

PUBLIC SAFETY REPORT

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BROADBAND MOVES IN AT

700 MHZ

Despite indecision about the details, wireless broadband is set to become the 700 MHz band's new tenant.

By David K. Stern and Gary Hartman

During the past year, there has been tremendous activity in regard to public-safety broadband-data systems, 700 MHz reallocation to support these systems, additional 700 MHz spectrum, and broadband interoperability. This article addresses the current regulatory proposals, technical perspectives on upcoming public-safety broadband systems, and some additional elements in the broadband interoperability discussion.

The FCC's Current Proposal

The FCC's recent notice of proposed rulemaking for the 700 MHz public-safety spectrum recommends modifying the existing band plan to achieve a nationwide interoperable

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broadband service for public safety in a significant departure from the typical public-safety allocation model. The proposal would consolidate, on a nationwide basis, the existing public-safety 12-megahertz wideband spectrum with a single licensee or National Public Safety Broadband Licensee (NPSBL). The NPSBL would provide access to public safety on a fee-for-service basis and would provide commercial access on a pre-emptible basis.

The FCC intends to establish baseline performance requirements, including interoperability, nationwide buildout coverage requirements, unconditional pre-emption of commercial use, and disaster restoration as conditions for operating the system. The NPSBL is encouraged to achieve efficiencies in network deployment, including collocation with commercial operator network systems. The NPSBL would also be permitted to use other public-safety 700 MHz spectrum on a secondary noninterference basis for additional public-safety broadband opportunities.

The FCC envisions this will provide public safety with a nationwide broadband network capable of a wide range of communications services on a standardized broadband backbone, enabling nationwide interoperability, with reduced costs, increased spectrum usage efficiency, and enhanced network robustness. Fees derived from the secondary commercial use of spectrum assigned to the NPSBL could provide an additional source of funding to build the nationwide public-safety network. The FCC envisions that the additional functionality, coupled with the potential

cost savings of collocating with commercial operator systems, will facilitate more rapid and extensive buildout of a public-safety broadband network than could be achieved under traditional licensing and funding mechanisms.

Other Proposals

In previous proposals, the FCC and others considered reallocating broadband to one end of the public safety 700 MHz spectrum, eliminating one of the two required guard bands, and moving the existing narrowband spectrum to the opposite end, to achieve additional broadband opportunities and spectral efficiencies for public safety. The FCC's ninth NPRM doesn't preclude the use of this band-plan proposal, which was raised in the eighth NPRM.

Another prior proposal considered combining the public-safety allocation and the commercial guard-band allocation, in addition to shuffling the public-safety narrowband and wideband segments, to achieve additional broadband opportunities by using more of the spectrum reserved for guard bands. This proposal would require public safety to deploy broadband systems in a cellular-like architecture, with base stations arranged with the commercial operator sites to facilitate operation with narrower guard bands, in addition to rebanding the existing public-safety 700 MHz narrowband allocations.

In February, Cyren Call Communications proposed to a Senate subcommittee to build out a nationwide network for public safety and commercial users in exchange for a

30-megahertz license in the 700 MHz spectrum band. The proposal envisions commercial and public-safety users sharing a system that is commercially constructed and operated while providing public safety with priority access to the commercial network. The Cyren Call proposal is similar to the FCC's current proposal; both will establish a national broadband public-safety network through a national licensee. However, the FCC proposes to implement the system in the existing public-safety 12-megahertz wideband allocation, and Cyren Call proposes to implement the system in a new allocation in the upper 700 MHz band, which will require congressional approval. Under the Cyren proposal, the system would be operated and controlled by a commercial entity, whereas under the FCC proposal, the system would be controlled by public safety. The plan faces strong opposition from CTIA and other groups that want the chance to buy the spectrum at auction.

Impact on Regional Planning

To achieve spectrum efficiencies, modern broadband technologies are deployed with a frequency reuse pattern of N=1 (using the same frequencies at all sites in the network) and use adjacent radio frequency (RF) carriers with compatible air-interface technologies. The FCC proceeding provides an opportunity for public safety to use spectrally efficient technologies, a common air-interface standard, and a consolidated and interoperable network on a large-scale geographic basis.

If the FCC adopts its current proposal, the regional planning committees will need to establish working relationships with the NPSBL. The FCC addresses the potential interference issues between broadband data and narrowband voice operations by establishing the noninterference of the broadband into the narrowband service. To use this spectrum for

broadband operations adjacent to narrowband operations, applications of guard bands within the allocation or use of other technical arrangements, such as collocation, could satisfy this requirement.

Broadband Basics

What will the future broadband system physically look like? The system will be consolidated among the various users within a jurisdiction. The cost for deploying separate broadband data networks for the police, fire, and other departments will be enormous compared with a consolidated network. Likewise, smaller jurisdictions may find the costs for construction and operation of a broadband system in a small area out of reach. Therefore, consolidation needs to take place at the jurisdictional level, where countywide and statewide systems are the norm.

The propagation characteristics of

700 MHz spectrum make it ideal for mobile wide-area deployments, where longer coverage distances, building penetration, and signal fading experienced in a mobile wide-area environment can be overcome by the lower propagation losses in this frequency band. As a rule of thumb, mobile applications require an additional 10 dB of fade margin over fixed designs — local conditions vary and must be considered for any final system design — increasing system site counts an additional two to four times over systems designed for fixed use.

Propagation characteristics of 700 MHz are also ideal for in-building coverage, with a small wavelength that penetrates windows and other building openings. However, for applications in large buildings, a 20 dB signal penetration margin — with local conditions varying — will be required, which will increase system

site counts by four to eight times over systems designed for outdoor use.

Many of the current requests for proposals (RFP) for municipal broadband systems call for only a minimum data delivery speed over a percentage of the coverage area, reminiscent of traditional “high and wide” two-way systems. For “low and small” wireless broadband deployments, this specification alone is not enough. Total data delivery capability in a defined area, or data density, must also be considered. If the data delivery speed is specified without any data density, only a single test unit driven throughout the test area without any additional loading on the system would be required. If other units are allowed on the system during testing, the capacity will be shared with all of these units, bringing down the delivered speed of the test unit. The solution is additional sites to deliver the

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additional capacity.

The design considerations for mobile networks require higher margins for the link budget and costs over fixed applications. High-bandwidth fixed applications, such as fixed-mounted video cameras, will not be practical to backhaul on a mobile broadband system. A more economical solution would be to operate a separate overlay network above 1 GHz designed for fixed applications, deploying high-gain antennas at both the infrastructure and client locations, and employing a network design with significantly reduced costs.

Mobile broadband networks may require supplemental incident-area networks to sustain the high traffic loading at major incidents. Most of the traffic load will be within the incident area. By off loading this traffic to a local network, such as an ad-hoc 4.9 GHz mesh network, the wide-area broadband system can manage the traffic from the incident area to other parts of the network. The wide-area broadband design must incorporate supplemental spot broadband coverage, such as an ad-hoc mesh network, fixed-network connections, or even satellite connections, to sustain the high traffic loading on the network during major incidents.

More than Radio Channels

In the past, public safety and the FCC have addressed interoperability at the radio-channel level through the use of a small number of dedicated, shared “interoperability” channels. This worked by assuming that there was a common understood application, namely voice.

What does it mean for a broadband data network to be interoperable? For example, consider two adjacent towns that have deployed broadband systems. If a police officer from Town A (Officer A) “roams” into Town B’s broadband service area, what would Officer A expect to connect to and communicate with?

- Can Officer A directly communicate with Town B’s applications?
- Can Officer A communicate with Town A’s applications, which then communicate with Town B’s applications?
- Does Officer A have the necessary software to connect and read data from Town B’s applications?
- If Officer A has the right software, but is two versions behind Town B’s system, is the software and system compatible?

Besides the raw communications pipe, applications on the broadband network must be standardized and

harmonized for a broadband data system to be fully interoperable. Although current broadband technologies are already capable of interconnection, in many cases, the politics and policies aren’t in place to achieve the necessary standardization of public-safety applications for true interoperability. In this area, the ball is clearly in public safety’s court; application standards must come from the community that uses the applications. To achieve true broadband interoperability, the various public-safety organizations and application suppliers need to begin application standardization soon to make public-safety wireless broadband a success. ■

Gary Hartman, Senior RF Engineer, has worked with both commercial and public-safety clients for V-Comm for the past six years. He has more than 25 years of experience in the commercial and broadcasting industries. David K. Stern, Vice President and Co-founder of V-Comm, has more than 23 years of experience in wireless telecommunications. He has worked with both large and small commercial wireless carriers and public-safety clients. Stern is a member of the Region 8 and Region 28 700 MHz technical subcommittees. For more information, visit www.vcomm-eng.com.

