

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of

Service Rules for the 698-746, 747-762 and
777-792 MHz Bands

Implementing a Nationwide, Broadband,
Interoperable Public Safety Network in the
700 MHz Band

Amendment of Part 90 of the Commission's
Rules

WT Docket No. 06-150

PS Docket No. 06-229

WP Docket No. 07-100

COMMENTS OF QUALCOMM INCORPORATED

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QUALCOMM Incorporated (“Qualcomm”) hereby submits these comments in response to the FCC’s 700 MHz Public Safety Network *FNPRM* seeking input on means of facilitating the deployment of an interoperable nationwide public safety network in the 700 MHz band.¹

First and foremost, Qualcomm applauds the Commission for moving ahead with a national, interoperable wireless broadband network for public safety. As Qualcomm has said in its filings over the years, it is essential that our nation’s first responders have access to a state-of-the-art mobile broadband network so that they can communicate with one another, particularly during emergencies, using the most advanced broadband services, which virtually all Americans

¹ See Service Rules for the 698-746, 747-762 and 777-792 MHz Bands, WT Docket No. 06-150, Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band, PS Docket No. 06-229, Amendment of Part 90 of the Commission’s Rules, WP Docket No. 07-100, *Third Report and Order and Fourth Further Notice of Proposed Rulemaking*, FCC 11-6 (Jan. 26, 2011) (“*FNPRM*”).

use in every facet of their lives. Almost ten years after the tragedy of September 11th, it is time to ensure that our first responders have these capabilities.

Second, as detailed in these Comments, Qualcomm's wireless technologies have been supporting public safety needs for decades. The company is actively working on several technologies that could be highly beneficial for public safety.

INTRODUCTION AND SUMMARY

Qualcomm is actively developing wireless technologies that can be used to support the successful deployment of a nationwide public safety network operating in the 700 MHz public safety band. Qualcomm's chipset division, QUALCOMM CDMA Technologies ("QCT"), has developed multimode wireless chipsets that support both LTE as well as 2G/3G technologies. As with any new wireless technology, it will take a substantial period of time before a public safety LTE network will have universal or near-universal coverage, and the same is true of commercial LTE deployments. To provide broad coverage in the meantime, all of QCT's LTE chipsets are multimode and support 3G/2G technologies. This capability will ensure that devices using LTE also will have support for 3G and 2G technologies and thus can roam on the existing commercial 3G/2G networks. This can provide near-universal coverage until the national public safety network is fully built out and even thereafter, to ensure the widest and most robust coverage on a cost-effective basis.²

In addition, to fill coverage holes and offer the broadest coverage possible, Qualcomm is working on incorporating satellite-based technology in the same wireless chipsets that support terrestrial broadband. Hybrid satellite-terrestrial user devices with the same form factor as terrestrial-only devices will support ubiquitous high speed wireless broadband coverage.

² See FNPRM at ¶ 122.

Moreover, Qualcomm has developed a spectrum access technology called FlashLinQ that introduces many possibilities for advanced public safety communications. FlashLinQ supports peer-to-peer (“P2P”) and device-to-device (“D2D”) communications in unpaired, licensed spectrum by creating a form of so-called “Proximal Communications” that allows hundreds of users (devices) within a one kilometer range to discover one another, and to continuously connect, disconnect, and directly communicate with one other at broadband speeds at ranges of up to several hundred meters. Particularly in emergencies, FlashLinQ can allow public safety personnel to discover and communicate with one another on an interoperable basis and even if there is no cellular infrastructure at the location of the emergency. FlashLinQ provides highly efficient communications among hundreds of users in just 5 MHz of unpaired, licensed spectrum without placing any burden on cellular networks.

Finally, Qualcomm and its wireless industry partners are developing a new, more dense network topology comprised of heterogeneous networks (so-called “hetnets”), wherein higher power cells, regular macrocells, and smaller cells (including picocells and femtocells) all operate within the same coverage area without interfering with one another or with operations in adjacent frequency blocks, and together achieve enhanced coverage and increased cellular capacity.³ Hetnets utilize adaptive interference management and advanced interference cancellation techniques to enable smaller sized cells that enhance coverage and capacity within the same area already receiving base coverage from a higher power cell. For public safety, it may well be that higher power base stations using high elevation antennas can provide a base level of indoor and outdoor coverage, using a minimum number of cells. But, for enhanced coverage in particular locations and added capacity, regular macro cells and picocells can be used, but those cells will

³ See FNPRM at ¶¶ 63-64.

have to be co-channel with the higher power cells, all operating on the same spectrum allocated to public safety. Hetnet techniques can optimize these arrangements. Hetnet techniques will enable the smaller cells to operate within the same coverage area as the higher power cells without causing any interference to one another or to operations on adjacent frequency blocks, and these techniques will achieve the greatest possible capacity and coverage. As a result, the research and development work performed by Qualcomm and other industry partners on hetnets is particularly important for public safety.

Qualcomm, on its own and along with its many industry partners, will continue its ongoing research and development efforts to enable the successful and timely deployment of a fully-interoperable, nationwide 700 MHz public safety network.

DISCUSSION

Qualcomm is a world leader in developing innovative wireless technologies, including Code Division Multiple Access (“CDMA”) -based and Orthogonal Frequency Division Multiple Access (“OFDMA”) -based cellular technologies used throughout the world for voice and broadband communications and countless mobile products and services. Qualcomm’s chip division, QCT, is the world’s largest provider of wireless chipset technology that is used in cell phones and consumer electronics devices. QCT’s multimode chipsets support the full gamut of standardized, globally harmonized 2G, 3G and 4G wide area mobile broadband and cellular technologies, Bluetooth, Wi-Fi, and many operating systems, such as Android, Windows Phone 7, and Qualcomm’s own Brew Mobile Platform. These highly integrated chips and the technologies they support, as detailed herein, will enable next generation public safety communications and advance the critically important work performed by America’s fire, police, emergency medical and other critical public safety personnel.

I. Qualcomm Has Played A Pioneering Role In The Development Of Many Innovative Wireless Technologies And Emergency Communications Tools

Qualcomm has been serving public safety needs since its founding more than 25 years ago. Qualcomm's Government Technologies division ("QGOV") has been at the forefront of developing wireless communication solutions for public safety personnel, pioneering efforts in cellular standards, microelectronics design, mobile broadband data, encryption, and value-added end-user applications for wireless phones. QGOV adapts Qualcomm's commercial products to meet the specialized needs of federal and state emergency personnel. By leveraging the company's wireless expertise, innovative technologies, and industry reach, Qualcomm offers product engineering and advisory services to meet government needs for classified and unclassified solutions in the areas of deployable mobile broadband, information sharing, interoperability, as well as tracking, locating, and situational awareness.⁴

II. Qualcomm Is Actively Developing Means Of Improving Wireless Coverage And Furthering Efficient Spectrum Use To Support A Nationwide And Fully Interoperable Public Safety Communications Network

A. Qualcomm's Multimode Chipsets

Qualcomm is actively engaged in wireless research and development to improve system capacity and data rates through, among other things, network topology enhancements and highly

⁴ Qualcomm also is partnering with Hughes Telematics and American Medical Alert Corporation to provide a mobile personal emergency response service to seniors and caregivers. *See* Qualcomm-Backed Venture Tries to Aid Seniors, Stylishly, Wall Street Journal Blog (Jan. 5, 2011) available at <http://blogs.wsj.com/digits/2011/01/05/qualcomm-backed-venturetries-to-aid-seniors-stylishly/>. In addition, Qualcomm's Wireless Reach initiative is supporting improved public safety communications in El Salvador. *See* Qualcomm Wireless Reach – Public Safety in El Salvador: Wireless Security, Helping Reduce Crime available at http://www.qualcomm.com/citizenship/wireless_reach/projects/public_safety.html.

integrated multi-mode chipsets.⁵ This work will be important for the successful rollout of a nationwide public safety network in the 700 MHz public safety band.

All of Qualcomm's chipsets that support LTE are multimode and also support 3G and 2G technologies. It will take many years in order for a nationwide LTE public safety network to achieve the coverage of today's 3G and 2G networks. To ensure the widest coverage for public safety personnel as quickly as possible and in a cost effective manner, Qualcomm believes that their devices should be multimode and support 3G and 2G technologies to enable roaming on the existing commercial 3G and 2G networks, thereby taking advantage of the billions of dollars in investment already spent to achieve near-universal coverage.⁶

Moreover, Qualcomm has developed a satellite-based technology to be included in the same wireless chipset that supports terrestrial broadband in order to reach areas that are unduly expensive to cover with terrestrial mobile broadband. Hybrid satellite-terrestrial user devices incorporating these chipsets can be used to fill coverage holes in terrestrial mobile broadband networks and support ubiquitous high speed wireless broadband coverage.⁷

⁵ See FNPRM at ¶¶ 63-64.

⁶ See *id.* at ¶¶ 71-75, 122.

⁷ See "SkyTerra's Mobile Satellite Ventures, ICO Global Communications, and Qualcomm Sign Groundbreaking Technology Agreement Enabling First-Ever Integration of Satellite Communications into Mass Market Cellular Handsets and Devices," (Sept. 22, 2008) and "TerreStar Signs Technology Agreement with Qualcomm to Broaden Market Opportunity for Conventional-sized Integrated Satellite-Cellular Handsets and Devices," (Dec. 11, 2008), available at <http://www.qualcomm.com/news/releases/2008/09/22/skyterra-s-mobile-satelliteventures-ico-global-communications-and-qualcomm> and http://www.businesswire.com/portal/site/home/permalink/?ndmViewId=news_view&newsId=20081211006242&newsLang=en.

B. Qualcomm’s FlashLinq Technology Uses Spectrum More Efficiently By Establishing Peer-to-Peer Connections On An As-Needed Basis

Qualcomm’s new FlashLinq technology also provides interesting public safety communications possibilities. This technology allows thousands of wireless devices within a several block radius to discover one another automatically and communicate directly at broadband speeds via direct peer-to-peer (“P2P”) and device-to-device (“D2D”) communications.⁸ FlashLinq uses unpaired licensed spectrum in a new, highly efficient manner, where devices near one another can communicate directly without the need to access cellular infrastructure. Operating in a 5 MHz unpaired allocation, FlashLinq allows thousands of devices to discover and remain “aware” of one another in a continuous background fashion, effectively creating mutual awareness in what Qualcomm calls a “neighborhood area network.”

This technology provides interesting opportunities for next generation public safety applications, for it creates a form of “Proximal Communications” using OFDMA, whereby mobile users (and devices) can discover each other up to one kilometer away, and then continuously connect, disconnect, and directly communicate with other mobile users (and devices) at broadband speeds at ranges of up to several hundred meters. FlashLinq creates a scalable, distributed “Control Plane” for managing proximal D2D communications involving a variety of communication technologies. Nearby devices “discover” each other using FlashLinq discovery, “estimate” their mutual link quality/path loss as a function of this discovery signal, “sense” their RF proximity and available interference-free communication channels, “infer” the quality of these channels based on their estimated path loss, “exchange” their RF proximity

⁸ See *Qualcomm to Demonstrate New Peer-to-Peer Technology at Mobile World Congress* (Feb. 8, 2011) available at <http://www.qualcomm.com/news/releases/2011/02/08/qualcomm-demonstrate-new-peer-peer-technology-mobile-world-congress>.

information and communication capabilities (*e.g.*, 3G/4G WAN connectivity, Wi-Fi variants, Bluetooth), “negotiate and agree” on the best means to communicate within that proximity, and subsequently “communicate” on those terms; all directly on a P2P/D2D basis, without burdening the cellular networks.

In this way, FlashLinq offers important benefits for first responders, who can use it to directly discover and communicate with one another and with victims during emergencies. It also enables entirely new types of direct D2D/P2P wireless services, and offloads traffic from the cellular network. Because FlashLinq communications are proximal (*i.e.*, relatively short range), transmission power levels are kept low, and high levels of spectrum reuse are achieved on par with cellular OFDMA and substantially higher than unlicensed technologies.

C. Qualcomm Is Increasing Capacity Via Network Topology Enhancements

In conjunction with its wireless industry partners, Qualcomm also is developing a new, more dense network topology that would rely upon heterogeneous networks or hetnets, comprised potentially of macro, pico, and femto cells, all operating within the same coverage area, but in a highly optimized manner to achieve greater capacity within a given allocation of spectrum. Picocells are small network cells deployed in the operator’s external plant, whereas femtocells are microcells typically located within the end user premises connected to a DSL, fiber, or cable broadband connection.⁹ Hetnets achieve enhanced coverage, greater spatial reuse,

⁹ Femtocells require new chipsets rather than standard infrastructure chips, and Qualcomm’s chipset roadmap includes chips for femtocells. *See Qualcomm Adds Femtocell Chipsets to Technology Portfolio, Company Will Offer Innovative Solutions Delivering the Broadband Capabilities of 3G to Homes and Offices* (Feb. 16, 2009) available at <http://www.qualcomm.com/news/releases/2009/02/16/qualcomm-adds-femtocell-chipsets-technology-portfolio>.

and increased cellular network capacity by enabling cells of different sizes to operate in concert with one another.

At the Mobile World Congress earlier this year, Qualcomm demonstrated that hetnets consisting of macro/pico/femto cells working together through adaptive interference management and interference cancellation in the user equipment could achieve a substantial increase in network capacity as opposed to a network consisting just of macrocells. For public safety, it may be most advantageous to use higher power base stations with high elevation antennas to provide a base level of indoor and outdoor coverage, using a minimum number of cells. But, for enhanced coverage in particular locations and for additional capacity, regular macro cells and picocells can be used, but those cells will have to be co-channel with the higher power cells, all operating on the same spectrum allocated to public safety. Hetnet techniques can optimize these arrangements to achieve the greatest possible coverage and capacity, while preventing interference within a network or to adjacent frequency blocks.

* * *

Spectrum is a precious, expensive, and limited resource. As explained herein, Qualcomm is dedicated to developing technical solutions to obtain the greatest possible capacity out of a given spectrum allocation, such as the 700 MHz public safety band.¹⁰

¹⁰ See FNPRM at ¶¶ 63-64.

CONCLUSION

Qualcomm is actively engaged in intensive research and technology development efforts in the hope that a fully-interoperable public safety network in the 700 MHz public safety band is successfully and timely deployed.

Respectfully submitted,

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