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TEC

टी ई सी संचारिका

NEWSLETTER

Vol. 20 NOVEMBER 2016 ISSUE 4

2nd India Telecom 2016: An Exclusive International Buyer Seller Business Expo held in New Delhi

Secretary (T) & Secretary (DIPP) at TEC stall during '2nd India Telecom 2016: An Exclusive International Buyer Seller Business Expo"

TEC participated in "2nd India Telecom 2016: An Exclusive International Buyer Seller Business Expo" organized by TEPC (Telecom Equipment and Services Export Promotion Council) on 3rd October 2016 in New Delhi.

The conference was inaugurated by Honourable Minister of Communications (Independent Charge) Shri Manoj Sinha. Shri J.S. Deepak, Secretary, DoT and Shri Ramesh Abhishek Secretary, DIPP addressed the participants. More than 68 buyers from 28 countries across the world participated in this event.

In the Exhibition, TEC exhibited its latest releases of different documents i.e. Generic Requirements, Interface Requirements, Service Requirements, Different standards and Technical Reports released by TEC on M2M/IoT domain (which are available on the link www.tec.gov.in/technical-reports).

Based on these technical reports, Prototype product related to Smart Lightening Solutions for Smart City and Smart Homes Solutions and Prototype product based on Embedded SIM for Vehicle tracking system were also demonstrated.

Inauguration of Online sale of documents by Member (Technology) at TEC

Member (Technology) DoT inaugurated the TEC portal of Online Sale of Documents

Shri G. K. Upadhyay, Member (Technology), DoT visited TEC on 19th Oct 2016. He was welcomed by Sr. DDG, TEC and a meeting with all DDsG of TEC was held. He inaugurated the TEC portal for Online Sale of Documents in TEC. This is a step towards achievement of TEC's Quality objectives.

Around 500 documents of TEC i.e. Generic Requirements (GR), Interface Requirements (IR), Service Requirements (SR) and Standards (SD) are available online. He was also appraised of the role and responsibilities of TEC and a brief presentation on TEC was made to him.

Member (T) in his address talked about vision & Mission of DoT and the role of TEC in the current telecom scenario of India. He also visited the NGN Transport Lab, IPv6 lab and SAR Lab in TEC.

This Issue on 5G

This issue discusses about forth coming 5G technology along with its regular feature of various activities related to preparation of GRs/IRs, activities of NTIPRIT and the latest approvals by TEC.

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TELECOMMUNICATION ENGINEERING CENTRE

IN THIS ISSUE

Path to 5G

1.0 Market drivers and Use Cases for 5G

3G and 4G technologies have mainly focused on the mobile broadband use case, providing enhanced system capacity and offering higher data rates. This focus will clearly continue in the future 5G era, with capacity and data rates being driven by services such as video. Future wireless networks shouldn't be restricted to an enhanced broadband, but should also offer wireless access to anyone and anything. A major use case will be Machine to Machine / IoT communication. Machine to machine communication, virtual reality and tactile internet ultra-reliable communications and high density data usage are all important use cases for 5G.

Section 2 describes the potential technologies for 5G followed by the regulatory considerations in Section 3 and Standardization activities in Section 4 and finally conclusion.

2.0 Potential Technologies for 5G

In this section the following potential technologies are discussed:

Radio side	Radio Access Network and Core Network
• Millimeter Waves • New Wave forms • Massive MIMO • Dynamic Spectrum Access	• Mobile Content Delivery Optimization • C-RAN • Efficient Small Data Transmission • Flexible mobility • Information Centric Networking • SDN and NFV

2.1 Millimeter Wave

Millimeter waves (mmW) occupy the frequency spectrum from 30 GHz to 300 GHz. Their high frequency makes them an efficient way of transmitting high amount of data and their small beam-width makes them useful in radar applications. Promising applications of mmW include mmW radar in automotive safety devices, Small Cell backhaul, mmW for radio access of cellular phones, WiFi Hotspot in 60GHz band like IEEE 802.11ad and Wireless HD.

2.2 New Waveforms

The new waveforms in 5G include advanced multi-carrier transmission and non-orthogonal transmission.

a. Advanced multi-carrier transmission: LTE radio access is based on OFDM transmission in both DL and UL: conventional OFDM for the DL and DFT-precoded OFDM for UL. OFDM transmission, which is a kind of multi-carrier transmission scheme, is also a candidate for 5G radio access. Other multi-carrier transmission schemes under consideration for 5G radio access are:

i. Filter-Bank Multi-Carrier (FBMC) transmission
ii. Universal Filtered Multi-Carrier (UFMC) transmission
iii. Generalized Frequency-Division Multiplexing (GFDM)

b. Non-orthogonal transmission: 4G radio access is based on orthogonal transmission for both DL and UL. Orthogonal transmission avoids interference and leads to high system capacity. However, for rapid access of small payloads, the procedure to assign orthogonal resources to different users may require extensive signaling and lead to additional latency. Thus, support for non-orthogonal access, as a complement to orthogonal access, is being considered for 5G. Examples include Non-Orthogonal Multiple Access (NOMA) and Sparse-Code Multiple Access (SCMA).

2.3 Massive MIMO

MIMO employs multiple antennas at the transmitter and receiver, and is a well-known technique to increase the spectral efficiency of a wireless link. Single-user MIMO and multi-user MIMO are both part of the 4G standards.

Massive MIMO extends the multi-user MIMO concept by dramatically increasing the number of antennas employed at the base station to be significantly larger than the number of users being served simultaneously in the same time-frequency block. With hundreds of antennas serving tens of users simultaneously, spectral efficiency can increase 5x to 10x, while users on a cell's fringes can maintain high throughput. Furthermore, the pre-coding required for each user's signal reduces to simple conjugate beamforming.

2.4 Dynamic Spectrum Access

To support the increasing bandwidth requirements, technical advancements in the air interface technologies have increased the spectral efficiency (bits/s/Hz), but now, the physical limits have been reached. To support next generation applications, operators will require more spectrum. Since spectrum is a scarce resource, methods like Dynamic Spectrum Access are being explored. DSA can be broadly divided into software-defined radio and cognitive radio access methods.

Software-defined radio, sometimes shortened to software radio, is generally a multiband radio that supports multiple air interfaces and protocols and

is reconfigurable through software run on DSP (Digital Signal Processor) or general purpose microprocessors.

Cognitive radio, built on a software radio platform, is a context-aware intelligent radio potentially capable of autonomous reconfiguration by learning from and adapting to the communication environment.

While dynamic spectrum access is certainly an important application of cognitive radio, cognitive radio represents a much broader paradigm where many aspects of communication systems can be improved via cognition.

But, DSA is an important approach that is being considered by regulators in other countries. Recently, Nokia carried out a demonstration of DSA called Authorised Shared Access (ASA) in Finland in TD-LTE at 2.3GHz.

2.5 Mobile Content Delivery Optimisation

The increasing amount of data is being consumed by mobile subscribers by way of watching and downloading of videos. This puts a huge stress on the backhaul which has to support the peak traffic and many moves/steps like caching at cell site, video transrating, video pacing etc have been undertaken to handle the traffic efficiently. With standardization in mobile content delivery optimization, the Quality of Experience (QoE) will improve; capacity in the core network will increase with hierarchical caching and operator OPEX will reduce by optimizing video delivery.

To standardise the interfaces, some of the standardization activities carried out in this field are IETF CDNi, 3GPP-MPEG DASH, 3GPP SAE/QoS Architecture and User Plane Congestion Management, MPEG Media Transport [MMT], 3GPP Release 13 Study items include Study on Application Specific Congestion control for Data Communication.

2.6 C-RAN

With the increased amount of capacity required in a telecom network, small cells are being added to cells providing macro coverage. A method of efficient implementation could be to separate the base station functionality into two-the distributed remote radio units (RU) and the digital unit (DU) and connecting the two using low latency and high bandwidth transport network. The DU is also known as the Baseband unit. The DUs can be on cloud & may provide centralized resource aggregation and pooling. Different RATs can be implemented on the C-RAN physical system. This architecture is known as the C-RAN or Cloud RAN.

The interface between the DU and the Remote radio has been standardized by few industry consortia. This provides advantage in capacity and coverage where there is abundant fiber. There are several use cases/deployment scenarios where C-RAN can be potentially deployed like providing indoor coverage, providing super-hotspot coverage. As C-RAN uses centralised computation resources, virtualization can also be added to it.

2.7 Efficient Small Data Transmission

Small data bursts are most efficiently handled by connectionless access whereby a device wakes up and sends a short user plane data burst on a common 5G carrier using contention based access, eliminating dedicated radio resource control and higher layer signaling between the mobile and the network.

For 5G, the radio system must support connectionless contention based access multiplexed with scheduled access on a common carrier, with flexible allocation of resources that may vary with traffic demand. This reduces device power consumption and saves network resources when the size of the data burst is small compared to the overhead needed to set up bearers and establish security and device context for scheduled access.

2.8 Flexible mobility

With wider variation in the mobility behavior of devices that need to be supported by 5G networks, from mobile phones to laptops/PDAs to M2M devices, the network should be aware of the mobility profile of the device and it should also have dynamic change in the mobility profile.

Flexible mobility for 5G embraces a selection of options, which may be dynamically assigned to a device or application according to the device and application context, or statically configured for specialized devices and applications. Flexible mobility consists of two components: one for managing mobility of active devices and the other for tracking and reaching devices that support a power-saving idle mode.

Offering a range of mobility options, not available today in 4G, enables a better match between the needs of the device, application and network resources. This has advantages for both the network and user/device.

2.9 Information Centric networking

5G should be based on new network architectures and protocols designed specifically with support for mobility, security and content caching as fundamental design criteria. Information Centric Networking (ICN) – for example, as realized in the Named-Data Networking (NDN) and Content-Centric Networking (CCN)5 programs – is emerging as a leading architecture that can meet such design criteria.

Key (networking) areas that are touched upon are summarized as follows:

i. Naming – focus on what content is of interest rather than where it is.
ii. Routing – based on (hierarchical) names rather than addresses.
iii. Mobility – now an intrinsic capability of networking layer.
iv. Caching/Storage- information resides anywhere in the network at any time.
v. Security – secure content rather than communication channels.

The basic concepts being explored in the NDN/CCN community have direct relevance to the design of the 5G core network and can result in significant simplification. The basic principles may serve to alter the evolution path of the current cellular core and enhance the service provider's role in the information delivery economic chain.

2.10 SDN and NFV

Network Functions Virtualisation (NFV) aims to address the problems caused by use of proprietary hardware appliances by evolving standard IT virtualization technology to consolidate many network equipment types onto industry standard high volume servers, switches and storage. This technology could provide significant benefits for network operators and their customers:

i. Reduced operator CAPEX and OPEX through reduced equipment costs and reduced power consumption
ii. Reduced time-to-market to deploy new network services
iii. Improved return on investment from newer services
iv. Greater flexibility to scale up, scale down or evolve services
v. Openness to the virtual appliance market and pure software entrants
vi. Opportunities to trial and deploy new innovative services at lower risk

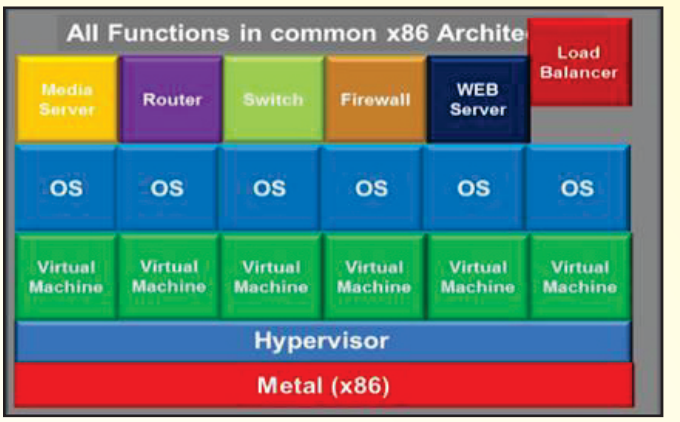

Figure 1. NFV

Network Functions Virtualisation is highly complementary to Software Defined Networking (SDN). These topics are mutually beneficial but are not dependent on each other. Network functions can be virtualised and deployed without an SDN being required and vice-versa. ETSI has released ETSI GS NFV 000X Phase-1 series specifications in this field which cover use cases, architectural framework and requirements. NFV or Network Function Virtualization creates more efficiency to deliver service to the end user by decoupling software from hardware and achieving gains from cloud computing.

SDN refers to the decoupling of the control plane and the data plane and the availability of central network control which enables network programmability through open APIs. OpenFlow is the most prominent SDN protocol today between the SDN controller and the network element. SDN with its concept of centralised network control simplifies the automation of network configuration and provisioning tasks and hence, leads to a reduction in OPEX. This makes introduction of services much easier.

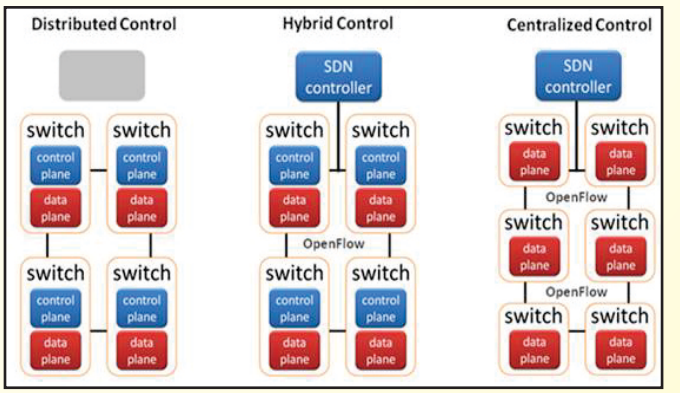

Figure 2. Software defined networking

3.0 Regulatory Considerations

The regulatory environment shouldn't be overlooked as 5G technologies are being developed. It is anticipated that existing regulations will be applicable to the 5G environment. The following challenges need to be addressed to support regulatory requirements in 5G:

i. **Flexible Spectrum Use-** With use of spectrum more than 6GHz probable in 5G, the spectrum licenses should be flexible to allow use of same spectrum for both backhaul and for providing wireless services.

ii. **Critical Infrastructure-** With increasing use of telecom networks for IoT services, it is necessary that 5G network should support increased reliability, resiliency, robustness and security. To fulfill this mandate, domestic roaming and network sharing should be promoted through regulations.

iii. **Accessibility-** Mobile broadband services are part of daily life, so 5G services must be accessible to people with disabilities, as is the case with 3G and 4G.

iv. **Lawful Interception-** 5G network has the potential for communication paths that doesn't traverse core network elements like device to device communication and 5G networks will have to be designed such that lawful intercept requirements can be met. Update in regulations might also be required.

4.0 Standardization Activities

Standardization work has started in various SDOs around the world. These are briefly discussed below:

4.1 3GPP

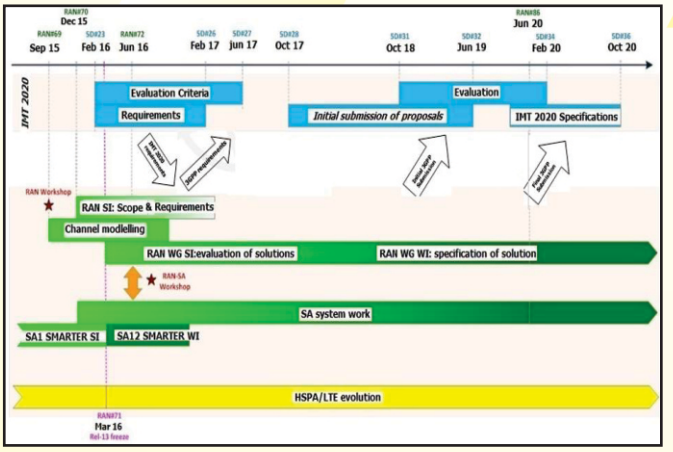

Figure 3. 3GPP RAN WG tentative work plan

Figure 4. Tentative release timing

4.2 ITU-R IMT 2020

ITU-R SG5 WP 5D is working on defining the requirements for mobile technologies for 2020 named IMT 2020 and has finalized its view of a timeline towards IMT-2020. In September 2015, ITU-R finalized its "Vision" of the "5G" mobile broadband connected society. Its timeline and processes are shown below:

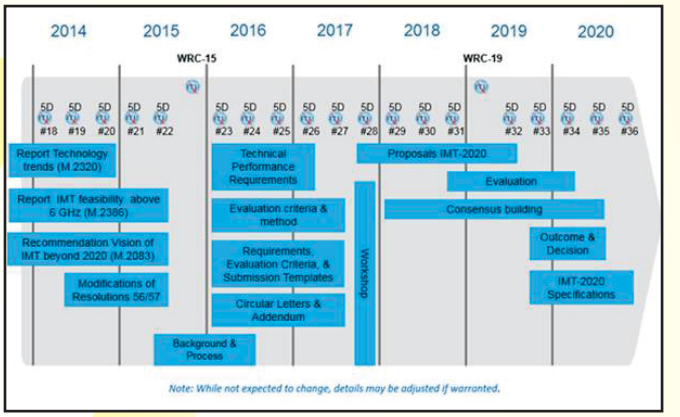

Figure 5. Detailed timeline and processes for IMT-2020 in ITU R

5.0 Conclusion

With the deployment of 4G technology picking up around the world, the time has come to look seriously at the future evolution path for telecom networks. Due to this, research into 5G has already started. Countries like EU, China, Korea and Japan have funded research projects and have setup platforms for the next generation of communication technology, so that they can be at the forefront of the technology evolution and can convert their ideas into projects that benefit the society.

Source:

The above data is mainly sourced from the following papers: 4G Americas' Recommendations on 5G Requirements and Solutions, October 2014, GSMA Intelligence Understanding 5G December 2014, NGMN 5G White Paper Feb 2015, METIS Vision, 5G PPP Vision document Feb 2015.

हिंदी पखवाड़ा–2016

दूरसंचार अभियांत्रिकी केंद्र, नई दिल्ली में 15 से 29 सितम्बर, 2016 तक हिंदी पखवाड़े का आयोजन सफलता एवं उत्साहपूर्वक किया गया। पखवाड़े का शुभारंभ श्री देबी प्रसाद डे, वरिष्ठ उप महानिदेशक द्वारा दीप प्रज्वलित कर किया गया तथा उन्होनें सभी उपस्थित अधिकारियों/कर्मचारियों को हिंदी प्रचार–प्रसार हेतु अधिक से अधिक योगदान करने के लिए प्रेरित किया। इस अवसर पर वरिष्ठ उप महानिदेशक द्वारा माननीय गृह मंत्री जी का संदेश पढ़कर सुनाया गया। हिंदी पखवाड़े के दौरान कुल 10 प्रतियोगिताओं का आयोजन किया गया एवं इनमें अधिकारियों/कर्मचारियों ने बढ़–चढ़कर भाग लिया।

वरिष्ठ उप महानिदेशक श्री डी.पी. डे प्रजज्वलन कर हिंदी पखवाड़े का उदघाटन करते हुए

समापन समारोह में वरिष्ठ उप महानिदेशक श्री डी.पी. डे, उप महानिदेशक (टी एंड ए) श्री बालकिशन एवं उप महानिदेशक (एन जी एस) श्री सुनील पुरोहित

समारोह का समापन वरिष्ठ उप महानिदेशक की अध्यक्षता में सम्पन्न हुआ जिसमें सभी विजेताओं को पुरस्कार राशि एवं प्रशस्ति पत्र प्रदान किए गए। इस पखवाड़े के दौरान दिनांक 27.09.2016 को एक हिंदी कार्यशाला का आयोजन किया गया। इस कार्यशाला में एन.जी.एस. अनुभाग द्वारा उपस्थित अधिकारियों/कर्मचारियों को यूनिकोड इन्स्टाल करने, गूगल–ट्रांसलेसन, गूगल वॉइस टाइपिंग और मोबाइल फोन पर गूगल वॉइस टाइपिंग का अभ्यास करवाया गया।

हिंदी पखवाड़े के दौरान उपस्थित अधिकारी एवं कर्मचारी गण

Activities at NTIPRIT (July-Oct., 2016)

1. In-service training courses for DoT Officers were conducted at NTIPRIT on the following topics:
   i. In-service training course on "LTE", (17-18 August) [30 Participants]
   ii. In-service training course on "Role of Telecom in Disaster Management", (14-15 September) [14 Participants including 3 from BSNL and 2 from NDMA]
   iii. In-service training course on "Lawful Interception System/Lawful Interception Monitoring", (20-21 September) [15 Participants]
   iv. Seminar on "Renewable Energy and Energy Storage Technologies", (04-05 October) [15 Participants including 10 from DoP]
2. A two day course on IPv6 was conducted from 8th to 9th September, 2016 for officers from state governments in which 17 officers from Madhya Pradesh and Uttarakhand participated.
3. Conducted Induction Training of the following:
   i. ITS-2014 Batch (17 officers)
   ii. ITS-2012 & 2013 Batch (6 officers)
   iii. JTO-2014 Batch (8 officers)
   iv. P&T BWS-2010 & 2013 Batch (8 officers)
4. Various training programs like technical modules, Field attachment and Study visit of the ITS/BWS and JTO were conducted during this period as per respective training calendar.
5. Sh. M. K. Jain, the then Advisor (O), DoT visited NTIPRIT on 24th August, 2016 and held a meeting to discuss issues related to NTIPRIT. He met officer trainees of ITS-2012/2013/2014 batches and impressed upon them to continuously keep themselves

abreast with fast changing technologies in telecom sector and work hard to fulfil the aspiration of common man.

The then Member (T) Shri N K Yadav inaugurating the in service course on LTE at TEC

The then Advisor (O) Shri M. K. Jain, 3rd from left, addressing a meeting at NTIPRIT

6. Recently NTIPRIT undertook a partnership activity with ITU Centre of Excellence CAICT, China. Sh. Vineet Verma, Director, represented NTIPRIT by participating in ITU Asia Pacific Centre of Excellence training programme on "Conformity & Interoperability" at Chongqing, China from 17 to 21 October, 2016 and delivered presentations on various topics as subject matter expert.

Approvals from July to Oct. 2016

S. No.	Name of the Company /Name of Product & Model No.
A	**ECI Telecom India Pvt. Ltd., Mumbai**
1	Interchange of STM-1, STM-4, STM-16, STM-64, & STM-256 signals between different networks/STM16, BG64
2	Interchange of Digital Signals at 2 Mbps, 8 Mbps, 34 Mbps, 45 Mbps, and 140 Mbps Ports/STM 64, BG64
3	Interchange of STM-1, STM-4, STM-16, STM-64, & STM-256 signals between different networks/STM16, BG30
4	Interface requirements for interchange of Ethernet signals between different networks/ SDH STM16, BG 30
5	Interface requirements for interchange of Ethernet signals between different networks/ SDH STM64, XDM 300
6	Interface requirements for interchange of Ethernet signals between different networks/ SDH STM64, XDM 900
7	Interface requirements for interchange of Ethernet signals between different networks/ SDH STM64, NPT 1200
8	Interface requirements for interchange of Ethernet signals between different networks/ SDH STM16, NPT 1020
9	Interface requirements for interchange of Ethernet signals between different networks/ SDH STM64, BG 64
B	**Cisco Systems (India) Pvt. Ltd.**
10	Router/ CISCO 3945
C	**M/s Arya Omnitalk Radio Trunking Services Pvt. Ltd.**
11	Service Approval for PMRTS at Vishakhapatnam, AP
D	**Sunren Technical Solutions Pvt. Ltd.**
12	Interchange of Digital Signals at 2, 8, 34, 45 & 140 Mbps Ports/Session Border Controller AP 1100
E	**Huawei Telecommunications India Co Pvt. Ltd.**
13	IP Media Gateway/UMG 8900 with Media Gateway Controller MSOFTX3000 (S/W ver V500R011)
14	IP Media Gateway/UMG 8900 with Media Gateway Controller MSOFTX3000 (S/W ver V200R010)
F	**Genband Telecommunication Pvt. Ltd.**
15	IP Media Gateway/G9
G	**Beetel Teletech Ltd.**
16	Electronic Telephone Instrument/Secure-I
H	**ITI Ltd.**
17	FTTH/ FTTB/ FTTC Broadband Access Applications Using GPON Technology/OLT-5X-ITI RBL & ONT-11-ITI RBL
I	**Nokia Solutions and Networks India Pvt Ltd.**
18	IP Media Gateway/Open MGW
J	**Fastech Telecommunications (I) Pvt. Ltd.**
19	EMF strength measuring instrument/ SRM 3006
K	**Alcatel-Lucent India Ltd.**
20	IP Media Gateway/MGW 7510
L	**Nomus Comm-System**
21	High Speed Line Driver/ Gateway e

Important Activities of TEC during JULY 16 to OCT. 16

New GRs/IRs issued

- GR on MPLS SDN Router
- GR on IP PABX with Media Gateway

Revised GRs/IRs issued

- GR on eMS Platform for NGN
- GR on Trunk Media Gateway
- GR on Integrated Access Device
- GR on Call Centre
- SD on Electromagnetic Compatibility for Telecommunication Equipment

DCC Meeting conducted

- GR on Solar Photo Voltaic (SPV) Power Supply for Telecom equipment
- EMF strength Measuring Instruments in 3/6 GHz frequency band

Study Paper/White Paper issued

- Cellular IoT
- LTE-V2X
- G. Fast
- EMF Exposure norms in India

ISO : 9001-2008

Certifications issued by TEC

Type Approval (TA)

Interface Approval (IA)

Certificate of Approval (CoA)

Visit

www.tec.gov.in

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Western Region	:	022-26610900
Northern Region	:	011-23329464
Southern Region	:	080-26642900

Representation of TEC in Training/Seminar/ Meetings

- ITU-T SG- 15 & 17 meetings at Geneva
- ITU-R WP-4B meeting at Geneva
- ITU-T SG 3 Regional Group meeting in TRAI, Delhi
- ITU-T standardization methodology training at Delhi
- 4th meeting of APT Preparatory Group for WTSA-16 at Da Nang, Viet Nam
- Meeting organised by TSDI on technical performance requirements to ITU-R at Chennai
- National seminar on New Government initiative VOIP, MVNO etc in Delhi
- Meeting on NDMA Pilot project steering committee in Delhi
- Seminar on Bridging the standardization gap for ITU-T

Other Activities

- Testing of Genband MGW, Elcom PABX in NGN Transport Lab completed.

Approvals issued by TEC during the period from July 2016 to Oct 2016

Interface Approvals.....18

Type Approvals 02

Service Approval.....01

टी ई सी संचारिका : दूरसंचार अभियांत्रिकी केन्द्र
नवम्बर 2016 : खुर्शीद लाल भवन
भाग 20 : जनपथ
अंक 4 : नई दिल्ली–110001

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