | G-3FAX Card, CLX-FAX 150 |
| 14.6 | G-3 FAX Machine, SDGOB-0604-03 |
| 14.7 | Black Berry 9900 Smart Phone Wireless Handheld,RDYT1UW |
| 14.8 | Black Berry 9860 Smart Phone Wireless Handheld,RDP71UW |
| 14.9 | Black Berry 9810 Smart Phone Wireless Handheld,RPM71UW |
| 14.10 | G3 FAX Machine, C451 A |
| 14.11 | G3 FAX Machine, DELL 1355CN |
| 14.12 | G3 FAX Machine, C441A |
| 15 | Tejas Network Limited |
| 15.1 | STM-4 TM/ADM, TJ 100ME |
| 16 | ZTE Telecom (I) (P) Limited |
| 16.1 | SDH Multiplexer, ZXMP S385 |
| 16.2 | STM-1 SDH Synchronous Multiplexer, ZXMP S385 |
| 16.3 | STM-4 SDH Synchronous Multiplexer, ZXMP S385 |
| 16.4 | GSM/UMTS Based Core Network Soft Switch, ZXWN(V3)(MGW/SGW/MSCS) |

# Important Activities of TEC during July 2011 to September 2011

## DCC Conducted on

- Integrated STP & SSTP
- Remote RF Monitoring System
- EMF Strength measuring Instrument
- BTS Shelter
- Thermoshrink sleeve, closure channel and branch off clip

## SUB DCC Conducted on

- Power system based on renewable energy
- SMPS based Power Plant,

## Validation conducted on

- C-DOT IP –DSLAM and ADSL 2+ CPEs
- GPON system

## GR Issued on

- Wi-Fi Access Point
- Wireless local area network

## TSTP Issued on

- UMTS Terrestrial Radio Access Network
- 3G DATA Card
- WCDMA Repeater
- LTE
- Lawful interception of mobile
- NTP server
- Monitoring Equipment for Lawful Interception

ISO 9001 : 2008

TEC Conducts
Type Approval
Interface Approval
Certificate of Approval
for
Telecom Products

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## Regional TEC Contacts

| | | |
|---|---|---|
| Eastern Region | : | 033-23570003 |
| Western Region | : | 022-26610900 |
| Northern Region | : | 011-23329464 |
| Southern Region | : | 080-26642900 |

## Activities at National Telecommunications Institute

- One week course on Lawful Interception & Monitoring
- Two days conference on 'National Security & Telecom : Issues & Challenges'
- One week course on Structure on Networks, Interconnections and Service Provisioning (ILD/NLD/ISP)
- One day workshop on Right to Information Act 2005

## Approvals issued by TEC during the period from July 2011 to Sep. 2011

**Interface Approvals.....32**
**Type Approvals .....03**
**Certificate of Approvals.....24**



टी ई सी संचारिका
अक्टूबर 2011
भाग 15
अंक 4

दूरसंचार इंजीनियरी केन्द्र
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