Consultation Paper No.10/2014

Telecom Regulatory Authority of India

Consultation Paper

on

Valuation and Reserve Price of Spectrum: Licences expiring in 2015–16

7th August 2014

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Jawahar Lal Nehru Marg,
New Delhi- 110002

Written Comments on the Consultation Paper are invited from the stakeholders by 8th September 2014 and counter-comments by 15th September 2014. This is also an advance notice that Open House Discussion on the consultation paper will be held on 22nd September 2014 in New Delhi.

Comments and counter-comments will be posted on TRAI's website www.trai.gov.in. The comments and counter-comments may be sent, preferably in electronic form, to Shri Arvind Kumar, Advisor (Networks, Spectrum and Licensing), TRAI on the Email : trai.jams@gmail.com.

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CHAPTER–I: INTRODUCTION

BACKGROUND

1.1 In India, the first ever Cellular Mobile Telephone Service (CMTS) licences were awarded in Metros (Mumbai, Delhi, Kolkata and Chennai) in 1994. Subsequently, another set of CMTS licences were given in 18 Licence Service Areas (LSAs) in 1995/1996. Two licences each in all LSAs were granted except West Bengal and Assam, where only one licence could be given. No licences could be awarded in Jammu and Kashmir and the then Andaman and Nicobar LSA as no bid was received. The CMTS licence was bundled with a certain amount of committed spectrum. The licence had a validity of 10 years extendable by a period of five years at a time. The New Telecom Policy 1999 (NTP-99) effected many changes to the licensing regime including the change in validity period of licences from 10 years to 20 years and provision for extension of licence by additional period of ten years.

1.2 The Department of Telecommunications (DoT), through its Press Statements dated 29th January 2011 and 15th February 2012 announced some important policy decisions which *inter-alia* included the following:

- In future, spectrum will not be bundled with the licence. The licence to be issued to telecom operators will be in the nature of a 'unified licence' and the licence holder will be free to offer any of the multifarious telecom services. In the event the licence holder would like to offer wireless services, it will have to obtain spectrum through a market-driven process. In future, there will be no concept of contracted spectrum [1] and, therefore, no

[1]CMTS/UAS Licences were issued along with some spectrum attached to it, known as start-up spectrum. The licensor was under contractual obligation to provide certain amount of spectrum to the CMTS/UAS licensee, known as contracted spectrum.

concept of initial or start-up spectrum. Spectrum will be made available only through a market-driven process.

- The validity of existing UAS (& CMTS and Basic services) licences may be extended for another 10 years at one time, as per the provisions of the extant licensing regime with suitable terms and conditions so as not to imply automatic continuance of existing licences and related conditions including the quantum and price of any spectrum allocated.

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.

1.4 In compliance of the order of the Hon'ble Supreme Court of India, auctions for the spectrum in the 1800 MHz and 800 MHz bands were held in November 2012. There was no bidder for the spectrum in the 800 MHz band. In 1800 MHz, except in the LSAs of Delhi, Mumbai, Karnataka and Rajasthan, some spectrum was sold in all the other LSAs.

1.5 The licences, which were awarded in the metros of Delhi, Mumbai and Kolkata in 1994, were due for expiry in 2014[2]. As these licences were holding spectrum in both 900 and 1800 MHz bands and the Government had decided to refarm the spectrum in the 900 MHz band, therefore, in March 2013, spectrum in the 900 MHz assigned to these licensees was put up for auction. The 1800 MHz band spectrum in the four LSAs viz Delhi, Mumbai, Karnataka and Rajasthan, where spectrum could not be sold in the last auctions, was also put up for bidding. However, there was no bidder for the spectrum in both the

[2] Licences awards for Chennai LSA in 1994 were merged with the licences given for Tamilnadu LSA. Therefore, their validity period got extended.

900 MHz and 1800 MHz bands. In addition, spectrum in the 800 MHz band was also put up for auction. M/s Sistema Shyam Tele-Services Limited (SSTL) was the sole applicant and it obtained spectrum in 800 MHz band in eight LSAs.

1.6 Auctions were again held in February 2014. In the 900 MHz band, spectrum was put up for auction only in those LSAs where the licences were due for expiry in 2014 i.e. Delhi, Mumbai and Kolkata LSAs. However, in the 1800 MHz band, since the DoT had spectrum available, it was put up for auction in all the LSAs. The entire spectrum in the 900 MHz band was sold. In the 1800 MHz band, 307 MHz of spectrum was sold out of total 385 MHz which was placed on auction.

DoT's REFERENCE

1.7 As discussed above, the spectrum becoming available as a result of licences expiring in 2014 has already been auctioned. Next in line is the renewal of licences which were awarded in 1995/1996. These licences are due for expiry in December 2015 and early 2016. These licensees hold spectrum in the 900 MHz and 1800 MHz bands.

1.8 In its recommendations on 'Auction of Spectrum' dated 23rd April 2012, the Authority had recommended that the 900MHz spectrum be auctioned at least 18 months in advance so as to enable the winning bidders to be ready with the deployment plans. In accordance with this recommendation, the DoT, through its letter dated 17th April 2014 **(Annexure-A)** has sent a reference and sought the Authority's recommendations on the applicable reserve price for all the service areas for the auction of spectrum in the 900 MHz and 1800 MHz bands. Subsequently, the DoT was requested to provide information regarding the availability of spectrum in contiguous and non-contiguous form and the quantum of spectrum that will be put up for auction. The DoT, through its letter dated 04th July 2014, provided the LSA-wise details of available spectrum. However, it informed that the

quantum of spectrum to be put up for auction and the auction of spectrum in Tamilnadu LSA (excluding Chennai) will be decided by the Government separately.

STRUCTURE OF THE CONSULTATION PAPER

1.9 The paper is divided into four Chapters. This Chapter provides a brief background to the subject. Chapter-II discusses the availability of spectrum in the 900 MHz and 1800 MHz bands and the preferable block-size for auction. Chapter-III discuses the different alternative approaches to valuation of spectrum in the 900 MHz and 1800 MHz bands and fixation of reserve price. The issues for consultation have been listed in Chapter-IV.

CHAPTER-II: AVAILABILITY OF SPECTRUM

SPECTRUM AVAILABILITY IN DIFFERENT LSAs

2.1 34 CMTS licences were given in 18 Licence Service Areas (LSAs) through a single-stage competitive bidding process in November 1995, two each in all LSAs except West Bengal and Assam, where only one licence was awarded. No bids were received for Jammu and Kashmir and the then Andaman and Nicobar LSA. One of these licences (licence to M/S Aircel for Tamilnadu) could be awarded w.e.f. 31.12.1998[3]. Over a period of time, four of these licences, given to Koshika Telecom for Orissa, Bihar, UP (West) and UP (East), were cancelled by the DoT. The remaining 29 CMTS licences given in 1995/1996 are due to expire between December 2015 and April 2016. As per the information provided by the Wireless Planning and Coordination wing (WPC), the quantum of spectrum being held by these licensees in 900/1800 MHz bands is as given in Table 2.1 below:

Table 2.1

Licences Expiring in 2015-2016

Sl. No.	LSA	TSP	Date of Expiry	Spectrum holding in	
				900 MHz band (MHz)	1800 MHz band (MHz)
1.	Maharashtra (MH)	Idea	11-12-15	7.8	2
		Vodafone	18-12-15	6.2	Nil
2.	Gujarat (GUJ)	Idea	11-12-15	6.2	Nil
		Vodafone	18-12-15	7.8	2
3.	Andhra Pradesh (AP)	Bharti	11-12-15	7.8	2.2
		Idea	18-12-15	6.2	1.8
4.	Karnataka (KTK)	Bharti	14-02-16	7.8	2.2
		Idea	08-04-16	6.2	Nil

[3] First, the Letter of Intent (LoI) was issued to Hinduja HCL Singtel Comunications Pvt. Ltd. (HHSCPL). However, it failed to fulfil the conditions of LoI. The matter went for litigation. Subsequently, LoI was issued to Aircel.

Sl. No.	LSA	TSP	Date of Expiry	Spectrum holding in	
				900 MHz band (MHz)	1800 MHz band (MHz)
5.	Tamil Nadu (TN)	Vodafone	11-12-15	6.2	1
6.	Kerala (KL)	Idea	11-12-15	6.2	1.8
		Vodafone	11-12-15	6.2	Nil
7.	Punjab (PB)	Bharti	11-12-15	7.8	Nil
		Idea	08-04-16	7.8	Nil
8.	Haryana (HR)	Idea	11-12-15	6.2	Nil
		Vodafone	11-12-15	6.2	Nil
9.	UP West (UP (W))	Idea	11-12-15	6.2	1.8
10.	UP East (UP (E))	Vodafone	11-12-15	6.2	2
11.	Rajasthan (RAJ)	Vodafone	11-12-15	6.2	Nil
		Bharti	21-04-16	6.2	2
12.	Madhya Pradesh (MP)	Idea	11-12-15	6.2	1.8
		RTL	11-12-15	6.2	Nil
13.	West Bengal (WB)	RTL	11-12-15	4.4	1.8
14.	Himachal Pradesh (HP)	Bharti	11-12-15	6.2	Nil
		RTL	11-12-15	6.2	Nil
15.	Bihar (BH)	RTL	11-12-15	6.2	1.8
16.	Orissa (OR)	RTL	11-12-15	6.2	Nil
17.	Assam (AS)	RTL	11-12-15	6.2	Nil
18.	North East (NE)	Bharti	11-12-15	4.4	1.8
		RTL	11-12-15	4.4	1.8
	Grand Total	**29**		**184.0**	**27.8[4]**

Spectrum availability in 900 MHz Band

2.2 Currently there is no spectrum available with the Government in the 900 MHz band i.e. all the spectrum available for commercial use is

[4] The licences, which are expiring in 2015 and 2016, have 27.8 MHz of spectrum in the 1800 MHz band. In some of the LSAs (AP, GUJ and UP (E)), these licence were awarded different frequencies in different districts depending upon the availability of spectrum after its vacation by the Defence. Now the spectrum, which was earlier selectively available in some of the districts, is now available in entire LSA. Therefore, 34.2 MHz of spectrum has been reported by the WPC as the spectrum that is becoming available because of expiry of these licences.

with the TSPs. Spectrum becoming available because of licences expiring in 2015-16 is the only spectrum that can be put for auction. 184 MHz of spectrum is being held by these licensees in the 900 MHz band. As per the information provided by the WPC, 135 MHz out of the total 184 MHz spectrum is available in contiguous blocks of 5 MHz while the remaining 49 MHz spectrum is non-contiguous. LSA-wise details of spectrum in 900 MHz that will become available because of expiry of licences in 2015 and 2016 along with quantum of contiguous spectrum in 5 MHz blocks are given in Table 2.2 below.

Table 2.2

Spectrum holding in 900 MHz band of the licences expiring in 2015 and 2016

Sl.No.	LSA	Quantum of spectrum available	Quantum of spectrum in 5 MHz contiguous block	Quantum of spectrum (Non-contiguous)
		MHz	**MHz**	**MHz**
1	MH (*)	14.0	10.0	4.0
2	GUJ	14.0	10.0	4.0
3	AP	14.0	10.0	4.0
4	KTK	14.0	10.0	4.0
5	TN	6.2	5.0	1.2
6	KL	12.4	10.0	2.4
7	PB	15.6	10.0	5.6
8	HR	12.4	10.0	2.4
9	UP (W)	6.2	5.0	1.2
10	UP (E)	6.2	5.0	1.2
11	RAJ	12.4	10.0	2.4
12	MP	12.4	10.0	2.4
13	WB	4.4	0.0	4.4
14	HP	12.4	10.0	2.4
15	BH	6.2	5.0	1.2
16	OR	6.2	5.0	1.2
17	AS	6.2	5.0	1.2
18	NE	8.8	5.0	3.8
	Total	**184.0**	**135.0**	**49.0**

(*)1st Block of 5 MHz is partially available in entire service area except GMRT (Pune's Giant Metrewave Radio Telescope) area of Maharashtra. Out of 5 MHz of the 2nd block, 1 MHz is available in entire service area except GMRT area and remaining 4 MHz is available in entire service area

2.3 As can be seen from Table 2.2, spectrum availability in the 900 MHz band varies from 4.4 MHz to 15.6 MHz in different LSAs. If a minimum of 5 MHz of spectrum is to be made available to the winning bidders, then in most LSAs, only 1-2 bidders can obtain it. In West Bengal, spectrum available is not even 5 MHz. In the 900 MHz band, only that spectrum is becoming available which is held under the licences expiring in 2015 and 2016. To ensure continuity of their services, these licensees would try to regain the spectrum in the 900 MHz band. In view of its better coverage and reach, spectrum in the 900 MHz band is far more efficient than that in the 1800 MHz band. Therefore, it is expected that most of TSPs participating in the auction will first try to bid for 900 MHz band spectrum. The auction poses a very real problem for incumbent licensees i.e. the very continuity of their service in an LSA is subject to the outcome of the auction. The situation becomes more serious considering the fact that in most LSAs, there is not much spectrum available in the 1800 MHz band either. As can be seen from Table 2.4, only in 7 LSAs, the quantum of spectrum that can be put up for auction in the 1800 MHz band is 5 MHz or more. Therefore, the incumbent TSPs will have no alternative but to try and win back spectrum in the 900 MHz band[5].

2.4 Another issue of significant importance is that the available spectrum is fragmented and non-contiguous. Not only is the overall availability of spectrum in the 900 MHz band limited, a considerable chunk of it is available in disjointed/non-contiguous form. In 7 LSAs, only one block of contiguous 5 MHz is available. The NE is one such LSA where only one contiguous block of spectrum is available for auction, whereas, in this LSA two licences are going to expire in 2015. Of the 184 MHz in 900 MHz band, 49 MHz of spectrum is available in non-

[5] It is worth mentioning here, that some of these TSPs have acquired spectrum in some LSAs in the 1800 MHz band in the November 2012/February 2014 auctions, as discussed later in this Chapter. Therefore, they will have some backup arrangement, though not a very preferable one, if they fail to get back spectrum in the 900 MHz band.

contiguous form. In 6 LSAs, the amount of non-contiguous spectrum ranges from 4 MHz (4 LSAs) to 5.6 MHz (PB). For example, in Punjab LSA, out of 15.6 MHz of available spectrum, 5.6 MHz is non-contiguous. If a TSP desires to buy spectrum in the 900 MHz band for providing 3G services (HSPA+) and gets non-contiguous spectrum, then it will not be feasible for it to provide the services and the spectrum bought by it will not be of much use to it.

2.5 In view of the above position, the Authority is of the view that before conducting the auction the Government should explore the possibility of making available one additional block of 5 MHz contiguous spectrum in the 900 MHz band in the 6 LSAs by (a) redistributing the spectrum amongst TSPs and other Government users to make 5.6 MHz of spectrum in Punjab LSA contiguous and (b) make additional spectrum of 1 MHz in Maharashtra, Gujarat, Andhra Pradesh, Karnataka and 0.6 MHz spectrum in West Bengal in the 900 MHz band so as to make available one additional block of 5 MHz in these LSAs.

Spectrum availability in 1800 MHz

2.6 The majority of the spectrum held under licences expiring in 2015-16 is in the 900 MHz band. However, a small amount of spectrum (34.2 MHz[6]) in the 1800 MHz band is also held by such licensee. Some part of this spectrum(8.2 MHz) is lying in the Defence Band (1765 MHz-1785 MHz/1860 MHz-1880 MHz) band); hence, it cannot be reassigned to the Telecom Service Providers (TSPs).

2.7 In February 2014, the DoT put up 385.2 MHz of spectrum in 1800 MHz band for auction, out of which only 307.2 MHz could be sold. Therefore, the DoT has a balance spectrum of 78 MHz which remained

[6] The licences, which are expiring in 2015 and 2016, have 27.8 MHz of spectrum in the 1800 MHz band. In some of the LSAs (AP, GUJ and UP (E)), these licence were awarded different frequencies in different districts depending upon the availability of spectrum after its vacation by the Defence. Now the spectrum, which was selectively available in some of the districts, is available in entire LSA. Therefore, 34.2 MHz of spectrum has been reported by the WPC as the spectrum that is becoming available because of expiry of these licences.

unsold. Combining all these factors, a total of 104 MHz of spectrum in the 1800 MHz band is available with the DoT. The LSA-wise availability of spectrum in the 1800 MHz band, as provided by the WPC, is as given in Table 2.3.

Table 2.3
Spectrum Availability in the 1800 MHz Band

Sl.No	LSA	Quantum of Spectrum put for auction in Feb 2014	Quantum of Spectrum sold in Feb 2014 auction	Quantum of Spectrum unsold in Feb 2014 auction	Quantum of Spectrum available due to expiry of licences	Out of spectrum being released, quantum of spectrum in defence band	Quantum of total available spectrum
		MHz	**MHz**	**MHz**	**MHz**	**MHz**	**MHz**
1	Delhi (DEL)	21.0	21.0	0.0	0.0	0.0	0.0
2	Mumbai (MUM)	23.4	23.4	0.0	0.0	0.0	0.0
3	Kolkata (KOL)	25.0	18.0	7.0	0.0	0.0	7.0
4	MH	14.0	14.0	0.0	2.0	0.0	2.0
5	GUJ	12.0	12.0	0.0	5.0	1.6	3.4
6	AP	22.6	22.6	0.0	5.6	1.8	3.8
7	KTK	24.6	23.8	0.8	2.2	1.2	1.8
8	TN	30.2	11.2	19	1.0	0.0	20.0
9	KL	28.0	27.0	1.0	1.8	1.8	1.0
10	PB	18.4	16.8	1.6	0.0	0.0	1.6
11	HR	16.4	8.4	8.0	0.0	0.0	8.0
12	UP (W)	2.4	2.0	0.4	1.8	0.0	2.2
13	UP (E)	8.0	7.6	0.4	3.8	0.0	4.2
14	RAJ	19.0	10.6	8.4	2.0	0.0	10.4
15	MP	19.2	19.2	0.0	1.8	1.8	0.0
16	WB	11.2	11.2	0.0	1.8	0.0	1.8
17	HP	20.4	10.2	10.2	0.0	0.0	10.2
18	BH	2.4	2.2	0.2	1.8	0.0	2.0
19	OR	26.2	10.0	16.2	0.0	0.0	16.2
20	AS	11.4	11.4	0.0	0.0	0.0	0.0
21	NE	25.0	20.2	4.8	3.6	0.0	8.4
22	J&K	4.4	4.4	0.0	0.0	0.0	0.0
	TOTAL	**385.2**	**307.2**	**78.0**	**34.2**	**8.2**	**104.0**

2.8 Of the 104 MHz of available spectrum, only 71.6 MHz spectrum is available in the entire LSA. The rest of the spectrum (32.4 MHz) is available only in part of the LSAs. If we focus on availability of spectrum in contiguous blocks of 5 MHz, it is available only in four LSAs, viz. Kolkata (1 block), Orissa (3 blocks), Rajasthan (1 block but available only in part of LSA) and Tamilnadu (3 blocks). LSA-wise details of availability of spectrum in 1800 MHz band, as provided by WPC, along with quantum of contiguous spectrum in 5 MHz blocks are given is given in Table 2.4 below:

Table 2.4

Spectrum Availability in the 1800 MHz Band: Partial & Contiguous Spectrum

Sl.No.	LSA	Quantum of total available spectrum	Quantum of partial spectrum	Quantum of spectrum available in entire service area	No. of possible 5 MHz block	Quantum of balance spectrum after possible 5 MHz block
1	DEL	0.0	0.0	0.0	0	0.0
2	MUM	0.0	0.0	0.0	0	0.0
3	KOL	7.0	0.0	7.0	1	2.0
4	MH	2.0	2.0	0.0	0	2.0
5	GUJ	3.4	2.0	1.4	0	3.4
6	AP	3.8	0.0	3.8	0	3.8
7	KTK	1.8	0.0	1.8	0	1.8
8	TN	20.0	0.0	20.0	3	5.0
9	KL	1.0	0.0	1.0	0	1.0
10	PB	1.6	0.0	1.6	0	1.6
11	HR	8.0	0.0	8.0	0	8.0
12	UP (W)	2.2	1.8	0.4	0	2.2
13	UP (E)	4.2	4.2	0.0	0	4.2
14	RAJ	10.4	10.4	0.0	1	5.4
15	MP	0.0	0.0	0.0	0	0.0
16	WB	1.8	1.8	0.0	0	1.8
17	HP	10.2	4.0	6.2	0	10.2
18	BH	2.0	1.8	0.2	0	2.0
19	OR	16.2	0.0	16.2	3	1.2

Sl.No.	LSA	Quantum of total available spectrum	Quantum of partial spectrum	Quantum of spectrum available in entire service area	No. of possible 5 MHz block	Quantum of balance spectrum after possible 5 MHz block
20	AS	0.0	0.0	0.0	0	0.0
21	NE	8.4	4.4	4.0	0	8.4
22	J&K	0.0	0.0	0.0	0	0.0
	TOTAL	**104.0**	**32.4**	**71.6**	**8**	**64.0**

2.9 As reported in Table 2.4, 32.4 MHz of spectrum is partially available in the LSAs. The LSA-wise details of the areas in which it is available is given in Table 2.5 below:

Table 2.5

Details of availability of partial spectrum in 1800 MHz Band

Sl. No.	LSA	Quantum of partial spectrum (MHz)	Places in the service area, where available
1	BH	1.8	Motihari, Gopalganj, Madhubani, Raxaul, Betiah, Sheohar, Sitamarhi
2	GUJ	2.0	Entire Gujarat except Ahmedabad, Jamnagar, Vadodara
3	HP	4.0	Entire Service Area except Chamba, Kangra, Kinnaur, Shimla, Sirmour, Solan
4	MH	2.0	Pune City
5	NE	1.8	Meghalaya only
		2.6	Entire Service Area except East Khasi Hill &Tawang
6	RAJ	10.4	Entire service area except Bikaner, Barmer, Bharatpur, Dausa, Ganganagar, Hanumangarh, Jodhpur, Jaipur, Jaisalmer, Jalore & Sirohi

Sl. No.	LSA	Quantum of partial spectrum (MHz)	Places in the service area, where available
7	UP (E)	4.2	Entire service area except Allahabad, Gorakhpur and Jhansi
8	UP (W)	1.8	Meerut Saharanpur, Muzaffarnagar, Bizanore and Firozabad
9	WB	1.8	Darjeeling, Kooch Bihar, Utter Dinajpur, Dakshin Dinajpur, Malda
	Total	**32.4**	

2.10 In the 1800 MHz band, of the total 104 MHz of spectrum that can be put up for auction, only 40 MHz is available in contiguous blocks of 5 MHz. Apart from Kolkata, Tamilnadu, Rajasthan and Orissa, no contiguous block of 5 MHz spectrum is available in other LSAs. In some of the LSAs, such as Haryana (8 MHz), Himachal Pradesh (10.2 MHz) etc, despite the availability of sufficient spectrum, no contiguous block of 5 MHz spectrum is available.

2.11 To encourage TSPs to make their spectrum holding contiguous, the NIA dated 30th January 2013 for the 'Auction of spectrum in 1800 MHz, 900 MHz and 800 MHz', permitted frequency re-configuration-rearrangement of spot frequencies in the same band- from within the assignments made to licensees with the authorization of WPC Wing. No charges were to be levied for re-arrangement of frequency spots. However, there was a condition that the entire spectrum held by the holder should be liberalized.

2.12 The need of having contiguous spectrum was discussed by the Authority in its recommendations on 'Valuation and Reserve Price of Spectrum' dated 9th September 2013, wherein the Authority mentioned that

"*The main motive behind the above provision was to allow such licensees to rearrange their assigned frequencies so as to make them*

contiguous for use for newer technologies which require higher carrier sizes than the GSM, e.g. for UMTS, a contiguous block of 5 MHz is the minimum requirement. Frequency harmonisation will certainly provide more capacity by reducing the number of guard bands, providing larger blocks of spectrum and will also simplify frequency planning in future. But in the present setting, most spectrum held by TSPs is in un-liberalised form. More often than not, the frequency re-arrangement by TSPs having liberalised spectrum shall entail corresponding frequency re-arrangement for those TSPs who hold un-liberalised spectrum. Since such TSPs having unliberalised spectrum, are not allowed to participate in mutual re-arrangement, therefore, in effect re-configuration of frequencies would not be feasible in many cases, until all TSPs either liberalise their entire spectrum holding or are permitted to participate in such re-arrangement without liberalising the spectrum."

Accordingly, the Authority had recommended that the frequency rearrangement in the same band, from within the assignments made to the licensees, should be permitted amongst all licensees irrespective of whether the spectrum is liberalised or not. However, the Government, till date has not accepted this recommendation.

2.13 The non-availability of sufficient spectrum in the contiguous form is a major concern for the industry as a whole and particularly for the TSPs whose licences are due for expiry in 2015 and 2016. During discussions, some of the TSPs raised concerns over non-availability of sufficient contiguous spectrum in 900 MHz and 1800 MHz bands as major road block in using it efficiently for new technologies. In this background, the stakeholders may comment on the issue of making available the additional spectrum in contiguous form in the 900 MHz and 1800 MHz band. As most of the IMT technologies require contiguous spectrum of sufficient quantity for delivery of high data rates, the stakeholders may also wish to discuss whether only

contiguous blocks of minimum 5 MHz spectrum should be put for auction.

Q.1. Please comment on the issue of making available additional spectrum in contiguous form (as discussed in para 2.5 and 2.13) in the 900 MHz and 1800 MHz band.

Q.2. Please comment whether only contiguous blocks of minimum 5 MHz spectrum should be put for auction.

BLOCK SIZE

2.14 In the auctions held in February 2014, the block size was kept as 1 MHz (paired) in the 900 MHz Band and a block size of 200 KHz (paired) in the 1800 MHz band. The bidder was required to bid for a minimum of 5 blocks (i.e. 5 MHz) in this band. In the 1800 MHz band, a new entrant[7] was required to bid for a minimum of 25 Blocks (i.e. 5 MHz), while an existing licensee was required to bid for a minimum of 3 blocks (i.e. 0.6 MHz) in this band.

2.15 In some of the LSAs, the spectrum availability in the 900 MHz band is limited e.g. in West Bengal, only 4.4 MHz of spectrum is available because of the expiry of a licence. The situation in 1800 MHz is even worse as in only 7 LSAs, spectrum becoming available is more than 5 MHz. The limited availability of spectrum poses a real challenge to existing licensees if these licensees wish to acquire enough spectrum to ensure continuity of services. It also requires revisiting the issue of block size in which spectrum, both in 900 and 1800 MHz bands, should be put up for auction.

[7] Licensees who do not hold UAS/ CMTS/ UL (AS) Licence could participate in the auction process as a 'New Entrant'. Existing UASL/CMTS/ UL (AS) licensees were treated as 'New Entrant' for the frequency bands in which they do not hold spectrum. For the limited purpose of this provision, 900MHz band and 1800MHz band were treated as the same band.

900 MHz band

2.16 If the requirement to bid for a minimum of 5 MHz in the 900 MHz band is retained in the upcoming auctions, then in West Bengal, no spectrum can be put up for auction since there is availability of only 4.4 MHz spectrum in 900 MHz band **(Table 2.6)**. It is to be noted here that in 1800 MHz band, the availability of spectrum in West Bengal LSA is only 1.8 MHz of spectrum. Therefore, the incumbent TSP in West Bengal LSA will be forced to close down its GSM services. Similarly, in North East, there would be only one successful winner, whereas there are two licences which are expiring.

Table 2.6

No. of licences getting expired and the quantum of spectrum available

Sl. No.	LSA	No. of Licences getting expired in 2015 and 2016	Quantum of spectrum available	
			900 MHz Band	1800 MHz Band
			MHz	MHz
1	DEL	0	0.0	0.0
2	MUM	0	0.0	0.0
3	KOL	0	0.0	7.0
4	MH	2	14.0	2.0
5	GUJ	2	14.0	3.4
6	AP	2	14.0	3.8
7	KTK	2	14.0	1.8
8	TN	1	6.2	20.0
9	KL	2	12.4	1.0
10	PB	2	15.6	1.6
11	HR	2	12.4	8.0
12	UP (W)	1	6.2	2.2
13	UP (E)	1	6.2	4.2
14	RAJ	2	12.4	10.4
15	MP	2	12.4	0.0
16	WB	1	4.4	1.8
17	HP	2	12.4	10.2

Sl. No.	LSA	No. of Licences getting expired in 2015 and 2016	Quantum of spectrum available	
			900 MHz Band	1800 MHz Band
18	BH	1	6.2	2.0
19	OR	1	6.2	16.2
20	AS	1	6.2	0.0
21	NE	2	8.8	8.4
22	J&K	0	0.0	0.0
	Total	**29**	**184**	**104**

2.17 The issue discussed above is not directly related to the block size. However, the requirement of bidding for a minimum of 5 MHz of spectrum in the 900 MHz band needs to be reconsidered due to the practical constraints. This is vital to some of the TSPs. One possible solution could be that the block size may be kept as 1 MHz. However, the bidders may be allowed to bid for a minimum of a smaller quantity (say 3 MHz) of spectrum (instead of 5 MHz). Another way could be to keep the minimum bid as 5 blocks (i.e. 5 MHz) in all LSAs except in West Bengal and NE LSAs where the minimum bid is reduced to 3 blocks instead of 5.

1800 MHz band

2.18 As can be seen from Table 2.7 and 2.8, some of the TSPs have already acquired some spectrum in the 1800 MHz band in the LSAs where their licences are expiring in 2015 and 2016. If the condition that a new entrant is required to bid for a minimum of 25 Blocks (i.e. 5 MHz) in the 1800 MHz band, is retained and the licensees, whose licences are due for renewal, are treated as new entrants (as was done in the last auction) then these licensees will be able to bid in only those LSAs where spectrum to be put for auction is 5 MHz. As these licensees have already acquired spectrum in some of the LSAs; therefore,

treating a renewal licensee as a new entrant may not be justified in respect of these licensees.

Table 2.7

Spectrum acquired by the licensees (expiring in 2015 and 2016) in the recent auctions in 1800 MHz

Sl. No.	LSA	TSP	Spectrum holding in		Spectrum acquired in the 1800 MHz band in 2014 auctions (MHz)	Spectrum acquired in the 1800 MHz band in 2012 (MHz)	Total spectrum acquired in recent auctions (MHz)
			900 MHz band (MHz)	1800 MHz band (MHz)			
1	MH	Idea	7.8	2	9	Nil	9
		Vodafone	6.2	Nil	Nil	1.25	1.25
2	GUJ	Idea	6.2	Nil	1.6	Nil	1.6
		Vodafone	7.8	5	4.4	Nil	4.4
3	AP	Bharti Airtel	7.8	2.2	8.8	Nil	8.8
		Idea	6.2	3.4	6	Nil	6
4	KTK	Bharti Airtel	7.8	2.2	8.8	Nil	8.8
		Idea	6.2	Nil	5	Nil	5
5	TN	Vodafone	6.2	1	Nil	Nil	Nil
6	KL	Idea	6.2	1.8	10	Nil	10
		Vodafone	6.2	Nil	7	1.25	8.25
7	PB	Bharti Airtel	7.8	Nil	8.2	Nil	8.2
		Idea	7.8	Nil	8	Nil	8
8	HR	Idea	6.2	Nil	6	Nil	6
		Vodafone	6.2	Nil	2.4	2.5	4.9
9	UP (W)	Idea	6.2	3.8	Nil	Nil	Nil
10	UP (E)	Vodafone	6.2	2	4	1.25	5.25
11	RAJ	Bharti Airtel	6.2	2	8.2	Nil	8.2
		Vodafone	6.2	Nil	0.8	Nil	0.8
12	MP	Idea	6.2	1.8	7	Nil	7
		RTL	6.2	Nil	Nil	Nil	Nil
13	WB	RTL	4.4	1.8	Nil	Nil	Nil

Sl. No.	LSA	TSP	Spectrum holding in		Spectrum acquired in the 1800 MHz band in 2014 auctions (MHz)	Spectrum acquired in the 1800 MHz band in 2012 (MHz)	Total spectrum acquired in recent auctions (MHz)
			900 MHz band (MHz)	1800 MHz band (MHz)			
14	HP	Bharti Airtel	6.2	Nil	10.2	Nil	10.2
		RTL	6.2	Nil	Nil	Nil	Nil
15	BH	RTL	6.2	1.8	Nil	Nil	Nil
16	OR	RTL	6.2	Nil	Nil	Nil	Nil
17	AS	RTL	6.2	Nil	Nil	Nil	Nil
18	NE	Bharti Airtel	4.4	1.8	7	Nil	7
		RTL	4.4	1.8	Nil	Nil	Nil

Table 2.8

No. of LSAs, where licensee need to win spectrum to ensure continuity of services

Name of the licensee	No. of licences due for expiry in 2015 and 2016	No. of LSAs where the licensee has already acquired spectrum.	No. of LSAs, where licensee need to win spectrum to ensure continuity of services	Name of such LSAs where Licensee need to win spectrum to ensure continuity of services[8]
Idea	9	7	2	UP(W), GUJ
Vodafone	7	4	3	MH, RAJ, TN
RTL	7	0	7	AS, BH, HP, MP, NE, OR, WB
Airtel	6	6	0	
Total	29	17	12	

[8] Some of these licensees has already acquired some spectrum in recent auctions. E.g. Idea-1.6 MHz in Gujarat, Vodafone -1.25 MHz in Maharashtra and 0.8 MHz in Rajasthan. However, this much quantum of spectrum is not enough for the continuance of services in 1800 MHz band.

2.19 As can be seen from above table, there are many licensees that need to win spectrum to ensure continuity of service. However, putting a restriction to bid for at least 5 MHz of spectrum will make them ineligible for bidding in some LSAs. For instance, Idea needs to acquire spectrum in UP (W) LSA in either 900 MHz or 1800 MHz band, if it wishes continuance of its GSM services. But, there is only 2.2 MHz of spectrum available in 1800 MHz band. Therefore, it would not be able to bid for the spectrum in the 1800 MHz band in UP (W). One possible way out to avoid above narrated problem could be to treat the renewal licensees at par with the existing licensees.

2.20 In view the above discussion, stakeholders are requested to respond to the following questions:

Q.3. What should be the block size to auction the spectrum in (a) 900 MHz band and (b) 1800 MHz band?

Q.4. What should be the minimum quantum of spectrum in the 900 MHz and 1800 MHz band that (a) a new entrant and (b) an existing licensee should be required to bid for?

Q.5. Should the licensee whose licences are due for expiry in 2015 and 2016 be treated as an existing licensee or as a new entrant?

CHAPTER-III :

THE VALUATION AND RESERVE PRICE OF THE SPECTRUM

3.1 Radio spectrum is a unique, ubiquitous natural resource shared by a wide variety of services. Unlike many other natural resources, it can be repeatedly reused and hence cannot be depleted. It has been considered as a limited – even scarce – natural resource because, given present technology, there is only a finite portion available for being put to valuable use at any point of time. Allocation of spectrum through auction leads to efficiency as spectrum is sold to those who value it the most.

3.2 The consumption of spectrum is both rivalrous and excludable. Though it has the potential to be reused and reallocated, its consumption or use by one TSP entails a smaller amount of spectrum available for another to employ as its availability is limited; hence, it is rival. To ensure interference-free operations by service providers given the present state of technology, spectrum has perforce to be excludable. Several restrictions prevail on the supply side due to its attributes of overall scarcity and rivalry and excludability in consumption besides use for other purposes of national importance e.g. defence services.

3.3 The demand for spectrum as a natural resource is a demand which is basically derived from the demand for final goods and services that require spectrum as an input. Valuation of spectrum is thus determined to a large extent by its demand which, in turn, depends on the willingness, requirement, and ability to pay of the spectrum users or TSPs who use it as an input in the production of telecom services. The supply of spectrum is also relatively inelastic as the Government controls it and makes it available for re-auction either when existing licences expire/are renewed or when 'new' spectrum becomes available.

3.4 As has been explained in greater detail in paragraphs 3.1 to 3.8 of the TRAI's consultation paper "Valuation and Reserve Price of Spectrum" dated 23rd July 2013, the interplay of demand and supply results in the revelation of the market price for spectrum through the mechanism of auction so as to ensure the most efficient allocation of spectrum as a natural resource.

Approach to Valuation of Spectrum and Reserve Price Determination in Earlier Exercise in 2013:

3.5 The Authority in its Recommendations on 'Valuation and Reserve Price of Spectrum' dated 9th September 2013 (hereinafter referred to as September 2013 Recommendations) made a departure from the approach of using the prices discovered in the 3G auction as the anchor price to determine the reserve price for spectrum in the 1800 MHz and 900/800 MHz bands. The approach of using 3G price as anchor price was adopted in TRAI's recommendations on 'Auction of Spectrum' dated 23rd April 2012. In September 2013, an exercise was initiated to estimate the valuation of spectrum based on a number of approaches rather than selecting one particular methodology of valuation, on the premise that it is simply not possible to accept deterministically that any one valuation is the 'right' valuation. It is well recognized that the economic valuation of spectrum depends on numerous variables. In functional form, one may posit that valuation of spectrum (V) is a function of available Market Information (I); Technological Factors (T); Macro and Micro Economic Variables (E). Or, more simply;

V= f (I, T, E)

Based on the functional relationship defined above the following approaches were adopted to arrive at spectrum value estimates:

(i) Market Data Analysis: Estimation of value of spectrum using a) single variable correlation and b) multiple regression analysis.

(ii) Opportunity Cost Analysis: Estimation of value of spectrum using a) producer surplus; b) production function; and c) economic efficiency.

(iii) Discounted Cash Flow: This method was used in TRAI's report on the "2010 Value of Spectrum in the 1800 MHz band" dated 8th February 2011.

3.6 In September 2013 Recommendations, the Authority had acknowledged that there are different ways to estimate the value of the spectrum, all of which have some merits as well as demerits. Any of these valuations could actually materialize in the market place. Thus, the Authority took the holistic view that rather than following a deterministic approach, it is best to work with a probabilistic average valuation that captures the range of possible valuations. On the assumption of equal probability of occurrence, the Authority had attempted and arrived at an expected average valuation for 1800 MHz spectrum as the simple mean of the various valuations arrived at using different valuation methodologies.

3.7 The Government/DoT accepted the reserve price of 1800 MHz recommended by the Authority with some modifications. The Government raised the reserve price for "Metro" and "Category A" LSAs and made it equal to the valuation of 1800 MHz spectrum which was recommended by the Authority. However, the reserve prices for "Category B" and "Category C" LSAs recommended by the Authority were accepted by the Government without any change. The auction for 1800 MHz spectrum started on 3rd February 2014 and ended after 68 clock rounds on the 13th February 2014. A comparative table showing the valuation and reserve price of 1800 MHz spectrum recommended by the Authority, reserve price as fixed by the Government and auction determined/realised price of 1800 MHz spectrum in February 2014 auction is shown in **Table 3.1**.

TABLE 3.1

Auction of 1800 MHz Spectrum held in February 2014

(Rs. in crore)

LSA	Valuation per MHz arrived at by TRAI (Sept.2013)	Reserve Price per MHz recommended by TRAI (Sept.2013)	Reserve Price per MHz fixed by DoT (Dec.2013)	Auction Price per MHz (Feb. 2014)	Remarks (Auction Price v. Reserve Price)
Delhi	218.90	175	219	364.00	**Higher** than Reserve Price
Mumbai	206.74	165	207	272.00	**Higher**
Kolkata	73.13	59	73	73.00	**Equal** to Reserve Price
Andhra Pradesh	162.62	130	163	163.00	**Equal**
Gujarat	143.39	115	143	237.80	**Higher**
Karnataka	155.21	124	155	155.00	**Equal**
Maharashtra	172.91	138	173	290.35	**Higher**
Tamil Nadu	207.89	166	208	208.00	**Equal**
Haryana	33.46	27	27	27.00	**Equal**
Kerala	72.22	52	52	52.00	**Equal**
Madhya Pradesh	81.52	43	43	50.40	**Higher**
Punjab	73.58	54	54	54.00	**Equal**
Rajasthan	76.63	26	26	26.00	**Equal**
U. P. (East)	123.67	61	61	64.00	**Higher**
U.P. (West)	77.71	62	62	94.95	**Higher**
West Bengal	40.50	21	21	24.60	**Higher**
Assam	11.32	7	7	36.10	**Higher**
Bihar	63.42	37	37	43.10	**Higher**
Himachal Pradesh	9.24	6	6	6.00	**Equal**
Jammu &Kashmir	16.43	5	5	6.10	**Higher**
North East	15.20	7	7	7.00	**Equal**
Orissa	24.20	16	16	16.00	**Equal**
Pan India	**2059.89**	**1496**	**1765**	**2270.40**	**-**

3.8 It can be seen that the auction determined price is higher than the Reserve Price (RP) set by DoT in 11 LSAs. In the remaining 11 LSAs the auction determined price is equal to the RP set by DoT. Also, the auction determined price was higher in 15 LSAs as compared to the RP recommended by the Authority. In 6 out of these 15 LSAs, the Authority had recommended that the RP should be the lower of the two figures – 80% of the average valuation or the price realized in the November 2012 auction in each LSA. In the remaining 7 LSAs (other than the 15 LSAs where the auction determined price was higher than the RP), the auction determined price was equal to the RP recommended by the Authority.

Need for Fresh Exercise of Valuation versus Use of February 2014 Auction Determined Prices

3.9 In view of the expiry of licences in different LSAs between December 2015 to April 2016, DoT has sought TRAI's recommendations on the valuation and RP of spectrum in the 1800 MHz and 900 MHz bands through letter no. L-14010/02/2014-NTG dated 17th April 2014. It is pertinent to mention here that the Authority in its September 2013 Recommendations had recommended the value and RP of 1800 MHz spectrum for all 22 LSAs and of 900 MHz spectrum for 3 Metro LSAs. Subsequently, DoT conducted auction for 1800 MHz (in 22 LSAs) and 900 MHz spectrum (3 Metro LSAs) in February 2014. About 80% of spectrum offered in the 1800 MHz band and the entire spectrum offered in the 900 MHz band was sold in this auction.

3.10 Only about 11 months have passed since the Authority made the Recommendations on valuation and reserve price of 1800 MHz spectrum in September 2013; indeed, less than 6 months have passed since the successful conduct of the February 2014 auction. The need for fresh valuation and estimating RP of 1800 MHz spectrum especially when the auction of 1800 MHz has been conducted in February 2014 (based on valuation and reserve price of 1800 MHz recommended by TRAI in September 2013), therefore, remains a moot

question. In the 1800 MHz spectrum auction held in February 2014, 80% of the spectrum put up for sale was bought by the bidders. It is not necessary that the results of a fresh estimation exercise will yield valuations that are significantly different from the TRAI's Recommendations of September 2013, since the variables and inputs used in different approaches for valuation of spectrum would not have changed radically. The only significant difference in the estimation would arise from factoring in the prices discovered in the February 2014 auction.

3.11 In this context, the Authority notes that the NIA of 25th February 2010 for 'Auction of 3G and BWA Spectrum' includes the following clause:

> "Para 4.7: If a further round of auction for 3G spectrum or BWA spectrum takes place within 12 months from the date of completion of the current round or the relevant Auction, the Reserve Price in such a round will be the same as the Successful Bid Amount in the current round of the relevant Auction for the respective service area"

Further, the Authority stated in its Recommendations of 11th May 2010 on 'Spectrum Management and Licensing Framework' that:

> " Para 3.50: The Authority recommends that Government should bring additional blocks into 3G services at the earliest and offer the same at the highest price being discovered through the present auction to the remaining bidders in the order of bids. If, however, more than a year lapses from now for this exercise, a fresh auction needs to be conducted."

It was also noted that the NIAs of 28th September 2012 (for 1800 MHz and 800 MHz) and 30th January 2013 (for 1800 MHz, 900 MHz and 800 MHz) for auction of spectrum included a clause which states that:

> "Para 2.3: Existing CMTS/UAS/UL(AS) licensees can liberalise their existing spectrum holding in 1800 MHz band after payment of auction determined price."

Further, the Authority took note of the NIA of 12th December 2013 for 'Auction of Spectrum in 1800 MHz and 900 MHz band' which stated that:

> "Para 2.3: Existing CMTS/UAS/UL licensees can liberalise their existing spectrum holding in 1800 MHz band for the balance validity period of spectrum assignment after payment of auction determined price prorated for the balance validity period of the Spectrum Assignment.
>
> In case more than one set of auction determined prices are available, the latest auction determined prices available at the time when the TSP wants to liberalise its spectrum holding, would be applied.
>
> 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".

3.12 If any auction of spectrum in a particular band takes place within less than one year of the previous auction in the same spectrum band, there may not be a need for new exercise for valuation and RP or indexation of auction price for that spectrum band. It can be argued that the price revealed through an auction process should remain valid for assignment of spectrum in that band if done within one year. However, it is also true that the NIAs for auction of 1800 MHz spectrum band (November 2012, March 2013 and February 2014) do not contain any explicit clause that the auction determined price of 1800 MHz spectrum shall be the RP for the next round of spectrum auction if it takes place within one year (unlike what was incorporated in the NIA dated 25th February 2010 for 'Auction of 3G and BWA Spectrum'). The following questions arise for consultation in this context:

Q6. Should the valuation exercise for 1800 MHz spectrum be undertaken afresh for all the 22 LSAs?

Q7. Should the prices revealed in the February 2014 auction for 1800 MHz spectrum auction be taken as the value of 1800 MHz spectrum for the forthcoming auction in the respective LSA? Would the response be different depending on whether the forthcoming auction is conducted within one year of completion of last round of auction of February 2014 or later?

Q8. If the prices revealed in the February 2014 auction for 1800 MHz spectrum are taken as the value of 1800 MHz for the forthcoming auction, would it be appropriate to index it for the time gap (even if this is less than one year) between the auction held in February 2014 and forthcoming auction? If yes, what rate should be adopted for the indexation?

Scope of the Current Valuation Exercise

3.13 In the auction for 1800 MHz spectrum conducted by DoT in February 2014, spectrum was sold in all the LSAs either partially or fully. Further, spectrum in 11 LSAs was sold at a price higher than RP and in 11 LSAs at a price equal to RP as can be seen from **Table 3.2**.

TABLE 3.2

Status of Sale of 1800 MHz Spectrum in February 2014 Auction

LSA	Quantity of spectrum put for sale (MHz)	Quantity sold in Feb. 2014 auction (MHz)	Quantity unsold in Feb. 2014 auction (MHz)	% sold of spectrum put for sale	Demand (D) and Supply (S) of spectrum[9]
Delhi	21.00	21.00	0	100%	**D > S**
Mumbai	23.40	23.40	0	100%	**D > S**
Kolkata	25.00	18.00	7.00	72%	**D < S**
Andhra Pradesh	22.60	22.60	0	100%	**D = S**
Gujarat	12.00	12.00	0	100%	**D > S**
Karnataka	24.60	23.80	0.80	97%	**D < S**

[9] D > S indicates that the auction determined price was higher than the reserve price in these LSAs. D = S and D < S indicate LSAs where the auction determined price did not exceed the reserve price.

LSA	Quantity of spectrum put for sale (MHz)	Quantity sold in Feb. 2014 auction (MHz)	Quantity unsold in Feb. 2014 auction (MHz)	% sold of spectrum put for sale	Demand (D) and Supply (S) of spectrum[9]
Maharashtra	14.00	14.00	0	100%	**D > S**
Tamil Nadu	30.20	11.20	19.00	37%	**D < S**
Haryana	16.40	8.40	8.00	51%	**D < S**
Kerala	28.00	27.00	1.00	96%	**D < S**
Madhya Pradesh	19.20	19.20	0	100%	**D > S**
Punjab	18.40	16.80	1.60	91%	**D < S**
Rajasthan	19.00	10.60	8.40	56%	**D < S**
U. P. (East)*	8.00	7.60	0.40	95%	**D > S**
U.P. (West)*	2.40	2.00	0.40	83%	**D > S**
West Bengal	11.20	11.20	0	100%	**D > S**
Assam	11.40	11.40	0	100%	**D > S**
Bihar*	2.40	2.20	0.20	92%	**D > S**
Himachal Pradesh	20.40	10.20	10.20	50%	**D < S**
Jammu & Kashmir	4.40	4.40	0	100%	**D > S**
North East	25.00	20.20	4.80	81%	**D < S**
Orissa	26.20	10.00	16.20	38%	**D < S**
Pan India	**385.20**	**307.20**	**78.00**	**80%**	**-**

* In UP (East), UP (West) and Bihar, the quantity left unsold was below the minimum quantity (0.6 MHz) to bid. Therefore these LSAs have been treated at par with those all LSAs where demand ≥ supply.

3.14 Thus, out of 22 LSAs, spectrum put up for auction was sold (either fully or partially) at RP in 11 LSAs. Therefore, one view that could be taken is that the realised price in these 11 LSAs was not a market clearing price (P_{MCP}) since demand did not exceed supply (D ≤ S) though it was still an 'auction determined price' (P_{ADP}). On the other hand, there is the set of 11 LSAs where 1800 MHz spectrum was sold at a price higher than reserve price (D > S) which indicates that $P_{ADP} = P_{MCP}$.

3.15 However, out of the 11 LSAs where the P_{ADP} was equal to RP, Andhra Pradesh is the only LSA where the entire spectrum on offer was sold (at RP). Thus, in 11 LSAs the demand was greater than the supply, in

one LSA the demand equal to the supply and in 10 LSAs the demand was less than the supply. As such, one view could be that P_{MCP} for 1800 MHz was achieved in 12 LSAs (where demand ≥ supply). In the remaining 10 LSAs (where demand<supply), the P_{ADP} cannot be considered as P_{MCP} as there were not enough buyers for 1800 MHz spectrum in these 10 LSAs. On the other hand, it could also be argued that since spectrum was sold in these LSAs as recently as in February 2014, a market determined price already exists for these LSAs that can serve as a basis for any forthcoming auction, especially since in most cases, the bulk of the spectrum was sold.

3.16 Different views are possible regarding the scope of the valuation exercise for 1800 MHz spectrum in this context. One view could be that the RP fixed in February 2014 auction was not able to yield the P_{MCP} for the 1800 MHz spectrum in some LSAs. Thus, it could be argued that in the LSAs where $P_{ADP} \neq P_{MCP}$, it may not represent the market value of spectrum and there is a case for a fresh valuation of spectrum in these LSAs.

The following questions arise for consultation in this regard:

Q9. What should be the criteria for defining a 'market clearing price'? Can the auction determined price be considered as market clearing price, when (i) the demand for spectrum is greater than the supply and when (ii) the demand is greater than or equal to the supply? Can the auction determined price be considered as the market discovered price?

Q10. Should the valuation of spectrum and determination of reserve price be done only for those LSAs where market clearing price was not achieved for 1800 MHz spectrum in February 2014 auction?

Q11. Should the auction determined price for LSAs where market clearing price was achieved in February 2014, be taken as equal to the value of spectrum?

Q12. Should the market determined price be taken as the value of spectrum in all LSAs?

VALUATION OF 1800 MHz SPECTRUM: ALTERNATIVE APPROACHES

Market Data Analysis

3.17 A supplementary question arises if the auction determined price in the LSAs where spectrum remained unsold in the February 2014 auction is not reckoned as the P_{MCP}: whether the P_{ADP} in those LSAs can be taken as representing the value of the 1800 MHz spectrum. If it is not to be so reckoned, an attempt can be made to revisit the valuation of the 1800 MHz spectrum for these LSAs (where $P_{ADP} \neq P_{MCP}$) either by correlating it with the prices realized in similar LSAs using a single explanatory variable one at a time or through multiple variable regression if possible.

Data Sources and Variables for Correlation with Single Variable or Through Multiple Regression

3.18 The realised price of 1800 MHz for LSAs, where P_{MCP} was achieved in February, 2014 can be used for this analysis. The auction determined price of LSAs where P_{MCP} was achieved can be correlated with other relevant variables to estimate value of spectrum in LSAs where P_{MCP} was not achieved.

3.19 The data on relevant variables used in estimating the value of spectrum can be gathered from various sources. The variables which could have an impact on the price of spectrum are:

- AGR (Wireless)[10]: It can be taken as a variable since the price of spectrum in a particular LSA is likely to depend on revenue earning potential of that LSA**.**
- Subscribers (Wireless)[10]: It represents the part of the population having mobile connections.
- Existing Tele-density[10]: It indicates the percentage of population having mobile telecom connectivity. Existing Tele-density = Number of mobile cellular subscribers per 100 persons.
- Residual Tele-density: It is the difference between an assumed maximum tele-density and the existing tele-density. It is an indicator of the potential mobile subscribership in the LSA. Maximum tele-density can be assumed as Metro circles (200%), Circle A (150%), Circle B (125%) and Circle C (100%).
- Minutes of Usage[10]: It indicates the volume of traffic in the market.
- Population[11]: Population across circles indicates the potential for growth for the industry as a whole conditional on the standard of living of the set of individuals.
- GSDP per capita[12]: A measure of the total output of a particular state that takes the gross state domestic product (GSDP) and divides it by the number of people in that state (i.e. population state-wise). It is sometimes used as an indicator of standard of living, with higher per capita GDP being interpreted as having a higher standard of living.

[10] Derived from figures reported by TSPs to TRAI.

[11] Population for year 2014 as projected by office of the Registrar General and Census Commissioner, India. Delhi's population adjusted for national capital region (NCR) as the subscribers reported by TSPs are for NCR. 50% of population of Faridabad, Gurgaon, Ghaziabad and Gautam Budh Nagar added to Delhi. Uttar Pradesh population divided between UP (West) LSA and UP (East) LSA in the proportion of subscribers.

[12] Data from Planning Commission.

- Herfindahl Hirschman Index (HHI): It is a measure of concentration calculated on market share in terms of (i) Adjusted Gross Revenue (AGR) and (ii) total Minutes of Usage (MoU). These are indicators of competition in the market.

- Growth rate of Gross Domestic Product across LSAs for the year[12] : It is the rate at which a particular LSA is growing in terms of GDP which again is an indicator of the potential for growth of the industry.

3.20 Such a valuation approach was adopted in the Authority's September 2013 Recommendations where the sale prices realised in 18 LSAs were correlated with some relevant variables to estimate the value of spectrum in 4 LSAs where spectrum remained unsold in the auction held in November 2012/March 2013. However, if the valuation exercise for 1800 MHz spectrum is undertaken as stated in Para 3.18, the sample of market revealed information (i.e. P_{MCP}) available is quite limited (either 12 or 11 data points). The availability of data points is further constrained if intra-category comparison is required to be attempted.

Estimating the Value of Spectrum by Correlating the Sale Prices Achieved in Similar LSAs with Known Relevant Variables

3.21 The value of spectrum in the LSAs where P_{MCP} was not achieved for the 1800 MHz spectrum can be estimated by establishing a correlation between the sale price realised in similar LSAs in the same category where P_{MCP} was achieved and some other relevant variables e.g. Adjusted Gross Revenue (AGR), Average Revenue Per User (ARPU) etc. The ratio established can then be used to estimate the value of spectrum in the LSAs where P_{MCP} was not achieved. LSAs in the same category are expected to bear a closer resemblance to each other in terms of AGR, ARPU, Revenue per Minute (RPM) and other economic indicators, than to LSAs in other categories. Thus, the valuation of spectrum for example in a 'B' category LSA (where P_{MCP} was not

achieved) could be done on the basis of a comparison with other 'B' category LSAs (where P_{MCP} was achieved) and further relationships on a similar basis could be established for other LSAs (Note that in category B, there are only 4 data points for comparison to arrive at correlated prices for the other 4 LSAs where P_{MCP} was not achieved).

Estimating the Value of Spectrum Using Multiple Regression Analysis

3.22 Linear regression establishes a relationship between a scalar dependent variable denoted as Y and one or more explanatory variables denoted as X. If only one explanatory variable is used, it is called simple linear regression; for more than one explanatory variable, it is called multiple linear regression.

3.23 If the goal is prediction or forecasting, linear regression can be used to fit a predictive model to an observed data set of Y and X values. After developing such a model, if an additional value of X is then given without its accompanying value of Y, the estimated model can be used to make a prediction of the value of Y. Multiple regression can therefore be adopted to estimate the value of spectrum (per MHz) for the LSAs where P_{MCP} was not achieved using the data available for the realized prices for spectrum in February 2014 for the remaining LSAs where the P_{MCP} was achieved.

3.24 The underlying model is as follows:

$$Y_i = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots\ldots + \beta_k X_{ki} + \varepsilon_i$$

Where,

Y_i = Value of 1800 MHz spectrum per MHz for i = 1, 2,...n LSAs;

X_1, X_2,.....,X_k = the possible independent variables (as explained earlier);

α= the intercept term;

β_1, β_2..... β_k= partial regression coefficients for the explanatory variables X_1, X_2,.....,X_k respectively;

and, ε_i is the error term.

A multiple regression model[13] can be fitted using the observed data set of Y [i.e. LSAs where P_{MCP} was achieved for 1800 MHz] and values of X (explanatory variables). Then, the value of spectrum in the LSAs where the P_{MCP} was not achieved can be arrived at. While using multiple regression in the present instance, it is necessary to note that since the number of data points (the market revealed information of spectrum prices in 1800 MHz spectrum) is limited to either 12 or 11, the explanatory variables cannot be increased beyond a point. This will only result in reducing the degrees of freedom and render the regression results unstable and may fail to yield a useful and precise prediction equation

The following questions are relevant in this context:

Q13. Should the value of spectrum in the LSAs where market clearing price was not achieved be estimated by correlating the sale prices achieved in similar LSAs where market clearing price was achieved with known relevant variables (para 3.19)? If yes, please suggest which single variable is best suited for this purpose?

Q14. Can multiple regression analysis be gainfully employed for this purpose given the limited number of sample data points?

OPPORTUNITY COST MODELS

Producer Surplus on Account of Additional Spectrum

3.25 Spectrum may also be valued on the basis of 'Producer Surplus' that arises when additional spectrum is allocated to an existing TSP. As there is an inverse relationship between the quantum of spectrum allocated and the expenditure on the 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.

[13] For a detailed discussion of the methodology and assumptions involved in single variable correlation and multiple regression approaches, **Annexure 4.1** of TRAI's September 2013 Recommendations may be seen.

The details of the bottom-up approach adopted by the Authority in the producer surplus model are available at **Annexure 4.2** of its September 2013 Recommendations.

3.26 The amount of producer surplus from deployment of additional 1800 MHz spectrum can be estimated by using the industry data available with TRAI of the number of subscribers of GSM TSPs, present usage by such subscribers, and overall growth patterns of voice, SMS and data for the telecom industry, as well as the CAPEX and OPEX cost of RAN. The projected growth rates would remain the same as adopted in **Table A** of **Annexure 4.2** of the September 2013 Recommendations with the base year being suitably updated. It is pertinent to note in this context that data usage has increased significantly in 2013-14 (from 4381 crore MB in April 2013 to 6055 crore MB in March 2014) and this may require to be built into the assumptions suitably subject to the usual limitations of linear equations/ models that may not always be able to capture the impact of such exponential growth. It is nevertheless true that the 1800 MHz spectrum is now recognized as the key to the rollout of LTE networks around the world and its potential as an LTE band would have an impact on the TSPs' valuation of the spectrum. The band's attractiveness for data carriage may need to be factored in during the valuation exercise.

Q15. Should the value of spectrum in 1800 MHz band be assessed on the basis of producer surplus on account of additional spectrum?

Q16. Is there any need for a change/revision of any of the assumptions adopted by the Authority in producer surplus model in the Recommendations of September 2013? Justify with reasons.

Valuation of Spectrum Using a Production Function Approach

3.27 An attempt can also be made to derive the value of spectrum (reserve price per MHz for 1800 band) across LSAs by taking spectrum and

Base Transceiver Stations (BTS) as two factor inputs to estimate a production function to 'produce' mobile traffic or minutes of usage. This approach of valuation was adopted in the TRAI's Recommendations on "Valuation and Reserve Price of Spectrum" dated 9th September 2013 (see **Annexure 4.3** of the September 2013 Recommendations for details). Prior to that, it was done in the TRAI's Report of February 2011 on 'The 2010 value of spectrum in the 1800 MHz band'. (In that Report, subscriber numbers were used as a proxy for minutes of usage).

3.28 The production function model detailed in **Annexure 4.3** of TRAI's Recommendations on "Valuation and Reserve Price of Spectrum" dated 9th September 2013 with the same assumptions (but with data updated for the latest available year) could be one of the approaches for estimating the value of the 1800 MHz spectrum in the current exercise as well.

Q17. Should the production function model based on the assumption that spectrum and BTS are substitutable resources be used as a valuation approach (as was done in the earlier valuation exercise)? Please support your response with justification/calculations/relevant data and results.

Revenue Surplus Model

3.29 The approaches for arriving at the valuation of spectrum described in the foregoing paragraphs have been used by the Authority in the previous valuation exercise for 1800 MHz spectrum. These different approaches could legitimately be used if a case is made out for a fresh valuation exercise in the present instance, instead of, for example, using the auction determined prices of February 2014 as the basis for recommendations. At the same time, there is also a question mark over the feasibility of using the multiple regression approach for arriving at the valuation of spectrum given the paucity of data points.

Under the circumstances, the Authority noted that a different valuation approach for the 1800 MHz spectrum could also be attempted as an alternative. Such an approach would estimate the valuation of spectrum from the perspective of an access service provider willing to invest the net revenue potential/revenue surplus from the GSM segment (since the 1800 MHz spectrum is used as a GSM band) over the licence time horizon of 20 years for acquiring the spectrum resource. The net present value (NPV) of projected revenue surplus over the 20 years (net of all expenses/costs) would potentially represent the maximum amount which a buyer would be willing to pay for acquiring the spectrum. It is obvious that the business model adopted by different service providers would influence the respective valuations if firm-level calculations are adopted. Hence, a full industry approach using aggregate data of the GSM segment has been adopted in the valuation exercise using this approach.

The following assumptions can be made in arriving at the valuation of 1800 MHz spectrum using this approach:

a) A bottom-up approach to be adopted with separate revenue surplus projections done for each LSA.

b) The revenue is calculated as the product of Average Revenue per User (ARPU) and average number of subscribers. The figures given by service providers to TRAI for the year 2013-14 have been used as the base figures in this exercise.

c) For the ensuing years, ARPU has been projected on the basis of the information received from service providers' reports and current trends. The year-wise growth rates adopted for ARPU for the subsequent years are:

TABLE 3.3

PROJECTED ARPU GROWTH RATES

Year	Growth of ARPU
2014-15	5%
2015-16	5%
2016-17	4.5%
2017-18	4.5%
2018-19	4.5%
2019-20	4%
2020-21	4%
2021-22	4%
2022-23	4%
2023-24	3%
2024-25	3%
2025-26	3%
2026-27	3%
2027-28	3%
2028-29	3%
2029-30	3%
2030-31	2%
2031-32	2%
2032-33	2%
2033-34	2%
2034-35	2%

d) The growth of subscribers is assumed to be the same as in the producer surplus model.

e) The EBITDA margin (%) varies across LSAs as well as TSPs. A uniform EBITDA margin of 30% of revenue has been adopted in the calculation to ensure that the incentive to invest is incorporated into the calculation.

f) Investment (Capex) required per subscriber (I_s) can be worked out based on the current level of Net Block (excluding spectrum auction fee, one time licence fee) and capital work-in-progress. This comes to about Rs 1500 per subscriber.

g) Capital investment for the first year (2015-16) would be equal to the number of subscribers multiplied by the investment required per subscriber. For subsequent years, additional capital investment is calculated on the basis of the number of incremental subscribers. Capital investment per year can be projected for a period of 20 years in the following manner:

$$\text{Capital investment (year 2015-16)} = N_{S\,(2015\text{-}16)} \times I_S$$

$$\text{Capital Investment}_n \text{ (subsequent year)} = [N_{S(n)} - N_{S\,(n\text{-}1)}] \times I_S$$

Where n = (year 2016-17, 2017-18,..., 2034-35)

h) Useful life for the capital investments is assumed to be 10 years.

i) Return on capital investment (net) is allowed @ 15%.

j) Revenue surplus (i.e. revenue net of costs and return on capital investment) is calculated for 20 years.

k) The NPV of revenue surplus for 20 years is computed using a discounting factor of 12.5 %.

l) The NPV of revenue surplus represent the surplus from the GSM bands which consists of 1800 MHz, 900 MHz and 2100 MHz. To work out the valuation of the 1800 MHz, spectrum allocated in 900 MHz and 2100 MHz is converted to 1800 MHz using factors of 1.5 and 0.83 respectively based on technical parameters and propagation characteristics.

m) To calculate the value per MHz of the 1800 MHz spectrum, the NPV of revenue surplus of each LSA is divided by the total available 1800 MHz spectrum in that LSA prior to the February

2014 auction (i.e. 1800 MHz spectrum + equivalent spectrum in 900 MHz and 2100 MHz spectrum).

Q18. Should the revenue surplus approach be used to arrive at the value of 1800 MHz spectrum? Do you agree with the assumptions made?

Discounted Cash Flow

3.30 The Authority in its September 2013 Recommendations has used DCF as one of the possible approaches of valuation in view of the stakeholder comments in favour of the DCF method. It was noted that a DCF valuation for "mature" operators had been attempted in TRAI's Report[14] (prepared by a group of Experts) on the "2010 Value of Spectrum in the 1800 MHz band" dated 8th February 2011 in respect of spectrum holdings up to 6.2 MHz. In this method, the value of a block of spectrum of 6.2 MHz was computed by determining the Net Present Value of cash flows that a mature operator would command over the licence period of 20 years by virtue of holding the corresponding block of spectrum. The values were indexed for 3 years by using SBI PLR (2010-11 to 2012-13) and were taken as one of probable values in the calculation of average value of 1800 MHz spectrum in the September 2013 exercise. In the current exercise of valuation, the values can be further indexed using the SBI PLR for one more year (i.e. 2013-14).

Q19: Should the values contained in the Report of 8th February 2011 for spectrum up to 6.2 MHz be incorporated after indexation in the calculation of the average value of the 1800 MHz spectrum in the current exercise?

[14] http://www.trai.gov.in/WriteReadData/Recommendation/Documents/reportmndive9feb11.pdf

Use of February 2014 Auction Determined Prices

3.31 As can be seen from Table 3.2, 1800 MHz spectrum was sold at the reserve price in some LSAs and at higher than the reserve price in the remaining LSAs. It is a fact that demand was palpable in all 22 LSAs. Of the offered spectrum, 80% was bought by the bidders and in all the 22 LSAs (except one) existing TSPs in an LSA bought spectrum in that LSA. This indicates that the realized price of 1800 MHz spectrum in the February 2014 auction can be taken as one of the indicators of the value of 1800 MHz spectrum.

Q20. Should the prices revealed in the February 2014 auction for 1800 MHz spectrum auction be used as one of the values of 1800 MHZ spectrum?

Q21. Apart from the approaches discussed as above, is there any other approach for valuation of spectrum that you would suggest? Please support your answer with detailed data and methodology.

Valuation of Spectrum: Single Approach *versus* Multiple Approaches

3.32 To assess the value of spectrum, various approaches have been discussed above. In case a fresh valuation approach is to be adopted (i.e., without adopting the indexed prices revealed in the February 2014 auction as the valuation), it would not be possible to say deterministically that one of these valuations is absolutely the right approach. Each approach of valuing 1800 MHz spectrum has its merits and drawbacks. Any of these valuations could actually materialize in the market place. A priori, there is no reason to pick one particular valuation as more likely than another. Therefore the Authority in its September 2013 Recommendations took the view that rather than following a deterministic approach, it is best to work with a probabilistic average valuation that captures the range of possible valuations that have been attempted. Rather than count on one method, prudence suggests it would be better to rely on a number of

such models to arrive at a final reasonable valuation and then to base a reserve price on such valuation. On the assumption of equal probability of occurrence, the Authority had arrived at an expected average valuation for 1800 MHz spectrum as the simple mean of the various valuations that were attempted.

Q22. Would it be appropriate to value 1800 MHz spectrum as the simple mean of the values thrown up in all the approaches? If no, please suggest with justification that which single approach should be adopted to value 1800 MHz spectrum?

VALUATION OF THE 900 MHZ SPECTRUM

3.33 As indicated in **Table 2.1**, 184 MHz of spectrum in the 900 MHz band is becoming available because of licences expiring in 2015-16 in 18 non-metro LSAs. The higher intrinsic value of the 900 MHz spectrum (when compared to the 1800 MHz band) due to better propagation characteristics and lower requirement of BTSs for coverage can be expected to be magnified even more in the non-metro LSAs where the population density is lower and geographic dispersal wider than in the metros. The coverage requirements of rural areas in these non-metro LSAs would increase the attractiveness of the 900 MHz spectrum and yield higher valuations, since TSPs would be keen to exploit the efficiency of this band.

3.34 In contrast to the 1800 MHz spectrum, market determined/realised prices are not available for 900 MHz spectrum except for 3 metro LSAs where prices were revealed in the auction held in February 2014. With this limited information – that too for a particular category of LSA – it would not be prudent to estimate the value of 900 MHz in the other 19 LSAs based on empirical information available for 3 Metro LSAs using <u>all</u> the approaches discussed in the earlier paragraphs (para 3.21 to 3.24) with respect to the valuation of 1800 MHz spectrum. However,

the valuation of 900 MHz spectrum can be done on the basis of the value of 1800 MHz spectrum using (a) relative technical efficiency, and, (b) relative economic efficiency of the 900 MHz band over the 1800 MHz band.

Technical Efficiency

3.35 One way of valuing the 900 MHz spectrum could be on the basis of the greater technical efficiency of the 900 MHz spectrum over the 1800 MHz spectrum. A detailed discussion of the relative efficiencies, coverage characteristics, capital and operational expenditure, and literature pertaining to the technical efficiency aspects of these bands were indicated at **para 4.45 - 4.47** of the September 2013 Recommendations.

3.36 The 900 MHz band spectrum thus intrinsically possesses a greater technical efficiency than 1800 MHz band in terms of cell range and coverage. This technical efficiency factor could lie anywhere between 1.5 times to 2 times; in TRAI's recommendations on spectrum dated May 2010, a factor of 1.5 for relative efficiency had been adopted. In TRAI's Recommendations on 'Auction of Spectrum' dated April 2012 the Authority decided that the technical efficiency of 900 MHz spectrum was twice that of 1800 MHz spectrum. In the September 2013 Recommendations too, the Authority noted that in working with technical efficiency, the value of the 900 MHz spectrum would be 1.5 times to 2 times of the average value worked out for the 1800 MHz spectrum. Accordingly, as shown at **Annexure 4.6** of the September 2013 Recommendations, the Authority had incorporated valuations of the 900 MHz spectrum using both 1.5 times of and 2 times of the average valuation of the 1800 MHz band in its estimation exercise.

Q23. Should the value of 900 MHz spectrum be derived on the basis of the value of 1800 MHz spectrum using technical efficiency factors (1.5 times and 2 times) as discussed above?

Economic Efficiency

3.37 Technical efficiency of the 900 MHz spectrum leads to economic efficiency in comparison to 1800 MHz in the form of reduced CAPEX and OPEX requirements. Therefore an alternate way of deriving a relative valuation for the 900 MHz band from the valuation worked out for the 1800 MHz band is by examining the trade-off in costs (CAPEX as well as OPEX) when spectrum in the technically more efficient 900 MHz band is substituted for spectrum in the technically less efficient 1800 MHz band. The premium a TSP would be willing to pay for a unit of 900 MHz spectrum would be less than or equal to the price of a unit of 1800 MHz spectrum plus the additional CAPEX and OPEX costs that the TSP saves by using the 900 MHz spectrum instead of the 1800 MHz spectrum. Based on the technical efficiency, the cost savings by using spectrum in the 900 MHz band theoretically would not be expected to be more than twice that of the 1800 MHz spectrum. However, the economic premium that a TSP would be willing to pay for the more efficient 900 MHz spectrum is also a factor of the geographical and demographic profile of - and the competition dynamic in - the respective LSA, as well as the business model of the TSP. It is also pertinent to note that the TSPs' willingness to pay for retaining spectrum holdings in the 900 MHz band would also account for intangible savings arising from a seamless transition/ renewal of licenced services. This willingness was also manifest in the February 2014 auction in the case of the 3 metros where the realized price of 900 MHz exceeded the realized price of 1800 MHz spectrum by a factor greater than two. **Table 3.4** gives the results of February 2014 auction for those LSAs where 900 MHz and 1800 MHz spectrum was bought by the bidders.

TABLE 3.4

LSA	Realised Price per MHz 900 MHz band (Rs. in crore)	Realised Price per MHz 1800 MHz band (Rs. in crore)	Ratio between realized price of 900 MHz and 1800 MHz
Delhi	740.96	364.00	2.04
Mumbai	563.09	272.00	2.07
Kolkata	194.63	73.00	2.67

3.38 Acknowledging the relationship between the values of 1800 MHz and 900 MHz, the Authority has in its Recommendations dated 23rd April 2012 (Para 3.87 to 3.88) recognized that additional CAPEX is required for operating in the 1800 MHz band, as compared to 900 MHz band, considering the operational efficiency 900 MHz over the 1800 MHz band. The additional costs in the form of infrastructure (CAPEX) and associated operating cost (OPEX) that arise when operations are switched from the 900 MHz band to the 1800 MHz band can be assessed for different LSAs. The actual position of spectrum holding in the 900 and 1800 MHz band varies by LSA and service provider. The following assumptions could be made:

i) Since disaggregated information on BTS is not available, in Metro LSAs, all BTS are considered to be in the urban area. In category 'A' LSAs 70% and in category 'B' and 'C' 60% of BTSs are considered to be in urban area.

ii) Since TSPs hold a mix of 900 and 1800 MHz spectrum, in Metro LSAs, 75% of BTS are considered to be in 900 MHz. In urban area of category 'A', 'B' and 'C', 60% of BTS are considered to be in 900 MHz and in rural areas 90% of BTS are considered in 900 MHz.

iii) While operating in 1800 MHz as compared to 900 MHz in urban areas, requirement of additional BTS would be lower in 900 MHz as there is concentration of population and BTS have already been

installed at comparatively close distances to cater to traffic loads. Thus after shifting from 900 MHz to 1800 MHz spectrum, number of BTS in 900 MHz band would have to be replaced by 1800 MHz BTS with an increase of 25% in urban area and of 100% in rural areas.

iv) A life of 10 years for BTS has been assumed. After 10 years, fresh investment in BTS will be required. CAPEX per additional BTS taken at Rs.5 lakh. CAPEX for replacing the existing BTS in 900 MHz band is taken at Rs.2 lakh as only TRX would need replacement on shift to 1800 MHz from 900 MHz band.

v) Since a number of operators are working on an outsourced model for towers, it is assumed additional towers would be taken on rent. OPEX on additional BTS includes rental for towers and other costs such as fuel, electricity etc. associated with running a BTS. OPEX per BTS in Metro LSA has been taken at Rs.6 lakh per year and for category A, B and C LSAs at Rs.4.32 lakh per year.

vi) Cash flows (CAPEX and OPEX) have been discounted over 20 years using rate of 12.50%.

3.39 This approach provides an approximate estimation of the premiums the TSPs might be willing to pay for 900 MHz spectrum, over and above the price for 1800 MHz spectrum. It is worth noting that the relative value is not fixed across the board using a single multiplication factor for all LSAs as in the technical efficiency model. It is individually computed for each LSA using a bottom-up approach. Since 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, its economic benefits would be more in areas where coverage requirements are paramount i.e. where the density of population is lower and the spread of population to be covered is relatively wider. The percentage of rural population in an LSA and the rural area to be covered would therefore have a direct

correlation to the premium a TSP might be willing to pay for 900 MHz spectrum.

Q24. Should the economic efficiency approach as discussed above be used to calculate the premium for the 900 MHz spectrum, based on the additional CAPEX and OPEX that would be incurred on a shift from this band to the 1800 MHz band?

Q25. Is there any other method that could be used for arriving at the valuation of the 900 MHz spectrum? Please support with detailed methodology.

Q26. As in the case of the September 2013 Recommendations and adopting the same basic principle of equi-probability of occurrence of each valuation, should the average valuation of the 900 MHz spectrum be taken as the simple mean of the valuations obtained from the technical and economic efficiency approaches (and any other method)?

RESERVE PRICE ESTIMATION

3.40 A reserve price refers to the minimum amount that the owner of an item will accept as the winning bid in an auction. The reserve price prevents the auction from being won at a price lower than the minimum the owner is ready to accept. Reserve prices are designed to protect the owner of an auctioned item from an unfavourable outcome. However, auction bidders dislike reserve prices because they reduce the possibility of winning the auction at a bargain price, and because they create uncertainty over the minimum price that must be paid to win the auction.

3.41 The reserve price is clearly related to the valuation of spectrum. It is important to note however that it is not the eventual realized price in the auction. The reserve price is the starting point for an ascending price auction and bidding is a means to price discovery. A reserve

price set lower than the a priori expected value of the object will enable price discovery and the final bid price is likely to be much higher than the reserve price.

3.42 The concept of auction efficiency, revenue maximization, reserve price in an auction and international practices were discussed in detail in the Authority's Consultation Paper dated 23rd July 2013 on 'Valuation and Reserve Price of Spectrum'.

3.43 From the analysis of realized prices of 1800 MHz spectrum in February 2014 auction, we have noted that in some LSAs the spectrum offered was fully sold and in others, spectrum was sold partially at the given reserve price. As discussed above, it is generally accepted that the reserve price is only the starting point for an ascending price auction and bidding is a means to price discovery. In other words, auction is the process of discovering the value of the goods/services offered. One could argue that in the 1800 MHz band, spectrum was bought by the bidders in all the 22 LSAs and there is an auction determined price available which could be taken as the value of 1800 MHz spectrum. In that case there is no need for a fresh exercise of fixing reserve price since auction determined prices as recent as of February 2014 are available for all 22 LSAs.

3.44 The Authority in its September 2013 Recommendations on 'Valuation and Reserve Price of Spectrum' decided on the general principle that the reserve prices should be fixed at 80% of the average valuation for a spectrum band. While giving recommendations on the reserve price for 1800 MHz spectrum, the Authority observed that in some LSAs, this method would result in reserve prices pegged higher than prices realized in the November 2012 auction / reserve prices in the March 2013 auction. The Authority was of the view, for the reasons stated in the recommendations of 9th September 2013, that reserve prices for 1800 MHz in different LSAs would therefore have to be tempered accordingly. The Authority recommended that reserve price for 1800

MHz should be the lower of (i) 80% of the average valuation or the price realized in November 2012 auction (in the 18 LSAs where spectrum was sold in November 2012 auction) and (ii) 80% of the average valuation or the reserve price in March 2013 (in the 4 LSAs where spectrum was not sold). The Authority also recommended that reserve price for 900 MHz in 3 Metro LSAs i.e. Delhi, Mumbai and Kolkata should be fixed at 80% of the average valuation of spectrum in each LSA.

3.45 However, during review of the Notice Inviting Applications for auction of spectrum issued by Government of India on 12th December 2013, it has been noted that, as against the reserve price recommended by the Authority, the Government has fixed the reserve price of 1800 MHz in Metro/A category LSAs equal to 100% of the average valuation of spectrum as worked out by the Authority. Similar is the position for 900 MHz in 3 Metro LSAs. Reserve prices for 1800 MHz in all other LSAs are as recommended by the Authority.

Q27. Should the reserve price of 1800 MHz spectrum in the forthcoming auction be fixed equal to the realized price of 1800 MHz spectrum in the February 2014 auction? If not, what should be the ratio between the reserve price for the auction and the valuation of the spectrum?

Q28. If the realized prices in the February 2014 auction for 1800 MHz spectrum is taken as the reserve price of 1800 MHz for forthcoming auction, would it be appropriate to index it for the time gap (even if less than one year) between the auction held in February 2014 and forthcoming auction? If yes, what rate should be adopted for the indexation?

CHAPTER-IV: ISSUES FOR CONSULTATION

Q.1. Please comment on the issue of making available additional spectrum in contiguous form (as discussed in para 2.5 and 2.13) in the 900 MHz and 1800 MHz band.

Q.2. Please comment whether only contiguous blocks of minimum 5 MHz spectrum should be put for auction.

Q.3. What should be the block size to auction the spectrum in (a) 900 MHz band and (b) 1800 MHz band?

Q.4. What should be the minimum quantum of spectrum in the 900 MHz and 1800 MHz band that (a) a new entrant and (b) an existing licensee should be required to bid for?

Q.5. Should the licensee whose licences are due for expiry in 2015 and 2016 be treated as an existing licensee or as a new entrant?

Q.6. Should the valuation exercise for 1800 MHz spectrum be undertaken afresh for all the 22 LSAs?

Q.7. Should the prices revealed in the February 2014 auction for 1800 MHz spectrum auction be taken as the value of 1800 MHz spectrum for the forthcoming auction in the respective LSA? Would the response be different depending on whether the forthcoming auction is conducted within one year of completion of last round of auction of February 2014 or later?

Q.8. If the prices revealed in the February 2014 auction for 1800 MHz spectrum are taken as the value of 1800 MHz for the forthcoming auction, would it be appropriate to index it for the time gap (even if this is less than one year) between the auction held in February 2014 and forthcoming auction? If yes, what rate should be adopted for the indexation?

Q.9. What should be the criteria for defining a 'market clearing price'? Can the auction determined price be considered as market clearing price, when (i) the demand for spectrum is greater than the supply and when (ii) the demand is greater than or equal to the supply? Can the auction determined price be considered as the market discovered price?

Q.10. Should the valuation of spectrum and determination of reserve price be done only for those LSAs where market clearing price was not achieved for 1800 MHz spectrum in February 2014 auction?

Q.11. Should the auction determined price for LSAs where market clearing price was achieved in February 2014, be taken as equal to the value of spectrum?

Q.12. Should the market determined price be taken as the value of spectrum in all LSAs?

Q.13. Should the value of spectrum in the LSAs where market clearing price was not achieved be estimated by correlating the sale prices achieved in similar LSAs where market clearing price was achieved with known relevant variables (paragraph 3.19)? If yes, please suggest which single variable is best suited for this purpose?

Q.14. Can multiple regression analysis be gainfully employed for this purpose given the limited number of sample data points?

Q.15. Should the value of spectrum in 1800 MHz band be assessed on the basis of producer surplus on account of additional spectrum?

Q.16. Is there any need for a change/revision of any of the assumptions adopted by the Authority in producer surplus

model in the Recommendations of September 2013? Justify with reasons.

Q.17. Should the production function model based on the assumption that spectrum and BTS are substitutable resources be used as a valuation approach (as was done in the earlier valuation exercise)? Please support your response with justification/calculations/relevant data and results.

Q.18. Should the revenue surplus approach be used to arrive at the value of 1800 MHz spectrum? Do you agree with the assumptions made?

Q.19. Should the values contained in the Report of 8th February 2011 for spectrum up to 6.2 MHz be incorporated after indexation in the calculation of the average value of the 1800 MHz spectrum in the current exercise?

Q.20. Should the prices revealed in the February 2014 auction for 1800 MHz spectrum auction be used as one of the values of 1800 MHZ spectrum?

Q.21. Apart from the approaches discussed as above, is there any other approach for valuation of spectrum that you would suggest? Please support your answer with detailed data and methodology.

Q.22. Would it be appropriate to value 1800 MHz spectrum as the simple mean of the values thrown up in all the approaches? If no, please suggest with justification that which single approach should be adopted to value 1800 MHz spectrum?

Q.23. Should the value of 900 MHz spectrum be derived on the basis of the value of 1800 MHz spectrum using technical efficiency factors (1.5 times and 2 times) as discussed above?

Q.24. Should the economic efficiency approach as discussed above be used to calculate the premium for the 900 MHz spectrum, based on the additional CAPEX and OPEX that would be incurred on a shift from this band to the 1800 MHz band?

Q.25. Is there any other method that could be used for arriving at the valuation of the 900 MHz spectrum? Please support with detailed methodology.

Q.26. As in the case of the September 2013 Recommendations and adopting the same basic principle of equi-probability of occurrence of each valuation, should the average valuation of the 900 MHz spectrum be taken as the simple mean of the valuations obtained from the technical and economic efficiency approaches (and any other method)?

Q.27. Should the reserve price of 1800 MHz spectrum in the forthcoming auction be fixed equal to the realized price of 1800 MHz spectrum in the February 2014 auction? If not, what should be the ratio between the reserve price for the auction and the valuation of the spectrum?

Q.28. If the realized prices in the February 2014 auction for 1800 MHz spectrum is taken as the reserve price of 1800 MHz for forthcoming auction, would it be appropriate to index it for the time gap (even if less than one year) between the auction held in February 2014 and forthcoming auction? If yes, what rate should be adopted for the indexation?

Abbreviation

S.No.	Abbreviation	Expansion
1.	3G	Third Generation
2.	ADP	Auction Determined Price
3.	AGR	Adjusted Gross Revenue
4.	ARPU	Average Revenue per User
5.	BTS	Base Transceiver Station
6.	BWA	Broadband Wireless Access
7.	CAPEX	Capital Expenditure
8.	CMTS	Cellular Mobile Telephone Service
9.	DCF	Discounted Cash Flow
10.	DoT	Department of Telecommunications
11.	EBIDBTA	Earnings Before Interest, Taxes, Depreciation and Amortization
12.	GDP	Gross Domestic Product
13.	GDP	Gross Domestic Product
14.	GSDP	Gross State Domestic Product
15.	GSM	Global System for Mobile Communication
16.	HHI	Herfindahl Hirschman Index
17.	HSPA	High Speed Packet Access
18.	IMT	International Mobile Telecommunications
19.	LSA	Licence Service Area
20.	LTE	Long Term Evolution
21.	MCP	Market Clearing Price
22.	MoU	Minutes of Usage
23.	NIA	Notice Inviting Application
24.	NPV	Net Present Value
25.	NTP 1999	New Telecom Policy 1999

Abbreviation

S.No.	Abbreviation	Expansion
26.	OPEX	Operating Expenditure
27.	RP	Reserve Price
28.	RPM	Revenue Per Minute
29.	SBI PLR	State Bank of India – Prime Lending Rate
30.	SSTL	Sistema Shyam Teleservices Limited
31.	TRAI	Telecom Regulatory Authority of India
32.	TSP	Telecom Service Provider
33.	UAS	Unified Access Service
34.	UL	Unified Licence
35.	UL(AS)	Unified Licence Access Service
36.	UMTS	Universal Mobile Telecommunication System
37.	WPC	Wireless Planning & Coordination Wing

Annexure-A

Government of India
Ministry of Communications & IT
WPC Wing, Sanchar Bhawan
New Delhi-110001

No.L-14010/02/2014-NTG Dated:17.04.2014

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 spectrum in 900 MHz and 1800 MHz Bands – Reg.

Sir,

The undersigned is directed to state that some of the Access Service licenses are due to expire during December, 2015 and early 2016. The Telecom Service Providers whose licenses are expiring in 2015 - 2016 are holding spectrum in 900 MHz and 1800 MHz Bands. The spectrum held by such licensees are to be put to auction atleast 18 months in advance of expiry of licenses. The list of Access (CMTS/ UAS) licences due to expire during 2015-2016 and the spectrum holding by these licensees are at Annexure.

2. Accordingly, TRAI is requested to kindly provide recommendations on applicable reserve price for all the service areas for auction of spectrum in 900 MHz and 1800 MHz Bands.

Yours faithfully,

17-04-2014

(R.B.Prasad)
Joint Wireless Adviser

Annexure (I)

Detail of the Spectrum in 900/1800 MHz bands of the CMTS/UASL licenses expiring during 2015-16

S.No.	Name of the licensee company	Service area	Type of license	Effective date of license	Spectrum Holding		Total spectrum holding
					900 MHz band	1800 MHz band	
1	Bharti Airtel Limited	Andhra Pradesh	UAS	12 Dec., 1995	7.8	2.2	10.0
2	Bharti Airtel Limited	Himachal Pradesh	UAS	12 Dec., 1995	6.2	-	6.2
3	Bharti Airtel Limited	Punjab	UAS	12 Dec., 1995	7.8	-	7.8
4.	Bharti Hexacom Ltd.	North East	CMTS	12 Dec., 1995	4.4	1.8	6.2
5.	Idea Cellular Ltd.	Gujarat	CMTS	12 Dec., 1995	6.2	-	6.2
6	Idea Cellular Ltd.	Haryana	CMTS	12 Dec., 1995	6.2	-	6.2
7	Idea Cellular Ltd.	Kerala	CMTS	12 Dec., 1995	6.2	1.8	8.0
8	Idea Cellular Ltd.	Madhya Pradesh	CMTS	12 Dec., 1995	6.2	1.8	8.0
9	Idea Cellular Ltd.	Maharashtra	CMTS	12 Dec., 1995	7.8	2.0	9.8
10	Idea Cellular Ltd.	Uttar Pradesh (West)	CMTS	12 Dec., 1995	6.2	1.8	8.0
11	Reliance Telecom Ltd.	Assam	UAS	12 Dec., 1995	6.2	-	6.2
12	Reliance Telecom Ltd.	Bihar	UAS	12 Dec., 1995	6.2	1.8	8.0
13	Reliance Telecom Ltd.	Himachal Pradesh	UAS	12 Dec., 1995	6.2	-	6.2
14	Reliance Telecom Ltd.	Madhya Pradesh	UAS	12 Dec., 1995	6.2	-	6.2
15	Reliance Telecom Ltd.	North East	UAS	12 Dec., 1995	4.4	1.8	6.2
16	Reliance Telecom Ltd.	Orissa	UAS	12 Dec., 1995	6.2	-	6.2
17	Reliance Telecom Ltd.	West Bengal	UAS	12 Dec., 1995	4.4	1.8	6.2
18	Vodafone Essar Cellular Ltd.	Kerala	UAS	12 Dec., 1995	6.2	-	6.2
19	Vodafone Essar Cellular Ltd.	Tamil Nadu (excluding Chennai Service Area)	UAS	12 Dec., 1995	6.2	1.0	7.2
20	Vodafone Essar Digilink Ltd.	Haryana	UAS	12 Dec., 1995	6.2	-	6.2
21	Vodafone Essar Digilink Ltd.	Rajasthan	UAS	12 Dec., 1995	6.2	-	6.2
22	Vodafone Essar Digilink Ltd.	Uttar Pradesh (East)	UAS	12 Dec., 1995	6.2	2.0	8.2
23.	Idea Cellular Ltd.	Andhra Pradesh	CMTS	19 Dec. 1995	6.2	1.8	8.0
24	Vodafone Essar Cellular Ltd.	Maharasthra	UAS	19 Dec. 1995	6.2	-	6.2
25	Vodafone Essar Cellular Ltd.	Gujarat	UAS	19 Dec. 1995	7.8	2.0	9.8
26	Bharti Airtel Limited	Karnataka	UAS	15 Feb., 1996	7.8	2.2	10.0
27	Spice Communications Ltd.	Karnataka	UAS	9 April 1996	6.2	-	6.2
28	Spice Communications Ltd.	Punjab	UAS	9 April 1996	7.8	-	7.8
29	Bharti Hexacom Ltd.	Rajasthan	UAS	22 April 1996	6.2	2.0	8.2