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Proposal for Spectrum for Public Safety and Disaster Relief (PSDR) and Public Protection and Disaster Relief (PPDR) towards National Frequency Allocation Plan (NFAP) 2010

Siddharth Shetty, Akshay Mishra and Abhay Karandikar
TTSL IITB Centre of Excellence in Telecommunication

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akshaymishra@gmail.com, shettysid@gmail.com, karandi@ee.iitb.ac.in

Executive Summary

This document presents the frequency allocation situation for public safety services in India, describes the urgent need for advanced secure public safety system to address the ever growing security situation in India, discusses international developments on the evolution of public safety services and their changing needs, and lays down recommendations and proposals for similar advancements in India to address India specific security requirements.

Anti terrorism and public safety

After the 911 attacks in the United States, a series of laws have been passed in the US to 'upgrade' the existing public safety services. Several independent bodies have been set up for this purpose, which have been entrusted with the responsibility to work along with the FCC to develop the policy and technical framework required for these next generation public safety broadband[1] services. The recently completed National Broadband Plan includes development of a broadband public safety network as one of the goals to be achieved over the next decade. [1]
Similarly the 2611 attacks in Mumbai exposed the urgent need for technology upgrades and changes in policy for emergency communications systems in India. Current systems which operate on spot frequencies in certain earmarked frequency bands can support only 2-way voice communications. In an emergency situation communications systems with capability to support services beyond simple voice communications (high quality images and videos) can prove to be life saving for the public safety personnel and civilians alike. There are similar requirements for information exchange during other emergency situations such as train / aircraft mishaps, earthquakes and other natural disasters etc. This document discusses the current scenario of frequency allocation for public safety in India, international developments on broadband PPDR requirements, recommendations to address India's security situation, and finally the proposals for advanced PPDR systems for India.

Frequency allocation for public safety in India

As per IND73 of the National Frequency Allocation Table (NFAP-2008) certain spot frequencies have been earmarked in the following bands for public protection and disaster relief (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

International developments on Broadband PPDR requirements

In recent developments in Europe band 380 – 470 MHz has been identified for digital PPDR applications and sufficient parts of this band will be made available for wide band PPDR services [2].The decision adopted in this ruling was based on findings from a previous report

[1] Broadband refers to the capacity of the radio frequency channel. A broadband channel can transmit live video, complex graphics and other data-rich information as well as voice and text messages.

(ECC Report 102 [3]) published in 2007 which discussed the need to develop spectrum requirements for Public Protection and Disaster Relief for wideband applications (e.g. wireless transmission of large blocks of data and video) and/or broadband applications (e.g. high-speed data, high quality digital real time video and high volume data exchange) with channel bandwidths dependent on the use of spectrally efficient technologies insuring interoperability.
The inclusion of Broadband (BB) PPDR over and above the systems that are available today were highlighted in this report. Technical details and use case scenarios for such broadband technologies have been included in the Annex of this document.

Recommendations for Indian scenario

Currently, all public safety communication infrastructures in India use narrowband radios. These radios employ narrowband channels and are operated on spot frequencies that are assigned to different public safety entities on a case-by-case basis. The narrowband nature of these radios limits them to 2-way voice communications with no inherent support for high-bandwidth transmission requirements such as interactive video communication, remote video surveillance of security or disaster sites. In addition, the technology used for most of the existing Indian security infrastructure do not provide the level of secure communication required by India's security forces resulting in easy leak of information to rogue entities, e.g., terrorists.

Thus, there is an urgent need for India to upgrade its PPDR infrastructure to address the following issues:

1. significantly increase the capacity of PPDR systems,
2. provide advanced mechanism to ensure that communications between India's security forces and agencies are not intercepted by anti-India elements.

The only way to improve the capacity of these public safety networks is to make more spectrum available for such services in the public safety bands. In future such networks should be able to support high-speed communications with capabilities of transmitting large volumes of data (such as high quality photographs, floor plans and live video). Since radios by design operate on continuous range of frequencies at a time, frequency bands should be allocated in a way that facilitates wider channel bandwidths thus enabling next generation of wireless broadband technologies.

Recommendations:

One of the big constraints for widespread deployment of public safety equipment is the high cost involved in the procurement of PPDR infrastructure as well as devices. Proprietary solution developed for niche markets are bound to cost more than standards based radios built for the commercial sector. This problem can be addressed by generating economies of scale by involving commercial radio vendors / carriers in the development and deployment of, for example, a common radio interface. An example is the 4.9GHz public safety band in the US where commercial 5GHz WiFi radios chipsets can be employed with minimum changes to the hardware. Similar frequency planning can be undertaken in sub-GHz frequencies where propagation characteristics are much better suited for long range communications. Adopting such

an approach in the lower frequency bands will extract maximum value at the lowest cost possible.

Moreover proprietary technologies that are custom-built for niche markets are highly dependent on support from a dedicated vendor, making system upgrades prohibitively expensive. This can lead to technology 'stagnation'. In addition to lowering system cost, there are other significant advantages of adopting standards based solutions:

1. To make of use the research and development work done by Indian academia, Indian security research bodies and industry to develop technologies specific to Indian use cases and scenarios
2. To have an interoperable standard based advanced PPDR system for various India security agencies enabling the use of homogeneous infrastructure and devices by all the agencies. This is critical to design a common platform where various security agencies can share vital security information among each other.
3. To empower India to be the sole owner of India's PPDR system and make it easy for Indian security forces and agency for adaptability for future upgrades of India's PPDR system. While not a requirement for commercial requirements, PPDR is unique since we would like to own, operate and manage emergencies with our own equipment to avoid compromises and embarrassments.

It is very well understood that the different frequencies have different propagation characteristics and sub-1GHz waves have better indoor to outdoor propagation since the waves can bend through obstacles. Also such frequencies at low power remain localized and can be re-used easily at different locations. Hence we also recommend that the PPDR/PSDR allocation under Sub-1GHz bands should be maintained and enhanced.

Proposal

- Align with the European decision to make available the 380 – 470 MHz band for broadband PPDR services.[2]
- Allocate continuous frequency slots (minimum 10MHz) for broadband wireless technologies in one or more of the available spots in the band listed above. Such a move will not only enable high data capabilities but will also enable reuse of components from commercially available broadband technologies (such as WiMax, LTE) which can be modified to meet the needs of PPDR services. As mentioned in the previous section, adopting such a strategy will help lower costs without compromising the benefits of the systems.

References

1. http://www.broadband.gov/download-plan/
2. http://www.erodocdb.dk/Docs/doc98/official/pdf/ECCDEC0805.PDF
3. http://www.erodocdb.dk/Docs/doc98/official/pdf/ECCREP102.PDF

Appendix

Broadband technology could be seen as a natural evolutionary trend from wideband. Broadband applications enable an entirely new level of functionality with additional capacity to support higher speed data and higher resolution images. It should be noted that the demand for multimedia capabilities (several simultaneous wideband and/or broadband applications running in parallel) puts a huge demand with very high bit rates on a wireless system deployed in a localized area with intensive on-scene requirements (often referred to as “hot spot” areas) where PPDR personnel are operating.

Broadband applications could typically be tailored to service localized areas (e.g. 1 km or less) providing voice, high speed data, high quality digital real time video and multimedia (indicative data rates in range of 1-100 Mbit/s) with channel bandwidths dependent on the use of spectrally efficient technologies. Examples of possible applications include:

- High-resolution video communications from wireless clip-on cameras to a vehicle-mounted laptop computer, used during traffic stops or responses to other incidents and video surveillance of security entry points such as airports with automatic detection based on reference images, hazardous material or other relevant parameters;
- Remote monitoring of patients and remote real-time video view of the single patient demanding up to 1 Mbit/s. The demand for capacity can easily be envisioned during the rescue operation following a major disaster. This may equate to a net hot spot capacity of over 100 Mbit/s.

Broadband systems may have inherent noise and interference tradeoffs with data rates and associated coverage. Depending on the technology deployed, a single broadband network may have different coverage areas in the range of a few metres up to hundreds of metres, providing a wide range in spectrum reuse capability. Collectively, the high data speeds and localized coverage area open up numerous new possibilities for PPDR applications (tailored area networks, hot spot deployment and ad-hoc networks).