

**Before The
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In The Matter Of)	
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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
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COMMENTS OF QUALCOMM INCORPORATED

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SUMMARY

In these Comments on the Second Further Notice of Proposed Rule Making (“Second FNPRM”) in the captioned proceedings, QUALCOMM Incorporated (“Qualcomm”) makes the following five fundamental points.

First, it is essential that public safety agencies and the people who work for them have access to a nationwide interoperable wireless broadband network. Whether that network actually consists of multiple interoperable regional networks or a single nationwide network, whether the network is built and operated via a public/private partnership or is entirely funded and operated by the public sector, and how quickly the network becomes operational are all important questions for the Commission and, possibly Congress, to resolve. In deliberating these questions, there should be one overriding policy objective: ensuring that the nation’s first responders and public safety personnel gain access to robust, state-of-the-art wireless broadband products, services, and applications to assist them in carrying out their vital roles to save lives and property. It is almost seven years after September 11th, and yet, many of the same public safety communications problems persist, and, there is no national strategy and funding mechanism in place to provide our first responders with a national interoperable wireless broadband network. It is time to solve this problem.

Second, with respect to the Appendix to the Second FNPRM, the so-called “Possible Technical Framework for a 700 MHz Public/Private Partnership Shared Wireless Broadband Network,” Qualcomm agrees that if the Commission decides to reactivate the D block on the basis of a revised public/private partnership, potential bidders should be given as much certainty as possible regarding the network requirements. However, the Appendix contains a major flaw. Although the Appendix does not mandate an air interface for the shared network, it mentions

only, and thus appears to favor, LTE and WiMAX, and it does not mention HSPA and CDMA2000 (EV-DO), even though the latter: 1) are very well suited to meet the needs of public safety; 2) are already deployed today to provide wireless broadband service all around the country and the world; 3) are undergoing a constant upgrade process to achieve even greater levels of performance; 4) are optimized for deployment in FDD spectrum in a 5 or 10 MHz bandwidth, the relevant bandwidth for public safety and potential D block bidders; 5) are proven technologies which perform comparably to LTE and WiMAX and which support broadband data and video, along with real-time applications such as push-to-talk and VoIP; and, 6) have a well developed ecosystem of infrastructure suppliers, handset vendors, and application providers, far surpassing the still nascent support for LTE and WiMAX, thereby creating economies of scale which will drive down costs for public safety and any D block licensee for a HSPA or CDMA2000 deployment. Without question, the Commission should not exclude HSPA and CDMA2000 by regulatory fiat.

The Appendix refers to a broadband network “based on advanced next generation mobile network standards and commercial technologies with performance characteristics supporting voice, data, and multimedia applications,” but goes on to provide only two examples of such standards—802.16e WiMAX and the LTE proposal being advanced within 3GPP. Technical Appendix at Pgs. 80, 84. There is simply no basis for the Commission to say that WiMAX is any more advanced than any other wireless broadband air interface, including HSPA and CDMA2000, and there is no basis to exclude, or in any way disfavor, HSPA and CDMA2000. There is no international definition of an “advanced” wireless broadband technology. To the contrary, HSPA, CDMA2000, and the TDD version of 802.16e in the 2.6 GHz band are all recognized by the ITU as air interfaces falling within IMT-2000.

Moreover, 802.16e is not a generation ahead of HSPA or CDMA2000. Rather, 802.16e and the latest versions of HSPA and CDMA2000, HSPA+ (also known as HSPA Evolved) and EV-DO Revision B, are all within the same generation. HSPA Plus and EV-DO Revision B support voice (including VOIP), very high speed data, and video. They enable multi-megabit downloads and uploads with substantial capacity and very low latency. The fact that some operators may opt to deploy LTE or some future variant of WiMAX in wider bandwidth FDD spectrum, as a complement to existing HSPA or CDMA2000 networks, particularly in dense urban areas, does not in any way minimize the important role that CDMA2000 and HSPA technology, in their constantly evolving forms, will continue to play in delivering ubiquitous wireless broadband service in the United States and around the world for many years to come. The CDMA2000 and HSPA networks will continue to operate and to be enhanced through a series of constant upgrades. CDMA2000 and HSPA will continue to be a critically important underlying basis for wireless broadband service, even for operators who have the bandwidth to deploy LTE or WiMAX as a complement to HSPA or CDMA2000. For all of these reasons, the Commission should fix the mistake in the Technical Appendix and make it clear that HSPA and CDMA2000 are acceptable air interfaces for the public safety/commercial network.

Third, again if the Commission decides to continue with the public-private partnership model for the D block and public safety, it should seriously consider revising the build out requirements, the rules regarding the subscription by public safety groups to the network, the reserve price, the default penalty, the definition of “emergency,” and the other rules governing the D block auction and the ultimate network deployment. The only effective way to revise the rules is through a collaborative process which engages all affected stakeholders—public safety,

prospective bidders, and vendors. Imposition of a new series of top-down requirements, in the absence of such collaboration, would risk another failure.

Fourth, Qualcomm urges the Commission to reject proposals that would needlessly restrict entry into the D block reauction or that would put the Commission in the position of mandating or forbidding particular business models by the high bidder. The Commission should continue to adhere to the policies that have made the US wireless market the envy of the world—the spectrum should be auctioned to all comers, without the imposition of any eligibility requirements, and the high bidder should be able to use the spectrum as it sees fit, without having to adopt or eschew any particular business model, such as wholesale-only.

Fifth, at paragraph 191 of the Second FNPRM, the Commission asks how a revenue shortfall could be addressed if the Commission were to auction the D block spectrum without a public/private partnership model, but with the auction revenues dedicated to funding construction of a nationwide interoperable wireless broadband network for public safety, presumably on the 700 MHz public safety broadband spectrum. In particular, the Commission asks if any shortfall could be made up by auctioning, for example, the so-called White Space spectrum—unused portions of TV Channels 2 to 51. In a companion filing commissioned by Qualcomm, economists technical consultant Charles Jackson and economists Dorothy Robyn and Coleman Bazelon of the Brattle Group show that the Commission could raise from \$9.9 billion to \$24.4 billion by auctioning the White Space spectrum, thereby more than making up for any shortfall. An auction of the White Space spectrum would garner substantial revenues for the US treasury, and those revenues could assist in funding the national interoperable wireless broadband network that our nation’s public safety agencies and their personnel deserve.

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COMMENTS OF QUALCOMM INCORPORATED

QUALCOMM Incorporated (“Qualcomm”), by its attorneys, hereby submits its Comments in response to the Second FNPRM, which the Commission released in the above-captioned proceedings on May 14, 2008.¹

I. Background

A. Qualcomm’s Interest

Qualcomm is a world leader in developing innovative digital wireless communications technologies and enabling products and services based on the digital wireless communications technologies that it develops. Qualcomm is the pioneer of code division multiple access (“CDMA”) technology, which is utilized in the 3G CDMA family of wireless technologies. These technologies include CDMA2000 and HSPA, which are two technologies used in today’s so-called third generation (“3G”) wireless networks and devices, which enable tens of millions of Americans now to enjoy advanced, high speed, and ubiquitous wireless broadband services. Qualcomm broadly licenses its technology to over 150 handset and infrastructure manufacturers

¹ Second Further Notice of Proposed Rule Making, FCC 08-128, released May 14, 2008.

around the world, who make infrastructure equipment, handsets and other consumer devices, and develop applications, all based on the CDMA2000 and/or HSPA air interfaces.

Qualcomm is also a Commission licensee. Qualcomm holds licenses covering the entire nation for Block D in the Lower 700 MHz Band, Channel 55, 716-722 MHz. On that spectrum, Qualcomm's wholly-owned subsidiary, MediaFLO USA, has launched a service called MediaFLO to deliver high quality video and ultimately high quality audio and data to third generation cell phones. Today, even before the DTV transition has been completed, the MediaFLO service is available in 58 major markets around the country, delivering news, sports, children's, and entertainment content to subscribers of Verizon Wireless and AT&T at mass market prices. In the recent 700 MHz auction, Qualcomm was the high bidder for licenses in the Lower 700 MHz B and E blocks, and Qualcomm was the sole bidder for a D block license, although Qualcomm's bid was below the D block reserve price.

Finally, Qualcomm's interest in this proceeding stems from another of its businesses. For many years now, Qualcomm, through its Qualcomm Government Technologies division (known as QGOV), has been developing a variety of applications of interest to the public safety community which leverage the CDMA2000 and/or HSPA technologies.

B. The Rapid Proliferation of CDMA2000 and HSPA

The CDMA2000 and HSPA technologies continue to proliferate rapidly around the world. To date, there are 478 wireless carriers in 138 countries who have deployed one of the 3G CDMA technologies. Of those 478 carriers around the world, 106 have deployed EV-DO, 40 of whom have deployed EV-DO Revision A. Another 198 of the 478 carriers have deployed HSDPA, 36 of whom have deployed HSUPA . These broad deployments create enormous

demand for EV-DO Revision A and HSDPA equipment, thereby creating economies of scale which bring down prices for carriers and ultimately consumers.

Worldwide, there are over 625 million subscribers using a 3G device. By 2012, the number of 3G subscribers is projected to exceed 1.6 billion, and at that time, most 3G subscribers will be using an EV-DO or HSPA-based device. This strong demand creates an ever-expanding market for 3G-based devices, including 3G phones, smartphones, PDAs, consumer electronics devices, and laptops. These devices include more than 570 EV-DO-based devices (56 of which incorporate EV-DO Revision A) and more than 635 HSDPA-based devices (66 of which incorporate HSUPA). The sheer number and wide variety of these devices is increasing every day.

Here in the United States, there is fierce competition among the carriers in the provision of wireless broadband services, which has gone hand-in-hand with the rapid deployment and expansion of 3G CDMA networks. As a result, American consumers are enjoying the 3G services at ever-increasing rates. Moreover, as the Commission found in its most recent annual report on competition in the CMRS marketplace (the "Twelfth Report"), U.S. carriers have deployed competing 3G technologies, which has only intensified the competition as the carriers seek to differentiate their networks by providing what each claims to be the best and most advanced high speed wireless broadband network and by offering the most robust and compelling wireless broadband services to consumers.²

Accordingly, Verizon Wireless, Sprint, ALLTEL, US Cellular, and Leap Wireless, among other carriers, have deployed the CDMA2000 (EV-DO) high speed wireless technology, and their deployments are expanding. Verizon Wireless has upgraded its entire network to EV-

² See Twelfth Report, FCC O8-28, released Feb. 4, 2008 at Pgs. 61-62.

DO Revision A, which supports both high speed downloads and uploads, and Sprint is in the midst of doing so throughout its entire network. On the other hand, AT&T has deployed the competing WCDMA/HSDPA technology, and it is expanding the footprint of its WCDMA/HSDPA network at a very rapid rate. Initially, AT&T deployed the HSDPA technology, and now, AT&T is in the midst of deploying HSUPA, thereby supporting high speed uploads and downloads. For its part, T-Mobile has also begun deploying HSDPA on its AWS-1 spectrum.

All told, the Commission found in the Twelfth Report that approximately 184 million Americans live within a census block in which two carriers provide mobile broadband service via EV-DO or WCDMA/HSPA, and 118 million Americans live within a block in which three carriers offer such service. Twelfth Report at para. 145. These numbers are literally increasing every day as the carriers constantly expand and enhance their mobile broadband networks.

In addition, the number and variety of devices, including handsets, PDAs, smartphones, and other consumer electronic devices, which incorporate CDMA2000 or HSPA is also growing by leaps and bounds every single day. These technologies are now embedded in numerous laptop models sold by the major laptop vendors offering consumers another way to access mobile broadband services. Wireless broadband via CDMA2000 or HSPA is or will soon be available in a whole variety of new consumer electronic devices—personal navigation devices, pocketable computers, mobile computing devices, and the like, all of which could be of tremendous use to public safety agencies and their employees.

C. The Constant Push to Upgrade and Enhance CDMA2000 & HSPA

As operators began deploying EV-DO and HSPA in its initial forms—EV-DO Release 0

and HSDPA—Qualcomm and the ecosystem of vendors who support these technologies were simultaneously working on upgrades to the technologies, and there is a constant and never-ending drive to enhance these technologies which continues to the present and shows no sign of slowing down into the future. The networks rapidly migrated to the first upgrade—EV-DO Revision A and HSUPA. Today, as noted supra, Verizon Wireless and Sprint provide wireless broadband service all over the nation via EV-DO Revision A, which supports peak data rates of 3.1 megabits per second (“Mbps”) on the downlink and 1.8 Mbps on the uplink, and AT&T is concluding its network upgrade to HSUPA, which will support peak data rates of up to 1.8 Mbps to 5.6 Mbps on the uplink. AT&T has also announced that it will upgrade its downlink in the near future to support peak data rates of 7.2 Mbps to 20 Mbps on the downlink.

The next upgrades to EV-DO and HSPA will result in dramatically faster data rates. EV-DO Revision B enables the aggregation of three EV-DO carriers in one 5 MHz channel. In its Phase I, EV-DO Rev. B will support downloads at a peak rate of 9.3 Mbps and eventually, in Phase II, at 14.7 Mbps, while supporting uploads at up to 5.4 Mbps. This technology will undergo an additional upgrade, now known as EV-DO Advanced, which, if implemented with four carriers, will support downloads of up to 34.4 Mbps and uploads of 12.4 Mbps. These upgrades are all backwards compatible, meaning that they will not require any new infrastructure. The net result of these upgrades to CDMA2000 will be wireless broadband service with data rates that are ten times faster than even today’s fastest EV-DO-based networks achieve.

Likewise, there are substantial upgrades for HSPA technology on its roadmap. The initial version of the technology known as HSPA + (also called HSPA Evolved—HSPA Release

7) will support peak downloads of 28 Mbps and uploads of 11 Mbps. Future releases of HSPA, Releases 8 and 9, will increase the peak downlink speeds, first to 42 Mbps and then to 84 Mbps.

These data rates are more than ample to meet public safety's requirements for wireless broadband—supporting very high speed data, extremely low latency video, and voice with tremendous capacity. Indeed, there is no requirement set forth in the Technical Appendix which cannot be met with a CDMA2000 or HSPA-based network.

D. The Deep CDMA2000 & HSPA Ecosystems

As noted supra, Qualcomm licenses its technology to over 150 companies, who manufacture infrastructure and subscriber devices (phones, smartphones, consumer electronic devices, and so on). These companies span the entire wireless industry. The result of this broad technology licensing program is that there is a deep ecosystem of vendors who supply equipment based on CDMA2000 and/or HSPA. Consequently, any D block licensee and the public safety groups will be able to leverage substantial economies of scale if they opt for a CDMA2000 or HSPA-based network.

In particular, the number of companies manufacturing devices based on the 3G technologies, including CDMA2000 and HSPA, continues to increase, along with the different types of devices themselves. At last count, 111 companies have manufactured at least one CDMA2000 device, and more than 110 companies have manufactured at least one WCDMA or HSPA device. These devices span all price points—from low end 3G phones to very high end smartphones and other consumer electronics devices. Eighteen laptop manufacturers now offer at least one laptop model with a form of 3G embedded inside, and more than 100 such laptop models have been brought to market.

Cost of both network equipment and subscriber devices will be a critical consideration for public safety and any D block licensee in selecting a technology. The deep CDMA2000 and HSPA ecosystems creates substantial economies of scale that can be leveraged by public safety and the D block licensee (or licensees) so that the costs of deploying CDMA2000 or HSPA in a nationwide network will be substantially lower than if they attempt to deploy any other technology.

II. Public Safety Should Finally Have Access to a Nationwide Interoperable Wireless Broadband Network

Qualcomm begins with a point that should certainly be settled by now, but inexplicably is still subject to debate. For once and for all, there should be a nationwide interoperable wireless broadband network for public safety agencies and the first responders they employ. More than two years ago, in urging the Commission to rechannelize the 700 MHz public safety band, Qualcomm wrote the following:

“Our nation’s first responders should have access to an interoperable, high speed, wide area wireless broadband network, the kinds of innovative devices that operate on such a network, and the full panoply of wireless broadband applications, including video surveillance, real-time text messaging and email, and high resolution digital video downloads. These tools are available today in the commercial wireless market, which is driven by constant technological innovation. By leveraging the economies of scale and competitive dynamics in that market, public safety agencies can use these highly beneficial services on a wireless broadband network dedicated to public safety. The Commission should re-channelize the 700 MHz public safety band to enable public safety agencies to take advantage of these important capabilities.”

Qualcomm Comments in Docket 96-86 at Pg. i, (filed June 6, 2006).

Those words remain true today, and it is time to make the 700 MHz national interoperable wireless broadband network for public safety a reality. Whether the Commission decides to continue with the public/private partnership model or to authorize a network on the

public safety spectrum to be built and operated with public funds, and whether it auctions the D block in one national license or several regional licenses, the Commission's overriding policy objective should be to ensure that the 700 MHz national public safety network is up and running as quickly as possible.

III. The Commission Should Revise the Technical Appendix to Make It Clear That The Shared Public/Private Network Can Be Based On CDMA2000 Or HSPA Technology

The Second FNPRM seeks comment on whether the Commission should clarify or modify any aspect of the technical network requirements previously adopted by the Commission or otherwise establish with more detail the technical requirements of the wireless broadband network to be shared by public safety and the D block licensee or licensees. Second FNPRM at para. 61. To that end, the Second NPRM states that the Commission attaches as an appendix a possible technical framework for the network in the form of a Technical Appendix to identify in greater detail the potential technical parameters for the network. Qualcomm supports the effort to provide greater clarity regarding the network requirements, which will surely assist potential bidders for the D block if the Commission continues to mandate the public/private partnership model.

Nevertheless, the Technical Appendix contains a flaw. As summarized supra, it provides that the D block licensee must deploy a broadband IP network "based on advanced next generation mobile standard and commercial technologies, with performance characteristics supporting voice, data, and multimedia applications," and the only examples provided by the Commission of such standards and technologies are the 802.16e WiMAX standard and the LTE proposal advanced by 3GPP. See Technical Appendix at Pg. 80. Moreover, the Technical Appendix states that the data rates for the network "should be consistent with state-of-the-art

commercial wireless systems, such as WiMAX Mobile, LTE, or other equivalent or advanced technologies.” Id. at Pg. 84.

The Commission should not exclude the CDMA2000 or HSPA technologies, the two major commercial wireless broadband technologies now and into the future, from deployment by the D block licensee to serve commercial customers and public safety. These state-of-the-art technologies would provide public safety users, in particular, with all the wireless broadband services to carry out their jobs, but which they now lack, in a nationwide network, and as a result of the substantial economies of scale because these technologies are already deployed in nationwide networks here and in many foreign countries, these technologies can do so at a lower cost than other technologies. Moreover, unlike WiMAX and LTE, CDMA2000 and HSPA are optimized for deployment in a 5 or 10 MHz FDD bandwidth, which is perfectly suited for deployment on the D block, the public safety spectrum, or both. In short, there is absolutely no basis for the Commission to exclude CDMA2000 or HSPA. Rather, the Commission should revise the Technical Appendix to clarify that the D block licensee may deploy CDMA2000 or HSPA.

The Technical Appendix does not define the term “advanced next generation mobile network standards,” and neither does the ITU. As already noted, the TDD form of 802.16e for deployment in the 2.6 GHz band, CDMA2000, and HSPA are all deemed by the ITU as IMT-2000, and, therefore, are all considered to be the same generation of technology. The data rates achieved by CDMA2000 (EV-DO Revisions A and B) and HSPA (HSPA + and HSPA Releases 8 and 9) are more than ample to provide robust, high capacity and high quality wireless broadband service. It is true, but for this purpose, irrelevant that some carriers have announced plans to deploy LTE or WiMAX to complement their existing CDMA2000 or HSPA networks,

particularly in dense urban areas. The CDMA2000 and HSPA networks, which today provide nationwide wireless broadband service are continuing to expand, and the technology employed to power these networks is continuing to undergo a constant upgrade process.

In sum, the Commission should amend the Technical Appendix to clarify that the D block licensee may serve its commercial customers and public safety with HSPA or CDMA2000 technology. These technologies have substantial advantages and should not be summarily taken out of the running because the Commission proposes some minimal specifications including loosely defined data rates which are consistent with the performance of two other evolving technologies mentioned by the Commission.

IV. The Commission Should Convene a Collaborative Process to Determine Revisions to the Build Out Requirements, Rules Governing Subscription By Public Safety, Reserve Price, Default Penalty, Definition of Emergency And Other Rules Governing the D block Auction and Ultimate Deployment

The Second NPRM seeks comment on a host of possible changes to the rules governing the D block auction and the ultimate network deployment on the D block and the public safety broadband spectrum. These changes run the gamut from the build out requirements, the rules regarding whether public safety agencies would be under any obligation to subscribe to the broadband service, the reserve price, the default penalty, the definition of “emergency” for purposes of determining when public safety can preempt commercial use of the D block, and many other topics.

On these issues, the Commission needs to balance competing interests. On the one hand, if the Commission auctions the D block again on the basis of a public/private partnership, the rules need to be liberalized to encourage bidders. In all likelihood, it would be futile to reacquire the D block on that basis without adopting revised build out requirements, a lower reserve price, a reduced default penalty (if at all), and providing greater clarity on the definition of

“emergency” and the number of public safety users who will subscribe to the network. On the other hand, the revised rules must ensure that public safety’s needs are met.

To balance these competing interests, Qualcomm suggests that at the close of the comment cycle in this proceeding, the Commission convene all affected stakeholders in a meeting or meetings to ensure that the revised rules strike the right balance—so that the D block spectrum and the 700 MHz public safety broadband spectrum are finally put to their highest and best use. The meeting or meetings should be convened quickly to avoid causing any delay in the Commission’s ultimate decision.

V. The Commission Should Not Restrict Entry in the D Block Auction or Mandate or Forbid Any Particular Business Model or Models

The Commission’s auction program has been and remains an American success story. By auctioning new spectrum to all comers, the Commission has ensured that the party who values the spectrum most highly and is, therefore, most likely to put the spectrum to its highest and best use wins the spectrum. In the Second FNPRM, the Commission asks for comment on whether it should adopt a restriction on eligibility for the D block auction and whether it should mandate a business model for the D block winner—i.e., mandate that the D block winner can operate on an exclusively wholesale and/or open access basis. See Second FNPRM at Pgs. 55-57, 67. Qualcomm respectfully suggests that the Commission should not restrict entry in the D block auction or mandate or forbid any particular business model or models.

As Qualcomm wrote last year in its comments on the original FNPRM in this proceeding:

“Auctions have enabled the US wireless market to flourish into what the Commission has found to be a robustly competitive market, in which new services, new devices, and new applications are brought to market literally every day at ever-decreasing price points. In fashioning final rules for the 700 MHz commercial spectrum, QUALCOMM urges the Commission to reject proposals that would needlessly restrict entry into the 700 MHz auction or that would put the Commission in the position of mandating or

forbidding particular business models. The Commission should continue to adhere to the policies which have made the US wireless market the envy of the world—the new spectrum should be auctioned to all comers, without the imposition of any eligibility requirements, and the high bidders should be able to use the spectrum as they see fit, without having to adopt or eschew any particular business model.”

Qualcomm Comments (filed May 23, 2007) at Pg. i.

There is no good reason for the Commission to change its rules in this regard. In fact, the failure of the first D block auction should cause the Commission to be less inclined to adopt intrusive rules governing eligibility or the business model that a D block winner must employ. There is already no shortage of intrusive rules with which a D block winner would have to comply. Certainly, the Commission should not add additionally burdensome rules into the mix.

VI. Auctioning the TV White Space Could Provide Substantial Funds for a National Interoperable Wireless Broadband Network for Public Safety

At paragraph 191 of the Second FNPRM, the Commission asks about how it might address a revenue shortfall if it were to reactivate the D block spectrum without a public/private partnership model, assuming that the revenues of the D block reactivation were dedicated to funding a national interoperable wireless broadband network for public safety on the 700 MHz public safety broadband spectrum. Specifically, the Commission asks if any such revenue shortfall could be made up by auctioning, for example, the so-called White Space spectrum—unused portions of TV Channels 2 to 51.

In a companion filing commissioned by Qualcomm, technical consultant Charles Jackson and economists Dorothy Robyn and Coleman Bazelon of the Brattle Group show that the Commission could raise from \$9.9 billion to \$24.4 billion by auctioning the White Space spectrum. Those funds could certainly offset any revenue shortfall and could provide substantial funding for a nationwide interoperable wireless broadband network.

VII. Conclusion

Wherefore, Qualcomm respectfully requests that the Commission adopt rules consistent with the comments set forth herein.

Respectfully submitted,

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