

ISO 9001 : 2008

TEC

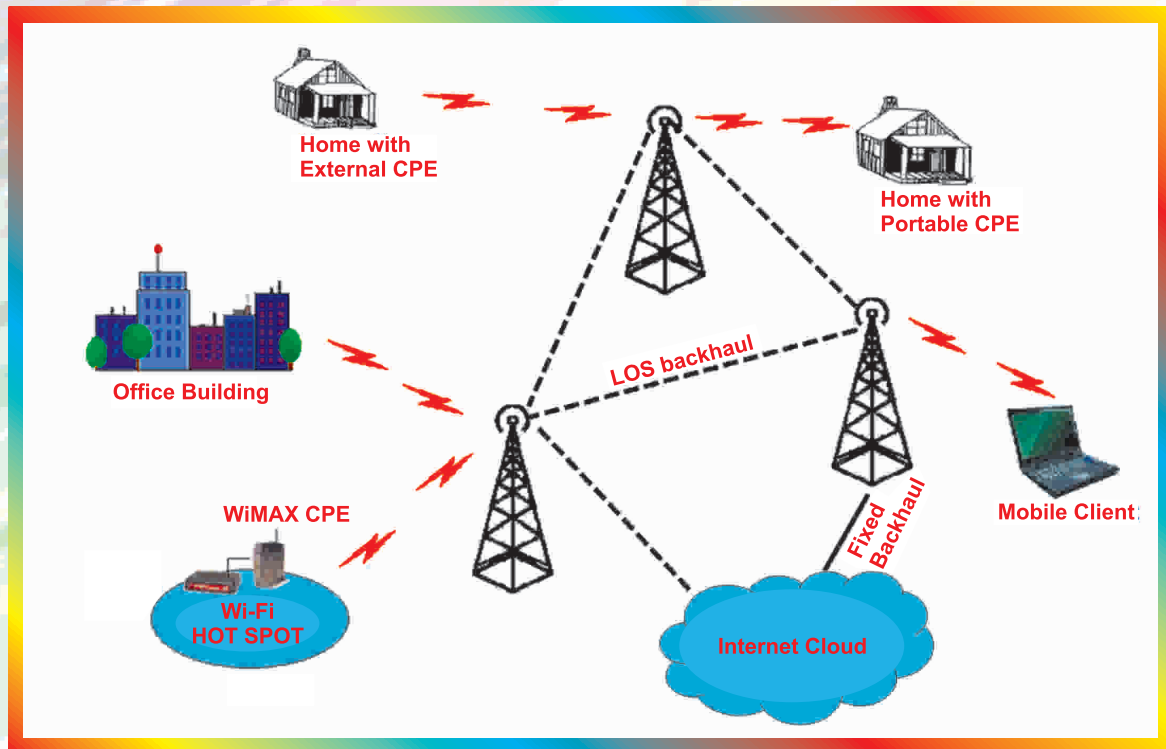
टी ई सी संचारिका NEWSLETTER

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ISSUE 3

BROADBAND WIRELESS ACCESS (BWA)



ISO 9001:2008

TELECOMMUNICATION ENGINEERING CENTRE

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Broadband Wireless Access

1. Introduction

Telecommunications, which was synonymous with voice telephony till a few years back, has not only become a means to exchange different kinds of information like voice, data, e-mails, messages & pictures, but is also becoming an essential medium for education, health-care and governance. Individual users are using the broadband extensively for personal banking, on-line reservations, on-line streaming for music and video etc. There is continuous demand for higher speeds. Broadband infrastructure can enable many other applications like e-Governance, tele-education, tele-medicine etc. About 1,00,000 Common Service Centres (CSC) are being established villages under Private Public Partnership (PPP) as part of national e-Governance plan would be ICT-enabled kiosks having broadband access.

But, the growth of this market in India so far is not as expected, though the latent demand for broadband is high. Low PC penetration, PC literacy rate, cost of smart Mobile devices are some of the key issues impacting the demand. Now, a target of 100 million Broadband subscribers is envisaged by 2014.

2. Current Broadband scenario in India

The total number of Broadband subscribers is 12.12 million at the end of May 2011(as per TRAI). There has been an impressive growth for the past 3 years.

	2005 Sep	2008 May	2011 May
Fixed Line	47.83	39.05	34.40
Cellular	65	277.92	840.28
Broadband	0.61	4.15	12.1

(Figures in millions)

Table1: Growth of Broadband and Cellular in India

Considering the phenomenal growth of wireless subscribers in India and the need to take the ICT revolution to rural India, it can be expected that wireless technologies like 3G, WiMAX and LTE will be the prime technology enablers for the future broadband market in India.

3. Broadband wireless Access Technologies

Wired broadband technology options are Digital Subscriber Line (XDSL), Passive Optical Network (XPON) and HFC (Hybrid Fibre Coaxial). Currently most of the subscribers use DSL for High-speed internet access. DSL is also best suited for IPTV. Down load speeds depend on the quality of copper pair. Optical Fibre also provides high bandwidth but involves expensive fiber and laying costs. Wireless technology options are HSPA (High Speed Packet Access), EV-DO (Evolution Data Optimised), WiMAX and Long Term Evolution (LTE). HSPA is a solution for migration of GSM networks to 3G whereas EV-DO provides existing CDMA networks to provide broadband services. They can support speeds up to 2Mbps. WiMAX based on IEEE 802.16e standard supports higher speeds upto 70 Mbps. LTE standards are being developed by 3GPP as an evolutionary path for operators deploying 3G networks. ITU-R has recently approved LTE – Advanced and IEEE 802.16m (WiMAX2) as the IMT advanced technologies (4G), with target peak data rates upto 100 Mbps (high mobility) and 1 Gbps (low mobility).

4. WiMAX

WiMAX is an acronym for Worldwide Interoperability for Microwave Access. WiMAX is described in IEEE 802.16 Wireless Metropolitan Area Network (MAN) standard.

WiMAX has emerged as a perfect technology for providing Broadband Wireless Access in numerous and quite diverse scenarios. It can be used as backhaul for other technologies like Wi-Fi in Point-to-Point and Point-to-Multi Point scenarios

replacing the wires in the remote areas. Thus deployment of WiMAX technology in Rural India can reduce the digital divide between the urban and rural areas.

Each WiMAX Base station can typically provide an operating range of 25 Km using Line of Sight (LoS) and about 3 to 5 Km for mobile stations, whereas coverage in Wi-Fi / 802.11 Standards is limited to only 100-300 feet (30 - 100m).

4.1 802.16 Standards

The IEEE 802.16 Working Group prepared the formal specifications for broadband wireless metropolitan area networks (Wireless MAN). The 802.16 family of standards is the basis of Mobile WiMAX.

IEEE 802.16-2004 (also called 802.16d) provides support for Non-Line-Of-Sight(NLOS) and indoor end-user terminals for fixed wireless broadband. It is also referred as "Fixed WiMAX" since it has no support for mobility.

In 2005, the standard was amended (IEEE 802.16e-2005 or 802.16e) to add support for data mobility. The system profile in IEEE 802.16e-2005 is not backward compatible with the Fixed WiMAX system profile.

IEEE 802.16e or Mobile WiMAX improves on the modulation schemes used in the original (Fixed) WiMAX standard by introducing Orthogonal Frequency-Division Multiple Access (OFDMA).

The upcoming IEEE 802.16m is claimed to be two times spectral efficient than release IEEE 802.16e. This means that higher data transfer capacity in the same quantum of spectrum and lesser number of base stations thus lowering capital investment.

4.2 WiMAX Forum

The 'WiMAX Forum' is an industry-led non profit corporate body. A major role of this organization is to certify the interoperability of

WiMAX products and its compliance to IEEE 802.16 standards. Currently, there are WiMAX certification labs in Spain, China, Taiwan, Korea, USA and Malaysia.

The WiMAX Forum defines and conducts conformance and interoperability testing to ensure that different vendor systems work seamlessly with each other. WiMAX certification profiles specify characteristics such as spectrum band, duplexing and channelization. Several profiles exist for Fixed and Mobile WiMAX.

Because IEEE 802.16 standardization only covers basic connectivity up to the Media Access (MAC) level, the WiMAX Forum also addresses network architecture issues for Mobile WiMAX networks. The first network architecture specification (Release 1.0) is focused on delivering a wireless Internet service with mobility.

Release 1.5 introduced support for telecom-grade mobile services, supporting full IMS interworking, carrier-grade VoIP, broadcast applications, such as mobile TV and over-the-air provisioning.

Release 2.0 profiles for IEEE 802.16m are being finalized by WiMAX Forum.

4.3 Network Architecture of WiMAX

The WiMAX network architecture is based on Converged Access Network (CAN) architecture. A typical WiMAX network architecture is given in Figure 1. In the existing architecture, the Access Terminal (AT) maintains a single air-interface protocol stack for communication with multiple Base Stations (BSs).

The following paragraphs provide a brief about the key elements of a WiMAX network :

Base Station (BS)

The BS is responsible for providing the air interface to the Mobile Station (MS). Additional function that may be part of the BS are micro mobility management functions, such as handoff

triggering and tunnel establishment, radio resource management, QoS policy enforcement, traffic classification, DHCP (Dynamic Host Control Protocol) proxy, key management, session management and multicast group management.

policy management of QoS and security. The CSN is also responsible for IP address management, support for roaming between different operators, location management between ASNs and mobility and roaming between ASNs.

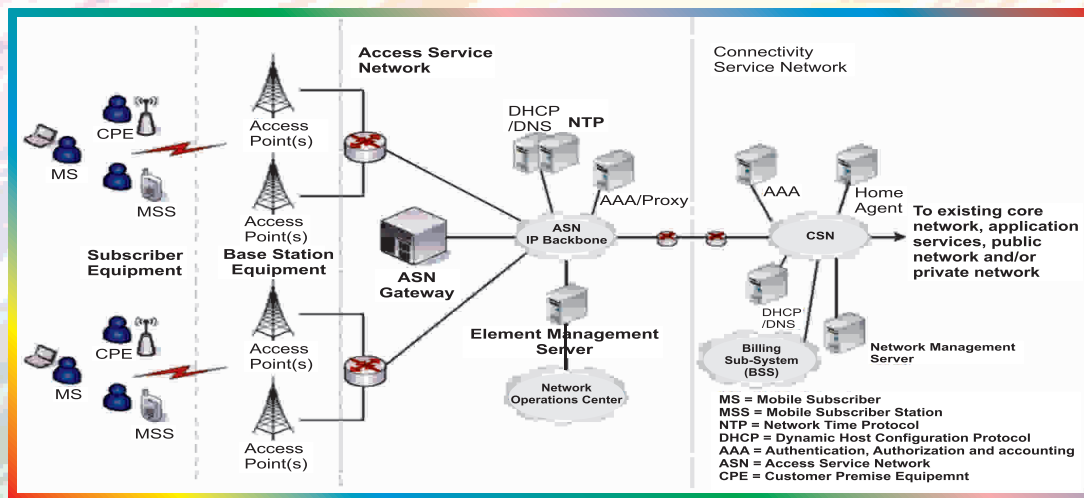


Figure 1. Network Architecture of WiMAX

Access Service Network Gateway (ASN-GW)

The ASN gateway typically acts as a layer 2 traffic aggregation point within an ASN. Additional functions that may be part of the ASN gateway include intra-ASN location management and paging, radio resource management and admission control, catching of subscriber profiles and encryption keys, AAA client functionality, establishment and management of mobility tunnel with base stations, QoS and policy enforcement and foreign agent functionality for mobile IP and routing to the selected CSN.

Connectivity Service Network (CSN)

The CSN provides connectivity to the Internet, other public networks and corporate networks. The CSN includes AAA servers that support authentication for the devices, users, and specific services. The CSN also provides per user

Further, CSN can also provide gateways and interworking with other networks, such as PSTN (public switched telephone network), 3GPP and 3GPP2.

The WiMAX architecture framework allows for the flexible decomposition and/or combination of functional entities when building the physical entities. For example, the ASN may be decomposed into base station transceivers (BST), base station controllers (BSC), and an ASNGW analogous to the GSM model of BTS, BSC, and Serving GPRS Support Node (SGSN). It is also possible to collapse the BS and ASN-GW into a single unit, which could be thought of as a WiMAX router. Such a design is often referred to as a distributed or flat architecture. By not mandating a single physical ASN or CSN topology, the reference architecture allows for vendor / operator differentiation.

In addition to functional entities, the reference architecture defines interfaces, called reference points, between function entities. The interfaces carry control and management protocols- mostly IETF - developed network and transport- layer protocols - in support of several functions, such as mobility, security, and QoS, in addition to bearer data.

Subscriber Units

WiMAX subscriber units are available in both indoor and outdoor versions from several manufacturers. Self-install indoor units are convenient, but radio losses mean that the subscriber must be significantly closer to the WiMAX base station than with professionally - installed external units.

4.4 WiMAX in Rural areas

Delivering high quality Wireless Broadband Access to rural communities is challenging. This is mainly due to the large distances between the remote areas and operator infrastructure.

It is not always cost-effective to deploy wired solutions. Wired solutions such as DSL or Cable can easily be deployed in areas with existing infrastructure. As a result, rural areas are often left uncovered contributing to Digital Divide. Here WiMAX technology particularly, fixed WiMAX can prove instrumental for providing Wireless access over large distances.

A typical Rural access connectivity scenario using Fixed WiMAX technology is shown below in Fig 2.

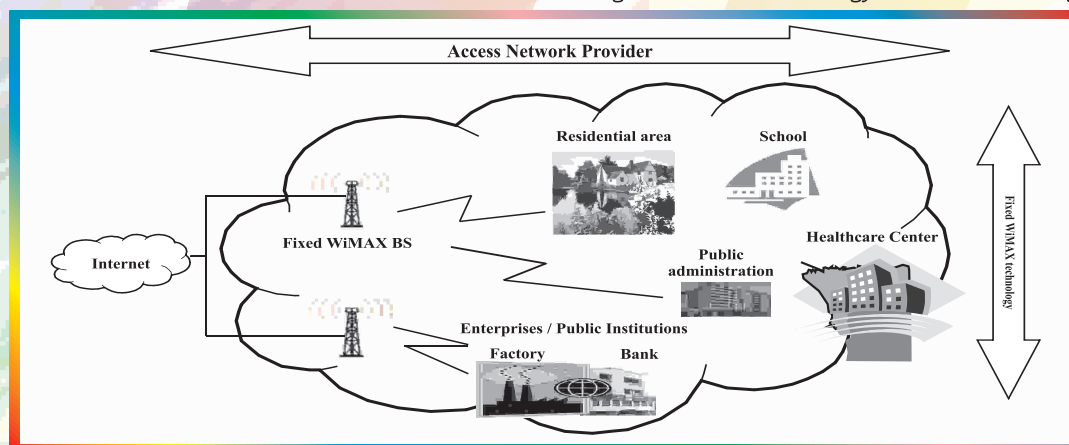


Figure 2. WiMAX in Rural Scenario

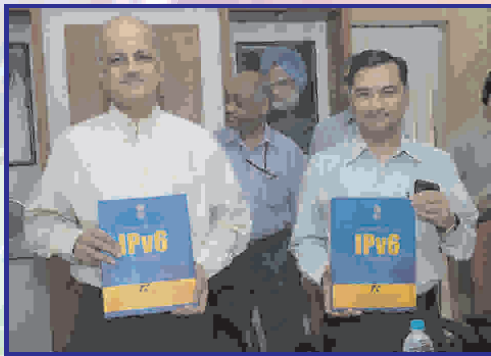
As such, indoor-installed units require a much higher infrastructure investment as well as operational cost (backhaul, site lease, maintenance) due to the high number of base stations required to cover a given area. Indoor units are comparable in size to a cable modem or DSL modem. Outdoor units are roughly the size of a laptop PC and their installation is comparable to the installation of a residential satellite dish.

One or more WiMAX BSs are connected to the operator core network and provide wireless broadband connectivity to the rural area. Several WiMAX Subscriber Stations (SSs) connected to the WiMAX Base Stations (BSs) are distributed over the remote area including health centers, residential areas, public institutions and enterprises in a Point-to-Multi Point Topology. In these areas nomadic scenarios are also an interesting application. The subscriber can take his indoor WiMAX SS (say from home) to another place (say hospital) and connect automatically to the WiMAX BS without requiring any technical support.

5. Special Events

✍ TEC celebrated World Telecommunication and Information Society Day (WTISD) on 18th May 2011 in a program presided over by Sr DDG Sh N.K. Srivastava. Many senior officers spoke on the occasion sharing the strategies and efforts made for realizing the ITU theme “Better Life in Rural Communities with ICTs” for year 2011.

✍ **Release of compendium on IPv6 and IPv6 Newsletter** : Sh R. Chandrashekhar, Secretary DoT released compendiums & Newsletter on World IPv6 day on 8th June 2011 at Sanchar Bhawan.



Left to right : Sh R. Chandrashekhar, Secretary(T) & Chairman Telecom Commission DoT, Sh S.C. Misra Member (S), seen in the background is Sh N.K. Srivastava Sr DDG TEC

Last year, TEC has conducted various workshops on IPv6 and numerous other activities to spread awareness about IPv6 and to facilitate its deployment in the country. The views and contributions received during these events have been captured in this compendium. It is expected that this document will prove to be an important knowledge bank for our service providers, Central and State Govt. Departments and all other stakeholders while planning for the deployment of IPv6 in their organization.

Other Activities

- Presentations on 2G/3G Coverage in urban area using micro sites over Fiber.
- Brain storming session of TEC & WPC officers on High Altitude Platform Stations (HAPS).
- Discussion on application of Intelligent Transport System.
- Presentations for E band and RFID
- Strategies on CCR improvement in NGN .
- Roadmap of NGN in rural area.

हिन्दी कार्यशाला

बहुभाषी भारतवासियों को परस्पर समीप लाने में सूचना प्रौद्योगिकी एक अहम भूमिका निभाती है। इसी संदर्भ में दूरसंचार अभियांत्रिकी केंद्र में हिंदी युनिकोड विषय पर दिनांक 15 जून 2011 को एक कार्यशाला का आयोजन किया गया। इस कार्यशाला में श्री केवल कृष्ण, वरिष्ठ तकनीकी निदेशक (राजभाषा) को अतिथी व्याख्याता के रूप में आमंत्रित किया गया। उन्होंने उपस्थित अधिकारियों व कर्मचारियों को हिंदी युनिकोड का प्रयोग व इंस्टॉलेशन तथा नॉन यूनिकोड फॉन्ट में उपलब्ध हिंदी फाईलों को युनिकोड में परिवर्तन करे की विधि आदि विषयों के बारे में जानकारी दी। यह कार्यशाला हिंदी में काम करने की प्रक्रिया को सरल एवं सुगम बनाने की दृष्टि से ही बहुत उपयोगी सिद्ध हुई।



हिंदी कार्यशाला में भाग लेते हुए अधिकारी गण

Approvals issued by TEC from 1st April 2011 to 30th June 2011

No	Company/Product
1	A.E.Telelink Systems Ltd.
1.1	Router, M320
1.2	Router, IBM J06 M
1.3	Router, IBM J11M
2	Alcatel Lucent India Limited
2.1	Synchronous Multiplexer, 1660SM (STM-16, STM-4)
2.2	Synchronous Multiplexer, 1660SM (STM-4)
2.3	STM-1 MS Edge Multiplexer, 1642 EM(STM-1)
2.4	STM-1 Optical Multiservice Node, 1662 SMC(STM-1)
2.5	STM-4 Optical Multiservice Node, 1662 SMC (STM-4)
2.6	STM-16 Optical Multiservice Node, 1662 SMC (STM-16)
2.7	IP PABX , Omni PCX Office
3	Atrie Technology Private Ltd.
3.1	Interface Converter, Wirespan 3000C
4	Avaya India Private limited
4.1	PABX, Avaya Aura Communication Manager
5	BPL Telecom Private Ltd.
5.1	IP PABX, IPX 500
6	Ciena Communications India (P) Ltd
6.1	SDH/Sonet based Optical Networking Eqpt.OME 6110 HDE
6.2	SDH/Sonet based Optical Networking Eqpt.OME 6110 HD
6.3	SDH/Sonet based Optical Networking Eqpt.OME 6110 Standard
6.4	SDH/Sonet based Optical Networking Eqpt.OME 6130 with STM-16 aggregator
6.5	SDH/Sonet based Optical Networking Eqpt.OME 6130 with STM-4 aggregator
6.6	SDH/Sonet based Optical Networking Eqpt.OME 6130 Combo
6.7	SDH/Sonet based Optical Networking Eqpt.OME 6130 with STM-16 aggregator
6.8	SDH/Sonet based Optical Networking Eqpt.OME 6130 with STM-4 aggregator
6.9	SDH/Sonet based Optical Networking Eqpt.OME 6130 Combo
6.10	Add & Drop Multiplexer, OM 4200
6.11	Add & Drop Multiplexer, OM 4100
7	Cisco Sytems India Private Limited
7.1	Router, CISCO CGR 2010
7.2	IP PABX for private use, CISCO 2951
7.3	IP PABX for private use, CISCO 3945
7.4	IP PABX for private use, CISCO 3925
8	Cygnus Microsystems Limited
8.1	Data Interface to G.703 Interface Converter, Cygnus 803 (V.35-E1 Converter)

9	Fibcom India Limited
9.1	STM-1 Synchronous Multiplexer, FIBCOM 6325 (STM-1)
9.2	STM-16 Synchronous Multiplexer, FIBCOM 6340 (STM-16)
10	Hewlett Packard India (Sales)(P) Ltd
10.1	G-3 FAX Machine, SNPRC-1101-01
10.2	G-3 Fax Machine, SDGOB-1051
10.3	G-3 FAX Machine, SDGOB1052
10.4	V-90 Modem, MT9234ZPXUPC1
11	Himachal Futuristic Communications Ltd
11.1	G.703 Interface Converter, B2101-V35 E1
12	IBM India Private Limited
12.1	V.90 Modem (Analogue), MT 9234 SMI
13	MRO TEK Limited, Bangalore
13.1	PINE/E1/V.35/AC/DC/CBL
14	Motorola Mobility India (P) Limited
14.1	GSM Mobile PC Tablet, Motorola XOOM MZ 601
15	Nokia India Private Limited
15.1	Nokia CS-11-1 (RD-160, GSM Internet Stick
15.2	GSM Mobile Phone, Nokia X7-00 (RM-707)
15.3	GSM Mobile Phone, Nokia C3-03 (RM -698)
15.4	GSM Mobile Phone, X1-01 (RM-713)
15.5	Nokia Blue Tooth Head Set, BH-219
15.6	Nokia Blue Tooth Head Set, HF-210
16	Nomus Communication System
16.1	High Speed Line Driver, Gateway
16.2	Gateway I, Data Interface to G.703 Interface Converter
17	Pelorous Technologies Private Limited
17.1	Optical Time Domain Reflectometer, (MINI) (TYPE-A), OT 8810
18	Precision Electronics Ltd.
18.1	Data Interface Converter, PCN-V.36-E1
19	Real Time Systems Ltd.
19.1	G-703 Interface Converter, RTS-RCN-400
20	Sunren Technical Solutions (P) Ltd
20.1	G-3 FAX Machine, Lexmark, 7510
20.2	Cisco Unified Coomn Manager Business Edition 3000 Appliance, MCS 7890
21	Tejas Networks Limited
21.1	STM-4 Synchronous Multiplexer, (TM/ADM) TJ1400(STM-4)
21.2	STM-1 Synchronous Multiplexer, (TM/ADM) TJ1400(STM-1)
22	ZTE Telecom India Private Limited
22.1	Media Gateway controlled by Soft Switch for E1 connectivity, Media Gateway, ZXMSG 9000

Important Activities of TEC during April 2011 to June 2011

New GRs/IRs Issued

- ✍ Armoured Optical Fibre Cable for Duct Application

New TSTP Issued

- ✍ OTN Analyser
- ✍ Armoured Optical Fibre Cable for Duct Application
- ✍ WiMAX CPE(Indoor)
- ✍ WiMAX CPE(outdoor)

Testing validation and Field trials

- ✍ Testing of BTS Antenna & M/W Antenna
- ✍ Validation of C-DOT IP-DSLAM and ADSL2+CPEs
- ✍ Validation of GPON System
- ✍ Validation of C-DOT IP-DSLAM, ADSL2+CPEs and GPON System

GRs/IRs Revised on

- ✍ Valve regulated lead acid battery
- ✍ Microduct for FTTH Application

GRs/IRs Amendment on

- ✍ SMPS based Power Plant

Other Activities

- ✍ Report submitted on pilot project of M/S VNL under USOF

Activities at National Telecommunications Institute For Policy Research, Innovation & Training

- ✍ One week course on Radio Communications
- ✍ One day workshop on 'Two way radio Trunking Technologies'
- ✍ Two days workshop on 'Broadband Wireless Access'
- ✍ One week course on 'Cyber Security'



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Regional TEC Contacts

Eastern Region	:	033-23570003
Western Region	:	022-26610900
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Approvals issued by TEC during the period from April 2011 to June 2011

Interface Approvals.....45
Type Approvals03
Certificate of Approvals.....07

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टी ई सी संचारिका

जुलाई 2011

भाग 15

अंक 3

दूरसंचार इंजीनियरी केन्द्र

खुशीद लाल भवन

जनपथ

नई दिल्ली - 110001

Editor : Sunil Purohit, DDG (S) Phone : 23329354 Fax : 23318724 Email : ddgs.tec@gov.in