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VNL Response on the chosen questions of TRAI Consultation Paper on IMT – Advanced: Mobile Wireless Broadband Services

Mandatory Characterization on IMT-A UE

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?

VNL View:

No vendor specific equipment or the architecture for LTE-A UE may be specified or allowed for the Indian market. At the same time, it should not be left completely for the market forces to decide. The differentiation in the UEs from various vendors is primarily on the differentiated technical mechanism which decides their performance. Some of such technical differentiation may add to the value for their increased complexity and the cost and many may not. India should have its technical competence to technically evaluate the various options available from the vendors and based on the cost-performance benefit, the suitable decisions may be taken and be made part of the national specifications of the IMT-A UE based on LTE-A technology. Failing which, India will continue to be the huge dumping ground at least for the initial stage till the local market or user group get adequately informed on the cost-benefit of the UE differentiation. However, it is also suggested that our standards organization may develop specifications of a few UEs for most popular / important applications which Indian manufacturers may start developing. The national telecom agencies must play a key role in providing adequate information to the user groups through necessary national standards and the regulation. The current technical preparedness in this aspect is poor and needs significant attentions of the concerned authorities.

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.

VNL View:

UE performance characterization over and above their basic interoperability, air interface protocol and emission conformance, through national standards is very important from two reasons:

1. It establishes a compulsory mechanism with in the country to keep track on the technology/product performance enhancements trends leading to national knowledge development and working collaboration of the Indian team with the global technical experts engaged in the advanced technology product development.

2. Once the right technical knowledge exists within the country, India can generate and keep enhancing the national standards controlling the inflow of the technically suitable high tech user equipments.

It is to be remembered that the UE under questions are extremely capable devices and they have IP connectivity with the mobile networks. The security implication of such IP enabled extremely capable devices may turn out be very serious and state need to have a mechanism to control their penetration whenever it is demanded. Establishing such mechanisms from the beginning through incentives to the indigenous development and manufacturing are necessary to keep the national interest in mind.

Security Issues relating to IMT-A

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?

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

VNL Views - Combined Response to both the Security questions:

Identification of the security concerns due to the enhanced capability of the UE and their network connectivity over open architectural framework of IP are quite elaborate in the consultation paper. Adding one or two very high level points on the security concerns, potential threat or the security framework through this consultation process may not bring much advantage. Instead, TRAI should look forward to receive necessary detailed technical information from, or be part of, a national technical expert group on "Telecom Network Security". TRAI should recommend establishing such 'Security Expert Group on Telecom". The expert group must be permanent in nature as the security issues and the technical solution for them are ever evolving. This must include the experts already working on this aspect from Government, Academic institutes, DRDO and Government funded R&Ds. It should also include technology experts from privately funded R&D organizations. This group should seek active contributions from Telecom Technology Standardization organizations. The expert group should also define, fund and coordinate the indigenous technology development programs for the enhancing the national capability of telecom network security.

Regulatory Issues in IMT-A System

Spectrum Issue (What bands?)

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

VNL View:

It is important to assign Spectrum bands which are also common to most of the countries. It will serve two purposes. First is that roaming to and from different countries will be easily possible and secondly the cost of UEs will be low due to economy of scales. It is observed that many countries including India have agreed to assign 698-806 MHz and/or 3.4-3.6 GHz Bands (Ref: IND 38 & IND66 in NFAP 2011 and WARC 2007) and small chunks of bands in 2GHz band for this purpose. For implementation of IMT-A to provide very high data rate services, there is a need for large spectrum bandwidth (min 500MHz) for allotment to several operators with 2X20 or 2X40MHz carrier BW. However spectrum availability in any of the bands is scarce, therefore re-farming is necessary preferably in 2 and 3GHz bands. In low frequency bands (700MHz) only a few carriers can be harnessed for FDD mode or TDD mode.

Block Size of Spectrum

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?

VNL View:

Though 2X20 MHz for FDD 1X40 MHz would be best to implement IMT-A, initially only 2X20MHz per operator may be put on auction. Depending on the implementation, provisioning of the services, and its success, another 2X20 MHz per operator could be auctioned/ allocated. The above suggestion is based on the assumption that MIMO technology with 4X4 antenna configuration will be implemented. In our opinion not more than six operators per service area be considered.

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

VNL View:

In our opinion at least 20MHz bandwidth per carrier should be allocated for effective provision of IMT-A (4G) services which could be increased to 40MHz at a later stage.

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

VNL View:

Initially 2X20MHZ max for FDD may be allocated per operator. This is based on the assumption that the technology allows frequency reuse factor of 1/1. For TDD, 20MHz per operator may be initially auctioned / allocated.

Duplex schemes: TDD Vs FDD

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?

VNL View:

In our opinion, both duplexing scheme i.e. FDD & TDD should be permitted for induction of service in India. Further there may not be any need to specify frame duration etc except that any technology to be adapted should comply IMT-A (3GPP)/ Indian Standards.

Reserve Price and Eligibility Criteria:

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

VNL has no comment.

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

VNL has no comment.

Roll-out Obligations:

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

VNL has no comment.

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

VNL has no comment.

Annual Spectrum usage charges

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

VNL has no comment.

Infrastructure sharing

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

VNL View:

The sharing of RF portion of the BTS using MIMO technology will depend upon the Antenna and RF Amplifier configuration etc. In MIMO technology, the intelligence can be built in the antenna including RF Amplifier and controlled by the BTS. In such condition sharing of Antenna/ RF cable etc may not be possible except Tower, Power Plant shelter etc. However it may be too early to comment on this aspect, except that there should not be any restriction imposed by the regulator on sharing of active or passive infrastructure.

3GPP has already specified architecture and interface details of the network sharing that may be adopted.

Key Performance Indicators (KPI)

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

Q17. Should the interoperability of services to legacy 2G/3G systems be 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.

VNL Views - Combined Response on Q16-18

There must be national standards on delivering Voice over IMT-Advanced systems as VoIP, interoperability of services to the legacy 2G/3G Mobile networks and the QoS/QoE parameters. The national standards should be developed with collaborating with Indian and international standards activities.

There should be enough regulatory mechanisms to support voice in a heterogeneous network environment. It should mandate signaling mechanism to support uninterrupted voice service in a highly mobile environment as the bandwidth fluctuates and the mechanism should allow the mobile to adapt accordingly. Future NGN application requires QoS support from lower layers. There should be regulatory requirement to provide feedback from the lower layers. These voice services should include multi-unicast or multicast-based group conferencing. The regulatory

mechanisms should be able to provide multi layer QoS such as at data link layer, network layer and application layer. These should provide multi-time scale granular measurements. IMT-A systems should also consider defining a set of requirements that is application specific and applicable to Indian rural environment.

Guaranteeing QoE (Quality of end-user experience) depends upon QoS measurements at several layers. KPIs should include both performance KPIS and security KPIs as these affect each other. QoS measurements from IMT-A systems should consider KPI at several layers including datalink, network, transport and application layers. Since IMT-A is dependent upon wireless access, datalink/MAC layer KPI would play an important role. These require multi-time scale measurements to provide the granularity of QoS, require multi layer measurements to provide the correlation between signaling and media (e.g., EPC and IMS), require DPI for application classification and control, require session-based measurements for both signaling and media.

New Access Models (Relays, Femto Cells and Pico cells)

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?

VNL Views:

New Access Models as visualized for Indian deployment:

India, being a mass consumer of the wireless technology for mobile communication, needs to evolve suitable set of deployment strategies for rural and urban before introducing the modern broadband wireless technology. The deployment architecture of the IMT-Advanced technology to meet two different needs to be suitably evolved. Such evolved different deployment architectures will then provide the necessary direction to the product developer using IMT-Advanced wireless technology.

The current scenario: At this point of time, the global focus is in maturing the IMT-Advanced wireless technology to the level such that the key radio technology specifications with regard to

maximum (peak) data rate with low and high mobility, latency, Spectral efficiency and technical compatibility with IMT (3G & 2G) Technologies, meets the criteria set by ITU to qualify as IMT-Advanced wireless technology candidate. The capabilities defined for IMT-A are technologically significant, but themselves do not necessarily guarantee the usefulness of the products for various deployment scenarios, especially for rural area. Suitable deployment architectures and the required product definition will emerge later ensuring the conformance to the needs and challenges of the prevailing deployment constraints.

Rural Deployment as driver for IMT-A System in India: Since the urban area in India has already experienced various modes of broadband services, the key beneficiary of the IMT-Advanced technology in India will be people in rural area. There is still very bleak possibility that State will be able to provide adequate electricity to rural areas to meet power requirements of the telecom and IT infrastructure in conventional way. **Therefore it is most important for the Regulator to specify the mandatory guideline with regard to the power efficiency of the IMT-Advanced base stations to operate on renewable source of energy with efficient storage.** The engineering requirements with respect to extreme weather tolerance, size, weight also need to be defined to meet the rural challenges.

These key specifications will force national and international telecom community to evolve suitable methods to achieve these deployment requirements.

Requirement assessment for rural deployment of IMT-A Systems: Coexistence with, and the best leveraging of, the existing telecom infrastructure in rural area is another important point for regulation for consideration to provide the best benefit of IMT-A technology in rural area. This consideration will lead to necessary **definition and specific requirements on account of the spectrum usage, power consumption requirements , EM radiation, Cost (CAPEX and OPEX) and the potential Return on Investment**. Therefore it will become necessary data for the **evolution of suitable policies** on every such account of importance.

Standardization of sustainable rural IMT-Adv Systems: The IMT-Advanced technology products for urban deployment in India are likely to follow the deployment architectures as being evolved in the developed world. **So far there has been no attempt globally to evolve suitable deployment architecture and the suitable product that can ensure sustainability of IMT-A or current technology based telecom infrastructure in rural areas.** India needs to find its own solution and lead international initiative in this direction. Such solutions and indigenously developed products may be provided preferential market access.

Phased deployment in rural India: In VNL's opinion, IMT-advanced Radio technology based products may get introduced in Indian rural network in two phases. The Phase1 will be small cell deployment where one or sometimes more cells (possibly overlapping), capable of high data rates (1Gbps) in low mobility mode will provide adequate capacity and coverage only for a

particular village or specific areas on interest in isolated villages. There will be no large cell deployment of IMT-Advanced Radio technology products in this phase. Therefore these small cells will be parented to the same core network which already have Large cell (or combination of large cells and Small cells) deployment in rural areas based on current GSM/EDGE (or upcoming 3G) technology. The small cells in rural area will not be Femto cells as defined currently but will Micro cells catering for outdoor and indoor requirements for short cell range with reasonably higher capacity then current Femto/Pico definitions. Additionally the small cells would be capable of the mechanisms being defined in Self organizing network (SON) architectures in global standardization forums.

The second phase of IMT-Advanced technology products deployment in rural India will be to covers the roads connecting the villages, agricultural fields, forests etc in Large Cell strategy supplementing the current GSM/EDGE Large cells in rural areas.

Higher through put and the performance of the IMT-Advanced systems will be the driver for the first phase while the more stringent cost-benefit criteria would be applied before justifying deployment of phase 2.

Key Performance Indicators (KPI): The key performance measurement focus will shift from parameters which defines the collective performance of all users being served by particular network element to the parameters which determines actual **quality of experience (QoE)** by an individual user.

Spectrum requirement & Relays as coverage extension: If the Phase1 deployment strategy is chosen, the Spectrum requirement for the small cells deployment of the IMT-Advanced technology will be efficient and the need for Relays as the coverage extension techniques will not be applicable for the rural deployment.

Infrastructure Sharing of IMT-A Systems: Such adopted deployment architecture will enable significant value if the rural telecom infrastructure is shared among multiple service providers. Suitable regulation change with regard to the spectrum sharing will be required to get the best benefit from the emerging advance technology deployment.