30th November 2011

Mr. Sudhir Gupta,
Principal Advisor (MN)
Telecom Regulatory Authority of India
Mahanagar Doorsanchar Bhawan
Jawahar Lal Nehru Marg (Old Minto road)
New Delhi-110002

Subject: **Consultation Paper on IMT – Advanced Mobile Wireless Broadband Services dated 19.08.2011**

Dear Sir,

With reference to your Consultation Paper dated 19th August 2011 on 'IMT – Advanced Mobile Wireless Broadband Services' seeking comments of the stakeholders, please find attached herewith the comments of Tata Teleservices Limited and Tata Teleservices (Maharashtra) Limited (together referred as TTL) .

Thanking you,

Yours sincerely,

Anand Dalal
Senior Vice President – Corporate Regulatory Affairs
Tata Teleservices Limited
And
Authorized Signatory
Tata Teleservices (Maharashtra) limited

Enclosure: As above

Tata Teleservices Limited
Response to
TRAI Consultation Paper

No 6/2011 on "IMT– Advanced Mobile Wireless Broadband Services"
Dated 19.08.2011

30th November 2011

Tata Teleservices Limited

Tata Teleservices Limited (TTL) response to TRAI Consultation Paper No 6/2011 on IMT– Advanced Mobile Wireless Broadband Services dated 19.08.2011

Q1. Whether there is a need to define a particular user equipment or architecture to be used by the vendors or this may be left to the market forces?

Response: In this context we submit that architecture to be deployed by service providers for rolling out IMT-Advance networks will depend upon the availability of spectrum, demand for various services and the affordability of user equipments. Further, Indian wireless market is very price sensitive. Therefore, in our opinion **there is no need to define particular user equipment**, as this may force the consumers to pay higher prices for user equipments which might support the features which are not required by consumer and thus may become an entry barrier for expansion of broadband services. Indian wireless market is well developed with multiple vendors for user equipments and hence are fully capable to handle this in the most competitive and transparent manner. Any specific definition of the user equipment or any regulatory binding thereon shall be counterproductive.

Similarly, **the architecture to be used by the vendors should also be left to the market forces**. It is pertinent to note that with multiple operators having pan India presence, there is already an intense competition in the Indian market, which will automatically force the operators to deploy the most efficient architecture available to them.

Q2. Whether there is a minimal set of performance characteristics the UE has to meet before it is permitted to enter a network? These characteristics are over and above the inter-operability, protocol conformance and emission tests which presumably the UE has already passed.

Response: It is submitted that the standards defined under the IMT– Advanced will ensure that networks rolled out by operators are compliant with these standards and user equipments (UE) of various categories offering different services and throughputs are able to work seamlessly with these networks. Specifying any minimal set of performance characteristics may create a situation where either some set of higher level services will be denied to customers though they may be interested in availing them or some of the customers will have to pay for certain set of services which are not relevant to them. Such a situation is not desirable and will hinder the growth of broadband services. It is an established fact that customer's demand and market dynamics will only decide an uptake of various services. **Therefore, we are of the opinion that only market dynamics may be allowed to prevail and no regulatory restrictions for definitions may be imposed**.

Q3. In addition to what has been described above, what can be the other security issues in IMT-Advanced services? How these security issues can be addressed?

Response: In this context it is submitted that since IMT-Advanced networks are going to be IP based packet networks, their security related aspects have to be

similar to any other IP based network. However, since such networks have mobility and are radio networks, additional care is required to be taken in ensuring that end user gets the desired level of security and is able to operate freely. The security aspects become further important due to the fact that these are going to be "Always On" kind of networks and hence susceptible to attacks from the external sources.

IPv6 should be made mandatory and backward compatible with IPv4. Network must be organized in such a way that it is secured against varieties of attacks such as but not limited to Black-hole, Grey-hole, Worm-hole, Spoofing of wireless infrastructure, Theft-of-service attack, Node Deprivation attack, Eves dropping, Traffic analysis, Masquerade, Message replay, Message modification, DoS etc. To ensure Network security and clean network environment for better user experience, any potentially disruptive network traffic from the customer end should be dropped at the source.

If we look at the security related provisions in the IMT-Advanced specifications, it is very clear that very robust systems have been built for User Equipment Authentication, User Identity Confidentiality, User Device Confidentiality, Confidentiality and Integrity for Signaling and User Data, Security aspects in Handovers etc taking in to considerations of the risks which are associated with packet based, "Always On" kind of IP networks on radio interface with mobility. It has to be also understood that such networks are likely to be commercially rolled out in other countries before they are deployed in India and hence those global experiences and solutions will be available to Indian operators and vendors/suppliers of these equipments.

In addition to the above, another important aspect of security is the interception of such networks by the Law Enforcement Agencies (LEAs). It is presumed that for such high capacity mobile networks, the requirements of the LEAs for the interception purpose will be much larger and stricter than what it is for 2G/3G or wire line broadband networks. Even the licensor has to look at the limit on the number of interceptions per LEA which might not be sufficient in the context of these networks. This aspect has to be looked in to before the deployment of such networks.

Q4. What basic security frameworks should be mandated in all networks to protect customer?

Response: The present security framework for 2G/3G and broadband networks is already in place and has evolved over a period of time. This framework needs to be further strengthened to take care of the enhanced security risks which these advanced networks can face. The following points need to be considered while defining the security framework:

a) **Customer education**: The customer should be clearly explained the operational model and possible exposures to this most advanced network. They should be made aware of the security risks associated with such advanced networks and advised suitably to take the actions required at their end to mitigate these risks.
b) Minimum UE authentication related aspects should be taken care of by the service providers.
c) Sharing of passive and active infrastructure should ensure that such sharing does not result in enhanced risks.

d) Licensor has to revisit the interception capacity and the quality/type of interception required for such networks.

Further, it is submitted that since the licenses are technologically neutral, operators will be free to deploy any of the technologies namely LTE-Adv or IEEE 802.16m (Wireless MAN -Advanced) or any other alternate technologies, and hence any mandate for specific framework may favour some of the technologies and this should be avoided. A general guideline on the framework can be considered so as to protect the interests of the customers. DoT's Guidelines dated 31st May 2011on security related issue may be adequate for basic security framework.

Q5. Which spectrum bands should be identified for the IMT Services in India?

Response: According to authority, following spectrum bands are available for future technologies in India:

a) 700 MHz band (698 - 806 MHz);
b) 2010 - 2025 MHz band;
c) 2.3 - 2.4 GHz band;
d) 2.5 - 2.69 GHz band;
e) 3.4 - 3.6 GHz band.

In addition, 800 MHz and 900 MHz spectrum bands may be evolved towards for IMT– Advanced services. Presently, 800 MHz and 900 MHz are being used for 2G mobile services based on CDMA and GSM. GSM services are already available on both 900 and 1800 MHz band, and it should be possible to provide a faster and clean roadmap of refarming of 900 MHz. The Authority has already recommended that, in future, when spectrum in 800 and 900 MHz is available (by allocating spectrum in 1800 and 1900/450 MHz for the licenses at the time of renewal); it may be refarmed and allocated for the IMT-A services. In our opinion, this recommendation of TRAI should be immediately implemented. However, CMDA spectrum of 2 x 5 MHz to be continued in the 800 MHz band as no alternative band has been created for CDMA by DoT/ WPC. In case it is decided by DoT to refarm 800 MHz, then it should be done only after consultation with the CDMA based service providers, and after identifying a industry-friendly process in a mutually agreed manner preferably after period of 5 years after alternative band is created for CDMA.

In terms of priority, DOT should prioritize spectrum bands in 700 MHz and 2.5-2.69 GHz as these bands have already allocated for LTE in other countries leading to a rapid evolution of ecosystem (devices and network) in such bands.

Since the requirements for wireless broadband services are going to be huge, all available spectrums, which can be utilized for IMT-A services, should be fully leveraged. Adoptions of advanced technologies should be encouraged without linking and mandating specific bands for any technologies.

Q6. What should be the block size of spectrum to be put on auction? How many blocks of spectrum should be allocated/ auctioned per service area?

Response: While deciding the block size of spectrum to be put on auction, the following points need to be considered:

a) It is a well known fact that wire line infrastructure for rolling out broadband services is very limited and majority of the growth is likely to happen in the wireless segment. As such, the block size should be large enough to take care of this.
b) The requirements of bandwidth for broadband access are going to increase substantially requiring higher throughput per Node B. This can be achieved only if block size is large enough.
c) Since the capital cost of the network is directly proportional to the number of Node B access point to be deployed, higher block size for each operator will be more CAPEX and OPEX efficient for the operators and would result in affordable services.
d) The block size of the spectrum to be made available to each operator should also take in to consideration the fact that the licenses are technology neutral and hence block size should not give undue advantage to any particular technology.

Spectral efficiencies of 4G technologies typically kicks in when larger bandwidths are available with the operator. Internationally; a minimum of 2x15 MHZ of spectrum has been allocated to operators for rolling out 4G networks. Given the under penetration of broadband in India, a minimum block size of 2x10 MHz for FDD and 1x20 MHz in TDD per operator should be auctioned to achieve better efficiency and throughput.

The number of blocks auctioned should ideally be equal to the number of potential bidders minus 1 to ensure that the Government realizes the true value of the spectrum and at the same time successful bidders do not face a "winners curse". . Given that the draft NTP suggests a minimum of 6 UASL/CMTS operators per service area plus ISP's and Other Service Providers who would be interested in acquiring IMT- A spectrum, *at least 6 blocks should be auctioned in every service area.*

Q7. What is the minimum spectrum block size for effective use of 4G technologies? And
Q8. What should be the maximum amount of spectrum which a service provider can be allocated through auction?

Response: Internationally, a minimum of 2x15 MHZ of spectrum has been allocated to operators for rolling out 4G networks. In India, as broadband services are underpenetrated, so minimum block should be of 20 MHz size i.e. 2x10 in FDD or 1x20 in TDD and same, maximum 20 MHz should be allocated through auction process. As already stated above, 2 x 10 MHz is the minimum block size for the effective use of 4G technologies and to ensure technology neutrality. This is also the barest minimum required for economies of scale and affordability of these services.

Based on the availability of the spectrum for IMT-A services, maximum amount of spectrum, which a service provider can be allocated, may be restricted to 2 x 10 MHz or 1x20 MHz for ensuring fair level of competition.

Q9. Whether there is a need to specify the use of particular duplexing scheme based on the band in which spectrum allocation is done? If yes, in the case of TDD, is it required to specify further the frame duration, mandate frame synchronization using one of a specified set of timing sources and

a permissible set of Uplink/Downlink sub-frame schemes compatible with the IMT-A standards?

Response: 2G and 3G technologies that use FDD are prevalent in the Indian market. Technologies that use TDD are expected to start operations soon. Also, Duplexing is a function of type of spectrum available (for ex.,TDD was already allocated in 2.3 GHz for BWA). Given this context, it is quite apparent that there will be a co-existence of FDD and TDD based technologies in the Indian operation and it may not be appropriate to recommend any one Duplexing for IMT-A. However, it is necessary to have a harmonized approach of duplexing for each band to get advantage of economies of scale and ensure efficient use of the spectrum.

In the event of TRAI deciding to agree for both FDD and TDD for the IMT-A services, it will have to specify, in the case of TDD, the frame duration, to mandate frame synchronization using one of a specified set of timing sources and a permissible set of Uplink/Downlink sub-frame schemes compatible with the IMT-A standards. Such an arrangement will have to ensure the necessary guard bands and the mechanism for minimizing the interference.

In our opinion, It should be technology neutral; both FDD and TDD should be allowed and offered.

Q10. What should be the reserve price per MHz in different spectrum bands?

Response: Reserve price primarily serves to provide an indication of the inherent value of the asset being auctioned, while the actual revenue realisation is market determined and conditioned by other aspects of the auction process such as sealed bid or increasing bid auction method, etc. As such it does not seem to have too high a bearing on the market valuation of the spectrum. Nonetheless, to arrive at a reasonable estimate for the same, certain key factors such as spectrum availability, technological aspects of the spectrum band being auctioned and their cost implications, market sentiments, result of last auction of a similar asset, etc., could be taken into consideration. Thus, it is recommended that government may determine the appropriate reserve price based on the prevalent conditions at the time of auction and this may be done through a consultation process involving various stakeholders.

However the reserve prices should differ across spectrum bands to reflect the propagation characteristics of each band. For example, the reserve price of a spectrum block in the 700 MHz band should be set higher than that of a similar sized spectrum block in the 2.5-2.6 GHz band to reflect the coverage constraints imposed by the higher frequency band.

Q11. What should be the eligibility conditions for bidding for spectrum?

Response: The 4G does require new spectrum blocks for operators, but it is still an access service covered by the UAS/CMTS/ISP license. As a result, no separate 4G license be required other than an UAS/CMTS/ISP license and only spectrum be auctioned for these categories of license holders. Therefore, it is submitted that the eligibility conditions for bidding for spectrum should be same as for BWA auctions. In case it is decided by licensor that all future licenses will be unified licenses, all the

entities eligible to apply for Unified License should be eligible for participating in the bidding process for spectrum.

Q12. Should there be any roll out obligations for spectrum given through auction? Should it be different in different band? And

Q13. Whether there should be any specific rollout obligations in respect of rural areas?

Response: Ideally, since the spectrum is being acquired through market price discovery, there should not be any roll out obligations since the acquirer pays for the spectrum based on its business case. The roll out obligations should normally be imposed only when the spectrum is made available below the market pricing.

However, in order to ensure that the available scarce resource is put to most efficient use and also fulfills the service penetration targets of the licensor in line with the national objectives, spectrum roll out obligations for IMT-A services can be specified as applicable for 3G/BWA spectrum.

With the new NTP looking to delink spectrum from licenses and allow spectrum trading, it is critical to impose rollout obligations to prevent speculators from bidding for the spectrum and trading them later. Specific lock in provisions tied to the rollout obligations too is needed to prevent such speculation and trading activity and provide for the most efficient use of spectrum. Since the reserve price as well as the final price would take into account rollout obligations and the limitations of each band, rollout obligations need not differentiate between bands.

Q14. What should be the spectrum usages charges? Should it be based on revenue share or be a fixed charge?

Response: Telecom subscribers pay a significant component of their bills as taxes and levies which include spectrum charges. To provide affordable services and to meet the projected penetration targets, spectrum usage charges should not be enforced.

Once the spectrum is auctioned and the winning bidder has paid the stipulated market price, there should not be any extra charge levied on the service provider. For spectrum acquired through the auction process, the value of spectrum gets realized upfront; hence, there is no merit in levying any additional fees on the same resource.

It is recommended that the regulator may not impose any revenue linked OR fixed spectrum usage charges on the operator.

Q15. Using MIMO technology what can be the possible infrastructure sharing issues and what can be the probable solutions.

Response: MIMO technology requires multiple antennae leading to larger form factor and complexity of tower space/ loading. Antenna sharing amongst operators should be permitted and encouraged.

Q16. What regulatory mechanisms are to be provided for delivery of voice services over IMT-A systems?

Response: IMT-A systems are all IP based systems. It is submitted that IP telephony is presently permitted from IP device to another IP device and not to PSTN/PLMN. If DOT/TRAI proposes to liberalise this, level playing field issues vis a vis UASL operators need to be taken care of who have paid large entry-fee for offering voice services.

Q17. Should the interoperability of services to legacy 2G/3G systems be left to market forces?

Response: It is a well known fact that the launch of IMT-A services will start from urban areas and its coverage in a licensed service area will be limited to high density pockets. Hence customers who subscribe to IMT-A service will definitely like to have basic voice and data connectivity outside these pockets. Such an arrangement will require inter-operability of these services with 2G/3G legacy systems.

This would be more driven by market forces and the competition and there appears to be no justification for TRAI to intervene in this matter. Further, in a scenario, where the IMT-A service provider is a standalone operator without 2G/3G spectrum, such operators should be allowed to enter in to intra-circle as well as inter-circle roaming with other 2G/3G/BWA/IMT-A service providers. There should not be any regulatory/licensing restrictions on this account.

Q18. What are the QoS measurements that can be reported on IMT-A systems? Suggest the appropriate KPI for data and voice services to guarantee customer satisfaction.

Response: The QoS techniques typically including Admission Control, Resource Allocation & Scheduling available in IMT-2000 systems are very much relevant and valid for IMT-Advanced systems as well. To this end, Scheduling of Mixed Service Classes, having differential KPI requirements as well as Joint Resource Allocation and Admission Control, will become standards for IMT-Advanced access technology candidates also as the required information mentioned is available at the eNB.

Multi-User Resource Allocation maximizing the Perceived Quality requires the data rates served by the Application layer to be adjusted. On the other hand, served data rates may be adjusted at the eNB directly via packet dropping (e.g. Active Queue Management). To this end, Scalable Video Codecs (SVC) ideally complement the proposed cross layer design, as it allows to flexibly adjust the data rate at the eNB by packet dropping, without any information exchange between eNB and application server. While packet dropping may be possible also with other codecs, the range for adjusting Application data rates is likely to be compromised. A further possibility for data rate adjustment at the eNB is via transcoding, which, however, is not applicable to delay sensitive services, due to the induced latency.

The KPIs could be broadly classified to include ***Network Availability Reports*** covering both the planned and unplanned network outages, ***Network Accessibility Reports*** covering the connection success rates for both the signaling and the payload bearers, ***Network Congestion Reports*** covering the time period in percentage for which the bearers, both for signaling and payload, were either in error or unavailable, ***Network Retainability Reports*** covering the bearer drop rates, handover reports covering both the intra-RAT as well inter-RAT handoffs, ***Network***

Throughput Reports covering the peak as well as average throughput as perceived by the end user, latency reports, retransmission reports, jitter reports, RTT reports.

Q19. In view of the likely deployment of scenarios where the cell radius is scalable to much smaller levels using the concepts of femto and pico cells:

a) What will be the impact of femto cells/SoN architecture on KPI?
b) What will be the impact of Relays/femto cells on spectrum policy?
c) What will be the impact on infrastructure sharing?
d) What policy guidelines are required to encourage low emission low energy and high capacity architecture like femto cells overlaid over macro cells?

Response: Since the wireless traffic data is increasing exponentially and the proportionate revenue growth is slowing down due to what is called "Scissors Effect", there is an evolving concept of "Heterogeneous Networks" deployment which supports macros, picos, femtos and relays in the same spectrum. These deployment will lead to:

a) Targeting coverage with Macro base stations for initial deployments
b) Pico/Femto and Relay stations are added for incremental capacity growth, richer user experience and in-building coverage and can offer flexible site acquisition with low power base stations
c) Relays & Femtos provide coverage extension and capacity with little to no incremental backhaul expense.

However, these heterogeneous networks create significant challenges in interference and RF management.

a) What will be the impact of femto cells/SoN architecture on KPI?

Response: Femto cells use fully standard wireless protocols over the air to communicate with standard mobile devices, including mobile phones and a wide range of other mobile-enabled devices. Both the IMT-A qualifying standard protocols by 3GPP, 3GPP2 and the IEEE, which collectively comprise the technologies included in the ITU-R definition of IMT-Advanced, support femto cell architecture. By operating in licensed spectrum licensed to the service providers, femtocells not only allow operators to provide assured quality of service to customers over the air, free from harmful interference, but also make efficient use of their spectrum as well as improving indoor coverage. Femto cells also create extra network capacity, serving a greater number of users with high data-rate services.

Since the femto cells would be fully under the control of the access provider and, in fact, work within the parameters set by the access provider, they would act as an extended part of the access provider's network using the same licensed spectrum. As such the KPI set that would be valid for macro cell architecture covering the Network Availability Reports, Network Accessibility Reports, Network Congestion Reports, Network Retainability Reports and Network Throughput Reports would also be valid with minor tweaking to suit the limited environment based on the services for which the femto cell has been deployed.

The existing specifications incorporate a security framework that allows networks to support a large number of access points via standard commercial IPSec based security gateways. These specifications also contain simple Self Organizing Network

(SON) capabilities to allow automatic configuration of large numbers of femtocells. It is expected that future revisions will further enhance the SON capabilities to standardize automatic interference management between femtocells and macro base stations.

b) What will be the impact of Relays/femto cells on spectrum policy?

Response: For an access provider, to deliver the maximum bit rate promised by the technology in IMT-A, it would definitely need the maximum spectrum. Both LTE-A and IEEE 802.16m would require 20 MHz for deliverance of the promised bit rate. Moreover, the access provider will need to have umbrella coverage of the entire area of its operation with the macro-network only. Femto/Relay cells could come handy for provisioning in a limited space catering to specified group of individuals only or for area not reached by the macro cell. As such, the femto/Relay cells could be used in enhancing the existing capacity of the access provider and its reachability for indoors and walled spaces, but the access provider will need to have a full fledged macro network. Femto/Relay cells could supplement the existing network capacity and act as an overlay over the macro network.

Independent spectrum block of 10 MHz in TDD and 2x5MHz for FDD recommended for Femto cells.

c) What will be the impact on infrastructure sharing?

Response: Existing infra sharing is for macro network only and is open to operators based on agreements arrived at amongst themselves. Since the Femto/Relay/Pico cells require much lesser infrastructure compared to a macro site, the market forces and the technological innovation will decide how this issue is being tackled by the operators.
Network interface for Femtos should be standardized for facilitating active infrastructure sharing.

d) What policy guidelines are required to encourage low emission low energy and high capacity architecture like femto cells overlaid over macro cells?

Response: Usage of a particular technology by an access provider is governed by its usability, effectiveness, ease of deployability, cost, quality and throughput, regulatory needs etc. Market forces will compel the access provider to go for one or the other technology/option based on its business model and plan.

As such, no special guidelines for encouraging or mandating use of femto cell or any particular mode of operations by access provider needs to be given by TRAI.

However, independent spectrum block of 10 MHz in TDD and 2x5MHz for FDD recommended for Femto cells and Network interface for Femtos should be standardized for facilitating active infrastructure sharing.