Consultation Paper No. 9/2011

Telecom Regulatory Authority of India

Consultation Paper

on

Allocation of Spectrum Resources for Residential and Enterprise Intra-telecommunication Requirements/ cordless telecommunications system (CTS)

New Delhi: 26th December, 2011

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Preface

During the recent times, indoor Telecommunications requirements in terms of Cordless telephone and wireless private branch exchange (PBX) applications for domestic and/ or enterprise usages have increased many folds including the demand for Wireless Local Area Network (LAN) in domestic and enterprise solutions. Wireless solutions are most widely used worldwide for extending the concept of home networking into the area of mobile devices around the home.

In the last decade, the progress in the field of mobile telecommunications has transformed the landscape of India's Telecom Network significantly. However, similar growth has not been observed in Residential and Enterprise Intra-telecommunication / cordless telecommunication system (CTS) in the country. The Intra-telecommunication requirements for residential and large enterprises are available only through wired PABXs options. Presently majority of wireless based PABX solutions available in the Indian market operate in 2.4 GHz de-licensed ISM band.

DECT Forum, India had requested TRAI for allocations of Spectrum for Intra-Telecommunication requirements of residential and enterprise. On 19th February, 2010 TRAI issued a "Request for Comments" for seeking the comments of various stakeholders. The comments received from the stakeholders had been posted on TRAI's website. This consultation paper has been prepared based on the comments received and the prevailing international practices,. It discusses the current allocation of spectrum for CTS, its requirement for allocation of additional spectrum, possibility of delicensing of 1880-1900 or 1910-1920 MHz band for low power CTS applications and its coexistence issues with adjacent GSM band.

Written comments on the issues raised in this consultation paper are invited from the stakeholders by 31st January, 2012 and counter-comments on the comments by 10th February, 2012. The comments and counter-comments may be sent, preferably in electronic form, to Shri Sudhir Gupta, Pr. Advisor

(MS), TRAI, who may be contacted at Tel No. +91-11-23220018, Fax No. +91-11-23212014 or email at pradvmn@trai.gov.in .

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Chairman, TRAI

Introduction

1. DECT Forum India vide its letter dated 13th January 2010 had requested TRAI for allocations of Spectrum for Technologies such as DECT, to meet the Residential and Enterprise Intra-Telecommunication Requirements. In order to identify the issues involved, TRAI vide its Press Release dated 19th February 2010 issued a "Request for Comments" on its website for seeking the comments of various stakeholders. The comments received from the stakeholders had been posted on TRAI's website.

2. Based on the comments and the International practices in various countries in respect of cordless home & enterprise solution this consultation paper on "Allocation of Spectrum Resources for Residential and Enterprise Intra-telecommunication Requirements/ cordless telecommunications system (CTS)" has been prepared.

Evolution of Cordless Telephony

3. Cordless telephones were introduced with the development of analogue cordless telephones standard known as First-generation cordless telephones (CT1). Although these phones were susceptible to noise and interference, had limited range and offered little- if any privacy, a consumer mass market was created due to their low cost. CT1 operated in the bands 914 – 915 MHz and 959 –960 MHz, which overlaps the bands 890 – 915 MHz and 935 – 960 MHz allocated to Global System for Mobile Communications ("GSM") networks.

4. These phones were popular for home applications, but in view of their limitations like poor capacity for high-density environments, lack of roaming capability and no privacy, there was lack of acceptance among business users.

5. A variant of CT1, known as **CT1+**, was developed in Europe. CT1+ operates in the bands 885 – 887 MHz and 930 – 932 MHz.

6. In the United States, analog cordless phones operated in the 49-MHz band under FCC Rules Part 15. The FCC had designated 25 pairs of

channels in the 46 and 49 MHz bands for cordless telephones. Although extremely popular in the homes, these phones enjoyed little success in the office.

7. Around 1990, due to the limitation of the analogue first generation cordless telephone technology, the United Kingdom developed the next generation cordless telephones, called **CT2**. CT2 was a digital system standard endorsed by European Telecommunications Standards Institute (ETSI), the European standards body, and was intended for residential and telepoint (public access) applications.

8. CT2 uses frequency division multiple access (FDMA) to share the spectrum allocation among different users, whereas communication between user handsets and base stations is on time division duplex (TDD). It uses low transmit power giving a coverage of up to 200 m radius. During a call set-up in CT2 system, the handset scans the available channels and lock onto an unoccupied channel for the duration of the call (ie. it does not change channel during a call). Being a digital technology, it offers improved signal quality, spectral efficiency and privacy in comparison to the CT1. Three major applications were envisioned for CT2 phones: (i) residential cordless phones with enhanced performance, (ii) wireless key telephone systems (WKTS) and wireless PBXs (WPBX), and (iii) pocket phones for outdoor wireless pay phone service—what later became known as Telepoint. The CT2 standard had been used in public access applications in the UK, France and Hong Kong. However, in the UK, though several network operators were licensed, but all have failed. In France the service has met with very limited acceptance. In Hong Kong, CT2 had been readily accepted; however recent reports indicate that all bar one of the networks have now been closed due to high level of churn and the high costs of relocating base stations.

9. In Sweden, another digital technology was developed by Ericsson specifically to accommodate business applications, which was called **DCT900 or CT3** system. CT3 was the digital CTS technology capable of operating in 900 MHz band. It uses TDMA and TDD for up to 4 calls per

base station transmitter. Dynamic Channel Allocation (DCA) was used to allocate the four channels of 1 MHz each. Each radio carrier is divided into 16 time slots, a pair of which is required for each duplex voice channel (talk and listen). There are 32 voice channels available per base station.

10. In order to provide a common "pan-European" digital cordless communications standard, and in view of the incompatibility of the CT3 and CT2 standards, Europe decided on a new standard operating near the 2 GHz range. This standard, developed by ETSI, was known as **DECT** (Digital European Cordless Telecommunications – now known as Digital Enhanced Cordless Telecommunications). It provides for applications that includes domestic telephones, telepoint, wireless PABX and wireless local loop access to the public network. It was designed to provide extremely high capacity to solve the problem of providing cordless telecommunications in high density, high traffic office and other business environments.

11. In Japan an alternate technology, called **PHS** (Personal Handyphone System) was developed for cordless applications. The technology and the type of applications it provides are very similar to DECT. The operating frequency range of PHS in Japan is 1895-1918.1 MHz; 77 channels are available; 37 channels for shared public and private use and 40 channels exclusively for public networks. In Australia, 20 MHz (1880-1900 MHz) is available to PHS on a shared basis, but in practice, PHS in Australia uses only 5 MHz (1895-1900 MHz). It is also a digital system using TDMA and TDD for up to 4 calls per base station transmitter. DCA is used to allocate the 16 channels, each of 300 kHz, in the 5 MHz band.

12. Digital cordless telephones for the residential market have also been developed to operate in the Industrial, Scientific and Medical (ISM) bands using spread spectrum techniques. The 2.4- 2.4835 GHz and 5.725 – 5.850 GHz ("5.8 GHz") are designated for low power devices (LPD) and non-licensed transmitters including cordless telephones.

13. **GSM CTS** also called **Private Mobile Networks (PMN**), provide the ability to access voice services using mobile handsets over a private GSM network. With PMN, the mobile phone can be the handset of choice for financial and practical reasons by replicating a cellular network in software and inter-operating with IP/SIP devices and applications.

14. PMN can be deployed into areas where network integration and infrastructure costs would otherwise be prohibitive or into areas of high mobile usage with poor or no GSM network coverage, such as warehouses or in-building areas with signal disruption. The solution is ideal at temporary locations, such as construction and outdoor events industries. In areas where voice privacy is an issue, PMN can be implemented as localised islands of communication with the inherent security of GSM. At the heart of the PMN is the Private Mobile eXchange. PMX creates a self contained, privately owned and managed mobile network based on standard GSM protocols.

Cordless Applications

15. Digital CTS can be used in a variety of short range, low power applications like:

- Residential (that is, domestic) CTS;
- Enterprise Intra-telecommunication:
  - wireless PABX &
  - wireless LAN;

16. **Residential Applications** The advanced cordless telecommunications systems can be used as a residential cordless telephone providing mobility within the home and enterprise. The same handset used in the home can be used at other locations to access wireless PABX or public access CTS, subject to appropriate registration with the operators of those systems.

17. **Enterprise Intra-telecommunication (Wireless PABX & Wireless LAN):** In the office or factory a cordless system can be used to provide wireless

access to the company's Private Automatic Branch Exchange (PABX) or Local Area Network (LAN).

17.1 **Wireless PABX** systems can range from a one cell system for a small office to multiple cell systems that cover several floors of a multi-storey office building or to a multi-cell system that provides coverage in a factory or large industrial complex. These multi-cell systems are capable of call handover between cells within the office or factory site. Wireless PABX systems such as these are already in operation in Australia in the 800 MHz bands using CT3 and in the 1.9 GHz band using DECT or PHS systems.

17.2 **Wireless LANs**, also known as Radio LAN (**RLAN**), uses low power radio to provide two way data communications within buildings/offices environment. RLAN provides a cost effective and flexible solution in data transfer between various computer terminals. RLAN is not intended for portable computing applications but as replacement of fixed wired LAN connections. In digital CTS standards such as DECT and PHS, each channel is divided into a number of time-slots, each carrying one digitised voice signal for telephony application. However, the standards also allow the time-slots to be combined to provide sufficient throughput required for computer applications. This feature is utilised by manufacturers to provide low to medium data transfer.

CHAPTER - I

INTERNATIONAL PRACTICE IN ALLOCATIONS OF SPECTRUM RESOURCES FOR CORDLESS TELECOMMUNICATIONS SYSTEM (CTS)

1.1 The international practice in respect of allocations of spectrum resource for Residential and Enterprise Intra-telecommunication Requirements/ cordless telecommunications system (CTS) adopted by the various countries are discussed below:

European Union (EU):

1.2 Allocation of spectrum for cordless telephony in Europe is guided by the Directive ERC/DEC/(94)03 dated 24th October 1994 of the CEPT. The purpose of this Directive was to make the Digital European Cordless Telecommunications (DECT), a single standard for cordless telephony, throughout Europe.

1.3 The standard covers cordless communications for voice and data at home, in the office and on the street. The frequency band designated for DECT is 1880-1900 MHz. As per the standard, free-space coverage will be limited up to 500m; while the normal coverage in the office will be 50-100m. With the utilisation of the allocated 20 MHz of frequency spectrum, a cell may have a theoretical peak capacity of between 50 to 144 voice channels depending on overlap with other DECT cells. It also got priority over other radio systems in that band, and got protection, in the designated band i.e. after the date of designation of the frequency band for DECT, existing radio systems may continue in the band, provided that they do not interfere with DECT systems that may be established according to commercial demand. As per the information from the European Commission official database[1], 33 member countries have implemented the Directive.

[1] Website http://www.erodocdb.dk/default.aspx

United Kingdom (UK):

1.4 In UK, older analog cordless telephones used the frequency bands 1642 to 1782 kHz and 47 MHz or 47 MHz and 77 MHz conforming to the EU's Radio Equipment and Telecommunications Terminal Equipment Directive 1999/5/EC (R&TTE Directive) and the United Kingdom Interface Requirement IR 2011. Their operation was limited to one of the pairs of pre set frequencies at any one time. However, from 1 April 2005, new equipment in the frequency bands 1642 to 1782 kHz and 47 MHz or 47 MHz and 77 MHz are not permitted, though the equipment in use on that date is allowed to be used. Presently, it is also following the DECT standards for digital cordless telephony applications.

1.5 As an alternative to the cordless telephony, the concept of private GSM network has been implemented in UK. UK had auctioned a portion of GSM band for low power usages within an enterprise/ campus, which is being commercially exploited by the winning parties in providing such solution to large enterprises in UK.

United States of America

1.6 In the United States, seven frequency bands have been allocated by the Federal Communications Commission (FCC) for various uses including for cordless phones. These are:

Sl. No.	Band Allocated
i.	1.7 MHz (1.64 MHz to 1.78 MHz)
ii.	43–50 MHz (43.72-46.97/ 48.76-49.99 MHz, allocated in 1986)
iii.	900 MHz (902–928 MHz) (allocated in 1990)
iv.	1.9 GHz (1920-1930 MHz) (allocated in 2005)
v.	The ISM bands 2.4 GHz and 5.8 GHz (allocated in 1998 & 2003 respectively)

Table-1.1

1.7 Cordless phones in the 1.7 MHz band were the earliest models available in US market using analog CT technology. Channel selection had to be

done manually by the user, and transmitted just above the AM broadcast band. These types are now obsolete due to being very susceptible to eavesdropping and interference, especially from fluorescent lighting and automobile ignitions.

1.8 Cordless phones in 43-50 MHz band, also of analog CT type and featured shorter bendable antennas plus auto channel selection, had a large installed base by the early 1990s. Despite being less susceptible to interference, these models have also become obsolete as these frequencies are easily detectable on practically any radio scanner.

1.9 Cordless telephones are also allowed in the 902-928 MHz, 2.4 GHz and 5.8 GHz ISM bands. The 900 MHz cordless phones have features of shorter antennas, up to 30 auto selecting channels, and higher resistance to interference. It is available in three varieties; analog, digital, and Digital Spread Spectrum (DSS). Digital transmission is immune to static interference but can experience signal fade (brief silence) as the phone goes out of range of the base. DSS variants spread their signal over a range of frequencies providing more resistance to signal fade. The FCC only allows DSS model phones to transmit at the full power of 1 watt, which allows increased range over analog and digital models.

1.10 The US Federal Regulation on Telecommunication Part 15 Subpart D—Unlicensed Personal Communications Service Devices (UPCS) sets out the regulations for unlicensed personal communications services (PCS) devices operating in the 1920–1930 MHz band. By definition PCS devices are intentional radiators operating in the frequency band 1920–1930 MHz that provide a wide array of mobile and ancillary fixed communication services to individuals and businesses.

1.11 Unlike the European regulation on DECT, the US regulation on PCS does not name the technology but define etiquettes for the band in keeping with its technology neutral approach. The regulation states that all transmissions must use only digital modulation techniques; defines Peak transmit power; Power spectral density; Peak transmission Power with a factor of Antenna Gain; the band of operation; emission bandwidth; spurious emission limits etc. Also these PCS devices are to meet the

specified radiofrequency radiation exposure requirements. As these devices are considered to operate in a "general population/uncontrolled" environment, they must contain a statement confirming compliance with radiation requirements for both fundamental emissions and unwanted emissions.

1.12 Virtually all telephones sold in the US use the 900 MHz, 1.9 GHz, 2.4-GHz, or 5.8 GHz bands, though legacy phones remain in use on the older bands. There is no specific requirement for any particular transmission mode on 900 Mhz, 1.9, 2.4, and 5.8 GHz bands, but in practice, 900 MHz phones are inexpensive analog models with digital features such as DSSS and FHSS generally available only on the higher frequencies. The recently allocated 1.9 GHz band is used by the popular DECT phone standard and is considered more secure than the other shared frequencies. The operating conditions established for the 1920 – 1930 MHz portion of the allocated spectrum are reserved for voice communication and also extensively used for wireless intra-office telephone systems like wireless PBX systems.

Australia

1.13 The operation of Cordless Telecommunications Devices is subjected to specific conditions of "class licence" and provisions of the Radiocommunications Act 1992 (the Act). The Radiocommunications (Cordless Communications Devices) Class Licence 2001 (the class licence) authorises the operation of a variety of communications devices such as those using technologies known as Digital Enhanced Cordless Telecommunications (DECT), Personal Handy Phone Systems (PHS) and CT3.

1.14 Radiocommunications devices authorised under "Class licences" are typically low power transmitters providing short range communications that do not require individual frequency co-ordination for interference management purposes. Under a class licence, all users operate in the same spectrum segment on a shared basis and are subject to the same conditions. A class licence governs the frequencies that may be used,

commonly prescribes equipment standards, and may specify other technical and operational parameters. Class licences do not have to be applied for, and no licence fees are payable.

1.15 The class licence authorises any person to operate a land station or hand set that uses:

Sl. No.	Band Allocated
i.	1.7175 - 1.7925 MHz;
ii.	30.0625 - 30.3125 MHz
iii.	39.7625 - 40.250 MHz;
iv.	857 MHz - 861 MHz;
v.	861 MHz - 865 MHz;
vi.	1895 - 1899.8 MHz PHS technology
vii.	1880 - 1900 DECT.

Table-1.2

1.16 The Act specifies the Technical Standards to be met for the different types of Cordless Devices (CT2, DECT, and PHS) and also Equivalent Isotropic Radiated Power (EIRP) limits (peak and average values) for the digital PHS and DECT cordless telephone / PABX systems as follows:

Cordless Station Type	Maximum EIRP (in dBm)
DECT	22 (average); 36 (peak)
PHS	12.5 (average); 21.5 (peak)

Table-1.3

Hong Kong:

1.17 The Telecommunications (Telecommunications Apparatus) (Exemption from Licensing) Order provides exemption from licensing in respect of the private use, sale or demonstration and import or export of various types of telecommunications apparatus including the cordless telephones.

1.18 The following bands have been allowed for cordless applications:

Technology	**Frequency Band (MHz)**
CTØ	1.6275 – 1.7965/ 47.43 – 47.56
FCC Type	43.71 – 44.49/ 46.6 – 46.98 48.75 – 50
	253.85 – 255 380.2 – 381.325
CT2	864.1 – 868.1
DECT	1880 – 1900
PHS	1895 – 1906.1
ISM Band	2400 – 2483.5; 5150 – 5350 5470 – 5725 and 5725 – 5850

Table-1.4

1.19 Cordless telephones are required to operate on shared spectrum on "no-interference no-protection" basis, i.e. they may not cause radio interference and cannot claim protection from interference.

1.20 Instead of deriving its own set of etiquettes, Office of the Telecommunications Authority (OFTA) has simply adopted the specifications of DECT as defined by European Telecommunications Standards Institute (ETSI) specifications and PHS by the Association of Radio Industries and Businesses (ARIB), Japan.

1.21 In addition to the cordless applications allowed in the lower VHF band, DECT and PHS systems, OFTA has permitted the cordless applications in ISM 2.4, 5.1 and 5.8 GHz band as evident from the allowed frequency bands given in the Table above.

1.22 In the case of ISM bands, 2.400 -2.4835 GHz, 5.15 - 5.35 GHz, 5.470 - 5.725GHz and 5.725-5.850 GHz, OFTA has adopted the specifications defined by ETSI and FCC for relevant part of their specifications.

Singapore

1.23 The Infocomm Development Authority of Singapore (IDA) has allocated the following bands for cordless telephony:

The technology	Operating Spectrum Band
CT (FDMA/FDD)	1.605 – 1.800/ 49.50 – 50.00
FCC Type	46.50 – 47.00/ 49.50 – 50.00 43.50 – 50.00/ 48.50 – 50.00
CT2	821 – 822/ 924 – 925
Digital System DECT	1880 – 1900 MHz
PHS	1895 – 1900 MHz

Table-1.5

1.24 IDA has allowed both, analog and digital technologies for cordless applications. They have also notified detailed specification in respect of the band of operation, the emission power limitation and other technical details for the cordless systems. These systems are exempted for licensing requirements. The IDA has followed the technology details as given by ETSI for DECT system and ARBI for PHS systems.

Malaysia

1.25 As per the Malaysian Communication and Multimedia Commission (MCMC) 'Class assignments no. 1 of 2010, cordless telephone device is a two-way low power mobile or portable device which communicates with a local base station in the designated frequency bands and is directly connected to a licensee. A cordless telephone device shall only utilize any of the frequency bands specified in the class assignment on a shared non-exclusive basis. The following frequency band have been permitted for cordless telephony under the said class assignment:

Item	Frequency Bands
i.	46.61 - 46.97 MHz
ii.	49.61 - 49.97 MHz
iii.	1880 - 1900 MHz
iv.	2400 - 2483.5 MHz

Table-1.6

Summary of Bands allocated for Cordless Applications:

1.26 The bands allocation for cordless telecommunications in different countries, as discussed in the forgoing para, have been summarised in the following table:

Type of Cordless	**EU**	**US**	**UK**	**Japan**	**HK**	**AUS**	**SNG**	**MLY**
CT1: (1.7 and 47 MHz)					√	√	√	
CT1: (914-915/959– 960 MHz)								
CT1+: (885 – 887 / 930 – 932 MHz)								
FCC Type: (46 and 49 MHz)		√			√		√	√
CT2: (864.1 – 868.1 MHz)	√		√		√	√	√	
PHS: (1895 – 1906.1 MHz)				√	√	√	√	
DECT: 1880 – 1900 MHz	√	√ *	√		√	√	√	√
902 – 928 MHz		√						
2.400 – 2.4835 GHz		√			√			√
5.725 – 5.850 GHz		√			√			

Table-1.7

* 1920-1930 MHz band with defined etiquettes

CHAPTER - II

INDIAN SCENE AND ISSUES ON CORDLESS TELECOMMUNICATIONS SYSTEM

Indian Scene:

2.1 In India, as per National Frequency Allocations Plan -2011 (NFAP-2011) IND 04, certain spot frequencies in 1.6 – 1.7MHz, 43-46MHz, paired with 48-50MHz and 150-151 MHz bands have been allocated for Cordless Telephony applications. Remarks IND 52 of NFAP also states that certain frequency spots in the frequency band 926 – 926.5 MHz may be considered for very low power cordless telephone systems on non-interference, non-protection and non-exclusiveness basis.

2.2 As per the notification GSR 45E dated 28.1.2005, usages, possession or dealing in low power equipments in the frequency band 2.4-2.4835 GHz using a maximum transmitter output power of 1 Watt (4 Watts Effective Radiated Power) with spectrum spread of 10 MHz or higher on non-interference, non-protection and shared (non-exclusive) basis has been exempted from licensing requirement.

2.3 Further the usages, possession or dealing in low power Wireless Access System, including Radio Local Area Networks, in the frequency band 5.150 to 5.350 GHz and 5.725 to 5.875 GHz with Maximum mean Effective Isotropic Radiated Power (EIRP) of 200 mW and a maximum mean Effective Isotropic Radiated Power density of 10 mW/ MHz in any 1 MHz bandwidth (with inbuilt antenna, indoor application), were exempted from licensing requirement vide Notification GSR 46(E) dated 28th January 2005. This exemption was subsequently, extended through Notification GSR 38(E) dated 19.1.2007, for outdoor application in the frequency band 5.825 to 5.875 GHz having maximum transmitter output power of 1 Watt (4 Watts Effective Radiated Power) with spectrum spread of 10 MHz or higher.

2.4 The analog cordless telephones in 46/ 49 MHz band are available in the country from various manufacturers and suppliers. However, they have limited features and are also susceptible to interference. This has made digital cordless systems more popular. Today, the digital spread spectrum technology based cordless telephones using ISM bands 2.4-2.4835 GHz, 5.150-5.350 GHz and 5.725 – 5.875 GHz cordless telephone are available and have large installation base.

2.5 In India the CorDECT, which is evolution of DECT technology, has been implemented in the band 1880-1900 MHZ band for providing Wireless in Local Loop (WLL) in various service areas. As per NFAP's IND57, "Requirements of micro cellular wireless access systems (fixed/mobile) based on TDD access techniques, especially indigenously developed technologies and low power digital cordless telephones systems and devices with maximum transmit power of 250 mW, capable of coexistence with multiple operators may be considered in the frequency band 1880-1900 MHz may be considered subject to coordination on a case-by-case basis. Further the IND58 states "The frequency band 1900-1910 MHz paired with 1980-1990 MHz may also be considered for cellular telecom systems for coordination on a case by case basis subject to availability of spectrum in these bands and after ensuring compatibility for coexistence with the systems operating in the frequency bands 1920-1980 MHz paired with 2110-2170 MHz" i.e. the 3G spectrum band.

2.6 As per IND57 of NFAP-2011, requirements of micro cellular wireless access systems (fixed/mobile) based on TDD access techniques, especially indigenously developed technologies and low power digital cordless telephones systems and devices with maximum transmit power of 250 mW, capable of coexistence with multiple operators, may be considered in the frequency band 1880-1900 MHz, subject to coordination on a case-by-case basis.

Issues identified

2.7 In response to the TRAI's "Request for Comments" dated 19th February 2010 on the "Allocations of Spectrum for Technologies such as DECT, to meet the Residential and Enterprise Intra-Telecommunication Requirements", various stakeholders, mainly the telecom service providers and the industry groups/ associations, have submitted detailed comments. In their comments, most of the existing telecom service providers and their associations have raised certain apprehensions in allocating separate spectrum band for residential and enterprise cordless communications requirements. The comments were placed on the TRAI's website. On these comments, the DECT Forum of India has submitted its detailed clarifications/ counter comments.

2.8 The comments and counter comments made by the stakeholders on the subject matter and the issues identified have been consolidated as below:

2.8.1 India should continue technology neutral approach: Any operator wishing to provide services that require spectrum should have to be subjected to same rules and regulatory principles and allocating spectrum for single niche technology would be inconsistent with basic licensing structure.

Counter comments: The concept of technology neutrality is related to wireless licensed services where an operator "owns" or has exclusive access rights to a spectrum block in a specific geographical area as long as this does not increase interference to adjacent spectrum blocks used by other operators. The operator needs to coordinate new proposed technology with the adjacent band users/ operators, and make sure its operation is within the assigned spectrum with a given limit on power and the out of band emissions. For a license exempt band, an additional etiquette is required to provide an intrinsic dynamic coordination of the channels used by the different systems.

The technologies have to comply with proper coexistence etiquette to ensure interference free sharing of the common spectrum by the private

license exempt uncoordinated system installations. In Europe this etiquette is the ETSI Harmonized Standard EN 301 406. Other countries where DECT is allowed also have restrictive coexistence etiquettes, removing the restriction to a single technology. The best example is the US FCC regulation Part 15 Subpart D—Unlicensed Personal Communications Service Devices (UPCS) operating in the band 1920-1930 MHz, which only contains the necessary elements for ensuring coexistence of high quality real time services.

2.8.2 De-licensed band will result in heavy loss of revenue: If the presently unallocated 1910-1920 MHz spectrum band gets delicensed for cordless applications, the services deployed over these bands are easily capable of being extended to mobility. Once DECT services become an alternative to mobile services, DECT providers would get unjustified cost advantage. Any change in the fundamentals of transparency of allocating the spectrum would raise serious issues of losses to the exchequer, threat to national security and competitive distortions. There is possibility of exploitation by some operators who may provide WLL services at zero regulatory cost etc. DECT can also be used in public access environment, and 1880-1930 MHz being an IMT band can fetch up to Rs. 10,000 crore. For large local mobility within a town/ city, the "cordless terminal mobility" was launched in a number of European countries (Fido system in Italy) but the system eventually failed. As there is no strong commercial interest in providing DECT based residential/ commercial/ public access cordless systems, it would not be prudent to reserve 10MHz of un-licensed spectrum for DECT.

Counter comments: The license exempt services are not public services. They are private on-site wireless extensions of existing public network, allowing local movement. There are small bands of unpaired spectrum, between the Up-link (UL) and Down-link (DL) of the paired spectrum band arrangements (FDD mode), that cannot be efficiently used for revenue creating public services. In India the obvious example seems to be the bands 1880-1900 MHz and 1910-1920 MHz. In America and Europe the etiquette controlled license exempt service is allocated in the

guard band between UL and DL of cellular services. Still revenue can be generated through duty structure and manufacturing base etc.

2.8.3 Interference, coexistence with adjacent bands and road block on the growth path of CDMA technology: The proposed DECT band 1880-1930 MHz (TDD mode) is in overlap with the 3G band 1920-1980/2110-2170 and adjoining the 2G band 1710-1785/ 1805-1880 MHz. Therefore, before any allocation to DECT/ cordless telephony, proper sharing studies need to be carried out. Moreover, as per NFAP the band 1900-1910/ 1980-1990 MHz have been identified for growth of the CDMA networks; TRAI has also recommended 1900 MHz band for CDMA; therefore, in no case DECT be allowed in this band.

The unallocated spectrum 1910-1920 MHz is having immediate adjacent allocations (on the lower side) (i) to the progressive allocation for micro cellular wireless access system and (ii) also to the PCS 1900 bands (1900-1910 / 1980 – 1990 MHz). Further, it is having adjacent allocations (on the upper side) to 3G spectrum band i.e. (1920-1980 / 2110 – 2170 MHz). There may be some interference/ coexistence issue to these adjacent allocations whenever they come across. Un-licensed operation in lower band could be counterproductive due to likelihood of interference to adjacent bands 3G / 2G. Therefore 1900 MHz band be kept for licensed operation of IMT only.

Counter comments: Spectrum allocations for cellular systems, all over the world, have a needed guard band between the up-link spectrum block (UL) and the down-link spectrum block (DL). These guard bands, if remain unused become an inefficient use of the natural resource. TDD technology based low power digital CTS and instant Dynamic Channel Selection procedures, will be able to efficiently utilize these guard bands. Early studies and subsequent experience in real life of large number of installed CTS confirm good coexistence between license exempt residential/enterprise systems and cellular systems. Any cellular technology, which is expected to be adjacent to a license exempt allocation in India, is already adjacent to the band allocated for digital

CTS applications in other countries and has been for years together. The following is the list of the spectrum allocation for CTS and adjacent cellular technologies:

Countries	**DECT allocation**	**Adjacent Cellular Technologies**
Europe, Australia, New Zeeland, several Asian and African countries	1880 – 1900 MHz	GSM, 3G, (LTE, Wimax)
Most Latin American countries Brazil and Uruguay 1910 -1920 MHz	1910-1930 MHz	GSM, CDMA, 3G
USA, Canada and a few Latin American countries	1920 – 1930 MHz	GSM, CDMA, 3G, (LTE)

Table-2.1

Further the analysis of interference to adjacent bands have been done by the CEPT and in its report they had concluded that the 3G technology in the adjacent band can co-exist with low power indoor usage of cordless telephony. These reports conclude that band allocated in European countries 1880 – 1900 MHz for CTS applications requires no guard band between unlicensed residential/enterprise CTS and cellular systems below 1880 MHz and above 1900 MHz band. These reports are also relevant to spectrum allocations in 2 GHz band in the European countries:

- ERC Report 31 on "Compatibility between DECT and DCS1800";
- ERC Report 65 on "Adjacent band compatibility between UMTS and other services in the 2 GHz BAND";
- ERC Report 100 on "Compatibility between certain radio communications systems operating in adjacent bands, evaluation of DECT / GSM 1800 compatibility".
- ECC Report 96 on " Compatibility between UMTS 900/1800 and systems operating in adjacent bands"
- ECC Report 146 on "Compatibility between GSM MCBTS and other services (TRR, RSBN/PRMG, HC-SDMA, GSM-R, DME, MIDS, DECT) operating in the 900 and 1800 MHz frequency bands"

2.8.4 No need of DECT phones - Duplicity of service: When the mobility, anywhere & everywhere can easily be provided through mobile phones under the existing UASL/ CMTS licenses, there is no requirement of DECT phones. Mobile service has unprecedented growth rates, therefore there is no scope for introduction of parallel service such as DECT. Also DECT has only limited demand mostly for enterprises solutions in urban areas only.

Counter comments: The CTS applications are in fact complementary to the full mobility cellular service, which allows freedom of in building movement to the fixed line connectivity. Also that fixed line telecom service provide toll quality voice, In fact CTS applications will help reduce burden on GSM and CDMA spectrum as most of the in building calls and inter-enterprise calls will be made on cordless phones then. Introduction of CTS in the un-allocated spectrum will help the consumers to a great extent. Moreover, being an extension of fixed phones, it would help increase in the fixed usages of phone and would reduce the spectrum demand for mobile phones. The technology available is low cost, low radiation and can co-exist with other technologies, for in-house wireless voice & data communications. The band 1910~1920 MHz remain undefined and unallocated in the NFAP, therefore for the benefit of efficient usages of natural resource, be allocated for license exempt onsite residential and enterprise CTS applications, which will be beneficial to the Indian public, administrations, enterprises and industry. It will decrease the load on the public telephone systems, since all onsite traffic is switched onsite without connecting to the public network.

2.8.5 Potential security threats- No monitoring of communications will be possible: It would be difficult to ensure subscriber verification and to impose necessary obligation regarding interception and monitoring.

Counter comments: The cordless applications are not for public switching. Therefore, all the outgoing/incoming calls from the premises will be on public network of landline or GSM/WLL and hence can be monitored.

2.8.6 Short range service in already delicensed 2.4 & 5.8 GHz band: un-licensed Wi-Fi have been successful in providing short range service in residential/ enterprises.

Counter comments: DECT provides excellent voice quality and a very high radio link reliability, which cannot be secured by Wi-Fi technology based equipment using the 2.4 or 5 GHz ISM bands. Both DECT and Wi-Fi are complementary technologies. However while DECT is more suitable for voice and mission critical real time applications, Wi-Fi is suitable for best effort data related activities. Wi-Fi band cordless as well as others cordless devices suffer from interference from WLAN devices, as well as micro wave oven, baby sitters and other host of applications. In USA, due to heavy deployment of broad band services over 2.4 GHz & 5.8 GHz band, Cordless phones in this band practically stopped working. This is one of the main reasons for DECT capturing 60% of USA market in three years.

2.8.7 If a license-free spectrum is provided for the Residential and Enterprise users and also possibly for the developers, there are several benefits that the citizens and the country can derive:

- Improved availability of intra-organisation telecommunication solutions will help improve the productivity and efficiency;
- Residential and Enterprise users can derive benefit from latest Intra-organisation solutions available world over at most cost-effective prices;
- Technology will revolutionise local communication in rural areas.
- Indian and Non-Indian companies could setup local manufacturing facilities and also tap a huge market worldwide, leading to job creation and increased exports;
- License-free regime and corresponding opened up local markets could give necessary boost to Innovation and R&D in this telecom equipment segment; this in turn could improve export opportunities.

- The enterprise solutions will help take the load off the cellular systems in urban areas. This will reduce the loading on spectrum resources and improve QoS for mobile services in dense urban environment;

CHAPTER – III

Issues for Consultation:

3.1 Whether the current allocation of spectrum for CTS is sufficient to meet the requirements? If not, then how to meet the demand of cordless telephony spectrum requirements?

3.2 In view of the availability of cellular mobile services in the country and possibility of Fixed Mobile Convergence (FMC), is there any need to have DECT Phones?

3.3 Is there any requirement of allocating spectrum for digital CTS, in view of similar solutions being available in already de-licensed band 2.4 & 5.8 GHz?

3.4 Whether de-licensing of the spectrum for digital CTS applications will be the right path?

3.5 Do you agree that the 1880-1900 or 1910-1920 MHz band (TDD Mode) be allocated for digital CTS applications? If yes, what should be the limits of emitted power (EIRP), power flux density (pfd), antenna gain etc?

3.6 Do you see any coexistence issues between existing cellular systems using adjacent band with low power CTS allocations in 1880-1900 or 1910-1920 MHz band?

3.7 Whether the de-licensing of either 1880-1900 MHz or 1910-1920 MHz band for low power CTS applications will result in loss of revenue to the government?

3.8 Will there be any potential security threat using CTS? If yes, how to address the same.

3.9 Amongst the various options of digital technologies available to meet the cordless telephony requirements, either spectrum allocation can be considered according to technology or the

etiquettes/ specifications can be defined for the de-licensed spectrum band. What method of allocation of spectrum for digital CTS applications should be adopted?

3.10 Any other issue?

List of Abbreviations Used

3G	Third Generation
ARIB	Association of Radio Industries and Businesses, Japan
CDMA	Code Division Multiple Access
CMTS	Cellular Mobile Telecom Service
CT1	First-generation cordless telephones
CT2	Second-generation cordless telephones
CTS	Cordless telecommunications system
DCS	Digital Cellular Service
DCT	Digital Cordless Telephony
DECT	Digital Enhanced Cordless Telecommunications
DSS	Digital Spread Spectrum
DSSS	Direct Sequence Spread Spectrum System
EIRP	Effective Isotropic Radiated Power
ETSI	European Telecommunications Standards Institute
FCC	Federal Communications Commission
FDMA	frequency division multiple access
FHSS	Frequency Hop Spread Spectrum System
GSM	Global System for Mobile Communications
IDA	Infocomm Development Authority of Singapore
ISM	Industrial, Scientific and Medical
LPD	Low Power Devices
LTE	Long Term Evolution
MCMC	Malaysian Communication and Multimedia Commission
NFAP	National Frequency Allocations Plan
OFTA	Hong Kong telecom authority
PCS	Personal Communications System
PFD	Power Flux Density
PHS	Personal Handyphone System
PMN	Private Mobile Networks
QoS	Quality of Service
RLAN	Radio Local Area Network

TDD	Time Division Duplex
UASL	Unified Access Service License
UMTS	Universal Mobile Telecommunications System
UPCS	Unlicensed Personal Communications Service Devices
WiMax	Worldwide Interoperability for Microwave Access
WKTS	Wireless Key Telephone Systems
WLL	Wireless in Local Loop
WPBX	Wireless Private Branch Exchange