Before The
Federal Communications Commission
Washington DC 20554

In the Matter Of	)	
	)	
A National Broadband Plan for Our Future	)	GN Docket No. 09-51
	)	
Inquiry Concerning the Deployment of Advanced	)	
Telecommunications Capability to All Americans	)	
In a Reasonable and Timely Fashion, and Possible	)	GN Docket No. 09-137
Steps to Accelerate Such Deployment Pursuant to	)	
Section 706 of the Telecommunications Act of	)	
1996, As Amended	)	
	)	
International Comparison and Survey Requirements	)	GN Docket No. 09-47
In the Broadband Data Improvement Act	)	
	)	

COMMENTS OF QUALCOMM INCORPORATED IN RESPONSE TO NBP PUBLIC NOTICE #2 REGARDING SMART GRID TECHNOLOGY

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SUMMARY

Qualcomm is pleased to respond to NBP Public Notice #2 concerning the use of broadband for the implementation of Smart Grid technology. Qualcomm shows herein that commercial mobile broadband networks are suitable and available for Smart Grid applications, and that in setting spectrum policy, the FCC should allocate additional spectrum for mobile broadband, which already covers the bulk of the US, to enable Smart Grid applications to leverage the enormous investments made already in these networks and the vast eco-system already supporting them, rather than allocating spectrum for construction of new dedicated single-use Smart Grid-only networks.[1] It would take many billions of dollars and a decade or more to build new dedicated networks. Dedicated networks will never achieve the coverage, reliability, or global harmonization, security, and scalability of existing commercial mobile broadband networks.

The Public Notice begins by asking a series of questions about the suitability of broadband technology and the availability of broadband networks for Smart Grid applications. Commercial mobile broadband networks, which are already widely deployed all over the nation and are used every day by tens of millions of Americans, are well suited for Smart Grid applications. To roll out Smart Grid applications broadly and rapidly, it is vital to leverage the massive economies of scale from the hundreds of billions of dollars already invested in these networks and the tens of billions of dollars invested each year to expand, maintain, and upgrade the networks.

Smart Grid projects will succeed if they leverage the highly reliable, secure, interoperable, standardized, and globally harmonized mobile broadband service provided by

[1] As used herein, consistent with Qualcomm's prior pleadings concerning the National Broadband Plan, the term "mobile broadband" refers to the 3G family of technologies and LTE.

these networks. Additionally, for the Smart Grid to realize its maximum economic potential, the Smart Grid communications suite must support communications with a mobile workforce in order to facilitate both preventative maintenance and rapid service restoration of Smart Grid services, thus requiring the use of mobile broadband technology and networks. The broad and rapid deployment of Smart Grid applications can occur by tapping the vast eco-system which supports the commercial mobile broadband networks—including the hundreds of device manufacturers and application providers who bring new devices and applications to market every day.

Indeed, Qualcomm and its partners, from the communications, smart grid infrastructure, and utility industries, are developing and implementing solutions for the Smart Grid which use commercial mobile broadband technology and networks. Qualcomm looks forward to continuing this work and partnering with other stakeholders to launch Smart Grid applications rapidly and broadly by leveraging the widely deployed commercial mobile broadband technologies and networks.

According to a report released by the FCC a few months ago, over 95% of all Americans are covered today by at least one commercial mobile broadband network. See Bringing Broadband to Rural America, Report on a Rural Broadband Strategy, rel. May 22, 2009, at Pgs. 12-13. These networks deliver high speed, low latency, ubiquitous mobile broadband service wherever most Americans live, work, or travel, and are constantly being expanded and upgraded. Commercial mobile broadband networks can bring Smart Grid applications to most Americans.

However, to realize its full potential of the Smart Grid and to ensure that the benefits of broadband are available to all Americans, the nation needs 100% mobile broadband coverage. There are two ways to achieve that. First, the National Broadband Plan should call for universal

mobile broadband coverage, and funds under the ARRA (American Recovery and Reinvestment Act) and the Commission's universal service program should be used to achieve the goal quickly. Second, to reach areas which will be unduly expensive to cover with terrestrial mobile broadband, Qualcomm has developed satellite-based mobile broadband technology, which will be integrated into the same chipsets providing terrestrial mobile broadband. Mass market hybrid satellite-terrestrial devices using these chipsets will have access to mobile broadband anywhere in the US. This satellite-based mobile broadband technology can be used to fill any coverage holes in commercial terrestrial mobile broadband networks. The result will be truly ubiquitous high speed wireless broadband coverage across the entire US, just what Smart Grid applications need.

Beyond developing the technology for universal mobile broadband coverage, Qualcomm is also working to drive Smart Grid applications over mobile broadband in other ways. As the world's largest supplier of chipsets for cell phones and wireless devices, Qualcomm CDMA Technologies ("QCT") offers modules which can power Smart Grid applications. One QCT module, known as Gobi, provides multi-mode mobile broadband connectivity so it can be used on any commercial 3G mobile broadband network, no matter which technology the network uses.[2] Gobi enables a utility to use multiple 3G network technologies for Smart Grid applications. Gobi is very well suited for two of the most prevalent Smart Grid applications: 1) automatic meter infrastructure ("AMI"), particularly at the "concentrator" level, where the data aggregated from hundreds of homes are collected and transmitted to the utility; and, 2) residential gateways, which can be used for load management and load shedding, in the home or the enterprise.

[2] For more information on Gobi, see www.gobianywhere.com.

Another QCT module, known as inGeo, uses Assisted GPS and wireless technology to report position location data from a very small, extremely low- power device. The architecture of InGeo facilitates the simple integration of sensors which measure, for example, pressure and temperature, so that the status of Smart Grid infrastructure can be reported in near time to a utility to improve Smart Grid performance and reliability while minimizing the need for expensive site visits in remote areas. InGeo is perfect for remote monitoring, sensing, and control—other key Smart Grid applications.

Commercial mobile broadband technology, networks, and chipsets are vital, but not sufficient, for the rapid penetration of Smart Grid applications. End to end solutions and network management platforms are also required. In late July, Qualcomm formed a joint venture with Verizon Wireless known as nPhase to deliver network management services and end-to-end applications for the Smart Grid and other forms of machine-to-machine communications. Already, nPhase is working with ABB, major manufacturer of equipment for utilities, to deliver Smart Grid applications for Con Edison of New York. By using near real-time wireless connectivity and services coupled with ABB's asset monitoring solution, utilities can improve grid reliability and reduce operating costs. Additionally, the nPhase wireless network services platform is being evaluated by many utilities to provide robust, secure, economical, and scalable connectivity throughout the Smart Grid.

Similarly, Qualcomm is working with San Diego Gas & Electric and 24 other local, national, and global organizations to demonstrate Smart Grid applications in the San Diego area. This coalition will use the most advanced technology available to empower consumers to exert greater control over their energy usage, as well as accommodating a growing number of electric vehicles, which will be connected to the grid. If funded (the coalition is seeking $100 million in

federal funds) and if successful, this project can be replicated and scaled up anywhere in the world.

The Public Notice goes on to ask a series of questions about spectrum. Public Notice NBP #2 at 3-4. In the first place, for both technical and economic reasons, the Smart Grid requires licensed, not unlicensed, spectrum to cover wide areas. Technically, Smart Grid applications require wide area communications—a communications link is needed, for example, from homes or from electric vehicle charging stations back to central monitoring points. Licensed spectrum is required to cover a wide area because protection from interference is required to maintain a communications link over a wide area. Economically, wide area networks operating on licensed spectrum are required because it is far too expensive to attempt to cover a wide area with lower power unlicensed transmitters. A viable business case requires minimizing the number of transmitters, and to do so, requires licensed spectrum with higher power transmitters.

Finally, additional licensed spectrum is required to meet the burgeoning demand for mobile broadband stemming from Smart Grid applications as well other applications which cover virtually every aspect of American life. It would be unwise and counterproductive to allocate spectrum for dedicated, single use, Smart Grid-only networks. It would take many billions of dollars and a decade or more for such networks ever to achieve the coverage of existing commercial broadband networks, and, it would take an equal if not greater sum to duplicate the reliability, security, and interoperability of today's commercial networks. Commercial mobile broadband networks will drive the Smart Grid.

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COMMENTS OF QUALCOMM INCORPORATED

QUALCOMM Incorporated ("Qualcomm"), by its attorneys, hereby submits these Comments in response to the Commission's Public Notice NBP #2, DA 09-2017, released September 4, 2009, seeking "tailored comment on how advanced infrastructure and services could help efficient implementation of Smart Grid technology." Public Notice at Pg. 1.

I. Introduction

Qualcomm agrees wholeheartedly with the statement in the Public Notice that Smart Grid technology is "a promising way to use broadband and other advanced communications to promote energy efficiency, reduce greenhouse gas emissions, and encourage energy independence." Id. Smart Grid technology offers tremendous benefits for the American people.

In these Comments, Qualcomm explains how Smart Grid technology can be deployed broadly, rapidly, and in the most cost-effective manner possible. Doing so requires use of the commercial mobile broadband networks, which already cover more than 95% of the US population with reliable, secure, interoperable, standardized, globally harmonized, and wide area high speed, low latency mobile broadband service where they live, work, and travel. There is no need to allocate spectrum to attempt to duplicate these extensive networks with expensive, impractical single-use, Smart Grid-only dedicated networks. Rather, the implementation of Smart Grid applications has already begun over the existing commercial mobile broadband networks, and the Commission should allocate additional spectrum for mobile broadband to

provide sufficient bandwidth for Smart Grid and other broadband applications, which are driving the exponential growth in demand for mobile broadband in all of its forms.

II. Commercial Mobile Broadband Is Well Suited and Available for Smart Grid Applications

The Public Notice asks a series of interrelated questions about the suitability and availability of broadband networks and technologies for Smart Grid applications. Public Notice at Pgs. 1-2. Qualcomm shows herein that commercial mobile broadband technology and networks are well suited and available for Smart Grid applications.

A. Qualcomm's Work in Developing and Proliferating Mobile Broadband

Qualcomm is a world leader in developing innovative mobile broadband technologies and enabling products and services based on the 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/WCDMA, which are used in today's 3G wireless networks and devices to enable tens of millions of Americans, in rural, suburban, and urban areas alike, to enjoy advanced, high speed, and ubiquitous mobile broadband services.

Qualcomm broadly licenses its technology to over 165 handset and infrastructure manufacturers 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 also licenses technology it developed for orthogonal frequency division multiple access ("OFDMA"), which will be used in wireless networks based on the Long Term Evolution ("LTE") air interface.

Qualcomm CDMA Technologies ("QCT"), a division of Qualcomm, is the world's largest provider of wireless chipset technology. QCT's chipsets provide a high degree of

integration and support all the major frequency bands, the full gamut of standardized, globally harmonized wide area mobile broadband and cellular technologies, Assisted GPS, Bluetooth, Wi-Fi, and many different operating systems, including Android, Windows Mobile, Symbian, and Qualcomm's Brew Mobile Platform.

Finally, Qualcomm recently formed a joint venture with Verizon Wireless by the name of nPhase. [3] The joint venture will provide machine to machine communications and smart service offerings across a wide variety of market segments, including Smart Grid, and will leverage existing commercial mobile broadband networks. nPhase is concentrating on the provision of end-to-end solutions to drive Smart Grid applications and many other forms of machine to machine communications.

B. The Proliferation of Commercial Mobile Broadband Networks & Devices

In the United States, as the Commission itself has found in May of this year, 95.6% of the US population is covered by a mobile broadband network (defined as a network based on EV-DO or WCDMA/HSPA), and that 99% of the non-rural US population and 82.8% of the rural US population is so covered.[4] EV-DO Revision A, the latest version of EV-DO, which is backwards

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[3] See "Verizon Wireless and Qualcomm Announce Joint Venture to Provide Advanced M2M Solutions," (released July 28, 2009); www.qualcomm.com/news/releases/2009/090728_ Verizon_Qualcomm_JV_M2M.html.

[4] See Bringing Broadband to Rural America, Report on a Rural Broadband Strategy, released May 22, 2009, at Pgs. 12-13. In making that finding, the Commission defined networks based on EV-DO and WCDMA/HSPA as constituting mobile broadband. The Commission used the same definition of mobile broadband in its annual reports on the state of competition in the US wireless market in 2009, 2008, and 2007. See Thirteenth Report, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services, WT Docket No. 08-27, DA 09-54, released January 16, 2009 at Pgs. 69, 73-74; Twelfth Report, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services, WT Docket No, 07-71, released Feb. 4, 2008, at Pgs. 8, 68-69; Eleventh Report, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services, WT Docket No, 06-17, released Sept. 29, 2006, at Pg. 54

compatible with the initial version of EV-DO and with earlier versions of CDMA technology, supports downloads of up to 3.1 megabits per second ("Mbps") and uploads of up to 1.8 Mbps. The latest version of HSPA technology deployed in the United States, which is being deployed in devices which also support WCDMA and GSM technology, supports downloads of 7.2 megabits per second and uploads of 1.8 Mbps to 5.6 Mbps. To the extent that Smart Grid applications require large wireless downloads or uploads with relative low latency, these networks are very well suited to support them. Likewise, if lower speeds are sufficient, the backwards compatibility ensures that they are supported as well.

Worldwide, there are 578 wireless carriers in 157 countries who have deployed one of the 3G CDMA technologies. Of those 578 carriers around the world, 108 have deployed EV-DO, 70 of whichy have deployed EV-DO Revision A. Another 274 of the 578 carriers have deployed HSDPA, 87 of which 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.

Currently, there are approximately 830 million people around the world who use a 3G device. By 2013, the number of 3G subscribers is projected to reach approximately 2.4 billion, and at that time, most 3G subscribers will be using an EV-DO or HSPA-based device.[5] 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 646 EV-DO-based devices (118 of which incorporate EV-DO Revision A) and more than

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[5] The source of the data on subscribers is Wireless Intelligence, a database which collects such information. Wireless Intelligence defines a subscriber (actually a "connections" as a "unique SIM, or where SIM cards do not exist, a unique telephone number, which has access to the network for any purpose (including data-only usage), but excluding telemetric applications."

1,910 HSDPA-based devices (305 of which incorporate HSUPA). The sheer number and wide variety of these devices is increasing every day.

As noted above, Qualcomm licenses its technology to over 165 companies, who manufacture infrastructure and subscriber devices (including phones, smartphones, smartbooks, consumer electronic devices, and the like). These companies span the entire wireless industry. In particular, the number of companies manufacturing devices based on mobile broadband technologies, such as 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 169 companies have manufactured at least one WCDMA or HSPA device. Thus, there is a broad and deep eco-system of commercial mobile broadband equipment and device manufacturers available for Smart Grid applications.

In terms of networks, there is fierce competition among US carriers in the provision of mobile broadband services, which has gone hand-in-hand with the rapid deployment and expansion of these mobile broadband networks across the country. Indeed, American consumers in urban, suburban, and rural areas are enjoying mobile broadband service at ever-increasing penetration rates and data speeds. Moreover, as the Commission found in its annual reports on the US wireless market, carriers have deployed competing mobile broadband technologies, which has 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 mobile broadband network and by offering the most robust and compelling mobile broadband services to consumers.[6]

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[6] See Thirteenth Report at Pg. 66.

Accordingly, Verizon Wireless, Sprint, US Cellular, Leap Wireless, and Cellular South, among other carriers, have deployed the CDMA2000 (EV-DO) mobile broadband technology, and their deployments are expanding every day. Overall, according to the Commission's latest report, EV-DO is available in over 1.5 million square miles across the country.[7]

On the other hand, AT&T has deployed the alternative WCDMA/HSDPA technology, and it is expanding the footprint of its WCDMA/HSDPA network at a very rapid rate. AT&T provides mobile broadband across much of the United States. Initially, AT&T deployed HSDPA, and subsequently, AT&T completed deploying HSUPA, thereby supporting higher speed uploads and downloads. For its part, T-Mobile USA has also launched HSPA on its AWS-1 spectrum in major markets around the country and now provides this mobile broadband service to an ever-increasing footprint. Thus, the mobile broadband networks based on HSPA/WCDMA technology are also expanding rapidly.

Mobile broadband networks based on these technologies are also operated by many smaller carriers. For example, Stelera Wireless provides mobile broadband service via HSPA to rural areas in Texas. Prior to Stelera's launch, these areas either had no broadband service of any kind or very limited service. Earlier this year, Cellular South announced a major expansion of its mobile broadband service, provided via EV-DO, in Mississippi to cover the Mississippi Delta region and as well as counties in Southwest and Eastern Mississippi. Mississippi has the lowest broadband penetration among the 50 states—mobile broadband is critical for that state and the others.

All told, in January 2009, the Commission found in the Thirteenth Report that approximately 263 million Americans live within a census block in which one carrier provides

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[7] Id. at Pg. 73.

mobile broadband service, as defined by the FCC to include EV-DO or WCDMA/HSPA; 207 million Americans live in a census block in which two or more carriers provide such mobile broadband; and, 145 million Americans live within a block in which three or more carriers offer mobile broadband. Thirteenth Report at Pg.73. The Commission's May 2009 Rural Broadband Report included a more recent statistic—now, over 95.6% of all Americans, i.e., approximately 272.55 million Americans, now live within a census block in which one carrier provides mobile broadband service as defined by the FCC to include EV-DO or WCDMA/HSPA. These numbers are increasing every day as the carriers constantly expand and enhance their mobile broadband networks.

Commercial mobile broadband networks are designed to be resillent. These networks operate during emergencies, disasters, and surge scenarios with a high degree of reliability. The carriers invest billions of dollars each year to maintain and improve this resiliency and reliability. Smart Grid applications should leverage this exceedingly high quality of service.

Smart Grid applications will proliferate rapidly, broadly, and in a cost-effective manner if they leverage the tremendous coverage, subscribership, and manufacturing base already available for commercial mobile broadband. Indeed, the failure to do so would severely limit and delay the implementation of the Smart Grid and drive up costs to uneconomic levels.

C. The Constant Drive to Upgrade Mobile Broadband Technology to Deliver Faster Data Rates, Lower Latency, and Greater Capacity

As already explained, the US commercial mobile broadband networks use two different technologies, but all together, these networks cover the territory in which over 95% of all Americans live. Verizon Wireless, Sprint, Leap Wireless and others provide mobile broadband service via EV-DO Revision A. AT&T and T-Mobile USA use HSPA mobile broadband technology. Both EV-DO and HSPA are being enhanced substantially, and these enhancements

will all be backwards compatible—carriers who use EV-DO and HSPA can upgrade their networks to the next version of these technologies. Moreover, LTE is also being developed and deployed rapidly.

These innovations will deliver mobile broadband at faster data rates and with lower latency. Other innovations will expand the coverage and capacity of mobile broadband networks. Smart Grid applications can and should leverage some or all of these innovations.

1. Faster Data Rates. 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.

Moreover, Qualcomm and many other vendors around the world are working on LTE, an OFDM-based technology, which achieves higher data rates and is optimized for wider bandwidths. This technology is under very active development. It does require new spectrum,

but by auctioning the 700 MHz spectrum last year, the Commission has filled that need. Both Verizon and AT&T have publicly stated their intention to deploy LTE.

2. Wider Coverage. As noted supra, over 4% of the US population is not covered today by any commercial mobile broadband network. The carriers are constantly expanding their networks, and so even with no new technology, this coverage gap is narrowing every day. In addition to those efforts, Qualcomm has developed a technological solution to fill coverage holes in mobile broadband networks, thereby achieving truly ubiquitous mobile broadband service across the entire United States.

Last year, Qualcomm announced that in conjunction with three licensees of mobile satellite systems (Skyterra, ICO, and TerreStar), Qualcomm would develop a satellite-based variant of EV-DO Revision A, known as S-DO, which will be included in the firmware of select Qualcomm multi-mode chips, thereby integrating satellite and cellular mobile broadband technology for use pursuant to the FCC's ATC (ancillary terrestrial component) rules.[8] In addition, Qualcomm will support the L and S-band mobile satellite frequencies in select RF processors, the same RF processors which are incorporated into Qualcomm chips which also support the cellular frequencies used by terrestrial mobile broadband networks. These chips will enable mass market terrestrial/satellitehybrid devices that will work even in areas where cellular coverage is spotty or non-existent.

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[8] 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), at http://www.qualcomm.com/news/releases/2008/080922_SkyTerra_Mobile_Satellite_Ventures_ICO_Global_Communications_and_Qualcomm_Sign.html; and http://www.businesswire.com/portal/site/home/permalink/?ndmViewId=news_view&newsId=20081211006242&newsLang=en, respectively.

Smart Grid applications can begin now with the extensive coverage provided today by commercial mobile broadband networks, which is expanding on a daily basis. Ultimately, however, for the Smart Grid to flourish and for all Americans to enjoy the benefits from the Smart Grid, complete mobile broadband coverage across the entire US may well be necessary, and if so, Qualcomm has the solution.

3. Lower Latency. Data rates, by themselves, only deal with one aspect of user experience. Latency is another important factor in any broadband network, including mobile broadband networks, especially for Smart Grid applications. Many Smart Grid applications will require low latency. Rate and latency are effectively a unified concept in broadband networks.

Driving network upgrades to achieve the fastest possible data rates in mobile broadband networks is a worthwhile goal, but increases in data rates alone, especially for Smart Grid applications which may not necessarily require the fastest possible data rates. As a result, improving latency is another important aspect of Qualcomm's research and development efforts.

4. Expanded Capacity. Smart Grid applications, if deployed broadly on existing commercial mobile broadband networks, will consume considerable network capacity. More spectrum is, of course, a solution, but new spectrum will not be allocated and auctioned overnight. As a result, Qualcomm developed several technologies to expand the capacity of mobile broadband networks to help ease the crunch which may otherwise occur due to the rapid proliferation of Smart Grid and other broadband applications.

Qualcomm has developed a technique known as interference cancellation ("IC"), which can be incorporated in all 3G-based networks to significantly improve the voice and data capacity without requiring new spectrum or a new network. IC can be applied to both downlink (forward link) and uplink (reverse link). The downlink IC is standard independent and

implemented in the handset (user device) and uplink IC is implemented in the base station. For 3G CDMA based technologies, such as HSPA and EV-DO, interference at the receiver limits the system capacity where each user represents interference to other users. Interference cancellation is a mechanism to cancel this interference from other users, thereby increasing the capacity. As Qualcomm explained in July of this year, a UMTS-based network's data throughput and capacity can be increased by 60 percent, voice capacity by 45 percent, and a user experience can be provided that is similar to LTE when a similar channel bandwidth is used.[9] Similar gains in capacity, throughput, and user experience can be attained by using uplink interference cancellation in EV-DO-based networks.

Using interference cancellation, the air link of a CDMA system can reach the theoretical limit. In fact, air links of all wireless technologies are approaching the theoretical limit, and IC is one of the major enhancements that bridge the performance gap between CDMA and OFDMA based technologies. As an example, an HSPA+ network with advanced receivers, IC and handset equalizer, provides similar spectral efficiency as LTE in the same amount of spectrum and for the same number of antennas. Significant future improvements to wireless networks (CDMA or OFDMA) will therefore come from optimizing the networks and the topology—such as adding femtocells—and not from the air interface technology. User data rates and system capacity can be increased significantly by bringing the transmitter closer to the users, e.g., adding picocells and femtocells. As an example, introducing femtocells with proper interference

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[9] See "ZTE and Qualcomm Colloborate to Boost UMTS System Performance," http://www.qualcomm.com/news/releases/2009/090705_ZTE_Qualcomm_Collaborate.html. See also the prior announcement on this same topic from Qualcomm and Huawei—"Qualcomm and Huawei to Cooperate on Advanced UMTS Node B Receiver Technology," Feb. 4, 2008, http://www.qualcomm.com/news/releases/2008/080204_Qualcomm_and_Huawei_to_Cooperate.html.

management can increase user data rates more than 10 times—significantly more than air link improvements can provide since the air link is approaching the theoretical limit.

For this reason, Qualcomm has developed femtocell technology. Femtocells are cellular access points that use DSL, fiber, or cable broadband connections to extend the reach of 3G mobile broadband service within a small area, such as within a home or office. Operators can use femtocells to enhance the overall capacity and coverage of their mobile broadband networks. Qualcomm will offer 3G mobile broadband chipsets for femtocell incorporating innovative technology to mitigate any interference that would otherwise occur between femtocells and the macro cellular network. See "Qualcomm Adds Femtocell Chipsets to Technology Portfolio," http://www.qualcomm.com/news/releases/2009/090216_Qualcomm_Adds_Femtocell_Chipsets_to_Technology_Portfolio.h (Feb. 16, 2009). Qualcomm has also licensed femtocell manufacturers. See "Qualcomm and Global Wireless Sign 3G Femtocell License Agreement," http://www.qualcomm.com/news/releases/2009/090910_Qualcomm_and_GlobalWireless_Sign.html (Sept. 10, 2009).

Qualcomm's DO-Advanced technology optimizes the performance of a CDMA2000 network by software upgrades used in concert with picocells, femtocells, macrocells, and advanced devices, which, taken together, significantly improve the overall capacity and coverage of the network. In addition, Qualcomm has developed technologies to expand the voice capacity of 3G networks. The 1X Advanced technology increases the voice capacity of a CDMA2000 network by up to four times. It requires new handsets and channel cards in network base stations.

5. Support for Full Mobility. The Smart Grid will allow automated outage detection as well as provide information for use in proactive maintenance of utility assets. To obtain the

maximum benefits from the availability of such information, the information must be readily available to a mobile workforce to facilitate efficient workforce management and rapid dispatch. Similarly, for security reasons, certain sites may be equipped with cameras and intrustion detection capabilities which trigger remote alarms. Again, this information must be made available in a timely manner to a mobile security workforce. Commercial mobile broadband networks support full vehicular mobility and are already used to support many of these applications for mobile workforces in other industries.

D. Mobile Broadband Chipsets & Modules for Smart Grid Applications

As noted, QCT is the world's largest provider of chipsets and software for mobile broadband devices. QCT constantly develops new chipsets incorporating more functionality and lower power to drive mobile broadband into an ever increasing variety of devices at all price points. As already noted, QCT's chipsets and software enable the provision of mobile broadband in all the US cellular frequency bands, using all of the various mobile broadband technologies, in devices covering all price tiers. In particular, QCT offers several products which are well suited for Smart Grid applications.

These products offer a number of important benefits for Smart Grid applications. They are future proof since they will incorporate future upgrades in mobile broadband technology already described herein. In addition, they use standardized physical and electrical interfaces already used today in mobile broadband data cards. Device manufacturers will not have to start from scratch as they make new devices for Smart Grid. Finally, QCT's products deliver low latency, which, as already noted, is important for Smart Grid applications.

1. The Gobi Solution for the Widest Possible Connectivity. The first such product addresses the need for Smart Grid applications to use devices which can access mulitple wireless

network technologies so that Smart Grid applications can leverage the coverage of multiple operators even if they use different technologies and gain the widest possible coverage at the lowest possible cost. The product, named Gobi, is a global mobile broadband and GPS embedded solution for wireless devices. A Smart Grid device containing Gobi can operate on mobile broadband networks in the United States and around the world. The original Gobi solution included a Qualcomm chipset, associated software and API, and a reference design for a data module supporting both the EV-DO Revision A and HSPA mobile broadband air interfaces as well as GPS. Earlier this year, Qualcomm announced its second generation embedded Gobi module. This module, which will launch commercially this year, provides a wide range of enhancements, including support for additional frequencies, increased data speeds, enhanced GPS functionality, and additional operating systems, such as Windows 7 and Linux.

While Gobi was initially deployed in notebook computers, it is now being embedded into other devices to provide worldwide mobile broadband connectivity. Just last week, IREX Technologies ("IREX") announced a new Gobi-embedded touch-screen, e-Reader, the IREX DR800SG. This innovative device will enable the wireless downloading of books, newspapers, and magazines around the world via the embedded 3G multi-mode capability provided by the Gobi module. This device is the first eReader to leverage Qualcomm's technology to support global connectivity.

For the Smart Grid to proliferate broadly, rapidly, and in a cost-effective manner, devices will need to use multiple networks and multiple technologies, but on a globally harmonized, standardized basis. In particular, Gobi is well suited for automatic meter infrastructure, which needs the broadest possible coverage, and residential gateways, which can be used to provide connectivity to multiple devices within a home to enable load shedding at peak times. Both of

those Smart Grid applications need the broadest possible connectivity, but at the least possible cost—the solution that Gobi provides. Gobi modules offer economies of scale because they can be used on a variety of device types and a variety of networks. The modules are also relatively easy for device manufacturers to use in building devices since they are standardized and typically have been tested and used on multiple networks. For all of these reasons, Gobi can help drive Smart Grid applications the proliferation of Smart Grid applications broadly and rapidly.

2. The inGeo Solution for Wireless Monitoring & Tracking. Another QCT product which is well suited and available for Smart Grid applications is a platform by the name of inGeo. The inGeo platform is a complete end-to-end solution for accurate, real time tracking and reporting of location and other data. It is designed for use in wireless monitoring, tracking, and safety applications.

InGeo currently uses CDMA2000 and Assisted GPS and is optimized for extremely small form factors and long battery life using Qualcomm's low duty cycle technology. (A next generation inGeo could be based on WCDMA.) The inGeo solution and associated server control technology provide accurate near real time location data that can be used for wireless tracking, safety and monitoring applications. At less than 1,000 mm2 in area, the inGeo module is one of the industry's smallest form factors, and it incorporates a a Bosch SMB380 3-axis accelerometer and 2.4 GHz ZigBee transceiver to limit power consumption and provide short range connectivity.

InGeo is extensible for both hardware and software. With relative ease, sensors can be integrated and drivers installed into a device containing InGeo. The platform even supports updates of firmware over the air and a variety of standards, including OMA Device Management. InGeo also supports the ability to to customize the device by upgrading

applications over the air using Qualcomm's BREW Application Distribution System. Not only does this capability ensure the longevity of a device that may be in the field for over 20 years, but BREW has implemented strong security principles of authentication and authorization to esnure the robustness of the Smart Grid for years to come.

Critically important Smart Grid applications will involve remote monitoring or tracking. For example, Smart Grid applications will entail monitoring and control of electric transmissions and distribution to address renewable intermittency, increase customer participation in demand management activities, and improve and maintain the reliability of the system. Having wireless connectivity integrated with sensors at remote locations will also ensure the system is secure, attain end-to-end integration, and manage customer distributed energy resources.

E. Commercial Mobile Broadband Technology and Networks Are Being Used for Smart Grid Applications

There are several examples of commercial mobile broadband technology and networks already being used for Smart Grid applications. One example involves nPhase, Qualcomm's joint venture with Verizon Wireless. In early September of this year, nPhase announced a series of ongoing pilot Smart Grid programs with ABB, a leader in power and automation technologies for ABB's utility customers, including Con Edison of New York. By using real-time wireless connectivity and services coupled with ABB's asset monitoring solution for high voltage circuit breakers, utilities can improve grid reliability and reduce operating costs. This solution can also prevent power outages and maintain environmental compliance.[10]

The ABB solution, known as Circuit Breaker Sentinel, gathers critical information from a utility asset to determine the health of the electrical transmission equipment; nPhase extracts

[10] See "nPhase Powers ABB's Asset Monitoring Solution," (released Sept. 1, 2009); http://www.reuters.com/article/pressRelease/idUS188177+01-Sep-2009+GNW20090901.

crucial data via the secure cellular network and forwards the data to ABB's Asset Insight hosted web platform, which allows the data to be reviewed and acted upon. This is the type of end-to-end solution, which would not be possible without a high speed, reliable, ubiquitous cellular connection, that will drive the rapid proliferation of the Smart Grid.

Likewise, Qualcomm is working with San Diego Gas & Electric and 24 other local, national, and global organizations to demonstrate Smart Grid applications in the San Diego area.[11] This project is the first secure end-to-end Smart Green Grid demonstration project, covering generation, transmission, distribution, and end customers. The coalition will use the most advanced technology available to empower consumers to exert greater control over their energy usage, as well as accommodating a growing number of electric vehicles. If funded (the coalition is seeking $100 million in federal funds) and if successful, this project can be replicated on a larger scale anywhere in the world.

Qualcomm is not the only company, by any means, working on Smart Grid applications over commercial mobile broadband networks. Verizon Wireless is working with Itron to use its 3G network for advanced metering and with Ambient Corporation to facilitate a host of Smart Grid applications.[12] AT&T has teamed with SmartSynch, a leader in the development of Smart Grid applications using commercial wireless networks, to offer a suite of smart grid solutions

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[11] See "Energy Technology Coalition Formed to Develop San Diego 'Smart Grid,' released Sept. 17, 2009, available at http://www.marketwire.com/press-release/San-Diego-Gas-and-Electric-NYSE-SRE-1046167.html.

[12] See "Verizon Wireless and Ambient Corporation Join Forces to Offer Utilities Smart Grid Communications Solutions," released March 4, 2009, available at http://www.reuters.com/article/pressRelease/idUS133942+04-Mar-2009+PRN20090304; Verizon Wireless and Itron Combine Forces to Harness the Power of Wireless Technology in Advanced Metering and Smart Grid Market," released April 1, 2009, available at http://news.vzw.com/news/2009/04/pr2009-04-01a.html.

using the AT&T wireless network.[13] These initiatives, and others in the pipeline, show that commercial mobile broadband networks and technology are well suited and already in use to drive the rapid proliferation of Smart Grid applications.

F. Using Mobile Broadband Connectivity for Electric Vehicles

Electric vehicles will certainly play an important part of the Smart Grid. The US Department of Energy has announced that a total of $2.4 billion in federal grants under ARRA have already been awarded to accelerate the manufacturing and deployment of the next generation of US batteries and electric vehicles.[14] These grants cover 48 projects in more than 20 states. This initial round of funding reflects a national commitment to facilitate the rapid proliferation of plug-in electric vehicles all over the US.

The rapid proliferation of plug-in electric vehicles is not likely to be achieved, however, without incorporating wireless connectivity into the Smart Grid applications which will be necessary to support the electric vehicles. The electric vehicles themselves and the charging stations they will require will both need wide area, high speed, ubiquitous mobile connectivity. These are just a few examples of the critical role that mobile connectivity is likely to play with respect to electric vehicles: drivers will need mobile connectivity to help them locate charging stations while travelling; utilities will need it to coordinate the storage of intermittent generation of energy for batteries and to aggregate battery capacity; vehicle manufacturers will need it to monitor and manage energy use to maximize the lifespan of batteries; and, charging stations will

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[13] See "AT&T to Offer Wireless Smart Grid Technology to Utility Companies," released March 17, 2009 and available at http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=26613.

[14] See "President Obama Announces $2.4 Billion in Grants to Accelerate the Manufacturing and Deployment of Next Generation U.S. Batteries and Electric Vehicles," released August 5, 2009, available at http://www.whitehouse.gov/the_press_office/24-Billion-in-Grants-to-Accelerate-the-Manufacturing-and-Deployment-of-the-Next-Generation-of-US-Batteries-and-Electric-Vehicles/.

require wireless connectivity so that utilities can monitor and manage the power loads from charging stations.

For all of the reasons discussed previously herein, commercial mobile broadband technology and networks are well suited to enable the rapid and broad deployment of Smart Grid applications. We now turn to the questions posed by the Public Notice concerning spectrum.

III. The Commission Should Allocate Additional Spectrum for Multi-Use Mobile Broadband Commercial Networks for Smart Grid and Other Applications; Single Purpose Dedicated Networks and Unlicensed Devices Will Not Drive the Rapid, Broad, or Cost-Effective Proliferation of Smart Grid Applications

The Public Notice asks a variety of questions concerning spectrum for Smart Grid applications. Public Notice at Pgs. 2 to 3. The Commission states that it "seek(s) to understand better how wireless spectrum could be used for Smart Grid applications." Id. at Pg. 2. As has been shown supra, commercial mobile broadband networks, which operate on licensed spectrum auctioned by the Commission, will be used to drive the rapid, broad, and cost-effective proliferation of Smart Grid applications. We have already provided considerable information to support this assertion, and we provide more below.

A. The Commission Should Avoid Allocating Spectrum for Single-Use, Dedicated Networks

Single-use, dedicated networks for Smart Grid only will not be cost effective to build, maintain, expand, or upgrade on a constant basis, unlike commercial mobile broadband networks, which have already received hundreds of billions of dollars in investment and can amortize future investments over the 264 million Americans who already subscribe to wireless service. It would take many billions of dollars and a decade, if not longer, to construct single-use, dedicated networks with the coverage already provided by commercial mobile broadband networks, not to mention the annual investments to maintain, upgrade, and expand such

networks. Smart Grid applications should leverage the investments already made by the commercial mobile broadband providers. There is no need for the Commission to allocate spectrum for single-use, dedicated Smart Grid-only networks. Also, during diasters and emergencies, the commercial network operators make herculean efforts to maintain and quickly restore communications capabilities as both the general public and emergency personnel rely on the networks for communications. It is doubful that the same degree of effort can and will be expended for one or more dedicated Smart Grid-only communications networks since the resources of energy companies will likely be devoted to maintaining and restoring the energy delivery infrastructure.

As Qualcomm has contended in its other filings in the proceedings over the National Broadband Plan, there is no doubt that additional licensed spectrum is required to meet the burgeoning demand for mobile broadband services, and as already shown, Smart Grid applications are one important driver of such demand. For the reasons set forth in Qualcomm's recent filing in response to the Commission's Notice of Inquiry on innovation in the wireless industry, the Commission should auction such spectrum with flexible use rights, liberal property rights, a technology neutral regulatory regime, full protection from interference, and free of encumbrances. See Comments of Qualcomm Incorporated, Dockets 09-157 & 09-51 (filed September 30, 2009) at Pgs. 27 to 36.

Smart Grid applications will bring the American public substantial benefits, but so will mobile health applications, mobile education applications, mobile commerce applications, and on and on. There is not enough spectrum for dedicated mobile Smart Grid-only networks and dedicated mobile education-only networks, dedicated mobile health-only networks, mobile commerce-only networks, and so on, and even if there were sufficient spectrum for such

networks, we have already shown that it would uneconomic and not feasible for such networks to be built and kept up to date.

B. The Commission Should Not Rely on Unlicensed Spectrum to Drive the Broad, Rapid, or Cost-Effective Proliferation of Smart Grid Applications

The Public Notice seeks information on the extent to which unlicensed spectrum will be used for Smart Grid applications. By way of background, it is important to distinguish between the appropriate uses for unlicensed, as opposed to licensed, spectrum.

Qualcomm discusses this topic as the developer and chip manufacturer of both licensed and unlicensed technologies. Qualcomm's mobile broadband technologies and chipsets use licensed spectrum, but QCT also offers chipsets for handsets and mobile devices based on 802.11n, the most advanced version of Wi-Fi, as well as Bluetooth solutions. Indeed, for Smart Grid applications, QCT has developed inGeo, which incorporates both ZigBee, an unlicensed technology, and CDMA2000, a licensed technology.

Unlicensed technologies, such as ZigBee and Wi-Fi, provide short range, low power service within a small confined area or space—a local area or space. Transmitters based on these technologies use extremely low power levels because they are only attempting to cover a small area. They do not require interference protection since they operate at such a short range and at such relatively low power. Unlicensed devices typically lack the ability to overcome interference, so they are typically deployed under use cases in which no interfering device is likely to be present within the confined coverage area.

On the other hand, mobile broadband technologies, including CDMA2000, WCDMA/HSPA, and LTE provide wide area, higher power service. Transmitters based on these technologies use relatively higher power since they provide coverage over a much wider area.

To ensure that the communications link across a wide area, from the base station to the phone or modem, is not dropped, these technologies do require interference protection.

These technical differences dictate vastly different business models for unlicensed versus licensed technologies. As noted, unlicensed technologies must operate at relatively low power levels. This means that to cover a wide area, an unlicensed deployment would require far more transmitters than licensed deployment. For example, in the TV White Space proceeding, Qualcomm showed that a 700 MHz licensed transmitter could cover approximately twenty times the area of an unlicensed transmitter. See Charles L. Jackson, "Unlicensed TV White Space Wireless Cannot Provide Substantial Rural Broadband Access," (October 22, 2008), attached to Qualcomm Ex Parte Filing in Dockets 04-186 & 02-380. This disparity establishes that there is no business case for the deployment of unlicensed technology to cover wide areas.

Some Smart Grid applications, such as remote monitoring, will require devices which utilize both unlicensed and licensed spectrum. These applications will involve taking a measurement by using a low power sensor within a local area and then communicating the results of the measurement to a central monitoring station or control point, which could be a large distance away. Other Smart Grid applications may involve only licensed spectrum. Qualcomm believes that it is unlikely that a Smart Grid application will only use unlicensed spectrum since for any Smart Grid application, there will likely be a need to communicate information over some wider distance, hence the requirement for licensed spectrum.

While there is undoubtedly a constant need for more licensed spectrum (a fact proven by the billions of dollars paid in recent spectrum auctions), there is no corresponding evidence that the unlicensed bands are congested. To the contrary, the evidence from the FCC's own database of equipment authorizations is that manufacturers continue to make new equipment for all of the

currently allocated unlicensed bands. If any unlicensed band was congested, new equipment authorizations for the band would decrease such equipment would be un-usable and would not sell. But, the data from the Commission's data base shows that manufacturers are continue to make equipment for all of the unlicensed bands. See Charles L. Jackson, Dorothy Robyn, and Coleman Bazelon, "Unlicensed Use of the TV White Space: Wasteful and Harmful," (filed in Dockets 04-186 & 02-380, Aug. 20, 2008) at Pgs. 4-13.

In sum, unlicensed devices are not going to be sufficient, in and of themselves, for the implementation of Smart Grid applications. Rather, Smart Grid applications will use both licensed and unlicensed technologies, although no Smart Grid application is likely to be deployed without some licensed technology but some applications will not need unlicensed technologies. Similarly, there is a need for additional licensed spectrum for both Smart Grid and other mobile broadband applications, but no corresponding need for additional unlicensed spectrum.

IV. Conclusion

Wherefore, Qualcomm requests that the Commission take actions in accordance with these Comments.

Respectfully submitted,

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