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Sub: Consultation Paper on "IMT-Advanced Mobile Wireless Broadband Services" (CP 06/ 2011)

Dear Sir,

We are pleased to present our views on the Consultation Paper on IMT-Advanced Mobile Wireless Broadband Services.

We would be glad to share and explain our suggestions in person as well.

Thanking you,

Yours faithfully,

Kapil Dev Kumar
Senior Vice President

INFOTEL BROADBAND SERVICES LTD'S VIEWS ON ISSUES IN CONSULTATION PAPER ON IMT-ADVANCED MOBILE WIRELESS BROADBAND SERVICES (CP 05/ 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?
AND
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.

The discussion point made in item 1.49 of the Consultation Paper is very valid and it is also true that the inter-operability, protocol conformance and emission tests do not cover any test case which can validate the accuracy of channel estimation and corresponding feedbacks from the UE. At the same time, we believe, that the UEs that have undergone strict Conformance Testing regimen and obtained certificates from international certification bodies like GCF are likely to provide accurate channel quality feedbacks. Thus only UEs that have undergone GCF certification should be allowed to be used in the Indian Market.

There is another aspect of user equipment that should be considered. In addition to the IMT-Advanced-only devices, there will be a plethora of devices in "Router" category which will create WiFi Access Points (AP) for the end-users and route the data traffic from WiFi devices through the IMT-Advanced air interface. The WiFi Access Point part of all such devices should be certified by WiFi Alliance and adequate filtering should be employed inside the device to avoid interference between WiFi AP radio and IMT-Advanced UE radio.

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

The recent licence amendment by the licensor has covered network and information security related issues in great detail which involves audit of the network, testing of network elements against applicable standards and associated requirements for inspection, monitoring, documentation etc. In our opinion, these measures are adequate enough to address most of the security concerns that can be envisaged at this stage. As and when required, these conditions can be modified to keep in pace with technological advances and associated security issues and there is no need for any other security framework.

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

Recently we have seen large adoption of array of data-hungry devices such as smart phones and tablets and with majority of consumers opting for these devices, the demand for broadband data is bound to accelerate at a faster rate than the already growth seen in the market today. The emerging data applications are becoming more data intensive consuming far more bandwidth than voice based services. Economic growth, technological developments, emergence of new devices is also fuelling demand for data services. This phenomenal growth in traffic will put more pressure on current networks and rising demand for network capacity will outpace technological advances of currently deployed networks. It has also been seen that there is interdependency between supply and demand of bandwidth i.e. with increased access to bandwidth results in more data intensive applications and services, which in turn leads to the requirement for more bandwidth. In line with this, with introduction of 3G and BWA services by the operators, there will be a strong growth of data

enabled devices in India and number of data users and data bandwidth requirement will increase exponentially. Therefore, there will be a requirement for more spectrum for existing operators and introduction of new technologies to satisfy the anticipated demand for higher bandwidth services.

At the same time, it is equally important for the Authority to provide a clear roadmap regarding availability of spectrum bands, current allocation/ usage and total amount of spectrum that can be made available in that particular spectrum band along with associated timelines. As we have already seen in the past, the allocation of new frequency bands and their assignment is a long drawn process. It is therefore necessary for the Authority to present a holistic picture taking into consideration the following:

- **Present and future requirement of existing wireless service providers -** Recent international trends indicate that in a few years, much more spectrum per operator will be required for 3G, BWA and Broadcasting services to meet the demand for higher throughput and quality of services. This would require existing spectrum rights holders to extend equivalent amount in their existing spectrum in a contiguous manner.

- **Present and future requirement of various Government agencies –** As in case of wireless operators, there might be increased demand from Government agencies such as Defence, Space etc. who are operating critical services in various bands that are being considered for IMT services. Taking into consideration, all stakeholders should have clarity with respect to agreed spectrum re-farming plan with these agencies as well as with commercial users in these spectrum bands along with associated timelines for such spectrum vacation or relocation

- **Policy changes under consideration having potential impact on spectrum valuation** – There are various critical policy decisions that are either consideration or pending for the final decision, which can have potential impact on the availability, use and valuation spectrum. These will include issues like introduction of Mobile Virtual Network Operator (MVNO), introduction of Unified Licence having all India service area, permissions for spectrum trading and/ or spectrum sharing, policy for mergers and acquisitions etc. Similarly there are pending recommendations with respect to re-farming of spectrum in 800 and 900 MHz at the time of licence renewal by allocating spectrum in 1800 and 1900 MHz.

An absolute clarity on above mentioned issues, at least for a few years down the line, is essential for potential investors to take informed decisions and thereby can reduce possible risks while committing for future investments. In absence of the same, it might create perception of scarcity for potential investors, forcing them to invest or re-invest in any available spectrum or technology out of 'now or never' syndrome. This approach will also provide existing as well as potential investors greater certainty in building spectrum portfolio necessary to provide intended services to the satisfaction of customers in an integrated and strategic fashion and decisions on which technologies to deploy are not rushed.

This is also required to enable the Authority to conduct a combined auction of all spectrum bands that have been identified for providing IMT-Services in India. It can be seen that internationally this is a preferred approach. This offers appropriate balance between providing all operators an opportunity to acquire spectrum across different bands while restricting any operator to acquire holding that might constrain overall competition in the market. The combined auction results in a significant increase in the supply of spectrum available which will have a positive impact upon competition, facilitating the launch of new innovative services and potentially the entry of new competitors. This also facilitates decision making of potential investors wishing to acquire spectrum in appropriate bands and at appropriate level that can support rollout of services within intended time and costs.

We suggest that any decision on deciding band for the IMT-Services in India should be taken by the Authority in holistic manner taking into consideration the above, which will enable India to capitalize on early head-start in spectrum planning and allocation. Additionally, the other important aspects should be taken into consideration for deciding band for the IMT-Services in India, such as harmonisation at International and regional level, co-existence with presently deployed technologies and associated interference issues etc.

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?
AND
Q7. What is the minimum spectrum block size for effective use of 4G technologies?

For deciding number of blocks of spectrum to be allocated/ auctioned per service area, it will be worthwhile to undertake the market assessment study to evaluate current wireless broadband market and likely future competition in the market as a result of release of additional spectrum. This assessment can assess current market competitiveness and explore feasibility and viability for developing separate markets for different technologies under different spectrum bands. Based on such assessment, a view can be taken on number of blocks of spectrum to be allocated or auctioned per service area which will promote effective competition in the future wireless broadband market and will work in the interests of consumers as well as operators while ensuring optimal use of the spectrum taking into account current and future demand.

Adequate availability of spectrum is necessary for growth of telecom services and to ensure quality of service (QoS) standards. While the minimum spectrum block size may vary depending upon the spectrum band and associated technology, spectrum available for allocation, number of optimal operators required in the interest of consumers and operators etc., it is expected that all IMT-Advanced technologies will require wider contiguous channels (20 MHz or more) to provide the desired services and level of performance. E.g. the larger the contiguous spectrum used for LTE, the higher the peak speeds that can be delivered and therefore a large contiguous spectrum block is likely to be more important for LTE.

Q8. What should be the maximum amount of spectrum which a service provider can be allocated through auction?

In general the policy for the maximum amount of spectrum which a service provider can be allocated should be such that it achieves the right balance between giving operators an opportunity to acquire spectrum across different bands, without allowing any participant to acquire holdings that might constrain overall competition in the market. This will have added significance when the spectrum available for allocation is across different spectrum bands wherein frequencies in lower spectrum bands will have advantage over higher frequencies in terms of coverage and may have an unmatchable technical advantage. It is therefore essential for any operator to have spectrum portfolio in different spectrum bands in order to provide credible as well as competitive service to consumers.

Considering this, the potential investor should be able to participate in allocation/ auction of spectrum in each band but should not be able to acquire more than one block in a given spectrum band. This will also be in line with the approach that has been successfully adopted during auctions for 3G and BWA spectrums.

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?

The band plan should be in accordance with the IMT-A specifications as the ecosystem for network infrastructure elements and the devices will evolve in accordance with the said specifications. Any deviation of spectrum allocation from this will lead to severe issues in identifying the technology vendors supplying the required infrastructure. Taking this into consideration, there is a need for specifying the duplexing scheme for each band as TDD and FDD cannot coexist in the same band.

For FDD, typically there are no stringent requirements. For TDD, there are critical requirements as below:

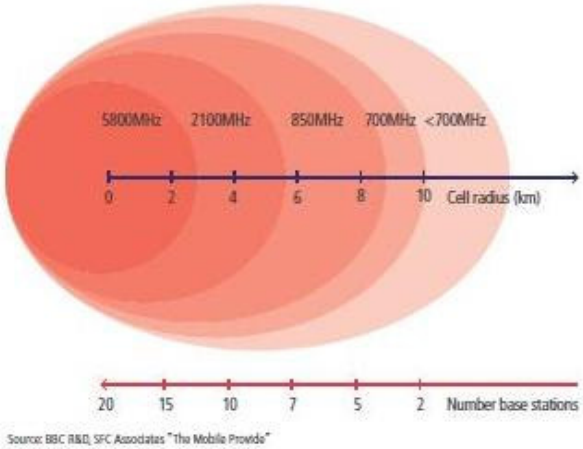
1. Frame synchronization should be mandated. The entire network of each operator has to be synchronized to one common clock. Indoor base station should be synchronized through IP network by IEEE 1588v2 and the grand master clock source of IEEE1588v2 should be synchronized to GPS. Thus all base stations should be synchronized to GPS. If the common clock is other than GPS, different operators must also synchronize their common clocks with each other.
2. All operators in a given area must use same Uplink/ Downlink subframe schemes. This should be specified after consultation with all stakeholders. If this is not possible and the operators are given flexibility of selecting their preferred Uplink/Downlink subframe schemes, the guard band between adjacent blocks of unpaired to different operators must be adequate enough to avoid adjacent channel interference between them. In addition to the provision of guard band, the use of “Block Specific” filters at the base stations should be mandated.

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

For deciding the reserve price, the final price in the last auction for spectrum with similar use should be made a benchmark base price, and this should be further modified to factor in (a) time value indexing, (b) coverage characteristics of the band, (c) the spectral efficiency of the technology likely to be used vis-à-vis the one used in the spectrum last auctioned, and (b) Relative value of Paired/ Unpaired spectrum.

Based on the above guiding factors, for IMT-Advanced, the successful 3G and BWA Auction prices should be the starting base reference. This should be further increased at the rate of WACC (about 13% p.a.) to reflect the time indexing.

This should be further increased by the propagation characteristics of the band to be auctioned. TRAI has previously recommended that value of spectrum in 900 MHz is 1.5 times the value of the spectrum in 1800 MHz, essentially on account of better propagation characteristics in lower bands. The accompanying chart shows that the cell radius for 700 MHz deployment would be about 3 times the cell radius for a 2.3/ 2.6 GHz deployment[1]. This means that a cell site with 700 MHz deployment can



[1] Source: GSMA White Paper on 2.6 GHz spectrum band

provide coverage equivalent to 9 cell sites deployed in 2.3/ 2.6 GHz. A TRAI Presentation titled "Digital Dividend: Use of 700 MHz frequency band" dated 4th September 2009 also shows that cell site with 700 MHz deployment can provide coverage equal to 10 cell sites deployed in 2.4 GHz. This better coverage characteristics help save both capex and opex.

In the auctions held in Germany in Apr-May 2010, the digital dividend spectrum (791-862 MHz) fetched a price that was more than **30** times the price for the spectrum in 2.6 MHz for same quantum (2*5 MHz) from the same set of operators (Deutsche Telecom, Telefonica O2, Vodafone)[2].

Further, as mentioned earlier, other factors to be considered are spectral efficiency of the technology likely to be used vis-à-vis the one used in the spectrum last auctioned, and the Relative value of Paired/ Unpaired spectrum.

Based on the above considerations, we believe that the All India total of the reserve price for spectrum in 700 MHz, before time indexing should be Rs 4000 – 5000 cr per MHz, which is 2.5-4 times the 3G Spectrum auction price and 6-8 times the BWA Spectrum Auction price. For spectrum in 2.6 GHz band, the All India total of the reserve price should be the same as BWA Spectrum Auction price with time indexing.

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

Considering future licensing path will be Unified licence with spectrum delinked from the licence, in addition to existing UASL or ISP licensees, any entity eligible to apply for Unified Licence should be eligible for participating in the bidding process for IMT spectrum.

Q12. Should there be any roll out obligations for spectrum given through auction? Should it be different in different bands?
AND
Q13. Whether there should be any specific rollout obligations in respect of rural areas?

By specifying a rollout obligation, especially in terms of rural areas, the Authority can ensure various objectives such as efficient use of spectrum, prevent hoarding or entry of non-serious operator, encourage quicker rollout, avoid denial of next generation technology to rural population etc. At the same time, the Authority should also take into account the costs of achieving these obligations and incremental benefits achieved out of this. This will have added significance, when the spectrum is awarded through auction and there are multiple spectrum bands for offering same or similar types of services. In our view, if different bands are going to be auctioned, preferably in a combined auction or irrespective of that, incremental costs of meeting these obligations will far exceed the incremental benefits which would accrue only to a relatively small and declining set of people.

Considering this, the rollout obligation for IMT services should be same as that for BWA spectrum and operator should be free to achieve these obligations by use of one or multiple spectrum bands acquired through the auction process and there should not be individual rollout obligation associated with every spectrum band.

[2] Source; GSA Digital Dividend Update - June 2010

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

In case of spectrum acquired through auction process, wherein the full value of spectrum gets realised upfront, there should not be any additional annual fee chargeable on the same resource.

If at all, any fee is to be levied, it should allow recovery of only spectrum management and administration costs actually incurred on annual basis, which can be in the form of revenue share. Such percentage arrived to be applied on the revenue generated out of services using applicable spectrum band, provided such revenue segregation can be clearly established and accounted for (similar to 1% spectrum usage charge applicable for UASL on BWA revenue). To reduce complexities and administrative overheads, this share should be applied on the entire revenue realised from all IMT spectrum bands of an operator and not on individual IMT spectrum band-wise revenue streams.

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

Possible Issues and Solutions are as under. We believe operators should be encouraged to resolve these issues with mutual consent through innovative technological solutions.

	Possible Issues	**Possible Solutions**
1	Assuming that the passive antenna and splitter/combiner infrastructure is shared among multiple operators, one of the issues is regulating interference arising out of the co-location of Base stations.	To control interference, additional filtering requirements will have to be mandated for each co-located base station.
2	Typically, EIRP limits are specified for capping maximum radiation from antenna for each operator. How will this be handled when multiple operators are radiating from same antenna system?	In case of sharing the antenna infrastructure, these limits will either have to be redefined or the power shall have to be measured at other specified points than antenna output and consequently EIRP analogous limits will have to be defined.
3	IMT-Advanced technologies will have a provision of using 2, 4 or 8 transmitter and receiver paths at the base station to achieve different MIMO schemes. Different operators may choose to adopt different MIMO schemes to suite their requirements. E.g. One operator may chose to deploy 2T-2R (2 Transmit - 2 Receive) base station while the other may chose to deploy 4T-4R base station. A two port antenna is sufficient for the former but the latter requires an antenna with four ports or two nos. of two port antenna with spatial separation. This is an example of issues that can be faced in sharing a common antenna. Similarly, there could also be issues of sharing the Distributed Antenna System (DAS) system infrastructure that is used to provide indoor coverage. In case of narrow band technologies like GSM the same base station can support multiple TRXs or multiple carriers thus opening up the possibility of sharing of base stations by	One of the options to overcome this is to use a modular architecture in which the critical capacity limits can be upgraded at incremental cost post-deployment. If that is not possible, another option is to finance the marginal cost of excess capacity in the initial deployment, planning for that cost plus interest to be paid by a late arriving competitor as its buy-in to the system.

	Possible Issues	Possible Solutions
	different operators. However, support of multiple, high bandwidth, IMT-Advanced channels by the same base station is unlikely in earlier releases of base stations. Thus, Any antenna sharing method will have hardware capacity limits. For example, a splitter/combiner will have ports for a certain number of base stations. How to future proof this limitation?	
4	Distributed Antenna Systems (DAS) unit will have a certain maximum transmit power shared among all operating carriers. How to future proof this limitation?	Same as 3
5	In case of co-located base stations sharing antennas, there may be some overlap/ leakage of spectral emissions from each or some of the base stations. How will this be handled?	Regulation will have to ensure strict adherence to spectral emission masks may be over and above 3GPP requirements.

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

As per the present policy, a voice call is permitted from an IP device to another IP device within the country and to PSTN outside the country. No call is permitted from an IP device to PSTN/ PLMN. Such a policy restriction has scuttled the growth of IP telephony in the country. Hence, TRAI, which has already supported the IP telephony in the domestic network should take steps to permit full blown IP telephony where a call can get terminated from IP device to PSTN/ PLMN or vice versa. This step will be essential so as to clear the way for IP telephone domestically and also for future interconnection framework for NGN.

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

As happens with any new network roll out, in the initial phase IMT-Advanced services are likely to be rolled out in urban pockets and that too in high usage areas due to its higher throughput and higher pricing in the beginning. However, the customers would like that they do get at least the basic 2G/ 3G services outside these limited coverage areas. This will require inter-operability of these services with legacy 2G/ 3G systems.

As a part of the Go-To-Market strategy, the operators would definitely like that these IMT service customers are assured of at least 2G/ 3G service outside the IMT service coverage area. Since this aspect is likely to be driven by market forces and the competition, there appears to be no justification for TRAI to intervene in this matter. In addition, since there will be stand alone operators who have only IMT services to offer and do not own any 2G/ 3G network, there is a need to allow such operators to enter in to intra-circle as well as inter-circle roaming with other IMT service providers as allowed in the cased of 3G and no restriction need to be imposed on such operators.

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.

The collective effect of service performance, which determines the degree of satisfaction of a user of a service, is characterized by the combined aspects of performance factors such as service operational performance, service accessibility performance, service retainability performance, service integrity performance and other factors specific to each service. The assessment of QoS for services being offered under IMT-Advanced technologies should be in line with what has already been defined under IMT-2000.

When defining the IMT-Advanced QoS classes the restrictions and limitations of the radio interface have to be taken into account. The QoS mechanisms provided have to be robust and capable of providing reasonable QoS resolution. The four different QoS classes (or traffic classes) are *conversational class, streaming class, interactive class* and *background class*. The main distinguishing factor between these classes is how delay sensitive the traffic is: *conversational class* is meant for traffic which is very delay sensitive while *background class* is the most delay insensitive traffic class.

As per the IMT standards, the KPIs could be broadly classified as defining:

- Network Availability Reporting covering both the planned and unplanned network outages
- Network Accessibility Reporting covering the connection success rates for both the signaling and the payload bearers
- Network Congestion Reporting covering the time period in percentage for which the bearers, both for signaling and payload, were either in error or unavailable
- Network Retainability Reporting covering the bearer drop rates, handover reports covering both the intra as well as inter network handoffs
- Network Throughput Reporting covering the peak as well as average throughput as perceived by the end user, latency reports, retransmission reports, jitter reports etc.

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?

Both the IMT-A standards namely LTE-Advanced and IEEE 802.16m support femto cell architecture. By operating in licensed spectrum licensed to the service providers, femto cells not only allow operators to improve their 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. 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.

Since the femto cells would be operational under the control of the access provider, they would act as an extended part of the access provider's network using the same licensed spectrum. As such, whatever KPIs are decided and set for macro cell architecture shall also be valid with minor changes to suit the limited coverage environment of femto cells.

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 femto cells. It is expected that future revisions will further enhance the SON capabilities to standardize automatic interference management between femto cells and macro base stations.

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

It is to be clearly understood that Relays/ femto cells only supplement the macro network and as such the spectrum requirement do not materially change as these cell solutions improve the coverage and incrementally enhance capacities in limited areas. 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. 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 to indoors and walled spaces. In any case the access provider has to build the macro network and hence spectrum issues have to be seen in the context of macro cell rather than the femto/ Relay cells.

c. What will be the impact on infrastructure sharing?

As has already been stated, the existing guidelines are only for sharing of passive and active infrastructure and that too for macro network only and is lest to the negotiations amongst the operators. Further, since the Femto/ Relay/ Pico cells require infrastructure at a much lower scale as compared to a macro site, the market forces and the technological innovation will decide how this issue is settled amongst the various operators.

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

Co-existence of small cells and macro cells will be major issue to be addressed, especially, if the same spectrum is to be used for both. The problem will be simplified to a great extent if the spectrum allocation is done in such a way that a single wideband channel (say 20 MHz or 40 MHz) can be used for macro cell deployment and a separate narrow band channel (say 1.25 MHz or 5 MHz) can be used dedicatedly for small cells.