Date 2011-11-25

Reference EILL/B-11:0376

Shri Sudhir Gupta
Pr. Advisor (MS)
Telecom Regulatory Authority of India
Mahanagar Doorsanchar Bhawan
(next to Zakir Hussain College) Jawaharlal Nehru Marg (Old Minto Road), New Delhi 110 002

Attending to this matter
Dinesh Chand Sharma

Subject: Ericsson inputs to TRAI Consultation Paper on IMT – Advanced Mobile Wireless Broadband Services

Dear Sir,

We would like to thank you for the opportunity to provide inputs to TRAI Consultation Paper No. 6/2011 on IMT – Advanced Mobile Wireless Broadband Services, dated 19th August 2011. This is a well drafted, thought-out and comprehensive consultation paper.

Our detailed feedback on issues of importance and applicability as a technology vendor is attached for your kind perusal.

Further, we are always available for any clarifications/discussions, on the recommendations that we have made.

With warm regards,

Sincerely yours,

(DINESH CHAND SHARMA)

Director—Regulatory Affairs & Industry Relations

M: +91-98100 79461

ERICSSON RESPONSE TO TRAI CONSULTATION PAPER ON IMT- ADVANCED MOBILE WIRELESS BROADBAND SERVICES

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?

Globally it is a general practice that choice of technology and architecture is left to market forces to bring the economy of scale by safeguarding minimum set of critical criteria. Also, there are standard bodies such as Global Certification Forum (GCF), 3GPP etc are involved in the activity of defining standards. Operators may choose to specify a minimal set of qualifications for UEs that may be allowed to operate in their networks to maintain the quality of service in their network.

We believe that the prior to IMT Advanced systems getting introduced for commercial rollouts ,global standardization forum responsible for UE certifications will address various category parameters such as below provided in 3GPP release 8 and as mentioned in the table below:

LTE UE category data rates (Mbps)

Category	**1**	**2**	**3**	**4**	**5**
Downlink	10	50	100	150	300
Uplink	5	25	50	50	75

Table 1.1

LTE UE category MIMO antenna configurations

Category	**1**	**2**	**3**	**4**	**5**
2 Rx diversity	Assumed in performance requirements across all LTE UE categories				
2 x 2 MIMO	Not supported	Mandatory			
4 x 4 MIMO	Not supported				Mandatory

Table 1.2

Modulation order as mentioned below

Category	1	2	3	4	5
Downlink	QPSK, 16QAM, 64QAM				
Uplink	QPSK, 16QAM				QPSK, 16QAM, 64QAM

Table 1.3

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.

Operators may determine that UEs might meet certain minimal set of performance characteristics to improve their network efficiency. Such criteria may also change over the lifetime of a network. Hence, it is best to leave these performance characteristics to be addressed by market forces.

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?

The consultation paper lists a comprehensive set of potential threats to IMT-Advanced systems. Most of these issues have already been considered in 3GPP, IETF and other standards bodies, and mitigation strategies have been incorporated into protocols under development.

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

The Government has already specified through its amendment dated May 31, 2011 that the security of the network is the responsibility of the licensees and has suggested various measures to do so. The same will hold good in all kinds of networks and as technology evolves all associated security measures will be addressed through security guideline amendments in consultation with industry.

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

and

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?

and

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

It may be noted that, with the current limited spectrum assignment, wireless networks will be capacity constrained irrespective of the technology used. When considered on a per MHz basis, the performance and efficiencies of current technologies as well as the newer technologies (like IMT-Advanced) are nearly the same when deployed in smaller quantum of

spectrum. While advanced radio technologies introduce further improved spectral efficiency, these technologies require wider bandwidths of spectrum. It is therefore important to make available sufficient spectrum especially in the bands identified by ITU for deployment of these IMT -Advanced wireless technologies without severely impacting existing services.

It is essential that substantial bandwidth is being made available to each operator so as to enable proper utilization of the spectrum resource to provide real benefits of technology for broadband services. Since, large bandwidths would be required to cater to higher speeds of 100 Mbps and more, it is imperative that fragmentation of the bands be avoided, instead large contiguous blocks and sufficient quantum are made available in a timely manner to the operators to achieve better efficiencies and throughputs. In order to make the services affordable to end user a fair competition would be needed hence there should be 3-4 service providers in each service area to provide BWA services.

The other important factor is the need for consideration of global harmonization of spectrum to achieve economies of scale. Report ITU-R M.2078 was developed on spectrum estimates for IMT Services. According to the estimation in this Report, even with significant improvements in spectral efficiency that may come from the development of new radio access technologies, the predicted total spectrum requirement was calculated to be 1280 MHz and 1720 MHz for low and high user demand scenarios, respectively. However, in view of data growth rate seen in the recent times, the spectrum already identified for IMT services in the Radio Regulations will not be able to meet the spectrum requirement in the year 2020 for even the lower user demand scenario of 1280 MHz as indicated in the Report ITU-R M.2078. Hence It is evident that to meet that demand for wireless broadband services, additional bands will need to be identified by the WRC for which India must take up the case with ITU APT and relevant international forums leading to the WRC 15/16.
It is not necessary to separate IMT-2000 and IMT-Advanced from spectrum point of view as the timing of technology introduction for commercial rollout, and its global harmonization will determine the technology spectrum band association .
We believe, the following spectrum bands as identified by 3GPP bands could be considered as possible candidates for IMT Services subject to its introduction timing –

Frequency Band (MHz)	**Spectrum (MHz)**	**Total Spectrum (MHz)**	**Block size of spectrum to be put on auction**	**Bandwidth (MHz) per Operator per Service Area**	**Type**
700	698-806	2x45	2x5	2x10	FDD
900	890-915/935-960	2x25	2x5	2x10	FDD
2300	2300-2400	1x100	1x20	1x20	TDD
2500	2500-2570/2620-2690	2x70	2x5	2x20	FDD
2500	2570-2620	1x50	1x10	1x10	TDD
3400	3400-3600	2x80	2x20	2x20	FDD

Table 1.4

Also in the context of IMT-Advanced, we believe that making available additional large chunks of spectrum for mobile broadband will be critical to achieve the goal to make at least 100Mbit/s broadband access available to all citizens. Close cooperation with the industry and government agencies will be vital in finding solutions to ensure that advanced wireless services can continue to flourish in all segments of the economy.

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?

We believe Yes, there is a need to specify duplexing scheme as early as possible and these should be based on standards specified by 3GPP to achieve global/regional harmonization. In Region 3, there are many developing countries that really need affordable device ecosystem to improve their broadband penetration which in turn has a direct positive impact on the growth of national GDP. One of the important and proven ways to achieve this goal is to take advantage of economies of scale and this can be realized by harmonized usage of spectrum. Following duplex schemes are suggested in view of its ongoing/completed harmonization.

Frequency Band (MHz)	Spectrum (MHz)	Type
700	698-806	FDD
900	890-915/935-960	FDD
2300	2300-2400	TDD
2500	2500-2570/2620-2690	FDD
2500	2570-2620	TDD
3400	3400-3600	FDD

In response to the second part of the question, TDD parameters may be left for operators who may choose them based on user/market requirements. However, it is important and critical that sufficient guard band, as identified globally, be provided between spectrum blocks allocated to different service providers to avoid any mutual interference.

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

No Comments

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

No Comments

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

No Comments

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

No Comments

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

No Comments

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

Multiple Input Multiple Output (MIMO) technology is a wireless technology that uses multiple antennas at both transmitter and receiver. The use of multiple antennas allows independent channels to be created in space.

When using MIMO, it is necessary to use multiple antennas to enable the different paths to be distinguished. There can be various MIMO configurations. For example, a 2x2 MIMO configuration is 2 antennas to transmit signals (from base station) and 2 antennas to receive signals (mobile terminal). Similarly 4X4 or even higher order configurations are possible in MIMO.

MIMO approach of communication in IMT-A to be evaluated for requirement and need in Indian scenario as its demand for additional investment in the infrastructure.

Alternative option of smart software and hardware upgrade in the existing base stations to substantiate MIMO technology approach of communication should be preferred first.

Infrastructure sharing issues using MIMO technology could be following

a) Individual Network Optimisation will be challenge due to use of common antenna
b) Degradation of KPI with use of combiners to support sharing of antenna.
c) Loading of Tower infrastructure with more feeder cables.
d) Loading of Building infrastructure for IBS.

It is relatively easy to add more antennas to a base station, the same is not true of mobile handsets, dimensions of the user equipment limit the number of antennas which should be place at least a half wavelength apart.

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

and

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

LTE-Advanced supports Quality of Service Differentiation (QoS), emergency call support, inter-system handovers, and seamless handovers. However, it may be noted in this context that several ITU study groups and global standardization Bodies are working to evolve QoS parameters for real time services (voice and video) for networks based on 'IP' and these should be implemented, as & when they are available from ITU.
As the technology and standards evolve minimal voice assured quality will be defined and guaranteed by dedicated QoS. IMT-A interworking with 2G and 3G existing network is preferred and shall support voice with VoLTE solution.

2G GSM/GPRS/EDGE and CDMA 2000 1x networks and 3G EV-DO and HSPA networks provide voice and data services to about 800 million users today. Mobile network operators have invested huge sums of money to build the networks that serve those users. Further, these networks utilize a large amount of spectrum that the government has already provided for this purpose. With these facts in mind, it is economical to continue to use these highly optimized 2G/3G networks in concert with LTE networks to be deployed.
Next, users would want seamless data session connectivity and reliable and affordable voice connectivity. This implies interworking and interoperability between LTE and 2G/3G networks should be supported. That said, this requirement is best left to market forces.

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.

It's early to comment as standardization efforts are still in progress and ongoing.

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?

- Femto cells or SON architecture can impact the network KPI in a manner such as mentioned below
    - The femto solution, if deployed, needs to be strictly co-ordinated and in sync with same Sync source as otherwise it could lead to interference and performance degradation
        a) Handover and Throughput impact on both femto and macro cells.
    - The femtocell is connected to the operator's network through an IP broadband backhaul connection such as fiber, DSL or cable. Femto networks will have latency and bandwidth issues depending upon backhaul solutions available for femto.
- As femtocell shares the licensed wireless spectrum with the macrocell, femto cells may create coverage holes or use spectrum that would otherwise be available for the macro layer.

  WiFi exploiting unlicensed or license-exempt bands is an attractive solution comparatively. Policy guidelines shall also explore use of low power nodes (LPNs) deployment in the existing network, which is characterized as heterogeneous network (HetNet). The category of the low power nodes can be Remote radio head (RRH), Micro eNB, Pico eNB (i.e., Hotzone), Home eNB (i.e. Femto), and Relay nodes. Different kinds of nodes can have different transmission power and be deployed for different scenarios.