CHAPTER EIGHT

Spectrum Allocation with asymmetric cost: A Model-Based Case Study of Indian Telecom Industry

8.1 Introduction

Spectrum allocation is a formidable challenge to the regulator particularly in market with existing and potential entrant firms. This paper considers Indian telecom industry and shows that cost asymmetry arising from coexistence of GSM and CDMA technology has made this problem more difficult. While discretionary allocation is prone to legal dispute, auction may also be inefficient due to switching cost of consumers. In this scenario the introduction of number portability becomes the need of the hour not only to benefit the consumer but to optimize the spectrum use as well.

The saga of blossoming of Indian telecommunication industry into a present network of mammoth size has begun since 1985 when Division Indian was separated from the Department of Posts and Telegraph and a new Department of Telecommunications (DoT), operating under the Ministry of Communications was formed in order to regulate, maintain and serve as primary policy-maker for the telecom industry. The process of privatization started in 1991 when the government separated fixed and value added services like cellular telephony, paging, internet etc, and permitted private operators to enter the market in value added market. The National Telecom Policy, released in May of 1994 formally opened up the basic telephony for private sector investment. To regulate the market Government established the Telecom Regulatory Authority (TRAI) in 1997, effectively separating regulatory policy from operating services. Presence of the
Government in this sector as a direct service provider was further reduced with the incorporation of Bharat Sanchar Nigam Ltd. (BSNL) as a public limited company in October 1, 2001.

Once cellular telephony came into being the issue of spectrum allocation among users appeared as a formidable task for the government in all countries of the world. Distribution of scarce resources like land has been historically settled but how to decide in the modern day allocation of a scarce resource like spectrum? Given that spectrum cannot be usurped by muscle power, four methods can be contemplated. A) First come first serve b) lottery c) discretionary allocation, known as beauty contest in the literature and d) auction. First come first serve fosters monopoly and cannot be relied upon. In the old days of radio service lottery system was followed in USA but it was found out that this system was grossly inefficient as it brought into the bidding a large number of casual and insincere parties, seeking to try luck to get some scarce resources. This leaves the last two as viable mode of spectrum allocation and the elative merits and demerits of the two has become a major debatable issue in the literature.

8.2 Background

entry into (and exit from) telecom services coupled with competitive auction of *tradable* spectrum permits.

The issue of pros and cons of spectrum auction have received wide attention of the literature. Zheng (2001) shows how high bid for spectrum auction can lead to bankrupt winners. But Cave and Valetti (2000) have shown that the spectrum auction through ascending auction need not necessarily be bad as the license fee is only a sunk cost. Haan and Toolsema (2003) show that consumers’ price may be lower under spectrum auction than under beauty contests. On the other hand, Burguet (2005) shows how beauty contest method is a better approach to spectrum distribution than the auction of licensing. It is thus observed that the relative merits and demerits of spectrum auction and beauty contests have remained unresolved and this paper is an addition in this large body of literature.

### 8.3 Indian story

In December 1991, the government invited competitive sealed bids for two non-exclusive digital mobile licenses, for a 10-year period, extendible by 5 years, for the four metropolitan cities of Mumbai, Delhi, Calcutta and Madras. The license specified the use of GSM standards for offering cellular services. The annual license fee for the first three years was a given parameter, while the license fee from the fourth year onwards was fixed at Rs.5,000 per subscriber (based on unit call rate of Rs.1.10) subject to a minimum total amount. Along with the license fee, call charges were also a given parameter and the bidding was for the lowest rental to be charged from customers. The evaluation was on the basis of financial strength, experience of the partners, committed rollout and lowest
At the end of the tender process, the value of lowest rental was fixed at Rs.156 per month and eight licenses were issued in October 1994.

Starting in December 1991 the government followed a policy of issuing a limited number of Cellular Mobile and Basic Fixed Service licenses through a process of first price sealed bid. The original auction process divided the country into 21 circle areas. DoT stipulated that there could be only two operators per area for cellular and only one additional operator for fixed services, choosing a combination of fiber optic and wireless in the local loop (WLL) for its fixed sector and designating Global System for Mobile Communications (GSM) as India's accepted cellular technology. GoI announced National Telecom Policy in 1994 and invited private companies to bid for Basic and Cellular licenses separately for each circle. DoT specified GSM for cellular and foreign partnership also mandated in 1995. Here we can mention that during that period CDMA mobile network started to be deployed in various parts of the world.

In the first bidding round the government invited bids for each circle for basic wireless services but when the bids were opened in August 1995, Himachal Futuristics Communications Limited (HFCL) had the highest bid in 9 circles. In many cases its bid was more than double the second highest bid. At this point the government announced a cap of three circles for a single bidder in Category A and B circles. The cap did not apply to Category C circles. This cap was also extended to cellular bids. The bidders selected for each circle were asked to match the license fee quoted by the highest bidder. As a result of this process 34 licenses were issued in 18 circles. Many observers considered the

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1 Entire country was divided into roughly 20-circles A,B,C based on revenue potential.

2 CDMA uses a single spectrum of bandwidth (not slices of bandwidth) for all users in the cell. Each conversation is assigned a unique code. The coded signal is extractable at the receiver, by the use of a complementary code.
winning bids extremely high and unsustainable. The total license fee quoted for the ten years was about Rs.20,000 crores with a present value of about Rs.10,260 crores. The category A circles of A.P., Gujarat, Tamil Nadu, Karnataka and Maharashtra accounted for about 65% of the total amount. It was further argued that the government is more concerned with revenue raising rather than speedy roll out of network. The second bidding round also faced major problems. As more lucrative circles were awarded in the first round there was lack of enthusiasm and only six bids were received. Naturally initial service rollout was slow, as a result of narrow licensing conditions and the high cost of license fees.

The single bid auctions were also used for cellular licenses for the four metropolitan cities with two licenses in each city. However this auction process was alleged to lack transparency and legal disputes ensued following the auction. Ultimately eight licenses were issued in 1995 but bidders could realize subsequently that they overestimated demand and revenue generation. This is called the winners' curse problem in the literature – which is the chief bane of auction. The government then relieved them of the obligation to pay further installments of their committed license fees and allowed them to move to a revenue sharing regime. Several other aspects of the license, such as calling charges, rentals, duration of the license and choice of technology were also altered over time. The cellular licenses provided for an initial spectrum allocation. In the Metros the licensees have each been allocated 4.5 MHz in the 900 MHz spectrum and in the circles the allocation is 4.4 MHz. The licensees can request the WPC for additional spectrum but allocation is not guaranteed.
In the year 1999 the government released the National Telecom Policy in 1999 (NTP 99) in order to help the transition and update policy and auction stipulations to encourage faster telecom development, essentially increasing the number of players in each service area. In the same year the government decided to go technology neutral, in consideration of MTNL’s network rollout of Code Division Multiple Access (CDMA) technology. But this led to a protracted legal battle in 2000 when TRAI proposed that mobile calling on the WLL licenses should be restricted to relevant short distance calling areas but, the basic service operators of WLL exploited a loophole in the license and offered full mobility services by using call forwarding and multiple number registrations. As a result, the GSM based operators who had paid a significant license fee (2.5 billion dollars) contested this decision. This legal battle continued for 3 years and was finally resolved when the government introduced Unified Licensing making cellular services technology neutral and allowing WLL players to provide full mobility after payment of an entry fee equal to what the GSM operators had paid. The GSM - CDMA controversy has become a part and parcel of Indian telecom industry since then.

The NTP 99 for the first time explicitly recognized that the number of cellular operators in a given geographical area would necessarily be limited by the availability of spectrum. According to NTP 99, based on the immediately available frequency spectrum band, apart from the two private operators already licenced, DOT / MTNL would be licenced to be the third operator in each service area. In order to ensure a 'level playing field' between different service providers in similar situations, licence fee would be payable by DoT also. 'However, as DoT is the national service provider having immense rural and social obligations, the Government will reimburse full licence fee to the DoT.'
The above history shows that auctioning was never smooth in the country and in regards to spectrum allocation, the Indian Spectrum Management Committee (created in May 1999) failed to specifically improve the effectiveness of the auction itself, resulting in a situation today in which services that require the same spectrum in neighboring bands are still considered and consequently treated differently by the government. There have been pious wishes as NTP 99 has observed that considering the growing need of spectrum for communication services, there is a need to review the spectrum allocations in a planned manner and to have a transparent process of allocation of frequency spectrum that is effective and efficient. Rather, the TRAI in making its recommendations on the entry of the fourth cellular operator in June 2000 is candid when it says that it is constrained in its ability to make recommendations because of lack of information about the availability of spectrum either for the third or the fourth operator. In what follows, we show in terms of a simple model why spectrum allocation in India in the present scenario is a formidable challenge and why even a transparent and effective auction may not be efficient.

The problem of initial allocation of spectrum was no doubt difficult but this allocation is perhaps more difficult in an existing industry, characterized by more than one technology. Presently the Indian telecom industry is characterized by the presence of GSM and CDMA technology and it is stated that their costs are not identical. This scenario makes the application of beauty contest principle i.e. discretionary allocation difficult, as the regulatory body does not know the exact cost nor other parameters. There is no empirical formula which can establish the spectrum requirement. Additional spectrum requirement depends on various parameters like number of subscribers, the density of subscribers, morphology of the service area - urban, semi-urban or rural terrain, type of applications.

http://www.trai.gov.in/cmtrc.html
(voice, data, multimedia application such as video/audio streaming, video on demand, mobile TV, etc.) and pattern of traffic, (voice, data, multimedia services), and the technology itself, etc, {2G (CDMA IS95A, GSM), 3G (WCDMA/CDMA2000), WiFi, WiMax} In a multi-operator scenario where market forces are in a position to decide the business strategies, it is difficult to assess the value of various parameters mentioned above. While a few parameters such as current subscriber base, current growth rate, etc. are known, there are several indeterminate factors, which can substantially alter the spectrum requirement estimates, the prominent among them are:- Nature of traffic, i.e. extent of voice and data traffic in the network.

When beauty contest faces difficulties one has to rely on auction but as we shall show in terms of our model that auction may not necessarily be efficient here. Here we confront a market with asymmetric cost structure with consumers' switching cost. Costs are asymmetric because CDMA technology users are said to be less costly service providers and a better users of spectrum, compared to GSM. Had it been the case one could argue that all spectrum could be given to CDMA technology users for the sake of efficiency. But it is not that easy where a large number of subscribers have GSM connection. As it is well known, in the absence of number portability, telecom consumers are subjected to switching cost. My phone number is used by others and therefore if I change it I lose contact with many who know my old number but not the new. This is known as switching cost. We show in terms of a simple Cournot type model how in the presence of switching cost higher spectrum allocation may reduce welfare, rather than increase it.
8.4 Model

There are two firms, selling homogenous goods or services in the market and they are involved in quantity competition. For simplification we assume that the firms face a linear demand function of the simplest form

\[ p = 1 - q_1 - q_2 \ldots \ldots (1) \]
\[ Q = q_1 + q_2 \ldots \ldots (2) \]

where \( p \) = price, \( q_i \) = output of \( ith \) firm, \( Q \) = industry output.

The firms have asymmetric cost structure and without loss of any generality we assume \( c_1 < c_2 \).

We further assume that although the product is homogenous a consumer suffers welfare loss if she is to change the firm in the second period.

We consider the following two stage game. In the first stage the firms play Cournot game and make profit. With that profit amount they buy spectrum through auctions. We assume that at the highest bid both firms get spectrum as per their revenue payments. The additional spectrum reduces their cost but the firm buying more spectrum enjoys greater cost reduction. In the second stage the firms again play Cournot game with new spectrum support.

Proposition: In the second stage output of the high cost firm may be less than its output at the first stage for which some consumers may be forced to change firm and suffer welfare loss.

Proof: The profit functions of the firms are
Then the equilibrium quantity, price and profit configurations in the first period are

\[ q_1^* = \frac{1+2c_1 + c_j}{3}, p = \frac{1+c_i + c_j}{3}, \pi_1 = \frac{1}{9}(1-2c_i + c_j)^2 \]

\[ \pi_1 > \pi_2 \text{ given } c_1 < c_2. \]

So low cost firm 1 will be able to buy more spectrum from the government.

Then in the second stage their costs of production will be

\[ c_1^* = c_1 - A \text{ and } c_2^* = c_2 - \beta A \text{ where } \beta < 1. \]

The cost of firm 1 will fall less.

In the second period

Then the equilibrium quantity, price and profit configurations in the second period are

\[ q_1 = \frac{1-2(c_1 - A) + (c_2 - \beta A)}{3}, q_2 = \frac{1-2(c_2 - \beta A) + (c_1 - A)}{3} \]

\[ Q^* = \frac{2 - (c_1 - A) - (c_2 - \beta A)}{3}, p^* = \frac{1+(c_1 - A) + (c_2 - \beta A)}{3} \]

Since some consumers of firm 2 may have to switch to firm 1 there may not be welfare improvement.

The above result highlights the role of number portability in efficient spectrum auction. Apparently these two issues may not appear to be closely related but our model shows that this measure is important for an optimal solution.
8.5 Other related issues of spectrum allocation

Our model has assumed that the firms can buy any quantum of spectrum, provided they can pay for it. But spectrum availability itself is a problem in a country like India. The overall spectrum of frequencies range from 300 Hz (cycles per second) all the way up to 300 Giga Hz; But with today’s technology, much of this range is not practically available for deployment in the telecom sector. With phenomenal growth of subscribers’ number there is steady increase in demand for more spectrum. Presently 800 MHz band has been earmarked for CDMA based systems, while 900 MHz is for GSM based cellular systems. The 1880-1900 MHz band has been earmarked for micro-cellular technology based on TDD mode. However, as per NFAP it is possible to use both GSM and CDMA technology under the concept of Unified Access Service licensing system. Problem however arises with regard to total spectrum for GSM 900 and GSM 1800 frequency bands is \(2 \times 100\) MHz (\(2 \times 25\) MHz of GSM 900 + \(2 \times 75\) MHz of GSM 1800). Most of GSM 900 spectrum has already been allocated to Railways for GSM-R systems but in GSM 1800 most of it is still being used by other users like Defense etc. Efforts are being made for allocation of additional spectrum in GSM 1800 band and recovery of some spectrum from defense for civilian use. Thus apart from arrangement of additional spectrum, the need remains for efficient use of spectrum.

The coexistence of two technologies side by side makes the issue of efficient use of spectrum quite vexed. The GSM lobby argues that CDMA is five times more efficient than GSM in spectrum use if they properly invest in infrastructure. Spectrum capacity is generated by setting up cell sites (towers), which allow the spectrum to be re-used in order to carry more traffic. The five times higher capacity that CDMA spectrum is
capable of can only be generated if CDMA operators set up equal number of cellsites as the GSM operators. But they allege that CDMA is not making that investment and are demanding more spectrum to save investment cost. The CDMA lobby levels the same charges against GSM. They argue that if GSM evolves to WCDMA, GSM operators will be able to achieve similar spectral efficiency and revenue generating services as CDMA operators. So they argue that allocation of half spectrum to CDMA is utterly discriminatory and this policy should be revised. They also allege that GSM service providers hoard spectrum and deprive the nation of the use of precious resources. Amidst this debate the government suddenly put an end to what was effectively automatic allocation of spectrum with increasing subscribers. Consequently, as it stands now, while more-established have the fruits of growth with grabbed additional spectrum, newer players are left with none. Moreover, the non-availability of 900 MHz spectrum means the existing service providers holding licenses in this frequency band have an edge over others new entrants.

We have presented a simple model that shows that additional spectrum may not lead to Pareto improvement in the absence of mobile number portability. There are two firms, selling homogeneous goods or services in the market and they are involved in quantity competition. It is no longer the mixed oligopoly situation. For convenience we assumed that the firms face a linear demand function of the simplest form.

We further assume that although the product is homogeneous a consumer suffers welfare loss if she is to change the firm in the second period because of the switching cost. If however there is mobile number portability, this switching cost is absent.
8.6 Remarks

Our analysis has assumed that the firms can buy any quantum of spectrum, provided they can pay for it. But spectrum availability itself is a problem in every country. The overall spectrum of frequencies range from 300 Hz (cycles per second) to 300 Giga Hz. But with today's technology, much of this range is not practically available for deployment in the telecom sector. With phenomenal growth of subscribers’ number base, there is steady increase in demand for more spectrum. In many countries certain band of spectrum is reserved for defense. Thus apart from arrangement of additional spectrum, the need remains for efficient use of spectrum. The upgradation from 1G to 2G and then to 3G and 4G is technological response to the problem of scarcity of spectrum. The latest technologies can transmit more data compared to the old one. However with improvement of technology the demand for data transmission also rises. Initially mobile is a voice transmission instrument but now mobile handset is an instrument that transmits voice, data and image. Thus, as in many other areas, supply and demand increases together keeping the scarcity of resources undiminished.

The coexistence of several technologies side by side makes the issue of efficient use of spectrum quite critical. The GSM technology is more efficient in long distance telephony while the CDMA is less costly in the short distance telephony. The service quality of 3G will not be up to the mark if service is not transmitted at appropriate spectrum level. (For example in India the service is provided at 5 MHz fo each firm, a third of global average). These factors are to be taken into consideration for efficient spectrum management. In 1997, Singapore was the world's first country to implement MNP. The UnitedKingdom
and the Netherlands first implemented MNP in Europe in 1999. Countries such as Spain (2000), Sweden and Denmark (all 2001), Belgium, Italy, Germany and Portugal (all 2002) followed suit. Estonia implemented MNP due to regulatory intervention.

Consumers of mobile telecommunications services typically face switching costs which derive from the real and psychological costs that consumers confront when changing suppliers (see, e.g., Klemperer 1987a, 1987b, 1988, 1995). These switching costs are endogenous if they emanate from customer loyalty programs (such as Deutsche Telekom's so-called Happy Digits program) or contractual clauses that make the change of suppliers more costly (such as contract termination penalties). There are also exogenous switching costs resulting from the transaction costs associated with switching providers (e.g. for changing the network assignment of a given number). Introducing MNP eliminates at least part of these switching costs.

Overall, the competitive effects of introducing MNP are fairly complex and ambiguous. MNP is likely to affect retail prices, termination charges, price elasticities, market shares, as well as entry and investment decisions. So far, it is fair to say that most analyses on MNP have supported the notion that, on the whole, MNP intensifies competition in mobile telecommunications.

Available empirical evidence on the portability of premium rate numbers appears to support this conclusion (Viard, 2004). Yet, it is unlikely that introducing MNP reduces all prices. Whereas prices for mobile services will decrease as competition intensifies (Buehler and Haucap, 2004). Furthermore, the pro-competitive effects of MNP are likely
to vary across countries, depending on the degree of competition achieved before introducing MNP.

In case of introducing MNP with customer ignorance problem where the customer cannot identify the terminating node then the customer charges are likely to be increased. An alternative method to avoid the customer ignorance problem would be the introduction of the so called receiving party pays regime (RPP), as in the United States, in Canada and some Asian countries. Since under RPP the calling party is charged for the origination but not for the termination of off-net calls, tariff transparency becomes irrelevant. That is, under RPP, the customer ignorance problem vanishes.

NERA/Smith study of the costs and benefits of introducing MNP in Hong Kong estimated the additional benefit from increase competition to amount to 1 Euro per customer over a period of 10 years, as competition was already quite intense even before MNP was introduced (see NERA/Smith, 1998). In contrast, Oftel (1997) estimated the additional benefits of increased competition resulting from MNP to lie around 69 Euros per customer over a 10 year period - quite a significant difference which is due to Oftel's assumption that competition would be significantly more intense with MNP than without MNP (see Oftel, 1997).

In the academic literature, the "customer ignorance problem" has been explored by Gans and King (2000) and Wright (2002). These authors show that mobile operators may have incentives to increase their termination charges if consumers only take notice of average prices. Dewenter and Haucap (2005) provide empirical support for this finding, and
Buehler and Haucap (2004) analyze the tradeoffs related to the introduction of MNP.

However, the loss of tariff transparency may be overcome. In Finland and Germany, for example, consumers can call a toll-free number to identify a particular number’s network assignment. In Portugal, an acoustic signal alerts consumers when placing off-net calls. Yet, such mechanisms generate costs on their own, and they are often considered a nuisance by many consumers.

Since license fees, network investments and customer acquisition costs are all specific investments, operators are vulnerable to expropriation through renegotiation of the regulatory contract (Goldberg, 1976; Sidak and Spulber, 1997). In dynamic and innovative industries such as mobile communications, dynamic efficiency aspects are highly relevant. Therefore, regulators should be hesitant to introduce regulations adversely affecting investment and innovation incentives.

Germany delayed the introduction of MNP due to the lack of an adequate technical solution. Also, Austria postponed the introduction of MNP several times Austrian operators such as tele.ring and Tele2 supported MNP, the larger operators mobilkom and T-Mobile had reservations about MNP.

Mobile number portability can be implemented by On-switch solutions or by in-switch solution. In the first case the fixed cost is low as the new operator is not at all creating the customer memory base keeping the first four digit of the previous number held by the subscribers. But with the increase in the subscriber base the recipient operator will get the advantage of decreasing variable cost in case of IN solution. Large number of subscribers,
porting to new service provider will give substantial cost efficiency.

The Government launched the mobile number portability services in Haryana on November 25, 2010 and on January 20, 2011 in rest of the country. In India after implementation of MNP large number of porting cases reported (TABLE1).
Table 1:

<table>
<thead>
<tr>
<th>Service provider</th>
<th>Subscriber In</th>
<th>Subscriber Out</th>
<th>Net Addition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vodafone</td>
<td>488250</td>
<td>295489</td>
<td>192761</td>
</tr>
<tr>
<td>Idea Cellular</td>
<td>391191</td>
<td>240402</td>
<td>150789</td>
</tr>
<tr>
<td>Airtel</td>
<td>530615</td>
<td>382400</td>
<td>148215</td>
</tr>
<tr>
<td>Aircel</td>
<td>162664</td>
<td>117822</td>
<td>44842</td>
</tr>
<tr>
<td>Uninor</td>
<td>31019</td>
<td>24689</td>
<td>6330</td>
</tr>
<tr>
<td>Videocon</td>
<td>5404</td>
<td>11633</td>
<td>-6229</td>
</tr>
<tr>
<td>MTNL</td>
<td>3793</td>
<td>14851</td>
<td>-11058</td>
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<tr>
<td>Tata Teleservices</td>
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<tr>
<td>Reliance</td>
<td>44753</td>
<td>351170</td>
<td>-306417</td>
</tr>
</tbody>
</table>

Trai Report 2011

The above table represents the status of porting in Indian Telecom Sector and it is apparent that there are net additions of subscribers for all the leading telecom operators in India except BSNL, the state owned telecom operator.

As per the data reported by the service providers, by the end of May 2011 about 105.70 lakh subscribers have submitted their requests to different service providers for porting their mobile number. Out of these requests around 6.32 lakh pertains to Haryana wherein MNP was implemented from 25th Nov. 2010. In rest of the country, in MNP Zone-I (Northern &
Western India) maximum number of requests have been received in Gujarat (10.53 lakh) followed by Rajasthan (8.25 lakh) whereas in MNP Zone-II (Southern & Eastern India) maximum number of requests have been received in Karnataka (7.95 lakh) followed by Tamil Nadu Service area (7.74 lakh). After implementation of mobile number portability (MNP), the number of BSNL subscribers as on June 30, 2011, who have switched over to other operators stood at 9.33 lakh. The subscribers who have switched over from other service providers and came to BSNL stood at 3.49 lakh, resulting in net out go of 5,84,261 customers (data source is the written reply of Minister of State for Communications and IT Milind Deora to Rajya Sabha).

Similarly, MTNL subscribers, who have switched over to other operators at the same period stood at 67,198 and users who have moved in stood at 11,593, resulting in net out go of 55,605 subscribers.
India's wireless market is growing at ~6-7 Million new subscribers every month
APPENDIX II

Key TRAI recommendations

• Tightening of subscriber-linked criteria for spectrum allocation by ~2x-4x the existing criteria.

• Introduction of one-time spectrum charges for obtaining additional spectrum beyond 10 MHz.

• Increase in annual spectrum usage charges (as percentage of revenue) by 100 bps beyond 8 MHz.

• Permitting rollout of dual technology services under an existing UASL license upon payment of requisite license fee.

Key Telecommunication Engineering Centre (TEC) recommendations

• Tightening of subscriber-linked criteria for spectrum allocation by upto ~8x the existing criteria

• Increase in annual spectrum usage charges (as percentage of revenue) by 2x-2.5x beyond 6.2 MHz

• Introduction of additional annual spectrum usage charges beyond 6.2 MHz

Key proposals accepted by DoT (currently under legal dispute)

• Permitting rollout of dual technology services under an existing UASL license upon payment of requisite license fee

• Spectrum allocation criteria proposed by TEC

• Other key guidelines issued by DoT
• Introduction of Mobile Number Portability (MNP) only in the Metro circles initially (by Q4 2008);

• Introduction in Category A circles to be considered in April 2008; all UASL operators to implement MNP.

• 3G services to be permitted in the 2.1 GHz band; 3G licenses to be granted through a controlled, simultaneous ascending e-auction.

• Broadband Wireless Access (BWA) services to be permitted in 2.5 GHz, initial allocation will be to existing UASL and Category A ISPs, besides MTNL/BSNL. Base/Reserve price would be 25% of amount for 3G spectrum.