Telecom Regulatory Authority of India

Recommendations

on

Valuation and Reserve Price of Spectrum in 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz and 2500 MHz Bands

27th January, 2016

Mahanagar Doorsanchar Bhawan

Jawahar Lal Nehru Marg,

New Delhi- 110002

Contents

CHAPTER–I: INTRODUCTION

1.1 The Department of Telecommunications (DoT), through its letter dated 9th July 2015 **(Annexure-1.1)**, requested the Authority to provide recommendations on applicable reserve price for auction of spectrum in 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz bands for all service areas under the terms of clause 11(1)(a) of TRAI Act 1997 as amended. DoT also referred to its earlier reference dated 16th October 2014 **(Annexure 1.2)** and requested the Authority to expedite the recommendations on applicable reserve price for 2300 MHz and 2500 MHz bands for all the service areas. DoT vide its letter dated 06th November 2015[1], has sent another reference **(Annexure 1.3)** and sought the recommendations of the Authority on the liberalization of administratively allotted spectrum in the 900 MHz band.

1.2 As the information given in its reference dated 9th July 2015 was not sufficient, the Authority vide its letter dated 24th July 2015 had sought additional information/clarification from DoT. In its reply dated 16th October 2015, DoT supplied some of the information. As the information provided by DoT was incomplete, the Authority sought further clarification on 16th November 2015. However, to save time, the Authority issued the Consultation Paper on 26th November 2015 based on the available information. DoT sent additional information on 17th December 2015.

BACKGROUND

1.3 The Hon'ble Supreme Court of India through its judgment dated 2nd February 2012 quashed the licences granted on or after 10th January, 2008 and ordered to issue fresh licences by auctions. This decision of the Hon'ble Supreme Court had a major bearing on the process of the award of spectrum, the assignment of which was hitherto done administratively. Since then four auctions have been held.

[1] It seems that DoT has inadvertently mentioned the date of letter as 6th October 2015.

1.4 Post-judgment of the Hon'ble Supreme Court, there have been four auctions in different spectrum bands. The summary of the same is given in table below:

Table 1.1
Spectrum Auctions Since 2012

Sl. No.	Year	Spectrum bands (MHz)	Spectrum put to auction (MHz)	Spectrum sold (MHz)
1.	November 2012	1800	295	127.5
		800	95	No bidder
2.	March 2013	900	46 (Delhi, Mumbai and Kolkata LSAs)	No bidder
		1800	57.5 (in the four LSAs viz Delhi, Mumbai, Karnataka and Rajasthan)	No bidder
		800	95	30
3.	February 2014	900	46 (in 3 LSAs -Delhi, Mumbai and Kolkata)	46
		1800	385	307.2
4.	March 2015	800	108.75	86.25
		900	177.8	168
		1800	99.2	93.8
		2100	85	70

1.5 In the upcoming auction, spectrum in the 700 MHz band is likely to be auctioned for the very first time. DoT has informed that 35 MHz paired spectrum is available in this band in each LSA.

1.6 In the 800, 900 and 1800 MHz bands, DoT has proposed to put to auction unsold spectrum of the last auction along with the spectrum linked to the licences expiring during May 2016 to March 2018 in these spectrum bands. The six Basic Service licences given in 1997-98, which subsequently migrated to Unified Access Service Licenses (UASL), are due to expire during this period. These licensees hold 22.5 MHz spectrum in the 800 MHz and 26.4 MHz in 1800 MHz bands[2]. In addition some of the spectrum i.e. 5.4 MHz in 1800 MHz band, 9.8 MHz in 900 MHz band and 22.5 MHz in 800 MHz band that remained unsold

[2] In its reference dated 09.07.2015, DoT has included MTNL's CMTS licences of Delhi and Mumbai in the list of licences expiring during May 2016 to March 2018. Later on, DoT has informed that MTNL's CMTS licences will expire in April 2019. Hence, MTNL's spectrum holding in 900 and 1800 MHz band has not been included here.

in the last auction, held in March 2015 will also be put to auction in the upcoming auction.

1.7 In 2100 MHz band, a total of 345 MHz[3] of paired spectrum, including the spectrum unsold in March 2015 auctions, is available for auction. This includes 15 MHz in each Licensed Service Area (LSA) which Ministry of Defence has agreed to vacate, in principle, in lieu of spectrum in 1900 MHz band in all LSAs.

1.8 Spectrum in 2300 MHz band was put to auction only once in the year 2010. In that auction, 2 blocks of 20 MHz (unpaired) spectrum were put to auction in all LSAs and all of it was sold. Now, DoT has intimated about the availability of one more block of 20 MHz (unpaired) in 16 LSAs.

1.9 In 2500 MHz band, out of total available spectrum of 190 MHz, only 40 MHz (unpaired) is available for terrestrial applications in India. Remaining 150 MHz has been assigned to Department of Space (DoS) for satellite services. From the 40 MHz available for terrestrial applications, entire 40 MHz is available in Metro and Category 'A' LSAs, while only 20 MHz spectrum is available for auction in Category 'B' and Category 'C', LSAs in this band. Remaining 20 MHz is assigned to Bharat Sanchar Nigam Limited (BSNL) in these LSAs.

1.10 LSA-wise details of the spectrum availability are given in Chapter-II.

CONSULTATION PROCESS

1.11 The Authority issued the Consultation Paper on the subject on 26th November 2015. In this Consultation Paper, specific issues like quantum of spectrum to be auctioned, block size, spectrum cap, Roll-out Obligations, liberalization of administratively allotted spectrum in the 900 MHz band and methods to be used for valuation and estimation of reserve price of spectrum in 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz and 2500 MHz bands were raised. Written

[3] 15 MHz x 22 LSAs + 5 MHz x 3 LSAs unsold in the last auction.

Comments on the Consultation Paper were invited from the stakeholders by 21st December 2015 and counter-comments by 28th December 2015. The Authority received total 24 comments and 5 counter comments. These are available on TRAI's web-site www.trai.gov.in. An Open House Discussion (OHD) was conducted on 4th January 2016. Subsequently, 3 more days (up to 7th January 2016) were given for submission of additional comments, if any.

STRUCTURE OF THE RECOMMENDATIONS

1.12 This Chapter provides background to the subject. Chapter-II discusses the availability of spectrum in the 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz and 2500 MHz bands. This chapter also deals with policy issues such as roll-out obligations, spectrum cap, preferable block-size for auction, liberalization of administratively allotted spectrum in the 900 MHz band etc. Chapter-III discuses the different alternative approaches to valuation of spectrum in the 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz and 2500 MHz bands and fixation of reserve price. The list of recommendations has been made in Chapter-IV.

CHAPTER-II: AUCTION RELATED ISSUES

A. SPECTRUM AVAILABILITY

2.1 This section discusses about the availability of spectrum in the various spectrum bands viz. 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz and 2500 MHz bands.

700 MHz (698-806 MHz)

2.2 700 MHz band is a sought after band for LTE deployment around the world due to its efficiency and higher penetration inside buildings. Due to lower frequency it provides wider coverage which reduces number of towers required for setting up the LTE network and thus significantly cuts down capital expenditure involved in making the network live.

2.3 There are three different band plans in the 700 MHz band viz. USA specific band plan, APT700 TDD plan and APT700 FDD plan. In the US specific band plan, also adopted by Canada, the band is divided into 4 paired frequency sub-bands known as LTE bands 12, 13, 14 and 17. Part of the band is being utilized for Public Protection and Disaster Relief (PPDR). The plan implemented in the US is not an efficient use of spectrum because it is highly fragmented and offers far less spectrum for mobile broadband use. It contains interleaved small blocks of spectrum, requiring more guard bands than a single contiguous block. TDD based band plan in 700 MHz band i.e. APT700 TDD is being considered for the deployment of TD-LTE in its entire band by China. APT700 FDD plan, designated as B28, is being adopted as a prime band for Long Term Evolution (LTE) technology by a number of countries in the Asia-Pacific (APAC), Middle East, Europe and Latin American region. The APT700 band plan offers 2x45 MHz contiguous spectrum.

2.4 In its recommendations on "IMT – Advanced Mobile Wireless Broadband Services" dated 19th March 2013, the Authority recommended that *"APT700 band plan should be adopted for the 700 MHz spectrum band (698-806 MHz) with FDD based 2x45 MHz frequency arrangement*."

2.5 In the present reference dated 9th July 2015, DoT has intimated that 2x35 MHz spectrum is available for commercial purpose in each of the 22 LSAs. DoT has not provided the carrier details and has stated that it will be decided in consultation with Defence. Since DoT did not give the exact frequencies or the band plan in which the spectrum in this band will be auctioned, the Authority through its letter dated 24th July 2015 asked DoT to confirm that the assignment through proposed auction in 700 MHz band will be as per APT700 band plan. In its response, DoT stated that while recommending the price of spectrum in 700 MHz band, if felt appropriate, TRAI may deliberate once again the issue of adopting APT700 band plan for 700 MHz band and provide its recommendations on this subject after taking into consideration current status of eco system.

2.6 Considering the fast developing device eco-system in the APT700 band plan (FDD Option) and its adoption by 40+ countries across the APAC and Latin America regions, the Authority is of the firm view that APT700 band plan should be adopted for the 700 MHz (698-806 MHz) spectrum band with FDD based 2x45 MHz frequency arrangement. The same was also conveyed to DoT through the letter dated 16th November 2015 **(Annexure 2.1).**

2.7 In the Consultation Paper, no specific question was raised on the timing of the auction of 700 MHz band. However, in their comments to the Consultation Paper, some stakeholders have requested the Authority to recommend that the auction of the spectrum in this band be held only after development of a strong device ecosystem. A few stakeholders have submitted that the existing spectrum is still in process of being fully utilized; Telecom Service Providers (TSPs) are planning roll-outs in recently acquired spectrum. Therefore, as per these stakeholders, auction of spectrum in 700 MHz, would clearly divert CAPEX from its already planned roll-outs.

2.8 In the consultation paper, it was shown in Annexure 1.4 that 12 commercial networks have been launched in this band and 13 countries have already auctioned 700 MHz band spectrum. As mentioned in para 2.6, device eco-system in the APT700 band plan (FDD Option) is developing fast and it has already been adopted by 40+ countries across the APAC and Latin America regions. Once India also auctions spectrum in 700 MHz band, it will act as a catalyst for faster development of eco-system in this band. Moreover, this will provide significant amount of additional spectrum to Telecom Service Providers (TSPs) who have been demanding more spectrum for better quality of service and to reduce the problem of call drops. Above all, non-auctioning of spectrum in this band will be a wastage of this precious resource.

2.9 **In view of the above, Authority reiterates its earlier recommendation that APT700 band plan should be adopted for the 700 MHz (698-806 MHz) spectrum band with FDD based 2x45 MHz frequency arrangement. Further, it recommends that entire available spectrum (2x35MHz) in the 700 MHz band should be put to auction in the upcoming auction.**

800 MHz Band (824-844 MHz/869-889 MHz)

2.10 As mentioned in Chapter-I, the six Basic Service licences given in 1997-98, which subsequently migrated to UASL, are due to expire during May 2016 to March 2018[4]. These licensees are holding administratively assigned spectrum in 800 and 1800 MHz bands. As per the information provided by DoT, the quantum of spectrum being held by these licensees in 800 and 1800 MHz bands is as given in Table 2.1 below[5]:

[4] TRAI in its earlier recommendations considered licensees whose licenses were expired for the period upto April, 2016. Therefore for the sake of continuity, period from May 2016 is taken even though licenses are expiring from 29th September,2017.

[5] MTNL's licences in both Mumbai and Delhi have been extended till 2019 and therefore MTNL's spectrum holding has been excluded from the spectrum availability in 800/900/1800 MHz bands.

Table 2.1

Licences Expiring in 2016-2018

Sl. No.	LSA	TSP	Date of Expiry of Licence	Spectrum Holding (MHz)	
				1800 MHz Band	800 MHz Band[6]
1	Mumbai	TTML	29-Sep-17	4.4	5
2	Maharashtra	TTML	29-Sep-17	4.4	5
3	Gujarat	RCL	29-Sep-17	4.4	3.75
4	Andhra Pradesh	TTL	29-Sep-17	4.4	3.75
5	Punjab	HFCL	29-Sep-17	4.4	2.5
6	Rajasthan	SSTL	03-Mar-18	4.4	2.5
	Total	**6 TSPs**		**26.4**	**22.5**

2.11 In the auctions held in March 2015, a total of 108.75 MHz paired spectrum was put to auction in the 800 MHz band. Out of that 22.5 MHz spectrum remained unsold. If 31.25 MHz spectrum, which is available with DoT, is also taken into account, a total of 76.25 MHz spectrum in this band can be put to auction. The details of the same is as shown in the Table 2.2 below:

Table 2.2

Spectrum availability in 800 MHz Band (MHz)

LSA	Total spectrum put in March 2015 auction	Spectrum that remained unsold	Spectrum becoming available due to expiry of licences during May 2016 to March 2018	Additional spectrum that is available with DoT	Total spectrum available for auction
	(A)	(B)	(C)	(D)	(E)=(B+C+D)
	MHz	MHz	MHz	MHz	MHz
DEL	3.75	2.5	0	0	2.5
MUM	7.5	0	5	0	5
KOL	1.25	0	0	1.25	1.25
MH	3.75	1.25	5	2.5	8.75
GUJ	2.5	0	3.75	1.25	5
AP	6.25	2.5	3.75	1.25	7.5
KTK	1.25	1.25	0	1.25	2.5
TN	1.25	1.25	0	1.25	2.5

[6] This includes the spectrum which was surrendered by TTSL but could not be auctioned as the matter is sub-judice.

KL		0	0	2.5	2.5
PB	3.75	1.25	2.5	1.25	5
HR	7.5	0	0	1.25	1.25
UP (W)	1.25	0	0	1.25	1.25
UP (E)	3.75	0	0	2.5	2.5
RAJ		0	2.5	2.5	5
MP	6.25	1.25	0	0	1.25
WB	1.25	0	0	3.75	3.75
HP	8.75	1.25	0	1.25	2.5
BH	5	0	0	1.25	1.25
OR	7.5	1.25	0	1.25	2.5
AS	13.75	3.75	0	1.25	5
NE	13.75	3.75	0	1.25	5
J&K	8.75	1.25	0	1.25	2.5
Total	**108.75**	**22.5**	**22.5**	**31.25**	**76.25**

2.12 However, DoT has indicated that either due to non-availability of inter-operator guard band or Government's own requirement, from the total available spectrum of 76.25 MHz, only 37.5 MHz may be put to auction. The details of the same is as shown in the Table 2.3 below:

Table 2.3

Spectrum in 800 MHz Band (MHz) that may be put to auction

LSA	Total spectrum available with DoT	Total spectrum that can be put to auction as per DoT	Remark
DEL	2.5	0	Unsaleable due to non-availability of inter-operator Guard band
MUM	5	5	
KOL	1.25	0	Unsaleable due to non-availability of inter-operator Guard band
MH	8.75	7.5	Out of total 7 carriers, 1 carrier is unsaleable due to non-availability of inter-operator Guard band
GUJ	5	3.75	Out of total 4 carriers, 1 carrier is unsaleable due to non-availability of inter-operator Guard band
AP	7.5	6.25	1 carrier is unsaleable due to non-availability of inter-operator Guard band
KTK	2.5	1.25	Out of total 2 carriers, 1 carrier is unsaleable due to non-availability of inter-operator Guard band
TN	2.5	1.25	Out of total 2 carriers, 1 carrier is unsaleable due to non-availability of inter-operator Guard band

KL	2.5	0	Both the carriers unsaleable due to non-availability of inter-operator guard band
PB	5	5	
HR	1.25	0	Unsaleable due to non-availability of inter-operator Guard band
UP (W)	1.25	0	The carrier is unsaleable due to non-availability of inter-operator guard band
UP (E)	2.5	1.25	Out of total 2 carriers, 1 carrier is unsaleable due to non-availability of inter-operator guard band
RAJ	5	5	
MP	1.25	1.25	
WB	3.75	0	All three carriers unsaleable due to non-availability of inter-operator guard band
HP	2.5	0	Both the carriers unsaleable due to non-availability of inter-operator guard band
BH	1.25	0	Unsaleable due to non-availability of inter-operator Guard band
OR	2.5	0	Both the carriers unsaleable due to non-availability of inter-operator guard band
AS	5	0	Government requirement of 4 carriers is under consideration
NE	5	0	Government requirement of 4 carriers is under consideration
J&K	2.5	0	Government requirement of 2 carriers is under consideration
Total	**76.25**	**37.5**	

900 MHz Band (890-915 MHz/935-960 MHz)

2.13 In the auctions held in March 2015, a total of 177.8 MHz paired spectrum in the 900 MHz band was put to auction out of which 168 MHz spectrum was sold and 9.8 MHz remained unsold. As no additional spectrum is becoming available in this band due to expiry of licences during May 2016 to March 2018, only unsold spectrum of 9.8 MHz can be put to auction in the upcoming auctions. The details of the same is given in Table 2.4:

Table 2.4
Spectrum availability in 900 MHz Band (MHz)

LSA	Total spectrum put to auction in March 2015	Balance spectrum left
DEL	0	0
MUM	0	0
KOL	0	0
MH	14	0
GUJ	14	3
AP	14	0
KTK	14	0.2
TN	0	0
KL	12.4	0
PB	15.6	0
HR	12.4	0.2
UP (W)	6.2	1.2
UP (E)	6.2	0.6
RAJ	12.4	0
MP	12.4	0
WB	4.4	0
HP	12.4	0
BH	6.2	4.6
OR	6.2	0
AS	6.2	0
NE	8.8	0
J&K	0.0	0
Total	**177.8**	**9.8**

1800 MHz (1710-1785 MHz/1805-1880 MHz)

2.14 In the auctions held in March 2015, a total of 99.2 MHz paired spectrum in the 1800 MHz band was put to auction. Out of that, 5.4 MHz spectrum remained unsold. The TSPs, whose licences are due for expiry during May 2016 to March 2018, hold 26.4 MHz spectrum in the 1800 MHz band, from which 8.8 MHz spectrum lies in the designated Defence Band (1765 MHz-1785 MHz/1860 MHz-1880 MHz). As a result only 17.6 MHz is becoming available due to expiry of licences. Further, DoT has excluded 2 MHz unsold spectrum in Tamilnadu LSA from the

available quantity. Therefore, a total of 21 MHz spectrum may be auctioned in 1800 MHz band (Table 2.5).

Table 2.5

Spectrum availability in 1800 MHz Band (MHz)

LSA	Total spectrum put to auction in March 2015 (A)	Balance spectrum left after auction (B)	Spectrum becoming available due to expiry of licences during May 2016 to March 2018 (C)	Spectrum that cannot be reassigned being in the Defence Band (D)	Total spectrum available (E)=(B)+(C)-(D)
DEL	0	0	0	0	0
MUM	0	0	4.4	4.4	0
KOL	7	0	0	0	0
MH	0	0	4.4	4.4	0
GUJ	3.4	0	4.4	0	4.4
AP	3.8	0	4.4	0	4.4
KTK	1.8	0.2	0	0	0.2
TN	19	2	0	0	0[7]
KL	1	0	0	0	0
PB	1.6	0	4.4	0	4.4
HR	8	0	0	0	0
UP (W)	2.2	0	0	0	0
UP (E)	4.2	0	0	0	0
RAJ	10.4	0.4	4.4	0	4.8
MP	0	0	0	0	0
WB	0	0	0	0	0
HP	10.2	0	0	0	0
BH	2	2	0	0	2
OR	16.2	0	0	0	0
AS	0	0	0	0	0
NE	8.4	0.8	0	0	0.8
J&K	0	0	0	0	0
Total	**99.2**	**5.4**	**26.4**	**8.8**	**21**

2.15 The available spectrum in this band is not only meager but fragmented too. Moreover, some of the spectrum in this band is available in only in some parts of the LSA. Fragmentation particulars and LSA-wise details

[7] DoT has excluded the unsold spectrum in Tamilnadu from the availability.

of the areas in which the spectrum is available is given in Table 2.6 below:

Table 2.6

Details of availability of spectrum in 1800 MHz Band

Sl. No.	LSA	Quantum of partial spectrum (MHz)	Places in the service area, where available
1.	Andhra Pradesh	4.4	Entire Service Area
2.	Gujarat	4.4	Entire Service Area
3.	Karnataka	0.2	Entire Service Area
4.	Punjab	4.4	Entire Service Area
5.	Bihar	1.8	Available in Motihari, Gopal Ganj, Madhubani, Raxaul, Betiah, Sheohar and Sitamarhi
		0.2	Available in entire LSA except Patna, Purnea, Chapra, Jahanabad and Ara.
6.	North East	0.8	Meghalaya only
7.	Rajasthan	3.4	Entire LSA except Bikaner, Barmer, Bharatpur, Dausa, Ganganagar, Hanumangarh, Jodhpur, Jaipur, Jaisalmer, Jalore and Sirohi
		0.4	Entire LSA except Bikaner, Barmer, Bharatpur, Dausa, Ganganagar, Hanumangarh, Jodhpur, Jaipur, Jaisalmer, Jalore, Sirohi
		0.2	Entire Service Area
		0.8	Entire Service Area

2.16 Earlier, the issue of auctioning of partial spectrum was examined by the Authority in its recommendations on 'Auction of Spectrum' dated 23rd April 2012. The Authority was of the view that in case the spectrum, proposed to be auctioned in a LSA, is available in majority of the districts, important cities and state capital(s), then only it should be considered for allocation through auction for commercial usages. Accordingly, the Authority recommended that, "*The spectrum which is available in at least 75% of total number of districts of the LSA including the State capital(s) should be considered for allocation through auction.*"

2.17 It can be seen from Table 2.6 that in Bihar, Rajasthan and North-East LSAs spectrum is available only in a few districts. Further, it is also not available in State Capital(s). Therefore, the Authority is of the view that partial spectrum available in Bihar, Rajasthan and North-East should not be put to auction till such time it becomes available in majority of the districts including important cities and State Capital(s).

2.18 In view of the above, **the Authority recommends that partial spectrum available in Bihar, Rajasthan and North-East LSAs should not be put to auction till such time it becomes available at least in 75% of total number of districts of the LSA including the State capital(s).**

2100 MHz Band (1920-1980 MHz/2110-2170 MHz)

2.19 In the auctions held in March 2015, one block of 5 MHz paired spectrum was put to auction in 17 LSAs. However, in Delhi, Mumbai and Andhra Pradesh LSAs, the spectrum remained unsold. DoT has intimated that additional 3 blocks of 5 MHz spectrum are likely to become available in the 2100 MHz band in all the LSAs. The total spectrum available in this band for auction will be the total of unsold spectrum and the additional spectrum becoming available due to vacation by Defence. The details are as given in Table 2.7 below:

Table 2.7
Spectrum availability in 2100 MHz Band (MHz)

LSA	Total spectrum put to 2015 auction	Balance spectrum left	Additional Spectrum likely to become available	Total spectrum available
DEL	5	5	15	20
MUM	5	5	15	20
KOL	5	0	15	15
MH	5	0	15	15
GUJ	5	0	15	15
AP	5	5	15	20
KTK	5	0	15	15

TN	5	0	15	15
KL	5	0	15	15
PB	0	0	15	15
HR	5	0	15	15
UP (W)	5	0	15	15
UP (E)	5	0	15	15
RAJ	5	0	15	15
MP	5	0	15	15
WB	0	0	15	15
HP	0	0	15	15
BH	0	0	15	15
OR	5	0	15	15
AS	5	0	15	15
NE	5	0	15	15
J&K		0	15	15
Total	**85**	**15**	**330**	**345**

2300 MHz Band (2300-2400 MHz)

2.20 Spectrum in 2300 MHz band was put to auction only once i.e. in the auctions held in 2010. In that auction, 2 blocks of 20 MHz (unpaired) spectrum were put to auction in all LSAs and entire spectrum in this band was sold. Now, DoT has intimated about availability of one block of 20 MHz in 16 LSAs. The details of the same is as given in Table 2.8 below:

Table 2.8
Spectrum availability in 2300 MHz Band

LSA	Spectrum likely to put to auction (MHz)
DEL	20
MUM	20
KOL	20
MH	20
GUJ	20
AP	20
KTK	20
TN	20
KL	20

PB	0
HR	0
UP (W)	0
UP (E)	0
RAJ	0
MP	20
WB	20
HP	20
BH	20
OR	20
AS	20
NE	20
J&K	0
Total	**320**

2500 MHz (2500-2690 MHz)

2.21 Presently, out of the 190 MHz of spectrum in this band, 150 MHz has been assigned to Department of Space (DoS) for satellite services. Only 40 MHz (unpaired) has been earmarked by WPC for terrestrial applications in frequency slots of 2535-2555 MHz and 2635-2655 MHz. From this 40 MHz, one slot of 20 MHz (unpaired) was assigned to MTNL/BSNL in all LSAs at the auction determined prices of 2300 MHz band in 2010 auctions. Later on, MTNL has surrendered its spectrum in this band in both Mumbai and Delhi LSAs while BSNL surrendered it in 6 LSAs viz. Kolkata, Maharashtra, Gujarat, Andhra Pradesh, Tamilnadu and Karnataka. Accordingly, the amount of spectrum in the 2500 MHz band that can be put to auction is given in table 2.9 below:

Table 2.9
Spectrum availability in 2500 MHz Band (MHz)

LSA	Spectrum surrendered by BSNL / MTNL	Additional spectrum likely to become available	Total spectrum available
DEL	20	20	40
MUM	20	20	40
KOL	20	20	40
MH	20	20	40

GUJ	20	20	40
AP	20	20	40
KTK	20	20	40
TN	20	20	40
KL	0	20	20
PB	0	20	20
HR	0	20	20
UP (W)	0	20	20
UP (E)	0	20	20
RAJ	0	20	20
MP	0	20	20
WB	0	20	20
HP	0	20	20
BH	0	20	20
OR	0	20	20
AS	0	20	20
NE	0	20	20
J&K	0	20	20
Total	**160**	**440**	**600**

B. AUGMENTING SUPPLY OF SPECTRUM

2.22 It is clear from the forgoing discussion that the available quantum of spectrum in 800, 900 and 1800 MHz band is very less. The licensees, whose licences are expiring during May 2016 to March 2018, hold spectrum in the 800 and 1800 MHz bands. If these licensees want to continue to provide services to their subscribers and safeguard their investment made hitherto, it's crucial for such licensees to re-acquire spectrum in the upcoming auction. In some LSAs viz Mumbai and Maharashtra, even the spectrum that is getting available in 1800 MHz band due to expiry of licences is not being put to auction (Refer Table 2.5). In other LSAs where licences are due to expire, the quantum of spectrum, being put to auction particularly in 1800 MHz band, is very less. In such a scenario, it is utmost important to examine the feasibility of augmenting the supply of spectrum mainly in these bands. This can be done by harmonisation of spectrum i.e. re-arrangement of the

carriers assigned to the TSPs and Government agencies, and by examining the use of administratively assigned spectrum to the TSPs.

B.1 Harmonisation of Spectrum

800 MHz band

2.23 As can be seen from the table 2.3, DoT proposes to auction only 37.5 MHz[8] out of total 76.25 MHz available spectrum. DoT does not propose to auction 12.5 MHz spectrum available in Assam, North-East and J&K, as it is likely to be assigned for the Government use. Further, in other 15 LSAs DoT does not propose to auction 26.25 MHz spectrum due to non-availability of inter-operator guard band. This will result in keeping this valuable spectrum idle. How the spectrum can be put to optimal use is surely an issue that needs careful examination. In this backdrop, the stakeholders were requested to comment upon whether the entire spectrum available with DoT in the 800 MHz band be put for auction. The stakeholders were also requested to comment upon how the spectrum in the 800 MHz band, which is not proposed to be auctioned due to non-availability of inter-operator guard band, can be utilised.

2.24 The stakeholders are generally of the view that the entire spectrum available with DoT should be put to auction. Some of them have pointed out that non-auction of the 800 MHz spectrum will result in creation of artificial scarcity. Some stakeholders suggested that harmonization exercise should be carried out for increasing the availability of spectrum in 800 MHz band for the upcoming auction. Some were of the view that it is desirable to make available spectrum in contiguous blocks to the extent possible as fragmented allocation of spectrum results in inefficiencies. A few stakeholders opined that there is no requirement for guard band in case 1.25 MHz is auctioned instead of 1.23 MHz.

[8] Carrier size is 2x1.23 MHz instead of 2x1.25 MHz.

Analysis

2.25 The Authority has noted that DoT does not propose to put to auction some carriers due to non-availability of inter-operator guard band. Inter-operator guard band can only be created by re-arrangement of the carrier frequencies amongst the TSP. Therefore, it is essential to examine the feasibility of rearranging the carriers in the 800 MHz band with the objective of creating inter-operator guard bands wherever required.

2.26 The Authority is aware that, in the 800 MHz band, a minimum inter-operator guard band is taken as 0.3 MHz. However, from the carrier details provided by DoT (refer **Annexure-2.2)** it is seen that there are some instances where guard band has been provided more than 0.3 MHz. Further, in some of the LSAs spectrum holding of a TSP is fragmented. Similarly, in some of the LSAs, available (unassigned) spectrum blocks are also disjointed. As a result there is an avoidable requirement of guard band(s). The Authority is of the view that the guard band requirement can be reduced in this band if (a) the existing inter-operator guard band is reduced to 0.3 MHz, (b) the spectrum holding of a TSP is made contiguous[9], and (c) unassigned spectrum blocks, which are to be auctioned, are also made contiguous. As a result of this exercise there will be some spectrum can be made available which can be put to auction even in larger contiguous blocks.

2.27 The above exercise will require re-arrangement of carriers amongst the licensees. As an illustration, **Annexure 2.3** may be referred that gives carrier frequencies after carrying out re-arrangement as discussed above in those LSAs, where there is a requirement of inter-operator guard band. The only objective of this illustration is to create inter-operator guard band wherever required so that the entire spectrum available with DoT can be put to auction. It would lead to a significant increase in the quantum of spectrum that may be put to auction and Government can

[9] Except for the carriers assigned through 2013 auctions

earn significant revenue. As stated in its recommendations of 27th November 2014, the Authority re-emphases that the sub-optimal utilisation of spectrum not only amounts to denial of the opportunity for its better use by others but also a revenue loss to the Government in terms of upfront payment, annual licence fees (LF) and spectrum usage charges (SUC). In addition, there is an opportunity cost in keeping the spectrum idle in terms of other taxes and levies such as service tax, corporate tax etc.

2.28 **In view of the above, the Authority recommends that DoT should carry out carrier re-assignment exercise in the 800 MHz band at the earliest and ensure that entire spectrum that is available for commercial use is put to auction so as to avoid a situation where precious spectrum in this band remains unutilized resulting in revenue loss to the Government. It should also be ensured that the spectrum, which is getting released due to re-assignment of carriers, is in contiguous blocks.**

1800 MHz band

2.29 As per DoT, 20 MHz (1765 -1785 MHz/1860-1880 MHz) has been earmarked as part of Defence Band and 55 MHz (1710-1765 MHz/1805-1860 MHz) of spectrum is earmarked for the commercial use in this band. Currently, frequency assignment in this band is not exactly as per this arrangement. Defence is occupying spectrum in commercial part of the band and vice-versa. In many LSAs, spectrum assigned to Defence is more than their share of 20 MHz.

2.30 DoT has decided that, in case any spectrum that is becoming available from the expiring licences falls within the portion of the band earmarked for Defence, the same will not be put to auction. As a result, approximately 111 MHz spectrum is lying vacant in the Defence Band. In Maharashtra and Mumbai LSAs, entire spectrum becoming available in 1800 MHz due to expiry of licences is from the portion earmarked as

Defence Band. Therefore, unless equal quantum of spectrum is not made able in the commercial part of the band, the service provider will not have any chance to win back that spectrum in the auction.

2.31 Due to the factors discussed above; total spectrum assigned for commercial purpose in the 1800 MHz band is less than 55 MHz in almost all the LSAs. If Defence shifts to the designated Defence Band and its assignment in all the LSAs is restricted to maximum 20 MHz, around 201 MHz additional spectrum can be made available for commercial purpose (Table 2.10). This requires adjustment of frequencies amongst Defence and TSPs.

Table 2.10

Additional spectrum that can be made available for commercial purpose after harmonisation process in the 1800 MHz band

Service Area	Spectrum assigned for commercial use[10] (MHz)	Spectrum proposed to be auctioned by DoT (MHz)	Total spectrum available for commercial use (MHz)	Additional spectrum that should be assigned for commercial purpose (MHz)
A	B	C	D=B+C	E=55-D
DEL	42	0	42	13
MUM	50	0	50	5
KOL	50.8	0	50.8	4.2
MH	41.25	0	41.25	13.75
GUJ	41.8	4.4	46.2	8.8
AP	50.4	4.4	54.8	0.2
KTK	50.6	0.2	50.8	4.2
TN	57.4	0	57.4	0
KL	52.65	0	52.65	2.35
PB	39.25	4.4	43.65	11.35
HR	47.3	0	47.3	7.7
UP (W)	40.1	0	40.1	14.9
UP (E)	49.25	0	49.25	5.75
RAJ	43.8	4.8	48.6	6.4
MP	51.9	0	51.9	3.1
WB	36.15	0	36.15	18.85

[10] 'Spectrum assigned for commercial use' excludes the spectrum linked with expiry licences but includes a guard band of 0.2 MHz in each LSA and the spectrum of 1.8 MHz reserved by DoT for Aircel in 11 LSAs viz. Assam, Rajasthan, UP (E), Mumbai, NE, Bihar, Delhi, J&K, Kolkata, Orissa and West Bengal following the Hon'ble TDSAT's order of January 2014. There is some spectrum available with DoT in small fragmented chunks of 0.2 MHz only. It has not been included in the spectrum to be auctioned by the DoT. Therefore, it has not been counted in the 'Spectrum assigned for commercial use'.

HP	43.25	0	43.25	11.75
BH	42.35	2	44.35	10.65
OR	54.5	0	54.5	0.5
AS	36.55	0	36.55	18.45
NE	45.5	0.8	46.3	8.7
J&K	22.7	0	22.7	32.3
Total	**989.5**	**21**	**1010.5**	**201.2**

2.32 In its reference dated 9th July 2015, DoT has stated that harmonisation of 1800 MHz band with Defence and TSPs is underway and if the harmonisation process gets completed before the commencement of process for conduction of forthcoming auction, spectrum released from this process will be added into the availability of 1800 MHz band.

2.33 Many stakeholders have suggested since 1800 MHz band is globally harmonized band for deployment of LTE networks, it is important that entire available spectrum in 1800 MHz band should be made available in contiguous blocks. Therefore, these stakeholders have requested that harmonization process should be completed before the auctions. One stakeholder opined that although all service providers have committed to this initiative, the progress is slow and needs to be expedited to ensure optimal use of available spectrum in this band. Another stakeholder suggested that vacant/available 1800 MHz spectrum identified by DoT may be put to auction and harmonization can be carried out post the auctions. It also desired that prospective bidders should be assured by DoT that their liberalized spectrum would be made contiguous.

2.34 Keeping spectrum unused not only creates artificial scarcity but also amounts to revenue loss to the Government. As can be seen from Table 2.10, by carrying out spectrum harmonisation amongst TSPs and Defence, approximately 201 MHz of additional can be made available for the auction. In the process of harmonization, it is also essential to ensure that the available spectrum is put to auction in the contiguous blocks. For having larger availability of quantity and contiguity of

spectrum, it is important that the exercise is completed at the earliest and the entire quantity of spectrum made available in this band is included in this auction.

2.35 In view of the above, **the Authority recommends that DoT, in coordination with Defence and the TSPs, should complete the harmonization process in the 1800 MHz band before upcoming auctions so that the entire spectrum that is made available due to this exercise is placed for bidding. The available spectrum must be put to auction in contiguous blocks, preferably in the block of 5 MHz.**

B.2 Effective Utilisation of Administratively Assigned Spectrum

2.36 As brought out in the Authority's recommendations of 9th September 2013, 22nd February 2014 and 27th November 2014, spectrum in the 800 MHz band assigned to PSUs is grossly unutilised and accordingly the Authority had recommended that *"The DoT should take back from* MTNL *its entire spectrum holding in the 800 MHz band. BSNL should be allowed to retain only one CDMA carrier in all the LSAs except in Jammu and Kashmir, Assam and North-East LSAs, where it can retain both the carriers. The DoT should take back other carriers assigned to BSNL in the 800 MHz band*." DoT has informed that MTNL has surrendered its entire spectrum in 800 MHz band in Delhi and Mumbai while BSNL has surrendered one carrier in 10 LSAs viz. AP, Bihar, Gujarat, Haryana, Himachal Pradesh, Punjab, UP (East), UP (West), Orissa and Kolkata[11]. However, BSNL has not surrendered any carrier in the remaining 7 LSAs. The Authority is of the view that DoT should expedite the process and take back one 800 MHz carrier from the BSNL in the remaining 7 LSAs also.

[11] It its back-reference dated 14th November 2014, DoT has informed about the surrender of 1 carrier by BSNL in 10 LSAs. However, as per the LSA-wise available carrier details in the 800 MHz band I **Annexure-2.2**, as informed by DoT, BSNL has surrendered one carrier in only 4 LSAs (HR, AP, Kol and PB). It is assumed that the surrender process in remaining LSAs will be completed before the upcoming auction.

2.37 Inefficient utilisation of spectrum is also observed in some of the TSPs who had been assigned spectrum administratively. Based on the information submitted by the TSPs, the Authority has observed that Ms Aircel in Haryana and MP LSAs, Tata in Himachal LSA and West Bengal LSAs, and Ms Quadrant LSA in 800 MHz or 1800 MHz bands are largely not utilizing the spectrum assigned to them. From the data it can be seen that these TSPs have not invested appropriately in building up the network for provision of services and therefore, are operating in a very limited manner with abysmally low subscriber base. Table 2.11 given below provides the details:

Table 2.11

Spectrum band	Licensee	Subscribers (Peak-VLR) in Oct-15	Administratively assigned spectrum (MHz)	AGR for Q.E. Sep-15 (Rs. Crore)	No. of BTSs installed as on Sep-15	Validity of license till
1800 MHz)	Aircel-Haryana	266	4.4	-0.12	28	14.12.2026
	Aircel-MP	23	4.4	-0.05	128	
	Tata-HP	198	4.4	NA#	5	30.01.2024
800 MHz)	Tata-WB	3431	2.5	NA#	26	
	Quadrant - Punjab	227	2.5	NA#	13	29.09.2017

AGR break-up between GSM and CDMA is not available

2.38 Considering the number of BTSs installed by Aircel and Tata in the LSAs mentioned above, it can be inferred that they have not been able to utilize the spectrum even after 9 years/12 years of its assignment. As regards Quadrant, it may be recalled that they were allocated spectrum in 1800 MHz for GSM technology under dual technology policy in 2008. Consequent to launch of GSM service by Quadrant, they have virtually curtailed their CDMA operations. It is clear that on the one hand spectrum assigned to these TSPs remain largely un-utilised, on the other hand these TSPs are not generating revenues and therefore not paying any License Fee (LF) and Spectrum Usage Charges (SUC) to the Government as these are linked to adjusted gross revenue.

2.39 Spectrum is a scarce natural resource and should not be allowed to be kept unutilized. As per clause 23.5 of the Unified Access Service licence (UASL), "*The frequencies shall be assigned by WPC from the designated bands prescribed in National Frequency Allocation Plan-2002. (NFAP-2002) as amended from time to time. Based on usage, justification and availability, spectrum may be considered for assignment, on case by case basis……." (Emphasis supplied).* Further, as per Clause 43.5 (iv) of UASL, "*the licensor has right to modify and / or amend the procedure of allocation of spectrum including quantum of spectrum at any point of time without assigning an reason*". (Emphasis supplied). As such the licensor has right to take back the assigned spectrum, if the service providers are not utilizing the administratively assigned spectrum without any justification.

2.40 **In view of the above, the Authority recommended that the 1800 MHz band administratively assigned spectrum to Aircel in Haryana and MP, and Tata in HP should be taken back. The Authority also recommends the 800 MHz band administratively assigned spectrum to Tata in WB and Quadrant in Punjab should be taken back. This spectrum should also be put to upcoming auction.**

B.3 Surrender of 800 MHz band Spectrum by TTSL

2.41 In April 2013, TTSL has surrendered the CDMA spectrum held by them beyond 2.5+2.5 MHz in all circles except in Delhi and Mumbai where it retained 3.75+3.75 MHz spectrum. However, the spectrum has not been put to auction by DoT because the matter is sub-judice.

2.42 In its reference back dated 14th November 2014, DoT stated that *"The Legal Opinion received by DoT indicates that the auction of spectrum proposed to be surrendered by M/s Tata Tele Services (TTL) and Tata Tele Services (Maharashtra) Ltd. (TTML) during the pendency of Writ Petitions before the Hon'ble High Courts of Bombay and Kolkata may likely to create third party interest, leading to legal complications. The DoT is of the view that since the matter related to surrender of spectrum by TTSL/TTML is sub-judice, the carriers proposed for surrender by TTSL/TTML cannot be considered for making a chunk of contiguous of 5 MHz."*

2.43 In its response dated 27th November 2014, the Authority stated that

> *"TTSL surrendered the spectrum in April 2013 to absolve it from any liability arising out of the one-time spectrum charges (OTC) on spectrum holding beyond 2.5 MHz in the 800 MHz band. This spectrum has already been lying idle for the past 18 months. Since conclusion of the entire judicial process may take considerable time, keeping the spectrum idle till such time is certainly neither desirable nor does it make economic sense[12]. The Authority is also not aware about the legal action taken by the DoT to ensure that the spectrum is not kept idle but is gainfully employed. Moreover, as per the subscriber-linked criteria of DoT, which was last amended in January 2008, no additional spectrum beyond what is available with it after surrender is justified to TTSL except in Maharashtra…."*

2.44 The Authority is not aware of the present status of the case. However, it is of the firm view that spectrum cannot be kept idle for indefinite period of time. Therefore, **the Authority recommends that DoT should ensure that the spectrum surrendered by TTSL is not kept idle and takes appropriate legal remedies to put it in the upcoming auction.**

B.4 Surrender of 2100 MHz band Spectrum by STEL

2.45 2100 MHz spectrum which was assigned to STEL stands available due to cancellation of its licence in three service areas viz. Bihar, Orissa and Himachal Pradesh. In its recommendations on 'Valuation and Reserve Price of Spectrum: 2100 MHz Band' dated 31st December 2014, the Authority recommended that "*the DoT should take all measures to ensure that the 2100 MHz spectrum which was earlier assigned to STEL in three service areas viz. Bihar, Orissa and Himachal Pradesh is also put to auction.*" However, DoT did not include this in the last auctions held in March 2015 as the matter was sub-judice. DoT has not included it in the quantum of spectrum that it intends to put in the next auction. Now, TDSAT, in its Judgment dated 06th July 2015, ordered DoT to refund the money that STEL paid for allocation of 3G spectrum. As the matter has been decided by TDSAT, spectrum assigned to STEL in Bihar, Orissa and Himachal Pradesh LSA can also be considered for

[12] The OTC issue dates to 2010. It applied to all allocated spectrum across all bands. Hence, even if the High Court takes a view in favour of the plaintiff (TSPs), the Government is not likely to accept such verdict. It will contest it in the Supreme Court. Thus, the entire process will take a lot of time.

putting in the next auction. A few stakeholders also requested that the spectrum taken back from STEL put to auction.

2.46 In view of the above, **the Authority recommends that the entire available spectrum in 2100 MHz band, including spectrum taken back from STEL, should be put to auction.**

C. BLOCK SIZE

2.47 Wherever practicable, spectrum is now typically awarded in blocks of 5 MHz (paired) in the case of Frequency Division Duplex (FDD). This is widely considered as the minimum quantity for 3G or 4G deployment. Awarding spectrum in block sizes smaller than 5 MHz may lead to reduced efficiency. Band-wise discussion on the issue is given below:

700 MHz band

2.48 The spectrum being put to auction is liberalised spectrum i.e. it can be used for the deployment of any technology. Sufficient spectrum (2x35 MHz) is available in 700 MHz band and it is desirable that this spectrum is not sold in small pieces. To offer all services that a liberalised spectrum is capable of, it is essential to have minimum 5 MHz of spectrum. With the use of carrier-aggregation, one can use 2 or more carriers for delivering more throughputs with better spectral efficiency. In their comments to the Consultation Paper, majority of the stakeholders also suggested that if the spectrum in 700 MHz is auctioned, it should be offered in the block size of 5 MHz (paired). The Authority is also of the view that the spectrum in 700 MHz band should be offered in the block size of 5 MHz. In order to have better coverage and higher speed of wireless broadband in this band, the Authority is of the opinion that in case a TSP is able to win more than one block of spectrum in the upcoming auctions, it should be allocated spectrum in contiguous blocks.

2.49 In view of the above, **the Authority recommends that spectrum in 700 MHz band should be offered in the block size of 5 MHz (paired). In case a TSP is able to win more than one block of spectrum in the upcoming auctions, it should be allocated spectrum in contiguous blocks.**

800 MHz/900 MHz/1800/2100 MHz band

2.50 In the auctions held in March 2015, the block size and the minimum spectrum that the bidders were required to bid for in the 800 MHz/900 MHz/1800/2100 MHz band were kept as given in Table below:

Table 2.12
Block size and minimum quantity for bidding as January 2015 NIA

Spectrum Band	Block Size (MHz)	Minimum amount of spectrum that a bidder is required to bid for	
		Existing licensees (MHz)	New Entrants (MHz)
800 MHz	1.25	1.25	2.5/3.75/5 depending upon availability of spectrum
900 MHz	0.20	0.6	5[13]
1800 MHz	0.20	0.6	5 MHz, if at least one chunk of contiguous 5 MHz is available; else, 0.6 MHz
2100 MHz	5	5	5

2.51 The stakeholders were requested to comment whether there is any requirement to change the provisions of the latest Notice Inviting Application (NIA) with respect to block size and minimum quantum of spectrum that a new entrant/existing licenses/expiry licensee is required to bid for in 800, 900, 1800 and 2100 MHz bands.

2.52 A number of stakeholders responded that the block size and the provisions regarding minimum spectrum required for bidding should be same as prescribed in the January 2015 NIA. One stakeholder suggested that the same block size as adopted in January 2015 NIA in respect of 800, 900, 1800 and 2100 MHz bands be continued with the only exception that the minimum amount of the spectrum allowed should be reduced from 0.6 MHz to 0.2 MHz in 900 MHz/1800 MHz for

[13] Except in West Bengal service area, where such bidders were required to bid for a minimum of 4.4 MHz as only 4.4 MHz spectrum was available in the 900 MHz band.

existing licensees, only in those LSAs where spectrum available is not even 0.6 MHz in 900/1800 MHz bands. Another stakeholder suggested that considering limited availability for 900 MHz, the minimum quantum for 900 MHz should be kept at 0.2 MHz for both Existing and New Entrants. One stakeholder wrote that in view of limited availability of spectrum in 1800 MHz band, expiring licensees should be allowed to bid for a minimum of 0.6 MHz. A few stakeholders requested that 1.25 MHz block size in 800 MHz band should translate into allocation of full 1.25 MHz instead of 1.23 MHz.

2.53 A few stakeholders were of the view that since the spectrum availability in 900 MHz is less than 10 MHz; new entrants/expiry licensee should be allowed to bid for a minimum block size of 2.4 MHz, in line with TRAI's recommendations of October 2014.

Analysis

2.54 The Authority concurs with the views expressed by many stakeholders that there is no need for the modification in the provisions of the latest NIA with respect to block size and minimum quantum of spectrum that a new entrant/existing licenses/expiry licensee is required to bid for in 800, 900, 1800 and 2100 MHz band. However, due to limited availability of spectrum in some LSAs in 900/1800 bands, minimum spectrum that a bidder is required to bid is required to bid for, is be amended in these LSAs.

2.55 As per the provisions of January 2015 NIA, existing licensee is required to bid for minimum 0.6 MHz of spectrum in the 900/1800 MHz band. In some LSAs, viz Karnataka, not even 0.6 MHz spectrum is available in 900 and 1800 MHz band. Therefore, in such cases, the bidder should be allowed to bid for even 0.2 MHz spectrum.

2.56 A new entrant was supposed to bid for minimum 5 MHz spectrum in 900 MHz. But, in 900 MHz band, there is no LSA where one block of 5 MHz is available. Therefore, requirement of bidding minimum 5 MHz of spectrum in 900 MHz band for the new entrants should be imposed in

only in those LSAs where there is at least one chunk of contiguous 5 MHz is put to auction. In the January 2015 NIA, similar provision was kept for 1800 MHz band. In 800 MHz band also, the minimum spectrum required to be bid for a new entrant was dependent on the available spectrum.

2.57 The spectrum in 2100MHz have been sold in blocks of 5MHz, same should be continued in the upcoming auctions. Higher speed can be provides through carrier aggregation of contiguous carriers. Therefore, in case a TSP is able to win more than one block of spectrum in the upcoming auctions, it should be allocated spectrum in contiguous blocks. Similarly, if the TSP already having spectrum in the 2100 MHz band, acquires additional carrier, it should be ensured that all its carriers are contiguous.

2.58 In view of the above, **the Authority recommends following block size and minimum quantum of spectrum that a new entrant/ existing licenses is required to bid for in 800, 900, 1800 and 2100 MHz bands.**

Table 2.13
Block size and Minimum amount of spectrum for bidding

<table>
<tr><th rowspan="2">Band</th><th rowspan="2">Block Size (MHz)</th><th colspan="3">Minimum amount of spectrum that a bidder is required to bid for (MHz)</th></tr>
<tr><th>Existing licensees</th><th colspan="2">New Entrants</th></tr>
<tr><td rowspan="3">800 MHz</td><td rowspan="3">1.25</td><td rowspan="3">1.25</td><td>5</td><td>If spectrum availability is 5 MHz or more</td></tr>
<tr><td>3.75</td><td>If 3.75 MHz spectrum is available.</td></tr>
<tr><td>2.5</td><td>If 2.5 MHz spectrum is available.</td></tr>
<tr><td rowspan="2">900/ 1800 MHz</td><td rowspan="2">0.2</td><td rowspan="2">0.2, if spectrum availability is less than 0.6 MHz; otherwise 0.6</td><td>0.2</td><td>If spectrum availability is less than 0.6 MHz</td></tr>
<tr><td colspan="2">5 MHz if at least one chunk of contiguous block of 5MHz is available; otherwise 0.6 MHz</td></tr>
<tr><td>2100 MHz</td><td>5</td><td>5</td><td colspan="2">5</td></tr>
</table>

2.59 **The Authority also recommends that in case a TSP is able to win more than one block of spectrum in 2100 MHz band, it should be allocated spectrum in contiguous blocks. Similarly, if the TSP**

already having spectrum in the 2100 MHz band, acquires additional carrier, it should be ensured that all its carriers are contiguous.

2300 MHz and 2500 MHz band

2.60 In the auctions held in May 2010, the block size in the 2300 MHz band was kept as 20 MHz (unpaired). MTNL/BSNL was awarded one block of 20 MHz (unpaired) in the 2500 MHz band. Additional 20 MHz spectrum is available with DoT for assignment for commercial purpose in most of the LSAs in each of these bands. In the Consultation Paper, stakeholders were requested to suggest block size in the 2300 MHz and 2500 MHz bands.

2.61 Many stakeholders were of the view that the block size for 2300 and 2500 MHz should continue to be kept at 20 MHz as was done in 2010 auctions. One stakeholder submitted that the block size for 2300 MHz and 2500 MHz spectrum bands may be kept at 10 MHz for the existing licensee but the minimum spectrum that a new entrant can bid in this band should be 20 MHz as that is the minimum optimum block size in these bands for meaningful business operations and is in line with past policy. Another stakeholder recommended that the block size of 10MHz as these are capacity bands and are supplementary to coverage networks. The stakeholder submitted that the proposed block size will create opportunities to acquire spectrum by more service providers – new as well as existing TSPs present in this band.

Analysis

2.62 As mentioned above, earlier spectrum assignments in 2300/2500 MHz bands were done in the block size of 20 MHz (unpaired) and certain guard band was provisioned between the assigned spectrum blocks. In asynchronous TDD duplexing operations, there is a requirement of substantial guard-band between spectrum assignments of different TSPs and reducing the block size would lead to wastage of precious spectrum. Therefore, in the spectrum trading guidelines also, it has

been decided to keep the block-size the same as was prescribed during the assignment of spectrum through the auction by the Licensor.

2.63 The UK regulator OFCOM in its statement and Consultation on 'Public Sector Spectrum Release: Award of the 2.3 and 3.4 GHz spectrum bands' dated 26th May 2015, has stated that in view of the synchronisation of the 2.3 GHz band, there is unlikely to be a need for the available spectrum to be used for guard bands to avoid interference. It is further stated that the 2.3 GHz spectrum will be awarded in 10 MHz lots.

2.64 Similarly, in India, if the network clocks of adjacent networks in 2300 and 2500 MHz bands are synchronised and all TSPs operating in these bands using the same frame structure, (as has been recommended by the Authority in these recommendations in a later section), there will be no need for any guard band.

2.65 With the technological development, TSPs are able to provide services using same technology by using multiple bands (800 MHz, 1800 MHz, 2300 MHz etc). Lower frequency bands are primarily used for the coverage purpose while higher frequency bands such as 2300 or 2500 MHz bands are mainly used for capacity enhancement. Therefore, TSPs having spectrum in other bands may like to have a smaller block of 2300/2500 MHz band for capacity augmentation. Further, in the subsequent section, it is discussed that a block size of 10 MHz in these bands will help to enhance competition as existing licensees having spectrum in 2300/2500 MHz bands will also be able to take part in the auction. As mentioned above that in case of synchronised TDD operation, it is feasible to allot spectrum in blocks of 10MHz.

2.66 In view of the above discussion, the Authority is of the view that spectrum in the 2300 MHz and 2500 MHz bands should be put to auction in the block size of 10 MHz (unpaired). Presently, spectrum trading in 2300/2500 MHz band is permitted in the block size of 20MHz. The Authority is of the view that after the network

synchronisation of all the TDD networks, spectrum trading in 2300/2500 MHz band should be permitted in the blocks of 10 MHz.

2.67 **Therefore, the Authority recommends spectrum in the 2300 MHz and 2500 MHz bands should be put to auction in the block size of 10 MHz (unpaired). Currently, spectrum trading in 2300/2500 MHz band is permitted in the block size of 20 MHz. The Authority also recommends that after network synchronisation of all the TDD networks, spectrum trading in 2300/2500 MHz band should be permitted in the blocks of 10 MHz.**

D. Spectrum Cap

2.68 Spectrum-acquisition caps are typically designed and enforced to prevent excessive spectrum concentration in one or two operators' hands. As per the NIA provisions of the recent auctions, the overall spectrum cap for each of the service areas is calculated as 50% of the total spectrum assigned for telecom services in a particular band and 25% of the total spectrum assigned for telecom services in 800, 900, 1800, 2100, 2300 and 2500 MHz bands put together. While calculating spectrum caps, the spectrum being put to auction was also taken into account.

2.69 The above definition does not include 700 MHz band. Now, since the spectrum in 700 MHz band is also proposed to be auctioned, above provision of spectrum cap needs to be reviewed. Many alternatives were discussed in the Consultation Paper as summarised below:

Alternative- I: Extend NIA provisions of the recent auctions to the 700 MHz band i.e. 50% of the spectrum assigned in each of the 700/800/900/1800/2100/2300/2500 MHz and 25% of the total spectrum assigned in all these bands put together in each service area. As 2x35 MHz is available in 700 MHz band in all the LSAs and if spectrum is put to auction in the block size of 2x5 MHz, 50% spectrum

limit in a band may allow a single bidder to acquire up to 2x15 MHz. In such a scenario, minimum 3 TSPs will get spectrum in this band.

Alternative II: If it is to be ensured that more TSPs get access to 700 MHz band, an additional auction specific cap may be imposed. If this cap is kept at say 10 MHz, this would ensure that at least 4 TSPs can acquire spectrum in this band.

Alternative III: As all the sub-1 GHz bands have better propagation characteristics and, hence, can be treated alike for formulating any spectrum cap for the lower frequency spectrum. Therefore, instead of having band-specific cap, there can be a cap on sub-1 GHz band spectrum. This would be in addition to the cap on the total spectrum that a TSP can acquire in all the bands taken together.

Alternative IV: If 50% spectrum cap in each band is retained then the existing TSPs in 2300 MHz band will not be able to acquire additional spectrum block in the same band as they will be crossing 50% spectrum cap in this band[14]. With the assumption that it is less likely that any new entrant will come in this band, one option discussed in the Consultation Paper was to treat 2300 MHz and 2500 MHz as one band for the purpose of intra-band spectrum cap with the view to have more competition.

2.70 With this background, the stakeholders were requested to comment on whether there is a need to modify the provisions of spectrum cap within a band and whether there is any need to specify a separate spectrum cap exclusively for the spectrum in 700 MHz band. The stakeholders were also asked to suggest whether a combined cap on the spectrum holding within all bands in sub-1 GHz frequencies be specified and in such a case, should the existing provision of band specific cap be done away with. On spectrum cap issue, another question raised in the Consultation Paper was whether 2300 MHz and 2500 MHz bands

[14] This would have arise in case 20 MHz block size is kept in this band in the upcoming auction.

should be treated as same band for the purpose of imposing intra-band Spectrum Cap.

2.71 A number of stakeholders submitted that the current 50% intra-band and 25% all-band spectrum caps as mandated by DoT, has effectively served the interest of consumers, competition and the Industry. According to these stakeholders, it not only avoids spectrum concentration in a particular band with one or two operators but also leaves scope for others to acquire adequate/proportionate spectrum in the same band. Thus, according to them, these spectrum caps should not be changed and the same should be extended for 700 MHz and 2500 MHz bands also.

2.72 A number of stakeholders opposed the idea of imposing a sub-1 GHz band instead of intra-band cap. As per these stakeholders, these spectrum bands are not directly substitutable at present, due to distinct ecosystem. These spectrum bands are presently used for offering distinctive technologies viz. 700MHz for LTE (not for 2G and 3G services), 800MHz for CDMA and LTE (not for GSM services) and 900 MHz for 2G and 3G services. Therefore, according to these stakeholders, TSPs would most likely require spectrum in every sub-GHz band for offering various services/technologies. Some of these stakeholders also submitted that the new spectrum caps tantamount to changing the rules midway and creation of a non-level playing field based on a new set of criteria, which are arbitrary.

2.73 Some stakeholder argued that introduction of a sub-1GHz cap, will in fact defeat the purpose for which a cap has been introduced and will in fact open the door to permitting excessive spectrum concentration in the hands of one or two TSPs. One stakeholder argued that the proposed changes in spectrum cap, i.e. sub-1 GHz band and 2300/2500 MHz band will lead to excessive consolidation of spectrum in 800 MHz & 2300 MHz band and will benefit only one TSP. Some stakeholders suggested that overall cap for spectrum holding be increased from

current 25% to 33%/40% of the total spectrum holding spread across all bands.

2.74 One stakeholder submitted that with liberalisation of spectrum, the intra-band spectrum caps have lost their relevance. The stakeholder also submitted that with the prevailing caps, the service providers are forced to opt for multiple bands owing to limited availability of spectrum in specific bands, thereby denying the benefits of higher quantum of spectrum for mobile broadband services in terms of enhanced spectral efficiencies. Thus, according to that stakeholder, the intra-band spectrum caps should be completely done away with. One stakeholder recommended transition from a 50% cap on an individual band basis to cover the entire sub-1 GHz band.

2.75 On the issue of specific cap for 700 MHz band, some stakeholders suggested imposing restriction on the quantum of spectrum that a bidder can acquire in the 700 MHz band through upcoming auctions. One of them submitted that one TSP should be allowed to acquire maximum one block of 5 MHz in the 700 MHz band. Some stakeholders recommended that a spectrum cap of 10 MHz be prescribed for 700 MHz band.

2.76 On the issue of treating 2300 and 2500 MHz band as same band for the purpose of spectrum cap, some stakeholders submitted that these two bands have a completely different device ecosystem and therefore, treating 2300 MHz and 2500 MHz bands as one band for intra-band cap may result in one TSP acquiring a disproportionate amount of the spectrum in one of the bands, which will create one TSP's monopoly over that particular spectrum band. Therefore, in the opinion of these stakeholders, there is no rationale for treating these two bands common for determining Intra-band spectrum cap. One such stakeholder argued that even though spectrum in 900 MHz and 1800 MHz are considered inter-changeable historically and are subjected to common rollout obligations, but these are still treated as different bands for the purpose

of spectrum cap. Another stakeholder suggested that it would be incorrect to club 2300 MHz and 2500 MHz together just for the purpose of facilitating the existing TSPs to buy more spectrum in the same band.

Analysis

2.77 There is a need to restrict spectrum holding of a TSP for the competitive concerns but too aggressive caps may lead to spectrum fragmentation and sub-optimal use of spectrum. Now, the spectrum is liberalised and the licensee is free to deploy any technology in any band or using multiple bands. Moreover, technology is not tied to a particular band. For instance, LTE device eco-system is available/developing in most of the spectrum bands. Therefore, ideally, licensees should be allowed to choose the combination of spectrum bands which they wanted, within an overall spectrum cap. Still, not all spectrum bands are equal in terms of their techno-economic implications. Frequencies below 1 GHz offer significantly superior propagation characteristics compared to higher frequencies. Harmonised use of frequencies is another important factor that distinguishes one band from another. At present 1800 MHz band is the most widely used band in LTE network deployments in commercial service which is used in over 43% of commercially launched LTE networks, either as a single band system, or as part of a multi-band deployment. The next most popular contiguous bands are 2.6 GHz (band 7) as used in 105 networks (23.7%) in commercial service, followed by 800 MHz (band 20) used in 92 networks (21%) and AWS (band 4) used in 41 networks (9%) (Refer Table 2.14 given below).

Table 2.14
Status of deployment of LTE networks in various bands[15]

Band	Frequency	Commercially launched LTE networks
LTE FDD		
B3	1800 MHz	192
B7	2.6 GHz	105
B20	800 MHz	92
B12, B13, B14 & B17	700 MHz	58

[15] GSA's report on' Evolution to LTE report' of October, 2015.

B4	AWS	41
B1	2100 MHz	17
B8	900 MHz	15
B28	700 (APT700)	12
B25	1900 MHz	10
B2	1900 MHz	9
LTE FDD		
B5, B18 & B19	850 MHz	9
B40	2.3 GHz	26
B38	2.6 GHz	15
B41	2.6 GHz	13
B42	3.5 GHz	12

2.78 The Authority also noted that some technologies are not available in all the bands. For instance, in Sub-1 GHz bands, 2G technologies like CDMA and GSM can be deployed in 800 and 900 MHz bands only. Therefore, the Authority concurs with the views expressed by a number of stakeholders that sub-1 GHz band spectrum cap in lieu of intra-band cap should not be imposed.

2.79 As per the January 2015 NIA, the overall spectrum cap for each of the access service areas is calculated as 50% of the total spectrum assigned for telecom services in a particular band and 25% of the total spectrum assigned for telecom services in 800/900/1800/2100/2300 and 2500 MHz bands put together. The same provision was part of all the NIAs since 2012 onwards. On 29th May 2015, DoT sought the Authority's views on the issues relating to spectrum cap and minimum spectrum holding by TSPs as follow up of Hon'ble S.C. interim order dated 14th May 2015 in the Transfer Case (Civil) Nos. 43/2015 and other similar matters. In its response dated 2nd July 2015, the Authority, inter-alia, stated that :

"The Authority is of the opinion that at present there is no need to modify the existing spectrum cap (50% of the spectrum assigned in each of the 800/900/1800/2100/2300/2500 MHz and 25% of the total spectrum assigned in all these bands put together in each service area).

On the methodology of calculating the spectrum cap, the Authority is of the opinion that all spectrum assigned to the TSPs including any spectrum which was put to an auction but remain unsold, spectrum which was assigned but subsequently surrendered by the TSP or taken back by the Licensor and spectrum put to auction should be counted. However, any spectrum out of the

above will not be taken into calculation, if the Government assigns it for any other non-commercial purpose e.g. assignment to Defence."

.....

2.80 After analysing the comments of the stakeholders and the Authority's views of July 2015 on the issue, the Authority find no plausible reason to change the present provisions of spectrum cap at this stage particularly when the last 4 auctions were held in the recent past on the same principles. However, the Authority may review the spectrum caps in future, if need arises based on development of market. On the issue of raising the overall cap from 25% to 33% or 40%, the Authority is of the view as the quantum of spectrum will increase significantly after the upcoming auction, overall 25% quantity in terms of quantity will be large enough for the TSPs and does not warrant any change in the overall cap. On the issue of specific cap on 700 MHz band, the Authority is of the view that spectrum cap provisions are enough to take care of concerns of concentration of spectrum in the hands of a few bidders and there seems no need to specify auction-specific cap in the 700 MHz band. As 2x35 MHz is being put to auction, existing spectrum caps will ensure that minimum 3 TSPs take spectrum in this band.

2.81 On the issue of calculating the spectrum cap, the Authority reiterates that all spectrum assigned to the TSPs including any spectrum which was put to an auction but remain unsold, spectrum which was assigned but subsequently surrendered by the TSP or taken back by the licensor and spectrum put to auction should be counted. However in case the Government assigns such spectrum for any other non-commercial purpose e.g. assignment to Defence, the same will not be taken into calculation of spectrum cap.

2.82 In view of the foregoing, **the Authority recommends that existing provision of a cap of 25% of the 'total spectrum assigned' in 700/800/900/1800/ 2100/2300/2500 MHz bands and 50% within a given band in each of the access service area shall apply for total spectrum holding by each TSP.**

E. Roll-out Obligations

Roll-out Obligations in 700 MHz

2.83 In the Consultation Paper, different approaches adopted in different countries for defining the roll-out obligations were discussed. Summary of the same is given in Table 2.15 below.

Table 2.15

Country	Auction	Prescribed Roll-out Obligations
Sweden	800 MHz band in 2009	• Roll-out obligation was placed upon only one spectrum lot of 2x5 MHz in the 800 MHz auction. • Obligation was to provide service of at least 1Mbit/s or better to a list of stated addresses (identified by regulator as being broadband 'not spots', lacking any other forms of broadband connection).
Germany	800 MHz band in 2010	• These licensees were obliged to roll-out the network in rural areas first, before rolling out to urban areas. • To prevent, duplication of infrastructure, operators were permitted to fulfil the obligations in a shared manner and it was up to individual operators to co-ordinate with regard to rolling out in particular areas. • Areas with higher populations couldn't be served until 90% of target population was served.
UK	800 MHz band in 2013	• A coverage obligation was attached to only one of the 800 MHz lots of size 2x10 MHz spectrum. • Obligation was to provide a mobile broadband service for indoor reception to at least 98% of the UK population and at least 95% of the population of each of the UK nations – England, Northern Ireland, Scotland and Wales - by the end of 2017 at the latest.

2.84 In both German and Sweden, obligations reflect the fact that the high cost of infrastructure roll-out in rural areas means that, whilst competition is desirable, network duplication is undesirable in those areas. UK case represents a different approach to Germany and Sweden cases as it does not explicitly require operators to cover specific areas where availability of other means of broadband service is limited.

2.85 This is for the first time that the spectrum in 700 MHz band would be put to auction in India. Therefore, unlike other bands, there is no instance of roll-out obligations prescribed earlier for this band. The stakeholders were asked to suggest an appropriate coverage obligation upon the successful bidders in 700 MHz band; and whether these obligations be imposed on some specific blocks of spectrum (as was done in Sweden and UK) or uniformly on all the spectrum blocks. The stakeholders were also requested to comment on whether it should be mandated to cover the villages/rural areas first and then urban areas as part of roll-out obligations in the 700 MHz band.

2.86 In response, stakeholders have given different suggestion. Some stakeholders commented that the network and device ecosystem in respect of APT 700 MHz band is still at a nascent phase and will require time to develop. Therefore, any mandate to deploy networks using 700 MHz band in rural and remote areas first may be a non-starter as the device costs will be a deterrent in its adoption. One such stakeholder suggested that considering the device ecosystem in 700 MHz band as compared to 800/900 MHz band, any stringent rollout obligations in respect of 700 MHz will worsen its adoption prospects. Therefore, in the opinion of that stakeholder, roll-out obligations in respect of 700 MHz should be kept similar to that of 800 MHz and 900/1800 MHz bands.

2.87 A few stakeholders suggested that there should not be any roll-out obligations for the auctioned spectrum in any band. Some stakeholders recommended that roll-out obligation should be linked to the licence instead of specific spectrum bands/blocks. Therefore, as per these stakeholders, roll out obligations may be mandated for a completely new entrant with no access spectrum holdings in any of the spectrum bands; and there should be no roll-out obligations for an existing service provider in a service area.

2.88 One stakeholder submitted that coverage obligation should be attached to only one block of 2x5 MHz in 700 MHz band and same should be sold

as a separate category. The reserve price of this block should be fixed at 25% of the reserve price set for other blocks. The stakeholder further suggested that the winner of this block should be mandated to first provide mobile broadband service in unconnected villages in a time bound manner. Another view was that the roll-out has to be uniformly applied on all blocks.

2.89 A few stakeholders supported the idea of mandating TSPs to roll-out their network in villages/rural area first followed by urban as part of roll-out obligations in the 700 MHz band. The stakeholder submitted that DoT should also identify specific rural areas to be covered by the successful bidder of 700 MHz and only after such coverage; the band should be used for any other area. Another stakeholder argued that there should be no roll-out obligation such as villages only first, as this will be against the principle of optimal utilization of spectrum, will lead to an anomaly between the Metros and the Circles and not be desirable in a market where the allocations are far lower than global averages.

Analysis

2.90 Mobile networks are a viable way to offer affordable broadband services in rural areas. Being a lower frequency band, 700 MHz band has the excellent propagation characteristics and, therefore, possesses the ability to support wider coverage using fewer base stations/sites than higher frequency bands like 1800 MHz, 2100 MHz, 2300 MHz etc. As is evident from the roll-out obligations imposed in Germany, Sweden and UK, this band may play an important part in improving broadband coverage in the remote areas and could be a cost-effective means to achieve the NTP 2012 broadband target **'broadband for all'**.

2.91 Despite the introduction of mobile service for more than two decades, there are still more than 55,000 villages which do not have any mobile coverage. On accessibility to wireless internet/broadband, the rural-urban divide is even more visible. As on QE September 2015, there are only 27 million broadband connections in rural areas as against around

94 million broadband connections in urban areas. There are around 84 million internet connections in rural areas whereas there are around 120 million internet connections in urban areas while population distribution is in the range of 70:30 in rural and urban India.

2.92 So far the roll-out obligations have been urban-centric. Till 2012, the roll-out obligations in 800/900/1800 MHz bands were restricted to covering 50% DHQs only. Since 2012, the roll-out obligations of these bands were enhanced, but still these were restricted to covering 30% BHQs only. Mobile TSPs usually roll-out networks first where there is the greatest density of population in order to maximize the return on their investment – i.e. in urban areas. Therefore, little purpose is served in imposing urban centric roll-out obligations.

2.93 Keeping in mind the primary objective of increasing broadband penetration in rural areas and reducing the urban-rural divide, the Authority is of the view that the special focus should be given for the coverage in smaller towns and villages. As rural roll-outs are mostly commercially unviable, regulatory initiatives are needed to ensure roll-out of networks in the remote areas. Ideally, broadband should be available in each and every town/village. However, there are more than six lakh towns/villages in the country. Therefore, some rationale approach is required to be adopted while mandating the roll-out obligations. As per Census 2011, there are around 8700 villages/towns with population of 10,000 or more but less than 50,000 population. Out of these villages/town, about 4400 villages/towns are having population of 15,000 or more but less than 50,000 and balance about 4300 are having population of 10,000 or more but less than 15,000. The Authority is of the view that these villages/towns should be provided broadband using the 700 MHz spectrum as part of the roll-out obligations.

2.94 During the consultation process some stakeholders have raised issue about device ecosystem in this band and have raised concerns that the

device cost in this band will be prohibitively high due to lack of economy of scale at present. The Authority, has noted the concerns of the stakeholders. The Authority is of the opinion that once spectrum is allocated in 700 MHz band in India having a mobile user bas eof more than one Billion, equipment manufacturers will accelerate the availability of equipment in this band and as a result benefit of economy of scale is likely to be passed on to the consumers/users. However, keeping the concerns of the stakeholders in mind the Authority is recommending to have roll-out in 5 years in those villages/towns having population between 15000 to 50,000 and 7 years in the villages/towns having population between 10000 to 15,000.

2.95 Roll-out of networks in the lesser and sparsely populated areas may not always be a profitable proposition for the TSPs. Considering high cost of infrastructure, there is a need to avoid duplication of network by mandating all the TSPs to cover all villages/towns. A TSP should also be permitted to fulfil the obligations by sharing network of other operator to the extent permissible as per guidelines/instructions applicable from time to time. A licensee should be allowed to cover any town/village as part of roll-out obligations using intra-service area roaming amongst TSPs having 700 MHz band spectrum, subject to the condition that at least one-third of the towns/villages shall be covered without intra-circle roaming.

2.96 Completion of the roll-out obligation is test checked by the Telecom Enforcement, Resource and Monitoring (TERM) cells of DoT. Till now, the roll-out obligations in most of the spectrum bands were limited upto District headquarters (DHQs) and Block headquarters (BHQs); therefore the number of towns to be covered was relatively less. However, with the increase of number of towns/villages to be covered as roll-out obligations, the Authority is of the view that self-certification by the TSP can be considered as compliance subject to the condition that at least 10%of the towns/villages self-certified by the TSP will be sample checked by the TERM cell in each LSA.

2.97 **In view of the above, the Authority recommends that the following roll-out obligations should be imposed for licensees who acquire access spectrum in 700 MHz band:**

- **All towns/villages having population of 15,000 or more but less than 50,000 to be covered within 5 years of effective date of allocation of spectrum for access services and all villages having population of 10,000 or more but less than 15,000 to be covered within 7 years of effective date of allocation of spectrum.**
- **To prevent, duplication of infrastructure, a TSP should also be permitted to fulfil the obligations by sharing network of other operator to the extent permissible as per guidelines/instructions applicable from time to time. A licensee should be allowed to cover any town/village as part of roll-out obligations using intra-service area roaming amongst TSPs having 700 MHz band spectrum, subject to the condition that at least one-third of the towns/villages shall be covered without intra-circle roaming.**
- **Self-certifications by the TSPs should be taken as compliance of roll-out obligations subject to the condition that at least 10% of such towns/villages self-certified by the TSP will be sample test checked by the TERM cell.**

Fee For Testing Roll-out Obligations

2.98 Some stakeholders have brought out the issue of fee being charged by the licensor for the purpose of testing roll-out compliance. One TSP submitted that since the operators are acquiring the spectrum through a market determined auction prices, roll-out testing fee should be recovered from the proceeds of the auction and it should not be an additional financial burden on the operators. Another stakeholder

submitted that test fee for the additional roll-out obligations or roll-out obligation in villages should be reduced.

2.99 The Authority noted that a substantial fee is charged by DoT as the Test Fee for the check of roll-out obligations. For instance, for testing 3G roll-out obligations of each DHQ/Town, a fee of Rs. 1 lakh as fixed fee and a variable fee of Rs. 17.5 thousand for each pair of BTS/nodes is charged. In these recommendations, the Authority has recommended small towns/villages centric roll-out obligations. Therefore, the Authority is of the opinion that for testing the roll-out obligations in block headquarters and villages, DoT should reduce the quantum of test fee.

2.100 **In view of the above, the Authority recommends that the quantum of test fee for the purpose of roll-out testing requirements may be reduced to 20% of the existing rates for testing in the block headquarters (for phase 3, 4 and 5 of the rollout obligations) and similarly for testing of coverage in rural SDCAs.**

Test Schedule for the roll-out obligations testing for 700 MHz band

2.101 Some stakeholders pointed out that the test schedule for the roll-out obligations testing for 3G and BWA network deployments was issued four years after the assignment of spectrum. Therefore, very little time was left for them to ensure its compliance. These stakeholders requested that the test schedule for the roll-out obligations testing for 700 MHz should be released without delay. The Authority concurs with the suggestion of the stakeholders.

2.102 **Accordingly, the Authority recommends that test schedule for the roll-out obligations testing for 700 MHz should be released within a period of one year from the date of completion of auction in this band.**

Roll-out obligations for 800/900/1800/2100 MHz Bands

2.103 In the NIA of 9th January 2015, the roll-out obligations were mandated for the spectrum in the 800 MHz, 900 MHz, 1800 and 2100 MHz bands. In case of Metro category service areas, 800/900/1800 MHz band spectrum holder was required to provide street-level coverage of 90% of the service area within one year of the date of allotment of spectrum [16] as part of the roll-out obligations whereas 2100 MHz spectrum holder was permitted three years period to provide street-level coverage in at least 90% of the Metro category service area. Roll-out obligations in respect of non-Metro service areas for the spectrum in the 800/900/1800 MHz bands and 2100 MHz bands are given in Table 2.16 and Table 2.17 respectively.

Table 2.16

Roll-Out Obligations as per NIA of 9th January 2015 for Spectrum in 1800MHz, 900MHz and 800MHz Bands

Phases of the Roll out	Roll Out Requirement	Time Period from the date of allotment of spectrum won in the auction
Phase 1	Coverage of 10% DHQs/ Towns	by the end of one year
Phase 2	Coverage of 50% DHQs/ Towns	by the end of three years
Phase 3	Coverage of 10% BHQs	by the end of three years
Phase 4	Coverage of additional 10% BHQs.	by the end of four years
Phase 5	Coverage of additional 10% BHQs (Cumulative 30% BHQs).	by the end of five years

Table 2.17

Roll-Out Obligations as per NIA of 9th January 2015 for Spectrum in 2100 MHz Bands

Roll Out Requirement	Time Period from the date of allotment of spectrum won in the auction
Coverage of 50% DHQs/ Towns, of which at least 15% of the DHQs should be rural Short Distance Charging Areas (SDCA)	by the end of three year
Coverage of additional 10% DHQs	by the end of four years
Coverage of additional 10% DHQs	by the end of five years

[16] The Effective Date is the later of the date when the right to use awarded spectrum commercially commences and the date when the UAS licence, if applicable, is granted to the operator.

2.104 As per NIA provisions, in case of Existing Licensees[17] having spectrum in 900 MHz and 1800 MHz bands, the roll-out already achieved in these bands would be counted. For this purpose, 900 MHz band and 1800 MHz band would be treated as the same band.

2.105 In the Consultation Paper, it was discussed that there can be two approaches to ensure that villages in large numbers are connected through mobile services. Either the TSPs decide themselves to ensure that a village is not covered by more than 2-3 TSPs as part of roll-out obligations or the Licensor/DoT itself decides which villages are to be covered as part of roll-out obligations by individual TSP.

2.106 With the above background, the stakeholders were requested to comment on: (a) how the roll-out obligations should be modified to enhance mobile coverage in the villages? For this purpose, which of the approaches discussed above should be used? (b) Whether there should be any roll out obligation for the existing service providers who are already operating their services in these bands?

2.107 In response, some stakeholders have suggested that for faster roll-out of networks in villages/ rural areas, these roll-out needs to be encouraged through provisions of incentives. One stakeholder opined that since USO fund @ 5% of AGR is collected from the TSPs, the coverage of specific uncovered villages should be undertaken by the Government through USO subsidy, if a TSP covers the specific number of uncovered villages. Another way could be reduction in the USOF levy for covering the specific uncovered villages.

2.108 Some stakeholders submitted that the rollout obligations for 800 MHz/900 MHz/1800 MHz have already been crystallized and have been adopted consistently for the several auctions held since 2012. These stakeholders recommended that it is neither necessary nor desirable to modify the rollout obligations for these bands. Some stakeholders

[17] Existing UASL/CMTS/ UL (AS) licensees were classified as 'Existing Licensee' in those service areas for the frequency band(s) in which they already hold spectrum.

suggested that in respect of the 2100 MHz spectrum, similar roll-out obligations should be applied as was mandated in March 2015 auctions.

2.109 Some stakeholders suggested that the existing TSPs have acquired the spectrum at a price while keeping in view the rollout obligations. Mandating any additional rollout obligations for the spectrum procured for additional capacity will inhibit such acquisitions. Therefore, these stakeholders were of the view that no additional roll-out obligations be mandated on an existing licensee acquiring additional spectrum in the band. One such stakeholder submitted that the present policy on roll-out obligation should be continued and any changes as suggested in this Consultation Paper will distort the continuity in policy. The stakeholder also submitted that in the present scenario, where liberalised spectrum is auctioned at market determined price, there should not be any requirement of additional rollout obligation to cover unconnected rural areas/ villages as the successful bidder will roll-out its network as per his business plans and ensure timely compliance of its existing rollout obligation.

Analysis

2.110 The primary objective of roll-out obligations is to ensure that spectrum is put to optimal use and the services are rolled-out for the benefit of the masses. Moreover, with the timely roll-out of the services, the Government starts getting revenue in the form of license fee and the spectrum usage charges.

2.111 The roll-out obligations for the 700 MHz band have been discussed earlier. For all other bands, roll-out obligations have already been defined as discussed above. The additional roll-out obligations involving coverage of 30% BHQs were incorporated for the spectrum in the 800/900/1800 MHz bands in the Auctions held in 2012/2013 and since then same roll-out obligations have been retained in all the subsequent auctions. In the 2100 MHz band, the roll-out obligations to cover additional 20% DHQ beyond the prevailing roll-out obligations on the

spectrum blocks acquired in 2010 auctions were imposed in the March 2015 auction. The Authority is of the view that there is no need to amend these roll-out obligations in 800/900/1800 and 2100 MHz band. The Authority is also of the view that an existing licensee, who had acquired any spectrum in 800/900/1800/2100 MHz band in the auctions held in 2012 or afterwards and thus already bound with these roll-out obligations, should not be subjected to fresh roll-out obligations.

2.112 In view of the above, **the Authority recommends that the same roll-out obligations, which were imposed on the successful bidder of spectrum in 800 MHz, 900 MHz, 1800 and 2100 MHz band in the auctions held in 2015, should be prescribed for these spectrum bands in the upcoming auctions for new entrant(s). The Authority also recommends that no fresh roll-out obligation should be imposed on existing service providers who are already operating their services in 800, 900, 1800 or 2100 MHz band, in case they acquire additional block of spectrum in the same band.**

Roll-out obligations for 2300/2500 MHz Band

2.113 Roll-out obligations were mandated for the successful licensees who obtained the spectrum in the 2300 MHz band in 2010 auction. In case of Metro Service Area, the licensees were required to provide required street level coverage using the 2300 MHz band spectrum in at least 90% of the service area within five years of the effective date. In Category 'A', 'B' and 'C' LSAs, the licensee has to ensure that at least 50% of the rural SDCAs are covered within five years of the effective date using the 2300 MHz band spectrum. Coverage of a rural SDCA would mean that at least 90% of the area bounded by the municipal/ local body limits should get the required street level coverage. Same roll-out obligation is mandated for 2500 MHz band.

2.114 With this background, the stakeholders were requested to comment on whether the same roll-out obligations which were specified during the 2010 auctions for BWA spectrum should be retained for the upcoming

auctions in the 2300 MHz and 2500 MHz bands and whether both these bands should be treated as same band for the purpose of roll-out obligations. The stakeholders were also requested to give their opinion on whether there should be any additional roll out obligation imposed on existing service providers who are already operating their services in 2300 MHz band, in case they acquire additional block of spectrum in 2300 or 2500 MHz band.

2.115 Some stakeholders recommended that the same roll-out obligations which were specified during the 2010 auctions for BWA spectrum should be retained for the upcoming auctions in the 2300 MHz and 2500 MHz bands for the sake of continuity and uniformity. Some were of the view that additional carrier only adds up to capacity requirement and not coverage and hence no additional coverage should be mandated in case existing TSPs having spectrum in 2300 and 2500 MHz bands acquire additional spectrum in the same band. One of them submitted that the rollout obligations for 2300 MHz and 2500 MHz band spectrum band were quite stringent during last spectrum auction in 2010. Therefore, as per the stakeholder, no additional rollout obligations be imposed on existing TSPs, if they acquire an additional spectrum block in the same band.Pointing to immature network ecosystem and low device availability in both 2300 and 2500 MHz bands, one stakeholder submitted that the rollout obligations for 2300 MHz and 2500 MHz should be kept akin to those specified for 800 MHz and 900/1800 MHz bands.

2.116 One stakeholder suggested that since 2300 MHz and 2500 MHz are being auctioned as two different bands, it is therefore, prudent that spectrum in 2300 MHz and 2500 MHz bands be treated as different bands for roll out obligations. Another stakeholder submitted that 2300 MHz and 2500 MHz band may be treated as same band for all practical purposes and that applies to the roll-out obligations as well. The stakeholder also submitted that the roll out obligations should only be mandated in case of new entrants.

Analysis

2.117 The Authority examined the comments of all stakeholders. It has noted that in the 2300/2500 MHz band, a period of 5 years has been allowed to cover 50% rural SDCA as part of the roll-out obligations. These roll-out obligations were part of NIA issued in 2010. The Authority has noted from the rollout coverage data even after more than 5 years TSPs have not been able to commercial launch their services largely due to multiple factors like device eco-system, coverage issues etc. Therefore, the Authority is of the opinion that there is no need to make those roll-out obligations more onerous which were imposed in 2010 auctions; same roll-out obligations may continue in these bands in the upcoming auctions for a new entrant. However, in case the existing TSPs acquire additional block of spectrum in these same bands (2300/2500 MHz), no additional roll-out obligations should be imposed on them. .

2.118 In view of the above, **the Authority recommends that same roll-out obligations, which were imposed on the successful bidder of spectrum in 2300 MHz band in the auctions held in 2010, should be prescribed for spectrum in 2300 and 2500 MHz band in the upcoming auctions too. The Authority also recommends that in case the existing TSPs, having spectrum in the 2300/2500 MHz band, acquire additional block of spectrum in the same band, no additional roll-out obligations should be imposed on them.**

2.119 As per the prevailing provisions of roll-out obligations, the 900/1800 MHz bands are treated as same band for the purpose of roll-out obligations. In its recommendations on "Terms and Conditions of Unified License (Access Services)" dated 2nd January 2013, the Authority had mentioned that *"This is not withstanding the fact that spectrum is liberalized in the new regime. It is not clear as to why this special provision is made for 900 and 1800 MHz band."* Earlier, the licensees were administratively assigned spectrum either in 900 or 1800 MHz band, and these were mandated to deploy GSM technology using the

spectrum assigned in 900/1800 MHz band. Now, the spectrum is awarded through auctions and the use of auctioned spectrum is liberalised. Licensee can independently bid and acquire spectrum in each of these bands. The licensees are not mandated to deploy same technology in both these bands. In fact, some licensees are deploying different technologies in these bands. Therefore, now treating 900 and 1800 MHz bands as same band does not serve any purpose.

2.120 In the eligibility conditions as specified in the January 2015 NIA, existing UASL/CMTS/UL(AS)/UL licensees were treated as 'Existing Licensee' in those service areas for the frequency band(s) in which they already hold spectrum and their eligibility to bid for spectrum blocks was that of an existing TSP. For this purpose of this provision, 900 and 1800 MHz band were treated as the same band. Therefore, still there are a few licensees who acquired only a meagre amount of spectrum in either 900 to complement its spectrum holding in 1800 MHz band or vice versa and use it jointly for the deployment of same technology. In that case, it won't be possible for such licensee to fulfill roll-out obligations separately in each band. However, there are some TSPs who have acquired sufficient spectrum in each of these bands and are deploying separate technologies in each of them. In such a case, there is no justification for treating 900 and 1800 MHz bands as the same band for the purpose of roll-out obligations. Therefore, the Authority is of the view that if licensee deploys different technologies in these bands, then there is no justification for relaxing it from the independent roll-out obligations in each of these bands.

2.121 In view of the above, **the Authority recommends that 900 and 1800 MHz bands should be treated as separate bands for the purpose of roll-out obligations if a licensee deploys different technologies in these bands. This would be applicable for the existing licensees also who have acquired spectrum through auction of 2012 and onwards.**

2.122 Presently compliance of roll-out obligation is linked to coverage testing alone. It has been noticed that some licensees, who otherwise have complied technically with the roll-out obligations, had either not started commercial services or the number of BTSs installed was negligible. The Authority is of the opinion that the very purpose of mandating the roll-out obligations is to ensure that spectrum assigned is effectively utilised.

2.123 The same issue was examined by the Authority earlier also. In its recommendations on "Terms and Conditions of Unified License (Access Services)" dated 2nd January 2013, the Authority had recommended that:

"For the purpose of compliance of roll-out obligations, the following needs to be fulfilled by the LICENSEE in each phase of the roll-out before offering it for testing:

i. Installing sufficient number of BTSs/Node-Bs for the required coverage;
ii. Launch the services commercially;
iii. File the tariff with TRAI as per TRAI's Telecom Tariff Order; and
iv. Make arrangement for subscriber complaint redressal."

2.124 The above recommendation was not agreed to by DoT. Recently, while reviewing the compliance of roll-out obligations by BWA spectrum holders, the Authority noted that the licensees who acquired BWA spectrum in 2010, in general have offered their networks for testing of roll-outs to TERM cell, but many of them have not launched commercial services using this spectrum. It effectively means that spectrum is not being utilised even after 5 years of its assignment. Therefore, the Authority is of the view that definition of roll-out obligations need to be amended in accordance with what was recommended by it earlier.

2.125 In view of the above, **the Authority reiterates its earlier recommends of 2nd January 2013 that for the purpose of compliance of roll-out obligations, the following needs to be fulfilled by the Licensee in each phase of the roll-out before offering it for testing:**

i. **Installing sufficient number of BTSs/Node-Bs for the required coverage;**
ii. **Launch the services commercially;**
iii. **File the tariff with TRAI as per TRAI's Telecom Tariff Order; and**
iv. **Make arrangement for subscriber complaint redressal.**

For efficient utilisation of spectrum, and early delivery of services, the above provision may be made applicable for existing licensees too who are assigned spectrum from 2010 onwards.

F. Guard band requirement in TDD mode

2.126 In 2300 MHz band, two blocks of 20 MHz were assigned to the TSPs through auction held in 2010. DoT has proposed to auction one more block of 20 MHz in 16 LSAs in the 2300 MHz band. Already assigned frequency blocks as well as the vacant block, proposed to be auctioned, are shown in Table below:

Table 2.18
Frequency spots in the 2300 MHz band

Sl. No.	LSA	Assigned Spot I	Assigned Spot 2	Vacant Spot
		MHz	MHz	MHz
1	DEL	2305.0-2325.0	2327.5-2347.5	2350.0-2370.0
2	MUM	2305.0-2325.0	2327.5-2347.5	2355.0-2375.0
3	KOL	2305.0-2325.0	2332.5-2352.5	2355.0-2375.0
4	MH	2305.0-2325.0	2327.5-2347.5	2355.0-2375.0
5	GUJ	2305.0-2325.0	2327.5-2347.5	2350.0-2370.0
6	AP	2302.5-2322.5	2347.5-2367.5	2325.0-2345.0
7	KTK	2302.5-2322.5	2325.0-2345.0	2350.0-2370.0
8	TN	2312.5-2332.5	2335.0-2355.0	2357.5-2377.5
9	KL	2302.5-2322.5	2325.0-2345.0	2350.0-2370.0
10	PB	2320.0-2340.0	2357.5-2377.5	
11	HR	2322.5-2342.5	2362.5-2382.5	
12	UP (W)	2320.0-2340.0	2357.5-2377.5	
13	UP (E)	2320.0-2340.0	2357.5-2377.5	
14	RAJ	2320.0-2340.0	2357.5-2377.5	
15	MP	2302.5-2322.5	2332.5-2352.5	2352.5-2372.5
16	WB	2305.0-2325.0	2332.5-2352.5	2355.0-2375.0
17	HP	2322.5-2342.5	2345.0-2365.0	2367.5-2387.5
18	BH	2302.5-2322.5	2335.0-2355.0	2357.5-2377.5

19	OR	2302.5-2322.5	2335.0-2355.0	2378.0-2398.0
20	AS	2302.5-2322.5	2325.0-2345.0	2347.5-2367.5
21	NE	2302.5-2322.5	2325.0-2345.0	2347.5-2367.5
22	J&K	2340.0-2360.0	2380.0-2400.0	
	Total	**22 Spots**	**22 Spots**	**16 Spots**

2.127 As can be seen from above the table, frequency spots in the 2300 MHz band are not the same in all LSAs. In such a scenario, there will be overlap of frequencies amongst TSPs in the LSA border areas. In some LSAs, though both the spot frequencies are same, but TSPs have been assigned different frequency slots in adjoining LSAs. Complete or partial spectrum overlap between two TSPs may result in interference in the areas falling at the borders of two adjoining LSAs.

2.128 Providing sufficient guard band between adjacent spectrum blocks or time-synchronization of adjacent network operations are two possible interference mitigation techniques. Guard band between adjacent spectrum blocks varies from LSA to LSA. In many LSAs, it is as low as 2.5 MHz which would pose challenges in mitigating interference in uncoordinated networks. In such cases, adjacent TDD networks should be time-synchronized to ensure interference free operation. However, only synchronizing the start of the frame is not enough to avoid interference between networks. It would also require alignment of the downlink (DL) and uplink (UL) transmitted radio frames of the two TDD networks in the same coverage area.

2.129 Synchronizing the frame structure would require TSPs agreeing on common parameters. One option could be that frame synchronization parameters may be left to the TSPs who may agree on common parameters based on user/market requirements. Another way could be that synchronization is mandated by the regulator/licensor and these parameters are also fixed by it. In this background, the stakeholders were requested to give their comments on following issues:

- Considering that guard band between adjacent spectrum blocks in 2300 MHz band is only 2.5 MHz in a number of LSAs, should the network synchronization amongst TSPs be mandated or should it be left to the TSPs for the interference free operation in this band?
- In case, synchronization of the TDD networks is to be dealt by the regulator/licensor, what are the parameters that the regulator/licensor should specify? What methodology should be adopted to decide the values of the frame synchronization parameters?
- If synchronization of the TDD networks is ensured, is there a need for any guard band at all? If no guard band is required, how best the spectrum left as inter-operator guard band be utilised?

2.130 Many stakeholders submitted that network clock and frame synchronisation should be mandated by the regulator/ licensor to enable interference-free coexistence and to ensure maximum spectrum utilization in 2300 MHz band. One such stakeholder emphasized that since the available guard band is very less, time synchronization between adjacent TDD networks is a must. Another stakeholder wrote that if the synchronisation is left to TSPs then the operational delay of execution and the change at free-will may reduce the available spectrum in LSA.

2.131 One stakeholder was of the view that the Authority should mandate that the TSPs operating within specific frequency proximity shall mutually agree and use the same configuration; and, only in case of failure to arrive at an agreement, the Authority may mandate the same TDD Configuration to all TSPs. Another stakeholder suggested that the issue of TDD networks regarding sufficient guard band or synchronisation etc. should be left to the service provider for mutual discussion and resolution.

2.132 On the issue that what should be the TDD frame structure to be used, some stakeholders recommended that spectrum in 2300 MHz and 2500 MHz will be used for broadband applications/data where asymmetric capacities are required with downlink data speeds greater than uplink data speeds. Therefore, as per these stakeholders, a TDD configuration of 3:1 should be mandated. One stakeholder was of the view that as ratio of downlink to uplink can change over time as per different operating/ business conditions, there should be a review of this after a pre-defined time.

2.133 Responding to the issue whether there will be need of inter-operator guard band in the 2300 MHz band after the synchronization of the TDD networks is ensured; some stakeholders suggested that for synchronised TDD network between TSPs, there is no need for any guard-band. One TSP cited the example of countries like Australia, Malaysia and China having TDD deployments where TSPs have done clock synchronisation with GPS to avoid the guard band requirement in 2300 MHz. However, one stakeholder opined that even in case of spectrum harmonization, guard band will still be necessary in some cases where large distance propagation is experienced due to tropospheric ducting.

2.134 Some stakeholders suggested that spectrum harmonization should be carried out across India for existing allocations whereby same spectrum block is allocated in all circles for each TSP. One view was that minimum 20 MHz guard band is required from the Wi-Fi band.

Analysis

2.135 The Authority has examined the comments of all stakeholders. There is no counter-view to the fact that there is insufficient guard band between adjacent spectrum blocks in the 2300 MHz band in many LSAs. It may lead to severe interference and degradation in the service quality if alignment of the downlink (DL) and uplink (UL) transmitted radio frames of the two TDD networks in the same coverage area is not ensured. This can only be done if the adjacent TDD networks are time-synchronized

and they use the same frame structure. Therefore, the Authority is of the view that the operation of TDD networks should be time-synchronised and the all networks should use same frame structure.

2.136 The Time Division Duplex (TDD) radio frame consists of a number of sub-frames. As per industry standards, there are many possible sub-frame structures which determine how these sub-frames in a radio frame are divided between the downlink and the uplink. For instance, in LTE technology, frame structure 2 allows more download throughput than upload throughput in the DL/UL configuration of 3:1 whereas frame structure 1 permits equal throughputs in both directions but have better link budget. The choice of frame structure will depend on many factors like user behaviour, product positioning, cell coverage etc and is dynamic in nature. However, DL/UL configuration 3:1 is the commonly adopted configuration. In India also, almost all the TSPs are using 3:1 ratio. Therefore, the Authority is of the view that LTE TDD networks should be mandated to deploy DL/UL configuration of 3:1 at present. These provisions may be mandated in the NIA for auctioning of spectrum in this band so that any new entrant is aware of the same. It can also be mandated that this provision can be reviewed later on as and when need arises. Other technical aspects such as clock source, requirement to be fulfilled by Wi-MAX networks for co-existence at LSA border areas etc can finalised by TEC.

2.137 In view of the above, **the Authority recommends that it should be mandated that the operation of adjacent LTE TDD networks in 2300/2500 MHz bands shall be time-synchronised and TSPs shall use the same frame structure with DL/ UL configuration of 3:1. Other technical aspects such as clock source, requirement to be fulfilled by Wi-MAX networks for co-existence at LSA border areas etc can be finalised by TEC. These provisions may be mandated in the NIA for auctioning of spectrum in this band. It can also be mandated that this provision can be reviewed later on as and when need arises.**

2.138 The frequency spots in the 2300 MHz band are not the same in all LSAs. In some LSAs, though both the spot frequencies are same, but TSPs have been assigned different frequency slots in adjoining LSAs. This causes overlap of frequencies amongst TSPs in the border areas of the LSA. Complete or partial spectrum overlap between two TSPs may result in interference in the areas falling at the borders of two adjoining LSAs. The Authority is not aware about the reasons for assigning different frequencies in different LSAs. Now, after the finalization of the Defence Band, there will be clear demarcation between the spectrum assigned to Defence and that for commercial use. Therefore, through carrier frequency re-assignment, it should be possible for DoT to assign same carrier frequencies in all the LSAs. As commented by many stakeholders, if the operation of TDD network operation is synchronized, there will not be any need of guard band. Therefore, contiguous carrier assignment should be carried out. It will result in additional spectrum that can be assigned for commercial use.

2.139 **In view of the above, the Authority recommends that DoT should carry out carrier frequency re-assignment to make uniform carrier frequency assignment though out the country to the TSPs without any inter-operator guard band in the 2300 MHz band. It will result in additional spectrum for commercial use. The Authority also recommends if TSPs acquires additional block of 10MHz, it should be ensured that all its carriers are contiguous.**

G. Eligibility condition for auction in 2300/2500 MHz bands

2.140 In the auctions held in March 2015, following category of bidders were allowed to take part in the auctions:

(i) Any licensee that holds a UAS/ CMTS/ UL(AS)/UL with authorization for Access Services for that Service Area; or
(ii) Any licensee that fulfils the eligibility for obtaining a Unified License with authorization for Access Services; or

(iii) Any entity that gives an undertaking to obtain a Unified License for access service authorisation through a New Entrant Nominee as per the DoT guidelines/licence conditions can bid for the Spectrum in 1800 MHz, 900 MHz and 800 MHz band (subject to other provisions of the NIA)

2.141 Similar eligibility conditions were paced for the auctions held in 2012 and afterwards for 800/900/1800 MHz and 2100 MHz band. However, NIA dated 25th February 2010 for 'Auction of 3G and BWA Spectrum' permitted assignment of 2300 MHz band spectrum to an entity having a UAS/ CMTS licence or ISP Category 'A' licence; or that gives an undertaking to obtain a UAS licence or ISP Category 'A' licence through a new entrant.

2.142 After 2010, it is for the first time that spectrum in the 2300 MHz band would be put to auction. Spectrum in the 2500 MHz band would be put to auction for the very first time in the country. In view of the above discussion, stakeholders were requested to suggest whether the ISP category 'A' licensee should be permitted to acquire the spectrum in 2300 and 2500 MHz bands or the same eligibility criteria that has been made applicable for other bands viz. 800 MHz, 900 MHz, 1800 MHz and 2100 MHz band should be made applicable for 2300 MHz and 2500 MHz bands also.

2.143 Majority of the stakeholders were of the view that eligibility criteria for all bands should be made similar and 2300 MHz and 2500 MHz band be allowed only to CMTS/ UASL/ UL (Access Service Authorization). One of them has submitted that majority of ISP-A operators who bought 2300 MHz spectrum under ISP have migrated or have applied for migration to Unified License (Access Authorization). The stakeholder also wrote that similar technologies (LTE/LTE-A) as deployed in other access bands are being deployed in 2300 MHz and 2500 MHz band. Another stakeholder submitted that unlike in 2010, a pan-India Unified License with Access Authorization only costs Rs. 15 Crores. One stakeholder was of the view that the access spectrum, as defined by DOT in Unified License,

includes spectrum in 800/900/1800/2100/2300/2500 MHz bands. Therefore the eligibility for the access spectrums in all spectrum bands should be the same.

Analysis

2.144 The Authority concurs with the stakeholders' view that uniform eligibility criteria should be made applicable for all the access spectrum bands. Earlier, it was envisaged that the spectrum in the 2300 MHz bands would be used for wireless broadband services. Over a period of time, the technology and the device eco system has evolved and now, as pointed out by some stakeholders also, same technology which is used in other bands can also be used in 2300 MHz band and 2500 MHz band. Therefore, as far as eligibility conditions to participate in an auction is concerned, there is no justification for separate treatment to 2300 MHz and 2500 MHz bands vis-à-vis other access spectrum bands.

2.145 In view of the above, **the Authority recommends that the same eligibility criteria that have been made applicable for other bands viz. 800 MHz, 900 MHz, 1800 MHz and 2100 MHz band in January 2015 NIA should be made applicable for 2300 MHz and 2500 MHz bands. The same eligibility criteria should also be made applicable for 700 MHz band also.**

H. Liberalisation of spectrum in 900 MHz band

2.146 DoT has issued guidelines for liberalisation of administratively allotted spectrum in 800 MHz and 1800 MHz frequency bands on 5th November 2015, which are annexed at **Annexure 2.4**. At present there are no guidelines for liberalization of administratively allotted spectrum holding in 900 MHz band. Therefore, DoT, through a reference dated 06th November 2015 has sought the recommendations of the Authority on the liberalization of administratively allotted spectrum in the 900 MHz band. On this subject, the stakeholders were requested to comment on whether the guidelines for liberalisation of administratively allotted

spectrum in 900 MHz band should be similar to what has been spelt out by DoT for 800 and 1800 MHz band. The stakeholders were also asked to suggest other feasible alternatives. The liberalisation of spectrum gives liberty to the TSPs to deploy the latest technologies which permit optimal and efficient use of spectrum. Therefore, the stakeholders were also asked whether the liberalization of spectrum in 800, 900 and 1800 MHz should be made mandatory.

2.147 In general, the stakeholders are of the view that the guidelines to liberalise administratively allotted spectrum in 900 MHz band should be similar to what has been spelt out by DoT for 800 MHz and 1800 MHz bands. One stakeholder submitted that the guidelines for 'liberalization' cannot be band-specific and should be uniformly and consistently applied across all bands.

2.148 A number of stakeholders were of the view that the guidelines for liberalization & harmonization of the administrative spectrum should also be optional. A few of them suggested that the liberalisation of spectrum in 800, 900 and 1800 MHz band should be made mandatory. During the OHD, some TSPs submitted that the availability of contiguous spectrum is a pre-requisite for the deployment of latest technologies. In the guidelines issued for the liberalisation of 800 and 1800 MHz bands, there is no assurance that after the liberalization of spectrum, the same spectrum will be made contiguous. If the liberalised spectrum remains split in the non-contiguous blocks; there is no use of liberalising its usage.

Analysis

2.149 The Authority concurs with the views of stakeholders that liberalization policy should be uniform across all bands. Therefore, the guidelines of liberalisation of administratively allotted spectrum in 900 MHz band should be similar to what has been spelt out by DoT for 800 and 1800 MHz band.

2.150 It is fact that minimum 5 MHz contiguous spectrum block is required for the deployment of latest technologies. Fragmented allocation of spectrum results in inefficiencies. Therefore, purpose of liberalization of spectrum will be defeated if the spectrum holding of the TSPs, who opts for the liberalization of spectrum, are not made contiguous. The spectrum holding of many TSPs in 800 and 1800 MHz bands are fragmented. In its reference dated 9th July 2015, DoT stated that the harmonisation of 1800 MHz band with Defence and Telecom Service providers is underway. In para 2.28 of these recommendations, the Authority has recommended that DoT should carry out re-assignment of carrier frequencies in 800 MHz band and ensure that entire spectrum that is available with DoT should be put to auction. Therefore, if any TSP wants to liberalise its entire spectrum holding in any of these bands, making its spectrum holding in that band as contiguous can easily be planned during the carrier-reconfiguration exercise. In general also, if any TSP wants to liberalize its spectrum holding, efforts should be made to make the spectrum holding of any TSP as contiguous if it wants to liberalise the entire spectrum in that band.

2.151 **In view of the above, the Authority recommends that (i) the guidelines of liberalisation of administratively allotted spectrum in 900 MHz band should be similar to what has been spelt out by DoT for 800 and 1800 MHz band. (ii) If any TSP wants to liberalize its entire spectrum holding in any band, efforts should be made to make its spectrum holding in that band contiguous.**

I. Spectrum Audit

2.152 Any amount of spectrum, if not put to use optimally and efficiently, result not only financial loss to the Government, but also hinders economic and social development of the country. All the Government agencies are assigned spectrum administratively. Therefore, it is essential to ensure that the spectrum assigned to them is put to optimal use. The Authority, on many occasions have recommended to the

Government that spectrum audit should be conducted which are reproduced below:

"The Authority would undertake regular spectrum audit through appropriate means. The details of the audit procedure and frequency of the exercise would be finalised through a separate consultation process."

(TRAI's recommendations on "Spectrum Management and Licensing Framework" dated 11.05.2010)

"*TRAI may undertake regular spectrum audit for efficient management of available spectrum. For conducting audit of the spectrum, the licensees shall provide all data, reports, test equipments & other accessories etc. The Licensee will also permit inspection of its installations and network sites to TRAI personnel and fully cooperate in conducting the spectrum audit".*

(TRAI recommendations on "Terms and Conditions of Unified License (Access services)" dated 02.01.2013)

"*There is an urgent need for audit by an independent agency of all allocated spectrum both commercial as well as spectrum allocated to various PSUs/Government organizations. This ought to be a national priority and must be undertaken within 3 months."*

(TRAI's recommendations on "Delivering Broadband Quickly: What do we need to do?" dated 17.04.2015)

2.153 However, the decision of the Government on these recommendations is still awaited. Apart from making additional spectrum available it is important to ensure that the spectrum which has been allocated to the existing users is utilized optimally and efficiently. Accordingly, the role of spectrum audit is utmost important. Recognizing the need of spectrum audit, one of the objectives of NTP 2012 is to "*promote efficient use of spectrum with provision of regular audit of spectrum usage*". The Authority is of the firm view that the regular spectrum audit should be conducted. However, Government needs to issue appropriate orders to facilitate the same.

2.154 In view of the above, the Authority reiterates its earlier recommendation that **there is an urgent need of audit for all allocated spectrum both commercial as well as spectrum allocated to various PSUs/ Government organizations. This should be done by an independent agency.**

CHAPTER-III: THE VALUATION AND RESERVE PRICE OF SPECTRUM

3.1 The current reference from DoT sought recommendations of the Authority on reserve price (RP) for auction in multiple bands (i.e. 700/800/900/1800/2100/2300/2500 MHz band).Of these, some have been auctioned in the past; however 700 MHz and 2500 MHz bands will be put on auction for the first time in the country. At the same time, in 2300 MHz spectrum (auctioned in 2010) commercial operations have started in few selected cities only. Since 2013, the Authority has given recommendations on valuation and reserve price on 800MHz, 900 MHz, 1800 MHz and 2100 MHz spectrum bands following a bottom-up approach (LSA wise valuation using LSA specific inputs).

3.2 The last spectrum auction was conducted by DoT in March 2015 in four bands i.e. 800 MHz, 900 MHz, 1800 MHz and 2100 MHz. Around 89% of the total spectrum (all bands) put to auction was sold and in many LSAs demand was much higher in different bands, as is evident from the auction determined prices in comparison to Reserve Price (RP) as can be seen from Tables 3.1 to 3.4 of the Consultation Paper (CP).

3.3 It is a well-established fact that the exercise to ascertain value of the spectrum and set reserve price for that band is dependent on the availability of cost, revenue and other information pertaining to that band. Further, the primary purpose of setting RP is to enable discovery of market prices. RP represents the starting point of an auction; the ultimate realised prices are determined by the bidding process.

3.4 Unlike the spectrum bands (800 MHz/900 MHz/1800 MHz/2100 MHz), where historical information – both financial and non-financial – is available; it is not the case for 700 MHz/2300 MHz/2500 MHz band, as there is no historical financial and non-financial data available for these three bands. Therefore, it would be better from the perspective of valuation exercise, if the spectrum bands where the Authority had given recommendations on valuation and reserve price in recent past (since 2013), are discussed separately from the bands which have not been

dealt in recent past and also lack historical financial and non-financial information. Accordingly, in first part, valuation and reserve price of 800 MHz, 900 MHz, 1800 MHz and 2100 MHz bands have been discussed and subsequently valuation and reserve price of 700 MHz, 2300 MHz and 2500 MHz band have been elaborated upon.

VALUATION OF 800 MH, 900 MHz, 1800 MHz AND 2100 MHz BANDS

Need for Fresh Exercise of Valuation *versus* Use of March 2015 Auction Determined Prices

3.5 One possible approach to valuation of 800 MHz/900 MHz/1800 MHz/2100 MHz bands discussed in the CP is adoption of auction determined price in the March 2015 auction as the value of the spectrum in respective bands and appropriately index (if required, considering the time gap) between the auction held in March 2015 and the next round of auction. In this context, the following question was raised in the CP:

Q: Can the prices revealed in the March 2015 auction for 800/900/1800/2100 MHz spectrum be taken as the value of spectrum in the respective band for the forthcoming auction in the individual LSA? If yes, would it be appropriate to index it for the time gap (even if this is less than one year) between the auction held in March 2015 and the next round of auction and what rate should be adopted for indexation?

3.6 Most stakeholders are of the opinion that there is no need for a fresh valuation exercise for the spectrum bands where auction determined price (in March 2015 auction) is available. The time elapsed since last Recommendations made on different bands is around 12 to 14 months and there have been no significant changes in economic factors or financial fundamentals of the Indian telecom service sector. Two stakeholders have favoured fresh valuation opining that each spectrum

auction is different and price discovery is a function of demand and supply. Some stakeholders commented that in LSAs (and in bands) where spectrum remained unsold/partially sold in March 2015, valuation/RP for forthcoming auction should be fixed at a discount to March 2015 valuation/RP.

3.7 One stakeholder commented that valuation for forthcoming auction should be equal to March 2015 auction determined prices duly indexed for the time gap. However, most of the stakeholders did not support the indexation of March 2015 auction prices to arrive at the valuation for forthcoming auction. Of these, some stakeholders categorically commented that since less than a year has elapsed from March 2015 auction, no indexation is required.

3.8 The comments of the stakeholders have been examined. In general, stakeholders are of the view that there is no need for fresh valuation of spectrum bands where auction took place in March 2015. However, it appears that responses do not seem to have factored the trend in key performance indicators of Indian telecom service sector since the time previous recommendations were made for different spectrum bands. The significant increase in data growth and its effect on ARPU cannot be ignored. The share of revenue from data services in total revenue rose from 14% in quarter ending March 2014 to 20% in the quarter ending March 2015. Other important key input factor, ARPU has also witnessed growth of 6.14% during the same period. Trends emerging from reports and information submitted to TRAI by TSPs (since previous recommendations on valuation of spectrum) also need to be factored in the valuation process to capture their effect. The Authority also recollects the similar situation that prevailed in October 2014 while making recommendations on valuation and reserve price of 1800 MHz, just after 8 months of February 2014 auction. The fresh valuation exercise undertaken for 1800 MHz spectrum (with updated and latest data/information) at that time ended at a point where fresh valuation exceeded February 2014 auction price in 15 LSAs.

3.9 In March 2015 auction, market clearing price[18] (P_{MCP}) was achieved in 18 out of 20 LSAs (where spectrum was put to auction) in 800 MHz band, 17 out of 17 LSAs in 900 MHz band, 11 out of 15 LSAs in 1800 MHz band and 14 out of 17 LSAs in 2100 MHz band. In the remaining LSAs (where demand<supply), the auction determined price (P_{ADP}) cannot be considered as P_{MCP} as there were not enough buyers for spectrum in those bands. Though they remain the best available and most recent indicators of the spectrum value coming from an auction process. In addition, there are LSAs (in all four bands) where no spectrum was offered in March 2015 auction leaving the debate of P_{MCP} versus Auction determined price ($P_{ADP)}$ immaterial from the perspective of fresh valuation exercise.

3.10 Further as can be seen from the stakeholder comments, majority of them are not in the favour of indexation of March 2015 auction prices for 800 MHz/900 MHz/1800 MHz/2100 MHz spectrum, as the time period is less than a year. Only one stakeholder favoured indexation for the time gap between March 2015 auction and forthcoming auction.

3.11 The absence of uniform NIA conditions on adoption of auction determined prices (indexed or not) for subsequent round of auction is another key factor that needs to be contemplated upon while dealing with the issue of need for fresh valuation. Thus, adoption of March 2015 auction prices (duly indexed) as value of spectrum in respective bands is not an appropriate valuation approach in the current exercise.

3.12 In view of discussion at foregoing paragraphs, **the Authority is of the view that a fresh valuation of 800 MHz, 900 MHz, 1800 MHz and 2100 MHz spectrum is the preferred way to initiate the process of determining valuation and reserve price of these four bands for the forthcoming auction**. The data and information used as inputs in valuation approaches/models has been updated with latest data and information, wherever available. The Authority has continued with the

[18] Auction determined price exceeds RP or entire quantity put on auction was sold at given RP.

assumptions taken and methodology followed in previous valuation exercises and any variation, if any, has been explained in the respective valuation approach.

3.13 The last recommendations on valuation of 900 MHz and 1800 MHz spectrum was given in October 2014, of 800 MHz in February 2014/November 2014 (response on reference back from DoT) and of 2100 MHz band in December 2014. In the past valuation exercises, there were some common approaches/methodologies adopted for valuation of these four spectrum bands (but with band specific inputs). In the current valuation exercise, these approaches have been discussed first and thereafter approach/methodologies specific to particular spectrum band (starting with 1800 MHz band) have been discussed.

VALUATION APPROACHES: COMMON TO DIFFERENT SPECTRUM BANDS

Market Data Analysis: Correlation with Single Variable and Multiple Regression

3.14 A possible approach to value spectrum may be based on market information revealed from the auction of March 2015 in different bands. The prices realised in the LSAs (in which P_{MCP} was achieved) can be correlated with other relevant variables to estimate the values of spectrum in the LSAs where spectrum was not put up for auction or did not receive any bid or was sold partially at RP. The exercise can be done using a single explanatory variable; one at a time for representative LSAs or through multiple variable regression. Annexure 4.1 of September 2013 Recommendations can be referred for the detailed methodology and variables considered in the market data analysis with data usage as an addition. These variables have been updated for latest information/data. The sample size of market revealed information (where P_{MCP} was achieved) in March 2015 auction in different bands was given in Table 3.6 of CP (at last row). In this regard, question was raised in the CP on the use of various valuation approaches/ methodologies

which includes Market Data Analysis as one of the possible values in valuation of spectrum in respective bands.

3.15 No comments have been received from the stakeholders on market data analysis as one of the valuation approach.

3.16 In a number of LSAs P_{MCP} was achieved in March 2015 auction. In LSAs where P_{MCP} was not available in March 2015 auction then the previous auction price of February 2014 (latest one-duly indexed y-o-y with SBI base rate) has been used as proxy to the current market price. Furthermore, in LSAs where auction prices are not available at all, market data analysis based on March 2015 auction prices can be used as one of the valuation approach. This approach of spectrum valuation was adopted by the Authority in its Recommendations of September 2013. However, at the same time, the Authority is also aware of the availability of limited data points in some categories (of LSAs/spectrum bands) and is of the view that correlation with single variable/multiple regression may fail to yield/estimate the true prediction and decided not to adopt market data analysis for spectrum valuation in such cases (multiple regression and single variable correlation in 1800 MHz/ 2100 MHz spectrum, single variable correlation - in Category A in case of 900 MHz). In view of the above, the Authority has decided that values arrived by using techniques under market data analysis can be used as one of the possible spectrum valuation for 800 MHz and 900 MHz bands.

3.17 The results obtained by establishing correlation with single variable and multiple regression are given in Annexure 3.2 for 900 MHz and Annexure 3.3 for 800 MHz spectrum bands.

Technical Efficiency

3.18 One of alternative spectrum valuation approach could be based on the relative technical efficiency of the band with another band. In the recent past exercises, the Authority has estimated the value of 800 MHz/900 MHz/2100 MHz spectrum based on their respective technical efficiency

with 1800 MHz spectrum. In this regard, question was raised in the CP on the use of various valuation approaches/ methodologies which includes technical efficiency approach as one of the possible values in valuation of spectrum in respective bands.

3.19 None of the stakeholders have commented on the relative technical efficiency factor for an estimated spectrum value of 800 MHz/900MHz/2100 MHz band based on technical efficiency factor with 1800 MHz band.

3.20 This approach of spectrum valuation was adopted by the Authority in the recent past recommendations on valuation of 800 MHz[19], 900 MHz[20] and 2100 MHz[21] spectrum. Staying consistent with its earlier valuation exercises, the Authority has decided to use the valuation worked out using technical efficiency factor with the average valuation of 1800 MHz spectrum as one of the possible valuations of 800 MHz, 900 MHz and 2100 MHz spectrum band.

Producer Surplus Approach on Account of Additional Spectrum

3.21 Spectrum can also be valued on the basis of the Producer Surplus approach. As there is an inverse relationship between the quantum of spectrum allocated and the expenditure on radio access network (RAN) required for serving a particular level of demand, the allocation of additional spectrum to an existing TSP will create a Producer Surplus. The model is a bottom-up approach to determine the opportunity of cost savings to an average TSP in the RAN upon getting additional spectrum (opportunity/MHz).

3.22 In this regard, question (also refer to Annexure 3.1 of CP) was raised in the CP on the use of Producer Surplus Approach as one of the possible method for valuation of spectrum. A few stakeholders have commented

[19]See Para 3.1 to 3.4 of December 2013 Consultation Paper on Valuation and Reserve Price of 800 MHz band
[20]See Para 4.45 to 4.47 of September 2013 Recommendations
[21]Para 3.6 and 3.7 of December 2014 Consultation Paper and Para 3.8 to 3.10 of December 2014 Recommendations.

on the assumptions used in the Producer Surplus approach. It is clarified that sufficient checks and balances in assumptions have used to develop a real-world network scenario. This approach of valuation was adopted in the Recommendations of September 2013 (see Annexure 4.2 for detailed methodology) and Recommendations of February/October/December 2014. As Producer Surplus approach provides a reasonable estimate of cost savings on the RAN when an average TSP deploys an additional unit of spectrum, the Authority has decided to use the results of Producer Surplus approach as one possible valuation. The results obtained from using Producer Surplus approach for 1800 MHz spectrum are given in Annexure 3.1, for 800 MHz spectrum in Annexure 3.3 and for 2100 MHz in Annexure 3.4.

Use of last Auction Determined Prices

3.23 As can be seen from Tables 3.1, 3.2, 3.3 and 3.4 of the CP, for the 1800 MHz, 900 MHz, 800 MHz and 2100 MHz spectrum bands respectively, the spectrum in these bands was sold at a higher than RP in many LSAs and at RP in the remaining LSAs, where it was sold. The auction determined price of March 2015 as such represents the bidders' preferred price for spectrum put on auction in the respective LSA. In this regard, Q20 (also refer Annexure 3.1 of CP) was raised in the CP on the use of last auction determined prices as one of the possible values in valuation of spectrum in respective bands.

3.24 Most stakeholders are of the opinion that there is no need for a fresh valuation exercise for the spectrum bands where auction determined price (in March 2015 auction) is available and the same can be taken as value of spectrum. Further, majority of stakeholders are not in the favour of indexation of March 2015 auction prices for 800 MHz/900 MHz/1800 MHz/2100 MHz spectrum, as the time period is less than a year. Only one stakeholder favoured indexation for the time gap between March 2015 auction and forthcoming auction.

3.25 The Authority has examined the comments of the stakeholders. The issue whether March 2015 auction price can be taken as value of spectrum in respective bands has been discussed at length at Para 3.8 to 3.12 above.

3.26 It is a fact that most of the spectrum in March 2015 auction (and in February 2014 auction) was sold at a price higher than RP or entire quantity put on auction was sold at given RP (see Table 3.6 of CP) in many of LSAs. Of the total spectrum offered in different bands, 79% (of 800 MHz) to 95% (of 1800 MHz) was sold in the auction indicating the demand for spectrum at the achieved price. Further, non-consideration of prices revealed in the most recent auction would not be prudent in view of the present market-based model in which spectrum is (and will be) allotted through auction only. The Authority is of the view that market price achieved as an outcome of a competitive bidding process is best available indicator of the spectrum value in the band. Therefore, the March 2015 auction price can be taken as one of indicative values of the spectrum in the respective spectrum band for the forthcoming auction. As less than a year has elapsed since the conduct of March 2015 auction, the Authority is of the view that there is no need to index the auction determined prices.

3.27 The Authority also considered the LSAs where no spectrum was offered for auction in March 2015 and hence, no auction determined price is available for those LSAs (e.g. in 900 MHz band in metro LSAs). In such cases, last auction determined price available from previous auction (latest one) can be taken as the indicative market value of spectrum in the band. If that price is more than a year old, the Authority is of the view that as followed in the previous valuation exercises, such auction determined prices need indexation with SBI base rate to incorporate effect of the elapsed time gap.

3.28 **Thus**, **the Authority has decided that the auction determined price of 800/900/1800/2100 MHz spectrum bands in March 2015**

auction (and where auction determined price in March 2015 auction is not available, then duly indexed available auction determined price of last auction) can be taken as one of possible values in the respective spectrum bands in the current valuation exercise.

3.29 The last auction determined price taken as one of possible value for 1800 MHz spectrum is given in Annexure 3.1, for 900 MHz spectrum in Annexure 3.2, for 800 MHz spectrum in Annexure 3.3 and for 2100 MHz in Annexure 3.4.

VALUATION OF 1800 MHz SPECTRUM

Production Function Approach

3.30 Spectrum valuation can be derived by taking spectrum and BTS as two factor inputs to estimate a production function to produce mobile traffic or minutes of usage. This approach is based on the assumption that the two inputs (spectrum and BTS) can be substituted for each other over a range of output. In this regard, Q20 (also refer Annexure 3.1 of CP) was raised in the CP on the use of Production Function Approach as one of the possible valuation approach of 1800 MHz Spectrum Band.

3.31 None of the stakeholders have commented on the use of production function approach as one of possible value in 1800 MHz spectrum valuation.

3.32 This approach of valuation was adopted in the Recommendations of September 2013 (see Annexure 4.3 for detailed methodology) and Recommendations of October 2014 (Para 3.32). Separate model under this approach have been run for Metros (Delhi & Mumbai), Kolkata, category A and category B with updated data for 2014-15. The growth of subscribers, minutes of usage, number of SMS and data usage is assumed to be the same as was taken in the October 2014 Recommendations (with 20th Year extended by one more year with same rates). In arriving at value for category 'C' LSAs using production

function approach, the ratio earlier used based on 2100 MHz market achieved prices has been replaced with ratio based on 900 MHz market achieved prices due to non-availability of 2100 MHz spectrum auction prices in March 2015 auction.

3.33 Production function approach provides a reasonable approximation to equivalent cost savings on BTS conserved by deploying an additional unit of spectrum. Therefore, the Authority has decided to use the results of production function approach as one possible valuation of 1800 MHz spectrum. The results obtained from using production function approach for 1800 MHz spectrum are given in Annexure 3.1.

Revenue Surplus Model

3.34 For arriving at one possible value of the 1800 MHz spectrum, an approach based on revenue surplus model could be attempted, as was previously adopted by the Authority in its Recommendations of October 2014. This approach would estimate the value of spectrum from the perspective of an access service provider willing to invest in spectrum to realize the net revenue potential/revenue surplus from the GSM segment over the licence period horizon of 20 years for acquiring 1800 MHz spectrum. The detailed methodology and assumptions used in this model have been explained at Annexure 3.3 of Recommendations of October 2014. In this regard, Q20 (refer Annexure 3.1 of CP) was raised in the CP on the use of revenue surplus model as one of the possible values in valuation of spectrum in 1800 MHz spectrum band.

3.35 One stakeholder has commented that detailed inputs and assumptions should be made public to examine their validity and provide comments. Stakeholder has further commented that revenue surplus and cost savings should be projected on post tax basis since operators will incur taxes on their income which will reduce savings. To take into account impact of taxes, stakeholder has recommended discount rate of 19.1% instead of 12.5% (used by TRAI). Also EBITDA margin (i.e. 30%) assumptions have not been specified.

3.36 The Authority has examined the stakeholder comments. In the Annexure 3.3 of Recommendations of October 2014, assumptions and methodology followed and inputs used in the revenue surplus model were elaborated in a detailed manner (similarly in respective Annexure for different models in different bands). Any modeling exercise has certain inherent uncertainties and the assumptions made cannot be foolproof, but can be best estimated in the light of current trends and data. EBITDA of 30% in the model was assumed to be reasonable to incorporate the incentive to invest. Further the Authority is of the view that discount rate of 12.5% is appropriate in the Indian telecom service sector. Considering all these, the Authority is of the view that revenue surplus model is a feasible approach (with updated data/information) to estimate the value of 1800 MHz spectrum from the perspective of a TSP willing to invest in the expectation of a targeted/projected revenue and profitability. The Authority has decided to use the results of the revenue surplus model as one of the possible valuations of 1800 MHz spectrum. The value of 1800 MHz spectrum thus obtained using revenue surplus approach is at Annexure 3.1.

VALUATION OF 1800 MHz SPECTRUM: SINGLE APPROACH *VERSUS* MULTIPLE APPROACHES

3.37 To assess the value of 1800 MHz spectrum, various approaches have been discussed above. Each approach of valuing spectrum has its merits and drawbacks. In this context, the following question was raised in the CP:

Q: As was adopted by the Authority in September 2013 and subsequent Recommendations and adopting the same basic principle of equal-probability of occurrence of each valuation, should the average valuation of the spectrum band be taken as the simple mean of the valuations obtained from the different approaches/methods attempted for that spectrum band? If no, please suggest with justification that which single

approach under each spectrum band, should be adopted to value that spectrum band.

3.38 Majority of stakeholders have not commented on the issue raised in the CP. Their responses are guided by their views that there is no need for any fresh valuation in view of March 2015 auction prices which are less than a year old. One stakeholder has favoured average valuation concept only for those LSAs where no market price was discovered in March 2015 auction. Another stakeholder has opposed concept of average valuation equal to simple mean of different valuation approaches adopted. It has represented that it is incorrect to assume equi-probability of various approaches without regard to market context. For a TSP, already having data spectrum in any band, purchasing data spectrum in other band, producer surplus model is the only relevant model.

3.39 The Authority has examined the comments of stakeholders. There is no denying the fact that each model has certain strengths as well as limitations. Some model better capture intrinsic technical features, other are based on economic and market realities. The Authority is of the consistent and considered view that it is simply not possible to say deterministically that any one valuation is the right valuation. Further any valuation exercise undertaken keeping in mind action of a particular segment (e.g. existing TSP) of possible bidders is against the basic principle of auction design which is open to all. Therefore, on the assumption of equal probability [22] of occurrence of each valuation approach, the Authority has decided to adopt an average valuation of 1800 MHz spectrum as the simple mean of the valuations obtained from the various valuation approaches. A Table containing the average valuation of 1800 MHz spectrum using different approaches is at Annexure 3.1. This principle of average valuation would equally apply in valuation of other spectrum bands.

[22] As was done in Recommendations of September 2013 on 900 MHz & 1800 MHz band, February 2014 on 800 MHz band, October 2014 on 900 MHz & 1800 MHz band and December 2014 on 2100 MHz band

VALUATION OF THE 800 MHz SPECTRUM

Valuation of 800 MHz Spectrum based on Potential Growth in Data Services

3.40 For arriving at one possible value of the 800 MHz spectrum, an approach based on potential growth in data services could be attempted, as was previously adopted by the Authority in its Recommendations of February 2014 for valuation of 800 MHz band. The detailed methodology and assumptions used in this model have been explained at Annexure 3.3 of February 2014 Recommendations and Annexure A of Authority's response of 27 November 2014 to reference received from DoT on February 2014 Recommendations. In this regard, Q20 (refer Annexure 3.1 of CP) was raised in the CP on the use of this model as one of the possible values in valuation of spectrum in 800 MHz spectrum band. None of the stakeholders have submitted any comments on the model. For the reasons given in the Para 3.51 to 3.54 of February 2014 Recommendations, the Authority is of the view that this model still is a feasible approach (with updated data/information) to estimate one of the possible value of 800 MHz spectrum. Therefore, the Authority has decided to use the results of model based on projected growth in data services, as one possible valuation of 800 MHz spectrum. The value of 800 MHz spectrum thus obtained under this model is at Annexure 3.3.

Use of March 2015 Auction Determined Prices of 900 MHz Spectrum in the valuation of 800 MHz band

3.41 In Recommendations of February 2014 on 800 MHz band (for the reasons explained in Para 3.68), the Authority had used auction determined price (P_{ADP}) of 900 MHz band in metro LSAs (of February 2014 auction) as one of possible value for 800 MHz band in respective metro LSAs. In this regard, Q20 (refer Annexure 3.1 of CP) was raised in the CP on the use of 900 MHz band auction determined prices as one of the possible value in valuation of 800 MHz band and vice versa. None of the stakeholders have commented on this approach.

3.42 The Authority noted that in comparison to 1800 MHz, technical efficiency of the 800 MHz band is similar to that of the 900 MHz band. Further, the 800 MHz and 900 MHz bands have been identified as IMT bands by ITU. It has been the articulated position of the Authority that auction determined price is the best indicator of the spectrum value in that band. Thus, where empirical data on market prices of similar assets is available, it can be utilized in combination with other approaches to arrive at a probabilistic basic valuation. The Authority does not find any justification to do away with the approach adopted in Recommendations of February 2014 on 800 MHz band. Therefore, the Authority is of the view that where auction determined market prices of either of these bands (800 or 900 MHz) are not available in a LSA, the auction determined price of other band, if available, can be utilized as one amongst the possible valuations of spectrum**.** In case the auction determined price in other band is older than one year, the same has been indexed for the time gap using SBI base rate. Accordingly the value incorporated in valuation of 800 MHz spectrum is at Annexure 3.3 and in valuation of 900 MHz is at Annexure 3.2.

VALUATION OF THE 900 MHz SPECTRUM

Economic Efficiency Approach

3.43 An alternative valuation approach would be to derive relative valuations for 900 MHz spectrum based on cost trade-offs (CAPEX as well as OPEX) when operations are switched from the 900 MHz spectrum to the 1800 MHz spectrum (a technically less efficient band). This approach[23] was followed in the Recommendations of September 2013 and October 2014.In this regard, Q20 (refer Annexure 3.1 of CP) was raised in the CP on use of economic efficiency approach as one of the possible values in valuation of spectrum in 900 MHz spectrum bands.

[23]See paragraph 4.49 and Annexure 4.5 of the September 2013 Recommendations and Annexure 3.5 of October 2014 Recommendations

3.44 None of the stakeholders has submitted any comments on the model. As explained in the earlier Recommendations of September 2013 (see paragraph 4.52), the intrinsic value of the 900 MHz band as compared to the 1800 MHz band lies in its better propagation characteristics and lower requirement of BTS for coverage. Therefore, the Authority has decided to use the results of economic efficiency approach as one possible valuation of 900 MHz spectrum. The results (i.e. average valuation of 1800 MHz plus economic efficiency premium) obtained from using economic efficiency approach for 900 MHz spectrum are given in Annexure 3.2.

AVERAGE VALUATION OF 900 MHz SPECTRUM

3.45 In its Recommendations of October 2014 (Para 3.54 and 3.55), the Authority based on technical efficiency between 900 MHz and 1800 MHz spectrum had recommended that the value of 900 MHz spectrum in each LSA should be the lower of the two figures - average valuation of 900 MHz or twice the value of 1800 MHz spectrum.

3.46 However, a review of market prices revealed in March 2015 auction show that the P_{ADP} of 900 MHz spectrum in all 12 LSAs (where both 900 MHz and 1800 MHz spectrum were sold)was higher than P_{ADP} of 1800 MHz spectrum by a factor ranging from 3 to 10 times. This defied the principle adopted by the Authority in 900 MHz spectrum valuation in Recommendations of October 2014 and indicates the TSP attractiveness and willingness to pay for the more efficient 900 MHz spectrum (in terms of better coverage and efficiency) than 1800 MHz spectrum in the backdrop of unfolding competition dynamics and various business models of the TSPs. It has been the consistent stand of the Authority that market revealed prices are the best available indicator of spectrum valuation and any deviation from that would be a step in a different direction from the current system of spectrum allocation which is nothing but auction based. Hence, the Authority is of the view that principle followed in October 2014 Recommendations by capping

average valuation of 900 MHz spectrum (coming from different adopted approaches) with twice of 1800 MHz spectrum valuation, is to be done away with.

VALUATION OF THE 2100 MHZ SPECTRUM

Data Usage Growth Based Valuation

3.47 This approach would estimate the value of spectrum from the perspective of an access service provider (providing 2G services but having no 2100 MHz spectrum) willing to invest potential revenue(mainly from mobile internet/data services)net off associated costs from 3G subscribers over the licence time horizon of 20 years for acquiring 2100 MHz spectrum. The detailed methodology and assumptions used in this model were explained at Annexure 3.4 of Recommendations of December 2014. In this regard, Q20 (refer Annexure 3.1 of CP) was raised in the CP on Data Usage Growth Model as one of the possible value in valuation of spectrum in 2100 MHz band.

3.48 One of the stakeholders has commented that assumption regarding 10% market share by the new operator in the first year and eventually growing to 20% is unrealistic as 20% market share of the data market will require the use of multiple carriers to support the resulting traffic; the cost of acquiring all such additional spectrum must also be factored into the calculations. Further, in view of more than 5 TSPs operating with data spectrum in LSAs, it is impossible for all of them to gain 20% market share just by virtue of purchasing a single piece of spectrum, leave alone a late entrant. Also, assumption on data ARPU and OPEX have not been provided.

3.49 The Authority examined the comments of the stakeholders. It may be noted this model was not developed from the perspective of a new entrant in the telecom service sector but is for a hypothetical operator who is already holding 2G licence in an LSA and has market share of 2G subscribers (potentially 3G/data subscriber). A review of March 2015

auction bidding pattern also backs this premise as only existing TSPs having 2G spectrum have bid for 2100 MHz except one 3G license holder in one LSA. Input on ARPU and OPEX are based on reports submitted by the TSPs to the Authority and therefore represents actual (i.e. data in base year) in the valuation exercise. Regarding assumption of the market share for new TSP (in 2100 MHz segment), the Authority is of the view that any projection regarding market share on lower side may be counter-intuitive to the business projections and revenue potential of the band and it has been decided to continue with the same assumptions used in previous valuation exercise.

3.50 In view of above and for the reasons given in the Para 3.20 and 3.21 of December 2014 Recommendations, the Authority is of the view that this model can be used as an alternative approach (with updated data/information/assumptions) to estimate one of the possible value of 2100 MHz spectrum from the perspective of a TSP providing 2G services and willing to acquire 2100 MHz spectrum in the expectation of targeted/ projected revenue from data services and profitability. The Authority has, therefore, decided to use the results of the model based on growth in data usage, as one of the possible valuations of 2100 MHz spectrum. The valuation of 2100 MHz spectrum (per MHz) thus obtained using this model is at Annexure 3.4.

ARRIVING AT AVERAGE VALUATION OF 1800 MHz, 800 MHz, 900 MHz and 2100 MHz SPECTRUM.

3.51 In view of various valuation approaches adopted for different spectrum bands and discussion at Para 3.39 above, the Authority has arrived at an expected average valuation for 1800 MHz, 900 MHz, 800 MHz and 2100 MHz spectrum as the simple mean of the various valuations that have been adopted and given at Annexure 3.1, Annexure 3.2, Annexure 3.3 and Annexure 3.4respectively.

3.52 The Authority recognizes that there was demand for spectrum in March 2015 auction where spectrum in four bands was put on auction. In

1800 MHz, out of 15 LSAs, bids were received in 14 LSAs and around 95% of the spectrum was sold. In 800 MHz band, out of 20 LSAs, bids were received in 18 LSAs and around 79% of the spectrum was sold. In 900 MHz, bids were received in all 17 LSAs and around 94% of the spectrum was sold. In 2100 MHz band, out of 17 LSAs, bids were received in 14 LSAs and around 82% of the spectrum was sold. Therefore, the March 2015 auction price can be treated as the bidders' revealed preference price for respective spectrum in the respective LSA. Each auction outcome is a function of a host of context-specific factors such as demand and supply, as well as macroeconomic conditions which may or may not (in most cases) remain same over longer period. Thus, the Authority is of the view that auction revealed prices of preceding two years would be reasonable to be considered for the purpose of valuation in the present exercise. Therefore, where March 2015 auction prices are not available, the revealed prices from February 2014 auction duly indexed with SBI base rate can be taken for the valuation purpose. In the context of the spectrum that was sold in March 2015/February 2014 auction, the Authority is of the view that any estimation of the value of spectrum at this stage should be tempered by revealed preferences (realized prices) of the market discovered in the last two years.

3.53 Consistent with that approach(as was done in Recommendations of October 2014), March 2015 auction revealed price wherever available can serve as a benchmark price representing a lower bound while estimating the valuation of 1800 MHz, 800 MHz, 900 MHz and 2100 MHz spectrum and where they are not available, February 2014 auction determined prices (duly indexed) can be considered. Therefore, **the Authority recommends that the average expected valuation of spectrum band in a LSA should be the higher of the two figures – (i) average expected valuation of that band based on simple mean <u>or</u> (ii) the price realized in March 2015 auction and where not available then February 2014 auction determined price (duly**

indexed at SBI base rate). Accordingly, the recommended average expected value of 1800/900/800/2100 MHz spectrum bands for each LSA is tabulated below:

TABLE 3.1

RECOMMENDED AVERAGE VALUE PER MHz

(Rs. in crore)

LSA	Category	Average Value per MHz of 1800 MHz	Average Value per MHz of 900 MHz	Average Value per MHz of 800 MHz	Average Value per MHz of 2100 MHz
Delhi	Metro	398.71	811.62	847.70	691.94
Mumbai	Metro	297.94	616.79	727.50	576.37
Kolkata	Metro	149.10	215.29	200.49	122.32
Andhra Pradesh	A	242.80	680.75	605.98	339.76
Gujarat	A	238.00	673.00	356.14	293.58
Karnataka	A	185.00	557.50	478.14	400.61
Maharashtra	A	318.04	773.00	799.42	426.58
Tamilnadu	A	225.00	586.20	506.37	412.82
Haryana	B	49.35	151.20	71.31	69.12
Kerala	B	94.31	369.40	304.17	221.57
Madhya Pradesh	B	103.42	309.50	408.39	153.73
Punjab	B	96.25	360.75	148.92	113.98
Rajasthan	B	113.74	708.65	255.26	161.61
U. P. (East)	B	143.59	775.60	273.30	137.47
U.P. (West)	B	104.37	738.55	227.78	139.15
West Bengal	B	57.10	207.50	102.65	64.53
Assam	C	47.88	184.95	89.01	57.10
Bihar	C	101.02	444.30	170.25	108.06
Himachal Pradesh	C	15.90	57.45	29.97	24.87
Jammu & Kashmir	C	32.54	132.41	33.92	27.38
North East	C	25.24	57.57	34.68	30.97
Orissa	C	47.62	139.00	71.84	47.56
PAN INDIA		**3086.93**	**9550.96**	**6743.18**	**4621.09**

RESERVE PRICE ESTIMATION IN 800 MHz, 900 MHz, 1800 MHz and 2100 MHz SPECTRUM BANDS

3.54 A reserve price refers to the minimum amount that the owner of an item will accept as the winning bid in an auction. The concepts of auction efficiency; revenue maximization; the RP in an auction; and various international practices were discussed in detail in the Consultation Paper dated 23rd July 2013 on 'Valuation and Reserve Price of Spectrum'. The Authority in its past Recommendations on different bands (April 2012. September 2013, February 2014, October 2014 and December 2014) had decided that as a general principle, the reserve price should be fixed at 80% of the average valuation for a spectrum band.

In this connection the following questions were raised in the CP:

Q. What should be the ratio adopted between the reserve price for the auction and the valuation of the spectrum in different spectrum bands and why?

Q. Should the realized prices in the recent March 2015 auction for 800/900/1800/2100 MHz spectrum bands be taken as the reserve price in respective spectrum bands for the forthcoming auction? If yes, would it be appropriate to index it for the time gap (even if less than one year) between the auction held in March 2015 and the forthcoming auction? If yes, then at which rate the indexation should be done?

3.55 Majority of stakeholders favoured setting of RP at 80% of average valuation. Two stakeholders suggested RP at 50% of average valuation. Few stakeholders suggested that in new spectrum bands i.e. bands which have not been put on auction in recent time (700MHz, 2300 MHz and 2500 MHz), RP should be fixed at the 70% of average valuation. Some stakeholders advocated that in 800MHz/900 MHz/1800 MHz/2100 MHz bands, RP should be linked to March 2015 auction determined prices and have given a range of 40% to 100% of auction prices for fixing RP in the forthcoming auction.

3.56 The Authority has carefully considered the comments of the stakeholders. It is a well-known principle that RP should not be fixed too close to the estimate of valuation. It is the starting point for an ascending price auction and bidding is a means to true price discovery. Consistent with its earlier Recommendations, the Authority is of the view that the reserve price for the forthcoming auction of 800 MHz, 900 MHz, 1800 MHz and 2100 MHz spectrum bands be fixed at 80% of the average valuation subject to qualifications discussed in successive paragraphs. The 80% of average valuation is given in Annexure 3.5 for 1800 MHz band, Annexure 3.6 for 900 MHz band, Annexure 3.7 for 800 MHz band and Annexure 3.8 for 2100 MHz band.

3.57 To accelerate the pace of investment in telecom infrastructure in the North East, the Authority recommended in its previous Recommendations of October 2014, November 2014 (i.e. reference back from DoT on 800 MHz band) and December 2014 that the reserve price for spectrum in a band should be kept at 50% of the calculated reserve price. The Authority also notes that Jammu & Kashmir is very much similar to North East in terms of geographical terrain and other operational challenges and is thus, of the view that like North East, reserve price of Jammu & Kashmir should also be kept at 50% of the arrived reserve price. Therefore, the reserve price for 800 MHz band, 900 MHz band, 1800 MHz band and 2100 MHz band in the North East and Jammu & Kashmir LSAs should also be kept at 50% of the reserve price given in Annexure 3.5 for 1800 MHz band, Annexure 3.6 for 900 MHz band, Annexure 3.7 for 800 MHz band and Annexure 3.8 for 2100 MHz band. **The Authority accordingly recommends that the reserve price for North East and Jammu & Kashmir LSAs in 800 MHz band, 900 MHz band, 1800 MHz band and 2100 MHz band may be fixed at a discount of 50% on the reserve price.** The discount in North East and Jammu & Kashmir will also be given while arriving at reserve prices of other spectrum bands.

3.58 In response to the question on factoring of March 2015 auction prices in arriving at RP for next round of auction; few stakeholders have suggested that March 2015 auction prices can be taken as RP. While many other stakeholders have not agreed to this approach.

3.59 The Authority has examined stakeholders' comments. Spectrum in all four bands in March 2015 auction in many LSAs, was sold at a price higher than RP or entire quantity put on auction was sold at the given RP (see Table 3.6 of CP). Of the total spectrum offered in different bands in March 2015 auction, spectrum in the range of 79% to 95% was sold indicating the demand for spectrum at the achieved price. In the process of arriving at RP for forthcoming auction, the Authority is of the view that the significance of market prices revealed in the auctions held in recent past cannot be ignored and need to be factored in for arriving at the RP. It is consistent view of the Authority that market price achieved as an outcome of a competitive, transparent bidding process is best available value placed on the spectrum. In view of the fact that market revealed prices of March 2015 auction prices are available in many LSAs, where not available, the revealed prices from February 2014 (duly indexed with SBI base rate), can be considered for the reserve price estimation.

3.60 After taking into consideration the bidding pattern, prices achieved and the time elapsed since last two auctions, it would be fair to assume that offered price in a spectrum band in forthcoming auction should not be lower than the March 2015/February 2014 auction determined prices (duly indexed) in that band. In other words, auction revealed price in last two years can serve as a benchmark representing a lower bound while arriving at RP (after discount, if any) for the forthcoming auction.

3.61 However, there are LSAs in these four bands where either no spectrum was put on auction or no bidding had taken place in March 2015 /February 2014 auctions. Thus, in these LSAs no auction determined price from these two auctions are available. In the absence of auction

determined prices, the principle recommended in Para 3.60 cannot be applied straight away in those LSAs.

3.62 In first set of LSA (where no spectrum was put on auction), the Authority is of the view that in such LSAs, last valuation and reserve price has not gone through the process of market discovery. Therefore, no view about market response on that or their validity in current valuation exercise can be formed. Therefore, the Authority is of the view that in such cases, 80% of the average valuation arrived should be the reserve price in spectrum band for the forthcoming auction.

3.63 In the second set of LSAs, spectrum was put on auction in a spectrum band but received no bid. This indicates the indifference of the bidders to the spectrum band at the given reserve price in auction of March 2015. It is unlikely that spectrum can be sold in those LSAs in next round of auction if the reserve price is fixed at higher level than March 2015 auction. The prime objective of setting reserve price to arrive at a value where bidders' participation is encouraged and the entire quantity offered sold (at its market value). Regardless of the results of valuation of spectrum, if a certain reserve price has recently been rejected by the market, there is no point in setting a higher reserve price. Accordingly, the Authority is of the view that in such cases the reserve price should be lower of the figures – 80% of average valuation or the reserve price as fixed in March 2015 auction.

3.64 Therefore, **the Authority recommends that the reserve price for 800 MHz band, 900 MHz band, 1800 MHz band and 2100 MHz band**

(i) should be higher of the two figures – 80% of the average valuation of spectrum band in the LSA or the price realised in the March 2015 auction /February 2014 (duly indexed with SBI base rate) auction;

(ii) in LSAs where no spectrum was offered in March 2015 and February 2014 auctions, reserve price should be 80% of average valuation; and

(iii) in LSAs where spectrum was offered in March 2015 auction

but remained entirely unsold, the reserve price should be lower of the figures – 80% of average valuation or the reserve price as fixed in March 2015 auction.

3.65 As can be seen from Chapter II, spectrum in different bands is not available in all 22 LSAs. Therefore, the Authority is of the view that reserve price should be recommended only for those LSAs where spectrum are likely to be put for auction in different bands as discussed in Chapter II. **Accordingly, the recommended reserve prices for 1800 MHz band, 900 MHz band, 800 MHz band and 2100 MHz band for the forthcoming auction are tabulated below:**

TABLE 3.2

RECOMMENDED RESERVE PRICE PER MHz (PAIRED)

IN 1800 MHz BAND

(Rs. in crore)

(1)	(2)	(3)	(4)
LSA	**Category**	**Reserve Price (as calculated)**	**Recommended Reserve Price (Rounded off)**
Delhi	Metro	398.71	399
Mumbai	Metro	297.94	298
Kolkata	Metro	149.10	149
Andhra Pradesh	A	242.80	243
Gujarat	A	238.00	238
Karnataka	A	185.00	185
Maharashtra	A	318.04	318
Tamil Nadu	A	225.00	225
Haryana	B	46.60	47
Kerala	B	83.45	83
Madhya Pradesh	B	82.74	83
Punjab	B	77.00	77
Rajasthan	B	90.99	91
U. P. (East)	B	114.87	115
U.P. (West)	B	95.95	96

West Bengal	B	45.68	46
Assam	C	39.54	40
Bihar	C	62.00	62
Himachal Pradesh	C	15.90	16
Jammu & Kashmir	C	13.02	13
North East	C	11.00	11
Orissa	C	38.10	38
* 1800 MHz spectrum is not available in Tamil Nadu. However, recommended reserve price for this LSA has been included in the table since there is linkage with 700 MHz spectrum band.			

TABLE 3.3

RECOMMENDED RESERVE PRICE PER MHz (PAIRED)

IN 900 MHz BAND

(Rs. in crore)

(1)	(2)	(3)	(4)
LSA	**Category**	**Reserve Price (as calculated)**	**Recommended Reserve Price (Rounded off)**
Gujarat	A	673.00	673
Karnataka	A	557.50	558
Haryana	B	151.20	151
U. P. (East)	B	775.60	776
U.P. (West)	B	738.55	739
Bihar	C	444.30	444

TABLE 3.4

RECOMMENDED RESERVE PRICE PER MHz (PAIRED)

IN 800 MHz BAND

(Rs. in crore)

(1)	(2)	(3)	(4)
LSA	**Category**	**Reserve Price (as calculated)**	**Recommended Reserve Price (Rounded off)**
Delhi	Metro	847.70	848
Mumbai	Metro	727.50	727
Kolkata	Metro	160.39	160
Andhra Pradesh	A	605.98	606
Gujarat	A	284.91	285

Karnataka	A	303.00	303
Maharashtra	A	799.42	799
Tamilnadu	A	360.00	360
Haryana	B	57.05	57
Kerala	B	243.33	243
Madhya Pradesh	B	408.39	408
Punjab	B	119.14	119
Rajasthan	B	204.21	204
U. P. (East)	B	218.64	219
U.P. (West)	B	182.23	182
West Bengal	B	82.12	82
Bihar	C	136.20	136
Himachal Pradesh	C	23.97	24
Orissa	C	57.47	57

TABLE 3.5

RECOMMENDED RESERVE PRICE PER MHz (PAIRED)

IN 2100 MHz BAND

(Rs. in crore)

(1)	(2)	(3)	(4)
LSA	**Category**	**Reserve Price (as calculated)**	**Recommended Reserve Price (Rounded off)**
Delhi	Metro	553.56	554
Mumbai	Metro	461.10	461
Kolkata	Metro	115.59	116
Andhra Pradesh	A	271.81	272
Gujarat	A	258.00	258
Karnataka	A	328.47	328
Maharashtra	A	341.27	341
Tamilnadu	A	344.00	344
Haryana	B	55.29	55
Kerala	B	177.26	177
Madhya Pradesh	B	122.98	123
Punjab	B	91.18	91
Rajasthan	B	139.82	140

U. P. (East)	B	109.98	110
U.P. (West)	B	111.32	111
West Bengal	B	51.62	52
Assam	C	45.68	46
Bihar	C	86.45	86
Himachal Pradesh	C	19.90	20
Jammu & Kashmir	C	10.95	11
North East	C	12.39	12
Orissa	C	38.05	38

VALUATION AND RESERVE PRICE OF 700 MHZ SPECTRUM BAND

3.66 The 700 MHz spectrum band is a lower frequency band and has better propagation characteristics as compared with other high frequency spectrum bands. This spectrum band is considered as premium spectrum band and is most suitable for Long Term Evolution (LTE) technology. Across the world the device eco-system for LTE technology is developing fast including a number of countries in the Asia-Pacific (APAC), Middle East, Europe, United States of America and Latin American region. However, 700 MHz spectrum is being contemplated for auction in India for the first time.

3.67 Like other spectrum bands, the valuation exercise for 700 MHz spectrum is also dependent on the availability of the financial and non-financial information, which is not available for this spectrum band. Thus, one alternative could be that the valuation of700 MHz spectrum band be ascertained by using technical efficiency factor with bands which are comparable to 700 MHz band.Accordingly, following questions were asked in the CP to derive the value of 700 MHz band:

Q. Should the value of 700 MHz spectrum be derived on the basis of the value of 1800 MHz spectrum using technical efficiency factor? If yes, what

rate of efficiency factor should be used? Please support your views along with supporting documents/literature, and;

Q. Should the valuation of 700 MHz spectrum be derived on the basis of other sub-GHz spectrum bands (i.e. 800 MHz/900 MHz)? If yes, what rate of efficiency factor should be used? Please support your views along with supporting documents/literature.

Q. In the absence of financial or non-financial information on 700 MHz, no cost or revenue based valuation approach is possible. Therefore, please suggest any other valuation method/approach to value 700 MHz spectrum band along with detailed methodologies and related assumptions.

3.68 Many of the stakeholders are of the view that auction of 700 MHz should not be done at present. They are of the view that network and device ecosystem for APT 700 MHz band is at a nascent stage and therefore, an early auction of this band will lead to a situation where in the spectrum may be underutilized for several years with blockage of industry's funds which are critically required for network roll-out. Some stakeholders submitted that any valuation based on technical efficiency factor with any other bands is appropriate keeping all other things/factors same.

3.69 However, at the same time many stakeholders suggested factors/ratio for valuation of 700 MHz band with respect to valuation of other spectrum bands, in case the Authority decided otherwise to auction 700 MHz band immediately. Few stakeholders are of the view that in terms of propagation characteristics, 700 MHz band may be similar to 800 MHz. They suggested value of 700 MHz band be equal to 50% of the market discovered price of 800 MHz band considering that the LTE ecosystem in APT 700 MHz is yet to be developed. One stakeholder favoured the equal valuation for 800 MHz and 700 MHz. Another stakeholder opined against value of 700 MHz band based on 800 MHz band in view of different stage of eco system development in these two bands. One stakeholder has suggested equal value for 1800 MHz and 700 MHz band and another stakeholder at 2 times of value of 2300 MHz

on a paired MHz basis. Few stakeholders have opposed valuation of 700 MHz band based on market price of 900 MHz band. They are view of the view that winning price of 900 MHz in the recent auctions was not representative of the true value of 900 MHz but represents the amount paid by existing TSPs for business continuity and survival.

3.70 However, two stakeholders are of the view that 700 MHz is being used worldwide for the high speed data services i.e., LTE and offers superior propagation and in building characteristics over > 1GHz bands and has its performance edge over 800/900 MHz bands. One stakeholder has specifically referred to the TRAI Recommendations of April 2012[24] which explained the superior technical characteristics of 700 MHz spectrum band. These stakeholders favoured valuation of 700 MHz equal to 1.25 times of last auction determined prices of 800 MHz band (post indexation using SBI PLR). One stakeholder based on international auction experience of sub-1GHz LTE spectrum, has suggested value of Rs.1419 crore per MHz on pan India basis. Another stakeholder submitted that 700 MHz spectrum comprises precisely of frequencies where broadband and digital TV services are being provided by Indian MSOs and LCOs and has opposed the auction of the band.

3.71 The Authority has carefully examined the comments received from stakeholders. It emerges from the stakeholders' that there is absolute consensus among the stakeholders' regarding better propagation characteristics of 700 MHz than other spectrum bands and its suitability for LTE technology. This was also echoed in the Open House Discussion[25] held on the CP. However, there is a wide variation among stakeholders on possible valuation of 700 MHz bands. Their suggestions appear to be primarily driven by the state of development of eco system for 700 MHz band. However, a review of Global Mobile Supplier (GSA) report of October 2015reveals that APT700 FDD is being adopted as a prime band for Long Term Evolution (LTE) technology by a large number

[24]Recommendations on 'Auction of Spectrum' dated 23rd April 2012
[25]OHD held on 4th January 2016.

of countries (42) including those from APAC/Oceania region, Latin America region, Middle East and Europe. Further,12 commercial networks (including at Australia and New Zealand) have already launched their services in APT700 MHz band plan and 139 devices are available. Two of biggest markets in world telecom (i.e. China and USA) have committed utilization of 700 MHz band, other than APT 700 band plan. Thus, to hold the auction of 700 MHz band in India till the commercial networks are deployed (of APT 700 band plan) in a larger part of world and consequent development of eco system/devices may not be a logical approach particularly in the context of Indian telecom service sector. In fact, the Authority in its April 2012 recommendations had recommended that spectrum in 700 MHz band should be put to auction in 2014.

3.72 In India, TSPs on many occasions and various platforms have raised their concerns about the inadequacy of spectrum available for commercial use and resultant operational challenges. It has been consistent stand and view of the Authority to make available all the spectrum (earmarked for commercial use) to the TSPs for fulfilling the requirement of telecom and broadband services in the country. Considering the fact that a large proportion of the broadband growth in India will continue to come from wireless segment, 700MHz band will be extremely useful as an additional band for providing broadband services in the country particularly in rural areas for widespread coverage. Better access to education, improved healthcare and financial inclusion are all likely to result from widespread access to high-speed mobile broadband.

3.73 The Authority is of the view that auction of 700 MHz band would ease the operational constraints/challenges faced by the TSPs as well as bring the money to public exchequer in the form of auction money and other recurring revenue. Further, with 100.35 crore (on October 2015) wireless subscribers (second highest after China and representing around 14% of world-wide wireless subscribers), India with allocation of

700 MHz would bring the needed momentum and attractiveness among the equipment manufacturers/vendors for APT 700 band plan particularly when two other biggest markets (USA and China) have different utilization plan for 700 MHz band. After taking all these into considerations, the Authority is of the view that auction of 700 MHz spectrum should be undertaken with other spectrum bands in the forthcoming auction.

3.74 The next and perhaps the more important issue is to arrive at the value of 700 MHz band for forthcoming auction. As mentioned above, there is great diversity in the stakeholders on the issue of valuation of 700 MHz band. As can be seen from stakeholders' comments, it is evident many of the stakeholders had suggested value of 700 MHz band to be arrived on the basis of value of other bands i.e. 800 MHz/1800 MHz/ 2300MHz band. Pan India value of Rs.1419 crore per MHz of 700 MHz band as suggested by one stakeholder does not seem to be a pragmatic valuation of market prices revealed in recent past auctions of different bands.

3.75 The Authority considers "bottom-up" approach (use of band and LSA specific inputs) to be best suited for the valuation exercise. However, in view of the non-availability of historical financial and non-financial information and 700 MHz band being put for auction for the first time in the country, a "bottom-up" approach based valuation is currently not possible in this band. Valuation based only on technical efficiency with other bands may not be correct approach as it ignores all other factors i.e. development stage of eco system, market preference towards any particular band, timing of auction etc. Technical efficiency based valuation can be one of possible valuation but not the only one. Market revealed value and trends is a better indicator of value placed to the spectrum. As was recommended by the Authority in April 2012, the auction of 700 MHz band, the reserve price should be around four times that of 1800 MHz band and therefore, the same can be used for valuation of 700 MHz band as market revealed prices for 1800 MHz band are available. In absence of any other better approach, the same is

being followed in the valuation of 700 MHz band. **The Authority recommends that reserve price of 700 MHz band should be equal to four times of reserve price of 1800 MHz. Accordingly, the recommended reserve price of 700 MHz spectrum band for each LSA is tabulated below:**

TABLE 3.6

RECOMMENDED RESERVE PRICE PER MHz (PAIRED) IN 700 MHz BAND

(Rs. in crore)

(1)	(2)	(3)	(4)
LSA	**Category**	**Recommended Reserve price per MHz**	**Recommended Reserve Price (Rounded off)**
Delhi	Metro	1594.84	1595
Mumbai	Metro	1191.75	1192
Kolkata	Metro	596.40	596
Andhra Pradesh	A	971.20	971
Gujarat	A	952.00	952
Karnataka	A	740.00	740
Maharashtra	A	1272.15	1272
Tamilnadu	A	900.00	900
Haryana	B	186.40	186
Kerala	B	333.80	334
Madhya Pradesh	B	330.96	331
Punjab	B	308.00	308
Rajasthan	B	363.98	364
U. P. (East)	B	459.47	459
U.P. (West)	B	383.80	384
West Bengal	B	182.72	183
Assam	C	158.17	158
Bihar	C	248.00	248
Himachal Pradesh	C	63.60	64
Jammu & Kashmir	C	52.07	52

North East	C	44.00	44
Orissa	C	152.40	152

VALUATION AND RESERVE PRICE OF THE 2300 MHZ SPECTRUM

3.76 The spectrum in 2300 MHz band was auctioned in 2010 for the first time in the country. Like other spectrum bands, valuation exercise for 2300 MHz spectrum is also dependent on the availability of financial data with regard to revenue, cost, investment and other non-financial information pertaining to this spectrum band. However, financial and non-financial information is not available in the case of the 2300 MHz spectrum band as available in other bands (800/900/1800/2100 MHz).

Q. Should the value of May 2010 auction determined prices be used as one possible valuation for 2300 MHz spectrum in the next round of auction? If yes, then how? And, if not, then why not?

Q. Should the value of the 2300 MHz spectrum be derived on the basis of the value of any other spectrum band using the technical efficiency factor? If yes, please indicate the spectrum band and technical efficiency factor with 2300 MHz spectrum along with supporting documents.

3.77 Most of the stakeholders are of the view that the final price for 2300 MHz band in May 2010 may be used as its valuation for the current exercise without any indexation considering the fact that even after five years the networks are yet to be made fully operational except in few cities. Few stakeholders are in favour of using May 2010 auction determined duly indexed with applicable SBI PLR rates for the valuation purpose. One stakeholder suggested that the value of 2300 MHz spectrum in the next round of auction should be fixed at a discount to May 2010 prices.

3.78 On the question of establishing technical relationship with any other band many of the stakeholders have not submitted any comments. One

of the stakeholder is of the view that no existing band is comparable to 2300 MHz band. On the other hand, one of the stakeholder has suggested technical efficiency with 2100 MHz band (but has not specified any factor) and another stakeholder has suggested relationship with 1800 MHz (0.75 to 0.80 times).

3.79 It has been the view of the Authority to follow "bottom-up" approach (use of band and LSA specific inputs) for the valuation exercise. However, in view of the constraints discussed above, it would not be possible to follow the "bottom-up" approach in valuation of 2300 MHz band leaving with very limited alternatives for valuation-last market discovered price/technical efficiency with other bands and international experience. On international auction experience, the Authority had delved on the subject in detail in Para 4.34 of September 2013 recommendations and Para 3.56 to 3.62 of February 2014 recommendations and concluded that valuation of spectrum in India may not be done merely on the basis of international prices realised in various countries. On the subject of technical efficiency with other bands, it can be seen that majority of the stakeholders are not supporting/have not given comments on this point. The Authority is of the view that 2300 MHz band is a TDD band and comparing it with other traditional bands (FDD) operating in India may not be desirable.

3.80 From the comments of the stakeholders it emerges that most of them are agreeable to the use of the price realized in the May 2010 auction as the value for this band, with or without indexation. In view of the constraints discussed above and the stakeholder comments, the Authority is of the view that that May 2010 auction prices can be used for arriving at the valuation of 2300 MHz.

3.81 As around six years have elapsed since the auction in this band, there has been a considerable movement in the development of the ecosystem, deployment of networks and other technological innovation. Thus, it would not be appropriate to keep the valuation of 2300 MHz band at the

level of May 2010 auction prices. However, to factor in the time-gap since the last auction and other developments, the Authority is of the view that May 2010 auction prices duly indexed with SBI Base rate can be presently used for estimating the value of 2300 MHz. **Thus, the Authority recommends that the value of 2300 MHz spectrum band should be equal to the May 2010 auction prices duly indexed with SBI base rate and the recommended Reserve Price should be 80% of the arrived valuation. Accordingly, the recommended value and reserve price of 2300 MHz spectrum band for each LSA is tabulated below:**

TABLE 3.7

RECOMMENDED VALUATION AND RESERVE PRICE PER MHz (UNPAIRED) IN 2300 MHz BAND

(Rs. in crore)

(1)	(2)	(3)		(4)
LSA	**Category**	**Recommended Valuation per MHz**	**Recommended Reserve Price per MHz**	**Recommended Reserve Price (Rounded off)**
Delhi	Metro	178.61	142.89	143
Mumbai	Metro	182.75	146.20	146
Kolkata	Metro	41.70	33.36	33
Andhra Pradesh	A	84.41	67.53	68
Gujarat	A	48.92	39.14	39
Karnataka	A	123.00	98.40	98
Maharashtra	A	72.98	58.38	58
Tamilnadu	A	164.93	131.95	132
Haryana	B	9.56	7.64	8
Kerala	B	20.62	16.49	16
Madhya Pradesh	B	9.94	7.95	8
Punjab	B	26.48	21.19	21
Rajasthan	B	7.76	6.21	6
U. P. (East)	B	11.36	9.09	9
U.P. (West)	B	14.65	11.72	12
West Bengal	B	5.66	4.52	5

Assam	C	2.63	2.11	2
Bihar	C	7.91	6.33	6
Himachal Pradesh	C	1.65	1.32	1
Jammu & Kashmir	C	1.70	0.68	1
North East	C	1.70	0.68	1
Orissa	C	5.07	4.06	4

VALUATION AND RESERVE PRICE OF THE 2500 MHz SPECTRUM BAND

3.82 So far as 2500 MHz spectrum band is concerned no valuation exercise has been done and also no auction of 2500 MHz spectrum band has taken place so far in the country. Therefore, no historical financial data with regard to revenue, cost and investment is also available to form the basis for the valuation of 2500 MHz spectrum band. Accordingly, following question was asked in the CP:

Q. Should the valuation of the 2500 MHz spectrum be equal to the valuation arrived at for the 2300 MHz spectrum? If no, then why not? Please support your comments with supporting documents/ literature.

3.83 Majority of the stakeholders have favoured the valuation of 2500 MHz with the valuation of 2300 MHz bands. Few stakeholders have suggested a discount of 20- 30% discount to the value of 2300 MHz band. One of the stakeholders has suggested that the value of 2500 MHz band should be equal to 0.70 times the value of 1800 MHz. One of the stakeholders is of the view that in view of almost negligible device eco system and complex high IBW radio requirement, a larger consultation and deliberation is required to finalise the right use of the 2500 MHz spectrum band. Few of the stakeholders are of view that the Spectrum in both 2500 MHz band and 2300 MHz band is being auctioned as an unpaired spectrum. Further, propagation characteristics of 2500 MHz can be compared with the 2300 MHz band due to both being next to

each other. Considering this, it is reasonable and justified to assume valuation of 2500 MHz as equivalent to spectrum in 2300 MHz band.

3.84 The Authority has examined the stakeholder comments. It is also aware of the fact that DoT in 2010 had assigned the 2500 MHz spectrum band to the PSUs viz., BSNL and MTNL at the May 2010 auction determined prices of 2300 MHz band. Many stakeholders are also in favour of valuing 2500 MHz band equal to 2300 MHz.

3.85 As already enumerated above, there are a number of constraints in undertaking the independent valuation exercise of this band. After taking into consideration all these factors, **the Authority recommends that the Reserve Price of 2500 MHz spectrum band should be equal to recommended Reserve Price of 2300 MHz.**

SPECTRUM USAGE CHARGES

3.86 SUC are levied as a percentage of the Adjusted Gross Revenue (AGR) earned by the spectrum holder. The SUC rate varies depending on the quantum of spectrum held by a licensee (in case of administratively assigned spectrum or mix of administratively assigned spectrum and spectrum acquired through auction).

3.87 The Authority, in its Recommendations of September 2013 on 'Valuation and Reserve Price of Spectrum', had delved in detail on the then SUC regime in India particularly with focus on complexities and anomalies involved and gave its recommendations on the SUC rates. In the forthcoming auction, 700 MHz and 2500 MHz spectrum will be put for the auction for the first time in the country. Thus, the Authority is of the view that a clear and unambiguous policy on SUC rate on these bands is required before the start of auction process. It may be noted that September 2013 Recommendations were not restricted to any specific spectrum band and are equally applicable to all spectrum bands. There is no change in the Authority's stand on the Recommendations made in September 2013. Thus, **the Authority reiterates its**

Recommendations of 9th September 2013 on 'Valuation and Reserve Price of Spectrum' (Para 5.31, 5.33, 5.35 and 5.37) on Spectrum Usage Charges for all the spectrum bands in the forthcoming auction.

CHAPTER-IV: SUMMARY OF RECOMMENDATIONS

4.1 The Authority reiterates its earlier recommendation that APT700 band plan should be adopted for the 700 MHz (698-806 MHz) spectrum band with FDD based 2x45 MHz frequency arrangement. Further, it recommends that entire available spectrum (2x35MHz) in the 700 MHz band should be put to auction in the upcoming auction. (Para 2.9)

4.2 **The Authority recommends that partial spectrum available in Bihar, Rajasthan and North-East LSAs should not be put to auction till such time it becomes available at least in 75% of total number of districts of the LSA including the State capital(s). (Para 2.18)**

4.3 The Authority recommends that DoT should carry out carrier re-assignment exercise in the 800 MHz band at the earliest and ensure that entire spectrum that is available for commercial use is put to auction so as to avoid a situation where precious spectrum in this band remains unutilized resulting in revenue loss to the Government. It should also be ensured that the spectrum, which is getting released due to re-assignment of carriers, is in contiguous blocks. (Para 2.28)

4.4 The Authority recommends that DoT, in coordination with Defence and the TSPs, should complete the harmonization process in the 1800 MHz band before upcoming auctions so that the entire spectrum that is made available due to this exercise is placed for bidding. The available spectrum must be put to auction in contiguous blocks, preferably in the block of 5 MHz. (Para 2.35)

4.5 The Authority recommended that the 1800 MHz band administratively assigned spectrum to Aircel in Haryana and MP, and Tata in HP should be taken back. The Authority also recommends the 800 MHz band administratively assigned

spectrum to Tata in WB and Quadrant in Punjab should be taken back. This spectrum should also be put to upcoming auction. (Para 2.40)

4.6 The Authority recommends that DoT should ensure that the spectrum surrendered by TTSL is not kept idle and takes appropriate legal remedies to put it in the upcoming auction. (Para 2.44)

4.7 The Authority recommends that the entire available spectrum in 2100 MHz band, including spectrum taken back from STEL, should be put to auction. (Para 2.46)

4.8 The Authority recommends that spectrum in 700 MHz band should be offered in the block size of 5 MHz (paired). In case a TSP is able to win more than one block of spectrum in the upcoming auctions, it should be allocated spectrum in contiguous blocks. (Para 2.49)

4.9 The Authority recommends following block size and minimum quantum of spectrum that a new entrant/existing licenses is required to bid for in 800, 900, 1800 and 2100 MHz bands.

Table 2.13
Block size and Minimum amount of spectrum for bidding

<table>
<tr><th rowspan="2">Band</th><th rowspan="2">Block Size (MHz)</th><th colspan="3">Minimum amount of spectrum that a bidder is required to bid for (MHz)</th></tr>
<tr><th>Existing licensees</th><th colspan="2">New Entrants</th></tr>
<tr><td rowspan="3">800 MHz</td><td rowspan="3">1.25</td><td rowspan="3">1.25</td><td>5</td><td>If spectrum availability is 5 MHz or more</td></tr>
<tr><td>3.75</td><td>If 3.75 MHz spectrum is available.</td></tr>
<tr><td>2.5</td><td>If 2.5 MHz spectrum is available.</td></tr>
<tr><td rowspan="2">900/ 1800 MHz</td><td rowspan="2">0.2</td><td rowspan="2">0.2, if spectrum availability is less than 0.6 MHz; otherwise 0.6</td><td>0.2</td><td>If spectrum availability is less than 0.6 MHz</td></tr>
<tr><td colspan="2">5 MHz if at least one chunk of contiguous block of 5MHz is available; otherwise 0.6 MHz</td></tr>
<tr><td>2100 MHz</td><td>5</td><td>5</td><td colspan="2">5</td></tr>
</table>

(Para 2.58)

4.10 The Authority also recommends that in case a TSP is able to win more than one block of spectrum in 2100 MHz band, it should be allocated spectrum in contiguous blocks. Similarly, if the TSP already having spectrum in the 2100 MHz band, acquires additional carrier, it should be ensured that all its carriers are contiguous. (Para 2.59)

4.11 The Authority recommends spectrum in the 2300 MHz and 2500 MHz bands should be put to auction in the block size of 10 MHz (unpaired). Currently, spectrum trading in 2300/2500 MHz band is permitted in the block size of 20 MHz. The Authority also recommends that after network synchronisation of all the TDD networks, spectrum trading in 2300/2500 MHz band should be permitted in the blocks of 10 MHz. (Para 2.67)

4.12 The Authority recommends that existing provision of a cap of 25% of the 'total spectrum assigned' in 700/800/900/1800/ 2100/2300/2500 MHz bands and 50% within a given band in each of the access service area shall apply for total spectrum holding by each TSP. (Para 2.82)

4.13 The Authority recommends that the following roll-out obligations should be imposed for licensees who acquire access spectrum in 700 MHz band:

- **All towns/villages having population of 15,000 or more but less than 50,000 to be covered within 5 years of effective date of allocation of spectrum for access services and all villages having population of 10,000 or more but less than 15,000 to be covered within 7 years of effective date of allocation of spectrum.**
- **To prevent, duplication of infrastructure, a TSP should also be permitted to fulfil the obligations by sharing network of other operator to the extent permissible as per**

guidelines/instructions applicable from time to time. A licensee should be allowed to cover any town/village as part of roll-out obligations using intra-service area roaming amongst TSPs having 700 MHz band spectrum, subject to the condition that at least one-third of the towns/villages shall be covered without intra-circle roaming.

- **Self-certifications by the TSPs should be taken as compliance of roll-out obligations subject to the condition that at least 10% of such towns/villages self-certified by the TSP will be sample test checked by the TERM cell.**

(Para 2.97)

4.14 The Authority recommends that the quantum of test fee for the purpose of roll-out testing requirements may be reduced to 20% of the existing rates for testing in the block headquarters (for phase 3, 4 and 5 of the rollout obligations) and similarly for testing of coverage in rural SDCAs. (Para 2.100)

4.15 The Authority recommends that test schedule for the roll-out obligations testing for 700 MHz should be released within a period of one year from the date of completion of auction in this band. (Para 2.102)

4.16 The Authority recommends that the same roll-out obligations, which were imposed on the successful bidder of spectrum in 800 MHz, 900 MHz, 1800 and 2100 MHz band in the auctions held in 2015, should be prescribed for these spectrum bands in the upcoming auctions for new entrant(s). The Authority also recommends that no fresh roll-out obligation should be imposed on existing service providers who are already operating their services in 800, 900, 1800 or 2100 MHz band, in case they acquire additional block of spectrum in the same band. (Para 2.112)

4.17 The Authority recommends that same roll-out obligations, which were imposed on the successful bidder of spectrum in 2300 MHz band in the auctions held in 2010, should be prescribed for spectrum in 2300 and 2500 MHz band in the upcoming auctions too. The Authority also recommends that in case the existing TSPs, having spectrum in the 2300/2500 MHz band, acquire additional block of spectrum in the same band, no additional roll-out obligations should be imposed on them. (Para 2.118)

4.18 The Authority recommends that 900 and 1800 MHz bands should be treated as separate bands for the purpose of roll-out obligations if a licensee deploys different technologies in these bands. This would be applicable for the existing licensees also who have acquired spectrum through auction of 2012 and onwards. (Para 2.121)

4.19 The Authority reiterates its earlier recommends of 2nd January 2013 that for the purpose of compliance of roll-out obligations, the following needs to be fulfilled by the Licensee in each phase of the roll-out before offering it for testing:

i. Installing sufficient number of BTSs/Node-Bs for the required coverage;
ii. Launch the services commercially;
iii. File the tariff with TRAI as per TRAI's Telecom Tariff Order; and
iv. Make arrangement for subscriber complaint redressal.

For efficient utilisation of spectrum, and early delivery of services, the above provision may be made applicable for existing licensees too who are assigned spectrum from 2010 onwards.
(Para 2.125)

4.20 The Authority recommends that it should be mandated that the operation of adjacent LTE TDD networks in 2300/2500 MHz bands shall be time-synchronised and TSPs shall use the same frame

structure with DL/ UL configuration of 3:1. Other technical aspects such as clock source, requirement to be fulfilled by Wi-MAX networks for co-existence at LSA border areas etc can be finalised by TEC. These provisions may be mandated in the NIA for auctioning of spectrum in this band. It can also be mandated that this provision can be reviewed later on as and when need arises. (Para 2.137)

4.21 The Authority recommends that DoT should carry out carrier frequency re-assignment to make uniform carrier frequency assignment though out the country to the TSPs without any inter-operator guard band in the 2300 MHz band. It will result in additional spectrum for commercial use. The Authority also recommends if TSPs acquires additional block of 10MHz, it should be ensured that all its carriers are contiguous. (Para 2.139)

4.22 The Authority recommends that the same eligibility criteria that have been made applicable for other bands viz. 800 MHz, 900 MHz, 1800 MHz and 2100 MHz band in January 2015 NIA should be made applicable for 2300 MHz and 2500 MHz bands. The same eligibility criteria should also be made applicable for 700 MHz band also. (Para 2.145)

4.23 The Authority recommends that (i) the guidelines of liberalisation of administratively allotted spectrum in 900 MHz band should be similar to what has been spelt out by DoT for 800 and 1800 MHz band. (ii) If any TSP wants to liberalize its entire spectrum holding in any band, efforts should be made to make its spectrum holding in that band contiguous. (Para 2.151)

4.24 The Authority reiterates its earlier recommendation that there is an urgent need of audit for all allocated spectrum both commercial as well as spectrum allocated to various PSUs/ Government organizations. This should be done by an independent agency. (Para 2.154)

4.25 The Authority is of the view that a fresh valuation of 800 MHz, 900 MHz, 1800 MHz and 2100 MHz spectrum is the preferred way to initiate the process of determining valuation and reserve price of these four bands for the forthcoming auction. (Para 3.12)

4.26 The Recommended reserve prices for 1800 MHz band, 900 MHz band, 800 MHz band and 2100 MHz band for the forthcoming auction are tabulated below: (Para 3.65)

RECOMMENDED RESERVE PRICE PER MHz (PAIRED)
IN 1800 MHz BAND

(Rs. in crore)

(1)	(2)	(3)	(4)
LSA	**Category**	**Reserve Price (as calculated)**	**Recommended Reserve Price (Rounded off)**
Delhi	Metro	398.71	399
Mumbai	Metro	297.94	298
Kolkata	Metro	149.10	149
Andhra Pradesh	A	242.80	243
Gujarat	A	238.00	238
Karnataka	A	185.00	185
Maharashtra	A	318.04	318
Tamil Nadu	A	225.00	225
Haryana	B	46.60	47
Kerala	B	83.45	83
Madhya Pradesh	B	82.74	83
Punjab	B	77.00	77
Rajasthan	B	90.99	91
U. P. (East)	B	114.87	115
U.P. (West)	B	95.95	96
West Bengal	B	45.68	46
Assam	C	39.54	40
Bihar	C	62.00	62

Himachal Pradesh	C	15.90	16
Jammu & Kashmir	C	13.02	13
North East	C	11.00	11
Orissa	C	38.10	38
* 1800 MHz spectrum is not available in Tamil Nadu. However, recommended reserve price for this LSA has been included in the table since there is linkage with 700 MHz spectrum band.			

RECOMMENDED RESERVE PRICE PER MHz (PAIRED)

IN 900 MHz BAND

(Rs. in crore)

(1)	(2)	(3)	(4)
LSA	**Category**	**Reserve Price (as calculated)**	**Recommended Reserve Price (Rounded off)**
Gujarat	A	673.00	673
Karnataka	A	557.50	558
Haryana	B	151.20	151
U. P. (East)	B	775.60	776
U.P. (West)	B	738.55	739
Bihar	C	444.30	444

RECOMMENDED RESERVE PRICE PER MHz (PAIRED)

IN 800 MHz BAND

(Rs. in crore)

(1)	(2)	(3)	(4)
LSA	**Category**	**Reserve Price (as calculated)**	**Recommended Reserve Price (Rounded off)**
Delhi	Metro	847.70	848
Mumbai	Metro	727.50	727
Kolkata	Metro	160.39	160
Andhra Pradesh	A	605.98	606
Gujarat	A	284.91	285
Karnataka	A	303.00	303
Maharashtra	A	799.42	799
Tamilnadu	A	360.00	360
Haryana	B	57.05	57
Kerala	B	243.33	243

Madhya Pradesh	B	408.39	408
Punjab	B	119.14	119
Rajasthan	B	204.21	204
U. P. (East)	B	218.64	219
U.P. (West)	B	182.23	182
West Bengal	B	82.12	82
Bihar	C	136.20	136
Himachal Pradesh	C	23.97	24
Orissa	C	57.47	57

RECOMMENDED RESERVE PRICE PER MHz (PAIRED)

IN 2100 MHz BAND

(Rs. in crore)

(1)	(2)	(3)	(4)
LSA	**Category**	**Reserve Price (as calculated)**	**Recommended Reserve Price (Rounded off)**
Delhi	Metro	553.56	554
Mumbai	Metro	461.10	461
Kolkata	Metro	115.59	116
Andhra Pradesh	A	271.81	272
Gujarat	A	258.00	258
Karnataka	A	328.47	328
Maharashtra	A	341.27	341
Tamilnadu	A	344.00	344
Haryana	B	55.29	55
Kerala	B	177.26	177
Madhya Pradesh	B	122.98	123
Punjab	B	91.18	91
Rajasthan	B	139.82	140
U. P. (East)	B	109.98	110
U.P. (West)	B	111.32	111
West Bengal	B	51.62	52
Assam	C	45.68	46
Bihar	C	86.45	86
Himachal Pradesh	C	19.90	20

Jammu & Kashmir	C	10.95	11
North East	C	12.39	12
Orissa	C	38.05	38

4.27 The recommended reserve price of 700 MHz spectrum band for each LSA is tabulated below: (Para 3.75)

RECOMMENDED RESERVE PRICE PER MHz (PAIRED)

IN 700 MHz BAND (Rs. in crore)

(1)	(2)	(3)	(4)
LSA	**Category**	**Recommended Reserve price per MHz**	**Recommended Reserve Price (Rounded off)**
Delhi	Metro	1594.84	1595
Mumbai	Metro	1191.75	1192
Kolkata	Metro	596.40	596
Andhra Pradesh	A	971.20	971
Gujarat	A	952.00	952
Karnataka	A	740.00	740
Maharashtra	A	1272.15	1272
Tamilnadu	A	900.00	900
Haryana	B	186.40	186
Kerala	B	333.80	334
Madhya Pradesh	B	330.96	331
Punjab	B	308.00	308
Rajasthan	B	363.98	364
U. P. (East)	B	459.47	459
U.P. (West)	B	383.80	384
West Bengal	B	182.72	183
Assam	C	158.17	158
Bihar	C	248.00	248
Himachal Pradesh	C	63.60	64
Jammu & Kashmir	C	52.07	52
North East	C	44.00	44
Orissa	C	152.40	152

4.28 The recommended value and reserve price of 2300 MHz spectrum band for each LSA is tabulated below: (Para 3.81)

RECOMMENDED VALUATION AND RESERVE PRICE PER MHz (UNPAIRED) IN 2300 MHz BAND

(Rs. in crore)

(1)	(2)	(3)		(4)
LSA	**Category**	**Recommended Valuation per MHz**	**Recommended Reserve Price per MHz**	**Recommended Reserve Price (Rounded off)**
Delhi	Metro	178.61	142.89	143
Mumbai	Metro	182.75	146.20	146
Kolkata	Metro	41.70	33.36	33
Andhra Pradesh	A	84.41	67.53	68
Gujarat	A	48.92	39.14	39
Karnataka	A	123.00	98.40	98
Maharashtra	A	72.98	58.38	58
Tamilnadu	A	164.93	131.95	132
Haryana	B	9.56	7.64	8
Kerala	B	20.62	16.49	16
Madhya Pradesh	B	9.94	7.95	8
Punjab	B	26.48	21.19	21
Rajasthan	B	7.76	6.21	6
U. P. (East)	B	11.36	9.09	9
U.P. (West)	B	14.65	11.72	12
West Bengal	B	5.66	4.52	5
Assam	C	2.63	2.11	2
Bihar	C	7.91	6.33	6
Himachal Pradesh	C	1.65	1.32	1
Jammu & Kashmir	C	1.70	0.68	1
North East	C	1.70	0.68	1
Orissa	C	5.07	4.06	4

4.29 The Authority recommends that the Reserve Price of 2500 MHz spectrum band should be equal to recommended Reserve Price of 2300 MHz. (Para 3.85)

4.30 The Authority reiterates its Recommendations of 9th September 2013 on 'Valuation and Reserve price of Spectrum' (Para 5.31, 5.33, 5.35 and 5.37) on Spectrum Usage Charges for all the spectrum bands in the forthcoming auction. (Para 3.87)

ABBREVATIONS

S.No.	Abbreviation	Expansion
1.	2G	Second Generation
2.	3G	Third Generation
3.	AGR	Adjusted Gross Revenue
4.	APAC	Asia Pacific
5.	APT	Asia-Pacific Telecommunity
6.	ARPU	Average Revenue per User
7.	BHQs	Block Head Quarters
8.	BTS	Base Transceiver Station
9.	BWA	Broadband Wireless Access
10.	CAPEX	Capital Expenditure
11.	CDMA	Code Division Multiple Access
12.	CMTS	Cellular Mobile Telephone Service
13.	DHQs	District Headquarters
14.	DL/UL	Downlink/Uplink
15.	DoS	Department of Space
16.	DoT	Department of Telecommunications
17.	EBITDA	Earnings Before Interest Tax Depreciation Amortization
18.	FDD	Frequency Division Duplexing
19.	GSA	Global Mobile Supplier Association
20.	GSM	Global System for Mobile Communication
21.	ISP	Internet Service Provider
22.	LCO	Local Cable Operator
23.	LF	Licence Fees
24.	LSA	Licence Service Area

S.No.	Abbreviation	Expansion
25.	LTE	Long-Term Evolution
26.	MTNL	Mahanagar Telephone Nigam Limited
27.	NFAP-2002	National Frequency Allocation Plan- 2002
28.	NIA	Notice Inviting Application
29.	NTP-2012	National Telecom Policy-2012
30.	OHD	Open House Discussion
31.	OPEX	Operating Expenditure
32.	OTC	One-Time Spectrum charges
33.	P_{ADP}	Auction Determined Price
34.	PLR	Prime Lending Rate
35.	P_{MCP}	Market Clearing Price
36.	PPDR	Public Protection and Disaster Relief
37.	PSU	Public Sector Undertaking
38.	QoE	Quality of experience
39.	RAN	Radio Access Network
40.	RF	Transmit Power
41.	RP	Reserve Price
42.	SBI PLR	State Bank of India – Prime Lending Rate
43.	SDCA	Short Distance Charging Area
44.	SUC	Spectrum Usage Charges
45.	TDD	Time Division Duplexing
46.	TDSAT	Telecom Disputes Settlement & Appellate Tribunal
47.	TEC	Telecommunication Engineering Centre
48.	TERM Cell	Telecom Enforcement, Resource and Monitoring Cell
49.	TRAI	Telecom Regulatory Authority of India

S.No.	Abbreviation	Expansion
50.	TSP	Telecom Service Provider
51.	TTO	Telecom Tariff Order
52.	UASL	Unified Access Service Licence
53.	UL	Unified Licence
54.	UL (AS)	Unified Licence (Access Services)
55.	USOF	Universal Obligation Service Fund
56.	Wi-Fi	Wireless Fidelity
57.	Wi-MAX	Worldwide Interoperability for Microwave Access
58.	WPC	Wireless Planning & Coordination Wing

Annexure 1.1

Government of India
Ministry of Communications and IT
Wireless Planning and Coordination (WPC) Wing
Sanchar Bhawan, 20, Ashok Road, New Delhi – 110001

No.L-14006/06/2015-NTG Dated: 09 .07.2015

To,

The Secretary
Telecom Regulatory Authority of India
Mahanagar Doorsanchar Bhawan
Jawahar Lal Nehru Marg (Old Minto Road)
New Delhi-110002

Subject: TRAI Recommendations on the Reserve Price for auction of right to use of Spectrum in 700 MHz, 800 MHz, 900 MHz, 1800 MHz and 2100 MHz, 2300 MHz and 2500 MHz bands – reg.

Sir

The undersigned is directed to state that the Government is planning to auction of right to use of spectrum in 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz and 2500 MHz bands in the forthcoming auction. The status of availability of spectrum in these bands is as under:

2. **700 MHz band:**

2.1 TRAI had made its recommendation on reserve price and other related issues for 700 MHz band along with the other bands in April 2012. Thereafter, band plan for 700 MHz was recommended by TRAI in March 2013.

2.2 Presently, 770.0 MHz (FDD) of spectrum is available in 700 MHz band (35 MHz (FDD) spectrum in each of 22 LSAs). It is pertinent to mention that during the period March 2013 to March 2015, 3 rounds of spectrum auction in various bands have been conducted. It is felt that reserve price as recommended by TRAI for 700 MHz band in April 2012 does not seems to be appropriate in the present scenario. Therefore, it is necessary to get fresh recommendations for auction of spectrum in 700 MHz band in the light of development taken place during the period since April 2012.

3. **800 MHz, 900 MHz and 1800 MHz Bands:**

3.1 It is noted that 8 service licenses are due to expire during May 2016 to March 2018. A total of 20.0 MHz, 12.4 MHz and 22.0 MHz spectrum will be released due to expiry of these 8 licenses in 800 MHz, 900 MHz and 1800 MHz bands respectively. The availability of spectrum in these bands is limited to spectrum to be released due to expiry of these 8 service licenses and unsold spectrum in 800 MHz, 900 MHz and 1800 MHz bands during last spectrum auction held in March 2015.

3.2 It is also pertinent to mention that the harmonisation of 1800 MHz band with Defence and Telecom Service providers is underway. If harmonisation process gets completed before the commencement of process for conducting of forthcoming auction, spectrum releases from harmonisation in 1800 MHz band will be added into the availability of 1800 MHz band.

4. 2100 MHz Band:

4.1 Defence has agreed, in principle, for swapping 15.0 MHz spectrum in 2100 MHz band with 1900 MHz band in all the service areas. Further, 15.0 MHz spectrum (5.0 MHz spectrum each in AP, Delhi and Mumbai service areas) remains unsold during last spectrum auction held in March 2015. Therefore, 345 MHz of spectrum (15.0 MHz each in 19 service areas and 20 MHz each in 3 service areas) in 2100 MHz band is available for auction.

5. 2300 MHz and 2500 MHz Bands:

5.1 TRAI was requested to give recommendations on the Reserve Price for auction of right to use of Spectrum in 2100 MHz, 2300 MHz and 2500 MHz bands vide this Ministry letter No. L-14006/01/2014-NTG dated 16.10.2014. TRAI had made recommendations on 2100 MHz band (**Valuation and Reserve Price of Spectrum: 2100 MHz Band dated 31.12.2014**) only. The recommendations on the Reserve Price and associated conditions for auction of right to use of Spectrum in 2300 MHz and 2500 MHz bands are awaited.

6. Service area wise details of availability of spectrum in various bands is at Annexure-I. The availability of spectrum in all the bands in all the service areas can vary vis-à-vis indicated in the Annexure-I.

7. TRAI is, therefore, requested to:

(a) provide recommendations on applicable reserve price and associated conditions for auction of spectrum in 700 MHz, 800 MHz, 900 MHz, 1800 MHz and 2100 MHz bands for all the services areas under the terms of clause 11(1)(a) of TRAI Act 1997 as amended by TRAI Amendment Act 2000.

(b) expedite the recommendations on applicable reserve price for 2300 MHz and 2500 MHz bands for all the services areas.

(R. B. Prasad)
Joint Wireless Adviser

Annexure-I

Availability of spectrum in various bands

S. No.	Service Area	700 MHz	800 MHz	900 MHz	1800 MHz	2100 MHz	2300 MHz	2500 MHz
1	Andhra Pradesh	35.00	6.25		4.40	20.00	20.00	40.00
2	Assam	35.00				15.00	20.00	20.00
3	Bihar	35.00		4.60	2.00	15.00	20.00	20.00
4	Delhi	35.00		6.20	2.20	20.00	20.00	40.00
5	Gujarat	35.00	3.75	3.00	4.40	15.00	20.00	40.00
6	Haryana	35.00		0.20		15.00		20.00
7	Himachal Pradesh	35.00				15.00	20.00	20.00
8	Jammu & Kashmir	35.00				15.00		20.00
9	Karnataka	35.00	1.25	0.20	0.20	15.00	20.00	40.00
10	Kerala	35.00				15.00	20.00	20.00
11	Kolkata	35.00				15.00	20.00	40.00
12	Madhya Pradesh	35.00	1.25			15.00	20.00	20.00
13	Maharashtra	35.00	6.25			15.00	20.00	40.00
14	Mumbai	35.00	5.00	6.20	2.20	20.00	20.00	40.00
15	North East	35.00			0.80	15.00	20.00	20.00
16	Orissa	35.00				15.00	20.00	20.00
17	Punjab	35.00	5.00		4.40	15.00		20.00
18	Rajasthan	35.00	5.00		4.80	15.00		20.00
19	Tamil Nadu	35.00	1.25			15.00	20.00	40.00
20	Utter Pradesh (East)	35.00	1.25	0.60		15.00		20.00
21	Utter Pradesh (West)	35.00		1.20		15.00		20.00
22	West Bengal	35.00				15.00	20.00	20.00
		770.00	36.25	22.20	25.40	345.00	320.00	600.00

Annexure 1.2

Government of India
Ministry of Communications and IT
Wireless Planning and Coordination (WPC) Wing
Sanchar Bhawan, 20, Ashok Road, New Delhi – 110001

No.L-14006/01/2014-NTG Dated: October 16, 2014

To,

The Secretary
Telecom Regulatory Authority of India
Mahanagar Doorsanchar Bhawan
Jawahar Lal Nehru Marg (Old Minto Road)
New Delhi-110002

Subject: **TRAI Recommendations on the Reserve Price for auction of right to use of Spectrum in 2100 MHz, 2300 MHz and 2500 MHz bands – reg.**

Sir

The undersigned is directed to state that the Government is planning auction of right to use of spectrum in 2100 MHz, 2300 MHz and 2500 MHz bands, preferably along with the auction of spectrum in 800 MHz, 900 MHz and 1800 MHz bands. The status of availability of spectrum in these three bands is as under:

2.1 **2100 MHz band:**

At present, no vacant spectrum is available with the Department in 2100 MHz band. Discussions with Defence are underway for release of one block of 5 MHz of spectrum in 2100 MHz and the possibilities are that the Defence may release spectrum with the availability either for entire service area or partial basis(i.e. released spectrum will not be available for entire service area). Spectrum in 2100 MHz band will be put for auction only after release of spectrum by Defence.

2.2 **2300 MHz and 2500 MHz Bands:**

Details of availability of spectrum in these two bands are attached at **Annexure.**

3. Further, the department has so far conducted spectrum auction in different bands since 2010 with a validity period of 20 years of right to use spectrum. The administratively assigned spectrum in 800 MHz, 900 MHz and 1800 MHz bands is co-terminus with expiry of service licenses. This has created a situation where TSPs are providing services in a service area, having spectrum with different validity period of right to use spectrum even in the same band.

3.1 The feasibility of auctioning varying validity periods of right to use spectrum (less than 20 years) so that expiry of validity period of right to use spectrum in a band in a service area occurs at same time may also be considered.

4. TRAI is, therefore, requested to provide recommendations on the following in terms of clause 11(1)(a) of TRAI Act 1997 as amended by TRAI Amendment Act 2000.:

(a) Applicable reserve price for 2100 MHz, 2300 MHz and 2500 MHz bands for all the services areas in both the cases i.e. spectrum available in entire service area and spectrum partially available in a service area.

(b) Auction of right to use of spectrum in a band with varying validity periods(less than 20 years) so that expiry of validity period of right to use spectrum in a band in a service area occurs at same time.

(R. B. Prasad)
Joint Wireless Adviser

Annexure

Details of availablity of Spectrum in 2300 MHzand 2500 MHz bands

S. No.	Service Area	Frequency spot in 2300 MHz Band	Frequency spot in 2500 MHz Band		Total Available Spectrum in (MHz)
1	Andhra Pradesh	2325.0-2345.0	2535-2555	2635-2655	60
2	Assam	2347.5-2367.5	2535-2555		40
3	Bihar	2357.5-2377.5	2535-2555		40
4	Delhi	2350.0-2370.0	2535-2555	2635-2655	60
5	Gujarat	2350.0-2370.0	2535-2555	2635-2655	60
6	Haryana		2535-2555		20
7	Himachal Pradesh	2367.5-2387.5	2535-2555		40
8	Jammu & Kashmir		2535-2555		20
9	Karnataka	2350.0-2370.0	2535-2555	2635-2655	60
10	Kerala	2350.0-2370.0	2535-2555		40
11	Kolkata	2355.0-2375.0	2535-2555	2635-2655	60
12	Madhya Pradesh	2352.5-2372.5	2535-2555		40
13	Maharashtra	2355.0-2375.0	2535-2555	2635-2655	60
14	Mumbai	2355.0-2375.0	2535-2555	2635-2655	60
15	North East	2347.5-2367.5	2535-2555		40
16	Orissa	2378.0-2398.0	2535-2555		40
17	Punjab		2535-2555		20
18	Rajasthan		2535-2555		20
19	Tamil Nadu	2357.5-2377.5	2535-2555	2635-2655	60
20	Utter Pradesh (East)		2535-2555		20
21	Utter Pradesh (West)		2535-2555		20
22	West Bengal	2355.0-2375.0	2535-2555		40
		320 MHz	440 MHz	160 MHz	920 MHz

Annexure 1.3

Government of India
Wireless Planning and Coordination (WPC) Wing
Ministry of Communications and IT
Sanchar Bhawan, 20, Ashok Road, New Delhi – 110001

No. L-14010/04/2015-NTG Dated: 06.10.2015

To,

The Secretary
Telecom Regulatory Authority of India
Mahanagar Doorsanchar Bhawan
Jawahar Lal Nehru Marg (Old Minto Road)
New Delhi-110002

Subject: Recommendations on the Liberalization of Administratively allotted Spectrum in 900 MHz band – reg.

Sir

The undersigned is directed to state that the Government has already made provisions for liberalisation of administratively allotted spectrum holding in 800 MHz and 1800 MHz bands. At present, there is no provision for liberalisation of administratively allotted spectrum holding in 900 MHz band.

2. Presently, 3 private telecom service providers in 8 service areas besides state owned PSUs (BSNL & MTNL) are holding administratively allotted spectrum in 900 MHz band. Details of TSPs along with service area and quantum of administratively allotted spectrum in 900 MHz band and expiry of their service license are attached.

3. TRAI is, therefore, requested to provide recommendations on liberalisation of administratively allotted spectrum in 900 MHz band.

6.10.2015

(R. B. Prasad)
Joint Wireless Adviser

Administrative allotted Spectrum holdings in 900 MHz by Telecom Service providers as on date

Sl. No.	Service Area	Name of the Telecom Service providers	Quantum of Administrative allotted spectrum in 900MHz Band	Effective date of expiry of License
1	Assam	Bharti Airtel Limited	1.80 MHz	07.07.2024
		Aircel/Dishnet Wireless Ltd.	4.40 MHz	20.04.2024
2	Bihar	Bharti Airtel Limited	6.20 MHz	09.02.2024
3	Jammu & Kashmir	Bharti Airtel Limited	6.20 MHz	09.02.2024
		Aircel/Dishnet Wireless Ltd.	4.40 MHz	20.04.2024
4	North East	Aircel/Dishnet Wireless Ltd.	4.40 MHz	20.04.2024
5	Orissa	Bharti Airtel Limited	6.20 MHz	09.02.2024
6	Uttar Pradesh (East)	Bharti Airtel Limited	6.20 MHz	09.02.2024
7	Uttar Pradesh (West)	Vodafone South Ltd.	6.20 MHz	12.03.2024
8	West Bengal	Bharti Airtel Limited	4.40 MHz	10.02.2024
		Vodafone South Ltd.	4.40 MHz	22.03.2024
9	Delhi and Mumbai	MTNL	6.2 MHz each	09.10.2017
10	All service areas except Delhi & Mumbai	BSNL	6.2 MHz each	28.02.2020

Annexure 2.1

भारतीय दूरसंचार विनियामक प्राधिकरण
TELECOM REGULATORY AUTHORITY OF INDIA
भारत सरकार/Government of India
महानगर दूरसंचार भवन, जवाहर लाल नेहरू मार्ग,
Mahanagar Doorsanchar Bhawan, Jawahar Lal Nehru Marg
(पुराना मिन्टो रोड) नई दिल्ली/(Old Minto Road), New Delhi-110002
फैक्स/Fax : +91-11-23213294, ईपीवीएक्स नं०/ EPBX No. : +91-11-23664145

No.103-8/2015-NSL-II

Date: 16th November 2015

The Secretary,
Department of Telecommunications,
Sanchar Bhawan,
Ashoka Road,
New Delhi-110001.

(Kind Attn: Shri R.J.S. Kushvaha, Wireless Advisor)

Subject: TRAI Recommendations on the Reserve Price for auction of right to use of Spectrum in 700 MHz, 800 MHz, 900 MHz, 1800 MHz and 2100 MHz, 2300 MHz and 2500 MHz bands – clarifications – reg.

Ref:- 1. TRAI letter of even no. dated 24th July 2015
2. DoT's letter No. L-14006/06/2015-NTG dated 16th Oct., 2015
3. DoT's letter No.L-14001/08/2015-NTG dated 26th Oct. 2015

TRAI had sought some information/clarifications from DoT with regard to the reference dated 9th July 2015 received from the DoT seeking TRAI's Recommendations on the Reserve Price for auction of right to use of spectrum in 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz and 2500 MHz bands.

2. DoT through their letter dated 16th October 2015 had furnished certain information on the subject. The information supplied has been examined and Authority's response to the same and information/ clarification required for preparation of the recommendations is given in the following paras.

(i) 700 MHz Band

On the issue of adoption of APT700 FDD (band 28) band plan by India, DoT has requested TRAI to deliberate once again, if felt appropriate, in view of the current status of eco-system in this band, as the recommendations of the Authority on 700 MHz band were given in March 2013. It may be noted that the Authority in its

recommendations on "IMT – Advanced Mobile Wireless Broadband Services" dated 19th March 2013, had recommended that "APT700 band plan should be adopted for the 700 MHz spectrum band (698-806 MHz) with FDD based 2x45 MHz frequency arrangement". The Authority has in its Recommendations dated 15th October 2014 on 'Valuation and Reserve Price of Spectrum: Licenses expiring in 2015-16' had reiterated the adoption of APT700 Band Plan.

As per Global Mobile Supplier (GSA) report of Oct,2015[1], in 700MHz band there are three different types of band plans adopted/being adopted worldwide. Due to allocation of same frequency in 700 MHz band to Public Protection and Disaster Relief (PPDR) there is a specific band plan for United States (Band 12, 13, 14 and 17) in this band. China is planning to use this band in TDD mode. Band 28 known as APT700 FDD is being adopted as a prime band for Long Term Evolution (LTE) technology in about 42 countries. List of these countries is available in **Annexure**.

APT700 band is licensed to mobile operators in 13 countries. In 9 out of these 13 countries, spectrum has also been auctioned in 700 MHz band. Further, 12 commercial networks have launched their services in this band plan and 139 devices are available in this band plan. Details are available in Annexure.

Based on above report it can be said that eco-system is developing fast in APT700 band plan and due to adoption of this plan by several countries, it is expected that in future due to harmonisation and economy of scale, equipment prices will come down.

In view of the above, the Authority is still of the view that India should also adopt APT700 band. Accordingly, the Authority is going ahead with this presumption while preparing consultation paper on the subject. However, if DoT has any other understanding, the same may be communicated.

As regard available frequencies, DoT has stated that out of 45 MHz, 35 MHz of spectrum is reserved for telecom services and the remaining 10 MHz is for defence. However, it is important to know the availability of exact frequencies/carriers in this band. Therefore, DoT is requested to provide information on frequencies available with defence on this band so that recommendations can be prepared accordingly.

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1 http://www.gsacom.com/downloads/pdf/APT700_zone_Snapshot_APT700_extract_GSA_Evolution_to_LTE_report_131015.php4

(ii) 2500 MHz Band

DoT in its response has informed that the Department of Space (DoS) has released 20 MHz spectrum in this band excluding guard-band requirement for IMT applications. In this reference the understanding of TRAI is that there is clear 20/40 MHz spectrum available for auction in this band and guard-band requirement, will be provided from the spectrum earmarked for DoS. In case DoT has any other interpretation, the same may be intimated.

3. Further, DoT vide its letter dated 26th October, 2015 has informed that during the review meeting of 'National Health Mission" by Prime Minister on 9th June,2015, among others, the following decision was taken on the issue linked to spectrum auction:

"To tackle public health problems, effective health education (IEC) is very critical. As the penetration of mobile phone in India is very widespread, it is an effective tool to reach out to the masses. While conducting auction of spectrum, efforts should be made to incorporate conditions to provide free space of the spectrum for dissemination of text and audio-visual messages for such public purpose."

DoT has requested TRAI to examine this issue and provide recommendations on this issue along with the earlier reference dated 9th July 2015 on reserve price for auction of right to use of spectrum in various bands. In this regard, the intent of DoT could not be understood as the afore-mentioned decision says provision of free space of spectrum for health purpose. Therefore, DoT is requested to clarify as to how free space of the spectrum be provided from the spectrum proposed to be auctioned for dissemination of text and audio-visual messages and how this reference is linked with its earlier reference.

16/11/15

(Sanjeev Banzal)
Advisor
(Networks, Spectrum & Licensing)

Annexure
(letter No. 103-8/2015-NSL-II dated 16.11.2015)

A. Countries where APT700 FDD (band28) band plan is being adopted as a prime band for Long Term Evolution (LTE) technology

(a) **APAC/Oceania**: (23 countries including Australia, Japan, Malaysia, Nepal, New Zealand, South Korea and Singapore)
(b) **Latin America region** (13 countries including Argentina, Brazil, Colombia and Mexico)
(c) **Middle East**: UAE has also confirmed adoption APT700 FDD (band 28)
(d) **Europe**: Finland, France, Germany, Sweden and UK

B. Countries (13) where APT700 band 28 is licensed to mobile operators

Argentina, Australia, Brazil, Chile, Ecuador, Fiji, Japan, Mexico, New Zealand, Panama, Papua New Guinea, South Korea, and Taiwan.

C. Commercially launched APT700 band 28 networks

12 commercial networks have launched their services in this band plan. The details are as per table below:

ATP700 Network	**Country**
Digicel	Papua New Guinea
FarEasTone	Taiwan
Taiwan Mobile	Taiwan
Vodafone	New Zealand
Optus	Australia
Telstra	Australia
Spark	New Zealand
Asia Pacific telecom	Taiwan
C and W	Panama
Movistar	Panama
Ambit Microsystems	Taiwan
Claro	Panama

Annexure 2.2

CDMA CARRIERS ASSIGNMENTS (EXISTING)

S. No.	Metro Circles																	
		1	42	83	124	0.6	185	226	267	308	0.6	369	410	451	492	0.6	553	594
		1.23	1.23	1.23	1.23		1.23	1.23	1.23	1.23		1.23	1.23	1.23	1.23		1.23	1.23
		870.03	871.26	872.49	873.72		875.55	876.78	878.01	879.24		881.07	882.3	883.53	884.76		886.59	887.82
1	Delhi	TTSL(Won in Mar 15 auction)	AVAILABLE	AVAILABLE	SSTL	0.3	RCL	RCL	RCL	RCL	0.6	TTL	TTL	TTL	TTL	0.6	SSTL	SSTL
		870.03	871.26	872.49	874.02	0.3	875.55	876.78	878.01	879.24		881.07	882.3	883.53	884.76		886.59	887.82
2	Mumbai	TTML (expiry of license in 2017-18)					TTSL(Won in Mar 15 auction)	TTSL(Won in Mar 15 auction)		RJIL(Won in Mar 15 auction)	RJIL(Won in Mar 15 auction)	RJIL(Won in Mar 15 auction)	RJIL(Won in Mar 15 auction)		RCL	RCL	RCL	RCL
		1	42	83	124	0.6			0.6					0.6	471	512	553	594
		870.03	871.26	872.49	873.72		875.55	876.78		878.61	879.84	881.07	882.3		884.13	885.36	886.59	887.82
3	Kolkata	AVAILABLE	BSNL	0.3	RCL(Won in Mar 15)	0.3	TTL	TTL	0.3	SSTL	0.33	TTL	0.3	SSTL	SSTL	0.9	RCL	RCL	RCL	RCL	0.6
		870.03	871.26		872.79		874.32	875.55		877.08		878.64		880.17	881.4		883.53	884.76	885.99	887.22	
A' Service Areas																					
1	AP	AVAILABLE	BSNL	0.3	TTSL (Won in Mar 15)	TTSL (Won in Mar 15)	TTSL (Won in Mar 15)	0.3	TTL (expiry of license in 2017-18)			0.6	RCL	RCL	RCL	RCL	0.6	AVAILABLE	AVAILABLE		
		870.03	871.26		872.79	874.02	875.25		876.78	878.01	879.24		881.07	882.3	883.53	884.76		886.59	887.82		
2	Gujarat	TTL	TTL	0.3	SSTL	SSTL	0.3	AVAILABLE	TTL	0.36	BSNL	BSNL	0.24	SSTL	0.3	RCL(Won in Mar 15)	RCL(Won in Mar 15)	0.3	RCL (expiry of license in 2017-18)		
		1	42		93	134			226		279	320							512	553	594
		870.03	871.26		872.79	874.02		875.55	876.78		878.37	879.6		881.07		882.6	883.83		885.36	886.59	887.82
3	Maharashtra	TTML (expiry of license in 2017-18)					TTSL (Won in Mar 15)	TTSL (Won in Mar 15)	AVAILABLE	Vacant	BSNL	BSNL	AVAILABLE		RCL	RCL	RCL	RCL
		1	42	83	124	0.6					347	388		0.03	471	512	553	594
		870.03	871.26	872.49	873.72		875.55	876.78	878.01		880.41	881.64	882.87		884.13	885.36	886.59	887.82
4	Karnataka	AVAILABLE	BSNL	BSNL	0.3	SSTL	0.3	TTL	TTL	TTL	0.3	AVAILABLE	0.3	RCL	RCL	RCL	RCL	0.6	SSTL	SSTL	
		870.03	871.26	872.49		874.02		875.55	876.78	878.01		879.54		881.07	882.3	883.53	884.76		886.59	887.82	
5	Tamil Nadu	AVAILABLE	BSNL	BSNL	0.3	SSTL	0.3	TTL (only in Chennai)	TTL	TTL	0.3	AVAILABLE	0.3	RCL	RCL	RCL	RCL	0.6	SSTL	SSTL	
		870.03	871.26	872.49		874.02		875.55	876.78	878.01		879.24		881.07	882.3	883.53	884.76		886.59	887.82	

CDMA CARRIERS ASSIGNMENTS (EXISTING)

		1	42	83	124		185	226	267	308		369	410	451	492		553	594
		1.23	1.23	1.23	1.23	0.6	1.23	1.23	1.23	1.23	0.6	1.23	1.23	1.23	1.23	0.6	1.23	1.23
		870.030	871.260	872.490	873.720		875.550	876.780	878.010	879.240		881.070	882.300	883.530	884.760		886.590	887.820
S. No	"B" Service Area																		
1	HARYANA	AVAILABLE	BSNL	0.3	RJIL (Won in Mar 15)	TTSL (Won in Mar 15)	0.3	RCL	RCL	RCL	0.3	RCL	0.3	TTL	TTL	TTL	0.6	RJIL (Won in Mar 15)	RJIL (Won in Mar 15)	RJIL (Won in Mar 15)
			42					185	226	267		15-Mar		369	410	451				
		870.03	871.26		872.79	874.02		875.55	876.78	878.01		879.54		881.07	882.3	883.53		885.36	886.59	887.82
2	MP	AVAILABLE	Vacant (0.99)		BSNL	BSNL	0.84	RJIL (Won in Mar 15)	RJIL (Won in Mar 15)	RJIL (Won in Mar 15)	RJIL (Won in Mar 15)	0.6	RCL	RCL	RCL	RCL	0.6	TTL	TTL	
					75	116							369	410	451	492		553	594	
		870.03			872.25	873.48		875.55	876.78	878.01	879.24		881.07	882.3	883.53	884.76		886.59	887.82	
3	PUNJAB	AVAILABLE	HFCL (expiry of license in 2017-18)		0.3	AVAILABLE	1.14	BSNL	0.6	RCL (Won in Mar 15)	RCL (Won in Mar 15)	0.39	RCL	RCL	RCL	0.6	TTL	TTL	TTL	
			42	83				213					369	410	451		512	553	594	
		870.03	871.26	872.49		874.02		876.39		878.22	879.45		881.07	882.3	883.53		885.36	886.59	887.82	
4	RAJASTHAN	Vacant	BSNL	0.6	TTL (except Kota)	0.63	SSTL (expiry of license in 2017-18)		AVAILABLE	AVAILABLE	0.39	TTL	0.6	BSNL	0.4	RCL	RCL	RCL	0.6	TTL	
			37		98		160	201				337		398		451	492	533		594	
			871.11		872.94		874.8	876.03	877.26	878.49		880.11		881.94	0.4	883.53	884.76	885.99		887.82	
5	KERALA	BSNL	BSNL	AVAILABLE	0.3	SSTL	0.3	AVAILABLE	TTL	TTL	TTL	0.6	RCL	RCL	RCL	RCL	0.6	SSTL	SSTL	
		1	42	83		134			226	267	308		369	410	451	492		553	594	
		870.03	871.26	872.49		874.02		875.55	876.78	878.01	879.24		881.07	882.3	883.53	884.76		886.59	887.82	
6	UP(E)	AVAILABLE	BSNL	BSNL	0.3	AVAILABLE	0.3	TTL	TTL	TTL	0.3	RJIL (Won in Mar 15)	0.3	RCL	RCL	RCL	RCL	0.6	RJIL (Won in Mar 15)	RJIL (Won in Mar 15)
			42	83		134		185	226	267				369	410	451	492			
		870.03	871.26	872.49		874.02		875.55	876.78	878.01		879.54		881.07	882.3	883.53	884.76		886.59	887.82
7	UP(W)	AVAILABLE	BSNL	BSNL	0.3	SSTL	0.3	RCL	RCL	RCL	RCL	0.3	RCL (Won in Mar 15)	0.3	TTL	TTL	TTL	0.6	SSTL	SSTL	
			42			134		185	226	267	308				410	451	492		553	594	
		870.03	871.26	872.49		874.02		875.55	876.78	878.01	879.24		880.77		882.3	883.53	884.76		886.59	887.82	
8	WEST BENGAL	AVAILABLE	BSNL	BSNL	0.6	TTL	AVAILABLE	SSTL	AVAILABLE	TTL	0.3	SSTL	SSTL	0.3	RCL	RCL	RCL	0.6	RCL (Won in Mar 15)		
			42	83		144		226		308		359	400		451	492	533				
		870.03	871.26	872.49		874.32	875.55	876.78	878.01	879.24		880.77	882.00		883.53	884.76	885.99		887.82		

CDMA CARRIERS ASSIGNMENTS (EXISTING)

		1	42	83	124		185	226	267	308		369	410	451	492		553	594
		1.23	1.23	1.23	1.23	0.6	1.23	1.23	1.23	1.23	0.6	1.23	1.23	1.23	1.23	0.6	1.23	1.23
		870.030	871.260	872.490	873.720		875.550	876.780	878.010	879.240		881.070	882.300	883.530	884.760		886.590	887.820
S. No.	"C" Service Area																	
1	ASSAM	AVAILABLE	BSNL 42	BSNL 83	0.3	AVAILABLE	0.3	RJIL (Won in Mar 15)	RJIL (Won in Mar 15)	RJIL (Won in Mar 15)	RJIL (Won in Mar 15)	0.6	AVAILABLE	AVAILABLE	0.6	RCL (Won in Mar 15)	RCL (Won in Mar 15)	RCL (Won in Mar 15)	RCL (Won in Mar 15)
		870.03	871.26	872.49		874.02		875.55	876.78	878.01	879.24		881.07	882.3		884.13	885.36	886.59	887.82
2	BIHAR	AVAILABLE	BSNL 42	BSNL 83	0.3	RJIL (Won in Mar 15)	0.3	TTL 185	TTL 226	TTL 267	0.3	RJIL (Won in Mar 15)	0.3	RCL 369	RCL 410	RCL 451	RCL 492	0.6	RJIL (Won in Mar 15)	RJIL (Won in Mar 15)
		870.03	871.26	872.49		874.02		875.55	876.78	878.01	879.54			881.07	882.30	883.53	884.76		886.59	887.82
3	HP	AVAILABLE	BSNL 42	BSNL 83	0.3	RCL (Won in Mar 15)	RCL (Won in Mar 15)	0.3	TTL 226	TTL 267	0.3	RJIL (Won in Mar 15)	AVAILABLE	0.3	RCL 410	RCL 451	0.6	RJIL (Won in Mar 15)	RJIL (Won in Mar 15)	RJIL (Won in Mar 15)
		870.03	871.26	872.49		874.02	875.25		876.78	878.01	879.54		880.77		882.30	883.53		885.36	886.59	887.82
4	J&K	AVAILABLE	BSNL 42	BSNL 83	0.3	AVAILABLE		DEFENCE			RCL (Won in Mar 15)	RCL (Won in Mar 15)	RJIL (Won in Mar 15)	0.3	RCL 410	RCL 451	0.6	RJIL (Won in Mar 15)	RJIL (Won in Mar 15)	RJIL (Won in Mar 15)
		870.03	871.26	872.49		874.02					878.31	879.54	880.77		882.30	883.53		885.36	886.59	887.82
5	NE	AVAILABLE	BSNL 42	BSNL 83	0.3	AVAILABLE	0.3	RCL (Won in Mar 15)	RCL (Won in Mar 15)	RCL (Won in Mar 15)	RCL (Won in Mar 15)	0.6	AVAILABLE	AVAILABLE	0.6	RJIL (Won in Mar 15)	RJIL (Won in Mar 15)	RJIL (Won in Mar 15)	RJIL (Won in Mar 15)
		870.03	871.26	872.49		874.02		875.55	876.78	878.01	879.24		881.07	882.3		884.13	885.36	886.59	887.82
6	ORRISSA	AVAILABLE	BSNL 42	BSNL 83	0.3	RCL (Won in Mar 15)	AVAILABLE	0.3	TTL 226	TTL 267	0.3	RJIL (Won in Mar 15)	0.3	RCL 369	RCL 410	RCL 451	0.6	RJIL (Won in Mar 15)	RJIL (Won in Mar 15)	RJIL (Won in Mar 15)
		870.03	871.26	872.49		874.02	875.25		876.78	878.01	879.54			881.07	882.30	883.53		885.36	886.59	887.82

Legends:	BSNL	Bharat Sanchar Nigam Ltd.	RCL	Reliance Communications Ltd.	TTL	Tata Teleservice Ltd.
	MTNL	Mahanagar Telephone Nigam Ltd.	RTL	Reliance Telecom Ltd.	SSTL	Shyam Telelink Ltd.
	HFCL	Himachal Futuristic Comm. Ltd.	RJIO	Reliance JIO Infocomm Limited	TTML	Tata Teleservice (Mah.) Ltd.

Annexure 2.3: Carrier Assignment after harmonisation-An Illustration

S. No.	Metro Circles																		
		1	42	83	124	0.6	185	226	267	308	0.6	369	410	451	492	0.6	553	594
		1.23	1.23	1.23	1.23		1.23	1.23	1.23	1.23		1.23	1.23	1.23	1.23		1.23	1.23
		870.03	871.26	872.49	873.72		875.55	876.78	878.01	879.24		881.07	882.3	883.53	884.76		886.59	887.82
1	Delhi	TTSL		AVAILABLE	AVAILABLE		SSTL		RCL	RCL	RCL	RCL		TTL	TTL	TTL	TTL		SSTL	SSTL
		1	0.3	52	93	0.3	144	0.3	195	236	277	318	0.3	369	410	451	492	0.6	553	594
		870.03		871.56	872.79		874.32		875.85	877.08	878.31	879.54		881.07	882.3	883.53	884.76		886.59	887.82
2	Mumbai	TTL (Expiry of license in 2017-18)					TTL(Won in Mar 15 auction)	TTL(Won in Mar 15 auction)		RJIO(Won in Mar 15 auction)	RJIO(Won in Mar 15 auction)	RJIO(Won in Mar 15 auction)	RJIO(Won in Mar 15 auction)		RCL	RCL	RCL	RCL			
		1	42	83	124	0.6			0.6					0.6	471	512	553	594			
		870.03	871.26	872.49	873.72		875.55	876.78		878.61	879.84	881.07	882.3		884.13	885.36	886.59	887.82			
3	Kolkata	AVAILABLE		BSNL	RCL(Won in Mar		TTL	TTL		SSTL		TTL		SSTL	SSTL		RCL	RCL	RCL	RCL	
			0.3	52	103	0.3	154	195	0.3	246	0.33	298	0.3	349	390	0.6	451	492	533	574	0.6
		870.03		871.56	873.09		874.62	875.85		877.38		878.94		880.47	881.7		883.53	884.76	885.99	887.22	
A' Service Areas																					
1	AP	BSNL		TTL	TTL	TTL		AVAILABLE	TTL(Expiry of license in 2017-18)					RCL	RCL	RCL	RCL		AVAILABLE	AVAILABLE	
		1	0.3	52	93	134	0.3	185	226	267	308		0.6	369	410	451	492	0.6	553	594	
		870.03		871.56	872.79	874.02		875.55	876.78	878.01	879.24			881.07	882.3	883.53	884.76		886.59	887.82	
2	Gujarat	TTL	TTL		SSTL	SSTL		TTL		BSNL	BSNL		SSTL		RCL(Won in Mar	RCL(Won in Mar		AVAILABLE	Expiry of license in 2017-18 (RCL)		
		1	42	0.3	93	134	0.3	185	0.3	236	277	0.3	328	0.3	379	420	0.3	471	512	553	594
		870.03	871.26		872.79	874.02		875.55		877.08	878.31		879.84		881.37	882.6		884.13	885.36	886.59	887.82
3	Maharashtra	TTML (Expiry of license in 2017-18)					TTL (Won in Mar 15)	TTL (Won in Mar 15)		AVAILABLE	AVAILABLE	Vacant(0.6)		BSNL	BSNL		RCL	RCL	RCL	RCL	
		1	42	83	124	0.6	185	226	0.3	277	318			379	420	0.3	471	512	553	594	
		870.03	871.26	872.49	873.72		875.55	876.78		878.31	879.54			881.37	882.6		884.13	885.36	886.59	887.82	
4	Karnataka	AVAILABLE	AVAILABLE		BSNL	BSNL		SSTL		TTL	TTL	TTL		RCL	RCL	RCL	RCL		SSTL	SSTL	
		1	42	0.3	93	134	0.3	185	0.3	236	277	318	0.3	369	410	451	492	0.6	553	594	
		870.03	871.26		872.79	874.02		875.55		877.08	878.31	879.54		881.07	882.3	883.53	884.76		886.59	887.82	
4	Tamil Nadu	AVAILABLE	AVAILABLE		BSNL	BSNL		SSTL		TTL	TTL	TTL		RCL	RCL	RCL	RCL		SSTL	SSTL	
		1	42	0.3	93	134	0.3	185	0.3	236	277	318	0.3	369	410	451	492	0.6	553	594	
		870.03	871.26		872.79	874.02		875.55		877.08	878.31	879.54		881.07	882.3	883.53	884.76		886.59	887.82	

		1	42	83	124	0.6	185	226	267	308	0.6	369	410	451	492	0.6	553	594
		1.23	1.23	1.23	1.23		1.23	1.23	1.23	1.23		1.23	1.23	1.23	1.23		1.23	1.23
		870.030	871.260	872.490	873.720		875.550	876.780	878.010	879.240		881.070	882.300	883.530	884.760		886.590	887.820
S. No	"B" Service Area																		
1	HARYANA	Available	0.3	BSNL	0.3	TTL (Won in	0.3	RCL	RCL	RCL	0.3	RCL	0.3	TTL	TTL	TTL	0.3	RJIO (Won in	RJIO (Won in	RJIO (Won in	RJIO (Won in
		1	0.3	52	0.3	103	0.3	154	195	236	0.3	287	0.3	338	379	420	0.3	471	512	553	594
		870.03		871.56		873.09		874.62	875.85	877.08		878.61		880.14	881.37	882.6		884.13	885.36	886.59	887.82
2	MP	AVAILABLE	Vacant (0.99)	BSNL	BSNL	0.84	RJIO (Won in Mar 15)	RJIO (Won in Mar 15)	RJIO (Won in Mar 15)	RJIO (Won in Mar 15)	0.6	RCL	RCL	RCL	RCL	0.6	TTL	TTL
		870.03		75	116							369	410	451	492		553	594
				872.25	873.48		875.55	876.78	878.01	879.24		881.07	882.3	883.53	884.76		886.59	887.82
3	PUNJAB	AVAILABLE	HFCL (expiry of license in 2017-		AVAILABLE	1.44	BSNL	0.6	RCL (Won in	RCL (Won in	0.39	RCL	RCL	RCL	0.6	TTL	TTL	TTL
		1	42	83	124		213		274	315		369	410	451		512	553	594
		870.03	871.26	872.49	873.72		876.39		878.22	879.45		881.07	882.3	883.53		885.36	886.59	887.82
4	RAJSATHAN	Vacant	BSNL	0.6	TTL (Except	0.63	STL (expiry of license in 2017-		AVAILABLE	AVAILABLE	0.39	TTL	0.6	BSNL	0.36	RCL	RCL	RCL	0.6	TTL
			37		Kota)		160	201				337		398		451	492	533		594
			871.11		872.94		874.80	876.03	877.26	878.49		880.11		881.94		883.53	884.76	885.99		887.82
5	KERALA	BSNL	BSNL	0.3	AVAILABLE	AVAILABLE	0.3	SSTL	0.3	TTL	TTL	TTL	0.3	RCL	RCL	RCL	RCL	0.6	SSTL	SSTL
		1	42		93	134		185		236	277	318		369	410	451	492		553	594
		870.03	871.26		872.79	874.02		875.55		877.08	878.31	879.54		881.07	882.3	883.53	884.76		886.59	887.82
6	UP(E)	AVAILABLE	AVAILABLE	0.3	BSNL	BSNL	0.6	TTL	TTL	TTL	0.6	RCL	RCL	RCL	RCL	0.3	RJIO (Won in	RJIO (Won in	RJIO (Won in
		1	42		93	134		195	236	277		338	379	420	461		512	553	594
		870.03	871.26		872.79	874.02		875.85	877.08	878.31		880.14	881.37	882.6	883.83		885.36	886.59	887.82
7	UP(W)	AVAILABLE	0.3	BSNL	BSNL	0.3	SSTL	0.3	RCL	RCL	RCL	RCL	0.3	RCL (Won in Mar 15)	0.3	TTL	TTL	TTL	0.3	SSTL	SSTL
		870.03		871.56	872.79		874.32		875.85	877.08	878.31	879.54		881.07		882.6	883.83	885.06		886.59	887.82
8	WEST BENGAL	BSNL	BSNL	0.3	AVAILABLE	AVAILABLE	AVAILABLE	0.3	SSTL	0.3	TTL	TTL	0.3	SSTL	SSTL	0.3	RCL	RCL	RCL	0.3	RCL (Won in
		1	42		93	134	175		226		277	318		369	410		461	502	543		594
		870.03	871.26		872.79	874.02	875.25		876.78		878.31	879.54		881.07	882.30		883.83	885.06	886.29		887.82

		1	42	83	124	0.6	185	226	267	308	0.6	369	410	451	492	0.6	553	594
		1.23	1.23	1.23	1.23		1.23	1.23	1.23	1.23		1.23	1.23	1.23	1.23		1.23	1.23
		870.030	871.260	872.490	873.720		875.550	876.780	878.010	879.240		881.070	882.300	883.530	884.760		886.590	887.820
S. No.	"C" Service Area																	
1	ASSAM	AVAILABLE	BSNL	BSNL	0.3	AVAILABLE	0.3	RJIO (Won in	RJIO (Won in	RJIO (Won in	RJIO (Won in	0.6	AVAILABLE	AVAILABLE	0.6	RCL (Won in	RCL (Won in	RCL (Won in	RCL (Won in
			42	83		134		185	226	267	308		369	410		471	512	553	594
		870.03	871.26	872.49		874.02		875.55	876.78	878.01	879.24		881.07	882.3		884.13	885.36	886.59	887.82
2	BIHAR	AVAILABLE	0.3	BSNL	BSNL	0.3	TTL	TTL	TTL	0.6	RCL	RCL	RCL	RCL	0.6	RJIO (Won in	RJIO (Won in	RJIO (Won in	RJIO (Won in
		1		52	93		144	185	226		287	328	369	410		471	512	553	594
		870.03		871.56	872.79		874.32	875.55	876.78		878.61	879.84	881.07	882.3		884.13	885.36	886.59	887.82
3	HP	BSNL	BSNL	0.3	RCL (Won in	RCL (Won in	0.3	TTL	TTL	0.3	AVAILABLE	AVAILABLE	0.3	RCL	RCL	0.6	RJIO (Won in	RJIO (Won in	RJIO (Won in	RJIO (Won in
		1	42		93	134		185	226		277	318		369	410		471	512	553	594
		870.03	871.26		872.79	874.02		875.55	876.78		878.31	879.54		881.07	882.3		884.13	885.36	886.59	887.82
4	J&K	AVAILABLE	BSNL	BSNL	0.3	AVAILABLE		Defence			RCL (Won in Mar 15)	RCL (Won in Mar 15)	RJIO (Won in Mar 15)	0.3	RCL	RCL	0.6	RJIO (Won in Mar 15)	RJIO (Won in Mar 15)	RJIO (Won in Mar 15)
			42	83											410	451				
		870.03	871.26	872.49		874.02					878.31	879.54	880.77		882.30	883.53		885.36	886.59	887.82
5	NE	AVAILABLE	BSNL	BSNL	0.3	AVAILABLE	0.3	RCL (Won in	RCL (Won in	RCL (Won in	RCL (Won in	0.6	Available	Available	0.6	RJIO (Won in	RJIO (Won in	RJIO (Won in	RJIO (Won in
			42	83		134		185	226	267	308		369	410		471	512	553	594
		870.03	871.26	872.49		874.02		875.55	876.78	878.01	879.24		881.07	882.3		884.13	885.36	886.59	887.82
6	ORRISSA	AVAILABLE	AVAILABLE	0.3	BSNL	BSNL	0.3	RCL (Won in	0.3	TTL	TTL	0.3	RCL	RCL	RCL	0.6	RJIO (Won in	RJIO (Won in	RJIO (Won in	RJIO (Won in
		1	42		93	134		185		236	277		328	369	410		471	512	553	594
		870.03	871.26		872.79	874.02		875.55		877.08	878.31		879.84	881.07	882.3		884.13	885.36	886.59	887.82

Legends:	BSNL
	MTNL
	HFCL

Bharat Sanchar Nigam Ltd.	RCL
Mahanagar Telephone Nigam Ltd.	RTL
Himachal Futuristic Comm. Ltd.	RJIO

Reliance Communications Ltd.	TTL
Reliance Telecom Ltd.	STL
Reliance JIO Infocomm Limited	TTML

Tata Teleservice Ltd.
Shyam Telelink Ltd.
Tata Teleservice (Mah.) Ltd.

Annexure 2.4

No. J-14025/212/2015-CDMA

Government of India
Ministry of Communication & Information Technology
Department of Telecommunication
Wireless Planning and Coordination Wing
Sanchar Bhawan, New Delhi

Dated: 05th November, 2015

Guidelines for Liberalisation of Administratively allotted Spectrum in 800 MHz and 1800 MHz frequency bands.

In accordance with the Clause 42.10 of UL amendment dated 05.11.2015, Clause 43.11 of UASL amendment dated 05.11.2015 and Clause 46.7 of CMTS amendment dated 05.11.2015 as well as the various provisions for liberalisation of spectrum in 800 MHz and 1800MHz frequency bands contained in Notice Inviting Applications (NIAs), relating to auction of spectrum held since 2012 onwards, the competent authority hereby, lays down the following terms, conditions and charging criterion in this regard:

1. Existing CMTS/UAS/UL with access service authorization licensees may liberalise their entire administratively allotted spectrum holding in 800MHz and 1800MHz band in a Service Area for the balance validity period of right to use spectrum.

2. Administratively allotted spectrum in 800 MHz and 1800 MHz bands refers to the spectrum allotted prior to auction of right to use spectrum in November 2012.

3. Liberalisation of spectrum in 800MHz and 1800MHz frequency bands will be considered only after a written request for liberalising the entire spectrum, pertaining to a frequency band and LSA, accompanied by a non-refundable processing fee amounting to Rs 50, 000/- per service area in the form of a DD/ Pay Order drawn in favour of PAO (HQ), DoT, New Delhi is received by WPC Wing, DoT from a Telecom Service Provider.

4. After the in-principle approval of the competent authority that the liberalisation of administratively allotted spectrum of the TSP is permitted subject to receipt of necessary payment in this regard, a Demand note to the concerned TSP indicating the total amount payable and due date of payment and terms of payment will be issued by Department.

5. The spectrum will be required to be liberalised for the balance validity period of right to use the same after payment of auction determined price prorated for the balance validity period.

6. The entry fee paid will be pro-rated for the balance validity period of the right to use spectrum and will be deducted from the total amount to be paid by the TSP for liberalising the spectrum.

7. In case more than one set of auction determined prices are available, the latest auction determined prices for the respective frequency band as available at the time of calculation of charges/ amount payable for liberalisation of spectrum, would be applied.

8. If the auction determined price is more than one year old then the prevailing market rates would be determined by indexing the last auction price at the rate of SBI PLR.

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05/11/2015

9. The *date for calculation* of the total amount due for liberalisation will be the thirtieth day from the date of issue of Demand note and the same will be taken as the *Effective Date* of liberalisation.

10. Payment of One Time Spectrum Charges (OTSC) by the TSPs will continue to be governed by this Ministry's Order P-11014/19/2008-PP (Pt.I) dated 28th December 2012 & dated 15th March 2013. In case the spectrum gets liberalised, the OTSC will be charged up to the *date for calculation* of charges for liberalising the spectrum and the same has to be paid by the licensee. However, if such demand is pending due to judicial intervention barring any coercive action, a bank guarantee equal to this amount shall be submitted pending final outcome of judicial process.

11. Payment will be required to be made within (30) thirty days from the date of issue of Demand note, failing which the Demand note will be deemed to have expired and the TSP will be required to make a fresh request for liberalisation of his administratively held spectrum, if he so desires.

12. A revised frequency allotment will be issued by WPC Wing, DoT after receipt of necessary payment.

13. After getting the spectrum liberalised, the TSPs may combine the same with the spectrum acquired by them in the same band through auctions/ trading.

14. SUC will be required to be paid for the liberalised spectrum as prescribed by the Government from time to time.

15. Notwithstanding above, the liberalized spectrum will be governed by all the relevant conditions laid down in respective NIAs issued from time to time and the relevant service license i.e. CMTS/ UAS/ UL and their amendments.

16. The above guidelines shall not be applicable for liberalisation of a frequency band in a service area where auction determined price is not available for that band.

05.11.2015

(Bhagirath)
Deputy Wireless Advisor
to the Govt. of India

Copy to:

1. All concerned
2. Wireless Finance Division, DoT
3. Director, Wireless Monitoring Organisation.
4. DDG (AS-I), DoT
5. Director, IT, DoT for uploading on DoT website
6. Sr. DWA (ASMS) for uploading on WPC Wing website

Annexure 3.1

VALUATION (PER MHz) USING DIFFERENT APPROACHES – 1800 MHz SPECTRUM

(Rs. in crore)

LSA	Achieved Price - March 2015 auction, if not available then previous achieved price (February 2014 duly indexed) of 1800 MHz	Producer Surplus Model	Production function Model	Revenue Surplus Model	Average (mean) Value
Delhi	398.71	185.02	204.21	208.40	**249.09**
Mumbai	297.94	233.62	142.15	142.93	**204.16**
Kolkata	149.10	98.02	48.51	57.44	**88.27**
Andhra Pradesh	242.80	133.85	134.07	234.14	**186.21**
Gujarat	238.00	246.98	130.58	150.18	**191.43**
Karnataka	185.00	191.56	129.21	212.60	**179.59**
Maharashtra	318.04	248.04	171.84	249.34	**246.81**
Tamilnadu	225.00	128.61	191.23	290.19	**208.76**
Haryana	46.60	76.24	25.54	49.03	**49.35**
Kerala	83.45	92.07	35.79	165.90	**94.31**
Madhya Pradesh	55.21	174.21	62.12	122.16	**103.42**
Punjab	71.00	180.68	36.23	97.10	**96.25**
Rajasthan	72.75	182.98	60.36	138.88	**113.74**
U. P. (East)	106.95	238.18	73.17	156.04	**143.59**
U.P. (West)	95.95	160.95	54.73	105.86	**104.37**
West Bengal	26.95	87.34	48.12	65.99	**57.10**
Assam	39.54	60.27	20.23	71.49	**47.88**
Bihar	47.21	182.20	48.59	126.09	**101.02**
Himachal Pradesh	15.90	18.63	6.28	21.89	**15.68**
Jammu & Kashmir	6.68	48.27	15.43	59.79	**32.54**
North East	11.00	45.78	5.68	38.50	**25.24**
Orissa	33.10	83.86	15.20	58.33	**47.62**
PAN INDIA	**2766.87**	**3097.35**	**1659.28**	**2822.29**	**2586.45**

Annexure 3.2

VALUATION (PER MHz) USING DIFFERENT APPROACHES - 900 MHz

(Rs. in crore)

LSA	Achieved Price - March 2015 auction, if not available then previous achieved price (February 2014 duly indexed) of 900 MHz	Economic premium over 1800 MHz plus average valuation of 1800 MHz band	1.5 times of average valuation of 1800 MHz band	2 times of average valuation of 1800 MHz band	Multiple Regression			Correlating with a single variable		Auction determined price of 800 MHz band(March 2015)	Average (mean) Value
					Population, AGR/Population, Residual Tele density and GSDP Growth	Data Usage, MoU and GSDP Growth	ARPU, Subscribers and GSDP Growth	AGR	ARPU		
Delhi	811.62	513.46	598.07	797.42						847.70	**713.65**
Mumbai	616.79	359.23	446.91	595.88						727.50	**549.26**
Kolkata	213.19	194.39	223.65	298.20						147.00	**215.29**
Andhra Pradesh	680.75	533.26	364.20	485.60						605.98	**533.96**
Gujarat	673.00	451.04	357.00	476.00						277.74	**446.96**
Karnataka	557.50	443.53	277.50	370.00							**412.13**
Maharashtra	773.00	601.95	477.06	636.08						799.42	**657.50**
Tamilnadu		491.06	337.50	450.00	558.88	905.74	774.01				**586.20**
Haryana	151.20	164.46	74.03	98.71						56.57	**108.99**
Kerala	369.40	311.21	141.46	188.61							**252.67**
Madhya Pradesh	309.50	360.86	155.14	206.85						408.39	**288.15**
Punjab	360.75	281.02	144.38	192.50						85.85	**212.90**
Rajasthan	708.65	356.56	170.61	227.49							**365.83**

U. P. (East)	775.60	466.20	215.38	287.17						134.00	**375.67**
U.P. (West)	738.55	296.28	156.56	208.74						95.00	**299.02**
West Bengal	207.50	283.34	85.65	114.20						57.00	**149.54**
Assam	184.95	166.46	71.82	95.77						82.22	**120.24**
Bihar	444.30	311.92	151.53	202.05						85.85	**239.13**
Himachal Pradesh	57.45	66.28	23.85	31.80						19.57	**39.79**
Jammu & Kashmir		129.84	48.81	65.09	220.72	142.52	226.29	89.01	241.12	28.28	**132.41**
North East	51.90	122.22	37.86	50.48						25.38	**57.57**
Orissa	139.00	173.85	71.44	95.25						41.04	**104.12**
PAN INDIA		**7078.45**	**4630.39**	**6173.86**							**6860.97**

Annexure 3.3

VALUATION (PER MHz) USING DIFFERENT APPROACHES – 800 MHz

(Rs. in crore)

LSA	Auction determined price - March 2015 auction of 800 MHz	Model based on projected revenue from data services	1.5 times of average valuation of 1800 MHz band	2 times of average valuation of 1800 MHz band	Producer Surplus Model	Multiple Regression			Correlating with a single variable		Auction Determined Price of 900 MHz band^	Average (mean) Value
						GSDP Per Capita, ARPU and AGR	ARPU, MoU/Subscriber and Residual Tele-density	ARPU, GSDP Growth and Subscribers	AGR	ARPU		
Delhi	847.70	476.39	598.07	797.42	417.67						811.62	**658.14**
Mumbai	727.50	332.62	446.91	595.88	393.02						616.79	**518.78**
Kolkata	147.00	113.45	223.65	298.20	207.45						213.19	**200.49**
Andhra Pradesh	605.98	194.10	364.20	485.60	83.67						680.75	**402.38**
Gujarat	277.74	144.22	357.00	476.00	208.85						673.00	**356.14**
Karnataka		232.80	277.50	370.00	382.37	578.64	607.01	488.29	687.78	599.53	557.50	**478.14**
Maharashtra	799.42	206.05	477.06	636.08	136.30						773.00	**504.65**
Tamilnadu		249.47	337.50	450.00	531.42	700.43	372.39	569.12	827.23	519.77		**506.37**
Haryana	56.57	29.42	74.03	98.71	17.95						151.20	**71.31**
Kerala		98.92	141.46	188.61	109.23	515.40	577.54	646.41	157.58	237.12	369.40	**304.17**
Madhya Pradesh	408.39	88.65	155.14	206.85	52.85						309.50	**203.56**
Punjab	85.85	68.78	144.38	192.50	41.28						360.75	**148.92**

Rajasthan		172.35	170.61	227.49	140.92	251.56	366.80	179.09	179.30	155.88	708.65	**255.26**
U. P. (East)	134.00	82.13	215.38	287.17	145.49						775.60	**273.30**
U.P. (West)	95.00	64.86	156.56	208.74	102.98						738.55	**227.78**
West Bengal	57.00	60.68	85.65	114.20	90.87						207.50	**102.65**
Assam	82.22	10.30	71.82	95.77	*						184.95	**89.01**
Bihar	85.85	71.24	151.53	202.05	66.56						444.30	**170.25**
Himachal Pradesh	19.57	14.02	23.85	31.80	33.12						57.45	**29.97**
Jammu & Kashmir	28.28	6.44	48.81	65.09	20.98							**33.92**
North East	25.38	7.76	37.86	50.48	*						51.90	**34.68**
Orissa	41.04	22.02	71.44	95.25	62.26						139.00	**71.84**
PAN INDIA		**2746.67**	**4630.39**	**6173.86**								**5641.72**

* No service provider is offering CDMA full-mobility services in these LSAs.

^Achieved Price - March 2015 auctionand if not available then previous achieved price(February 2014) duly indexed with SBI base rate

Annexure 3.4

VALUATION (PER MHz) USING DIFFERENT APPROACHES – 2100 MHz SPECTRUM

(Rs. in crore)

LSA	Auction Determined Price of 2100 MHz^^	0.83 times of average valuation of 1800 MHz band	Producer Surplus Model	Approach based on growth in data usage	Average (mean) Value
Delhi	1057.45	330.93	246.93	1132.47	**691.94**
Mumbai	1035.15	247.29	261.89	761.16	**576.37**
Kolkata	115.59	123.75	49.66	200.28	**122.32**
Andhra Pradesh	437.71	201.52	193.28	526.52	**339.76**
Gujarat	258.00	197.54	199.67	519.12	**293.58**
Karnataka	328.47	153.55	301.59	818.82	**400.61**
Maharashtra	301.00	263.97	254.92	886.45	**426.58**
Tamilnadu	344.00	186.75	303.96	816.56	**412.82**
Haryana	46.00	40.96	65.45	124.06	**69.12**
Kerala	117.71	78.27	272.73	417.56	**221.57**
Madhya Pradesh	91.35	85.84	157.27	280.45	**153.73**
Punjab	102.65	79.89	63.11	210.26	**113.98**
Rajasthan	139.82	94.41	162.05	250.15	**161.61**
U. P. (East)	90.30	119.18	132.50	207.90	**137.47**
U.P. (West)	105.07	86.63	158.61	206.28	**139.15**
West Bengal	39.53	47.39	69.48	101.70	**64.53**
Assam	38.64	39.74	59.37	90.67	**57.10**
Bihar	64.72	83.85	149.06	134.62	**108.06**
Himachal Pradesh	11.80	13.20	19.40	55.11	**24.87**
Jammu & Kashmir	9.56	27.01	31.63	41.33	**27.38**
North East	11.07	20.95	32.10	59.78	**30.97**
Orissa	36.05	39.53	72.94	41.73	**47.56**
PAN INDIA	**4781.65**	**2562.15**	**3257.60**	**7882.97**	**4621.09**

^^ Achieved Price in March 2015 auction, if not available then previous achieved price (May 2010) duly indexed with SBI Base Rate

Annexure 3.5

RESERVE PRICE PER MHz: COMPARISON OF 80% OF AVERAGE VALUATION PER MHZ OF 1800 MHZ SPECTRUM WITH MARCH 2015 AND FEBRUARY 2014 (INDEXED) AUCTION REVEALED PRICE

(Rs. in crore)

LSA	Category	80% of average valuation per MHz of 1800 MHz spectrum	Auction revealed price per MHz of 1800 MHz spectrum		Reserve Price per MHz: Higher of 80% of recommended average valuation or achieved price March 2015/ indexed Feb 2014
			March 2015 Auction	February 2014 Auction (indexed with SBI Base Rate)	
Delhi	Metro	318.97		398.71	398.71
Mumbai	Metro	238.35		297.94	297.94
Kolkata	Metro	119.28	149.10		149.10
Andhra Pradesh	A	194.24	242.80		242.80
Gujarat	A	190.40	238.00		238.00
Karnataka	A	148.00	185.00		185.00
Maharashtra	A	254.43		318.04	318.04
Tamilnadu	A	180.00	225.00		225.00
Haryana	B	39.48	46.60		46.60
Kerala	B	75.44	83.45		83.45
Madhya Pradesh	B	82.74		55.21	82.74
Punjab	B	77.00	71.00		77.00
Rajasthan	B	90.99	72.75		90.99
U. P. (East)	B	114.87	106.95		114.87
U.P. (West)	B	83.50	95.95		95.95
West Bengal	B	45.68		26.95	45.68
Assam	C	38.31		39.54	39.54
Bihar	C	80.82		47.21	80.82
Himachal Pradesh	C	12.72	15.90		15.90
Jammu & Kashmir	C	26.03		6.68	26.03
North East	C	20.19	11.00		20.19
Orissa	C	38.10	33.10		38.10
PAN INDIA		**2469.54**			**2912.45**

Annexure 3.6

RESERVE PRICE PER MHz: COMPARISON OF 80% OF AVERAGE VALUATION PER MHZ OF 900 MHZ SPECTRUM WITH MARCH 2015 AND FEBRUARY 2014 (INDEXED) AUCTION REVEALED PRICE

(Rs. in crore)

LSA	Category	80% of average valuation per MHz of 900 MHz spectrum	Auction revealed price per MHz of 900 MHz spectrum		Reserve Price per MHz: Higher of 80% of recommended average valuation or achieved price March 2015/ indexed Feb 2014
			March 2015 Auction	February 2014 Auction (indexed with SBI Base Rate)	
Delhi	Metro	649.29		811.62	811.62
Mumbai	Metro	493.43		616.79	616.79
Kolkata	Metro	172.23		213.19	213.19
Andhra Pradesh	A	544.60	680.75		680.75
Gujarat	A	538.40	673.00		673.00
Karnataka	A	446.00	557.50		557.50
Maharashtra	A	618.40	773.00		773.00
Tamilnadu	A	468.96			468.96
Haryana	B	120.96	151.20		151.20
Kerala	B	295.52	369.40		369.40
Madhya Pradesh	B	247.60	309.50		309.50
Punjab	B	288.60	360.75		360.75
Rajasthan	B	566.92	708.65		708.65
U. P. (East)	B	620.48	775.60		775.60
U.P. (West)	B	590.84	738.55		738.55
West Bengal	B	166.00	207.50		207.50
Assam	C	147.96	184.95		184.95
Bihar	C	355.44	444.30		444.30
Himachal Pradesh	C	45.96	57.45		57.45
Jammu & Kashmir	C	105.93			105.93
North East	C	46.05	51.90		51.90
Orissa	C	111.20	139.00		139.00
PAN INDIA		**7640.77**			**9399.48**

Annexure 3.7

RESERVE PRICE PER MHz: COMPARISON OF 80% OF AVERAGE VALUATION PER MHZ OF 800 MHZ SPECTRUM WITH MARCH 2015 AUCTION REVEALED PRICE

(Rs. in crore)

LSA	Category	80% of average valuation per MHz of 800 MHz spectrum	March 2015 Auction revealed price per MHz of 800 MHz spectrum	Reserve Price per MHz: Higher of 80% of recommended average valuation or March 2015 auction revealed price
Delhi	Metro	678.16	847.70	847.70
Mumbai	Metro	582.00	727.50	727.50
Kolkata	Metro	160.39	147.00	160.39
Andhra Pradesh	A	484.79	605.98	605.98
Gujarat	A	284.91	277.74	284.91
Karnataka	A	382.51		382.51
Maharashtra	A	639.53	799.42	799.42
Tamilnadu	A	405.10		405.10
Haryana	B	57.05	56.57	57.05
Kerala	B	243.33		243.33
Madhya Pradesh	B	326.71	408.39	408.39
Punjab	B	119.14	85.85	119.14
Rajasthan	B	204.21		204.21
U. P. (East)	B	218.64	134.00	218.64
U.P. (West)	B	182.23	95.00	182.23
West Bengal	B	82.12	57.00	82.12
Assam	C	71.21	82.22	82.22
Bihar	C	136.20	85.85	136.20
Himachal Pradesh	C	23.97	19.57	23.97
Jammu & Kashmir	C	27.14	28.28	28.28
North East	C	27.74	25.38	27.74
Orissa	C	57.47	41.04	57.47
PAN INDIA		**5394.54**		**6084.49**

Annexure 3.8

RESERVE PRICE PER MHz: COMPARISON OF 80% OF AVERAGE VALUATION PER MHZ OF 2100 MHZ SPECTRUM WITH MARCH 2015 AUCTION REVEALED PRICE

(Rs. in crore)

LSA	Category	80% of average valuation per MHz of 2100 MHz spectrum	March 2015 Auction revealed price per MHz of 2100 MHz spectrum	Reserve Price per MHz: Higher of 80% of recommended average valuation or March 2015 auction revealed price
Delhi	Metro	553.56		553.56
Mumbai	Metro	461.10		461.10
Kolkata	Metro	97.86	115.59	115.59
Andhra Pradesh	A	271.81		271.81
Gujarat	A	234.87	258.00	258.00
Karnataka	A	320.49	328.47	328.47
Maharashtra	A	341.27	301.00	341.27
Tamilnadu	A	330.26	344.00	344.00
Haryana	B	55.29	46.00	55.29
Kerala	B	177.26	117.71	177.26
Madhya Pradesh	B	122.98	91.35	122.98
Punjab	B	91.18		91.18
Rajasthan	B	129.28	139.82	139.82
U. P. (East)	B	109.98	90.30	109.98
U.P. (West)	B	111.32	105.07	111.32
West Bengal	B	51.62		51.62
Assam	C	45.68	38.64	45.68
Bihar	C	86.45		86.45
Himachal Pradesh	C	19.90		19.90
Jammu & Kashmir	C	21.91		21.91
North East	C	24.78	11.07	24.78
Orissa	C	38.05	36.05	38.05
PAN INDIA		**3696.87**		**3770.02**