

Consultation paper No. 6/2009



Telecom Regulatory Authority of India

Consultation paper

on

Overall Spectrum Management and review of license terms and conditions

16th October, 2009

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Preface

Spectrum has been the focus of constant attention in the context of a significant growth of the telecommunication sector in India over the last few years.

In August 2007, this Authority had made certain recommendations pursuant to which issues relating to spectrum assignment etc., were examined by committees setup by Department of Telecommunications. In July, 2009, Department of Telecommunications has sought the recommendations of this Authority on various aspects. An examination revealed the need to take a comprehensive look at different issues concerning spectrum availability for telecom services and its management. The present consultation paper is an attempt in this direction.

The issues raised in this consultation paper are for the purpose of discussion. As is the practice, views of this Authority will be finalised after receiving comments of the stakeholders.

It is hoped that stakeholders will benefit us with their detailed views before 12th November 2009. Comments will be posted on TRAI's website as and when they are received. Counter comments, if any, to the comments received may be send to TRAI preferably within a week of their being placed on the website but not later than 19th November 2009.

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INTRODUCTION

1. Spectrum, a vital input for wireless services, is a finite and scarce natural resource. In the past decade the number and range of wireless applications has considerably increased, touching upon most areas of economic and social activities. Consequently, the demand for spectrum has increased multifold. In the event, spectrum management for its optimal utilization assumes great significance.

2. The Department of Telecommunications (DoT), vide its letter no. 20-100/2007-AS-I (Vol-II) dated 7th July 2009 (**Annex I**), has sought the Authority's recommendations on the Recommendations /comments of the Committee on "Allocation of Access (GSM/CDMA) spectrum and pricing" of May 2009. In addition, the Authority has also been requested to furnish its recommendations on the terms and conditions of existing UAS/CMTS licence for extending validity of these licences perpetually or otherwise vis-à-vis 2G spectrum (GSM and/or CDMA) allocated and/or 3G spectrum owned by existing licensees, as the case may be.

3. Besides, in terms of letters dated 7th July 2009 and 22nd July 2009, DoT has sought the Authority's clarification on auctioning of all spectrum other than 800, 900 and 1800 MHz bands as stated in para 2.79 of their recommendations dated 28.8.2007 on 'Review of license terms and conditions and capping on number of access providers' (**Annex II**) and the Authority's recommendation on the policy of no capping on the number of Access Service providers in each service area in terms of pending applications for grant of new UAS licenses received from 26.9.2007 to 01.10.2007. (**Annex III**).

Background

4. In the above context, it will be useful to recall the chronology of events in this regard. In India, duopoly was introduced in the cellular mobile segment in 1994/1995 with the introduction of two private operators for providing cellular

mobile services only. MTNL/BSNL was licensed as third cellular mobile operator in the year 1997/2000. A Fourth Cellular Mobile Service provider was introduced in 2001. Unified Access service (UAS) licensing regime was introduced in 2003. In India, unlike other countries, spectrum allocation in 800/900/1800 MHz band is bundled with the license. Licence conditions provide for assignment of spectrum up to 2x6.2 MHz in case of GSM and 2X5 MHz in case of CDMA. Further spectrum is assigned subject to guidelines from time to time.

5. In April 2007, Government in the Department of Telecom (DOT) sought the Authority's recommendations on the issue of determining the number of Access providers in each service area and review of the terms and conditions of Access provider Licence. The Authority forwarded its recommendations on 28th August 2007¹. In these recommendations the Authority, suo motu, recommended enhanced subscriber linked criteria for allotment of additional spectrum and also suggested the constitution of a multi-disciplinary committee
6. On 6th August 2007, and before the receipt of recommendations from the Authority, DoT asked TEC to study matters relating to spectrum utilization by operators and spectrum efficiency on 6th August 2007. In its report dated 26th October 2007², TEC recommended enhanced subscriber linked criteria which was even higher than what was recommended by the Authority. Consequent upon representations from the Industry, Government, on 7th November 2007, constituted a Committee (henceforth called the **First Committee**), to recommend revised subscriber-based criteria for allocation of spectrum. The First Committee submitted its report on 18th December 2007³. The committee could not arrive at a definitive conclusion regarding the criteria to be adopted and left the decision to the Government to adopt the subscriber base criteria as recommended either by the Authority or TEC.

¹ <http://www.trai.gov.in/WriteReadData/trai/upload/Recommendations/73/recommen29aug07.pdf>

² <http://www.tec.gov.in>

³ <http://www.trai.gov.in/WriteReadData/trai/upload/misc/119/subscribercriterion.pdf>

7. The Government, as an interim measure, decided to adopt subscriber based spectrum allocation criteria as recommended by the Authority with the condition that incremental spectrum shall be allocated each time, in tranches of 2x1MHz, beyond 2X6.2 MHz for GSM technology and in tranches of 2x1.25MHz, beyond 2X2.5 MHz, in case of CDMA technology. The subscriber base figures were extrapolated accordingly. Government issued orders on these lines on 17th January, 2008.
8. On 16th June 2008, Government constituted another Committee (henceforth called **Second Committee**) consisting of representatives of DoT, TEC, C-DOT, WPC, Defence and educational institutes like IIT, IIM etc. The Second Committee submitted its recommendations on 13th May 2009⁴. The terms of reference of the Second Committee are available at page no 2 of its report.
9. The Second Committee, in its report, mainly focused on spectrum allocation and pricing for 2G services and merger/transfer/sharing of assigned 2G spectrum. It did not however address a number of issues mentioned in the terms of reference such as reward and punishment regime for efficient usage of spectrum by the service providers, use of technology and refarming to bridge the gap between availability and requirement, etc. Now the Government has sought the Authority's recommendations on the recommendations /comments of the Second Committee along with other issues indicated in ¶3.

Need for spectrum review

10. Spectrum management is one of the most critical issues in deciding the future of telecommunication in the country. The last decade has witnessed an unprecedented growth of wireless subscribers. The number of mobile subscribers worldwide has crossed 4.3 billion. In India too, the growth is mostly being registered in the wireless segment and at the end of August 2009, the total wireless subscriber base has crossed the figure of 456 million. **Figure 1** shows the growth of total wire-line

⁴ <http://www.trai.gov.in/WriteReadData/trai/upload/misc/117/FinalReportSpectrumCommittee.pdf>

and wireless subscriber base since 1997. With the present growth rate, the overall wireless subscriber base is expected to cross 1 billion by 2014. However, to sustain this growth rate with the desired quality of service, availability of adequate amount of spectrum is essential.

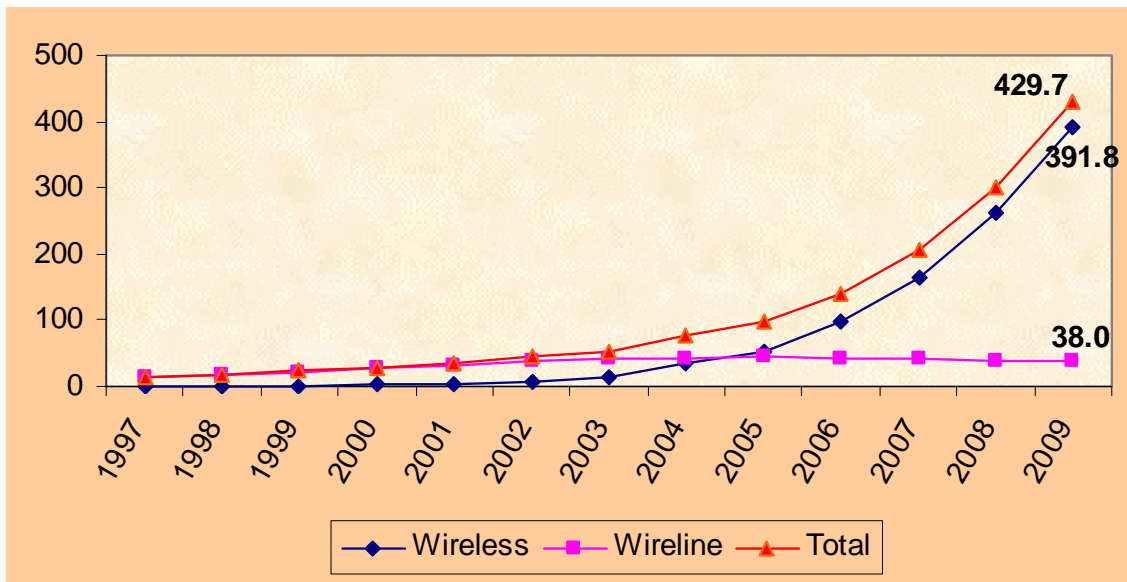


Figure 1: Wireline and Wireless Telecom subscriber base

11. Presently, the total number of CMTS/UAS licences in a service area ranges from 12 to 14 and the total number of pending UASL applications in a service area ranges from 13 to 19. The introduction of 3G and broadband wireless services will further increase the number of spectrum users, and given that wireless communication is supporting the fast growing Indian market, it is but logical to expect that spectrum will only continue to be sought after to a greater degree.
12. Given these changes in the market and the increasing number of users of spectrum, it is essential that the spectrum management regime should be able to handle the increasing growth of subscribers in a fair and equitable manner. It is important to

ensure a level-playing field, while encouraging competition amongst those seeking to access this resource.

13. It is obvious that market developments necessitate a review of spectrum management policy. Secondly, like any natural resource, spectrum is now, more than ever, a highly contested for and valuable input for a variety of economic activities. Consequently, it is important to revisit the present framework of management of spectrum, treating it as a valuable natural resource for which there is increasing competition.
14. In order to address all the above mentioned issues in a holistic manner so as to harmonize the various policies concerning the radio spectrum management in the country and to ensure that the new radio spectrum management framework is able to take care of the present and future demand between different technologies and the users in an equitable and transparent manner, the Authority has decided to consult the stakeholders on all the issues brought forth in preceding ¶2 and ¶3. In this consultation paper requirement of spectrum for the next five years has been discussed.
15. The main issues for deliberation include spectrum related issues which include identification of spectrum bands for commercial usage, assessment of demand for spectrum and its availability, ensuring efficient utilization of available spectrum, policy for refarming of spectrum, spectrum allocation mechanisms including provision for in building coverage, spectrum pricing, spectrum trading & spectrum sharing. Licensing related issues include need for limiting the number of access service providers in a service area, De-linking spectrum from license, Terms and conditions of existing UAS/CMTS license for extending validity of these licenses perpetually or otherwise. Spectrum consolidation methods including M&A, spectrum trading/sharing, technological advance, etc.

16. In addition, suggestions of stakeholders are also invited on any other related issues not explicitly covered in this consultation paper.

17. In this consultation paper Chapter 1 covers issues related to spectrum requirement and its availability in various commercial bands for 2G/3G/BWA services. Chapter 2 covers issues related to licensing including Merger/Acquisition and trading & sharing of spectrum. Chapter 3 discusses issues related to spectrum allocation, assignment and pricing for 2G bands. Chapter 4 gives the summary of the issues for consultation.

CHAPTER 1: SPECTRUM REQUIREMENT AND AVAILABILITY

Identification of spectrum bands

- 1.1 Each administration responsible for managing spectrum develops a National Frequency Allocation Plan (NFAP) based on the inputs received from user organizations viz. Industry, manufacturers, service providers and other concerned. The inputs/requirements of the stakeholders are examined and then codified within the frame work of Radio Regulations of ITU w.r.t. availability of equipments and requirements of emerging applications and technology. This document forms the basis for the spectrum utilization activities in the country.
- 1.2 In India, the Wireless Planning & Coordination (WPC) wing of the Ministry of Communications was created in 1952 as the National Radio Regulatory Authority responsible for Frequency Spectrum Management, including licensing. In line with New Telecom Policy, 1999 (NTP'99), the National Frequency Allocation Plan 2000 (NFAP-2000) was evolved. It was reviewed and revised in 2002 in line with the decisions taken in the WRC-2000 and also taking into consideration the requirements of various stakeholders. The existing NFAP-2008, which came into effect from 1.4.2009, has also been evolved in line with the over all frame work of ITU, taking into account spectrum requirements of government as well as private sector and national priorities.
- 1.3 Earlier, the bands identified for IMT 2000 in WARC-92/WRC-2000 included 1885-2025 MHz, 2110-2200 MHz, 2500-2690 MHz, 806-960 MHz and 1710-1885 MHz band. However, in WRC 2007, some additional frequencies were identified for IMT.
- 1.4 The different spectrum bands identified for various wireless telecom services in India by WPC, include the following:

Frequency bands ⁵	
450 MHz	450.5-457.5 MHz paired with 460.5-467.5 MHz ⁶
585 – 806 MHz ⁷	
800 MHz	824-844 paired with 869-889 MHz
900MHz	890-915 paired with 935-960 MHz ⁸
1800MHz	1710-1785 paired with 1805-1880 MHz
1785-1805 MHz ⁹	
1880-1900 MHz ¹⁰	
1900MHz	1900-1910 MHz paired with 1980-1990 ¹¹
2010-2025 MHz ¹²	
2.1 GHz	1920-1980 paired with 2110-2170 MHz
2.3-2.4 GHz ¹³	
2.5-2.69 GHz ¹⁴	

⁵ Footnotes from 5 to 15 are from NFAP 2008

⁶ The requirement of IMT applications in the frequency band 450.5-457.5 MHz paired with 460.5-467.5 MHz may be considered for coordination on a case by case basis subject to its availability.

⁷ In the context of frequency band 585-806MHz, bearing in mind that the band is predominantly for broadcasting services which include mobile TV, requirements of IMT and Broadband Wireless Access (BWA) subject to availability of spectrum in the frequency band 698-806 MHz may be considered for coordination on case by case basis, as appropriate.

⁸ Frequency band 890-902.5MHz paired with 935-947.5MHz has been earmarked for cellular telecom systems. Additional requirements for cellular telecom systems in the frequency band 902.5-915 MHz paired with 947.5-960 MHz may be coordinated on case by case basis. Certain frequency spots in the frequency bands 902.5-915 MHz and 947.5-960 MHz may be considered for train control & mobile train radio systems for specific locations on a case-by-case basis.

⁹ The requirement of cellular telecommunication systems in the frequency band 1785-1805 MHz may be considered for coordination on a case by case basis subject to availability of spectrum in the band and after ensuring compatibility for coexistence with the systems in the frequency bands 1710-1785 MHz paired with 1805-1880 MHz

¹⁰ Requirements of micro cellular wireless access systems (fixed/ mobile) for telecommunication services based on TDD access techniques, especially indigenously developed technologies, capable of coexistence with multiple operators will be considered in the frequency band 1880-1900 MHz on a case by case basis. Additional requirements of micro cellular systems based on TDD access techniques, especially indigenously developed technologies, capable of coexistence with multiple operators in the frequency band 1900-1910 MHz may be progressively considered on a case-by- case basis

¹¹ 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.

¹² Requirements of IMT (3G) applications in the frequency bands 1920-1980 MHz paired with 2110-2170 MHz (FDD mode) and 2010-2025 MHz (TDD mode) may be coordinated with existing users depending upon the availability, as far as possible.

¹³ The requirement of IMT applications including Broad Band Wireless Access (BWA) in the frequency band 2300-2400 MHz may be considered for coordination on a case by case basis

¹⁴ INSAT system uses the frequency band 2535-2655 MHz for Radio Networking, cyclone warning dissemination system, meteorological data dissemination, satellite time frequency dissemination and digital multi media applications (BSS). Requirements of IMT applications including Broadband Wireless Access (BWA) may be considered for coordination on a case by case basis in this band.

3.3-3.4 GHz ¹⁵
3.4-3.6 GHz ¹⁶

Table 1

In addition the spectrum bands of 2.4-2.4835 GHz, 5.15-5.35 GHz & 5.725-5.875 GHz have been declared as unlicensed spectrum bands.

Assessment of demand for spectrum and its availability

- 1.5 The country has witnessed an exponential growth of wireless services in the last decade. Proper policy and regulatory framework has led to such explosive growth. As mentioned in para 10 of Introduction, with the present growth rate, the overall wireless subscriber base is expected to cross 1 billion by 2014. However, to sustain this growth rate it is essential to ensure availability of adequate spectrum for wireless services. The first step in this process would be to assess the spectrum requirement for the future by projecting the mobile subscriber base for the next 5 years.
- 1.6 The Second Committee in its report relied on the S-curve model of growth (Gompertz model) to predict the mobile density and projected the subscriber base until the year 2015 as follows:

<i>Year (ending Dec)</i>	<i>Population (in million)</i>	<i>Estimated Mobile Density (per 100 Population)</i>	<i>Estimated Mobile Subscriber Base (in million)</i>
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¹⁵ Requirements of Broadband Wireless Access (BWA) applications may be considered in the frequency band 3.3 – 3.4 GHz on a case-by-case basis.

¹⁶ The requirement of IMT including Broad Band Wireless Access (BWA) in the frequency band 3400-3600 MHz may be considered for coordination on a case by case basis subject to availability of spectrum in this band and appropriate protection from out of band emission to the networks in the FSS in the frequency band 3600- 4200 MHz.

2008	1,167.70	28.91	337.58
2009	1,184.16	37.15	439.92
2010	1,200.86	46.54	558.88
2011	1,217.79	55.84	680.02
2012	1,233.26	64.69	797.80
2013	1,248.92	72.86	909.96
2014	1,264.78	80.20	1,014.36
2015	1,280.85	86.66	1,109.98

Table 2

In its consultation paper on ‘Determination of port transaction charge, dipping charge and porting charge for Mobile Number Portability’ dated 22nd July 2009, the Authority had also projected the wireless subscriber base till March 2014 based on the CAGR of the previous years. It is given in **Table 3**.

<i>Year Ending (March)</i>	<i>Projected Wireless Subscriber Base (in million)</i>
2007	165
2008	261
2009	392
2010	557
2011	730
2012	888
2013	999
2014	1093

Table 3

1.7 In India, spectrum is allocated service area wise and therefore spectrum requirement needs also should be assessed service area wise. As an initial exercise, the subscriber base till 2014 in Delhi metro service area has been projected with an assumption that in the next 5 years, it will attain a teledensity of more than 150 (**Table 4**). Delhi service area has been chosen because it is a Metro with a very high

population density and the spectrum requirements are expected to be the maximum in this service area.

Sl. No	Service area	Projected subscriber base in 2014 ¹⁷	Projected Population Density in 2014(per sq KM)
1	Delhi & NCR	34.9	16500

Table 4

1.8 Spectrum requirement assessment requires prediction of growth trend for both voice and data services. Today in 800/900/1800 MHz bands mainly voice and low speed data services are being offered. Around 30% of the total mobile subscribers have subscribed to GPRS services, as on June 2009. While pursuant to the auction of 3G and BWA spectrum, data traffic is likely to grow further, it is difficult to predict growth trend of data services at this stage. However, it will be useful to make projections based on certain assumptions in order to get some idea about the likely future spectrum requirement. These projections are based on certain assumptions and the actual subscriber growth and the population density may vary depending upon actual market conditions at that time.

1.9 As discussed subsequently in para 2.5, the requirement for 2G services would be 2X100 MHz (GSM) and 2X37 MHz (CDMA) i.e. 274 MHz. For data services also it can be assumed that by 2014, in a metro like Delhi, at least 50% of the population shall be using the mobile for accessing the internet and other non-voice services. For providing 3G and high speed data services like HSPA etc., at least 2X10 MHz of spectrum will be required by each service provider, in line with the international practice for providing adequate data speed. Thus, a total of at least 100 MHz of spectrum for 5 operators will be required for 3G services till 2014.

¹⁷ **Assumption: 150% teledensity**

- 1.10 Regarding BWA services, if we assume that there will be 5 operators, each requiring 20 MHz of spectrum for providing reasonably high data speed, then, a total of 100 MHz of spectrum will be required till 2014.
- 1.11 Though the LTE is still to be introduced commercially, it is expected that in next one year, a number of networks will be LTE compatible. Therefore, it can be presumed that by 2014, India will also have operators providing LTE to the subscribers. In addition, the next 1-2 years will also see the introduction of Mobile TV and Terrestrial Digital TV. As discussed subsequently, 700 MHz band is the targeted band for the broadcasting. For LTE too the operators worldwide prefer to use this band. Therefore, to provide both broadcasting and the LTE, 108 MHz of spectrum, available in this band may be required.
- 1.12 From above, it is observed that a total of 582 MHz (approx) of spectrum in various bands will be required to be made available for mobile and broadband wireless services in next 5 years. These are just indicative figures and the actual spectrum requirements may be different depending upon market conditions at that time.
- 1.13 The band wise allocation and spectrum availability situation for various bands useful for commercial services is discussed in the following paragraphs.

450 MHz band

- 1.15 As per the information available with the Authority, spectrum in this band is used by Government agencies, and the same is not available for commercial wireless services, as of now.
- 1.16 NFAP 2008 mentions that the requirement of IMT applications in the frequency band 450.5-457.5 MHz paired with 460.5-467.5 MHz may be considered for coordination on a case by case basis subject to its availability. As per the 3G Guidelines, spectrum shall be auctioned in this band when it becomes available.

700 MHz band

1.17 Due to better propagation characteristics, the 700 MHz is a target resource for rural broadband wireless access worldwide. It reduces capital expenditure, which makes deployments especially in rural or high-cost regions economically viable. It is claimed that LTE network in 700 MHz would be 70% cheaper to deploy than an LTE network in the 2.1 GHz band¹⁸. The different uses/users of the band include Wireless broadband, Digital terrestrial television, High definition TV, Mobile television & Data broadcasting.

1.18 As per WRC-07, spectrum in the band 698-806 MHz (700 MHz band) has been identified for IMT services for India. Unlike a number of other countries, where this band was earlier used for the transmission of analogue broadcasting, in India, this band is largely unused. As per the available information, though, frequency earmarking has been done in favor of Doordarshan to operate Digital Transmitters in four Metros, however, they have yet to launch commercial services. Government agencies and BSNL are operating some point to point microwave links in 610-806 MHz.

800 MHz band

1.19 In 800 MHz band a total spectrum of 2X20 MHz is available for commercial services.

900 MHz Band

1.20 In the 900 MHz band, a total of 2X25 MHz is available for wireless services. Government agencies currently have an allocation of 2X6.4 MHz in the GSM 900 MHz band. However, in the Delhi and Mumbai service areas, a portion of this spectrum has already been made available for commercial GSM usage.

1800 MHz band

1.21 In 1800 MHz band, a total of 2X75 MHz is available for wireless services. However, the actual available spectrum in this band for commercial services varies

¹⁸ Source: GSMA

from service areas to service area. Information pertaining to spectrum availability in 900 and 1800 MHz band is provided in Annex A3-1 of the Second Committee's report and rest of the spectrum in 1800 MHz band is being used by Government agencies.

1900 MHz band

1.22 A total of 2X10 MHz is available in this band for commercial services subject to sorting out of interference related issues with GSM/WCDMA services.

1.23 As per the 3G Guidelines, spectrum shall be auctioned in 1900 MHz band (1900 – 1910 paired with 1980-1990 MHz) when it becomes available.

2.1 GHz band

1.24 As per 3G guidelines spectrum shall be auctioned in this band for 3G telecom services in blocks of 2x5 MHz. The number of blocks to be auctioned may vary from 0 to 5 subject to availability in different telecom service areas. Most of the remaining spectrum in this band is being used by Government agencies.

2.3-2.4 GHz band

1.25 A number of captive users like State electricity boards, power utilities, oil companies, the railways and security organizations have deployed microwave links in this band. As per Guidelines for auction and allotment of Spectrum for BWA Services a total of 40 MHz shall be auctioned in this band.

2.5-2.69 GHz band

- 1.26 The status of existing assignments in this band in India are as follows:
- 2.500-2.520 GHz paired with 2.670-2.690 GHz is being used for mobile satellite service (MSS),
 - 2.520-2.535 GHz paired with 2.655-2.670 GHz is proposed for MSS,

- 2.535-2.550 GHz and 2.630-2.655 GHz are being used for Local Multichannel Distribution system (LMDS) and Microwave Multichannel Distribution System (MMDS) applications, and
- 2.550-2.630 GHz is being used for broadcasting satellite service (BSS) in India by Government agencies.

NFAP 2008 mentions that

“INSAT system uses the frequency band 2535-2655 MHz, for Radio Networking, cyclone warning dissemination system, meteorological data dissemination, satellite time frequency dissemination and digital multi media applications (BSS). Requirements of IMT applications including Broadband Wireless Access (BWA) may be considered for coordination on a case by case basis in this band.”

- 1.27 As per Guidelines for auction and allotment of Spectrum for BWA Services a total of 40 MHz shall be auctioned in this band.

3.3-3.4 GHz

- 1.28 As per the information available with the Authority, this band of 100 MHz has been already assigned to seven ISPs in FDD mode.

3.4-3.6 GHz

- 1.29 The lower extended C band from 3.4 to 3.7 GHz is currently being used for television reception.

- 1.30 The total spectrum allocation versus availability situation in India is summarized in **Table 5.**

Spectrum available for Telecom Service Providers in different frequency bands							
S.No.	Frequency Band (in MHz)	Total available spectrum in the Band (in MHz)	Telecom	Spectrum currently available (in MHz) with		Likely additional available for Telecom by 2014	Total available for Telecom by 2014
				Govt. Agencies	Commercial		
1	450-470	20	-	8-9	11-12 (State Police, Security Organisations, Captive Users)		
2	698-806	108	-	24-48	36 (Others)		
3	806-824	18	-	-	18 (CMRTS & PMRTS)		
4	824-844	20	20	2.5 (only in Jammu)	-		20
5	869-889	20	20	2.5 (only in Jammu)	-		20
6	890-915	25	18.6-21.8	1.2-6.4	-		18.6-21.8
7	935-960	25	18.6-21.8	1.2-6.4	-		18.6-21.8
8	1710-1785	75	35-75	0-40	-	20	55-75
9	1785-1805	20	-	20	-	-	-
10	1805-1880	75	35-75	0-40	-	20	55-75
11	1880-1900	20	0-20 (after coordination)	0-20	-	-	0-20 (after coordination)
12	1900-1910	10	-	10	-	-	-
13	1920-1980	60	0-60	0-60	-	25	60-25
14	2010-2025	15					
15	2110-2170	60	60	-	-	-	60
16	2300-2400	100	40	24	36 (other)	20	60
17	2500-2690	190	40	150	-	-	40
18	3300-3400	100	100 (ISPs)	-	-	-	100 (ISPs)
19	3400-3600	200	-	200	-	-	-
	Total	1161	287.2-453.6			85	

Table 5

1.31 As per the above table, out of 1161MHz of identified spectrum, a minimum of 287 MHz and a maximum of 454 MHz (approx.) only is presently available for commercial usage. From the projections made in the pre paras, it is observed that a total of 582 MHz (approx.) of spectrum will be required for mobile and broadband wireless services till 2014. It is reiterated that these are just indicative figures based on certain assumptions and the actual spectrum requirements may be different depending upon market conditions at the relevant period.

Spectrum reforming

1.32 As is evident from Table 5, most of the spectrum useful for mobile services is used by incumbent users and vacation/refarming efforts need to be reinforced. With

increased pace of competing commercial demands for spectrum access, the incumbents including Government agencies are expressing difficulty in vacating the spectrum. It is imperative to ensure that the needs of security and development are both taken into consideration, which calls for a short and long term plan for refarming of spectrum in different bands after taking into account the requirement of the incumbents.

1.33 The NTP'99 also captured this issue and accordingly states the following:

“Spectrum Management

With the proliferation of new technologies and the growing demand for telecommunication services, the demand on spectrum has increased manifold. It is therefore, essential that spectrum be utilised efficiently, economically, rationally and optimally. There is a need for a transparent process of allocation of frequency spectrum for use by a service and making it available to various users under specific conditions.”

“Relocation of existing Spectrum and Compensation:

- *Considering the growing need of spectrum for communication services, there is a need to make adequate spectrum available.*
- *Appropriate frequency bands have historically been assigned to defence & others and efforts would be made towards relocating them so as to have optimal utilisation of spectrum. Compensation for relocation may be provided out of spectrum fee and revenue share levied by Government.*
- *There is a need to review the spectrum allocations in a planned manner so that required frequency bands available to the service providers.”*

There is a need to have a transparent process of allocation of frequency spectrum which is effective and efficient. This would be examined further in the light of ITU guidelines.”

- 1.34 Refarming may be seen as process constituting any basic change in conditions of frequency usage in a given part of radio spectrum. Such basic changes might be:
- Change of technical conditions for frequency assignments;
 - Change of application (particular radio communication system using the band);
 - Change of allocation to a different radio communication service.

ITU Definition of Spectrum Refarming:

- 1.35 The growing demand for spectrum refarming has led to the development within the ITU of a comprehensive Recommendation, ITU-R SM.1603, “Spectrum redeployment as a method of national spectrum management”.

ITU-R SM.1603 states: *“Spectrum redeployment (spectrum refarming) is a combination of administrative, financial and technical measures aimed at removing users or equipment of the existing frequency assignments either completely or partially from a particular frequency band. The frequency band may then be allocated to the same or different service(s). These measures may be implemented in short, medium or long time-scales.”*

- 1.36 In the context of growing demand for spectrum, there is a case for optimisation of spectrum allocation between Government agencies for noncommercial applications and for commercial usage. As most of the Government agencies were assigned spectrum at a time when it was available in abundance and its commercial usage was limited, it is necessary to examine whether the spectrum is being used in the most efficient manner. Though transition costs are involved in refarming the spectrum, the likely benefits from shift to new advanced technologies and services are substantial and generally outweigh the costs involved.

In-band services

- 1.37 With more subscribers shifting to high speed UMTS/HSxPA and some of GSM spectrum being freed up, has given rise to much discussion, research and testing concerning the re-use or refarming of GSM spectrum to be used for future UMTS/HSxPA deployments. Operators wishing to introduce WCDMA to their

GSM, CDMA, or TDMA bands can now refarm part or all of their frequencies and roll out 3G at remarkably low cost. Lower frequencies transmit over greater distances and penetrate better indoors. This means fewer sites cover greater areas, saving considerable rollout and operating costs to bring bonafide broadband to rural areas and improved metropolitan indoor locations. There could be added ability to re-use existing site, antenna systems and feeders maximizing returns on legacy assets and resources. Many markets are ready for refarming today; others are poised to follow suit. Due to its better propagation characteristics, the 800 & 900 MHz band are very useful bands for deployment of UMTS networks. It results in saving on capital infrastructure as fewer base stations are required.

1.38 It is claimed that in these bands, the operators can offer comparable data rates and coverage using 60% fewer sites compared to a 2 GHz network build. Furthermore, operators can re-use significant elements of their GSM infrastructure – including antennas and network management systems. In 2006, CEPT-ECC (Electronic Communications Committee) designated the 900 MHz (and 1800 MHz) bands for the deployment of UMTS. Based on the decisions of individual administrations, mobile operators can thus decide when to deploy UMTS in GSM 900 MHz band in line with their business plans. A growing number of mobile operators are already deploying UMTS/HSPA services alongside their exiting GSM networks operating in the 900 MHz band. Seven operators in Australia, Estonia, Finland, Iceland, and Thailand are already running commercial UMTS/HSPA networks in this band. France and Italy have also published national decisions allowing the deployment of UMTS in the GSM900 frequency band in 2007¹⁹.

1.39 Recent developments have added an additional dimension of consideration for both the regulators and the operators. When UMTS900 was initially contemplated several years ago, LTE was still a long way from being a commercial reality, but this is no longer the case. It is claimed that the network equipment for LTE is likely to be available from 2009-2010 and subject to demand from mobile operators for

¹⁹ Source: UMTS forum website

rural roll out and regulatory framework in place, LTE 900 data devices could be in the market by 2010–11.

1.40 Recently in July 2009, the European Parliament approved a proposal from the European Commission to modify the legislation – the GSM Directive – on the use of the radio spectrum needed for mobile services. The GSM Directive of 1987 reserved the use of part of the 900MHz spectrum band to GSM access technologies such as mobile phones. The updated Directive now allows the 900 MHz frequency band to be used to provide faster, pan-European services such as mobile internet while ensuring the continuation of GSM services. Industry savings of up to €1.6 billion are expected from the reform of the GSM Directive. The renewed Directive will enter into force in October, this year.

1.41 Similarly, in the 800 MHz band, the operators can provide CDMA 1X services and also EVDO i.e. high data services. In our present licensing regime, initial spectrum in 800, 900 and 1800 MHz is bundled with the licence and the additional spectrum is given based on the subscriber linked criteria. The spectrum in the 800 MHz band is with the CDMA operators while the spectrum in the 900 MHz band has been assigned in each service area to the first three Access service licensees. The later licensees were assigned spectrum in the 1800 MHz band which requires more CAPEX for rolling out the similar network. The issue for consideration is in view of our policy of technology and service neutrality licences, should any restriction be placed on these bands for providing a specific service and secondly, after the expiry of present licences, how will the spectrum in the 900 MHz band be assigned to the operators?

Digital Dividend

1.42 A number of countries, where 700 MHz band is used for analogue broadcasting, are planning to switch to the digital broadcasting and freeing a large portion of the band for other services as Digital broadcasting is claimed to be roughly six times more efficient than analogue, allowing more channels to be carried across fewer

- airwaves. Therefore, plans for digital switchover will allow for an increase in the efficiency. The cleared spectrum – the Digital Dividend²⁰ – offers real opportunities for wireless innovation.
- 1.43 In the developed world, governments are looking to mobile broadband networks to increase Internet penetration. The US acted on this opportunity recently, with the allocation of the Digital Dividend for more use and the EU has established a fund to support broadband development, in which mobile will play a key role.
- 1.44 The use of digital dividend for a combination of services gives an opportunity to the governments for reaping economic benefits. Many studies have shown that exploitation of the digital dividend for new services is expected to have a positive impact on the economy. UK regulator OfCom has estimated that the allocation of the digital dividend would provide between €7.5 billion and €15 billion over 20 years for the UK economy alone, with the European Commission (EC) estimating that a coordinated approach would increase the potential impact of the digital dividend by an additional €20 billion - €50 billion between now and 2015.
- 1.45 As discussed above, we are in a fortunate position as the Digital dividend band is largely available and can be exploited for providing various services. Since it will be possible to offer high data rate services using the digital dividend spectrum, a clear road map on the availability of digital dividend spectrum may help including in the planning of 3G services.

Issues for consultation

- 1. Do you agree with the subscriber base projections? If not, please provide the reasons for disagreement and your projection estimates along with their basis?**

²⁰ The large amount of spectrum that would be freed up in case of switchover from analogue to digital terrestrial TV is known as the Digital Dividend.

- 2. Do you agree with the spectrum requirement projected in ¶ 1.7 to ¶1.12? Please give your assessment (service-area wise).**
- 3. How can the spectrum required for Telecommunication purposes and currently available with the Government agencies be re-farmed?**
- 4. In view of the policy of technology and service neutrality licences, should any restriction be placed on these bands (800,900 and 1800 MHz) for providing a specific service and secondly, after the expiry of present licences, how will the spectrum in the 800/900 MHz band be assigned to the operators?**
- 5. How and when should spectrum in 700 MHz band be allocated between competitive services?**
- 6. What is the impact of digital dividend on 3G and BWA?**

CHAPTER 2: LICENSING RELATED ISSUES

Defining the number of access service providers in a service area.

- 2.1 Vide its letter dated 22nd July 2009, the Department of Telecommunications has sought the recommendations of this Authority on the policy of no capping on the number of Access Service providers in each service area. (**Annex III**).
- 2.2 It may be recalled that the Authority in its recommendations on “Review of license terms and conditions and capping of number of access providers” dated August 28, 2007, had recommended that “...no cap be placed on the number of access service providers in any service area.” While Government accepted the recommendations of the Authority, there was a sudden spurt in the number of applications for grant of UAS Licenses. This resulted in DoT prescribing a cut-off date for receipt of new UASL applications. In total, 575 applications were received by DoT till the cut-off date. So far, DoT has given 122 new licences out of 232 applications received till 25th September 2007 and the remaining applications are pending. The current reference on limiting the number of Access providers in each service area is in view of such large number of pending applications and non-availability of spectrum.
- 2.3 Before deliberating on the issue, it would be pertinent to look at the quantum of spectrum required by each service provider. While it is undeniable that larger amount of spectrum would enable an operator to realize lower costs, the fact that spectrum is a scarce resource imposes an obligation on all service providers to utilize the spectrum in the most efficient manner. The Second Committee has dealt with the spectrum requirements in its Report.
- 2.4 An eminent technical expert has argued that 2x8 MHz is sufficient for an operator (i) to deploy a 2G network with reasonable levels of spectrum efficiency, and (ii) to satisfy the subscriber needs in the densest areas. Lower allotments leads to

substantial loss in spectrum efficiency. The capacity (in Erlangs per BTS or site) per MHz is quite high even for 2x8 MHz, while being rather poor for 2x6.2 MHz and lower. Thus, it does not pay to have a very large number of operators with less than 2x6.2MHz spectrum each. An inter-site distance of 350 m, or cell radius of 200m, gives around 10 sites per sq. km per network. Since 2x8 MHz gives 65E per site, we obtain a capacity of 650E per sq. km per network. Even assuming a traffic level of 0.1E per sq. km, on par with landlines, it can support 6500 subscribers per sq. km. per operator, which given the multiple number of operators, is sufficient to meet the requirements of India's metros. The above figure may not include capacity improvements due to some technology innovations that are already available on the ground. These innovations take time to penetrate, and it is therefore conservative to leave them out of a baseline calculation. However, they can be expected to provide further increase in capacity. The above calculation does provide for a certain level of deviation in practice from theoretical calculations.

2.5 The expert has also indicated that for GSM service the minimum spectrum requirement would be about 2X75 to 2X100 MHz. Regarding CDMA services additional spectrum of 2x7 MHz in 450 MHz band and 2X10 MHz in 1900 MHz band i.e. a total of 34 MHz may be required so as to cater to the increased subscriber base and data traffic. There is a case for increasing the availability in the dense urban areas, and spectrum availability varies between 75 and 100 MHz across the country.

2.6 We now look at the present position of number of Licensees in each service area, number of pending application and the amount of spectrum already assigned (Table 6). As discussed earlier, presently, there is only one Licence called UASL which permits the Licensee to provide Basic and /or Cellular Services using any technology in a defined service area. The initial start-up spectrum in the bands 800/900/1800 MHz comes bundled with the UAS License. As the spectrum available in these bands is limited, it needs to be examined if the available spectrum

is sufficient to cater to the requirement of the existing operators and also for assigning to new licensees including, the pending applications.

S.No.	Service Area	Number of Licensed Access Providers	Number of Pending Applications	Assigned Spectrum	
				GSM (900/1800)	CDMA (800)
1	Delhi*	13	16	53.6	15.00
2	Mumbai	12	16	72.6	15.00
3	Kolkata	11	14	60.4	13.75
4	Maharashtra	13	16	69.4	15.00
5	GUJ	12	17	60.4	12.50
6	AP	13	16	69.4	15.00
7	KTK	13	15	69.4	15.00
8	TN	4			
	Chennai	4		31.0	6.25
	TN + Chennai	8	16	67.0	12.50
9	Kerala	12	16	61.2	15.00
10	Punjab	13	16	63.2	15.00
11	Haryana	13	17	63.8	12.50
12	UP-W	12	19	61.2	13.75
13	UP-E	12	17	62.4	13.75
14	Raj	12	19	63.8	15.00
15	MP	12	16	63.0	12.50
16	WB&A&N	11	14	53.0	11.25
17	HP	12	13	57.6	10.00
18	Bihar	13	13	66.8	13.75
19	Orissa	12	16	59.4	11.25
20	Assam	12	13	55.0	10.00
21	NE	12	13	53.2	10.00
22	J&K	12	13	49.4	10.00
		273	341		

* In Delhi service 5 number of operators have not yet received spectrum

Table 6

2.7 For ascertaining the sufficiency of the spectrum, we are examining the situation in three service areas viz. Delhi, Maharashtra and Bihar, each representing a different category of service area i.e. Metro, Category ‘A’ and Category ‘C’ service area respectively.

2.8 In its earlier recommendations in its report dated 27th October, 2007 TRAI had indicated certain levels of subscribers to be enrolled before a service provider became eligible for additional spectrum. TEC had also examined this issue and suggested a different set of figures. The figures suggested by TRAI as well as TEC are given in table-7 in below.

S.No.	Service Area	4.4+4.4 MHz			6.2+6.2 MHz			8+8 MHz			10+10 MHz			12.4+12.4 MHz		
		Existing criteria	TEC	TRAI	Existing criteria	TEC	TRAI	Existing criteria	TEC	TRAI	Existing criteria	TEC	TRAI	Existing criteria	TEC	TRAI
1	Delhi	3	6	5	6	19	15	10	34	20	16	48	30	21	63	50
2	Mumbai	3	7	5	6	23	15	10	41	20	16	58	30	21	75	50
3	Chennai	2	5	5	4	17	15	6	31	20	10	43	30	13	56	50
4	Kolkata	2	6	5	4	20	15	6	36	20	10	50	30	13	65	50
5	MH	4	14	8	8	42	30	14	74	50	20	105	80	26	136	100
6	GUJ	4	12	8	8	39	30	14	68	50	20	96	80	26	124	100
7	AP	4	13	8	8	42	30	14	73	50	20	103	80	26	133	100
8	KTK	4	9	8	8	30	30	14	52	50	20	73	80	26	95	100
9	TN	4	11	8	8	36	30	14	64	50	20	90	80	26	116	100
10	Kerala	3	8	8	6	25	30	10	44	50	16	62	80	21	80	100
11	Punjab	3	8	8	6	25	30	10	45	50	16	63	80	21	82	100
12	Haryana	3	4	8	6	12	30	10	21	50	16	30	80	21	39	100
13	UP-W	3	10	8	6	32	30	10	57	50	16	80	80	21	104	100
14	UP-E	3	13	8	6	41	30	10	72	50	16	101	80	21	130	100
15	Raj	3	10	8	6	32	30	10	56	50	16	79	80	21	102	100
16	MP	3	13	8	6	39	30	10	69	50	16	97	80	21	126	100
17	WB&A&N	3	10	8	6	31	30	10	54	50	16	77	80	21	99	100
18	HP	2	2	6	4	7	20	6	12	40	9	17	60	12	22	80
19	Bihar	2	12	6	4	36	20	6	64	40	9	90	60	12	116	80
20	Orissa	2	10	6	4	31	20	6	55	40	9	77	60	12	100	80
21	Assam	2	10	6	4	33	20	6	58	40	9	81	60	12	105	80
22	NE	2	6	6	4	19	20	6	34	40	9	48	60	12	63	80
23	J&K	2	2	6	4	7	20	6	13	40	9	19	60	12	25	80

Table 7

2.9 The total spectrum earmarked for 2G (primarily voice service) cellular services is 2x100 MHz (in 900/1800 MHz band) and 2X20 MHz (in 800 MHz band) for GSM and CDMA technologies respectively. Out of this, the spectrum assigned across the country to the service providers is as shown in Table 6. As indicated in ¶2.4 above, it is argued by some that 2x8 MHz is sufficient for (i) an operator to deploy a 2G network with reasonable levels of spectrum efficiency, and (ii) to meet the subscriber needs in the densest areas.

Spectrum Requirement												
Service Area (1)		Mobile Operators (2)	Spectrum Allotted (in MHz)		Spectrum Availability (in MHz)		HHI as on June 2009 (7)	Additional Spectrum Required		Additional Spectrum Required - presently available		
			GSM (3)	CDMA (4)	GSM (5)	CDMA (6)		GSM (8)	CDMA (9)	GSM (8-5)	CDMA (9-6)	
Delhi	1	Bharti	10.0		3.6	2.5	0.18			47.2	2.5	
	2	Vodafone	10.0									
	3	MTNL	12.4	2.50					2.5			
	4	Idea	8.0									
	5	Aircel Ltd	4.4						3.6			
	6	Etisalat DB	4.4						3.6			
	7	Datacom	NA						8			
	8	Loop	NA						8			
	9	Unitech	NA						8			
	10	Spice	NA						8			
	11	Reliance	4.4	5.00					3.6			
	12	Tata Teleservices*	NA	5.00					8			
	13	Sistema Shyam		2.50					2.5			
		53.6	15.00		50.8	5						
MH	1	Vodafone	6.2		-	1.25	0.17			30.6	3.75	
	2	Idea	9.8									
	3	BSNL	10.0	2.50					2.5			
	4	Bharti	8.2									
	5	Aircel	4.4						3.6			
	6	Datacom	4.4						3.6			
	7	Etisalat DB	4.4						3.6			
	8	Unitech	4.4						3.6			
	9	Spice	4.4						3.6			
	10	Loop	4.4						3.6			
	11	Reliance	4.4	5.00					3.6			
	12	Tata Teleservices	4.4	5.00					3.6			
	13	Sistema Shyam		2.50					2.5			
		69.4	15.0		30.6	5						
Bihar	1	Reliance	8.0	5.00	4.4	3.75	0.19			28	2.5	
	2	BSNL	10.0	2.50					2.5			
	3	Bharti	9.2									
	4	Dishnet Wireless	4.4						3.6			
	5	Vodafone	4.4						3.6			
	6	Idea	4.4						3.6			
	7	Datacom	4.4						3.6			
	8	Unitech	4.4						3.6			
	9	S Tel	4.4						3.6			
	10	Loop	4.4						3.6			
	11	Allianz	4.4						3.6			
	12	Tata Teleservices	4.4	3.75					3.6			1.25
	13	Sistema Shyam		2.50								2.5
		66.8	13.75		32.4	6.25						

Note :- Operators with Bold have not started their services. Operators in Italics have not started services for. GSM operations. NA = Not allocated

Table 8

2.10 With the above assumption, now let us examine the present situation in the three service areas mentioned above. Table 8 gives the number of service providers in these service areas along with their present spectrum assignment.

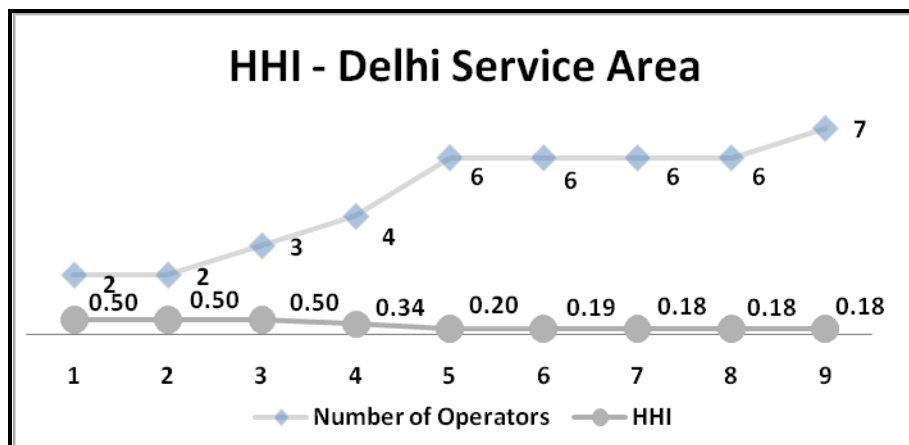
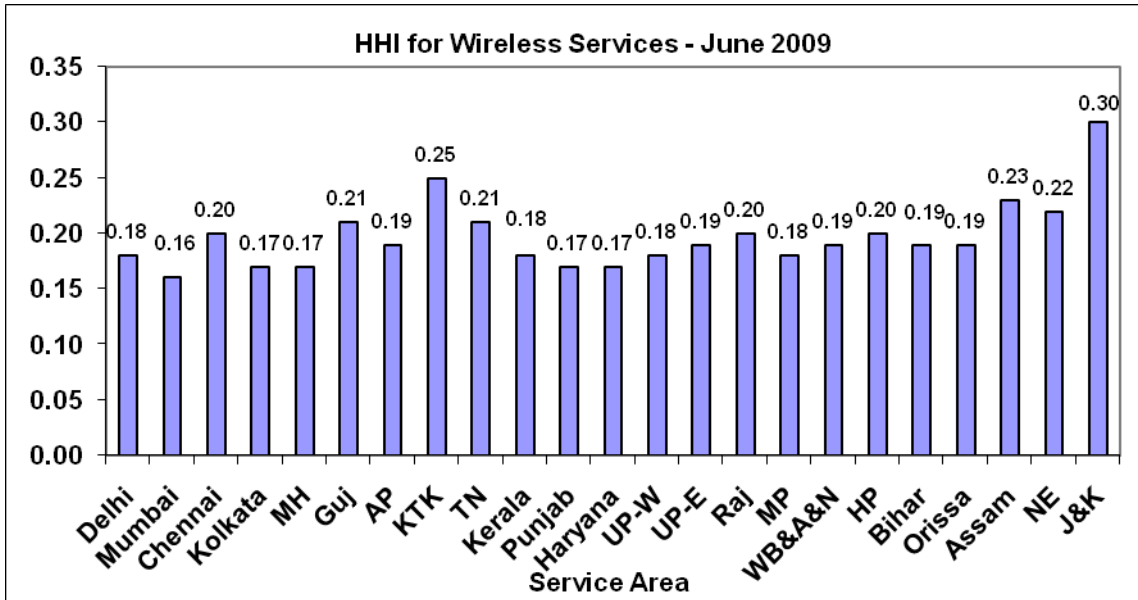
2.11 As mentioned in pre paras, the total spectrum availability for 2G (primarily voice service) cellular services is 2x100 MHz (in 900/1800 MHz band) and 2X20 MHz (in 800 MHz band) for GSM and CDMA technologies respectively. In Delhi service area, presently there are 13 mobile operators. A total of 2X 53.6 spectrum in 900/1800 MHz bands has already been allocated to GSM operators and 5 operators have yet to be allocated initial start up spectrum of 2X4.4 MHz. Presuming an

average assignment of 2X8 MHz per GSM operator, an additional spectrum of 2x50.8 MHz spectrum will be required for GSM mobile services in Delhi. This would make the total requirement of spectrum in 900/1800 MHz as 104.4 MHz. which is more than the total earmarked spectrum. As indicated in Table 8, only 2x3.6 MHz spectrum is presently available in Delhi service area. Similarly for CDMA services presently 2x15 MHz of spectrum has been assigned. If it is assumed that a total of at least 2x5 MHz shall be allocated to each CDMA mobile operator then an additional of 2x5 MHz is required to be made available for CDMA mobile services in Delhi. Only 2x2.5 MHz spectrum is available for CDMA services in Delhi service area.

2.12 On similar assumptions a total of 2x30.6 MHz in Maharashtra (MH) and 2x32.4 MHz spectrum in Bihar is required to be made available for GSM mobile services and a total of 2x5 MHz in MH and 2x6.25 MHz, in Bihar is required to be made available for CDMA services. Presently no additional GSM spectrum is available in MH service area and only 2x4.4 MHz of GSM spectrum is available in Bihar service area. If the assigned spectrum and the additional required in these is added then the total requirement comes to 100 MHz and 99.2 MHz for MH and Bihar service areas respectively. In case of CDMA services only 2x1.25 MHz spectrum is available for CDMA services in MH service area and 2x3.75 of CDMA spectrum is available in Bihar service area.

2.13 Hirschman-Herfindahl Index (HHI) is based on the total number and size distribution of firms in an industry. It is computed as the sum of the squares of the market shares of all firms in the industry. The HHI ranges from 0 in a market with many very small firms, to 1 in a pure monopoly. HHI takes into account the relative size and distribution of the firms in a market. HHI increases both as the number of firms in the market decreases and as the disparity in size between those firms increases. From economic efficiency point of view, the HHI, which is a commonly accepted measure of market concentration, of the four circles (Delhi, Maharashtra, Kerala and Himachal) is studied for the assessment of the number of service

providers required in these service areas. The HHI graphs for the different service areas as at the end of QE June 09 and the graphs for the HHI vs. number of operators for four service areas (Metro, 'A', 'B' and 'C' circles) are given below:-



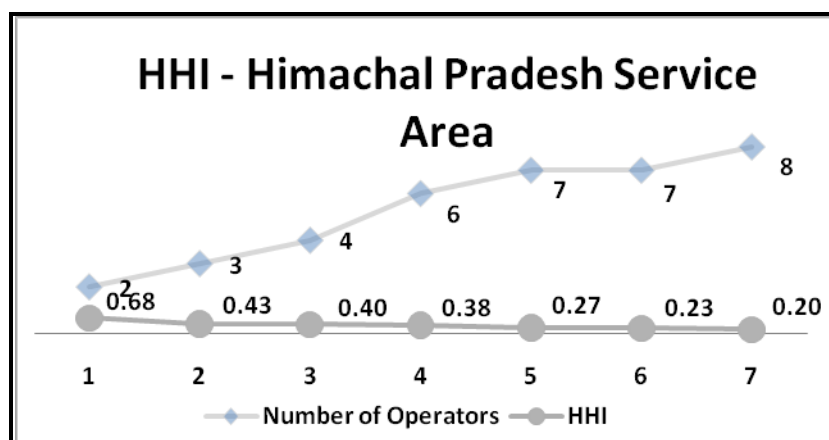
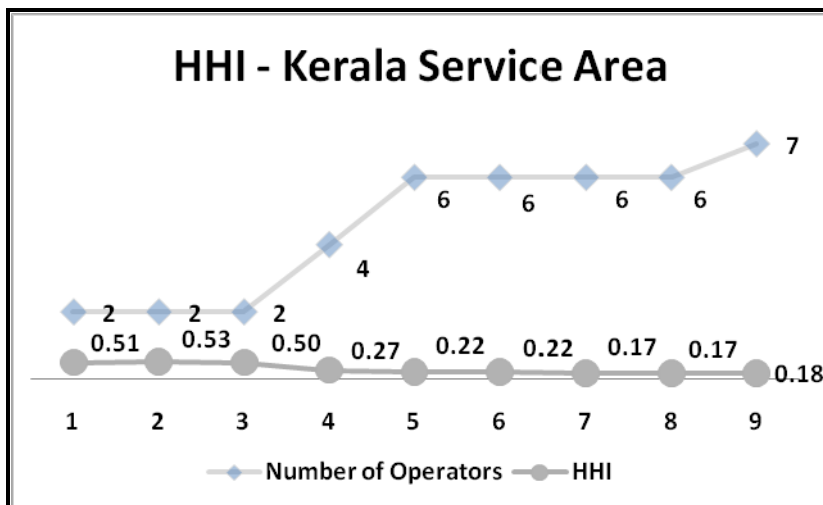
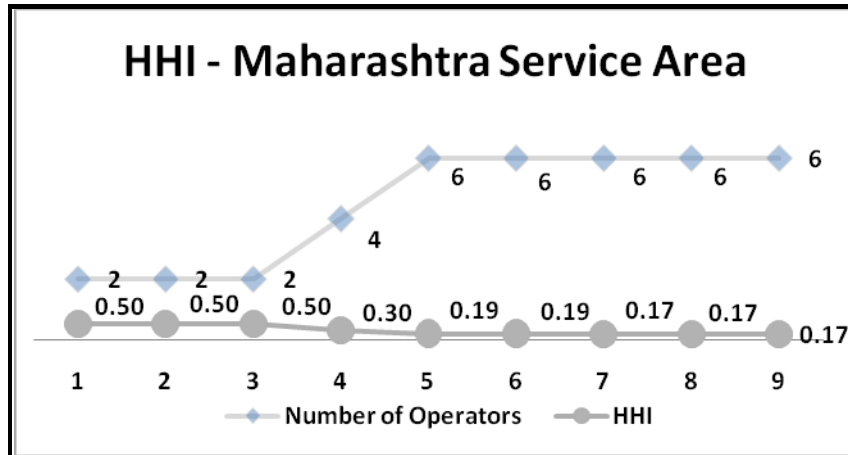


Figure 2:- HHI graph of Delhi, Maharashtra, Kerala & Himachal Pradesh service areas

- 2.14 It can be seen from the above figures that beyond six service providers, there is no significant change in the HHI number. It is therefore for consideration whether the number of operators in a service area should be limited and if so what should be the number. A related issue is the minimum number of operators required in each area to ensure an effective competition. From several studies, this figure is seen to be four. Thus it is for discussion if each service area should have a limited number of operators, so that each of them can get adequate spectrum to meet their business needs.
- 2.15 Since spectrum is a scarce resource, it will be desirable that all service providers have equitable spectrum distribution as far as possible and effective market competition exists. The important issue would be to determine total cap on spectrum holding by each entity. Should such spectrum cap consider only 2G spectrum band or it may also include 3G and BWA spectrum bands?
- 2.16 From the above discussions, it can be argued that as the spectrum in 800, 900 and 1800 MHz bands is not even sufficient to cater to the present licensees, even if the entire 100 MHz of spectrum in the 900/1800 MHz band and 20 MHz in the 800 MHz band is earmarked for assignment. Therefore under the present licensing regime, where 2G spectrum is bundled with the UASL, it may not be possible to entertain any new applicants for the licence.
- 2.17 It can be argued that because of the bundling of spectrum with the UAS License, the issue of limiting the number of access providers is directly linked with the availability of 2G spectrum. In case the 2G spectrum is delinked from the license then perhaps the issue of having a cap on the number of access provider may not be relevant.
- 2.18 This may also be relevant in the context of auction for the spectrum for 3G and BWA services, because as per the DoT guidelines on 3G

“Any person

(i) who holds a UAS/CMTS licence; or

(ii) (a) who has previous experience of running 3G Telecom Services; and

(b) gives an undertaking to obtain Unified Access Services Licence (UASL) as per Department of Telecommunications guidelines dated 14.12.2005 before starting telecom operations can bid for 3G spectrum”

- 2.19 The Second Committee has also commented on this issue at para 3 (h) of chapter II in their report. It must however be noted that the recommendations of the Authority dated 28th August, 2007 on delinking of spectrum from the licensing regime was not accepted by the Government.
- 2.20 In case the Spectrum in the 800, 900 and 1800 bands is delinked from the license then a linked issue will be determination of the entry fee for a UASL. Presently, a pan India UAS License has an entry fee of Rs.1651 crore and as the licence has a provision for some amount of start up spectrum, therefore, it can be argued that the entry fee is a combination of fee for giving license for providing the services in the designated service area and fee for getting a right to the initial spectrum. In case, this spectrum is delinked from the license then probably the amount of entry fee will also need to be reassessed. Similarly, even if the grant of spectrum is linked with the license, the quantum of the Entry fee needs to be deliberated upon.
- 2.21 Another issue that impacts the spectrum assignment is the use of spectrally efficient technologies that permit larger number of subscribers to be served by a specific quantity of spectrum. TRAI and various committees have commented in their report about the importance of using spectrum efficient technologies. Some of the prevalent technologies are: Synthesized frequency hopping (SFH), Tighter Frequency Reuse Plan, Fractional Load Planning (FLP), and Adaptive Multi Rate Codec (AMR). Other techniques that can be used are Antenna Hopping, Multiple layers (underlay/overlay concept) Power control, Deployment of EDGE, Common BCCH functionality, Synchronized Network, Electrical down tilt antenna/reduced

power/cell splitting, Software Features: Dynamic SDCCH allocation, Directed Retry, Handover Power Boost, Interference Rejection Combining, etc. Selection of appropriate technologies and techniques by the operator would depend on density of subscribers, type of traffic, availability of compatible handsets, topography of area being served and the amount of spectrum the service provider has.

2.22 It is necessary that all the service providers employ the latest and advanced spectrum efficient technologies in their networks so as to serve more number of subscribers and provide better quality of service. However presently there is no institutionalised mechanism to ensure the same. One alternative could be that a periodic technical audit of the networks is carried out on a sample basis, especially in dense urban and urban areas.

2.23 The utilization of spectrum in metro, urban and rural areas is not uniform. There are 42 cities in India with a population of more than a million. Of these, there are about 10 cities that have a population of more than 3 million. (Table-9)

Rank	City	Population (2009)	Population (2001)	State/UT
1	<u>Mumbai</u>	13,922,125	11,978,450	<u>Maharashtra</u>
2	<u>Delhi</u>	12,259,230	9,879,172	Delhi
3	<u>Bangalore</u>	5,310,318	4,301,326	<u>Karnataka</u>
4	<u>Kolkata</u>	5,080,519	4,572,876	<u>West Bengal</u>
5	<u>Chennai</u>	4,590,267	4,343,645	<u>Tamil Nadu</u>
6	<u>Hyderabad</u>	4,025,335	3,637,483	<u>Andhra Pradesh</u>
7	<u>Ahmedabad</u>	3,913,793	3,520,085	<u>Gujarat</u>
8	<u>Pune</u>	3,337,481	2,538,473	<u>Maharashtra</u>
9	<u>Surat</u>	3,233,988	2,433,835	<u>Gujarat</u>
10	<u>Kanpur</u>	3,144,267	2,551,337	<u>Uttar Pradesh</u>

11	<u>Jaipur</u>	3,102,808	2,322,575	<u>Rajasthan</u>
12	<u>Lucknow</u>	2,685,528	2,185,927	<u>Uttar Pradesh</u>
13	<u>Nagpur</u>	2,403,239	2,052,066	<u>Maharashtra</u>
14	<u>Patna</u>	1,814,012	1,366,444	<u>Bihar</u>
15	<u>Indore</u>	1,811,513	1,474,968	<u>Madhya Pradesh</u>
16	<u>Bhopal</u>	1,752,244	1,437,354	<u>Madhya Pradesh</u>
17	<u>Thane</u>	1,739,697	1,262,551	<u>Maharashtra</u>
18	<u>Ludhiana</u>	1,701,212	1,398,467	<u>Punjab</u>
19	<u>Agra</u>	1,638,209	1,275,134	<u>Uttar Pradesh</u>
20	<u>Pimpri Chinchwad</u>	1,553,538	1,012,472	<u>Maharashtra</u>
21	<u>Nashik</u>	1,521,675	1,077,236	<u>Maharashtra</u>
22	<u>Vadodara</u>	1,513,758	1,306,227	<u>Gujarat</u>
23	<u>Faridabad</u>	1,464,121	1,055,938	<u>Haryana</u>
24	<u>Ghaziabad</u>	1,437,855	968,256	<u>Uttar Pradesh</u>
25	<u>Rajkot</u>	1,395,026	967,476	<u>Gujarat</u>
26	<u>Meerut</u>	1,365,086	1,068,772	<u>Uttar Pradesh</u>
27	<u>Kalyan-Dombivli</u>	1,327,927	1,193,512	<u>Maharashtra</u>
28	<u>Varanasi</u>	1,200,558	1,091,918	<u>Uttar Pradesh</u>
29	<u>Amritsar</u>	1,194,740	966,862	<u>Punjab</u>
30	<u>Navi Mumbai</u>	1,187,581	704,002	<u>Maharashtra</u>
31	<u>Aurangabad</u>	1,167,649	873,311	<u>Maharashtra</u>
32	<u>Solapur</u>	1,128,884	872,478	<u>Maharashtra</u>
33	<u>Allahabad</u>	1,125,045	975,393	<u>Uttar Pradesh</u>
34	<u>Jabalpur</u>	1,066,965	932,484	<u>Madhya Pradesh</u>
35	<u>Srinagar</u>	1,060,871	898,440	<u>Jammu and Kashmir</u>
36	<u>Visakhapatnam</u>	1,058,151	982,904	<u>Andhra Pradesh</u>

37	<u>Ranchi</u>	1,047,490	847,093	<u>Jharkhand</u>
38	<u>Howrah</u>	1,034,372	1,007,532	<u>West Bengal</u>
39	<u>Chandigarh</u>	1,033,671	808,515	<u>Chandigarh</u>
40	<u>Coimbatore</u>	1,008,274	930,882	<u>Tamil Nadu</u>
41	<u>Mysore</u>	1,007,847	755,379	<u>Karnataka</u>
42	<u>Jodhpur</u>	1,006,652	851,051	<u>Rajasthan</u>

Table 9

- 2.24 It is such cities wherein a service provider needs to invest in several measures to optimally utilize the given spectrum. Typically, it can be said that the cost of getting additional spectrum should be more than that of additional capex so as to make the service provider utilize the spectrum most efficiently. We need to therefore reflect whether it is desirable to have an asymmetric pricing of spectrum in such manner that the higher tranches of spectrum beyond 6.2 MHz are charged (or the base price of such spectrum fixed) at a much higher level than the lower tranches.
- 2.25 At the same time, the service provider needs to recover his investment. If this is charged to the consumers uniformly over the country, the rural consumer pays for the facilities enjoyed by the urban and metropolitan consumer. It needs to be explored whether it would be appropriate for the consumers in the metropolitan areas or even the large cities to pay higher rates for telecom services than those paid by those in the villages. The feasibility and desirability of an asymmetric pricing of services needs to be deliberated upon.
- 2.26 Currently, spectrum is assigned for the service area. A Circle which is the service area is only an administrative unit. Since most service areas have urban areas and rural areas, and since a service provider may require more spectrum in the urban areas, the feasibility of assigning spectrum District-wise could be explored. If this is found to be not feasible, at least can spectrum in Metros and Districts having large cities – those with a population of more than one million- be assigned separately?

Issues for consultation

- Q1. Should the spectrum be delinked from the UAS Licence? Please provide the reasons for your response.**
- Q2. In case it is decided not to delink spectrum from UAS license, then should there be a limit on minimum and maximum number of access service providers in a service area? If yes, what should be the number of operators?**
- Q3. What should be the considerations to determine maximum spectrum per entity?**
- Q4. Is there is a need to put a limit on the maximum spectrum one licensee can hold? If yes, then what should be the limit? Should operators having more than the maximum limit, if determined, be assigned any more spectrum?**
- Q5. If an existing licensee has more spectrum than the specified limit, then how should this spectrum be treated? Should such spectrum be taken back or should it be subjected to higher charging regime?**
- Q6. In the event fresh licences are to be granted, what should be the Entry fee for the license?**
- Q7. In case it is decided that the spectrum is to be delinked from the license then what should be the entry fee for such a Licence and should there be any roll out condition?**
- Q8. Is there a need to do spectrum audit? If it is found in the audit that an operator is not using the spectrum efficiently what is the suggested course of action? Can penalties be imposed?**
- Q9. Can spectrum be assigned based on metro, urban and rural areas separately? If yes, what issues do you foresee in this method?**
- Q10. Since the amount of spectrum and the investment required for its utilisation in metro and large cities is higher than in rural areas, can asymmetric pricing of telecom services be a feasible proposition?**

Consolidation of Spectrum

2.27 As discussed in para 2.11, there is not enough spectrum in the 800/900 and 1800 MHz bands to cater to the requirement of all the Licensees. Therefore, in order to ensure that the present licensees have sufficient spectrum to provide good coverage and quality of service, an easy exit clause is required so as to achieve an optimum number. In this direction, it is proposed to review the Merger and Acquisition norms and explore other market based mechanisms like Spectrum trading and Spectrum sharing.

Mergers & Acquisitions

2.28 It is well established that M&A play an important role in any economy. M&A may improve efficiency, reduce costs and ensure optimal utilization of resources. In the growing liberalized economic scenario of the country and also considering that the economic boundaries are narrowing globally, it is likely that M&A activities are decided by the market. At the same time, anti-competitive and monopolistic concerns also need to be addressed while formulating M&A policy.

2.29 Today, corporate restructuring has gained momentum and companies are merging, demerging, divesting and taking in or taking over companies, both unregistered and registered, in India and outside. In this background, policy and guidelines for Mergers and Acquisitions in telecom sector need to be framed to ensure fair competition and efficient service network, particularly with regard to efficient and optimal utilization of spectrum, which is a limited and valuable national resource.

2.30 M&A in Indian Telecom Sector is presently guided by the Department of Telecommunications (DoT) guidelines dated 22.04.2008 for intra service area Merger of Cellular Mobile Telephone Service (CMTS)/Unified Access Services (UAS) Licences. Besides, UAS License Agreements also contain certain terms and conditions relating to M&A, transfer of license and lock-in of promoter's equity. The issues relating to M&A were extensively considered by the Authority in the Recommendations dated 28 August 2007 on Review of license terms and

conditions and capping of number of access providers. The DoT guidelines dated 22.04.2008 referred above were issued subsequent to these recommendations.

Present norms on Merger & Acquisition in Telecom Sector

Provisions under License agreement

2.31 Terms and Conditions of License relating to Transfer of License and Merger & Acquisition in existing UASL agreement are given below:

“6.1 The LICENSEE shall not, without the prior written consent as described below, of the LICENSOR, either directly or indirectly, assign or transfer this LICENCE in any manner whatsoever to a third party or enter into any agreement for sub Licence and/or partnership relating to any subject matter of the LICENCE to any third party either in whole or in part i.e. no sub leasing/partnership/third party interest shall be created. Provided that the LICENSEE can always employ or appoint agents and employees for provision of the service.

6.2 Intra service area mergers and acquisitions as well as transfer of licences may be allowed subject to there being not less than three operators providing Access Services in a Service Area to ensure healthy competition as per the guidelines issued on the subject from time to time.

6.3 Further, the Licensee may transfer or assign the License Agreement with prior written approval of the Licensor to be granted on fulfilment of the following conditions and if otherwise, no compromise in competition occurs in the provisions of Telecom Services :-

- (i) When transfer or assignment is requested in accordance with the terms and conditions on fulfilment of procedures of Tripartite Agreement if already executed amongst the Licensor, Licensee and Lenders; or*
- (ii) Whenever amalgamation or restructuring i.e. merger or demerger is sanctioned and approved by the High Court or Tribunal as per the law in force; in accordance with the provisions; more particularly Sections 391 to 394 of Companies Act, 1956; and*

- (iii) *The transferee/assignee is fully eligible in accordance with eligibility criteria contained in tender conditions or in any other document for grant of fresh license in that area and show its willingness in writing to comply with the terms and conditions of the license agreement including past and future roll out obligations; and*
- (iv) *All the past dues are fully paid till the date of transfer/assignment by the transferor company and its associate(s) / sister concern(s) / promoter(s) and thereafter the transferee company undertakes to pay all future dues inclusive of anything remained unpaid of the past period by the outgoing company.”*

DoT guidelines on Merger & Acquisition²¹

2.32 The DoT guidelines dated 22.04.2008 for intra service area Merger of Cellular Mobile Telephone Service (CMTS)/Unified Access Services (UAS) Licences are at **(Annex-IV)**. Some of the salient points are summarized below:

- Prior approval of the Department of Telecommunications shall be necessary for merger of the licence.
- Merger of licence(s) shall be permitted between CMTS and CMTS, UASL and UASL and CMTS and UASL. Merged licences in all the categories above shall be in UASL category only.
- The market share of merged entity in the relevant market shall not be greater than 40% either in terms of subscriber base separately for wireless as well as wireline subscriber base or in terms of Adjusted Gross Revenue.
- No M&A activity shall be allowed if the number of UAS/CMTS access service providers reduces below four in the relevant market consequent upon such an M&A activity under consideration.
- Consequent upon the Merger of licenses in a service area, the post merger licensee entity shall be entitled to the total amount of spectrum held by the

²¹ DoT guidelines dated 22.04.2008 for intra service area Merger of Cellular Mobile Telephone Service (CMTS)/Unified Access Services (UAS) Licences

merging entities, subject to the condition that after merger, licensee shall meet, within a period of 3 months from date of approval of merger by the Licensor, the prevailing spectrum allocation criterion separately for GSM & CDMA technologies, as in case of any other UAS/CMTS licensee(s).

In case of failure to meet the spectrum allocation criterion in the above mentioned period of 3 months, post merger Licensee shall surrender the excess spectrum, if any, failing which it may be treated as violation of terms and conditions of the licence agreement and action accordingly shall be taken. In addition, after the expiry of above mentioned period of 3 months, the applicable rate of spectrum charge shall be doubled every 3 months in case of excess spectrum held by post merger licensee.

Further, the spectrum transfer charge, as may be specified by the Government, shall be payable within the prescribed period.

- On merger, spectrum enhancement charge shall also be charged as applicable in case of any other UAS/CMTS licensee.
- Discretion to choose the band to surrender the spectrum beyond the ceiling will be of new entity.
- In case consequent to merger of licences in a service area, the licensee becomes a “Significant Market Power” (SMP) post merger, then the extant rules & regulations applicable to SMPs would also apply to the merged entity.
- For regulating acquisitions of equity stake of one access services licensee Company/legal person/promoter company in the enterprise of another access services licensee in the same license area, present guidelines on Substantial Equity shall continue i.e

“No single company/legal person, either directly or through its associates, shall have substantial equity holding in more than one LICENSEE Company in the same service area for the Access Services namely; Basic, Cellular and Unified Access Services. ‘Substantial equity’ herein will mean

‘an equity of 10% or more’. A promoter company/Legal person cannot have stakes in more than one LICENSEE Company for the same service area”.

- Any permission for merger shall be accorded only after completion of 3 years from the effective date of the licences.
- The duration of licence of the merged entity in the respective service area will be equal to the remaining duration of the Licence of the two merging licensees whichever is lower on the date of merger.

Lock-in of Promoter’s Equity

2.33 Recently, DoT²² has amended UAS Licence Agreement with respect to Lock-in Period for sale of equity of UAS Licensee Company vide letter dated 23rd July, 2009. By this amendment, the following new Clause 1.8 has been inserted after the Clause 1.7 of the Schedule to the Licence Agreement for Unified Access Services (UAS):

“1.8: There shall be following conditions for sale of equity of the UAS licensee company:

- (i) There shall be a Lock-in-period for sale of equity of a person whose share capital is 10% or more in the UAS licensee company on the effective date of UAS licence and whose net-worth has been taken into consideration for determining the eligibility for grant of UAS license, till completion of three years from the effective date of the UAS licence or till fulfilment of all the rollout obligations under clause 34, whichever is earlier.
- (ii) Issue of additional equity share capital by the UAS licensee company by way of private placement/ public issues is permitted. However, such a person (on whom the Lock-in condition applies as per para (i) above) shall not transfer in any manner such as sale, assignment etc., his share capital directly or indirectly to any other person during lock-in period i.e. the invested amount in the shareholding by the equity holder shall not be reduced in any circumstances during the lock-in period.

²² http://www.dot.gov.in/as/2009/Ammendment_lock-in-Period.pdf

- (iii) In case of issue of fresh equity, within the lock-in period the declaration of dividend and/or special dividend shall be barred.
- (iv) The provision of lock-in period shall not apply, in pursuance to enforcement of pledge by the lending financial institutions/banks in the event of defaults committed by the UAS licensee company.”

2.34 It can be argued that merger of licenses, and transfer/merger/sharing of assigned spectrum among licensees provides an important method of consolidation of spectrum, especially in the context of scarcity of this resource. Accordingly, it would be appropriate to revisit the present policies (eg. M&A guidelines, lock-in of promoter equity, etc.) in line with the future requirement.

Issues for Consultation

- Q.1 Whether the existing licence conditions and guidelines related to M&A restrict consolidation in the telecom sector? If yes, what should be the alternative framework for M&A in the telecom sector?**
- Q.2 Whether lock-in clause in UASL agreement is a barrier to consolidation in telecom sector? If yes, what modifications may be considered in the clause to facilitate consolidation?**
- Q.3 Whether market share in terms of subscriber base/AGR should continue to regulate M&A activity in addition to the restriction on spectrum holding?**
- Q.4 Whether there should be a transfer charge on spectrum upon merger and acquisition? If yes, whether such charges should be same in case of M&A/transfer/sharing of spectrum?**
- Q.5 Whether the transfer charges should be one-time only for first such M&A or should they be levied each time an M&A takes place?**
- Q.6 Whether transfer charges should be levied on the lesser or higher of the 2G spectrum holdings of the merging entities?**
- Q.7. Whether the spectrum held consequent upon M&A be subjected to a maximum limit?**

Spectrum Trading

- 2.35 Besides M&A, another provision for ensuring availability of spectrum to those who require it and are willing to pay is by allowing Trading and Sharing of spectrum. Today, both these mechanisms are not permitted as per the conditions of UASL. The following paras discuss the two options.
- 2.36 Spectrum trading is an option available for transferring the spectrum among licensed entities having spectrum and institutional framework. It denotes a mechanism whereby rights of use are transferred voluntarily from one user to other for a certain price. The sum paid by the new owner of the spectrum usage right is retained either in full or part by the previous licensee. The trading will only take place if the spectrum is worth more to the new user than it was to the former user, reflecting the greater economic benefit the new user expects to drive from its use. The spectrum trading may permit faster rollout/expansion of the networks. This in turn is likely to boost market competition.
- 2.37 Need to consolidate the spectrum may require lifting the restrictions presently imposed on spectrum trading. However, Government may have legitimate concerns that licensees who have not acquired spectrum at market price, could use this opportunity to sell scarce spectrum at a premium and make windfall gains. This is more relevant in view of the fact that UASL has been allocated initial startup spectrum bundled with the license and the value of the Entry fee (including the bundled Spectrum) may be significantly at variance with the value of traded spectrum . The operators in India have been provided additional spectrum based on the subscriber based spectrum assignment criteria adopted by the government from time to time. Some of them are having spectrum much higher than startup spectrum given with UASL license.

- 2.38 One can argue that in view of the fact that presently all the spectrum available with the service providers has been allocated for the one time Entry fee, it is akin to lease of land. The ownership of the spectrum continues to rest with the Government. Permitting trading for such spectrum may not be legally tenable.
- 2.39 However in case it is decided to permit trading then it will be necessary to lay down rules as to who can trade the spectrum. As per present spectrum policy, assignment of the spectrum is associated with certain obligations on the part of licensee (eg. Roll out obligations etc). There are penalty provisions for delays if roll out obligations are not completed in pre-defined time including termination of the license. Government is keen to spread wireless services especially in rural areas. More licenses have been awarded with well defined roll out obligation, primarily with the aim to ensure better coverage to the uncovered areas especially for rural population. In such a case, the issue for consideration would be whether licensees who have not fulfilled their roll out obligations be permitted spectrum trading?
- 2.40 Spectrum trading is fundamentally encouraged to increase spectrum efficiency. The provisions for spectrum trading may include clearly defined framework, the tradable spectrum bands, safeguards to ensure competition, maximum spectrum which can be held by one entity etc. Effective market dynamics is necessary to protect interest of subscribers.
- 2.41 Internationally spectrum allocation has been done using market driven mechanism. In contrast, 2G startup spectrum is given bundled with license in our country. Moreover, only spectrum usage charges are levied on additionally allocated spectrum based on subscriber linked criteria. The low cost of acquiring the 2G spectrum has to be factored while permitting spectrum trading. Service providers may pay certain spectrum trading charges to government when such trading is done first time. The charges prescribed for such spectrum trading should be set at an appropriate level i.e it should neither be so high to discourage consolidation of spectrum nor so low to provide unjustifiable benefits to licensee transferring the

spectrum usage right through trading. Such a charge will ensure that a licensee does not make a windfall gain simply by trading in a scarce commodity.

2.42 The determination of one time spectrum trading charge payable to the government is crucial. There can be different methods. The simplest could be to prescribe some percentage of the spectrum trading charges per MHz. However, one may argue that this formulation may not determine the real market spectrum charges thus seriously impacting the government interest. The other method could be to prescribe certain fixed charge/rate per MHz per circle. The price of spectrum should not only depend on the direct benefits that can be attributed considering the business model but even future gains due to likely innovation in technology, the economic growth of the country, its positive impact on ARPU, better coverage etc. The impact is likely to be more visible in category “B” and Category “C” circles as most of the new telecom growth is likely to come from these areas in years to come.

2.43 The other issue for consideration is what should be the minimum quantum of spectrum for trading. This issue is also linked with ensuring the interference free spectrum for use once allocated to a service provider. The present assignment by WPC ensures proper guard band between two allocated frequencies for interference free use. This will be desirable for traded spectrum also. The trading of the spectrum would be market driven and need based. The licensees trading the spectrum will be the best persons to determine the need and protect the interest including proper provision of the guard band. Therefore one can argue that blocks of spectrum trading may be left to licensees within overall capping limit of the spectrum which can be allocated to an entity. Pricing of such spectrum can be done by rounding off to next higher multiple of 1 + 1 MHz duplex pair. View and comments of the stakeholders are invited.

Issues for consultation

Q.1 Is spectrum trading required to encourage spectrum consolidation and improve spectrum utilization efficiency?

- Q.2 Who all should be permitted to trade the spectrum ?**
- Q.3 Should the original allottee who has failed to fulfill “Roll out obligations” be allowed to do spectrum trading?**
- Q.4 Should transfer charges be levied in case of spectrum trading?**
- Q.5 What should be the parameters and methodology to determine first time spectrum transfer charges payable to Government for trading of the spectrum? How should these charges be determined year after year?**
- Q.6 Should capping be limited to 2G spectrum only or consider other bands of spectrum also?**
- Q.7 Should size of minimum tradable block of spectrum be defined or left to the market forces?**
- Q8. Should the cost of spectrum trading be more than the spectrum assignment cost?**

Spectrum sharing

- 2.44 Spectrum sharing typically involves more than one service provider sharing the spectrum for same or different wireless services. Spectrum sharing is a model that enables operators leasing their spectrum to other operators on commercial terms. Sharing is a viable option for two or more operators because spectrum is a scarce resource that is often underutilized by one operator in a given area.
- 2.45 Spectrum sharing can also be useful for new operators to cut initial roll out cost in terms of reduced number of Base Transceiver Stations (BTS) by pooling the spectrum.
- 2.46 Different varieties of spectrum sharing concepts are prevalent among service providers world over. Spectrum sharing in most simple form can be leasing of the given quantum of spectrum in a geographical area/ LSA for a given period. The quantum of spectrum taken on lease is totally available to other licensee for the period of lease and can be most optimally used for design of the network or to provide better services to its subscribers. The other method is pooling of spectrum

resources jointly by the concerned service providers and effectively deploying it to provide better services to customers and economize on number of BTS to roll out the services. In such cases dependency of the operators on each other increases and such spectrum sharing are generally preceded by active infrastructure sharing among them.

2.47 Operators may use spectrum sharing in many different ways depending on the total spectrum available with them, status of roll out in LSA, service coverage, congestion in the network, type of services being provided and willingness of other operators to share the spectrum. The business model of spectrum sharing will be very different from case to case basis.

2.48 Some of the different spectrum sharing requirements are discussed below:

- When there are pockets in licensed service areas (LSA) where one operator does not have spectrum or has less spectrum.
- Operators have non uniform and complementary subscriber base in different parts of licensed service area.
- When more than one operator wants to set up a common network with pooled spectrum reducing initial rollout cost.
- When operator wants to rollout some services for which others are having the suitable spectrum and willing to share.

2.49 The innovative technologies such as Dynamic spectrum access (DSA), Software defined radio (SDR), and cognitive radio (CR) are likely to be play a crucial role in encouraging spectrum sharing in future.

2.50 Internationally, while spectrum trading has been well defined and detailed regulatory framework is prescribed, spectrum sharing is generally treated as part of active infrastructure sharing.

2.51 The spectrum sharing and spectrum trading are two different phenomena though both focus towards increasing spectrum utilization efficiency. The comparison of spectrum trading and spectrum sharing is given in table 10 :

Sl no	Spectrum Trading	Spectrum sharing
1.	The total right of spectrum use is transferred for total duration of spectrum allocation.	The operator sharing the spectrum gets temporary right of spectrum usage as per the agreement. Exclusive rights still rests with individual operators who have been allocated the spectrum.
2.	Spectrum is available for exclusive use to licensee after the trade.	Spectrum may or may not be available for exclusive use.
3.	The right of use of the spectrum is transferred for full period of spectrum assignment.	The period of sharing the spectrum is based on mutual agreement.
4.	It is always for the economic gain of the operator trading the spectrum.	Generally sharing results in indirect economic gains. However, direct economic gains in some cases can not be ruled out.
5.	Rights of spectrum use are transferred for complete licensed service area (LSA)	The sharing of spectrum may be limited to identified geographical area only and may only be valid in part of LSA.
6.	Once the trading is complete, the exclusive right to use the spectrum is transferred.	Spectrum sharing can be terminated in accordance with the contract provisions after giving suitable notice.

Table 10

2.52 In case of spectrum sharing, the frequencies in question are not exclusively available for any of the operator as in case of spectrum trading. It is an established fact that spectrum sharing in most of the cases results in economic advantage but quantification of such economic advantages is very difficult and varies with type of spectrum sharing being adopted. Hence, spectrum sharing charges have to be worked out in this background.

- 2.53 Since consolidation of spectrum increases spectrum utilization efficiency, the pertinent question would be identify the appropriate administrative charges payable to government for permitting spectrum sharing without giving undue benefit to the licensees sharing the spectrum. Such charges have to be so determined to ensure that spectrum is used efficiently without distorting market dynamics and ensuring level playing field.
- 2.54 The sharing of spectrum is generally for a limited period and may not engage total allocated spectrum in a LSA for sharing. So, will it be desirable to put a condition that operators can share their spectrum only when total spectrum allocated in that LSA is being shared. One can argue that partial sharing of the spectrum may be permitted among service providers willing to do so, but the pertinent question would be to ensure effective monitoring of such spectrum sharing and timely action to address any violation to this effect. Views of the stakeholders are invited.

Issues for consultation:

- Q.1 Should Spectrum sharing be allowed? If yes, what should be the regulatory framework for allowing spectrum sharing among the service providers?**
- Q.2 What should be criteria to permit spectrum sharing? Give your comments with justification.**
- Q.3 Should spectrum sharing charges be regulated? If yes then what parameters should be considered to derive spectrum sharing charges? Should such charges be prescribed per MHz or for total allocated spectrum to the entity in LSA?**
- Q.4 Should there be any preconditions that rollout obligation be fulfilled by one or both service provider before allowing the sharing of spectrum?**
- Q5. In case of spectrum sharing, who will have the rollout obligations? Giver or receiver?**

Extending the validity of licenses perpetually or otherwise.

- 2.55 Initially duopoly was introduced in the mobile services segment in 1994/95 and licences were granted for 10 years in each service area and then extended to 20 years effective from the initial date of the licence. Subsequently, MTNL/BSNL was licensed as third operator in 1997/2000. Fourth Cellular Mobile Service Provider (CMSP) was introduced in 2001. In 2003, the Basic and the CMSP were allowed to migrate to the UASL. Subsequently, a number of additional UASL were granted by the government in each service area and presently, the total number of CMTS/UAS licenses in a service area ranges from 12 to 14.
- 2.56 As per the current UAS Licence, the validity period of the Licence is 20 years from the effective date of issue of the same. The licensor may extend, if deemed expedient, the period of licence by 10 years at one time, upon request of licensee, if made during 19th year of the licence period on terms mutually agreed. The decision of the licensor shall be final in regard to the grant of extension.
- 2.57 As per the licencing regime, the spectrum rights assigned to a licensee is co-terminus with the period of licence. The spectrum allocated for mobile services is assigned in phases. Initial spectrum is bundled with the license. Subsequent spectrum is allocated, based on the subscriber based criterion wherein a specified amount of spectrum is allocated upon reaching a specified subscriber base. Therefore, though different tranche of spectrum are received by the licensee at different periods of time, they all have validity upto the same date, i.e. upto the expiry of UASL/CMTS. A number of existing licenses have completed more than 10-12 years. The issue for consideration is how the spectrum available with such licensee should be considered on completion of the validity period of their licence.
- 2.58 Similarly, on permitting dual technology operations under the same licence, the Government assigned spectrum for the alternate technology to the operators after payment of a fee equivalent to the entry fee applicable to the new UAS licenses.

TRAI has received some representations that the validity of dual technology track (GSM spectrum) of dual technology operators should be 20 years from the date of amendment of the license, as such operators have paid the same fee. It is stated that if the validity is not extended upto 20 years, the excess amount of entry fee paid for GSM track should be refunded to the dual technology operators, or in case the excess amount cannot be refunded, the same may be adjusted against future license fee and spectrum charges payable against the licensed operations.

2.59 As per the existing 3G guidelines, if the period of existing UAS telecom licence of a successful bidder is expiring before the period of 20 years²³, its existing UAS licence shall be extended in the 19th year of its validity to a date 20 years from the date of 3G spectrum allotment in such manner, as the Government deems fit. This extension shall be done in the 19th year of the UAS licence for the period required to make it co-terminus with the 3G spectrum allocation period by amending licence conditions if required.

2.60 Similarly, as per the existing BWA guidelines, the successful bidder shall get spectrum allotment for BWA services for a period of 15 years duration. If the period of the UAS or ISP license is expiring before the extended spectrum allotment for BWA services, its existing UAS or ISP license shall be extended in the 19th or 14th year of its validity as applicable, to a date 15 years from the date of BWA spectrum allotment in such manner, as the Government deems fit. This price would be determined by the Government at the time of extension of licence. This automatic extension of the UAS or ISP licence shall be done for the period required to make it co-terminus with the BWA spectrum allocation period by amending licence conditions, if required.

Issues for consideration

Q1. Should there be a time limit on licence or should it be perpetual?

²³ As per the existing 3G guidelines, the successful bidder shall get spectrum allotment for 3G services for a period of 20 years.

- Q2. What should be the validity period of assigned spectrum in case it is delinked from the licence? 20 years, as it exists, or any other period?**
- Q3. What should be the validity period of spectrum if spectrum is allocated for a different technology under the same license midway during the life of the license?**
- Q4. If the spectrum assignment is for a defined period, then for what period and at what price should the extension of assigned spectrum be done?**
- Q5. If the spectrum assignment is for a defined period, then after the expiry of the period should the same holder/licensee be given the first priority?**

UNIFORM LICENSE FEE IN TELECOM SECTOR

2.61 Telecom Services in India are provided through various licenses issued by the Licensor, the Department of Telecommunications (DoT). The licenses include Unified Access Services (UAS), Cellular Mobile Telephone Service (CMTS), National Long Distance (NLD), International Long Distance (ILD), Internet Service Provider (ISP), Very Small Aperture Terminal (VSAT), Public Mobile Radio Trunk Service (PMRTS) etc. Infrastructure Provider Category - I (IP- I) requires registration only.

2.62 Total number of licenses in the Access Services as on 31.08.2009 is 281 (Basic²⁴ – 2, CMTS – 39 and UAS – 240)²⁵. For Access Services, the Country is divided into 23 Service Areas consisting of 19 Telecom Service Areas and 4 Metro Service Areas.²⁶ These are further classified into three categories – “A”, “B” and “C”.

2.63 For the Access Services (Basic/UAS/CMTS), License Fee is levied at 10/8/6 % of Adjusted Gross Revenue (AGR) for Metro and Category ‘A’, Category ‘B’ and

²⁴ Basic Service Licenses have been issued to the MTNL (for Delhi & Mumbai) and BSNL for All India (except Delhi & Mumbai)

²⁵ No new CMTS and Basic service licenses are being granted after issue of the guidelines for UAS License.

²⁶ W.e.f. 15.09.2005, Service Areas of Chennai Metro and Tamil Nadu Telecom Circles were merged and new UAS licenses issued thereafter are for the merged service area.

Category 'C' Service Areas respectively. For NLD, ILD, VSAT Commercial service providers, Infrastructure Service Providers (IP-II) and ISP with Internet Telephony, the LF is 6% of AGR. The LF is inclusive of Universal Service Levy (USL) of 5% of AGR. There is nil LF for ISP without Internet Telephony. For IP-I also, which requires registration only, no LF is payable.

2.64 There is a view that the differential License Fee (LF) across services and service area categories provides a scope for arbitrage in revenue reporting for the purpose of LF. In the current market scenario in telecom sector, some of the telecom companies are holding Pan-India Access Service Licenses and some of them are integrated operators providing Access as well as other telecom services (NLD, ILD, ISP, IP-I etc.). There is concern that such companies may take advantage of differential rates of license fee, which may result in the understatement of revenue by the telecom service providers, affecting the Government Revenue from telecom operations.

2.65 On the other hand, there is also a view that a flat spectrum charge is against the framework of the current spectrum policy, wherein higher spectrum charges are attracted for higher spectrum and that a uniform fee, particularly since it would be lower than the maximum being charges, would result in considerable loss to the Government. Besides, it would hurt the smaller operators with limited spectrum and that this would lead to a lack of level playing field.

Issues for Consultation:

- Q1. What are the advantages and disadvantages of a uniform license fee?**
- Q2. Whether there should be a uniform License Fee across all telecom licenses and service areas including services covered under registrations?**
- Q3. If introduced, what should be the rate of uniform License Fee?**

CHAPTER 3: SPECTRUM ASSIGNMENT AND PRICING

- 3.1 In the preceding chapters, keeping in mind a time frame of 5 years, we have discussed the spectrum and licensing related issues like assessment of future requirement of spectrum in all the commercial bands, how to refarm/vacate the spectrum from the incumbents, need for limiting the number of service providers in a service area, review of M&A norms, feasibility of permitting spectrum trading and sharing etc. **The discussions in this chapter, however, is limited to the specific issue of assignment and pricing of spectrum in the 800/900 and 1800 MHz bands (2G band) only.**

Historical perspective of spectrum assignment in India

- 3.2 The spectrum in the bands of 800, 900 and 1800 MHz has been allocated to cellular mobile services. Assignment of blocks of frequencies in these bands is being done on a subscriber linked criterion (SLC).
- 3.3 After opening up of the sector for private participation, licensing was done in two phases. The first phase consisted of auction of licenses in the year 1991 for cellular services in the 900 MHz band i.e. 890-915 MHz paired with 935-960 MHz. The technology at that point of time was specified as GSM and the licences had a spectrum commitment of 6.2+6.2 MHz. Subsequently, in order to enable fixed service providers (basic service operators) to provide fixed wireless service, another technology known as Code Division Multiple Access (CDMA) was introduced in the year 1997, with the frequency allocation being in the 800 MHz band i.e. 824-844 MHz paired with 869-889 MHz. After the announcement of NTP-99 all the existing license holders could "migrate" to a new regime that involved a one-time payment as entry fee and an annual licence fee based on percentage of adjusted gross revenue to the government. The NTP-99 envisaged that spectrum should be

utilised efficiently, economically, rationally and optimally. The third Cellular Mobile license was granted to the MTNL and BSNL in 1997/2000.

- 3.4 In the second phase in 2001, cellular services in the 1800 MHz band were licensed through auction. Informed Ascending Bidding Process (IABP) was used and the bidders were to bid on entry fee, which would be a one-time payment, and the selected service provider would be required to pay a license fee as revenue share as decided by the government from time to time. There was also a slab based annual spectrum usage charge of 2% of adjusted gross revenue for initial allotment and higher for additional spectrum that could be sought depending on availability and the ability to justify the need for the same.

Subscriber Linked Criteria (SLC) for assignment of spectrum

- 3.5 By 2002 service providers were demanding additional spectrum assignments for increasing number of subscribers and handling traffic. The technical committee formed by DOT on 28th January 2003 examined the utilization of spectrum, compared with international practices. Considering the constrained availability the committee said that though it was desirable to earmark the required spectrum upfront, to keep the criteria simple it was better to maintain a linkage of spectrum with the subscriber base, which had been worked out on the basis of average traffic per subscriber. The committee recommended for GSM technology assignment beyond 6.2+6.2MHz when subscriber base reaches 5 lakh, beyond 8+8MHz on attaining a subscriber base of 10 lakh and beyond 10+10 MHz once the subscriber base crosses 15 lakh in a service area.
- 3.6 Subsequently, WPC prescribed subscriber based criterion through letters J-14025/200(17)/2004-NT (GSM) and J-14025/ 200(17)/ 2004-NT(CDMA) dated 29 March 2006. In this order, it also prescribed that the active subscribers and peak traffic averaged over a month (for a minimum of 40 mErlangs per subscriber) in the Visitor Locator Register (VLR) would be taken into account for this purpose.

- 3.7 The Authority in its recommendations on ‘Review of License terms and conditions and number of access service providers’ dated 28th August 2007 had indicated that the subscriber linked criteria did not account for the varying subscriber distributions within and across service areas and resulted in inefficient utilization. It was further said that the subscriber linked criteria led to attempts at over-reporting subscriber base. It was noted that some service providers were able to serve a larger number of subscribers in the same amount of spectrum by using spectrally efficient technologies and putting more number of BTSs for increasing capacity. As an interim measure, the Authority recommended enhancing the subscriber line criteria as indicated in the Table 7. It must be noted that the recommendations of the Authority on this aspect were not on a reference from the Government but as suo motu recommendations.
- 3.8 Even before TRAI submitted its recommendations, the DoT, on 6th August, 2007 asked the Telecom Engineering Centre (TEC) to study matters relating to spectrum utilisation by operators and spectral efficiency. On 19th October 2007, the Government issued a press release accepting the TRAI’s recommendation of enhanced SLC for assignment of spectrum. Through its report dated 26th October 2007 TEC recommended steeper tightening of norms than that recommended by TRAI.
- 3.9 Government accepted the report of TEC on 30th October 2007. Later, on 7th November 2007, Government constituted a committee, to recommend revised subscriber-based criterion for assignment of spectrum, under the chairmanship of Additional Secretary (T) DoT(referred to in this document as the First Committee). This committee submitted its report on 18th December 2007.
- 3.10 The First Committee cited different assumptions on inter-site distance, technology dependent statistical parameters, technological advances and realizable cell capacities as the reasons for difference in the subscriber base recommended by

WPC in 2006, TRAI on 19th October 2007 and TEC on 26th October 2007. The First Committee recommended that a combination of auction and subscriber linked criteria may be explored. It also recommended that a technical committee be formed to specify the method to be followed for allotting incremental spectrum and as an interim measure DoT may decide on the SLC as recommended by TRAI or by TEC.

- 3.11 As an interim measure, Government decided on 17th January, 2008 to adopt SLC recommended by TRAI with the condition that incremental spectrum shall be allocated in steps of 2x1MHz for GSM technology and in steps of 2x1.25MHz in case of CDMA technology with appropriate extrapolation of subscriber figures. Spectrum is presently being allocated based on this revised subscriber base criteria for the GSM and CDMA technologies.
- 3.12 On 16th June 2008 the Government constituted another Committee (referred to in this document as the Second Committee) to recommend the methodology to be followed for assignment of access (GSM/ CDMA) spectrum and pricing. The Second Committee submitted its recommendations on 13th May 2009. As noted earlier, this Committee did not address various issues referred to it by the Government but restricted itself to two aspects. In July 2009, Government referred the report to the Authority for its recommendations.

Review of spectrum assignment criteria

- 3.13 Assignment of spectrum is a complex process. It is not merely allocation of frequencies but has to take into account available technologies, the type of area: rural, urban, dense urban and metro. To maintain the same quality of service, requirement of spectrum would be different for different type of areas e.g. relatively larger spectrum for the central business districts in a city and lower for rural areas. The current method consists of assignment of an initial/start-up spectrum with the licence and subsequent assignment based on subscriber linked criteria.

Methods for spectrum assignment

- 3.14 If the demand does not exceed supply for a particular band in a service area then assignment is a trivial process. It could be assigned on the basis of equal distribution of spectrum to all as the request comes. However, if demand of spectrum exceeds its supply then an assignment method must be used to choose from among competing applicants. Methods of doing this involve dividing the existing spectrum in usable blocks and then awarding through a market or non-market based assignment approach.

First-come-first-served basis

- 3.14.1 Eligibility criteria may be set. Blocks of spectrum may be assigned to eligible seekers on the first-come-first served basis. No further request can be entertained when the available spectrum is exhausted.

Beauty contest

- 3.14.2 In a comparative process or beauty contest method, the qualifications of each of the competing spectrum applicants are formally compared based on established and published national criteria like coverage, number of BTS proposed to be deployed for this coverage, Grade of service, level of customer service. Other criteria are financial viability, viability of business plan, willingness to accept obligations like infrastructure sharing, providing roaming, MVNO and so on. Some criteria which may be difficult to predict over licence period are tariffs, types of services, revenues costs and customer base. Key issues in the design of comparative selection procedures are the criteria used to choose the winning applicant, the precision and transparency of the criteria (i.e. publication in advance of the tender), the weighting given to different criteria and the transparency of reasons for the final decision.
- Beauty contests were used to award majority of initial GSM licences in Europe and around half of the 3rd Generation (3G) mobile licences.

Lottery

3.14.3 In a lottery, licensees are selected at random from among all competing spectrum applicants.

Auction

3.14.4 Auctions represent a form of assignment mechanism where the applicants determine the value to be charged. In an auction, spectrum is allocated by bidding among competing spectrum applicants. Auctions award spectrum to those who value it the most. However for a positive outcome of auction method, it is necessary that there are sufficient viable bidders. Wherever there are insufficient bidders, it is important that the reserve price set by the Government/Regulator reflects as closely as possible the economic value of the spectrum. Auctions might also be used if the spectrum packages to be offered differ and the spectrum is valued differently by the bidders. For example, in the German 3G mobile auction, the amount bid per MHz for paired spectrum was around 30 times higher than that bid for unpaired spectrum, reflecting the greater utility that paired spectrum was felt to have at the time. The key to the success of an auction is the design, which must address a number of concerns, and objectives, some of which are given below:

- Avoidance of collusion between participants to avoid high prices
- Encouraging a sufficient number of bidders, particularly new market entrants
- Setting of appropriate reserve prices
- Potential market structure
- Default after winning the auction
- Type of auction i.e. single stage vs multi-stage.

Several types of auctions have been used by different countries: Sealed-bid auction, Ascending-price auction (English format), Descending-price auction (Dutch format), Simultaneous multiple round auction and Anglo-Dutch Auction. FCC, USA has pioneered

simultaneous ascending auction methodology. Ascending price auctions have been used in Canada, Australia, UK, Germany and Austria.

Exploring the options

3.15 Currently the assignment of initial spectrum is made by WPC to all UAS licensees, subject to its availability. Subsequent assignment is based on subscriber linked criteria. Now we have to discuss the following options :

3.15.1 As discussed in ¶2.17 to ¶2.20, one of the options is delinking the initial spectrum from the licence. However, if the spectrum is delinked from licence then how should the spectrum to the new licensee be assigned. Another linked issue would be whether there should be any roll out obligations in such a regime.

3.15.2 In case we continue with the present licensing regime of start-up spectrum linked with the licence, then

- Should subsequent assignments be continued to be based on SLC or should it be assigned based on any other mechanism such as Auction or a two-tier mechanism i.e. SLC upto a certain quantum of spectrum and an alternate method beyond.
- In either case should there be any cap on total spectrum holding in a service area

Issues for the Consultation:-

Q1. If the initial spectrum is de-linked from the licence, then what should be the method for subsequent assignment?

Q2. If the initial spectrum continues to be linked with licence then is there any need to change from SLC based assignment?

Q3. In case a two-tier mechanism is adopted, then what should be the alternate method and the threshold beyond which it will be implemented?

Q4. Should the spectrum be assigned in tranches of 1 MHz for GSM technology? What is the optimum tranche for assignment?

Q5. In case a market based mechanism (i.e. auction) is decided to be adopted, would there be the issue of level playing field amongst licensees who have different amount of spectrum holding? How should this be addressed?

Q6. In case continuation of SLC criteria is considered appropriate then, what should be the subscriber numbers for assignment of additional spectrum?

Assignment of spectrum other than 800, 900 and 1800 MHz

3.16 As mentioned in ¶3 of Introduction, the DoT vide its letter dated 7th July 2009 has sought clarification on TRAI's recommendations for auctioning of all spectrum other than 800, 900 and 1800 MHz bands. DoT had informed TRAI that WPC Wing has been assigning frequencies for different services/users and applications in various bands other than 800, 900 and 1800 MHz bands including government organizations. In addition to above, spectrum is also allotted for new technologies as and when required on case to case basis, which have not yet become commercial. In view of the above, the DoT has requested TRAI to urgently furnish clarification on auctioning of all spectrum other than 800, 900 and 1800 MHz bands as stated in TRAI's recommendations on Review of license terms and conditions and capping of number of access providers dated August 28, 2007.

3.17 In its above mentioned recommendations, TRAI had recommended that in future all spectrum excluding the spectrum in 800, 900 and 1800 bands should be auctioned so as to ensure efficient utilization of this scarce resource.

3.18 Today, broadly, there are two category of spectrum users. One, who are licensed to provide telecom services using spectrum. The other category consists of organisations who do not have service license but require spectrum for their operations viz. Defence, DoS, ONGC, AAI, etc. These are largely individual organization and either the spectrum required by them does not have competing demand or the spectrum is required for public safety or for strategic functions. Therefore, it may perhaps be not possible to equate them with the category where this spectrum is used purely for commercial purpose. However, it can be argued

that the charge for spectrum given to them may be fixed in an adhoc fashion keeping the broad value of spectrum in mind.

Issue for consultation

Q1. In your opinion, what should be the method of assigning spectrum in bands other than 800, 900 and 1800 MHz for use other than commercial?

SPECTRUM PRICING

Objective of Spectrum Pricing

3.19 In general, the role of pricing in a market is to guide the users in making decisions to use the spectrum resource more efficiently. It follows that the approach to pricing should reflect the scarcity besides incentivising efficiency in use. It is important to decide upon the objectives that the pricing policy should achieve. These objectives are generally a combination of following principles:

- (i) To promote efficient use of scarce resource of radio spectrum, where it serves as a means to ensure that those using the spectrum do not acquire more than they need to provide a service.
- (ii) Prevent users from stockpiling spectrum that they do not really need;
- (iii) Reflecting market value of spectrum in the wake of scarcity, to ensure its efficient utilization.
- (iv) Recovering the costs associated with managing the spectrum.
- (v) Increasing roll-out of services
- (vi) To facilitate access to radio spectrum particularly to innovative technologies and services
- (vii) Provide an incentive to move to alternative bands when this would be desirable;
- (viii) To afford opportunity for equal competition.

Present Pricing Policy in India:

3.20 In India, existing 2G licensing framework imposes the following levies/fees on a UASL/CMTS licensee seeking to provide access services using wireless technologies:-

- a) Entry fee for acquiring a license
- b) License fee as a percentage of Adjusted Gross Revenue (AGR) paid on a quarterly basis
- c) Spectrum usage charges as a percentage of AGR paid on a quarterly basis

3.21 The entry fee for acquiring a UASL license enables the licensee to become eligible for spectrum assignment in certain specified bands without any additional fee for acquisition of spectrum. This means that some amount of spectrum is bundled with the licence subject to its availability. The licence fee is charged as a percentage of annual AGR. It is 10% AGR for metros and "A" category service areas, 8% for "B" category service areas and 6% for "C" category service areas. The spectrum usage charge is also payable as a percentage of AGR on annual basis It ranges from 2% to 6% depending on amount of spectrum held by the licensee.

3.22 Methods of spectrum pricing

3.22.1 Determination of upfront charges for spectrum

Presently the UAS licence fee (which includes the charge for initial spectrum) has been administratively determined based on the prices discovered through a market based mechanism applicable for the grant of licence to the 4th cellular operator.

There are broadly two methods for determination of spectrum pricing, Administrative Incentive Pricing (AIP) and Market Driven Pricing.

3.22.2 Administrative Incentive Pricing (AIP)

The administrative assignment of spectrum is often supplemented by imposing charges for its use. These charges can take the form of simply setting fees sufficient to recover the costs of spectrum management. Alternatively, they could be incentive based prices that could encourage efficient utilization of spectrum. One way to do this would be to set a charge equal to an estimate of what the spectrum might be worth in the market context. Prices are set by the government reflecting the opportunity cost of spectrum while incorporating potential 'incentive' to encourage efficient use reflecting spectrum scarcity. One of the predominant methods in this category is Beauty contest or comparative selection

Beauty contest or comparative selection fixes the price of the spectrum to ensure optimum utilization by awarding spectrum to the users(s) who score the highest against a group of preset criteria.

3.22.3 Market-based prices

Prices can also be discovered through an authentic market transaction such as an auction or secondary trading. The underlying concept of spectrum pricing is that the price should be based on the amount of spectrum used and on the value of the spectrum to its users. A market price is a fair payment criterion for the use of scarce resources. Proper pricing and assignment principles would also encourage investment in more spectrally efficient technologies.

In case of auctions, applicants determine the value to be charged. In this way, the price of spectrum is determined fully by market forces and the spectrum allotted to the winning bidder. An auction may be based purely on the price bid or the administration may set criteria that form the entrance conditions applicants have to meet to take part in the auction and the administration may also set a reserve price.

3.23 Determination of annual spectrum usage charges

Some of the common methods that are applied to determine annual charges are:

3.23.1 Spectrum fees based on users' gross income

A fee can be charged based on a percentage of the gross income of a company. The value of the gross income used in the fee calculation must be directly related to the company's use of the spectrum to avoid difficulty in the accounting and auditing processes. This is simple to calculate but does not promote spectral efficiency if revenues are not proportional to quantity of spectrum used.

A variation of this method is to allow some deductions, like pass through revenues, from the gross income to calculate *adjusted gross revenue*. A percentage of this adjusted gross revenue is then charged as spectrum fee. This method is currently used in India

3.23.2 Incentive spectrum fees

An incentive fee attempts to use price to achieve spectrum management objectives by incentivising efficient use of spectrum. Assignment fee levels are not dependent on cost-based limitations but the fee structure approximates the market value of the spectrum. The overall aim of incentive fees is to encourage more efficient spectrum use, with the intention of bringing the demand for spectrum into equilibrium with its supply by encouraging users to move to more spectrally efficient equipment; handing back spectrum they do not need and moving to a less congested part of the spectrum.

3.23.3 Opportunity cost fees

An opportunity cost fee tries to simulate the market value of the spectrum. This process may require financial analysis, estimations of demand or market studies to achieve a valuation, and considerable expertise.

3.23.4 Charges based on cost recovery

In the case of charge based cost recovery, the fees depend on the actual costs incurred by the regulatory authority in the licensing of the networks/ services concerned and associated management of the radio spectrum. There will be additional “indirect” costs such as international activities or work on licence-exempt services that cannot be directly attributed to a service that is licensed. These costs will have to be spread across the different services according to some transparent basis. Alternatively, some Regulatory Authorities recover costs by means of a levy on turnover.

3.24 Points for discussion

3.24.1 Pricing of initial allotment of spectrum

1. As the spectrum has been given at different stages of time, therefore, presently, the service providers are having varying quantum of spectrum. To bring them at par, one of the options could be to levy a one time upfront fee on the spectrum beyond the committed amount. The other option may be not to charge anything extra as they are already paying a higher annual spectrum charge. In case, it is decided to charge an upfront fee then the issue of methodology to determine the charge and the period from which it should be levied will need to be decided.
2. The second issue will be pricing of spectrum to be given in future. As the spectrum in future will also probably available in tranches, therefore, it needs to be deliberated whether the price should be uniform for a period of time or it changes from lot to lot.

3.24.2 Annual spectrum usage charge

The current practice in India is to levy and upfront fee and annual share based on the amount of spectrum held. In many other countries besides an initial upfront charge determined administratively or through auction there is an annual spectrum

usage charge. It needs to be deliberated upon by the stakeholders whether there should be an annual spectrum charge in case the market based regime is ushered in. If yes, then whether this charge should depend on the amount of spectrum held or should it be uniform.

Issues for Consideration

- Q.1 Should the service providers having spectrum above the committed threshold be charged a one time charge for the additional spectrum?**
- Q2. In case it is decided to levy one time charge beyond a certain amount then what in your opinion should be the date from which the charge should be calculated and why?**
- Q3. On what basis, this upfront charge be decided? Should it be benchmarked to the auction price of 3G spectrum or some other benchmark?**
- Q4. Should the annual spectrum charges be uniform irrespective of quantum of spectrum and technology?**
- Q5. Should there be regular review of spectrum charges? If so, at what interval and what should be the methodology?**

Structure for spectrum management

3.25 Currently the identification, refarming and assignment of bands for different users is carried out by the WPC wing of the DoT. TRAI had earlier made certain recommendations suggesting a review of the existing structure and framework. It is perhaps an opportune time to revisit the issue.

Issues for Consideration

- Q.1 What in your opinion is the desired structure for efficient management of spectrum?**

CHAPTER 4: SUMMARY OF ISSUES FOR CONSULTATION

All stakeholders are requested to give their comments along with relevant international experience, technical data and established case law on the following issues. Stakeholders are free to raise any other issue that they feel is germane to the issues under discussion or any issue relating to Spectrum policy and management and give their comments thereon. They are however requested to list such issues under the head – ‘other issues’.

The last date for receipt of comments is 12th November 2009.

Chapter 1

Spectrum requirement and availability

1. Do you agree with the subscriber base projections? If not, please provide the reasons for disagreement and your projection estimates along with their basis?
2. Do you agree with the spectrum requirement projected in ¶ 1.7 to ¶1.12? Please give your assessment (service-area wise).
3. How can the spectrum required for Telecommunication purposes and currently available with the Government agencies be re-farmed?
4. In view of the policy of technology and service neutrality licences, should any restriction be placed on these bands (800,900 and 1800 MHz) for providing a specific service and secondly, after the expiry of present licences, how will the spectrum in the 800/900 MHz band be assigned to the operators?
5. How and when should spectrum in 700 MHz band be allocated between competitive services?
6. What is the impact of digital dividend on 3G and BWA?

Chapter 2

Licensing issues

7. Should the spectrum be delinked from the UAS Licence? Please provide the reasons for your response.
8. In case it is decided not to delink spectrum from UAS license, then should there be a limit on minimum and maximum number of access service providers in a service area? If yes, what should be the number of operators?
9. What should be the considerations to determine maximum spectrum per entity?
10. Is there a need to put a limit on the maximum spectrum one licensee can hold? If yes, then what should be the limit? Should operators having more than the maximum limit, if determined, be assigned any more spectrum?
11. If an existing licensee has more spectrum than the specified limit, then how should this spectrum be treated? Should such spectrum be taken back or should it be subjected to higher charging regime?
12. In the event fresh licences are to be granted, what should be the Entry fee for the license?
13. In case it is decided that the spectrum is to be delinked from the license then what should be the entry fee for such a Licence and should there be any roll out condition?
14. Is there a need to do spectrum audit? If it is found in the audit that an operator is not using the spectrum efficiently what is the suggested course of action? Can penalties be imposed?
15. Can spectrum be assigned based on metro, urban and rural areas separately? If yes, what issues do you foresee in this method?
16. Since the amount of spectrum and the investment required for its utilisation in metro and large cities is higher than in rural areas, can asymmetric pricing of telecom services be a feasible proposition?

M&A issues

- 17. Whether the existing licence conditions and guidelines related to M&A restrict consolidation in the telecom sector? If yes, what should be the alternative framework for M&A in the telecom sector?**
- 18. Whether lock-in clause in UASL agreement is a barrier to consolidation in telecom sector? If yes, what modifications may be considered in the clause to facilitate consolidation?**
- 19. Whether market share in terms of subscriber base/AGR should continue to regulate M&A activity in addition to the restriction on spectrum holding?**
- 20. Whether there should be a transfer charge on spectrum upon merger and acquisition? If yes, whether such charges should be same in case of M&A/transfer/sharing of spectrum?**
- 21. Whether the transfer charges should be one-time only for first such M&A or should they be levied each time an M&A takes place?**
- 22. Whether transfer charges should be levied on the lesser or higher of the 2G spectrum holdings of the merging entities?**
- 23. Whether the spectrum held consequent upon M&A be subjected to a maximum limit?**

Spectrum Trading

- 24. Is spectrum trading required to encourage spectrum consolidation and improve spectrum utilization efficiency?**
- 25. Who all should be permitted to trade the spectrum ?**
- 26. Should the original allottee who has failed to fulfill “Roll out obligations” be allowed to do spectrum trading?**
- 27. Should transfer charges be levied in case of spectrum trading?**
- 28. What should be the parameters and methodology to determine first time spectrum transfer charges payable to Government for trading of the spectrum? How should these charges be determined year after year?**

29. Should capping be limited to 2G spectrum only or consider other bands of spectrum also? Give your suggestions with justification.
30. Should size of minimum tradable block of spectrum be defined or left to the market forces?
31. Should the cost of spectrum trading be more than the spectrum assignment cost?

Spectrum sharing

32. Should Spectrum sharing be allowed? If yes, what should be the regulatory framework for allowing spectrum sharing among the service providers?
33. What should be criteria to permit spectrum sharing?
34. should spectrum sharing charges be regulated? If yes then what parameters should be considered to derive spectrum sharing charges? Should such charges be prescribed per MHz or for total allocated spectrum to the entity in LSA?
35. Should there be any preconditions that rollout obligation be fulfilled by one or both service provider before allowing the sharing of spectrum?
36. In case of spectrum sharing, who will have the rollout obligations? Giver or receiver?

Perpetuity of licences

37. Should there be a time limit on licence or should it be perpetual?
38. What should be the validity period of assigned spectrum in case it is delinked from the licence? 20 years, as it exists, or any other period
39. What should be the validity period of spectrum if spectrum is allocated for a different technology under the same license midway during the life of the license?

40. If the spectrum assignment is for a defined period, then for what period and at what price should the extension of assigned spectrum be done?
41. If the spectrum assignment is for a defined period, then after the expiry of the period should the same holder/licensee be given the first priority?

Uniform License Fee

42. What are the advantages and disadvantages of a uniform license fee?
43. Whether there should be a uniform License Fee across all telecom licenses and service areas including services covered under registrations?
44. If introduced, what should be the rate of uniform License Fee?

Chapter 3

Spectrum assignment

45. If the initial spectrum is de-linked from the licence, then what should be the method for subsequent assignment?
46. If the initial spectrum continues to be linked with licence then is there any need to change from SLC based assignment?
47. In case a two-tier mechanism is adopted, then what should be the alternate method and the threshold beyond which it will be implemented?
48. Should the spectrum be assigned in tranches of 1 MHz for GSM technology? What is the optimum tranche for assignment?
49. In case a market based mechanism (i.e. auction) is decided to be adopted, would there be the issue of level playing field amongst licensees who have different amount of spectrum holding? How should this be addressed?
50. In case continuation of SLC criteria is considered appropriate then, what should be the subscriber numbers for assignment of additional spectrum?
51. In your opinion, what should be the method of assigning spectrum in bands other than 800, 900 and 1800 MHz for use other than commercial?

Spectrum pricing

- 52. Should the service providers having spectrum above the committed threshold be charged a one time charge for the additional spectrum?**
- 53. In case it is decided to levy one time charge beyond a certain amount then what in your opinion should be the date from which the charge should be calculated and why?**
- 54. On what basis, this upfront charge be decided? Should it be benchmarked to the auction price of 3G spectrum or some other benchmark?**
- 55. Should the annual spectrum charges be uniform irrespective of quantum of spectrum and technology?**
- 56. Should there be regular review of spectrum charges? If so, at what interval and what should be the methodology?**

Structure for spectrum management

- 57. What in your opinion is the desired structure for efficient management of spectrum?**