ISO 9001 : 2008
TEC
TELECOMMUNICATION ENGINEERING CENTRE
टी ई सी संचारिका
NEWSLETTER

Vol. 21 JULY 2017 ISSUE 3

Inauguration of Tarang Sanchar web portal

In this Issue

On 2nd May 2017, Hon'ble Minister of Communications Shri Manoj Sinha launched 'Tarang Sanchar', a web portal for Information sharing on Mobile Towers and EMF Emission Compliance. On this occasion, Shri Sinha said that it will go a long way in clearing the myths and misconceptions of public on mobile towers and emissions from them. He expressed hope that the portal will empower the common man to know, at the convenience of a mouse click, about towers working in a particular locality and whether they are compliant to the EMF emission norms defined by the Government.

This Portal also enables the public to go through the latest developments and corresponding information available in respect of EMF emissions from mobile towers and to submit their feedback and comments on the same. More information is available on the Tarang Sanchar website www.tarangsanchar.gov.in.

(Sitting from left Shri R. K. Misra, Member (S), Shri R. S. Sharma, Chairman (TRAI), Shri Manoj Sinha Hon'ble Minister of Communications, Shri P. K. Pujari, the then Secretary (T) and Shri G. K. Upadhyay, Member (T), Standing : The members of Validation committee of Tarang Sanchar portal)

Communication aspects of Unmanned Aircraft System (UAS)

1.0 Introduction

The unmanned aerial vehicle (UAV) or the unmanned aircraft system (UAS) sector is facing a massive expansion, from all points of view. The UAV is also interchangeably called drone, however the standard terminology is UAS. The number of drones put in operation is exploding, with several millions devices produced annually in the recent past years. The range of devices is expanding from micro-drones weighing a dozen of grams to large machines of the size of a passenger aircraft. Once reserved to specific military operations, drones are now used or planed for use for an increasingly wide number of civil applications. Considering the pace of development, the numbers involved and the apparently unlimited possibilities offered by drones technology, there is no doubt that unmanned aerial devices will fundamentally change the face of the air transportation industry.

The regulatory landscape with respect to UAS is still in its nascent stage with formal regulations in place in USA. Other countries are still in the process of drafting the regulations for the adoption of UAS in the civil application landscape. The major concern lies in the safe operation of the UAS and in accordance with the prevalent laws of air-space. The efficient inclusion and integration of UAS in the existing civil aviation framework is what is being aimed for, and there is no denying the fact that communication system of a UAS plays a crucial role in achieving this.

2.0 Definition of UAS

The International Civil Aviation Organization (ICAO) in its Circular 328 defines UAS as;

"An aircraft and its associated elements which are operated with no pilot on board."

3.0 Classification of UAS

3.1 ICAO Classification

The ICAO classifies UAS, broadly in two categories:

- **Remotely-piloted aircraft system:** A set of configurable elements consisting of a remotely-piloted aircraft, its associated remote pilot station(s), the required command and control links and any other system elements as may be required, at any point during flight operation.
- **Autonomous aircraft:** An unmanned aircraft that does not allow pilot intervention in the management of the flight.

3.2 Classification based on weight

Civil UA are classified in accordance with weight of UA as indicated below:

- Micro : Less than two kg.
- Mini : Greater than two kg and less than 20 kg.
- Small : Greater than 20 kg and less than 150 kg.
- Large : Greater than 150 kg.

3.3 Classification from spectrum perspective

ITU classifies UAS in the following three categories based on the spectrum perspective:

UA categories from a spectrum perspective

UA Category	Weight (kg)	Maxime altitude (m)	Cruise speed (km/h)	Endurance (hours)	Maximum range (km)
Small	<25	<300	<111	<5	Visual LoS <3
Medium	25-2000	300-5500	111-185	5-30	RF LoS 150-250
Large	>2000	>5500	>185	>30	Beyond RF LoS

The UAS can also be classified based on its functionality and deployment scenario like Target and decoy – providing ground and aerial gunnery a target that simulates an enemy aircraft or missile, Reconnaissance – providing battlefield intelligence, Combat – providing attack capability for high-risk missions, Logistics – delivering cargo, Research and development – improve UAV technologies, Civil and commercial UAVs – agriculture, aerial photography, data collection, to name a few.

4.0 UAS Application Scenarios

Figure 1 below depicts the major application scenarios of UAS. These include civil applications like high voltage power line monitoring, environmental monitoring, high accuracy terrain mapping etc.

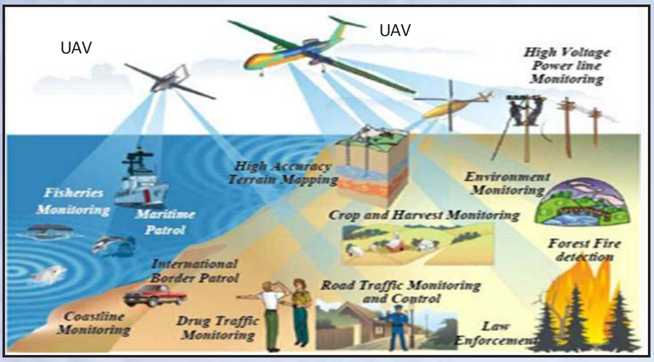


Figure 1 : UAS Deployment and usage scenarios

5.0 UAS Deployment Methodologies

Various regulatory methods can be deployed to mitigate the safety risks associated with the integration of drones.

5.1 Segregation

The method which has been applied historically is airspace segregation, where unmanned aircraft are simply required to remain outside of the airspace open to civil aviation.

5.2 Visual Line of Sight operations

This method, which applies specifically to Remote Piloted Aircraft Systems (RPAS) consists in requiring the remote pilot to retain permanent visual contact with its aircraft and to take any necessary action to avoid a collision between the latter and ordinary aircraft or other drones.

5.3 Beyond Visual Line of Sight

Beyond Visual Line of Sight (BVLOS) operations are based on methods which allow both RPAS and autonomous aircraft to fly, including within civil aviation airspace, without the need for a human operator to retain permanent visual contact with the drone.

6.0 Communication aspects in UAS

6.1 The ITU-R Report M. 2171 lists out the following aspects of radio communication pertaining to a UAS

6.1.1 Types of radio communications links

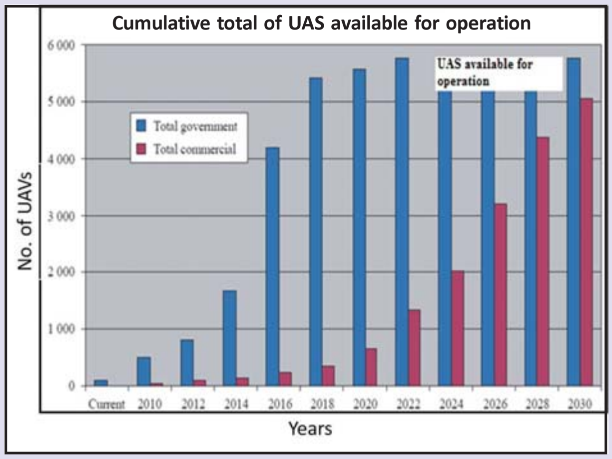
For safe operations of UA under LoS and BLoS conditions, three types of radio communications between the UA and the UACS are required, which are as follows:

- Radio communications in conjunction with air traffic control relay;
- Radio communications for UA command and control;
- Radio communications in support of the sense and avoid function.

It is left to the UA system designer to combine two or more of these three radio communications into a common physical link.

UAS use segments: What does ITU say?

As per the ITU-R Report M.2171, there are two major UAS use segments, government and commercial. The distribution of UAS among use segments is, today, highly skewed to the government use segment. Currently, according again to the Teal Group World Unmanned Aerial Vehicle Systems: Market Profile and Forecast, 2008, there are no commercial UAS operating. Studies predict that by 2018 the Government use segment will have completed its ramp up and be at a reasonably constant level through future years. The commercial use segment will not likely begin to grow significantly until sometime after certification standards become available in the 2020-time frame. The following figure is an example of a cumulative total of UAS available for operation in a specific area illustrates the growth of these two use segments using data developed through the remainder of this section.



6.1.2 Radio communications for air traffic control relay

In non-segregated airspace a link between air traffic control and the UACS via the UA, called ATC relay, will be required to relay ATC and air-to-air communications received and transmitted by the UA. For communicating with ATC, the UA uses the same equipment as a manned aircraft. This report only considers the downlink bringing the ATC information from the UA to the UACS and the uplink from the UACS to the UA allowing the UACS to communicate with ATC. As these communications are critical for a safe management of the controlled airspaces, especially in terminal approach areas with high density of aircraft, future ICAO standards are obviously mandatory for these kinds of communications.

6.1.3 Required radio communications for command and control

Command and control is the typical link between the UACS and the UA. The following two ways of communications are:

The uplink: To send telecommands to the aircraft for flight and navigation equipment control.

The downlink: To send telemetry (e.g. flight status) from the UA to the UACS.

It is anticipated that in some flight conditions or in specific airspaces it could be necessary to downlink video streams. This consideration is of a high importance for the work of the ITU-R related to Resolution 421 (WRC-07) and it must also be considered with the similar requirement that may come from the support of sense and avoid function. Such a requirement could lead to data rates of several hundreds of kbit/s per UA. In areas under the responsibility of the aeronautical authorities, it is expected that the command and control communications will have to be compliant with ICAO standards to be further specified on this function. Nevertheless, in the periods where the UA will follow a full autonomous flight, the up and down links could have very low data rates.

6.1.4 Required radio communications in support of "sense and avoid"

Sense and avoid (S&A) corresponds to the piloting principle "see and avoid" used in all air space volumes where the pilot is responsible for ensuring separation from nearby aircraft, terrain and obstacles (e.g. weather).

To determine appropriate spectrum requirements related to the S&A function, two aspects must be considered:

– Firstly, all the RF equipments designed to collect raw data related to the "sense" function will have specific requirements depending on the ITU-R services involved.

- Secondly, the control of the proper operation of this S&A function will be permanently or regularly checked at the UACS. If necessary, S&A parameters may be modified by the UACS, depending upon the area of flight, the weather conditions or the level of autonomy assigned to the UA.

Similar to the command and control considerations, it is expected that the "S&A data" RF communication requirements will have to be compliant with future ICAO standards for the safe flight of the UA in areas under the responsibility of the aviation authorities.

6.2 VLOS (Visual Line of Sight) and BLOS (Beyond Line of Sight) communication in UAS

As per the ITU-R Report M. 2171, the following figure depicts the links and the spectrum requirements for VLOS deployment scenario of UAS.

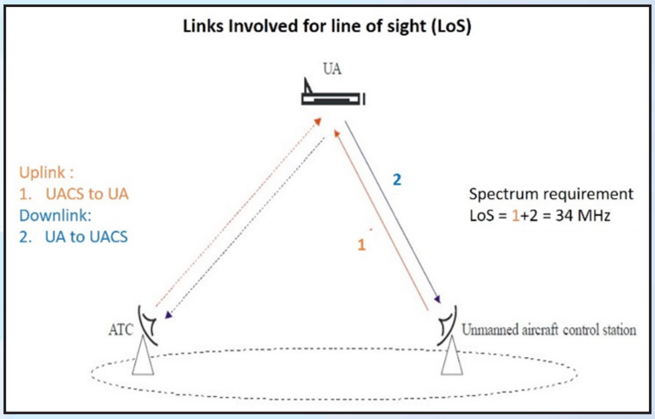


Figure 2: VLOS links in UAS

The links and the spectrum requirements for BLOS deployment scenario of UAS is depicted by the following figure.

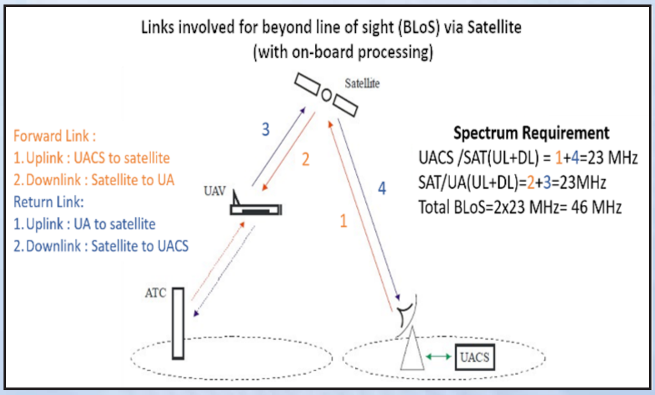


Figure 3: BLOS links in UAS

6.3 Frequency bands of operation for UAS

The category of small UAS generally, uses the unlicensed band of 2.4 GHz, 5.8 GHz unlicensed 900 MHz and UHF bands for communication. The UAS has to comply to the national regulations applicable for operation of other technologies in these bands. WRC-12 allocated the frequency band 5030 – 5091 MHz to be used for the terrestrial RPAS control links.

Subsequently, WRC-15 identified the following spectrum to be used by satellite systems controlling drones. However, it was also noted that ICAO is to develop the relevant SARPS before the spectrum can be used and there will be a progress report to WRC-19 and WRC-23 will review the effectiveness of the allocation. There are power limits associated with some of these frequency bands.

Region 1	Region 2	Region 3
12.5-12.75 GHz space to Earth	10.95-11.2 GHz space to Earth	12.2-12.75 GHz space to Earth
14.0-14.47 GHz Earth to space	11.45-11.7 GHz space to Earth	14.0-14.47 GHz Earth to space
19.7-20.2 GHz space to Earth	11.7-12.2 GHz space to Earth	19.7-20.2 GHz space to Earth
29.5-30.0 GHz Earth to space	14.0-14.47 GHz Earth to space	29.5-30.0 GHz Earth to space
	19.7-20.2 GHz space to Earth	
	29.5-30.0 GHz Earth to space	

7.0 Typical Regulation Regime for UAS

In this section a typical regulation regime which is also under study by ICAO, EASA has been described. This regulatory framework also draws from the FAA regulations on UAS. The ultimate objective of the framework should be to achieve an environment where drones operation do not require any human attention, in the sense that these devices are capable of detecting themselves the presence of other flying objects, whether ordinary aircraft or other drones, and to take appropriate measures to avoid any collision.

7.1 *Open category*

The open category, which will comprise the vast majority of unmanned aerial vehicles. In a first step, the avoidance of collisions between these drones and ordinary aircraft will be achieved by the means of airspace segregation. These devices, for the foreseeable future are meant to operate at low altitudes, below the airspace sectors used for civil aviation purposes and maintaining a safe distance from airspace reserved for airport operations. VLOS operations can support drones activity close to or even within airspace sectors open to civil aviation (such as aerodrome control zones).

7.2 *UAS Traffic Management (UTM)*

It is however becoming apparent that some sort of infrastructure will need to be deployed to ensure the safety of drones operations also outside of the airspace open to civil aviation. The purpose of such an infrastructure would be primarily to keep drones separated from each other, but also from the few aircraft such as low flying helicopters with which they may need to share the airspace. That infrastructure should also integrate a function preventing drones to enter airspace sectors where their operation is prohibited. The concept of UAS Traffic Management (UTM) which is being considered in the USA responds to such a need.

7.3 *Specific category*

A similar strategy should be pursued to regulate special purpose operations into civil aviation airspace. Until drones are capable of assuring their own separation from other aircraft, airspace segregation and VLOS operations will remain the primary means to ensure separation.

7.4 *Certified category*

The certified category comprises those drones which are expected to operate on a routine basis within the airspace open to civil air navigation. The civil ATM system is presently excessively complex both from an operational and a regulatory perspective and the primary objective must be to achieve integration without adding another layer of complexity.

What is the law of land for UAS?

Draft Guidelines for obtaining Unique Identification Number (UIN) & Operation of Civil Unmanned Aircraft System (UAS) (April-2016) were circulated by DGCA. Some of the features of these draft guidelines include:

- Register all civil UAVs and issue a UAV Operator Permit (UAOP) on case to case basis.
- All UAVs to have UIN, one of requirements of UIN is to have operation frequency approval from DoT.
- UAV operations at or above 200ft AGL in uncontrolled airspace will require UAOP from DGCA
- UAOP exemption cases are also cited.
- Operational considerations for UAV like notification to local authorities about the UA flight, flight details etc are also present in the guidelines.

8.0 Conclusions

The UAS technology and its applications in the civil sector is growing at a very high rate. In order to be able to control a drone, communication between the user and the drone and/or its payload is required. For this communication frequency spectrum is required. At this moment, there is no spectrum available dedicated to drones only. Currently, the spectrum usage by drones can be facilitated by license-free spectrum or licensed spectrum on a national basis. Efforts have to be made to make spectrum available specifically for drone usage in order to accommodate the international usage of drones. Since frequency spectrum does not end at national borders, international coordination of its use is required. This is an essential part in the operation of drones. Therefore, standards have to be developed in order to create a feasible worldwide market which is not causing interference to other services or suffers from interference from other services. Future developments of drone technology include drones becoming smaller, lighter, more efficient, and cheaper. Therefore, drones will become increasingly widely available to the general public and they will be used for an increasing scope of applications. It is to be expected that drones will become more autonomous and more capable of operating in swarms in the near future.

The spectrum requirements for UAS be it for CCNP or Payload Communication in the Indian scenario should be studied and laid down in a framework to facilitate safe and regulated proliferation of UAS in the civil aviation sector.

References:

1. Report ITU-R M.2171 Characteristics of unmanned aircraft systems and spectrum requirements to support their safe operation in non-segregated airspace, 2009.
2. REPORT ITU-R M.2204 Characteristics and spectrum considerations for sense and avoid systems use on unmanned aircraft systems, 2010.
3. REPORT ITU-R M.2229 Compatibility study to support line-of-sight control and non-payload communications links for unmanned aircraft systems proposed in the frequency band 15.4-15.5 GHz, 2011.
4. REPORT ITU-R M.2233 Examples of technical characteristics for unmanned aircraft control and non-payload communications links, 2011.
5. REPORT ITU-R M.2237 Compatibility study to support the line-of-sight control and non-payload communications link(s) for unmanned aircraft systems proposed in the frequency band 5 030-5 091 MHz, 2011.
6. REPORT ITU-R M.2238 Compatibility study to support line of sight control and non-payload communications links for unmanned aircraft systems proposed in the frequency band 5 091–5 150 MHz, 2011.
7. Guidelines for obtaining Unique Identification Number (UIN) & Operation of Civil Unmanned Aircraft System (UAS): DGCA AIR TRANSPORT CIRCULAR XX of 2016.
8. ICAO Circular 328 on Unmanned Aircraft System, 2011.
9. Joint Authorities for Rulemaking of Unmanned Systems: JARUS- FCL RECOMMENDATION, DOCUMENT IDENTIFIER: JAR_DEL_WG1_D.04, 2015.

Activities at NTIPRIT (APR-17 to JUN-17)

1. Visit of Japanese delegation at NTIPRIT, Ghaziabad

   A Japanese delegation comprising of members from Ministry of Internal Affairs & Communication (MIC), Government of Japan and Embassy of Japan in India visited NTIPRIT, Ghaziabad on 21st June, 2017 for discussions about future cooperation in the area of telecommunications. During the discussions, a presentation about capacity building capabilities of NTIPRIT including availability of training infrastructure, areas of possible cooperation between Japan and India etc. was delivered. This was followed by detailed deliberations between Japanese delegation and DoT/NTIPRIT officers to exchange ideas about future cooperation between the two countries in the area of telecommunications. Sh. D. P. De, the then Sr. DDG (TEC/NTIPRIT), DDG (IR) & Director (IR) from DoT and DDsG & Directors from NTIPRIT were present during the deliberations. The Japanese delegation also visited NGN/IMS and 3G labs of ALTTC, Ghaziabad during the visit.

Japanese delegation and senior officers of DoT/NTIPRIT

2. Valedictory Programme of Officer Trainees of ITS-2013 batch and P&T BWS-2010/2013 batch

   A Valedictory Module as a mark for completion of Induction Training of ITS-2013 batch and P&T BWS-2010/2013 batch Officer Trainees was organized at NTIPRIT from 29th May to 7th June, 2017. Sh. D. P. De, the then Sr. DDG (TEC/NTIPRIT), in his valedictory address on 02.06.2017, exhorted upon Officer Trainees to carry out their assigned works sincerely and diligently. He also advised Officer Trainees to keep themselves updated with latest technological changes happening in their respective fields.

Sh. D. P. De, the then Sr. DDG (TEC/NTIPRIT) and NTIPRIT faculty members with officer trainees of ITS-2013 batch and P&T BWS-2010/2013 batch

3. Induction Training of the following batches of Officer Trainees of ITS/BWS and JTO probationers was conducted during the period:
   i. ITS-2015 batch (36 officers)
   ii. BWS-2015 batch (1 officer)
   iii. ITS-2014 batch (17 officers)
   iv. ITS-2013 batch (4 officers)
   v. JTO-2015 Batch (23 officers)
   vi. P&T BWS-2010 & 2013 Batch (8 officers)

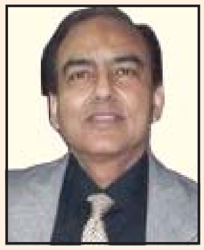
   Various training programs like technical modules and Field attachment of ITS/BWS and JTO batches were conducted during this period as per respective training calendar.
4. In-service training courses for DoT Officers were conducted at NTIPRIT on the following topics:
   i. Training course on "Cyber & Telecom Network Security", (11-12 May, 2017) [17 Participants]

हिंदी कार्यशाला

दूरसंचार अभियांत्रिकी केंद्र में दिनांक 19.06.2017 को एक हिंदी कार्यशाला का आयोजन किया गया। इस कार्यशाला में कुल 25 अधिकारियों/कर्मचारियों ने भाग लिया। इस कार्यशाला के अतिथि वक्ता श्री केवल कृष्ण, वरिष्ठ तकनीकी निदेशक, राजभाषा विभाग द्वारा गूगल–ट्रांसलेशन, गूगल वॉइस टाइपिंग, मोबाइल फोन पर गूगल वॉइस टाइपिंग और एंडरॉइड फोन में जीमेल डॉक्स पर कार्य करने के बारे में विस्तार से बताया गया।

हिंदी कार्यशाला के दौरान उपस्थित अधिकारी एवं कर्मचारीगण

Shri Lav Gupta to Head TEC



Shri Lav Gupta took over as Sr. DDG TEC on 13.07.2017. He belongs to ITS 1978 batch. He has obtained Bachelor's & Master's qualification in engineering from IIT Roorkee and IIT Kanpur respectively. In his 36 years of career in the Telecom Sector, he has worked in various areas of telecommunication viz operation, development, maintenance and commercial. During this period his noteworthy contribution has been in introducing ADSL broadband in India and strategic planning. As Principal Advisor in TRAI, he has been involved in important regulation/recommendation relating to National Broadband plan, Next Generation Network, Manufacturing of Indigenous Equipment and Interconnect Usage charges. Shri Gupta has contributed a number of technical papers to reputed journals and is a senior member of IEEE.

Approvals from APR-17 to JUN-17

Sl. No.	Name of the Manufacturer/Trader & Name of Product & Model No.
A	Brightstar Telecommunications India Limited
1	Electronic Telephone Instrument, Secure-I
B	Tejas Networks Ltd
2	Interchange of digital signals at 2 Mbps, 8 Mbps, 34 Mbps, 45 Mbps and 140 Mbps ports, STM-1 TM/ADM, TJ 1400
3	Interchange of digital signals at 2 Mbps, 8 Mbps, 34 Mbps, 45 Mbps and 140 Mbps ports, STM-4 TM/ADM, TJ 1400
4	Interchange of STM-1, STM-4, STM-16, STM-64 & STM-256 signals between different networks,STM-4 TM/ADM, TJ 1400
C	Aspect Contact Centre Software India Pvt Ltd.
5	Systems Employing Computer Telephony Integration, UMS-00
D	Coral Telecom Limited.
6	PABX for Network Connectivity, DX2000
E	Sunren Technical Solutions Pvt Ltd
7	Interchange of Ethernet Signals between different Networks, XTC-4
8	Group 3 Fax Machine/Card, SDGOB-1502
9	Group 3 Fax Machine/Card, SNPRH-1502
10	Group 3 Fax Machine/Card, Xpress M2060FW
11	Group 3 Fax Machine/Card, Xpress M2880FW
12	Group 3 Fax Machine/Card, ProXpress M3870FW
13	Group 3 Fax Machine/Card, SNPRC-1501-01
14	Group 3 Fax Machine/Card, SNPRC-1501-02
15	Group 3 Fax Machine/Card, SNPRC-1601-01
16	Group 3 Fax Machine/Card, VCVRA-1504-00
17	PABX For Network Connectivity, Sonus SBC 1000
F	Progility Technologies Pvt Ltd
18	PABX For Network Connectivity, HP-256
G	Hewlett Packard Enterprise India Pvt Ltd.
19	Router, BJNGA-BB0008

Important Activities of TEC during APR-17 to JUN-17

New GRs/IRs issued:

- GR on Telephony Application Server

Revised GRs/IRs issued:

- GR on Lawful Interception System for PSTN / NGN / IMS
- GR on Monitoring Equipment for Lawful Interception of PSTN / NGN / IMS
- GR on Lightening and Surge Protection of Telecom Sites
- GR on 12 volts SMPS for wireless/wireline terminals & similar systems
- Amendment to GR on FTTH/FTTB/FTTC Broadband Access Applications using GPON Technology

DCC meeting conducted for:

- GR on SAR measurement system for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 MH)

Representation of TEC in Training/Seminar/Meetings

- ITU-R Study Group-5 Meeting in Canada
- 3GPP SA3 Meeting in Florida, USA
- TCOE, India meeting on Independent Evolution Groups at DoT
- FTTH APAI Conference 2017 at Arrow City, Delhi
- 4th National Standard Conclave at Department of Commerce, New Delhi
- Ericsson Taste of Barcelona Event at Gurugram
- Workshop on Central Equipment Identity Register at CDoT
- Workshop regarding implementation of e-office Lite (SPARROW) in DoT
- Workshop on "Future Proof Smart cities with a common service layer: a standard approach" at CDoT, Delhi
- Seminar on "The 4th edition of India M2M+IoT Forum 2017" in New Delhi

Brief About TEC

Telecommunication Engineering Centre (TEC) functions under Department of Telecommunications (DOT), Government of India. Its activities include:

- Issue of Generic Requirements (GR), Interface Requirements (IR), Service Requirements (SR) and Standards for Telecom Products and Services
- Field evaluation of products and Systems
- National Fundamental Plans
- Support to DOT on technology issues
- Testing & Certification of Telecom products

For the purpose of testing, four Regional Telecom Engineering Centers (RTECs) have been established which are located at New Delhi, Bangalore, Mumbai, and Kolkata.

For more information visit TEC website

www.tec.gov.in

Other Activities

- Meeting of NSG-5 study group on "Terrestrial Services" in TEC
- Technical presentation cum Practice demonstration of Amateur Radio (Ham Radio) by Shri V. K. Arya, Ex DDG, TEC was successfully organised in TEC
- Technical presentation on "Telephony Application Server" by M/s Huawei and on "Rural LTE" by VNL & Vanu/HFCL in TEC
- Testing of CDOT STBR completed in IPv6 Ready Logo lab in TEC

DISCLAIMER : TEC Newsletter provides general technical information only and it does not reflect the views of DoT, TRAI or any other organisation. TEC/Editor shall not be responsible for any errors, omissions or incompleteness.

टी ई सी संचारिका : दूरसंचार अभियांत्रिकी केन्द्र
जुलाई 2017 : खुर्शीद लाल भवन
भाग 21 : जनपथ
अंक 3 : नई दिल्ली–110001

Editor : Sunil Purohit, DDG (NGS) Phone : 23329354 Fax : 23318724 E-mail : ddgs.tec@gov.in

Printed at : Yugantar Prakashan Pvt. Ltd., New Delhi; M: 9811349619