Cellular Operators Association of India

WITHOUT PREJUDICE

RSM/COAI/2013/149
August 14, 2013

Telecom Regulatory Authority of India
Mahanagar Door Sanchar Bhawan
Jawahar Lal Nehru Marg, (Old Minto Road)
New Delhi – 110002

Dear Sirs,

SUBJECT: TRAI CONSULTATION PAPER ON VALUATION AND RESERVE PRICE OF SPECTRUM

This is with reference to the TRAI Consultation Paper No. 06/2013 dated July 23, 2013 on Valuation and Reserve Price of Spectrum.

In this regard, please find enclosed our response for your kind perusal.

We hope our views and submissions will merit the kind consideration and support of the Authority.

This is without prejudice to our existing and future submissions on various related issues in various present and future legal proceedings.

Kind regards,

Rajan S. Mathews
Director General

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COAI comments on TRAI Consultation paper
On

VALUATION AND RESERVE PRICE OF SPECTRUM:
Released on 23rd Jul 2013

Q1. What method should be adopted for refarming of the 900 MHz band so that the TSPs whose licenses are expiring in 2014 onwards get adequate spectrum in 900/1800 MHz band for continuity of services provided by them?

Q.2. In case spectrum is to be "reserved" for such TSPs, should it be restricted to licenses expiring in 2014 (metros) or include licenses expiring afterwards (LSAs other than metros)?

Q.16. Should the premium to be paid for the 900 MHz and liberalised 800 MHZ spectrum be based on the additional CAPEX and OPEX that would be incurred on a shift from these bands to the 1800 MHz band?

COAI Comments

a. The proposal to "re-farm" spectrum is not in consonance with the policy and license provisions which clearly provide for extension of existing licenses, which are bundled with allocated spectrum and unambiguously establish a technology-neutral license regime in India.

b. Since 1999, India has adopted a technology neutral regime whereby CMTS and UAS Licensees are permitted to offer mobile services using any technology. The proposal for re-farming of 900MHz spectrum thus suffers from a serious legal infirmity which cannot be disregarded.

c. "Re-farming" as has being proposed and advocated in India is not how it is understood internationally. Globally, the term "Re-farming" is commonly used to describe:

   i. *Spectrum Clearing* - change of spectrum from one use to another involving a change of owner of the spectrum like from defence/security service to commercial public mobile services.

   ii. *Technology Re-farming* - change in the nature of the service from say GSM to UMTS, by the existing owner of the spectrum. This kind of re-farming is needed in regulatory regimes where there are restrictions that define the specific technology that can be used in specific bands (e.g., dictating that 900MHz can only be used for GSM). Technology re-farming is not relevant in India where a technology-neutral regime has been in place since 1999.

d. However in India, the term "re-farming" has been used to denote a very different and disruptive concept i.e. forcible confiscation of 900MHz spectrum current held and used band assignments by the existing license holders and redistributing the same to others, which represents an undesirable and most intrusive elimination of the existing rights of

licensees. Besides being legally untenable, this would be extremely harmful to interests of consumers and investors.

e. Only a handful of Regulators have considered drastic interventions such as re-distribution of 900MHz spectrum and that too in a very limited set of special circumstances – for example, to create one additional 900 MHz block for a fourth player in a market with only three Service Providers.

f. It is also pertinent to note that in all such cases internationally, the existing players held far larger quantities of spectrum than is the case in India and even after redistribution each retained a minimum of 10MHz of spectrum in the 900 MHz band. The situation in India is starkly different with far greater number of players, trying to address the local coverage and capacity requirements within a highly competitive market as well as with much smaller holdings of 900MHz spectrum. This by itself is unprecedented and would be appreciated by the TRAI.

g. It is also pertinent to note that the re-farming would be extremely harmful to interests of consumers and investors. Most severely affected would be the rural consumers who are being served predominantly by the operators who have allocations in the 900MHz band.

h. These aspects have been very well explained by the Analysys Mason Report titled *"TRAI's recommendations on spectrum re-farming: Critique of key assumptions and procedural considerations"* of 2012, which states:

"….We have not come across any re-farming situation globally where a specific band of spectrum (especially 900MHz) has been fully withdrawn for re-farming…" Partial withdrawal, primarily used to allow entry of a new operator, generally involves retrieval of a tiny fraction of overall spectrum holding without disrupting existing operations. The figure below illustrates re-farming in some markets. Evidently, incumbent operators had a lot of spectrum in multiple bands (such as 900MHz, 1800MHz, 1900MHz, 2100MHz and 2600MHz) and withdrawal of a small part of the spectrum will not impact their on-going operations substantially. Even in these markets, the regulator carried out the withdrawal activity through collaborative discussions with service providers.

Market	Operator	900MHz re-farming (MHz)		Spectrum holdings in other key bands (MHz)			
		Before	After	1800	1900	2100	2600
Sweden	Tele2	2×10	2×7.5	2×3	5[1]	2×19.8	2×20
	TeliaSonera	2×10	2×10	2×3			2×20
	Telenor	2×10	2×7.5	2×3	5	2×19.8	2×20
	Swefour	2×5	2×5	-	-	-	-
	Hi3G	-	2×5	-	5	2×19.8	2×10/20
France	Bouygues Telecom	2×9.8	2×9.8	2×26.6(21.6)	5	2×14.6	-
	Orange France	2×12.4	2×10	2×23.8	5	2×19.6	-
	SFR	2×12.4	2×10	2×23.8	5	2×9.8	-
	Free Mobile	-	2×5	-	-	2×5	-
Denmark	Telia	2×14.8	2×11.8	2×23.6	5	2×15	2×20/15
	TDC Mobil	2×9	2×9	2×17.2	5	2×15	2×20
	Telenor	2×9	2×9	2×20.2	5	2×15	2×20/10
	Hi3G	-	2×5	2×10	5	2×15	2×10/25

[Source: Analysys Mason, 2012]

i. Globally, partial withdrawal of spectrum for competitive entry has been the primary approach to re-farming, with adequate mechanisms in place to ensure that operators have sufficient spectrum across bands to provide services across technologies.

j. In the UK, this has been under consideration for several years where after following a lengthy review process it was found that there was no case to retrocede spectrum from either of the operators holding 2x17.5MHz in the 900MHz band. Other operators have spectrum in the 1800MHz/2.1GHz bands and the opportunity to compete for spectrum in the upcoming 800MHz/2.6GHz auction. There has been no 'redistribution' of 900MHz spectrum in the UK.

k. It is pertinent to highlight that in 2010, TRAI had noted that spectrum re-farming 900MHz poses significant challenges and that there was a need to carefully assess the impact thereof. TRAI had also stated that it would carry out a separate consultation on the issues involved such as (i) traffic management, the frequency coordination & reconsideration of the spectrum, (ii) need for guard band & transitional zones, management of voice & data traffic loads, (iii) issues of site optimization and that DoT should wait its recommendations before taking a decision in the matter. However, till date no separate consultation has been carried out by TRAI and no deliberation has taken place on the issues and challenges as outlined by TRAI in May 2010 till date.

l. This approach is radically different from the general practice of other NRAs who have ensured that stakeholder concerns are addressed in a fair, objective and collaborative manner, even if it requires a multi-year consultation process to do so.

m. The Analysys Mason report observes that *International regulators follow a much more rigorous consultation process for re-farming, accounting for key near-term and long-term*

[1]Represents spectrum holding by Svenska, a company owned by Tele2 and TeliaSonera

issues for consumers and industry. The TRAI consultation and recommendations lack the rigor, and comprehensive review of potential impact on consumers and industry considered by regulators in global markets while considering critical issues such as re-farming of spectrum.

n. The Report published by Analysys Mason concludes that the re-farming as proposed by TRAI will have a substantial cost to industry, lead to an increase in retail tariffs and cause significant inconvenience to consumers, with no benefit to any involved stakeholders. In particular, it would:

i. Require replacement of 286,590 base stations currently using 900MHz and installation of additional 171,954 base stations to provide equivalent coverage using 1800MHz spectrum
ii. Require incremental CAPEX of INR 54,739 crores (USD 9 billion), and incremental annual OPEX of INR 11,762 crores (USD 2 billion);
iii. Require additional CAPEX of about INR 26,653 (USD 4.5 billion) crores to deploy new towers to support the incremental base stations;
iv. Require write-offs of existing 900MHz assets at an estimated cost of INR 22,310 (USD 3.7 billion) crores;

Thus, it would cost the GSM operators approximately Rs 1.25 lakh crores (USD 21 billion) in incremental CAPEX and Rs 25,000 crores (USD 4.1 billion) in equipment write-off. <u>This is just the cost of network migration from 900MHz to 1800MHz and the cost of buying spectrum at auction, would be over and above this cost.</u>

o. Analysys Mason Report also estimates that:

i. In urban areas, active equipment will have to be replaced on the existing 94,670 sites and an additional 56,802 base stations on 1800MHz will be needed to provide equivalent coverage.
ii. In rural areas, active equipment will have to be replaced at about 191,920 site locations, and an additional 115,152 base stations will be needed.

p. The view that the equipment currently deployed for 900MHz is already depreciated and close to replacement, is based on an incorrect presumption that no network investment has been made in the past few years, which is clearly not the case. It is common knowledge that GSM players have been steadily expanding both capacity in the urban areas as well as coverage to the hinterland adding more and more rural customers, which clearly establishes that the equipment is not old / fully depreciated. In fact, the majority of the growth has come only in the last 5 years, so the equipment is at best half way through its technical life time.

q. Besides the aforesaid implications on costs, “re-farming” would severely weaken service continuity in semi-urban, rural and remote areas as well as irreversibly slow down the growth of services in such areas since these are predominantly served by TSPs having assignments in 900MHz. A new operator would take years to build up a comparable level of coverage, and that too if it deems investment in such less-lucrative markets viable.

r. Apart from “re-farming” being legally untenable, the additional costs of re-farming are per se unjustified as they are wasteful, avoidable and amount to a forced obsolescence of infrastructure. They constitute a destruction of national infrastructure which a developing economy like India can ill-afford. They are all the more unjustified in view of the worsening financial state of the Telcos, which has been recognized by the Authority in its present

consultation. The expenditure on “re-farming” will further deteriorate balance sheets of Service Providers and make borrowing impossible. Investments will also suffer as the fund raising capacity of Service Providers is limited.

s. Refarming was recommended on the incorrect ground that existing spectrum allocations are not liberalized and therefore 900MHz will have to be taken back and re-allocated to be used for 3G. This is an incorrect understanding of the policy and licensing regime as technology neutrality /liberalized spectrum has been enshrined in our policy and licensing regime since 1999 and the same has also been repeatedly confirmed by both DoT and TRAI.

t. In November 2012, the EGoM had recommended that telecom operators be allowed to retain 2.5 MHz of spectrum in the 900 MHz band at the time licenses come up for extension. However, during the March 2013 auction, the entire 900 MHz band spectrum presently allocated to the licensees coming up for extension in 2014 was put up for auction. Even the said retention of 2.5 MHz of spectrum in the 900 MHz band was made conditional/consequent to the participation in auction that too when the operator procured at least 5 MHz of spectrum in either of the 900 MHz/ 1800 MHz band. It is evident that different segments of the Government give varying signals that do not lend to enhancing investor confidence. We recommend that regulatory continuity be enshrined in the proposals offered and decisions being taken.

u. It is also to be noted that in this auction, no assurance was given to the operators that they would get at least 5MHz of spectrum in 900 MHz band nor were they assured that the spectrum they acquire would be contiguous. Under both the circumstances, the spectrum could not be liberalised and used for LTE by the operators. For better network dimensioning, at least the spectrum should be available in the block of 5MHz and the same should be contiguous. Hence, even if the operators paid huge sums to acquire spectrum in the 900 MHz band, they were not sure of its usage. This defeats the sole purpose of pricing the spectrum at such higher price for allowing operators to offer LTE in this band.

v. At this juncture, we point out the technical implications of the recommendation of allowing operators to retain only 2.5 MHz of 900 MHz spectrum:

   i. It will be next to impossible to service 450-500 million subscribers in the existing 900 MHz band with the same quality of service with limited 2.5 MHz in the 900 MHz band and remaining on 1800 MHz band without any disruption of wide-scale services. There is no precedence of this anywhere in the world. Neither has the TRAI/DoT/WPC taken this up for consideration at any ITU forum for discussion as precursor to finding a solution with such spectrum assignments for the Indian needs.

   ii. In fact an operator with 2.5 MHz in 900 MHz band and remaining spectrum in 1800 MHz band is worse off than an operator with complete network in 1800 MHz band as this network will give a false delusion of coverage. The difference in spectrum propagation/ network design in the two bands will lead to coverage constraints.

w. It may also be noted that in India, the entire 35 MHz of 900 band is not being used by the GSM industry. In India, CDMA band is allocated as 824-844 MHz for uplink and 869-889 MHz for downlink. On the other hand for GSM, the band allocated is 890-915 MHz for uplink and 935-960 MHz for downlink. However, globally, the GSM band extends from 880-915 MHz for uplink and 925-960 MHz for downlink. Thus, we believe that the 800 MHz spectrum band should be harmonized with the international band plan to become part of an “extended” 900 MHz band. Details of the same are dealt in subsequent sections.

x. Also, as of now there is a pool of spectrum already available with the Government, including 1800 MHz, 2100 MHz, 2300 MHz and 2600 MHz, for the use of LTE. Thus, it would be most inadvisable and disruptive to withdraw the spectrum that is already in use and has the maximum subscriber base in the country.

y. The 10 MHz released as the E-GSM band should also be put up for auction. The reserve price for this E-GSM 900 MHz spectrum could be derived by applying an appropriate multiplication factor of 1.3 of 1800MHz reserve price.

z. The Authority is also aware that the Hon'ble Supreme Court has directed that the entire spectrum quashed by it must be put to auction; hence there can be no question of reserving any spectrum.

All our submissions herein below are subject to the above.

Q.3. Is any restriction required to be imposed on the eligibility for participation in the proposed auction?

COAI Comments

a. We submit that the eligibility for participation in the auction should remain the same as has been specified in the recent auctions of November 2012 and March 2013.

b. The same has also been specified in the TRAI Consultation Paper.

c. It is important to retain the clause of a cap of 25% of the 'total spectrum assigned' in all bands put together and 50% within a given band in each service area shall apply for total spectrum holding by each operator.

Q.4. Should India adopt E-GSM band, in view of the diminishing interest in the CDMA services? If yes,

a) How much spectrum in the 800 MHz band should be retained for CDMA technology?
b) What are the issues that need to be addressed in the process?
c) What process should be adopted for migration considering the various issues involved?

COAI Comments

a. With the diminishing interest of operators in CDMA technology and the reducing subscriber base of CDMA, we believe that there is a need to harmonize the GSM band in India with the global GSM i.e. from 880-915 and 925-960 MHz (35+35 MHz as compared to existing 25+25 MHz), which is globally considered as a part of 900MHz band and will enhance the 900 MHz band from present 25 MHz to 35 MHz. This also conforms to "international harmonization" standards as acknowledged even by TRAI in its "Recommendations on Spectrum related issues", dated May 3, 2005.

b. It is a known fact that currently, only a part of the spectrum in the 800 MHz band is being utilized for CDMA operations. In fact, one of the operators has sought to return back a part

of the allocated CDMA spectrum. The spectrum utilization by the CDMA operators similar to the table in Table 2.10 at page 29 of this Consultation Paper needs to be considered/ compared with other bands for spectrum utilization for estimating the efficiency of utilization of the spectrum utilization in respective bands. The utilization by operators other than the PSUs can be seen in Annexure – 1.

c. Given the higher appetite/demand for 900MHz, the reconfiguration of the available 800MHz spectrum will not only increase the availability of spectrum in the 900 MHz band but will also lead to more efficient use of spectrum. It will also benefit the Government through the generation of revenues and also help increase the broadband penetration in the country. There will be no impact on the existing CDMA operations as they can continue providing the services with the allocated spectrum. This exercise may be carried out by the Government after mutual discussions with all stakeholders and on a case to case basis.

d. As has been rightly pointed out by TRAI that the PSUs have minimal CDMA subscribers and can easily surrender their spectrum in this band. The remaining CDMA operators can be easily accommodated in the lower part of the 800 MHz band, i.e., 869 – 879 MHz downlink band, to meet the diminishing 2G demand.

e. For 880 – 890 MHz as the uplink of GSM from CDMA band, 925 – 935 MHz is required as the downlink of GSM. The band 925 – 935 MHz is free as per NFAP except for two usages covering a total of 0.61 MHz out of a total of 10 MHz as under:

    i. In the band 925 – 935 MHz, which is now proposed to be included in 900 MHz, the spot of 926 to 926.5 MHz (0.05 MHz) is earmarked for low power cordless telephone systems (as per IND 52 of NFAP 2012).

    ii. Spots from 933.0125 to 933.1250 MHZ (0.01125 MHz) are earmarked for SCADA (Supervisory Control and Data Acquisition System) (as per IND 45 of NFAP 2012).

    Since these two users are not in the global GSM band plan, most low power cordless phones and SCADA are not operating in these bands. Hence, it should not be difficult to allocate these users to a different band(s). If required, the DoT could configure 10 MHz in 925 to 935 MHz whilst reserving 0.6125 MHz for these services until they can be migrated to other band(s).

f. If these two services (mentioned in the above para) could be allocated to some other band(s), then by reconfigurations of 10 MHz from the downlink of spectrum band 880 – 890 MHz, the current 900 MHz band could be extended from 25+25 to 35+35 MHz.

g. Regarding the technical aspects for CDMA operators:

    i. Network Side: Most of the Equipment supplied for CDMA technology should be able to support the complete band of 850 MHz and it should be possible to retune the new frequency from OSS. Additionally, there could be a requirement to change/retune CDMA TX filters to avoid interference at EGSM side by restricting their transmission to 879 MHz.

    ii. Devices side: All standard CDMA devices should support the complete CDMA band to facilitate roaming.

h. Regarding the GSM side, almost all the devices available in India support the complete 900 MHz band.

i. The amount of guard band between these frequencies will depend on the kind of technologies that will be used on either side of the band and can be decided during the auction of spectrum.

j. We submit that allocation of E-GSM band for India will facilitate optimum utilization of the precious national resource and also benefit the Government in helping improve the Broadband availability in the country. Additionally, the Government will also be able to generate revenues that were denied due to the absence of bidders for the 800 MHz spectrum during the auction.

Q.5. Should roll out obligations for new/existing/renewal/quashed licenses be different? Please give justification in support of your answer.

Q.6. Is there a need to prescribe additional roll-out obligations for a TSP who acquires spectrum in the auction even if it has already fulfilled the prescribed roll-out obligations earlier?

COAI Comments

a. The rollout obligations should be the same for all TSPs and should continue to be as have been defined in the recent auctions of November 2012 and March 2013.

b. We believe that there is no need to prescribe roll-out obligations for a TSP who acquires spectrum in the auction if that TSP has already fulfilled the prescribed roll-out obligations once, as the present obligations are quite comprehensive.

c. However, we believe that the Government should consider incentives for TSPs to encourage them for faster rollout of services in uncovered areas. The Government at one stage had approved reduction in license fee by 2% in case operators cover more than 95% of the block headquarters. 90% of on-road coverage shall be treated as sufficient for the purpose of considering a block headquarter as covered. These incentives will encourage operators to rollout services in uncovered area and also meet the universal service objectives. Therefore, it is suggested that license fee may be reduced by 2% if they cover 95% of the block headquarters in a service area.

Q.7. What should be the framework for conversion of existing spectrum holdings into liberalised spectrum?

COAI Comments

a. We submit that technology neutrality is already enshrined in the existing policy and licensing regime since 1999 and the same has been repeatedly stated, confirmed, clarified, reconfirmed by the Government on several occasions. Some of the relevant references supporting technology neutrality are mentioned below:

i. NTP-99 which stipulated that the Cellular mobile service provider (CMSP) shall be free to provide all types of mobile services utilizing any type of network equipment that meet the relevant International Telecommunication Union (ITU) / Telecommunication Engineering Center (TEC) standards.(Clause 3.1.1)

ii. DoT Press Release dated 13 September 1999 that was issued pursuant to NTP-99, stipulating that all cellular licenses would be technology wise neutral.

iii. Choice of technology to be available to all existing CMSPs on migration to NTP-99 (DoT Press Release, 10 October 1999).

iv. CMSPs permitted to operate the cellular mobile telephone services in any technology, however, the technology shall be digital and has to operate in the designated frequency band" i.e. 890-915MHz paired with 935-960MHz. (DoT Letter, 9 April 2001).

v. The Government's commitment to technology neutrality was continued in the Unified Access Licensing regime introduced in 2003 through:

a) An addendum to NTP-99 which permitted a Unified access Licensee to provide Basic and /or Cellular Services using any technology in a defined service area.

b) The DoT guidelines for UASL dated 11 November 2003 which stipulated that Unified Access service providers are free to use any technology without any restriction.

vi. The right to technology neutrality is thus enshrined in the UAS license which:

a) permits the licensee to offer all types of access services (Clause 2.2(a);

b) using any technology based on standards issued by ITU/TEC or any other International Standards Organization/ Body/Industry; any digital technology having been used for a customer base of one lakh or more for a continuous period of one year anywhere in the world, shall be treated as established technology and will be permissible for use regardless of its changed versions (Clause 23.1) and further

c) provide additional facilities in case of any value addition/ upgrade that the technology permits at later date with prior intimation to Licensor and TRAI (Clause 23.6).

vii. Similarly when the 3G and BWA auctions were conducted, it was clear that what was being auctioned was only the spectrum and that the scope of service will be determined by the underlying license. This is evident from the fact that the NIA clearly and explicitly stated that:

The spectrum shall not be used for any activity other than the activities for which the operator has a licence. The award of spectrum by itself does not confer the right to provide services. (Section 2.1)

b. This understanding of technology neutrality has also been re-affirmed by TRAI at various times.

i. In its Consultation Paper dated 16.07.2003 on Unified Licensing for Basic and Cellular Services, TRAI stated:

"*Though CMSPs are allowed to use any digital technology, they are using GSM technology."*

ii. In its recommendations dated 28.10.2003, TRAI re-affirmed and recommended that:

"The technology neutral stance of the present licencing policy shall continue. Service Providers shall also be free to use any media (e.g. telephone wire, telegraph wire, TV cable, electricity wire, wireless) to provide telecom services."

These recommendations of TRAI were accepted by DoT, Group of Ministers and even approved by the Cabinet.

iii. The TRAI Consultation Paper on Spectrum Related Issues dated 31.05.2004 once again noted that all licenses were made technology neutral in 1999. The paper also further stated that the policy of spectrum use is technology neutral, but equipment availability and the accruing economies of scale also govern choice of technology.

iv. The fact that licenses have been technology neutral was once again noted by TRAI in 2007 in its Consultation Paper dated 12.06.2007 wherein it stated "*Initial CMTS licenses were technology specific, allowing the use of GSM network technology only. However, subsequently the licenses were made technology neutral in 1999."*

c. We would also like to point out the dual spectrum operators have been openly offering 3G EVDO services in the 800MHz band

While this has been brought to the notice of TRAI several times, we believe that TRAI has not initiated any action probably in the understanding and their interpretation of the spirit of respecting the stated TRAI position on technology neutrality. This is reflective of the Government (DoT) and TRAI position in the matter thereby reinforcing the commitment to technology neutrality.

The above further reinforces TRAI's own view that spectrum is technology neutral and is "liberalised*".*

d. We would also like to submit that Spectrum comes bundled with license. Use of spectrum is governed by provisions of license. This has been repeatedly and amply clarified by DoT in response to the various queries leading to the auction of 2.1GHz and 2.3GHz spectrum in 2010.

The attempt now to try and de-link the two and claim that license is technology neutral while spectrum is not is trying to create an artificial and incorrect distinction where none exists.

e. We would further submit that TRAI's definition of liberalised spectrum use as:

i. "Liberalisation of spectrum refers to the removal of technology restrictions to give the licensee an option to deploy new technologies in the same. For example, UMTS or HSPA could be deployed in spectrum bands where traditionally GSM, CDMA or TDMA has been used." (Para 2.18)

ii. "…Liberalisation of spectrum essentially means the removal of technology restrictions to enable new access technologies to be deployed within the same band or bands as existing and legacy technologies. This would mean that the

operators will be free to choose any technology in the spectrum bands held by them. …" (Para 3.73) has already been permitted under NTP 99 read with DoT's Press Note of 13.09.1999, 01.10.1999 and letter dated 09.04.2001.

f. We thus submit that all spectrum holdings by our member operators are already liberalised and no such effort should be made to set an arbitrary high reserve price for spectrum on the basis of spectrum liberalization at this stage.

Q.8. Is it right time to permit spectrum trading in India? If yes, what should be the legal, regulatory and technical framework required for trading?

COAI Comments

a. We believe that with the delinking of spectrum and license, spectrum trading should be permitted in the country. Removal of restrictions in trading would lead to efficient utilization of spectrum and faster roll-out of telecom services.

b. Spectrum trading can unleash the potential of mobile and facilitate technology upgrades. For operators, allowing spectrum trading will increase flexibility and will enable them to refine the alignment of their spectrum holdings with their business needs.

c. We also believe that introduction of spectrum trading would be desirable for encouraging spectrum consolidation and improving spectrum utilization efficiency. The following aspects should be considered for spectrum trading:

   i. Any licensee/entity holding spectrum in any band should be permitted to trade the same.

   ii. Fulfillment of rollout obligations should not be prescribed as a pre-requisite for permitting spectrum trading by original allottees.

   iii. There should be no distinction between spectrum transferred through an M&A transaction or traded directly in the market.

   iv. The size of the trading block will depend upon a number of factors, viz. spectrum band, technology, channeling plan, etc., hence should be left to the operators.

d. We submit that the trading transactions should be subject to spectrum cap of 50% of any band and 25% of the total commercial spectrum assigned in a service area, irrespective of technology mix and/or spectrum band deployed or else, it will only lead to administrative complexity and enforcement issues.

Q9. Would it be appropriate to use prices obtained in the auction of 3G spectrum as the basis for the valuation in 2013? In case the prices obtained in the auction of 3G spectrum are to be used as the basis, what qualifications would be necessary?

Q.10. Should the value of spectrum for individual LSA be derived in a top-down manner starting with pan-India valuation or should valuation of spectrum for each LSA be done individually?

Q.11. Is indexation of 2001 prices of 1800 MHz spectrum an appropriate method for valuing spectrum in 2013? If yes, what is the indexation factor that should be used?

Q.12. Should the value of spectrum in the areas where spectrum was not sold in the latest auctions of November 2012 and March 2013 be estimated by correlating the sale prices achieved in similar LSAs with known relevant variables? Can multiple regression analysis be used for this purpose?

Q.13. Should the value of spectrum be assessed on the basis of producer surplus on account of additional spectrum? Please support your response with justification. If you are in favour of this method, please furnish the calculation and relevant data along with results.

Q.14. Should the value of spectrum in the 1800 MHz band be derived by estimating a production function on the assumption that spectrum and BTS are substitutable resources? Please support your response with justification. If you are in favour of this method, please furnish the calculation and relevant data along with results.

Q.15. Apart from the approaches discussed in the foregoing section, is there any alternate approach for valuation of spectrum that you would suggest? Please support your answer with detailed data and methodology.

Q.17. Should the valuation of spectrum and fixing of reserve price in the current exercise be restricted to the unsold LSAs in the 1800 MHz band, or should it apply to all LSAs?

Q.18.

a) Should annual spectrum usage charges be a percentage of AGR or is there a need to adopt some other method for levying spectrum usage charges? If another method is suggested, all details may be furnished.

b) In case annual spectrum usage charges are levied as a percentage of AGR, should annual spectrum charges escalate with the amount of spectrum holding, as at present, or should a fixed percentage of AGR be applicable?

c) If your response favours a flat percentage of AGR, what should that percentage be?

Q.19. What should be the ratio adopted between the reserve price for the auction and the valuation of the spectrum?

COAI Comments

a. COAI had engaged an independent consultant, Price Waterhouse Coopers, to do a detailed study on the above questions. The responses to these questions are in their Report titled – "TRAI Spectrum Pricing Consultation Paper Response Document" dated August 14, 2013. The same is enclosed as Annexure – 2.

b. However, without prejudice to our existing and future submissions on Dual Spectrum in various present and future proceedings, we submit that dual spectrum operators are yet to pay even the required amount of prescribed fee, as required under the Press Release of 19.10.2007 read with the judgment dated 02.02.2012 of the Hon'ble Supreme Court.

The Press Release of 19.10.2007 states that:

"*Allocation of spectrum for the alternate technology may be done to private UAS Licensees on payment of prescribed fee, which will be an amount equal to the amount prescribed as entry fee for getting a new UAS licence in the same service area*"

c. Further, the in-principle approval given to the CDMA operators stated that *"The company shall…make payment of non-refundable fee equal to the same amount of prescribed entry fee… which has been paid by existing Licensees using the GSM technology or which would be paid by a new UAS licensee in each service…"*.

d. It is evident from the above that the prescribed fee for the dual/GSM spectrum allocations is equal to the entry fee that would be paid by a new UAS license and the spectrum held by them must be the same as has been paid by the new UAS licensees in November 2012 in the various service areas. It is pertinent to note that licensees whose spectrum was quashed in 2012 had acquired spectrum in the same 1800 MHz band along with the dual spectrum operators. These licensees while acquiring spectrum through auction have paid the entry/spectrum fee as determined through the auction, which is much higher than the earlier price of INR 1650 crores, however, the dual spectrum operators are yet to pay this entry fee. It is submitted that for payment of entry fee they should be treated at the same level as the quashed licensees and DoT should ask them to pay the requisite entry fee based on auction determined price.

OTHER ISSUES

1. BLOCK SIZE

a. We would like to highlight the change of allocation block size from the earlier 200KHz to the 1.25MHz in 1800 bands in the November auctions has resulted in wastage of spectrum. The wastage of spectrum can vary from 0.05 to 0.20MHz if the spectrum is used for GSM and is further magnified in case the allocations are not as per the GSM ARFCN (Absolute Radio Frequency Channel Number) table, where due to the unaligned start and stop frequency allocations, an operator may in fact get only 5 ARFCN allocations, resulting in two blocks of 200KHz i.e. 400KHz being rendered unusable for any operator. The wastage can be as much as 1.1MHz in case the spectrum is deployed for LTE. It is well accepted that spectrum lying unutilized is the most inefficient use /waste of a scarce valuable resource. The loss to the Government on this account could run into thousands of crores.

b. Also, the block size of 1.25MHz is also out of alignment with the current SUC slabs, which have been formulated on the basis of a block size of 200KHz for 900MHz and 1800MHz bands. While this issue can be addressed if the Authority were to recommend a flat fee/MHz for SUC, there are compelling technical reasons to review the block size of 1.25MHz and revert to the allocation of spectrum in carrier blocks of 200KHz.

2. MERGERS & ACQUISITIONS

a. In this regard we submit that vide its Press Release dated 15th February 2012, DoT announced that:

> "14. 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."*

However, it appears that DoT has not sought any recommendations from TRAI so far on this issue. We request the Authority to provide recommendations to DoT on this related issue also so that while finalizing the M&A guidelines, DoT also comes out with detailed guidelines for approving the M&A beyond 35% market share.

b. We would like to state that M&A framework needs to be significantly liberalised so as to facilitate market based consolidation. In this regard, the proposal to have different spectrum caps (25% of 900 & 1800MHz spectrum and 10MHz for CDMA) is retrograde and against the principle of technology neutrality enshrined in our policy. We also state that there is no legal or logical basis to distinguish between technologies and provide different caps based on technologies or bands or different caps for M&A versus organic growth. Since, less than 20 MHz of spectrum is available for CDMA operators, allowing a cap of 10 MHz would tantamount to an operator holding more than 50% of the total spectrum in the relevant market; in fact, when E-GSM is introduced, the M&A cap would be 100%!.

c. It is relevant to note that the Authority in its recent recommendations of April 23, 2012 reviewed its earlier recommendation and stated as under:

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

The above has been accepted by the Government in the NIA documents for the recent auctions held in November 2012 and March 2013 and the same also needs to become part of the M&A guidelines.

d. Hence, it is our view that the spectrum cap under M&A should be irrespective of the technologies or bands used by the service providers and should be set at 50% of each band and 25% of the total assigned spectrum in a service area irrespective of band and technology mix deployed, as has already been done in the recent auctions.

e. We would also like to state that since, under M&A guidelines, spectrum will be acquired on a market based price, imposition of any further or additional price for spectrum is not warranted and any contemplation of the same, will discourage M&A and deter market based consolidation.

f. We also submit for the need to ensure that the substantial equity clause does not hinder the process of M&A. Any M&A activity would necessarily involve a transient equity holding in two entities within same service area, before the actual merger. This transient period needs to be acknowledged as part of M&A process.

g. The present M&A guidelines are limited to CMTS/UASL operators. As the ISPs are also holding the BWA spectrum now, clarity needs to be given on applicable terms & conditions if:

   i. One ISP acquires another ISP with BWA spectrum
   ii. One UASL operator acquires an ISP with BWA spectrum
   iii. One ISP with BWA spectrum acquires a UASL operator

We submit that this aspect also needs to be covered while finalizing the new M&A guidelines.

3. CHANGE IN OWNERSHIP OF SPECTRUM

a. The present policy of the government aims at providing M&A guidelines for merger of two entities along with the spectrum they have been allocated. However, there is no exit route available to an operator, having spectrum in multiple bands, to exit from business for the services which can be provided through a specific spectrum due to techno-commercial reasons.

b. For instance, at present if an entity having both 3G and BWA spectrum, allocated via auction, intends to exit from either BWA or 3G business, the only option available to it is to get merged/ acquired with its entire 3G and BWA spectrum or surrender the specified spectrum and forgo all investments made thereof.

c. In the changed telecom scenario where operators are allocated spectrum in multiple bands, there may be a situation where the entity may not find it viable to continue with any spectrum band, say 3G or BWA, due to techno-commercial reasons; however it would like to continue with its other networks, then the policy should allow the entity to sell off its 3G or BWA spectrum along with the relevant assets to another entity. Thus change in ownership of such spectrum should be permissible.

d. We would therefore submit that a change in ownership of spectrum be allowed, thus permitting the transfer of spectrum (allocated via auction) along with assets either directly or through the process of demerger/ merger under the M&A policy so that M&A can take place for different spectrum bands separately between two licensed operators without anyone losing its license and spectrum in other bands.

4. Spectrum Sharing

a. We believe that spectrum sharing should be allowed between operators having UASL/CMTS/UL (between 2 or 3 operators). Spectrum sharing will be economically feasible when the entire spectrum with the concerned operators is allowed to be shared in a service area. This will prove to be extremely beneficial for the consumers of that area as operators will be able to provide better quality of service to the customers. It will also lead to efficient utilization of scarce resource – spectrum. Spectrum sharing will enable more revenue for the operators as they will be able to cater to more subscribers, which in turn will increase revenues for the Government.

b. However, the current norms for spectrum sharing are designed to discourage/ deter rather than encourage such transactions. We believe that the spectrum sharing norms need to be reviewed especially the provision that spectrum usage charges be paid individually by both operators on their combined spectrum. There should also not be any other fee or price charged for spectrum post sharing. We believe that this will act as a disincentive for the operators to share spectrum and hence the benefits of spectrum sharing envisaged in the above paragraph will be lost.

c. We earnestly request that this be reviewed and submit that operators should pay the spectrum usage charges only on the spectrum held individually by them. This will provide maximum benefit of spectrum sharing and anyways, the operators will be individually responsible for their roll-out and QoS obligations. We believe that our suggestion that SUC be paid as a flat fee/MHz will address this concern.

d. We also strongly recommend that the period of spectrum sharing should be left to the mutual negotiations between the operators sharing the spectrum.

5. Compensation for the TSPs who participate in the last auction

The Authority has rightfully summarized in Para 1.35 and Para 1.38 of the current consultation paper, that the two auctions held in Nov 2012 and March 2013 were not successful. The Authority has also acknowledged that these auction were “distress purchases” rather than genuine price discovery. Hence, we recommend that in case the present auction determined price is at a level lower than the auction determined price of 2012/ 2013, then the TSPs who participated in the auctions held in November 2012 and March 2013 should be adequately compensated. This will be consistent with the principles of natural justice and level playing field.

6. Unlocking 3G Spectrum Availability

a) DoT and the Ministry of Defence (MoD) have agreed to equally share 300 MHz in the 1700-2000 MHz spectrum band. We understand that under this agreement the usage plan for the DoT’s share of 150 MHz is :–

i. 20 MHz in 2.1 GHz band is currently in use for 3G service.
ii. 15 MHz in 1900 MHz band is lying unused and reserved for refarming of 800 MHz band.

iii. 110 MHz in 1800 MHz band is currently in use for 2G GSM services.

b) In this regard, we have suggested a more realistic sharing of this band so that it becomes useful for all the stakeholders including Defence and the Indian telecom industry vide our letter No. RSM/COAI/2013/033 dated February 15, 2013. We have suggested the following as DoT's revised usage for its 150 MHz share:

i. 2x55 (110) MHz for GSM 1800 MHz band
ii. 40 MHz for 3G HSPA in 2100 MHz band (of which 20 MHz has already been auctioned)

c) The proposed solution will give DoT additional bonus of leveraging an additional 15MHz of the 3G band, which falls in the downlink 2110-2170 MHz and is beyond the scope of sharing agreement.

d) The MoD should have no objection to this scheme since the DoT's demand for 15 MHz in lieu of 2x7.5 MHz of the US PCS band will keep undisturbed the150 MHz cap agreed between them. The OFC network currently being executed for the MoD will be ready long before the CDMA licenses fall due for extension in next 10 years. This will enable the MoD to release additional spectrum for refarming of 800 MHz band, if at all this is ever needed.

e) Our nation is broadband starved and the proposed step is a win-win for every stakeholder and for every Indian. India is literally at the broadband crossroad. The right direction will provide immeasurable societal benefits for decades. Equally, the wrong turn will cause incalculable damage.

****

Annexure - 1

in MHz

S. No.	LSA	No. of Carriers Assigned*	No. of Operators except PSUs	Amount of spectrum assigned in CDMA	Spectrum left for auction	Spectrum surrendered by M/s TTSL (*)	Spectrum left for auction in EGSM post considering spectrum surrendered by TTSL (**)	Spectrum in excess of SLC (Reliance)	Spectrum left for auction post considering spectrum surrendred by Tata & Spectrum in excess of SLC by Reliance
1	Delhi	11	3.00	15.71	4.29	1.25	5.54	-	5.54
2	Mumbai	8	2.00	11.42	8.58	1.25	9.83	-	9.83
3	Kolkata	10	3.00	14.48	5.52	1.25	6.77	1.25	8.02
4	Maharashtra	8	2.00	11.42	8.58	2.50	10.00	1.25	10.00
5	Gujarat	9	3.00	13.25	6.75	1.25	8.00	-	8.00
6	AP	7	2.00	10.19	9.81	2.50	10.00	1.25	10.00
7	Karnataka	10	3.00	14.48	5.52	1.25	6.77	1.25	8.02
8	Tamil Nadu	9	3.00	13.25	6.75	1.25	8.00	1.25	9.25
9	Kerala	10	3.00	14.48	5.52	1.25	6.77	1.25	8.02
10	Punjab	8	3.00	12.02	7.98	1.25	9.23	1.25	10.00
11	Haryana	6	2.00	8.96	11.04	2.50	10.00	1.25	10.00
12	UP - West	10	3.00	14.48	5.52	1.25	6.77	1.25	8.02
13	UP - East	7	2.00	10.19	9.81	1.25	10.00	1.25	10.00
14	Rajasthan	10	3.00	14.48	5.52	1.25	6.77	-	6.77
15	M.P.	6	2.00	8.96	11.04	-	10.00	1.25	10.00
16	West Bengal	8	3.00	12.02	7.98	-	7.98	-	7.98
17	H.P.	4	2.00	6.50	13.50	-	10.00	-	10.00
18	Bihar	7	2.00	10.19	9.81	1.25	10.00	1.25	10.00
19	Orissa	5	2.00	7.73	12.27	-	10.00	1.25	10.00
20	Assam	4	2.00	6.50	13.50	-	10.00	-	10.00
21	North East	4	2.00	6.50	13.50	-	10.00	-	10.00
22	J&K	4	2+ Defence	7.10	12.90	-	10.00	-	10.00
Total				244.31	195.69	22.50	192.43	16.25	199.45

(*) M/s TTSL has reportedly surrendered 1.25 MHz in 800 MHz band in 12 circles and 2.5 MHz in 3 circles

(**) This does not include the excess 800 MHz spectrum being held by other operators in excess of their eligibility on Subscriber Linked Criterion

TRAI spectrum pricing consultation paper
Response document

14 August 2013

Our guidance

This paper has been prepared by PwC India on behalf of the Cellular Operators' Association of India (COAI), in response to the Telecom Regulatory Authority of India's (TRAI's) Consultation Paper on "Valuation and Reserve Price of Spectrum" dated 23 July 2013,issued to the telecommunications industry as well as other parties with interest in spectrum pricing in India. The questions raised by TRAI are pertinent topics, which merit detailed consideration in order to ensure that appropriate solutions are adopted in the best interests of the Indian telecom sector, the government, and most importantly, the end users of telecommunications services in India.

We believe that the key objective of the TRAI consultation paper is to determine the appropriate spectrum auction reserve price in order to ensure the successful execution of the auction (that is, all spectrum put up for auction is sold in a free, fair and a transparent manner). To achieve this objective, TRAI is attempting to navigate through myriad potential approaches in order to arrive at a reasonable approach to value spectrum, which is fair as well as practical (that is, valuation may be estimated with reasonably robust data). We recognise that any single approach will have drawbacks or limitations, since the attempt is to value a commodity against unknown future uses. In our response document, we discuss the various approaches out forward while addressing the set of questions put forth by TRAI in its consultation paper.

Mohammad Chowdhury

Executive Director and Telecom, Media and Technology Industry Leader

PwC India

Table of contents

1 Indexation on the basis of 3G auction prices

TRAI CP Q No.9*: Would it be appropriate to use prices obtained in the auction of 3G spectrum as the basis for the valuation in 2013? In case the prices obtained in the auction of 3G spectrum are to be used as the basis, what qualifications would be necessary?*

We believe that the auction-determined prices obtained in the 3G spectrum auction do not provide an appropriate basis for the valuation of the 1800 MHz spectrum in 2013. The reasons are as follows:

A. The key price drivers for the 3G auction in 2010 were specific to that auction and are not applicable to the proposed 1800 MHz auction
B. The auction price in the 2.1 GHz auction in India was higher as compared to international benchmarks for similar auctions in the 2.1 GHz spectrum band
C. Deteriorating financial performance of the Indian telecom sector since 2010 means operators have limited the operators' ability to pay
D. The decline in India's growth outlook between 2010 and 2013 has dampened the sector outlook as well as investor sentiment.

1.1 *3G auction price drivers are not applicable for proposed 1800 MHz auctions*

1.1.1 Spectrum scarcity led to hyper-competitive bidding: Compared to the high demand for spectrum, there was a significant supply constraint, with only 15 to 20 MHz of spectrum made available per LSA across 10 to 12 operators as well as potential new entrants**.**

1.1.2 Operators had a fear of being left out: The lack of clarity over future spectrum availability for 3G services also compounded the operators' fear that failure to buy spectrum in this auction can prevent them from offering high-speed data services in the foreseeable future. This resulted in skewed bidding strategies of the operators towards a 'must-get spectrum' tactic for premium LSAs.

1.1.3 The auctions commanded a significant first-mover advantage: Only a limited amount of spectrum was being auctioned, and at that time, the Government did not communicate the time-frame when further spectrum would be made available. Therefore, the winners of the auction were expected to gain a first-mover advantage in the lucrative mobile data segment, which could give them a several-year head start over competition.

1.1.4 Significant premiums were paid to protect the existing revenue base: The 3G auctions held in 2010 heralded the introduction of an exciting new technology for the telecom sector, offering the potential of high-speed data on the move. Prior to these auctions, the Indian telecom sector was largely a voice-driven market, and 3G spectrum was anticipated to act as the future growth engine for the industry. The auction participants expected that 3G users would pay a premium for high- speed data offerings.

1.1.5 Lack of visibility on spectrum availability in the 1800 MHz band fuelled higher bidding in the 2.1 GHz auction: Some operators were already facing congestion in some of their LSAs and at the same time could not foresee when further spectrum suitable for carrying voice traffic would be made available. This forced them to bid higher prices for 2.1 GHz to support expected voice growth.

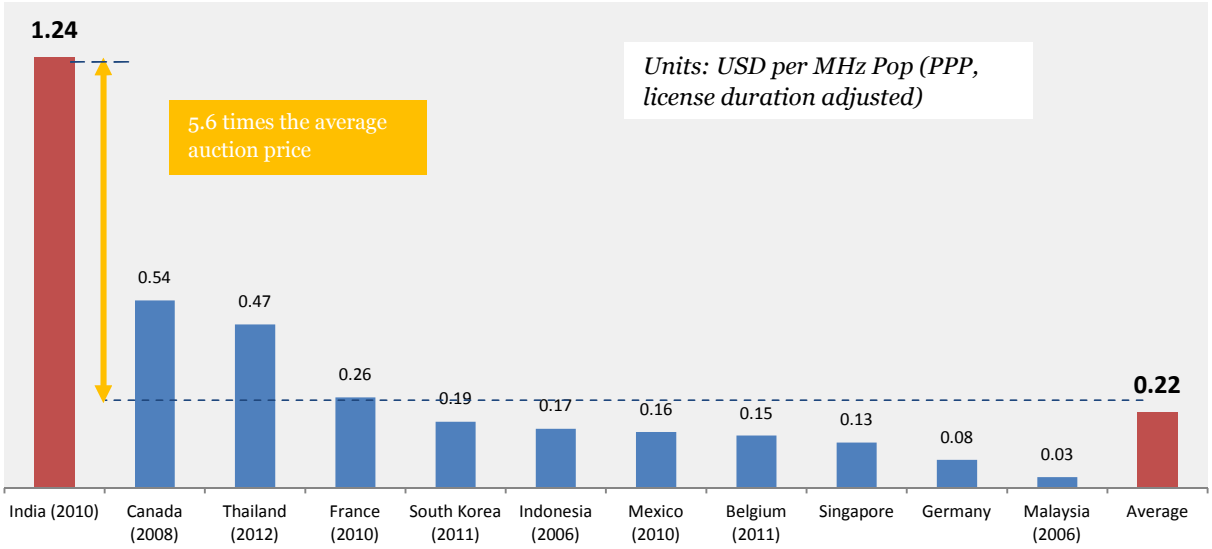
Due to these factors, some bidders were willing to pay a significant premium in order to attract high end ARPU customers towards their network, while other bidders were forced to bid at these prices in order to protect their existing revenue base.

Since none of the above mentioned drivers are applicable for the forthcoming auctions, deriving the spectrum valuation on the basis of 3G auctions will be inappropriate.

1.2 The auction price in the 2.1 GHz auction in India was higher as compared to international benchmarks

1.2.1 Compared to the auction price of the 2.1 GHz spectrum band in other countries, Indian operators paid over **5.6 times** the average price per MHz on a per capita basis. In the light of the above factors, this is not surprising. However, when Indian auction outcomes are compared to those of the more developed markets of the world, the numbers are startlingly high.

Figure 1: India 2.1 GHz auction price were significantly high as compared to the auction prices in other countries

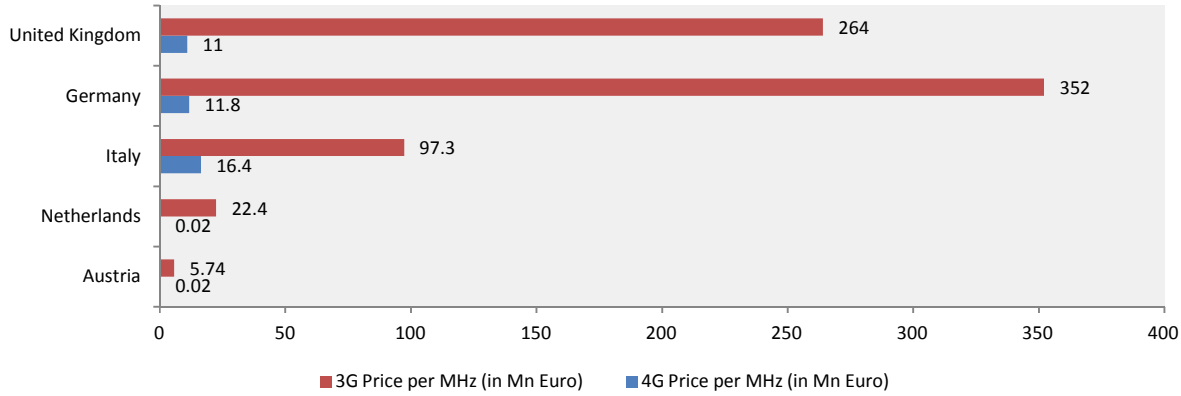


Source: Global research

Figure 1 illustrates how auction participants in India overpaid compared to other countries.

1.2.2 We have also observed that operators tend to overpay when 3G spectrum bands are put up for auction for the first time. This can be corroborated from the 3G auction experiences held in other developed economies in the early 2000s. For example, operators in Germany and the UK paid 35 billion USD and 46 billion USD in 2000 for 3G spectrum respectively. In contrast, in the recent 4G auctions held in Germany and the UK, the spectrum was sold at 3.6 billion USD (in 2010) and 5.7 billion USD (in 2013) respectively. This is illustrated in the figure below.

Figure 2: Significantly high auction prices paid by operators for 3G spectrum as compared to 4G in other countries (auction price per MHz)

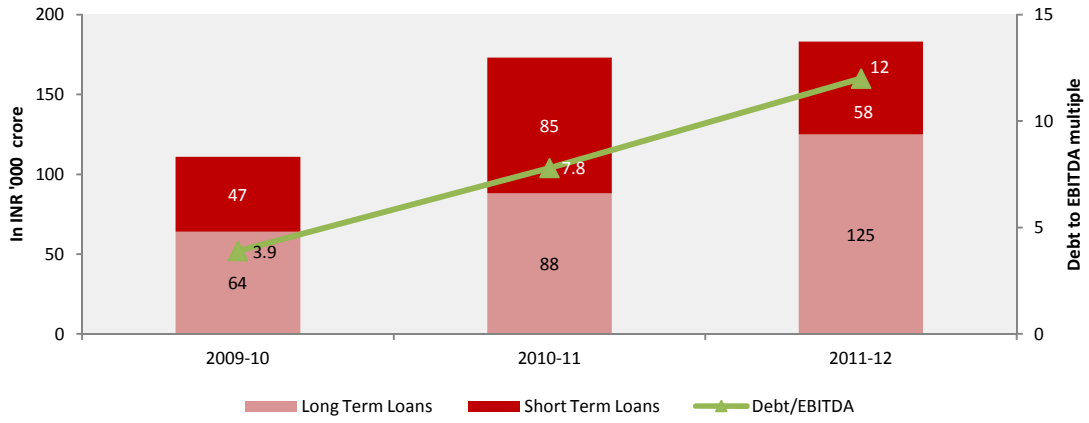


Source: Global Research services and PwC research

1.3 *Deteriorating financial performance of the telecom sector since 2010*

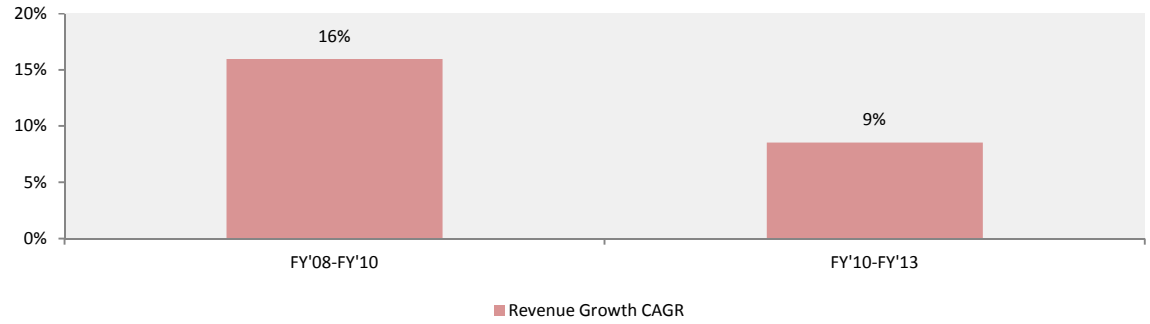
Since 2010, the industry financial parameters have worsened due to higher debt levels, declining profitability and a sharp slowdown in revenue growth. The industry debt burden has gone up by 147% since 2010 with the industry debt to EBITDA multiples rising to 12x due to significant funding needed by operators in order to afford spectrum as well as network expansion. This compares to a general acceptance of a 3x debt to EBITDA margin, representing an acceptable debt exposure to lenders. The majority of spectrum investments made by operators have been funded through debt. In the current debt-burdened scenario, it will be increasingly difficult for operators to raise further debt for acquiring spectrum, and this factor points against ambitious or high reserve prices.

Figure 3: Increasing debt burden on the industry and debt and EBITDA multiple



Source: TRAI consultation paper, July 2013

Figure 4: Declining industry revenue growth



Source: TRAI and PwC analysis

As is evident from the above figures, the deteriorating financial performance of the Indian telecom sector has limited the operator's ability to pay the high 3G like premium paid in 2010 for current spectrum auction.

1.4 The decline in India's growth outlook between 2010 and 2013

1.4.1 The outlook of the Indian economy leading up to the 2010 auction was consistently higher and positive in nature, whereas currently, the outlook is significantly different, both in terms of the lower GDP growth rate as well as the expected high inflation.

The outlook was positive in 2010…

1.4.2 The Indian economy registered an average growth rate of 8% year-on-year, starting from 2003 up to 2010. Back in 2010, analysts predicted that this strong growth trend of the Indian economy was expected to continue over the coming years. At that time, out of all major emerging market economies, only China had a stronger outlook than India.

…whereas the outlook in 2013 is downbeat

1.4.3 Today, however, perspective on the future of the Indian economy is much more negative. At present, the Indian economic growth rate has come down to a decade low of 4.8% in the quarter ending March 2013.

Despite depressed expected demand, going forward, inflation is expected to be higher, as compared to what was expected in 2010, partly fuelled by the import price inflation due to the weakening of the Indian rupee. The Year 5 CPI outlook is 6.7% today, whereas it was only 4% in 2010.

Figure 5: GDP growth outlook in 2010 and 2013

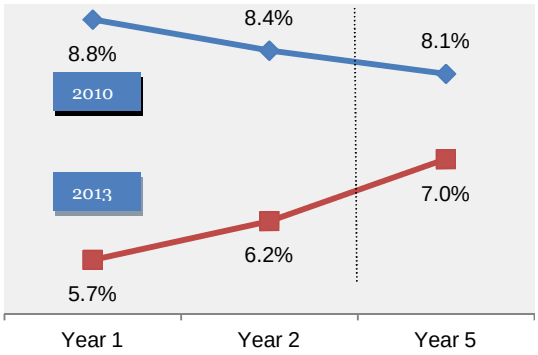
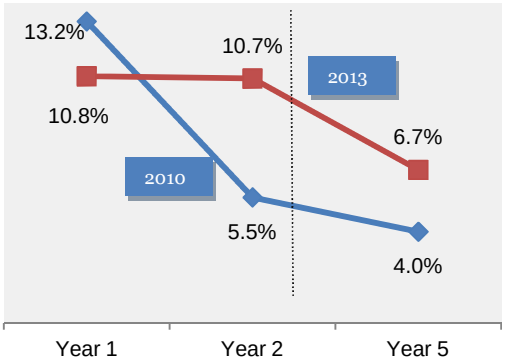


Figure 6: CPI outlook in 2010 and 2013



Source: IMF World Economic Forecast, April 2010 and April 2013

The figures above clearly indicate a significant deterioration in India's growth outlook between 2010 and 2013.

We have already witnessed two failed auctions, where the reserve prices were artificially linked to the 3G auction prices. To avoid a reiteration of a similar failure in the forthcoming auctions, we recommend the reserve prices to be decoupled from the 3G auction prices.

***Recommendation*:** Besides the above discussed points, according to the TRAI consultation paper, comparing the 3G band and 900, 1800 or 800 MHz bands is akin to comparing apples and oranges, **and hence the approach suggested by TRAI of using the 3G auction prices as the basis for the forthcoming auctions is fallible.**

2 *Top-down versus bottom-up approach for spectrum valuation*

TRAI CP Q No.10: *Should the value of spectrum for individual LSA be derived in a top-down manner starting with pan-India valuation or should valuation of spectrum for each LSA be done individually?*

Significant inter-circle differences in terms of macroeconomic, socio-economic as well as telecom parameters necessitate a distinct business case for each LSA. Since the Department of Telecommunications (DoT) also issues licences on an LSA basis, we recommend that it will be best to follow a 'bottom-up' approach in order to ensure that the objectives of the buyers (the operators) as well as the seller (the Government) are well- aligned.

2.1 *Macro and socio-economic differences across LSAs*

Large variations in key macroeconomic factors lead to a differing business case by LSA. Not only do revenue drivers such as population, tastes and affordability, population growth rate, per cent of rural population and per capita income and distribution vary significantly, even the cost-to-serve varies by LSA, due to factors such as population density, labour costs, local governance issues and availability and topography.

Table 1: Key macroeconomic indicators across LSAs in macroeconomic profile (2012)

LSA	Population (in mn)	Population density (people per sq km)	Per capita income (INR)	Rural population of the total population (%)
Kerala	35	961	83,725	52%
Madhya Pradesh	100	235	41,167	72%
Punjab	29	624	78,171	63%
Rajasthan	70	214	42,434	75%
UP (West)	90	828	NA	~73%
UP (East)	125	828	NA	~77%
Assam	32	421	33,633	86%
Bihar	139	802	27,681	88%
Himachal Pradesh	7	132	73,608	90%
Jammu & Kashmir	13	57	41,833	73%
North East	14	NA	NA	NA
Orissa	42	282	46,150	83%

Source: CSO survey, Census 2011 and Indiafacts

2.2 From an economic perspective, India's LSAs are as different, as many countries of the world differ from one other. Applying a 'one-size-fits-all' approach to pricing spectrum will be as inappropriate, as applying consistent prices for spectrum across certain countries in Europe and Africa.

Table 2: Each LSA in India is comparable to a different nation in the world

LSA	Population	GDP	GDP per capita
Delhi	Romania	Guinea	St Vincent
Andhra Pradesh	Ethiopa	Slovakia	Nicaragua
Gujarat	United Kingdom	Angola	Congo-Brazzaville
Karnataka	Italy	Croatia	Philippines
Maharashtra (including Mumbai)	Philippines	Singapore	Sri Lanka
Tamil Nadu	Turkey	Angola	Mongolia
West Bengal (including Kolkata)	Democratic Republic of Congo	Angola	Ghana
Haryana	Ghana	Serbia	Armenia
Kerala	Canada	Tunisia	Papua New Guinea
Madhya Pradesh	Philippines	Guatemala and Ivory Coast together	Benin
Punjab	Venezuela	Tunisia	Fiji
Rajasthan	Democratic Republic of Congo	Dominican Republic	Sudan
UP (West)	Brazil	Qatar and Mozambique together	Kenya
UP (East)			
Assam	Peru	Bolivia	Tajikistan
Bihar	Russia	Bosnia and Uzbekistan together	Eritrea
Himachal Pradesh	Hong Kong	Mauritius	Honduras
Jammu & Kashmir	Zimbabwe	Bahamas	Gambia
North East	Malawi	-	-
Orissa	Argentina	Uruguay	Sudan

Source: The Economist

2.3 *Difference in telecom operations across LSAs*

The maturity of the telecom market varies significantly by LSAs, to the extent that India represents the equivalent of continental differences in standard telecoms metrics. Factors such as tele-density and ARPU reflect the contrast in the future revenue growth potential in India. On the other hand, factors such as Average Cost per User (ACPU) and EBITDA margin depict the variation in business conditions as well as business cases by LSA.

Table 3: Distinction between the LSAs in terms of telecom operations (2011-12)

LSA	Tele-density (%)	Spectrum availability per mn population	ARPU (INR)	ACPU (INR)	EBITDA Margins (%)
Delhi	225	4.3	117	128	18
Mumbai	192	5.0	132	186	-7.5
Kolkata	170	6.7	80	108	-6
Andhra Pradesh	74	1.2	106	106	21
Gujarat	82	1.3	86	101	5.4
Karnataka	88	1.6	101	119	8.7
Maharashtra	89	1.2	93	100	17
Tamil Nadu	106	1.3	98	111	15
West Bengal	72	3.3	64	81	-3
Haryana	83	3.0	71	95	-9.5
Kerala	100	1.0	113	116	16
Madhya Pradesh	49	2.7	72	88	0.3
Punjab	104	0.9	93	104	12
Rajasthan	65	0.6	82	88	12
UP (West)	53	0.9	72	94	-5
UP (East)	53	1.3	74	81	9
Assam	39	2.4	112	127	7.6
Bihar	42	0.6	68	85	-2.5
Himachal Pradesh	111	11.1	71	86	8.5

LSA	Tele-density (%)	Spectrum availability per mn population	ARPU (INR)	ACPU (INR)	EBITDA Margins (%)
Jammu & Kashmir	51	4.5	138	171	3.3
North East	57	5.4	110	116	17
Orissa	56	2.2	70	94	-8.5

Source: TRAI consultation paper on 'Valuation and Reserve Price of Spectrum'

As indicated in the TRAI consultation paper (para 3.33), each LSA represents a unique business case. Attempting to work out a pan- India approach to spectrum valuation will be difficult and fraught with the risk of error. An LSA level approach to valuation of spectrum can factor in special characteristics of the market in each LSA.

***Recommendation*: Given the variations, we strongly recommend the use of a bottom-up approach to value the spectrum.**

3 *Indexation to the 2001 spectrum auction prices*

TRAI CP Q No. 11*: Is indexation of 2001 prices of 1800 MHz spectrum an appropriate method for valuing spectrum in 2013? If yes, what is the indexation factor that should be used?*

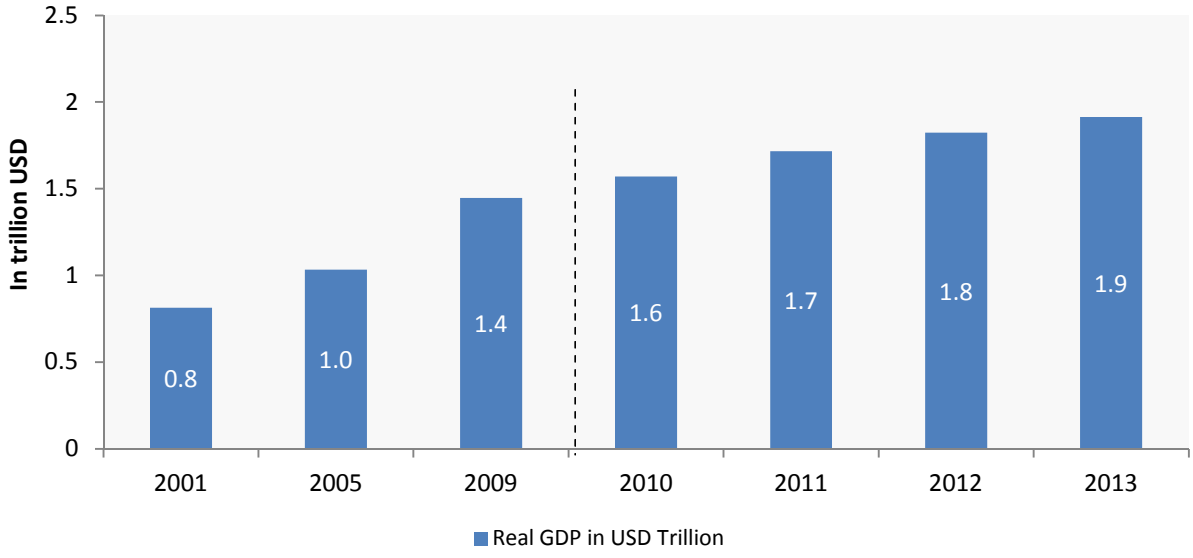
We believe that indexation of the 2001 prices of 1800 MHz does not offer an appropriate base to value the spectrum in 2013. The reasons are as follows:

An indexation approach for deriving the value of a product or service is most reliable when the only factor used for adjustment has changed during the same time period, while all other factors have largely remained constant. There have been significant fundamental changes within the economy as well as the telecom sector in India, rendering the application of indexation approach inapplicable in the current context. However, if the right indexation factor reflecting the changes that have occurred over the period can be arrived at, then indexation as an approach can be explored for valuation of spectrum.

3.1 Changes in the economic scenario between the two auctions of 2001 versus 2013

3.1.1 In our opinion, given the rapid rate of change of India as an emerging economy, the time difference of 12 years is far too huge for two spectrum auctions to be compared on a like-for-like basis.

Figure 7: India's GDP has grown more than two-fold over the last decade at a CAGR of 7.4%



Source: Planning Commission report

3.2 Changes in the telecom sector outlook between the two auctions

3.2.1 While the economic change between 2001 till 2013 indicates a much stronger attainment, the telecom opportunity as compared between 2001 to the present day scenario indicates a far more saturated market, with greater competitive intensity. The telecom sector has grown substantially since 2001, primarily driven by factors such as increasing geographic coverage and greater affordability, making telecom services far more accessible to the larger populace. As a result, unmet demand for telecom services (at least voice services) is far less than it was over a decade ago. Today, 90% of the Indian population is covered by telecom operators as compared to less than 20% back in 2001. Wireless services penetration has also grown from under 1% in 2001 to 71% today.

3.2.2 Since 2001, the competitive intensity of the market has also changed significantly. Today, we have eight to 10 market participants as compared to two to three players at the time of the 2001 auctions. Therefore, while the outlook in 2001 was for significant growth in an almost virgin sector, with strong signs of unmet demand, today, the outlook is for a more measured growth amongst a well-saturated industry, with more players fighting it out for a market share.

Figure 8: Wireless tele-density has crossed 70% and expected to witness slower growth going forward

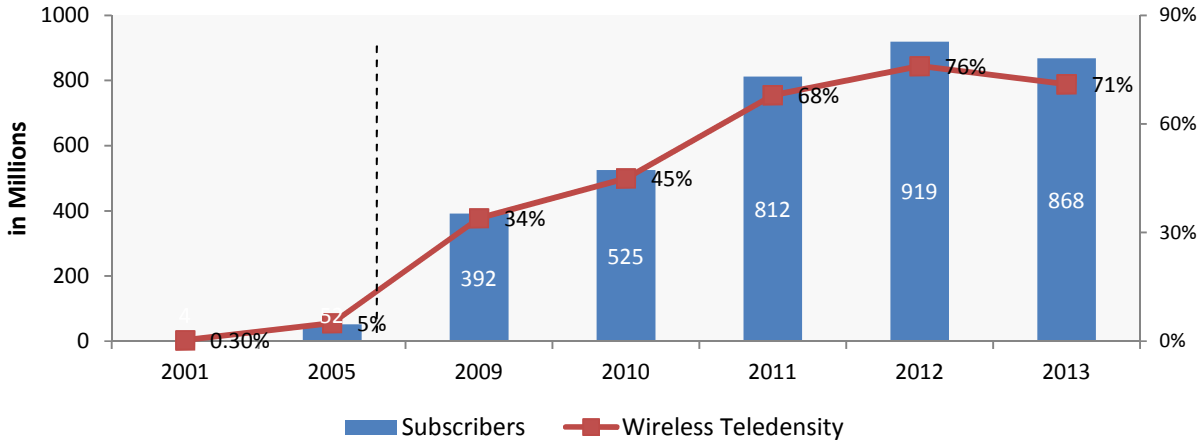


Table 4: Change in the market potential of the wireless industry between the two auctions

	2001	2013	Similarity with current auction scenario
Potentially available market size	99.66%*	29%*	X
Competitive intensity in LSAs	Low	High	X

	2001	2013	Similarity with current auction scenario
Potential geography coverage availability	~80%	~10%	X
Growth potential	High-growth potential	Voice-driven growth saturated, data-driven growth but at a much lower profitability	X

**Assuming 100% population penetration is the total addressable market size*

***Recommendation*: Based on the above discussion, we believe that the approach suggested by TRAI of determining the spectrum value in 2013 on the basis of previous auction determined prices is fallible.** This view is also shared in the TRAI's consultation paper, where it is stated that indexing may be good for measuring valuations over a shorter time period, not over a long-haul as it will not be reflective of all the changes that have occurred in the intervening period.

4 Valuation of unsold spectrum based on the November 2012 and March 2013 auctions

***TRAI CP Q No.12**: Should the value of spectrum in the areas where spectrum was not sold in the latest auctions of November 2012 and March 2013 be estimated by correlating the sale prices achieved in similar LSAs with known relevant variables? Can multiple regression analysis be used for this purpose?*

We believe that the spectrum value in unsold LSAs should not be estimated by correlating the last two auction sale prices because there was no real market price discovery in the 1800 MHz auctions during November 2012 and March 2013. Our reasoning is as follows:

A. The operators whose licences were cancelled were forced to buy spectrum at the set reserve price to continue operations. Few operators scaled down their operations to limited number of LSA and bought spectrum in only few LSAs to ensure negligible net cash outflow.
B. Despite the forced buying, there was no market clearance for the auctioned spectrum at the set reserve price with 76% of the spectrum offered (in value terms) remaining unsold.
C. As 95% of the spectrum was sold at exactly the reserve price, it depicts that there was no price discovery.

Since there was no price discovery in the last auctions, using this as a basis to arrive at the coefficients of the multiple regression would be inappropriate and inaccurate.

4.1 Operators forced to buy spectrum to continue operations

4.1.1 The November 2012 and March 2013 auctions were held after the cancellation of licences by the Supreme Court judgment in February 2012. Post the judgment, while legal options were pursued and considered, the operators whose licences were quashed had two options to continue operations:

A. Purchase rights to use spectrum in the November 2012 auction.
B. Exit the India market and forgo the licence fees already paid to the government.

Hence, the price at which spectrum was bought is not reflective of the operator's willingness to pay for it based on any cash flow-based business case. About 75% of the spectrum lots (87% in value terms) were bought by operators obligated to do so in order to continue operations.

Table 5: Percentage of spectrum sold vs spectrum bought to continue operations in November 2012 auctions

LSA	Spectrum value unsold as a % of spectrum value put on auction (%)	Spectrum value paid to continue operations as a % of total sold spectrum value(%)
Delhi	100	None
Mumbai	100	None
Kolkata	64	100
Andhra Pradesh	64	100
Gujarat	27	100
Karnataka	100	None
Maharashtra	55	80
Tamil Nadu	64	100
West Bengal	36	71
Haryana	45	67
Kerala	91	0

LSA	Spectrum value unsold as a % of spectrum value put on auction (%)	Spectrum value paid to continue operations as a % of total sold spectrum value(%)
Madhya Pradesh	45	67
Punjab	91	0
Rajasthan	100	None
UP (west)	9	80
UP (east)	18	89
Assam	36	57
Bihar	0	67
Himachal Pradesh	91	0
Jammu & Kashmir	45	67
North East	45	67
Orissa	45	67
Pan India	**76**	**87**

4.1.2 Additionally, these operators had participated in the auctions to set off the money paid for obtaining licenses initially. Else, these amounts would have been forfeited completely. This resulted in minimal cash inflow for the exchequer. Hence, we believe it reasonable to conclude that much of the participation in the November 2012 auction was coercive so that certain operators could operate in the market place.

4.2 No market clearance of the 1800 MHz auctioned spectrum at the set reserve price

4.2.1 Seventy-six per cent of the spectrum offered remained unsold in the November 2012 auction while 100% remained unsold in the March 2013 auctions. LSAs with higher spectrum price per MHz per capita received lower participation, resulting in a higher unsold value in such LSAs.

4.2.2 Ninety five per cent of the spectrum bought in the November 2012 auction was sold at exactly the base price. With the sole exception of Bihar, where the spectrum was sold at a marginal premium, in all other LSAs, spectrum was sold at the base price. This suggests that this was more of an administratively set price rather than a market discovered price.

Table 6: Percentage of spectrum sold vs spectrum bought to continue operations in November 2012 auction

LSA category	Spectrum price in INR per MHz per capita	Spectrum value unsold as a % of spectrum value put on auction (%)	Spectrum value paid to continue operations as a % of total sold spectrum value(%)
Metro	1.93	97	100
Category A	0.28	65	95
Category B	0.07	52	75
Category C	0.03	28	69
Pan India	**0.21**	**76**	**87**

It is evident from the above discussion that the last two auctions failed due to unduly high reserve prices, which were fixed on the basis of the 3G auction prices. As a result of the failed auctions, there was no price discovery in the November 2012 and March 2013 auctions.

In theory, the multiple regression methodology is used to derive robust estimates of market values. However, right basis should be considered for deriving the regression coefficients. Since no price discovery happened during the last auctions in any LSA, using the November 2012 auction prices as the basis to determine the regression coefficients will be inaccurate in estimating the true market spectrum value.

***Recommendation*: Therefore we believe that the approach suggested by TRAI to estimate spectrum value in unsold LSAs by correlating the sale prices achieved in similar LSAs with known relevant variables is fallible.**

5 Producer surplus approach for spectrum valuation

TRAI CP Q No.13: *Should the value of spectrum be assessed on the basis of producer surplus on account of additional spectrum? Please support your response with justification. If you are in favour of this method, please furnish the calculation and relevant data along with results*

We believe that the producer surplus approach is not appropriate for valuing spectrum in the forthcoming 1800 MHz spectrum auction because of the following reasons:

A. The Indian telecom market is relatively heterogeneous.
B. There is no clearly realisable benefit in terms of reduced costs due to the additional spectrum.
C. The producer surplus approach is appropriate only for incremental spectrum valuation to reduce incremental capital and operating cost, while the forthcoming auctions have different objectives.

We discuss the producer surplus approach and then elaborate on each of these three conditions below:

5.1 Relevance of the producer surplus approach for spectrum auctions

In the telecom industry, there is an inverse relationship between the quantum of spectrum used and the expenditure incurred on the radio access network for serving a given level of demand (though subject to a minimum threshold of the spectrum and the network build). Thus in theory it should be possible to derive an incremental spectrum value by calculating the cost saving on building and operating the network due to the additional spectrum bought. This can be done by deriving the net present value of reduced capital and operating expenditure on the network over a period of years (e.g. 20 years). .

5.2 The Indian telecom market is relatively heterogeneous

Homogeneity is essential since the producer surplus calculations are based on network cost reduction estimates for a generic operator which will have to apply consistently across all operators. However, we see India's LSAs differ significantly (as described in section 1.2).

The Indian market is also varied due to the following reasons:
A. The geography and demographics within an LSA
B. Subscriber density and patterns of demand and usage (data, voice)
C. Relative customer and revenue market shares of players
D. Quantum of spectrum holding of each player

Therefore, it will be unworkable for any particular producer surplus calculation to be applied to the whole Indian telecom market, or to all the players in it.

5.3 No clearly realisable benefit in terms of reduced costs due to the additional spectrum

5.3.1 As a theoretical approach, the producer surplus function is useful in instances where the factors of production can actually be substituted to derive benefit. This is more often the case in a factory production environment where labour and capital (not usually land, the third factor) can be interchanged over a period of time particularly where labour markets are fluid and manufacturers have flexibility over their production supply chain and the amount of machinery they hold in their own factories – flexibility which allows them to adjust labour and automation up or down over a relatively short period of time.

5.3.2 We do not believe this condition applies as well in case of Indian telecom as it might in other industries, since in most LSAs operators already have live and evolved networks (some very mature) where arbitrage of network against spectrum will be practically infeasible since it requires operators to dismantle existing networks.

5.4 The producer surplus approach is appropriate only for incremental spectrum valuation to reduce future capital and operating cost, while the forthcoming auctions have different objectives

5.4.1 The producer surplus approach for calculating spectrum value is suited only for the incremental spectrum sale since it values incremental spectrum against substitution of network marginal costs. The approach, in principle relies on deriving the incremental cost savings for an operator when it gains an additional 1 MHz of the spectrum. As the objective of all proposed auction participants is not to reduce costs by replacing BTS sites with additional spectrum holding, any costing based on producer surplus approach will not be reflective of the true market scenario. For example, the approach will not apply to cases when an entrant is looking to enter the market or to determine market-linked pricing for licence extension.

***Recommendation*: Due to the above three points discussed, the producer surplus approach suggested by TRAI is fallible.**

6 The production function approach for spectrum valuation

TRAI CP Q No. 14*: Should the value of spectrum in the 1800 MHz band be derived by estimating a production function on the assumption that spectrum and BTS are substitutable resources? Please support your response with justification. If you are in favour of this method, please furnish the calculation and relevant data along with results.*

We believe that the production function is not appropriate for deriving the spectrum value for the forthcoming auctions because of the following reasons:

A. There is no complete substitutability of the two factor inputs (spectrum costs and capex)
B. Operators cannot dynamically adjust their spectrum holding at market prices.
C. The output elasticity of the factor inputs is not constant for a particular technology in spectrum pricing context

We discuss the production function approach along with our arguments in further detail below:

6.1 Relevance of the production function approach for spectrum auctions

The production function relies on the primary assumption that factor inputs (labour and capital) are substitutable resources and the mix can be dynamically adjusted based on the current incremental costs. Typically this approach has found relevance in the manufacturing and production industry. In the context of telecom spectrum pricing, the production function approach based on the Cobb-Douglas function, quantum of spectrum and Base Transceiver Stations (BTS) are the two factor inputs and mobile traffic (minutes of network) is the output.

6.2 There is no complete substitutability of the two factor inputs (spectrum costs and capex)

Telecom network planning is driven through a pre-determined estimation of how the projected demand will evolve over a certain period of time. Demand has to be estimated in advance because network engineers should know how large and complex a network the operator requires before they can build. Networks cannot be built to be infinitely and endlessly flexible in terms of geographical reach and capacity to carry volumes of voice and data. For these reasons, investment in the radio access network is largely fixed in nature, with limited flexibility of adjusting the number of BTS sites dynamically.

Similarly, once a network is built, any reduction in existing BTS sites from gaining more spectrum could also jeopardise the stability and quality of the network for the existing subscriber. Further, within an LSA there are usually certain areas that are highly congested and others that are under-utilised. In these congested areas, wherein theory addition of such new BTS sites might be an option compared to additional spectrum purchase, practically setting up such new BTS sites may not be feasible due to difficulties in obtaining rights of way, gaining environmental clearance, land shortage, power supply and citizen activism.

6.3 Operators cannot dynamically adjust their spectrum holding at market prices.

One of the assumptions of the Cobb-Douglas function is that the factor inputs can be adjusted dynamically for a certain level of output and there is no restriction on the availability of any of the factor inputs' supply or tradability. In the case of Indian telecom, this condition does not apply for the following reasons:

A. Spectrum trading is prohibited in India and therefore operators are unable to adjust their spectrum holdings upwards or downwards at will.
B. Operators lack clarity on the quantum of spectrum that might be available in the future.
C. The total quantum of spectrum available for commercial use in each frequency band is fixed, restricting the applicability of the Cobb-Douglas function.

6.4 The output elasticity of the factor inputs is not constant for a particular technology in spectrum pricing context

In India, spectrum is made available to operators in blocks. As the spectrum holding of an operator increases, the capacity does not increase proportionately. This is because incremental spectrum lots are not always contiguous and subject to different interference issues. When spectrum is released in large and contiguous lots, it offers higher capacity.

In addition to the above key points, we also note that the production function approach suggested in the TRAI consultation paper uses 2007-12 panel data to arrive at the co-efficient estimates to determine spectrum value. Any spectrum pricing based on historical data will not accurately reflect future cost savings in a dynamic telecom network. However, our key concern with the Cobb-Douglas function is that the production function as a whole is unworkable in the current Indian spectrum pricing context.

Recommendation: **Due to these above mentioned limitations, TRAI's suggestion of valuing the spectrum in the 1800 MHz band by using the production function approach is fallible.**

7 Alternative valuation approaches

TRAI CP Q No. 15*: Apart from the approaches discussed in the foregoing section, is there any alternate approach for valuation of spectrum that you would suggest? Please support your* ***answer with detailed data and methodology.***

7.1 Discounted cash flow

Discounted Cash Flow (DCF) analysis is the primary and most established method used by businesses, investors and public policy decision makers to project future cash flows on a project or venture, to estimate the stream of profits that could be realized over a period of time, expressed in today's value (the Net Present Value, or NPV). An appropriate discount rate is applied to the forecast cashflows over time to quantify the net present value of these future flows of cash. The value arrived at normally represents the maximum willingness to pay for the opportunity, since paying any amount above that would result in not recovering the additional amount.

DCF analysis is used as a basis for all major investment decisions in the telecoms industry, including for the acquisition of spectrum since it allows investors and operators to determine the upper limit of how much they may wish to pay for access to spectrum over an extended period of time. They also know that any valuation of spectrum higher than their forecast DCF valuation will limit an operator's ability to achieve a reasonable return on its investment. The DCF valuation approach is also used by financial institutions for the same purposes, when they are considering lending to or investing in the acquisition of spectrum to pursue a business opportunity.

Though this approach captures the net present value (NPV) of total business cash flows and can vary based on assumptions used, it **provides guidance on an upper limit** of what might be charged for such spectrum sale.

We have adopted a "full industry value" approach for the valuation of spectrum over 20 years. This entails valuing the spectrum by calculating the net present value (NPV) of total Indian mobile industry cash flows that may be accrued using all available spectrum from the 850, 900 and 1800 MHz bands.. A per MHz value is then derived by dividing the NPV by the total supply of spectrum from within these bands.

To account for inter-circle variances, a bottom up approach is used to calculate separate cash flow projections for each LSA. The LSA spectrum values are then summed together to arrive at a pan-India spectrum value. The approach takes into consideration the demand and supply of spectrum per LSA, and hence appropriately represents the current market scenario in each LSA.

We have developed a model based on the DCF approach to arrive at the valuation of the spectrum for each of the 22 LSAs individually. The key assumptions made are outlined below.

Table 7: Key Assumption Summary (Details are provided in the annexure)

Key Assumptions	Key Factors
Revenue assumptions by circle	Population Growth
	Voice and data subscriber penetration
	Voice and data ARPU
	Voice and data revenue share for relevant spectrum bands (800 MHz, 900 MHz and 1800 MHz)
Operating cost assumptions by circle	Interconnect cost as % to revenue
	Network operating cost as % to revenue
	Personnel cost as % to revenue
	Subscriber acquisition cost per gross addition
	Other operating costs as % to revenue (G&A)
3. **Other assumptions**	Depreciation as % to capital base
	Capex as % to revenue
	Effective tax rate
	Spectrum efficiency multiple for 800/900 to 1800 MHz
	Discounting factor for discounting future cash flows

Reasonable assumptions have been made and are summarized in the **appendix 'A'** at the end of the document.

We believe that the DCF methodology for valuation of spectrum does not suffer from the highlighted flaws of the methodologies discussed earlier. However, while it may be a better analytical tool compared to the other methods discussed, we acknowledge that even the DCF method suffers from the inherent limitations arising from inadequate, inaccurate and erroneous assumption sets and inputs, which might distort the final conclusion. In that respect all models are fallible to some extent. Therefore, particular attention must be paid to evaluate the quality of the inputs/assumptions used.

In order to mitigate some of the acknowledged limitations of the DCF method, we have provided sensitivity analysis to the model output for some of the key assumptions and have provided a range of expected outcome. As, the objective of this exercise is set a base price for the auction, we recommend that Authority should be conservative in estimating the value of spectrum and let market forces determine the true price.

Model Output

The table below provides an output details for All India and a select circle in each circle category.

Table 8: Per MHz residual value in INR Crore

Circle	Spectrum value
Delhi	99
Mumbai	87
Kolkata	26

Circle	Spectrum value
Andhra Pradesh	89
Gujarat	68
Karnataka	78
Maharashtra	77
Tamil Nadu	81

PwC model generated a spectrum valuation of INR 1010 Cr. per MHz for 1800 MHz band for the base scenario considered. The results by LSA are depicted above

Sensitivity to alternative scenarios of market development

To see the results in the context that various outcomes are possible in future, we have considered three scenarios to describe the possible evolution of the market environment:

A. **Base scenario**: this is the most likely scenario to prevail and holds the central assumptions around growth and uptake

B. **Optimistic scenario**: in this scenario we assume growth and uptake will be faster, resulting in higher revenues and therefore higher margins

C. **Conservative scenario**: here we assume a slower uptake of services and weaker revenue growth than in the base case.

In order to account for uncertainties in our assumptions in certain dimensions, we introduce sensitivities along EBITDA:

Factor	Base Case	Optimistic	Conservative
EBITDA in 2034	29%	33%	24%

Table 9: Per MHz residual value in INR Crore

Circle	Base Case	Optimistic	Conservative
Delhi	99	117	81
Mumbai	87	99	74
Kolkata	26	31	22
Andhra Pradesh	89	106	72

Circle	Base Case	Optimistic	Conservative
Gujarat	68	83	54
Karnataka	78	93	63
Maharashtra	77	95	60
Tamil Nadu	81	99	63
Haryana	23	28	19
Kerala	40	47	32
Madhya Pradesh	46	56	35
Punjab	29	37	21
Rajasthan	46	59	33
Uttar Pradesh (East)	49	64	35
Uttar Pradesh (West)	43	53	33
West Bengal	31	39	23
Assam	22	26	17
Bihar	41	53	28
Himachal Pradesh	4	6	3
Jammu & Kashmir	12	16	8
North East	7	10	5
Orissa	11	15	7
Total	1,010	1,230	789

Please refer to the annexure 'A' for detailed calculations and assumptions.

7.2 International comparables

7.2.1 The comparables approach attempts to reflect the operator's willingness to pay for the spectrum in the same frequency band, for similar market conditions in other countries. The comparables approach works on the underlying principle that two goods, services of the same quality sold in the similar time-frame should inherently be valued at the same price.

7.2.2 The advantage of using a comparable approach is that it is based on real market determined prices and hence has fewer assumptions, restricted to a minimal set of standardising parameters. However, it is difficult to accurately mimic inter-country differences with the help of standardising factors as it is improbable to factor in all the spectrum value impacting parameters and their relative impact on the spectrum price. The other hindrance in using the comparable approach is the element of comparability and variation of time. For example, variations over time could reflect a range of factors such as the maturity of the market, stage in the technology lifecycle and the availability of funding. Given the difficulty of controlling for all such factors, the most appropriate course may be to restrict benchmarking derived price as a sense check on the spectrum value and not the precise spectrum value. For this reason we preferably refer to this as a 'comparables' approach rather than formal term of 'benchmarking'.

7.2.3 To ensure that comparables are done for similar transactions, we select an appropriate set of panel data of spectrum auctions that have taken place in the same frequency band and in a recent time period. We have assumed the same panel data as used by the TRAI in its consultation paper as we have found this to be a reasonable set.

7.2.4 We then apply three steps to undertake the comparison:

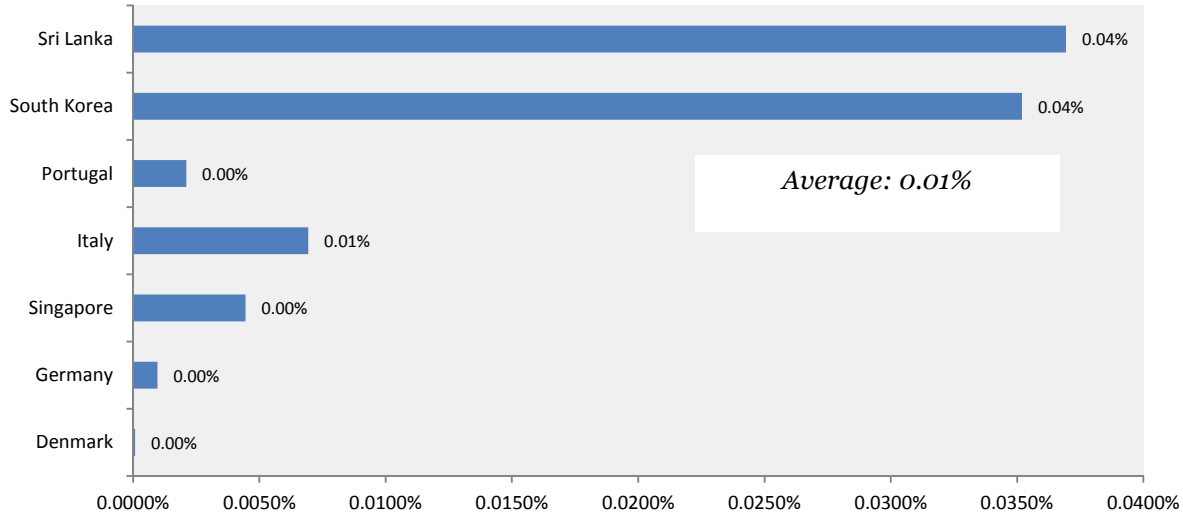
A. **Step 1**: Convert spectrum prices paid in each market to a common unit of USD/MHz of spectrum

B. **Step 2**: Adjust for economic differences between valuing the spectrum in the different markets correcting for affordability, population size and licence duration as below:
   a. *Purchasing power parity (PPP): PPP adjusts for relative purchasing power in different markets and therefore offers a better comparison on affordability than a direct GDP comparison.*
   b. *Population: Higher population indicates larger addressable market opportunity for operators, thereby increasing the value of spectrum to them.*
   c. *Duration of the licence validity: Countries have different licence durations, resulting in different value of the spectrum.*

C. **Step 3:** Determine the average of the comparable prices across the following two dimensions, to improve the comparability further
   a. *ARPU levels: ARPU levels indicate the average telecom spending power by users. Countries with lower ARPU will have a lower valuation of spectrum.*
   b. *GDP per capita: GDP per capita indicates the average spending factor. Countries with lower GDP per capita will have a lower valuation of the spectrum.*

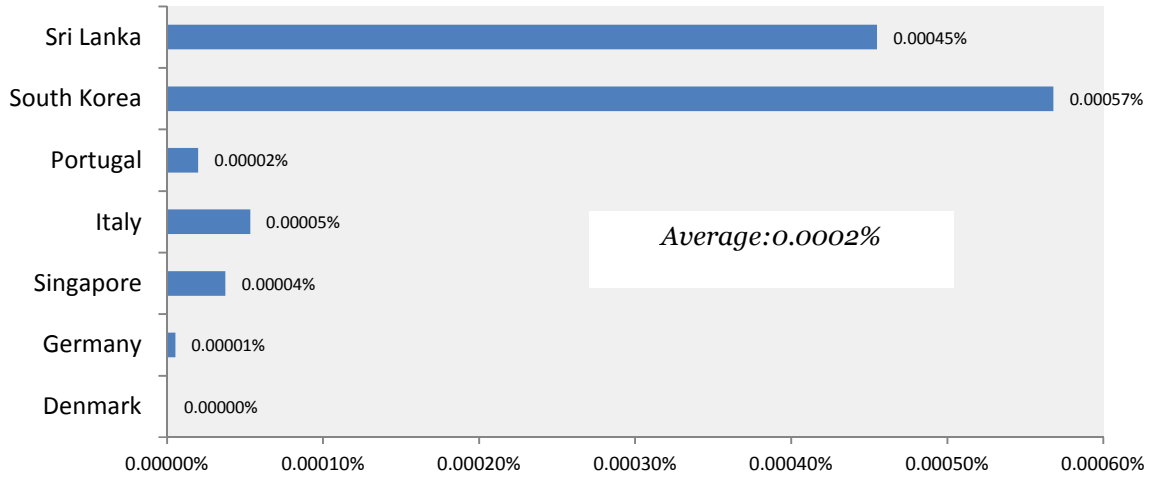
International benchmarking for 1800 MHz (Panel data from TRAI consultation paper)

Figure 9: PPP adjusted auction price/ MHz/ pop/ per annum as a percentage to ARPU



Using the average price discovered for India, 1800 MHz spectrum price is INR 431 crore per MHz

Figure 10: PPP adjusted Auction price/ MHz/ pop/ per annum as % to GDP per capita



Using the average price so discovered for India, 1800 MHz spectrum price is INR 240 crore per MHz

8 Fixing reserve prices for unsold LSAs versus pan India

***TRAI CP Q No.17**: Should the valuation of spectrum and fixing of reserve price in the current exercise be restricted to the unsold LSAs in the 1800 MHz band, or should it apply to all LSAs?*

We have explained in section 4 that there was no discovery of market determined prices in the November 2012 and March 2013 auctions. Since spectrum remained unsold even in the 18 LSAs where spectrum was offered, it is evident that there was no demand from the operators at those prices at that time. Therefore we believe that valuation for any LSA for any auction on the basis of last two auctions might lead to further auction failure. Hence we recommend that not only should the four LSAs but all the other remaining LSAs be valued by the TRAI once again at this point in time.

9 Ratio of reserve price to spectrum value

TRAI CP Q No.19*: What should be the ratio adopted between the reserve price for the auction and the valuation of the spectrum?*

9.1 Auctions are useful when there is uncertainty around the value of the good for sale. As far as setting the reserve prices is concerned, the following are the objectives, in order of preference.

A. Ensure sale
B. Induce participation
C. Determine optimal value
D. Avoid collusion

9.2 Setting reserve prices is typically a conundrum, because if the reserve price is set too high it increases the probability of auction failure, whereas if set too low frivolous bidders can enter the auction. Every failed auction results in missed opportunity for the economy, lower investor interest in the industry, revenue loss to the exchequer and inefficient allocation of spectrum and therefore sensible reserve prices are important.

9.3 Internationally, auction failure was observed in the recent 4G auctions that took place in Australia where some quantum of the spectrum was left unsold. This also resulted in enhancing he competitive gap rather than narrowing it. On the other hand, if the reserve price is set very low, there is an underlying risk of a collusive outcome and likely loss of revenue to the exchequer. The risk of collusive outcome is nullified as the number of operators participating in the auction increases.

9.4 While the entire spectrum was sold in the 2010 auctions, only a portion of it was sold in last two auctions (details explained in section 4). One of the key reasons for the differential outcomes in the three auctions is the different reserve price that was set in the respective auctions. TRAI's consultation document shows that the reserve price across numerous auctions in other countries in the recent past has been set at a ratio of around 0.4-0.5 to the final auction-determined values.

Recommendation: Given that the DCF approach (discussed in section 7) provides an upper limit for spectrum valuation, we recommend this ratio should be further reduced to 0.3.

10 Spectrum usage charging methodology

TRAI CP Q No.18 (a): *Should annual spectrum usage charges be a percentage of AGR or is there a need to adopt some other method for levying spectrum usage charges? If another method is suggested, all details may be furnished.*

10.1 We believe that when spectrum is acquired through an auction mechanism with the fee payable upfront, there should be no requirement for further annual payments beyond specific (and relatively minor) administrative fees because the intrinsic value of spectrum has already been paid in the auction in full.

10.2 Internationally, it has been seen that whenever the price of the spectrum is derived through an auction, the recurring spectrum charge is levied only to recover the administrative costs. This is because it is reasonable to assume that bidders will bid values at an auction up to that point where they can justify their valuation of the spectrum. And therefore, it is unreasonable to then expect operators to pay more later, since they have paid already for the future utility.

10.3 We believe that it is timely and opportune for TRAI to correct all existing anomalies in the spectrum usage charges (SUC) regime and recommend that minimal SUC on uniform fixed fee per MHz basis be charged. It will ensure an efficient auction which is fair and non-discriminatory.

10.4 We also believe this will enable the transition to a simple, fair and transparent spectrum usage charge regime that is based on charging for administration charges only. In determining these charges it is important that regulators ensure the following:

A. Charges are not discriminatory (i.e., that they do not differentiate unfairly between licencees, spectrum blocks)
B. The charges do not distort competition (i.e. they do not penalise the efficient operators)
C. The charges do not result in spectrum being relinquished from its most productive use.

11 Escalating spectrum usage charging mechanism

TRAI CP Q No.18 (b): *In case annual spectrum usage charges are levied as a percentage of AGR, should annual spectrum charges escalate with the amount of spectrum holding, as at present, or should a fixed percentage of AGR be applicable?*

11.1 When the spectrum is allocated through an auction and upfront fees are being collected by way of auction proceeds, continuing with the current approach of applying a higher spectrum usage charge on additional spectrum holdings will not be appropriate. It will also lead to anomalies as the winning bidder who is chosen based on the highest up-front fee without taking into account the recurring charges paid over the tenure of the licence.

11.2 We believe, once the spectrum is allocated through an auction mechanism, continuing with the current escalating charge approach will be detrimental to consumers and operators as it will work as an inverted duty structure. It increases the input cost of the spectrum leading to excessive burden on operating margins and revenues for the spectrum holders. This may lead to an imposition of stringent barriers for the operators to invest in superior quality of services.

11.3 The current approach of applying spectrum charges separately on different spectrum band creates a window of arbitrage opportunity as stated in the consultation paper. Hence continuing with the existing SUC regime will make it difficult for the government to monitor and may lead to loss for the exchequer. This problem will be further aggravated as additional spectrum from newer frequency bands is auctioned creating severe and serious problems for the government.

12 SUC as a flat percentage of AGR

TRAI CP Q No.18(c): *If your response favours a flat percentage of AGR, what should that percentage be?*

12.1 Rather than a percentage levy, we suggest that the TRAI should look at the option of recommending a uniform fixed price per MHz on auctioned spectrum as the spectrum usage charge. This, if agreed, will remove present issues of differential annual spectrum charges among operators and would set equal rules at the time of auction for all eligible players.

12.2 As an alternative, we recommend that the uniform spectrum usage charge be prescribed to converge to a flat fee of 1% of AGR, in line with what is charged for a BWA spectrum today.

Appendix A. - Model Output Sheets and Assumptions

A.1. Model Output Sheets

Table 1: All India spectrum valuation (by adding all LSA numbers)

Overall India	Unit	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032	FY 2033	FY 2034
Subscribers	*In Million*	906	944	984	1,025	1,068	1,113	1,159	1,196	1,234	1,274	1,315	1,357	1,401	1,446	1,493	1,541	1,591	1,643	1,697	1,753	1,810
Data Subscribers	*In Million*	185	231	264	301	344	394	450	482	518	556	598	643	692	745	802	865	933	1,007	1,088	1,175	1,271
Voice Subscribers	*In Million*	906	944	984	1,025	1,068	1,113	1,159	1,196	1,234	1,274	1,315	1,357	1,401	1,446	1,493	1,541	1,591	1,643	1,697	1,753	1,810
ARPU	*INR*	149	156	163	170	177	184	193	196	200	205	210	213	216	220	224	227	230	234	238	242	246
Data	*INR*	69	76	84	88	92	97	102	103	105	108	111	113	115	117	119	120	120	121	122	123	123
Voice	*INR*	135	138	141	144	147	150	153	155	156	158	159	160	160	160	160	160	160	160	160	160	160
For 800MHz, 900MHz and 1800 MHz band																						
Gross Revenues	*INR Crore*	148,282	156,351	164,294	171,506	179,123	187,192	195,749	201,450	206,217	211,201	216,417	220,026	223,499	227,164	231,037	234,702	238,556	242,612	246,885	251,390	256,145
Data Revenues	*INR Crore*	9,038	12,114	14,910	16,835	19,020	21,503	24,325	26,281	28,078	30,027	32,144	34,445	36,587	38,899	41,396	43,663	46,095	48,706	51,511	54,525	57,763
Voice Revenues	*INR Crore*	139,243	144,238	149,383	154,671	160,102	165,689	171,424	175,169	178,140	181,174	184,273	185,581	186,912	188,265	189,641	191,039	192,461	193,905	195,374	196,866	198,382
Cost	*INR Crore*	113,228	118,388	123,168	126,234	130,824	135,649	140,723	143,602	146,697	149,903	153,227	155,785	158,284	160,880	163,581	166,185	168,883	171,681	174,585	177,601	181,147
Interconnect Costs	*INR Crore*	45,967	48,469	50,931	53,167	55,528	58,030	60,682	62,449	63,927	65,472	67,089	68,208	69,285	70,421	71,621	72,758	73,952	75,210	76,534	77,931	79,405
Network Opex	*INR Crore*	34,204	35,230	35,935	36,653	37,387	38,134	38,897	39,675	40,468	41,278	42,103	42,945	43,804	44,680	45,574	46,485	47,415	48,363	49,331	50,317	51,324
Sales and Marketing Costs	*INR Crore*	6,801	7,124	7,461	6,437	6,738	7,052	7,377	7,189	7,199	7,200	7,190	7,171	7,140	7,097	7,041	6,971	6,886	6,784	6,665	6,528	6,781
Personnel costs	*INR Crore*	4,093	4,195	4,283	4,339	4,394	4,449	4,502	4,170	4,269	4,372	4,480	4,555	4,626	4,702	4,782	4,858	4,938	5,022	5,111	5,204	5,302
Other costs	*INR Crore*	8,897	9,381	9,858	10,290	10,747	11,232	11,745	12,087	12,373	12,672	12,985	13,202	13,410	13,630	13,862	14,082	14,313	14,557	14,813	15,083	15,369
Spectrum Usage Charges	*INR Crore*	5,081	5,358	5,631	5,879	6,142	6,419	6,714	6,911	7,077	7,251	7,433	7,560	7,682	7,811	7,947	8,075	8,211	8,353	8,503	8,661	8,828
License Fees	*INR Crore*	8,185	8,631	9,069	9,467	9,888	10,333	10,805	11,120	11,383	11,658	11,946	12,145	12,337	12,539	12,753	12,956	13,168	13,392	13,628	13,877	14,139
EBITDA	*INR Crore*	35,054	37,963	41,126	45,273	48,299	51,543	55,026	57,848	59,520	61,298	63,190	64,240	65,214	66,284	67,456	68,517	69,672	70,931	72,300	73,789	74,998
Depreciation & Amortisation	*INR Crore*	18,541	17,873	17,337	16,917	16,598	16,371	16,231	16,174	16,168	16,201	16,271	16,375	16,498	16,636	16,790	16,959	17,141	17,335	17,542	17,763	17,998
PBIT	*INR Crore*	16,513	20,090	23,789	28,356	31,701	35,172	38,794	41,674	43,352	45,097	46,919	47,865	48,717	49,648	50,666	51,558	52,531	53,595	54,757	56,026	57,000
Capex	*INR Crore*	11,863	12,508	13,143	13,721	14,330	14,975	15,660	16,116	16,497	16,896	17,313	17,602	17,880	18,173	18,483	18,776	19,084	19,409	19,751	20,111	20,492
Adjusted FCF	*INR Crore*	3,570	5,275	7,157	9,896	11,560	13,321	15,188	16,677	17,249	17,863	18,522	19,095	19,621	20,210	20,869	21,458	22,111	22,832	23,627	24,502	25,136

Table 2: Details for Sample Metro Circle ("Delhi")

Delhi	Unit	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032	FY 2033	FY 2034
Subscribers	*In Million*	43	45	48	51	53	56	60	62	65	68	70	73	77	80	83	87	90	94	98	102	107
Data Subscribers	*In Million*	17	21	24	28	32	36	42	44	47	50	53	56	60	63	67	71	76	80	85	90	96
Voice Subscribers	*In Million*	43	45	48	51	53	56	60	62	65	68	70	73	77	80	83	87	90	94	98	102	107
ARPU	*INR*	271	286	300	313	327	343	360	365	372	380	388	394	398	403	408	412	416	420	424	428	433
Data	*INR*	94	103	113	119	125	131	138	139	143	147	152	156	160	163	166	168	169	171	173	174	176
Voice	*INR*	234	238	243	248	253	258	263	266	269	271	274	274	274	274	274	274	274	274	274	274	274
For 800MHz, 900MHz and 1800 MHz band																						
Gross Revenues	*INR Crore*	11,544	12,176	12,815	13,395	14,018	14,694	15,427	16,024	16,501	16,993	17,500	17,876	18,229	18,590	18,957	19,298	19,644	19,997	20,356	20,721	21,093
Data Revenues	*INR Crore*	818	1,122	1,418	1,648	1,914	2,223	2,582	2,733	2,843	2,957	3,076	3,200	3,296	3,395	3,497	3,567	3,638	3,711	3,785	3,860	3,937
Voice Revenues	*INR Crore*	10,726	11,054	11,397	11,747	12,104	12,470	12,845	13,290	13,658	14,036	14,424	14,677	14,933	15,194	15,460	15,731	16,006	16,286	16,571	16,861	17,156
Cost	*INR Crore*	8,641	9,042	9,424	9,701	10,073	10,471	10,899	11,198	11,494	11,798	12,110	12,359	12,598	12,841	13,088	13,322	13,560	13,801	14,045	14,293	14,571
Interconnect Costs	*INR Crore*	3,579	3,775	3,973	4,153	4,346	4,555	4,782	4,967	5,115	5,268	5,425	5,542	5,651	5,763	5,877	5,982	6,090	6,199	6,310	6,424	6,539
Network Opex	*INR Crore*	2,634	2,713	2,767	2,822	2,879	2,937	2,995	3,055	3,116	3,179	3,242	3,307	3,373	3,441	3,509	3,580	3,651	3,724	3,799	3,875	3,952
Sales and Marketing Costs	*INR Crore*	372	395	421	371	394	418	444	432	437	441	446	449	452	454	455	456	455	453	451	446	468
Personnel costs	*INR Crore*	319	327	334	339	344	349	355	332	342	352	362	370	377	385	392	399	407	414	421	429	437
Other costs	*INR Crore*	693	731	769	804	841	882	926	961	990	1,020	1,050	1,073	1,094	1,115	1,137	1,158	1,179	1,200	1,221	1,243	1,266
Spectrum Usage Charges	*INR Crore*	408	430	453	474	496	519	545	567	583	601	619	632	644	657	670	682	694	707	720	733	746
License Fees	*INR Crore*	637	672	707	739	774	811	852	885	911	938	966	987	1,006	1,026	1,046	1,065	1,084	1,104	1,124	1,144	1,164
EBITDA	*INR Crore*	2,903	3,134	3,391	3,694	3,945	4,222	4,528	4,826	5,007	5,195	5,391	5,517	5,631	5,749	5,869	5,975	6,084	6,196	6,310	6,428	6,522
Depreciation & Amortisation	*INR Crore*	1,443	1,391	1,350	1,317	1,293	1,276	1,266	1,262	1,264	1,270	1,279	1,291	1,305	1,320	1,337	1,355	1,374	1,394	1,414	1,436	1,458
PBIT	*INR Crore*	1,460	1,742	2,041	2,377	2,653	2,947	3,262	3,563	3,743	3,925	4,112	4,226	4,326	4,428	4,532	4,620	4,710	4,802	4,896	4,992	5,064
Capex	*INR Crore*	924	974	1,025	1,072	1,121	1,175	1,234	1,282	1,320	1,359	1,400	1,430	1,458	1,487	1,517	1,544	1,572	1,600	1,628	1,658	1,687
Adjusted FCF	*INR Crore*	435	569	722	914	1,054	1,206	1,373	1,539	1,614	1,691	1,769	1,843	1,909	1,977	2,047	2,108	2,171	2,236	2,304	2,373	2,423

Table 3: Details for Sample Category "A" Circle ("Karnataka")

Karnataka	Unit	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032	FY 2033	FY 2034
Subscribers	*In Million*	55	57	60	62	64	67	70	72	74	77	80	82	85	88	91	94	98	101	105	108	112
Data Subscribers	*In Million*	15	18	21	24	27	31	35	37	40	43	46	49	52	56	60	64	68	73	78	84	90
Voice Subscribers	*In Million*	55	57	60	62	64	67	70	72	74	77	80	82	85	88	91	94	98	101	105	108	112
ARPU	*INR*	177	186	195	202	211	221	231	235	241	246	252	257	260	265	269	273	277	281	285	289	294
Data	*INR*	73	80	88	92	97	102	107	108	111	114	118	121	124	126	129	130	131	133	134	135	137
Voice	*INR*	158	161	164	167	171	174	178	179	181	183	185	185	185	185	185	185	185	185	185	185	185
For 800MHz, 900MHz and 1800 MHz band																						
Gross Revenues	*INR Crore*	10,676	11,328	11,968	12,541	13,146	13,785	14,462	14,902	15,313	15,741	16,188	16,519	16,835	17,164	17,508	17,829	18,161	18,505	18,863	19,233	19,617
Data Revenues	*INR Crore*	767	1,036	1,281	1,449	1,639	1,852	2,093	2,270	2,439	2,620	2,815	3,024	3,216	3,422	3,640	3,834	4,039	4,255	4,482	4,721	4,973
Voice Revenues	*INR Crore*	9,909	10,292	10,687	11,092	11,507	11,933	12,369	12,631	12,874	13,121	13,373	13,495	13,618	13,743	13,868	13,994	14,122	14,251	14,381	14,512	14,644
Cost	*INR Crore*	8,114	8,518	8,893	9,143	9,498	9,871	10,262	10,492	10,748	11,013	11,288	11,507	11,719	11,938	12,164	12,380	12,601	12,828	13,062	13,302	13,576
Interconnect Costs	*INR Crore*	3,309	3,512	3,710	3,888	4,075	4,273	4,483	4,620	4,747	4,880	5,018	5,121	5,219	5,321	5,427	5,527	5,630	5,737	5,847	5,962	6,081
Network Opex	*INR Crore*	2,436	2,509	2,559	2,610	2,662	2,716	2,770	2,825	2,882	2,939	2,998	3,058	3,119	3,182	3,245	3,310	3,377	3,444	3,513	3,583	3,655
Sales and Marketing Costs	*INR Crore*	461	482	504	433	452	471	491	488	489	490	491	490	489	487	484	480	475	469	461	452	470
Personnel costs	*INR Crore*	295	304	312	317	323	328	333	308	317	326	335	342	348	355	362	369	376	383	390	398	406
Other costs	*INR Crore*	641	680	718	752	789	827	868	894	919	944	971	991	1,010	1,030	1,050	1,070	1,090	1,110	1,132	1,154	1,177
Spectrum Usage Charges	*INR Crore*	383	406	429	450	472	495	519	535	549	565	581	593	604	616	628	640	652	664	677	690	704
License Fees	*INR Crore*	589	625	661	692	726	761	798	823	845	869	894	912	929	947	966	984	1,002	1,022	1,041	1,062	1,083
EBITDA	*INR Crore*	2,562	2,810	3,074	3,398	3,648	3,915	4,200	4,410	4,564	4,728	4,900	5,012	5,116	5,226	5,344	5,449	5,560	5,677	5,801	5,931	6,041
Depreciation & Amortisation	*INR Crore*	1,335	1,287	1,249	1,220	1,198	1,183	1,175	1,173	1,175	1,180	1,188	1,199	1,211	1,225	1,240	1,256	1,273	1,291	1,310	1,330	1,351
PBIT	*INR Crore*	1,227	1,523	1,826	2,179	2,450	2,731	3,025	3,236	3,389	3,548	3,712	3,813	3,905	4,001	4,104	4,193	4,287	4,387	4,491	4,602	4,690
Capex	*INR Crore*	854	906	957	1,003	1,052	1,103	1,157	1,192	1,225	1,259	1,295	1,322	1,347	1,373	1,401	1,426	1,453	1,480	1,509	1,539	1,569
Adjusted FCF	*INR Crore*	291	442	604	818	959	1,108	1,266	1,374	1,436	1,501	1,569	1,634	1,694	1,759	1,828	1,890	1,956	2,026	2,100	2,179	2,240

Table 4: Details for Sample Category "B" Circle ("Madhya Pradesh")

Madhya Pradesh	Unit	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032	FY 2033	FY 2034
Subscribers	*In Million*	55	59	62	66	70	74	78	80	83	85	87	90	92	95	97	100	103	106	109	112	115
Data Subscribers	*In Million*	5	7	8	9	11	13	16	18	20	22	25	28	32	35	40	45	50	57	64	72	81
Voice Subscribers	*In Million*	55	59	62	66	70	74	78	80	83	85	87	90	92	95	97	100	103	106	109	112	115
ARPU	*INR*	115	119	123	126	130	135	139	142	145	149	153	156	159	162	166	169	173	178	183	188	195
Data	*INR*	49	54	59	62	65	69	72	73	75	77	80	82	84	85	87	88	89	90	91	91	92
Voice	*INR*	111	113	115	118	120	122	125	126	127	129	130	130	130	130	130	130	130	130	130	130	130
For 800MHz, 900MHz and 1800 MHz band																						
Gross Revenues	*INR Crore*	7,257	7,723	8,203	8,683	9,191	9,729	10,299	10,647	10,866	11,097	11,344	11,504	11,668	11,849	12,047	12,248	12,467	12,707	12,969	13,256	13,571
Data Revenues	*INR Crore*	180	260	336	392	458	534	623	708	799	902	1,018	1,149	1,285	1,436	1,606	1,777	1,967	2,178	2,411	2,669	2,954
Voice Revenues	*INR Crore*	7,076	7,462	7,868	8,291	8,733	9,195	9,676	9,939	10,067	10,196	10,326	10,355	10,384	10,412	10,441	10,470	10,499	10,529	10,558	10,587	10,617
Cost	*INR Crore*	5,731	6,031	6,322	6,535	6,836	7,154	7,489	7,632	7,777	7,929	8,088	8,206	8,327	8,455	8,592	8,730	8,877	9,034	9,201	9,381	9,597
Interconnect Costs	*INR Crore*	2,250	2,394	2,543	2,692	2,849	3,016	3,193	3,301	3,368	3,440	3,517	3,566	3,617	3,673	3,735	3,797	3,865	3,939	4,020	4,109	4,207
Network Opex	*INR Crore*	1,825	1,880	1,917	1,956	1,995	2,035	2,075	2,117	2,159	2,202	2,246	2,291	2,337	2,384	2,431	2,480	2,530	2,580	2,632	2,685	2,738
Sales and Marketing Costs	*INR Crore*	388	413	440	389	414	439	467	426	425	422	420	416	412	407	402	395	388	380	371	360	372
Personnel costs	*INR Crore*	200	207	214	220	225	231	237	220	225	230	235	238	242	245	249	254	258	263	268	274	281
Other costs	*INR Crore*	435	463	492	521	551	584	618	639	652	666	681	690	700	711	723	735	748	762	778	795	814
Spectrum Usage Charges	*INR Crore*	233	248	263	279	295	312	331	342	349	356	364	369	374	380	387	393	400	408	416	425	436
License Fees	*INR Crore*	401	426	453	479	507	537	569	588	600	613	626	635	644	654	665	676	688	701	716	732	749
EBITDA	*INR Crore*	1,526	1,692	1,881	2,148	2,354	2,575	2,811	3,015	3,088	3,168	3,256	3,298	3,342	3,394	3,455	3,518	3,590	3,673	3,767	3,875	3,974
Depreciation & Amortisation	*INR Crore*	907	875	849	830	816	808	805	807	811	817	824	833	841	851	860	871	882	893	906	919	933
PBIT	*INR Crore*	618	817	1,032	1,319	1,538	1,767	2,006	2,208	2,277	2,351	2,431	2,465	2,500	2,543	2,595	2,647	2,709	2,780	2,862	2,956	3,041
Capex	*INR Crore*	581	618	656	695	735	778	824	852	869	888	908	920	933	948	964	980	997	1,017	1,037	1,060	1,086
Adjusted FCF	*INR Crore*	4	104	222	403	524	652	787	908	930	954	983	1,005	1,029	1,058	1,093	1,129	1,172	1,221	1,278	1,344	1,400

Table 5: Details for Sample Category "C" Circle ("Orissa")

Orissa	Unit	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032	FY 2033	FY 2034
Subscribers	*In Million*	26	26	27	28	29	30	32	32	33	33	34	34	35	36	36	37	37	38	39	39	40
Data Subscribers	*In Million*	2	3	4	4	5	5	6	7	7	8	9	10	10	11	12	13	14	16	17	18	20
Voice Subscribers	*In Million*	23	23	24	24	25	25	25	25	25	25	25	25	25	24	24	24	23	22	22	21	20
ARPU	*INR*	102	106	109	113	116	120	124	126	129	132	135	137	138	141	143	145	147	150	153	156	159
Data	*INR*	46	51	56	59	62	65	68	69	71	73	75	77	79	81	82	83	84	85	85	86	87
Voice	*INR*	98	100	102	104	106	108	111	112	113	114	115	115	115	115	115	115	115	115	115	115	115
For 800MHz, 900MHz and 1800 MHz band																						
Gross Revenues	*INR Crore*	3,028	3,154	3,275	3,385	3,498	3,616	3,737	3,800	3,832	3,866	3,903	3,906	3,909	3,915	3,923	3,929	3,938	3,950	3,964	3,981	4,001
Data Revenues	*INR Crore*	105	141	169	185	202	220	240	265	289	315	343	374	404	437	472	504	539	577	617	660	705
Voice Revenues	*INR Crore*	2,923	3,013	3,105	3,200	3,296	3,395	3,497	3,535	3,543	3,551	3,559	3,532	3,505	3,478	3,452	3,425	3,399	3,373	3,347	3,321	3,296
Cost	*INR Crore*	2,504	2,555	2,595	2,600	2,636	2,671	2,706	2,690	2,678	2,667	2,655	2,629	2,603	2,579	2,556	2,534	2,513	2,494	2,476	2,460	2,455
Interconnect Costs	*INR Crore*	1,114	1,117	1,118	1,118	1,116	1,112	1,108	1,086	1,055	1,024	993	952	912	873	834	797	760	724	690	656	624
Network Opex	*INR Crore*	691	712	726	740	755	770	786	801	817	834	850	867	885	903	921	939	958	977	996	1,016	1,037
Sales and Marketing Costs	*INR Crore*	169	176	183	157	163	170	176	164	162	159	156	153	149	146	142	138	133	129	124	119	121
Personnel costs	*INR Crore*	84	85	85	86	86	86	86	79	79	80	81	81	81	81	81	81	82	82	82	82	83
Other costs	*INR Crore*	182	189	196	203	210	217	224	228	230	232	234	234	235	235	235	236	236	237	238	239	240
Spectrum Usage Charges	*INR Crore*	167	174	181	187	193	200	206	210	212	213	215	216	216	216	217	217	217	218	219	220	221
License Fees	*INR Crore*	98	102	105	109	113	116	120	122	123	124	126	126	126	126	126	127	127	127	128	128	129
EBITDA	*INR Crore*	524	599	679	785	862	945	1,030	1,110	1,154	1,199	1,247	1,278	1,306	1,336	1,367	1,395	1,425	1,456	1,488	1,521	1,547
Depreciation & Amortisation	*INR Crore*	379	365	354	345	337	331	327	324	322	321	320	319	318	318	317	317	317	316	316	317	317
PBIT	*INR Crore*	145	234	325	441	525	613	703	785	831	879	928	959	988	1,018	1,050	1,079	1,108	1,139	1,171	1,204	1,230
Capex	*INR Crore*	242	252	262	271	280	289	299	304	307	309	312	313	313	313	314	314	315	316	317	318	320
Adjusted FCF	*INR Crore*	58	78	102	150	169	189	209	229	222	215	209	199	189	179	171	161	153	145	138	132	121

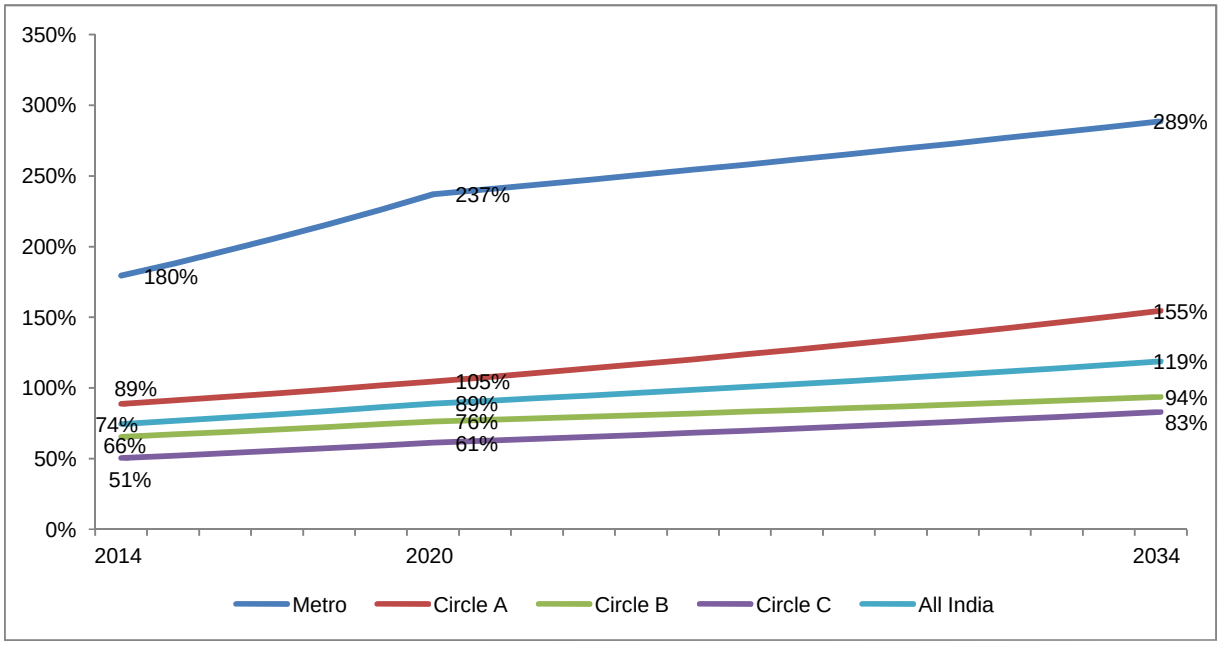
A.2. Revenue assumptions

Base Assumptions:

- **Population and Population Growth**: Source: Report of the technical group on population projection constituted by the National Commission on Population

- **Mobile penetration**: India telecommunication report by Business Monitor International, May 2013 and CRISIL report on telecom outlook dated Oct 31, 2012

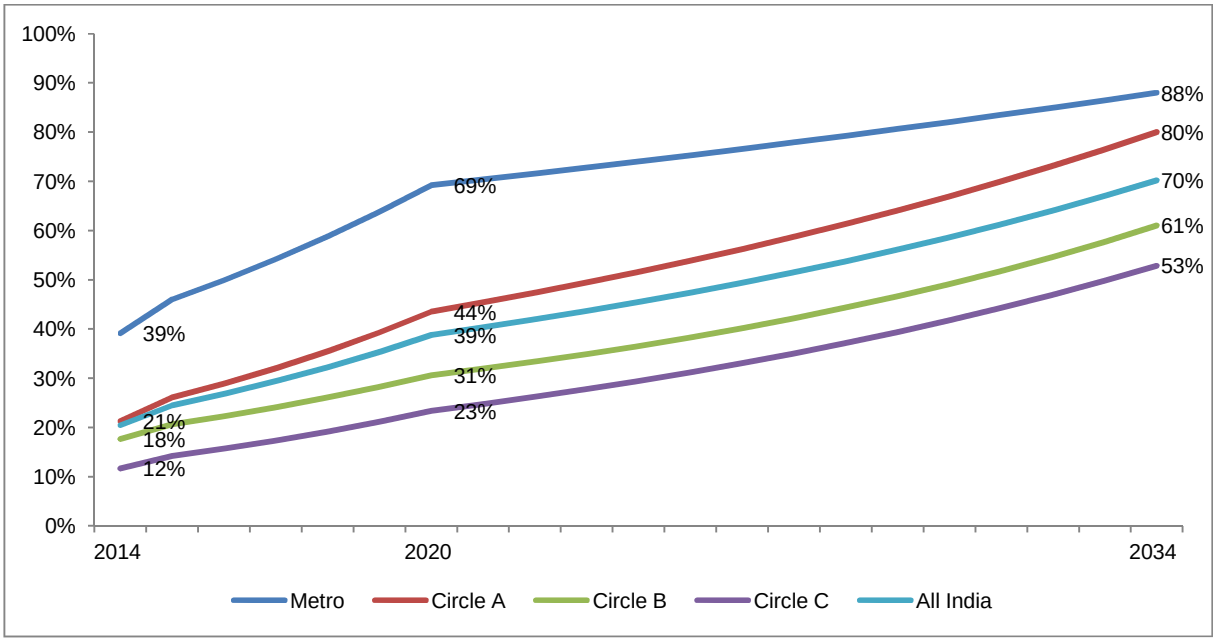
Figure 1: Mobile penetration over 2014-2034, by circle



Source: BMI, CRISIL, Wireless Intelligence, PwC estimate

- **Data penetration as % to Mobile subscribers**: Estimation basis IDC report dated 04 March 2013, India telecommunication report by Business Monitor International, May 2013 and CRISIL report on telecom outlook dated Oct 31, 2012.

Figure 2: Data penetration over 2014-2034, by circle



Source: BMI, CRISIL, IDC shipment projections, PwC estimates

– **Average revenue per user (ARPU):**

India telecommunication report by Business Monitor International, May 2013 and CRISIL report on telecom outlook dated Oct 31, 2012. Following table represents data/voice ARPU for the years 2014, 2020 and 2034.

Table 6: ARPU (Voice and Data) comparison for 2014, 2020 and 2034

	Units	2014	2020	2034	CAGR (%), 2014-2020	CAGR (%), 2014-2034
Overall ARPU	***INR***	**149**	**193**	**246**	**4%**	**3%**
Data ARPU	*INR*	69	102	123	7%	3%
Voice ARPU	*INR*	135	153	160	2%	1%

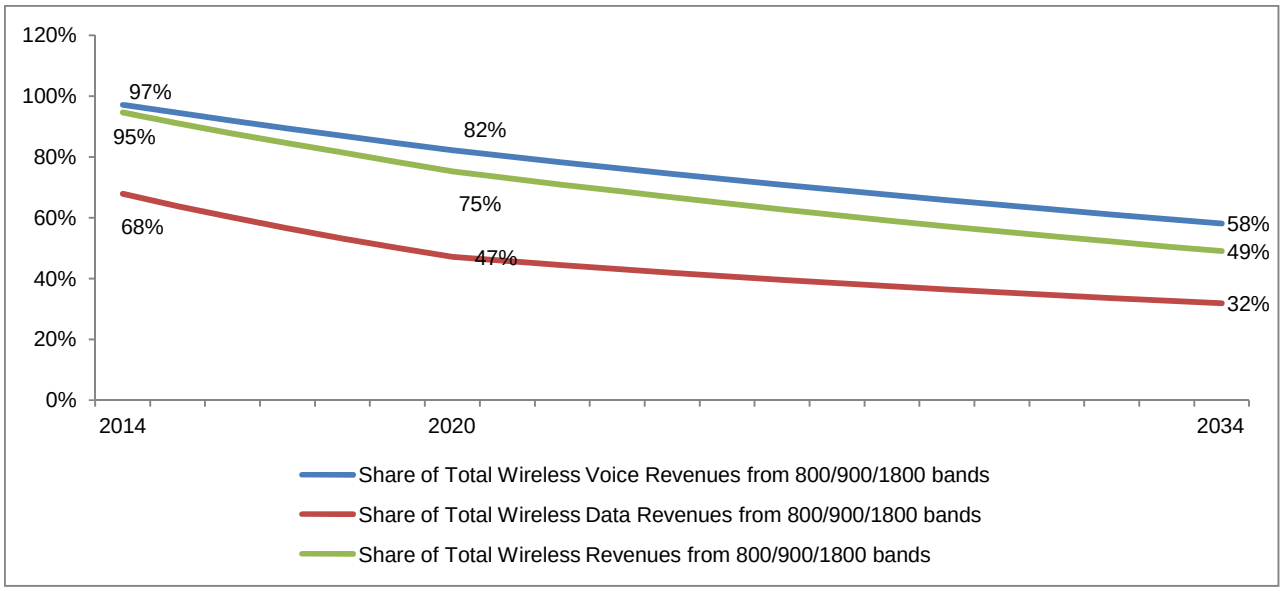
Based on above assumptions overall market revenues are expected to grow to INR 5,23,000 crores by 2034 at a CAGR of 6%

Table 7: Gross Revenues (Voice and Data) comparison for 2014, 2020 and 2034

	Units	2014	2020	2034	CAGR (%), 2014-2034
Gross Revenues (All Bands)	INR Million	1,567,419	2,601,161	5,229,758	6%
Data Revenues	INR Million	133,782	515,347	1,814,545	14%
Voice Revenues	INR Million	1,434,939	2,085,591	3,415,610	4%
Data as % of revenues		8.5%	20%	35%	

– **Revenues share from 800/900/1800 bands**: Estimation basis IDC Smartphones shipments projections report dated 04 March 2013, India telecommunication report by Business Monitor International, May 2013 and CRISIL report on telecom outlook dated Oct 31, 2012

Figure 3: % of revenue (Data and Voice) from 800/900/1800Mhz over 2014-2034



Cost Assumptions

Interconnect charges: Basis TRAI performance indicator report.

– **Network Opex**: Operators annual / quarterly reported numbers

– **Other non-network costs**: Operators annual / quarterly reported numbers

– **Depreciation:** Based on Industry reported numbers, we have considered a depreciation rate of 10% (% of capital block)

Other Assumptions

While arriving at pan-India spectrum valuation, following additional assumptions were made:

– **Capex**: Upgrade/maintenance capex increases with increase in telecom network. We have assumed it to be constant through 2014-2034 at 8% of revenues (based on observed international benchmarking and equipments life)

– **Effective tax rate**: Effective tax rate will gradually increase as current loss making operators turn profitable

	Units	2014	2020	2034
Tax Rate	%	11%	17%	20%

– **Spectrum multiple:** We have assumed efficiency multiple of 1.3 for spectrum in 900 and 800 MHz band over 1800 MHz band.

– **WACC**: we have assumed fixed cost of capital at 12.6% over the period 2014-2034