Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	
Promoting Expanded Opportunities for Radio Experimentation and Market Trials under Part 5 of the Commission's Rules and Streamlining Other Related Rules	ET Docket No. 10-236
2006 Biennial Review of Telecommunications Regulations – Part 2 Administered by the Office Of Engineering and Technology (OET)	ET Docket No. 06-105

COMMENTS OF QUALCOMM INCORPORATED

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QUALCOMM Incorporated hereby submits these Comments on the Commission's *Part 5 Notice of Proposed Rulemaking* that aims to provide increased opportunities for experimentation and innovation by opening new avenues for wireless research and by streamlining current regulations. Qualcomm generally supports the FCC's proposals, as expanded herein, for they are designed to "inspire researchers to dream, discover and deliver" wireless innovations that expand "the boundaries of the broadband ecosystem."[1] This proceeding goes part and parcel with the FCC's other proceedings that are actively looking at means of making available additional spectrum as discussed in the National Broadband Plan to support the so-called Internet of Things and America's expanding mobile broadband ecosystem.[2]

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1 *See* Promoting Expanded Opportunities for Radio Experimentation and Market Trials under Part 5 of the Commission's Rules and Streamlining Other Related Rules, ET Docket No. 10-236, *Notice of Proposed Rulemaking*, FCC 10-197 (Nov. 30, 2010) at ¶ 1 ("*Part 5 NPRM*").

2 *See* FCC National Broadband Plan: Connecting America at 18 (Mar. 16, 2010). *See also* Innovation in the Broadcast Television Bands: Allocations, Channel Sharing and Improvements

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INTRODUCTION AND SUMMARY

There can be no question that ongoing, indeed increased, experimentation throughout the mobile broadband ecosystem is vital to supporting the present and future tidal wave of mobile data demands and, in the long term, appropriately "promote economic growth, global competitiveness, and a better way of life for all Americans."[3] The FCC's Experimental Radio Service ("ERS") has had notable successes. For example, as noted in the *Part 5 NPRM*, nearly two decades ago the Commission granted Qualcomm an experimental license for wireless development work at 1850 to 1990 MHz that led to the creation of today's thriving Personal Communications Service ("PCS").[4]

The FCC is wise to take the steps proposed in the *NPRM* to enable increased wireless research. As the National Broadband Plan accurately predicted, very soon:

> Billions of objects will be able to carry and exchange information with humans and with other objects, becoming more useful and versatile. For example, the Internet of Things will likely create whole new classes of devices that connect to broadband, and has the potential to generate fundamentally different requirements on the fixed and mobile networks: they will require more IP addresses, will create new traffic patterns possibly demanding changes in Internet routing algorithms, and potentially drive demand for more spectrum for wireless communications.[5]

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to VHF, ET Docket No. 10-235, *Notice of Proposed Rulemaking*, FCC 10-196 (Nov. 30, 2010) (noting the need to use incentive auctions to free additional broadcast TV spectrum for mobile broadband); Promoting More Efficient Use of Spectrum Through Dynamic Spectrum Use Technologies, ET Docket No. 10-237, *Notice of Inquiry*, FCC 10-198 (Nov. 30, 2010).

3 *Part 5 NPRM* at ¶ 1.

4 *See* Part 5 NPRM at ¶ 4, n.4.

5 FCC NBP at 18. The Commission projects that the growth in mobile data usage that will soar by more than 3500% by 2014 when compared to 2009 data usage levels. *See Mobile Broadband: The Benefits Of Additional Spectrum*, FCC OBI Technical Paper No. 6 (Oct. 21, 2010) at 9.

Not only will additional allocations of clear spectrum, such as would be made available via voluntary incentive auctions of the broadcast TV spectrum, be needed to support mobile data demands, but also ongoing research and experimentation into novel ways of using existing spectrum more effectively are needed. In this regard, the FCC should allow commercial wireless concerns that engage in extensive research, such as Qualcomm and other for-profit entities, to take advantage of the proposed Research Program Experimental License. Qualcomm respectfully requests that the FCC give serious consideration to this request as well as the other points made in these Comments because they will support the goals set out in the forward-looking *Part 5 NPRM*.

BACKGROUND

A. Qualcomm, Since Its Inception More Than 25 Years Ago, Has Developed Countless Wireless Technology Innovations

Qualcomm is a world leader in developing innovative wireless technologies, including the Code Division Multiple Access ("CDMA") -based and Orthogonal Frequency Division Multiple Access ("OFDMA") -based cellular technologies used in a number of different frequency bands in the U.S. and around the world to support wireless voice and broadband communications. Qualcomm technologies serve as the foundation for countless 3G and 4G mobile products and services and enable wireless carrier networks to support highly advanced mobile voice and broadband data services for hundreds of millions of Americans, in rural, suburban, and urban areas alike.

Since its inception in 1985, Qualcomm has invested more than $15.5 billion in R & D. In fiscal 2010 alone, the company spent $2.55 billion, or 23% of its revenues, on R & D. These enormous expenditures have directly enabled Qualcomm to invent many of the wireless technologies fueling the unprecedented growth in mobile voice and broadband data services.

Qualcomm has an extensive portfolio of U.S. and foreign patents relating to digital wireless communications technologies, and the company continues to pursue patent applications in the U.S., Europe, China, Japan, South Korea, Brazil, India, Taiwan, and other countries around the globe. In fact, every division and subsidiary of Qualcomm around the world has multiple research teams working on projects with the expectation that their original work will lead to patentable inventions.

Through its Technology Licensing ("QTL") business unit, Qualcomm broadly licenses its technology worldwide to more than 180 handset and infrastructure manufacturers that make network equipment, handsets and other consumer devices, and develop applications for cellular networks based on 3G and 4G technologies.

Qualcomm's chip division, Qualcomm CDMA Technologies ("QCT"), is the world's largest provider of wireless chipset technology that is used in cell phones and other consumer electronics devices. QCT chipsets support all the major frequency bands, the full gamut of standardized, globally harmonized 3G and 4G wide area mobile broadband and cellular technologies, Assisted GPS location tools, Bluetooth, Wi-Fi, and many operating systems, such as Android, Windows Mobile, Symbian, and Qualcomm's own Brew Mobile Platform. QCT produces chips that the world's leading equipment manufacturers integrate into their 3G devices. QCT also is producing chips based on the 4G Long Term Evolution ("LTE") interface that incorporate 3G technologies to ensure wide coverage for multi-mode LTE/3G devices.

B. The Experimental Radio Service Rules Have Enabled Qualcomm And Its Partners To Develop Countless Wireless Devices, Services, And Applications

The Commission's Experimental Radio Service ("ERS") Rules have allowed Qualcomm to develop many innovative and spectrum efficient technologies that Qualcomm and its wireless industry partners are integrating into new mobile devices, services and applications. Qualcomm

currently is working on a number of wireless technologies that are or soon will be developed further through testing conducted under the ERS rules. These technologies, which were described in detail in the company's Comments on the *Dynamic Spectrum Use NOI*, are summarized below.[6]

In addition to this wireless technology development work, Qualcomm strongly believes that the FCC, the Administration, and Congress should use voluntary incentive auctions to provide new, clear spectrum for mobile broadband use, specifically through repurposing the broadcast television spectrum and other underutilized bands. Government-led efforts to allocate additional clear spectrum for mobile broadband services coupled with technology advances in the science of spectrum access, such as those described below, will be needed to meet America's exploding mobile data demands.

Authorized Shared Access ("ASA"). ASA is a technology that can be used in conjunction with mobile broadband air interfaces to permit one or more authorized commercial operators to share spectrum assigned to the U.S. government, subject to geography, time, and/or frequency restrictions. ASA will enable closely coordinated sharing between incumbent government operators[7] and commercial mobile broadband providers that can operate whenever and wherever the government is not using the spectrum, and where commercial operators can vacate the spectrum in a matter of seconds when they learn that the incumbent user needs to access the spectrum. In this way, incumbent operators would be completely protected from interference. ASA licensees can operate cellular macrocells, picocells, and femtocells that are location-aware

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6 *See* Qualcomm's Comments on the *Dynamic Spectrum Use Notice of Inquiry*, ET Docket No. 10-237 (filed Feb. 28. 2011).

7 *See* U.S. Department of Commerce, *An Assessment of the Near-Term Viability of Accommodating Wireless Broadband Systems in the 1675-1710 MHz, 1755-1780 MHz, 3500 - 3650 MHz, and 4200-4220 MHz, 4380-4400 MHz Bands* (Oct. 2010) at v, 2-5.

and interface with an ASA dynamic spectrum access controller that knows when and where primary incumbent user are not operating. ASA would allow commercial operators to gain access to the spectrum in a timely manner, well before incumbent government users permanently vacate the bands, because ASA fully protects incumbent operations. Importantly, because ASA spectrum would be licensed, operators can support a predictable quality of service and develop sound business plans to build mobile broadband network infrastructure where it is economically and technically feasible. Finally, ASA rights can be auctioned and provide much needed funds for the U.S. Treasury.

FlashLinq supports mobile communications on a direct peer-to-peer ("P2P") and device-to-device ("D2D") basis, creating 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 one another at broadband speeds at ranges of up to several hundred meters. In this way, FlashLinq allows thousands of devices to discover and remain "aware" of one another in a continuous background fashion, effectively creating a "neighborhood area network" with mutual awareness. FlashLinq, which was developed through use of an experimental license, is designed to use a 5 MHz unpaired licensed spectrum block in a new and highly efficient manner. FlashLinq enables new types of direct D2D/P2P wireless services, offloads traffic from cellular networks, and is beneficial, for example, for public safety, social networking, advertising, and interactive gaming applications, to name a few.

Notably, there is no need for any RF planning for FlashLinq. Cellular spectrum or network capacity is not needed for proximal communications, as nearby devices communicate directly *without* infrastructure. FlashLinq-enabled femtocells merely require backhaul (wired or

wireless) and an IP address – the remaining radio access network could be an IP infrastructure network, similar to Wi-Fi in this regard – far simpler than that required for cellular femtocells.

Network Topology Enhancements. Spectrum efficiency can be improved through use of a denser network topology using hetnets, *i.e*., smaller cells operating within the same coverage area as macrocells in a heterogeneous yet seamless fashion. Hetnets comprised of cellular macrocells, picocells (small network cells) and femtocells (end-user premises-based microcells), achieve greater frequency reuse and increase cellular network capacity by shrinking cell size. Qualcomm's chipset roadmap includes chips for femtocells, and the company is working with operators to manage interference between femtocells and macrocellular networks.

Interference Cancellation and Equalization. Qualcomm also is expanding cellular capacity through the use of advanced interference cancellation and equalization techniques. The company's most advanced chips include full support for the latest version of this technology, which Qualcomm has been developing and refining for many years.

Supplemental Downlink Technology allows mobile operators to combine unpaired spectrum with paired spectrum bands to better support mobile broadband download needs. Qualcomm expects that supplemental downlink technology will create opportunities in the U.S. and around the world by allowing wireless carriers to integrate under-utilized unpaired spectrum bands (perhaps in conjunction with ASA) with their existing networks operating on paired bands to substantially improve mobile broadband capacity and performance.

Each of these innovative technologies, and others, will be further developed, tested and refined via operations conducted pursuant to the FCC's ERS rules. Qualcomm welcomes the FCC's efforts to expand its ERS rule to spur continued wireless innovation to support new mobile broadband services and applications.

DISCUSSION

I. Qualcomm Supports Commission Efforts To Provide Increased Opportunities For Wireless Experimentation And Research

Qualcomm supports the Commission's efforts in the *Part 5 NPRM* to spur increased experimentation in the mobile broadband ecosystem because such efforts are needed now in order to support "the tsunami of broadband demand."[8] Enabling increased wireless research by expanding the ERS regulatory framework will help the wireless industry timely develop "new services and devices for all sectors of the economy" and thus "promote economic growth, global competitiveness, and a better way of life for all Americans."[9]

At the same time, as noted in the *NPRM*, all testing conducted under the new ERS regulatory framework needs to provide full protection to authorized operations, and Part 5 wireless experimentation must be able to cease operation at a moments notice should it cause harmful interference to authorized users. Controls, such as the appointment of a single point of contact for wireless experimentation conducted under the proposed program licenses and revocation of licenses from repeat offenders, will help provide the necessary protection.

A. The Commission Should Allow Commercial Wireless Researchers To Receive A Research Program Experimental License

The FCC should expand its proposed Research Program Experimental License to include commercial research laboratories, such as those within Qualcomm's facilities, that "have defined campus settings and institutional processes" and can "effectively manage a wide variety of research projects."[10] Commercial entities are just as able to manage wireless experimentation on a non-interference basis as the universities and non-profit research organizations that the FCC

8 *Part 5 NPRM* at ¶ 11.

9 *Id.* at ¶ 1.

10 *Id*. at ¶ 20.

proposes to allow to receive Research Program Experimental Licenses. And, like universities and non-profit research institutions, Qualcomm and other commercial technology developers invest substantial sums of money into wireless R & D and are behind many of the technologies fueling the current mobile broadband boom.

In fact, commercial wireless developers have invented via experimentation conducted under the ERS rules countless wireless technologies, services, devices, and applications in use today.[11] Supporting these efforts via a Research Program Experimental License would further the goals set out in the *NPRM*, and help to bring to market more quickly innovative technologies in the areas of education, mHealth, smart grid, social networking, among others.

B. Alternatively, The FCC Should Allow For Profit Wireless Researchers To Receive An Innovation Zone License

If the Commission does not permit commercial wireless research organizations to receive Research Program Experimental Licenses, it should allow such organizations that occupy a campus-like location to take advantage of the Commission's proposed Innovation Zone experimental licenses to allow research, development and testing of new wireless technologies on the commercial research organization's campus, where it can effectively manage signal usage within a contained and controlled environment.

C. Safeguards To Protect Incumbent Licensees Are Critically Important

While additional flexibility in the Part 5 experimental licensing regime proposed above will help to facilitate additional wireless innovation, appropriate safeguards are needed to fully protect incumbent licensees, including commercial mobile voice and broadband operators. For example, the FCC should require each experimental licensee to appoint a single point of contact

[11] *See Part 5 NPRM* at ¶ 4.

who is ultimately responsible for all wireless experimentation conducted under the research license and has the ability to resolve quickly all legitimate interference concerns.[12] Furthermore, the Commission should take strong action against noncompliant operation by Research Program Experimental Licensees or Innovation Zone licensees, for example, by revoking those licenses and limiting the ability of repeat offenders to receive such licenses.

II. Qualcomm Also Supports The Commission's Proposals Associated With The Importation Of Uncertified Equipment And Testing Inside An Enclosure

Qualcomm supports the FCC's proposal to increase the importation limit for uncertified devices that do not require an individual station license from 200 units to 1200 units, for doing so will support increased wireless experimentation and innovation within U.S. borders and reduce the administrative burden on the industry and Commission to deal with waivers of the current rule and associated border reporting requirements.[13]

Qualcomm also supports the FCC's proposal of allowing wireless testing within an anechoic chamber or Faraday cage without the need of an experimental license.[14] The FCC should not specify attenuation requirements for such enclosures, as there is no documented need to do so. Indeed, by codifying the common industry practice of conducting wireless experimentation within such enclosures without the need for an experimental authorization, as currently allowed by the FCC and acknowledged in the *NPRM*, the FCC will encourage greater levels of experimentation and relieve itself of the burden of responding to such inquiries from industry.

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12 *See id.* at ¶ 33.

13 *See id.* at ¶¶ 70-71.

14 *See id.* at ¶ 82 (noting that FCC staff have routinely allowed entities to conduct experiments within such enclosures without an experimental authorization because the potential for interference is "practically non-existent").

CONCLUSION

Qualcomm applauds the Commission's forward looking proposals in the *Part 5 NPRM*, as expanded herein, for they will enable increased experimentation in the mobile broadband ecosystem and "accelerate the rate at which … ideas transform from prototypes to consumer devices and services."[15] The FCC's ERS regulatory regime has allowed countless wireless carriers, equipment manufacturers, systems integrators, and entrepreneurs to develop, test, and refine innovative wireless equipment, services, and applications. These wireless innovations are fueling the unprecedented growth of the mobile broadband ecosystem, and the increasing consumption of mobile data by businesses and consumers is driving the need for additional spectrum to sustain continued growth throughout the 21st century. Simply stated, adding more fuel to this virtuous cycle is very solid and sound policy.

Respectfully submitted,

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15 *Part 5 NPRM* at ¶ 1.