Telecom Regulatory Authority of India

सत्यमेव जयते

Recommendations

on

Auction of Spectrum

23rd April, 2012

Mahanagar Doorsanchar Bhawan, Jawahar Lal Nehru Marg,
New Delhi – 110002

Preface

In the recommendations of May 2010, this Authority had recommended that all future licences should be Unified Licences and spectrum should be delinked from the licence. Since February 2011, the Authority had been advocating the auction of spectrum, consequent upon adequate amount of spectrum being available for auction.

In February 2012, the Hon'ble Supreme Court had directed TRAI to make fresh recommendations for grant of licence and allocation of spectrum in 2G band in 22 Service Areas by auction. In so far as grant of licenses is concerned, the recommendations have been sent to the Government on 16th April, 2012 after due consultation process.

Immediately on receipt of the Orders of the Hon'ble Supreme Court, the authority issued a pre-consultation paper on 3rd February 2012. Based on the comments received, the Authority prepared a Consultation Paper and issued the same on 7th March 2012. After receipt of comments, Open House Discussions were held on 4th April, 2012. The recommendations now being issued are a result of this extensive consultation process.

The recommendations address various issues related to the conduct of auction of the spectrum. It is hoped that these will serve as guidelines for the spectrum auctions for the next few years.

(Dr. J S Sarma)
Chairperson

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INTRODUCTION

1. In its Judgment dated 2nd February 2012 in writ petitions no. 423/2010 and 10/2011, the Hon'ble Supreme Court of India has directed as follows:

   i *"The licenses granted to the private respondents on or after 10.1.2008 pursuant to two press releases issued on 10.1.2008 and subsequent allocation of spectrum to the licensees are declared illegal and are quashed.*

   ii *The above direction shall become operative after four months.*

   iii *Keeping in view the decision taken by the Central Government in 2011, TRAI shall make fresh recommendations for grant of licence and allocation of spectrum in 2G band in 22 Service Areas by auction, as was done for allocation of spectrum in 3G band.*

   iv *The Central Government shall consider the recommendations of TRAI and take appropriate decision within next one month and fresh licenses be granted by auction.*

   v to vii ……"

2. In keeping with the directions of the Hon'ble Supreme Court, TRAI had issued a pre-consultation paper on 3.2.2012. It was pointed out to the stakeholders that on the issue of grant of licences, TRAI had, in its recommendations dated 11th May 2010 on "Spectrum Management and Licensing Framework", already recommended that all future licences should be Unified Licences and that spectrum should be delinked from the licence. Pursuant to this recommendation, DOT requested TRAI, on 10th October 2011, to recommend the guidelines for the Unified Licence as well as for migration of the existing licences to the Unified Licence regime. The "Draft Guidelines for Unified Licensing Regime" were placed on TRAI website www.trai.gov.in on 16th January 2012 seeking comments of the stakeholders. After

completion of the consultation process, this Authority issued its recommendations on the subject on 16th April 2012.

3. In so far as allocation of spectrum is concerned, TRAI sought the comments, at the pre-consultation stage, of the stakeholders on the issue of allocation of spectrum in 2G bands in 22 service areas by auction. Comments were received from the stakeholders by 15th February 2012.

4. Since the order of the Hon'ble Supreme Court referred to the "decision taken by the Central Government in 2011", TRAI vide its letter dated 17th February 2012, requested DoT to provide the complete details of the decision taken by the Central Government in the year 2011.In response, DoT vide its letter dated 1st March 2012 forwarded the decisions announced by the Government, regarding TRAI recommendation on 'Spectrum Management and Licensing Framework' of May 2010 along with the policy for spectrum management and pricing through two Press Statements dated 29th January 2011 and 15th February 2012. **(Annexures-I and II)**.

5. On the basis of the comments received from the stakeholders and its own analysis, TRAI issued a consultation paper on 'Auction of Spectrum' on 7th March 2012. In response to the consultation paper, comments were received from 30 stakeholders and counter-comments from 7 stakeholders. An Open House Discussion was conducted on 4th April 2012. Having carefully studied the different aspects, the Authority makes its recommendations as contained in Chapters I to IV that follow.

CHAPTER – I

AUCTION OF SPECTRUM - OBJECTIVES

1.1 Spectrum in the 2G bands (800 MHz, 900 MHz and 1800 MHz bands) was last auctioned in the year 2001. Subsequently, upto and including in August 2007, TRAI did not recommend the auction process for spectrum in these bands. In 2006, it had recommended auction of spectrum in the 2100 MHz and 2300 MHz bands. In May 2010, TRAI had held that it was not feasible to auction spectrum in the 2G bands. However, in its recommendations of February 2011, TRAI referred to its recommendations of November 2010 regarding cancellation of some licenses issued from the year 2006 onwards and the resultant availability of spectrum and recommended auction of the spectrum to determine the actual price. In its order of 2.2.2012, the Hon'ble Supreme Court ordered that spectrum in 2G Bands must be auctioned.

1.2 A recapitulation of some of the observations made by the Hon'ble Supreme Court in its judgement dated 2.2.2012 in writ petitions no 423/2010 and 10/2011 was considered necessary in determining the objectives for the auction of spectrum in the 2G bands and the same were mentioned in the Consultation Paper. These are:

- Even though there is no universally accepted definition of natural resources, they are generally understood as elements having intrinsic utility to mankind. They may be renewable or non-renewable. (Para 63)
- A natural resource's value rests in the amount of the material available and the demand for it. The latter is determined by its usefulness to production. (Para 63)
- Natural resources belong to the people but the State legally owns them on behalf of its people and from that point of view natural resources are considered as national assets, more so because the State benefits immensely from their value. (Para 63)

- The State is empowered to distribute natural resources. However, as they constitute public property/national asset, while distributing natural resources, the State is bound to act in consonance with the principles of equality and public trust and ensure that no action is taken which may be detrimental to public interest. Like any other State action, constitutionalism must be reflected at every stage of the distribution of natural resources. (Para 63)

- In Article 39 (b) of the Constitution, it has been provided that the ownership and control of the material resources of the community should be so distributed so as to best sub-serve the common good, … (Para 63)

- The State is deemed to have a proprietary interest in natural resources and must act as guardian and trustee in relation to the same. Constitutions across the world focus on establishing natural resources as owned by, and for the benefit of, the country. (Para 64)

- Spectrum has been internationally accepted as a scarce, finite and renewable natural resource which is susceptible to degradation in case of inefficient utilisation. It has a high economic value in the light of the demand for it on account of the tremendous growth in the telecom sector. (Para 65)

- In Jamshed Hormusji Wadia's case, this Court held that the State's actions and the actions of its agencies/instrumentalities must be for the public good, achieving the objects for which they exist and should not be arbitrary or capricious. (Para 66)

- In the field of contracts, the State and its instrumentalities should design their activities in a manner which would ensure competition and not discrimination. They can augment their resources but the object should be to serve the public cause and to

do public good by resorting to fair and reasonable methods. (Para 66)

- As natural resources are public goods, the doctrine of equality, which emerges from the concepts of justice and fairness, must guide the State in determining the actual mechanism for distribution of natural resources. In this regard, the doctrine of equality has two aspects: *first*, it regulates the rights and obligations of the State vis-a-vis its people and demands that the people be granted equitable access to natural resources and/or its products and that they are adequately compensated for the transfer of the resource to the private domain; and *second*, it regulates the rights and obligations of the State vis-a-vis private parties seeking to acquire/use the resource and demands that the procedure adopted for distribution is just, non-arbitrary and transparent and that it does not discriminate between similarly placed private parties. (Para 69)

- In conclusion, we hold that the State is the legal owner of the natural resources as a trustee of the people and although it is empowered to distribute the same, the process of distribution must be guided by the constitutional principles including the doctrine of equality and larger public good. (Para 72)

1.3 As already mentioned, the DOT indicated the decisions taken by the Central Government as contained in the Press Releases of 29th January 2011 and 15th February 2012. These were reproduced in the Consultation paper. The following are the decisions taken by the Central Government relevant to the present exercise.

- With improvement in the telecom technology, and provision of Broadband services with increasing speeds, it is now possible for the telecom services to play a significant role in the realization of key development goals. We (should) use these technological

advancements for ushering in a truly inclusive society. *(Press statement dated 29.1.2011).*

- Government would like to make a directional shift from past practice and bring in a fresh policy regarding spectrum. *(Press statement dated 29.1.2011).*

- In future, the spectrum will not be bundled with the licence. The licence to be issued to telecom operators will be in nature of '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. *(Press statement dated 29.1.2011).*

- In future, there will be no concept of contracted spectrum and, therefore, no concept of initial or start-up spectrum. Spectrum will be made available only through market driven process. *(Press statement dated 29.1.2011).*

- While moving towards a new policy dispensation, it is necessary to ensure a level playing field between all players. Hence going forward, any new policy of pricing would need to be applied equally to all players. *(Press statement dated 29.1.2011).*

- Assignment of balance of contracted spectrum may need to be ensured for existing licensees who have so far been allocated only the start up spectrum of 4.4 MHz. …. the additional 1.8 MHz will be assigned on their becoming eligible, but the spectrum will be assigned to them at a price determined under the new policy. *(Press statement dated 29.1.2011).*

- No more UAS licences linked with spectrum will be awarded. *(Press statement dated 15.2.2012).*

- All future licences will be Unified Licences and allocation of spectrum will be delinked from the licence. Spectrum, if required, will have to be obtained separately. *(Press statement dated 15.2.2012).*

- The need for refarming of spectrum is accepted in-principle. Further steps will be taken after receipt of TRAI's recommendations in this regard. *(Press statement dated 15.2.2012).*

- The prescribed limit on spectrum assigned to a service provider will be 2x8 MHz/2x5 MHz for GSM/CDMA technologies for all service areas other than in Delhi and Mumbai where it will be 2x10MHz/2x6.25MHz. However, the licensee can acquire additional spectrum beyond prescribed limits, in the open market, should there be an auction of spectrum subject to the limits prescribed for merger of licences. *(Press statement dated 15.2.2012).*

- In respect of spectrum obtained through auction, spectrum sharing will be permitted only if the auction conditions provide for the same. *(Press statement dated 15.2.2012).*

- Spectrum trading will not be allowed in India, at this stage. This will be re-examined at a later date. *(Press statement dated 15.2.2012).*

1.4 On the issue of grant of licences, TRAI in its recommendations on 'Spectrum Management and Licensing Framework' dated 11th May 2010 had recommended that all future licenses should be unified licenses and that spectrum be delinked from the licence. On 10th October 2011, while referring back certain recommendations to TRAI, DoT had requested TRAI to recommend the Unified Licence guidelines including, *inter alia*, recommendations on entry/eligibility, PBG, FBG etc. TRAI was also requested to recommend modalities & guidelines

for enabling existing UAS/CMTS/ISP/NLD/ILD/GMPCS licensees including IP-I providers to migrate to National/Service Area level Unified Licence.

1.5 The draft guidelines for Unified and Class Licence were placed on TRAI website on 16th January 2012, for comments of stakeholders. Subsequently, draft guidelines for migration of existing Licences to the Unified licensing Regime were also put on TRAI website www.trai.gov.in on 10th February 2011 for comments of the stakeholders. After examination of the comments received from the stakeholders, TRAI has issued its recommendations on 'Unified Licensing Regime' on 16th April, 2012.

1.6 In the consultation Paper, while dealing with the issue of allocation of spectrum, all stakeholders were requested to offer their comments on the manner in which the directions of the Hon'ble Supreme Court can be sufficiently incorporated in the auction design and the key objectives to be kept in mind in the auction of the spectrum. Stakeholders suggested that the auction process to be recommended by the Authority should be open, fair, just, transparent and non-arbitrary and should not discriminate between similarly placed private parties. Some stakeholders suggested that more participants should be encouraged to participate in the auction to keep the market competitive and that the reserve price should be set at a level that only deters frivolous bidders. While some stakeholders suggested that all existing operators and new entrants be allowed to participate in the auction, others felt that the auction must follow the principle of equality between similarly placed operators. One of the stakeholders was of the view that in the present case with more than six operators in each service area, there was no need for the regulator to make an effort to introduce additional entrants. It was contended that if the new operators based on their own judgement of the market, decide to enter the fray, they should not face any discrimination. One stakeholder was of the opinion that sufficient quantum of spectrum in 1800/800 MHz should be put up for 2G auction for fair discovery

of the actual market price of the natural resource without causing the winner's curse and also to ensure fair competition in the market. Some of the stakeholders were of the opinion that the auction should focus on maintaining requisite level of competition in the market as well as competition for right to use spectrum.

1.7 The need for a balance between maximisation of revenue to the Government and affordability of services to the customers was underlined by some stakeholders. One stakeholder was of the view that the aim of the auction should not be to maximize revenue to the National Exchequer, but affordable, ubiquitous service to the consumer through a sustainable telecom industry should be at the heart of all telecom policies. Another stakeholder opined that the public interest would be better served by striking a balance between government revenue and affordability of services by the consumer. In its opinion, the aim of the auction should be to maximize public good by bringing in more competition rather than maximising revenue for the Government of India, as affordable services and ease of access can only be provided if the resources and thereby tariffs are reasonably priced.

1.8 Several stakeholders suggested that the auction should ensure public trust by making it transparent and fair and all policy issues should be explicitly covered in the auction document and any subsequent clarifications issued should be explicitly in writing. A view was also expressed that the auction for 2G spectrum should be so designed that it encourages sincere bidding which is free from collusion, predation, artificial demand reduction etc.

1.9 The Authority has carefully considered the various suggestions that have been made by the stakeholders. Keeping in view the observations and the directions of the Hon'ble Supreme Court as well as the decisions of the Central Government, the Authority is of the view that in so far as the issue of licences is concerned, the guidelines relating to the grant of unified Licence will meet the requirements. As regards the auction of spectrum, the Hon'ble Supreme Court had laid

down that instrumentalities of the State must achieve the objectives for which they exist. The Preamble to the TRAI Act, 1997, as amended in the year 2000, reads as under;

"An Act to provide for the establishment of Telecom Regulatory Authority of India and the Telecom disputes Settlement and Appellate tribunal to regulate the Telecommunication services, adjudicate disputes, dispose of appeals and ***to protect the interests of service providers and consumers of the Telecom sector, to promote and ensure orderly growth of the telecom sector and for matters connected therewith or incidental thereto****" (emphasis supplied).*

1.10 The Hon'ble Supreme Court has enjoined that the State is deemed to have a proprietary interest in natural resources and must act as guardian and trustee in relation to the same. Constitutions across the world focus on establishing natural resources as owned by, and for the benefit of, the country. It has also observed that the State is empowered to distribute natural resources. However, as they constitute public property/national asset, while distributing natural resources, the State is bound to act in consonance with the principles of equality and public trust and ensure that no action is taken which may be detrimental to public interest. It has also observed that as natural resources are public goods, the doctrine of equality, which emerges from the concepts of justice and fairness, must guide the State in determining the actual mechanism for distribution of natural resources. In this regard, the doctrine of equality has two aspects: *first*, it regulates the rights and obligations of the State vis-a-vis its people and demands that the people be granted equitable access to natural resources and/or its products and that they are adequately compensated for the transfer of the resource to the private domain; and *second*, it regulates the rights and obligations of the State vis-a-vis private parties seeking to acquire/use the resource and demands that the procedure adopted for distribution is just, non-arbitrary and transparent and that it does not discriminate between similarly placed

private parties. The Hon'ble Supreme Court has also laid down that in the field of contracts, the State and its instrumentalities should design their activities in a manner which would ensure competition and not discrimination. They can augment their resources but the object should be to serve the public cause and to do public good by resorting to fair and reasonable methods. In conclusion, the court held that the process of distribution must be guided by the constitutional principles including the doctrine of equality and larger public good.

1.11 The Authority has therefore kept the observations and directions of the Hon'ble Supreme Court in view while arriving at the various recommendations that are contained in the next two chapters.

CHAPTER II

SPECTRUM FOR AUCTION- BANDS AND QUANTITY

A. Amount of spectrum available

2.1. The data regarding the availability of the spectrum in various bands i.e., 800, 900, 1800, 2100 and 2300 MHz bands is given in Tables 2.1 to 2.7 below.

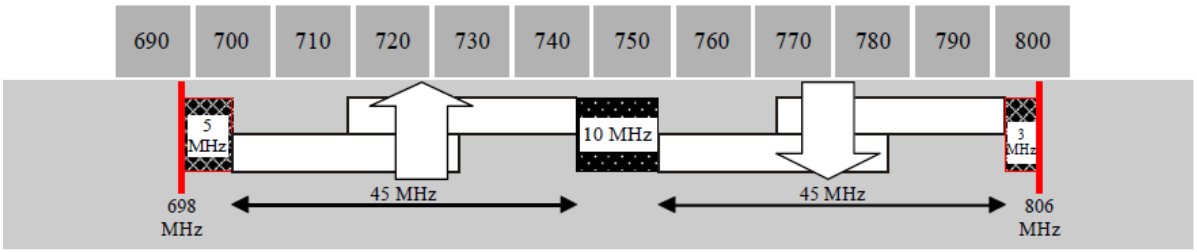
700 MHz band (698-806 MHz)

2.2. 700 MHz band (698-806 MHz) is one of the bands identified by ITU at the 2007 World Radio Conference (WRC -07), for use by IMT systems. APT has agreed for a harmonized band plan for this band. As per that, there are two frequency channel arrangements/plans for 698-806 MHz band. The first plan is based on Frequency Division Duplexing (FDD) and the other plan is based on Time Division Duplexing (TDD). In FDD plan, there are 2x45 MHz bandwidth available from 703-748 MHz paired with 758 -803 MHz with 10 MHz center gap and duplex separation of 55 MHz. Internal guard bands of 5 MHz (698-703 MHz) and 3 MHz (803-806 MHz) are provided at the lower and upper edge of the band for better co-existence with adjacent radio communication services. The TDD option of frequency arrangements in the band has also been considered with appropriate guard bands. In TDD plan, a minimum internal guard-band of 5 MHz at the lower edge (698 MHz) and 3 MHz at the upper edge (806 MHz) are proposed. Both the arrangements are shown in the chart below[1].

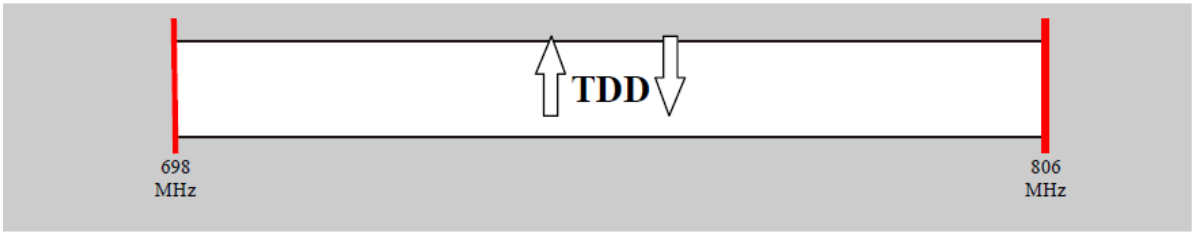
[1] Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications: A Report by Working Party 5D (ITU-R M.1036-4)

Chart 2.1

APT Plan- I: Harmonised FDD Arrangement of 698-806 MHz band



APT Plan- II: Harmonised TDD Arrangement of 698-806 MHz band



2.3. As regards the 700 MHz band, (698-806 MHz), as per the information given by WPC, there are allocations/assignments of 40 MHz to different PSUs and captive usages and 48 MHz to Ministry of I&B in this band. Also, Security agencies have been allocated/assigned 20 MHz spectrum. Defence and BSNL/MTNL are operating some point to point microwave links in 698-806 MHz and Public Protection & Disaster Relief (PPDR) has some spots earmarked in 750 – 806 MHz. Based on the data given by WPC, TRAI undertook the exercise of ascertaining the present usage of spectrum from PSUs and Doordarshan, and it is found that most of the spectrum assigned to

these units assigned for point to point microwave links is lying unused.

2.4. As per the information provided, the entire spectrum in 698-806 MHz band is likely to be available for assignments for commercial telecom services. However, certain agencies have raised doubts regarding this position and as such, at this stage, it appears safe to assume availability of about 2 X 30 MHz of spectrum in this band.

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

2.5. As per the information provided by WPC, at present 77.7 MHz spectrum is available in non-contiguous form. The information relating to the spectrum to be vacated due to cancellation of 122 licences in the 800 band was provided by WPC. As a result of the cancellation of 122 licences, a total 60 MHz of spectrum shall become free. According to WPC, the no. of carriers in the 800 MHz band, generally varies from 13 to 14, depending upon the number of inter operator guard bands, which translates to effective utilisation of 16.25 or 17.5 MHz of spectrum. Out of 20 MHz of spectrum, the service area wise information about spectrum availability in this band is given in the Table 2.1.

Table 2.1

Spectrum availability on the 800 MHz Band

S.No.	Service Area	Total spectrum	Spectrum assigned presently	Spectrum to be vacated due to cancellation of Licence	Available spectrum
1	Delhi	20	16.25	2.5	3.75
2	Mumbai	20	15	2.5	3.75
3	Kolkata	20	13.75	2.5	5
4	Maharashtra	20	15	2.5	3.75
5	Gujarat	20	12.5	2.5	7.5
6	AP	20	16.25	2.5	2.5
7	Karnataka	20	13.75	2.5	6.25
8	Tamil Nadu	20	13.75	2.5	5

9	Kerala	20	15	2.5	5
10	Punjab	20	15	2.5	3.75
11	Haryana	20	13.75	2.5	6.25
12	UP - West	20	13.75	2.5	6.25
13	UP - East	20	13.75	2.5	5
14	Rajasthan	20	15	0	0
15	M.P.	20	12.5	2.5	6.25
16	West Bengal	20	11.25	2.5	7.5
17	H.P.	20	10	2.5	10
18	Bihar	20	13.75	2.5	6.25
19	Orissa	20	11.25	2.5	8.75
20	Assam	20	10	5	12.5
21	North East	20	10	5	12.5
22	J&K	20	10	5	10
	Total	440	291.25	60	137.5

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

2.6. The spectrum assigned to commercial telecom services varies from 18.6 to 22.4 MHz in different service areas. As shown in the Table 2.2, there is no spectrum available in this band at this stage for further allocation to the Telecom services.

Table 2.2

Spectrum Availability in the 900 MHz band

S.No.	Service Area	Total available spectrum (MHz)	Already Allotted Spectrum (MHz)	Net Spectrum available (MHz)
1	Delhi	22.2	22.2	0
2	Mumbai	22.2	22.2	0
3	Kolkata	20.2	20.2	0
4	Maharashtra	20.2	20.2	0
5	Gujarat	20.2	20.2	0
6	AP	20.2	20.2	0

7	Karnataka	20.2	20.2	0
8	Tamil Nadu	21.2	21.2	0
9	Kerala	18.6	18.6	0
10	Punjab	21.8	21.8	0
11	Haryana	18.6	18.6	0
12	UP - West	18.6	18.6	0
13	UP - East	18.6	18.6	0
14	Rajasthan	18.6	18.6	0
15	M.P.	18.6	18.6	0
16	West Bengal	19.4	19.4	0
17	H.P.	18.6	18.6	0
18	Bihar	18.6	18.6	0
19	Orissa	18.6	18.6	0
20	Assam	18.6	18.6	0
21	North East	19.4	19.4	0
22	J&K	18.6	18.6	0
	Total	**431.8**	**431.8**	**0**

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

2.7. In its recommendations of May 2010, the Authority observed that *"BSNL and MTNL hold spectrum of 2X12.4 MHz in most service areas. Going by the subscriber figures of both these service providers, it is apparent that the spectrum is being underutilised and as such the Authority would like the Government to withdraw the spectrum of 2X2.4 MHz from both these agencies. It is necessary for the Government to maintain a level playing field between the public and private sector service providers."*

2.8. **The Authority recommends that excess spectrum of 2x2.4 MHz should be immediately taken back from MTNL.**

2.9. The service area-wise information about spectrum availability in this band is given in the Table 2.3. It also includes the spectrum which is available in a part of the service area.

Table 2.3

Spectrum Availability in 1800 MHz band

S.No.	Service Area	Total spectrum	Spectrum Assigned in 1800 MHz band including 122 Licences	Spectrum to be vacated due to cancellation of Licences including partial	Balance available spectrum including partial spectrum assignment	Excess spectrum with MTNL	Total available spectrum
1	Delhi	43	31.4	4.4	16	2.4	18.4
2	Mumbai	55.2	50.2	13.2	18.2	2.4	20.6
3	Kolkata	63.2	40.2	17.6	40.6	0	40.6
4	Maharashtr	55.2	49.2	22	28	0	28
5	Gujarat	44.6	40.2	17.6	22	0	22
6	AP	64.2	49.2	22	37	0	37
7	Karnataka	61	49.2	22	33.8	0	33.8
8	Tamil Nadu	58.8	33.4	22	47.4	0	47.4
9	Kerala	70.6	42.6	17.6	45.6	0	45.6
10	Punjab	42.8	41.4	17.6	19	0	19
11	Haryana	49.6	45.2	22	26.4	0	26.4
12	UP - West	50.8	42.6	17.6	25.8	0	25.8
13	UP - East	43.8	43.8	17.6	17.6	0	17.6
14	Rajasthan	48.4	45.2	17.6	20.8	0	20.8
15	M.P.	62.4	44.4	17.6	35.6	0	35.6
16	West	37.6	33.6	17.6	21.6	0	21.6
17	H.P.	45.4	39	17.6	24	0	24
18	Bihar	48.2	48.2	22	22	0	22
19	Orissa	58.8	40.8	22	40	0	40
20	Assam	40.2	36.4	22	25.8	0	25.8
21	North East	40.8	33.8	22	29	0	29
22	J&K	37.2	30.8	22	28.4	0	28.4
	Total	**1121.8**	**910.8**	**413.6**	**624.6**	**4.8**	**629.4**

2.10. As per the information provided by WPC, in some of the Licence Service Areas (LSA), spectrum in the 1800 MHz band has not been assigned to some of the service providers in some of the districts. As given in Table 2.3 above, the total spectrum which would be available in all the service areas, after the cancellation of 122 UAS licences

issued in the year 2008, will be 624.6 MHz. However, this includes 105.6 MHz of spectrum which is partially available in some of the service areas. As the spectrum is now being given through auction, the question arises, whether the spectrum, which is available in part of the LSA, should be auctioned. The Authority has examined the issue and is of the view that spectrum, being a scare resource, should be utilised optimally. If the spectrum is available in majority of the districts in LSA including important cities and state capital(s), it should be allocated for commercial use. Therefore, the Authority is of the opinion that if the spectrum is available for allocation in at least 75% of the number of districts in a LSA including state capital(s), then that spectrum should be put to auction. However, the fact that this spectrum is presently available only in part of the LSA should be clearly informed to the bidders before the auction, along with the details of the districts where it is not available. While giving the details, the WPC should endeavour to furnish the likely time period when the spectrum can be made available in such districts. Whenever, the spectrum is vacated in those districts, the successful bidder will be assigned the same.

2.11. Accordingly, the amount of spectrum available for auction in the 1800 MHz band is as given in Table 2.4.

Table 2.4

Availability of spectrum in the 1800 MHz band without partial spectrum

S.No.	Circle	Spectrum presently available	Spectrum to be vacated due to cancellation of Licences including partial spectrum assignment	Total available spectrum including partial spectrum assignment	Spectrum either not available in state capital(s) or is available in less than 75% of districts of the LSA	Total Spectrum available including spectrum available in at least 75 % districts including state capital(s)
1	Delhi	11.6	4.4	16	0	16.0
2	Mumbai	5	13.2	18.2	0	18.2
3	Kolkata	23	17.6	40.6	0	40.6
4	Maharashtra	6	22.0	28	0	28.0
5	Gujarat	4.4	17.6	22	0	22.0
6	AP	15	22.0	37	0	37.0
7	Karnataka	11.8	22.0	33.8	0	33.8
8	Tamil Nadu	25.4	22.0	47.4	0	47.4
9	Kerala	28	17.6	45.6	0	45.6
10	Punjab	1.4	17.6	19	0	19.0
11	Haryana	4.4	22.0	26.4	0	26.4
12	UP - West	8.2	17.6	25.8	4.4	21.4*
13	UP - East	0	17.6	17.6	0	17.6
14	Rajasthan	3.2	17.6	20.8	17.6	3.2*
15	M.P.	18	17.6	35.6	0	35.6
16	West Bengal	4	17.6	21.6	0	21.6
17	H.P.	6.4	17.6	24	4.4	19.6*
18	Bihar	0	22.0	22	8.8	13.2*
19	Orissa	18	22.0	40	0	40.0
20	Assam	3.8	22.0	25.8	0	25.8
21	North East	7	22.0	29	0	29.0
22	J&K	6.4	22.0	28.4	13.2	15.2
	Total	211	413.6	624.6	48.4	576.2

* Spectrum not available in state capital.

2.12. **The Authority recommends that the spectrum which is available in at least 75% of total number of districts of the LSA including the State capital(s) should be considered for allocation through auction.**

1880-1990 MHz band

2.13. As per the National Frequency Allocation Plan (NFAP)-2011, (IND 57), requirements of micro cellular wireless access systems (fixed/mobile) based on TDD access techniques, especially indigenously developed technologies and low power digital cordless telephones systems and devices with maximum transmit power of 250 mW, capable of coexistence with multiple operators may be considered in the frequency band 1880-1900 MHz, subject to coordination on a case-by-case basis. As per the provisions in the UAS Licence, "In the event, a dedicated carrier for micro-cellular architecture based system is assigned in 1880 – 1900 MHz band, the spectrum not more than 3.75 + 3.75 MHz in respect of CDMA system or 4.4 + 4.4 MHz in respect of TDMA system shall be assigned to any new Unified Access Services Licensee.

2.14. As per the information available, this band is not in use for commercial purpose. This is also a part of US PCS band, but the paired frequencies (upper band) falls in the 2.1 GHz band. Efforts should be made to use this band using indigenous technologies.

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

2.15. This is one of the bands which have been identified for IMT applications. 3-4 blocks of 2x5 MHz of spectrum has already been auctioned in this band. Also, MTNL/BSNL was assigned one block of spectrum in this band. As per the information provided by WPC, at present there is no vacant spectrum available, but 5 MHz may be vacated by the defence. Service area wise information on spectrum availability is given in Table 2.5.

Table 2.5

Spectrum Availability in 2100 MHz band

S.No.	Circle	Total available spectrum (MHz)	Already Allotted Spectrum (MHz)	Net Spectrum available after vacation (MHz)
1	Delhi	20.0	20.0	5
2	Mumbai	20.0	20.0	5
3	Kolkata	20.0	20.0	5
4	Maharashtra	20.0	20.0	5
5	Gujarat	20.0	20.0	5
6	AP	20.0	20.0	5
7	Karnataka	20.0	20.0	5
8	Tamil Nadu	20.0	20.0	5
9	Kerala	20.0	20.0	5
10	Punjab	25.0	25.0	5
11	Haryana	20.0	20.0	5
12	UP - West	20.0	20.0	5
13	UP - East	20.0	20.0	5
14	Rajasthan	20.0	20.0	5
15	M.P.	20.0	20.0	5
16	West Bengal	25.0	25.0	5
17	H.P.	25.0	25.0	5
18	Bihar	25.0	25.0	5
19	Orissa	20.0	20.0	5
20	Assam	20.0	20.0	5
21	North East	20.0	20.0	5
22	J&K	25.0	25.0	5
	Total	**465.0**	**465.0**	**110**

2300 MHz band (2300-2400 MHz)

2.16. As per the Radio Regulation provisions, this band is among the IMT identified bands. In India too, this band has been allocated for IMT applications including BWA on a case by case basis. Out of the total 100 MHz spectrum, 40-60 MHz is available for commercial telecom

services whereas remaining spectrum is with the Govt. Agencies/ captive users. 40 MHz of spectrum has already been allocated for the commercial telecom service. The information is shown in Table 2.6.

Table 2.6

Spectrum Availability in the 2.3-2.4 GHz band

S.No.	Circle	Total available spectrum (MHz)	Already Allotted Spectrum (MHz)	Net Spectrum available (MHz)
1	Delhi	60	40	20
2	Mumbai	60	40	20
3	Kolkata	40	40	0
4	Maharashtra	60	40	20
5	Gujarat	60	40	20
6	AP	60	40	20
7	Karnataka	60	40	20
8	Tamil Nadu	40	40	0
9	Kerala	60	40	20
10	Punjab	40	40	0
11	Haryana	50	40	10
12	UP - West	40	40	0
13	UP - East	40	40	0
14	Rajasthan	40	40	0
15	M.P.	60	40	20
16	West Bengal	40	40	0
17	H.P.	60	40	20
18	Bihar	60	40	20
19	Orissa	60	40	20
20	Assam	60	40	20
21	North East	60	40	20
22	J&K	60	40	20
	Total	1170	880	290

2.17. The summary of spectrum availability for allocation for commercial telecommunication services in different service areas for various spectrum bands is given in Table 2.7.

Table 2.7

Spectrum Available (in MHz)

S.No.	Licence Service Area	700 MHz	800 MHz	900 MHz	1800 MHz	2100 MHz	2300 MHz
1	Delhi	30	3.75	0	18.4	0	20
2	Mumbai	30	3.75	0	20.6	0	20
3	Kolkata	30	5	0	40.6	0	0
4	Maharashtra	30	3.75	0	28	0	20
5	Gujarat	30	7.5	0	22	0	20
6	AP	30	2.5	0	37	0	20
7	Karnataka	30	6.25	0	33.8	0	20
8	Tamil Nadu	30	5	0	47.4	0	0
9	Kerala	30	5	0	45.6	0	20
10	Punjab	30	3.75	0	19	0	0
11	Haryana	30	6.25	0	26.4	0	10
12	UP - West	30	6.25	0	21.4*	0	0
13	UP - East	30	5	0	17.6	0	0
14	Rajasthan	30	0	0	3.2*	0	0
15	M.P.	30	6.25	0	35.6	0	20
16	West Bengal	30	7.5	0	21.6	0	0
17	H.P.	30	10	0	19.6*	0	20
18	Bihar	30	6.25	0	13.2*	0	20
19	Orissa	30	8.75	0	40	0	20
20	Assam	30	12.5	0	25.8	0	20
21	North East	30	12.5	0	29	0	20
22	J&K	30	10	0	15.2	0	20
	Total	**660**	**137.5**	**0**	**581**	**0**	**290**

B. Liberalisation of Spectrum

2.18. As discussed earlier, in India, for 2G mobile services, spectrum has been assigned in the 800/900/1800 MHz bands, depending upon whether licensee is deploying CDMA or GSM technology. Therefore, the spectrum assigned for 2G services is for a specific technology; it cannot be used for any other technology, until its use is liberalised. Liberalisation of spectrum refers to the removal of technology restrictions to give the licensee an option to deploy new technologies in the same. For example, UMTS or HSPA could be deployed in spectrum bands where traditionally GSM, CDMA or TDMA has been used.

2.19. Spectrum, being a scarce resource, is required to put to optimal use. New technologies use the spectrum more efficiently. Also harmonised use of spectrum is vital to ensure that consumers can make use of the wide range of affordable devices. When spectrum is harmonised, manufacturers can reach economies of scale and amortise costs across markets. ITU has already earmarked 800/900 and 1800 MHz bands for IMT services. Spectrum liberalisation would enable mobile operators to launch new services and technologies and increase competition. Spectrum liberalisation also offers a number of benefits including better rural and in-building coverage, faster roll-out of mobile broadband and more choice for consumers.

2.20. In many countries, the use of 900 and 1800 MHz bands has been liberalised. As was discussed earlier, 40 commercial UMTS900 networks have been launched in 29 countries and more than 700 devices are available in this band. Liberalisation of the 1800 MHz band in a number of countries has enhanced its importance vis-à-vis other bands. Commercial LTE services using 1800 MHz have been launched in Europe, Middle East, and APAC which includes Poland, Lithuania, Singapore, Germany, Latvia, Finland, Saudi Arabia, Australia, Denmark, Finland and Hong kong. These factors give rise to

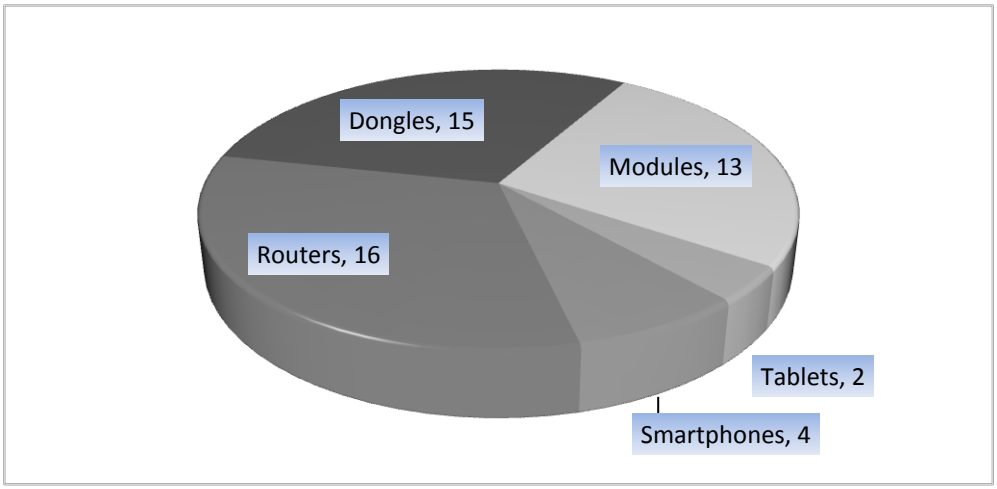
the strong possibilities that 1800 MHz will emerge as a prime band for LTE deployments in virtually all regions of the world, and will also be important for international roaming.

2.21. Due to the delay in the allotment of spectrum in the 700/800 MHz and 2.6 GHz bands, 1800 MHz band (3GPP Band 3) has emerged as a crucially important option for LTE network deployment. More than 350 operators are estimated to have been allocated 1800 MHz spectrum. In many markets, 1800 MHz represents the largest spectrum allocation. Providing widespread coverage with LTE in the 1800 MHz band is substantially cheaper than covering the same area with LTE using higher frequency bands.

2.22. There is an excellent choice of LTE1800 devices in the market today. An update to the 'Status of the LTE Ecosystem' report published by the GSA (Global mobile Suppliers Association) on January 2012[2], confirms 50 LTE1800 in the 1800 MHz band. The number of LTE1800 devices has tripled over the past 6 months. The form factor wise bifurcation of these devices has been shown in the chart below.

Chart 2.2

Form factor wise breakup of 50 devices which were available as on Jan 2012



2.23. In view of the deliberations above, clearly there is the need for liberalisation of the use of spectrum in various frequency bands.

[2] http://www.gsacom.com/news/gsa_345.php4

2.24. On the issue of liberalisation of spectrum before the auction, opinions of stakeholders were divided. While some of the incumbent GSM operators were of the view that spectrum is already liberalised, some of the other stakeholders argued that liberalisation is beyond the scope of SC Directive and Government's intended objectives and that the liberalised use of 800 MHz and 900/1800MHz at this stage will distort competition in the Indian mobile markets. Some of them suggested that keeping in view the timelines of the direction of Hon'ble Supreme Court, the liberalisation of spectrum should be taken up at a later stage

2.25. Stakeholders holding the view that the spectrum in the 800/900/1800 MHz bands is already liberalised argued that spectrum & licences are already technology neutral in India and this position was reinforced by DoT in the last 3G & BWA auction, wherein it had clearly mentioned that the auction is only for spectrum on which network of any technology can be deployed. Therefore as per their understanding, spectrum is already liberalized and its use is limited only by the technology supported in that band and any financial consideration decided by the Government.

2.26. One of such service providers also contended that the de facto liberalisation of 2G spectrum can be seen by the fact that the CDMA operators are already providing EVDO services in the spectrum allocated for 2G services. It was suggested that before liberalisation of spectrum in 800 MHz band, the CDMA/dual technology operators should be asked to pay for the use of 2G/CDMA spectrum for the purpose of establishing EVDO networks.

2.27. Another such operator was of the opinion that liberalisation, as is being postulated by TRAI and its linkage with re-farming would mean a change of use of existing GSM technology to futuristic

UMTS /LTE technology primarily for Wireless Broadband. It was further claimed by the operator that any attempt now to link the so called liberalisation of band with refarming of spectrum band would have disastrous impact on customers, operators, investors and overall growth of mobile sector in the country. On the need for liberalisation, the service provider was of the view that the GSM services in India will be phased out only after all high income and mid income countries have migrated out of GSM 2G technology and based on current trends, this is not expected before years 2025-2030 when the eco system of equipment, devices and applications has fully matured for UMTS/LTE, and has reached scale for becoming affordable to an average mass market Indian.

2.28. While supporting the liberalisation, one individual argued that the first question to be addressed is whether the Hon'ble Supreme Court order implies the use of only 2G technologies only. He was of the view that at no place there is a reference to technology and the order refer to only 2G spectrum that cover all bands viz. 1800 MHz, 900 MHz and 800 MHz bands. Therefore, in the opinion of the stakeholder, the regulator would be entirely within its rights to consider all issues associated with all these bands.

2.29. On the issue of liberalisation of spectrum, the argument of operators that the spectrum is already liberalized is incorrect. Clause 43.5 (i) & (ii) of UAS licence clearly restricts the use of spectrum in the 800/900/1800 bands to a prescribed channel plan.

"43.5.(i) For wireless operations in SUBSCRIBER access network, the frequencies shall be assigned by WPC wing of the Department of Telecom from the frequency bands earmarked in the applicable National Frequency Allocation Plan and in coordination with various users. Initially a cumulative maximum of upto 4.4 MHz + 4.4 MHz shall be allocated in the case of TDMA based systems @ 200 KHz per carrier or 30 KHz per carrier or a maximum of 2.5 MHz + 2.5 MHz shall be allocated in the case of CDMA based systems @

1.25 MHz per carrier, on case by case basis subject to availability. While efforts would be made to make available larger chunks to the extent feasible, the frequencies assigned may not be contiguous and may not be the same in all cases or within the whole Service Area. For making available appropriate frequency spectrum for roll out of services under the licence, the type(s) of Systems to be deployed are to be indicated."

"43.5(ii) ..... The spectrum shall be allocated in 824-844 MHz paired with 869 – 889 MHz, 890 – 915 MHz paired with 935 – 960 MHz, 1710 – 1785 MHz paired with 1805 – 1880 MHz."

2.30. On this issue, the Authority in its recommendations of May 2010 in Para 1.78 had also observed that -

"On the issue of restrictions on the usage of spectrum in the bands of 800, 900/1800 MHz for providing a specific service, it is true that the UAS license is service and technology neutral and the licensee can use any recognized technology. However, the spectrum given in the bands of 800, 900/1800 MHz are for using specific technology i.e. CDMA and TDMA (GSM) respectively. The Wireless Telegraphy License given for using spectrum in these bands also restricts the licensee to use particular technology i.e. either CDMA or GSM. As such, the Authority is of the opinion that the licensee is permitted to use the assigned spectrum only for deploying the specific technology as specified in the Wireless Telegraphy License."

2.31. As discussed above, the spectrum in the bands 700/800/900/1800 MHz is being increasingly used for IMT technologies like HSPA and LTE. The Authority in its May 2010 recommendations has estimated the future requirement of spectrum for voice and data services and has observed that the nature of Telecommunications is undergoing considerable change from provision of only voice communication to increasing provision of data as well as of applications. The next five years are going to see the spread of 3G as well as the introduction of 4G services enabling subscribers to benefit from data and application services. An increasing availability of smartphones with significant processing capacity and a wide array of applications is resulting in higher requirements of spectrum. It is estimated that the total requirement of spectrum in the next five years would be of

the order of 500 to 800 MHz including 275MHz for voice services alone. On the other hand, the availability of spectrum is only to the tune of about 287 to 450 MHz.

2.32. On the issue of refarming/liberalisation, the Authority opined that spectrum being limited in availability, the main aim of the frequency management administrator is to ensure allocative efficiency i.e. the spectrum must be allocated in such a way as to maximize the creation of community wealth, resulting from its use. This general objective provides the foundation for the procedures for assignment of frequencies and for spectrum refarming.

2.33. As has been discussed above, many countries have already liberalised the use of spectrum in 800, 900 and 1800 MHz bands. In our country, while the licences are technology neutral, due to legacy issues, the use of 800, 900 and1800 MHz bands has been restricted to CDMA and GSM technologies only. It is for the first time that the spectrum is being delinked from the licence and is being separately being allocated through the auction process. Technology is evolving constantly and the pace of technological progress is such that artificial restrictions may not prove effective in the long run. Restrictions would also mean sub-optimal utilisation of available spectrum leading to lower productivity and higher costs to the society. The Hon'ble Supreme Court has also observed that spectrum is a scarce resource which is susceptible to degradation in case of inefficient utilisation. It must be noted that the effect of any stipulation restricting the use of spectrum to specific technologies will be felt for 20 years, which is the life span of the spectrum allocation being made through the proposed auction. And any attempt at a later stage to modify or relax such restrictions will be fraught with the risk of complications since the price obtained presently even through auction would be a function of the permitted use of the spectrum. Price adjustment at a future date through administrative mechanisms, however well intentioned

and however meticulously carried out is bound to face challenges. Considering that spectrum in the 800, 900 and 1800 MHz bands are being put to diverse use offering many an attractive service to the subscribers, the Authority is of the view that, like 3G and BWA spectrum, the spectrum now to be allocated through auction, should not suffer any restriction regarding use of technology or channel spacing etc. Holders of spectrum obtained through the auction process should be able to use the spectrum for deploying any services in any technology.

2.34. **The Authority recommends that all spectrum to be assigned through the auction process in future shall be liberalised. In other words, spectrum in any band can be used for deploying any services in any technology.**

C. Refarming of Spectrum in the 800 and 900 MHz Bands

1. Evolution in India

2.35. Before finalising the details of allocation of spectrum in the 1800 MHz band through auction, it is necessary to assess the amount of spectrum in this band for the purpose of refarming of spectrum in the 800 and 900 MHz bands. It may be recalled that this Authority had, in its recommendations on 'Licensing framework and Spectrum Management' issued in May 2010, pointed out that spectrum in 800 and 900 MHz bands was technically and economically far more efficient and that UMTS 900 networks had recently been launched in several countries. It accordingly recommended, in Para 1.73 of the recommendations, that Spectrum in 800 and 900 MHz bands should be refarmed and that substitute spectrum should only be assigned in 1800 MHz band for holders of spectrum in 900 MHz band, and spectrum in 450 /1900 MHz bands should be assigned for licence holders of 800 MHz band. It was also indicated, in Para 1.74 of the May 2010 recommendations, that the Authority will carry out a separate consultation process on the issues involved in the refarming

of 800/900 MHz spectrum and shall endeavour to give its recommendations before the licences come up for renewal. Accordingly, the present consultation paper involves spectrum refarming.

2.36. Refarming of spectrum involves re-planning and reassigning of spectrum over a period of time for services with higher value. A key motive for refarming of spectrum is to use the refarmed frequency bands for communications services that yield greater economic or social benefit than existing use as well as to enable the introduction of new or emerging technologies.

2.37. The case for refarming is supported both in the judgment dated 02.02.2012 of the Hon'ble Supreme Court as well as Press Statement of DoT. In its judgement dated 02.02.2012, the Hon'ble Supreme Court had also observed that a natural resource's value rests in the amount of the material available and the demand for it. The latter is determined by its usefulness to production. It also observed that spectrum has a high economic value in the light of the demand for it on account of the tremendous growth in the telecom sector. The Court also pointed out that Spectrum has been internationally accepted as a scarce, finite and renewable natural resource which is susceptible to degradation in case of inefficient utilisation.

2.38. The Press Statement dated 29th January 2011 of the Department of Telecommunications recognises that it is now possible for the telecom services to play a significant role in the realization of key development goals and that these technological advancements be used for ushering in a truly inclusive society. It points out that the radio spectrum is a valuable and finite national resource which plays an increasingly important role in delivering communications services to the consumer. The Press Statement also states that new and improved wireless and mobile services are constantly being developed and availability of radio spectrum to promote such innovation for the benefit of the users,

operators and the country is becoming increasingly important. The Press Statement of 15th February 2012 states that the need for refarming of spectrum is accepted in principle and that further steps in this regard will be taken after receipt of this Authority's recommendations. Accordingly, stakeholders were asked to respond to various issues raised in the consultation paper regarding refarming of spectrum in the 800 and 900 MHz bands.

2.39. In India, for 2G mobile services, spectrum has been assigned in the 900 MHz band, for GSM technology. In its recommendations of May 2010, this Authority had noted, in Para 1.78 thereof, that "the spectrum given in the bands of 800, 900/1800 MHz are for using specific technology i.e. CDMA and TDMA (GSM) respectively. The Wireless Telegraphy License given for using spectrum in these bands also restricts the licensee to use a particular technology i.e. either CDMA or GSM. As such, the Authority is of the view that the licensee is permitted to use the assigned spectrum only for deploying the specific technology as specified in the Wireless Telegraphy License." While the licenses themselves are technology neutral, the spectrum in the 900 MHz band for GSM technology cannot be used for any other technology, until its use is liberalised.

2.40. In India, initially, from 1994 to 2000, spectrum in 900 MHz band was allotted to licensees for providing GSM service. In the year 1994/95, the first two CMTS licences were granted in Metros, through Beauty contest and in Circles through a single stage bidding process. In all, 42 licences were issued. The licence fee for Metros and Circles to be paid over a period of ten years was as shown in Tables 2.8 and 2.9 below.

Table 2.8

CMTS Licence Fee (For Metros)

(Rs. in Crore)

Service area	1st year	2nd year	3rd year	4th to 6th year (each year)	7th year onwards (each year)	Total of 10 years
Bombay	3	6	12	18	24	171
Delhi	2	4	8	12	16	114
Calcutta	1.5	3	6	9	12	85.5
Madras	1	2	4	6	8	57

4th year onwards @ Rs. 5 Lakh per 100 subscribers or part thereof; subject to the minimum shown in table above.

Table 2.9

CMTS Licence Fee (For Circles)

(Rs. in Crore)

Service Area	Licence Fee to be paid during 10 years	Service Area	Licence Fee to be paid during 10 years
AP	1001.00	MH	1657.70
Assam	1.32	NE	1.90
Bihar	136.53	Orissa	89.22
Gujarat	1794.10	Punjab	1266.00
Haryana	240.00	Rajasthan	382.00
HP	14.96	TN	836.00
Karnataka	1393.00	UP (East)	210.89
Kerala	517.00	UP (West)	406.21
MP	51.00	West Bengal	42.00

2.41. Subsequently, the New Telecom Policy announced in 1999 allowed the licensees to migrate from a fixed licence fee regime to a revenue share regime. The Government exercised its right to enter as the third mobile operator and granted MTNL a licence in 1997 for Delhi and Mumbai service areas. BSNL was licensed as third cellular mobile operator in rest of the country (except Delhi and Mumbai) in the year

2000. A fourth cellular mobile service provider was introduced in 2001 through a multi stage bidding process.

2.42. The first three licences were given spectrum in the 900 MHz band. Subsequently from the year 2001, when spectrum in 900 MHz band was not available in most of the service areas, spectrum in 1800 MHz was allotted to the new licensees. Presently, only 3 licensees have spectrum in 900 MHz band in most of the licence service areas, except in West Bengal, Assam and North East, where 4 licensees have been allotted spectrum in 900 MHz band.

2.43. Table 2.10 gives the amount of spectrum in the 900 MHz band available with various service providers and the amount of entry fee paid by them. The two PSUs i.e. MTNL/BSNL were given the CMTS licence without payment of any entry fee.

Table 2.10

Spectrum Allotment in 900 MHz

Entry Fee - Rs. In Crores

Service Area	Bharti		Vodafone		MTNL/BSNL		RTL		Loop		Aircel		Idea/Spice	
	Entry Fee Paid	Spectrum Allotted in 900 MHz	Entry Fee Paid	Spectrum Allotted in 900 MHz	Entry Fee Paid	Spectrum Allotted in 900 MHz	Entry Fee Paid	Spectrum Allotted in 900 MHz	Entry Fee Paid	Spectrum Allotted in 900 MHz	Entry Fee Paid	Spectrum Allotted in 900 MHz	Entry Fee Paid	Spectrum Allotted in 900 MHz
Delhi	98.15	8.0	70.94	8.0	Nil	6.2								
Mumbai			83.33	8.0	Nil	6.2			88.96	8.0				
Chennai	20.95	6.2			Nil	6.2					21.59	6.2		
Kolkata	31.5	6.2	25.8	7.8	Nil	6.2								
MH			470.1	6.2	Nil	6.2							473.03	7.8
Gujarat			508.78	7.8	Nil	6.2							511.95	6.2
AP	285.64	7.8			Nil	6.2							283.87	6.2
KTK	375.7	7.8			Nil	6.2							395.04	6.2
TN			238.56	6.2	Nil	6.2					44.35	7.8		
Kerala			147.53	6.2	Nil	6.2							147.53	6.2
Punjab	488.49	7.8			Nil	6.2							359.02	7.8
Haryana			68.49	6.2	Nil	6.2							68.49	6.2
UP-W					Nil	6.2							115.92	6.2
UP-E			138.25	6.2	Nil	6.2								
Rajasthan	108.34	6.2	108.99	6.2	Nil	6.2								
MP					Nil	6.2	14.56	6.2					14.56	6.2
WB	1	4.4			Nil	6.2	12.24	4.4						
HP	4.27	6.2			Nil	6.2	4.27	6.2						
Bihar					Nil	6.2	89.5	6.2						
Orissa	5	6.2			Nil	6.2	58.49	6.2						
Assam					Nil	6.2	0.38	6.2						
North East	1.21	4.4			Nil	6.2	1.21	4.4						
J&K	2	6.2			Nil	8.0								

Source: TRAI's recommendations on 'Unified Licensing Regime', 27th October 2003

2.44. From **Annexure –III,** it can be seen that four service providers have about 85% of the spectrum in the 900 MHz band. By virtue of this, the service providers having a lower frequency band allocation enjoy considerable superiority over other service providers, raising issues of fair competition in the market place and underlining the need for and significance of refarming of the spectrum.

2.45. Regarding spectrum in 800 MHz band, initially it was allocated to the basic service operators for providing limited mobility services. However, in the year 2003, after coming into force of the Unified Access Service Regime, the basic operators except MTNL/BSNL

migrated to the new regime and started providing fully mobile services using CDMA technology in the 800 MHz band.

2.46. Operating the mobile systems in lower frequency bands has distinct advantages as shown in Table 2.11. Thus those who operate in lower frequency bands, have significant savings in capex and opex.

Table 2.11

Coverage comparison of IMT-2000 systems at various frequency ranges

Frequency (MHz)	*Cell radius (km)*	*Cell area (km2)*	*Relative Cell Count*
450	*48.9*	*7521*	*1*
850	*29.4*	*2712*	*2.8*
950	*26.9*	*2269*	*3.3*
1800	*14.0*	*618*	*12.2*
1900	*13.3*	*553*	*13.6*
2500	*10.0*	*312*	*24.1*

*Source: Qualcomm ITU 8/F Submission, June 11, 2001, "**COVERAGE COMPARISON OF IMT-2000 SYSTEMS AT VARIOUS FREQUENCY RANGES, INCLUDING 450 MHZ"*

2.47. The Authority, in its recommendations of May 2010, had also drawn attention to the greater efficiency of the 900 MHz band vis-a-vis the 1800 and 2100 MHz bands, as can be seen from the Tables 2.12 and 2.13 below[3]:

Table 2.12

Impact of Frequency on base station densities

Base stations per km²	**UMTS 900**	**UMTS 1800**	**UMTS 2100**
Suburban	0.017	0.027	0.037
Remote/rural	0.008	0.013	0.018

[3] http://www.analysysmason.com/PageFiles/14182/GSM_refarming.pdf

Table 2.13

Percentage increase in coverage area[4]

Frequency	Percentage increase in coverage area per Node-B (km^2)			
	Dense Urban	**Urban**	**Suburban**	**Rural**
900MHz vs. 2100MHz	87%	44%	60%	119%

2.48. Spectrum in the 800 MHz band enjoys similar advantages. In addition, by virtue of the carrier specification being 1.25 MHz, service providers holding 800 MHz spectrum are able to operate the EVDO services.

2. International Experience

a. Eco System in 800/900 MHz Bands

2.49. With improved telecommunication technology, the utility of the spectrum in the 2G bands has undergone a major change. ITU has since assigned the spectrum in the 800,900 and 1800 MHz bands for IMT applications. In line with global harmonization and accordingly, for reaping the benefits of the economies of scale, these bands needs to be liberalised, so as to be used for newer and more advanced technologies like UMTS/LTE etc.

2.50. UMTS in 800 and 900 MHz bands has already been deployed in many countries, whereas LTE has been deployed in the 700/1800 MHz bands. Extensive eco system has been developed in these bands. Some of the devices available with ease include excellent UMTS900 compatible devices, several phones in different form factors, USB dongles, and LTE devices in 1800 MHz band with number of devices multiplying over a short period. In addition, in India, it is desirable to use 700/800/900/1800 MHz bands for IMT technologies for proliferation of devices in rural areas at a low cost.

[4] http://www.gsmworld.com/documents/umts900_exec_sum.pdf

2.51. GSA in its latest report on ""Evolution to LTE" (January 13, 2012) confirmed that 301 operators in 95 countries are investing in LTE. This figure comprises 242 operator commitments in 81 countries and 59 additional on-going pre-commitment trials in 14 more countries. 57 commercial LTE networks in 32 countries were launched by that date. GSA forecasts that 128 networks will be in commercial service by end 2012. The eco-system of LTE-capable user devices has rapidly established to meet current and anticipated needs of operators and customers.

2.52. Different technologies deployed in various spectrum bands have been indicated in the Table 2.14

Table 2.14

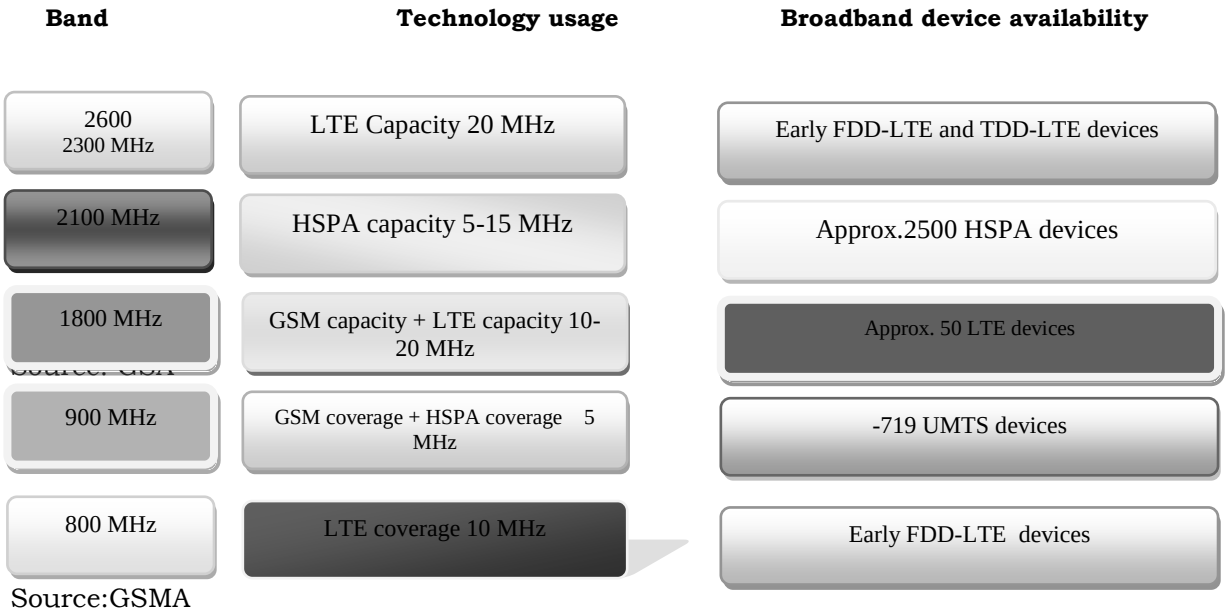
Region\Technology	**LTE**	**UMTS**	**GSM**
Europe	800/900/1800/ 2100/2600	900/2100	900/1800
North America	700/2100/AWS	850/1900	850/1900
Latin America	900/1800/AWS /2100	850/900/1900 /2100	850/900/1800 /1900
Asia Pacific	1800/2300/2600	850/900/2100	900/1800
Africa and Middle East	900/1800/2100	900/2100	900/1800

Source:LTE1800 Terminal Paper by Huawei

2.23. Eco system present in various bands is discussed below.

Chart 2.3

Device ecosystems per frequency band – case EMEA /APAC



Source:GSMA

2.53. Various countries have adopted different approaches while liberalising the use of spectrum, the use of which was, hitherto, restricted to using GSM technologies. Some countries have amended technology specific existing licences to allow deployment of new technology. e.g. France and Finland amended the technology specification of the 900 licenses for their three existing licensees to allow them to use the 900 band for both GSM and UMTS/HSPA. Some countries have completely abolished technology/service restrictions to make existing licences technology/service neutral, e.g. in Sweden, a combined renewal and refarming process was implemented by PTS and allowed new licensees to choose technology.

2.54. While in some countries e.g. in UK, the spectrum in 900/1800 MHz bands have been liberalised in the hands of incumbent operators, regulators in some countries felt that liberalising the use of spectrum in 900/1800 MHz bands in the hands of incumbents may give rise to serious competitive issues, as it may give undue benefits to the operators having access to these bands as compared to those who don't have. To address this issue, these regulators have first refarmed

the spectrum and redistributed it to give equal opportunities to all operators.

2.55. The eco system of 800 and 900 MHz band alongwith different ways adopted by different countries for refarming/liberalisation of 900/1800 MHz bands with varying impact on incumbent operators is summarized in the **Annexure IV**.

2.56. In view of the prospects, implications as well as international experience, there is a strong need for urgently refarming of spectrum in 800 and 900MHz bands. This refarming will lead to better utilisation of spectrum resources, enhance economic yields and deliver better services to public.

2 Methodology for Refarming

a. Consultation Paper – Issues relating to options and their implications

2.57. Having dealt with the issue of the rationale for refarming, the next issue to be considered is the methodology for refarming. In so far as spectrum in the 900 MHz band is concerned, three different options to refarming were discussed in the consultation paper.

2.58. Under the **first option**, the 900 MHz spectrum available with the licensees whose licence are expiring during 2014-16, is refarmed at the time of renewal of licence and in its place, spectrum in the 1800 MHz be given to them. In the **second Option,** the existing licensees, whose licences are expiring during 2014-16, are allowed to retain 5 MHz of spectrum in 900 MHz band at the time of renewal of their licences and the rest of the spectrum in 900 MHz band is refarmed by assigning spectrum in 1800 MHz in lieu of the refarmed spectrum. However, the licensees will have to pay the price of spectrum both in the 900 and 1800 MHz bands as determined in the auction. Under the **third Option, a**ll the licensees holding spectrum in 900 MHz, irrespective of the expiry dates of their licences are given an option to surrender spectrum in excess of 5 MHz in the 900 MHz band in lieu of

equal amount of spectrum in 1800 MHz allocated to them and allowing them liberalisation of spectrum held by them.

b. Stakeholders' comments

2.59. In the consultation paper, stakeholders were requested to comment on which of the options given in the consultation paper should be adopted for refarming of spectrum in 800/900 MHz band and what issues, in their opinion, may arise in the above refarming process. In response, service providers whose licences have been ordered to be quashed expressed that refarming of spectrum is a separate issue and should not be linked to the Supreme Court's judgment, to ensure that there is no delay in the process of auction. These stakeholders suggested that such issues should be deferred for the time being and should be discussed in a separate consultation process. Some of these operators also expressed apprehension that the amount of spectrum in 1800 MHz band which stands vacated from cancellation of licenses by Hon'ble Supreme Court would be considered for the process of re-farming of 900 MHz band and that this would reduce the spectrum available for fresh auction of licenses.

2.60. Operators having spectrum in the 900 MHz band were of the view that refarming is a separate issue and should not be linked with the order of the Hon'ble supreme court. They suggested that a separate consultation process may be carried out on this issue. One of these stakeholders, while strongly opposing the idea of refarming and reassignment of these bands for IMT application, submitted that even after the launch of 3G services across the world for several years and in India for more than a year, less than 5% of the total handsets/CPEs are compatible with 3G network and LTE services are yet to be launched. Therefore, in its opinion, bulk migration of millions of existing 2G customers, which are being served from the network using 900MHz spectrum, to a 3G/LTE or any other alternate technology network is not possible in near future. The stakeholder claimed that withdrawal of 900MHz will severely and immediately affect the growth

and penetration of services in semi-urban, rural and remote areas where 900MHz plays a crucial role in providing coverage and service as the existing service provider will be deprived of the spectrum used to serve the rural consumers whilst the new operator will have no network /presence and will take years to build up to the level of investments and presence of an existing 900MHz operator.

2.61. These operators also stated that designing of network is done on the basis of the spectrum allocated and the availability of sites in any service area and change to an alternate frequency, from 900MHz band to 1800MHz band, entails substantial changes which will not only disturb the service to a great disadvantage of the public at large but will also require a considerable period of time to stabilize the network configuration for a good quality service. In their opinion, there will be unnecessary/wasteful capital expenditure as a costly duplicate network will have to be rolled out by both the licensee gaining the re-distributed 900MHz spectrum and the licensee losing the 900MHz spectrum, which will then have to set up an infrastructure/build coverage using an alternate spectrum. They also contended that option-2 and 3 proposed in consultation paper will reduce existing spectrum quantity which will force sub optimal splitting of the 900 MHz spectrum resulting into spectral inefficiency and steep drop in quality of service.

2.62. On the other hand, other service providers were of the view that 900 MHz should be re-farmed immediately as sufficient spectrum is available in 1800 MHz to relocate existing operators. These stakeholders suggested that only first option of refarming should be adopted as second and third option will distort competition in the Indian mobile markets as it will benefit only existing holders of 900 MHz spectrum band. They further stated that the imbalance likely to be caused by spectrum re-farming in the proposed second and third option will lead to a highly skewed factor in the mobile operator market and not ensuring the equitable access to the spectrum for use

of advanced UMTS/LTE services would lead to a non-level playing field. One of these operators commented that no operator needs more than 2.2 MHz spectrum in 900 MHz for coverage and the remaining spectrum in 900 MHz is being used for the purpose of capacity. It suggested that the capacity requirement upto 6.2 MHz can be met using 1800 MHz spectrum band and the spectrum requirement beyond 2.2 MHz of the existing 900 MHz operators can be met from 1800MHz spectrum band without hurting any operator and without any sacrifice to QoS/capacity and coverage requirements.

2.63. On the refarming of 800 MHz spectrum, these operators were of the opinion that withdrawal of 800 MHz spectrum can be considered only when alternate spectrum is available for relocation of CDMA subscriber base. These stakeholders suggested that at present, re-farming of 800 MHz spectrum is not an appropriate decision as sufficient spectrum in 2G band is to be made available in 22 Service Areas for existing operators as well as new operators so that they have scalable operations and are able to effectively compete in the market.

2.64. Another issue raised in the consultation paper was whether the refarming in 800/900 MHz bands should be dealt independently or whether a comprehensive approach should be adopted linking it with the availability and auctioning of 700 MHz band. On this issue too, service providers whose licences are ordered to be quashed were mostly of the view that 700 MHz band should be independently auctioned subsequent to auctioning of 2G spectrum in 22 service areas and that the spectrum in 800 MHz and 900 MHz bands may be refarmed at the time of expiry of the duration of the license.

2.65. Operators with 900 MHz holding were view that the eco system of 700 MHz band is different from that of 800/ 900 MHz band and the same should not be linked. They were of the view that spectrum in the 900 MHz band is being used for existing 2G customers and it may take a very long time for an operator to change the network from 2G to IMT-

Advanced, as such migration of network from 2G to LTE/IMT-A is largely dependent on the choices exercised by the voice/GSM customers to switch over to the new LTE/IMT-A network. Therefore, it was argued that the operators planning to convert their 2G spectrum/networks to LTE/IMT-A network will have to face considerable delays and will be put to a competitive disadvantage compared to operators with 700MHz spectrum who can start the provision of IMT-A services upon allocation of spectrum without any delay. In their view, the 700 MHz band is useful for the provision of IMT-A services, to provide mobile broadband services and any linkage of the auctioning of 700 MHz spectrum with a refarming of 900 MHz spectrum will put existing operators in a disadvantageous position and will also deprive more than 800 million customers being served by these operators from the benefit of digital dividend spectrum.

2.66. One stakeholder opined that the refarming of spectrum in 800/900MHz bands should commence at the earliest. It was of the opinion that after the spectrum in 800/900MHz is refarmed and the band plans of 700/800/900 MHz are decided through public consultation, the spectrum in 700, 800, and 900MHz may be put to auction simultaneously with mutually exclusive clause on spectrum holding i.e. a single player will be allowed to hold spectrum in only one of the three sub-1GHz spectrum bands to ensure fair and equitable competition in these highly precious bands.

c. Analysis of stakeholders' comments

2.67. In their response, some of the service providers have suggested that refarming of spectrum should be discussed in a separate consultation process and should not be linked to the judgment of the Hon'ble Supreme Court. As discussed above, the Authority in its May 2010 recommendations had recommended that spectrum in the 800/900 MHz band should be refarmed at the time of renewal of the licences of operators holding spectrum in these bands and that they should be

allocated substitute spectrum in lieu of the refarmed spectrum in 1800/1900 MHz bands. The Hon'ble Supreme Court in its order has directed TRAI to give its recommendations on auction of spectrum in the 2G bands. The 2G bands refer to spectrum in the bands of 800/900/1800 MHz, therefore, before making its recommendations on auction of spectrum in 1800 MHz band, it is necessary to ascertain the availability of the spectrum in these bands. Moreover, the first two licences given for cellular services are due for renewal in the year 2014/2015. Therefore, for refarming of 900 MHz spectrum available with these licensees, provision has to be made from the available spectrum in the 1800 MHz band before putting it to auction as per the judgement. Therefore, it is necessary that the issue of refarming is discussed before recommending the auction process. Some of the stakeholders suggested that withdrawal of 800MHz spectrum can be considered only when alternate spectrum is available of CDMA subscriber base.

2.68. The Authority therefore reiterates its earlier recommendation that DoT should complete the interference studies at an early date and allocate spectrum in the 1900 MHz band for refarming of 800 MHz band.

2.69. On the issue of the need for adopting a comprehensive approach for refarming the 800/900 MHz bands and auctioning the 700 MHz band, some of the stakeholders commented that the issue of 700MHz spectrum be dealt separately as the eco system of 700MHz band is different from that of 800/900MHz band and the same should not be linked. The Authority is of the view that auction of spectrum in the 700MHz band spectrum may be carried out at a later date preferably in 2014. (see para 2.115)

2.70. Licences for mobile services (CMTS/UAS) were issued at different point of times, starting from the year 1994, when the CMTS licences were given for the first time. Year wise expiry of the number of licences

having spectrum in 800 MHz and 900 MHz bands are shown in the Table 2.15 below:

Table 2.15

Year	2014	2015	2016	2017	2018	2020	2021	2024
800 MHz	0	2	0	7	1	20	22	13
900 MHz	7	25	4	2	1	20	1	11

2.71. Different licences are expiring in different years; therefore, the pertinent issue is the time of refarming i.e. when the refarming should be done or when the process of refarming is initiated. The amount of spectrum in the 800 and 900 MHz bands, year-wise, which could be available for refarming on expiry of present licences having spectrum in these bands is as per Table 2.16 and Table 2.17 below. As can be seen, 900 MHz spectrum was mostly assigned to the licenses issued between 1994 and 1996 and later in the years 1997 and 2000 for MTNL and BSNL respectively.. Accordingly, the licenses that are due to expire between the years 2014 and 2016, along with the licenses of BSNL and MTNL account for 84% of the total 900 MHz spectrum as can be seen from the Table 2.16 below.

Table-2.16

900 MHz

LSA	2014	2015	2016	2017	2018	2020	2021	2024
Delhi	16			6.2				
Mumbai	16			6.2				
Chennai	6.2							
Kolkata	14					6.2		
Maharashtra		14				6.2		
Gujarat		14				6.2		
AP		14				6.2		
Karnataka			14			6.2		
TN (Exc. Chennai)		6.2			7.8			

TN (inc.Chennai)						6.2	6.2	
Kerala		12.4				6.2		
Punjab		7.8	7.8			6.2		
Haryana		12.4				6.2		
UP (West)		6.2				6.2		6.2
UP (East)		6.2				6.2		6.2
Rajasthan		6.2	6.2			6.2		
M.P.		12.4				6.2		
West Bengal		4.4				6.2		8.8
H.P.		12.4				6.2		
Bihar		6.2				6.2		6.2
Orissa		6.2				6.2		6.2
Assam		6.2				6.2		6.2
North East		8.8				6.2		4.4
Jammu & Kashmir						8		10.6
Grand Total	**52.2**	**156**	**28**	**12.4**	**7.8**	**125.8**	**6.2**	**54.8**

Table-2.17

800 MHz

LSA	**2015**	**2017**	**2018**	**2020**	**2021**	**2024**
Delhi		3.75			10	
Mumbai		7.5			5	
Kolkata				2.5	5	3.75
Maharashtra		5		2.5	5	
Gujarat		3.75		2.5	3.75	
AP		5		3.75	5	
Karnataka				2.5	8.75	
Tamil Nadu inc. Chennai				2.5	8.75	
Kerala				3.75	5	3.75
Punjab		2.5		2.5	3.75	3.75
Haryana				2.5	3.75	5
UP-West				2.5	5	3.75
UP-East				2.5	5	3.75
Rajasthan			5	2.5	3.75	3.75

M.P.				2.5	5	2.5
West Bengal				2.5	3.75	2.5
H.P.				2.5	2.5	2.5
Bihar				2.5	5	3.75
Orissa				2.5	3.75	2.5
Assam	2.5			2.5		
North East	2.5			2.5		
J&K				2.5		2.5
Total	**5**	**27.5**	**5**	**52.5**	**97.5**	**43.75**

2.72. As indicated above, three different options of refarming were discussed in the consultation paper. In the first option, the entire spectrum holding of the incumbents in the 900 MHz band was proposed to be substituted by an equal amount of spectrum in 1800 MHz band. This is the same approach which was recommended by this Authority in May 2010. If this approach is chosen, then the spectrum required for refarming and the balance amount of spectrum that will be available is given in Table 2.18. A drawback in this approach is that there will not be enough spectrum left for auction in the 1800 MHz band in some of the service areas. Secondly, this approach covers only those licensees whose licences are expiring during 2014-16. It does not cover rest of the licensees having spectrum in 900 MHz band.

Table 2.18

Option I of Refarming

S.No.	Circle	Available spectrum in 1800 MHz band	Spectrum required for refarming	Balance Available
1	Delhi	16.0	16	0
2	Mumbai	18.2	16	2.2
3	Kolkata	40.6	12.2	28.4
4	Maharashtra	28.0	12.2	15.8
5	Gujarat	22.0	12.2	9.8
6	AP	37.0	12	25
7	Karnataka	33.8	12	21.8

8	Tamil Nadu	47.4	6.2	41.2
9	Kerala	45.6	12.4	33.2
10	Punjab	19.0	15.6	3.4
11	Haryana	26.4	12.4	14
12	UP – West	21.4	6.2	15.2
13	UP – East	17.6	6	11.6
14	Rajasthan	3.2	12.2	-9
15	M.P.	35.6	12.4	23.2
16	West Bengal	21.6	4.4	17.2
17	H.P.	19.6	12.4	7.2
18	Bihar	13.2	6.2	7
19	Orissa	40.0	6.2	33.8
20	Assam	25.8	6.2	19.6
21	North East	29.0	8.8	20.2
22	J&K	15.2	0	15.2
	Total	**576.2**	**220.2**	**356**

2.73. In the second option, it was proposed that such licensees can be allowed to retain 5 MHz of spectrum in 900 MHz band at the time of renewal of their licences and the rest of the spectrum in 900 MHz band is refarmed by assigning spectrum in 1800 MHz in lieu of the refarmed spectrum. However, the licensees will have to pay the price of spectrum both in the 900 and 1800 MHz as determined in the auction. In this option, after refarming, there will be sufficient spectrum left over in most of the service areas for allocating to the new licensees, as can be seen from Table 2.19.

Table 2.19

Option II of Refarming

S.No.	Circle	Available spectrum in 1800 MHz band	Spectrum required for refarming	Balance Available in 1800 MHz
1	Delhi	16.0	6	10
2	Mumbai	18.2	6	12.2
3	Kolkata	40.6	2.2	38.4
4	Maharashtra	28.0	2.2	25.8
5	Gujarat	22.0	2.2	19.8
6	AP	37.0	2	35
7	Karnataka	33.8	2	31.8
8	Tamil Nadu	47.4	NA	NA
9	Kerala	45.6	2.4	43.2
10	Punjab	19.0	5.6	13.4
11	Haryana	26.4	2.4	24
12	UP – West	21.4	1.2	20.2
13	UP – East	17.6	1	16.6
14	Rajasthan	3.2	2.2	1
15	M.P.	35.6	2.4	33.2
16	West Bengal	21.6	0	21.6
17	H.P.	19.6	2.4	17.2
18	Bihar	13.2	1.2	12
19	Orissa	40.0	1.2	38.8
20	Assam	25.8	1.2	24.6
21	North East	29.0	0	29
22	J&K	15.2	0	15.2
	Total	**576.2**	**45.8**	**483**

2.74. However, this approach also covers only those licenses that would be expiring during 2014-16. It does not cover rest of the licensees having spectrum in 900 MHz band. More importantly, as observed by several service providers in their response to the consultation paper, this approach will distort competition in the Indian mobile markets as it

will benefit only existing holders of 900 MHz spectrum band. This would still leave the existing 900 MHz spectrum holders to retain most of their 900 MHz spectrum. According to some stakeholders, the imbalance likely to be caused by spectrum re-farming in the proposed second and third option will lead to a highly skewed factor in the mobile operator market and not ensuring the equitable access to the spectrum for use of advanced UMTS/LTE services would lead to a non-level playing field.

2.75. In the third option, all the licensees holding spectrum in 900 MHz, irrespective of the expiry dates of their licences, are given an option to surrender spectrum in excess of 5 MHz allocated to them in the 900 MHz band in lieu of equal amount of spectrum in 1800 MHz. The incumbents in the 900 MHz are re-assigned 2x5MHz of contiguous spectrum and in lieu of the remaining assignment, same amount of spectrum shall be assigned to them in the 1800 MHz band, subject to the prescribed limit. In this option also, after refarming, there will be sufficient spectrum left over in most of the service areas for allocating to the new licensees and all the licensees having spectrum in 900 MHz band will be covered, as can be seen from Table 2.20. However, this option also suffers from the same inequity, as discussed above i.e. lack of level playing field between the licensees who are allowed to keep 5 MHz of spectrum in 900 MHz band and licensees who will have to participate in the auction to get the spectrum in this band.

Table 2.20

Option III of Refarming

S.No.	Circle	Available spectrum in 1800 MHz band	Spectrum required for refarming	Balance Available in 1800 MHz
1	Delhi	16	7.2	8.8
2	Mumbai	18.2	7.2	11
3	Kolkata	40.6	3.4	37.2
4	Maharashtra	28.0	3.4	24.6
5	Gujarat	22.0	3.4	18.6
6	AP	37.0	3.2	33.8
7	Karnataka	33.8	3.2	30.6
8	Tamil Nadu	47.4	NA	NA
9	Kerala	45.6	3.6	42
10	Punjab	19.0	6.8	12.2
11	Haryana	26.4	3.6	22.8
12	UP – West	21.4	3.6	17.8
13	UP – East	17.6	3.4	14.2
14	Rajasthan	3.2	3.4	-0.2
15	M.P.	35.6	3.6	32
16	West Bengal	21.6	1.2	20.4
17	H.P.	19.6	3.6	16
18	Bihar	13.2	3.6	9.6
19	Orissa	40.0	3.6	36.4
20	Assam	25.8	2.4	23.4
21	North East	29.0	1.2	27.8
22	J&K	15.2	4.2	11
	Total	**576.2**	**78.8**	**450**

2.76. As discussed above, Options II and III, suffer the drawback that in both these options, incumbent operators having spectrum in 900 MHz band are allowed to retain 2x5 MHz of spectrum in the 900 MHz band- a substantial amount in view of the very limited availability of

spectrum in this band. Moreover, in these two options, only one block of 5 MHz of spectrum will be released for auction among rest of the operators. In fact, in quite a few cases only 3.6 MHz of spectrum will be released. As such, auction of this spectrum may not realise the full value of the 900 MHz spectrum.

2.77. The Authority in its recommendations of May 2010, had recommended that at the time of renewal of the licences, the entire spectrum in 800/900 MHz band should be refarmed and that these licensees will be given spectrum in 1800/1900 MHz band in lieu of the refarmed spectrum, subject to the prescribed limits. Having examined the different alternatives, the Authority reiterates the view that the entire spectrum in the 800/900 MHz band should be refarmed. This will apply to all the service providers, in all the service areas, who have been assigned spectrum in the 900 MHz band. The refarming of the spectrum should be carried out progressively but not later than the due date of renewal of licences.

2.78. Regarding the timing of refarming, the Authority had, in Para 1.71 of the May 2010 recommendations, had recommended that in view of the huge potential of these bands in the proliferation of wireless broadband services through deployment of IMT technologies, it will be desirable to refarm the spectrum at the earliest. However, in view of the factors discussed in the said para, the Authority was of the view that the refarming of spectrum in 900 MHz band should be done at the time of renewal of the licences.

2.79. It must be noted that the first two licences given for Metro service areas are expiring in November 2014. Those for the other Circles are due to expire in the year 2015. The licences of MTNL and BSNL, both of whom have substantial spectrum in the 900 MHz band will expire in 2107 and 2020 respectively. Since extensions of all these licences are not automatic, the Authority is of the view that the licences will have no right over the spectrum once the licences expire and the

Government should be able to refarm the spectrum from these licensees. It is to be noted that the money paid for this spectrum by the licensees of 1994 and 1995 is very little and in the case of MTNL / BSNL, the licenses were given without payment of any entry fee.

2.80. Spectrum in the 900 MHz band is very valuable both from the technical and commercial angles. Currently, this spectrum can only be used for GSM services as per the licence conditions. In order to realise the market value of this spectrum, Government will be well advised to explore the feasibility of taking back the 900 MHz spectrum by November 2014, from the licensees of 1994 and 1995 -1996 as well as the two PSUs. From Table 2.17, it can be seen that these licenses account for 84% of the total spectrum. These licensees may be given the liberalised spectrum in the 1800 MHz band, on payment of the price prevalent in November 2014, or the Reserve price now being suggested, whichever is higher.

2.81. **The Authority therefore recommends that the refarming of spectrum in the 800 MHz and 900 MHz bands should be carried out progressively at an early date but not later than the due date of renewal of the licences. The spectrum available with the service providers in the 900 MHz band should be replaced by spectrum in the 1800 MHz band, which should be charged at the price prevalent at the time of refarming.**

2.82. **The Authority also recommends that the Government must actively explore the possibility of refarming of the spectrum in the 900 MHz band immediately, by invoking the authority to change the licence conditions.**

2.83. In its recommendations of May 2010 the Authority mentioned that *"the current licensing conditions required the licensee to apply for renewal in the 19th year of the licence. Since renewal is not a matter of right and is at the sole discretion of the government and is also subject to terms and conditions to be mutually agreed upon, application for renewal in 19th year does not leave*

enough time for the licensee or its subscribers to readjust in the event of the renewal being rejected. As such the Authority is of the opinion that renewal must be applied for at least 30 months prior to the expiry of licence and that the licensor must take a decision within six months of such application and preferably within three months. This way, at least two years are available to the licensee to readjust to the resultant situation……". Accordingly, the Authority recommended that that a licensee must apply for renewal of licenses 30 months in advance before expiry of its license and spectrum auction for 900MHz may be carried out 18months in advance i.e. in year 2013, so as to enable the winning bidders to be ready with the deployment plans.

2.84. **Since the application for renewal of licenses must be made at least 30 months in advance of the expiry of licenses, the Authority recommends 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. Accordingly, the Authority recommends that the auction of 900MHz spectrum may be carried out in the first half of the year 2013.**

2.85. Regarding the availability of spectrum for refarming, the Authority is of the opinion that in view of the judgment of Hon'ble Supreme Court, at least one block of 2x5 MHz spectrum in the 1800 MHz band should be reserved for auction in all the service areas before allocating the spectrum in lieu of the refarmed spectrum. In view of the foregoing, the position of the spectrum available and spectrum required to carry out refarming will be as given in Table 2.21.

Table 2.21

S.No.	Circle	Available spectrum in 1800 MHz band	Spectrum Required for Auction	Spectrum available for refarming	Spectrum required for refarming including PSUs	Balance Spectrum
1	Delhi	18.4	5	13.4	22.2	-8.8
2	Mumbai	20.6	5	15.6	22.2	-6.6
3	Kolkata	40.6	5	35.6	16.4	19.2
4	Maharashtra	28	5	23	16.4	6.6
5	Gujarat	22	5	17	18.4	-1.4
6	AP	37	5	32	16.2	15.8
7	Karnataka	33.8	5	28.8	16.2	12.6
8	Tamil Nadu	47.4	5	42.4	10.4	32
9	Kerala	45.6	5	40.6	16.6	24
10	Punjab	19	5	14	21.8	-7.8
11	Haryana	26.4	5	21.4	16.6	4.8
12	UP – West	21.4	5	16.4	10.4	6
13	UP – East	17.6	5	12.6	10.2	2.4
14	Rajasthan	3.2	5	NA	18.4	NA
15	M.P.	35.6	5	30.6	16.6	14
16	West Bengal	21.6	5	16.6	10.6	6
17	H.P.	19.6	5	14.6	16.6	-2
18	Bihar	13.2	5	8.2	10.4	-2.2
19	Orissa	40	5	35	10.4	24.6
20	Assam	25.8	5	20.8	10.4	10.4
21	North East	29	5	24	13	11
22	J&K	15.2	5	10.2	8	2.2
	Total	**581**	**110**	**472.8**	**328.4**	**162.8**

Note: 2.4MHz of spectrum in 1800 MHz band to be withdrawn from MTNL in Delhi and Mumbai is shown in the available spectrum.

2.86. As can be seen from the table above, out of 22 service areas, in 7 service areas viz. Delhi, Mumbai, Gujarat, Punjab, Rajasthan, H.P. and Bihar, the amount of spectrum in 1800 MHz band is not sufficient for refarming of complete spectrum holding in the 900 MHz band. Out of these 7 service areas, in Rajasthan service area, there is not enough spectrum even for auction of 1 block of 2x5 MHz.

2.87. **The Authority recommends that in Circles where the amount of spectrum in 1800 MHz band is insufficient for carrying out fully the refarming exercise, immediate steps must be taken to get the Government agencies to vacate the 1800 MHz spectrum so that the entire 900 MHz spectrum can be refarmed.**

Refarming of 800 MHz Band

2.88. Regarding the refarming of 800 MHz band, most of the licences will be expiring in the year 2020(PSU) and 2021 and only few of the licences will be expiring between 2015 and 2018. The amount of spectrum in the 800 MHz bands, year-wise, which could be available for refarming on expiry of present licences, is given in the Table 2.22.

Table 2.22

LSA	2015	2017	2018	2020	2021	2024
Delhi		3.75			10	
Mumbai		7.5			5	
Kolkata				2.5	5	3.75
Maharashtra		5		2.5	5	
Gujarat		3.75		2.5	3.75	
AP		5		3.75	5	
Karnataka				2.5	8.75	
Tamil Nadu inc. Chennai				2.5	8.75	
Kerala				3.75	5	3.75
Punjab		2.5		2.5	3.75	3.75
Haryana				2.5	3.75	5
UP-West				2.5	5	3.75

UP-East				2.5	5	3.75
Rajasthan			5	2.5	3.75	3.75
M.P.				2.5	5	2.5
West Bengal				2.5	3.75	2.5
H.P.				2.5	2.5	2.5
Bihar				2.5	5	3.75
Orissa				2.5	3.75	2.5
Assam	2.5			2.5		
North East	2.5			2.5		
J&K				2.5		2.5
Total	**5**	**27.5**	**5**	**52.5**	**97.5**	**43.75**

2.89. For the refarming of 800 MHz band, the Authority had recommended in May 2010 that the for licence holders of 800 MHz band, spectrum should be assigned in 450 /1900 MHz bands. However, since the 450 MHz band is a sub-1GHz band, the Authority would like the Government to consider allocation of spectrum only in the supra-1GHz band for the refarming of 800 MHz spectrum. Accordingly, the **Authority would like to partially modify its recommendation contained in para 1.73 of the May 2010 recommendations as follows:**

"……. for license holders of 800 MHz band spectrum should be assigned in 1900 MHz band".

2.90. Regarding the 1900 MHz band, the Authority has observed the following in its May 2010 recommendations:

"------- In view of non availability of future growth path for the CDMA operators in the 800 MHz band, this band can be used as an alternate band for the CDMA. However, as the 2.1 GHz uplink band (1920-1980 MHz) overlaps with the PCS1900 downlink band (1930-1990 MHz) except for 10 MHz between 1980-1990 MHz, it is contended that there would be interference at the WCDMA base station receiver and the CDMA2000 handset receiver if both bands operate simultaneously. Therefore only 2 x 10 MHz (1900-1910 MHz paired with 1980-1990 MHz) can be made available in

this band, that too only if the future requirements of microcellular TDD technologies are covered in some other band.

The Authority in its recommendations on 'Allocation and Pricing of 3G and BWA services' dated 27th Sept.2006 had recommended that the Government should conduct the trial to verify practical feasibility of coexistence of mixed band allocations."

2.91. Earlier, the issue of mixed band allocation of both IMT-2000 2 GHz band and 1900 MHz USPCS band was discussed in the Authority's recommendations on 'Spectrum related issues' dated 13th May 2005 and it was recommended that "*It is not desirable to allocate spectrum both in IMT-2000 2 GHz band and 1900 MHz USPCS band in a mixed manner due to non-availability of 1900 MHz USPCS band, Interference issues, spectrum reserved for micro cellular WLL systems based on TDD access techniques, etc.*"

2.92. In its recommendations on 'Allocation and pricing of spectrum for 3G and broadband wireless access services' dated 27th September,2006, the Authority discussed about possibility of allocating both PCS1900 and the 2.1 GHz band for 3G Services to CDMA and GSM based telecom service operators under 'mixed band plan'. At that time telecom service providers with CDMA technology had strongly advocated in favour of a mixed band allocation. Their contention was that the Government should allocate spectrum in PCS 1900 band (1850-1910 MHz paired with 1930-1990 MHz) to ensure a level playing field and thus not stifle the growth of CDMA operations in the country.

2.93. The problem with the 'mixed band plan' was that the 2.1 GHz uplink band (1920-1980 MHz) overlaps with the PCS1900 downlink band (1930-1990 MHz). GSM operators claim that there will be interference at the WCDMA base station receiver and the CDMA2000 handset receiver if both bands operate simultaneously. To overcome this interference problem, CDMA operators had suggested using only the

small non-overlapping portion of the PCS1900 band (1900-1910 MHz paired with 1980-1990 MHz) and installing filters in the CDMA base station transmitter and WCDMA Node-B receiver to mitigate interference.

2.94. During the consultation process, one group was of the view that the 'mixed band plan' would not be technically feasible. The other group suggested that while interference will occur, it should be possible to mitigate the problem by using appropriate filters and spatial separations between the antennas.

2.95. In order to obtain an authoritative/academic perspective on this issue and examine the feasibility of the mixed band plan, the Authority contracted a consultant, IIT Delhi. In its report the consultant showed that it was feasible to have a mixed-band allocation, i.e. systems can operate simultaneously in 2x10 MHz in the PCS1900 band and 2x25 MHz in the 2.1 GHz band, provided adequate filters are installed and a dead-space is provided between the two bands. As per the report, the resulting mixed band plan would be:

(i) PCS1900: 1900-1910 MHz paired with 1980-1990 MHz (2x10 MHz)

(ii) 2.1 GHz: 1920-1970 MHz paired with 2110-2160 MHz (2x50 MHz)

(iii) Dead space: 1970-1980 MHz (10 MHz)

2.96. As mentioned above, the AUSPI/CDMA operators had proposed to conduct a field trial to verify the possibility of co-existence of PCS1900 and UMTS 2.1 GHz system in a defined geographical area at their own cost and Defence has not completely ruled out the availability of the above mentioned spectrum. Accordingly, the Authority recommended that *"the Government should conduct the trial to verify practical feasibility of coexistence of mixed band allocations, and in case the co-existence is found feasible and economically practicable, then it should*

work towards re-farming of the PCS1900 band, specifically 2 x 10 MHz to enable the future growth of 3G cellular services in India".

2.97. Further, the Authority apprehended that even if the mixed band trial was successful, it might still not be possible to deploy both PCS1900 and 2.1 GHz system in the country simultaneously as the availability of 25 MHz in 2.1 GHz band was expected in next six to nine months and vacation of PCS1900 band was expected to take longer time given its extensive use by Defence services. Therefore the Authority concluded that since spectrum was not available in the PCS 1900 band, it was not be possible to implement the mixed band plan at that time.

2.98. Field trial/measurement regarding co-existence of PCS 1900 MHz CDMA & UTMS 2100 MHz WCMA system, was held in October, 2007 at Hyderabad by AUSPI/CDMA operators, in presence of representative from WPC, TRAI and TEC. In their report to WPC, it was observed by the representatives that further trial needs to be carried out in other areas/locations before arriving at firm conclusions on the feasibility of co-existence of 3G networks of WCDMA and CDMA.

2.99. In response to the consultation paper, one stakeholder commented that that it would be erroneous to consider the frequency allocations in 1900 MHz band 1850-1910 MHz (UL)/paired with 1930-1990 MHz (DL), as this band (part or whole) is not considered compatible for co-existence with the ITU-R recommended UMTS (3G)/WCDMA frequency band 1920-1980 MHz (UL)/paired with 2110-2170 MHz (DL) for 'IMT' (3G) services. The stakeholder stated that the IMT band 1920-1980 MHz/2110-2120 MHz band had already been auctioned (2010) and deployed in the country by the licensees for IMT/3G/WCDMA mobile services.

2.100. Regarding the mixed band field trial in respect of EVDO and WCDMA, in the frequency band 1900-1910/1980-1990 MHz, WPC wing of DoT

vide its letter dated 22.08.2008, had intimated that "The report submitted by the Group consisting of representatives from WPC wing, TRAI and TEC reveals that more observations of the field trial are required to conclude feasibility of the co-existence of 3G networks of WCDMA and CDMA".

2.101. The maximum spectrum required in 1900 MHz band to accommodate all the CDMA operators including the cancelled licensees in 15 MHz. However, the spectrum available in the 1900 MHz band is only 10 MHz, which will be insufficient to refarm the total holding in the 800 MHz band. As per the data regarding subscribers numbers of CDMA operators, it can be seen that the subscriber base of the two PSUs is very low. Therefore, the Authority is of the opinion that, the spectrum in the 800 MHz band is very valuable and is not being utilised efficiently by the PSUs, who got it free of cost, therefore, at the time of renewal of their licences, they may not be allocated any spectrum in lieu of spectrum in 800 MHz band. Consequently, the spectrum required in the 1900 MHz band for refarming from the private operators will be as given in the Table 2.23.

Table 2.23

S.No.	Service Area	Spectrum required for refarming	Spectrum held by PSUs	Spectrum required for refarming excluding PSUs
1	Delhi	13.75	3.75	10
2	Mumbai	12.5	2.5	10
3	Kolkata	11.25	2.5	8.75
4	Maharashtra	12.5	2.5	10
5	Gujarat	10	2.5	7.5
6	AP	13.75	3.75	10

7	Karnataka	11.25	2.5	8.75
8	Tamil Nadu	11.25	2.5	8.75
9	Kerala	12.5	3.75	8.75
10	Punjab	12.5	2.5	10
11	Haryana	11.25	2.5	8.75
12	UP - West	11.25	2.5	8.75
13	UP - East	11.25	2.5	8.75
14	Rajasthan	15	2.5	12.5
15	M.P.	10	2.5	7.5
16	West Bengal	8.75	2.5	6.25
17	H.P.	7.5	2.5	5
18	Bihar	11.25	2.5	8.75
19	Orissa	8.75	2.5	6.25
20	Assam	5	2.5	2.5
21	North East	5	2.5	2.5
22	J&K	5	2.5	2.5
	Total	**231.25**	**58.75**	**172.5**

2.102. As per Table 2.23, a maximum of 10 MHz of spectrum will be required for refarming which is available in the 1900 MHz band, subject to the outcome of the interference study.

2.103. **Accordingly, the Authority recommends that the DOT should immediately arrange to allocate spectrum in the 1900 MHz band for refarming the spectrum in the 800 MHz band.**

2.104. **The Authority recommends that the DoT should immediately carry out the interference study. The spectrum in the 800 MHz band should progressively be refarmed at the time of renewal of licences of such operators.**

D. 700 MHz Band

2.105. In the last few years, the growth in the Internet and broadband connections has been modest in contrast to the rapid growth in voice segment in India. While Internet subscribers increased from 19.67 million in April 2011 to 22.39 million as on February 2012, the number of Broadband connections increased from 11.89 million to only 13.54 million. Broadband penetration is just 1% as compared to 74% mobile telephones.

2.106. Unlike other countries where the Digital Dividend (making available spectrum in 700 MHz band for telecom services) poses problems, India has readily available spectrum in this band. Keeping this in view, the consultation paper sought the view of the stakeholders on the timing of auction of this spectrum and related issues.

2.107. In response, most of the stakeholders were of the view that there should not be any bar for participating in the auction of spectrum in the 700 MHz band. Some of them commented that as the 800/ 900 MHz spectrum band is being used for 2G services band and 700 MHz spectrum band will be auctioned for advanced LTE services, debarring existing 800/900 MHz spectrum band holders from participation in 700 MHz would be extremely unfair and highly discriminatory. Another stakeholder commented that auction in 700 MHz band should not be linked to permission for liberalised use of 800/900 MHz band as they differ significantly, different technologies will be deployed on 700, 800, 900 MHz with different levels of maturity in the ecosystem globally and also, the technologies to be deployed on 700, 800, 900 MHz also differ in terms of eco system and the expected revenue per MHz.

2.108. One of the service providers was of the view that the 700MHz auctions should be conducted at the earliest so as to put the available spectrum to optimal use to deliver on the mobile broadband objectives

enunciated in the draft NTP-2012. It was of the opinion that all operators should be allowed to participate in the 700MHz auctions and any attempt to adopt a restrictive or exclusionary approach would not only be most incorrect and unfair but also legally untenable and would also adversely impact the efficiency of the auction process and also the optimal utilization of the spectrum. On the issue of spectrum cap, it suggested that one option could be to cap the spectrum at say 25% of the total spectrum assigned in a service area irrespective of band and technology mix deployed or alternatively another approach could be to put an overall cap of 2x25MHz of sub-1GHz spectrum (25% of assigned sub-1GHz spectrum).

2.109. One more issue raised in the consultation paper was on the timing of auction of spectrum in the 700 MHz band and whether the auction in the 700 MHz band be linked with the permission for the liberalised use of 800/900 bands.

2.110. On the timing of auction, a number of the stakeholders were of the view that the ecosystem in 700 MHz is still at a nascent stage and will take time to reach the scale needed for cost conscious Indian market. One of the stakeholder submitted that over the last decade, despite somewhat maturing of 3G technology, worldwide there are only 1.4 billion 3G subscribers and only 6.4 million 4G LTE subscribers as against 5.6 billion mobile subscribers. The stakeholder contended that despite winning spectrum in the BWA auction and paying over US $7.5 billion, no operator in the country has been able to launch 4G services due to lack of eco-system & lack of economic viability. Therefore, in the opinion of the stakeholder, under these circumstances, any untimely auction of spectrum in 700 MHz band may accrue revenue to the Government, but the commercial exploitation of such scarce resource for the larger interest of the society may be permanently impaired if the operators are forced to bid for such auction ahead of its commercial viability & in the process they may become sick & unviable. In the assessment of the

stakeholder, it will take 2-3 years for 3G UMTS to stabilize & reach the mass market and real commercial scale volumes for mobile broadband using LTE technology will be achieved only around 2015-2017, accordingly, it was suggested by the stakeholder that the auction of 700 MHz band should be delayed by at least 2-4 years.

2.111. Suggesting that the auction could be planned for 2H 2012, one of the stakeholders commented that the ITU approval for the band plans/frequency arrangements for this frequency band is expected by end April 2012. Based on these frequency arrangements/band plans, '3GPP' has targeted release of the specifications/standards for equipment and eco-system by June 2012 and commercial availability of equipment and eco-system is expected by 1H 2013.

2.112. Some of the stakeholders suggested that the auction in 700 MHz band should not be linked with any liberalisation of 800/ 900 MHz band, because the digital dividend spectrum, i.e. 700 MHz spectrum is a new spectrum which is required by any operator planning to launch mobile broadband services irrespective of whether or not they already operate a GSM/ CDMA based network. In their opinion since, the usage of frequencies in the 800/ 900 MHz band and the 700 MHz band differs considerably; therefore there is no justification for linking the auction of 700 MHz band with any kind of liberalization of the 800/900 MHz band.

2.113. Another issue related with the assignment of spectrum in the 700 MHz band was that how much spectrum in 700 MHz band should be put to auction initially and what should be the amount of spectrum which a licensee should be allowed to win in that auction.

2.114. On this issue, a number of stakeholders commented that all available spectrum in the 700 MHz band, i.e. 2x45 MHz, should be auctioned as there is no economic justification for keeping the scarce resource idle when it can be better utilized by putting it to use to increase

broadband penetration and consequently the growth of the country and also to earn additional revenues for the exchequer.

2.115. Regarding the amount of spectrum, which a service provider may be allowed to bid for, most of the suggestions were either one or two blocks of 5 MHZ. However, few of the stakeholders suggested a higher quantity so that the full potential of IMT and IMT advanced technologies can be exploited.

2.116. During the consultation process, some of the stakeholders have commented after recommended by ITU Study Group– 5 (SG-5), the APT band plans have been circulated by the Radio Communication Assembly for approval within the notice period of three months (RA-2012/mid-Jan 2012) and the same is expected by end April 2012. Similarly, the standardization body '3GPP2' has targeted release of the specifications/standards by June 2012.

2.117. The draft National Telecom Policy 2011, seeks to provide affordable and reliable broadband on demand by the year 2015 and to achieve 175 million broadband connections by the year 2017 and 600 million by the year 2020 at minimum 2 Mbps download speed and making available higher speeds of at least 100 Mbps on demand.Until now the growth in telecom services has been mainly limited to urban areas with majority of rural population still un-served. One of the prime considerations in the effort at connecting the 1.2 billion people is the medium. The slow growth of broadband at present is attributed to inadequate infrastructure to provide broadband both in rural and urban areas. At present about 86% of total broadband connections are being provided using Digital Subscriber Line (DSL) which have limited geographical availability and contribution of Broadband Wireless Access (BWA) is meagre 1%.

2.118. Keeping such constraints in mind, TRAI, in the year 2010, took note of the criticality of Telecommunications to the country's development and made several significant policy recommendations to the

Government. In order to provide ubiquitous availability of a communications network, capable of providing both voice and data services, the Authority gave its recommendations on National Broadband Plan in December 2010. The Authority recommended establishment of a fibre optic based, open access, National Broadband Network to connect all Habitations with a population of 500 and above. It also recommended the provision of Fiber-to-the- Home (FTTH) in 63 major cities of the country and Fiber-to-the-curb (FTTC) in all other cities and towns. The recommendations for optic fiber network in rural areas have since been accepted by the Government.

2.119. Also, TRAI has emphasised the need of allotment of additional spectrum for fulfilling the requirement of telecom services in the country. Till such time as the optic fibre network is effectively utilised to provide fixed line broadband network, a large proportion of the broadband growth will continue to come from wireless segment. In its recommendations of May, 2011, the Authority estimated that an additional 500 MHz of spectrum was required to meet the telecom requirements by the year 2015. It is in this context that TRAI also discussed the issue of 700MHz band.

2.120. The Authority is of the view that to achieve the broadband penetration as per the above objectives and to facilitate the propagation of wireless broadband services in rural areas with lesser capital investment and at affordable price, spectrum in the 700 MHz band will play a crucial role, as less capital expenditure is required for roll-out of services.

2.121. Allocating the 700 MHz band to broadband would also bring significant social benefits, particularly in rural areas which currently lag behind urban living standards. Better access to education, improved healthcare and financial inclusion are all likely to result from widespread access to high-speed mobile broadband. Mobile broadband could also greatly increase efficiency in the provision of government services, especially in rural areas. Therefore, TRAI

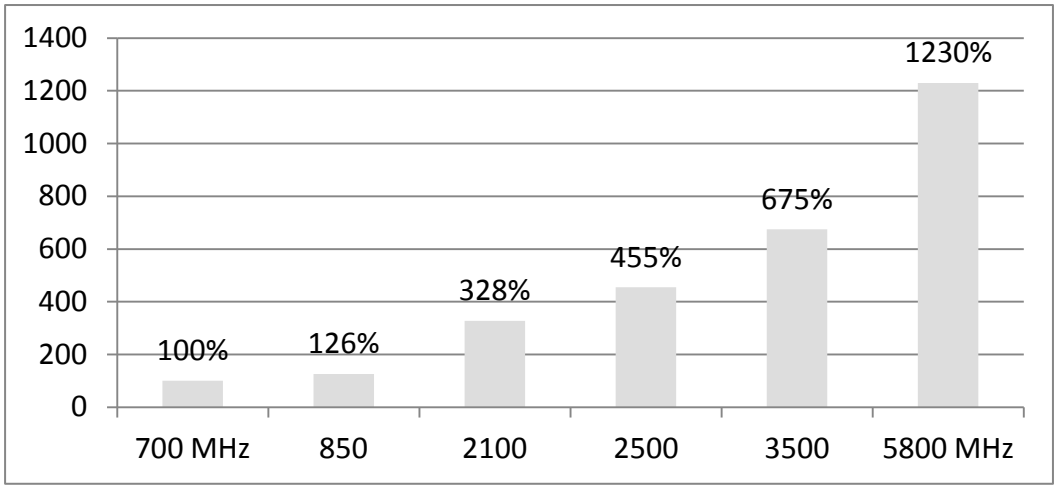
recommended that the spectrum in this band be refarmed from the present users, so that spectrum 698 – 806 MHz can be completely utilized for the IMT technologies.

2.122. Spectrum in the 700 MHz band is especially important to deliver affordable access to broadband, especially in rural areas. It is approximately 70% cheaper to provide mobile broadband coverage at frequencies around 700MHz than using the core 3G frequencies at 2100MHz.5 This means networks can be rolled out quickly and cost effectively, bringing cheaper services to consumers. These effects are multiplied if countries work together to ensure that they implement a harmonised band plan regionally, or globally if possible. Adoption of APT band plan by majority of the countries is likely to provide this advantage of economies of scales.

2.123. The following chart gives the Relative Capex, as a percentage, required for network infrastructure investments in various spectrum bands[6]:

Chart 2.4

Relative Capex, as a percentage, required for network infrastructure investment



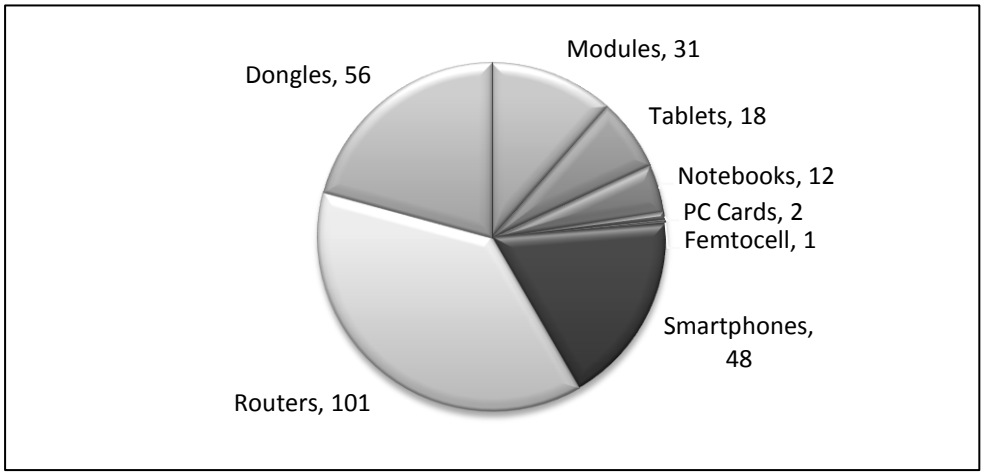
2.124. As per report - 'Status of the LTE Ecosystem' researched and published by GSA in January 2012, there are 269 LTE devices launched in the market by 57 suppliers, and that a robust user device

[5] GSMA website

[6] http://www.itu.int/ITU-D/tech/events/2011/Broadcasting_Hanoi_May11/Presentations/Hanoi_May11_Session7_Qualcomm.pdf

ecosystem has been established in support of LTE as the fastest developing mobile communications system technology. The number of LTE devices - 269 - announced in this report is 36% higher than the figure GSA reported on October 28, 2011. More than 200 new LTE user devices were launched in the past year (GSA reported 63 devices in its first "Status of the LTE Ecosystem" report on February 9, 2011)[7].

Chart 2.5



Source of data: Status of the LTE Ecosystem report-GSA, January 2012

2.125. The main LTE bands are supported by the devices ecosystem as given in Table 2.24 below:

Table 2.24

LTE FDD:

700 MHz	142 devices
800 MHz	52 devices
1800 MHz	50 devices
2600 MHz	65 devices
800/1800/2600	43 devices
AWS	51 devices

LTE TDD

2300 MHz	142 devices
2600 MHz	41 devices

[7] The Global Mobile Suppliers Association: www.gsacom.com

2.126. Allocating the 700 MHz band to broadband would bring significant social benefits, particularly in rural areas which currently lag behind urban living standards. Better access to education, improved healthcare and financial inclusion are all likely to result from widespread access to high-speed mobile broadband. Mobile broadband could also greatly increase efficiency in the provision of government services, especially in rural areas. Therefore, TRAI, in its recommendations of May 2010, recommended that the spectrum in this band be refarmed from the present users, so that spectrum 698 – 806 MHz can be completely utilized for the IMT technologies.

2.127. As discussed above, the entire spectrum in 698-806 MHz band is likely to be available for assignments for new technologies. However, certain agencies have raised doubts regarding this position and as such, at this stage, it appears safe to assume availability of about 2 X 30 MHz of spectrum in this band. In the consultation paper, two approaches for the assignment of spectrum in 700 MHz band were discussed. As per the first approach, licensees, not having any spectrum in 800/900 MHz, are allowed to participate in the auction of 700 MHz band to give them opportunity to get spectrum in sub-1GHz bands. Another approach was to allow all the licensees to take part in the auction after defining a spectrum cap in sub-1GHz band and also overall spectrum cap on total spectrum that a licensee can hold.

2.128. As per the available information, because of pending approval of APT band plan for the 700 MHz band by the ITU and the release of specifications/standards by 3GPP2, presently there are no devices available commercially. The devices available in the market are specific to US band plan, which is different from the APT band plan. It is expected that when 3GPP2 comes out with the standards, eco system shall grow in the APT band plan and the equipment and the end devices will be commercially available only by 1H 2013. The claim that equipment will be commercially available is, at this stage, only an assessment. Even if this is realised, it would take some more time for

the devices to be available at affordable rates especially in a price sensitive market like India. At the same time, a prior announcement of our plans would definitely have a salutary effect on the development of the required eco-system.

2.129. In the absence of the availability of the equipments and the end devices, the Authority agrees with the view expressed by majority of the stakeholders that the auction of 700 MHz band should not be clubbed with the upcoming auction in the 1800 MHz band.

2.130. **The Authority recommends that the auction of spectrum in 700 MHz band may be carried out at a later date, preferably in 2014 as and when the ecosystem for LTE in the 700 MHz is reasonably developed, so as to be able to realise the full market value of the spectrum.**

2.131. On the issue of amount of spectrum which a licensee can bid for, it has been mentioned earlier, that certain agencies have raised doubts regarding availability position of spectrum in this band and as such, at this stage, it appears safe to assume availability of about 2 X 30 MHz of spectrum in this band. In view of the foregoing, the Authority is of the opinion that a final view on this issue can be taken only after getting the complete information regarding the exact amount of spectrum available for allocation in this band.

CHAPTER III

AUCTION DESIGN

3.1. The Auction design depends on a number of elements like key objectives, auction format, single or multi-stage, amount of commodity available for auction, number of blocks, restriction like the maximum amount one can bid for etc.

A. Structure of Auction

1. Auction Format

3.2. Various auction formats commonly used world over are:-

- **First-price sealed bid auction**: In this auction, each bidder is asked to submit a bid. The highest bidder wins the auction and pays an amount equal to his bid amount. Despite the complex analysis of equilibrium, the first-price sealed-bid auction has the merit of being extremely simple. This is borne out by the fact that it is one of the most widely used auctions in general.

- **Second-price sealed bid auction (Vickrey auction)**: The second-price sealed-bid auction also asks buyers to place a bid on the object. The highest bidder wins the object but pays an amount equal to the second highest bid.

- **Dutch auction (Descending price auction)**: A popular auction is the descending price auction, also known as the Dutch auction. The auctioneer sets a high price on the object initially and lowers it continuously. A bidder who expresses his willingness to buy the object first wins the auction at the current price. Theoretically, this auction is equivalent to the first-price sealed-bid auction. Like the first-price sealed-bid auction, every bidder needs to determine an amount at which he must express his willingness to buy.

- **English or Japanese auction (ascending price auction):** In ascending price auction format, there are two commonly used variants. In the first variant called the English auction, the seller starts the auction at a very low price (possibly zero). The bidder who wants to win the object increases the price. The auction ends when there is no price increase. The last bidder to bid wins the object and pays his bid amount. In another variant, called the Japanese auction, the seller starts the auction at a low price (possibly zero). Bidders express their willingness to buy the object at every price. If the number of bidders who want to buy the object at the current price is more than one, then the seller increases the price by a pre-determined amount, called the bid increment. The auction stops when there is exactly one bidder who wants to buy the object. Usually, there are activity rules which require each bidder to express his willingness to buy the object at every price in the auction, and once a bidder says no to buy the object at a price, he is no longer allowed to participate in the auction. The Japanese auction is also referred to as the clock auction.

3.3. In the consultation paper, the stakeholders were asked to suggest the structure of the auction process which should be adopted for the auction of spectrum. In their response, most of the stakeholders were in favour of adopting the auction process similar to what has been done in the case of 3G and BWA. However, some of these stakeholders were of the view that simultaneous closure of all service areas should not be mandated as it leads to excessive/irrational increase in bid price in some of the areas. Some of these respondents also submitted that the experience gained in the earlier auction will enable the Government to manage the process in the shortest period of time.

3.4. Regarding the auction process, majority of the stakeholders favoured the process which was earlier deployed for 3G auction. It may be recalled that TRAI, in its recommendations on "Allocation and pricing of spectrum for 3G and broadband wireless access services" dated 27th

September 2007, had recommended that the spectrum auction for 2.1 GHz band should use a simultaneous multiple round ascending auction system (SMRA). The DoT accepted the recommendation and accordingly, the 3G auction was held in the year 2010.

3.5. As compared to other auction formats, the SMRA has the following advantages[8]:

- Price Discovery- Bidders can react to price information for individual spectrum blocks as well as relative prices;
- Simplicity for bidders- Bidders only have to accept/reject prices announced by the auction manager;
- Efficiency of outcome- The auction of all spectrum blocks closes simultaneously. Bidders see all prices before the auction ends.

3.6. As the SMRA format has been successfully used in India in the auction of 3G and BWA spectrum, the Authority is of the view that Simultaneous Multiple Round Auction (SMRA) format should be followed in the upcoming auction. It is also expected to lead to a comparatively shorter preparatory time.

3.7. *The Authority recommends that the auction of spectrum shall be conducted using Simultaneous Multiple Round Auction (SMRA) format.*

2. Single or Multi-stage Auction and eligibility

3.8. Stakeholders were asked whether the auction should be held in a single stage or multi-stage and who all should be eligible to participate in it. Regarding eligibility, four categories were mentioned in the paper- a) Only licensees whose licences have been cancelled; b) Only eligible applicants as on 10.01.2008; c) only licensees whose licences have been cancelled and all new eligible entrants at the time of auction; or d) Open to all including the existing Licensees.

[8] 800 MHz Auction 28th April 2010– NERA, economic Consulting

3.9. On the above issues, broadly, there were three views on the design of the auction process and the eligibility of the participants. On the number of stages/phases, several stakeholders proposed that the auction should be held in multiple phases. The number of phases proposed was two or three. Most of the licensees, whose licences have been ordered to be cancelled were of the view that in the first stage, licensees falling under option 'C' given in the consultation paper should be permitted and in the subsequent stages of auction, all including the existing players should be allowed to participate. One stakeholder was of the view that this approach can benefit the Indian market by: 1) correcting the licensing anomalies of 2008; 2) enhancing the attractiveness of the Indian telecom industry to new players; 3) stimulating and protecting downstream service and price competition; 4) ensuring fair valuation of scarce resources, and; 5) protecting long-term impact on public finance and avoid economic distortions of one-off revenues from auctions.

3.10. Another view in support of the above was that eligibility for licenses and the consequent spectrum allocation in 2008 was restricted to fresh applicants only. It was contended that in the current case, the Supreme Court has effectively stepped back to 2008 and, without requiring any change to the eligibility criteria, has held that the first-come-first-served policy used by DoT in 2008 as flawed and the method of selection of successful licensees by fixing a certain cut-off date as arbitrary. It was further argued that to correct the above situation, the Supreme Court has said the procedure adopted for distribution should be just, non-arbitrary and transparent and that it should not discriminate between similarly placed private parties. The service provider was of the view that the spirit and letter obviously was to ensure that all the then eligible parties should have been treated at par while selecting the successful licensees and that therefore, it is evident that the SC judgment did not intend that the

auction of 2G licenses and spectrum should also be open to parties, who, in 2007/2008 already held UASL / CMTS licensees.

3.11. The opposite view was that auction should be open to all including the existing licensees. One of the stakeholders, in favour of this view, stated that if the auctions are restricted only to new entrants, then demand is likely to be equal to or less than supply of spectrum, meaning that the auction will close at the reserve price. In its opinion, this would not be a genuine auction process, but effectively an offer of spectrum at an administratively-determined (reserve) price and such a restrictive approach will raise the issues of fair process, transparency and equal opportunity and will be against the judgment / findings of the Hon'ble Supreme Court as well as violation of the DoT press release dated 29 January 2011. Another stakeholder was of the view that the Hon'ble SC has clearly stated that there should be a transparent and fair method for making selections so that all eligible persons get a fair opportunity of competition, the State and its agencies/instrumentalities must always adopt a rational method for disposal of public property and no attempt should be made to scuttle the claim of worthy applicants. Therefore, it was contended that holding separate auctions will be against the judgement of Hon'ble Supreme Court.

3.12. A third view was that all entities which undertake to take UASL after successful bid should be eligible to participate in the 2G spectrum auction for new GSM and CDMA spectrum licence and for additional allocation of spectrum beyond 6.2 MHz GSM Spectrum and 5 MHz CDMA spectrum, all existing UASL and CMTS operators except operators holding spectrum beyond the 'Prescribed Limit' of 8 MHz/10 MHz for GSM in circles and metros respectively and 5 MHz/ 6.25 MHz for CDMA in circle and metros respectively should be eligible to participate in the auction. They were of the view that the operators holding spectrum equal to or beyond the Prescribed Limit should not be allowed to participate in the auction.

3.13. In their responses, few stakeholders were of the opinion that as per the direction of the Hon'ble supreme Court, in the first stage of the auction, only those licensees whose licences have been ordered to be quashed should be allowed to participate along with other entities who are eligible for a UASL and do not hold the licence. The Authority is of the view that the Hon'ble Court has only directed TRAI to recommend for grant of licence and allocation of spectrum in the 2G bands. The Hon'ble court has not directed TRAI to recommend auction for allocation of spectrum to only these licensees or to consider any category of entities as a separate category.

3.14. Secondly, as identified in Chapter I, some of the key objective of the auction process are (a) the state is bound to act in consonance with the principles of equality; (b) that people should be granted equal access to natural resources; (c) activities should be designed in a manner to ensure competition & not discrimination and (d) there should be no discrimination between similarly placed parties. Therefore, the Authority is of the view that there should be only a single auction open for all including the existing licensees and any entity holding or eligible for a Unified Licence subject to the condition that the licensee does not have spectrum above the spectrum cap. Having a separate auction for only one set of participants will be against the stated objectives. The only bar should be in respect of those that hold spectrum above a given cap. If a new entity is successful, then the Authority recommends that such an entity will have to take either the National level or the State level Unified Licence, as the case may be.

3.15. *As regards the auction of spectrum in 1800 MHz and 800 MHz bands to be conducted immediately following these recommendations, the Authority recommends that it should be held in single stage.*

3.16. *The Authority recommends that every auction shall be open to all those holding CMTS licence/ UAS licence / Unified licence or eligible for grant*

of Unified Licence. Auction shall not be open to those that hold spectrum above the prescribed cap.

3.17. *The Authority recommends that if a new entity is successful, then the Authority recommends that such an entity will have to take either the National level or the State level Unified Licence, as the case may be.*

3. Block Size

3.18 In the present licensing regime, the operators are initially given the 4.4/2.5 MHz of spectrum for GSM/CDMA technology and are given additional spectrum in the tranche of 1.8/1.25 for GSM/CDMA, subject to fulfilment of the Subscriber based criteria. In the auction of 3G and BWA spectrum, the block size was 5MHZ for 3G and 20 MHz for BWA. In future, the spectrum will be allocated only through the process of auction and the successful bidder will be permitted to deploy any technology for providing any service. Therefore, the stakeholders were asked to comment on the block size and the cap, if any, on the amount of spectrum which one can bid for.

3.19 Regarding the block size of spectrum in the auction, the contention of the most stakeholders was that block size should be dependent on the frequencies and should be different for start-up spectrum and the additional spectrum. Majority of the stakeholders have suggested a block size of 4.4 MHz in GSM/2.5 MHz in CDMA for the start up spectrum and for additional/incremental spectrum, a block size of 1.8 MHz in GSM and 1.25 in CDMA. One stakeholder suggested a block size of 3.75 in CDMA. While justifying the block size, the stakeholders have opined that the start of spectrum of 4.4 MHz/2.5 MHz will have a parity with the existing players.

3.20 Another view expressed by a few stakeholders was that the block size in the 1800 MHz and 800 MHz band should be 2x1 MHz and 2X1.25 respectively. They were of the view that any new entrant, who is bidding for spectrum in the 1800 MHz band, may be allowed to bid for

a minimum of 4 to 5 blocks and the existing operator may be allowed to bid for a minimum of 1 block of 2x1MHz and a maximum of 5 blocks of 2x1MHz. They felt that similarly, in the 800 MHz band, any new entrant who is bidding for spectrum may be allowed to bid for a minimum/maximum of 2 blocks and the existing operator may be allowed to bid for either 1 or 2 blocks of 2 x 1.25 MHz. For the 700 MHz band, these stakeholders were of the view that the block size should be kept at 2X5 MHz and for an efficient deployment of LTE/IMT-A network, a minimum of 2 blocks of spectrum should be allocated to an operator.

3.21 In the new Unified licensing regime, spectrum is delinked from licence. This Authority's recommendation is that all spectrum should only be allocated through auction, the only exception being what was stated in Paras 3.21 to 3.22 above. There will be no concept of start-up or initial spectrum. This was also mentioned in the Press Statement of DoT dated 29th January 2011.

3.22 All spectrum to be auctioned in future will be liberalised spectrum, and therefore the block size should be such as to satisfy the needs of any technology. 5 MHz is the minimum amount of spectrum required to ensure that any technology can be deployed with the allocated spectrum. Therefore, the Authority holds that all auctions must offer spectrum of at least 5 MHz in any band, unless the available spectrum itself is less than 5 MHz. The participants in the auction may or may not be new entrants. The Authority believes that there should not be any entry barrier and that persons or entities should be able to decide for themselves whether or not there is a business case for them to participate in a given auction. At the same time, restricting the block to a minimum of 5 MHz can pose difficulty for existing players at any given time as their requirement may be below this size, or they may be restricted from acquiring the same because of spectrum cap. Therefore, the design of the block size should be such as to allow the requisite flexibility. The Authority is of the view that

blocks of 1.25 MHz each would adequately meet the needs of any given situation, enabling the bidder to choose the number of blocks as per any technology. The bids will accordingly be per block of 1.25 MHz.

3.23 There will however be an exception to the above rule in respect of the auction relating to 800 MHz and 1800 MHz that immediately follow these recommendations. The Authority recommends that in respect of these auctions, only an amount of 5 MHz be put to auction in all Service areas. This is with a view to balancing the different requirements. Firstly, even as there is a need to offer spectrum to all aspirants in all service areas, there is also the need for setting aside spectrum in the 1800 MHz band for refarming of the spectrum in the 900 MHz band. Secondly, there is need to properly determine the full price of spectrum, which will then be the base price in the given band for the next auction whenever it takes place, with the rider that it will suitably be adjusted in the event of gap beyond one year.

3.24 The Authority is conscious of the current situation where some of the existing licences have been quashed by the Hon'ble Supreme Court or those who had earlier applied for licences might wish to bid for the spectrum. The Authority therefore recommends that <u>for this round of auction only</u>, a provision be made to allow a successful bidder who is a new entrant to take upto 4 blocks of 1.25 MHz so that it has the minimum spectrum to commence operations. In the event the successful bidder is an existing spectrum holder of that band, it shall be restricted to only two blocks of 1.25 MHz each. Also, in such a case, if the second highest bidder is a new entrant, it shall be entitled to 4 blocks of 1.25 MHz each, but at the price offered by the highest bidder. Only in such an event, the total spectrum made available through this auction will be 7.5 MHz.

3.25 *Accordingly, the Authority recommends that in all auctions at least 5 MHz of spectrum shall be offered, except where the spectrum available is less than 5 MHz.*

3.26 *The Authority recommends that spectrum shall be offered in blocks of 1.25 MHz each.*

3.27 *The Authority recommends that for the auction that is to immediately follow these recommendations, the amount of spectrum to be offered will follow the scheme laid out in Para 3.39 above.*

3.28 *The final bid price of one auction in a given band shall be the base price for the next auction whenever it takes place, with the rider that it will suitably be adjusted in the event of gap beyond one year.*

4. Spectrum Cap

3.29 In reply to the question of cap on amount of spectrum which one can bid for, some of the stakeholders opined that there should be a cap on the overall spectrum holding, thus suggesting cap on the amount of spectrum one can bid for. They were of the view that this would ensure level playing field amongst all operators in terms of time to market and access to the highly efficient bands and that no operator will be at advantageous position on account of legacy allocation. These stakeholders further submitted that overall spectrum holding in a licensed service area should meet the prescribed limit of 8/5 MHz for GSM/CDMA for all service areas except Delhi and Mumbai where it can be 10/6.25 MHz.

3.30 One stakeholder was of the view that for quashed licenses and new eligible applicants, the start up spectrum should be limited to 4.4 + 4.4 MHz in 1800 MHz and 2.5 MHz in 800 MHz and an existing operator in a specified Service Area should be allowed to acquire up to a maximum limit as applicable under the 'Subscriber Linked Criteria' (as per Government Order dated 17th January 2008), if its application is approved by DoT before the finalisation of auction. One of the

stakeholders wanted a cap of 2X5 MHZ and 2X2.5 MHz on spectrum in 1800 and 800 MHZ bands respectively for bidding but no cap for spectrum in 700 MHz band.

3.31 On the overall cap on the total amount of spectrum one can hold, some of the stakeholders were of the opinion that the limit should be 25% of the total spectrum in the available in 900/1800 MHz band in the given service area. One service provider was of the view that the Government has announced a policy which allows an operator to hold a maximum of 10 MHz spectrum in 800 MHz band and 25% of the allocated spectrum in 900/ 1800 MHz band, which in its opinion is discriminatory and tends to favour dual technology operator who can independently hold 10 MHz of spectrum in 800 MHz band along with 25% of the allocated spectrum in 900/ 1800 MHz band where as a standalone GSM operator is allowed to hold a maximum of 25% of the allotted spectrum in 900/ 1800 MHz. It further contended that this anomaly creates a serious non level playing field between the GSM and CDMA/dual technology operators and recommended a common cap of 25% of the total 2G spectrum to be applied for combined spectrum holding in 2G bands i.e. 800 MHz, 900MHz and 1800MHz.

3.32 One of the stakeholders wanted that for 2G band, the present prescribed limit of 8MHz and 10MHz should continue and that individual spectrum cap for 700MHz, 800MHz, and 900MHz bands should be set at the time of auction of these bands.

3.33 One stakeholder suggested differential caps on sub-1 GHz and above-1 GHz bands to maintain a level playing field and avoid hoarding of spectrum in a particular band leading to a competitive advantage over others. It suggested a total holding of 10 MHz (FDD) and 25 MHz (FDD) on sub-1 GHz and above 1 GHz bands respectively. Another suggested that cap should be 25% of the total spectrum available.

3.34 On the cap on the total spectrum which one can hold, some of the stakeholders have suggested that the total spectrum holding should

be limited to the 'Prescribed Limit'. The other view was that the total spectrum holding should be limited to 25% of the total spectrum assigned in the licence area.

3.35 In its recommendations of 3rd November 2011, TRAI had clarified that ".....the concept of 'prescribed limit' is with reference to the assignment by the Government and does not preclude the licensee from acquiring additional spectrum in the open market should there be an auction or in terms of consolidation through mergers. In so far as Mergers & Acquisitions are concerned, the Authority had also recommended that "Consequent upon the merger of licences in a service area, the total spectrum held by the Resultant entity shall not exceed 25% of the spectrum assigned, by way of auction or otherwise, in the concerned service area in case of 900 and 1800 MHz bands. In respect of 800 MHz band, the ceiling will be 10 MHz. In respect of spectrum in other bands, relevant conditions pertaining to auction of that spectrum shall apply".

3.36 The Press Statement of the DOT dated 15th February 2012 states that " .....the licensee can acquire additional spectrum beyond prescribed limits in the open market should there be an auction of spectrum subject to the limits prescribed for merger of licences." (emphasis supplied)

3.37 The Authority has carefully considered the entire issue afresh. The earlier recommendation was in a different context and also did not contain any limit in respect of acquisition of spectrum through auction. The present recommendations are in respect of spectrum as a whole and that too through auction. The Authority would like the limits specified to be such as to prevent monopolistic tendencies even as they allow service providers to benefit from economies of scale.

3.38 *The Authority therefore recommends that the limit for acquisition of spectrum shall be 50% of the spectrum assigned in each band in the*

respective service area and 25%of the total spectrum assigned in all bands put together in each service area.

3.39 **Accordingly, the Authority recommends the following structure for the auction of spectrum in future:**

- **The auction of spectrum shall be conducted using Simultaneous Multiple Round Auction (SMRA) format.**
- **As regards the auction of spectrum in 1800 MHz and 800 MHz bands to be conducted immediately following these recommendations, it should be held in single stage.**
- **Every auction shall be open to all those holding CMTS licence/ UAS licence / Unified licence or eligible for grant of Unified Licence. Auction shall not be open to those that hold spectrum above the prescribed cap.**
- **If a new entity is successful, then the Authority recommends that such an entity will have to take either the National level or the State level Unified Licence, as the case may be.**
- **In all auctions at least 5 MHz of spectrum shall be offered, except where the spectrum available is less than 5 MHz.**
- **Spectrum shall be offered in blocks of 1.25 MHz each.**
- **For the auction that is to immediately follow these recommendations, the amount of spectrum to be offered will follow the scheme laid out in Para 3.39 above.**
- **The final bid price of one auction in a given band shall be the base price for the next auction whenever it takes place, with the rider that it will suitably be adjusted in the event of gap beyond one year.**

- **The limit for acquisition of spectrum shall be 50% of the spectrum assigned in each band in the respective service area and 25%of the total spectrum assigned in all bands put together in each service area.**

B. Additional spectrum for partial spectrum holders

3.40. As indicated in the Introduction, the direction of Hon'ble Supreme Court to TRAI was to "keep (ing) in view the decision taken by the Central Government in 2011". The DOT's Press Statement of 29th January 2011, it was states that "*In future, there will be no concept of initial or start up spectrum. Spectrum will be made available only through market driven process. ... assignment of balance of contracted spectrum may need to be ensured for existing licensees who have so far been allocated only the start up spectrum of 4.4 MHz ..... the additional 1.8 MHz will be assigned on their becoming eligible, but the spectrum will be assigned to them at a price determined under the new policy.*"

3.41. After the auction indicated in Para – above, the amount of spectrum that will be remaining in the 1800 MHz band is given in Table 3.1.

Table 3.1

S.No.	Circle	Balance spectrum	No. of operators at 4.4 MHz
1	Delhi	13.4	2
2	Mumbai	15.6	4
3	Kolkata	19.2	2
4	Maharashtra	6.6	3
5	Gujarat	17	3
6	AP	15.8	3
7	Karnataka	12.6	3
8	Tamil Nadu	30	1
9	Kerala	24	3
10	Punjab	14	4
11	Haryana	4.8	3
12	UP – West	6	3
13	UP – East	2.4	3
14	Rajasthan	3.2	4

15	M.P.	14	3
16	West Bengal	6	2
17	H.P.	14.6	4
18	Bihar	8.2	4
19	Orissa	24.6	3
20	Assam	10.4	1
21	North East	11	2
22	J&K	2.2	3

3.42. The need for refarming of spectrum in the 900 MHz band has been brought out in Chapter II. For reasons brought out therein, the Authority is of the view that refarming of the 900 MHz band is critical and therefore takes priority.

3.43. In the new regime, there is no concept of blocks of 1.8 MHz or 2 MHZ etc. The blocks are in terms of 1.25 MHz only. In order to comply with the above direction of the Hon'ble Court, the Authority is of the view that in service areas where spectrum is available in the 1800 MHz band after the auction and after setting aside spectrum for refarming, licensees who have 4.4 MHz of spectrum may be offered one block of 2X1.25 MHz spectrum at the price discovered in the auction for that service area. Since the block size now is 1.25 MHz, allocation of two blocks would take the total allocation beyond the contracted spectrum of 6.2 MHz.

3.44. **The Authority recommends that after conducting the auction for spectrum in the 1800 MHz band, and reserving the spectrum required for refarming, out of the remaining spectrum if any, one block of 2x1.25 MHz of spectrum may be allocated to those licensees having 4.4 MHz of spectrum in the service area, at the auction discovered price for that service area. It should be clearly understood that while this tranche of 2x 1.25 MHz will be paid for at the auction discovered price, it will be treated on par with the unliberalised spectrum of 4.4. MHz that is held by the licensee,**

unless the licensee opts to liberalise the 4.4.MHz spectrum also by paying the auction discovered price.

3.45. **The Authority recommends that the Government may consult the Ministry of Law on the appropriateness of the course of action recommended in Paras 3.22 above, keeping in view the licence conditions as well as the order of the Hon'ble Supreme Court.**

C. Liberalisation of existing assignment in 1800 MHz band

3.46. After the auction, there will be three categories of operators in 1800 MHz band- the first category of operators will be those who were not having the spectrum prior to auction and after being successful in the auction, have only liberalised spectrum; the second category will be of existing operators who after winning some spectrum in the auction have some spectrum in the liberalised form and some spectrum assigned earlier through administratively means in the un-liberalised form; and the third category will be the existing operators who only have spectrum acquired earlier through administrative assignment.

3.47 As discussed above, the spectrum being auctioned is liberalised and its validity will be for a period of 20 years. However, the spectrum available with the existing operators is presently not liberalised and its validity will be equal to the validity period of the licence of the operator. Therefore, the Authority is of the view that the existing operator should also be given the option to convert their present holding of spectrum to liberalised spectrum and also increase its validity subject to payment of price now determined through auction. They can be allowed to set off the price earlier paid for the spectrum they hold for the remaining period on pro-rata basis.

3.48 The Authority is of the view that in order to create a uniformly liberalised environment with a level playing field, the Government may consider incorporating a suitable incentive package for service providers in NTP 2012 to encourage all of them to migrate immediately to the new regime envisaged above.

3.49 **Accordingly, the Authority recommends that the Service providers may be allowed to convert their existing 1800 MHz spectrum into liberalised spectrum on payment of the auction determined amount in which case they will be granted spectrum rights for a period of 20 years. They will be allowed to adjust the price paid by them for the existing spectrum on pro-rata basis for the balance period of the existing license.**

3.50 **The Authority recommends that in order to create a uniformly liberalised environment with a level playing field, the Government may consider incorporating a suitable incentive package for service providers in NTP 2012 to encourage all of them to migrate immediately to the new regime envisaged above.**

E. Conduct of auction in 1800 MHz and 800 MHz bands

3.51 The spectrum, which is being vacated due to the Hon'ble Supreme Court order quashing certain licences, include spectrum both in the 800 MHz band as well as 1800 MHz band. Therefore, the stakeholders were asked to give their opinion whether the auction of spectrum in both the bands should be conducted simultaneously or separately.

3.52 On the issue of simultaneous auction for 800 and 1800 MHz bands, the stakeholders had different views on this issue. Some stakeholders, mainly those providing services using CDMA technology have opined that CDMA spectrum in 800 MHz and GSM spectrum in 1800 MHz should be auctioned separately like 3G and BWA but simultaneously for all 22 circles for determining a true and fair market value. Some of these stakeholders also submitted that 800 MHz spectrum auction should precede 1800 MHz spectrum auction.

3.53 One of the stakeholders suggested that the 800MHz band has also been termed as the Digital Dividend Band and worldwide efforts are being made to refarm the band for IMT-Advanced services. Therefore, it was suggested that similar to 900MHz band, this band should also be refarmed and no further allotment for CDMA services should be

done, except auctioning that many blocks of 2.5MHz of 800MHz spectrum for CDMA services so as to comply with the Supreme Court judgment. Another stakeholder was of the view that the two bands are not strong substitutes and auctioning them simultaneously will increase the complexity of the procedure. Its contention was that the interrelation between the 850 MHz band and the 1800 MHz band is weak but it is probably not zero. The stakeholder was of the view that that 1800 MHz spectrum being more valuable, should be auctioned first, with 850 MHz quickly afterwards.

3.54 Having considered the issue, the Authority is of the view that the eco systems associated with these two bands – 800 MHZ and 1800 MHz - are different. Spectrum in 800 MHz band has superior propagation characteristics than that of 1800 MHz band. Besides, the commercial value of both the bands is vastly different, 800 MHz band being a sub-1GHz band. As discussed in the section on reserve price, the reserve price for both the bands has also been set differently. Moreover, auctioning of two bands in the same auction might pose difficulties in conducting the various rounds and implementing the activity rules etc. Therefore, the Authority is of the view that separate auction should be conducted for discovering the market price in the two bands. Nevertheless, considering that there may be parties interested in commencing / continuing operations in the 800 MHz band immediately, the Authority would like the auction for spectrum in this band also to be conducted in quick sequence, like the auction conducted for 3G and BWA spectrum in the year 2010.

3.55 **The Authority recommends that the auction of 800 and 1800 MHz spectrum should be held through two separate auction processes and in quick sequence.**

F. Reserve Price

3.56 On the issue of reserve price per MHz of spectrum in the 1800 MHz band, the stakeholders enunciated various principles for setting the reserve price. Some of these principles are:

i The Reserve Price should encourage aggressive participation from new entrants to increase competition;

ii Setting a reserve price equal to the administratively derived price of the spectrum is against the fundamental premise associated with auction of spectrum;

iii A high reserve price for spectrum is likely to reduce spectrum demand and it also reduces the opportunities for price discovery.

iv It has been observed by the Hon'ble Supreme Court that state's actions have to be in public interest and while they may augment their resources, adequate compensation should be obtained. In the context of public interest, the regulator will have to exercise its wisdom and determine to what extent maximization of revenue for the state is in the interest of the consumer.

v Setting a reserve price too high or too low has its obvious shortcomings - setting reserve price too low can lead to collusion and setting it too high can deter even serious bidders from participation.

vi Value of Spectrum is a function of the business potential and profitability outlook for the services that are to be offered using the spectrum. For determining the true economic value of Spectrum through auction, fixing reserve price for various spectrum bands closer to their fair market value is crucial.

vii The clear objectives enunciated in draft NTP-2011 are maximizing public good by making available affordable, reliable and secure

telecommunication and broadband services across the entire country. It also enunciates creating multiplier effect and transformational impact of such services on the overall economy. It has been clearly stated that direct revenue generation would be a secondary objective.

3.57 On the actual amount of reserve price, several stakeholders were of the opinion that the price discovered in the last auction for the 4th cellular license, i.e. Rs.1659 Crore for 6.2 MHz GSM spectrum, should be taken as base price for arriving at the reserve price. Some stakeholders were of the view that the reserve price per MHz of spectrum in 2012 for 1800 MHz should be the 2001 price indexed with SBI PLR.

3.58 However, some of the other stakeholders were of the view that the reserve price of Rs. 1659 Crore should be adjusted for PLR but discounted for various competitive indices which have impacted the telecom sector since 2001. They were of the view that the reserve price based on indexation on 2001 price alone will be improper as the societal conditions, demography, affordability etc have changed. The changes that have taken place since 2001 are that there is higher level of saturation in dense urban, suburban markets and the demand is expected to be mainly from rural markets, the total addressable market effectively is only 170 million subscribers starting from 2013, ARPUs are around Rs 100 compared to Rs 600 in 2001 and are continuously coming down, the tariff levels are amongst lowest in the world, cost of finance is high etc. One of the stakeholders has calculated the weighted average impact of these competitive indices to be around 66% on the 2001 auction discovered price for 6.2 MHz spectrum. On the bases of this indexation method, the stakeholder has argued that the reserve price should be in the range of Rs 1800 crore to Rs 2100 crore.

3.59 One stakeholder was of the opinion that the 3G and BWA auctions are the only recent auctions of comparable nature. Due to spectrum scarcity at that time, some skewing of the market may have taken place in the 3G auction while BWA auction was without voice communication facility. Therefore, in its opinion, the reserve price could be set as a median value between the discovered price for 3G and BWA auctions suitably indexed to the current date.

3.60 Another service provider was of the view that for the primary stage of the auction, the reserve price should be set at the same per MHz level (adjusted for inflation, if required) as used in auction of 2.1 GHz 3G spectrum in 2010.

3.61 One stakeholder was of the opinion that, after the issuance of licenses and spectrum in 2008, many companies had sold off their equity stakes. The enterprise value of these target companies may be determined from the deal value of the partial stake sold and then extrapolated to determine the pan-India level of per MHz of 1800MHz spectrum.

3.62 One stakeholder was of the view that keeping in view the directions given by Hon'ble Supreme Court and the Authority's earlier recommendations, the Authority may fix the reserve price for the first block of 4.4MHz spectrum at a level which promotes competition, provides level playing field, and gives fair and equitable opportunity to all those whose licenses are being cancelled and new aspirants, if any. He further mentioned that the Expert Committee of TRAI has determined the price of spectrum in 1800MHz band for spectrum holding 'beyond 6.2MHz' at 2.6 times the level of the price of holdings 'up to 6.2 MHz'. Thus, in his opinion, the reserve price for auction for allocation beyond 6.2MHz may be fixed by the Authority as the higher of its own recommended price for spectrum holding 'beyond 6.2MHz' or at 2.6 times of the winning price of the first stage of auction.

3.63 On the reserve price for 1800MHz spectrum in liberalized form, one stakeholder was of the view that it cannot be based on the above prices as the 1800MHz band has better propagation qualities and significantly better geographic and in-building coverage than 2100MHz; and LTE technology is now compatible with the 1800MHz band. Therefore, in case the 1800MHz band is auctioned with technology neutrality, its economic value is much higher than 2100MHz band and the reserve price should be much above the 3G auction prices.

3.64 One of the stakeholders commented that in his view, the reserve price could be pegged to the 2001 price discovery by suitably indexing it for both inflation and cost of money-PLR. He further submitted that, by following this method the price arrived at would be around Rs 6500 to 9000 crore at PLR of say 12% to 15%. The stakeholder further contended that, assuming that number of subscribers is 50 crore and the ARPU is Rs 200, the monthly revenue will sum up to Rs 10,000 crore which is greater than the EMIs paid in all the three situations by all the six players, with the assumption that the new players will have 10% market share.

3.65 On the issue of reserve price in the 700/800/900 MHz bands, some of the stakeholders were of the opinion that this issue should be taken up only after the auction of 2G spectrum in the 1800 MHz band, whereas other stakeholders have given different point of views on the quantum of reserve price in each of these bands.

3.66 A few stakeholders suggested that the reserve price for 700 MHz, 800 MHz and 900 MHz should be similar to the 2010 3G auction reserve price of Rs 3500 crore for 5 MHz spectrum for 20 years.

3.67 One stakeholder commented that the reserve price for 1MHz of 900/800MHz band can be determined on the basis of relative valuation i.e. by applying a comparable factor based on benchmarking of international auctions to the market determined price of some other

band. Using the data of price discovered in some countries for different bands, the stakeholder suggested that the reserve price for sub-1GHz can be 4.5 times the 3G auction price or 10.3 times the 2.3/2.6GHz spectrum in FDD mode. For 700 MHz spectrum, the reserve price may be kept around 7-8 times of 3G auction prices.

3.68 One stakeholder submitted that the 700 MHz spectrum band has much higher coverage advantage compared to the 2.3 MHz spectrum band, therefore, the value of 700 MHz spectrum should be at least three times the auction discovered price of BWA in 2.3 GHz band. Another stakeholder commented that that the reserve price for 700/800/900 MHz spectrum should be suitably indexed between 1.25 to 1.5 times depending upon the technical and commercial aspects of the band on offer (i.e. if the 900 MHz is more efficient than 700 MHz then the 1.5 time reserve price should be for 900 and 700 MHz should be 1.25 times of 1800 MHz).

3.69 Some of the stakeholders, including the CDMA operators, commented that the reserve price for 800 MHz spectrum band should not be based on earlier prices as the market conditions have significantly changed. They stated that the eco system for CDMA and GSM technologies are different resulting in entirely different valuation of 800 MHz spectrum for CDMA and 1800 MHz spectrum for GSM. As per their opinion, the CDMA spectrum in 800 MHz has much lower value compared to 1800 MHz due to the fact that CDMA has a much lower adoption rate, as almost 85% of the global subscriber base is on GSM and only remaining 15% on CDMA. Further, CDMA equipment and devices have much higher prices compared to GSM due to economies of scale advantage heavily tilted in favour of GSM. Also, CDMA ARPUs are lower at Rs 71 against Rs 93 for GSM and CDMA technology has limited market for international roaming. These stakeholders further stated that TRAI while recommending 1.5 times pricing for CDMA compared to GSM had gone only by the radio efficiency factor and not by the development of eco system, whereas

the eco system plays a bigger role in realizing value from any spectrum. One such stakeholder suggested that the indexed 2001 auction discovered price for 5 MHz CDMA spectrum should be discounted by at least 5 times to get the equivalent reserve price. According to the stakeholder, the reserve price based on indexation method for 800 MHz band for 5 MHz block on pan-India basis should be in the range of Rs 1000 crore to Rs 1200 crore.

3.70 Most of the stakeholders were of the opinion that the reserve price depends on available market, buying power, geography, number of operators etc. Each circle differs significantly on these parameters and therefore, in their view, the reserve price should be decided circle-wise. One of the stakeholders also submitted that setting a uniform reserve price suitable for a high potential area, for all service areas, may result in operators deciding not to bid for low potential service areas, thus limiting the growth of telecom ecosystem in these areas which would adversely affect competition.

3.71 A reserve price in an auction is a price floor below which a block will not be sold. As outlined in Chapter I, some of the key objectives identified for auction are (a) Government can augment its resources but the objective should be to serve public cause and public good by adopting fair and reasonable methods, (b) Transfer of resource to private domain must be adequately compensated and (c) Efficient utilisation of spectrum should be promoted. Therefore, revenue maximization is not the sole objective, and the priority is to ensure the efficient use of spectrum.

3.72 On the issue of quantum of reserve price in 1800 MHz band, several stakeholders have suggested a reserve price based on the entry fee discovered in the year 2001 for the fourth cellular licence. Their premise is that this was the last price discovered through auction for 2G spectrum bundled with the licence. However, in the consultation paper, it has been already mentioned that in the recommendations on

spectrum pricing of May 2010, the Authority has expressed the opinion that the price of Rs.1659 crore is no longer relevant. Moreover, the spectrum being auctioned now will be liberalized and therefore, the operators will have an option to use it for deployment of any technology.

3.73 Worldwide, the trends are towards technology neutral usage of spectrum. Liberalisation of spectrum essentially means the removal of technology restrictions to enable new access technologies to be deployed within the same band or bands as existing and legacy technologies. This would mean that the operators will be free to choose any technology in the spectrum bands held by them. Greater spectrum liberalisation could enable mobile operators to launch new services and technologies and increase competition. The rationale behind the liberalisation of the spectrum has already been given in chapter II. The telecom licensing regime in India is also technology neutral and fits in seamlessly with spectrum liberalisation.

3.74 Eliminating possible constraints associated with spectrum usage will certainly enhance its value to the operators. As the right of use of spectrum would be auctioned for a period of 20 years, it will be appropriate if the liberalisation precedes the spectrum auction. This will ensure that the full market value of the spectrum is realised. If spectrum is liberalised after the auction, the enhanced value would either not be realised, or, arbitrary increases in price would have to be effected.

3.75 One stakeholder in his response has submitted that the 1800MHz band has better propagation qualities and significantly better geographic and in-building coverage than 2100MHz; and LTE technology is now compatible with the 1800MHz band. Therefore, its economic value is much higher than 2100MHz band and the reserve price should be much above the 3G auction prices.

3.76 As discussed in Chapter II, 1800 MHz band has emerged as a crucially important option for LTE network deployment. It provides wider coverage at cheaper rates as compared to the higher frequency bands. In a number of countries, refarming in this band has been carried out and in some of the countries in Europe, Middle East and in APAC, commercial LTE service has been launched.

3.77 In view of the above, the Authority is convinced that for the determination of the reserve price for spectrum in the 1800 MHz band, the reference price should be the price discovered in the year 2010 for 3G spectrum and not the price discovered in the year 2001.

3.78 While determining the reserve price of 1800 MHz band on the basis of price of 2100 MHz, it is required to ascertain the relative efficiency of 1800 MHz band vis-a-vis 2100 MHz band. As discussed in Chapter II, Table 2.12, the number of base stations required for the coverage of the same area is 1.3 times less in UMTS 1800 as compared to UMTS 2100. As per the report9 prepared by consultant Vilicom Limited for ComReg, the Ireland operator, the cell sizes and range for various spectrum bands for UMTS systems based on link budgets and propagation models are as follows –

Table 3.2

Freq (MHz)	**Urban Cell range (km)**	**Suburban cell range (km)**	**Rural cell range (km)**
900	1.0329	1.697	16.198
1800	0.558	0.918	10.949
2100	0.470	0.772	9.753

3.79 As per the above table, for the suburban areas, the cell range which can be achieved in case of 1800 MHz band is around 1.2 times more

[9] Vilicom Report for ComReg (VIlicom, 2009, UMTS Network Design & Cost – Estimation for National UMTS 900, UMTS 1800 & UMTS21200 Networks for ComReg; ComReg document number 09/14a) as accessed from http://www.comreg.ie/_fileupload/publications/ComReg0914a.pdf

than the cell range in 2100 MHz band. The same report also mentions that the deployment cost of a UMTS1800 network is 88.5% of the cost of deploying UMTS 2100 network.

3.80 In view of the above discussion, the Authority holds that the 1800 MHz band can be taken as 1.2 times more efficient than 2100 MHz band for the purpose of calculating the reserve price in this band.

3.81 The auction for 3G spectrum was held in the year 2010. It was mentioned in the Notice Inviting Applications (NIA) document for the Auction of 3G and BWA spectrum released on 25th February 2010 that 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. The auction of 3G spectrum was completed in May 2010. By the time the upcoming auctions are held, the 3G prices will be around two years old. The NIA document had stated that for next twelve months same price as determined in the 3G auction would be taken as the reserve price. Therefore, for calculating the reserve price per MHz, the 3G auction prices per MHz for different service areas are indexed for one year using SBI average PLR rate @ 12.63%.

3.82 Economic Consultant DotEcon limited have, in their report titled 'Award of 800 MHz, 900 MHz and 1800 MHz of spectrum-Further update report on benchmarking' dated 24.08.2011, prepared for ComReg have mentioned that "it is appropriate to set minimum prices reflecting market value. The closer the chosen reserve price to market value, the less incentives bidders have to act strategically within the auction. This has to be balanced with the risk of exceeding market value given that this level is unknown. Therefore, it would be inappropriate to set minimum prices at an uncertain estimate of market value, but there is a good case for setting minimum prices as

high as uncertainty about market value allows. This means striking a balance by picking a minimum price that is as high as possible subject to the risk of exceeding market value being acceptably low."

3.83 A study of various auctions held globally in last 3-4 years reveals that the reserve prices are generally around 0.5 times the final prices. However, in the context of Indian telecom sector, where the demand for spectrum is considerably higher, the Authority has decided to use a factor of 0.8 to determine the reserve price.

3.84 As regards the concern expressed by some stakeholders about the Reserve price being uniformly applied irrespective of the economy of the different Circles being different, the Authority notes that the auction mechanism does throw up different prices for different regions. The Authority is applying the same formula, which is based on the prices for 2100 MHz spectrum that have been realised in the year 2010. These prices range from Rs. 6.06 crore per MHz in Jammu & Kashmir to Rs. 663.39 crore in Delhi, thus exhibiting a hundred-fold variation. Resultantly, the Reserve price for the 1800 MHz spectrum as well as the Spectrum in other bands will suitably reflect the inter-regional variation.

3.85 The reserve price for 1800 MHz band for different service areas will be as given in Table 3.3.

Table 3.3

Reserve price per MHz in 1800 MHz Band (in Rs. crore)

S.No.	Service Area	Reserve price per MHz (by applying average PLR 12.63% of 2010-11 * 1.2 * 0.8)
1	Delhi	717.26
2	Mumbai	702.14

3	Kolkata	117.69
4	Maharashtra	271.99
5	Gujarat	232.69
6	Andhra Pradesh	296.93
7	Karnataka	341.64
8	Tamil Nadu (incl. Chennai)	316.78
9	Kerala	67.58
10	Punjab	69.63
11	Haryana	48.14
12	Uttar Pradesh (West)	111.16
13	Uttar Pradesh (East)	78.83
14	Rajasthan	69.42
15	Madhya Pradesh	55.87
16	West Bengal	26.74
17	Himachal Pradesh	8.05
18	Bihar	43.99
19	Orissa	20.98
20	Assam	8.97
21	North East	9.15
22	Jammu & Kashmir	6.55

3.86 **The Authority recommends that the Reserve price for the 1800 MHz spectrum shall be as given in Table no. 3.3.**

Reserve price for Spectrum in sub-1GHz band

3.87 As discussed in Chapter II, spectrum in the sub- 1GHz bands is far more efficient in terms of its propagation characteristics as compared to spectrum in 2100 MHz and other higher frequency bands. As shown in Table 2.12, the number of base stations required for the

coverage of same area is approximately 2.1 times less in UMTS 900 as compared to UMTS 2100. Similarly, Chart 2.4 of Chapter II shows that the relative capex required for network infrastructure investment in 2100 MHz spectrum band is approximately 2 times more as compared to the sub- 1GHz bands.

3.88 Vilicom, in its report has suggested that the deployment cost of a UMTS900 network is 65.6% of the cost of deploying a UMTS 2100 network. Ovum in its report "Market Study for UMTS 900- A report to GSMA" has analysed the network cost of a UMTS 900 network v/s that of a UMTS 2100 network for markets in Western Europe, Asia Pacific, Middle East and sub-Saharan Africa. The study found that the cumulative capex cost over a five year period for a UMTS 900 operator would be around 60% that of a UMTS 2.1GHz operator. On the relative value of 1800 MHZ and sub-1GHz spectrum, DotEcon in its report10 has mentioned that based on the auction data and substantiating with technical studies, the relative value of 1800 MHz and sub-1GHz should range between 45%-60%.

3.89 In view of the above, the Authority is of the opinion that the reserve price in 800 and 900 MHz bands should be at least 2 times that of 1800 MHz band. Accordingly, the reserve prices for these two bands shall be as given in Table 3.4.

[10] A report for ComReg: Award of 800MHz, 900 MHz and 1800 MHz- Fifth Benchmarking Report, March 2012.

Table 3.4

Reserve price per MHz in 800/900 MHz Band (in Rs. crore)

S.No.	Service Area	Reserve price per MHz for 800/900 MHz bands
1	Delhi	1434.52
2	Mumbai	1404.28
3	Kolkata	235.38
4	Maharashtra	543.98
5	Gujarat	465.38
6	Andhra Pradesh	593.86
7	Karnataka	683.28
8	Tamil Nadu (incl. Chennai)	633.56
9	Kerala	135.16
10	Punjab	139.26
11	Haryana	96.28
12	Uttar Pradesh (West)	222.32
13	Uttar Pradesh (East)	157.66
14	Rajasthan	138.84
15	Madhya Pradesh	111.74
16	West Bengal	53.48
17	Himachal Pradesh	16.1
18	Bihar	87.98
19	Orissa	41.96
20	Assam	17.94
21	North East	18.3
22	Jammu & Kashmir	13.1

3.90 **The Authority recommends that the Reserve price for the 800/900 MHz spectrum shall be as given in Table no. 3.4.**

3.90 Regarding the reserve price of 700 MHz band, as discussed earlier in Chapter II, being a sub- 1GHz band and also the fact that on account of vacation of large part of this band world over due to conversion of analog to digital broadcasting transmission, in a number of countries the operators are deploying LTE technology for wireless broadband services. Therefore, though, the 800/900 bands are sub- 1GHz, result of recent auctions in a number of countries reveals that the comparative valuation between this band and the 1800/2100 MHz bands is far higher than that of 800/900 MHz bands.

3.91 As per Ofcom consultation report (Jan 2012), worldwide, the trends in the auction price (per MHz-per pop) of the 800 MHz (700 MHz in case of India) spectrum are as shown in the Table below.

Table 3.5

Auction prices in European countries (£/Mhz/pop)

£/MHz/pop[41]	Date auction concluded	800 MHz	1800 MHz	2.6 GHz (paired, FDD)	2.6 GHz (unpaired, TDD)
Austria	October 2010			0.0212	
Belgium	November 2011			0.0396	0.0394
Denmark[42]	May 2010			0.1506	
Finland	November 2009			0.0027	0.0048
France	December 2011	0.5809			
	September 2011			0.0883	
Germany	May 2010	0.6217	0.0218	0.0192	0.018
Italy	September 2011	0.6993	0.2252	0.0510	0.0350
Netherlands	April 2010			0.0010	
Norway[43]	November 2007			0.0220	0.0460
Portugal[44]	December 2011	0.3616	0.2651	0.0241	0.0096
Spain	July 2011	0.4043		0.0229	
	November 2011				0.0061
Sweden[45]	March 2011	0.3174			
	October 2011		0.1788		
	May 2008			0.1287	0.0296
Average (simple)		0.4809	0.1727	0.0400	0.0236

3.92 In view of the above data, the Authority is of the opinion that in India, for the auction of 700 MHz band, the reserve price should be around 4 times that of 1800 MHz band, as given in Table 3.6.

Table 3.6

S.No.	Service Area	Reserve price per MHz (in crore)
1	Delhi	2869.04
2	Mumbai	2808.56
3	Kolkata	470.76
4	Maharashtra	1087.96
5	Gujarat	930.76
6	Andhra	1187.72
7	Karnataka	1366.56
8	Tamil Nadu	1267.12
9	Kerala	270.32
10	Punjab	278.52
11	Haryana	192.56
12	Uttar Pradesh	444.64
13	Uttar Pradesh	315.32
14	Rajasthan	277.68
15	Madhya	223.48
16	West Bengal	106.96
17	Himachal	32.2
18	Bihar	175.96
19	Orissa	83.92
20	Assam	35.88
21	North East	36.6
22	Jammu &	26.2

3.93 **The Authority recommends that the Reserve price for the 700 MHz spectrum shall be as given in Table no. 3.6.**

Reserve price of 2100 MHz

3.94 As discussed above, the NIA document for the auction of 3G spectrum or BWA spectrum had stated that for next twelve months same price as determined in the 3G auction would be taken as the reserve price. The auction of 3G spectrum was completed in May 2010. By the time the upcoming auctions are held, the 3G prices will be around two years old. Therefore, for calculating the reserve price per MHz of 2100 MHz band, the 3G auction prices per MHz for different service areas are indexed for one year using SBI average PLR rate @ 12.63%. Accordingly, the reserve prices for this band shall be as given in Table Table 3.7

Table 3.7

S.No.	Licence Service Area	Reserve Price per MHz (in Crore)
1	Delhi	747.17
2	Mumbai	731.43
3	Kolkata	122.60
4	Maharashtra	283.34
5	Gujarat	242.39
6	AP	309.31
7	Karnataka	355.89
8	Tamil Nadu	329.99
9	Kerala	70.39
10	Punjab	72.54
11	Haryana	50.14
12	UP - West	115.79
13	UP - East	82.12
14	Rajasthan	72.32
15	M.P.	58.20
16	West Bengal	27.85
17	H.P.	8.39
18	Bihar	45.83
19	Orissa	21.85
20	Assam	9.34
21	North East	9.53
22	J&K	6.83
	Total	**3773.24**

3.95 **The Authority recommends that the Reserve price for the 2100 MHz spectrum shall be as given in Table no. 3.7.**

Reserve Price of 2300 MHz

3.96 Similarly, the for calculating the reserve price per MHz of 2300 MHz band, the BWA auction prices per MHz for different service areas are indexed for one year using SBI average PLR rate @ 12.63%. Accordingly, the reserve prices for this band shall be as given in Table Table 3.8.

Table 3.8

S.No.	Licence Service Area	Reserve Price per MHz (in Crore)
1	Delhi	126.20
2	Mumbai	129.13
3	Kolkata	29.46
4	Maharashtra	51.56
5	Gujarat	34.57
6	AP	59.64
7	Karnataka	86.91
8	Tamil Nadu	116.54
9	Kerala	14.57
10	Punjab	18.71
11	Haryana	6.75
12	UP - West	10.35
13	UP - East	8.02
14	Rajasthan	5.48
15	M.P.	7.02
16	West Bengal	4.00
17	H.P.	1.16
18	Bihar	5.59
19	Orissa	3.58
20	Assam	1.86
21	North East	1.20
22	J&K	1.20
	Total	**723.52**

3.97 **The Authority recommends that the Reserve price for the 2300 MHz spectrum shall be as given in Table no. 3.8.**

3.98 Having arrived at the Reserve Price of spectrum in different bands, the Authority has set out to evaluate with reference to different objectives. While deciding the reserve price of 3G auction in the year 2006, the Authority made a study of international allocations after 2002 and arrived at an average price for international allocations of Rs 68 per Hz. Current auctions worldwide indicate that liberalised spectrum capable of voice and data services in 2G, 3G or newer technologies are fetching high prices. One of the indicators is price per MHz per population. This figure is in the range of 0.4 to 0.6 Euros in European countries and it is as high as 1 euro in an auction held in Hong Kong. The prices of spectrum in recent auctions in around 9 countries are given in **Annexure -VI**

3.99 As against these prices, it is seen that the price per MHz per population in the 3G auction held in India in 2010 was only 0.21 euro. The present recommended reserve price of Rs 3622.16 for 1800 MHz spectrum works out to only 0.25 euro per MHz per population. Therefore the recommended reserve price is in line with international prices.

3.100 During the consultation process, some of the stakeholders have expressed their apprehension that in case the reserve price is set high, then it may result in lower competition and the operators may pass the high price paid in the auction to the consumers by increasing the tariff and this make the services unaffordable. In order to analyse the effect of auction price on per minute costs of the operators over a 20 year licence period, TRAI carried out an analysis using Equated Monthly Instalment (EMI) method with interest @ 15% per annum for recovery of investment in auction fee. The following two cases have been considered. 1) The cost impact on per minute basis of auction

fees on wireless (GSM) service segment of the telecom industry and 2) the cost impact on per minute basis on a hypothetical operator who acquires 5 MHz of spectrum on pan India basis in wireless (GSM) service segment.

3.101 In case 1 above i.e. the cost impact on per minute basis of auction fees on wireless (GSM) service segment of the telecom industry, the following assumptions have been made:

i. The amount of spectrum available in the 1800 MHz band is 576.20 MHz. (Table 2.4)

ii. Reserve price per MHz is based on 3G auction prices per MHz as discussed earlier.

iii. The total number of Minutes of Usage (MOUs) - 257285 crore minutes for wireless (GSM) services in 2010-11- has been taken as base for future projection of MoUs for 20 years (from 2012-13 to 2031-32) as per the growth rates indicated in **Annexure VII**.

iv. The EMI for the auction money based on reserve price calculated for 20 years @ 15% per annum has been annualized. Return on Capital Employed @ 15% used by the Authority in past exercises has been taken as rate of interest for the purpose of calculating EMI.

v. The calculation sheet is at **Annexure -VII.** As can be seen, the per-minute cost impact (including interest) reduces from Re. 0.044 per minute in 2012-13 to Re. 0.017 per minute in 2031-32. Under the further assumption that the share of annualized EMI, met out of revenue generated from non-voice services, increases from 18% in the year 2012-13 to 30% in the year 2016-17, 40% in the year 2018-19 and 50% from the year 2020-21 onwards, per minute impact for voice services reduces from Re. 0.036 in 2012-13 to Re. 0.008 in 2031-32.

3.102 For case 2, i.e. the cost impact on per minute basis on a hypothetical operator who acquires 5 MHz of spectrum on pan India basis in

wireless (GSM) service segment, the following assumptions have been made:

i. The service provider has a subscriber base of 5 crore in 2012-13. The assumed growth rates of subscriber base up to 2031-32 are as indicated in **Annexure VIII**.

ii. The service provider acquires 5MHz of spectrum (GSM) on pan India basis.

iii. Reserve price per MHz is based on 3G auction prices per MHz as discussed earlier.

iv. The MoU (Minutes of Usage) per subscriber per month is taken as 340. The MoU per year has been projected by multiplying MoU per subscriber per month by the projected number of subscribers and annualizing the same.

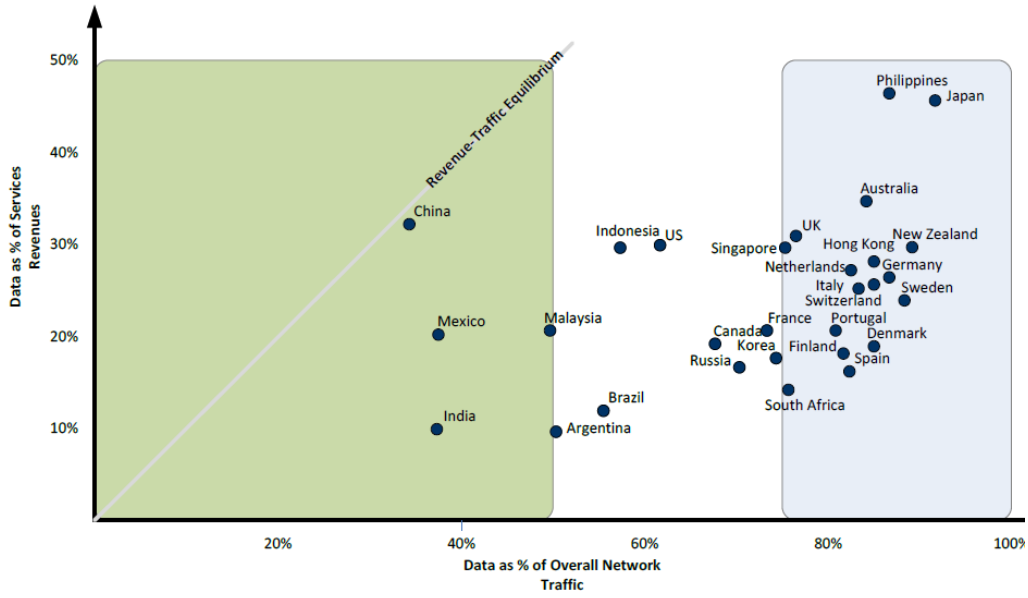
v. The EMI for the auction money based on reserve price calculated for 20 years @ 15% per annum has been annualized. Return on Capital Employed @ 15% used by the Authority in past exercises has been taken as rate of interest for the purpose of calculating EMI.

ii. The calculation sheet is at **Annexure-VIII**. As can be seen, the per-minute cost impact (including interest) reduces from Re. 0.14 in 2012-13 to Re. 0.099 per minute in 2031-32. Under the further assumption that the share of annualized EMI met out of revenue generated from non-voice services increases from 18% in the year 2012-13 to 30% in the year 2016-17, 40% in the year 2018-19 and 50% from the year 2020-21 onwards, per minute impact for voice services reduces from Re. 0.115 in 2012-13 to Re. 0.05 in 2031-32 per minute.

3.103 The assumptions regarding growth of revenue share from data services are borne out by a recent study by “Pyramid Research” which states that the total telecom service revenue in 2011 was $42.2bn and is expected to grow to $46.1bn by the end of 2012. This is expected to

reach $61.3bn by the end of 2017, growing at a CAGR of 5.9%. Mobile voice's contribution to the total revenue will decline from 68.0% in 2011 to 56.0% in 2017 largely due to faster growing data-related service on both the fixed and mobile networks. The mobile data is set to grow at a CAGR of 20.0%, increasing from $5.1bn in 2012 to $12.8bn in 2017, while fixed data will experience an even higher CAGR at 23.4%, taking the 2012 total of $1.4bn to $4.1bn by 2017. Worldwide from 2010 there has been significant migration from voice to data services and revenues. Major economies are slowly transitioning from a voice-centric universe to the one where voice is just another application on the all-IP network. The shares of data revenues as a percentage of the total revenues in various countries are shown below:-

Chart 3.1

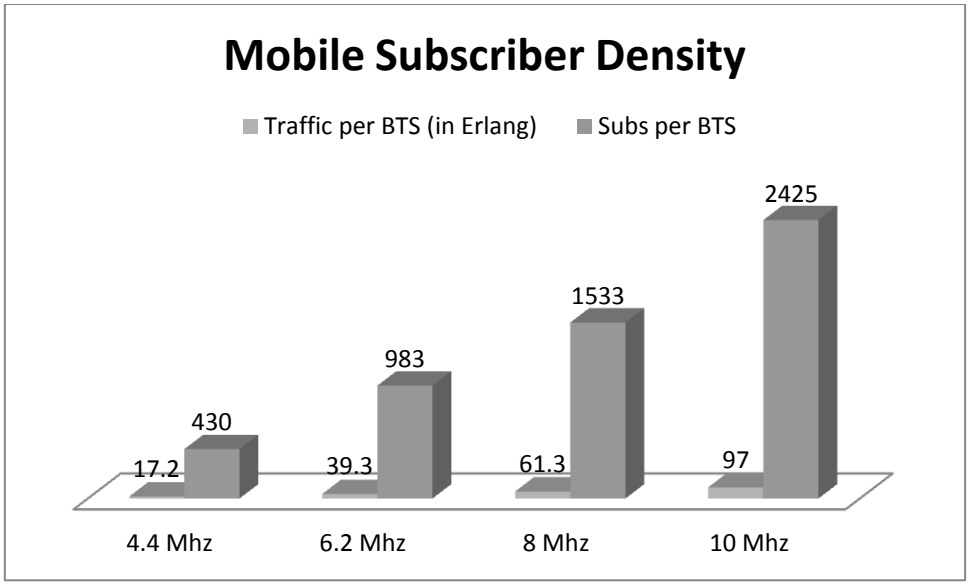


3.104 As per an Analysys Mason report, the data access revenue will be the biggest revenue driver by 2015. In addition to data access on handsets, connected computing devices and dongles will also contribute significantly to increase in data access revenues.

3.105 As regards competition it is observed that the telecom sector in India is highly competitive. It is a fact that the existence of a large number of operators including several new players who had entered the industry in 2008, had played an important role in bringing down the tariff levels in the Indian market in recent years. However, even after exclusion of the 122 licenses which were cancelled under the orders of the Hon'ble Supreme Court of India, there will be no adverse effect on the Herfindahl-Hirschman Index (HHI). The HHI in different service areas remains favourable as indicated in the **Annexure –IX.** It is expected that there would be adequate competition. However, each bidder makes his/her own assessment of the market situation and the business potential. In case the level of competition during bidding is not high, an adequate reserve price will ensure realisation of value for spectrum. This will also incentivize the operators to efficiently utilize the spectrum, maximizing the coverage and reach.

3.106 A question which arises is whether a high reserve price will adversely impact the business cases and the EBITDA margins of the operators. While the outflows on account of payments for the spectrum would be expected to negatively impact the EBITDA margins in the sector, increased availability of spectrum will help to reduce the increase the number of subscribers and traffic served by each BTS as indicated in the Chart 3.2, thus reducing the capital and operational costs of their network and increasing the EBITDA and profitability margins.

Chart 3.2



3.107 In response to the pre-consultation paper, some stakeholders had suggested that keeping in mind the present funding problems in the telecom industry, the payment of the spectrum auction amount should be in instalments. Accordingly, in the consultation paper, the stakeholders were asked to give their views on whether the Government should allow a deferred payment schedule for the spectrum auction fee or whether the payment should be upfront in nature. In response, some stakeholders were of the view that the payment should be upfront in nature, because deferred payment schedule does not allow for a true market discovery of the spectrum price and encourages bidders to bid a higher value than justified by the potential business case. These stakeholders also felt that upfront payment will ensure that only serious operators participate in the auction. According to these stakeholders, deferred payment option would not only impact the rollout of networks but also pose challenges in the recovery of amounts accruing out of the auction.

3.108 Some stakeholders were of the view that the flexible auction payment programme would have beneficial effects on telecom growth by reducing funding cost and would help faster rollout of affordable

services especially in hinterland areas, whereas the lump sum payment of bid amount would put a difficult financial burden on winning bidders just at the time when they are beginning to invest in infrastructure. According to them, phased payment plans have been adopted for successful bidders in other countries. They suggested that the annual payment of bid amount can be indexed against the wholesale /consumer price index to protect government revenues.

3.109 One stakeholder suggested that the winning bidders should be allowed to pay only 25% of the amount of their bids after auction and the remaining 75 per cent in future instalments. Another opinion was that deferred payment plan should only be given to new entrants obtaining start-up spectrum, since their gestation period would be higher. One stakeholder suggested that winners could have a deferred payment plan in an economically increasing manner (cash-flow related) i.e. year 1: 10%, year 2: 10%, year 3: 20%, year 4: 30% and year 5: 30%. Another stakeholder suggested that the deferred payment schedule should consist of 5 instalments spread over the period of validity of spectrum. Another stakeholder was of the view that the Government should specify the options for upfront payment or a deferred payment schedule (quantum & timing) before the auction to eliminate any subjectivity or discretion after the auction is done.

3.110 Another aspect that needs to be kept in mind is regarding the availability of sufficient liquidity in the banking system to absorb the requirement of funds for the auction. Liquidity in the economy is also very tight; however the Reserve Bank of India has been taking a number of measures including Cash Reserve Ratio (CRR) cuts and injection of funds through Open Market Operations (OMO). In March 2012, RBI made 75 basis points cut in the CRR to inject nearly Rs.48000 crore into the Indian economy. In fact, CRR cuts by 1.25 per cent since January released Rs 78,000 crore into the system, while OMOs conducted in recent months injected over Rs 1.3 lakh crore to tide over the tight liquidity condition. The Reserve Bank has recently

stated that liquidity condition is likely to improve in the Q1 of 2012-13. Nonetheless, the Authority is of the view that keeping in view the liquidity position in the Indian economy, the licensees obtaining spectrum through the auction process should be facilitated

3.111 Having examined different aspects of the Reserve price, the Authority is convinced that the principles listed in Para 3.71 above are satisfied. Even as the reserve price assures that the transfer of the natural resource viz., spectrum to the private domain is adequately compensated, affordability to the consumer as well as viability of the Business are assured, thereby fulfilling the principle of larger public good.

3.112 **Accordingly, the Authority recommends the following Reserve Price for spectrum in different bands:**

Table 3.9

Reserve Price per MHz (in Rs. Crore)

S.No.	Licence Service Area	700 MHz	800 MHz	900 MHz	1800 MHz	2100 MHz	2300 MHz
1	Delhi	2869.04	1434.52	1434.52	717.26	747.17	126.20
2	Mumbai	2808.56	1404.28	1404.28	702.14	731.43	129.13
3	Kolkata	470.76	235.38	235.38	117.69	122.60	29.46
4	Maharashtra	1087.96	543.98	543.98	271.99	283.34	51.56
5	Gujarat	930.76	465.38	465.38	232.69	242.39	34.57
6	AP	1187.72	593.86	593.86	296.93	309.31	59.64
7	Karnataka	1366.56	683.28	683.28	341.64	355.89	86.91
8	Tamil Nadu	1267.12	633.56	633.56	316.78	329.99	116.54
9	Kerala	270.32	135.16	135.16	67.58	70.39	14.57
10	Punjab	278.52	139.26	139.26	69.63	72.54	18.71
11	Haryana	192.56	96.28	96.28	48.14	50.14	6.75
12	UP - West	444.64	222.32	222.32	111.16	115.79	10.35
13	UP - East	315.32	157.66	157.66	78.83	82.12	8.02
14	Rajasthan	277.68	138.84	138.84	69.42	72.32	5.48
15	M.P.	223.48	111.74	111.74	55.87	58.20	7.02

16	West Bengal	106.96	53.48	53.48	26.74	27.85	4.00
17	H.P.	32.2	16.10	16.10	8.05	8.39	1.16
18	Bihar	175.96	87.98	87.98	43.99	45.83	5.59
19	Orissa	83.92	41.96	41.96	20.98	21.85	3.58
20	Assam	35.88	17.94	17.94	8.97	9.34	1.86
21	North East	36.6	18.30	18.30	9.15	9.53	1.20
22	J&K	26.2	13.10	13.10	6.55	6.83	1.20

3.113 **The Authority recommends the following schedule for deferred payment of the bid amount by the successful bidders.**

Table 3.10

Spectrum	Initial Payment	Moratorium	Period for balance payment
Supra-1 GHz (1800,2100 and 2300 MHz bands)	**33% of the Bid amount**	**2 years**	**10 years (equal annual instalments)**
Sub-1 GHz bands (700,800 and 900 MHz bands)	**25% of the Bid amount**	**2 years**	**10 years (equal annual instalments)**

3.114 **The Authority further recommends that the annual instalments for deferred payments shall be duly securitised and the Net Present Value of the Bid amount is safeguarded by imposing a suitable rate of interest, which shall be decided by the DOT in consultation with the Reserve Bank of India/ Ministry of Finance.**

G. Sequence of spectrum auctions

3.115 Spectrum available across various bands needs to be auctioned such that while making it available for commercial telecom services, the full value of the spectrum is realised. The Authority has given careful consideration to the establishment of reserve price. An assessment of

the value of the available spectrum in different bands on the basis of the reserve price, works out to about Rupees seven lakh crore. The sequencing of spectrum auction, therefore, has to take into consideration the ability of the telecom sector to generate requisite funds as well as to utilise the spectrum in most effective manner.

3.116 Keeping in view the above schedule, the Authority is of the view that it is essential for the Department of Telecommunications to engage an auctioneer for a period of three years so that all the auctions can be conducted smoothly and without delay.

3.117 **The Authority recommends that the sequencing could be as follows:**

(a) 5 MHz of 1800 MHz band- This auction would be to establish the market value of spectrum. This could be done in the current year 2012-13 as early as possible.

(b) Allocation of additional 1.25 MHz spectrum to the holders of 4.4 MHz in 1800 MHz bands, subject to the legal opinion.

(c) Auction of spectrum in the 800 MHz band- This should also be done in the current financial year.

(d) Auction of spectrum in the 900 MHz band- This auction should be conducted in the first half of 2013-14 preferably in the first quarter so that there is adequate time for deployment as and when 900 MHz spectrum is available by November, 2014.

(e) Balance Spectrum in 1800 MHz band- This should be done in the first half of 2013-14

(f) Auction of Spectrum in 2100 MHz band - This should also be carried out in the second half of 2013-14.

(g) Auction of available spectrum in 700 MHz band- This should be carried out in the first half of financial year 2014-15.

(h) Auction of additional spectrum in 2300 MHz band- This should be carried out in the second half of financial year 2014-15.

3.118 **The Authority recommends that the Department of Telecommunications should engage an auctioneer for a period of three years so as to conduct the auctions without delay.**

H. Spectrum Mortgage

3.119 Keeping in view the comments at the pre-consultation stage, stakeholders were asked whether spectrum can be mortgaged for raising capital. Several stakeholders were in favour of using spectrum as collateral for raising finances. They based their arguments on the fact that once the licence is delinked from the spectrum, the main asset with an operator will be spectrum and it is necessary that spectrum should be allowed to be mortgaged for raising financial resources for meeting various business needs of the telecom operators. According to one stakeholder, most of the operators have adopted the concept of infrastructure / network sharing and outsourcing of most of the operational services and operators hold minimal fixed assets on their balance sheet. It was further argued that this limits the capacity of operators to borrow secured funding, resulting in higher interest costs as lenders classify the same as uncovered. It was of the view that spectrum being the most valuable and important asset for all telecom operators and more so since spectrum has been unbundled from license, it can be rightfully mortgaged to raise capital and loans by the operators. Though classified as intangible, amount of spectrum is easily quantifiable as well as can be valued. Another stakeholder commented that the tripartite agreement has served a very useful purpose for raising capital for telecom projects and the agreement, which is presently prescribed among the service licensee, the licensor and the lender, should instead now be prescribed among the spectrum licensee, the licensor and the lender. It further submitted that this will ensure adequate flow of resources required by the licensees and will ease the difficulty that telcos are facing to raise capital in India. Currently, the license/ spectrum fee paid by the licensees is considered as an

intangible asset in the books of the licensees as per RBI instructions. The stakeholder further commented that since spectrum is classified as intangible asset, when banks provide funds for rollout of business plan or for meeting entry fee/ BG requirement, the loans to that extent have to be treated as unsecured loans, even though the licenses are assigned in favour of the lenders. Holding unsecured assets on the banks books have in turn several implications in terms of lower ratings, higher provisioning, etc. Therefore, in the opinion of the stakeholder, in case the future spectrum is priced at higher levels, as in the case of 3G spectrum, then lenders may not be in a position to fund these business plans considering the unsecured nature of the lending. Another comment was that allowing mortgage arrangements offers particular benefit to not only new entrants but also incumbents, who may otherwise struggle to gain access to finance at low cost, therefore, the stakeholder suggested that the spectrum may be allowed to be mortgaged.

3.120 Few stakeholders have suggested that it will not be appropriate to allow mortgaging of spectrum for raising capital for telecom purpose. They were of the opinion that spectrum is a different kind of natural resource where title (or ownership) may not be legally established through auction as against the case of land or building. According to one of the stakeholders, the Supreme Court has observed that natural resources belong to the people but the State legally owns them on behalf of its people and from that point of view natural resources are considered as national assets, more so because the State benefits immensely from their value. In the opinion of the stakeholder, since mortgaging assumes a degree of ownership, whereas spectrum remains under the ownership of the state, mortgaging spectrum by a licensee should not be allowed. Another stakeholder commented that one of the major aims of the banks/financial institutions for mortgaging is procuring collateral security that could be legally sold to adjust part or full amount of possible default which is only possible if

a trading market exists in India. Otherwise, spectrum would not be as easily 'encashable' by the financing institutions as the apparently more tangible land and/or buildings. Also, as per the opinion of the stakeholder,, the mortgager cannot hold the spectrum 'intangible asset' and use, re-sell or re-allocate it as it wishes, but can only give it back to the DoT for re-farming.

3.121 One stakeholder commented that permission to mortgage spectrum by treating it as tangible asset will only be a notional step unless spectrum trading is permitted. Therefore the issue related to mortgage of spectrum should also be deferred for the time being till the time the new telecom policy is announced.

3.122 One stakeholder suggested that only that portion of spectrum should be allowed to be mortgaged which has been acquired through the Government auction route. Another stakeholder suggested that this is a separate subject and needs to be examined separately. According to one of the stakeholders, views of the Reserve Bank of India must be separately sought by TRAI in this regard.

3.123 After carefully analysing the comments of the stakeholders, the Authority is of the view that telecom sector requires huge capital investment periodically and it is necessary that telecom players have access to adequate funds from the financial institutions. Earlier when spectrum was bundled with the spectrum, there was a provision of tri-partite agreement between the licensee, lender and the licensor for facilitating loans to the telecom operators. As the spectrum will now be given through auction, therefore, there should be a provision of allowing operators to mortgage the spectrum in order to secure loans.

3.124 In case an operator defaults in its payments, the concerned financial institutions will be allowed to recover their dues by auctioning the mortgaged spectrum. However, in case the financial institutions themselves decides to auction the spectrum, then, in order to ensure that this facility of mortgaging of spectrum do not provide a back door

method foe spectrum selling, the auction will be done under the supervision of DoT and all proceeds in excess of the liabilities of the operator should be remitted to the Government.

3.125 **The Authority recommends that mortgage of spectrum may be allowed by spectrum holders to a registered Indian financial institution against borrowings. The mortgage will be subject to the condition that in the event of default of the liability, the spectrum shall be auctioned by the financial institution under the supervision of the DOT and all proceeds in excess of the liability shall be remitted to the Government.**

3.126 Telecom sector is a cost intensive sector requiring huge capital investment and the gestation period is also long. Therefore, the operators should be facilitated in terms of funding. As per a recent statement made by the Ministry of Finance, the banking system already has an exposure of about Rs. 28,000 crore to telecom companies for funding licence fee, infrastructure and roll out of 2G services. As per the Reserve Bank of India (RBI), the overall exposure of Indian banks to the telecom sector (2G, 3G and others) was almost Rs 91,000 crore until November 2011. Considering the level of investment required to enable the Indian telecom sector to play its role fully in the socio-economic development of the country, it is essential for the Indian Banking sector to deepen its association with this sector. The Authority has, in Para 3.114 recommended the mortgaging of spectrum as security against borrowings from the Indian financial institutions. The Government and the Reserve Bank of India should take measures to remove all the road blocks in the framework for borrowings by the telecom sector against the spectrum assigned to them.

3.127 **The Authority recommends that the Department of Telecommunications must take up with the Ministry of Finance and the Reserve Bank of India to remove all the road blocks in**

the framework for borrowings by the telecom sector against the spectrum assigned to them.

I. Roll Out Obligations

3.128 One of the questions raised in the consultation paper was regarding the roll out obligations linked to the auctioned spectrum. In response to the question, some of the stakeholders were of the view that as the spectrum is being acquired through market price discovery, there should not be any roll out obligations. One such stakeholder suggested that as the competitive situation will force the operators to roll-out services and also TRAI QoS norms ensure grade of service, ideally roll-out obligations are not essential.

3.129 On the other hand, some of the stakeholder were of the opinion that in order to ensure that the available scarce resource is put to most efficient use and also fulfils the service penetration targets of the licensor in line with the national objectives; rollout obligations are required for spectrum.

3.130 Some of stakeholders suggested that, in case, any bidder having spectrum in the 800, 900 or 1800 MHz spectrum band, had already met the rollout obligations provided in their UAS license, then there should not be any additional rollout obligation applicable for the post 2G auction and the rollout obligations should apply for the start up spectrum cases only.

3.131 One stakeholder commented that the low density and rural rollout obligations must not be linked to new entrants with start-up spectrum at least in 1800 MHz; rather it should be clubbed with additional spectrum over and above start-up spectrum or for players who already have 5 MHz (FDD) of sub-1GHz spectrum. Another stakeholder commented that for spectrum holdings beyond 6.2MHz, the rollout obligations should be stringent and they should be mandated that 95% of rural SDCA shall be covered within the prescribed time-limit.

3.132 Another stakeholder was of the opinion that the rollout obligations, in case of spectrum acquired through auction, cannot be more onerous than the existing licensees' obligations w.r.t. roll-out. It further commented that obligations must be reasonable considering that there are already multiple service providers in the market and any onerous rollout obligations will only lead to duplicity of critical infrastructure and investments. It was of the view that in case any rural area based rollout obligations or sparsely populated inhabitation based obligations are proposed, the funding of such obligations must be provided to players from USO Fund.

3.133 One stakeholder suggested that for the auctioned spectrum, Government can adhere to the rollout obligations, which were recommended by TRAI in its consultation paper on "Spectrum Management and Licensing Framework" in May, 2010, (the same was modified after comments from DOT). In its opinion, meeting the rural rollout obligations could be accompanied with suitable incentives for the USOF portion of the license fee.

3.134 In a market like India where the spectrum is already scarce, it becomes essential to ensure that the available spectrum is put to efficient use. In such a market if roll out obligations are not defined for the spectrum that is purchased in auction, it may result in licensees buying the spectrum in auction and hoarding it to realize speculative gains at later stage. Further, the rural tele-density in India has not been able to keep pace with the urban tele-density as can be seen from the Table 3.11.

Table 3.11

Year (as on 31st Dec.)	Wireless Tele-Density	Rural Wireless Teledensity	Urban Wireless Teledensity
2009	44.72	19.95	103.20
2010	63.22	30.11	140.53
2011	74.15	36.56	161.01

3.135 In such a scenario, it becomes essential to mandate the rollout obligations, so as to ensure efficient use of spectrum for delivery of telecom services in rural and far flung areas.

3.136 In most of the countries, stringent rollout obligations have been laid even for the spectrum that is assigned through auction. Some of the regulators have laid rollout obligations in such a manner that the operators are required to mandatorily cover the rural areas first and then move to urban areas.

3.137 The Authority while deliberating on the issue of rollout obligations in its recommendations on "Spectrum Management and Licensing Framework" of 11th May, 2010, had observed that –

a. The present roll out obligations are very lenient and are urban centric.
b. In several countries, the roll out obligations is quite stringent even when the spectrum is given through market mechanism.
c. The roll out obligations prescribed in the licence do not carry any condition regarding rural coverage.

3.138 Accordingly, the Authority in its recommendations of 11th May 2010 had recommended replacing existing roll out obligations in CMTS/UAS license by rural centric roll out obligations. While reconsidering the same, Authority in its recommendations of 3rd Nov, 2011, recommended rollout criteria as follows:

Table 3.12

Time	Villages having population >10000	Villages having population 5000-10000	Villages having population 2000-5000
2 years from effective date	100%	50%	-
3 years from effective date	100%	100%	50%
4 years from effective date	100%	100%	100%

3.139 For the existing Licensees, the Authority recommended that they should be given one more year to complete the two years roll out obligations and two years to complete the third and fourth year roll out obligations from 01.04.2012.

3.140 The Guidelines for Unified Licence do not impose any roll out obligations as no natural resource is being given to the licensee. However, the guidelines stipulate that in case the licensee is assigned spectrum, it will be required to comply with roll out obligations as applicable with attendant incentives and penalties. Spectrum being a scarce and valuable resource, every spectrum holder is obliged to discharge its duty to the society at large.

3.141 **Therefore, the Authority reiterates its recommendation regarding rural roll-out obligations as spelt out in 3rd Nov, 2011 recommendations and that the measures contained therein should be made applicable to all spectrum holders.**

J. Spectrum Usage Charge

3.142 In response to the question on the applicable annual spectrum usage charges for the spectrum being auctioned, some stakeholders suggested that the spectrum usage charge for the auctioned spectrum

should be uniform and kept at the minimum required to recover the cost of administration. According to them, internationally, whenever the price of the spectrum is derived through auction, the recurring spectrum charge is levied only to recover administrative costs.

3.143 One stakeholder suggested that spectrum usage charges for the auctioned spectrum should be same as that for 3G/BWA services i.e. 1% of AGR, but existing players who obtain additional spectrum through auction should continue to pay charges as per the present criteria of escalating charge.

3.144 One stakeholder argued for lowering of spectrum usage charges as the telecom operators in India, who are already facing the problem of declining profit margin because of lower ARPU and high operating costs, have to bear in addition a high burden of regulatory charges amounting to 19% to 28% of their revenues. In other developing Asian countries like China, Sri Lanka, Malaysia, Pakistan etc., these charges range from 3% to 7%. The stakeholder suggested that spectrum usage charges should only recover administrative costs and should not be more than 2-3% of AGR. Other stakeholders suggested 3% and 5% as rates for spectrum usage charges.

3.145 A few stakeholders suggested that spectrum usage for all operators should be the same irrespective of the amount of spectrum that they have. They pointed out that the escalating fee structure approach penalizes successful (larger) operators who are utilizing spectrum more efficiently and generating higher revenues, as they have to pay a higher rate on the higher revenues that accrue from the deployment of the incremental spectrum. The escalating price structure also results in different operators facing very different marginal pricing of the same increment of spectrum as the operators with higher allotments of spectrum, and consequently more customers, pay a higher charge. On similar lines, another stakeholder suggested that TRAI could recommend a uniform fixed price per MHz as spectrum usage charge

as this would not only address the present issues of discriminatory annual spectrum charges and would set equal rules at the time of auction for all eligible players, but would also incentivize all players to use their spectrum more efficiently. One stakeholder suggested that graded/escalated charges must be applied to only those service providers who have obtained spectrum allocations with the license and/or on the basis of SLC criteria, and licensees who acquire spectrum through market mechanism, should not be required to pay escalating spectrum usage charges (SUC).

3.146 One stakeholder commented that as revenue earned from spectrum allocated administratively and through auction cannot be segregated, the cumulative amount of spectrum allocated administratively and through auction should be counted for calculating the slab of total spectrum holding by a service provider for levy of spectrum usage charges.

3.147 A few stakeholders commented that the current approach of applying spectrum charges separately on GSM and CDMA spectrum not only discriminates between similarly placed operators holding similar amounts of spectrum and offering the same mobile services, but also creates an opportunity for operators to divert/misreport revenues and pay lower charges which is very difficult for the Government to monitor in order to avoid loss to the exchequer. They commented that this problem will be further aggravated as more spectrum from different bands is auctioned.

3.148 Presently, the spectrum usage charge varies from 3% to 8% for GSM and CDMA spectrum as shown in Table 3.13.

Table 3.13

Amount of Spectrum (MHz)		Spectrum charges as a Percentage (%) of AGR
GSM	**CDMA**	
Upto 2x4.4	Upto 2 x5MHz	3
Upto 2x6.2	Upto 2 x6.25	4
Upto 2x8.2	Upto 2x 7.5	5
Upto 2x10.2	Upto 2x10	6
Upto 2x12.2	Upto 2x12.5	7
Upto 2x15.2	Upto 2x15	8

3.149 After the auction of spectrum, there will be three categories of licensees as below:

1. Licensees who have acquired spectrum only through the proposed auction.

2. Licensees who are having some spectrum assigned administratively and have also acquired some spectrum through the proposed auction.

3. Licensees who have been assigned spectrum only through administrative process.

3.150 In case of 3G and BWA auction, the licensee under category 1 was to pay 3% and 1% of AGR for 3G and BWA spectrum respectively. In case of licensee under category 2, for 3G spectrum, they continued paying the same spectrum usage charge as applicable on their 2G spectrum. However, after acquiring 3G spectrum, the usage charge was on combined AGR of both 2G and 3G spectrum. For BWA spectrum, such licensees were to pay 1% of AGR on the revenue earned through BWA spectrum.

3.151 Regarding licensees under category 3, the spectrum usage charges were as given in Table above.

3.152 The Authority is of the view that once spectrum is obtained through an open auction, the other charges should not have any further element of collecting the rent for assignment of spectrum. Any such charge should be only to cover the administrative costs attendant with resource management. As all spectrum in future shall be acquired through auction, the Authority would like the Spectrum Usage Charges to be minimal at 1% of the Adjusted Gross Revenue. The guidelines for Unified Licence already stipulate that only the revenue accrued through wireless services shall be taken into consideration for the purpose of levy of Spectrum Usage charges.

3.153 In respect of licensees who have a mix of administratively assigned spectrum and spectrum acquired through auction, the principle for levy of Spectrum usage charges shall be on lines similar to the 3G spectrum i.e., the spectrum holder will continue to pay the SUC as applicable on the spectrum acquired through administrative process. However, in their case, the AGR will be the total AGR earned through spectrum acquired through auction and administratively acquired spectrum. In the event the spectrum holder, who is in category 2 or 3 pays the current auction determined price for the spectrum that is administratively assigned, then it will be entitled to the payment of Spectrum usage charges at the rate of 1% of the AGR.

3.154 **The Authority recommends that**

A. Licensees who have acquired spectrum only through auction conducted here onwards shall be levied spectrum usage charge only at the rate of 1% of the Adjusted Gross Revenue spectrum.

B. Licensees who have a mix of spectrum assigned administratively and spectrum acquired through auction and Licensees who have been assigned spectrum only through administrative process shall be levied the spectrum

Usage charges at the rate applicable on the administratively assigned spectrum and on the entire AGR.

C. In the event the spectrum holder, who falls under 'B' above pays the current auction determined price for the spectrum that is administratively assigned, then it will be entitled to the payment of Spectrum usage charges at the rate of 1% of the AGR.

3.155 In its recommendations of May, 2010, the Authority noted that the even though the rollout obligations for new licensees are applicable from the date of allocation of start up spectrum, some of the service providers do not commence their operations even after the lapse of sufficient time. A new licensee having received initial start-up spectrum and not commencing its services results in the Government not receiving its due share of annual licence fee and spectrum charges as a percentage of the AGR. As such, inefficient usage of spectrum leads to loss of government revenues. Accordingly the Authority proposed to levy the license fee and spectrum usage charges as a percentage of a presumptive adjusted gross revenue or the actual adjusted gross revenue, whichever is higher. Accordingly the Authority recommended that *w.e.f. 1.4.2010, the licence fee and spectrum usage charges payable by each such licensee shall be on actual AGR, subject to a minimum AGR as shown in Table 2.13* (of the recommendations*). This minimum figure would be reviewed by TRAI every year*.

3.156 Since the spectrum now will be allocated based on auction, there should be a minimum AGR for the purpose of levy of Spectrum usage charges. The Table 2.13 in the May 2010 recommendations was in the context of the 2G services. The Authority is of the view that the recommendations of May 2010 in this regard need to be revised and recommends that the minimum AGR shall be 5% of the Bid amount. This will be applicable from the 2nd year from the date of auction.

3.157 **The Authority recommends that for the purpose of calculation of the Licence fee as well as SUC, there shall be a Minimum AGR, which shall not be less than 5% of the Bid amount. The calculation will be on the basis of Minimum AGR or the actual AGR, whichever is higher.**

K. Validity Period

3.158 On the issue of validity period of the rights to the auctioned spectrum, several stakeholders were of the opinion that spectrum should be granted for a longer term of about 20 years as the telecom sector requires large investments and the payback period covers several years. One stakeholder was of the opinion that the underlying UAS License/Unified License as the case may be, should be extended to be co-terminus qua the auctioned spectrum, as this approach was followed in the case of 2.1GHz auctions and it should be continued in the proposed auctions as well. Another stakeholder felt that the time duration of spectrum should be co-terminus with that of license as this would reduce the possibility of complex scenarios emerging at the time of expiry of either of the two. Another suggestion was that the auction could be held for a period of allocation of 20 years; however, the winner would be allotted the spectrum for the remaining life of the licence and charged accordingly on pro rata basis.

3.159 Regarding the period of validity of spectrum, most of the stakeholders have suggested 20 years. Regarding the suggestion by some stakeholders that the underlying License should be extended to be co-terminus qua the auctioned spectrum, the Authority is of the view that as spectrum will be allotted by auction only in future, it will not be possible to extend validity period of licence every time. Besides, in the Unified Licence regime, the licence being separate from spectrum, it shall be the responsibility of the licensee to keep his licence active by seeking further renewal from time to time. As far as spectrum is concerned, in view of the fact that the telecom sector requires large

investment and payback period is high, the Authority agrees with the suggestions given that the validity period of spectrum should be 20 years.

3.160 **The Authority recommends that the validity period of the spectrum should be for 20 years.**

L. Spectrum Trading

3.161 TRAI, in its recommendations of May 2010, had recommended that "*it is premature to consider introducing spectrum trading in India and therefore, recommends that spectrum trading should not be allowed in India, at least at this stage. This will be re-examined at a later date".*

3.162 The recommendations of May 2010 were against the background that the spectrum was assigned at an administered price. Now, the spectrum is proposed to be auctioned. Therefore, in the consultation paper, the stakeholders were asked to comment on whether spectrum trading should be allowed in India.

3.163 In their response, some stakeholders suggested that spectrum trading should be allowed in India as it provides a decentralized market mechanism to revise and update initial spectrum allocations providing the licensees an option to align their spectrum holdings with their spectrum requirements. They have claimed that this mechanism can be more effective than re-farming or re-auctioning, and will also reduce the shortage of spectrum by making it freely available in the market. In their opinion, if spectrum trading is allowed, a licensee could sell or lease a sub-block of spectrum in a particular geographical area, where the same is not being efficiently used for internal consumption. One stakeholder commented that spectrum trading will help in effective and efficient use of scarce natural resources and will also provide an exit route to operators. Another stakeholder felt that any concerns that spectrum trading could lead to

significant concentration of spectrum in a few hands, could be addressed through setting caps on overall spectrum.

3.164 Stakeholders opposed to spectrum trading, have submitted that if spectrum is traded at a premium, it may have implications on tariff, which will be counterproductive. In their view, spectrum is a national asset with Government having a sovereign right over it. Therefore, this natural resource should be allowed to be used for a certain period and should not be allowed to be traded during that period. They further contented that the TRAI should specify spectrum cap equivalent to the prescribed limit so that there is no excess spectrum, no hoarding and no possibility of trading. In their opinion, having a larger number of players in the Indian market has been more effective in promoting competition than a policy of spectrum trading may be , as it will only encourage spectrum hoarding.

3.165 Some stakeholders suggested that given the fact that there are operators who have not rolled out services even after acquiring the spectrum, trading should not be allowed as it would provide an exit path to a spectrum holder in terms of transfer of ownership of the spectrum. In their opinion, spectrum sharing should be the preferred option for enabling efficient spectrum utilization in the long run, whereas spectrum trading at this point in time may not be suitable and could result in speculation in the spectrum market. One stakeholder suggested that only if the 'Merger & Acquisition' policy announced by the Government results in overall consolidation of telecom operators resulting in large chunks of spare spectrum being available with a few operators, then a detailed consultation process on spectrum trading should be initiated. In their view, TRAI should at present focus on making the recently announced liberated Spectrum Sharing Policy a success and if necessary, modify the existing terms so that industry is encouraged to share spectrum. In their opinion, spectrum trading can be announced only after the country has a robust and thriving MVNO policy for encouraging operators to expand

reseller services in the market and an exit policy which encourages service operators or telecom business entrepreneurs hoarding excess spectrum to return the same back to the Government for reuse by existing /active service telecom operators.

3.166 Some stakeholders were of the opinion that new licensees should be given enough time to roll out service and gain market share before spectrum trading is allowed. These stakeholders further contented that spectrum trading is a very complex and important issue that merits a consultation on its own. They have felt that as the Government has already decided and announced in its press statement dated 15 February 2012 that spectrum trading will not be allowed in India at this stage, the issues related to trading of spectrum should be deferred till the new telecom policy is announced.

3.167 The traditional approach to spectrum management is based on the allocation and assignment of frequencies. At the national level, spectrum is most often allocated in accordance with existing international frequency allocations and prospective changes resulting from national planning processes. Assignment involves assigning and licensing of frequencies to systems and individual services[11].As per the ITU, in the traditional administrative approach to assignment and authorisation system, spectrum is first allocated specified uses and then assigned to particular firms or public organizations that carry out the authorised use according to specific obligations as are laid down in a licence or permit. Secondary trading of spectrum, or simply 'Spectrum Trading,' permits the purchaser to change the use to which the spectrum was initially put while maintaining the right to use[12]. However, spectrum trading covers a range of possibilities, from straightforward change of ownership of an assignment with no change

[11]Telecommunications Regulation Handbook ITU www.infodev.org/en/Document.1067.pdf
[12]http://www.ictregulationtoolkit.org/en/PracticeNote.3076.html; The ICT Regulation Toolkit is a joint production of infoDev and the International Telecommunication Union.

of use to more advanced variants in which assignments may be divided or amalgamated and use changed[13].

3.168 Accordingly, the Authority in its consultation paper had asked the stakeholders to comment on the model of spectrum trading that can be adopted in India. Only those stakeholders who have supported introduction of spectrum trading have commented on the model to be adopted in India. One stakeholder suggested that spectrum trading in the beginning should be by allowing only for change of assignment rights. According to this stakeholder, though the detailed regulatory commercial and legal framework needs to be worked out, the broad principles can be defined as: (i) No revenue loss to Government; (ii) Shared obligations to the Licensor; and (iii) Efficient utilization of Spectrum.

3.169 Another stakeholder suggested that a trading regime which allows changing both allocation and assignment rights would promote an economically efficient outcome and would also be more in line with the policy of technology neutrality; otherwise, if only assignment right is changed, spectrum allocations could only be made more allocatively efficient within use, but not across uses. The stakeholder suggested that as a first step TRAI may recommend trading of assignment rights including for the spectrum assigned in the 3G and BWA auctions. A few other stakeholders also suggested adoption of a model in which both allocation and assignment rights are allowed to change.

3.170 Another stakeholder referred to the Australian model where spectrum licences are tradable and are technology neutral. The stakeholder stated that in Australia, the spectrum licences authorize the use of spectrum and licensees are free to use any device and technology within their spectrum, provided that such devices comply with the

[13]Messolonghi, September 2002, REFARMING AND SECONDARY TRADING IN A CHANGING RADIOCOMMUNICATIONS WORLD, Electronic Communications Committee (ECC) within the European Conference of Postal and Telecommunications Administrations (CEPT)

conditions of the licences and the advisory guidelines established for the corresponding bands to avoid interference. It was further informed that these private rights are limited for a period of time (15 years plus an additional 15 year extension if requested), but they can be traded without limitation other than the technical condition related to each TUC to protect against interference.

3.171 Since the spectrum in India has been assigned using various criteria over the period of time including initial start up spectrum, subsequent subscriber linked allocation and auction, the Authority in the consultation paper raised the issue as to who should be allowed to trade the spectrum.

3.172 One stakeholder suggested that the service provider who is interested in trading should have a licence to operate in the respective circle and if the operator already has spectrum, he can only trade for further spectrum if he is using the spectrum efficiently. The stakeholder suggested that the total spectrum of the receiver after trading should not exceed a prescribed limit and the receiver of the spectrum should also have fulfilled his "Roll out Obligation". If the operator is sharing the spectrum, then both the giver & receiver of the spectrum should not be allowed to participate in any spectrum trading in that region.

3.173 Another stakeholder suggested that spectrum which has been allocated as part of License agreement without any auction process (initially or subsequently thereafter) should not be allowed to be traded as basically its ownership remains with the Government and only spectrum purchased by the Licensees through the Government auction should be allowed to be traded, as market price for the same has been paid. The stakeholder further commented that the Government may fix a transfer fee to authorize such a transaction in order to keep a full record of spectrum with each Licensee and also mandate that trading of such spectrum would be permitted either way after the lapse of the roll out period.

3.174 One stakeholder suggested that both operators who are involved in spectrum trading need to have valid licence to operate in the circle. The stakeholder suggested that in case of 2100 MHz and 2300MHz bands, the acquirer of such spectrum through spectrum trading should not already be holding spectrum in similar bands so as to prevent creation of a monopolistic/near monopolistic situation in the market. In the opinion of the stakeholder, in case of 700 MHz bands, if the number of market participants is equal to less than 3 (given the quantity of spectrum being put up for auction), similar restrictions as in 2100/2300 MHz bands would apply. The stakeholder further commented that in case of spectrum trading in 800/900/1800 MHz bands, the acquiring operators should have completed the rollout obligation before acquisition of new spectrum through trading routes.

3.175 On the issue of allowing trading of 3G and BWA spectrum bands, some of the stakeholders were of the view that all spectrum that has been procured through market mechanism should be allowed to be traded.

3.176 One stakeholder was of the view that as only limited spectrum has been auctioned in 3G/BWA and as the number of operators offered 2100 MHz is limited to 4 (as against M&A desire of 5-6 operators) and 2300 MHz to 3, the auction resulted in fragmented spectrum allocation. In its opinion, unless Government is able to increase the spectrum availability/ competitive intensity for these services, no spectrum trading should be permitted. In its view, immediate objective of the Regulator /WPC/DoT should be to co-ordinate with the defence and other related users on 2100 and 2300 MHz and refarm the same for the next generation UMTS and LTE services, because availability of nationwide spectrum for minimum 5-6 operators should be the Authority's priority and trading currently should not be permitted.

3.177 On the issue of spectrum trading, the Authority in its recommendations of May 2010, had observed that *"In countries where*

spectrum trading is permitted, the spectrum is normally assigned through market mechanism, i.e. auction. However, in India, the 2G spectrum till date has been either given along with the licence or given based on Subscriber Linked Criteria, without any additional charges for the spectrum. These licensees have not competed in the open market to buy spectrum. Now, to allow them to trade the scarce spectrum at a premium would not be proper. Regarding spectrum for 3G and BWA services, though the spectrum will be given through the auction process, but presently, the amount of spectrum available is limited and there is a restriction that no licensee can acquire more than one block of spectrum either in auction or subsequently through M&A. As such allowing trading in these bands will be premature and may not be of any benefit to the industry."

3.178 The Authority is conscious of the fact that from now on all the spectrum should be given through auction process. Therefore, the reservation expressed earlier that as the licensees have not competed in the open market to buy the spectrum, to allow them to trade the scarce spectrum would not be proper, would no longer hold good. This will be the first time that the spectrum in 800/900 and 1800 MHz bands is being put to auction in recent years and a substantial portion of these bands has been already allocated through administrative process, therefore, the Authority is of the opinion that it is still pre-mature to allow spectrum trading and this issue may be may be taken up at a later date.

3.179 In India, unlike other countries, the spectrum was given to the operators in tranches over a period of time. Moreover, as the spectrum was being vacated from other agencies on need basis, a number of operators have been assigned spectrum in non-contiguous blocks. As in the GSM technology, the channel width is only 200 KHz, it was not a major constraint in providing services. However, now the spectrum is being liberalised and the operators were be allowed to use it for any technologies. As discussed earlier, a number of IMT technologies

require a channel width of contiguous 5 MHz for efficient utilisation. Therefore, the need for reconfiguration of frequencies assigned has arisen.

3.180 On the issue of need of reconfiguration of frequencies assigned to operators to avoid fragmentation and to make frequency block contiguous, one stakeholder commented that frequency harmonisation will certainly provide more capacity by avoiding large number of guard bands, providing larger blocks of spectrum and will also simplify the frequency planning in future. In its view, the harmonisation of frequencies requires extensive frequency planning, network re-optimisation in metro cities and possibly in other towns where the inter site distances are relatively lower and coordination among different operators as the timing will have to be synchronized in such a way that one frequency is being used only by one operator at any point of time. Another stakeholder commented that fragmented allocation of GSM spectrum has happened due to non availability of contiguous spectrum due to usage of the cellular band by other users for non commercial use, but in present allocation scenario, reconfiguration would be a very difficult exercise, therefore, it suggested that fragmentation issue can be taken at the time of extension/renewal of licences.

3.181 One point of view was that if the entire spectrum in 800MHz and 900MHz band is refarmed, most of the spectrum will become available in continuous 5MHz slots. Another view was that all spectrum vacated by holders of Quashed Licences is not majorly fragmented, hence, reconfiguration should be considered after the auction in 2G band is completed.

3.182 In order to understand the extent of the problem, TRAI requested DoT vide letter dated 20.03.2012 to provide the information regarding details of uplink and downlink frequencies assigned to each operator in 800, 900 and 1800 MHz. DoT has provided the information

regarding the carriers allotted to GSM Telecom Service Providers in 1800 MHz bands in some of the service areas. The information regarding the frequencies allotted to different operators is placed at **Annexure-V**. As can be seen from the data that in a large number of service areas, spectrum allotted to some of the operators is non-contiguous.

3.183 As discussed above, for new technologies e.g. UMTS/LTE etc., 5 MHz is the minimum amount of spectrum required. Fragmented spectrum results in reduced efficiency, increased requirement of inter operator guard bands and availability of lesser amount of spectrum for productive use. As can be seen from the assignments in 800 MHz band, if there are more operators, then in the number of carriers that can be allotted in 20 MHz band gets reduced from 14 to 12.

3.184 Therefore, there is need for making the spectrum assignment to various operators in contiguous form and some mechanism is required to be established so that the operators may rearrange the frequencies assigned to them to make them contiguous block.

3.185 The Authority is of the view that the mechanism should be such which entails inter operator cooperation and also provides incentive to the operators to carry out reconfiguration of their frequency bands and the role of WPC should be minimal so as to save time and unnecessary paper work. In chapter III, the issue of spectrum trading has been discussed and the Authority is of the view that at present it may not be allowed. However, to facilitate frequency redistribution amongst the existing operators, the Authority is of the view that limited trading only to facilitate exchange of frequency blocks can be permitted.

3.186 **The Authority recommends that Spectrum trading should be allowed between spectrum holders having obtained spectrum through auction or having paid the auction determined price for the spectrum held by them, only for the limited purpose of**

frequency configuration (arranging spectrum in a contiguous band).

CONCLUSION

1. The Recommendations contained in chapters I to III give the framework for allocation of spectrum in 2G bands. They hold equally for other bands currently in use like the 2.1 and 2.3 GHz bands and those proposed for commercial telecom services like the 700 MHz band. Over time and given the incessant technological innovations and resultant demand for additional spectrum, there would be need for identification of additional spectrum bands. Since such location of additional bands is a long drawn exercise, requiring harmonisation across countries for development of suitable eco-systems, the need for efficient utilisation of spectrum in any given band cannot be overstated. The various measures proposed in the preceding chapters assume salience in this context.
2. It may be recalled that this Authority, in May 2010, estimated that there would be requirement of spectrum between 500 to 660 MHz for voice and data services, particularly given the enormous growth of data services. There is enough evidence to believe that even this may be inadequate given the phenomenal growth of smart phones as well as convergence bringing high definition and 3D television to the consumers. Recognising the cost as well as the limitations of spectrum, which currently is virtually the sole medium to meet the phenomenal demand, the Authority had separately recommended, to the Government, the establishment of a National Optic Fibre network connecting all the Gram Panchayat followed by all the villages and habitations. That work is separately under progress. The Authority would like to underline the need for speedy and timely execution of this work besides re-emphasising that this network should be taken to all the Habitations having a population of 500 persons and above.

3. Notwithstanding the establishment of this network, given the economic progress and the increased mobility of people, wireless services will continue to be in high demand necessitating the availability of adequate spectrum. Today, substantial amount of spectrum continues to be with various Government agencies. In May, 2010, the Authority had recommended that TRAI should be entrusted with the task of carrying out a review of the present usage of spectrum available with government agencies. The Authority reiterates its recommendation that TRAI should be entrusted with this responsibility.

4. In May 2010, the Authority had also emphasised the need for constituting a spectrum refarming fund by setting apart 50% of the realisation from all proceeds from spectrum including from the auction. Given the resources that are likely to be raised from the proposed auction of spectrum, the Authority strongly re-emphasises the need to constitute a spectrum refarming fund and setting aside the requisite funds.

5. In order to enable the telecom sector to raise the necessary resources as well as to be able to use them efficiently, the sector need to be supported strongly. First and foremost is the need for the banking sector to adequately support the telecom sector in raising of funds. This would call for a close review at the level of Ministry of Finance and Reserve Bank of India. A review of the taxation structure to which the telecom sector is subject would also be useful so as to enable it to improve its performance.

SUMMARY OF RECOMMENDATIONS

1. **The Authority recommends that excess spectrum of 2x2.4 MHz should be immediately taken back from MTNL. (Para 2.8)**

2. **The Authority recommends that the spectrum which is available in at least 75% of total number of districts of the LSA including the State capital (s) should be considered for allocation through auction. (Para 2.12)**

3. **The Authority recommends that all spectrum to be assigned through the auction process in future shall be liberalised. In other words, spectrum in any band can be used for deploying any services in any technology. (Para 2.34)**

4. **The Authority recommends that the refarming of spectrum in the 800 MHz and 900 MHz bands should be carried out progressively at an early date but not later than the due date of renewal of the licences. The spectrum available with the service providers in the 900 MHz band should be replaced by spectrum in the 1800 MHz band, which should be charged at the price prevalent at the time of refarming. (Para 2.81)**

5. **The Authority recommends that the Government must actively explore the possibility of refarming of the spectrum in the 900 MHz band immediately, by invoking the authority to change the licence conditions. (Para 2.82)**

6. **Since the application for renewal of licenses must be made at least 30 months in advance of the expiry of licenses, the Authority recommends 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. Accordingly, the Authority recommends that the auction of 900MHz spectrum may be carried out in the first half of the year 2013. (Para 2.84)**

7. The Authority recommends that in Circles where the amount of spectrum in 1800 MHz band is insufficient for carrying out fully the refarming exercise, immediate steps must be taken to get the Government agencies to vacate the 1800 MHz spectrum so that the entire 900 MHz spectrum can be refarmed. (Para 2.87)

8. Authority would like to partially modify its recommendation contained in para 1.73 of the May 2010 recommendations as follows:

"……. for license holders of 800 MHz band spectrum should be assigned in 1900 MHz band". (Para 2.89)

9. The Authority recommends that the DOT should immediately arrange to allocate spectrum in the 1900 MHz band for refarming the spectrum in the 800 MHz band. (Para 2.103)

10. The Authority recommends that the DoT should immediately carry out the interference study. The spectrum in the 800 MHz band should progressively be refarmed at the time of renewal of licences of such operators. (Para 2.104)

11. The Authority recommends that the auction of spectrum in 700 MHz band may be carried out at a later date, preferably in 2014 as and when the ecosystem for LTE in the 700 MHz is reasonably developed, so as to be able to realise the full market value of the spectrum. (Para 2.130)

12. The Authority recommends the following structure for the auction of spectrum in future:

- **The auction of spectrum shall be conducted using Simultaneous Multiple Round Auction (SMRA) format.**

- **As regards the auction of spectrum in 1800 MHz and 800 MHz bands to be conducted immediately following these recommendations, it should be held in single stage.**

- **Every auction shall be open to all those holding CMTS licence/ UAS licence / Unified licence or eligible for grant of Unified Licence. Auction shall not be open to those that hold spectrum above the prescribed cap.**

- **If a new entity is successful, then the Authority recommends that such an entity will have to take either the National level or the State level Unified Licence, as the case may be.**

- **In all auctions at least 5 MHz of spectrum shall be offered, except where the spectrum available is less than 5 MHz.**

- **Spectrum shall be offered in blocks of 1.25 MHz each.**

- **For the auction that is to immediately follow these recommendations, the amount of spectrum to be offered will follow the scheme laid out in Para 3.39 above.**

- **The final bid price of one auction in a given band shall be the base price for the next auction whenever it takes place, with the rider that it will suitably be adjusted in the event of gap beyond one year.**

- **The limit for acquisition of spectrum shall be 50% of the spectrum assigned in each band in the respective service area and 25%of the total spectrum assigned in all bands put together in each service area. (Para 3.39)**

13. The Authority recommends that after conducting the auction for spectrum in the 1800 MHz band, and reserving the spectrum required for refarming, out of the remaining spectrum if any, one block of 2x1.25 MHz of spectrum may be allocated to those

licensees having 4.4 MHz of spectrum in the service area, at the auction discovered price for that service area. It should be clearly understood that while this tranche of 2x 1.25 MHz will be paid for at the auction discovered price, it will be treated on par with the unliberalised spectrum of 4.4. MHz that is held by the licensee, unless the licensee opts to liberalise the 4.4.MHz spectrum also by paying the auction discovered price. (Para 3.44)

14. **The Authority recommends that the Government may consult the Ministry of Law on the appropriateness of the course of action recommended in Paras 3.44 above, keeping in view the licence conditions as well as the order of the Hon'ble Supreme Court. (Para 3.45)**

15. **The Authority recommends that the Service providers may be allowed to convert their existing 1800 MHz spectrum into liberalised spectrum on payment of the auction determined amount in which case they will be granted spectrum rights for a period of 20 years. They will be allowed to adjust the price paid by them for the existing spectrum on pro-rata basis for the balance period of the existing license. (3.49)**

16. **The Authority recommends that in order to create a uniformly liberalised environment with a level playing field, the Government may consider incorporating a suitable incentive package for service providers in NTP 2012 to encourage all of them to migrate immediately to the new regime envisaged above. (3.50)**

17. **The Authority recommends that the auction of 800 and 1800 MHz spectrum should be held through two separate auction processes and in quick sequence. (3.55)**

18. **The Authority recommends that the Reserve price for the 1800 MHz spectrum shall be as given in Table no. 3.3. (Para 3.86)**

19. The Authority recommends that the Reserve price for the 800/900 MHz spectrum shall be as given in Table no. 3.4. (Para 3.90)

20. The Authority recommends that the Reserve price for the 700 MHz spectrum shall be as given in Table no. 3.6. (Para 3.93)

21. The Authority recommends that the Reserve price for the 2100 MHz spectrum shall be as given in Table no. 3.7. (Para 3.95)

22. The Authority recommends that the Reserve price for the 2300 MHz spectrum shall be as given in Table no. 3.8. (Para 3.97)

23. The Authority recommends that the Reserve Price for spectrum in different bands shall be as given in Table no. 3.9 (Para 3.112)

24. The Authority recommends the following schedule for deferred payment of the bid amount by the successful bidders. (Para 3.113)

Spectrum	Initial Payment	Moratorium	Period for balance payment
Supra-1 GHz (1800, 2100 and 2300 MHz bands)	33% of the Bid amount	2 years	10 years (equal annual instalments)
Sub-1 GHz bands (700,800 and 900 MHz bands)	25% of the Bid amount	2 years	10 years (equal annual instalments)

25. The Authority further recommends that the annual instalments for deferred payments shall be duly securitised and the Net Present Value of the Bid amount is safeguarded by imposing a

suitable rate of interest, which shall be decided by the DOT in consultation with the Reserve Bank of India/ Ministry of Finance. (Para 3.114)

26. The Authority recommends that the sequence of spectrum auction could be as follows:

(a) 5 MHz of 1800 MHz band- This auction would be to establish the market value of spectrum. This could be done in the current year 2012-13 as early as possible.

(b) Allocation of additional 1.25 MHz spectrum to the holders of 4.4 MHz in 1800 MHz bands, subject to the legal opinion.

(c) Auction of spectrum in the 800 MHz band- This should also be done in the current financial year.

(d) Auction of spectrum in the 900 MHz band- This auction should be conducted in the first half of 2013-14 preferably in the first quarter so that there is adequate time for deployment as and when 900 MHz spectrum is available by November, 2014.

(e) Balance Spectrum in 1800 MHz band- This should be done in the first half of 2013-14

(f) Auction of Spectrum in 2100 MHz band - This should also be carried out in the second half of 2013-14.

(g) Auction of available spectrum in 700 MHz band- This should be carried out in the first half of financial year 2014-15.

(h) Auction of additional spectrum in 2300 MHz band- This should be carried out in the second half of financial year 2014-15. (3.117)

27. The Authority recommends that the Department of Telecommunications should engage an auctioneer for a period of three years so as to conduct the auctions without delay. (3.118)

28. The Authority recommends that mortgage of spectrum may be allowed by spectrum holders to a registered Indian financial institution against borrowings. The mortgage will be subject to

the condition that in the event of default of the liability, the spectrum shall be auctioned by the financial institution under the supervision of the DOT and all proceeds in excess of the liability shall be remitted to the Government. (Para 3.125)

29. The Authority recommends that the Department of Telecommunications must take up with the Ministry of Finance and the Reserve Bank of India to remove all the road blocks in the framework for borrowings by the telecom sector against the spectrum assigned to them. (Para 3.127)

30. Therefore, the Authority reiterates its recommendation regarding rural roll-out obligations as spelt out in 3rd Nov, 2011 recommendations and that the measures contained therein should be made applicable to all spectrum holders. (Para 3.141)

31. The Authority recommends that

A. Licensees who have acquired spectrum only through auction conducted here onwards shall be levied spectrum usage charge only at the rate of 1% of the Adjusted Gross Revenue spectrum.

B. Licensees who have a mix of spectrum assigned administratively and spectrum acquired through auction and Licensees who have been assigned spectrum only through administrative process shall be levied the spectrum Usage charges at the rate applicable on the administratively assigned spectrum and on the entire AGR.

C. In the event the spectrum holder, who falls under 'B' above, pays the current auction determined price for the spectrum that is administratively assigned, then it will be entitled to the payment of Spectrum usage charges at the rate of 1% of the AGR.

(Para 3.154)

32. The Authority recommends that for the purpose of calculation of the Licence fee as well as SUC, there shall be a Minimum AGR, which shall not be less than 5% of the Bid amount. The calculation will be on the basis of Minimum AGR or the actual AGR, whichever is higher. (Para 3.157)

33. The Authority recommends that the validity period of the spectrum should be for 20 years. (Para 3.160)

34. Therefore, the Authority recommends that Spectrum trading should be allowed between spectrum holders having obtained spectrum through auction or having paid the auction determined price for the spectrum held by them, only for the limited purpose of frequency configuration (arranging spectrum in a contiguous band). (Para 3.186)

Annexure I

Press Information Bureau

Government of India

Ministry of Communications & Information Technology

29-January-2011 15:42 IST

Text of the Press Statement of Shri Kapil Sibal on the Policy for Spectrum Assignment and Pricing

Following is the text of the Press Statement given by the Union Minister of Communications & IT, Shri Kapil Sibal here today on Policy for Spectrum Assignment and Pricing:

"Currently, there is a considerable debate regarding the assignment of licences in the year 2008 in which spectrum was bundled with the licences. I have already indicated that this was done following the then existing policy and the recommendations received by the Government. This policy was in the context of Government's effort to increase the teledensity and reduce tariffs through increased competition thereby extending the reach of telecom services to all sections of society. There is no doubt that this policy has paid rich dividends and today, India is in the enviable position of being the fastest growing market as well as the second largest market in the world. Telecom services are being availed by all sections of society and the tariffs are the lowest in the world. There is adequate and healthy competition among the service providers bringing the benefits of competition to the consumers at large. The introduction of Mobile Number Portability has heightened and reinforced the element of competition for the benefit of the consumers at large. We are now at a stage when our subscriber base is increasing rapidly and the teledensity is of the order of 62.5%. People in the rural areas too are increasingly accessing the telecom services with the growth rate in the rural areas outpacing the growth rate in the urban areas.

“At the beginning of this year, I had indicated that we would be making a change in the direction of the telecom policy. That exercise is now well under way. The effort in the earlier policies has been to increase teledensity and competition with a focus on voice communications. With improvement in the telecom technology, and provision of Broadband services with increasing speeds, it is now possible for the telecom services to play a significant role in the realization of key development goals. I am keen that we use these technological advancements for ushering in a truly inclusive society. Spectrum continues to be a critical resource in this endeavour given the preponderance of wireless services in India. The time has now come to review the policy regarding spectrum assignment.

“It is in this area that Government would like to make a directional shift from past practice and bring in a fresh policy regarding spectrum. It is important that we ensure adequate availability of spectrum for telecom services. For this, we would be seeking a plan of action from the Regulator i.e. TRAI. Our aim is to make available adequate spectrum to meet the entire requirement of the telecom sector, with due regard to the requirements of other sensitive sectors while at the same time ensuring that there are adequate measures in place to ensure that operators use allocated spectrum efficiently and optimally.

“The assignment process would also need to undergo a major change from the past practice. Given the current level of competition and availability of spectrum, the time has come to review the need to allocate spectrum bundled with the licence at a fixed fee. This policy was adopted in the past in order to introduce more competition while providing a level playing field between old and new players. It has not been revised as yet. We believe that the stage has been reached where there is enough of competition to warrant a market driven process for allocation of 2G spectrum.

“In future, the spectrum will not be bundled with licence. The licence to be issued to telecom operators will be in the nature of ‘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 and, therefore, no concept of initial or start-up spectrum. Spectrum will be made available only through market driven process.

“While moving towards a new policy dispensation, it is necessary to ensure a level playing field between all players. Hence going forward, any new policy of pricing would need to be applied to equally to all players. Additionally, assignment of balance of contracted spectrum may need to be ensured for the existing licensees who have so far been allocated only the start up spectrum of 4.4 MHz. It may be recalled that showcause notices have been issued to certain licensees for cancellation. Only in respect of the licences that will be found valid after the process is completed, the additional 1.8 MHz will be assigned on their becoming eligible, but the spectrum will be assigned to them at a price determined under the new policy.

“We need to seriously consider the adoption of an auction process for allocation and pricing of spectrum beyond 6.2 MHz while ensuring that there is adequate competition in the auction process.

“TRAI had made recommendations in May 2010 and indicated that it would apprise the Government of the findings of a study on the question of pricing of 2G spectrum in future. This is expected shortly. We would examine their recommendations speedily as soon as they are received, keeping the perspectives that I have outlined, while finalizing our new policy. I am confident that we will be able to design a policy that ensures that existing licence holders get the spectrum they need and are entitled to, while simultaneously, ensuring that the Government also receives revenues commensurate with the current market value of spectrum”.

Annexure II

Press Information Bureau

Government of India

Ministry of Communications & Information Technology

15-February-2012 17:22 IST

Press Statement of Shri Kapil Sibal issued today

Shri Kapil Sibal, Union Minister for Communications and Information Technology held a Press Conference here today. Following is the text of statement given by Shri Sibal.

Text

"Recommendations of TRAI on 'Spectrum Management and Licensing Framework' of May 11, 2010 along with its further recommendations of February 08, 2011, clarifications of May 03, 2011 and response dated November 03, 2011 were considered by the Telecom Commission. After consideration of the recommendations of the Telecom Commission, the Department of Telecommunications has taken following decisions:

1. No more UAS licences linked with spectrum will be awarded.

2. All future licences will be Unified Licences and allocation of spectrum will be delinked from the licence. Spectrum, if required, will have to be obtained separately. A final view on implementation of the Unified License Regime would be taken after receipt of detailed Guidelines and Terms & Conditions from TRAI for Unified Licence including migration path for all existing licence(s) to Unified Licence.

3. In the event of any auction of spectrum pending finalisation of the Unified Licensing Regime, UAS licence without spectrum may be issued

which could be subject to a requirement to migrate to Unified licence as and when the regime is put in place. Detailed guidelines for such UAS licence without spectrum would be finalised after receipt of recommendations of TRAI in this regard.

4. There will be uniform licence fee across all telecom licenses and service areas which will progressively be made equal to 8% of the Adjusted Gross Revenue (AGR) in two yearly steps starting from 2012-13.

5. The licence fee and spectrum usage charges payable by each such licensee shall be on actual AGR, subject to a minimum presumptive AGR. This minimum figure would be reviewed by TRAI every year.

6. A decision on the recommendation to bring IP-I Service Providers under licencing regime, who are currently unlicenced passive infrastructure providers, has been deferred for further examination.

7. A rapid comprehensive techno-economic study will be carried out by DoT to examine issues relating to increase in coverage & tele-density in rural areas while at the same time ensuring sustained quality of service and also to examine the adequacy of USOF mechanism alone to achieve these objectives and the need for augmenting USOF schemes with appropriate direct incentivisation of TSPs for rural rollout.

8. 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 & Conditions so as not to imply automatic continuance of existing license and related conditions including quantum and price of any spectrum allocated.

9. On extension, the UAS licensee will be required to pay a fee which will be Rs. 2 crore for Metro and 'A' Circles, Rs. 1 crore for 'B' circles and Rs. 0.5 crore for 'C' circles. This fee does not cover the value of spectrum, which shall be paid for separately. While extending the licence, the licensee shall be assigned spectrum only up to the

prescribed limit or the amount of spectrum assigned to it before the extension, whichever is less. Spectrum assigned by the Government to the licensee in excess of the Prescribed Limit shall be withdrawn.

10. The need for refarming of spectrum is accepted in-principle. Further steps will be taken after receipt of TRAI's recommendations in this regard.

11. The prescribed limit on spectrum assigned to a service provider will be 2X8MHz/ 2X5MHz for GSM/ CDMA technologies respectively for all service areas other than in Delhi and Mumbai where it will be 2X10MHz/ 2X6.25 MHz. However, the licensee can acquire additional spectrum beyond prescribed limits, in the open market, should there be an auction of spectrum subject to the limits prescribed for merger of licences.

12. Decisions on all matters relating to One Time Spectrum Charge including pricing of spectrum in cases of M&A and Spectrum Sharing will be taken separately.

13. Spectrum usage charges were revised in 2010 by the Government and the matter is sub-judice. Further action will be taken by DoT after the matter is decided by the court.

14. The broad guidelines in respect of intra-service area merger of CMTS/UAS licences will, inter-alia, include:

    i. For determination of market power, market share of both subscriber base and Adjusted Gross Revenue of licensee in the relevant market shall be considered. The entire access market will be the relevant market for determining the market share, and will no longer be classified separately as 'Wire line' and 'Wireless'.

    ii. Merger up to 35% market share of the resultant entity will be allowed through a simple, quick procedure. However, there may be a need to consider cases of merger beyond 35% market share in certain

circumstances without breaching the 25% cap on GSM spectrum/ 10 MHz for CDMA spectrum holding in any service area. Recommendation of TRAI that such cases will be considered up to a market share of 60% has been taken note of. In order to ensure clarity on the circumstances and extent to which merger above 35% limit would be permissible, detailed transparent criteria will be prescribed/ adopted after receipt of TRAI's recommendations and after due consultation with the appropriate authorities.

iii. Consequent upon the merger of licences in a service area, the total spectrum held by the Resultant entity shall not exceed 25% of the spectrum assigned, by way of auction or otherwise, in the concerned service area in case of 900 and 1800 MHz bands. In respect of 800 MHz band, the ceiling will be 10 MHz. In respect of spectrum in other bands, relevant conditions pertaining to auction of that spectrum shall apply**.**

iv. If, as a result of the merger, the total spectrum held by the resultant entity is beyond the limits prescribed, the excess spectrum must be surrendered within one year of the permission being granted. Government may prescribe the band which will be required to be surrendered in accordance with spectrum refarming policy to be announced separately.

v. The substantial equity and cross holding of the Resultant entity shall be in conformity with the provisions of the UAS licence.

vi. The duration of licence of the resultant entity in the respective service area will be equal to the higher of the two periods on the date of merger. This does not however entitle the resultant entity to retain the entire spectrum till the expiry of licence period.

vii. In case of renewed validity beyond the original validity of any of the merged entity, holding of spectrum in 800/900 MHz band shall be subject to the applicable spectrum refarming guidelines to be

announced in future w.e.f. the deemed date of extension of merging entity having lesser validity of licence at the time of merger or the date of spectrum refarming guidelines whichever is later.

viii. Issues related to spectrum price, to be paid by the resultant entity, would be decided separately. The same shall also apply in case of renewal of wireless operating licence, post merger.

ix. On the merger of the two licenses, the AGR of the two entities will also be merged and the license fee will be therefore levied at the specified rate for that service area on the resultant total AGR. Similarly, for the purpose of payment of the spectrum charge, the spectrum held by the two licensees will be added /merged and the annual spectrum charge will be at the prescribed rate applicable on this total spectrum. However, in case of holding of spectrum for various technologies by the entity subsequent to Merger, spectrum charges & license fee etc. or any other criterion being followed by the licensor shall be applicable as in case of any other UAS/CMTS licensee.

x. Existing provisions in the UAS licence relating to Lock-in period for sale of equity/merger shall continue.

15. Broad guidelines for sharing of 2G spectrum (800/900/1800 MHz bands) will, inter-alia, include:

i. Spectrum sharing will be permitted but in each case, it will be in the same licence service area and will be with the prior permission of the licensor. A simple automatic approval process will be put in place for this purpose.

ii. Permission for Spectrum sharing will be given initially for a period of 5 years. Government may renew the permission for a further one term of five years, on terms to be prescribed.

iii. Spectrum can be shared only between two spectrum holders both of which are holding spectrum either in 900/1800 MHz band or in 800 MHz band.

iv. Total quantum of spectrum, as a result of the spectrum sharing, shall not exceed the limit prescribed in case of mergers of licences.

v. In respect of spectrum obtained through auction, spectrum sharing will be permitted only if the auction conditions provide for the same.

vi. Parties sharing the spectrum will be deemed to be sharing their entire spectrum for the purpose of charging.

vii. Both the parties shall fulfill individually the roll out obligations as well as the QoS obligations prescribed under the licence.

viii. Spectrum usage charges will be levied on both the operators individually but on the total spectrum held by both the operators together. In other words, if an operator 'X' having 4.4MHz of spectrum shares 4.4 MHz of spectrum of another operator 'Y', then both 'X' and 'Y' will be liable to pay spectrum usage charges applicable to 8.8 MHz of spectrum.

ix. Spectrum sharing would involve both the service providers utilising the spectrum. Leasing of spectrum is not permitted.

x. Decision on matters related to pricing of spectrum, post sharing, would be taken separately.

xi. Spectrum sharing will not be permitted among licensees having 3G spectrum.

16. Spectrum trading will not be allowed in India, at this stage. This will be re-examined at a later date.

17. For efficient management of available spectrum, TRAI may undertake regular spectrum audit. TRAI may carry out review on the present

usage of spectrum available. In both the cases, TRAI may make recommendations to the Government.

18. The judgement of the Supreme Court pronounced on 2nd February, 2012 cancelling 122 licenses has implications for some of the recommendations of the Telecom Commission. Such recommendations are being examined further with reference to legal and other aspects and decisions in this regard will be announced later."

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Annexure III

Sl.No.	Licence Service Area	Bharti					Vodafone					MTNL/ BSNL					Idea				
		800	900	1800	2100	2300	800	900	1800	2100	2300	800	900	1800	2100	2300	800	900	1800	2100	2300
1	Delhi		8	2	5			8	2	5		3.75	6.2	6.2	5	20			8		
2	Mumbai			9.2	5			8	2	5		2.5	6.2	6.2	5	20			4.4		
3	Kolkata		6.2	1.8	5	20		7.8	2			2.5	6.2	3.8	5	20					
4	MH			8.2		20		6.2		5		2.5	6.2	3.8	5	20		7.8	2	5	
5	GJ			6.2				7.8	2	5		2.5	6.2	1.2	5	20		6.2		5	
6	AP		7.8	2.2	5				6.2			3.75	6.2	3.8	5	20		6.2	1.8	5	
7	KTK		7.8	2.2	5	20			8			2.5	6.2	3.8	5	20					
8	TD + Chennai			0.6	5			6.2		5			6.2	2	5	20					
9	Kerala			6.2				6.2				3.75	6.2	3.8	5	20		6.2	1.8	5	
10	Punjab		7.8			20			6.2			2.5	6.2		5	20				5	
11	Haryana			6.2				6.2		5		2.5	6.2	3.8	5	20		6.2		5	
12	UP(W)			6.2	5			6.2				2.5	6.2	3.8	5	20		6.2	1.8	5	
13	UP(E)		6.2	1				6.2	2	5		2.5	6.2	3.8	5	20			6.2	5	
14	RJ		6.2	2	5			6.2				2.5	6.2	1.8	5	20			6.2		
15	MP			8					4.4			2.5	6.2	3.8	5	20		6.2	1.8	5	
16	WB		4.4	1.8	5			4.4	1.8	5		2.5	6.2	1.8	5	20					
17	HP		6.2		5				4.4			2.5	6.2	3.8	5	20			4.4	5	
18	Bihar		6.2	3	5				4.4			2.5	6.2	3.8	5	20			4.4		
19	Orissa		6.2	1.8					4.4			2.5	6.2	3.8	5	20					
20	Assam		1.8	4.4	5				4.4			2.5	6.2	3.8	5	20					
21	NE		4.4	1.8	5				4.4			2.5	6.2	3.8	5	20					
22	J&K		6.2		5				4.4			2.5	8		5	20				5	
Total		0	85.4	74.8	70	80	0	79.4	63	40	0	56.25	138.2	72.4	110	440	0	45	42.8	55	0
	% of Total	0.00	19.78	15.04	15.05	11.76	0.00	18.39	12.67	8.60	0.00	24.32	32.01	14.56	23.66	64.71	0.00	10.42	8.61	11.83	0.00
% Holding in 900 and 1800MHz			17.24					15.33					22.67					9.45			

Annexure III (Contd.)

Sl.No.	Licence Service Area	Aircel					Reliance					Loop					TTSL				
		800	900	1800	2100	2300	800	900	1800	2100	2300	800	900	1800	2100	2300	800	900	1800	2100	2300
1	Delhi			4.4			5		4.4	5							5				
2	Mumbai			4.4			5		4.4	5			8	2			5		4.4		
3	Kolkata			4.4	5		5		6.2								3.75		4.4	5	
4	MH			4.4			5		4.4								5		4.4	5	
5	GJ			4.4			3.75		4.4								3.75		4.4	5	
6	AP			4.4	5	20	5		4.4								5		4.4		
7	KTK			4.4	5		5		4.4								3.75		4.4	5	
8	TD + Chennai		7.8		5	20	5		4.4								3.75		4.4		
9	Kerala			4.4	5		5		4.4								3.75		4.4	5	
10	Punjab			4.4	5		3.75		4.4	5							3.75		4.4	5	
11	Haryana			4.4			3.75		4.4								5		4.4	5	
12	UP(W)			4.4			5		4.4								3.75		4.4	5	
13	UP(E)			4.4	5		5		4.4								3.75		4.4		
14	RJ			4.4			3.75		4.4	5							3.75		4.4	5	
15	MP			4.4			5	6.2		5							2.5		4.4	5	
16	WB			4.4	5	20	3.75	4.4	1.8	5							2.5		4.4		
17	HP			4.4			2.5	6.2		5							2.5		4.4		
18	Bihar			4.4	5	20	5	6.2	1.8	5							3.75		4.4		
19	Orissa			4.4	5	20	3.75	6.2		5							2.5		4.4		
20	Assam		4.4	1.8	5	20	2.5	6.2		5											
21	NE		4.4		5	20	2.5	4.4	1.8	5											
22	J&K		4.4		5	20	2.5		4.4	5											
Total		0	21	81	65	160	92.5	39.8	73.2	60	0	0	8	2	0	0	72.5	0	79.2	50	0
	% of Total	0.00	4.86	16.29	13.98	23.53	40.00	9.22	14.72	12.90	0.00	0.00	1.85	0.40			31.35	0.00	15.93	10.75	0.00
% Holding in 900 and 1800MHz			10.98					12.16					1.08					8.53			

Annexure III (Contd.)

Sl.No.	Licence Service Area	Spice					HFCL					Shyam Telelinks					S. Tel					Total				
		800	900	1800	2100	2300	800	900	1800	2100	2300	800	900	1800	2100	2300	800	900	1800	2100	2300	800	900	1800	2100	2300
1	Delhi																					13.75	22.2	27	20	20
2	Mumbai																					12.5	22.2	37	20	20
3	Kolkata																					11.25	20.2	22.6	20	40
4	MH																					12.5	20.2	27.2	20	40
5	GJ																					10	20.2	22.6	20	20
6	AP																					13.75	20.2	27.2	20	40
7	KTK		6.2																			11.25	20.2	27.2	20	40
8	TD + Chennai																					11.25	21.2	11.4	20	40
9	Kerala																					12.5	18.6	25	20	20
10	Punjab		7.8				2.5		4.4													12.5	21.8	23.8	25	40
11	Haryana																					11.25	18.6	23.2	20	20
12	UP(W)																					11.25	18.6	25	20	20
13	UP(E)																					11.25	18.6	26.2	20	20
14	RJ											5		4.4								15	18.6	27.6	20	20
15	MP																					10	18.6	26.8	20	20
16	WB																					8.75	19.4	16	25	40
17	HP																			5		7.5	18.6	21.4	25	20
18	Bihar																			5		11.25	18.6	26.2	25	40
19	Orissa																			5		8.75	18.6	18.8	20	40
20	Assam																					5	18.6	14.4	20	40
21	NE																					5	19.4	11.8	20	40
22	J&K																					5	18.6	8.8	25	40
	Total	0	14	0	0	0	2.5	0	4.4	0	0	5	0	4.4	0	0	0	0	0	15	0	231.25	431.8	497.2	465	680
	% of Total	0.00	3.24	0.00	0.00	0.00	1.08	0.00	0.88	0.00	0.00	2.16	0.00	0.88	0.00	0.00	0.00	0.00	0.00	3.23	0.00					
% Holding in 900 and 1800MHz			1.51					0.47					0.47					0.00								

Annexure IV

ECO System in 800 and 900 MHz Bands:

800 MHz band (824-844 MHz/869-889 MHz): Globally, this is known as the 850 MHz band (824-849 MHz/869-894 MHz). Deploying HSPA in lower bands (below 1 GHz) gives a much larger coverage area and a significant reduction in cell sites needed, compared to 2100 MHz. These benefits have been derived from deployments in 850 MHz band in Americas, Australia and Asia. Device availability in 850 MHz band vis-à-vis other bands is given in the table below:

Table 2.15

3GPP Band	Band Name	No. of devices
Band I	2100 MHz	2563 devices
Band V	850 MHz	1339 devices
Band I,II,V	2100 /1900/ 850MHz	979 devices
Band I, V	2100 /850MHz	1123 devices
Band VIII	900 MHz	719 devices
Band IV	AWS	158 devices

*Source: GSA website

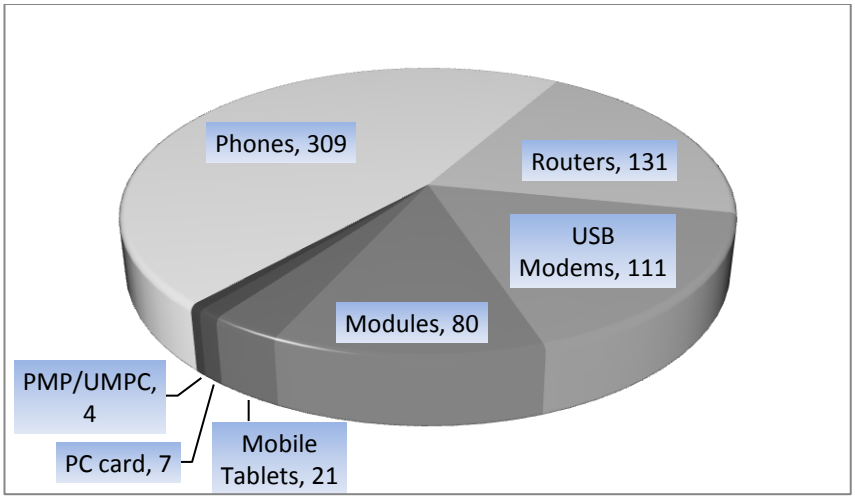
900 MHz band (880-915 MHz/ 925-960 MHz): In India, instead of 35 MHz, only 25 MHz has been allocated in this band. The band plan is 890-915 MHz/935-960 MHz. UMTS900 (WCDMA-HSPA) systems in 900 MHz efficiently extend voice, data and mobile broadband coverage by leveraging the benefits of lower frequencies. Because of its superior propagation characteristics, which provides for lower path-loss, reduced CAPEX and OPEX, for the same service offering and coverage, the number of sites at 900 MHz is less than half that is needed at 2100 MHz, improved quality of service and the user experience, a large number of operators in various countries are increasingly deploying their HSPA/HSPA+ networks in the 900 MHz band. UMTS900 can complement 2100 MHz deployments and the GSM operators can also re-use many existing network assets e.g. antennas, network management systems.

As per UMTS900 Global Status report published by GSA, February 9, 2012, 40 commercial UMTS900 networks have been launched in 29 countries. Some of

these are, Australia, Belgium, Finland, France, Germany, Hong Kong, Kazakhstan, Malaysia, New Zealand, Poland, Romania, Russia, South Africa, Spain, Sweden, Thailand, UK, and Venezuela. At least 52 countries permit, or are considering allowing, UMTS900 system deployments. The report also confirms the excellent availability of UMTS900-compatible user devices (719). All form factors are available including 335 phones and 120 USB dongles. 118 UMTS900 devices support HSPA+ and 49 support 42 Mbps DC-HSPA+. Excluding notebooks and e-book readers, 25% of HSPA devices operate in the 900 MHz band. Some UMTS900 devices also operate on LTE networks. As per status report published in October 2011, there were 663 devices UMTS900-compatible user devices in various form factors as shown in the chart.

Chart-2.2

Form factor-wise breakup of devices



Source- GSA website; PMP- Personal Media Players; UMPC:Ultra-Mobile PC

Data traffic on mobile broadband networks is growing exponentially as both consumers and business users turn to smart-phones, connected laptops, tablet computers and other devices to access the Internet, email, business applications and social networking services. This also requires the proliferation of wireless broadband services with greater pace. Moreover, in India, the growth in telecom services has been mainly limited to urban areas with majority of rural population still un-served. Uptake of broadband has been poor so far. To facilitate the propagation of wireless broadband services in rural areas with lesser capital investment and at affordable price, it is required to allow the use of spectrum in the bands of 700/800/900/1800 MHz for IMT technologies.

Various approached adopted by countries for Refarming of spectrum

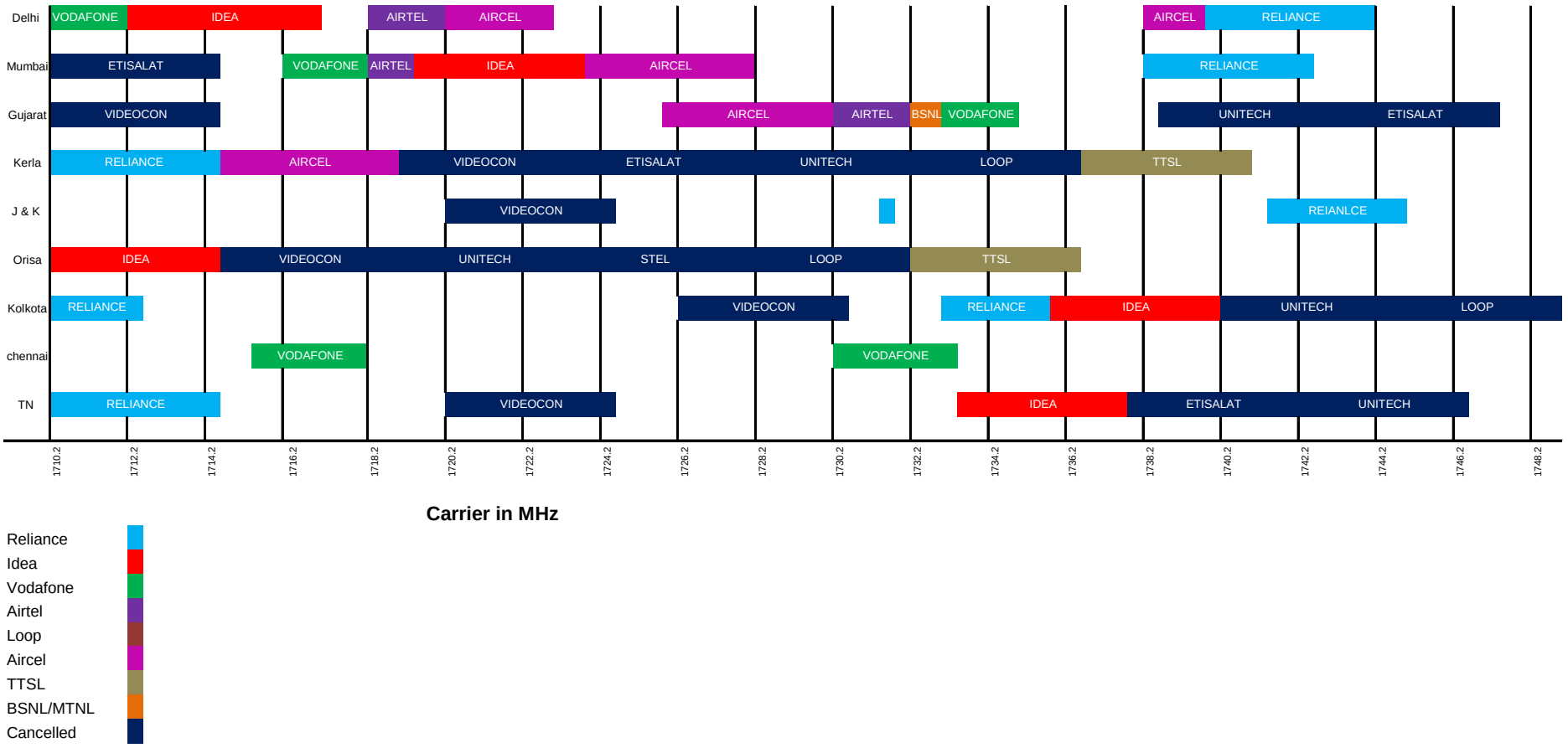
Country	Key Decisions
Sweden	**900 MHz Band** • Prior to liberalization/refarming in Sweden, four operators (Swefour, Tele2, Telenor and TeliaSonera_ held both 2G 900MHz licences and 3G 2100MHz licences; one operator (HI3G) had 2100MHz licence only. • Refarming decision resulted in all 900MHz spectrum in Sweden being distributed among the five operators, with spectrum holding ranging from 2×5 MHz to 2×10 MHz. This process was carried out on a mutually agreed proposal submitted by all five operators to the regulator PTS. • Subsequently, use of spectrum in the band has been liberalized and all licences are technology and service neutral wef 01st May 2011.
	1800 MHz • A total of 2x35 MHz was relicensed to 4 incumbents with an expiry date of Dec 2027 (Dec 2017 for Swefour), ie reduction in the existing spectrum holding with the intention of releasing 2x40 MHz spectrum to be awarded in a planned auction. • The renewed licenses was issued as more technology neutral and service neutral in accordance with the applicable EU law; the 1800 MHz band has been allowed to be used for GSM and UMTS and mobile technologies that can co-exist with those technologies from 1 January 2013.
Denmark	**900/1800 MHz** • Prior to the refarming, almost all the spectrum in the two bands was licensed to Denmark's three GSM operators: TDC, Telia and Telenor. • The refaming decision by NITA on 23rd Dec 2009 provided for the redistribution of spectrum to accommodate new entry licensees in

	both bands and reshuffling of existing licensees meaning all operators had to spectrally move their current operations and adjusting expiry dates of existing licenses. Refarming within the band freed 2x5 MHz and 2x10 MHz in 1800 bands. • An auction of the 900MHz and 1800MHz spectrum, reserved for a 'new entrant', was held in October 2010 and resulted in Hi3G being successfully granted both licences. • Use of spectrum liberalised wef 1st May 2011. • The incumbent 900MHz/1800MHz operators' liberalised licences now expire in 2019/2017.
Ireland	**900/1800 MHz** • On 24.08.2011, the ComReg released the document "Multi-Band Spectrum Release: Release of the 800 MHz, 900 MHz and 1800 MHz radio spectrum bands", which contained ComReg's comprehensive proposals for making these spectrum bands available from 2013 on a competitive basis, based on a multi-band spectrum auction. • The core proposition advanced in the document was to hold an open auction for the entire spectrum in the 800 MHz, 900 MHz and 1800 MHz bands and not to make any administrative assignment to incumbents of 900/1800MHz on expiry of their licences or to new entrant. • Two of these three spectrum bands (900 MHz and 1800 MHz) are used for providing the 2G mobile services); the third band (800 MHz) is currently used for broadcasting analogue terrestrial signals.
UK	**900/1800 MHz** • In their February 2009 consultation, OFCOM said that they believed that liberalisation of the 900MHz and 1800MHz spectrum had the potential to bring significant benefits to consumers but they were also concerned that liberalisation of the 900MHz spectrum in the hands of the incumbent holders could lead to competition issues. To address this risk, OFCOM proposed that O2 and Vodafone release 1 block (2x5 MHz) of 900MHz spectrum in total (i.e. 2x2.5 MHz each) and that this spectrum be awarded

	to a third party. • In the OFCOM's subsequent assessment, the likelihood and size of a competitive distortion arising out of the liberisation of 900/1800 MHz bands was significantly reduced when it prepared the advice to the Government in October 2010. The most important factor contributing to the change in the perception of OFCOM is the merger between Orange and T-Mobile creating Everything Everywhere (EE) which has the largest amount of 2100 MHz spectrum and access to the largest number of base station sites. • Accordingly, 2G licences (900/1800 MHz) were liberalised in the hands of existing licence holders.

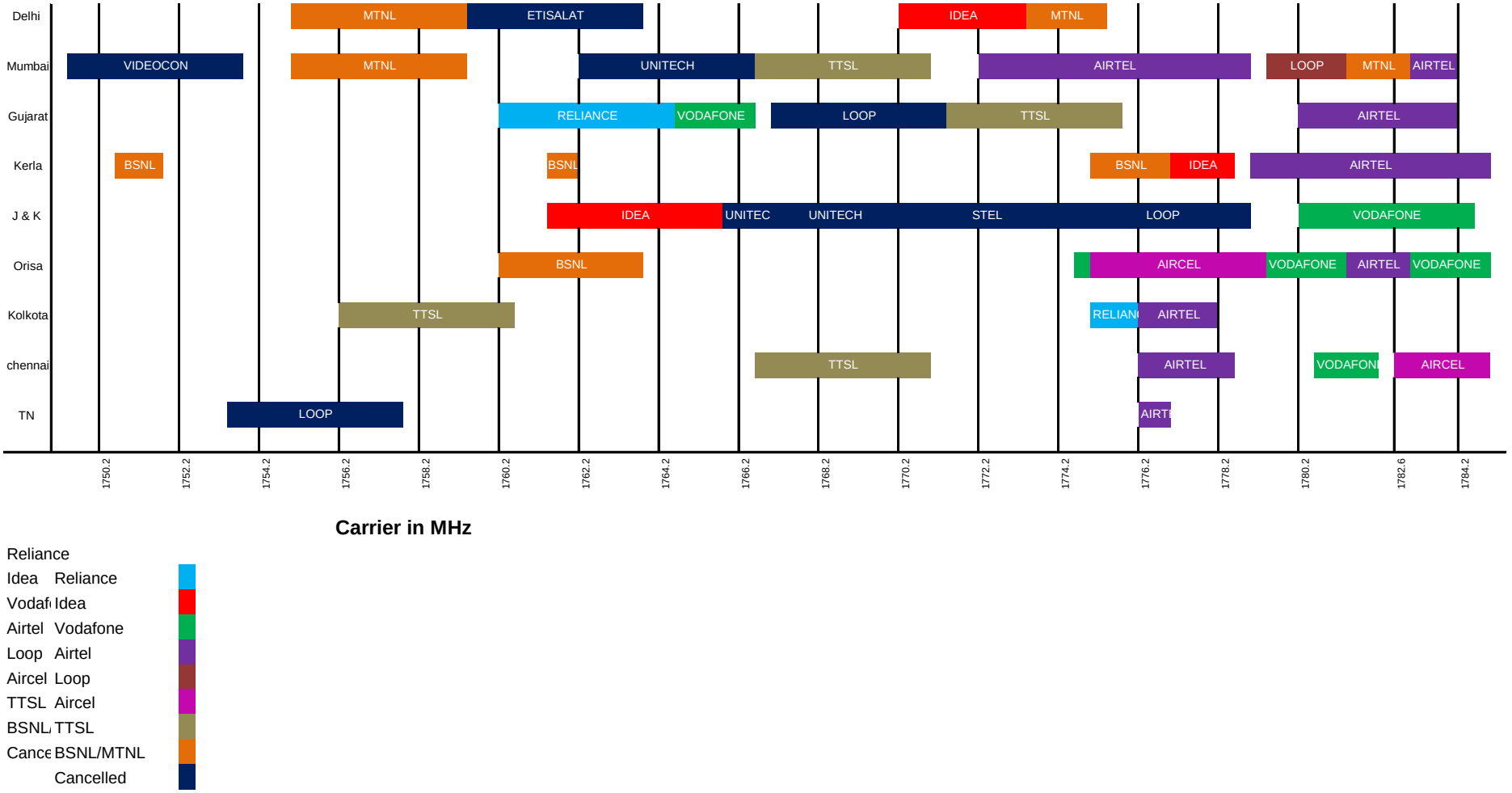
Annexure V

Carrier Distribution of GSM Spectrum Alloted to Telecom Service Providers Licence Service Area wise



Annexure V(Cont.)

Carrier Distribution of GSM Spectrum Alloted to Telecom Service Providers Licence Service Area wise



Annexure VI

Sl. No.	Country	Year	Spectrum Band	Amount of Spectrum Auctioned (MHz)	Auction Price per MHz US$					
					Amount (in mn)	Currency	Implied PPP Rate	US$ (in mn) IPPP Rate	INR (in mn) IPPP Rate @19.566	US$ (in mn) currency exchange Rate
1	Germany	2010	800	60	60.00	€ (mn)	0.841	71.34	1,395.91	78.00
		2010	1800	50	2.10	€ (mn)	0.841	2.50	48.86	2.73
		2010	2000	59.2	5.88	€ (mn)	0.841	6.99	136.76	7.64
		2010	2600	190	1.82	€ (mn)	0.841	2.16	42.24	2.36
2	Sweden	2011	800	60	34.23	SEK mn	9.368	3.65	71.50	5.14
		2008	2600	190	11.05	SEK mn	9.197	1.20	23.51	1.66
3	Hongkong	2012	2300	90	5.22	HK$ mn	5.597	0.93	18.26	0.67
		2011	850/900	20	97.60	HK$ mn	5.429	17.98	351.75	12.58
		2009	2600	90	17.06	HK$ mn	5.364	3.18	62.24	2.20
4	Singapore	2011	1800	20	1.08	S $ mn	1.047	1.04	20.27	0.86
		2010	2100	30	2.00	S $ mn	1.037	1.93	37.74	1.59
5	France	2011	2600	140	6.69	€ mn	0.897	7.45	145.83	8.69
		2011	800	60	44.00	€ mn	0.897	49.05	959.76	57.20
6	Spain	2011	800	60	21.76	€ mn	0.770	28.25	552.81	28.28
		2011	900	10	16.90	€ mn	0.770	21.95	429.44	21.97
		2011	2600	190	0.91	€ mn	0.770	1.18	23.09	1.18
7	USA	2008	700	62	386.44	US$ mn	1.000	386.44	7,561.09	386.44
8	Brazil	2010	3G Band H	40	18.00	US$ mn	1.000	18.00	352.19	18.00
9	Canada	2008	1700-2100	105	40.95	CAD mn	1.233	33.21	649.86	40.62
	Average							**34.65**	**678.06**	**35.67**

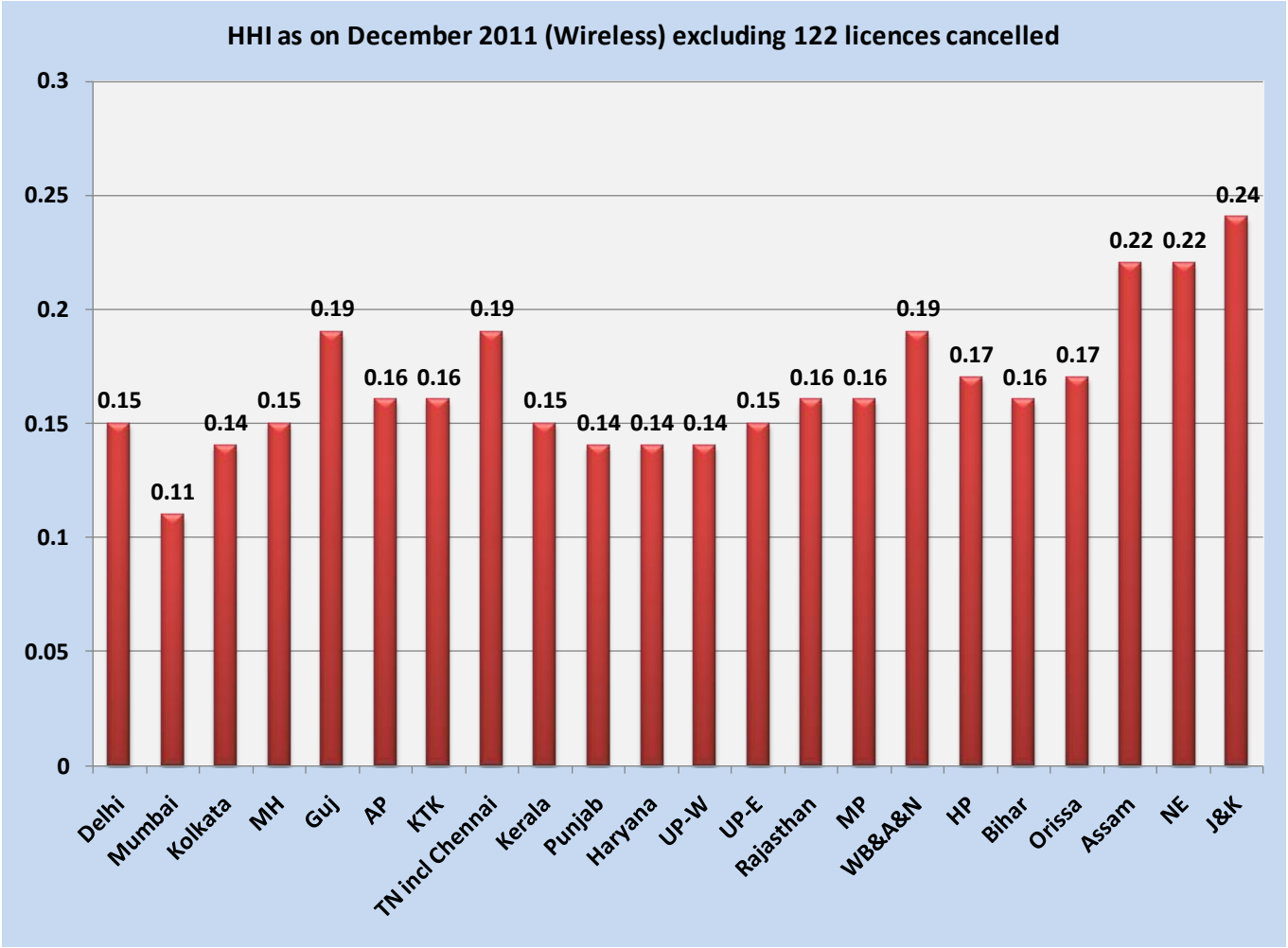
Annexure VII

Impact of Auction Fees on wireless (GSM) services segment (using EMI method)																				
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32
Projected Growth in MoU	15%	10%	10%	10%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	3%	3%	3%	3%	3%	3%
Total projected MOU for wireless (GSM) services (crore)	340260	374286	411714	452886	475530	499307	524272	550485	578010	606910	637256	669118	702574	737703	759834	782629	806108	830291	855200	880856
Auction fee For 1 Mhz (Rs. crore)	3622																			
Auction Fee For 576.2 Mhz on pan India basis (Rs. in crore)	93721																			
Annualised EMI (Rs. in crore) for Auction fee i.e. Rs.93721 crore after considering interest @15%	14808	14808	14808	14808	14808	14808	14808	14808	14808	14808	14808	14808	14808	14808	14808	14808	14808	14808	14808	14808
Impact of EMI (per minute) (Rs.) i.e. Annualised EMI/MoU	0.044	0.040	0.036	0.033	0.031	0.030	0.028	0.027	0.026	0.024	0.023	0.022	0.021	0.020	0.019	0.019	0.018	0.018	0.017	0.017
EMI per minute amortised from revenue from non-voice services (Rs.)	0.008	0.008	0.009	0.009	0.009	0.010	0.011	0.012	0.013	0.012	0.012	0.011	0.011	0.010	0.010	0.009	0.009	0.009	0.009	0.008
EMI per minute amortised from revenue from voice services (Rs.)	0.036	0.032	0.027	0.024	0.022	0.019	0.017	0.015	0.013	0.012	0.012	0.011	0.011	0.010	0.010	0.009	0.009	0.009	0.009	0.008
Assumptions:-																				
(i) The amount of spectrum available in the 1800 MHz band is 576.20 MHz.																				
(ii) Reserve price per MHz is based on 3G auction prices per MHz for different service areas in 2010-11, which are indexed to 2011-12 using SBI average PLR rate @ 12.63%. This has further adjusted																				
with an efficiency factor 1.2 for 1800 MHz over the 3G band. 80% of the computed value has been adopted as the reserve price of Rs. 3622 crore per MHz.																				
(iii) The total number of Minutes of Usage (MOUs) - 257285 crore minutes for wireless (GSM) services in 2010-11 has been taken as base for future projection of MoUs for 20 years (from 2012-13 to																				
2031-32).																				
(iv) The EMI for the auction money based on reserve price calculated for 20 years @ 15% per annum has been annualized. Return on Capital Employed @ 15% used by the Authority in past exercises has																				
been taken as rate of interest for the purpose of calculating EMI.																				
(v)The share of annualized EMI met out of revenue generated from non-voice services increases from 18% in the year 2012-13 to 30% in the year 2016-17, 40% in the year 2018-19 and 50% from the year 2020-21 onwards																				

Annexure VIII

Impact of Auction Fees for Hypothetical Service Provider (wireless GSM service) (using EMI method)																				
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32
Growth in Subscribers	10%	8%	6%	5%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Total projected subscribers (Crore)	5.00	5.40	5.72	6.01	6.07	6.13	6.19	6.25	6.32	6.38	6.44	6.51	6.57	6.64	6.71	6.77	6.84	6.91	6.98	7.05
MoU (p.m.)	340																			
Total projected MoU (crore)	20400	22032	23354	24522	24767	25015	25265	25517	25772	26030	26290	26553	26819	27087	27358	27632	27908	28187	28469	28754
Auction Fee for 1 Mhz (Rs. crore)	3622																			
Auction fee for 5 Mhz on pan India basis (Rs. crore)	18111																			
Annualised EMI (Rs. in crore) for Auction fee i.e. Rs.18111 crore after considering interest @15%	2856	2856	2856	2856	2856	2856	2856	2856	2856	2856	2856	2856	2856	2856	2856	2856	2856	2856	2856	2856
Impact of EMI (per minute) (Rs.) i.e. Annualised EMI/MoU	0.140	0.130	0.122	0.116	0.115	0.114	0.113	0.112	0.111	0.110	0.109	0.108	0.106	0.105	0.104	0.103	0.102	0.101	0.100	0.099
EMI per minute amortised from revenue from non-voice services (Rs.)	0.025	0.026	0.029	0.031	0.035	0.040	0.045	0.050	0.055	0.055	0.054	0.054	0.053	0.053	0.052	0.052	0.051	0.051	0.050	0.050
EMI per minute amortised from revenue from voice services (Rs.)	0.115	0.104	0.093	0.085	0.081	0.074	0.068	0.062	0.055	0.055	0.054	0.054	0.053	0.053	0.052	0.052	0.051	0.051	0.050	0.050
Assumptions:-																				
(i) Reserve price per MHz is based on 3G auction prices per MHz for different service areas in 2010-11, which are indexed to 2011-12 using SBI average PLR rate @ 12.63%. This has further adjusted																				
with an efficiency factor 1.2 for 1800 MHz over the 3G band. 80% of the computed value has been adopted as the reserve price of Rs. 3622 crore per MHz.																				
(ii) The EMI for the auction money based on reserve price calculated for 20 years @ 15% per annum has been annualized. Return on Capital Employed @ 15% used by the Authority in past exercises has																				
been taken as rate of interest for the purpose of calculating EMI.																				
(iii)The share of annualized EMI met out of revenue generated from non-voice services increases from 18% in the year 2012-13 to 30% in the year 2016-17, 40% in the year 2018-19 and 50% from the year 2020-21 onwards																				

Annexure IX


HHI as on December 2011 (Wireless) excluding 122 licences cancelled
0.3
0.25
0.2
0.15
0.1
0.05
0
0.15
0.11
0.14
0.15
0.19
0.16
0.16
0.19
0.15
0.14
0.14
0.14
0.15
0.16
0.16
0.19
0.17
0.16
0.17
0.22
0.22
0.24
Delhi
Mumbai
Kolkata
MH
Guj
AP
KTK
TN incl Chennai
Kerala
Punjab
Haryana
UP-W
UP-E
Rajasthan
MP
WB&A&N
HP
Bihar
Orissa
Assam
NE
J&K