Response to TRAI Consultation Paper Consultation Paper No. 15/2017 Next Generation Public Protection and Disaster Relief (PPDR) communication networks'

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EXECUTIVE SUMMARY

The National Center of Excellence in Technology for Internal Security (NCETIS) at Indian Institute of Technology Bombay has been setup with the support of Ministry of Electronics and Information Technology (MeitY). In NCETIS, several products and technologies are being developed including those in Communications Systems to address the requirements of state and central police forces. Our response to TRAI consultation paper is based on our understanding of the requirements of state and central police forces through sustained interactions.

COMMENTS & SUGGESTIONS

The following are comments and suggestions for some questions listed in the consultation paper.

Q1. Do you consider the existing fragmented model of PPDR communication network in the country adequate to meet the present day challenges? If not, what are the deficiencies in the existing model of PPDR?

Our Response –

The existing fragmented model of PPDR communication network in India is definitely not adequate to cater to the present day challenges. The following are the deficiencies of the current model.

1. Currently, there is no uniformity in the operational frequency bands for Narrowband PPDR across the country. Various state and central security agencies are adopting different non-interoperable technologies such as APCO Project 25 (P25), Terrestrial Trunk Radio (TETRA) or Digital Mobile Radio (DMR) for their voice networks deployed over varying frequency bands in 300MHz/400MHz/800MHz. The devices for these technologies are restricted to operate only in the frequency bands for which the devices are made available by vendors. This prohibits the use of a homogeneous infrastructure and devices by different agencies of the country, which is very critical when there is a need for various security agencies to share vital information with each other especially during emergency.

2. High situational awareness is a very important contemporary PPDR requirement that cannot be met by the currently deployed Narrowband PPDR technologies. Such systems typically operate on spot frequencies and can only support two-way voice communications with little or no inherent support for data or multimedia services.Hence there is an urgent need for a technology upgrade of PPDR network by leveraging broadband wireless emergency communication systems. The dependence on public networks for inter-agency communication

needs to be eliminated. While security compromise is a crucial issue, unavailability or overloading of public networks during a disaster scenario would make it impossible for inter-agency coordination and knowledge sharing. For instance, in the event of a natural calamity like a flood or earthquake, or a man-made disaster such as a building fire or bomb explosion, multiple first responders from various agencies such as the police force, fire services etc. could be involved in field operations. A centralized command center monitoring the situation could guide all the field responders of various agencies if all of them were communicating over a single frequency using the same radio technology. If the field responders of a certain agency are using equipment that are incompatible with a rapidly deployable central monitoring node that could be setup during emergencies, it is possible that they are unable to receive crucial inputs which could result in compromising their safety as well along with civilian lives.

3. Besides deploying a uniform radio technology for all the security agencies, it is also important for the agencies to have access to devices that support a harmonized frequency band dedicated for operations across the country. This would allow the agencies to coordinate in real-time during emergencies using the harmonized band as otherwise crucial time could be lost if using mechanisms to relay messages through more than one communication system.

Q2. In the various models described in para 2.11-2.15, in your opinion which of the model (dedicated, commercial, hybrid) will be more suitable for Indian conditions? or Is there any other alternate model which would be more suitable for Indian telecom environment? Please provide rationale for the suggested model.

Our Response –

It would be most prudent to primarily adopt the integrated coordinated model for a nationwide public safety broadband network to ensure that the network is resilient and secure. This would involve designation of a dedicated spectrum for PPDR operations.

Please note that the State Police forces already deploy and manage state wide network based on narrow band PPDR such as TETRA or P25 and other such systems. However, these networks do not inter-operate with other states. Integration of these networks through a centrally coordinated effort as a dedicated nationwide PPDR network will help in inter-operability with all state police and other first responders like fire brigade and addressing the problem of fragmentation.

Allocation of dedicated spectrum for the nationwide broadband network is likely to foster an indigenous device ecosystem and provide an impetus to the development of sophisticated communication devices in the country. It would pave the way for various agencies in the country to work together and coordinate PPDR operations in realtime.

Building anintegrated dedicated PPDR network under the coordinated control of the central agency will make the network highly reliable and highly available.Also, an integrated dedicatednetwork will be necessary for the security of data.The level of security and exclusivity required by security agencies cannot be provided by commercial telecom networkeven if PPDR users are treated as a privileged special user group.

Q3. Should PSUs be earmarked for providing nationwide broadband PPDR communication network? Please justify your answer.

Our Response-

State and Central Security agencies already deploy and manage state wide PPDR network through their wireless divisions in respective organization. It is necessary to integrate all these networks, enhance with broadband capabilities and create a nationwide B-PPDR communication network under the overall coordination of a central agency.

Q4.Will it be technically feasible and beneficial to permit PPDR trunking service roaming on public telecom networks? If yes, what challenges do you foresee in implementation of such an arrangement? Please justify your answer.

Our Response –

See our response to Question no 2. It is not advisable to permit PPDR trunking service roaming on public telecom networks for security operations as the level of security and exclusivity required cannot be ensured. However, priority services for mobile phones (as per TRAI recommendations on Priority Call Routing) of security personnel can be offered in addition to exclusive PPDR network.

Q5. Can frequency bands be identified exclusively for public protection and disaster relief? What are the candidate bands for PPDR operations in India?

Our Response –

There is an indispensable need for the allocation of dedicated spectrum for broadband services in the public safety bands. It is important for India to assign bands for exclusive deployment of Broadband PPDR systems as being done by many other countries (USA, Korea, Canada, France etc.).The current frequency allocation for public safety communication in India (IND82 in NFAP 2011) recommends the following bands for PPDR communications:

380-400 MHz, 406.1-430 MHz, 440-470 MHz, 746-806 MHz, 806-824/851-869 MHz, 4940-4990 MHz and 5850-5925 Mhz.

It is recommended to designate the band 440-470 MHz as the nationally harmonized spectrum dedicated for Broadband PPDR operations. This band would be an ideal candidate for B-PPDR in India considering the following factors.

1. In its Resolution 646 of World Radiocommunications Conference (WRC)-15, ITU-R has recognized that bands 406.1-430 MHz, 440-470 MHz and 4940-4990 MHz could be used for PPDR applications including Broadband PPDR in Region 3 (where India belongs). Even though ITU-R Radio Regulations have identified 450-470MHz as an IMT band, the WRC solution for PPDR applications for Region 3 does not preclude the countries in the region from realizing anddeploying B-PPDR in a non-IMT band. Since the frequency range of 440-470 MHz has been identified as one of the PPDR bands for Region 3 in WRC 15 Resolution 646, this complete 30 MHz range, instead of a subset of the same, should be considered for B-PPDR applications. Designating this complete range (440-470 MHz) for B-PPDR would help in harmonization as well as better alignment of NFAP with WRC 15-Resolution 646.

2. In terms of path loss in outdoor environments, performance in 400 MHz will be better than that of other higher frequency bands, say 700/800 MHz. Building penetration in urban areas, including indoor coverage in difficult places such as stairwells, is also good for 400MHz.

3. The propagation characteristics of 400 MHz band are typically better than those of 700/800 MHz band. Therefore the communication network using 400 MHz band is likely to have lesser number of base stations than the one using 700/800 MHz band, which is expected to result in the reduction of capital expenditure(CAPEX) and Operational and Maintenance cost (OPEX). This also means that with the introduction of broadband services in the 400 MHz band, coverage of a given area can be achieved with the same number of radio sites as the current narrow band networks deployed in the same band.

Considering that existing narrow band systems (TETRA/P25 /DMR) are currently deployed in 400MHz/800MHz and in view of the operational needs outlined above, requirement of broadband public protection and disaster relief (B-PPDR) communications should be considered in the frequency band 440-470 MHz.

Products and systems based on Long Term Evolution- Public Safety (LTE-P) are available now for broadband PPDR. LTE standard is being enhanced with many mission critical features such as Mission Critical Push to Talk and Group Call normally present in PPDR technology such as TETRA.

Q6. If wideband/broadband PPDR is to be implemented in India, what quantum of spectrum will be needed for such solution for PPDR?

Our Response –

The quantum of spectrum depends on the use cases (some of them are outlined below) but B-PPDR systems would require a minimum bandwidth of 10 MHz for satisfactory operations. However, considering the large population in big cities in India, a contiguous frequency band of at least 20MHz should be allocated for B-PPDR so that it could cater to the requirement of all public safety related communications.

Other nations like the US, Canada and South Korea have also allocated 20MHz of bandwidth for B-PPDR. The Federal Communications Commission (FCC) in the United States (US) has designated "758-769/788-799 MHz" as a broadband public safety communication spectrum. Similarly in countries like Canada and South Korea, the government has allocated 2x10 MHzof 700 MHz spectrum for a public-safety broadband network.

The requirement of high speed data and video transmission varies depending on the use cases-

1. **Day to Day police operation**- It involves maintenance of law and order, traffic management including road accidents, building fire, festival scenario etc.

This requires video transfer from accident site or other events. This may require uplinking images and video from incident locations.

2**. Public Events**- It involves police bandobast during pre-planned events such as cricket match, large public rally, congregation of people during various religious and cultural festivals.

This may require perimeter monitoring and sending video streams about situational updates on regular basis for effective monitoring from different points and angles etc.

This requires uplinking many simultaneous video streams and may require high aggregate bandwidth.

3. **Emergency Situations**- It involves riots control, terrorist attacks, major fire events involving large area etc.

This requires high definition video streams from cameras mounted on helmets of police/commandos personnel and rescue/relief vehicles.

Depending on various scenarios outlined, the data rate requirement may vary from 512 Kbps (daily law and order scenario) to 2 Mbps per video stream (for public events/emergency scenarios) for standards definition video. The scenarios 2 and 3 would require multiple video streams to be uplinked to central control room.

Spectral efficiency of a communication system depends on the technology employed. As per the 3GPP standard for LTE-Advanced technology, the expected peak spectral efficiency for downlink transmission with 2X2 MIMO and 64-QAM is ~8 bps/Hz, while the average spectral efficiency is expected to be ~2.4 bps/Hz for the same configuration. Similarly, on the uplink with 1X2 MIMO and 16-QAM, the expected peak spectral efficiency is ~2.8 bps/Hz while the average spectral efficiency is ~1.2 bps/Hz.

Considering the average spectral efficiency for transmission under LTE-A systems, a <u>minimum of 10-20 MHz bandwidth would be required for scenarios 2 and 3 for streaming of multiple video streams from incident sites.</u>

Q7. What is the cost and benefits tradeoff envisaged for public protection and disaster relief viz-a-viz commercial value of spectrum?

Our Response-

The spectrum suggested in our response (440-470 MHz) is not meant for commercial broadband as per ITU-R Region 3 allocation. The benefits by allocating this spectrum and deploying network for security agencies will greatly enhance the entire security apparatus in the country. The significant value that would be created will more than offset any cost including any so called commercial value of spectrum. The other spectrum bands such as 700/800 MHz, though advocated by some industry for B-PPDR, do have commercial usages as well in India and according to us, are not recommended in India.

Q8. Do you suggest any other workable option that can be adopted?

Our Response –

Please refer to responses to earlier questions. No specific comments to offer.

Q9. Please give your comments on any related matter not covered in this consultation paper.

Our Response –

The TRAIconsultation paper focuses primarily on the city wide operations.

It does not consider Rapidly Deployable scenarios in emergency situations. In emergency scenarios, like Terrorist attacks, where commandos of Quick Response Team (QRT) of state police and central police such as National Security Guards (NSG) may use wearable (helmet mounted) broadband communication devices with cameras and where the portable base station may be mounted in a command and control vehicle located at some distance away from the site of operation.

Current tactical networks(including systems which are used by Central paramilitary forces such as Central Reserve Police Force (CRPF) deployed in left wing extremist affected areas) provide reliable and secure voice services. But they cannot support broadband applications, such as video surveillance, geo-location or high-speed data exchanges. Instead, their data capabilities are limited to the narrowband range.Rapidly deployable network in a box system with broadband capabilities (such systems are available with LTE-Public Safety version) can be of significant operational use by agencies such as CRPF. Thebase station is designed to beportable or vehicle-mounted and is integrated with a control center where a team can remotely monitor ongoing public safety operations in a geographical area and an application server which can host a couple of applications such as group call etc.

The above scenarios require allocation of dedicated spectrum for broadband PPDR.Third Generation Partnership Project's (3GPP's) Long Term Evolution (LTE)-Advanced technology is emerging as the de-facto world-wide standard for mission critical wireless broadband communication system. LTE Releases are being enhanced with all features that are typically required in PDR system in addition to all broadband features already present in LTE. Commonly deployed narrowband PPDR standards such as Terrestrial Trunk Radio (TETRA) and Project 25 (P25) are also moving towards a mobile broadband technology solution. "TETRA and Critical Communications Association" (TCCA) has recently forged a partnership with 3GPP and are working together towards the development of a common wireless broadband communication system based on LTE.