Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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

COMMENTS OF CTIA – THE WIRELESS ASSOCIATION®
NBP PUBLIC NOTICE #6

CTIA – The Wireless Association® ("CTIA")[1] submits the following comments in response to the Federal Communications Commission's ("FCC" or "Commission") Public Notice seeking comment on whether current spectrum allocations are sufficient to support near- and longer-term demands for wireless broadband.[2] As eloquently stated by Chairman Julius

[1] CTIA – The Wireless Association® is the international organization of the wireless communications industry for both wireless carriers and manufacturers. Membership in the organization covers Commercial Mobile Radio Service ("CMRS") providers and manufacturers, including, cellular Advanced Wireless Service, 700 MHz, broadband PCS, and ESMR, as well as providers and manufacturers of wireless data services and products.

[2] *Comment Sought on Spectrum for Broadband – NBP Public Notice #6*, GN Docket Nos. 09-47, 09-51, 09-137, Public Notice, DA 09-2100 (Sept. 23, 2009) ("*Public Notice*"). In keeping with the Commission's request in the *Public Notice*, CTIA has largely structured these comments in adherence with the organization of the *Public Notice. See Public Notice* at 7. However, because the issues discussed therein are related, CTIA has combined its responses to questions 3 and 5 of the *Public Notice* into Section IV of these Comments.

Genachowski: "Spectrum is the oxygen of our mobile networks."[3] However, current spectrum allocations are insufficient to meet the growing demand for wireless broadband services. To meet projected demand, CTIA has asked the Commission to identify and allocate a significant amount of additional spectrum – at least 800 MHz – for licensed commercial wireless use within the next six years. Such an allocation would be an important step towards meeting the rapidly accelerating demand for mobile wireless broadband services and maintaining a competitive and innovative mobile wireless ecosystem.

Without a significant additional allocation, U.S. consumers and businesses will find themselves unable to reap the full benefits of the mobile broadband age. In the last 24 months, many of the most advanced handsets have been launched in the U.S., including Apple's iPhone 3GS; LG's Voyager and Venus; Samsung's Instinct and Instinct S30; Google's G1 and MyTouch; Research in Motion's Blackberry Storm, Bold, Pearl Flip, Tour, and Curve 8900; and the Palm Pre.[4] If the U.S. fails to meet the spectrum needs of next generation networks, there is

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[3] Julius Genachowski, Chairman, Federal Communications Commission, *America's Mobile Broadband Future*, Remarks at International CTIA WIRELESS I.T. & Entertainment at 4 (Oct. 7, 2009) *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-293891A1.pdf ("*Chairman Genachowski CTIA Remarks*").

[4] *See, e.g.*, Press Release, Apple, Apple Announces the New iPhone 3GS—The Fastest, Most Powerful iPhone Yet (June 8, 2009), *available at* http://www.apple.com/pr/library/2009/06/08iphone.html (last accessed Sept. 23, 2009); Press Release, Verizon Wireless, The Hottest Phones of the Season Have Arrived: Verizon Wireless Introduces the Voyager and Venus by LG (Nov. 19, 2007), *available at* http://news.vzw.com/news/2007/11/pr2007-11-19.html (last accessed Sept. 23, 2009); Press Release, Sprint Nextel, Award-Winning Samsung Instinct(TM) Available Exclusively from Sprint on June 20 for Just $129.99 (June 18, 2008), *available at* http://newsreleases.sprint.com/phoenix.zhtml?c=127149&p=irolnewsArticle_newsroom&ID=1124417 (last accessed Sept. 23, 2009); Press Release, Sprint Nextel, Samsung Instinct s30, Exclusively from Sprint, Adds Attractive Styling, Instant Messaging, Improved Web Experience and Enhanced Open Development Capabilities to Popular Instinct (Mar. 31, 2009), *available at* http://newsreleases.sprint.com/phoenix.zhtml?c=127149&p=irol-newsArticle_newsroom&ID=1271892&highlight=instinct (last accessed Sept. 23, 2009); Martyn Williams and James Niccolai, *T-Mobile's Android-based G1 Goes on Sale*, ComputerWorld, Oct. 22, 2008, *at* http://www.computerworld.com/s/article/9117740/T_Mobile_s_Android_based_G1_goes_on_sale (last accessed Sept. 23, 2009); Press Release, Verizon Wireless, BlackBerry Storm Available in U.S. November 21 Exclusively from Verizon Wireless (Nov. 13, 2008), *available at* http://news.vzw.com/news/2008/11/pr2008-11-13.html (last accessed Sept. 23, 2009); Bonnie Cha, *Flipping Out: RIM BlackBerry Pearl Flip 8220 debuts*, CNET, Sept. 9, 2008, *at* http://reviews.cnet.com/8301-12261_7-10036487-51.html (last accessed Sept. 23, 2009); Press Release, BlackBerry, T-Mobile USA to Offer Customers the Thinnest and Lightest Full-QWERTY BlackBerry Smartphone (Jan 7. 2009), *available at* http://na.blackberry.com/eng/newsroom/news/press/release.jsp?id=1984 (last accessed Sept. 23, 2009); Press Release, Sprint Nextel, Sprint to Offer Palm Pre Nationwide on June 6 (May 19, 2009),

little reason to believe that the U.S. will remain the market of choice for innovative devices or applications. Instead, U.S. consumers and businesses will find themselves without the tools to compete in a global marketplace and the U.S. will find itself less able to harness the many positive externalities of high-bandwidth mobile services that are literally transforming almost all aspects of the way we work, learn, get health care, and enhance our public safety.

It is also critical that policymakers maintain the most effective spectrum policies to promote U.S. leadership in mobile broadband development. To ensure our limited spectrum resources are used effectively and efficiently, the Commission should continue to employ an exclusive-use, flexible rights licensing model that allows the market and consumers, rather than regulators, to determine the highest and best use of the spectrum.

I. CURRENT SPECTRUM ALLOCATIONS WILL BE INSUFFICIENT TO SUPPORT THE EXPLOSIVE DEMAND FOR VOICE AND DATA SERVICES AS NEXT GENERATION NETWORKS ARE DEPLOYED.

As recognized by both CTIA and Chairman Genachowski, there is a spectrum crisis looming.[5] Spurred largely by the dramatic increase in data traffic caused by the adoption of new applications and services, mobile wireless networks are experiencing unprecedented usage levels.[6] As U.S. mobile network operators continue to deploy 3G networks and transition to 4G platforms, forecasts universally show that the demands placed on wireless networks will grow exponentially.[7] As just one example, Cisco projects that mobile data traffic will double every

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available at http://newsreleases.sprint.com/phoenix.zhtml?c=127149&p=irol-newsArticle_newsroom&ID=1289761&highlight=Palm%20Pre (last accessed Sept. 23, 2009).

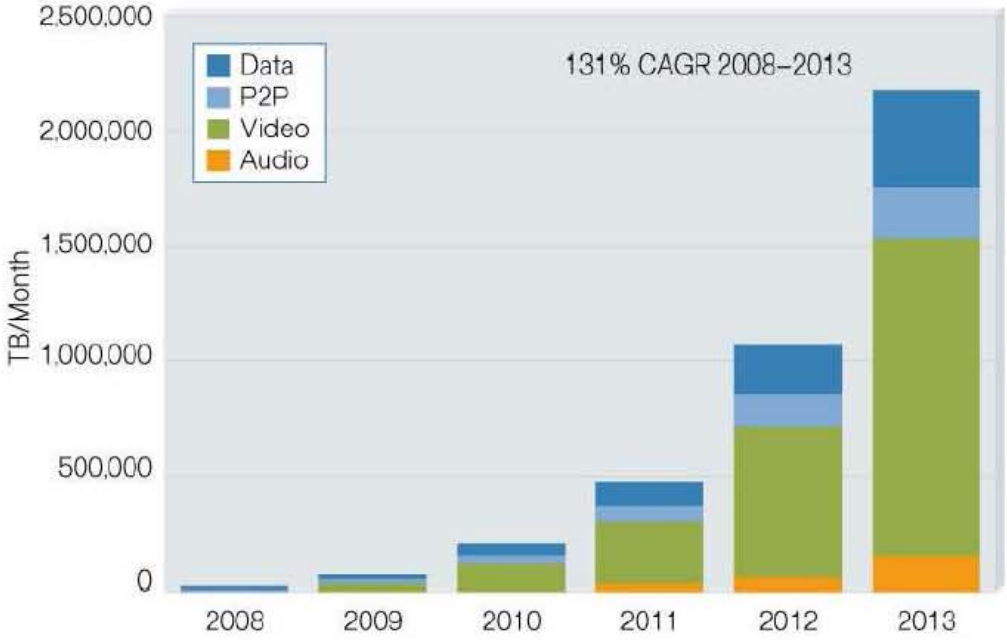
[5] *Chairman Genachowski CTIA Remarks* at 4 ("In fact, I believe that that the biggest threat to the future of mobile in America is the looming spectrum crisis.").

[6] *See, e.g.*, Kristin Rinne, Senior Vice President Architecture and Planning, AT&T, Remarks at the Wireless Broadband Workshop at 5-6, 40 (Aug. 13, 2009) (transcript available at http://www.broadband.gov/docs/ws_06_tech_wireless_transcript.pdf) ("*Rinne Remarks*") (stating that AT&T has recently witnessed mobile data traffic on its network increase by 5,000 percent).

[7] *See* Section I.B., *infra.*

year between 2008 and 2013, resulting in traffic 66 times 2008 levels.[8] That staggering growth rate is depicted in the following graphic:

Cisco Forecasts 2 Exabytes Per Month of Mobile Data Traffic in 2013



Source: *Cisco Mobile Data Traffic Forecast* at 6.

Although network operators are constantly investing in their networks and innovating to enhance spectral efficiency, the technological capacity limits of existing spectrum allocations

[8] *See also* Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update," Cisco Systems, Inc. at 1-2 (Jan. 2009), *available at* http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.pdf ("*Cisco Mobile Data Traffic Forecast*").

will not keep pace with expected demand.[9] Thus, to support next generation wireless voice and data services, additional commercial wireless spectrum will be essential. Below, CTIA describes the factors leading to the present explosion in network demand, future usage expectations, and technological limits on further re-mining current spectrum allocations.

A. Wireless Network Usage has Grown Dramatically with Developments in Devices, Technology, Applications, and Pricing Models.

Ironically, the spectrum predicament threatening the wireless ecosystem is the direct effect of the industry's own success in providing innovative and affordable services that appeal to business and retail consumers alike. Across the geographic, demographic, and economic strata, mobile wireless networks are carrying more users than ever. As documented in CTIA's recently released 2009 Semi-Annual Wireless Industry Survey, there are more than 276 million U.S. wireless subscribers, with an average increase of over 22 million new subscribers in each of the five previous calendar years.[10] Network operators are already feeling the strain of recent surges in usage, and as next generation technologies are deployed, bringing with them new bandwidth-intensive applications, existing spectrum allocations will prove insufficient to meet consumer demand. As explained more fully in CTIA's written *ex parte* communication submitted in this same proceeding,[11] and in the *Mobile Broadband Spectrum Demand* report that

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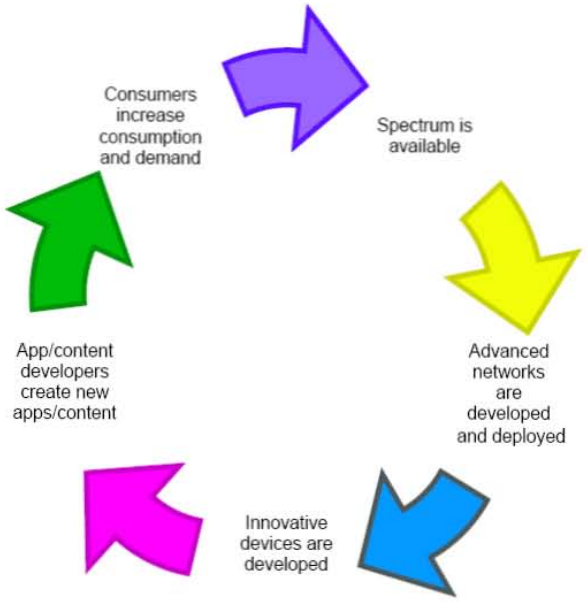
[9] Scott Corson, Vice President of Engineering, Qualcomm Flarion Technologies, Remarks at the Wireless Broadband Workshop at 17 (Aug. 13, 2009) (transcript available at http://www.broadband.gov/docs/ws_06_tech_wireless_transcript.pdf) ("*Corson Remarks*").

[10] *See* CTIA's Wireless Industry Indices: Semi-Annual Data Survey Results: A Comprehensive Report from CTA Analyzing the U.S. Wireless Industry, Mid-Year 2009 Results ("*CTIA's Wireless Industry Indices Report*").

[11] *Ex Parte* Letter from Christopher Guttman-McCabe, V.P., Regulatory Affairs, CTIA – The Wireless Ass'n, to Chairman Julius Genachowski, and Commissioners Copps, McDowell, Clyburn, and Baker, Federal Communications Commission, GN Docket No. 09-51 (filed Sept. 29, 2009) ("CTIA September 29 *Ex Parte*").

accompanied it,[12] various market forces – including increasing mass market adoption of mobile broadband, the growing popularity of smartphones and other mobile broadband devices, development of bandwidth intensive applications and services, and innovative pricing – have coalesced into a virtuous cycle of innovation that results in skyrocketing demand for and usage of wireless services and a wealth of consumer benefits.

The following chart depicts the "virtuous cycle" of innovation taking place in the wireless ecosystem:



1. Mass Market Adoption of Mobile Broadband

Mobile broadband is the fastest growing broadband platform in the country, outpacing combined Digital Subscriber Line ("DSL") and cable modem activations between December

[12] *Mobile Broadband Spectrum Demand*, Rysavy Research (Dec. 2008) *available at* http://www.rysavy.com/Articles/2008_12_Rysavy_Spectrum_Demand_.pdf ("*Mobile Broadband Spectrum Demand*").

2007 and June 2008.[13] Rysavy Research reports that as of May 2008, the number of active users of mobile Internet services in the US had grown to 40 million, twice as many as two years prior.[14] This dynamic is echoed by other sources. A recent survey by the Pew Internet & American Life Project found that 56 percent of Americans have accessed the Internet wirelessly, with 32 percent of Americans doing so via a handheld device.[15] The Commission's own data indicate the existence of over 59 million mobile wireless high speed "lines" in the U.S.,[16] and these adoption trends will only accelerate in coming years. Indeed, as noted below,[17] mobile broadband is poised to become the dominant means of Internet access globally in the coming years, with a recent survey of experts predicting that mobile devices will be the only Internet connection for a majority of people across the world by 2020.[18]

2. Smartphones and Other Mobile Broadband Devices

Smartphone handsets, which bring advanced computing and Internet functionalities to mobile devices, are becoming increasingly popular and are a driving force both in mobile broadband adoption and increased network usage. The number of smartphones and wireless-enabled PDAs reported on carriers' networks as of June 2009 was 40.7 million.[19] That number is expected to continue to increase, as overall handset sales volume grew 14 percent in the

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[13] *High-Speed Services for Internet Access: Status as of June 30, 2008*, Federal Communications Commission, Tbl. 1 (July 2009).

[14] *Mobile Broadband Spectrum Demand* at 6.

[15] *Wireless Internet Use*, Pew Internet & American Life Project, at 3 (July 2009) ("*2009 Pew Wireless Internet Use*")

[16] *High-Speed Services for Internet Access: Status as of June 30, 2008*, Federal Communications Commission, at Tbl. 1 (July 2009).

[17] *See infra* Section I. B.

[18] *See The Future of the Internet III*, Pew Internet & American Life Project, at 5 (Dec. 2008) ("*The Future of the Internet III*").

[19] *CTIA's Wireless Industry Indices Report* at 2.

second quarter of 2009 compared with the previous year, with smartphone sales constituting 28 percent of purchases, a 47 percent increase from the previous year.[20] Smartphones are a product of the convergence of innovation and investment at both the device and network levels. This investment and innovation at both levels of the wireless ecosystem facilitates the creation of new products that allow consumers to enjoy unprecedented levels of connectivity and productivity through cutting-edge devices and state-of-the-art networks. As 3G networks have expanded, smartphones have grown increasingly attractive, and as device prices have dropped (as a result of wireless service provider subsidies in many cases), their market penetration has steadily risen. Although not yet as popular as smartphones, the wireless marketplace is also witnessing the spread of mobile broadband capable laptops and low-priced "netbooks," a trend that is certain to continue. According to CTIA's 2009 Semi-Annual Wireless Industry Survey, the number of wireless-enabled laptops, aircards, and wireless modems reported on carriers' networks was 10.8 million, a significant increase from just six months ago.[21]

However exciting as it may be, one result of this dramatic increase in access to data over mobile broadband networks is an even more dramatic increase in network traffic. The *Mobile Broadband Spectrum Demand* report explains that smartphone users are significantly more likely to use their devices for mobile Internet and other non-calling activities than users of traditional feature phones.[22] In fact, one smartphone generates more data traffic than 30 basic feature cell phones and a laptop mobile broadband access card generates more data traffic than 450 basic

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[20] The NPD Group, *Feature Phones Comprise Overwhelming Majority of Mobile Phone Sales in Q2 2009* (Aug. 19, 2009) *available at* http://www.npd.com/press/releases/press_090819.html.

[21] *CTIA's Wireless Industry Indices Report* at 2.

[22] *Mobile Broadband Spectrum Demand* at 8.

feature cell phones.[23] AT&T reports that wireless data traffic has increased by nearly 5,000 percent in the past 12 quarters,[24] and other carriers have reported similarly dramatic increases.[25] This remarkable surge in traffic is a major contributing factor to the looming spectrum crisis.

3. High-Bandwidth Applications and Services

Related to the surge in smartphone usage is the increasing popularity of high-bandwidth, data-intensive applications. Wireless devices are no longer simply a means of mobile voice communications. Today's mobile devices are used to browse the web, transmit, edit, and display documents and presentations, consume streaming media, and many other such applications that have traditionally been within the sole purview of the personal computer. But this functionality comes with a significant bandwidth cost. As is explained in the *Mobile Broadband Spectrum Demand* report, these new applications consume many times the bandwidth of traditional voice calling.[26] For example, watching a YouTube video on a wireless device consumes almost one hundred times the data bandwidth of a voice conversation, and downloading a five megabyte PowerPoint file consumes the same amount of data on downlink as having a one hour phone conversation.[27]

4. Innovative and Diverse Pricing Models

Irrespective of the significant technological developments in wireless over recent years, one of the most important contributors to growth in usage has been the proliferation of varied

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[23] *Mobile Data Traffic Forecast* at 3.

[24] *See Rinne Remarks* at 6.

[25] *See, e.g.*, *Ex Parte* Letter from Kathleen O'Brien Ham, T-Mobile USA, to Marlene H. Dortch, Federal Communications Commission, GN Docket No. 09-51, WT Docket No. 06-150, PS Docket No. 06-229, WT Docket No. 05-265, WT Docket No. 00-193, WC Docket No. 05-25, at 9 (filed Aug. 6, 2009) ("T-Mobile G1 customers use 50 times the data of the average T-Mobile customer").

[26] *Mobile Broadband Spectrum Demand* at 6.

[27] *Mobile Broadband Spectrum Demand* at 6.

and innovative pricing models. Historically, wireless voice service was billed entirely on usage and the perception of potentially high costs kept some consumers out of the marketplace. For the last decade, however, commercial wireless providers have continuously competed and distinguished themselves from each other on the basis of innovative service and pricing plans.[28] Today's wireless voice and data customers enjoy numerous service options, including: first free minute, bucket plans, family plans, unlimited flat rate calling, free nights and weekends, on-net calling, prepay, rollover minutes, mobile to anyone, unlimited voice calling, and now unlimited data plans. In its comments to the *Mobile Wireless Competition* proceeding, CTIA presented a detailed description of some of the many variations that service providers are devising to meet the needs of consumers, whether high or low volume users.[29] Indeed, even in the short time since CTIA filed its comments in that proceeding, service providers have continued to innovate in service and rate plans, driven by consumer demand and competitive pressures.[30] This flexibility allows consumers to select a plan that best meets their needs and budgets, and has contributed to the overall increase in network usage.

B. As Next Generation Platforms are Deployed, Usage and Spectrum Demand is Expected to Surge.

Due to the developments detailed above, mobile broadband providers are already experiencing dramatic increases in traffic. As carriers continue to build out 3G networks and

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[28] *See Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services*, Thirteenth Report, 24 FCC Rcd 6185, 6243-49 at ¶ 111-24 (Jan. 15, 2009); *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions With Respect to mobile Wireless Including Commercial Wireless Services*, Comments of CTIA – The Wireless Association, WT Docket No. 09-66 at 40-42 (filed Sept. 30, 2009).

[29] Comments of CTIA – The Wireless Association®, WT Docket No. 09-66, at 40-43 (filed Sept. 30, 2009) ("*CTIA Mobile Wireless Competition Comments*").

[30] Reply Comments of CTIA – The Wireless Association®, WT Docket No. 09-66, at 16 (filed Oct. 22, 2009) ("*CTIA Mobile Wireless Competition Reply Comments*") (noting that both Tracfone and T-Mobile announced new aggressively-priced unlimited data plans within the last week).

begin to migrate to 4G networks, advances in devices and applications will drive data use to grow exponentially. As CTIA has described,[31] the wireless industry is characterized by a "virtuous cycle" where, as spectrum is made available, carriers develop and deploy advanced networks, which then lead to innovations in devices and applications. These innovations, in turn, lead to an increase in consumption and demand for services, which then creates a need for more spectrum. The imminent deployment of 4G networks is certain to push this cycle through another rotation, leading to remarkable innovation and consequently a significant increase in demand.

Several entities have tried to forecast the future demands that will be placed upon wireless networks, and the results have been staggering. There appears to be a consensus that wireless data traffic volume is more than doubling each year.[32] AT&T projects that by 2018 its own data traffic will grow to 250-600 times its 2007 level.[33] In the *Mobile Data Traffic Forecast*, Cisco made several striking projections, including that by 2013 mobile traffic data will reach over 2 exabytes per month, nearly 64 percent of the world's mobile traffic will be video, and that mobile broadband handsets with higher than 3G speeds and mobile broadband capable laptops will drive over 80 percent of global mobile traffic.[34] Cisco also explains that due to the increasing number of consumer electronic devices that will utilize mobile broadband networks, the mobile data traffic footprint of a single subscriber in 2015 may be 450 times what it was 10 years earlier in 2005.[35]

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31 *See, e.g.*, Comments of CTIA, GN Dockets No. 09-51 and 09-157 at Fig. 1 (filed Sept. 30, 2009).

32 *See Mobile Data Traffic Forecast* at 1; *Mobile Broadband Spectrum Demand* at 12, 13.

33 *Mobile Broadband Spectrum Demand* at 12.

34 *See Mobile Data Traffic Forecast* at 1.

35 *See Mobile Data Traffic Forecast* at 5.

The following graphic shows the staggering projected growth in mobile data traffic for a single subscriber in 2015:

Source: *2009 3G Americas Spectrum Demand Paper* at 6.[36]

As made clear by numerous commenters in response to the Commission's Broadband Innovation NOI,[37] existing spectrum allocations will be insufficient to meet the expected demands of next generation networks.[38] Next generation technologies like WiMAX, LTE, and

[36] *3GPPTechnology Approaches For Maximizing Fragmented Spectrum Allocations*, 3G Americas at 18 (July 2009) ("*2009 3G Americas Spectrum Paper*").

[37] *Fostering Innovation and Investment in the Wireless Communications Market, A National Broadband Plan For Our Future*, Notice of Inquiry, GN Dockets 09-157 and 09-51, FCC 09-66 (rel. Aug. 27, 2009) ("*Innovation NOI*").

[38] *See, e.g.*, Comments of AT&T, GN Dockets No. 09-51 and 09-157 at 68-70 (filed Sept. 30, 2009); Comments of Comcast Corporation, GN Dockets No. 09-51 and 09-157 at 5 (filed Sept. 30, 2009); Comments of CTIA, GN Dockets No. 09-51 and 09-157 at 69-71 (filed Sept. 30, 2009); Comments of Ericsson Inc., GN Dockets No. 09-51 and 09-157 at 14 (filed Sept. 30, 2009); Comments of MetroPCS Communications, GN Dockets No. 09-51 and 09-157 at 18-19 (filed Sept. 30, 2009); Comments of Sprint Nextel Corp., GN Dockets No. 09-51 and 09-157

LTE-Advanced are most efficient when deployed using wide radio channels, delivering higher peak-data rates and more intensive spectrum use.[39] Currently, WiMAX operates in 10 MHz radio channels, while LTE operates in up to 20 MHz and LTE-Advanced in up to 40 MHz channels.[40] Mobile wireless providers do not have sufficiently large blocks of contiguous spectrum available across their service areas to take advantage of the efficiencies of these new technologies.[41] Thus, to support the high-bandwidth applications and usage demands that are forecast with LTE and WiMAX, service providers will need access to significant amounts of new spectrum in large contiguous blocks.

C. Wireless Providers Are Nearing the Technological Limits of Capacity In Existing Spectrum Allocations.

The *Public Notice* seeks comment on "the tradeoff between more spectrum and greater investment in network infrastructure as a means of adding network capacity."[42] While the FCC is technically correct that, to some degree, the capacity of a particular license can be increased by investing in more efficient modulation schemes or investing in infrastructure to enhance spectrum re-use, there are technical and economic limits to increasing capacity in existing bands. These limits are being tested on carriers' existing mobile allocations and the remaining efficiencies that might be wrung from existing spectrum bands will in no way meet the compounding demand for data services. As discussed below, in the highly competitive wireless marketplace, providers – exclusive licensees with extremely large investments in their networks

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at 4 (filed Sept. 30, 2009); Comments of T-Mobile USA, Inc., GN Dockets No. 09-51 and 09-157 at 21 (filed Sept. 30, 2009); Comments of TIA, GN Dockets No. 09-51 and 09-157 at 10 (filed Sept. 30, 2009).

[39] *Mobile Broadband Spectrum Demand* at 20.

[40] *Mobile Broadband Spectrum Demand* at 20.

[41] For example, wireless licensees would need to have both cellular licenses in a market area to have access to paired 20 MHz channels.

[42] *Public Notice* at 5.

– recognize the economic necessity of extracting maximum value from their spectrum. Indeed, as Thomas Hazlett and Matthew Spitzer have explained, "[t]he pressure to increase spectral efficiency is relentless."[43] Providers are constantly experimenting with and deploying technologies in an attempt to meet usage requirements and gain a competitive edge.[44] But, this does not replace the need for additional spectrum.

For example, one modification that network operators have made to address capacity challenges is antenna sectorization. Unlike traditional omni-directional antennas, sectorized antennas allow operators to transmit signals in specific directions within a cell, allowing reuse of the same frequencies within a single cell to serve customers located in different areas. Another very common technique is cell splitting, a process through which a congested cell is divided into smaller cells using lower height antennas at lower powers. Again, this allows network operators to reuse frequencies more often over a given area. The latest development in cell splitting is the advent of the femtocell, which is essentially an extremely low power, short-range base station that users connect to an existing broadband connection, typically to expand coverage within a home or office.[45] Despite these innovations, however, the ever increasing demand for voice and data services indicate that a technological limit to spectrum reuse is fast approaching.

As noted in the *Public Notice*, questions about the balance between investing in network infrastructure and the need for more spectrum were front and center during the August 13, 2009 workshop on wireless broadband technology.[46] While the industry experts agreed that there

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[43] Comments of Thomas Hazlett and Matthew Spitzer, ET Docket No. 03-237 at 35 (filed April 5, 2004).

[44] *See* Comments of Verizon Wireless, GN Dockets No. 09-51 and 09-157 at 93-96 (filed Sept. 30, 2009) (describing some of the technologies used by the wireless industry to promote efficient use of spectrum).

[45] *See also* Comments of CTIA – The Wireless Association®, WT Docket No. 09-157, at 28 (filed Sept. 30, 2009) ("*CTIA Innovation and Investment Comments*").

[46] *See Public Notice* at 3-4.

have been and will continue to be promising advances in spectral efficiency technologies, they were equally uniform in their conviction that there was no way around the need for more spectrum.[47] Despite the best efforts of the wireless industry, it does not seem feasible that any technological fixes will be able to keep up with the growing consumer demand.[48] As Qualcomm indicated at the workshop, we may be reaching a limit on what is possible in terms of technology.[49] The only answer to the demand for more capacity is more licensed spectrum.

In addition to the Shannon bound that limits, from a physics standpoint, the ability to wring further efficiency from existing bands, there are also economic and practical problems.[50] Most notably, the measures undertaken by network operators to enhance efficiency—sectorization and denser radio cells—all require modifying existing radio sites or adding new sites. Deploying a three sector cell in lieu of an omni-directional cell, for example, requires installing triple the number of transmitters and receivers on a tower. Not only may the tower not support this type of weight loading, changes of this nature may require renegotiating leases with the tower owner and may, in certain cases, require revisiting tower authorizations. More importantly, in the case of adding new towers, a host of new approvals is required. The idea, for example, of doubling the number of cells in a major urban center verges on the impossible.

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47 *See generally*, Remarks at the Wireless Broadband Workshop (Aug. 13, 2009) (transcript available at http://www.broadband.gov/docs/ws_06_tech_wireless_transcript.pdf).

48 *See* Tom Anderson, Head of Architecture for Mobility, Office of CTO, Alcatel-Lucent, Remarks at the Wireless Broadband Workshop at 26 (Aug. 13, 2009) (transcript available at http://www.broadband.gov/docs/ws_06_tech_wireless_transcript.pdf) (indicating that even while the industry works on increasing the efficient use of spectrum, it will not be able to keep up with the incredible growth rates already being observed); *see also Rinne Remarks* at 5-6, 40 (identifying a growth in data usage – 5,000 percent over the last three years – that is too great for a technological solution alone).

49 *Corson Remarks* at 17.

50 The Shannon bound of a communications channel is the theoretical maximum information transfer rate of the channel, for a particular noise level. In effect, this predicts the data rate limit associated with a particular channel in a communications system. *See e.g.*, http://en.wikipedia.org/wiki/Noisy-channel_coding_theorem (last visited Oct. 23, 2009).

Thus, even if a carrier may have the technical ability to increase capacity through enhanced reuse, and the engineering resources to coordinate such a change, tower and cell siting issues may prove to be an intractable barrier.

II. SIGNIFICANT ADDITIONAL AMOUNTS OF SPECTRUM BELOW 3 GHz MUST BE ALLOCATED TO SUPPORT MOBILE WIRELESS BROADBAND.

In the second major question associated with the *Public Notice*, the Commission asks "what spectrum bands are best positioned to support mobile wireless broadband?"[51] As discussed above, demand for wireless broadband services is exploding and current allocations for commercial mobile services will not be sufficient to meet expected demand. Accordingly, CTIA has urged the Commission to identify and allocate at least 800 MHz of additional spectrum below 3 GHz for commercial wireless services over the next six years. As CTIA suggested in its *ex parte*, as a first step the Commission and NTIA should initiate a large scale, targeted review of both Federal and non-government allocations to identify unused and underutilized spectrum. In conducting this review, the Commission should give attention to identifying spectrum bands for potential reallocation that could be harmonized with international spectrum allocations. Harmonization would lower equipment costs, stimulate global innovation, and lower barriers to market entry.

Spectrum Identification. In 2006, the International Telecommunications Union ("ITU") published estimates of future broadband needs in the theoretical case of a single network per country in the years 2010, 2015, and 2020.[52] ITU's research indicated that in a country that had developed mobile capabilities early ("higher market setting"), a total of 840 MHz of spectrum

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[51] *Public Notice* at 5.

[52] *Estimated Spectrum Bandwidth Requirements for the Future Development of IMT-2000 and IMT-Advanced*, International Telecommunications Union, Report ITU-R M.2079 (2006) ("*ITU Spectrum Requirements*").

would be required by 2010, 1300 MHz by 2015, and 1720 MHz by 2020.[53] When the Next Generation Mobile Networks Alliance reviewed the ITU projections, it estimated an additional 500 MHz to 1 GHz of spectrum beyond current allocations would be required, depending on region.[54] Based upon these findings, CTIA has previously urged U.S. policymakers to identify and allocate at least 800 MHz of additional spectrum for licensed commercial wireless use.[55]

CTIA is committed to working with the FCC to identify 800 MHz of additional spectrum for allocation to commercial wireless services. Previous experiences with reallocation of spectrum and relocation of incumbent users, however, have proven to be complex and time consuming. If U.S. consumers are to timely reap the benefits of a truly mobile broadband marketplace the process of identifying this spectrum must begin immediately. CTIA supports plans to review existing spectrum use as a means of identifying new allocations, such as the inventory contained in the Radio Spectrum Inventory Act introduced by Senators Kerry and Snowe and Congressmen Waxman and Boucher.[56] Even in the absence of legislation, NTIA and the Commission can and should begin an inventory and assessment of spectrum usage, with a goal of identifying significant additional amounts of spectrum for licensed commercial wireless use. Because it is likely that underutilized spectrum currently assigned to Federal government users will be a critical source of spectrum to be repurposed, it is essential that the Commission work closely with NTIA to ensure transparency in analyzing spectrum allocated to the Federal government.

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53 *ITU Spectrum Requirements* at 25.

54 *NGMN Spectrum Requirements* at 22.

55 *See Wireless Crisis Foretold: The Gathering Spectrum Storm . . . and Looming Spectrum Drought* at 19-20 *att. to* CTIA Sept. 29 *Ex Parte*.

56 *See* Radio Spectrum Inventory Act, S.649, 111th Cong. 1st Sess (2009).

Spectrum Characteristics. When investigating spectrum for possible reallocation, the Commission should consider the differences in propagation characteristics and thus what types of services are better suited for various bands of spectrum, as well as efforts at international harmonization of spectrum. Although mobile wireless broadband services could potentially be provided in most spectrum bands between 400 MHz and 5 GHz, lower-band spectrum is generally considered more desirable for providing wide coverage because of its superior propagation characteristics and the need for fewer base stations.[57] This spectrum allows for more throughput over larger areas, it penetrates buildings more effectively, and it suffers less attenuation from trees, foliage, and variations in land.[58] Thus, CTIA recommends that the Commission focus on spectrum bands below 3 GHz for future commercial mobile wireless allocations.

Even among the bands below 3 GHz, there are significant differences that have an impact upon a band's best utilization from a technological and economic perspective. For example, the 700/800 MHz bands are ideally suited for build-out in sparsely populated, rural areas that are currently underserved, and other situations in which long range coverage is required, as fewer

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[57] *See Spectrum Requirements for the Next Generation of Mobile Networks*, Next Generation Mobile Networks Alliance at 4, 12, 14 (2007) *available at* http://www.ngmn.org/fileadmin/user_upload/Downloads/Technical/Spectrum_Requirements_for_the_Next_Generation_of_Mobile_Networks.pdf ("*NGMN Spectrum Requirements*"); *see also Technical and Operational Information for Identifying Spectrum for the Terrestrial Component of Future Development of IMT-2000 and IMT-Advanced*, Report ITU-R M.2079 at 6 (2006) ("ITU Technical Report") (Indicating that bands less than 5 GHz are best suited for mobile communications: "In particular, bands below 5 GHz allow sufficient mobility and there is an acceptable trade-off between cost and full area coverage."); *Federal Operations in the 1755-1850 MHz Band: The Potential for Accommodating Third Generation Mobile Systems*, Interim Report, U.S. Department of Commerce at 7 (rel. Nov. 15, 2000) ("*NTIA Interim Report*"), *available at* http://www.ntia.doc.gov/osmhome/reports/imt2000/imt2000.pdf (explaining that the physical processes governing the propagation of radio waves in the frequency range below 3 GHz let them be efficiently transmitted and received by small user devices and give them the ability to support high data rates, making them ideal for mobile telecommunications uses).

[58] *See, e.g., NTIA Interim Report* at 7.

antennas can transmit at power levels sufficient to serve a large geographic area.[59] Sufficient amounts of low-band spectrum may not be available to meet the capacity needs of densely populated urban areas, however, and some of their same characteristics make these frequencies less effective in such areas. For example, siting the large antennas needed for low-band transmitters may prove difficult and the high power of low-band transmissions may result in more self-interference. Spectrum in the 1800 MHz or similar higher ranges may be a better solution for urban areas, as signals can be transmitted efficiently with a number of smaller antennas at lower power, which also allows for more frequency reuse, boosting capacity for high population densities.[60]

Spectrum Harmonization. The Commission should make efforts to harmonize future commercial wireless spectrum allocations with those done internationally. International harmonization has both economic and social benefits.[61] From an economic perspective, harmonization drives down the costs of devices both by making them less complex to manufacture, and by creating economies of scale for manufacturers who no longer have to design different devices for every country or region.[62] From a social perspective, reduced costs lead to greater enjoyment of the benefits of broadband services internationally, and harmonized

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[59] *See* Neville Ray, Senior Vice President, Engineering, T-Mobile USA, Remarks at the Wireless Deployment Workshop at 84 (Aug. 12, 2009) (transcript available at http://www.broadband.gov/docs/ws_03_deploy_wireless_transcript.pdf) ("*Ray Remarks*") (indicating that one thing preventing T-Mobile from expanding into rural coverage is their lack of low-band licenses); *see also NGMN Spectrum Requirements* at 12.

[60] *See Ray Remarks* at 94 (identifying spectrum as high as 3.5 GHz as perhaps having "great application" in densely populated urban areas).

[61] *See 3GPP Technology Approaches for Maximizing Fragmented Spectrum Applications*, 3G Americas at 15-16 (July 2009) *available at* http://www.3GAmericas.org/documents/3GA%20Underutilized%20Spectrum_Final_7_23_092.pdf.

[62] *See* Ed Evans, Chairman and CEO, Stelera Wireless, and Neville Ray, Senior Vice President, Engineering, T-Mobile USA, Remarks at the Wireless Deployment Workshop at 96-98 (Aug. 12, 2009) (transcript available at http://www.broadband.gov/docs/ws_03_deploy_wireless_transcript.pdf) (discussing how spectrum and technology harmonization lowers barriers to entry and other costs both for new commercial entrants and for developing countries).

spectrum facilitates international roaming and allows countries sharing a border to better manage interference.

ITU has identified a number of bands for global harmonization through the IMT-2000 and IMT-Advanced efforts, and the FCC would do well to continue to strive to parallel these suggestions. At the 1992 World Administrative Radio Conference ("WARC-92"), 230 MHz of spectrum at 1885-2025 MHz and 2110-2200 MHz was identified for use by countries in implementing 3G systems. Subsequently, at the 2000 World Radio Conference ("WRC-2000"), ITU further identified the 698-960 MHz band, the 1710-1885 MHz band, and the 2500-2690 MHz band for use. Although spectrum in some of these bands has already been identified by the Commission for commercial wireless services in the cellular, PCS, AWS, BRS/EBS, MSS, and 700 MHz bands, additional frequencies within the bands identified by ITU have yet to be reallocated.[63] For example, as discussed further below, CTIA encourages the Commission to consider reallocating for licensed commercial wireless use the 1755-1780 MHz band, which has been identified by the ITU for commercial wireless use, combined with spectrum in the 2155-2180 MHz.[64]

III. THE COMMISSION SHOULD RELY ON THE MARKET AND ITS EXCLUSIVE AND FLEXIBLE USE POLICIES TO ENSURE SPECTRUM IS USED FOR ITS HIGHEST AND BEST USE.

As noted by Chairman Genachowski, "the last thing we want is heavy-handed and prescriptive regulation."[65] CTIA agrees with the Chairman that the market and consumers, not

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63 *See* CTIA September 29 *Ex Parte* at 20.

64 *See* Section II., *infra*.

65 *Chairman Genachowski CTIA Remarks* at 7.

regulators, are best positioned to determine the highest and best use for spectrum.[66] Indeed, the Commission's exclusive-use, flexible licensing regime has ensured that commercial mobile wireless spectrum is used effectively and efficiently. CTIA believes that the Commission should continue to license spectrum for commercial wireless use on an exclusive basis and should continue to provide licensees with maximum flexibility to meet the dynamic needs of the ever-changing wireless marketplace. In addition, as described below, the Commission should take steps to ensure that all existing spectrum allocations are being used for their highest and best use.[67]

A. The Commission's Exclusive-Use, Flexible Licensing Regime Has Ensured Commercial Mobile Wireless Spectrum Is Used Effectively and Efficiently.

The Commission has long embraced exclusive-use licensing and flexible service rules with great success.[68] Indeed, in licensing the cellular service, the Commission first adopted exclusive-use licensing.[69] Then, in the 1990s, the agency expanded this approach and provided

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66 The *Public Notice* asks "what are the key issues in moving spectrum allocations toward their highest and best use in the public interest?" *Public Notice* at 6.

67 *See* Section III. B., *infra*.

68 *See, e.g., Promoting Efficient Use of Spectrum Through Elimination of Secondary Markets*, Report and Order and Further Notice of Proposed Rulemaking, 18 FCC Rcd 20604, 20632 at ¶ 57 (2003) ("For its part, the Commission has promoted innovative policies and licensing models that seek to increase communications capacity and efficiency of spectrum use, and make spectrum available to new uses and users. Of particular importance to this proceeding is the Commission's embrace of policies that provide exclusive use licensees in the Wireless Radio Services with increased flexibility to make use of their licensed spectrum in ways that respond quickly and effectively to evolving needs (*e.g.*, consumer demands), technologies (*e.g.*, access-enhancing or efficiency-improving innovations), and market development). Typified by the Part 24 rules for broadband Personal Communications Services, the Part 27 rules for Wireless Communications Services, and the Part 202 rules for the 39 GHz Service, these licensing models have provided licensees increasing flexibility with regard to the applicable technical and service rules. In adopting these more flexible rules, the Commission has determined that it is in the public interest to afford Wireless Radio Services licensees significant flexibility in the design of their systems to respond readily to consumer demand for their services, thus allowing the marketplace to dictate the best uses of the licensed spectrum.").

69 *An Inquiry Relative to the Future Use of the Frequency Band 806-960 MHz*, Second Report and Order, 46 FCC 2d 752, ¶ 13 (1974) (allocating 40 MHz for a single cellular system); *An Inquiry Into the Use of the Bands 825-845 MHz and 870-890 MHz for Cellular Communications Systems*, Report and Order, 86 FCC 2d 469, ¶ 15 (1981) (modifying the cellular licensing scheme and concluding that "the licensing two 20 MHz systems [in the cellular band] would best serve the public interest, convenience and necessity").

licensees with significantly more flexibility. For example, the Commission gave PCS and cellular licensees flexibility to provide virtually any service, mobile or fixed, and noted that this flexibility "will provide the most effective approach for meeting [the agency's] four objectives of universality, speed of deployment, diversity of services and competitive delivery.[70] In addition, the agency licensed PCS on a purely geographic basis, allowing licensees to construct and modify facilities (subject to any necessary tower clearances) without unnecessary Commission oversight, and adopted a default maximum signal strength at the boundary that permitted licensees to negotiate commercially reasonable arrangements to avoid harmful interference.[71] The FCC also allowed licensees to employ the technology and air interface standard of their choice.[72]

This flexible, exclusive-use licensing regime encouraged investment and innovation in wireless networks and promoted competition.[73] Specifically, this regime provided licensees with the certainty they needed to invest in their networks without the threat that their services would be subjected to harmful interference. It also allowed competing service providers to choose different approaches and change technologies when needed. With no need for regulatory

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[70] *New Personal Communications Services*, Second Report and Order, 8 FCC Rcd 7700, 7712 at ¶ 23 (1993) (authorizing the PCS band primarily for mobile and portable communications and ancillary fixed communications).

[71] *Id.* at 7732 at ¶ 73 (concluding that "a combination of MTA and BTA service areas would promote the rapid deployment and ubiquitous coverage of PCS and a variety of services and providers"); *New Personal Communications Services*, Memorandum Opinion and Order, 9 FCC Rcd 4957, ¶ 172 (1994).

[72] *New Personal Communications Services*, Second Report and Order, 8 FCC Rcd 7700 (1993); Memorandum Opinion and Order, 9 FCC Rcd 4957 (1994); Third Memorandum Opinion and Order, 9 FCC Rcd 6908 (1994).

[73] *See, e.g.*, Thomas W. Hazlett, *A Law and Economics Approach to Spectrum Property Rights: A Response to Weiser and Hatfield*, 15 Geo. Mason L. Rev. 975, 1005 (2008) ("With broad, exclusive spectrum rights, de facto owners invest aggressively in wireless infrastructure complementary to their airwaves and then promote intense utilization of the opportunities thereby afforded").

intervention, licensees also have been able to evolve their systems from analog 1G networks to 2G digital voice networks, to high-speed 2.5G, then to 3G, and currently 4G networks.[74]

Under a flexible, exclusive-use licensing regime, licensees receive a bundle of well-established rights and specific boundaries within which those rights may be exercised. Licenses (and the related FCC rules) define for the licensee any limits on how the spectrum can be used. The spatial and frequency boundaries are set as well. As a result, an exclusive licensee knows where spectrum may be used and protected from harmful interference by others. Exclusive, flexible-use licensing therefore encourages licensees to invest in their networks and efficiently utilize their spectrum.[75] For example, licensees can upgrade their networks without worry that their investment will be futile due to harmful interference. The flip-side of this principle is that companies will not invest billions of dollars in infrastructure for wireless service if they have little certainty that they can operate it at a planned level of quality and modify it to meet the demands of a dynamic, evolving marketplace.

The Commission also sought comment on whether "unlicensed devices have adequate access to spectrum that can be used to provide wireless broadband services or as a complement to services provided over licensed spectrum."[76] While some of the benefits and limitations of unlicensed use are described below, CTIA believes that at the core of the spectrum identification,

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[74] *See e.g.*, Verizon Wireless Comments, GN Dkt. Nos. 09-157, 09-51, at 93-100 (filed Sept. 30, 2009).

[75] *See, e.g.*, Thomas W. Hazlett & Matthew L. Spitzer, *Advanced Wireless Technologies and Public Policy*, 79 S. Cal. L. Rev. 595, 646-647 (2006) ("In [exclusively-assigned, flexible-use spectrum] bands, licensees invest enormous sums to deploy advanced technologies. They do so due to two advantages offered by the property rights regime. First, the governance rules imposed on unlicensed users, including power limits and technology standards, are absent. With exclusive rights, decisions about governance are delegated to rights holders, providing the network operator wider latitude to optimize spectrum use than networks accessing unlicensed bandwidth enjoy. Second, unlicensed bandwidth potentially allows large numbers of users to access spectrum now and in the future without the permission of network investors. This constitutes a threat of appropriation for such investors, lowering expected returns for irreversible network infrastructure investments. Exclusive ownership of spectrum rights, alternatively, provides security for investors sinking capital complementary to the use of frequencies.").

[76] *Public Notice* at 5.

reallocation, and assignment process must be a laser-like focus by the Federal government on making licensed spectrum available.

Some of CTIA's members are among the largest operators of unlicensed "hot spots" and CTIA believes that unlicensed devices will continue to have a complementary role to the mobile broadband network.[77] As indicated in *CTIA's Innovation and Investment Comments*, unlicensed shared use is well suited for short-distance communications among limited numbers of devices, *i.e.*, cordless phones, Wi-Fi LAN, and Bluetooth.[78] Indeed, unlicensed "hot spots" can serve as an important means to offload traffic from broadband networks in certain localized areas. It is notable that, including the recent substantial allocations in the TV bands and the 5 GHz band, there is approximately 674-956 MHz of spectrum available for unlicensed devices.[79]

At the same time, CTIA continues to believe that, for large-scale mobile networks requiring extensive infrastructure investment, exclusive-use licensing is the only viable approach. The exclusive licensee has the best economic incentives to invest in the network and to innovate in the technical use of the spectrum and the services provided over it. Without an exclusive license, it is largely impossible to know the level of use by other devices in the spectrum band, and consequently a wireless network operator can accurately predict neither the capacity of the network nor the revenues it will earn.[80] As MetroPCS indicated in its comments submitted in response to the *Innovation NOI*, wireless providers "naturally are reluctant to incur the substantial investments in network infrastructure, customer acquisition costs, and

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[77] *See, e.g.*, Comments of T-Mobile USA, Inc., GN Dockets No. 09-51 and 09-157 at 14 (filed Sept. 30, 2009) (discussing T-Mobile's use of Unlicensed Mobile Access (UMA) to supplement its licensed wireless network).

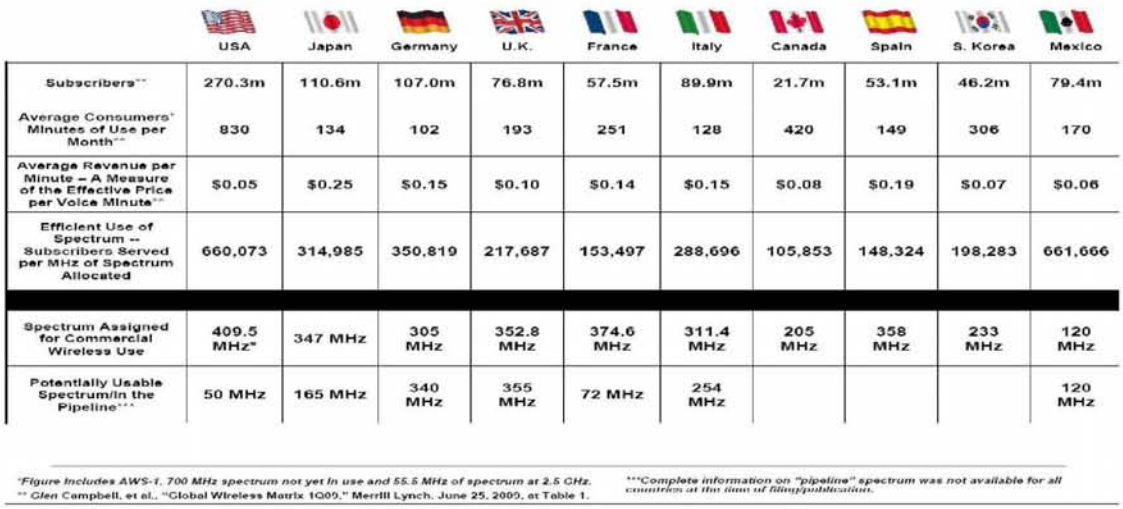
[78] *See* Comments of CTIA, GN Dockets No. 09-51 and 09-157 at 68 (filed Sept. 30, 2009).

[79] *See* Comments of Verizon Wireless, GN Dockets No. 09-51 and 09-157 at 145 (filed Sept. 30, 2009). This number is best expressed as a range because of restrictions placed on unlicensed TV band devices with respect to their access to certain frequencies for certain uses and in certain areas. *See* 47 C.F.R. § 15.707.

[80] *See id.*

constructing the necessary customer service infrastructure in circumstances where they do not have assured exclusive use of an identifiable spectrum resource."[81]

Due to the Commission's exclusive and flexible use policies, commercial mobile wireless spectrum is used extremely efficiently. Today, more calls and more bytes of data are transmitted in a given amount of time and spectrum than ever before. This is because commercial wireless licensees make highly efficient use of their spectrum. Indeed, United States mobile wireless providers lead the world in efficient use of spectrum.



	USA	Japan	Germany	U.K.	France	Italy	Canada	Spain	S. Korea	Mexico
Subscribers**	270.3m	110.6m	107.0m	76.8m	57.5m	89.9m	21.7m	53.1m	46.2m	79.4m
Average Consumers' Minutes of Use per Month**	830	134	102	193	251	128	420	149	306	170
Average Revenue per Minute – A Measure of the Effective Price per Voice Minute**	$0.05	$0.25	$0.15	$0.10	$0.14	$0.15	$0.08	$0.19	$0.07	$0.06
Efficient Use of Spectrum -- Subscribers Served per MHz of Spectrum Allocated	660,073	314,985	350,819	217,687	153,497	288,696	105,853	148,324	198,283	661,666
Spectrum Assigned for Commercial Wireless Use	409.5 MHz*	347 MHz	305 MHz	352.8 MHz	374.6 MHz	311.4 MHz	205 MHz	358 MHz	233 MHz	120 MHz
Potentially Usable Spectrum/In the Pipeline***	50 MHz	165 MHz	340 MHz	355 MHz	72 MHz	254 MHz				120 MHz

*Figure includes AWS-1, 700 MHz spectrum not yet in use and 55.5 MHz of spectrum at 2.5 GHz.
** Glen Campbell, et al., "Global Wireless Matrix 1Q09," Merrill Lynch, June 25, 2009, at Table 1.
***Complete information on "pipeline" spectrum was not available for all countries at the time of filing/publication.

Source: *Global Wireless Matrix*, CTIA Estimates.

U.S. carriers pack more subscribers using more minutes of calling and more megabytes of data into each megahertz of spectrum than any other nation's providers. Carriers have achieved this efficiency by making significant investments in highly advanced technologies, along with

[81] Comments of MetroPCS Communications, Inc., GN Dockets No. 09-51 and 09-157 at 43 (filed Sept. 30, 2009).

designing and redesigning networks to get the most out of their spectrum holdings.[82] As such, the Commission should ensure that any new spectrum allocations follow this successful model – allowing new spectrum licensees to have exclusive use of their spectrum and permit flexibility in how services are deployed.

The market, not regulators, are best positioned to determine the highest and best use of spectrum.[83] The best way of doing this is to provide licensees with maximum flexibility to provide an ever-changing array of services that meet the dynamic needs of consumers. Indeed, as the Commission's Spectrum Policy Task Force noted more than five years ago, "[f]lexibility enables spectrum users to make fundamental choices about how they will use spectrum (including whether to use it or transfer their usage rights to others), taking into account market factors such as consumer demand, availability of technology, and competition. By leaving these choices to spectrum users, this approach tends to lead to efficient and highly-valued spectrum uses."[84]

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[82] This intensive and efficient spectrum use typically entails transmitting signals at lower and lower power levels, because innovative technology allows the reception and use of extremely weak signals that at one time would have been considered unusable. This fact has several important consequences. First, the "noise floor" – actually, the "noise-plus-interference floor" – within the commercial mobile bands has decreased over time. As spectrally or geographically neighboring systems utilize lower signal levels, their potentially interfering signals reaching another system are even more attenuated, allowing the perceived ambient level of thermal noise and interference to become closer to the thermal noise floor resulting from the laws of physics. This in turn allows the use of ever more sensitive receivers and even lower transmitter power. In other words, exclusive-use licensing – which allows the licensee to focus on managing intrasystem interference – leads not only to more efficiency, but also to a lower noise floor. The second consequence of the use of very weak signals is that these signals are increasingly subject to interference as mobile devices come close to each other. This makes interference protection even more important and makes the preservation of exclusive-use licensees' bundle of usage rights all the more critical.

[83] See, e.g., Reed Hundt, Chairman, Federal Communications Commission, *The Hard Road Ahead – An Agenda for the FCC in 1997* (Dec. 26, 1996) ("Spectrum should be put to its most valued use. The Commission should trust markets to assure this result, although we should act as the 'register of deeds' for spectrum licenses – maintaining information as to which firms hold what licenses. Auctions allow markets to determine who will use the spectrum. We should also rely on markets to determine how the spectrum will be used. The Commission should move away from the old top-down, central planning approach of the past towards a decentralized approach that allows the spectrum licensee, rather than the government, to determine how spectrum will be used.").

[84] FCC Spectrum Policy Task Force, ET Docket No. 02-135, Report at 16 (2002).

B. The Commission Should Take Additional Steps To Ensure All Spectrum Is Being Used for its Highest and Best Use.

While commercial mobile wireless spectrum is being used extremely efficiently, there are a number of actions the Commission could consider to ensure all spectrum is being used efficiently and for its highest and best use. First, as described above, U.S. policymakers must identify and allocate a significant amount of additional spectrum – at least 800 MHz – for licensed commercial use. As discussed below, that effort will likely require reallocation of Federal government spectrum and reallocation of non-Federal government spectrum. The Commission also must work to clear spectrum that already has been allocated and auctioned for CMRS use. Moreover, the Commission can continue to promote the use of secondary markets to ensure that spectrum is put to its highest and best use. Finally, the Commission can rely on its well-established procedures, with minor changes, for clearing and repurposing government and non-government spectrum.

Reallocation of Federal Government Spectrum. As described above, CTIA supports plans to review existing spectrum use as a means of identifying new allocations, such as the inventory requirements contained in the Radio Spectrum Inventory Act introduced by Senators Kerry and Snowe and Congressmen Waxman and Boucher. It is likely that underutilized spectrum currently assigned to the Federal government (as well as some commercial users) will be a critical source of spectrum to be repurposed. To this end, it is essential that the Commission work closely with NTIA to ensure transparency in analyzing spectrum usage.

To address near-term spectrum needs of the wireless industry, CTIA reiterates its support for the NTIA and Commission to immediately reallocate the 1755-1780 MHz band for commercial wireless use. Initially, the 1710-1885 MHz band has been identified by ITU for

commercial wireless uses, allowing for better international spectrum harmonization.[85] Moreover, the wireless industry has a great deal of recent experience in working with federal incumbents in the adjacent 1710-1755 MHz band over the past three years.[86] These recent experiences in relocation and the lessons learned through them by the Commission, CMRS providers, and federal incumbents would serve to greatly ease the transition of this spectrum from federal to commercial use.

Finally, the 1755-1780 MHz band is an ideal target for repurposing because of the readiness with which it could be paired with existing spectrum in the 2155-2180 MHz band that has already been reallocated for commercial wireless use.[87] The 2155-2180 MHz band is currently unpaired, a situation that both CTIA and 3G Americas have pointed out conflicts with the goals of global spectrum harmonization.[88] Pairing of these two bands would enable a rapid injection of an additional 50 MHz of spectrum that would be ideally suited for mobile broadband and other next generation wireless applications. Furthermore, such a pairing would conform to international allocations, reducing the time to market and costs of compatible devices and services, as providers and manufacturers could draw upon the work that has been done elsewhere with this spectrum.

In addition to the 1755-1780 MHz band that should be rapidly reallocated for commercial use, the Commission and NTIA should work together to identify other government spectrum that is being underutilized. It has long been recognized that the Federal government is not always the most efficient user of spectrum. Indeed, the Commercial Spectrum Enhancement Act ("CSEA")

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85 *Id.*

86 *See* NTIA Interim Report at 15. *See also*, CTIA September 29 *Ex Parte* at 21.

87 *See* CTIA September 29 *Ex Parte* at 21.

88 *See Ex Parte* Presentation of 3G Americas LLC, WT Docket No. 07-195 (filed Oct. 23, 2008).

requires the government to identify underused spectrum and transition it to commercial use.[89] Further, it is established Federal policy that government users should rely on commercial radio services where possible, and the public is well served by opening underutilized government spectrum to non-government use.[90]

Accordingly, U.S. policymakers should carefully consider (i) whether any Federal government spectrum is either being underutilized and (ii) whether current operations on Federal government spectrum could be accommodated on commercial networks. With the significant evolution of commercial wireless services, many services historically available only to the government (*e.g.*, smart grid and machine-to-machine communications) are now commercially available. Indeed, many Federal, state, and local government users already utilize commercial wireless products and services. Spectrum under 3 GHz that could be freed up by the Federal government would be ideal for wireless broadband services and could go a long way to solving the critical need for additional licensed commercial wireless spectrum.

If NTIA and the Commission ultimately identify Federal government spectrum that could be repurposed for commercial use, the agencies should work together to ensure adequate dissemination of information so that applicants for reallocated spectrum will have a clear understanding of the technical requirements of incumbents and their relocation needs. As CTIA recently commented to NTIA:

> The more commercial carriers know about Federal systems and licensee priorities, the better they will be at working within the relocation structure to achieve the best results for their customers and the public generally. The more Federal users understand about

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[89] Pub. L. 108-494, Title II, 118 Stat. 3986, codified at 47 U.S.C. §§ 309(j)(3), 921, 923, 928 & note. *See also Implementation of the Commercial Spectrum Enhancement Act and Modernization of the Commission's Competitive Bidding Rules and Procedures*, Report and Order, 21 FCC Rcd 892 (2006).

[90] NTIA, Spectrum Management for the 21st Century: The President's Spectrum Policy Initiative – Federal Strategic Spectrum Plan, at 9-11 (Mar. 2008), *available at* http://www.ntia.doc.gov/reports/2008/FederalStrategicSpectrumPlan2008.pdf.

> commercial licensees' plans and priorities, the more they will be able to coordinate and pre-plan to avoid unnecessary spectrum usage conflicts.[91]

The facilitation of information sharing prior to an auction of reallocated Federal spectrum will ensure that new licensees are fully aware of and able to protect the needs of incumbent Federal government users.

Reallocation of Non-Federal Spectrum. It is also likely that a spectrum inventory may identify underutilized non-government spectrum that could be put to a higher and better use. Indeed, as Blair Levin, Executive Director of the Commission's Omnibus Broadband Initiative, has stated, all spectrum options should be on the table to meet U.S. consumers' growing demand for mobile wireless broadband services.[92] To this end, and while not an exhaustive list, CTIA describes below two areas that are ripe for Commission attention, spectrum allocated to the U.S. broadcast industry and fixed wireless spectrum below 3 GHz.

First, CTIA urges the Commission to take a hard look at the spectrum use of the U.S broadcast industry and urges the Commission to consider reallocating this valuable spectrum to services better able to serve the needs of U.S. consumers. The highly inefficient broadcasters currently occupy a large band of spectrum in the UHF frequency band (470 MHz – 698 MHz). This spectrum, immediately adjacent to the 700 MHz spectrum, was recently described by the Commission as "beach front property" for mobile broadband services and is uniquely suited to the provision of mobile services. Broadcast television, by contrast, is almost completely provided to U.S. consumers through wired technologies. If the public interest in providing over-the-air television to the fraction of U.S. households without cable or satellite television has not

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[91] Comments of CTIA at 3, NTIA Docket 0906231085-91085-01 (filed Aug. 21, 2009).

[92] *See* "In broadband plan, FCC's Levin acknowledges need for more spectrum,"FierceWireless (Sept. 2, 2009) *available at:* http://www.fiercewireless.com/story/levin-lays-out-broadband-priorities-spectrum-key/2009-09-02.

already been overtaken by technological changes, it is rapidly becoming so. In recognition of the importance of mobile broadband services to the more than 276 million U.S. wireless subscribers, the well-documented explosion in mobile data traffic and mobile video traffic in particular, and the lengthy process of reallocating and licensing new spectrum, the Commission should immediately open a proceeding to consider the reallocation of broadcast spectrum for mobile broadband services.

In the short term, there are steps with respect to the broadband spectrum that the Commission can take to immediately further the provision of mobile wireless broadband services. As an initial matter, as the Commission begins to authorize devices for use in the television white spaces it should do so by beginning with authorizations at the bottom end of the available white spaces. To the extent the Commission should decide that broadcasters, white space devices and mobile broadband services should continue to coexist in the television bands, the Commission would do well to ensure that additional spectrum for licensed mobile broadband services is available at the top end of the television band, adjacent to existing 700 MHz allocations.

CTIA also urges the Commission to begin immediately looking at the broadcast spectrum bands closest to the 700 MHz allocation and reallocating unused DTV channels to licensed mobile wireless broadband use. In geographic areas where channel 51, for example, is unused, reallocation to licensed wireless broadband services will provide a needed and immediate infusion of spectrum to help meet growing consumer demand for wireless broadband services.

Commission action to ensure that the spectrum in the remaining UHF bands is used to meet the needs of the more than 276 million U.S. consumers, businesses, and government users who subscribe to, rely on, and increasingly demand mobile access to data will advance the

Commission's goals of ubiquitous broadband, competition for broadband services, and putting spectrum to its highest, best and most efficient use.

Second, the Commission should also consider relocation of spectrum below 3 GHz that is currently allocated for fixed wireless use. As discussed in more detail above, spectrum below 3 GHz is ideally suited for commercial wireless services. Accordingly, the Commission should consider whether fixed wireless services below 3 GHz could be relocated, as described below [93]. Such relocations would free up a significant amount of spectrum for mobile wireless services that can only be accommodated in spectrum below 3 GHz.

Clearing Spectrum Already Allocated and Auctioned for Licensed Commercial Use. CTIA has explained in prior filings that, in addition to allocating additional resources for wireless broadband provision, the Commission can act to speed access to existing allocated spectrum.[94] Existing AWS-1, 2 GHz, and 700 MHz licensees face a myriad of impediments to use of the bands to provide service. Commission action in this area would provide short-term relief for congested wireless networks and wireless providers attempting to expand or offer service in underserved areas.

Secondary Markets. As an initial matter, the Commission should continue to promote the use of secondary markets to ensure spectrum gets to its highest and best use. As Michael Katz has noted, "reliance on secondary markets and other economic incentives can be expected to lead to more efficient deployment of broadband wireless networks and other new technologies than would creation of government-mandated underlay rights."[95]

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93 *See* Section IV., *infra.*

94 *See, e.g., CTIA Mobile Wireless Competition Comments* at 86-87.

95 Michael L. Katz, *Don't Let Short-Term Reforms Interfere with Long-Term Policy Goals* at 19, *att. to* Comments of CTIA, ET Docket No. 03-237 (filed Apr. 5, 2004).

Today, spectrum is available through a variety of secondary markets mechanisms. In addition to the traditional means of obtaining spectrum on the secondary market (*e.g.*, assignments, partitions, and disaggregations), interested parties can gain access to spectrum through a lease. Companies like Spectrum Bridge even provide licensees with an easy means of identifying and pricing available spectrum throughout the country.[96] In addition, interested parties also can enter into sharing arrangements with licensees. For example, many wireless carriers currently sell capacity to device developers and marketers so they may provide wireless data communications in conjunction with consumer, machine-to-machine, and other devices. This sale of capacity is the functional equivalent of a secondary market transaction. CTIA believes this mechanism for providing broadband services will continue to grow with the development of machine-to-machine products and services such as smart grid applications.

Spectrum Relocation Policies. The Commission has well-established procedures for clearing and repurposing government and non-government spectrum. Specifically, the CSEA has been used previously to relocate Federal users out of the 1710-1755 MHz band and to clear the way for commercial Advanced Wireless Services ("AWS-1") licensees. While this process was far from perfect, it provides a good starting point for future Federal government relocations. Indeed, the implementation of minor changes that would facilitate the sharing of information between the Federal government and commercial licensees would solve many of the problems associated with the AWS-1 reallocation.

On the non-government side, the Commission gives the incumbent licensee a defined period of time during which it may negotiate an agreement with the new licensee for voluntary

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[96] *See* Press Release, Spectrum Bridge, *Wireless Carriers, Utilities, Railways and Others Have Made Specex.com the Number One Source for Secondary Market Spectrum* (Aug. 10, 2009) available at http://spectrumbridge.com/pdf/SpecExNumber1SourceSecondarySpectrum_7-30.pdf.

relocation, after which it may be subject to mandatory relocation at the expense of the new licensee.[97] This approach has worked well. It represents an appropriate balance of burdens, in that the new licensee ultimately assumes the cost of relocating the incumbent and gives both parties an incentive to reach agreement early. The Commission and its licensees have experience with this system, which has been modified multiple times in response to unforeseen concerns and has withstood judicial review.[98] Given that this system is tried, tested, and refined, there is no need to "reinvent the wheel," which would inevitably give rise to a new set of unforeseen complications requiring lengthy proceedings to resolve.

IV. THE COMMISSION SHOULD IDENTIFY ADDITIONAL SPECTRUM ABOVE 4 GHz FOR FIXED WIRELESS USES.

CTIA recognizes that fixed wireless has an important complementary role to play in the deployment of future mobile wireless networks.[99] Indeed, fixed wireless services are one important source for mobile wireless backhaul. As such, the Commission should consider identifying additional spectrum that can be allocated for fixed wireless uses. In doing so, however, the FCC should focus on spectrum over 4 GHz, as these bands are much better suited for fixed wireless than for mobile uses.[100]

As discussed above, spectrum above 4 GHz is not ideal for mobile wireless uses because of unfavorable propagation and penetration characteristics at the low power levels used in mobile

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97 *See Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies*, First Report and Order and Third Notice of Proposed Rulemaking, 7 FCC Rcd 6886 (1992), Second Report and Order, 8 FCC Rcd 6495 (1993), Third Report and Order and Memorandum Opinion and Order, 8 FCC Rcd 6589 (1993), Memorandum Opinion and Order, 9 FCC Rcd 1943 (1994), Second Memorandum Opinion and Order, 9 FCC Rcd 7797 (1994), *aff'd sub nom. Ass'n of Public-Safety Communs. Officials-International v. FCC*, 76 F.3d 395 (1996).

98 *Id.*

99 *See Public Notice* at 6-7 (inquiring as to the ability of current spectrum allocations to support the fixed wireless broadband and mobile wireless backhaul market).

100 *See Public Notice* at 6 (asking "[w]hat spectrum bands are best positioned to support fixed wireless broadband?").

wireless transmission.[101] However, this higher band spectrum can be very effective for fixed and nomadic wireless uses. As, by definition, fixed wireless deals with transmissions between two defined, fixed points, operators can make effective use of higher frequency spectrum by raising antenna heights to allow for line of sight and using directional antennas, increasing signal gain to achieve transmission over sufficient distances. Additionally, nomadic services, like Wi-Fi, are less susceptible to the propagation issues of higher frequencies. Although attenuation problems caused by rain and other obstructions become more significant at higher frequencies, fixed microwave transmission is still very effective over long distances and nomadic services still provide good local coverage in the bands above 4 GHz where propagation characteristics start to make mobile coverage infeasible.

[101] *See* Part II *supra*.

V. CONCLUSION

The wireless industry currently provides a wide range of innovative and competitive wireless broadband services. The lifeblood of this industry, however, is spectrum and current spectrum allocations are insufficient to meet the skyrocketing demand for wireless broadband services. CTIA's member companies are committed to meeting this demand but they need spectrum and conducive spectrum policies to do so. As described in these comments, the Commission can use the National Broadband Plan to lay out a road map for the mobile broadband future that will maintain U.S. global leadership and empower U.S. consumers with the extraordinary capabilities of mobile broadband services.

Respectfully submitted,

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