

Consultation Paper No. 04/2012



Telecom Regulatory Authority of India

Consultation Paper

on

Auction of Spectrum

New Delhi 7th March, 2012

Preface

The Hon'ble Supreme Court of India in its Judgment dated 2nd February 2012 in the writ petitions no 423/2010 and 10/2010, has directed TRAI to 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, keeping in view the decision taken by the Central Government in 2011.

In accordance with the judgment of Hon'ble Supreme Court of India, TRAI issued a pre-consultation paper on 03rd February 2012, on the issue of "Allocation of spectrum in 2G band in 22 Service Areas by auction".

On the basis of the comments received from the stakeholders on the Pre-consultation paper and considering the international practices, this Consultation paper on 'Auction of Spectrum' has been prepared. The consultation paper has been placed on TRAI website www.traigov.in.

Written comments on the issues raised in the Consultation paper are invited from the stakeholders by 21st March 2012 and counter-comments by 28th March 2012. The comments and counter-comments may be sent, preferably in electronic form. For any clarification/information, Shri Sudhir Gupta, Pr. Advisor (MS), TRAI, may be contacted at Telephone No. +91-11-23220018 Fax No. +91-11-23212014 or email at pradvmn@traigov.in.

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Chapter I

BACKGROUND

A. Decision of Hon'ble Supreme Court

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

“

- i The licences 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 licences be granted by auction.*
- v Respondent Nos.2, 3 and 9 who have been benefited at the cost of Public Exchequer by a wholly arbitrary and unconstitutional action taken by the DoT for grant of UAS Licences and allocation of spectrum in 2G band and who offloaded their stakes for many thousand crores in the name of fresh infusion of equity or transfer of equity shall pay cost of Rs.5 crores each. Respondent Nos. 4, 6, 7 and 10 shall pay cost of Rs.50 lakhs each because they too had been benefited by the wholly arbitrary and unconstitutional exercise undertaken by the DoT for grant of UAS Licences and allocation of spectrum in 2G band. We have not imposed cost on the respondents who had submitted their applications in 2004 and 2006 and whose applications were kept pending till 2007.*
- vi Within four months, 50% of the cost shall be deposited with the Supreme Court Legal Services Committee for being used*

for providing legal aid to poor and indigent litigants. The remaining 50% cost shall be deposited in the funds created for Resettlement and Welfare Schemes of the Ministry of Defence.

vii However, it is made clear that the observations made in this judgment shall not, in any manner, affect the pending investigation by the CBI, Directorate of Enforcement and others agencies or cause prejudice to those who are facing prosecution in the cases registered by the CBI or who may face prosecution on the basis of chargesheet(s) which may be filed by the CBI in future and the Special Judge, CBI shall decide the matter uninfluenced by this judgment. We also make it clear that this judgment shall not prejudice any person in the action which may be taken by other investigating agencies under Income Tax Act, 1961, Prevention of Money Laundering Act, 2002 and other similar statutes.”

1.2 While dealing with the above writ petitions, the Supreme Court raised the following issue among others:

"(i) whether the government has the right to alienate, transfer or distribute natural resources/national assets otherwise than by following a fair and transparent method consistent with the fundamentals of the equality clause enshrined in the constitution?"

1.3 While considering this issue, the Hon'ble Supreme Court observed as follows:

- 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)

1.4 As mentioned, the Hon'ble Supreme Court directed that "keeping in view the decision taken by the central government in 2011, TRAI shall make fresh recommendations for grant of license and allocation of spectrum in 2G band in 22 service areas by auction, as was done for allocation of spectrum in 3G band". (Para 81)

1.5 Hon'ble Supreme Court also directed the Central Government to take appropriate decision within one month of the recommendations of TRAI.

B. Decision of the Government

1.6 In the light of the orders of the Hon'ble Supreme Court dated 2.2.2012, TRAI had requested the Government, on 17.2.2012, to communicate the decisions taken in the year 2011. In reply, the Department of Telecommunications, vide its letter dated 1.3.2012, communicated the decisions announced by the Government regarding TRAI recommendations on "Spectrum Management and Licensing Framework" and policy for spectrum management and pricing. The reply of the Department of Telecommunications contains (a) the text of the Press Statement dated 29.1.2011 of the Minister of Communications and IT on the policy for spectrum assignment and pricing and the Press Statement dated 15.2.2012 of the Minister of Communications and IT indicating the decisions taken by the Department of Telecommunications on the recommendations of TRAI. (Annexure – I)

1.7 Some of the decisions take by Department of Telecommunications are as follows.

- 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. 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.
- Additionally, 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. It may be recalled that show cause 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.

- No more UAS licences linked with spectrum will be awarded.
- 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.
- The need for refarming of spectrum is accepted in-principle. Further steps will be taken after receipt of TRAI's recommendations in this regard.
- 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.
- In respect of spectrum obtained through auction, spectrum sharing will be permitted only if the auction conditions provide for the same.
- Spectrum trading will not be allowed in India, at this stage. This will be re-examined at a later date.

C. Spectrum Availability

- 1.8 DoT vide letter dated 03.02.2012 has requested TRAI to provide its recommendation as per the directions of Hon'ble Supreme Court in Judgement dated 2nd February 2012 in writ petition (civil) No. 423/2010 and 10/2010.
- 1.9 In reference of above, TRAI requested WPC wing of DoT to intimate the likely availability of Spectrum after cancellation of 122 licenses.
- 1.10 WPC provided the data regarding the availability of the spectrum for GSM & CDMA, after taking into account cancellation of 122 licenses (excluding partial allotment and including partial allotments) and spectrum presently available with WPC wing of DoT.
- 1.11 On the basis of the information provided by WPC, the status of spectrum availability in 800 MHz and 1800 MHz is as given in Table 1.1 and Table 1.2 below.

Table:1.1

Spectrum Availability in 800 MHz band after cancellation of 122 Licenses issued in 2008

S.No.	Circle	Spectrum Presently Available	Spectrum to be vacated due to cancellation of Licence	Total available spectrum
1	Delhi	1.25	2.5	3.75
2	Mumbai	1.25	2.5	3.75
3	Kolkata	2.5	2.5	5
4	Maharashtra	1.25	2.5	3.75
5	Gujarat	5	2.5	7.5
6	AP	0	2.5	2.5
7	Karnataka	3.75	2.5	6.25
8	Tamil Nadu	2.5	2.5	5
9	Kerala	2.5	2.5	5
10	Punjab	1.25	2.5	3.75
11	Haryana	3.75	2.5	6.25
12	UP - West	3.75	2.5	6.25
13	UP - East	2.5	2.5	5
14	Rajasthan	0	0	0
15	M.P.	3.75	2.5	6.25
16	West Bengal	5	2.5	7.5
17	H.P.	7.5	2.5	10
18	Bihar	3.75	2.5	6.25
19	Orissa	6.25	2.5	8.75
20	Assam	7.5	5	12.5
21	North East	7.5	5	12.5
22	J&K	5	5	10
		77.5	60	137.5

Note: In stray cases, Spectrum allocated varies slightly from the above tranches

Table 1.2

1800 MHz band after cancellation of 122 Licenses issued in 2008									
S.No.	Circle	Spectrum Presently Available	Spectrum to be vacated due to cancellation of Licence including partial Spectrum Assignment	Balance available spectrum including partial spectrum assignment	Partial spectrum allocated to cancelled licensee	Spectrum Vacated excluding partial spectrum	Total Spectrum available excluding partial spectrum	Total Districts in LSA (*)	Number of districts Spectrum not available(*)
1	Delhi	11.6	4.4	16	0	4.4	16	Metro	0
2	Mumbai	5	13.2	18.2	0	13.2	18.2	Metro	0
3	Kolkata	23	17.6	40.6	0	17.6	40.6	Metro	0
4	Maharashtra	6	22.0	28	0	22	28	36	0
5	Gujarat	4.4	17.6	22	4.4	13.2	17.6	29	3
6	AP	15	22.0	37	0	22	37	23	0
7	Karnataka	11.8	22.0	33.8	0	22	33.8	29	0
8	Tamil Nadu	25.4	22.0	47.4	0	22	47.4	33	0
9	Kerala	28	17.6	45.6	0	17.6	45.6	15	0
10	Punjab	1.4	17.6	19	4.4	13.2	14.6	22	2
11	Haryana	4.4	22.0	26.4	13.2	8.8	13.2	21	1/2/1
12	UP - West	8.2	17.6	25.8	4.4	13.2	21.4	37	4
13	UP - East	0	17.6	17.6	4.4	13.2	13.2	48	3
14	Rajasthan	3.2	17.6	20.8	17.6	0	3.2	33	11/11/11/11
15	M.P.	18	17.6	35.6	0	17.6	35.6	68	0
16	West Bengal	4	17.6	21.6	4.4	13.2	17.2	25	3
17	H.P.	6.4	17.6	24	4.4	13.2	19.6	12	6
18	Bihar	0	22.0	22	8.8	13.2	13.2	62	5/5
19	Orissa	18	22.0	40	0	22	40	30	0
20	Assam	3.8	22.0	25.8	13.2	8.8	12.6	27	3/3/3
21	North East	7	22.0	29	13.2	8.8	15.8	55	2/2/2
22	J&K	6.4	22.0	28.4	13.2	8.8	15.2	22	2/2/2
	Total	211	413.6	624.6	105.6	308	519		

Note: In stray cases, Spectrum allocated varies slightly from the above tranches

*** x/y/z indicate the partial spectrum not available to the one TSP in x no. of districts, second TSP in y no. of districts, third TSP in z no. of district. This is as per the information available with TRAI**

700 MHz band

1.12 In India, as far as 700 MHz band (698-806 MHz) is concerned, 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.

- 1.13 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. As per the information provided, the entire spectrum in 698-806 MHz band is likely to be available for assignments for new technologies.

2100 MHz band:

- 1.14 5 MHz is likely to be vacated by Defence.

2.3-2.4 GHz band:

Table 1.3

Spectrum Availability in 2.3-2.4 Ghz band				
S.No.	Circle	Total aviable 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

2500 MHz band

- 1.15 The portion of 2535-2555 MHz band may be available subject to interference analysis and compatibility with DoS operations.
- 1.16 The summary of spectrum availability for allocation for telecom services in different service areas is given in table 1.4.

Table 1.4 Summary of Spectrum Availability

Band	Spectrum Availability (Range in MHz)
700 MHz	2x45
800 MHz	0-12.5
900 MHz	Nil
1800 MHz	3.2-47.4
2.3.-2.4 GHz	0-20

D. Unified Licence

- 1.17 The Hon'ble Supreme Court of India in its Judgment has directed TRAI as under:

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.

- 1.18 On the issue of grant of licences, TRAI in its recommendation on "Spectrum Management and Licensing Framework" dated 11th May 2010 had already recommended that all future licences should be Unified Licences and that spectrum be delinked from the licence. Pursuant to this recommendation, the DoT had accepted the recommendations of TRAI. In press release dated 15th February 2012, DoT conveyed the following decision regarding Unified Licences:

"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 Licence 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."

1.19 Pursuant to this recommendation and decision of the Government, “Draft Guidelines for Unified Licence/Class Licence and Migration of Existing Licences” were also placed on TRAI website www.trai.gov.in on 20th February 2012 for comments of the stakeholders. Some of the provisions of the draft guidelines of Unified/Class Licence are as given below:

“Subject to fulfilment of relevant eligibility conditions, Licence shall be issued on non exclusive basis, without any restriction on the number of licences.”

“Unified Licence will not, per se, carry with it any spectrum. A holder of Unified Licence, other than District level Unified Licence, may separately obtain spectrum as per the prevailing policy.”

1.20 On the draft Guidelines for Unified Licence/Class Licence and Migration of Existing Licences, comments of stakeholders have been received and are separately being examined by the Authority. The Authority will separately make appropriate recommendations to the Government.

Chapter-II

AUCTION DESIGN: PRINCIPLES AND GLOBAL EXPERIENCES

A Principles of Auction Design

1. Single Object Auctions

2.1. **Auction Formats:** The theory of auctions is an elegant theory with an enormous potential for applications. The simplest form of auction involves sale of a single (indivisible) object. Suppose there are some potential buyers (bidders) who want to buy this object. Each bidder has a valuation for the object which is completely known to the bidder but not known to other bidders or the seller. An auction tries to recover the valuation information, either directly or indirectly, from the bidders. Inputs to the auction are typically bids that depend on the valuations of the bidders. As an output, an auction produces two things (as a function of the input): (a) an allocation indicating who wins the object and (b) prices indicating who pays how much. A typical assumption is that those who do not win the object pay nothing. There are many formats of auction, differing in their input and output that achieve efficiency. Some of the commonly used auction formats are described below:-

2.2. **First-price sealed bid auction:** In this auction, each bidder is asked to submit a bid. The highest bidder wins the auction but pays an amount equal to his bid amount. It is not necessary that the bidder with the highest value will place the highest bid. This is because the bid amount of a bidder depends on what he believes other bidders are bidding. Under appropriate assumptions, it can be shown that it is

equilibrium for bidders to bid below their valuation in this auction by an amount that decreases with the number of bidders. The bidder with the highest value always bids the highest in such an equilibrium (Krishna, 2009). 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.

- 2.3. **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. Vickrey (1961) showed that an optimal strategy for every bidder is to bid his true valuation irrespective of what she believes others will bid. Despite this elegant theoretical property, Vickrey auctions are not frequently used in practice (Ausubel and Milgrom, 2006; Rothkopf et al., 1990).
- 2.4. **Dutch auction (descending price auction):** A popular auction is the descending price auction, also known as the Dutch auction - flowers in the Netherlands are sold using this format. 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 in the Dutch auction. Since the bidder who wins the object pays this amount in both the first-price sealed-bid and the Dutch auction, both the auctions are strategically equivalent. One of the problems with the descending price auctions is that the seller must have a good knowledge of the upper bound on the values of the bidders. Otherwise, the seller may lose potential revenue from the auction.

2.5. **English or Japanese auction (ascending price auction):** The ascending price auction is the ascending counterpart of the Dutch auction. There are two commonly used variants of this format. The first variant called the English auction, works as follows. 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. A bidder can be silent for most of the auction and bid at the end (a phenomenon commonly observed in the English auctions conducted on e-Bay.com). 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. Theoretically, this auction converges to the outcome of the second-price sealed-bid auction if the bid increment is small enough. As soon as the price in the auction crosses the second highest value, exactly one bidder is interested in the object, and the auction stops. The highest value bidder wins the object and pays a price (close to the) equal to the second highest value. The Japanese auction is also referred to as the clock auction.

2.6. **Efficiency and Revenue:** Efficiency in a single object auction requires the object to be allocated to the bidder with the highest value. One can theoretically show that under plausible assumptions, all the auctions

above have an equilibrium (appropriately defined) in which the highest bidder wins the object, and hence, efficiency is achieved. The Vickrey auction and the ascending price auction achieve efficiency in a stronger equilibrium sense than the first-price sealed-bid or the Dutch auction. For instance, the equilibrium in the ascending price auction says that irrespective of what other bidders bid, a bidder's best strategy is to express interest in the object till the price reaches his value. The equilibrium in the first-price sealed-bid auction and the Dutch auction requires bidders to bid optimally given their beliefs on what other bidders are doing, and hence, their optimal bidding maximizes their expected payoff.

2.7. The other important objective in auction design is revenue. When we say revenue maximization, we mean expected revenue maximization. The reason for this is that the seller does not know the valuations of the bidders. If valuations are known, then an auction is unnecessary; the seller could simply allocate the good to the potential buyer with the highest valuation and charge this buyer's valuation. It is standard in the theory to assume that the seller has beliefs about the possible valuations of the bidders. Once bidder valuations are realized and bidders make their bids, the seller obtains revenue. However, since the realizations are unobserved by the seller, the revenue obtained by the seller is a random variable in the language of probability theory. The best that the seller can hope to achieve is to maximize the mean (or expectation) of this random variable.

2.8. An important observation is that the objectives of efficiency and revenue may be incompatible. To see this consider the following example with just one bidder. Suppose there is a single bidder whose value is not known to the seller but the seller knows that it is distributed uniformly between 0 and 100. In this setting, efficiency will require that the seller always allocates the object to the bidder.

Note that the bidder must pay zero in this case. To see this note that (i) he must pay zero when his value is zero otherwise he will make negative profit (this is called the individual rationality or voluntary participation constraint) and (ii) if he pays anything else for any other value then he will strategically say that his value is zero and get zero payment. Hence, efficiency in this example leads to zero revenue. Can we increase revenue in this example? It is possible to do so using a reserve price. A reserve price indicates the minimum amount a bidder must pay to win the object. In this example, if the seller sets a reserve price of 40, then the bidder will take the object if his value is above 40 and pay an amount equal to 40 whenever he takes the object. So, suppose the bidder sets a reserve price r . The bidder, whenever he takes the object, pays an amount equal to r . Note that if r equals 100, then the object will never be sold and the revenue from the auction is again zero. We have already seen that setting r equal to zero achieves efficiency but gives a revenue of zero. What is the optimal value of r ? We need to compute the expected revenue from setting a reserve price. To do so, note that the seller earns zero revenue if the value of the bidder is less than r and earns a revenue r if the value of the bidder is more than r . The probability that the bidder has a value more than r is $(1-r/100)$. Hence, the expected revenue from this reserve price auction is $r(1-r/100)$. This expression can be maximized by setting $r=50$.

- 2.9. There are four observations worth making. First, the selection of an optimal reserve price increases revenue. Second, the optimal reserve price depends on the distribution of values of bidders. This analysis can also be extended to more than one bidder. Myerson (1981) shows that an ascending price auction (or a Vickrey auction) with an optimally chosen reserve price maximizes expected revenue among all auction formats – (Krishna (2009)).

- 2.10. The second observation is that it is not generally optimal for the seller to choose the highest possible valuation that the seller believes that a buyer may have. In the example above, it is easy to see that setting $r=100$ is disastrous from the point of view of revenue. Setting a high reserve price increases the likelihood of the good not being sold; i.e. of the probability of there being “no-takers”. On the other hand, setting too low a reserve price is also injudicious because it is unlikely that the reserve price will be effective in any eventuality. Clearly setting an intermediate reserve price is best, balancing the twin goals of having a high probability of sale (achieved by selecting a low reserve price) and getting a high price when sale takes place (achieved by selecting a high reserve price).
- 2.11. The third observation is that the optimal reserve price increases with the number of bidders if bidder valuations are not correlated (i.e., if value for the object for a bidder does not depend on private information of other bidders - a reasonable assumption). This is so because the likelihood of the presence of a high valuation bidder increases as the number of bidders increases. In the limited case where valuations are independently drawn and the number of bidders is infinitely large, the seller can be statistically certain that there a bidder with the highest conceivable valuation. The optimal reserve price is therefore the higher support of the distribution of possible bidder valuations (100 in the example).
- 2.12. Finally, setting reserve prices deters collusion. For instance, consider the Japanese (clock) auction for a single object. Suppose there is no reserve price. The price will then start at zero. Suppose there are only two bidders. If these two bidders reach a private agreement, only one bidder can express demand at price zero. The auction stops at price zero and the resulting revenue is zero. Setting a reserve price thus helps in mitigating the effect of collusion on revenue.

2. Setting of the Reserve Price

2.13. It is clear from our earlier discussion that an optimal selection of reserve prices helps in increasing revenue. However, computing an optimal reserve price is not a trivial exercise. Theoretically, if the objective is to maximize revenue, then computing the optimal reserve price requires knowledge about the distribution of valuations of the bidders. Some of the practical difficulties in computing an optimal reserve price are discussed below. All the explanations are for the single object auction and the problems are magnified manifold when there is more than one object.

2.14. It is important to keep in mind that in the standard theory of auctions, the seller does not know the valuations of the bidders but has some information about the distribution of valuations - in particular, the range of possible valuations of the bidders and the probability (how likely) of each of these valuations.

- One feature of the optimal reserve price computation is that if the bidders are symmetric (i.e., their range of possible valuations are exactly the same and their probabilities are also the same), then there is a common optimal reserve price for all bidders, which can be computed from this distribution information. However, if the bidders are not symmetric in the above sense, the seller is better off by setting different reserve prices, i.e., a common reserve price is not optimal (Myerson (1981) or Krishna (2009)).
- Even if we assume that bidders are symmetric, the computation of an optimal reserve price requires two pieces of information:
 - the range of possible valuations - this involves getting an idea of the highest and lowest possible net revenue that a firm can generate using spectrum.

- the probability of each of the possible valuations being realized - this is an extremely difficult exercise. Heuristically, if we assume that each valuation is equally likely to occur, then the optimal reserve price is the mid-point of the range of the distribution of valuations. Using the uniform distribution can be justified by the principle of “insufficient reason”, advocated among others by Bernoulli and Keynes.

2.15. The sale of multiple objects presents more complex challenges. Computation of reserve prices of individual objects in this case becomes even more tricky, mainly because the valuation for any bundle of objects is not necessarily the sum of valuations of the objects in that bundle. A naive procedure is to treat each object in isolation, and compute the reserve price for each object independently.

3. Combinatorial Auctions

2.16. Often, multiple objects are available for sale from the seller. Bidders may be interested in all the objects for sale. A typical bidder will have values for many possible bundles of objects. Table 1 gives an example of three bidders and two objects a and b . Notice that bidder 1 enjoys synergies between objects a and b . On the other hand, bidder 2 has no value for object b and bidder 3 has additive value for objects a and b together.

Bidders	Value for a	Value for b	Value for bundle a,b
1	10	6	20
2	7	0	7
3	5	8	13

Table 2.1: Example of combinatorial values on multiple objects

- 2.17. The presence of such synergy and substitute properties among multiple objects makes the sale of multiple objects an interesting problem. Sequentially selling each object one by one makes the strategic behaviour of bidders more complex - for instance, in the example in Table 2.1, if object a is auctioned first, followed by b, then it is not clear how much bidder 1 should bid each of the objects, and how he can exploit his synergy between the two objects.
- 2.18. To take care of such problems, multiple objects are often sold simultaneously. However, the four standard auction that we described earlier for the single object case do not generalize easily to combinatorial auctions case. First, consider the sealed-bid auctions. Since the bidders have value on bundles of objects (henceforth, referred to as packages), it is natural to ask for bids on packages in a sealed-bid auction. The first-price auction can then be generalized straightforwardly. Notice that an allocation in a combinatorial auction setting is an assignment of objects to bidders so that no object is assigned to more than one bidder. In the combinatorial version of the first-price sealed-bid auction, bidders submit bids on packages. Then, the seller chooses an allocation which maximizes the sum of bids (breaking ties arbitrarily). Each bidder chosen in the allocation wins the package assigned to him and pays the amount he bid for that package.
- 2.19. Consider the example in Table 2.1 with three bidders and two objects. The first-price sealed-bid auction for this set up will ask for bids from the bidders on all three packages (if a bidder is not interested in a package then he may not bid on it, indicating a zero bid). Suppose the bids are as shown in Table 2.2. There are many allocations possible - for instance allocating object a to bidder 1 and object b to bidder 3, and no objects to bidder 2 is one allocation; allocating both the objects to bidder 1 and nothing to others is another allocation. The total sum of bids (or revenue) from the first allocation is $8+8=16$ and that from

the second allocation is 18. As it turns out, the second allocation maximizes the sum of bids over all allocations.

Bidders	Bid for a	Bid for b	Bid for package a,b
1	8	5	18
2	6	0	6
3	4	8	13

Table 2.2: Illustration of first-price sealed-bid auction with package bids

2.20. Efficiency will require us to choose an allocation which maximizes the sum of values. Since the bids submitted by the bidders need not equal value, it is not clear that the first-price sealed-bid auction will choose an efficient allocation. Indeed, the equilibrium analysis of first-price sealed-bid auction becomes intractable for the multiple objects case, and there is no known result about its efficiency properties (unlike in the single object case).

2.21. In contrast, the Vickrey auction (second-price sealed-bid auction) has been extended to allow for package bids such that bidding true value remains an equilibrium (optimal strategy) for the bidders. This generalization is called the Vickrey-Clarke-Groves (VCG) auction. The VCG auction also asks bidders to bid for all packages. It also selects the allocation which maximizes the sum of bids. However, if a bidder wins a package, the price he pays is his bid for the package minus a discount. This discount makes it an optimal strategy for the bidders to bid their value compared to the first-price sealed-bid auction where such an optimal strategy does not exist. The discount given to a bidder in the VCG auction is his marginal contribution to the revenue. To understand this, consider the example in Table 2, and assume that these are the bids of the bidders in the VCG auction. Then, as we have computed earlier, the allocation that maximizes the sum of bids is

bidder 1 gets both objects. The bidders who do not win any object, i.e., bidders 2 and 3 do not pay any amount. On the other hand, bidder 1 gets a discount. To compute his discount, remove bidder 1, and compute an allocation involving only bidders 2 and 3 which maximize the sum of bids. As can be seen, such an allocation must allocate object a to bidder 2 and object b to bidder 3, and the sum of bids of this allocation is 14. Hence, by including bidder 1, our revenue improves from 14 to 18. This difference $18 - 14 = 4$ is the marginal contribution of bidder 1. So, he pays an amount equal to $18 - 4 = 14$.

2.22. The VCG auction has several drawbacks (Rothkopf et al., 1990; Ausubel and Milgrom, 2006). First, it is very difficult to explain the rule of the VCG auction to bidders - the discount scheme makes it hard. Second, allowing for all package bids may become computationally expensive in many settings. Third, the VCG auction is aimed at achieving efficiency, and not maximizing revenue. Finally, the VCG auction is not a price discovery process. This leads us to our next topic on ascending price auctions. We do not discuss descending price auctions here since they are somewhat impractical in spectrum auction settings - it is very difficult to get a good upper bound from which prices can be lowered.

4. Ascending Auctions for Combinatorial Auctions

2.23. In the single object auction case, the English or Clock auction was a natural price discovery mechanism which achieved the same outcome as the theoretically elegant but impractical second-price sealed-bid auction. A natural question is then is how to extend the English or Clock auction for implementing the VCG auction. Unfortunately, the ascending auctions which achieve the VCG auction outcome are complex (except for few specific cases where bidders want at most one object - (Demange et al. (1986)). Such ascending auctions require (a) prices for every possible package and (b) separate prices for separate

bidders. These prices are increased in every round of the auction depending on the demand of the packages – (Parkes (1999), Ausubel and Milgrom (2002), Bikhchanani and Ostroy (2006), de Vries et al. (2007), and Mishra and Parkes (2007)).

- 2.24. Some of the problems we discussed with the VCG auction continue to exist in these ascending auctions - they are tailored for efficiency, the number of packages is too high, the price adjustment procedure may be too complex etc. This has given rise to a simple ascending auction, now popularly known as the simultaneous ascending auction (SAA) - it was first reported in Milgrom (2000), also see Milgrom (2004).
- 2.25. There are two versions of SAA - the English auction version, where bidders increase the prices and the Clock auction version where the seller increases the prices after receiving demands of bidders. We describe the Clock auction implementation of SAA. The SAA maintains prices on objects - the price of a package is the sum of prices of objects in a package. The SAA goes in rounds. In each round, the bidders see the prices on objects, and convey to the bidders the objects they are interested in buying at the current prices. If the number of bidders who demand (express interest in buying) a particular object is more than one, then its price is increased by a pre-defined bid increment. For instance, if there are two objects, and bidders 1 and 2 demand object a and bidder 3 demands object b, then the price of object a is increased by the bid increment, while the price of object b is not increased.
- 2.26. After such a price increase, the demand of all the bidders at the current price is again elicited. This process continues till the demand on each object is no more than one, in which case each bidder gets the objects he demands at the current price.

2.27. Theoretically, the analysis of equilibrium of SAA is very complex even with a small number of bidders - see Milgrom (2004). However, its simplicity makes it a very practical auction to run. Indeed, it was successfully used in spectrum auctions all over the world, including US, India, and many European countries

5. A Package Modification of the SAA

2.28. One drawback with the SAA is commonly referred to as the exposure problem. The exposure problem can be described in a simple manner without even referring to the SAA. Consider two objects a and b being sold to some bidders. Consider a bidder who has a value of 10 for object a, a value of 15 for object b, but value of 30 for package (a,b). Suppose there are two other bidders, one values object a at 15 but does not value the other object, and the other bidder values object b at 10 but does not value the other object. If we allow bidding for only objects (and not packages), it is difficult for the first bidder to express his synergy. Note that it is efficient for the first bidder to win both the objects. But, if he bids on individual objects, then he must bid high on both objects to get his synergy. For instance, if he bids 12 on object a and 16 on object b, and the other bidders bid their values on objects, then the first bidder wins only object b, and gets negative profit. This is a general phenomenon which can also happen in the SAA. In the SAA, a bidder may be bidding aggressively on a pair of objects due to synergy but may lose one of them to a bidder, resulting in loss.

2.29. The Clock auction version of the SAA minimizes the exposure problem to some extent because it allows bidders to express demand in every round. However, it still exposes bidders to low profit risks, and may eliminate synergy effects. A potential solution is to modify the SAA by allowing for package bidding. We describe the Clock auction variant of the Simultaneous Ascending Package Auction (SAPA). SAPA goes in rounds. Before the start of the first round, bidders are asked to

submit packages they are interested in - for computational tractability (or any other practical purposes), the number of such packages may be restricted to 10. Call the set of all such packages reported the feasible packages. The auction starts by maintaining one price for each feasible package - these will be the reserve prices for each package. At each round, the bidders indicate the packages out of the feasible packages they are interested in buying in each round. One possibility is to restrict each bidder to submit demand for at most one feasible package. But allowing for more than one feasible package demand will likely improve efficiency. Once the demand of the bidders is known, the seller chooses a provisional allocation which maximizes the sum of prices (or revenue) at this round. In the provisional allocation a bidder is either assigned one package from his demanded packages or not assigned any package. The bidders who did not win any package (or object) but demanded some package in the current round are called provisional losers. The price of packages demanded by the provisional losers are increased by a bid increment. The process continues till there are no provisional losers. In that case, the provisional allocation of the last round becomes the final allocation, and each bidder pays the price of the package he is allocated.

2.30. As an example, suppose there are three objects (a,b,c), and the feasible packages are (a, c, ab, ac, bc, abc). Suppose there are three bidders. Table 3 shows a typical demand of bidders at a price vector. One can compute that provisionally allocating package bc to bidder 2 and package a to bidder 1 gives a total revenue of 17, and this is the maximum revenue obtained in any allocation (here, package a can also be given to bidder 3, but we have broken the tie in favor of bidder 1 arbitrarily). Hence, bidder 3 becomes the provisional loser. The packages he is demanding are a, c, and abc. The prices of these packages are raised by the price increment amount in the next round, and the demand of the bidders is elicited again.

Packages	<i>a</i>	<i>c</i>	<i>ab</i>	<i>ac</i>	<i>bc</i>	<i>abc</i>
Prices	5	6	10	13	12	16
Demand	Bidders 1,3	Bidder 2,3	Bidders 1,2,3	Bidder 1	Bidder 2	Bidder 3

Table 2.3: SAA with package bidding

- 2.31. Allowing for package bidding reduces the exposure problem. However, the process of computing a provisional allocation requires computational power. Activity rules can be imposed to discourage arbitrary bidding behavior - for instance, if a bidder is demanding a package in a round, and the price of that package did not increase, then this bidder must continue to demand that package in the next round.
- 2.32. Ausubel et al. (2006) propose a Clock-Proxy Auction which combines the simplicity of SAA and the ability to capture synergy via package bidding. The clock-proxy auction is a two-stage auction. In the first stage, the clock auction variant of SAA is run. Once the SAA terminates, these prices become the starting point for the proxy phase. The name “proxy” is derived from the fact that instead of bidders, computer proxies are used to place bids in this phase. The proxy phase allows bidders to place bids on packages. Similar to SAPA discussed earlier, each bidder (or the proxy associated with the bidder) in each round finds the package which gives him the maximum profit, and demands that package. If the values of the packages are programmed into a computer proxy, then the proxy can do this task automatically. The price of a package is increased if there are more than one bidder on it. The proxy phase stops when there is no more than one bidder in each package. The final allocation is then calculated using an optimization procedure similar to SAPA.

2.33. It is possible to modify the proxy phase along the lines of SAPA. Indeed, one can run the entire SAPA in the proxy phase. The SAPA has the advantage that bidders (or proxies) can express demand on multiple packages. Moreover, the computation of provisional allocation in each round in SAPA gives bidders more information on whether they will be the eventual winners of any package

B Global Experience in Spectrum Auction

1. USA

2.35 Since 1994, the Federal Communications Commission (FCC) has conducted 97 spectrum auctions, raising over \$60 billion for the US treasury. In general, auctions have been a success fostering efficiency and generating huge revenue.

2.36 The Simultaneous Ascending Auction has emerged as the standard approach to spectrum auctions in which groups of related licenses are auctioned simultaneously over many rounds of bidding. This design has been successfully used and refined by the FCC in over two-dozen auctions. All but two of the FCC auctions have used the simultaneous ascending design.

2.37 The standard FCC auction format and its special features are discussed below.

Spectrum Cap and Set Asides

2.38 With the objective of promoting competition, regulatory authorities use Spectrum Cap and Set Asides in auction. In Set Asides, spectrum is put aside for new entrants where as in a Spectrum Cap a firm is limited in the quantity of spectrum that it can hold in any market. Spectrum Caps and Set Asides promote competition in the wireless service.

- 2.39 FCC has used both Spectrum Cap and Set Asides in its spectrum auctions. For the broadband PCS A and B blocks, incumbent cellular carriers were prevented from buying “in-region” licenses because of a 45MHz spectrum cap. In that auction, FCC also set aside the Broadband PCS C block for small businesses.
- 2.40 FCC placed important rules on public safety for the auction of 700 MHz spectrum conducted in 2008. 20 MHz of the valuable 700 MHz spectrum were set aside for the creation of a public/private partnership that will eventually roll out to a new nationwide broadband network tailored to the requirements of public safety.

Package Bidding

- 2.41 FCC has till recently discouraged package bidding (combinatorial auctions). However, for two of the recently conducted auctions—(1) AWS, Advances Wireless Services and (2) the 700 MHz auction conducted in 2008, it allowed package bidding to reduce exposure problem. It adopted the package clock auctions which allows package bids but retains the simple price discovery of the SMR auction by starting with an initial clock stage where bidders express their demand for licenses as the auctioneer raises prices.

Bidding Credits

- 2.42 Bidders of a favored type get a percentage discount on a winning bid. For example, new entrants may get a 30% bidding credit. In this case, a new entrant submitting a bid of \$2000 would only have to pay \$1400 if the bid won. Bidding credits differ from set asides and binding spectrum cap in that they do not ensure that a new entrant would win the auction. They serve the dual purpose of encouraging competition and assigning value on having a new entrant.

Activity Rule in Auction

2.43 An important element of the basic auction design is an activity rule to address the problem of bid snipping- waiting till the last minute to bid. The rule adopted by the FCC and used in all simultaneous ascending auctions to date is a quantity-based rule. The auction process aided by eligibility criteria requires the bidders to bid on a minimum amount of spectrum each round to maintain their eligibility to bid in future rounds. Thus, a bidder cannot hold back and wait, and then pounce late in the auction, thereby winning without making its true intent known until the last instant.

Pace of Auction

2.44 FCC uses multiple mechanisms to control minimum bid increments, and number of rounds per day. FCC specifies a minimum bid increments to assure that the auction concludes in a reasonable amount of time. Bid increments are set at the greater of a percentage increment and an absolute increment. Bid increments are adjusted in response to bidder behaviour. In the early rounds, when bid activity is high, the FCC sets larger bid increments; in the later rounds, when bid activity is low, the FCC sets smaller bid increments. Typically, the bid increments are between 5 and 20 percent.

2.45 The pace of the auction is also controlled by the number of rounds per day. Typically, fewer rounds per day are conducted early in the auction. Later, when there is much less bidding activity, the number of rounds per day is increased.

2.46 ¹In the U.S. 'Auction 73' of 700MHz spectrum kicked off on 24 January 2008 and concluded on 18 March 2008, after nearly two

¹ http://wireless.fcc.gov/auctions/default.htm?job=auction_summary&id=73

months of multi-round bidding. The auction offered a total of 62 MHz of bandwidth, between 2 and 22 MHz of bandwidth per license that was sold. Five blocks of spectrum were sold:

- Block A: 2X6 MHz (698-704 / 728-734 MHz), divided into 176 geographical areas
- Block B: 2X6 MHz (704-710 / 734-740 MHz), divided into 734 geographical areas
- Block E: 6 MHz unpaired (722-728 MHz), divided into 176 geographical areas
- Block C: 2X11 MHz (746-757 / 776-787 MHz), divided into 12 geographical areas
- Block D: 2X5 MHz (758-763 / 788-793 MHz), sold as nationwide.

2.47 The provisional winning bids for the A, B, C, and E Block licences exceeded the aggregate reserve prices for those blocks. The provisionally winning bid for the D Block license did not meet the applicable reserve price. Accordingly, Auction 73 raised a total of \$19,120,378,000 in winning bids and \$18,957,582,150 in net winning bids.

2. Denmark²

2.35 To comply with GSM Directive of European decision to make 900 MHz and 1800 MHz frequency bands service and technology neutral, the National IT- and Telecom Agency (NITA) decided to reform the 900 MHz and 1800 MHz.

2.36 Prior to the refarming, almost all the spectrum in the two bands was licensed to Denmark's three GSM operators: TDC, Telia and

² **900 MHz and 1800 MHz band refarming case study : Denmark**
http://www.gsm.org/documents/Refarming_case_study_Denmark_2011124.pdf

Telenor. Another operator Hi3G, having a UMTS licence with spectrum in 2.1 GHz, had no access to frequencies in 900 MHz or 1800 MHz band. Therefore, there was a fear of distortion of market competition, if the usage of 900 MHz and 1800 MHz bands is liberalised in the hands of incumbent operators. To ensure that the competition in the market for mobile communication was not distorted, NITA decided that it was necessary that the fourth operator also be given access to 900 MHz and 1800 MHz bands.

- 2.37 To accommodate new entry licensees in both bands, refarming process of 900MHz and 1800 MHz bands was adopted which consisted of redistribution of spectrum and reshuffling of existing licensees meaning all operators had to spectrally move their current operations. The licensees were given one year time period for the required spectral moving of their operations. The process freed 2 x 5 MHz in 900 MHz band and 2x10 MHz in 1800 MHz band for the benefit of a new entrant.
- 2.38 The expiry dates of existing licenses were also extended. Existing licenses were expiring in 2011 or 2012 prior to the refarming decision but NITA extended the duration so that all existing licenses now expire by end of 2019 and NITA made it clear that there will be no renewals and only new awards when prolonged licenses expire by end 2019. Coverage Requirements and obligations were amended so that existing licensees now were permitted to use any technologies including GSM to fulfil its obligations.
- 2.39 In order to prevent potential distortion of competition in the mobile markets concerned, the mobile service providers already holding licenses in the 900 MHz and 1800 MHz frequency bands were

excluded from participating in the upcoming auctions. On 18 October 2010, the licenses were issued to Hi3G³.

2.40 It was decided by NITA that only after 1 May 2011, existing licensees can use the 900 MHz band for deployment of other technologies that can co-exist with GSM. This was done for allowing nearly 6 months time period to the new licensee to start commercial services so that it is also make use of liberalised spectrum bands simultaneously along with other existing licensees.

3. Ireland⁴

2.41 The Commission for Communications Regulation (ComReg) released draft information memorandum on 24th October 2011 containing proposals for auction 800, 900 and 1800 MHz bands for the period 2013 to 2030 through a multi-band spectrum. The core proposition advanced in the document is to hold an open auction for the entire spectrum in the 800 MHz band (2x30 MHz), 900 MHz band (2x35 MHz) and 1800 MHz band (2x75 MHz).

2.42 Earlier, ComReg proposed a sealed bid combinatorial (SBC) auction. The existing service providers expressed the apprehension that using a single round auction would create a risk that an incumbent GSM operator could (due to strategic or mistaken beliefs underpinning their bidding) fail to win any 900 MHz spectrum, and this could result in large scale consumer disruption to GSM services. To deal with these concerns, ComReg changed its original proposal to use a sealed bid combinatorial (SBC) auction to a Combinatorial Clock Auction (CCA) so as to provide adequate means to avoid significant consumer disruption on the assumption that incumbent operators are willing to pay the price determined by the auction for the relevant spectrum.

³ <http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/900-1800-mhz-auction>

⁴ http://www.comreg.ie/_fileupload/publications/ComReg1160.pdf

2.43 The Award Process includes an “early liberalisation option” whereby an existing GSM licensee has the option to surrender their 2G licences before their expiry and take part in auction and thus getting the opportunity to getting liberalised spectrum instead of 2G restricted spectrum. In case, these licensees fail to acquire spectrum through the auction, they will be allowed to hold their spectrum but its use will be restricted to 2G only. For this purpose, a concept of ‘Party-specific Lots’ has been introduced in the auction which refer to the lots which can be acquired by the existing licensees opting for “early liberalisation option.”

2.44 In the proposed auction, a spectrum cap of 2×20 MHz of sub-1 GHz and 2×50 MHz of total spectrum holding has been placed. Moreover, the Licensee will have to achieve and maintain a minimum coverage obligation of 70% of the population of Ireland within a set timeframe. The timeframe for meeting this licence condition will depend on whether the Licensee is an Existing MNO or a New Entrant. For an Existing MNO the timeframe for meeting the minimum coverage obligation of 70% of the population of Ireland is three years from the commencement date of its Liberalised Use Licence; and for a New Entrant the timeframe is seven years. In addition, the New Entrant shall meet an interim coverage obligation of 35% of the population of Ireland within three years of the commencement date of its licence.

4. Sweden

Auction in 800 MHz⁵:

2.45 The Swedish government conducted the auctions for the 800MHz band in the year 2011. In that auction, a spectrum cap of 2×10 MHz was laid down. The online auction concluded 31 bidding rounds before awarding licences for SEK 2,054 million

⁵ <http://www.pts.se/upload/Beslut/Radio/2010/10-10534-decision-limiting-800-mhz-band.pdf>

(approximately EUR 233 million). In the auction, one of the blocks (FDD6) was linked with the broadband coverage requirement. The FDD6 licence holder was required to cover the permanent homes and fixed places of business that lack broadband and which have been identified by PTS. The objective was to minimise the number of households and businesses that do not have access to broadband. The requirement of coverage was limited to a rollout cost corresponding to the licence holder's coverage bid in the auction.

Refarming of 900 MHz band⁶

2.46 In May 2011, the renewing of the incumbents licences⁷ was permitted after the refarming of the 900 MHz band, by the Post and Telecom Authority (PTS) Sweden. Prior to refarming, there were 4 mobile operators in 900 MHz band (880-915 MHz/925-960 MHz). Also there are 3 UMTS operators in 2.1 GHz band. HI3G was the only licensee having spectrum in 2.1 GHz band, but no spectrum in 900 MHz band.

2.47 On 20 November 2008, all 4 incumbents of 900 MHz band (Swefour, Tele2, Telenor, TeliaSonera) and HI3G jointly placed a proposal to PTS that the licences of the four incumbents having 900 MHz spectrum may be extended. They also requested PTS to make their licences technology- and service-neutral in line with the European Commission's statements. To overcome the threat to the competition issues and to ensure the level playing field, they proposed that they may be allowed to transfer 2x5MHz spectrum in 900 MHz band in favour of HI3G which will be the fifth licensee in the 900 MHz band.

⁶ 900 MHz band refarming case study 29th November 2011
http://www.gsm.org/documents/Refarming_case_study_Sweden_900_MHz_20111129.pdf

⁷ <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-decision-900-mhz-march-2009.pdf>

2.48 PTS concluded that continued use for securing GSM services being offered and renewing the incumbents licenses were the most efficient use of the 900 MHz band resources. Also, need for continuing the provision of GSM services was considered very important to the Swedish society and its consumers. Therefore, renewal of the licenses and assignment of some additional bandwidth was granted.

2.49 Accepting the above proposal, the refarming process was completed in three phases. The first phase was about renewing incumbent's licenses and granting them some additional bandwidth. Assignment of some additional bandwidth was possible after the band was expanded from 2x30 MHz to 2x35 MHz. The second phase of the refarming process was about two incumbent operators each transferring 2x2.5 MHz of spectrum to the mobile operator without access to 900 MHz band spectrum. HI3G became the fifth 900 MHz band licensee controlling 2x5 MHz of bandwidth through the secondary market transaction. In the process of reconfiguring the 2x35 MHz 900 MHz band, all four incumbents had to move spectrally and consequently engage in adjusting their existing networks etc. The third phase of the refarming process was to lift the GSM technology restrictions simultaneously when the reconfiguration of the band was finalized.

5. Germany

2.50 Germany was the first European country to auction licenses in the 800 MHz frequency band. It was auctioned in a multi-band auction process that concluded in May 2010. A total of 358.8 MHz of paired and unpaired spectrum in the 800 MHz, 1.8 GHz, 2 GHz, 2.6 GHz bands was put on auction. The auction was a combinatorial simultaneous multi-round auction. All blocks were auctioned simultaneously and bidders were allowed to place a single bid for packages of spectrum blocks rather than bidding

individually on separate blocks. The overall result was an average price of €0.15 (US\$0.19) per MHz per head of German population. For the 800 MHz band a spectrum cap of 2x10 MHz was implemented.

2.51 The peculiar aspect of the German auction was that the 800MHz spectrum band had been designated to provide mobile broadband coverage in rural areas. Mobile operators usually roll-out networks first where there is the greatest density of population in order to maximise the return on their investment – i.e. in urban areas.. But, it was mandated that the licensees in the 800 MHz band must first build coverage for 90% of the population in villages with a population of not more than 5,000 inhabitants. In phase 2, towns from 5,000 to 20,000 and subsequently in phase 3 towns 20,000 to 50,000 are to be covered. Then only in phase 4, they will be allowed to deploy the spectrum in larger cities.

2.52 The winning bids and the spectrum allocated in the auction is as given below:

Table 2.4

Operators	Frequency allotted in 800 MHz band	Frequency allotted Other Bands	Total Frequency allotment in the auction
Vodafone	20 MHz	74.9 MHz	94.9 MHz
E-Plus		69.8 MHz	69.8 MHz
Telefonica O2	20 MHz	79.1 MHz	99.1 MHz
Telekom Deutschland	20 MHz	75 MHz	95 MHz

2.53 The multiband auction raised the total of €4.384bn in auction revenue. Revenue collected from selling the 800 MHz band was €3.576bn, over 81.5% of the multiband auction’s total revenue.

Table 2.5

Spectrum Band	€/MHz/Pop
800MHz	0.88 to 0.92
1800	0.03
2 GHz (Paired)	0.01 to 0.03
2 GHz (Unpaired)	0.01
2.6GHz	0.03

6. UK

2.54 Recently, UK proposed the auction of 4G spectrum in the 800MHz and 2.6GHz bands in 2012. To prevent any one mobile operator holding a disproportionate amount of spectrum Ofcom proposed caps to spectrum allocated. Ofcom is proposing two safeguard caps: an overall spectrum cap of 2 x 105MHz; and a sub-1GHz cap of 2 x 27.5MHz. OFCOM is also considering reserving certain block of frequencies to ensure the entry of fourth operators. Any auctions that do not result in at least four operators winning the minimum amount of spectrum necessary to provide high-quality mobile broadband services would be disregarded.

2.55 Ofcom has proposed to compel the winner of one of the spectrum licences - in the 800MHz band – that it intends to auction in 2012- to provide a mobile broadband service for 95 per cent of the population.

C Spectrum Auction- Indian Experience

1. Auction of license for mobile operators in 2001

Background:

2.56 In April, 1999, pursuant to National Telecom Policy 99, the Government sought the recommendations of TRAI on the appropriate level of entry fee, percentage of revenue to be shared with the licensor, definition of revenue for the purpose and the basis of selection of new operators and any other issue considered relevant.

Recommendations of TRAI dated 23rd June, 2000

2.57 Having considered various aspects and having carried out an analysis of the economics of the cellular service operation, TRAI sent its recommendations to DoT on 23rd June, 2000, wherein it inter-alia recommended that all new operators barring DoT/MTNL should be selected through a competitive process, by a multistage bidding process (multistage informed ascending bid) which would be preceded by prequalification round.

2.58 The prequalification was to be on grounds of Financial strength and experience as Telecom Service Provider, Minimum roll out obligation, Technical Plan, Business Plan, Payment terms and other commercial conditions. For checking pre-qualification, TRAI recommended that the financial strength and Roll out obligations can be kept the same as in the case of the existing licenses. The applicants were required to submit Technical plan, based on the mandatory part of the technical specifications contained in the tender document, giving evolutionary path to be followed for introduction of seamless national and international roaming and introduction of the state of the art tele-services. The business plans of the bidders were to be evaluated on financial feasibility, commercial viability and Managerial capability.

2.59 Further, it was recommended that prospective bidders who meet the pre-determined threshold as set out in the pre-qualification criteria, should be short-listed for bidding for entry fee in the next stage. No weightages need be attached to the pre-qualification criteria. TRAI recommended a multi-stage informed ascending bid. TRAI felt that revenue sharing is a better basis on which to invite bids for licenses and not entry fee. But, given the circumstances where the incumbent operators had already been selected through a bid process, the same had to be applied to the fourth operator. TRAI recommended that the number of licences that can go to a single bidder need not be restricted.

2.60 TRAI also stated that more than the market, the determining factor has to be the availability of spectrum and its optimal utilization and that a fair balance between the two objectives of increasing competition on the one hand and price efficiency of service on the other will have to be struck.

Bidding Process as detailed in the Tender Document (March 2011)

2.61 The government accepted TRAI's recommendation and issued a Tender Document for Cellular Mobile Telephone Service in March 2001. In the tender document, three rounds of "Multi Stage Informed Ascending Bids" were prescribed.

2.62 Eligibility conditions: The tender specified the mandatory eligibility conditions prescribed for the bidders which inter-alia included:

- a. 49% cap on foreign equity,
- b. The constituents having atleast 30% of total equity in Applicant Company must have an experience of telecom.
- c. Paid-up equity capital of bidding company of the bidder company and its promoters of Rs.3 crores/5 crores/10 crores for

submitting bids for C/B & C'/A, B & C circles respectively

d. Minimum networth of Rs. 100/50/30 crores in category A/B/C service areas.

- 2.63 Pre-Qualification: As per Pre-qualifications criteria mentioned in the Tender Document the bids were to be technically and commercially evaluated giving due consideration for their conformity to the pre-qualification criteria with regard to eligibility conditions such as financial strength, minimum roll-out obligation, technical and business plans and compliance to technical, commercial, operating and financial conditions as laid down in this Tender Document. The pre-qualification criteria was applied for the purpose of short-listing bidders whose first financial bids for entry fee were to be opened.
- 2.64 The highest offer emanating from the first financial bid was to be treated as 'Reserve Price' for subsequent rounds. If there were more than four pre-qualified bidders, the lowest bidder was to be dropped and others would qualify for the second round of financial bidding. If pre-qualified bidders were four or less, all would qualify for second round of financial bidding. In every successive round of bidding, the bidders could only enhance the bid amount or retain the bid amount of the last bid. Backing-out of the last quoted amount attracted forfeiture of EMBG.
- 2.65 The bidders, except those dropped in the last round, were required to submit a Second Financial Bid for the second round. The bid amount in the second round was required to be equal or more than the 'Reserve Price' and the bidder who fall below was to be disqualified for further round of bidding. Bidders were not be permitted to reduce the amount bid in their financial bid of the first round. In the event of such happening their EMBG was to be encashed and forfeited.

- 2.66 All the bidders who quoted more than the 'Reserve Price' in the second round of financial bidding were to be short-listed. If there were three or more such short-listed bidders, excepting the lowest bidders; the rest would qualify for the third round of financial bidding. In case there were only two short-listed bidders, both would qualify. In case, there is only one short-listed bidder, there would be no third round of bidding.
- 2.67 The bidders, who qualified for bidding for the third round, were required to submit the third and final bid. The highest bidder of the third round financial bidding was to be declared successful for grant of Licence. The successful bidder after being so declared during the bid opening, was required to deposit at least 20% of the bid amount (quoted Entry Fee). The balance 80% of the bid amount (quoted Entry Fee) was to be paid within 10 days of issue of demand letter. Failure to do so would invite encashment of EMBG and the amount forfeited. In case of a tie in the conclusive round of bidding, the bidder who quoted higher amount in the previous round was to be declared successful for award of Licence.
- 2.68 In the Service Areas, where more than one licenses were to be awarded, the first highest bidder, next highest bidder and so on in the third and conclusive round was to be declared successful to sign the Licence provided that the difference in entry fee quoted between the highest and other such bidders was less than 25%. The higher of the bidders was to operate the service in 900 MHz band against the vacant slot(s) and lowest of successful bidder in 1800 MHz as fourth operator. In case the difference in entry fee quoted by the successful bidders (other than the highest) is lower by more than 25% compared to the highest bidder, there was to be another round of financial bidding from amongst successful bidders of previous round.

2.69 The successful bidders who paid Entry Fee was also required to submit Financial Bank Guarantee and Performance Bank Guarantee within one month from the notification and prior to signing of the Licence agreement. The Licence was to become effective after signing. EMD Bank Guarantee amount specified in the Tender Document was Rs 20/10/2 Crores for Category 'A'/'B'/'C' circles respectively.

Entry Fee discovered in 2001

2.70 The auction was held for 21 Circles; however bids were received in only 17 Circles. No bid was received in WB, Bihar, Orissa and Andaman & Nicobar Telecom Circles. Post-auction status of these 21 Circles is as below:

Table 2.6

Entry Fee (Rs. in Crore)			
Sl.	Service Area	Category	Entry fee 2001
1	Delhi	Metro	170.7
2	Mumbai	Metro	203.66
3	Kolkata	Metro	78.01
4	Chennai	Metro	154.0
5	Maharashtra	A	189
6	Gujarat	A	109.01
7	Andhra Pradesh	A	103.01
8	Karnataka	A	206.83
9	Tamilnadu	A	79
10	Kerala	B	40.54
11	Punjab	B	151.75
12	Haryana	B	21.46
13	Uttar Pradesh (West)	B	30.55
14	Uttar Pradesh (East)	B	45.25
15	Rajasthan	B	32.25
16	Madhya Pradesh	B	17.4501
17	West Bengal	B	No bid received
18	Himachal Pradesh	C	1.1
19	Bihar	C	No bid received
20	Orissa	C	No bid received
21	Andaman & Nicobar	C	No bid received
	Total		1633.57

2. 3G and BWA Spectrum Auction 2010

Background

2.71 The Department of Telecommunications (DoT), on May 22, 2006 had sought recommendations from TRAI, on the methodology for allotment of spectrum for 3G services and its pricing aspects.

2.72 TRAI submitted its recommendations on 'Allocation and pricing of spectrum for 3G and broadband wireless access services' on 27th Sept 2006. In the recommendations, TRAI in addition to addressing the issue of allocation and pricing of spectrum for 3G, submitted its recommendations on spectrum allocation and pricing for Broadband Wireless Access (BWA) technologies as well, to help boost broadband penetration in the country, especially in the rural areas. In the recommendations TRAI, inter-alia recommended:

- a. Allocation of 3G spectrum through simultaneous ascending e-auction as per the defined auction process.
- b. spectrum in the block of 2x5 MHz was to be auctioned
- c. BWA spectrum to be auctioned through one-stage sealed bid auction
- d. Specific roll out obligation for 3G and BWA services was prescribed.

For 2.1 GHz band the roll out obligations were prescribed as follows:

Table 2.7

Category of circle	At the end of 3 years	At the end of 5 years
Metros	-	90% of metro area
A, B, and C	30% of the DHQs or cities in the circle out of which at least 10% should be rural SDCAs	50% of the DHQs or cities in the circle out of which 15% should be rural SDCAs

Subsequent Developments

2.73 Government on 1st July 2008 had referred back some of the recommendations on 3G services like amount of reserve price, auction process, amount of spectrum to be allocated. DoT in its

reference had proposed that based on the experience of successful 3G auctions in certain countries, the reserve price for a block of 2 x 5 MHz in the 2.1 GHz band should be 0.5% of GDP, which in the case of India, would come to US\$ 0.5 billion or about Rs. 2,100 crores, which is twice that recommended by TRAI. Thus the reserve price proposed by DoT was as follows:

Table 2.8

Circle	Reserve Price (Rs. Crore)
Mumbai, Delhi & Category 'A'	160.00
Chennai, Kolkatta & Category 'B'	80.00
T Category 'C'	30.00

TRAI sent its recommendations on 12th July 2008 wherein it accepted the proposals of DoT with some minor modifications.

2.74 In an another reference dated 1st July 2008 DoT referred back some of the recommendations on BWA services which included eligibility criteria, amount of spectrum to be allocated, reserve price and performance bank guarantee, auction process and duration of BWA spectrum license. On reserve price for BWA auction the DoT proposed that the reserve price for each 10 MHz block of BWA spectrum for a period of 15 years should be 25% of the reserve price of 3G spectrum. Thus the reserve price and PBG as proposed by DoT was :

Table 2.9

Circle	Reserve Price Rs(Cr)	PBG Rs(Cr)
Metro & 'A'	40	20
'B'	20	10
'C'	7.5	3.75

2.75 On the auction methodology for BWA spectrum, DoT proposed a controlled simultaneous e-auction similar to that in case of 3G spectrum and also proposed that all successful bidders should be asked to match the highest bid i.e. H1. TRAI agreed with this proposal of DoT.

Auction Methodology as given in (Notice Inviting Application) NIA:

2.76 For awarding the spectrum blocks, the Simultaneous Ascending e-auction was conducted over the Internet. Bidders were able to access the Electronic Auction System (EAS) using standard web browsing software. Only such applicants who qualified a pre-qualification test were allowed to bid in auction process.

2.77 In the auction of 3G and BWA spectrum, the block size was 2x5 MHz (FDD) for 3G and for BWA spectrum, the block size was 20 MHz (TDD). The reserve price specified for 3G and BWA spectrum was as below:

Table 2.10

Type of Service area	Price for 3G spectrum for 2x5MHz (FDD) Rs(Cr)	Price for BWA spectrum for 20MHz (TDD) Rs(Cr)
Metro & 'A'	320	160
'B'	120	60
'C'	30	15

Pre-qualification tests

2.78 In order to pre-qualify, the Applicant was required to comply with the requirements for provision of information, the required certification and payment of the Earnest Money Deposit. In addition, no two Applicants in any of the Auctions should have the same entity directly or indirectly owning more than 10% equity in them. If two Applicants having common ownership greater than 10% apply for prequalification in the same Auction, one of them

must withdraw until the last date for submission of Ownership Compliance Certificate, failing which both shall not be pre-qualified. However, common shareholding by the Government of India between any of the entities was permitted.

2.79 Prior to the Auction, those bidders who pre-qualified, were issued with authentication tokens to allow secure access to the EAS. These tokens consisted of (i) a cryptographic authentication token (supplied on CD-ROM in encrypted form that will need to be installed on any computer used for bidding) and (ii) a number of passwords. Applicants were provided with a detailed in advance the manual explaining how to use the EAS.

The Auction stages

2.80 The award was a two-stage process:

- (a) **Clock Stage:** To establish the Bidders to be awarded a block in each of the service areas where there is at least one block available for auction (the “3G Service Areas”). In this stage, in each 3G Service Area, Bidders will bid for a generic block (i.e. a right to a single 2X5MHz spectrum block but not linked to any specific frequency). The Clock Stage consisted of a number of rounds. These rounds were to stop once (i) for every 3G Service Area the number of bids at the prices set in the last completed Clock Round is less than or equal to the number of blocks available; and (ii) there are no opportunities for Bidders to increase their demand allowed by the Activity Rules. This would establish a common Winning Price for all blocks within a service area, and the Winning Bidders in each service area;
- (b) **Frequency Identification Stage** that will identify specific frequencies available to the Winning Bidders. The frequencies identified were to be announced simultaneous with the outcome of Auction of 3G and BWA Spectrum – Notice Inviting Applications the

Clock Stage. The initial identification of the frequencies was to be performed automatically by the Electronic Auction System through a random allocation mechanism.

2.81 Winning Bidders were to pay the sum of the relevant Winning Prices set in the Clock Stage for service areas in which they are assigned a block. All winning bidders in a service area had equal Winning Prices as a consequence of the Auction Rules.

Price discovered for 3G & BWA spectrum through auction methodology

2.82 The price of 3G & BWA spectrum discovered through the auction process was as below:

Table 2.11

Auction Price(Rs Cr)			
Type	Circle	3G Price (2x5MHz)	BWA Price 20MHz
Metro	Delhi	3,316.93	2241.02
Metro	Mumbai	3,247.07	2,292.95
A	Maharashtra	1,257.82	915.64
A	Gujarat	1,076.06	613.85
A	Andhra Pradesh	1,373.14	1,059.12
A	Karnataka	1,579.91	1,543.25
A	Tamil Nadu	1,464.94	2,069.45
Metro	Kolkata	544.26	523.20
B	Kerala	312.48	258.67
B	Punjab	322.01	332.27
B	Haryana	222.58	119.90
B	Uttar Pradesh (E)	364.57	142.50
B	Uttar Pradesh (W)	514.04	183.87
B	Rajasthan	321.03	97.32
B	Madhya Pradesh	258.36	124.66
B	West Bengal	123.63	70.97
C	Himachal Pradesh	37.23	20.66
C	Bihar	203.46	99.28
C	Orissa	96.98	63.63
C	Assam	41.48	33.02
C	North East	42.3	21.27
C	Jammu & Kashmir	30.3	21.27
Total		16,750.58	12,847.77

3. Auctions for the award of FM Radio Licence

2.83 As a part of the Policy objective of the 9th Five Year Plan, the Government allowed private participation in the FM Radio sector. The prime objectives were to improve the variety of content and technical quality of Radio. Thus, as a part of phase I of FM Radio expansion in India through private participation, in May 2000, the Government auctioned 108 frequencies in the FM spectrum across 40 cities in the country. Multiple round auction mechanism was followed to award these licenses. The licenses were awarded for a period of 10 years and the annual license fee was escalated at the rate of 15% per annum on the base of the first year fee. The city was the geographical basis for the grant of FM licenses. These cities were divided into five categories on the basis of the amount of reserve license fees.

Procedure for award of FM Radio License in the phase I (Year 2000)

2.84 In the phase I of FM Radio expansion, for award of the letter of intent (LOI), applications received together with the earnest money deposit (EMD) were scrutinised and the eligible applicants were invited to participate in the auction process after depositing 50% of the reserve fees for the first year. There was an escalation of 10% in each round of the auction process till the number of frequencies equalled the number of applicants. However, in places where the number of applicants was less than the number of frequencies, all the applicants were eligible for the LOI. After the receipt of the LOI each successful bidder had to furnish a bank guarantee equal to the license fee for first year. The successful applicants were also required to apply to WPC for frequency allocation and SACFA clearance within 3 months of the date of

issue of LOI. The roll-out obligation was fixed as 12 months from the date of earmarking of frequency by WPC.

2.85 For the 108 frequencies in 40 cities put up for auction, Government received 101 bids for an aggregate of Rs 425 crores as against the estimated amount of Rs.79.65 crores. However, the actual collection was only Rs.158.8 crores from bids for 37 frequencies as bidders in respect of 64 frequencies defaulted. A total of 37 licenses were issued out of which 24 licenses became operational, including the two licenses which were deemed operationalised as they had paid the license fees.

2.86 The deadline for operationalising the licenses was one year from signing the License Agreements, i.e. December 29, 2001. However, even after furnishing the bank guarantees and signing the License Agreement, 13 successful bidders did not operationalise their licenses within the required time frame and ultimately surrendered their licenses. Also, even the existing licensees reported their operations as unviable. The private FM Radio industry reported heavy losses and sought relief by way of migration to a revenue share regime.

4. Phase II expansion of FM radio through private participation (Year 2005)

2.87 **Background:** The Working Group on Information and Broadcasting Sector for the Formulation of the Tenth Five Year Plan group felt that treating FM radio services as source of revenue for the Government is counterproductive as they hinder the growth and quick roll out of the services to the people. As such it is felt that suitable corrective policy measures should be taken, so that, in future growth of these services is accelerated and substantial private investment is attracted to supplement the efforts and investment of All India Radio. The Tenth Five Year Plan

emphasized the need for substantially enhancing FM coverage from the present 30 per cent population to 60 percent by the end of the plan. One of the thrust areas of the Plan was to encourage private participation in providing quality services and replacing the existing system of bidding for licenses with a revenue sharing mechanism.

2.88 As such the Government decided to reformulate its policy for the second phase of licensing of the FM Radio and subsequently constituted a Radio Broadcast Policy Committee on 24.7.2003 to make recommendations for radio broadcasting for phase – II. The Committee was headed by Dr. Amit Mitra, Secretary General, FICCI and it submitted its Report in November 2003. The Committee found that the broadcast industry appears to be unviable under phase-I licensing regime and, therefore, recommended restructuring of the FM broadcast industry and the phase-I licenses. It recommended, inter alia, revision of license fee structure and migration of the license terms from fixed license fee basis to a one time entry fee with an annual revenue sharing arrangement. The Government notified broadcasting to be a telecommunication service under Section 2 (i) (k) of TRAI Act On 19th January, 2004. On February 12, 2004, the Ministry of Information and Broadcasting, Government of India sent the report of the Radio Broadcast Policy Committee to TRAI for making appropriate recommendations.

2.89 For the allocation of frequencies in Phase II, TRAI had recommended the following:

- i. Licenses should be allocated based on the entry fee quoted by bidders.
- ii. All bidders in phase-I should be eligible to bid for phase – II also, subject to them withdrawing pending litigation. Eligibility

conditions would be the same as in Phase I. All bidders, both new and those of Phase I, would be evaluated to check if they satisfy the minimum conditions laid down.

- iii. To prevent gaming by non serious players all pre qualified bidders would have to deposit an amount equal to 50% of the reserve price of Phase I along with the financial bids. In addition each successful bidder would have to pay within a week of being so informed the difference between this amount and the entry fee amount as determined by the bidding process and also provide a Performance Bank Guarantee (PBG) equal to 50% of the entry fee amount as determined by the bidding process. The entry fee along with the PBG would be forfeited if there is any default at any stage – the PBG would be returned after the station is operational and the first instalment of license fees has been paid.
- iv. The highest bidders (the number of such bidders being equal to the number of frequencies offered) for any location would be selected and each would pay the amount bid by him/her.
- v. The existing license fee structure would be changed to one with a one-time entry fee and a revenue share of 4% of gross revenue.
- vi. There should be separate accounts for each license and the Government should have the right to get the accounts audited by CAG annually.
- vii. The existing license period of 10 years could be extended by another 5 years on an automatic basis unless there are grounds for complete reorganization of the industry due to changes in technology (for example developments in the field of Digital Radio Broadcasting) in which case no extension should be given to any licensee.
- viii. Licenses would continue to be put on bid on a city basis and not on a regional or national basis.

- 2.90 In phase II a total of 338 frequencies in 91 cities, across the country, were put for allocation on the basis of One –Time-Entry – Fee (OTEF) quoted by the bidders (Closed Tender System). Every applicant and its related entities were allowed for only one channel per city provided that the total number of channels allocated to an applicant and its related entities shall not exceed the overall limit of 15% of the total channels allocated in India.
- 2.91 The process of granting permission for new participants under phase II consisted of two rounds. The first round was for prequalification and only applicants qualifying in accordance with prescribed eligibility criteria were allowed to participate in the next round for making financial bids for specific channels in different cities. For making the financial bid the bidder had to deposit a demand draft for an amount equal to 50% of its financial bid and unconditional and irrevocable performance bank guarantee for an amount equal to 50% of its financial bid valid for one year from the date of the closure of the bidding process.
- 2.92 On the basis of the Financial Bids received for each City, the Government determined the Reserve One Time Entry Fees for such City (“Reserve OTEF”), which was an amount equivalent to 25% of the highest Financial Bid submitted for the particular City. All the bids below the Reserve OTEF were summarily rejected.
- 2.93 After evaluation of the financial bids and fulfilment of other eligibility conditions, bidders with the highest valid Financial Bids, equal to the number of available channels for the respective City were selected as the Successful Bidders. Thus, channels were allocated in accordance with descending order of valid financial bids received. The roll-out obligation was fixed as 12 months from the date of signing of the Grant of Permission Agreement (GOPA) which the successful bidder had to sign with the Min of I&B after

furnishing a PBG of an amount equal to the annual fee (10% of Reserve OTEF).

- 2.94 In the event of the number of valid bids being more than the available number of frequencies, those unsuccessful bidders, who are above Reserve OTEF limit, and who are willing to continue the deposit of their PBG for the amount equal to 50% of their respective financial bids, were placed in the waiting list in accordance with the descending order of their financial bids for a period of two years.
- 2.95 The annual fee was to be charged at the rate of 4% of the gross revenue for the year or at the rate of 10% of the Reserve OTEF limit for the concerned city, whichever is higher. The permissions were granted for a period of 10 years from the date of operationalization of the channel.
- 2.96 The policy has been well received and presently, a total of 245 channels are operational, including 21 channels of Phase-I, in 86 cities.

5. Phase III expansion of FM radio through private participation

- 2.97 For the phase III expansion of FM Radio, on 22nd Feb 2008, TRAI recommended that the bidding process may be kept the same as envisaged in policy on expansion of FM radio broadcasting service through private agencies (phase II). It was also recommended that the geographical basis for the grant of licenses may be changed from city to district and the Reserve OTEF should be fixed at 50% of the highest bid. However, on a reference from the Min of I&B it was agreed to retain the earlier practice of grant of licenses on city basis and the same formula for calculation of Reserve OTEF as that in phase II. However, for J&K and North Eastern states, the rate of annual fee was recommended to be reduced to 50% of what is being charged from all existing permission holders in other areas for a

period of 3 years from the issue of LOI. The method of calculation of annual fee was recommended to be the same as prescribed for Phase II.

2.98 Later referring to the GoM recommendations, the Min of I&B, in its reference dated 27th Jan 2011, sought the recommendations of the Authority on the issues of adoption of 3G ascending e-auction methodology for grant of licenses, period of license, annual license fee and reserve price for new channels. In response, the Authority had stated that it would have no objection regarding reserve price of new channels to be based on the actual prices received during the second phase for comparable cities, period of license as 15 years as recommended by GoM and adoption of the 3G ascending e-auction methodology, *mutatis mutandis* for awarding licenses for FM radio phase III. Regarding, annual license fee, the Authority agreed to the recommendation of the GoM to have the same formula for the calculation of annual license fee as used for calculation of the license fee for the FM phase II.

Chapter – III

ISSUES FOR CONSULTATION

- 3.1 In accordance with the judgment of Hon'ble Supreme Court of India, TRAI issued a pre-consultation paper wherein it was stated that on the issue of grant of new licences, TRAI in its recommendation on "Spectrum Management and Licensing Framework" dated 11th May 2010 had already recommended that all future licences should be Unified Licences and that spectrum be delinked from the licence. Pursuant to this recommendation, "Draft Guidelines for Unified Licence/Class Licence and Migration of Existing Licences" were also placed on TRAI website www.trai.gov.in on 20th February 2012 for comments of the stakeholders. On the issue of "Allocation of Spectrum in 2G band in 22 Service Areas by Auction", Stakeholders were requested to send their comments/suggestions on the issues involved.
- 3.2 In response to the pre-consultation paper, 32 comments were received from various stakeholders including the service providers, their associations and individuals, raising a number of issues.
- 3.3 In Chapter-I of this paper, certain observations of the Hon'ble Supreme Court have been quoted. Some of those observations are as follows:
- "-----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."

- “----- Constitutions across the world focus on establishing natural resources as owned by, and for the benefit of, the country.”
- “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.”
- “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.”
- “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.”
- “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.”

Q1. How can the various principles outlined by the Hon’ble Supreme Court in various observations brought out in para above be sufficiently incorporated in the design of spectrum auction?

Q2. What are the key objectives to be kept in mind in the auction of the spectrum?

3.4 In response to the Pre-consultation paper, the stakeholders have raised a number of issues viz. eligibility criteria for participating in the auction, reserve price, structure of auction, roll out obligations, permitting spectrum trading etc. However, in order to ensure fairness and transparency in the auction process and also to ensure that the participants bidding in the auction can make a informed decision keeping in mind their future business plans, it is necessary that they are fully informed about the present availability of the spectrum in different bands and the usage/technology for which the spectrum can be deployed.

A. Quantum of Spectrum to be auctioned

3.5 In response to the pre-consultation, many stakeholders raised the issues regarding the amount of spectrum which should be auctioned, the block size of the spectrum, number of blocks and cap on the amount of spectrum that one licensee can acquire through this auction and also the overall cap on the quantum of the spectrum one can possess.

3.6 Several stakeholders were of the view that the entire spectrum available with the Government should be put to auction and no artificial scarcity of the 2G spectrum by limiting the amount of spectrum should be created. Some of the stakeholders have stated

that even the spectrum likely to be vacated by the defence should also be made available for auction. Their argument was that for any scarce resource, the primary economic objective of the Government will be to maximise the net benefits to the society that can be generated from that resource by ensuring an efficient distribution of resources; no purpose will be served by keeping such a resource idle. It was further argued that unused spectrum brings no benefit to society or consumers. Spectrum available to the mobile industry will bring cheaper voice and data services to more people, increase productivity and support other industries, and reduce the need for additional base stations.

3.7 Supporting the above line of argument, one stakeholder commented that more towers result in increased use of diesel /power to run the sites, which leads to higher energy consumption. Due to the sub-optimal spectrum allocations, the diesel consumption has gone up by millions of tonnes per year. This waste of energy is avoidable and government's objective of green telecom can be met in a substantial manner if optimal spectrum allocations are ensured.

3.8 One stakeholder was of the view that it would be prudent and in the larger interest of the Nation and the consumers that this newly created inventory of spectrum in 2G band is gainfully utilized for refarming of precious spectrum in 900MHz by setting aside adequate spectrum for the purpose after considering the excess spectrum already held up by the operators. TRAI can expedite the process of refarming of more efficient spectrum in 900 MHz band by setting aside partially a quantum of spectrum for refarming from the newly created stock of spectrum in 1800MHz band and then auction the rest of the stock. Another stakeholder commented that such spectrum pool may also include the spectrum which has been allocated to incumbent operators beyond the contracted limit

of 6.2 MHz for which no additional fee has been charged by the licensor. This would ensure that the principle of equality is maintained while new entrants and fresh licensees are invited to participate in the auction to create a healthy and competitive environment.

- 3.9 In Chapter –I, Section C, the amount of spectrum, in various bands, which is likely to be available for allocation through auction is summarised in Table 1.4.

Q3. What should be the amount of spectrum which should be auctioned?

B. Liberalisation of Spectrum

- 3.10 In India, for mobile services, spectrum has been assigned from different spectrum bands depending upon whether licensee is deploying CDMA or GSM technology. Therefore, the spectrum assigned for mobile services is bound with the technology chosen by the licensee.
- 3.11 ITU has assigned the spectrum in the 800,900 and 1800 MHz bands for IMT applications. In response to the pre consultation, some stakeholders suggested that the auctioned spectrum should be technology neutral. It was contended that once the spectrum is obtained in auction, it is necessary that the bidder must be allowed to use this spectrum with whichever technologies he wants. The stakeholder further argued that putting artificial restrictions on technology would lead into sub-optimal usage of the spectrum. On the issue of technology neutrality of the spectrum being auctioned, another view point was that keeping in view the Judgment of the Hon'ble Court and the decision taken by the Central Government in 2011, the use of technology in the proposed spectrum band is limited. If at all this spectrum is also

to be used for providing IMT advanced services, the policy decisions in this regard will have to be taken before the Auction to ensure 'Level Playing' field. It was also contended that the use of spectrum by the incumbent operators who got this spectrum bundled with the license or got it allocated subsequently based upon the Subscriber Linked Criteria is restricted for the purpose of providing 2G services only.

- 3.12 Therefore, one view can be that in line with global harmonization and accordingly, for reaping the benefits of the economies of scale, the spectrum to be auctioned now, should be liberalized, so as to be used for newer and better technologies like UMTS/LTE etc providing mobile wireless broadband services. There can be other view, that the licences quashed are all 2G licences and that the Hon'ble Supreme court of India of India has directed TRAI to make fresh recommendations for grant of licence and allocation of spectrum in 2G band in 22 Service Areas by auction.
- 3.13 There can be other challenges like measures that need to be taken to avoid interference and regulatory intervention required to avoid interference, if spectrum being auctioned is liberalized. However, if the spectrum is not liberalized, then one issue that needs consideration is the validity period of the right to use the spectrum to be auctioned. It is quite possible that 2G technologies may not remain relevant for long duration of time. Also, it delays the opportunity to put the valuable spectrum to best usage and for newer and more spectrum efficient technologies.
- 3.14 In Europe, until the latter part of 2009, 900 MHz band could only be used for the provision of GSM mobile telephony services – i.e. 2G comprising traditional voice and text services and 2.5G comprising limited data services. In the third quarter of 2009, two pieces of legislation were adopted at a European level which

provided for liberalisation of the 900MHz band and harmonisation of the 900 and 1800 MHz frequency bands. As a result, it is now possible to introduce other terrestrial systems capable of providing electronic communications services that can co-exist with GSM systems in the 900 MHz and 1800 MHz bands. These pieces of legislation are:

- 3.15 European Directive 2009/114/EC, adopted on 16 September 2009, which amended the existing GSM Directive and removed the exclusive reservation of the 900 MHz band for GSM services (GSM Amendment Directive); and
- 3.16 European Commission Decision on the harmonisation of the 900 MHz and 1800 MHz frequency bands for terrestrial systems capable of providing pan-European electronic communications services in the Community (2009/766/EC), adopted on 16 October 2009, which sets out the technical harmonisation measures for the introduction of other terrestrial systems capable of providing electronic communications services that can co-exist with GSM systems in the 900 MHz and 1800 MHz bands (the EC Decision on the 900 and 1800 MHz bands)
- 3.17 Internationally, regulatory status in the 900 MHz band refarming and UMTS900 network deployments as on October 2011 is given at Annexure-III .
- 3.18 The spectrum liberalisation/refarming poses quite a few challenges for the operators, particularly in the transition phase There can be many alternative approaches, like
 - a. Reshuffling/Redistribution of spectrum: GSM channels are 200 kHz, UMTS/HSPA channels are 5 MHz, LTE is standardized with different channel width including 5, 10 and 20 MHz.

- b. Withdrawing and re-assigning spectrum: Some countries have considered withdrawal of GSM licenses (partly/wholly) for re-planning the frequency bands and then issue licenses that make deployment of UMTS/HSPA and/or LTE possible

Q4. Should the spectrum be liberalised before it is put to auction?

C. Spectrum Refarming

- 3.19 In India, initially, in the years 1994 to 2000, spectrum in 900 MHz band was allotted to licensees for providing 2G GSM service. 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 are having 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.
- 3.20 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.
- 3.21 In the responses received, one of the stakeholders has commented that TRAI in its Recommendation on ‘Spectrum Management and Licensing Framework’ dated May 11, 2010, supported the efforts underway in different countries to reform the 900 MHz spectrum in view of its value for providing 3G services and for future technologies. However, due to the insufficiency of equal amount of spectrum in 1800MHz band, TRAI had mentioned that spectrum in 900MHz band would be refarmed on renewal. It was further

contended that as per the data released by WPC as on January 31 2011, there is a spare spectrum of 211 MHz available with DOT and the decision of cancellation of 122 licenses by the Hon'ble Supreme Court will result in an addition of 413.6 MHz of spectrum in the pool of spare spectrum in 1800 MHz band. Therefore, in their view, there is ample amount of spectrum in 2G band and TRAI can expedite the process of refarming of more efficient spectrum in 900 MHz band by setting aside partially a quantum of spectrum for refarming from the newly created stock of spectrum in 1800MHz band and then recommending auction for the rest of the stock.

3.22 TRAI, in its recommendations on "Spectrum Management and licensing framework" dated 11.05.2010 in May 2010 has recommended that

Spectrum in 800 and 900 MHz bands should be refarmed at the time of renewal of the licenses. For holders of spectrum in 900 MHz band, substitute spectrum should only be assigned in 1800 MHz band and for licence holders of 800 MHz band; spectrum should be assigned in 450 / 1900 MHz bands. (Para 1.73)

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. (Para 1.74)

Keeping in view the value of 900 MHz spectrum, the Authority recommends that on renewal of the licence, spectrum held by a licensee in the 900 MHz band shall be replaced by assignment of equal amount of spectrum in 1800 MHz. In case sufficient spectrum in 1800 MHz band is not available with the Government to replace the 900 MHz, the licensee will be allowed to retain the 900 MHz band spectrum on a purely temporary basis subject to the condition, and an undertaking by the licensee, that on availability of spectrum in the 1800 MHz, the spectrum given in the 900 MHz will be taken back by the Government at 6 months' notice. Renewal of the licence will be subject to, inter alia, this express condition. Similar action would be taken in respect of the 800 MHz band spectrum which would be replaced by spectrum in 1900 MHz/450 MHz band. (Para 2.175)"

- 3.23 DoT has accepted the recommendation of TRAI and now in view of the availability of spectrum in 1800 MHz band, this consultation on refarming of spectrum in 800/900 MHz bands is being done.
- 3.24 The present assignment of spectrum in 800, 900 and 1800 MHz bands is as per Annexure II.
- 3.25 Licences for mobile services (CMTS/UAS) have been 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 licences having spectrum in 800 MHz and 900 MHz bands are shown in the table below:

Table 3.1

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

- 3.26 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 initiated.
- 3.27 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 3.2 and Table 3.3 below.

Table-3.2
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-3.3**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

3.28 The first two mobile licences given in different service areas in the years 1994 to 1996 will be expiring between 2014 and 2016. One of the option could be that the 900 MHz spectrum available with these licensees is refarmed and in its place, spectrum in the 1800 MHz be given to them, as recommended by TRAI in May 2010. If such an option is adopted, then keeping in view the recent

judgment of Hon'ble Supreme Court, the likely availability of spectrum in the 1800 MHz band after the cancellation of the licences, spectrum required for refarming and the balance availability of spectrum will be as given in table below:

Table-3.4

S.No.	Circle	Available spectrum in 1800 MHz band	Spectrum required for refarming	Balance Available
1	Delhi	16.0	16	0.0
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	17.6	12.2	5.4
6	AP	37.0	12	25.0
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	14.6	15.6	-1.0
11	Haryana	13.2	12.4	0.8
12	UP - West	21.4	6.2	15.2
13	UP - East	13.2	6	7.2
14	Rajasthan	3.2	12.2	-9.0
15	M.P.	35.6	12.4	23.2
16	West Bengal	17.2	4.4	12.8
17	H.P.	19.6	12.4	7.2
18	Bihar	13.2	6.2	7.0
19	Orissa	40.0	6.2	33.8
20	Assam	12.6	6.2	6.4
21	North East	15.8	8.8	7.0
22	J&K	15.2	0	15.2
	Total	519.0	220.2	298.8

- 3.29 As can be seen from the above table, after allocation of spectrum in the 1800 MHz band in lieu of refarmed spectrum in 900 MHz band, in some of the service areas, there will not be sufficient spectrum for allocation to new licensees as directed by Hon'ble Supreme Court.
- 3.30 Second Option could be to allow the existing licensees to hold a part of their current holding and refarm the remaining part of spectrum. As discussed earlier, it is also proposed to liberalise the usage of spectrum in the 800, 900 and 1800 bands i.e. permit the assigned spectrum to be used for providing any service using any technology. As can be seen from Annexure-II, the first three licensees are holding spectrum in 900 MHz band in the range of 6.2 MHz to 8 MHz in different service areas. As 5 MHz of spectrum is considered minimum amount to support UMTS/LTE, therefore, in this approach, these licensees can be allowed to retain 5 MHz 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.

Table-3.5

S.No.	Circle	Available spectrum in 1800 MHz band	Spectrum required for refarming	Balance Available in 1800 MHz
1	Delhi	16.0	6	10.0
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	17.6	2.2	15.4
6	AP	37.0	2	35.0

7	Karnataka	33.8	2	31.8
8	Tamil Nadu	47.4	NA	NA
9	Kerala	45.6	2.4	43.2
10	Punjab	14.6	5.6	9.0
11	Haryana	13.2	2.4	10.8
12	UP - West	21.4	1.2	20.2
13	UP - East	13.2	1	12.2
14	Rajasthan	3.2	2.2	1.0
15	M.P.	35.6	2.4	33.2
16	West Bengal	17.2	0	17.2
17	H.P.	19.6	2.4	17.2
18	Bihar	13.2	1.2	12.0
19	Orissa	40.0	1.2	38.8
20	Assam	12.6	1.2	11.4
21	North East	15.8	0	15.8
22	J&K	15.2	0	15.2
	Total	519.0	45.8	473.2

3.31 As can be seen from the above table, in this option, even after refarming there will be sufficient spectrum left over in most of the service areas for allocating to new licensees in accordance with the order of Hon'ble Supreme Court and for further allocation to all the existing licensees.

3.32 The third approach could be that all the licensees holding of 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. In such a scenario the amount of spectrum in 900 and 1800 MHz band which will be available for further allocation through auction is as given in the table below.

Table-3.6

S.No.	Circle	Available spectrum in 1800 MHz band	Spectrum required for refarming	Balance Available in 1800 MHz
1	Delhi	16.0	7.2	8.8
2	Mumbai	18.2	7.2	11.0
3	Kolkata	40.6	3.4	37.2
4	Maharashtra	28.0	3.4	24.6
5	Gujarat	17.6	3.4	14.2
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	42.0
10	Punjab	14.6	6.8	7.8
11	Haryana	13.2	3.6	9.6
12	UP - West	21.4	3.6	17.8
13	UP - East	13.2	3.4	9.8
14	Rajasthan	3.2	3.4	-0.2
15	M.P.	35.6	3.6	32.0
16	West Bengal	17.2	1.2	16.0
17	H.P.	19.6	3.6	16.0
18	Bihar	13.2	3.6	9.6
19	Orissa	40.0	3.6	36.4
20	Assam	12.6	2.4	10.2
21	North East	15.8	1.2	14.6
22	J&K	15.2	4.2	11.0
	Total	519.0	78.8	440.2

3.33 In this option also, even after refarming there will be sufficient spectrum left over in most of the service areas for allocating to new licensees in accordance with the order of Hon'ble Supreme Court and for further allocation to all the existing licensees.

- Q5. For the refarming of 800 and 900 MHz bands from the existing licensees, which of the three options given above should be adopted? Please elaborate with full justification.**
- Q6. What are the issues that may arise in the above mentioned refarming process?**
- Q7. For new technologies e.g. UMTS/LTE, 5 MHz is the minimum amount of spectrum required. Certain licensees have only 4.4 MHz spectrum in 900 MHz band and 2.5 MHz spectrum in 800 MHz band. What are the possible options in case of such licensees?**
- Q8. Some GSM spectrum allocations may be interleaved between operators; to avoid fragmentation, reconfiguration between operators may be required. Whether frequency reconfiguration is required and what are the challenges and possible solutions?**
- Q9. Should the refarming of spectrum in 800/900 MHz bands be dealt independently or should a comprehensive approach be adopted linking it with the availability and auctioning of 700 MHz band?**

D. 700 MHz band

- 3.34 In its recommendations on “Spectrum Management and Licensing Framework” dated 10.05.2010, TRAI has discussed the issue of allocating spectrum in the 700MHz band for IMT technologies. Subsequently in its response dated 03rd November 2011 to DoT’s reference dated 10th October 2011, the Authority has recommended the following:

“The need for refarming of the spectrum in 800/900 MHz bands has been explained in Paras 1.62 to 1.72 of the May 2010 recommendations. As explained therein, spectrum in these two

bands needs to be utilised for the IMT services. Also, commercial exploitation of these bands would result in substantial revenues, in tens of thousand crore rupees, accruing to the Government. The Authority is, at the same time, conscious of the concerns of certain service providers who hold the spectrum in these bands. The Authority is separately initiating a consultation process regarding the issues involved in refarming and expects to give its recommendations well in time. It will also consider, as part of this exercise, the feasibility of liberalisation of spectrum along with limiting the auction of spectrum in the 700 MHz band initially to those not holding spectrum in the 800/900 MHz bands, subject to the condition that holders of 800/900 MHz spectrum would pay the market price. This is so as to establish a level playing field. It would be necessary therefore that the Government should at least bring out the need for refarming of the spectrum in these bands as part of the New Telecom Policy 2011 with the proviso that the details will be worked out in consultation with TRAI.”

3.35 All the sub-1GHz bands have excellent propagation characteristics. Therefore, there can be two approaches for the assignment of spectrum in 700 MHz band. In the first approach, only 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 could be 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.

Q10. Which of the two approaches outlined above be adopted?

Q11. When should 700 MHz spectrum be auctioned?

Q12. Should the auction in 700 MHz band be linked with the granting permission for the liberalised use of 800/900 MHz band?

Q13. 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?

E. Structure of Auction

- 3.36 In this paper, in Chapter-II the principles of auction design and global and Indian experience regarding various spectrum auctions have been discussed. In India, as auctions have already been conducted for 3G and BWA in 2010, using the simultaneous ascending e-auction method, the issue that was raised by many stakeholders was whether to adopt the same auction format used in 3G/BWA auction in the upcoming auction.
- 3.37 Stakeholders, who were in favour of adopting the same model for the proposed auction also argued that the experience garnered should position the DoT to manage the process in the shortest period of time. Arguing further, they stated that as the auction is required to be held as quickly as possible, use of “tested and true” auction formats such as ‘Simultaneous Multiple-Round Auction’ (SMRA) is preferable.
- 3.38 There were some stakeholders not in favour of adopting the 3G/BWA auction format. Their argument was that inherent features of the model adopted for the auction of 3G/BWA spectrum, such as activity levels and simultaneous closing of all circles led to artificial higher prices than would have been bid in a normal auction. They contended that it led to overall revenue maximization from the auction but in the process distorted market prices that would otherwise have been paid.
- 3.39 Stakeholders, who were not in favour of allowing incumbent operators to take part in the auction, have suggested that auction should be conducted in two or more phases with Phase-I for only the new licensees. One stakeholder suggested for inclusion of those licensees also in the first stage of auction, who are waiting for the start-up spectrum.

- 3.40 Some of the proponents of multi-stage auction were in favour of open auction in the second stage, whereas some of these stakeholders have argued that after the first stage of auction, there should be two more stages. In the second stage, all those licensees having 4.4 MHz of spectrum in GSM but less than 6.2 MHz spectrum can take part to bid for 1.8 MHz spectrum. In the third stage, spectrum should be held for spectrum beyond 6.2 MHz in each licence area upto the maximum cap as recommended by TRAI in May 2010.
- 3.41 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. It gives rise to another issue that whether the auction of spectrum in both the bands should be conducted simultaneously or separately. One opinion received is that the spectrum in 800 MHz, 900 MHz and 1800 MHz must be auctioned separately for a true and fair determination of their respective market values. Another comment received is that auctions for 800 MHz and 1800 MHz frequency should be treated as two separate auctions just like 2100 MHz and 2300 MHz auctions were treated previously. This is because these two spectrum bands have very different ecosystems associated with them and the revenue/MHz for GSM and CDMA spectrums are significantly different. Hence any price calibration of one band based on market price discovery of the other band would be inappropriate. Thus a separate market price discovery mechanism i.e. two different auctions need to be carried out for 800 MHz and 1800 MHz bands.

Q14. What should be the structure of the auction process?

Q15. Should auction be held in single stage or multi stage?

Q16. Should there be a simultaneous auction for spectrum in 800 and 1800 MHz bands?

F. Block Size

- 3.42 On the issue of block size for spectrum for auction, there were divergent views. The block sizes advocated by different stakeholders were primarily 4.4 MHz and 6.2 MHz. Some stakeholders also suggested a block size of 5 MHz. The arguments given were that any bidder, who is eligible to bid for a new unified access license/unified license start-up spectrum of 4.4 MHz/ 2.5 MHz GSM/CDMA spectrum, should be allowed to bid only for one slot of 4.4/2.5 MHz in eligible circles in the auction process. Another argument was that the block size should be 6.2 MHz., as in 2008, start-up blocks were intended to be supplemented by further “contracted” spectrum. One stakeholder was of the view that for auction of initial start-up spectrum / upto contractual limit, minimum block size should be 5MHz (or 6.2 MHz being the contractual spectrum which is granted by DoT) as this is minimum quantum of spectrum required to build a viable and sustainable GSM-2G network. It was argued that in the last auction in 2001, a block of 6.2MHz was identified as a single lot for allocation. Therefore, if at all any lesser quantum has to be considered, then it should be atleast 5 MHz to protect the technology-neutrality of spectrum and make it amenable to use for any network. It was also contended that for existing operators, with more than or equal to 6.2/5 MHz but less than the prescribed limit may be allowed to acquire additional 1.8/1.25 MHz GSM/CDMA spectrum respectively through a separate auction.
- 3.43 To avoid spectrum hoarding, all the stakeholders were in favour of putting a cap on the amount of spectrum that a licensee can acquire through the proposed auction. For the new entrants, the

general view was that they should be allowed to acquire maximum one block of spectrum in each service area. As far as the limit of the spectrum that an existing licensee can acquire, there were divergent views such as keeping it (a) equal to 5 MHz, (b) upto the maximum limit as applicable under the 'Subscriber linked Criteria' (as per Government Order dated 17th January 2008), if its application for same is approved by DoT before the finalisation of Auction and (c) upto the prescribed limit. Stakeholders have also commented that these limits on the quantum of spectrum to be acquired through the proposed auction shall be subject to fact the licensee does not exceed the overall spectrum holding cap in that licence area.

- 3.44 Regarding overall spectrum holding cap, various suggestions received from the stakeholders, are (a) to keep the ceiling at 25% of the 2G spectrum in that service area, (b) cap as per existing applicable Government policy and (c) maximum prescribed limit 8MHz/10 MHz for GSM (5MHz / 6.25 MHz for CDMA) in circles and metros respectively.
- 3.45 The amount of spectrum likely to be available for auction in the bands of 700/800/1800 MHz is given in Chapter I under Section 'C' 'Spectrum Availability'. As discussed in Section B on 'Liberalisation of Spectrum' and Section C on 'Spectrum Refarming' in the current chapter, it is also proposed to reform the spectrum in the 800/900 MHz band and also to liberalise the spectrum in the 2G bands. As detailed in Chapter II, a number of countries like USA, UK, Sweden, Ireland and Germany have applied spectrum cap on the amount of spectrum which an operator can hold in various bands, In view of this and the stakeholders' comments, the following issues needs consideration.

Q17. What should be the block size of the spectrum?

- Q18. Should the block size be dependent on the frequency? If so, what should be the block size in each band?**
- Q19. Should there be a cap on amount of spectrum one can bid? If so, what should it be?**
- Q20. Should there be a separate cap on the total amount of spectrum one can hold; if so, what amount should it be?**
- Q21. Should there be a cap on the amount of spectrum one can hold in respect of sub-GHz spectrum? If so, what should it be?**

G. Eligibility Criteria

- 3.46 One of the major issues raised by most of the stakeholders related to the eligibility criteria for participation in the auction for allocation of spectrum in 2G band.
- 3.47 Some of the stakeholders, were of the opinion that only those operators whose licences have been quashed should be allowed to participate in the auction, while few stakeholders were of the view that along with the operators whose licences have been ordered to be quashed, new applicants, who meet the prescribed eligibility criteria, should also be allowed to participate in the auction. However, stakeholders in both of these two categories were of the view that the incumbent licensees should not be allowed to participate in the auction.
- 3.48 Another point of view, mainly expressed by the incumbent operators, is that auction cannot be restricted to only to 122 licensees whose licenses have been quashed; but all existing licensees and potential new entrants should also be allowed to participate in the auction.

3.49 In support of the view that the incumbent operators should not be allowed to participate in the upcoming auction, one major line of argument, given in the responses, was that permitting new telecom players to enter the sector will promote and increase competition. It was further argued that well established operators, who over a period of time have been allocated spectrum based on a subscriber linked criteria, have gained in terms of lower capital expenditure requirement and have recovered a major part of their investments; thus placing them in a better position to bid for the additional spectrum as against a licensee whose licences have been cancelled or a new entrant. It was further argued that the well-established operators may try to out-bid the new licensees, not only to acquire spectrum, but also to eliminate competition. Therefore, it is important to avoid a situation where the stronger operators are allowed to reduce competition by foreclosing the market via the strategic purchase of spectrum.

3.50 Proponents of open auction argued that it would not be logical to restrict the auction only to the spectrum which was allocated in 2008, and only to the parties who acquired the spectrum in 2008. In that case, virtually by definition, the supply of spectrum would be equal to or less than the demand for the spectrum. Such artificial restriction would lead to an outcome no different from an administered price regime. Also, it will raise the issues of fair process, transparency and equal opportunity. Further, they argued that any discriminatory restrictions on participation will lead to rigidities and any such rules will block the deployment of advanced mobile data networks and deter the coverage of mobile networks. Restricting the auction to a specific “class of operators,” will be contrary to the judgment / findings of the Hon’ble Supreme Court and will again give rise to the litigation, as the Hon’ble Supreme Court has clearly held that the auction process should be non-discriminatory and non-arbitrary. This will favour only one set

of players and will seriously restrict the competition in the bidding process and will create an uneven level playing field, which is not in the interest of the consumers.

3.51 In this context one stakeholder was of the view that the DoT press release dated 29th January'11 clearly establish that in the auction scenario, the concept of "initial spectrum" or "startup spectrum" does not exist. Therefore, he contended that for the upcoming auction, no artificial distinction should be created between these two categories. One view was that all the applicants for additional spectrum may also be allowed to participate in the Auction for additional spectrum but within the prescribed maximum limit. Incumbent operators having maximum Prescribed Limit spectrum 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 barred from participating in the auction in order to achieve the level playing field and to prevent monopolization of scarce resource. There was also a suggestion that those existing licensees, who have already defaulted on their rollout obligations, should not be permitted to participate in the auction.

Q22. Who all should be eligible to participate in the auction?

- 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.**

H. Reserve Price

3.52 Another important issue raised by almost all the stakeholders in their responses was regarding the amount of the reserve price for the auction. The stakeholders were of the opinion that the 'Reserve

Price' for the spectrum should be set considering the expected demand in the industry. If the reserve price is set too high, there may not be many takers for the spectrum, whereas a low reserve price may lead to lower realizations to the Govt. One view was that the reserve price must be fair and must incentivise a market price discovery. Another stakeholder was of the view that the decision on the reserve price will be the key parameter which will have profound impact on discovery of true economic value of the scarce resource like spectrum through the proposed auction process. Accordingly it will be incumbent upon the Authority to decide reserve price in such a manner that the price discovery through auction should be in line with the fair value estimated by the Authority.

- 3.53 On the actual amount of the reserve price, several stake holders were of the opinion that it should be fixed at the level of the final bid price of the 4th Cellular license i.e. Rs. 1658/- crore pan India for 1800 MHz spectrum for a period of 20 years. It was further argued by one of the stakeholders that considering Rs. 1,659 crore as the reserve price for the quantum of 6.2 MHz spectrum, i.e. Rs. 267 crore per MHz pan India, the reserve price for additional 1.8 MHz GSM spectrum should be Rs. 480 crore and for 1.25 MHz CDMA spectrum it should be Rs. 415 crore. One argument given is that the reserve price should be such that it enables a successful bidder to have an economically viable & bankable business plan within a reasonable period of time. The contention is that even at a level of Rs 1,650 Cr entry fees paid by new operators, the operators have not been able to breakeven and that the experience of 3G auction at Rs 16,750 Cr for a pan India spectrum has also not been encouraging so far
- 3.54 Some stakeholders suggested that the amount of Rs. 1658 crore should be suitably indexed for both, inflation and cost of money-

PLR. By following this method the price arrived at would be around Rs 3500 to 4000 crore at PLR of say 12%. One stakeholder favoured the experience of the 3G auction wherein a reserve price of Rs 3,500 Cr (for 5 MHz – Pan India) was set, which not only enhanced the interest of telecom players in the auction but also led to competitive bidding. It was further suggested that a reserve price at similar price range adjusted for the spectrum bandwidth to be auctioned may be considered along with fixed annual spectrum usage & license fees charges related to the AGR. Another stakeholder commented that if this spectrum is also to be used for providing IMT advanced services, the reserve price has to be higher than the 3G Auction price taking into consideration the time indexing and efficiency factor of this band.

3.55 Few stakeholders also advocated setting the reserve price benchmarked against either the price recommended by the expert committee of TRAI for ‘upto 6.2 MHz’ of spectrum or the recent equity sales in the market.

3.56 In its recommendations of May 2010 on spectrum pricing, the Authority expressed its opinion that the price of Rs. 1659 crore is no longer relevant. It calculated the spectrum price based on the following three methods:

- Pre- tax weighted cost of capital.
- State Bank of India PLR
- Ratio of growth in Adjusted Gross Revenue per MHz

3.57 Apart from the above three methods, the other spectrum prices available are auction price of 3G and BWA spectrum. Additionally, the Expert Committee has also estimated the spectrum price. The details are as given in the table below.

Table-3.7

Methods	All India Basis Price (Per MHz) in Rs. Cr.
WACC Method	818.39
SBI PLR	620.48
Ratio of growth in AGR /MHz	1336.29
3 G Auction Price	3350.12
BWA Auction Price	642.39
Experts' price: For spectrum up to 6.2 MHz	1769.75
Experts' price: For spectrum more than 6.2 MHz	4571.85

- Q23. What should be reserve price per MHz of spectrum in the year 2012 for 1800 MHz band?**
- Q24. What should be the reserve price per MHz of spectrum in the 700/800/900 MHz bands.**
- Q25. Whether the reserve price should be uniform across the country or service area wise?**

I. Roll Out Obligations

- 3.58 Given that spectrum is a valuable and scarce natural resource, it is important that any spectrum acquired should be used efficiently. In order to avoid the cases where operators acquire spectrum but do not use it, it is important to define the roll out obligations, despite the fact, the auction is being acquired through auction. The obligation reflects the need to ensure the efficient use of spectrum and also to provide a reasonable level of service to a wide cross-section of customers.
- 3.59 As per UAS/CMTS licence terms and conditions, in category A, B and C service areas, the licensee shall ensure that atleast 10% of

the District Headquarters (DHQs) are covered in the first year and 50% of the District Headquarters are covered within three years of effective date of Licence. In the metro service area, the licensee shall be required to provide in 90% of the service area Street as well as in-building coverage within one year of the effective date.

3.60 As per roll out conditions linked with 3G spectrum, in the metro service area, the licensee shall be required to provide required street level coverage using the 3G Spectrum in at least 90% of the service area within five years of the Effective Date. In category A, B and C service areas, the licensee shall ensure that at least 50% of the District Headquarters (“DHQ”) in the service area will be covered using the 3G Spectrum, out of which at least 15% of the DHQs should be rural Short Distance Charging Areas (“SDCA”), within five years of the Effective Date.

3.61 In response to the Pre-consultation, one of the stakeholders opined that the new license should not have more onerous roll out obligations than the existing licenses, in order to ensure a level playing field. Another comment was that in the current regime, for 2G services the rollout obligation is linked to the licence. With proposed auction and implementation of unified licence regime, the rollout obligation will get de-linked from the licence and will have to be linked to the spectrum. Therefore, it was suggested that the Authority will have to propose rollout obligation which will be linked to spectrum and hence should be in proportion to the amount of spectrum.

Q26. What should be the roll out obligations linked to the auctioned spectrum?

J. Spectrum Usage Charges

3.62 At present, Spectrum Usage Charges are levied on revenue share basis starting from 3% of AGR to 8% of AGR depending upon the quantum of spectrum held by the licensee.

Table 3.8

Spectrum slab		Annual spectrum charges (as a percentage of AGR)
GSM	CDMA	
Upto 4.4 MHz	Upto 5 MHz	3
Upto 6.2 MHz	Upto 6.25 MHz	4
Upto 8.2 MHz	Upto 7.5 MHz	5
Upto 10.2 MHz	Upto 10 MHz	6
Upto 12.2 MHz	Upto 12.5 MHz	7
Upto 15.2 MHz	Upto 15 MHz	8

3.63 In order to determine the spectrum usage charges for the licensee who holds 3G spectrum, AGR of 3G and 2G services are taken together and spectrum charges as per schedule given above are made applicable. Amount of 3G spectrum is not counted for calculating the slab of the total spectrum holding by a licensee for levy of spectrum usage charges Slab rate. For standalone 3G operators, the usage charge is equal to the lowest slab rate in the above schedule i.e. 3% of AGR. Licensees using BWA Spectrum need to pay 1% of AGR from services using this spectrum as annual spectrum charge irrespective of the licence held by them.

3.64 Above methodology gives rise to a situation, where licensees having same amount of 3G spectrum acquired through auction, pays spectrum usage charges at different rates.

3.65 One stakeholder commented that internationally, whenever the price of the spectrum is derived through auction, the recurring

spectrum charge is levied only to recover the administrative cost; therefore, the spectrum usage charge on the auctioned spectrum should be kept at minimum to recover the cost of administration. This will be in line with the international best practices. Another opinion expressed was that earlier as the Operator was not paying anything upfront for the right to use spectrum, the graded spectrum charge was logical, now as the right to use spectrum will be won at a market price, the above mentioned logic does not stand any longer. The spectrum usage charge should be fixed at a nominal rate, say 1% of the AGR.

Q27. What should be the annual spectrum usage charge for the spectrum being auctioned?

Q28. Should the spectrum usage charge be in line with present criteria of escalating charge with the amount of spectrum holding or a fix percentage as was done for 3G and BWA spectrum?

3.66 Apart from the issues discussed so far, different stakeholders have raised different issues in their responses, which are discussed in the subsequent paragraphs.

3.67 One suggestion received is that the right to use the spectrum, acquired through the proposed auction, should be co-terminus with the validity of the existing licence period; therefore, the rights of the auctioned spectrum should be given for 20 years.

3.68 A per another suggestion, the terms and conditions as specified in the existing Licence Agreement could remain the same as for incumbent operators including the duration of licence (i.e. duration of 20 years from the date of allocation of the spectrum after completion of the auction).

- 3.69 One suggestion received is that TRAI may formulate a yearly payment plan linked to Consumer Price Index / Whole Sale Price Index for winning bid amount. Keeping in mind that the present situation of funding for telecom industry is difficult, the yearly payment of bid amount in instalment will help faster roll out and provide affordable services to consumers.
- 3.70 Another comment on the same issue is that it has been the practice of the Government to collect the auction / bidding amount upfront. It was contended that this practice should continue for the upcoming auction as well and operators should be required to pay the auction amount upfront. It was argued that this will ensure that only the serious operators participate in the auction process; In case, a different policy is followed now for allowing the payment of the amount in instalments, then the same policy may be applied to those operators, who have already paid the huge sums of money in the last 3G / BWA auction.
- 3.71 Another way for payment of spectrum could be that while the bidder can hold the spectrum for 20 years, but the payment is for a shorter period. This is because the price of spectrum is becoming higher on account of more efficient usage and increasing demand. The Hon'ble Supreme Court has also observed "----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."

Q29. What should be the period of validity of spectrum?

Q30. What should be the period of price of spectrum?

Q31. Should the government allow deferred payment schedule of the spectrum auction fee, or should the payment be upfront in nature?

K. Spectrum Trading

3.72 In response to the pre consultation, one stakeholder suggested that sharing/leasing/trading of spectrum may be allowed. Arguing in favour of above suggestion, it is said that considering the finite nature of spectrum and the increased emphasis on efficient utilization of spectrum, spectrum sharing should be permitted along with the introduction of MVNO. These steps taken together would not only optimize the monetary value of spectrum but will also help optimize its utilization. On the same issue, another comments received is that it may be considered to amend the license agreement to include within its ambit (only for those licensees who got spectrum by auction) - spectrum sharing within a licensed service area, intra-service roaming and inter-service roaming irrespective of whether the spectrum is held by the licensee in that licensed service area or not and active infrastructure sharing should be permitted.

3.73 ITU study material on radio frequency management⁸ explains spectrum trading as- “In the traditional administrative approach to assignment and authorization system, spectrum is first allocated specified uses and then assigned to particular firms or public organisations that carry out the authorized 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.”

⁸ <http://www.ictregulationtoolkit.org/en/PracticeNote.3076.html>; The ICT Regulation Toolkit is a joint production of infoDev and the International Telecommunication Union.

3.74 In its recommendations on Spectrum management and Licensing framework dated 11th May 2010, TRAI has observed – “Spectrum trading allows parties to transfer their spectrum rights and obligations to another party, in return for a financial or market benefit. It allows the present user to decide when and to whom the spectrum authorization will be transferred and what sum it will receive in return. The market, not the regulator, determines the value.” Further, a consultancy report commissioned by the European Commission, the consulting firm Analysys was cited whereby the following methods for transferring rights of use were identified -

- Sale – Ownership of the usage right is transferred to another party.
- Buy back – A usage right is sold to another party with an agreement that the seller will buy back the usage right at a fixed point in the future.
- Leasing – The usage right is transferred to another party for a defined period of time but ownership remains with the original rights holder
- Mortgage – The usage right is used as collateral for a loan, analogous to taking out a mortgage on an apartment or a house.

3.75 The current Licensing framework in India does not provide for spectrum trading. The spectrum bands are allocated for particular use by Wireless and Planning Commission (WPC) wing of Department of Telecom (DoT). The rights to use of frequencies within these allocated bands are assigned to various licensees for use as authorized in their respective licences.

3.76 TRAI in its recommendations on Spectrum Management and Licensing Framework dated 11th May 2010, carefully studied the responses of the stakeholders and the International practices

along with the volume of trading activity in the countries where trading has been permitted and has observed the following:

- “• 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.
- Presently, there are operators who have been given licences some years back and have a stable and mature network and also, there are operators, on the other hand, who have to either roll out their network or are in the process of doing so. It is possible that allowing spectrum trading at this juncture might result in anti-competitive conduct through consolidation/hoarding of spectrum or through an incumbent precluding the newcomers from providing service by buying out the spectrum necessary for such services. This would adversely affect the consumers and the growth of telecom services in India.
- Spectrum – a national asset with sovereign right over it by the Government has only been assigned on a “right to use” basis

for a fixed period to the service provider. A licensee has no ownership right to enable it to 'trade' in it. Accordingly, acquisition of spectrum through sale/purchase is not possible in the current context."

- 3.77 In view of observations made above, the Authority 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*".
- 3.78 The Government in its decision dated 15th February, 2012 has accepted the above recommendation of TRAI.
- 3.79 The recommendations of May 2010 were against the background of the licences as they existed, where spectrum was assigned at an administered price. Now, the spectrum is proposed to be auctioned. Auction will have to be as per certain conditions that need to be spelt out *apriori*. Therefore, the question arises whether auction trading should be allowed.

Q32. Should Spectrum trading be allowed in India?

- 3.80 In case it is decided to introduce spectrum trading in India in line with the other countries, the next issue would be to have a model for spectrum trading.
- 3.81 There are various models available that have been implemented successfully in different countries. They vary from the extreme of allowing the purchaser to even change the allocated use of spectrum to just allowing transfer of ownership within already defined allocation. Two possible scenarios with respect to change of spectrum allocation and assignment rights in spectrum trading as depicted below will need to be deliberated –
- a) Where both allocation as well as assignment rights can be changed

b) Where allocation right cannot be changed but assignment rights can be changed

3.82 Based on the type of trading allowed the design elements will change and the appropriate legal, regulatory, commercial and technical frameworks required will differ in both cases. Case a) is a more complex scenario which will require the concept of band managers to be introduced. One can argue that given the complexities of Indian market, if the spectrum trading is to be allowed, the beginning should be by allowing only for change of assignment rights.

Q33. (a) Among the various models discussed above, in your opinion which model of spectrum trading is best suited for India?

(b) In your opinion is there any other model which can be implemented in India? If yes, please describe.

3.83 At different point of time the telecom access service licenses have been given in India in different ways. The CMTS/UAS licensees holding 2G spectrum have got initial spectrum in 2G bands bundled with the licence. Subsequently these licensee have been assigned additional spectrum based on subscriber-linked criterion. In case of 3G and BWA spectrum holders, they have obtained spectrum through auction. In case spectrum trading is permitted to the access service licensees, the issue that will need deliberation is which of the licensees should be allowed to trade.

Q34. What should be the eligibility criteria to trade the spectrum?

3.84 Most of the countries where spectrum trading is allowed, the spectrum bands that will be tradable are assigned first. One example is that of ECOWAS/UEMOA states⁹ - when spectrum

⁹ West African Common Market Project: Harmonization of Policies Governing the ICT Market in the UEMOA-ECOWAS Space", [Final Guidelines on Spectrum Management](#), WATRA, 2005

trading was to be considered there, it was envisaged that the trading would likely be limited to a few frequency blocks in the first instance. In India since spectrum trading is not permitted at present. Further, spectrum allocated to the various service providers are not large enough to facilitate trading of the spectrum. In such scenario, the issue would arise as to which spectrum bands should be identified for trading.

Q35. Whether the spectrum assigned for 3G and BWA services be allowed to trade? If yes, give reasons.

L. Misc Issues

3.85 The license/ spectrum fee paid by the licensees is considered as an intangible asset in the books of the licensees. Also, as per RBI instructions, the licenses/ spectrum fees are to be treated as intangible assets. Spectrum is a primary asset of any telecom operator and is an essential requirement for any operator to implement its business. 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. In case the future spectrum is priced at higher levels, as in the case of 3G spectrum (approx. Rs 67,000 Crs), then lenders may not be in a position to fund these business plans considering the unsecured nature of the lending. Hence, we suggest that TRAI may initiate a consultation process with RBI for treating the Spectrum fees as a tangible asset for the purpose of lending by banks.

Q36. Can spectrum be allowed to be mortgaged for raising capital for telecom purposes?

Chapter IV

SUMMARY OF ISSUES

- Q1. How can the various principles outlined by the Hon'ble Supreme Court in various observations brought out in para above be sufficiently incorporated in the design of spectrum auction?**
- Q2. What are the key objectives to be kept in mind in the auction of the spectrum?**
- Q3. What should be the amount of spectrum which should be auctioned?**
- Q4. Should the spectrum be liberalised before it is put to auction?**
- Q5. For the refarming of 800 and 900 MHz bands from the existing licensees, which of the three options given above should be adopted? Please elaborate with full justification.**
- Q6. What are the issues that may arise in the above mentioned refarming process?**
- Q7. For new technologies e.g. UMTS/LTE, 5 MHz is the minimum amount of spectrum required. Certain licensees have only 4.4 MHz spectrum in 900 MHz band and 2.5 MHz spectrum in 800 MHz band. What are the possible options in case of such licensees?**
- Q8. Some GSM spectrum allocations may be interleaved between operators; to avoid fragmentation, reconfiguration between operators may be required. Whether frequency reconfiguration is required and what are the challenges and possible solutions?**

- Q9. Should the refarming of spectrum in 800/900 MHz bands be dealt independently or should a comprehensive approach be adopted linking it with the availability and auctioning of 700 MHz band?**
- Q10. Which of the two approaches outlined above be adopted?**
- Q11. When should 700 MHz spectrum be auctioned?**
- Q12. Should the auction in 700 MHz band be linked with the granting permission for the liberalised use of 800/900 MHz band?**
- Q13. 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?**
- Q14. What should be the structure of the auction process?**
- Q15. Should auction be held in single stage or multi stage?**
- Q16. Should there be a simultaneous auction for spectrum in 800 and 1800 MHz bands?**
- Q17. What should be the block size of the spectrum?**
- Q18. Should the block size be dependent on the frequency? If so, what should be the block size in each band?**
- Q19. Should there be a cap on amount of spectrum one can bid? If so, what should it be?**
- Q20. Should there be a separate cap on the total amount of spectrum one can hold; if so, what amount should it be?**
- Q21. Should there be a cap on the amount of spectrum one can hold in respect of sub-GHz spectrum? If so, what should it be?**

- Q22. Who all should be eligible to participate in the auction?**
- e. Only licensees whose licences have been cancelled;**
 - f. Only eligible applicants as on 10.01.2008;**
 - g. Only licensees whose licences have been cancelled and all new eligible entrants at the time of auction; or**
 - h. Open to all including the existing Licensees.**
- Q23. What should be reserve price per MHz of spectrum in the year 2012 for 1800 MHz band?**
- Q24. What should be the reserve price per MHz of spectrum in the 700/800/900 MHz bands.**
- Q25. Whether the reserve price should be uniform across the country or service area wise?**
- Q26. What should be the roll out obligations linked to the auctioned spectrum?**
- Q27. What should be the annual spectrum usage charge for the spectrum being auctioned?**
- Q28. Should the spectrum usage charge be in line with present criteria of escalating charge with the amount of spectrum holding or a fix percentage as was done for 3G and BWA spectrum?**
- Q29. What should be the period of validity of spectrum?**
- Q30. What should be the period of price of spectrum?**
- Q31. Should the government allow deferred payment schedule of the spectrum auction fee, or should the payment be upfront in nature?**
- Q32. Should Spectrum trading be allowed in India?**

Q33. (a) Among the various models discussed above, in your opinion which model of spectrum trading is best suited for India?

(b) In your opinion is there any other model which can be implemented in India? If yes, please describe.

Q34. What should be the eligibility criteria to trade the spectrum?

Q35. Whether the spectrum assigned for 3G and BWA services be allowed to trade? If yes, give reasons.

Q36. Can spectrum be allowed to be mortgaged for raising capital for telecom purposes?

**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”.

**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 unlicensed 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.”

Annexure II

Spectrum Allotted Details																										
S.No.	Name of Service Provider	Delhi			Mumbai			Chennai			Kolkata			MH			GUJ			AP			KTK			
		Spectrum			Spectrum			Spectrum			Spectrum			Spectrum			Spectrum			Spectrum			Spectrum			
		900	1800	800	900	1800	800	900	1800	800	900	1800	800	900	1800	800	900	1800	800	900	1800	800	900	1800	800	900
1	Bharti	8.0	2.0			9.2		6.2	2.4		6.2	1.8			8.2			6.2			7.8	2.2		7.8	2.2	
2	Vodafone	8.0	2.0		8.0	2.0			8.0		7.8	2.0		6.2			7.8	2.0			6.2			8.0		
3	MTNL / BSNL	6.2	6.2	3.75	6.2	6.2	2.50	6.2	1.8	2.50	6.2	3.8	2.50	6.2	3.8	2.50	6.2	1.2	2.50	6.2	3.8	2.50	6.2	3.8	3.75	
4	Idea		8.0			4.4						4.4		7.8	2.0		6.2			6.2	1.8			4.4		
5	Aircel Ltd		4.4			4.4		6.2	2.4			4.4			4.4			4.4			4.4			4.4		
6	Etisalat DB		4.4			4.4									4.4			4.4			4.4			4.4		
7	Videocon		0.0			4.4						4.4			4.4			4.4			4.4			4.4		
8	S. Tel																									
9	Loop		0.0		8.0	2.0						4.4			4.4			4.4			4.4			4.4		
10	Unitech		0.0			4.4						4.4			4.4			4.4			4.4			4.4		
11	Spice		0.0												4.4						4.4		6.2			
12	RTL / RCL		4.4	5.00		4.4	5.00					6.2	5.00		4.4	5.00		4.4	3.75		4.4	5.00		4.4	5.00	
13	Tata Teleservices		0.0	5.00		4.4	5.00					4.4	3.75		4.4	5.00		4.4	3.75		4.4	5.00		4.4	3.75	
14	HFCL Infocom																									
15	Sistema Shyam			2.50			2.50						2.50			2.50			2.50			2.50			2.50	
	Total Spectrum Allotted	22.2	31.4	16.3	22.2	50.2	15.0	18.6	14.6	2.5	20.2	40.2	13.8	20.2	49.2	15.0	20.2	40.2	12.5	20.2	49.2	15.0	20.2	49.2	15.0	

Source:- WPC data as on 31.1.2011

Annexure II (Contd.)

Spectrum Allotted Details			Spectrum Allotted Details																								
S.No.	Name of Service Provider	TN			TN including Chennai			Kerala			Punjab			Haryana			UP-W			UP-E			Raj				
		Spectrum			Spectrum			Spectrum			Spectrum			Spectrum			Spectrum			Spectrum			Spectrum				
		900	1800	800	900	1800	800	900	1800	800	900	1800	800	900	1800	800	900	1800	800	900	1800	800	900	1800	800		
1	Bharti		6.2			0.6			6.2			7.8				6.2			6.2			6.2	1.0		6.2	2.0	
2	Vodafone	6.2	1.0					6.2				6.2			6.2			6.2			6.2	2.0		6.2			
3	MTNL / BSNL	6.2	1.8	2.50		2.0		6.2	3.8	3.75	6.2		2.50	6.2	3.8	2.50	6.2	3.8	2.50	6.2	3.8	2.50	6.2	1.8	2.50		
4	Idea					4.4		6.2	1.8			4.4		6.2			6.2	1.8			6.2			6.2			
5	Aircel Ltd	7.8	2.0						4.4			4.4			4.4			4.4			4.4			4.4			
6	Etisalat DB					4.4			4.4			4.4			4.4			4.4			4.4			4.4			
7	Videocon					4.4			4.4						4.4			4.4			4.4			4.4			
8	S. Tel																										
9	Loop					4.4			4.4			4.4			4.4			4.4			4.4			4.4			
10	Unitech					4.4			4.4			4.4			4.4			4.4			4.4			4.4			
11	Spice										7.8				4.4												
12	RTL / RCL					4.4	5.00		4.4	5.00		4.4	3.75		4.4	3.75		4.4	5.00		4.4	5.00		4.4	3.75		
13	Tata Teleservices					4.4	3.75		4.4	3.75		4.4	3.75		4.4	5.00		4.4	3.75		4.4	3.75		4.4	3.75		
14	HFCL Infocom											4.4	2.50														
15	Sistema Shyam						2.50			2.50			2.50			2.50			2.50			2.50			4.4	5.00	
	Total Spectrum Allotted	20.2	11.0	2.5	0.0	33.4	11.3	18.6	42.6	15.0	21.8	41.4	15.0	18.6	45.2	13.8	18.6	42.6	13.8	18.6	43.8	13.8	18.6	45.2	15.0		

Source:- WPC data as on 31.1.2011

Annexure II (Contd.)

		Spectrum Allotted Details																								
S.No.	Name of Service Provider	MP			WB&A&N			HP			Bihar			Orissa			Assam			NE			J&K			
		Spectrum			Spectrum			Spectrum			Spectrum			Spectrum			Spectrum			Spectrum			Spectrum			
		900	1800	800	900	1800	800	900	1800	800	900	1800	800	900	1800	800	900	1800	800	900	1800	800	900	1800	800	900
1	Bharti		8.0		4.4	1.8		6.2			6.2	3.0		6.2	1.8		1.8	4.4		4.4	1.8		6.2			
2	Vodafone		4.4		4.4	1.8			4.4			4.4			4.4			4.4			4.4			4.4		
3	MTNL/BSNL	6.2	3.8	2.50	6.2	1.8	2.50	6.2	3.8	2.50	6.2	3.8	2.50	6.2	3.8	2.50	6.2	3.8	2.50	6.2	3.8	2.50	8.0		2.50	
4	Idea	6.2	1.8			4.4			4.4			4.4			4.4			4.4			4.4			4.4		
5	Aircel Ltd		4.4			4.4			4.4			4.4			4.4		4.4	1.8		4.4			4.4			
6	Etisalat DB		4.4									4.4														
7	Videocon		4.4			4.4			4.4			4.4			4.4			4.4			4.4			4.4		
8	S. Tel								4.4			4.4			4.4			4.4			4.4			4.4		
9	Loop		4.4			4.4			4.4			4.4			4.4			4.4			4.4			4.4		
10	Unitech		4.4			4.4			4.4			4.4			4.4			4.4			4.4			4.4		
11	Spice																									
12	RTL/RCL	6.2		5.00	4.4	1.8	3.75	6.2		2.50	6.2	1.8	5.00	6.2		3.75	6.2		2.50	4.4	1.8	2.50		4.4	2.50	
13	Tata Teleservices		4.4	2.50		4.4	2.50		4.4	2.50		4.4	3.75		4.4	2.50			2.50			2.50			2.50	
14	HFCL Infocom																									
15	Sistema Shyam			2.50			2.50			2.50			2.50			2.50			2.50			2.50			2.50	
	Total Spectrum Allotted	18.6	44.4	12.5	19.4	33.6	11.3	18.6	39.0	10.0	18.6	48.2	13.75	18.6	40.8	11.25	18.6	36.4	10.0	19.4	33.8	10.0	18.6	30.8	10.0	

Source:- WPC data as on 31.1.2011

Regulatory status in the 900 MHz band refarming and UMTS900 network deployments¹⁰

Country	Re-farming status	Operator	Deployments
Armenia	UMTS900 is allowed	Orange	Launched
Australia	UMTS900 is allowed	Optus	Launched
		Vodafone	Launched
Belgium	UMTS900 is allowed	Mobistar	Launched
		Proximus	Launched
Bulgaria	UMTS900 is allowed	Vivacom	Launched
		Globul	Testing
Croatia	UMTS900 is allowed	Tele2	Launched
Cyprus	UMTS900 is allowed	-	-
Denmark	UMTS900 is allowed	3 (Hi3G)	In deployment
Estonia	UMTS900 is allowed	Elisa	Launched
		EMT	Launched
		Tele2	Launched
Faroe Islands	UMTS900 is allowed	Faroese Telecom	Launched
Finland	UMTS900 is allowed	Elisa	Launched
		DNA	Launched

¹⁰ http://www.gsacom.com/downloads/pdf/LTE_Update_GSA_Dubai_November_2011.php4

		TeliaSonera	Launched
France	UMTS900 is allowed	SFR	Launched
		Orange	Launched
		Bouygues Telecom	Testing
French Guiana	UMTS900 is allowed	-	-
Germany	UMTS900 is allowed	E Plus	In deployment
Ghana	UMTS900 is allowed	MTN Ghana	Launched
Greece	Under consideration	Cosmote	Testing
Greenland	UMTS900 is allowed	TELE	Launched
Guadeloupe	UMTS900 is allowed	-	-
Hong Kong	UMTS900 is allowed	CSL Limited	Launched
Hungary	UMTS900 is allowed	-	-
Iceland	UMTS900 is allowed	Siminn	Launched
Indonesia	UMTS900 is allowed	-	-
Ireland	Under consideration	-	-
Italy	UMTS900 is allowed	-	-
Kazakhstan	UMTS900 is allowed	Tele2	Launched
La Reunion	UMTS900 is allowed	-	-
Latvia	UMTS900 is allowed	LMT	Launched
Lithuania	UMTS900 is allowed	-	-

Malaysia	Under consideration	-	-
Malta	UMTS900 is allowed	-	-
Martinique	UMTS900 is allowed	-	-
Netherlands	UMTS900 is allowed	-	-
New Zealand	UMTS900 is allowed	Vodafone	Launched
Norway	UMTS900 is allowed	TeleNor	Planned
		Netcom	Planned
Poland	UMTS900 is allowed	Aero2	Launched
		P4 (Play)	Launched
		Polkomtel	Planned
Portugal	UMTS900 is allowed	-	-
Qatar	UMTS900 is allowed	Vodafone	Launched
Romania	UMTS900 is allowed	Vodafone	Launched
		Orange	In deployment
		Cosmote	In deployment
Russia	Under consideration	Megafon	In deployment
Saudi Arabia	UMTS900 is allowed	-	-
Singapore	UMTS900 is allowed	-	-
Slovakia	Under consideration	-	-
Slovenia	UMTS900 is allowed	Si.mobil- Vodafone	Launched

		Tusmobil	Launched
South Africa	UMTS900 is allowed	Cell C	Launched
		MTN	Launched
		Vodacom	Testing
Spain	UMTS900 is allowed	Telefonica	In deployment
		Orange	In deployment
		Vodafone	In deployment
Sweden	UMTS900 is allowed	3 (Hi3G)	Launched
Switzerland	UMTS900 is allowed	Orange	In deployment
Thailand	UMTS900 is allowed	AIS	Launched
UAE	UMTS900 is allowed	-	-
UK	UMTS900 is allowed	o2	Launched
Ukraine	Under consideration	Beeline	Planned
		MTS	Planned
Venezuela	UMTS900 is allowed	Digitel	Launched

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