

Qualcomm Comments on
U.S. House of Representatives
Committee on Energy and Commerce
“Modernizing U.S. Spectrum Policy” White Paper
April 25, 2014

Introduction

Qualcomm commends the Members of the House Energy and Commerce Committee for undertaking this effort to modernize the laws governing the communications and technology sector and is pleased to provide comments on the spectrum policy white paper. Sound spectrum policy is not only critical to the future of the wireless industry and Qualcomm itself, but it also is essential for consumers who increasingly rely on mobile devices for daily activities, including in emergency situations. It is critical that policymakers make well-informed, sound judgments with respect to this scarce resource. Qualcomm’s views on spectrum policy are driven by rigorous technical analysis to determine which technology or technologies are optimal for each given spectrum band, and, accordingly, what policies will facilitate rapid and broad use of the spectrum.

Qualcomm was founded in July 1985 by a group of engineers who were focused on ways to commercialize Code Division Multiple Access (CDMA), an innovative high-capacity wireless technology that many in the wireless industry believed was not viable for cellular communications. At this time, cellular telephony was in its infancy with only 340,213 cell phone subscribers.¹ The FCC’s decision in 1989 to allow wireless operators to deploy the wireless technology of their choosing, including CDMA, an industry upstart at the time, was critical to Qualcomm’s early success.² And the policies set in motion by this Committee as far back as 1993 and 1997 and as recently as 2012 authorizing the FCC to conduct spectrum auctions have played an integral role in the extraordinary growth of the wireless industry.

Today, Qualcomm is the world’s largest provider of chips for wireless devices, and the largest licensor of wireless technology. Since its founding, Qualcomm has invested more than \$28.6 billion in advancing wireless technologies, and we work with virtually every wireless carrier and equipment manufacturer in the world.

Our chips, which are used in many of the world’s most advanced smartphones and tablets, support technologies that operate in both licensed and unlicensed spectrum. In licensed spectrum, our chips support 2G, 3G and 4G wireless services. In unlicensed spectrum, our chips support Wi-Fi, Bluetooth, and NFC, and we are developing chips that will enable the

¹ <http://www.ctia.org/your-wireless-life/how-wireless-works/wireless-history-timeline>

² Dave Mock, *The Qualcomm Equation*, (American Management Association, 2005), 60.

deployment of LTE in unlicensed spectrum. Consistent with the FCC's E-911 mandate, our chips provide highly accurate position location capabilities so that emergency callers are accurately located.

Because of our focus on wireless technology, Qualcomm is very active in helping to shape spectrum policy. In our view, it's critical that the Federal Government continue to identify spectrum, particularly spectrum below 5 GHz that can be cleared for licensed mobile broadband use to support the growing user demand for mobile broadband data. For those cases where spectrum cannot be cleared completely by a date certain, within a reasonable timeframe, Qualcomm recommends use of a sharing framework called Authorized Shared Access (ASA). ASA fully protects incumbent federal operations and allows commercial operations where and when incumbents are not operating. Qualcomm also supports the allocation of additional unlicensed spectrum in higher bands such as 5 GHz and above, where multiple wide channels, such as 160 MHz, are available to support short-range, high-data-rate connections.

The Roles for Licensed and Unlicensed Spectrum

Qualcomm designs chips that use both licensed and unlicensed spectrum, and is therefore uniquely suited to discuss the roles they should play in the wireless ecosystem. It is clear to us as wireless innovators that both licensed spectrum and unlicensed spectrum have a significant part to play in accommodating the exponential growth in mobile broadband.

Much of our research and development efforts are focused on finding ways to use spectrum more efficiently. In 2012, we set a goal to meet the "1000x Challenge" and expand the capacity of today's mobile networks by 1000 times. Globally, mobile data traffic has been doubling each year for the last several years. If this trend continues for the next ten years, mobile data traffic will be 1000x what it is today. Qualcomm, in close partnership with its wireless industry partners, is working on a number of wireless technology advances to help meet this challenge. The Government will also play a key role by enabling creative ways to make more spectrum available for mobile broadband use.

Qualcomm commends the Energy and Commerce Committee for its work in passing the *Middle Class Tax Relief Act of 2012 (a.k.a. The Spectrum Act)*, which included authorization for the world's first voluntary incentive auction.

The Spectrum Act struck the appropriate balance between licensed and unlicensed spectrum. It is critical that the voluntary incentive auctions maximize the amount of exclusively licensed spectrum to be made available through the clearing process. If the auction is implemented correctly in accordance with the Spectrum Act, the guard bands and duplex gap should be "no larger than is technically reasonable" to prevent harmful interference from adjacent operations. Qualcomm is concerned, however, that various groups have been advocating at the FCC to allow unlicensed operations in the guard band and duplex gap. Our technical analysis has demonstrated that these unlicensed devices would cause interference to adjacent licensed

operations.³ Therefore, allowing unlicensed devices in the guard band and duplex gap would violate the law. While the Spectrum Act is clear in its intent, oversight by Congress of the FCC implementation of voluntary incentive auctions is needed to ensure that the auction is designed in accordance with the law.

Furthermore, deploying unlicensed devices in the 600 MHz spectrum is not the best use for this spectrum band, which is ideally suited for wide area networks that require protection from interference. This spectrum is “overqualified” for unlicensed services, which rely on low transmit power levels that operate over a short range. Generally speaking, spectrum below 3 GHz should be prioritized for licensed use to ensure the maximum benefit is realized from this “beachfront” spectrum. Indeed, as noted by Coleman Bazelon, Dorothy Robyn and Chuck Jackson in their 2008 study of 700 MHz spectrum, “Unlicensed Use of the TV White Space: Wasteful and Harmful,” devoting TV spectrum to unlicensed use would be like “using land in downtown Tokyo to grow rice.”⁴

The Spectrum Act also required the FCC to initiate a proceeding to allow unlicensed U-NII devices to operate in the 5350-5470 band. This is appropriate, as spectrum for unlicensed services, such as Wi-Fi, increasingly requires wider bandwidth channels. Indeed, for the most advanced Wi-Fi services that use the 802.11ac standard, very wide contiguous bands that are adjacent to existing unlicensed bands are essential, as the 11ac standard uses 160 MHz-wide channels. In addition, Congressional oversight is warranted to ensure that the Spectrum Act provisions relating to 5850-5925 MHz spectrum are implemented as intended. The Spectrum Act required the NTIA in conjunction with the Department of Defense and other impacted agencies to conduct a study evaluating known and proposed spectrum-sharing technologies and the risk to Federal users if unlicensed U-NII devices were allowed to operate in the 5850-5925 MHz spectrum. It did not require the FCC to open a proceeding to allow sharing of unlicensed devices with Intelligent Transportation Systems (ITS) technologies in the 5859 – 5925 MHz spectrum. Nonetheless, the FCC has opened a proceeding to examine this possibility.

ITS technologies hold great promise for reducing highway fatalities, and the FCC should carefully consider whether sharing in 5.9 GHz spectrum would negatively impact the DSRC (Dedicated Short-Range Communications) technologies that are currently permitted in the band. Qualcomm has submitted a compromise proposal to the FCC that carefully balances the various potential uses for the band while preserving the future possibilities for vastly improving highway

³ Qualcomm February 19, 2014 response to January 30, 2014 ex parte filing from Google and Broadcom in which Qualcomm demonstrates that inserting unlicensed services in the 600 MHz band – without unduly expanding the size of the guard band (s) and duplex gap (and thus violating the incentive auction statute) – will impair the adjacent mobile spectrum blocks and effectively destroy the fungibility of the licensed mobile spectrum that the Commission is working so hard to repurpose through the upcoming voluntary incentive auction. See Federal Communications Commission, GN Docket No. 12-268.

⁴ Coleman Bazelon, Chuck Jackson, and Dorothy Robyn, “Unlicensed Use of the TV White Space: Wasteful and Harmful, August 20, 2008.

safety through DSRC.⁵ Congress should encourage the FCC to closely consider this proposed compromise.

The Government Should Seek to Use Spectrum More Efficiently

More needs to be done to encourage efficient use of spectrum by Government users. Qualcomm supports enactment of H.R. 3674, the Federal Spectrum Incentive Act, sponsored by Representatives Guthrie, Matsui, Walden, Eshoo and Waxman. This commonsense, bipartisan legislation would provide an incentive to federal agencies to relinquish spectrum by allowing the agencies to share in the proceeds from an auction. The same principles that are being put in place for the upcoming voluntary incentive auctions for broadcasters can work for federal agencies as well, and Congress should enact this legislation to help meet the 1000x challenge.

Furthermore, in certain instances, it makes sense for the FCC and NTIA to explore sharing of spectrum between Government and commercial users. Some Government spectrum bands are used only in limited locations and only during limited periods of time. One such example is the 3.5 GHz band, which, according to the FCC and the NTIA, is used by naval radars only at certain locations and during certain times. This band is ideally suited for sharing with commercial users, in particular small cells. Small cells are one promising approach to addressing the 1000x challenge. A small cell, which is roughly the size of a deck of playing cards, can be deployed indoors. It has the connectivity of a typical cellular base station, but at much lower power. Qualcomm has recommended using Authorized Shared Access (ASA), to allow for sharing in the 3.5 GHz band. ASA, which is also known as Licensed Shared Access (LSA), relies on a database to provide an operator access to the spectrum only when and where it's available. This approach would ensure that both Government users and commercial users are protected from interference. Because it does not require any new cellular technology or device changes, ASA can be implemented quickly and can provide access to bands, such as 3.5 GHz, that would otherwise be unavailable for many years, if ever. Congress should encourage the FCC and NTIA to use ASA in the 3.5 GHz band to allow sharing with small cells.

Suggested Changes to the Communications Act

Qualcomm believes the Communications Act has been successful in providing for growth in the wireless industry. Any changes to the Act should maintain the light regulatory approach that has worked exceptionally well as well as the auction process for allocating spectrum.

Changes to the Communications Act are warranted to expedite the process of allocating additional spectrum for commercial mobile broadband, and to create certainty as to which spectrum bands will become available and when. Congress should formalize a robust FCC process of forecasting spectrum needs, and require the FCC to release a detailed timeline of when new spectrum will be made available.

⁵ Qualcomm Comments, ET Docket No. 13-49, May 28, 2013. Rep. Walden included these comments in the record of the Communications and Technology Subcommittee hearing, "Challenges and Opportunities in the 5 GHz Spectrum Band" held on November 13, 2013.

Further, we recommend enactment of H.R. 3674 because it would create incentives for Government agencies to use spectrum more efficiently. Additional procedures could also be included in the Act to compel federal agencies to relinquish (or in certain circumstances, share) spectrum for commercial mobile broadband.

Finally, Qualcomm believes that specific guidance from Congress would be helpful to ensure that spectrum is allocated effectively between unlicensed and licensed use. In particular, a legislative directive to the FCC to prioritize for licensed use new spectrum made available below 3 GHz would be an improvement to the Communications Act. As stated previously, spectrum below 3 GHz is best suited for wide area networks where protection from interference is needed.

Qualcomm looks forward to continuing to work with the Committee as its review of the Communications Act progresses over the coming months.



April 25, 2014

Electronically Filed Via E-mail

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U.S. House of Representatives
Committee on Energy & Commerce

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The Honorable Greg Walden
Chairman
U.S. House of Representatives
Subcommittee on Communications and
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Re: *Comments of the Rural Wireless Association, Inc. in response to White Paper #2:
Modernizing U.S. Spectrum Policy*

Dear Chairman Upton and Chairman Walden:

The Rural Wireless Association, Inc. (“RWA”),¹ by its attorneys, hereby submits its comments in response to the U.S. House of Representatives Committee on Energy & Commerce (“Committee”) White Paper #2: Modernizing U.S. Spectrum Policy.² RWA appreciates the opportunity to share its views on spectrum policy as the Committee’s work to update the Communications Act of 1934, as amended, (“the Act”) goes on. Spectrum policy in our country and its effect on competition directly impacts the way that Americans live, work, and play. The nation’s spectrum landscape continues to change as the Federal Communications Commission

¹ The Rural Wireless Association, Inc. (formerly known as the Rural Telecommunications Group, Inc.) is a 501(c)(6) trade association dedicated to promoting wireless opportunities for rural wireless companies who serve rural consumers and those consumers traveling to rural America. RWA’s members are small businesses serving or seeking to serve secondary, tertiary, and rural markets. RWA’s members are comprised of both independent wireless carriers and wireless carriers that are affiliated with rural telephone companies. Each of RWA’s member companies serves fewer than 100,000 subscribers.

² U.S. House of Representatives Committee on Energy & Commerce, *White Paper #2: Modernizing U.S. Spectrum Policy* (rel. Apr. 1, 2014), available at <http://energycommerce.house.gov/sites/republicans.energycommerce.house.gov/files/analysis/CommActUpdate/20140401WhitePaper-Spectrum.pdf>.

(“FCC” or “Commission”) prepares for the AWS-3³ and Broadcast Incentive Auctions,⁴ and also readies an order addressing wireless mobile holdings.⁵

When the Commission released its Sixteenth Annual Mobile Wireless Competition Report, more than 400,000 people in rural areas still had no mobile wireless voice coverage.⁶ Then-Acting FCC Chairwoman Mignon L. Clyburn noted that, between the release of the FCC’s Fifteenth and Sixteenth Annual Mobile Wireless Competition Reports, the number of Americans with access to two or fewer mobile providers *increased* by over 600,000.⁷ In many rural communities, there is only one CMRS carrier and thus no marketplace competition. Assuming that they have service in the first place, rural wireless consumers are left with fewer service choices than their urban counterparts. Many of those same Americans are unable to use the services they have in their home markets when they roam to either nearby territories or distant cities elsewhere in the country. This forces many consumers to buy service from two different providers and carry two handsets; one to use at home, and one to use when away from his or her home service area.

³ *Amendment of the Commission’s Rules with Regard to Commercial Operations in the 1695-1710 MHz, 1755-1780 MHz, and 2155-2180 MHz Bands*, Report and Order, GN Docket No. 13-185, FCC 14-31 (rel. Mar. 31, 2014).

⁴ *In the Matter of Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Docket No. 12-268.

⁵ *In the Matter of Policies Regarding Mobile Spectrum Holdings*, Docket No. 12-269.

⁶ *In the Matter of 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 Mobile Services*, Sixteenth Report, WT Docket No. 11-186 (Terminated), FCC 13-34, at p. 27 (rel. March 21, 2013) (*Sixteenth Report*).

⁷ *In the Matter of 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 Mobile Services*, Sixteenth Report, Statement of Commissioner Mignon L. Clyburn, WT Docket No. 11-186 (Terminated), FCC 13-34, at p. 336 (rel. March 21, 2013). *See also Sixteenth Report* at p. 27. The Commission stated that the data it used in this report likely overstated the coverage actually experienced by consumers. *Id.*

The fact that millions of Americans have either no access to wireless service or only have a choice of two providers (typically the dominant “Twin Bells” of Verizon Wireless and AT&T), is direct evidence of the lack of competition in the wireless marketplace. The technological sophistication offered by today’s mobile devices, the capacity of the underlying networks supporting those mobile devices, and the creativity and efficiency of the software and “apps” utilized by those mobile devices are all meaningless to everyday Americans if mobile wireless services are unavailable in a particular rural market, customers are unable to roam beyond their local service territories, or rural carriers do not have access to up-to-date mobile devices and therefore cannot offer those devices to customers.

Competition is eroding in the domestic mobile wireless marketplace due to: (1) an over-concentration of spectrum in the hands of a few providers; (2) the lack of mobile device interoperability; (3) the inability of small and rural service providers to procure certain, highly-desirable mobile devices; and (4) the continued inability of small and rural mobile carriers to secure commercially reasonable data roaming rates. RWA suggests that the Committee incorporate the proposals discussed below into its Communications Act update to address these issues. There is no doubt we are at a pivotal point in the structuring of the mobile broadband marketplace. With its Communications Act update, this Committee has the opportunity to significantly improve the ability of American consumers, particularly those located in rural areas, to have high quality access to mobile wireless broadband services for years to come.

I. INSTITUTING A PERCENTAGE-BASED SPECTRUM CAP ON THE TOTAL AMOUNT OF SPECTRUM ONE CARRIER CAN HOLD IN A GIVEN MARKET WILL ALLOW MORE CARRIERS TO ENTER THE MARKETPLACE AND REMAIN COMPETITIVE FOR THE LONG TERM.

The Committee seeks comment on what principles Congress and the FCC should consider when addressing spectrum aggregation limits. Spectrum is a finite resource, and there

is a general consensus among industry players, regulators and consumers that more spectrum needs to be re-purposed and dedicated solely to support commercial mobile wireless services. However, even upcoming FCC spectrum auctions do not change the fact that: (1) the current pool of licensed spectrum designated only for commercial mobile wireless use is inadequate to support the forecasted growth of broadband applications; (2) spectrum is not distributed in a manner that supports a competitive marketplace that encourages an *increase* in market players and a correlating *decrease* in the retail rates consumers pay; and (3) the only way to maintain some degree of equitable spectrum distribution both now and in the future is to institute a hard, percentage-based spectrum cap on spectrum aggregation.

RWA has been a long-time proponent of sensible limits on the amount of licensed spectrum commercial mobile wireless carriers can hold in any given market.⁸ Both the Commission⁹ and the U.S. Department of Justice (“DOJ”)¹⁰ have recognized the competitive harms that result from a degree of spectrum concentration that would result in less than four nationwide carriers. The Commission noted in the *Sixteenth Report* that Verizon Wireless, AT&T, T-Mobile, Sprint and Clearwire “hold close to 80 percent of all spectrum, measured on a MHz-POPs basis, that is potentially usable for the provision of mobile wireless services.”¹¹ Additionally, spectrum below 1 GHz is superior to spectrum above 1 GHz, and according to a

⁸ *In the Matter of Policies Regarding Mobile Spectrum Holdings*, Comments of the Rural Telecommunications Group, Inc., WT Docket No. 12-269 (filed Nov. 28, 2012) (“*Spectrum Cap Comments*”) at pp. 1-2.

⁹ *In the Matter of Applications of AT&T Inc. and Deutsche Telekom AG for Consent to Assign or Transfer Control of Licenses and Authorizations*, Order, WT Docket No. 11-65, DA 11-1955 (rel. November 29, 2011) at ¶ 3; see <http://transition.fcc.gov/transaction/DA-11-1955.pdf>.

¹⁰ *United States of America, Department of Justice, Antitrust Division, et. al. vs. AT&T Inc., T-Mobile USA, Inc., and Deutsche Telekom AG*, Amended Complaint, Civil Action No. 11-01560 (ESH) at ¶ 36; see <http://www.justice.gov/atr/cases/f275100/275128.pdf>.

¹¹ *Sixteenth Report* at ¶ 118.

2013 DOJ filing, the Twin Bells of AT&T and Verizon Wireless already control no less than 78% of the suitable and available “beachfront” spectrum below 1 GHz in the United States.¹²

The need for a separate spectrum aggregation limit for all mobile telephony/broadband spectrum below 1 GHz is based on two factors – technical superiority and scarcity – which make such spectrum far more valuable than spectrum above 1 GHz. Low-band spectrum has inherent technical superiority for providing coverage in rural markets. As noted in *Digital Crossroads: Telecommunications Law and Policy in the Internet Age*, “[l]ow-band spectrum presents the most significant advantages in sparsely populated rural areas, where its superior propagation characteristics enable providers to build fewer cell towers that cover larger cells.”¹³

FCC Chairman Tom Wheeler also made this point in a recent blog post when he said:

“[s]pectrum below 1 GHz...has physical properties that increase the reach of mobile networks over long distances. The effect of such properties is that fewer base stations and other infrastructure are required to build out a mobile network. This makes low-band particularly important in rural areas. A legacy of earlier spectrum assignments, however, is that two national carriers control the vast majority of low-band spectrum. As a result, rural consumers are denied the competition and choice that would be available if more wireless competitors also had access to low-band spectrum.”¹⁴

The Commission has already recognized that low-band spectrum is a much scarcer resource than high-band spectrum.¹⁵

¹² *In the Matter of Policies Regarding Mobile Spectrum Holdings*, Ex Parte Submission of the United States Department of Justice, WT Docket No. 12-269 (filed Apr. 11, 2013) at p. 14.

¹³ Nuechterlein, Jonathan E., Veiser, Philip J., *Digital Crossroads: Telecommunications Law and Policy in the Internet Age*, 2nd. Ed., MIT Press Books (2013) at p. 136. *See also* *Nokia Solutions and Networks: APT700 Discussion Paper*, Nokia Solutions Network (rel. 2013) at p. 3. (“Spectrum resources are highly prized by many industries around the world. In particular, sub 1 GHz spectrum is valued because of its excellent indoor and outdoor propagation performance. This gives technical advantages and the ability to support high quality signals and wider coverage using fewer base stations/broadcast sites.”).

¹⁴ *Getting the Incentive Auction Right*, FCC Chairman Tom Wheeler, Official FCC Blog, available at <http://www.fcc.gov/blog/getting-incentive-auction-right> (Apr. 18, 2014).

¹⁵ *In the Matter of Policies Regarding Mobile Spectrum Holdings*, Notice of Proposed

In order to foster competition between no fewer than four separate carriers in each market, RWA supports a bright line spectrum aggregation limit. The Commission's reliance on a case-by-case analysis since 2003 has thus far failed to achieve the Commission's aim of preventing competitive harms. Legislation to update the Act should prohibit any carrier from holding more than 25% of the total suitable and available spectrum at the county level and more than 40% of the suitable and available spectrum below 1 GHz at the county level. The Commission should be encouraged to adopt a process that will allow it to add newly licensed spectrum bands to its list of suitable and available spectrum on a timely basis.

While the Commission has previously relied largely on Cellular Market Areas ("CMAs") as the local geographic markets in which to address spectrum concentration, these areas are too large and do not constitute the local markets where consumers "live, work and shop."¹⁶ RWA notes that every county has a county seat and that consumers identify with a county or a county equivalent with respect to where they live, work, pay taxes, vote, and shop.¹⁷ Accordingly, the Act should treat counties (or their equivalent) as the relevant local geographic market. By requiring that spectrum aggregation be examined at the county level, the Committee will help ensure that *all* local markets are afforded the same protection against anticompetitive spectrum aggregation.

Under RWA's proposal, once new spectrum aggregation limits are in place, licensees exceeding the 25% or 40% cap will have 18 months to divest themselves of excess spectrum, or alternatively, keep the excess spectrum on a "grandfathered" basis provided that the licensee

Rulemaking, WT Docket No. 12-269, FCC 12-119 (rel. Sept. 28, 2012) at ¶ 35. ("[T]here currently is significantly more spectrum above 1 GHz potentially available for mobile broadband services than spectrum below 1 GHz.").

¹⁶ See *id.* at ¶ 31.

¹⁷ *States, Counties and Statistically Equivalent Entities*, Chapter 4, U.S. Census Bureau; see <http://www.census.gov/geo/www/GARM/Ch4GARM.pdf>.

commits to certain conditions. First, the carrier must continually offer data roaming to any requesting carrier at commercially reasonable rates, terms and conditions.¹⁸ Second, the carrier must offer to its own customers devices that are fully interoperable (*i.e.*, the mobile device must work on all spectrum that is available and usable in that particular spectrum band, as well as any other spectrum band where that carrier offers service). Finally, any nationwide (Tier I) carrier exceeding the spectrum caps must work to ensure that mobile devices it sells to its own customers are available on a non-exclusive basis to medium (Tier II) and small (Tier III) carriers who utilize the same technology as the Tier I carrier.¹⁹ The objective of this two-tier, percentage-based spectrum cap is simple: it will ensure that American consumers in all markets benefit from the competitive presence of at least four, spectrum-healthy, facilities-based mobile wireless carriers.

II. MANDATING DEVICE INTEROPERABILITY THROUGHOUT ALL NEW SPECTRUM BANDS AUCTIONED BY THE FCC IN THE FUTURE WILL REDUCE EQUIPMENT PRICES FOR ALL MARKET PLAYERS AND ALLOW CONSUMERS GREATER FLEXIBILITY TO PORT DEVICES BETWEEN CARRIERS.

The 700 MHz spectrum allocation resulted in the creation of sub-set band classes²⁰ that had never materialized in the Cellular, PCS and AWS-1 Bands. These band classes significantly hindered the ability of small and rural carriers to acquire mobile devices. As will be explained in

¹⁸ See *infra* Sec. IV.

¹⁹ See *infra* Sec. III.

²⁰ The 700 MHz band contains four band classes: 12, 13, 14 and 17. While the 3GPP, an international partnership of industry-based telecommunications standards bodies that establishes standards for different LTE band classes, introduced the Band Class 12 LTE standard, Motorola took steps to establish a new industry standard (Band Class 17) that was limited to the Lower 700 MHz B and C Blocks under the guise of it being necessary to address interference concerns. The result was the incompatibility of Band Class 12 and Band Class 17 signaling, and the inability of devices to operate in both bands. See *Promoting Interoperability in the 700 MHz Commercial Spectrum, Requests for Waiver and Extension of Lower 700 MHz Band Interim Construction Benchmark Deadlines*, Report and Order and Order of Proposed Modification, WT Docket No. 12-69, WT Docket No. 12-33 (rel. Oct. 29, 2013).

greater detail in the next section regarding device exclusivity, the mobile device marketplace is plagued by a troublesome axiom: vendors who design, test and manufacture mobile wireless devices will only produce a specific type of mobile device if there is sufficient demand by mobile carriers. Furthermore, a critical mass of demand for broadly inclusive band classes is thwarted when “exclusive” band classes favored by large national carriers are developed and those carriers with licenses outside of those band classes are unable to stimulate enough demand to warrant mobile device manufacturers to actually produce devices using the more broadly inclusive band classes.

Rather than relying on the Commission to correct the industry-wide problem of a lack of interoperability for LTE devices on a rulemaking by rulemaking basis, Congress should update the Act to mandate that all devices operating in *any* new commercial mobile wireless spectrum band auctioned in the future be fully interoperable across the entire licensed band. Legislation and Commission policies should be designed to benefit America’s paying consumers. Rules mandating universal mobile device interoperability within a particular spectrum band do just that by allowing a consumer to more easily port a device away from one service provider to another. When the element of device interoperability is removed as a factor from a consumer’s consideration of what device to choose, he or she can then focus on truly important distinguishing elements such as price, customer service, and local coverage. If a carrier, whether large (like AT&T and Verizon Wireless) or small (like an RWA member), is unable to provide the services that truly matter to a paying subscriber, that customer should have the freedom to bring his or her mobile device to a competing carrier and not feel like a hostage solely because that recently purchased (and expensive) smartphone or tablet is not designed to work on adjacent frequencies. RWA is confident that once intra-band device interoperability becomes

commonplace, one barrier to entry for carriers will be erased and one barrier to consumer choice will also disappear.

III. VOLUME ORDER REQUIREMENTS IMPOSED BY MOBILE DEVICE VENDORS PREVENT SMALL AND RURAL MOBILE CARRIERS FROM OFFERING HIGHLY-SOUGHT MOBILE DEVICES.

The reluctance of vendors to sell high-end devices like the iPhone in quantities that are not (and never will be) as large as those commandeered by the country's largest mobile wireless carriers impedes the sale of these devices in rural America. Simply put, being able to offer the latest and greatest device matters. Several RWA carrier members have tried for years to procure the iPhone, only to be told by Apple that they were simply too small. (Or they were ignored altogether – the end result is the same.) Apple generally requires individual carriers to order a minimum of 10,000 iPhones – a substantial barrier when you have 5,000 or fewer subscribers in total.

While price, local coverage, and customer service are guiding factors that influence a particular consumer's choice of mobile wireless carrier, they are by no means the only influences. Americans today, especially younger Americans who are more likely to switch between providers,²¹ are heavily influenced by whether a particular carrier offers specific mobile devices operating specific mobile platforms. The prickly matter of device exclusivity agreements between large carriers (like AT&T) and mobile device manufacturers (like Apple)

²¹ *Mobile Trends: Consumer Views of Mobile Shopping and Mobile Service Providers*, White Paper by Oracle, at p. 10, (rel. Apr. 2011); <http://www.oracle.com/us/industries/communications/oracle-atg-mobile-wp-345770.pdf> (“Younger consumers tend to jump around more frequently from one mobile provider to the next. 30 percent of respondents ages 18 to 34 have purchased mobile services from two or more providers in the past five years. By comparison, 22 percent of those ages 35 to 54 and 19 percent of those ages 55 and older have used multiple providers. 20 percent of consumers ages 18 to 34 said they are likely to leave their current mobile provider in the next 12 months.”).

has not disappeared from the industry; it has merely moved downstream to impact the smallest of the nation's mobile carriers who are often located in rural markets serving rural consumers.

When Apple ceased its exclusive distribution agreement with AT&T in 2011 and started selling the iPhone through Verizon Wireless (and later Sprint, T-Mobile and other large and mid-size carriers), it revealed an interesting insight into the relationship between consumer choice and specific mobile devices/platforms. For example, in a survey conducted by ChangeWave Research, in the final months of the AT&T/Apple exclusivity period in 2011, one-in-four (26%) AT&T iPhone subscribers surveyed responded that they would switch specifically to Verizon Wireless once it began selling the iPhone.²² This means that all other factors being equal, a significant number of Apple iPhone consumers wanted to keep using the iPhone but were unable to go to another carrier until AT&T lost its rights to exclusivity. A more recent survey by ChangeWave Research noted that 54% of future smartphone buyers in America “are committed to buying the iPhone.”²³

While these surveys clearly show that Americans have an intense love affair with the Apple iPhone, consumers also want to be able to pair their “device of choice” with their “service provider of choice.” For example, last April, a news report surfaced showing that at least 250,000 consumers pre-registered with T-Mobile in order to secure the Apple iPhone 5, despite the fact that by this time well over a dozen carriers in the United States had distribution and sales

²² *New Survey Shows Verizon iPhone Will Have Major Impact on U.S. Wireless Service Providers*, Paul Carton, Vice President of Research, ChangeWave Research, (Jan. 13, 2011); <http://investorplace.com/2011/01/impact-verizon-apple-iphone-wireless-service-providers/>.

²³ *ChangeWave Research Points to Massive Smartphone Buying Wave*, MobileMarketingWatch, (Jan. 12, 2012); <http://www.mobilemarketingwatch.com/changewave-research-points-to-massive-smartphone-buying-wave-20347/>.

agreements with Apple to sell the iPhone.²⁴ According to the news report, which relied upon an internal T-Mobile communication, 80 percent of those pre-registering to acquire a new iPhone were already T-Mobile customers. This means that hundreds of thousands of T-Mobile subscribers wanted to obtain an iPhone, but were willing to wait in order to use it with T-Mobile service. The news report also reported that 50,000 of those pre-register requests were from subscribers with service on a competitor of T-Mobile's. This means that most, if not all, of those 50,000 consumers could already purchase an Apple iPhone on a host of other service providers, but they wanted to use it with T-Mobile as the underlying carrier.

Accordingly, there is substantial evidence demonstrating that American consumers want the ability to purchase the mobile device of their choosing, but also want a choice in the underlying service provider. Unfortunately, many rural mobile carriers in the United States are unable to offer the Apple iPhone and other recently launched, popular devices to their consumers. This means that rural carriers, despite any competitive advantages they may have when it comes to price, local coverage, and customer service, are skipped over by local consumers because they do not sell a specific product. As a result, the ability of these carriers to compete on a level playing field is compromised.

More importantly, rural carriers are sometimes the only mobile service provider with actual coverage in remote locations. This means that a rural carrier's inability to sell specific devices harms rural consumers because the applications and services associated with these devices are completely and utterly out of reach. In other words, rural consumers throughout certain portions of the U.S. are treated differently and denied devices and services solely because

²⁴ "Leaked Memo Shows 250K Have Pre-Registered for T-Mobile's Apple iPhone 5," PhoneArena (Apr. 9, 2013); http://www.phonearena.com/news/Leaked-memo-shows-250K-have-pre-registered-for-T-Mobiles-Apple-iPhone-5_id41711.

of where they live. The demand for up-to-date mobile wireless devices by local consumers and rural carriers is obvious. By mandating device interoperability and preventing device vendors from discriminating against consumers just because of where they live, Congress can provide consumers with a real choice of carriers.

IV. LEGISLATION IS NEEDED TO ENSURE COMMERCIALY REASONABLE DATA ROAMING RATES.

Rural mobile wireless carriers are disproportionately more reliant upon roaming than nationwide and regional carriers. American consumers expect their wireless devices to work from coast-to-coast and everywhere in between. Nationwide carriers, with deep spectrum resources and nationwide networks, rely less on roaming to fill in their coverage gaps. In contrast, small and rural carriers with modest spectrum holdings in smaller geographic markets and with fewer economies of scale need roaming access to other carriers' mobile networks in order to offer nationwide service to their current and prospective customers.

For years, larger carriers could strong-arm small and rural carriers during roaming negotiations or just deny access to data roaming altogether. However, in 2011, the Commission adopted the *Second Report and Order*, which mandated that carriers offer data roaming arrangements to requesting carriers on commercially reasonable terms and conditions.²⁵ While access to data roaming seems to no longer be a problem, the wholesale prices that are frequently charged to smaller and rural operators to access data roaming services are far from commercially reasonable.

While retail data roaming rates are fully transparent, inter-carrier wholesale data roaming rates are almost universally confidential in nature. Nonetheless, there is a widespread existence

²⁵ *In the Matter of Reexamination of Roaming Obligations of Commercial Mobile Radio Service Providers and Other Providers of Mobile Data Services*, Second Report and Order, WT Docket No. 5-265, FCC 11-52 (rel. Apr. 7, 2011).

of inter-carrier, wholesale data roaming rates that are *higher* than the rates paid by retail consumers and even higher than the rates paid by resellers or mobile virtual network operators (“MVNOs”) for those very same network access services. Rural carriers need nationwide data roaming access in order to compete effectively with nationwide providers. However, rural carriers must also pass their wholesale data roaming costs on to consumers, which makes it relatively impossible for rural carriers to effectively compete with larger carriers because rural consumers could reduce their service costs by purchasing services from the roaming partner for less money. Rural consumers are being forced to pay whatever the serving carrier is demanding because any competing carrier dependent upon roaming is almost always paying more for roaming access, and by default, forced to offer higher rate plans for all existing and potential consumers.

Mandating access to data roaming was only the first half of the battle to create a level playing field in the realm of roaming access. The second (and equally important) step is to make sure that all carriers across the country, large and small, offer commercially reasonable wholesale data roaming rates. A very simple litmus test to determine whether a wholesale rate is commercially reasonable is to ask whether the serving carrier’s own customers pay lower retail rates for those same services. If the answer is yes, then the higher wholesale rates offered to roaming partners are *de facto* commercially unreasonable. RWA supports legislation that would set a bright line limit on what constitutes commercially reasonable wholesale data roaming rates. In all instances those rates should never be higher than the retail rates paid by consumers nor the wholesale rates paid by resellers and MVNOs.

V. CONCLUSION

Rural consumers, and the rural carriers that serve them, face a gauntlet of obstacles that tilt the competitive playing field against them. Whether it is the Twin Bells hoarding disproportionate amounts of spectrum, mobile device vendors limiting access to interoperable or highly-coveted devices, or crucial roaming partners denying access at commercially reasonable roaming rates (or in many cases, all of the above), rural carriers are constantly behind the proverbial eight ball. Ultimately, it is rural American consumers who suffer.

RWA supports the Committee's comprehensive examination of the Act, and appreciates the work that Committee members and staff have done so far. By amending the Act to accommodate the proposals detailed above, the Committee will help to strengthen the collective mobile wireless industry through vigorous competition, and American consumers will reap the benefits. RWA stands ready to assist the Committee with this work.

Respectfully submitted,

RURAL WIRELESS ASSOCIATION, INC.

By: */s/ Caressa D. Bennet*

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April 25, 2013



April 25, 2014

The Honorable Fred Upton
Chairman
Energy and Commerce Committee
U.S. House of Representatives
Washington, D.C.

The Honorable Henry Waxman
Ranking Member
Energy and Commerce Committee
U.S. House of Representatives
Washington, D.C.

The Honorable Greg Walden
Chairman
Communications and Technology
Subcommittee
Energy and Commerce Committee
U.S. House of Representatives
Washington, D.C.

The Honorable Anna Eshoo
Ranking Member
Communications and Technology
Subcommittee
Energy and Commerce Committee
U.S. House of Representatives
Washington, D.C.

Via Email

commactupdate@house.gov

Re: Spectrum Policy White Paper

The Satellite Industry Association¹ (“SIA”) welcomes the opportunity to respond to the U.S. House of Representatives Commerce Committee’s recent White Paper on spectrum policy. The satellite industry is uniquely qualified to comment on spectrum policy because of the ubiquitous, critical services it provides to consumers, government users, and industry throughout the United States and the world. Below we focus our comments on the discussion points in the White Paper that are most important to the satellite industry.

FCC Licensing Structure (Discussion Question #1). SIA supports the continued use of individual Bureaus or offices handling licensing for different communications technology, with appropriate engineering support in each office. Many technologies, including satellite, have complex technical requirements that must be evaluated as part of any licensing process. Moreover, issues related to the timing of different applications from an operational standpoint will be very different depending on the

¹ SIA is a U.S.-based trade association providing worldwide representation of the leading satellite operators, service providers, manufacturers, launch services providers, and ground equipment suppliers. Since its creation almost twenty years ago, SIA has advocated for the unified voice of the U.S. satellite industry on policy, regulatory, and legislative issues affecting the satellite business.

technology/service at issue. It is extremely useful to have staff that is familiar with these operational timing needs so that consumers can receive service in a timely fashion. Accordingly, because of these unique features that require technology-specific expertise, it would be ill-advised to have a single licensing group review all FCC license applications. Instead, each broad area of technology, whether satellite or terrestrial wireless or broadcast, should have dedicated staff with appropriate legal and engineering expertise to adequately review each application.

Spectrum Sharing (Discussion Point #3). The satellite industry is used to sharing its spectrum. In a number of satellite bands, the satellite industry shares its spectrum with government users, terrestrial microwave services or intelligent transport systems. Moreover, in all satellite bands, satellite operators must share their licensed frequencies with all other satellite operators that have been licensed to use the same frequencies to serve the same area from slightly different orbital locations (typically, every two degrees across the geostationary arc). This is a form of spatial sharing that has been a feature of the satellite industry since its inception. Importantly, these sharing regimes assume that each service in the band can continue to grow, unlike some recent “sharing” proposals that effectively “freeze” an existing service in place to make room for a new service.

SIA expresses no view on whether increased sharing would encourage efficient use of spectrum by government users. But as an experienced user of shared spectrum, SIA and its members would caution against adopting an unthinking policy that more spectrum sharing is always good. Instead, there are invariably trade-offs, as each service that is required to share will be constrained by the interference created by the other service or the need to protect the other service. In the satellite context, for example, the constraints imposed by the need to protect terrestrial microwave systems in some bands have resulted in reduced deployment of both satellite and microwave systems when compared with bands where either service is exclusive. Even in successful sharing scenarios, e.g. Wi-Fi, spectrum can become “exhausted” by too much sharing (i.e., over-deployment), leading to calls for more unlicensed spectrum.

Auctions as Public Interest Consideration (Discussion Question #5). SIA has considerable concern about the FCC utilizing auction revenue as part of the public interest licensing analysis. Most noticeably, SIA is concerned that if auction revenues are utilized as a factor in the public interest calculation in licensing scenarios, non-auctioned services, such as unlicensed devices, satellite and fixed microwave services, could be negatively impacted – especially in situations where frequency bands are shared between non-auctioned and auctioned services.

Congress has found that international satellite services are appropriately exempted from any auction requirements.² This sound policy was based on the recognition that domestic auctions would be unduly burdensome on international satellite systems assigned spectrum on a non-exclusive basis to serve multiple countries. Operators of these systems could not continue to serve multiple countries if faced with auction

²47 U.S.C. 765(f); see GAO, *Intelsat Privatization and Implementation of the Orbit Act* (2004) available at: <http://www.gao.gov/assets/250/244064.pdf>

scenarios in each of them. Mandating auctions under these circumstances would put at risk critical public interest services provided by international satellite systems, including for emergency response, rural, and government communications.

Ascribing public interest value to services based on auction revenue could undermine the licensing of non-auctioned services to the detriment of the public interest – for example, by encouraging the deployment of new services with auction revenues in bands occupied by non-auctioned services, even when the non-auctioned services are intrinsically valuable (e.g., for public safety). The FCC’s public interest evaluation should continue to include an assessment of the social value of different spectrum uses and encourage spectrum efficiency while protecting services from harmful interference. Communications policy should not be based on which service will bring the most revenue. Accordingly, SIA continues to support the Communications Act’s current prohibition on the use of auction revenues as a determinant in licensing.

Licensing Flexibility (Discussion Question #6). With regard to licensing flexibility, SIA is concerned that authorizing services without regard to the Table of Allocations or without appropriate technical rules in place would result in harmful interference to adjacent and co-channel services. Flexibility must be balanced by predictability and interference protection, which are particularly important for sustained investment in satellite services. Satellite services are particularly vulnerable to potential interference from “flexible” usage because weak satellite signals, whether received in space or on the Earth, can be easily overwhelmed or masked by co-frequency or adjacent frequency interference. Further, such an approach would likely result in decreased spectrum efficiency because unfettered spectrum usage would make it extremely difficult for equipment to be designed to account for the unpredictable interference environment that such an approach would create. The result could be a “shouting match” whereby every service transmits high power levels in an attempt to overcome interference. This unregulated interference environment likely would result in constant degradation of – at some point – all services, to the detriment of all consumers. Accordingly, while SIA supports limited flexibility for service providers, such flexibility must be based on the Table of Allocations and the technical rules that ensure a predictable interference environment and provide interference protection.

Build-out requirements (Discussion Question #8). With regard to build-out requirements (or in the case of satellite services, construction milestones) for spectrum-based services, in many cases they lead to increased use of spectrum resources. However, as currently structured, many services are exempt from build-out or milestone requirements. To the extent that build-out requirements are utilized as a means to increase spectrum efficiency use, all radio services should be subject to reasonable requirements.

Receiver Standards (Discussion Question #9). With regard to receiver standards, it is important to recognize that different technologies have different sensitivity levels. Satellite receivers are designed to be very sensitive in order to receive weak signals from space or from the Earth. Accordingly, if there is a review of receiver performance standards, the review should take into account the appropriate sensitivity levels of

satellite receivers, including the potential cost of more resilient receiver front-ends. Any proposed receiver standard should be based on reasonable differences between devices and bands used for terrestrial applications and those used for satellite applications, considering what the present state of the art can deliver.

SIA appreciates the opportunity to comment on this important White Paper. We remain available to answer any questions you may have or provide additional information.

On behalf of the members of the Satellite Industry Association (SIA),³

Respectfully,



Patricia Cooper
President
Satellite Industry Association

³ SIA Executive Members include: The Boeing Company; The DIRECTV Group; EchoStar Corporation; Harris CapRock Communications; Intelsat S.A.; Iridium Communications Inc.; Kratos Defense & Security Solutions; LightSquared; Lockheed Martin Corporation.; Northrop Grumman Corporation; SES Americom, Inc.; and SSL. SIA Associate Members include: Artel, LLC; Astrium Services Government, Inc.; ATK Inc.; Cisco; Cobham SATCOM Land Systems; Comtech EF Data Corp.; DigitalGlobe, Inc.; DRS Technologies, Inc.; Encompass Government Solutions; Eutelsat America Corp.; Globecomm Systems, Inc.; Glowlink Communications Technology, Inc.; iDirect Government Technologies; Inmarsat, Inc.; Exelis, Inc.; Marshall Communications Corporation.; MTN Government; NewSat America, Inc.; O3b Networks; Orbital Sciences Corporation; Panasonic Avionics Corporation; Raytheon Space and Airborne Systems; Row 44, Inc.; Spacecom, Ltd.; TeleCommunication Systems, Inc.; Telesat Canada; The SI Organization, Inc.; TrustComm, Inc.; Ultisat, Inc.; ViaSat, Inc., and XTAR, LLC.



Sprint – Government Affairs

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April 25, 2014

The Honorable Fred Upton
Chairman, Committee on Energy and
Commerce
U.S. House of Representatives
2125 Rayburn House Office Building
Washington, DC 20515

The Honorable Greg Walden
Chairman, Subcommittee on
Communications and Technology
U.S. House of Representatives
2125 Rayburn House Office Building
Washington, DC 20515

Dear Chairmen Upton and Walden:

Thank you for the opportunity to present Sprint's response to the questions posed in the Committee's "Modernizing U.S. Spectrum Policy" white paper. We look forward to continuing to participate in the Committee's ongoing efforts to examine the Communications Act of 1934, as amended. Please don't hesitate to contact me or Bill Barloon if you have any questions regarding the attached submission.

Sincerely,


Lawrence R. Krevor
Vice President Legal and Government Affairs - Spectrum

cc: Honorable Henry A. Waxman, Ranking Member, Committee on Energy and
Commerce; Honorable Anna G. Eshoo, Ranking Member, Subcommittee on
Communications and Technology

Attachment



Spectrum Policy: Sustainable Competition Should Be the Basis for Any Update to the Communications Act

April 25, 2014

Sprint encourages the Committee on Energy and Commerce, in evaluating the need for potential revisions to the Communications Act, to continue to adhere to the principles that have guided previous updates to the Act. Congress has consistently recognized that promoting competition represents the single most effective legislative and regulatory tool to foster innovation and growth in the communications and technology sector and promote the public interest.¹ As the Committee considers how “communications law can be rationalized to address the 21st century communications landscape” it must recognize that sustainable competition in the wireless industry critically depends on the Federal Communications Commission’s (“FCC’s”) authority to make spectrum allocation, regulation, and licensing decisions. Unlike other segments of the industry where fundamental resources for market entry can be acquired on the open market, the wireless industry relies on the FCC, carrying out the will of Congress, for its primary resource: spectrum. Given the rapidly changing characteristics of the communications and technology sector – where new products and services can render legislative enactments unduly inflexible or even obsolete virtually overnight – Congress has wisely chosen to delegate significant authority and discretion to the FCC in acting as the steward of this public resource. Thus, FCC decision making plays a critical role in shaping policies that promote competition, thereby

¹ H.R. REP. No. 104-204, pt. 1, at 48 (1995) (“Technological advances would be more rapid and services would be more widely available and at lower prices if telecommunications markets were competitive rather than regulated monopolies. Consequently, the Communications Act of 1995 opens all communications services to competition. The result will be lower prices to consumers and businesses, greater choice of services, more innovation, a competitive edge for American businesses, and less regulation.”).

facilitating commercial entities' ability to meet increasing U.S. consumer demand for wireless broadband services that depend on access to this scarce public resource.

1. Q: What structural changes, if any, should be made to the FCC to promote efficiency and predictability in spectrum licensing?

The FCC should continually review its internal processes to ensure that its spectrum allocation and licensing functions are open, predictable, and efficient. Congress should exercise its oversight and legislative authority as necessary to ensure these reviews occur as appropriate. The FCC has authority under the Act to conduct these reviews as evidenced by the February 14, 2014 *Report on FCC Process Reform*.² In that report, the FCC staff identified several challenges affecting the efficiency and transparency of FCC operations and recommended approaches to analyze and address those challenges. Some of those recommendations identify areas where additional statutory authority or revisions to existing statutory authority may be beneficial, and Sprint encourages Congress to give full consideration to these recommendations.

2. Q: What role should unlicensed spectrum play in the wireless ecosystem? How should unlicensed spectrum be allocated and managed for long-term sustainability and flexibility?

As a nationwide carrier, Sprint relies on licensed spectrum to deliver broadband service to its customers. Licensed spectrum allocations provide a higher degree of certainty and security to carriers and to the capital markets to support the billions of dollars of infrastructure investment needed to offer carrier-grade wireless broadband communications services with full mobility. Operators utilizing licensed spectrum can deliver a more reliable quality of service experience to their customers whose expectations regarding data throughput and availability are rapidly increasing. Flexible use and unlicensed allocations have their place in the wireless broadband ecosystem, of course, especially as “test beds” for innovative

² *Report on FCC Process Reform*, Staff Working Group – Federal Communications Commission (Feb. 14, 2014), available at http://transition.fcc.gov/Daily_Releases/Daily_Business/2014/db0214/DA-14-199A2.pdf.

wireless applications.³ Any reform of the Communications Act should promote the availability of both licensed and unlicensed spectrum allocations while recognizing their varied utility and deployment capabilities.

3. Q: What should be done to encourage efficient use of spectrum by government users?

Over the years, several approaches have been proposed for encouraging the efficient use of spectrum by government users, including setting spectrum use fees,⁴ allowing government users to relinquish spectrum and receive a portion of net auction revenues,⁵ and requiring government users to relocate out of spectrum bands.⁶ In many cases, actions to improve government efficiencies have enabled the creation of new commercial spectrum allocations that are essential to meet the ever-growing needs of mobile broadband consumers. Given the overwhelming need for greater commercial access to spectrum, legislators and policymakers should explore all alternatives to achieving more efficient spectrum use by government users. Where inefficiencies within government use are identified, spectrum should be reallocated for exclusive commercial use or, at a minimum, be allocated for shared use.

Sprint encourages the Committee to recognize the many ways in which sharing can be accomplished. Intensive spectrum sharing among commercial operators has already been successfully implemented in the CMRS bands. Carriers in these bands often hold licenses for the same frequencies in adjacent markets ('geographic sharing') and coordination is used effectively to minimize the risk of or mitigate interference at their common borders. Carriers also have experience reusing spectrum within

³ For example, unlicensed allocations can be effective in circumstances in which advanced interference management technology permits numerous parties to access the same spectrum bands at essentially the same time.

⁴ President's 2014 Budget proposal at 67 *available at* <http://www.gpo.gov/fdsys/pkg/BUDGET-2014-BUD/pdf/BUDGET-2014-BUD.pdf>; President's 2006 Budget Proposal at 330, *available at* <http://www.gpo.gov/fdsys/pkg/BUDGET-2006-PER/pdf/BUDGET-2006-PER.pdf>.

⁵ Federal Spectrum Incentive Act of 2013, H.R. 3673, 113th Cong. (2013).

⁶ Commercial Spectrum Enhancement Act, Pub. L. No. 108-494, 118 Stat. 3986, Title II (2004) (codified in various sections of Title 47 of the United States Code) ("CSEA"), § 202 (codified at 47 U.S.C. § 923(g)(2)).

their own licensed bands to ensure their user devices do not cause interference with each other (‘time’ and ‘frequency sharing’). Indeed, the entire ‘cellular’ architecture is predicated on the principle of users sharing and reusing spectrum resources through “interference-limited” cellularized frequency reuse and network design principles.

Under the Act, the FCC already has significant authority in overseeing sharing arrangements and interference mitigation techniques. This experience will be brought to bear on the 1,000 MHz of spectrum the Secretary of Commerce has directed federal spectrum users to identify for shared use.

4. Q: What steps can be taken to increase the amount of commercially available spectrum?

Congress, the Administration, and the FCC should continue to look at ways to increase the amount of commercially available spectrum for mobile broadband use. Forecasts indicate that mobile broadband data consumption will continue to grow at significant rates for the foreseeable future.⁷ While mobile broadband operators can address some of that growth through more efficient technologies, such as LTE and Advanced LTE, and through continued expansion of their existing networks, additional commercial spectrum allocations will also be needed.

Spectrum availability is only the first step in bringing competitive offerings of wireless broadband services to consumers. As policymakers focus on making more spectrum commercially available, they should recognize the distinguishing features among bands (including propagation characteristics associated with low/mid/high frequency spectrum) that affect their *utility* for specific commercial uses, such as wireless broadband networks. FCC decision-making should reflect a recognition and understanding of this varying utility and promote outcomes that enable all carriers to obtain the mix of spectrum bands they need to engage in sustainable long-term competition to spur the innovation that drives new and more efficient services and thereby benefits consumers. Simply making spectrum available, without adequate consideration of the competitive impact of the allocation, its timing,

⁷ Cisco, *Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2013-2018* (Feb. 5, 2014), available at http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white_paper_c11-520862.pdf.

or the context of the allocation in relation to adjacent bands (with potentially conflicting operations), is not enough; the Commission should take all of the above factors into account in making additional spectrum resources available for commercial broadband use. Congress should make sure the Commission has the authority and clear overall policy direction to pursue these goals and in doing so promote optimal and efficient use of this vital public resource. The people of the United States own the nation's spectrum resources and the FCC should manage this limited but essential resource pursuant to Congress' enlightened direction.

A salient historical example starkly exemplifies the importance of allocation decisions shaping 'available' spectrum. In making cellular spectrum available for commercial use, the FCC split the initial 745 licenses between two entities in each market. With a sanctioned duopoly, wireless services and innovation languished. Coverage was spotty, handsets were enormous, call-quality was lackluster, and the service was prohibitively expensive for most Americans. It was the wisdom of Congress, in directing the FCC to conduct competitive PCS auctions in the mid-1990s that guided the FCC to create an auction structure that for the first time promoted real wireless competition.⁸ The result: a robustly competitive wireless industry, with tremendous growth in devices, network technology, and coverage, with lower prices for consumers.

The overall state of competition within the wireless industry must also be considered when considering the "availability" of spectrum. Effective competition promotes investment and innovation and ensures continual improvement in service quality and better values for all consumers and businesses which increasingly depend on wireless services. In making additional spectrum available for commercial use, Congress should recognize and reinforce that the FCC has an enduring duty to prevent inordinate concentration of spectrum holdings, particularly spectrum that has a disproportionate impact on competition because of its scarcity and/or advantageous propagation characteristics (for instance, highly valuable low-band spectrum within the mobile broadband market).

⁸ Omnibus Budget Reconciliation Act of 1993, Pub. L. No. 103-66, § 6002 (1993).

5. Q: Should the Act permit the FCC to use expected auction revenue as the basis for a public interest finding? What criteria should the FCC consider as part of its analysis?

Section 309(j)(7) appropriately prohibits the FCC from making a “finding of public interest, convenience, and necessity on the expectation of Federal revenues from the use of a system of competitive bidding”. While FCC auction policies were adopted as a means to assign licenses to parties who place the highest value on the particular spectrum band offered in a particular auction, thereby ensuring meaningful compensation for this valuable public resource, maximizing auction revenues should not be the only or even a primary objective. Because of the enormous benefits of effective wireless industry competition for the economy and for U.S. businesses and consumers and the importance of public safety, the public interest is not served by limiting the FCC’s consideration to auction revenue generation. It is axiomatic that the auction of a monopoly license could generate the greatest amount of revenue; the corresponding (and long-term) harms to consumer welfare, however, significantly outweigh the potential short-term revenue benefits.

6. Q: Should all FCC licenses be flexible use? In what instances should the FCC exercise control over the service offered? How can the Act enable better use of spectrum, either flexible or specified?

The FCC’s flexible use policies have fostered aggressive competition on price, performance, and capacity, especially when compared to nations that have pursued less flexible, single-technology licensing approaches. Under existing statutory authority, the FCC implemented flexible use policies that promoted wireless innovation leading to a rapid evolution of broadband services for U.S. consumers. However, not every spectrum band should be licensed under these policies. Promoting flexible use does not supersede the FCC’s obligation to make allocation and licensing decisions in a manner that avoids harmful interference among services. Notably, the principle of promoting increased flexibility must be bounded by the countervailing priority of ensuring that flexible operations in one allocation do not undermine or threaten operations in neighboring bands.

7. Q: What principles should Congress and the FCC consider when addressing spectrum aggregation limits? How has the converging marketplace and growing demand for services changed the discussion of spectrum aggregation?

The purpose of the FCC's spectrum holdings policies is to ensure that in the context of a particular spectrum acquisition, competing firms retain the ability to swiftly and effectively enter the market or expand output in mobile broadband services in response to another firm's attempt to exercise market power. Given the exponentially increasing demand for ubiquitous and data intensive use of wireless spectrum, the FCC must revise its spectrum holdings policies to reflect the competitive utility of low, mid, and high frequency spectrum bands. The varying propagation characteristics of these bands directly and significantly affect the ability, timeliness, and even feasibility of wireless operators' deployments to meet marketplace demand.

The FCC must also take into account the scarcity of low band spectrum and consider the long-term consequences of the current concentration of low-band licenses in the two largest carriers. The FCC's stewardship role of overseeing the distribution of this public resource should be guided by the rapid market changes that have occurred since the last revision of the Spectrum Act. As an independent expert agency on spectrum, the FCC's authority and discretion in revising its spectrum holdings policies must be maintained to adapt to these changes.

8. Q: Should the Act promote competitive and efficient use of spectrum through build out requirements? How effective is the current Act in doing so? How effectively has the FCC used the tools at its disposal to encourage competition?

The FCC has abundant statutory authority to modify wireless license services rules and performance requirements after the licenses are issued, even when they are assigned pursuant to competitive bidding. The FCC must continue to review the performance requirements for each licensed service and eliminate unwarranted regulatory disparities among service rules and spectrum bands. Failure to do so will create uncertainty as federal government spectrum users evaluate plans to share or relocate their active operations to make additional spectrum available for commercial use.

The FCC should harmonize broadband build-out obligations across bands used to provide wireless broadband services to ensure that all spectrum licensees have the same basic obligation to deploy broadband services to the American public as expeditiously as possible. The FCC, for example, should rationalize the various substantial service deadlines in the different commercial broadband spectrum bands to develop a common service deployment goal for all bands. The present build-out deadlines have little rational relationship to either the capacity to provide broadband services using the spectrum, or to the national imperative of deploying robust broadband service to the public as rapidly as possible.

9. Q: With regard to receiver standards, what is the best balance between mitigating interference concerns and avoiding limiting flexibility in the future? Can engineering and forward-looking spectrum strategies account for the possibility of unanticipated technologies and uses in adjacent spectrum bands? How do we promote flexibility without unreasonably increasing the cost of services and devices? Does the Act provide the FCC tools to address this problem?

Given the exploding demand for data intensive uses of spectrum, Congress should clarify that the FCC has the authority to adopt policies to mitigate harmful interference among and between spectrum bands, including through adopting receiver standards. All commercial mobile carriers recognize their responsibility to cost effectively design their transmitters and receivers in a manner that avoids interfering with—or receiving interference from—adjacent spectrum users. Indeed, the National Broadband Plan criticized the Commission’s spectrum policy for failing to make incumbent licensees absorb the opportunity costs of their use of spectrum. “The result,” the Plan concluded, “can be inadequate consideration of alternative uses, artificial constraints on spectrum supply and a generally inefficient allocation of spectrum resources.”⁹

However, there are rare instances where certain radio devices, either by design or defect, receive unwanted emissions that diminish the device’s capabilities. To address these “outlier” cases, the FCC should have full legal authority to develop, implement, and enforce receiver performance standards

⁹ Federal Communications Commission, “Connecting America: The National Broadband Plan,” at 82 (rel. March 16, 2010), *available at*: <http://download.broadband.gov/plan/national-broadband-plan.pdf> (“National Broadband Plan”).

relative to their potential to receive harmful interference from nearby spectrum transmissions to ensure that the FCC's spectrum allocation and licensing decisions can effectuate the public interest goals that underlie them.

10. Q: What role should NTIA play in the licensing and management of spectrum? Is their current role appropriate and necessary, given the potentially duplicative functions of the FCC and NTIA in spectrum allocation and assignment?

Sprint recognizes the important dual roles of NTIA and the FCC in the management of spectrum. We support greater dialogue on ways to encourage improvements in coordination, transparency, efficiency, and public participation in the conduct of the respective allocation and assignment activities of NTIA and the FCC.

Conclusion

Sprint appreciates the opportunity to participate in the Committee's focused inquiry on spectrum allocation, regulation, and licensing as it examines the Communications Act of 1934, as amended. We look forward to working with the Members and staff of the Committee as it continues to promote sustainable competition in the wireless industry, for the benefit of American businesses and consumers.

T-MOBILE USA, INC. RESPONSE TO HOUSE WHITE PAPER ON MODERNIZING U.S. SPECTRUM POLICY

T-Mobile USA, Inc. (“T-Mobile”)^{1/} submits the following response to the White Paper released by the House Committee on Energy and Commerce (“Committee”) on April 1, 2014, seeking comment on modernizing U.S. spectrum policy, as a part of the Committee’s ongoing efforts to reform the Communications Act of 1934, as amended (the “Act”).^{2/}

I. INTRODUCTION

As the fourth largest wireless carrier in the United States, T-Mobile, including the MetroPCS brand, offers nationwide wireless voice, text, and data services to approximately 46.7 million subscribers and provides products and services through over 70,000 points of distribution.^{3/} T-Mobile is the fastest growing wireless company today, with its 4G Long-Term Evolution (“LTE”) network now reaching 210 million people in 273 metropolitan areas.^{4/} We are planning on upgrading our 2G/EDGE network and expect that our 4G LTE will reach more than 250 million people by the end of next year.^{5/}

^{1/} T-Mobile USA, Inc. is a wholly-owned subsidiary of T-Mobile US, Inc., a publicly traded company.

^{2/} See House Committee on Energy and Commerce, *Modernizing the U.S. Spectrum Policy* (Apr. 1, 2014) (“White Paper”), available at <http://energycommerce.house.gov/sites/republicans.energycommerce.house.gov/files/analysis/CommActUpdate/20140401WhitePaper-Spectrum.pdf>; 47 U.S.C. § 151 *et seq.*

^{3/} See T-Mobile News Release, *T-Mobile US Reports Fourth Quarter and Full Year 2013 Results and Third Consecutive Quarter of Over One Million Net Customer Additions* (Feb. 25, 2014), available at <http://newsroom.t-mobile.com/phoenix.zhtml?c=251624&p=irol-newsArticle&ID=1903058&highlight=>. As of the end of 2013, T-Mobile added more than 4.4 million total customers, and we expect to add between two to three million in post-paid subscribers in 2014. See *id.*

^{4/} See T-Mobile News Release, *T-Mobile Celebrates 1st Anniversary of LTE Rollout By Launching Major Network Upgrade Program* (Mar. 13, 2014), available at <http://newsroom.t-mobile.com/phoenix.zhtml?c=251624&p=irol-newsArticle&ID=1908666&highlight=> (noting that T-Mobile’s efforts have resulted in the fastest LTE deployment the U.S. has ever seen).

^{5/} See *id.*

T-Mobile applauds the Committee's efforts to examine how the Communications Act may be reformed to better reflect current market and technological conditions. T-Mobile provided feedback in response to the Committee's initial White Paper and focused its response on spectrum matters.^{6/} Indeed, many of the topics T-Mobile raised in its initial submission are covered by the Committee's questions in the latest White Paper. Among other things, T-Mobile suggested that the Commission must be able to continue to address spectrum use in a way that promotes competition and innovation, including by assessing the amount and type of spectrum that providers hold. Specifically, T-Mobile stressed that Congress must retain the FCC's authority to auction spectrum and its authority to impose limits on the amount and type of spectrum that providers can acquire through auctions and secondary market transactions in order to prevent market dominance. In addition, T-Mobile recommended that Congress provide, in a separate service-neutral Title, sufficient authority for the Commission to promote how spectrum should be utilized to ensure its best and highest use, including by requiring, where appropriate, the adoption of new technologies to replace inefficient and outdated systems.

T-Mobile is grateful for the opportunity to now provide more detailed responses to the Committee's questions about spectrum. As T-Mobile suggests below, in order to recognize the central role that spectrum plays in our telecommunications ecosystem, legislation should, among other things:

- Establish an organization within the FCC (a Bureau, under the current structure) that focuses exclusively on spectrum matters;
- Provide tools for the more effective management of federal spectrum, including requiring agencies to pay reasonable fees for their spectrum use and justify their spectrum

^{6/} See T-Mobile USA, Inc. Response to House White Paper on Modernizing the Communications Act (filed Jan. 31, 2014) ("T-Mobile White Paper #1 Comments"), *available at* http://energycommerce.house.gov/sites/republicans.energycommerce.house.gov/files/analysis/CommActUpdate/WP1_Responses_91-100.pdf.

requirements and providing agencies with incentives to use spectrum more efficiently, so that it may be reallocated for commercial use where appropriate;

- Ensure that the FCC has the ability to manage spectrum in a manner that results in the reallocation of spectrum from outdated or simply less valuable operations to new, innovative, and more valuable services and to provide incentives to licensees to repurpose spectrum to use new technology; and
- Retain the ability to auction spectrum, including spectrum reallocated by the FCC from incumbent licensees such as broadcasters, and impose spectrum aggregation limits.

By taking these and the other actions that T-Mobile proposes below, Congress will help ensure that carriers are provided with the tools they need to facilitate an innovative and competitive mobile services marketplace.

II. RESPONSE TO WHITE PAPER QUESTIONS

A. White Paper Question No. 1 – Structural Changes at the FCC.

Recognizing that the industry has experienced convergence, the White Paper points out that the current licensing structure at the FCC, which is housed in disparate bureaus, may no longer be the most efficient or appropriate method to maximize spectrum use.^{7/} It therefore seeks comment on what, if any, structural changes should be made to the FCC to promote efficiency and predictability in spectrum licensing.

T-Mobile agrees that the FCC's current organizational structure may no longer be appropriate. As T-Mobile previously noted, Title I of the Act creates the FCC and sets forth detailed provisions regarding its composition.^{8/} While a re-written Act need not specify Commission organization, the FCC should be structured around functional responsibilities. In particular, T-Mobile supports the creation of a new organizational structure at the FCC to address spectrum issues. Under the Commission's current configuration, this could involve the

^{7/} See White Paper at 2.

^{8/} See T-Mobile White Paper #1 Comments at 8; 47 U.S.C. § 154.

creation of a Bureau that would, among other things, perform the functions of licensing, establishing technical rules, and otherwise regulating spectrum use.

While there are admittedly differences in the licensing of, for example, wireless, broadcast and satellite facilities, there are also basic radiofrequency characteristics common to all services. It would be efficient for the Commission to take a more standardized approach to applications for spectrum-based services, so that it could use the same engineering and legal expertise across all services. A single organization that performs licensing functions would be able to make more uniform application of the type of information required to obtain authorizations across services, benefiting the public and potentially streamlining Commission actions. A single licensing organization with a uniform spectrum authorization approach will also enable the Commission to manage all spectrum more efficiently, including potential reallocation of licensed spectrum, regardless of how the spectrum is used. Doing so will promote an efficient and comprehensive approach to spectrum management, ultimately enabling more intense use of scarce spectrum resources.

B. White Paper Question No. 2 – The Role of Unlicensed Spectrum.

The White Paper asks about the role unlicensed spectrum should play in the wireless ecosystem, including how unlicensed spectrum should be allocated and managed.^{9/} As T-Mobile has explained, exclusively licensed spectrum provides carriers with more certainty than unlicensed spectrum, allowing providers to engage in more precise network planning and to make the most efficient use of spectrum.^{10/} Without the certainty that licensed spectrum offers, carriers may not be willing to make the investment required in a particular frequency band,

^{9/} See White Paper at 2-3.

^{10/} See Comments of T-Mobile USA, Inc., GN Docket No. 12-354, at 4 (filed Feb. 20, 2013) (“T-Mobile 3.5 GHz Comments”).

driving economic growth and satisfying consumer and business demands. Robust commercially licensed spectrum must therefore be the focus for satisfying customer demand for network capacity.

However, spectrum for licensed and unlicensed operations are both important, and indeed complementary, assets for providers.^{11/} Carriers like T-Mobile make effective use of unlicensed spectrum for, among other things, traffic offloading. In fact, T-Mobile has had a long history of using unlicensed spectrum.^{12/} From the launch of a nationwide Wi-Fi hotspot network, to the early incorporation of Wi-Fi into handsets, to being the only major carrier to provide Wi-Fi-based calling, unlicensed spectrum has been and continues to be an important tool in the T-Mobile spectrum toolkit. Thus, there should continue to be sufficient capacity for unlicensed technologies as well.

Several factors are relevant in determining the proper mix of spectrum available for licensed and unlicensed use. First, as T-Mobile and others have pointed out, frequencies below 3 GHz are particularly well suited for mobile operations and therefore should be prioritized for clearing and exclusive commercial use on a licensed basis.^{13/} Other frequencies, either because

^{11/} As T-Mobile noted in the Commission's proceeding governing the 3550-3700 MHz band, carriers can play a critical role in opening a band that is used for both licensed and unlicensed operations. The ability to use licensed spectrum will drive carrier investment in a band which will help develop a market for infrastructure and customer equipment capable of using unlicensed spectrum in the same band. See Letter from Russell H. Fox, Mintz, Levin, Cohn, Ferris, Glovsky and Popeo, P.C., Counsel to T-Mobile US, Inc., to Marlene H. Dortch, Secretary, FCC, WT Docket No. 12-354 and WT Docket No. 12-269, at Attachment at 2 (filed Apr. 16, 2014).

^{12/} See T-Mobile 3.5 GHz Comments at 4.

^{13/} See Comments of T-Mobile USA, Inc., Docket No. OSTP-2014-0002-0001, at 5-6 (filed Mar. 20, 2014) ("T-Mobile OSTP Comments"), available at http://www.whitehouse.gov/sites/default/files/microsites/ostp/rfi_responses_-_fr_doc._2014-03413_filed_2-14-14_all.pdf; see also *Connecting America: The National Broadband Plan*, at 84 (2010) ("*NBP*"), available at <http://www.broadband.gov/plan/> (targeting the frequencies between 225 MHz and 3.7 GHz for mobile broadband services); Department of Defense, *Electromagnetic Spectrum Strategy 2013: A Call to Action*, at 2 (2013), available at <http://www.defense.gov/news/dodspectrumstrategy.pdf> (acknowledging that lower frequencies are necessary for mobile communications).

of their physical properties or because of other constraints, such as conditions related to sharing the spectrum, may not be as suitable for accommodating mobile wireless technologies and therefore may be more appropriate for unlicensed operations. Second, licensed spectrum satisfies different needs than unlicensed spectrum. Only spectrum to which carriers have exclusive access can provide the quality of service that customers expect and on which they rely. That same quality of service may not be as critical for applications that may be able to use unlicensed spectrum. Indeed, Congress has recognized these facts by requiring the Commission to develop unlicensed operations in the 5 GHz band.^{14/} The Act should not permit the Commission to unnecessarily attempt to circumvent this direction and permit spectrum designated for licensed use to *also* be employed for unlicensed operations. The Commission should not dilute the value of licensed spectrum by attempting to satisfy multiple competing demands and allowing unlicensed applications in those frequencies.

C. White Paper Question No. 3 – Efficient Use of Spectrum By Federal Entities.

The White Paper notes that spectrum sharing between federal and non-federal users is one proposed technological solution that addresses the issue of spectrum scarcity and encourages efficiency.^{15/} However, as the White Paper also recognizes, entities such as T-Mobile have suggested that clearing unused or underused federal spectrum for exclusive commercial use is a vital part of any strategy for maximizing spectrum resources.^{16/} Consequently, the White Paper seeks comment on what should be done to encourage efficient use of spectrum by federal users.

^{14/} See 47 U.S.C. § 1453.

^{15/} See White Paper at 3.

^{16/} See T-Mobile OSTP Comments at 15; *see also, e.g.*, Letter from Steve Largent, CTIA – The Wireless Association®, to Tom Power, Deputy Chief Technology Officer, Telecommunications, Office of Science and Technology Policy, at 1-3 (filed Mar. 20, 2014), *available at* http://www.whitehouse.gov/sites/default/files/microsites/ostp/rfi_responses_-_fr_doc._2014-03413_filed_2-14-14_all.pdf; Letter from Rebecca Murphy Thompson and C. Sean Spivey, Competitive

T-Mobile continues to support providing government spectrum users with incentives to vacate spectrum so that it may be available for commercial use. T-Mobile has proposed that one way by which federal agencies can be incentivized to maintain access only to the spectrum they need is to pay a more realistic fee for spectrum use.^{17/} While federal agencies currently pay a fee per spectrum assignment, this fee is fixed and fails to consider differences in spectrum values, which are affected by factors such as spectral location, bandwidth, and population coverage. T-Mobile has therefore recommended that federal spectrum user fees account for these differences and that, once spectrum is authorized for federal use, agencies should be subject to an annual review to ensure that spectrum does not lie fallow. Further, T-Mobile, as discussed in further detail below, has recommended that federal agencies be provided with broad access to funds outside the spectrum auction context for research and development activities.^{18/}

As the White Paper observes, legislation has been introduced in the House by Representatives Guthrie and Matsui – the Federal Spectrum Incentive Act of 2013 (H.R. 3674) – that would, in the context of offsetting sequestration-related funding reductions, offer federal spectrum users a portion of net auction revenues as an incentive for relinquishing spectrum. T-Mobile applauds Representatives Guthrie and Matsui for recommending this approach which could create a strong incentive for federal agencies to vacate their spectrum. However, other methods by which federal agencies are provided incentives must also be explored, including providing federal users with a portion of proceeds related to the spectrum they agree to vacate, outside of the sequestration funding-reduction process. As FCC Commissioner Rosenworcel

Carriers Association, to Tom Power, Office of Science and Technology Policy (filed Mar. 20, 2014), available at http://www.whitehouse.gov/sites/default/files/microsites/ostp/NSTC/rfi_responses_-_fr_doc._2014-03413_filed_2-14-14.pdf.

^{17/} See T-Mobile OSTP Comments at 3-10.

^{18/} See *id.* at 10-12.

recently noted, federal agencies must be provided not only with sticks, but with carrots to encourage more efficient spectrum use and relocation from spectrum that is not efficiently employed.^{19/}

D. White Paper Question No. 4 – Increasing Access to Commercial Spectrum.

Recognizing the enormous economic benefits of innovation spurred by access to commercial spectrum, the White Paper requests input on the steps that can be taken to increase the amount of commercially available spectrum.^{20/} As an initial matter, Congress should retain the FCC’s authority to auction spectrum, including spectrum held by existing FCC licensees, including broadcasters. The FCC has a successful history of repurposing spectrum, auctioning that spectrum, and relocating incumbent licensees.^{21/} That should continue to be a part of the Commission’s spectrum management strategy.

In addition, as noted above, federal users should be provided with incentives to use spectrum more efficiently, which will result in more spectrum becoming available for commercial use. In particular, Congress should establish a federal spectrum innovation fund unrelated to spectrum auctions that will promote research and development leading to federal users migrating to more spectrum-efficient systems. Federal entities currently receive funding

^{19/} See FCC News Release, *FCC Commissioner Jessica Rosenworcel on Presidential Memorandum Promoting Efficient Use of Spectrum by Federal Agencies*, at 1 (June 14, 2013), available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-321613A1.pdf.

^{20/} See White Paper at 3.

^{21/} See, e.g., FCC Auctions, Auction 66: Advanced Wireless Services (AWS-1), Fact Sheet (last visited Apr. 24, 2014), http://wireless.fcc.gov/auctions/default.htm?job=auCTION_factsheet&id=66 (explaining that the AWS-1 bands were used for a variety of government and non-government services and required relocating incumbent systems); FCC News Release, *Statement of Chairman Kevin J. Martin on the Conclusion of Advanced Wireless Services Auction*, at 1 (Sept. 18, 2006), available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-267473A1.pdf (noting that the auction of AWS-1 spectrum was “the biggest, most successful wireless auction in the Commission’s history”); see also FCC Auctions, Auction 71: Broadband PCS, Fact Sheet (last visited Apr. 24, 2014), http://wireless.fcc.gov/auctions/default.htm?job=auCTION_factsheet&id=71 (reporting that private and common carrier fixed microwave services had to be relocated from the band).

for relocation or sharing primarily through a Spectrum Relocation Fund (“SRF”) created by the Commercial Spectrum Enhancement Act of 2004 (“CSEA”).^{22/} While T-Mobile appreciates Congress’ efforts to increase the types of funding available to federal users through the Middle Class Tax Relief and Job Creation Act of 2012 (“Spectrum Act”),^{23/} this funding is still tied to the auction of spectrum.^{24/} As T-Mobile has proposed, Congress should amend the CSEA to provide agencies with expanded access to funds outside of the spectrum auction context because such funding will allow agencies to evaluate and develop new technologies to reduce their spectrum consumption and produce a “virtuous cycle” of reducing agencies’ overall spectrum costs and funding needs.^{25/} The fund can be created from a portion of spectrum auction revenues already available – approximately \$5.3 billion – or through separate appropriations. In either case, these funds should be made in addition to, and not as a substitute for, any relocation costs incurred by federal agencies. Making such resources available will produce two important long-term revenue generating benefits – more spectrum that can be auctioned for commercial use and less money spent by agencies in the future for spectrum assets.

E. White Paper Question No. 5 – The Consideration of Auction Revenues in the FCC’s Public Interest Analysis.

The White Paper asks whether the Commission should be permitted to base its determination of whether granting spectrum licenses serves the public interest, convenience, and

^{22/} See Commercial Spectrum Enhancement Act, Pub. L. No. 108-494, Title II, 118 Stat. 3986, (2004) (codified in various sections of Title 47 of the U.S. Code).

^{23/} See Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, 126 Stat. 156 (2012) (codified in various sections of Title 47 of the U.S. Code).

^{24/} See 47 U.S.C. § 928(c) (providing that funds “from auctions of eligible frequencies are authorized to be used to pay relocation or sharing costs . . . with respect to relocation from or sharing of *those frequencies*”) (emphasis added).

^{25/} See T-Mobile OSTP Comments at 11.

necessity on expected auction revenues.^{26/} It also seeks comment on the criteria the FCC should consider as part of the public interest analysis required under the Communications Act.

Revenues derived from spectrum auctions are rightly credited for creating win-win scenarios that increase the amount of spectrum made available for commercial wireless use while at the same time satisfying other public policy objectives. For example, as noted in the FCC's National Broadband Plan, auction revenues made available to federal entities through the SRF have been instrumental in facilitating the reallocation of the AWS-1 spectrum and making it available for commercial use.^{27/} Auction revenues also generate other benefits such as providing funding for the First Responder Network Authority and reducing the federal deficit, as contemplated by the Spectrum Act.^{28/}

Nevertheless, while auction revenues help accomplish such goals, the Act today properly recognizes that they alone should not drive auction design and the Commission's determination of what is in the public interest.^{29/} To the contrary, the FCC must take a broader view of the public interest and promote other important goals when it considers granting licenses. The Communications Act requires the Commission to "generally encourage the larger and more effective use of radio in the public interest" and to "promot[e] economic opportunity and competition and ensur[e] that new and innovative technologies are readily accessible to the American people by avoiding excessive concentration of licenses and by disseminating licenses

^{26/} See White Paper at 3.

^{27/} See *NBP* at 81 (finding that "Congress gave the FCC a powerful mechanism to encourage incumbent federal users to clear spectrum bands so that reallocated spectrum can be made available for commercial use").

^{28/} See 47 U.S.C. § 1457.

^{29/} See 47 U.S.C. § 309(j)(7)(B) (prohibiting the FCC from basing its decisions "solely or predominantly on the expectation of Federal revenues").

among a wide variety of applicants.”^{30/} As T-Mobile previously pointed out to the FCC, the Act today requires that auction design must necessarily be a careful balancing of all of the Commission’s statutory obligations.^{31/} An auction structure that makes high quality spectrum available and encourages a competitive environment can lead to increased auction revenues. Nevertheless, the Act must continue to direct the Commission to take these additional critical goals into consideration and not merely focus on revenues in designing auctions and evaluating whether grants of particular applications are in the public interest.

F. White Paper Question No. 6 – Commission Management of Spectrum and Technical Flexibility.

The White Paper requests input on the FCC’s processes for managing spectrum use.^{32/} Specifically, it asks whether all FCC licenses should be flexible-use authorizations that permit licensees to use their spectrum for any service. The White Paper also asks whether the Commission should exercise control over services offered in certain instances and, more broadly, how the Communications Act can better enable the use of spectrum.

T-Mobile supports making spectrum use as flexible as possible so long as such flexibility will not affect, and the rules will protect, other potentially affected licensees, such as co-channel and adjacent-channel licensees. The Commission should also continue to avoid specifying particular technologies for spectrum it licenses so that it does not lock in outdated technologies. New technologies are being developed every day and while one technology may be the favored

^{30/} See 47 U.S.C. §§ 303(g), 309(j)(3).

^{31/} See Letter from Thomas J. Sugrue, Senior Vice President, Government Affairs, T-Mobile, to Julius Genachowski, Chairman, FCC, *et al.*, WT Docket No. 12-269, at 10, n.51 (filed May 7, 2013) (“T-Mobile May 2013 Response to AT&T”).

^{32/} See White Paper at 3-4.

standard of today, it may be supplanted in the future.^{33/} Technological mandates would hamstring innovation and development and would be contrary to the FCC's proven policy to preserve technical flexibility and refrain from imposing technical standards.^{34/} While there are occasions where the Commission has appropriately determined that unique market conditions require it to impose a technological requirement, that determination should be the exception and not the rule.^{35/}

On the other hand, as T-Mobile has suggested, the Commission must continue to have the tools to manage spectrum availability to ensure its best and highest use.^{36/} The Act must therefore ensure that the Commission, through its more general authority over competition, maintains the ability to manage spectrum in a manner that results in the reallocation of spectrum to more innovative and valuable uses. As noted above, the Commission should continue to have the authority to reallocate and auction currently licensed spectrum. The Act must also permit the Commission to promote efficient spectrum use across services, mandating, where appropriate, the adoption of new technologies or repurposing of spectrum so that inefficient, antiquated

^{33/} See T-Mobile White Paper #1 Comments at 2; Reply Comments of T-Mobile USA, Inc., GN Docket No. 13-185, *et al.*, at 20-21 (filed Oct. 28, 2013).

^{34/} See, e.g., *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 Mobile Services*, Sixteenth Report, 28 FCC Rcd. 3700, ¶ 120 (2013) (stating that “the Commission has adopted a general policy of providing licensees with significant flexibility to decide which services to offer and what technologies to deploy on spectrum used for the provision of mobile wireless services”); *Expanding Access to Broadband and Encouraging Innovation Through Establishment of an Air-Ground Mobile Broadband Secondary Service for Passengers Aboard Aircraft in the 14.0-14.5 GHz Band*, Notice of Proposed Rulemaking, 28 FCC Rcd. 6765, ¶ 101 (2013) (stating that the Commission “strive[s] to establish technology neutral rules that allow for competing technologies and changes in technology over time without the need to change our rules”).

^{35/} See *Promoting Interoperability in the 700 MHz Commercial Spectrum, et al.*, Report and Order and Order of Proposed Modification, 28 FCC Rcd. 15122 (2013).

^{36/} See T-Mobile OSTP Comments at 4.

systems do not continue to use spectrum that can better serve the public interest in other applications.

Similarly, the Commission should be reluctant to permit flexibility or allow a licensee to completely change the type of service for which it is authorized without a careful consideration of the impact on other licensees, such as co-channel and adjacent band interference. Licensees plan systems based on the rules that govern nearby licensees. It is difficult to engage in that planning if nearby licensees' service is unknown or may be materially changed. For example, while T-Mobile has supported repurposing Mobile Satellite Service ("MSS") spectrum for terrestrial mobile broadband use, it has cautioned that the Commission should take into account interactions between new and established services and ensure that the latter are protected from harmful interference.^{37/} The Commission must be sensitive to existing spectrum environments and strive to facilitate technical compatibility before it allows a use of spectrum that may be substantially inconsistent with that environment.

G. White Paper Question No. 7 – Spectrum Aggregation Limits.

Noting the complex history of the FCC's attempts to place limitations on spectrum holdings and its use of other tools to enhance competition in the wireless marketplace, the White Paper asks about the principles Congress and the FCC should consider when addressing spectrum aggregation limits.^{38/} T-Mobile strongly supports the Commission's continuing authority over spectrum aggregation, so that it may promote competition and satisfy other important goals specified in the Communications Act. Because competition ensures innovation

^{37/} See, e.g., Comments of T-Mobile USA, Inc., IB Docket No. 11-109 and ET Docket No. 10-142, at 2, 4 (filed Feb. 27, 2012).

^{38/} See White Paper at 4.

and other behavior that benefits consumers, the Commission should have the authority to use a variety of tools to promote it.

For example, T-Mobile has urged, in the FCC’s mobile spectrum holdings proceeding, that the Commission establish a cap on spectrum acquired during an auction, while continuing to use a spectrum “screen” for transactions, to ensure that all the available spectrum does not wind up in the hands of only a few carriers.^{39/} A cap at spectrum auctions would not only give effect to the Commission’s current statutory obligations, noted above, to “avoid excessive concentration of licensees” and to distribute licenses to “a wide variety of applicants”^{40/} – both of which should remain in the Act – but would also increase regulatory certainty, encouraging auction participation and resulting in increased auction revenues.^{41/}

In addition, T-Mobile has suggested that high- and low-band spectrum be treated differently for purposes of assessing permissible spectrum aggregation because differences in propagation characteristics, among other factors, make low-frequency spectrum more valuable than high-frequency spectrum for mobile service providers.^{42/} The Act should continue to provide the Commission with the ability to consider a variety of factors – including spectrum

^{39/} See, e.g., Comments of T-Mobile USA, Inc., WT Docket No. 12-269 (filed Nov. 28, 2012); Reply Comments of T-Mobile USA, Inc., WT Docket No. 12-269 (Jan. 7, 2013); T-Mobile May 2013 Response to AT&T.

^{40/} See 47 U.S.C. § 309(j)(3)(B).

^{41/} See Comments of T-Mobile US, Inc., WT Docket No. 13-135, at 14-18 (filed June 17, 2013) (“T-Mobile Wireless Competition Comments”).

^{42/} See Declaration of Mark McDiarmid at 2-3, *attached to*, Letter from Trey Hanbury, Hogan Lovells US LLP, Counsel to T-Mobile USA, Inc., to Marlene H. Dortch, Secretary, FCC, GN Docket No. 12-268 and WT Docket No. 12-269 (filed Apr. 1, 2014) (observing that “some of the characteristics of low-band spectrum . . . make this scarce resource uniquely valuable to mobile broadband network operators” and that “the predicted and observed differences between and low- and high-band signal propagation simply mean that a dearth of low-band spectrum imposes constraints on the ability of a wireless carrier to cost-effectively serve customers across multiple operating environments”); T-Mobile OSTP Comments at 5-7; T-Mobile Wireless Competition Comments at 18-20; Reply Comments of T-Mobile US, Inc., WT Docket No. 13-135, at 12-16 (filed July 25, 2013).

type – when prescribing spectrum aggregation limits. The Commission should similarly continue to have the authority to use a variety of other tools – *e.g.*, set-asides, bidding credits, and auction design – in order to enhance competition and achieve other public interest goals.

H. White Paper Question No. 8 – Build-Out Requirements.

The White Paper notes that the FCC promotes the efficient use of spectrum through build-out requirements and operating rules.^{43/} It asks how effective this method is and whether the Communications Act should continue to promote competitive and efficient use of spectrum in this manner.

Build-out rules and operating requirements are valuable tools by which the Commission can ensure that spectrum is put to use, and the Commission should have the continued authority to use them flexibly. Indeed, T-Mobile has long supported the implementation of build-out requirements as a means to spur deployment and prevent spectrum warehousing.^{44/} Build-out obligations may vary from band-to-band and service-to-service depending on, for example, the existence of incumbents and propagation characteristics. T-Mobile recently suggested that federal entities also be subject to similar showings.^{45/} However, build-out rules and operating requirements designed to ensure efficient use of spectrum alone are not sufficient to promote competition. Merely ensuring that spectrum is being used does not prevent anti-competitive behaviors that may result from excessive spectrum concentration.

As suggested above, the Commission should be authorized to use a variety of tools to more effectively manage spectrum. Specifically, in addition to using build-out requirements, the

^{43/} See White Paper at 4.

^{44/} See, *e.g.*, Comments of T-Mobile USA, Inc., WT Docket No. 12-357, at 7-8 (filed Feb. 6, 2013); Comments of T-Mobile USA, Inc., GN Docket No. 13-185, at 32-33 (filed Sept. 18, 2013).

^{45/} See T-Mobile OSTP Comments at 9.

Commission must have the continued authority to limit spectrum aggregation, including by adopting spectrum caps at auctions that account for differences in spectrum values.

I. White Paper Question No. 9 – Interference Issues and Receiver Performance.

The White Paper seeks comment on methods for mitigating interference while still allowing for flexibility in providing services.^{46/} Observing that some parties have proposed receiver performance standards as a potential solution to interference issues, the White Paper asks how Congress can promote flexibility without unreasonably increasing the cost of services and devices and whether the Act provides the FCC with tools to address this problem.

Managing interference between licensees and services must continue to be a core Commission function. Indeed, spectrum management is generally considered to have been the driving force behind the adoption of the Communications Act and its predecessor.^{47/}

Accordingly, T-Mobile supports the further assessment of mechanisms like the “harm claim thresholds” approach proposed by the Commission’s Technical Advisory Committee (“TAC”) to manage spectrum.^{48/} The TAC has recommended that the FCC adopt an interference limits policy approach to spectrum management, defining a radio environment in which receivers are expected to operate. Under this proposal, certain limits on in-band and out-of-band interfering signals would have to be exceeded before a radio system could claim that it is

^{46/} See White Paper at 4-5.

^{47/} See, e.g., Science and Technology Policy Institute, *A Review of Approaches to Sharing or Relinquishing Agency-Assigned Spectrum* (Jan. 2014), available at <https://www.ida.org/upload/stpi/pdfs/p5102final.pdf> (“The Communications Act of 1934 (Public Law 416-73) created the Federal Communications Commission (FCC) to control spectrum access by non-Federal users and assigned the President the authority to manage Federal spectrum use.”); see also 47 U.S.C. § 301 (“It is the purpose of this chapter, among other things, to maintain the control of the United States over all the channels of radio transmission.”).

^{48/} See Receivers and Spectrum Working Group, FCC Technological Advisory Council, *Interference Limits Policy: The Use of Harm Claim Thresholds to Improve the Interference Tolerance of Wireless Systems* (Feb. 6, 2013) (“TAC White Paper”), available at <http://transition.fcc.gov/bureaus/oet/tac/tacdocs/WhitePaperTACInterferenceLimitsv1.0.pdf>.

experiencing harmful interference.^{49/} These harm claim thresholds could be adjusted through a multi-stakeholder forum that includes representation from all interested parties, and manufacturers and operators would be left to determine whether and how to build receivers that can tolerate such interference.

T-Mobile believes this approach represents an appropriate balance between allowing for industry flexibility and encouraging enhanced receiver performance. As the TAC recognized, however, harm claim thresholds may not be appropriate in all circumstances. The TAC noted that they may be problematic in cases where licensees do not control the design, sale or operation of receivers, *i.e.*, where receivers are “decoupled” from licensees, such as in the television broadcast service.^{50/} In such situations, where it may not be feasible to create an effective harm claim threshold, Congress should confirm that the Commission has the authority to take the additional step of regulating receivers directly. Receiver regulation should not be the preferred approach, but may be necessary when other tools, such as the proposed harm claim threshold, are impractical.

J. White Paper Question No. 10 – NTIA’s Role in Spectrum Management.

Finally, the White Paper requests input on the role that NTIA should play in the licensing and management of spectrum.^{51/} T-Mobile suggests that NTIA remain the steward of federal spectrum holdings and maintain its oversight and management of such spectrum. As T-Mobile previously explained, the NTIA Organization Act granted to NTIA the authority to assign frequencies to federal agencies and to modify or revoke such assignments.^{52/} Federal agencies

^{49/} See TAC White Paper at 3.

^{50/} See *id.* at 34.

^{51/} See White Paper at 5.

^{52/} See T-Mobile OSTP Comments at 14; 47 U.S.C. § 902(b)(2)(A).

do not “own” their spectrum and thus should not be provided with greater rights to their authorizations, such as by granting them spectrum property rights. To the contrary, NTIA should take a more pro-active approach to managing federal spectrum in the same way as the FCC should continue to manage spectrum for non-federal operations. T-Mobile is encouraged by NTIA’s recent development of the spectrum.gov website, which shows federal operations in various spectrum bands.^{53/} That assessment should only be the beginning of the process by which NTIA evaluates whether federal spectrum should continue to be licensed as it is today.

Moreover, a comprehensive approach, which involves both NTIA and the FCC, is required to better manage spectrum and promote use of unemployed or underemployed assets. Congress should therefore further encourage more effective coordination and cooperation between NTIA and the FCC. While NTIA and the FCC have enjoyed a long history of coordinating spectrum planning activities,^{54/} each agency remains committed to its own goals and objectives. As the demand for spectrum capacity rises, it is imperative that both agencies work together to free up additional spectrum resources while protecting critical government missions. Creating a mechanism for more effective cooperation between NTIA and the Commission would lead to greater transparency and a better understanding of both agencies’ needs, allowing them to achieve this balance and better serve the public interest.

III. CONCLUSION

T-Mobile is encouraged by the actions the Committee has taken thus far to obtain information that may lead it to modernize the Communications Act in general and to update the Nation’s spectrum policies in particular. T-Mobile respectfully requests that Congress carefully

^{53/} See NTIA (last visited Apr. 24, 2014), www.spectrum.gov.

^{54/} See, e.g., Memorandum of Understanding Between the Federal Communications Commission and the National Telecommunications and Information Administration (Jan. 31, 2003), *available at* http://www.ntia.doc.gov/files/ntia/publications/fccntiamou_01312003.pdf.

consider T-Mobile's proposals above to ensure that our Nation's spectrum policies encourage competition and facilitate growth in the industry. T-Mobile looks forward to continuing to work with the Committee on these important matters.

April 25, 2014

Response to Request for Comments by the House Energy and Commerce Committee and Communications and Technology Subcommittee on the Update to the Communications Act

April 24, 2014

Introduction: The Taxpayers Protection Alliance (TPA) is very interested and concerned as to how Congress will be looking to make changes regarding communications policy and how those changes will impact the Federal Communications Commission (FCC) and the issue of government-owned spectrum. There is no doubt that taxpayers, consumers, and businesses will be impacted by how the committee, Congress, and the FCC proceed. That being said, it is important to take into account where all stakeholders stand on these debates. TPA is a 501 (c)(4) organization that represents the interests of millions of American taxpayers across the country and as such we feel compelled to submit comments that expressly states recommendations to two questions posed in the recent white paper issued by the committee regarding these issues.

Question#4: What other steps can be taken to increase the amount of commercially available spectrum?

TPA Response: TPA believes that the best way to achieve this is to make more spectrum available through auctions. The last auction was held in February 2012 and the next is on hold for now. The auction process should proceed as soon as possible and it should be open for all to participate in without any preferential treatment to pick or choose winners in the bidding. Experts estimate that, over the next decade, spectrum auctions will net the U.S. Treasury at least \$20 billion in revenue. We simply cannot ignore the positive impact that an open-auction process would have on the economy. The open-auction process is the best route to take if the FCC wants to encourage more commercially available spectrum and they should reject any calls for a restrictive auction process that hinders participation by any interested party.

Question #5: Should the Act permit the FCC to use expected auction revenue as the basis for a public interest finding? What criteria should the FCC consider as part of its analysis?

TPA Response: The criteria TPA looks at is whether or not spectrum sales are good for taxpayers and the economy. The FCC holds the key and it is important to realize that spectrum is readily available and just waiting to be used in the marketplace by businesses looking to satisfy the needs of consumers. Once a private sector obtains new spectrum, it's in their best interest to turn around and use it in a way that best meets customer's demands. From personal to commercial use, an expanding and thriving economy will rely more and more on the wireless industry and spectrum to deliver those services. By holding onto unused spectrum, the FCC is denying taxpayers and the economy valuable resources.

Conclusion: Taking into account all of the positive aspects of freeing more government-owned spectrum and allowing an open-auction to take place, there is simply no reason why Congress and the FCC can't move forward on the issues addressed in this comment. Allowing the private sector to take ownership of more spectrum is the best way to encourage innovation and benefit taxpayers and consumers. TPA is aware there will be more hearings on this issue in the coming months, but we urge swift action to make these potential positive impacts, as noted in this comment, a reality.

Thank you for this opportunity to weigh in on this important issue.



David Williams
President



April 25, 2014

The Honorable Greg Walden
U.S. House of Representatives
2182 Rayburn House Office Building
Washington, DC 20515

The Honorable Anna Eshoo
U.S. House of Representatives
241 Cannon House Office Building
Washington, DC 20515

Dear Chairman Walden and Ranking Member Eshoo:

The Telecommunications Industry Association (TIA), the leading trade association for global manufacturers, vendors, and suppliers of information and communications technology, wishes to thank you for your efforts towards updating and modernizing the Communications Act.

Please find attached TIA's responses to the questions asked in the spectrum policy white paper released by the Energy and Commerce Committee on April 1. Please also find attached a TIA white paper on Spectrum Sharing Research and Development, released last December.

We look forward to working with you on this important issue. For more information, please contact Danielle Coffey at (703)-907-7734 or by email at dcoffey@tiaonline.org.

Sincerely,

A solid black rectangular box redacting the signature of Grant E. Seiffert.

Grant E. Seiffert
President

Enc.: (1) TIA responses to questions in House E&C white paper on spectrum policy
(2) TIA white paper – Spectrum Sharing Research and Development



Telecommunications Industry Association
Modernizing U.S. Spectrum Policy
Responses to Questions from the House Energy and Commerce Committee
April 25, 2014

Radio spectrum has never before been more important. In commercial communications networks, mobile data use is exploding as consumers embrace smartphones, tablets and other devices. Wireless connectivity is becoming the way in which consumers access the Internet from technologies such as LTE, Wi-Fi and satellite. The government also has a significant dependency on spectrum for both communications and non-communications purposes.

Meanwhile, radio technologies themselves are changing, placing new demands on spectrum allocations, and raising new operational and regulatory challenges. As a result of these dynamic changes, spectrum allocations and uses that met the country's needs during the 20th century are increasingly under stress.

However, U.S. policymakers are no longer writing spectrum policy on a blank sheet of paper, and virtually all spectrum suitable for mobile service has been allocated. For that reason, TIA believes that a national spectrum policy must reflect the following principles to allow the nation's use of radio spectrum to evolve to meet changing demand and promote innovation:

- *Predictability.* Spectrum allocations need to be predictable. Identifying demand and changes in demand, understanding the pace of radio technology development by platform, and long term planning are all essential parts of a spectrum policy that can provide predictability for both commercial and government users.
- *Flexibility.* For commercial allocations, flexible use policies consistent with baseline technical rules that are technology-neutral have proven to be the best approach. Government allocations of spectrum should be better managed to ensure better usage of scarce spectrum resources for all users.
- *Efficiency.* Policies should encourage more efficient use of spectrum where technically and economically feasible. Cleared, exclusively licensed spectrum allows for the most efficient and dependable use of spectrum for commercial mobile broadband deployment.
- *Priority.* In cases where spectrum sharing is technically and economically possible, policies must advance good engineering practice to best support an environment that protects those with superior spectrum rights from harmful interference.

TIA has long-advocated for realizing the broadly-expressed national policy goal of making more spectrum available for commercial use. This will create hundreds of thousands of jobs for Americans while improving U.S. technological competitiveness. It will enable the mobile

industry to meet the demand for high-speed wireless applications, and will help drive the U.S. economy, both near-term and long-term.

1. The FCC is responsible for licensing spectrum for a number of services, including public safety, fixed and mobile wireless, broadcast television and radio, and satellite. Although many of the processes are the same among these services, the licensing authority is housed in disparate bureaus. What structural changes, if any, should be made to the FCC to promote efficiency and predictability in spectrum licensing?

Congress need not, and should not, dictate the internal organizational structure of the FCC. The Communications Act wisely grants significant discretion to the Commission itself to organize the agency in a manner best suited to achieve the statutory objectives established by Congress.¹ For example, the former Mass Media and Cable Bureaus were merged into one Media Bureau in 2002, reflecting the commonalities in the underlying approach to content delivery.² The Public Safety and Homeland Security Bureau was created in 2006 to help the agency better fulfill its national security obligations under the existing Communications Act.³

Future revisions to the Communications Act may lead to an eventual restructuring within the agency to better align with its revised statutory objectives. However, hard-wiring an organizational structure into the Act itself, even if seemingly a “modernizing” reform by today’s standards, will limit the agency’s ability to adapt to a rapidly evolving communications industry and new technologies through re-structuring in the future.

2. What role should unlicensed spectrum play in the wireless ecosystem? How should unlicensed spectrum be allocated and managed for long-term sustainability and flexibility?

Unlicensed spectrum should continue to play a very important role in the wireless ecosystem. Opening spectrum to unlicensed services has undoubtedly led to great innovations, including microwave ovens, cordless phones, garage door openers, sensors, and perhaps the most important innovation, Wi-Fi. This ecosystem of unlicensed operation has been an important ingredient in facilitating next-generation technologies and maintaining U.S. leadership in ICT innovation. It has also helped mobile operators cope with exploding demand, since Wi-Fi is virtually omnipresent in consumer devices such as smartphones and tablets.

However, a one-size-fits-all approach to “the role of unlicensed spectrum” is not appropriate. To begin with, spectrum bands under consideration for unlicensed will not have the same propagation characteristics, and particular bands may lend themselves to support certain types of

¹ See Communications Act of 1934 § 5(b) [47 U.S.C. § 155(b)].

² See Order, *Establishment of the Media Bureau, the Wireline Competition Bureau and the Consumer and Governmental Affairs Bureau*, FCC 02-10 (rel. March 14, 2002), available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-02-10A1.pdf

³ See Order, *Establishment of the Public Safety and Homeland Security Bureau*, FCC 06-35 (rel. Sep. 25, 2006), available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-06-35A1.pdf

services. Also, the incumbent users of a band as well as adjacent bands can impact the types of unlicensed operations that can successfully occur. Indeed, spectrum policy is not being written on a blank slate – incumbent users exist in many bands used today and under consideration for future use by unlicensed devices.

The choice of a band management plan is therefore dependent upon several factors, including:

- *A band's physical propagation characteristics.* For example, higher frequencies may lend themselves to short range coverage (e.g., Wi-Fi “hotspots”) while lower frequencies are considered to be more efficient for large area coverage.
- *The nature of incumbent or nearby users.* Avoiding harmful interference is important, and unlicensed operations may pose (for example) different enforcement challenges vs. co-existence with users having controlled or managed access to spectrum.
- *The proposed unlicensed use or uses.* For some proposed uses, the need for assured quality of service may be a factor, or else statutory and regulatory mandates such as public safety / 911 requirements may apply.

Both Congress and the FCC have wisely considered many of these factors in their approaches to spectrum management. For example, the 2012 Spectrum Act required licensing of the 600 MHz band while encouraging the FCC to open more spectrum for unlicensed operations in the 5 GHz bands. (TIA has supported both aspects of the 2012 Spectrum Act as sound policy decisions that reflect the various factors above.)⁴ Moreover, the FCC is beginning to experiment with a tiered approach to spectrum access in the 3.5 GHz band utilizing a geo-location database as a means to manage spectrum access among the tiers of users/services and provide interference protection, as required.⁵

Management approaches. Where spectrum is opened to unlicensed uses, multiple tools are available to policymakers to ensure the unlicensed uses can be maximized. These include:

- A “*pure commons*” approach, such as at 2.4 GHz where devices may use spectrum subject to only the most limited of emissions rules;
- A “*spectrum sensing*” approach, such as is used in some bands at 5 GHz to enable unlicensed operations to co-exist with an incumbent;
- *Database-driven approaches*, such as that used for “white spaces” in the television broadcast bands.

⁴ Other examples of unlicensed use potentially include at 6.78 MHz and 900 MHz for industrial, scientific, and medical applications (ISM), Wi-Fi at 2.4 GHz, 5 GHz, or 60 GHz, and ultrawideband (UWB) operations above 6 GHz.

⁵ See Further Notice of Proposed Rulemaking, *Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band* (rel. Apr. 23, 2014) (“3.5 GHz FNPRM”), available at <http://www.fcc.gov/document/fcc-proposes-make-150-mhz-spectrum-available-broadband>

In the end, the choice of a band management plan or the use of particular approaches should be made to encourage more efficient uses of spectrum by all users. Forward-looking management of radio spectrum is essential to the goal of expanding telecommunications services and ensuring that the public derives maximum benefit from the use of spectrum, whether by its government, wireless operators, consumers or enterprises.

3. Spectrum sharing is one proposed technological solution that addresses the issue of spectrum scarcity and encourages efficiency. There are multiple ways to share spectrum, including geographic sharing, temporal sharing, and sharing through dynamic spectrum access. * However, [some] assert that spectrum sharing is only part of the solution ... and that clearing unused or underused federal spectrum for exclusive commercial use is a vital part of any strategy... *** What should be done to encourage efficient use of spectrum by government users?**

Spectrum Sharing

Spectrum “sharing” already exists in many forms today, including in licensed approaches whereby wireless carriers provide access to millions of customers using relatively narrow bands, or in unlicensed approaches such as Wi-Fi. Moreover, very different types of spectrum uses – from commercial wireless services, to military or medical applications, or scientific and deep space research – have been assigned by the FCC to share the same spectrum band.

Cleared spectrum is preferred for commercial mobile wireless. At the outset, TIA strongly supports the clearing and re-purposing of spectrum bands for commercial mobile broadband use to the maximum extent feasible. Where possible, cleared, exclusively licensed spectrum bands allow for the most efficient and dependable use of spectrum suitable for commercial mobile broadband deployment, and maximize network investment, marketability, availability and consumer use.

TIA supports recent efforts by the FCC, NTIA, and DoD. When incumbent uses make clearing infeasible, TIA supports consideration of sharing opportunities. As described above, TIA recognizes that for low-power technology such as Wi-Fi, shared spectrum use such as at 5 GHz is a very good option. The FCC’s recent actions in the 3.5 GHz band are another example of sharing approaches in a situation involving a federal incumbent. Licensed Shared Access (LSA) is one approach permitting sharing on a geographic, frequency, or time basis that holds promise to improve overall spectrum use efficiency.

Meanwhile, TIA has been encouraged by the recent work done by NTIA and the Department of Defense (“DoD”) to facilitate opening the 1755-1780 MHz band for commercial use, although work is still needed regarding co-existence with services that will remain in the band in the near term. TIA also appreciates the Department of Defense (“DoD”)’s recently- announced Electromagnetic Spectrum Strategy, which clearly and publicly articulates to the DoD spectrum

community the need for increased efficiency, creativity and flexibility in spectrum use.⁶ In doing so, DoD specifically called out various mechanisms that it believes may be useful in circumstances where spectrum sharing is possible. Critically, DoD also recognized that wise use of spectrum is a matter of national economic security as well as national security, and that appropriate balancing of these interests is required.

Federal Spectrum Management

Congress can enact or facilitate a number of actions towards improving federal spectrum management and encouraging more efficient use. These include:

Better tracking. A better spectrum use tracking and management process will undoubtedly encourage more efficient uses of spectrum by all users, including government users. Such a process should include appropriate inventories of usage, valuations, and transparency. In cases of spectrum sharing, federal policy should support forums for all stakeholders to periodically exchange information to better ensure that the sharing environment is and remains workable.

Stronger central coordination. NTIA is currently tasked with coordinating spectrum use for the federal government.⁷ However, as various spectrum-related efforts in recent years have demonstrated, a stronger level of coordination or management for federal spectrum usage may be required. Indeed, in some cases NTIA has had difficulties obtaining current information from other government agencies, making it difficult for NTIA to effectively respond to Congressional and Administration requests for more detailed information regarding federal use. It may be valuable to have government agencies' spectrum offices engage more closely and more often with NTIA to improve coordination.

Agency incentives. Spectrum plays an essential role in fulfilling government missions, and this will continue despite any transition or sharing of particular bands for commercial use. For this reason, although political leadership by Congress and the Administration is necessary, agency-level incentives are also necessary to ensure that federal spectrum uses (and users) are responsive to constraints of efficiency, predictability, flexibility, etc. in a similar manner to those faced by commercial users.

The proposed Federal Spectrum Incentive Act (H.R. 3674, introduced by Reps. Guthrie and Matsui) represents potentially important legislative progress towards this goal. This bi-partisan legislation is designed to provide agencies with voluntary budgetary incentives to transition spectrum to commercial uses, by simply allowing agencies to keep a portion of the proceeds of any auctioned spectrum for their own use. However, even while supporting this effort, Congress should also explore ways to provide incentives for more efficient spectrum use deeper within the

⁶ Department of Defense, *Electromagnetic Spectrum Strategy*, Release No. NR-091-14 (Feb. 20, 2014), available at <http://www.defense.gov/news/dodspectrumstrategy.pdf>

⁷ See NTIA, *Manual of Regulations and Procedures for Federal Radio Frequency Management (Redbook)*, available at <http://www.ntia.doc.gov/page/2011/manual-regulations-and-procedures-federal-radio-frequency-management-redbook>. Chapter 1.1 § 5 collects various statutory authorities delegated to NTIA.

agency budgeting process, *i.e.*, at a more granular level than simply an agency’s top-line retention of a portion of auction proceeds.

Flexible-use funding. The use of commercial auction proceeds has traditionally been an important and effective tool to migrate and upgrade federal systems to make way for commercial uses, and to support cost impacts on existing programs/contracts when changes are made. As future spectrum transitions are contemplated, Congress should ensure that any spectrum transition funds can be used in a manner flexible enough to cover a wide range of costs. Indeed, such flexibility may also help overcome any agency resistance to “unknowns” associated with any particular transition of spectrum.

Commercial alternatives. For those communications capabilities that can be provided equally well by commercial providers, agencies should be considering commercial options in lieu of using their own legacy systems – options that may be more cost-effective while providing much greater flexibility in serving an agency’s mission. Indeed, any legacy uses of agency spectrum for communications purposes may need to be re-evaluated in favor of a more flexible approach that will ultimately benefit the agencies themselves.⁸ For example, DoD has recently committed that it will seek to use commercial services and technologies to meet its requirements where possible.⁹

4. [B]oth the government and the private sector are concerned with making more spectrum available to meet commercial demand. [T]he FCC considers spectrum to be “currently available” if providers have the legal authority to build out and provide services ... or “in the pipeline” if ... there are government plans to make it available to commercial providers within the next three years. Congress and the FCC have worked to increase the amount of spectrum available to commercial providers.... What other steps can be taken to increase the amount of commercially available spectrum?

Congress must promote spectrum sharing research and development. Most transitions of federal spectrum to commercial use involve the government incumbents upgrading their equipment to more spectrally-efficient technology, which is what commercial providers are doing every day. To ensure this trend continues, Congress must continue to actively encourage federal users to free up more spectrum by operating more efficiently. However, spectrum sharing research and development is necessary to continue exploring sharing in bands that require sharing as part of a transition or cannot be cleared.

In December 2013, TIA released its *Spectrum Sharing Research and Development* white paper.¹⁰ This paper was developed with input from stakeholders across the ICT industry, and includes recommendations for actions by policymakers in Congress, the Administration, and at specific

⁸ The outcomes of such re-evaluations may be different for each agency, particularly when considering certain non-“communications” uses of spectrum (radar, telemetry, etc.).

⁹ DoD Electromagnetic Spectrum Strategy, *supra* n. 6, at 7.

¹⁰ Telecommunications Industry Association, *Spectrum Sharing Research and Development* (Dec. 11, 2013), available at <https://www.tiaonline.org/policy/spectrum-sharing-research-development-white-paper>

funding agencies.¹¹ (The paper is attached to this response.) Congressional action is required for progress on several of these recommendations, including:

- *Updating the NITRD statute to encompass spectrum.* The Networking and Information Technology Research and Development (NITRD) program is a multi-agency effort that coordinates the activities of 20 member agencies that support advanced IT R&D. The NITRD program office has developed or coordinated working groups to address emerging areas of need, including a Wireless Spectrum Research and Development Senior Steering Group (WSRD SSG) established by Presidential Memorandum in June 2010.¹² However, these efforts have occurred even as Congressional efforts to update the NITRD statute have stalled. Congress should enact legislation to update the statutory basis of the NITRD program to encompass and prioritize areas such as spectrum sharing research.
- *Updating NITRD's reporting requirements.* NITRD's annual budget report appears to indicate total federal IT R&D expenditures of approximately \$3.9 billion in FY 2014,¹³ but the reality is quite different. As the President's Council of Advisors on Science and Technology (PCAST) has found, a large majority of the NITRD-reported funding is actually used for IT *infrastructure* to support R&D in fields other than network and information technology.¹⁴ Congress should enact legislation to update NITRD's reporting requirements to ensure a more accurate picture of federal funding for network and information technology research, including in priority areas such as spectrum sharing research.
- *Providing additional funding for spectrum sharing research.* Current federal research funding for spectrum sharing is very limited. The total NTIA research budget (including all programs, not just spectrum sharing) is just \$13 million,¹⁵ which is insufficient to support the rapid pace of development needed to obtain transformative results. While recent White House efforts to administratively target additional funding are helpful, to achieve transformational advances in spectrum sharing R&D that will yield economic

¹¹ TIA presented the white paper at a meeting of the NITRD-led interagency Wireless Spectrum Research and Development Senior Steering Group (WSRD SSG) held on February 6, 2014.

¹² See Presidential Memorandum, *Unleashing the Wireless Broadband Revolution*, June 28, 2010, § 3 (“The Secretary of Commerce, working through NTIA, in consultation with the National Institute of Standards and Technology, National Science Foundation (NSF), the Department of Defense, the Department of Justice, NASA, and other agencies as appropriate, shall create and implement a plan to facilitate research, development, experimentation, and testing by researchers to explore innovative spectrum-sharing technologies, including those that are secure and resilient.”), available at <http://www.whitehouse.gov/the-press-office/presidentialmemorandum-unleashing-wireless-broadband-revolution>

¹³ See NITRD, *Supplement to the President's FY 2015 Budget Request*, at 5 (rel. March 2014), available at <http://www.nitrd.gov/pubs/2015supplement/FY2015NITRDSupplement.pdf>

¹⁴ PCAST, *Designing a Digital Future: Federally Funded Research and Development in Networking and Information Technology*, at ix (rel. December 2010), available at <http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-nitrd-report-2010.pdf>

¹⁵ See NTIA, *FY 2015 budget request*, at 33 (rel. March 2014), available at <http://www.ntia.doc.gov/files/ntia/publications/ntia2015cjfinal.pdf>

benefits several times over, Congress should provide significant additional funding for spectrum sharing research.

Congress should connect transitions and auctions to R&D funding. Spectrum R&D is the “seed corn” that has enabled more efficient uses of spectrum by federal and commercial users alike, resulting in macroeconomic benefits to the U.S. economy as well as direct benefits to the Treasury when more spectrum is made available for auction. To ensure that the pipeline of spectrum continues into the future, Congress should enact legislation requiring re-investment of a portion of spectrum funds in spectrum research and development efforts.

Congress should support efforts to identify under-utilized bands. NTIA has recently announced the debut of a Federal Government Spectrum Compendium, and made it publicly available at the new www.spectrum.gov website. On April 11, 2014, NTIA posted information on the website regarding current uses of federal bands between 225 MHz and 5 GHz. While stakeholders are still reviewing this information to determine whether it is sufficiently detailed to identify additional bands for possible transition, NTIA’s efforts are certainly to be commended. Congress should support the work of NTIA and the FCC in this area.

5. [T]he Communications Act requires the FCC to make an affirmative finding that granting [a] license serves the public interest, convenience, and necessity. Moreover, the Act prohibits the FCC from basing its finding on the expectation of auction revenues. Should the Act permit the FCC to use expected auction revenue as the basis for a public interest finding? What criteria should the FCC consider as part of its analysis?

First, properly designed spectrum auctions that adhere to certain principles – avoiding aggregation caps or limits, technology neutrality, flexible service allocations, etc. – will naturally result in both higher auction revenues and a greater likelihood that spectrum will be put to its highest and best use. While auction revenue is a consideration in scoring federal laws for budget purposes, the long-term economic benefit to the nation comes from auction winners building networks that in turn enable economic activity throughout the economy.

Second, Congress is generally better positioned to make policy decisions about the relationship between spectrum usage and revenue for the Treasury – much of which is used to pay for non-telecommunications federal priorities. However, allowing the FCC to consider auction revenues may make sense in certain instances, such as when the agency is considering competing commercial uses for a band. Even so, there are some instances where financial considerations could distort the agency’s view, such as where public safety, universal access, and similar issues are at play.

6. Many of the existing allocations were made because certain spectrum bands are better suited for certain uses. However, changes in technology have changed assumptions over the years. While restrictions have eased in recent years, there are still certain limited-use spectrum licenses. Flexible use licenses permit licensees to use their spectrum for any service, including wireless, broadcast, or satellite services. Should all FCC licenses be

flexible use? In what instances should the Commission exercise control over the service offered? How can the Act enable better use of spectrum, either flexible or specified?

Flexible-use licenses go hand-in-hand with the convergence to broadband. The laws of physics mean that spectrum is limited, so government must continue to play an important role in avoiding the “tragedy of the commons” problem whereby spectrum becomes unusable. However, today’s service-specific and balkanized regulations governing spectrum allocations need to be overhauled in response to the convergence around *broadband*. The Act should look to the future by accommodating various assignment approaches including traditional exclusive licensing, unlicensed uses, or emerging hybrid models based on technological advances in spectrum sharing.

The FCC is moving in this direction. The FCC has recently proposed to allow flexible uses in the 3.5 GHz band, which may promote small cell technologies while also allowing for other possibilities. These principles of service flexibility could increasingly allow commercial providers room for innovation (assuming sufficient licensing certainty to support investment) that will lead to spectrum being deployed for its highest use. Congress should continue to encourage this approach.

7. The FCC has placed limitations on spectrum holding in a number of ways. In mobile wireless, the Commission has implemented policies that included the cellular cross-interest rule, the PCS cross-ownership rule, and the CMRS spectrum cap. Currently, the Commission conducts a case-by-case analysis of spectrum aggregation for each entity. * The FCC has considered other tools.... Among these are [spectrum “set-asides,” bidding credits,] and auction design including reserve prices, package bidding, and proposed restrictions on bidder eligibility.**

What principles should Congress and the FCC consider when addressing spectrum aggregation limits? How has the converging marketplace and growing demand for services changed the discussion of spectrum aggregation?

Convergence around broadband is creating multi-modal competition, both between wireless and wireline services and within the wireless marketplace itself. Indeed, the wireless environment is particularly competitive. Of course, public interest factors such as universal access remain important, and antitrust law remains an important backstop against the development of anti-competitive practices that harm consumers. But in this evolving marketplace, a light-touch approach to regulation is most appropriate and spectrum aggregation limits have not shown to be necessary – and could be an impediment to providing next generation services that will require more spectrum to support services requiring more bandwidth.

8. Build-out rules require licensees to construct and activate infrastructure within a certain timeframe, or risk losing that license. The operating rules require some licensees to return a license if not used for any 12-month period after construction.... These provisions help to ensure that spectrum ... becomes available to those who will put it to dynamic use.

Should the Act promote competitive and efficient use of spectrum in this way? How effective is the current Act in doing so? How effectively has the FCC used the tools at its disposal to encourage competition?

Build-out requirements can be an effective tool to promote competitive and efficient use of spectrum. Used properly, such requirements encourage licensees to build out their services in a timely manner, while preventing spectrum warehousing and promoting innovation. A recent GAO study of several services found that 75% of licensees successfully met their build-out requirements, with 14% of licenses being revoked and the remainder having other outcomes.¹⁶ Waivers were requested in 9% of cases, with the FCC granting 74% of those requests.¹⁷ These statistics demonstrate that the FCC has used the tools available to strike an appropriate balance between the need to encourage service deployment while preserving flexibility when limited waivers are needed.

Importantly, build-out requirements are not inconsistent with principles of service flexibility. Indeed, they may promote innovation by motivating licensees to provide services in a manner not originally anticipated in order to meet a required deadline. However, since uncertainty regarding the usefulness or value of building out particular legacy services should be lessened in an all-IP, broadband-based world, any “uncertainty” burdens associated with build-out requirements will be lessened as the convergence around broadband continues.

9. The FCC sets limits on transmissions, but doesn’t regulate the receivers used by wireless devices to receive wanted signals and eliminate the noise coming from the other surrounding spectrum bands. * Some have proposed receiver standards as a solution, but others argue that such a step could result in over-engineering and higher consumer prices. What is the best balance between mitigating interference concerns and avoiding limiting flexibility in the future? Can engineering and forward-looking spectrum strategies account for the possibility of unanticipated technologies and uses in adjacent spectrum bands? How do we promote flexibility without unreasonably increasing the cost of services and devices? Does the Act provide the FCC tools to address this problem?**

TIA supports voluntary standards. TIA recognizes that receiver performance is integrally connected to issues of spectrum use efficiency, whether in adjacent bands or in scenarios involving spectrum sharing. While mandatory standards are inadvisable due to their potential to increase device cost or inhibit flexibility, TIA supports the development of voluntary standards, potentially through an ANSI-accredited standards process.

The FCC’s Technical Advisory Committee (TAC), which was chaired by now-agency Chairman Tom Wheeler, seems to have found some common ground with this position. The TAC issued

¹⁶ GAO-14-236, *Spectrum Management – FCC’s Use and Enforcement of Buildout Requirements*, at 18 (Feb. 2014), available at <http://www.gao.gov/assets/670/661153.pdf>

¹⁷ *Id.* at 20-21.

its first white paper in February 2013,¹⁸ and issued a follow-up white paper in March 2014 that called for the FCC to:

- Identify boundaries (i.e., between specific services) where defining “harm claim thresholds” would add significant value;
- Encourage a multi-stakeholder process to work out implementation details; and
- Engage in rulemaking as required.¹⁹

TIA is prepared to play a leading role. While rulemaking would be premature, TIA is prepared to facilitate an industry-government multi-stakeholder process to explore issues of receiver performance, whether based on “harm claim thresholds” or an alternative approach. TIA is an ANSI-accredited standards development organization, so to the extent that such standards are deemed appropriate as a result of the multi-stakeholder process, TIA is well-situated to facilitate development of such standards. TIA looks forward to working with the FCC as it responds to the TAC recommendations and seeks to develop a multi-stakeholder process.

10. In a report on reducing duplication in the federal government, GAO identified spectrum management as “fragmented” between NTIA and the FCC and urged coordination. What role should NTIA play in the licensing and management of spectrum? Is their current role appropriate and necessary, given the potentially duplicative functions of the FCC and NTIA in spectrum allocation and assignment?

At the outset, TIA cautions against any agencies other than the FCC allocating spectrum rights for commercial use. The FCC has established open and transparent processes and developed a strong track record in transitioning spectrum to commercial use and for its administration, and future spectrum transitions should leverage this expertise.

As described above (see response to question 3), better tracking of spectrum usage and stronger central coordination of government uses – by NTIA in close coordination with the spectrum offices of other agencies – are both important for improving the efficiency of overall spectrum use. As experience has shown, NTIA requires additional resources to interface effectively with other agencies’ spectrum offices and respond effectively to Congressional or other requests regarding spectrum use. In an era where spectrum auctions are producing tens of billions of dollars for the federal Treasury, this situation is becoming increasingly untenable and Congress should correct it.

In the end, Congress may wish to consider far-reaching changes in the roles of NTIA and/or the FCC in spectrum management. However, a better course of action may be for Congress to begin

¹⁸ FCC Technological Advisory Council, Receivers and Spectrum Working Group, *Interference Limits Policy: The use of harm claim thresholds to improve the interference tolerance of wireless systems* (February 6, 2013), available at <http://transition.fcc.gov/bureaus/oet/tac/tacdocs/WhitePaperTACInterferenceLimitsv1.0.pdf>

¹⁹ FCC Technological Advisory Council, Spectrum / Receiver Performance Working Group, *Interference Limits Policy and Harm Claim Thresholds: An Introduction*, at 9 (March 5, 2014), available at <http://transition.fcc.gov/oet/tac/tacdocs/reports/TACInterferenceLimitsIntro1.0.pdf>

by ensuring that NTIA is better funded and thus better-positioned to execute its important spectrum management mission.

Enclosure: TIA White Paper, *Spectrum Sharing Research and Development* (released December 11, 2013), available at <https://www.tiaonline.org/policy/spectrum-sharing-research-development-white-paper>

Spectrum Sharing Research and Development

Spectrum is the fuel powering the mobile broadband revolution. As millions of American consumers are demanding more voice, video, and data from their mobile devices, efficient use of scarce spectrum resources is a subject of increasing interest to policymakers, the information and communications technology (ICT) industry, other industry sectors, and the scientific research community.

Increasingly, the focus of these efforts has turned towards spectrum sharing. This has been necessitated in part by the parallel increase in demand for spectrum uses beyond commercial communications — including for satellite or aeronautical applications, radiolocation, or other civilian or military capabilities. Against this backdrop, spectrum sharing may hold promise as a means to increase the efficient use of spectrum — whether by accommodating multiple user groups or types of uses — and to help alleviate challenges in spectrum scarcity. However, significant technical research and development, as well as progress on the associated regulatory issues, is needed to broaden the range of sharing technologies and solutions that can be moved towards practical applications — and ultimately into the networks that consumers, businesses, and governments rely upon every day.

Spectrum “sharing” already exists in many forms today, including in licensed approaches whereby wireless carriers provide access to millions of customers using relatively narrow bands, or in unlicensed approaches such as Wi-Fi®. Moreover, very different types of spectrum uses — from commercial wireless services, to military or medical applications, or scientific and deep space research — have been assigned by the FCC to share the same spectrum band. Many current discussions of spectrum sharing have involved the possibility of re-purposing spectrum used by the federal government for commercial wireless use, and the President recently issued a memorandum urging agencies to take further actions to facilitate this process.¹ Meanwhile, the President’s simultaneous announcement to target \$100 million of R&D funding towards spectrum sharing research is a welcome and long-awaited step,² and follows a July 2012 report finding that spectrum sharing is essential to exploiting the nation’s spectrum resources over the long term.³

This white paper reviews current and proposed sources of R&D funding for spectrum research, and identifies some specific research and development areas that hold promising potential for rapidly advancing the state of spectrum sharing technology. The recommendations below are intended to assist in guiding actions by policymakers in Congress and the Administration and as a blueprint for R&D activities in academia, industry, and elsewhere.

SECTION I — FUNDING FOR SPECTRUM SHARING R&D

Federal funding for research and development in networking technology, including for wireless research, has not kept pace with the relative importance of this field to the U.S. economy. Indeed, the ICT industry contributes \$1 trillion to U.S. GDP (roughly 7 percent) and supports 3.5 million

¹ Presidential Memorandum, *Expanding America’s Leadership in Wireless Innovation*, rel. June 14, 2013, available at <http://www.whitehouse.gov/the-press-office/2013/06/14/presidential-memorandum-expanding-americas-leadership-wireless-innovation>

² See White House, *Fact Sheet: Administration Provides Another Boost to Wireless Broadband and Technological Innovation*, rel. June 14, 2013, available at http://www.whitehouse.gov/sites/default/files/spectrum_fact_sheet_final.pdf

³ See President’s Council of Advisors on Science and Technology (PCAST), *Realizing the Full Potential of Government-Held Spectrum to Spur Economic Growth*, July 20, 2012, available at http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast_spectrum_report_final_july_20_2012.pdf

jobs.⁴ Estimates show that for every \$1 of new wireless broadband investment, U.S. GDP will increase by \$7-10;⁵ a mere 1 percent increase in broadband deployment could mean the creation of as many as 300,000 new jobs.⁶ Overall, the shift from 2G to 3G resulted in 1.6 million new jobs between April 2007 and June 2011.⁷

NITRD. The Networking and Information Technology Research and Development (NITRD) program is a multi-agency effort that coordinates the activities of 20 member agencies that support advanced IT R&D.⁸ But while NITRD's annual budget report appears to indicate total federal IT R&D expenditures of approximately \$4 billion (FY 2014),⁹ the reality is quite different. As the President's Council of Advisors on Science and Technology (PCAST) has found, a large majority of the NITRD-reported funding is actually used for IT infrastructure to support R&D in fields other than network and information technology.¹⁰

Meanwhile, the NITRD program office has developed or coordinated working groups to address emerging areas of need. This includes a June 28, 2010, Presidential Memorandum that established a Wireless Spectrum Research and Development Senior Steering Group (WSRD SSG) to coordinate inter-agency efforts in that area.¹¹ Since its establishment, the WSRD SSG has conducted a series of workshops beginning in 2011 to help facilitate research, development, experimentation, and testing to explore innovative spectrum-sharing technologies. These efforts have occurred even as attempts in Congress to update the statutory foundations of the NITRD program have stalled.¹²

Recommendation: Congress should enact legislation to update the statutory basis of the NITRD program to encompass and prioritize areas such as spectrum sharing research.

⁴ Robert J. Shapiro and Apama Mathur, *The Contributions of Information and Communication Technologies to American Growth, Productivity, Jobs, and Prosperity*, Sept. 2011, available at http://www.tiaonline.org/gov_affairs/fcc_filings/documents/Report_on_ICT_and_Innovation_Shapiro_Mathur_September_8_2011.pdf.

⁵ See Alan Pearce and Michael S. Pagano, "Accelerated Wireless Broadband Infrastructure Deployment: The Impact on GDP and Employment," New York Law School, *Media Law and Policy Law Journal*, vol. 18 at 11-12 (Spring 2009) (\$17.4 billion will increase U.S. GDP by between \$126.3 billion and \$184.1 billion) available at http://www.nyls.edu/user_files/1/3/4/30/84/187/245/Pearce%20&%20Pagano,%20SPRING%202009%20&%20Pagano,%2018%20MEDIA%20L%20&%20POL%E2%80%99Y.pdf

⁶ See Brookings Institute, *The Effects of Broadband Deployment on Output and Employment: A Cross-sectional Analysis of U.S. Data* at 2.12 (July 2007), available at <http://www.brookings.edu/views/papers/crandall/200706litan.pdf>.

⁷ Robert J. Shapiro and Kevin A. Hassett, *The Employment Effects of Advances in Internet and Wireless Technology: Evaluating the Transitions from 2G to 3G and from 3G to 4G*, Jan. 2012, available at http://ndn.org/sites/default/files/blog_files/The%20Employment%20Effects%20of%20Advances%20In%20Internet%20and%20Wireless%20Technology_1.pdf

⁸ See <http://www.nitrd.gov/>

⁹ See NITRD, *Supplement to the President's FY 2014 Budget Request*, available at <http://www.nitrd.gov/pubs/2014supplement/FY2014NITRDSupplement.pdf>

¹⁰ See PCAST, *Designing a Digital Future: Federally Funded Research and Development in Networking and Information Technology*, Dec. 2010, available at <http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-nitrd-report-2010.pdf>

¹¹ See Presidential Memorandum, *Unleashing the Wireless Broadband Revolution*, June 28, 2010, § 3 ("The Secretary of Commerce, working through NTIA, in consultation with the National Institute of Standards and Technology, National Science Foundation (NSF), the Department of Defense, the Department of Justice, NASA, and other agencies as appropriate, shall create and implement a plan to facilitate research, development, experimentation, and testing by researchers to explore innovative spectrum-sharing technologies, including those that are secure and resilient."), available at <http://www.whitehouse.gov/the-press-office/presidential-memorandum-unleashing-wireless-broadband-revolution>

¹² See H.R. 967 (113th Congress), *Advancing America's Networking and Information Technology Research and Development Act of 2013*; see also H.R. 3834 (112th Congress) (same) and H.R. 2020 (111th Congress) (similar). In each case, the House has passed the bills by voice vote of overwhelming majorities. In recent years, however, the bill(s) have been caught up in House-Senate disagreements regarding comprehensive cybersecurity legislation.

Recommendation: Congress should enact legislation to update NITRD’s reporting requirements to ensure a more accurate picture of federal funding for network and information technology research, including in priority areas such as spectrum sharing research.

NTIA. NTIA’s Institute for Telecommunication Sciences (ITS), based in Boulder, Col., is the research and engineering laboratory of NTIA. The ITS conducts some basic research in radio sciences, including many different program areas such as digital land mobile radio, audio and video quality research, propagation measurements and models, and technology transfer.¹³ While spectrum research is a component of ITS work, the total NTIA research budget (including all programs) is just \$13 million,¹⁴ insufficient to support the rapid pace of development needed to obtain transformation results in spectrum sharing technologies.

DARPA. Through the Defense Advanced Research Projects Agency (DARPA), the Department of Defense has solicited and awarded research proposals related to spectrum sharing. These include a 2012 solicitation to begin investigating Advanced Radio Frequency Mapping, or “RadioMap,”¹⁵ and a February 2013 solicitation on Shared Spectrum Access for Radar and Communications (SSPARC) that focuses on mechanisms to improve performance or reduce interference when sharing spectrum.¹⁶ SSPARC represents a significant departure from traditional, unilateral spectrum sharing approaches, because the envisioned radar and communications radio networks are contemplated to share both their current and next-state information in near-real-time. This will enable radar systems and radios to achieve unprecedented levels of spectrum sharing at short standoff ranges.

June 2013 White House Initiative. On June 14, 2013, the White House announced that \$100 million would be invested in research on spectrum sharing and advanced communications. This includes \$23 million in NSF spectrum sharing research and development grants by September 2013, DARPA spectrum sharing contracts worth \$60 million to be issued over five years (an average of \$12 million/year) beginning in FY 2014, and \$17.5 million at NIST for spectrum and advanced communications research, along with accelerating public-private collaboration at Federal laboratories.¹⁷ These executive actions represent an important step forward and will help build on the current efforts underway at these various agencies.

Recommendation: The White House and funding agencies should continue to seek opportunities to administratively target research funding towards spectrum sharing R&D.

Proposals for Additional Funding. The Administration has previously proposed a \$3 billion Wireless Innovation Fund (WIN) to help drive innovation. The WIN fund was intended to support

¹³ NTIA Institute for Telecommunications Sciences, *ITS Mission and History*, <http://www.its.bldrdoc.gov/about-its/its-mission-history.aspx>

¹⁴ See NTIA, *FY 2013 budget request*, available at http://www.osec.doc.gov/bmi/budget/13CJ/NTIA_2013%20Budget_to_Congress.pdf

¹⁵ DARPA-BAA-12-26, available at

https://www.fbo.gov/index?s=opportunity&mode=form&id=701c80210c46b7e497bc90cb0b5c120c&tab=core&_cview=1

¹⁶ DARPA-BAA-13-24, available at https://www.fbo.gov/index?s=opportunity&mode=form&id=8e85f738e53747b502b4b9c3732c2e54&tab=core&_cview=1

¹⁷ See White House, *Fact Sheet: Administration Provides Another Boost to Wireless Broadband and Technological Innovation*, rel. June 14, 2013, available at http://www.whitehouse.gov/sites/default/files/spectrum_fact_sheet_final.pdf

basic research, experimentation and testbeds, and applied development in a number of areas, with spectrum R&D being a key component of any such work.¹⁸ Unfortunately, these funding proposals were progressively reduced or eliminated during the legislative process. Although a leading Senate proposal called for spending \$1 billion over five years to fund advanced information and technology research through NSF and DARPA (plus \$500 million for public safety research),¹⁹ the spectrum auction legislation that eventually passed in 2012 included only \$100 million for public safety research, and no funding specifically dedicated to spectrum sharing or other advanced communications R&D.²⁰

Recommendation: To achieve transformational advances in spectrum sharing R&D that will yield economic benefits several times over, Congress should provide significant additional funding for spectrum sharing research.

SECTION II — RESEARCH AREAS

As the White House, Congress, and various funding agencies seek to support spectrum sharing R&D activities, several different research areas should be considered. A survey of some important topics for further research is presented here.

Authorized Shared Access/Licensed Shared Access. Much of the current research work in spectrum sharing has been focused on unlicensed sharing regimes (television white spaces, Wi-Fi, etc.). Meanwhile, more efforts are needed to facilitate the deployment of Authorized Shared Access (ASA)/Licensed Shared Access (LSA) approaches. ASA is a “third way” spectrum management system that combines elements of traditional “command and control” spectrum management with geolocation technology, e.g., by providing users with a “token” to use spectrum at certain times/places. It leverages existing 4G technologies and harmonized spectrum and has significant support from the wireless industry including Ericsson, Intel, Nokia Siemens Networks, and Qualcomm.²¹

The ASA/LSA approach is being considered for shared access to the 2.3 GHz band in the European Union, where government-funded trials have begun,²² while in the United States, the FCC is

¹⁸ See White House, *Fact Sheet: President Obama's Plan to Win the Future through the Wireless Innovation and Infrastructure Initiative*, FY 2012, available at <http://www.whitehouse.gov/sites/default/files/microsites/ostp/Wi3-fs.pdf>. More specifically, the proposal would have provided \$1 billion to NSF; \$500 million each to DARPA, the Spectrum Relocation Fund, and NIST for a Public Safety Innovation Fund; and \$100 million each to the Economic Development Administration, DOT/Intelligent Transportation, ARPA-Energy, the Centers for Medicare & Medicaid Services, and ARPA-Education. See OMB, *FY 2012 Budget Appendix* at p. 1231, available at <http://www.gpo.gov/fdsys/pkg/BUDGET-2012-APP/pdf/BUDGET-2012-APP-1-31.pdf>

¹⁹ See SPECTRUM Act, S. 911 (as reported in Senate), 112th Congress, at §§ 223, 224, 401.

²⁰ See Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, at § 6413(b)(4) (providing \$100 million to NIST for public safety research).

²¹ See Qualcomm, *1000x – More Spectrum, Especially for Small Cells, Including ASA – A New License Model to Access Underutilized, High Quality Spectrum*, <http://www.qualcomm.com/media/documents/files/wireless-networks-1000x-more-spectrum-especially-for-small-cells.pdf>; Nokia Siemens Networks, *2020: Beyond 4G Radio Evolution for the Gigabit Experience*, http://www.nokiasiemensnetworks.com/sites/default/files/document/nokia_siemens_networks_beyond_4g_white_paper_online_20082011_0.pdf; see also Red Technologies, *Licensed Shared Access (LSA)*, <http://www.redtechnologies.fr/en/lsa.html>

²² The ASA/LSA concept was demonstrated with a live LTE network operating in the 2.3 GHz band in Finland on April 25, 2013. The trial was carried out by the Finnish CORE+ consortium coordinated by the VTT Technical Research Center of Finland. The project was funded by Tekes – the Finnish Funding Agency for Technology and Innovation – and involved participation from three research organizations, seven industry companies, and two governmental agencies. See VTT, *Up to 18% more bandwidth for mobile broadband users with spectrum sharing*, Apr. 25, 2013, available at http://www.vtt.fi/news/2013/25042013_ASA.jsp?lang=en

currently considering such approaches as part of its 3.5 GHz proceeding.²³ Tiered spectrum sharing in the 3.5 GHz band may offer an excellent opportunity to manage multiple spectrum users through database-driven prioritized access. Researching such methods might identify solutions that could allow Federal/DoD users to successfully coexist with commercial users to unlock valuable spectrum resources. ASA/LSA approaches may also be useful in the 1.7 GHz band in cases where federal users cannot be moved. Database-driven spectrum sharing approaches could offer the ability to dynamically allocate spectrum to the highest and best uses on a near real-time basis.

Recommendation: Government R&D funding should be used to support further ASA/LSA trials, potentially leading to a viable near-term option for spectrum sharing in the United States.

ASA/LSA approaches show great promise as a means to enable sharing among disparate uses. They provide a means to ensure ongoing viability of incumbent uses by creating a policy environment that enables compatible operations with new uses. Meanwhile, these approaches also provide secondary users a means to gain access to spectrum that is already licensed to one or more primary users, but may be under-utilized or capable of supporting multiple uses. As such, they can enable new business models through differentiated service offerings (driving affordable mobile broadband) and low-cost access strategies.

However, to achieve these benefits, spectrum released on a shared basis should be globally harmonized to ensure the economies of scale that will facilitate the large-scale deployments necessary to fully utilize the promise of these technologies. Harmonization will thus facilitate further private-sector development of standards that incorporate spectrum sharing into the toolbox of techniques used for network management and operational support.

Recommendation: Policymakers should facilitate the development of globally harmonized spectrum sharing access technologies.

Geolocation Database Effectiveness. Effective geolocation is essential to both unlicensed spectrum sharing (such as TV white spaces) and for ASA/LSA models requiring heightened coordination. Geolocation capabilities in networks may be assisted by databases that map location, time, and usage characteristics to rules and policies for spectrum under management. Some database systems are now operational, perhaps most notably for implementing the FCC's rules for utilizing television white spaces.²⁴ The effectiveness of such systems depends on various factors, including accurate propagation models and systems to manage geolocation and frequency

²³ See Notice of Proposed Rulemaking and Order, *Enabling Innovative Small Cell Use in 3.5 GHz Band*, FCC 12-148, Dec. 12, 2012, available at <http://www.fcc.gov/document/enabling-innovative-small-cell-use-35-ghz-band-nprm-order>. The FCC has proposed general authorized access for Tier 3 (effectively unlicensed or licensed by rule as in white space) and priority access for Tier 2 (for safety of life). Ericsson, Nokia Siemens Networks, and Qualcomm have asked the FCC to modify their proposed rules for the 3.5 GHz band in the United States to use LSA.

²⁴ See Second Memorandum Opinion and Order, *Unlicensed Operations in the TV Broadcast Bands*, FCC 10-174, Sep. 23, 2010 ("FCC White Spaces Order"), available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-10-174A1.pdf

information from TV white space devices and other users such as wireless microphones. Three FCC-certified TV white space databases are now operational in the United States.²⁵

Recommendation: Geolocation databases should be further enhanced or adapted to address scalability and applicability to different domains and use cases, such as in bands shared with non-commercial systems and/or using ASA/LSA or some other shared spectrum access system.

Cognitive Radio and Intelligent Network Selection. Cognitive Radio refers to a class of radios capable of dynamically reconfiguring their operational characteristics in accordance with their usage or environment. At the extreme, cognitive radios are synonymous with software-defined radios and can have the ability to change a wide range of characteristics such as frequency of operation, protocol stacks, waveforms, and bandwidth. However, cognitive behavior can span a wide variety of techniques.

One recognized class of cognitive radios is designed to be aware of dynamically changing conditions of spectrum quality and thereby automatically choose the best wireless channels in the vicinity of operation. This can, for example, be accomplished by means of spectrum sensing, and research has been ongoing towards developing better algorithms for spectrum sensing, both in narrowband and in wideband.²⁶ However, while sensing is one tool enabling cognitive behavior, its effectiveness is limited in some scenarios that involve widely dispersed operation, lack of coverage, non-reciprocal use cases, etc. Moreover, some obstacles to practical operation of autonomous cognitive radios must eventually be addressed on the policy level, such as modifying existing regulations regarding the frequencies used by such radios.

Cognitive radio technologies can also be enabled through intelligent network management, where individual radios are made aware of spectrum opportunities through network assistance. Database-directed spectrum allocation schemes, as well as database-assisted policy control are thus another set of enablers for cognitive radio. Cooperation between network sensors and database directed approaches can offer synergistic advantages when used together.

Recommendation: Cognitive radio research should be funded and should focus on both intelligent network management and advanced sensing techniques.

Wideband Sensing. Traditional narrowband sensing algorithms include matched filtering, energy detection, and cyclostationary feature detection.²⁷ However, efficient spectrum use will eventually require wideband sensing; i.e., device sensors that can operate across a bandwidth ranging from hundreds of megahertz to several gigahertz. For example, future wideband devices may eventually make use of the entire UHF band from 300 MHz to 3 GHz.

²⁵ Spectrum Bridge, iconectiv, and Google have been certified. See FCC, *White Space Database Administrators' Guide*, <http://www.fcc.gov/encyclopedia/white-space-database-administrators-guide>

²⁶ See Hongjian Sun and Arumugam Nallanathan, et al, "Wideband Spectrum Sensing for Cognitive Radio Networks: A Survey," March 6, 2013, accepted for publication in *IEEE Wireless Communications*, 2013, ("Survey of Wideband Sensing Techniques"), available at <http://arxiv.org/pdf/1302.1777v2.pdf> or at <http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=6507397>

²⁷ See *Survey of Wideband Sensing Techniques*, supra n. 26 at 3.

Some wideband sensing and sampling techniques are theoretically more effective, but in practice are difficult to implement.²⁸ Therefore, recent interest in wideband sensing techniques has focused on less computationally intensive sub-Nyquist wideband sensing, i.e., acquiring wideband signals using sampling rates lower than the Nyquist rate and detecting spectral opportunities through partial measurements. However, these approaches will require further work on problems, including sparse basis selection, adaptive wideband sensing, and cooperative wideband sensing.²⁹

Distributed Sensing. Distributed sensing allows smart devices (and networks) to exploit information about the spectrum environment obtained by many different sensors operating simultaneously. Some research efforts are underway — in early 2012, DARPA issued a solicitation to begin investigating Advanced Radio Frequency Mapping, or “RadioMap.”³⁰ Such research efforts should be expanded and should include work towards exploiting millions of sensors in existing sensor networks for multiple purposes such as assessments of the spectrum environment.

Recommendation: Spectrum sensing research should be focused on both individual sensing and distributed sensing approaches.

Spectrum Aggregation. The newest wireless technologies, such as LTE-Advanced (3GPP release 11) include standards by which wireless operators can aggregate multiple non-contiguous blocks of physical spectrum to create a single, high-rate aggregate logical data channel.³¹ As these new technologies are deployed, the amount (and type) of use in particular blocks of physical spectrum should be tracked, since this information may help inform future research in this area.

Interference Mitigation. In an increasingly active spectral environment, more sophisticated interference mitigation techniques should be studied. This includes the need for further research and development regarding receiver performance — particularly before any mandatory performance objectives are imposed by the FCC. Policymakers have been actively exploring possible actions in this area, even as the need for underlying technical research remains.³²

Meanwhile, in systems using database approaches to avoid interference — including the FCC’s White Spaces database system — research is needed to determine and refine the appropriate size of various exclusion zones. In this respect, a significant gap exists in the modeling of propagation in cellular environments when compared with accepted models for long-range propagation observed with airborne systems, radar, and broadcast. Each of these environments has a justified basis for using particular propagation models, but the models do not behave consistently when analyzing co-existence between different use cases.

²⁸ For example, wideband sampling at the Nyquist rate (twice maximum frequency) over the range from zero to 10 GHz would require sampling at up to 20 GHz. Given today’s hardware technologies, high-rate analog-to-digital conversion would be difficult to implement, or at best very expensive in the context of contemporary wireless networks. See *Survey of Wideband Sensing Techniques*, supra n. 26 at 5.

²⁹ See *Survey of Wideband Sensing Techniques*, supra n. 26 at 8-10.

³⁰ DARPA-BAA-12-26, available at https://www.fbo.gov/index?s=opportunity&mode=form&id=701c80210c46b7e497bc90cb0b5c120c&tab=core&_cview=1

³¹ See, e.g., Elko Seidel, *LTE-A Carrier Aggregation Enhancements in Release 11*, August 2012, available at http://www.nomor.de/uploads/44/31/4431565c44fed73a799493f63b07aeaf/NewsletterNomor_CA_Enhancements_2012-08.pdf

³² See FCC Public Notice, *Office of Engineering and Technology Invites Comments on Technological Advisory Council (TAC) White Paper and Recommendations for Improving Receiver Performance*, DA 13-801, Apr. 22, 2013, available at http://transition.fcc.gov/Daily_Releases/Daily_Business/2013/db0423/DA-13-801A1.pdf. See also House Energy and Commerce Committee, Subcommittee on Communications and Technology, *The Role of Receivers in a Spectrum Scarce World*, hearing held Nov. 29, 2012, available at <http://energycommerce.house.gov/hearing/role-receivers-spectrum-scarce-world>

Recommendation: More research into cross-application and environment propagation modeling is needed to allow more accurate prediction of interference across various use cases.

In addition, directional signal transmission approaches, such as transmit beamforming and the use of “smart antennas,” can improve transmit-receive performance while potentially reducing overall levels of interference. Such approaches are present to some extent in current versions of LTE but could be further developed.

The recent (February 2013) DARPA solicitation for the SSPARC program (see above) includes research on several separation mechanisms to improve performance or reduce interference when sharing spectrum, including:

- ▶ Radar beam avoidance by communications systems.
- ▶ Communication nodes adjust transmit power based on measured path loss to the radar receivers.
- ▶ Identify the specific devices causing interference followed by modifying their transmission parameters to mitigate it.
- ▶ Hardware components, subsystems, waveforms, and signal processing methods that improve separation.

The solicitation also seeks additional separation mechanisms, noting that mechanisms that leverage the information sharing subsystem and mechanisms that operate in isolation are both of interest.³³ This work should be continued and expanded upon.

Wireless Ad Hoc Networks. Wireless ad hoc networks are decentralized networks established between devices without reliance on pre-existing infrastructure, such as access points. Spectrum sharing poses a unique challenge for such networks, and these issues require further study.

Network Resiliency. Spectrum sharing presents new challenges regarding network resiliency. For example, geolocation database-based approaches need studies to address redundancy in the event of database failure. Meanwhile, the type of frequency agility needed in devices to support spectrum sharing techniques may actually promote hardening of systems against certain forms of attack, but further research is needed to determine the practical extent of such benefits.

Security. Spectrum sharing in certain well-defined cases, such as between the U.S. Department of Defense and commercial systems, may pose unique challenges regarding system security. To promote assurance and confidence among federal stakeholders, research should be conducted regarding potential spectrum-based security considerations. For instance, given the need to protect both location and/or frequency identification data of some sensitive and advanced federal capabilities, additional research into how to facilitate sharing through spectrum access databases or other means should be undertaken. Meanwhile, waveform interference susceptibility research may help determine which portions of spectral waveforms for particular networks/protocols are most vulnerable, and such research may have useful applications both in security contexts and toward interference mitigation.

³³ See DARPA-BAA-13-24, *supra* n. 16.

Network protocol and architecture evaluation. Systemic research is needed to determine how various network protocols and architectures respond in environments with link-layer interference caused by spectrum sharing.

General Recommendation: Spectrum sharing research and development should proceed in the following areas — authorized shared access, geolocation database effectiveness, cognitive radio and intelligent network selection, wideband sensing, distributed sensing, spectrum aggregation, interference mitigation, wireless ad-hoc networks, network resiliency, security, and network protocol and architecture evaluation.

SECTION III – NEAR-TERM POLICY OPTIONS

Many current discussions of spectrum sharing have involved the possibility of re-purposing federal spectrum for commercial use, often from the Department of Defense. In the near-term, policymakers should support the clearing of re-purposed federal spectrum bands to the maximum extent feasible, while ensuring that the Department of Defense and other agencies' capabilities to execute their missions are not compromised. Cleared, exclusively licensed spectrum bands currently allow the most efficient and dependable use of spectrum suitable for mobile broadband deployment and maximize network investment, marketability, availability and consumer use.

In spectrum bands that cannot be cleared for exclusive licensed use, the most promising forms of sharing by mobile broadband networks, including those based on LTE technology, are licensed sharing with geographic, frequency or time-based coordination, as well as exclusion zones. Spectrum sharing, whether based on sensing technology or the FCC's Part 15 unlicensed rules, still presents technical challenges when required of certain technologies, including LTE.

Meanwhile, on June 14, 2013, the President issued a memorandum on federal spectrum management in conjunction with the research funding discussed above.³⁴ This memorandum will encourage further progress in federal-commercial spectrum sharing by improving public-private collaboration, requiring agencies to report on their spectrum use, placing constraints on agency requests for additional spectrum, and requiring spectrum efficiency to be considered in procurements, among other steps. Congress has also done its part by holding numerous hearings that continue to draw attention to the important issue of federal spectrum management.

CONCLUSION

Spectrum is not just powering the wireless revolution, but helping to transform the entire U.S. economy. Wireless broadband growth is one of the nation's largest economic drivers, and the need for spectrum will only increase in the coming years. Investment in innovative spectrum technologies is therefore essential to maintaining U.S. economic leadership in an increasingly competitive global marketplace. Moreover, spectrum will also play an ever more important role in supporting the mission of government agencies (civilian or military).

Even as policymakers are focused on near-term issues, it is essential to continue investing in long-term solutions that will enable more efficient use of scarce spectrum resources. Spectrum sharing technologies hold great promise, but a significant and sustained research and development effort

³⁴ Presidential Memorandum, *Expanding America's Leadership in Wireless Innovation*, rel. June 14, 2013, available at <http://www.whitehouse.gov/the-press-office/2013/06/14/presidential-memorandum-expanding-americas-leadership-wireless-innovation>

is required to help move many of these technologies into the mainstream. By modernizing the foundations of the research ecosystem and focusing R&D efforts in priority areas, Congress and the Administration can work in partnership with industry to ensure that the future for spectrum remains a bright one.

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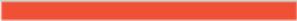
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I. Introduction

As demand for more complex wireless technologies increases, so does the demand for spectrum suitable for wireless broadband services. This is true for both government and commercial users. On the commercial side, Cisco predicts that U.S. mobile data traffic will grow 8-fold between 2013 and 2018.¹ On the federal side, users have over 240,000 frequency assignments² and their needs are increasing.³ Sharing between federal and commercial users will be a key component of the strategy to meet growing demands for spectrum.

It is widely accepted that until Federal users internalize the costs associated with their spectrum use, they have little incentive to use spectrum more efficiently or support sharing spectrum with commercial users. If federal users paid for spectrum use, they would internalize the cost associated with holding spectrum assignments. Recognizing the costs of spectrum through a fee would incentivize federal users to adjust their usage to efficient levels and reduce costs.

By imposing a spectrum based fee, the cost of spectrum based services for federal users will more closely reflect the use of this scarce resource. While there are limitations to a fee-based approach, it would require government users to incur some cost for spectrum usage. One of several important questions is: *what should the fee be tied to?*

We suggest that a federal spectrum user fee should be based on the commercial value of spectrum. By tying the fee for federal spectrum to spectrum's commercial price, federal users

¹ See, Cisco, "VNI Mobile Forecast Highlights, 2013 – 2018: United States – 2018 Forecast Highlights," at: http://www.cisco.com/web/solutions/sp/vni/vni_mobile_forecast_highlight/index.html#~Country (last visited 25 April 2014).

² See, GAO, "Spectrum Management, Incentives, Opportunities, and Testing Needed to Enhance Spectrum Sharing," *GAO-13-7*, November 2012, (herein, "GAO 13-7 Spectrum Sharing"), at page 5.

³ See, Testimony of Mr. Karl Nebbia, Associate Administrator, Office of Spectrum Management, National Telecommunications and Information Administration, U.S. Department of Commerce, Before the Subcommittee on Communications and Technology, Committee on Energy and Commerce, United States House of Representatives, Hearing on "Equipping Carriers and Agencies in the Wireless Era," 27 June 2013, (herein, "Nebbia, 2013"), available at: <http://www.ntia.doc.gov/spechttestimony/2013/testimony-associate-administrator-nebbia-hearing-equipping-carriers-and-agencie> (last visited 12 Aug. 2013).

would be incurring the foregone economic value, or “opportunity cost”, of the spectrum in deploying these federal services. A fee based on the commercial value of spectrum would require that federal users at least acknowledge this opportunity cost of the spectrum use and justify their use as higher than this opportunity cost.

As part of a fee based approach, however, federal users must be assured that they will be able to acquire spectrum assignments when they have a justifiable need. Otherwise, they may not have an incentive to relinquish unused spectrum, regardless of spectrum based fees.

II. Facilitating Sharing: Incentivizing Federal Users

A. NEED FOR FEDERAL INCENTIVES

It is widely accepted that until federal users internalize the costs associated with their spectrum use, they have no incentive for using spectrum more efficiently or maximizing spectrum’s total social value. There remain, however, at least two long term challenges for incentivizing federal users.

First, policymakers need a mechanism for government users to adjust their spectrum usage—and even assignments—according to current needs, availability and cost-effectiveness. Rather than holding spectrum assignments for some future objective or utilizing more spectrum in lieu of potentially more spectrum efficient alternatives, agencies should have a mechanism and reason to relinquish assignments they are no longer using, or adjust usage to increase the overall efficiency of spectrum, including through increased sharing.

An important component of this, however, is that federal users must be assured that they will be able to acquire spectrum assignments when they have a justifiable need. Without such assurances, they will still not have an incentive to relinquish underused spectrum.

Second, to weigh the true costs and benefits of a wireless communication service, government users need a way to internalize the cost of the spectrum they use. Spectrum is a highly valued, scarce resource. However, once they receive an assignment, federal users do not incur costs to holding on to the asset. This valuable asset is essentially free to them.

Federal users typically incur costs associated with utilizing many other valuable assets. For instance, the Government Services Administration (GSA) charges federal users rent for office

space.⁴ DOD pays for artillery and machinery. If federal users paid for spectrum use, they would internalize the cost associated with holding spectrum assignments that prevent other productive uses of the frequencies.

Recognizing the costs associated with spectrum use would incentivize federal users to adjust their usage to efficient levels and reduce costs. For instance, users could adjust the timing of their spectrum related missions, invest in higher quality filters to limit their spectrum use, lease capacity from commercial carriers rather than deploy their own services, or more readily accommodate sharing with other users.

Several critical stakeholders have already endorsed a fee based approach.⁵ FCC Commissioner Rosenworcel voiced similar sentiments in late 2012.⁶ Other countries, notably the UK, have adopted significant fees for spectrum usage.⁷

Moreover, this fee based approach is consistent with recent Presidential directives and Office of Management and Budget (OMB) guidance. A Presidential memorandum released in June 2013 called for an evaluation of spectrum efficiency in procurements and market-based incentives for the efficient use of federal spectrum.⁸ The 2013 OMB guidance instructs federal agencies to consider the economic value of spectrum in weighing alternative proposals for deploying

⁴ In fact, Technology Policy Institute recently suggested that such a fee-based approach for federal spectrum users be administered through a Government Spectrum Ownership Corporation (GSOC), which could own spectrum for federal use and lease it to government users for a fee when those users need it. The GSOC would operate similar to the current GSA. *See* letter to Tom Power, Office of Science and Technology Policy, “Re: Agency Incentives—Spectrum,” 20 Mar. 2014, from Thomas M. Lenard and Lawrence J. White, available at: https://www.techpolicyinstitute.org/files/lenard_white_ostp_gsoc.pdf (last visited April 25, 2014).

⁵ *See*, GAO, Federal Government’s Use of Spectrum and Preliminary Information on Spectrum Sharing, Testimony Before the Subcommittee on Communications and Technology, Committee on Energy and Commerce, House of Representatives, GAO-12-1018T, 13 September 2012.

⁶ *See*, Remarks of Commissioner Jessica Rosenworcel at Silicon Flatirons: The Next Ten Years of Spectrum Policy, 13 November 2012.

⁷ *See*, for example, Ofcom, “Annual License Fees for 900 MHz and 1800 MHz Spectrum Consultation,” 10 October 2013. Available at: http://stakeholders.ofcom.org.uk/consultations/900-1800-mhz-fees/?utm_source=updates&utm_medium=email&utm_campaign=alf-consultation (last visited 22 December 2013).

⁸ *See*, Presidential Memorandum, 2013, sections 4 and 6.

spectrum based services.⁹ However, government spectrum users still have no consistent basis or incentive to quantify the economic value of spectrum.

B. TYING SPECTRUM FEE TO THE OPPORTUNITY COST OF SPECTRUM

While there are limitations to a fee-based approach,¹⁰ it would require government users to incur some cost for spectrum usage. Furthermore, accurately set fees would make the costs of federal spectrum usage more transparent. By imposing a spectrum based fee, the cost of spectrum based services for federal users will reflect the use of this scarce resource. The question is: *what should the fee be tied to?*

We suggest that a federal user fee should be based on the commercial value of spectrum. While the theoretical economic value of a band of spectrum is difficult to determine, the commercial price of spectrum realized at auction or in secondary trades is one observed estimate of this value. By tying the fee for federal spectrum to spectrum's commercial price, federal users would be incurring the foregone economic value or opportunity cost of the spectrum in deploying these

⁹ See, Office of Management and Budget, Preparation, Submission, and Execution of the Budget, Circular No. A-11, July 2013, section 31.12, available at:

http://www.whitehouse.gov/omb/circulars/all_current_year/all_toc (last visited 11 Aug. 2013). According to this guidance:

The value of radio spectrum required for telecommunications, radars, and related systems should be considered, to the extent practical, in economic analyses of alternative systems/solutions. In some cases, greater investments in systems could enhance Federal spectrum efficiency (e.g., purchase of more expensive radios that use less bandwidth); in other cases, the desired service could be met through other forms of supply (e.g., private wireless services or use of land lines). Therefore, to identify solutions that have the highest net benefits, agencies should consider greater investment to increase spectrum efficiency along with cost minimizing strategies. To this end, section 6411 of the Middle Class Tax Relief and Job Creation Act directed that A-11 be updated with sections (a) and (c). Subsection (b) provides a methodology for determining a baseline to evaluate improvements in spectrum efficiency.

¹⁰ Since agencies are still dependent on Congress to set its budget, any reduced costs would essentially mean a reduced budget from Congress, rather than a reallocation of resources to other important missions of that agency.

federal services. A fee based on commercial spectrum value would require that federal users at least acknowledge the opportunity cost of the spectrum and justify their use based on this cost.

Calculating the fee could be a two-step process. First, commercially attractive swaths of spectrum currently occupied by federal users could be identified and valued.¹¹ For instance, spectrum might be valued in 50 MHz or 100 MHz bands.¹² Standard spectrum valuation techniques could be applied to estimate the commercial value, assuming no federal users, of the identified bands.¹³ This value would represent the opportunity cost of the band if it were to remain exclusively under federal control. It could also be translated into annual payments through the application of the appropriate discount rate.

Second, individual federal user fees could then be allocated based on the total value of the band (step 1) and individual usage. Agencies would have an incentive to work with the administrator to correct the record and ensure that they are not allocated too large a share of the band's costs.

Note that under this scheme, the fee for individual federal users is tied to the usage and opportunity cost of the entire band. When the band is more heavily used, individual fees are lower. Conversely, if a federal user chose to stop using an assignment, the opportunity cost of the entire band (step one) would now be allocated to a smaller group of users. This approach creates additional incentives for federal users to engage in spectrum sharing, with both other federal users and commercial users. Introducing commercial users in a band would reduce the share of opportunity costs that would need to be covered by the federal users.

This process can be illustrated with a hypothetical example. Suppose that a 100 MHz swath of spectrum is allocated to federal users. Further, assume the commercial value of this band of

¹¹ The National Telecommunications and Information Administration's (NTIA) recently released Federal Government Spectrum Compendium is a very useful resource in identifying federal spectrum assignments. See NTIA, Federal Government Spectrum Compendium, available at: <http://www.ntia.doc.gov/other-publication/2014/federal-government-spectrum-compendium> (last visited April 25, 2014).

¹² The size of the bands could depend on any number of factors, such as the preferred size of commercial deployments.

¹³ See, Bazelon & McHenry (2013).

spectrum is \$1/MHz-pop, suggesting the total commercial value of the band is \$31.2 billion.¹⁴ Using a 10% discount rate, the annual cost of using this spectrum would be \$3.1 billion.¹⁵ Suppose there are 10 federal agencies that have national assignments of 10 MHz each. One allocation of the fees among the federal users would be to allocate one-tenth, or an annual fee of \$310 million, to each agency.

First, if a federal agency believed that the value of their spectrum use was less than one-tenth of the value of all federal users in the band, then that agency would have the incentive to provide supporting evidence of the relative value of the various federal users in the band. Suppose, purely hypothetically, that one of the 10 federal users was the Forest Service and the other nine were law enforcement agencies. In such a case, the Forest Service might submit analysis suggesting that its use is relatively less valuable than law enforcement and, therefore, it should be assigned less than one-tenth of costs of using the band. This incentive for individual users to “correct the record” would ensure that fees generally reflect the relative value of federal users.

Such a fee would also motivate efficient spectrum sharing, both among federal users and with commercial users. Federal users might decide to more intensively share the spectrum between agencies and consolidate their collective usage. For instance, suppose the Forest Service determined that its usage was geographically complementary to one of the law enforcement agencies. If these two agencies chose to geographically share the spectrum, the total federal usage could be reduced by 10 MHz, reducing the collective federal fee, and opening more spectrum for other uses.

Similarly, federal users would be well incentivized to share the band with commercial users. In the case, a share of the value of the band would then be paid by commercial users, rather than included in the spectrum fees. For example, if commercial users deployed \$10 billion worth of the spectrum, then the total value allocated to federal use would drop to \$21 billion. The annual fee for the 10 federal users would now be \$210 million. This creates the incentive for federal users to share with commercial users so long as the value foregone to the federal users is less than the value created by the commercial users.

¹⁴ \$1/MHz-pop x 312 million pops x 100 MHz.

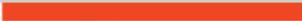
¹⁵ \$3.1 billion per year discounted at 10% per year in perpetuity has a present value of \$31 billion.

III. Conclusion

As demand for more complex wireless technologies increases, so does the demand for spectrum suitable for wireless broadband services. Allocating spectrum “efficiently” is increasingly essential to ensuring that all users—federal and commercial—have the valuable spectrum resources they need. One way to foster more efficient use of federal spectrum sharing has been to implement fees on federal spectrum users. The question remains, however, what should those fees be tied to create the proper incentives for federal users. We propose that these fees should be tied to the commercial value of spectrum.

No federal spectrum user fee scheme will ever create perfect incentives for federal users to use their spectrum assignments efficiently. Beyond the usual principal agent issues that arise with public sector provision of goods and services, the budgetary incentives will never reflect underlying valuations. Congress cannot credibly commit to letting a federal agency keep the value gained by more efficiently using spectrum because they cannot commit to multiyear budgets for agencies. Nevertheless, a spectrum fee would create some incentives for efficient spectrum use, if for no other reason than shining a light on the costs of spectrum use by federal users. The fee setting process we propose would tie fees to the opportunity cost of federal spectrum use, which would provide information policymakers can utilize in more direct spectrum management decisions.

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April 25, 2014

Honorable Fred Upton, Chair
Honorable Greg Walden
Committee on Energy and Commerce
U.S. House of Representatives
Washington, DC 20515

The Information Technology and Innovation Foundation (ITIF)¹ welcomes the Committee's interest in modernizing U.S. spectrum policy as a part of an update to the Communications Act and appreciates this opportunity to comment. Although it may seem obvious, it is worth reiterating how important radio spectrum is to our economy. Proliferation of wireless technologies, especially the recent growth of wireless broadband, has been an incredible boon to our economy, increasing American prosperity and innovation. A recent White House report shows annual investment in U.S. wireless networks rising more than 40% – from \$21 billion to \$30 billion – between 2009 and 2012.² With this transformation happening around us, the time is ripe to re-evaluate and improve spectrum policy to further facilitate such investment and growth.

A holistic re-working of spectrum licensing would be difficult – many existing allocations and rights are intricately defined, and starting over from scratch is unworkable. However, spectrum allocation and management is an ongoing process that will benefit from guidance by a set of fundamental principles. Rather than simply re-assigning spectrum from legacy systems to mobile networks, policymakers need to reform the system that has created a critical shortage of spectrum in the most dynamic sector of the economy while over-allocating spectrum to wasteful and obsolete systems. The spectrum crisis is an opportunity for fundamental reform in the logic of spectrum assignment.

¹ The Information Technology and Innovation Foundation (ITIF) is a non-partisan research and educational institute – a think tank – whose mission is to formulate and promote public policies to advance technological innovation and productivity internationally, in Washington, and in the states. Recognizing the vital role of technology in ensuring prosperity, ITIF focuses on innovation, productivity, and digital economy issues.

² Office of Science and Technology Policy & The National Economic Council, "Four Years of Broadband Growth," June, 2013, http://www.whitehouse.gov/sites/default/files/broadband_report_final.pdf.

An improved system of spectrum assignment would respect the principles that are evident in the operation of actual high-demand, high-performance, and high-efficiency wireless networks. ITIF has written extensively on guiding principles to fuel the expansion of innovative wireless services. In brief, these principles are:

1. Sharing: Prefer assignments that serve multiple users, as commercial networks do, over those for single uses.
2. Application Flexibility: Prefer assignments that support a variety of applications over those that support a single application.
3. Dynamic Capacity Assignment: Prefer networks that allow capacity to be adjusted on demand to those that allocate capacity statically.
4. Technology Upgrade Flexibility: Permit technology upgrade without permission.
5. Aggregation Efficiency: Prefer large allocations over small ones to minimize guardband losses.
6. Appropriate Facilities-Based Competition: Seek an ideal number of networks, a number that is likely to be larger than two and smaller than six in most instances.
7. High-Performance Receivers: Favor systems of high-performance receivers over those that can't tolerate common sources of RF noise.
8. All Relevant Dimensions: Allocate "patches" of spectrum by frequency, power level, place, transmission direction, beam spread, modulation, coding, and time.
9. Promotion of New Technologies: Use rules modification rather than exclusive allocation as a means of enabling the next generation of spectrum technologies.
10. Maximize Redeployment Opportunities: When upgrades to existing systems free up spectrum for new ones, as was the case in the DTV transition, require the upgrade.

These allocation principles can help guide spectrum policy reform under the Update, and we encourage the Committee to examine ITIF's research in detail.³ However, there are a number of the Committee's prompts we would like to address specifically.

Auctions, flexible use licenses, and secondary markets are all successful tools to allocate spectrum rights to socially optimal uses, and should be encouraged. The next steps in liberalizing spectrum management, however, are in transitioning away from technical micromanagement. To the extent possible, we should attempt to shift responsibilities of interference mitigation and

³ See Richard Bennett, "Powering the Mobile Revolution: Principles of Spectrum Allocation," July, 2012 <http://www.itif.org/publications/powering-mobile-revolution-principles-spectrum-allocation>.

coordination to the parties themselves instead of consolidating these functions within the Commission. As long as the details of spectrum management are centralized in one location, inefficient rent-seeking through protracted rulemakings will restrict the flow of spectrum to the highest valued use. To achieve this, we should generally favor policies granting clearly defined spectrum rights with flexible uses over specific, narrow uses that require protection with detailed technical rules.

The FCC's Technological Advisory Council (TAC) has been investigating interference limits policies that can potentially clarify the rights and responsibilities of operators in a way that would help facilitate a move towards more decentralized spectrum management.⁴ These policies, which would specify the amount of interference a licensee would expect to tolerate before having a legitimate claim of harmful interference, would also be an appropriate, light-touch mechanism to incorporate receivers into the regulatory picture without specifying receiver standards or a particular architecture for a band.

As noted in the Committee's White Paper, although cheap receivers have allowed for widespread availability of low-cost consumer devices, their sensitivity to adjacent channel interference can prevent the entry of innovative services and reduce flexibility in service allocation. Considering the tremendous growth in demand for wireless service, and the resulting need to pack diverse systems increasingly close together in frequency and space, new mechanisms to resolve interference disputes will be needed. The mechanisms described in the TAC's White Paper are still experimental and should be introduced incrementally;⁵ however, the Committee is right to be concerned with receiver overload and should consider the proposals.

Continuing to liberalize spectrum management does not necessarily mean a world of only exclusive licenses. Undoubtedly, the right to exclude, *i.e.* the right to protection against interference, is needed to assure uninterrupted mission-critical services and certainly makes a key difference in

⁴ See FCC Technological Advisory Council, Receivers and Spectrum Working Group, "Interference Limits Policy," Feb. 2013, <http://transition.fcc.gov/bureaus/oet/tac/tacdocs/WhitePaperTACInterferenceLimitsv1.0.pdf>.

⁵ The Commission has sought comment on the TAC's recommendation for introduction into the proposed 3.5 GHz Citizens Broadband Radio Service. See *In the Matter of Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Notice of Proposed Rulemaking, FCC 12-148, Dec. 12, 2012, ¶ 141.

incentivizing the heavy investment needed for most wireless architectures. However, unlicensed applications like WiFi have been a tremendous success, add considerable value to the economy, and should be encouraged.⁶ Unlicensed spectrum makes more sense in higher frequency bands, where natural attenuation and absorption help reduce the likelihood of interference. Ideally, unlicensed spectrum will have minimal rules to ensure against interference, allowing for lower cost devices and easier entry. This means that although unlicensed can opportunistically fill gaps in some under-used spectrum like as guard bands, unlicensed spectrum works best in its own bands.

Another key opportunity lies in unlocking access to government spectrum. An Update to the Communications Act should work to include a comprehensive regime to incentivize efficient use of government spectrum, especially that used by the federal government. This is, of course, no small task. Federal spectrum allocations are incredibly complex, and it is unlikely that the NTIA currently has sufficient resources to accurately know how each part of the government is using its spectrum. Clearing and relocating spectrum users is an expensive and difficult process, but a well-designed incentive mechanism can potentially spur more efficient use.

It is important that such mechanisms be designed to avoid simply pushing the problem into the budgetary process. Real incentives, both carrots and sticks, will be needed for legacy systems to realize the true value of this resource. The Obama Administration is in the process of investigating reforms,⁷ and a long-term Communications Act Update should take their findings into account. It is likely that a combination of top-down administrative relocations and a more bottom-up incentive mechanism will be necessary to unlock sufficient government spectrum. In the short term, Congress can take an important step by expanding the scope of the spectrum relocation fund.⁸

⁶ See, e.g., Raul Katz, *Assessment of the Economic Value of Unlicensed Spectrum in the United States*, Feb. 2014.

⁷ See Tom Power, *Request for Information: Agency Incentives to Share or Relinquish Spectrum*, Feb. 2014, <http://www.whitehouse.gov/blog/2014/02/14/request-information-agency-incentives-share-or-relinquish-spectrum>.

⁸ While the Federal Spectrum Incentive Act introduced by Representatives Guthrie and Matsui, proposing a small incentive on top of relocation funds, is a great step in the right direction, but the relocation fund should also be expanded to fund relocation studies, general planning of relocation or sharing, and research into new, more efficient equipment.

It is important that we not let the difficult challenge of relocating federal users prevent full clearing to make way for full access for more socially beneficial uses. Where alternative economically viable technologies or spectrum exists that would allow federal users to continue achieving their mission, full relinquishment of federal spectrum should be preferred. The expenses of coordination and sharing will slow the growth of wireless broadband and increase costs throughout the ecosystem.

Where full relinquishment is not feasible, spectrum sharing holds great promise. Of course, most spectrum is already extensively shared, but recent advances in technology indicate the possibility to automate such sharing at a much more granular level, increasing total spectrum use and improving efficiency. The Commission's proposals for the 3.5 GHz Citizens Broadband Radio Service, which aims to implement many of the PCAST report's spectrum sharing recommendations, will be a key experiment and testing ground for these technologies. Experimentation and further research into the use of sharing technologies should certainly be encouraged, but where the incentive to share is lacking, it is unlikely these innovations will be a panacea.

Spectrum management is a complex and constantly evolving area of policy. A Communications Act Update is an opportunity to take stock of and expand those policies that have led the U.S. to be a global leader in wireless innovation.

Robert D. Atkinson
President and Founder

Douglas Brake
Telecom Policy Analyst

Information Technology and Innovation Foundation

Modernizing U.S. Spectrum Policy

U.S. House of Representatives Committee on Energy and Commerce

Comments Submitted by



THE WIRELESS BROADBAND COALITION®

April 25, 2014

The Wireless Broadband Coalition® (“WBC”) is pleased to have this opportunity to respond to the Energy & Commerce Committee’s (“the Committee”) request for comments on modernizing U.S. spectrum policy. Any comprehensive strategy to meet the broadband deployment objectives outlined by Congress, President Obama, and the Federal Communications Commission must include additional licensed commercial spectrum allocations below 3.7 GHz. The WBC seeks to improve the United States’ spectrum allocation process and build a pipeline of licensed spectrum for commercial mobile use. We look forward to working with the Committee as it analyzes the record and develops recommendations for modernizing U.S. laws governing the communications and technology sector, especially laws that apply to the provision of commercial mobile services.

The American wireless marketplace is dynamic and continues to grow at an exponential pace. The United States has been a world leader in mobile innovation and competition as well as a bright spot in a sluggish U.S. economy. During the depths of the recession in 2008, the U.S. wireless industry invested over \$20 billion in wireless network upgrades and new technologies. Over the past 5 years, wireless capital investment exceeded \$134 billion, spurring economic growth and creating tens of thousands of jobs in America. These investments have occurred as the wireless industry responds to soaring demand from American consumers for mobile services, devices, and applications.

Since the March 2010 release of the Federal Communications Commission’s National Broadband Plan, the wireless marketplace has changed dramatically:

- Approximately 40% of U.S. consumers have “cut the cord” and now only use wireless services;
- Accounting for a mere five percent of the world’s wireless subscribers, the United States leads the world in fourth generation (“4G”) innovation and investment with about half of all global LTE subscribers;
- Last year, U.S. mobile data traffic reached 370 petabytes per month and is projected to increase over 550% by 2017;
- Nearly 4,000,000 mobile applications made by thousands of entrepreneurs are available to American consumers, with hundreds more becoming available every day;
- 58% of American adults have a smartphone, including 59% of African Americans and 61% of Hispanics;
- 42% of American adults have a wireless tablet;
- 37% of American teens have a smartphone and 23% have a tablet; and
- 98% of American small businesses now use wireless to conduct their day-to-day operations.

As this data demonstrates, the future of the Internet is mobile. Consumers demand intuitive, portable devices such as tablets and smartphones that deliver myriad applications for information, commerce, education and entertainment. Similarly, first responders increasingly rely on wireless

devices and technologies in connection with their day-to-day tasks. In the near future, emerging wireless applications such as intelligent transportation systems, smart energy grids, telemedicine, and connected appliances will require even greater coverage and capacity. Yet, as the Committee notes, Congress enacted the primary body of law governing this sector in 1934.

In the 1990s, Martin Cooper observed that spectral efficiency—the amount of information that can be crammed into a given slice of radio spectrum—has doubled every 30 months (“Cooper’s Law”) since Marconi patented the wireless telegraph in 1897. Despite steady gains in radio transmission efficiency and digital compression improvements that significantly improved throughput, meeting the explosive consumer demand for reliable, secure, ubiquitous mobile broadband services requires more quality commercial mobile spectrum allocations.

While progress has been made by both the Federal Communications Commission (“Commission” or “FCC”) and Congress, the current ad hoc spectrum allocation process makes it difficult for Congress, the Obama Administration and the FCC to make the spectrum allocations needed to keep pace with consumer demand for mobile broadband services. A strategic process redesign aimed at anticipating future spectrum needs is sorely needed. Ideally, the laws governing our nation’s communications and technology sector will include forward-looking spectrum policies and a regular, formal long-term spectrum management and planning process.

Against this backdrop, the WBC respectfully offers the following suggestions in support of Congressional action to update U.S. spectrum policy. First, Congress should structurally modify the FCC’s spectrum licensing function to promote efficiency and predictability. Next, Congress should emphasize the importance of long-term spectrum planning by requiring the FCC to prepare, at regular intervals, a detailed technical and economic forecast that documents (1) consumer demand for mobile data and its effect on the capacity of wireless networks and (2) spectrum allocation recommendations creating a pipeline of spectrum for commercial mobile use that the Commission will make available, as well as a recommended timetable for the availability of such spectrum. Third, Congress should prioritize the availability of spectrum below 3.7 GHz for licensed mobile use to ensure that spectrum ideal for mobile services is available to satisfy consumer demand. Finally, Congress should further streamline the federal government’s use of spectrum by encouraging increased sharing among federal operations, and by creating additional alternatives to the use of propriety federal communications systems for each federal function that relies upon spectrum.

Spectrum licensing should be more efficient and predictable. The FCC would benefit from the clarity and navigational ease of a new, comprehensive licensing system. If designed properly, the system would significantly ease the task of examining applications proposing license assignments and transfers of control, especially those involving numerous authorizations across various spectrum bands. For example, a modern system would provide a straightforward illustration of the parties’ spectrum holdings, thereby reducing the staff time dedicated for analyzing spectrum holdings pre- and post-transaction. This new tool would shore up the Commission’s ability to review and approve secondary market transactions in a timely manner. A robust secondary spectrum market promotes commercial spectrum efficiency, and provides carriers an option to secure spectrum needed to satisfy consumer demand, especially between scheduled auctions.

Long-term planning and detailed, technical and economic spectrum forecasting. Just as the Commission needs a modern licensing system to effectively manage the spectrum in use, the FCC would also benefit from a forward-looking spectrum planning strategy. The release of spectrum into the market and the development and construction of advanced wireless networks spur economic growth, stimulate billions in private sector capital investment, propel technological advances, and create jobs. In many respects, advanced wireless networks are the critical infrastructure for the 21st century economy. Given the stakes, the government and the private sector have a mutual interest in ensuring a more predictable supply of spectrum.

Congress should thus create a formal role for the FCC through new legislation that tasks the agency with long-term spectrum planning, including preparation of regular technical and economic forecasting reports. As a preliminary matter, the Coalition notes that a new licensing system (discussed above) would also facilitate the agency's ability to identify and plan spectrum reallocations. The FCC's National Broadband Plan noted that making new spectrum available for commercial use has historically taken between six and thirteen years. That statistic highlights a challenge for the wireless industry.

Based on the FCC's analysis, the average time from "First Step" to "Available for Use" for two recent spectrum auctions—AWS-1 and 700 MHz—is 9.5 years. Unfortunately, those FCC statistics dramatically understate the actual time required under the current system to identify, auction, and clear spectrum for commercial use. As an initial matter, the FCC timetable starts with enactment of a law requiring the FCC to allocate and auction spectrum bands for commercial use. As the Committee knows, identification of new spectrum bands and enactment of laws implementing new spectrum allocation recommendations is a process that can take years. Second, the FCC's definition of when spectrum is available appears to be the conclusion of an FCC spectrum auction. That fails to consider the time required for incumbents to relocate, or for the winning bidders to develop, deploy, and test their networks. In the case of the 2006 AWS-1 auction, federal agencies using the bands were supposed to clear such bands within 3 years. Several agencies had great difficulty adhering to those deadlines. Finally, deployment of nationwide or regional networks does not happen overnight. Even with infrastructure already in place, network deployment can take 2 years or longer. A more accurate and complete measure of the current commercial spectrum allocation and network deployment process is 12-15 years.

With actual traffic on wireless networks exceeding all the forecasts used by the FCC in developing its 2010 National Broadband Plan recommendations, the wireless industry cannot afford to wait over a decade for the next commercial spectrum allocations.

Better long-term planning could significantly reduce the timetable for a spectrum allocation process that now takes years. Constructing a pipeline of spectrum that details in a more predictable manner when future commercial allocations will be available would reduce uncertainty for wireless carriers focused on ensuring that they have sufficient spectrum to satisfy consumer demand. It would also boost spectrum efficiency and accelerate broadband deployment by prompting continued investment by manufacturers in new devices and technologies that can be utilized on those bands.

The FCC staff has the expertise to assess and analyze spectrum needs, as it did in the October 2010 Staff Technical Paper that validated the need for additional mobile broadband spectrum in the near-term, and estimated the economic value associated with making new spectrum available.

Spectrum below 3.7 GHz should be prioritized for exclusive licensed commercial mobile services. As the Commission grapples with how to ensure that spectrum supply keeps pace with the demand for commercial mobile broadband services, Congress should provide clear direction to the Commission that recognizes that, to the greatest extent possible, spectrum below 3.7 GHz should be allocated for licensed commercial mobile services. Such spectrum possesses the propagation characteristics ideal for such services. Spectrum below 3.7 GHz also provides for better economic efficiencies for mobile broadband network deployment.

Unlicensed spectrum plays an important role in the Internet ecosystem. For example, every U.S. commercial carrier uses unlicensed spectrum to offload traffic on licensed networks. Based on the current state of technology and the scarcity of licensed spectrum, additional unlicensed allocations should be focused on bands above 3.7 GHz. For example, the WBC supports the FCC's March 2014 decision to allocate an additional 100 MHz spectrum for unlicensed use in the 5 GHz band.

Encouraging more efficient use of spectrum by Federal users. New legislation should include additional options to incentivize Federal users to relocate to different spectrum bands, or to use alternative communications options. While certain types of sharing arrangements can be beneficial,

there is no substitute for cleared spectrum for commercial use, where the risk of intra-band interference is negligible.

The WBC encourages Congress to facilitate spectrum sharing pilot projects in which federal users share frequencies. Doing so should promote federal spectrum efficiency in a budget-constrained environment, and allow federal agencies and policy-makers to assess the risks and benefits of such arrangements. However, as commercial wireless networks are the critical infrastructure for the 21st century economy, Congress should be skeptical of broad government-commercial sharing proposals based on unproven technologies and untested business models.

Congress should also consider additional alternatives to federally owned and operated wireless communications systems. For example, some federal communications systems may be replaced by commercial off-the-shelf systems. Other agencies may be interested in budgetary incentives such as those outlined in the Guthrie-Matsui Federal Spectrum Incentive Act that are designed to consolidate or reduce spectrum usage.

Conclusion. Despite continued network investments and advancements in radio transmission efficiency, skyrocketing consumer demand for reliable, secure, ubiquitous mobile broadband services and the economic benefits of mobile technologies demonstrate the need to shift to a more strategic spectrum planning process. As the Committee contemplates new legislation covering the communications and technology sector, the Coalition encourages the Committee to design U.S. spectrum policy for the 21st century. All spectrum users – whether commercial or governmental – would benefit from a more strategic, transparent, predictable, data-based process designed to anticipate future needs and put more quality spectrum into the hands of wireless consumers.

Wireless services have unleashed unparalleled innovation in our nation and made the United States the world leader in deploying new technologies, devices, services, and applications. To ensure that the United States retains that leadership position, spectrum policy must ensure that commercial mobile services have access to a predictable supply of spectrum with the propagation characteristics needed to support the reliable, secure, mobile broadband services that American consumers demand.

COMMENTS OF UNITED STATES CELLULAR CORPORATION

Introduction

U.S. Cellular provides wireless service, in regional “clusters,” to nearly 200 markets in 24 states. Founded in 1983, when the FCC awarded the first cellular licenses, U.S. Cellular now serves 4.8 million customers, ninety percent of which are served by our high speed broadband LTE network. The majority of U.S. Cellular’s markets are rural in character, and our policy perspective is informed by our experience as a wireless provider serving rural America.

Eighteen years ago, in the Telecommunications Act of 1996, Congress declared that rural citizens should have access to telecommunications and information services that are reasonably comparable to those available in urban areas. Our country is stronger when citizens living in both urban and rural areas have access to the tools needed to participate in the world economy. Access to mobile broadband is vital to such participation, especially in light of the fact that an ever growing number of U.S. households are “wireless-only.”

Our research indicates that, if they had to choose, most rural citizens would give up their home wireline Internet connection rather than their wireless broadband service because they view mobile access as a critical communications tool. For example, rural consumers traveling in remote areas believe it is essential to travel with a wireless device capable of dialing 911.

Many of our new customers tell us that they chose U.S. Cellular because of our superior coverage in rural areas. There is a general policy assumption that most consumers have access to two or more mobile carriers. But this assumption does not consider the quality of access experienced by those living in rural areas, where services and coverage can vary significantly.

In areas where population density and geographic challenges make it too expensive to string fiber to homes, mobile services can provide a cost-effective way for subscribers to have

broadband access. Today's technology ensures that mobile broadband can provide speeds greater than 4 megabits, and next generation LTE technology promises significant increases in speed, in addition to mobility.

While looking ahead, policymakers must also consider the challenges that exist today. Anyone who travels through rural areas knows there remain "dead zones" lacking coverage, and that mobile phones do not work on all mobile wireless networks. Those problems will continue in the coming 4G world because significant challenges will remain for carriers seeking to provide wireless services in remote areas of the country.

The Communications Act update provides policymakers with the opportunity to ask: what kind of wireless network should rural consumers have access to? Is the Act equipped to meet the challenge? Can changes to the Act enhance competition and service to the public?

Spectrum Auctions

The Act should foster rules that ensure broad auction participation with the goals of increasing competition and promoting service deployments in rural and other underserved areas. Maximizing the amount of paired spectrum encourages both of these goals by providing carriers with the spectrum they require and allowing for faster 4G network deployments. In addition, small license area sizes permit small and regional carriers like U.S. Cellular to participate in auctions on a level playing field with the dominant national carriers. Large service areas often are too expensive and expansive for small and regional providers because they include densely-populated urban locations and extend beyond these carriers' desired service areas. Small license areas ensure that most rural areas will have a carrier which seeks to serve that specific market, treating the market as a build-out priority rather than an afterthought, such as how a carrier primarily focused on serving an adjacent urban market may prioritize its deployments. Smaller

license areas, as well as smaller spectral block sizes, also spur additional bidders to participate in an auction, and data has shown that broader participation increases auction proceeds.

However, these public interest benefits of smaller license areas and blocks sizes likely will not arise in an auction where the FCC permits the largest carriers to bid on packages of licenses. Package bidding effectively forecloses auction participation by smaller bidders by skewing an auction in favor of the largest bidders, who can end up acquiring licenses at a discount over what they would have paid by bidding on licenses individually..

Interoperability

The Act should include a basic requirement that mobile devices in a given spectrum band include the capability to tune to all of the frequencies within that band. In addition, every network operating in that same spectrum band should be required to support the use of such devices. Absent this legal requirement, the largest carriers, which are focused on urban areas and which may have no incentive to offer interoperable devices, can drive device development to favor their networks and effectively raise the cost of competing devices to the point that competition is stifled. On the other hand, an explicit statutory requirement would reduce risk for small and regional carriers, and thereby increase auction participation and revenue. An explicit requirement also would prevent a repeat of the situation in the Lower 700 MHz band, where the lack of interoperability has stranded investment and drastically delayed network deployments to many rural and underserved areas.

RESPONSES TO WHITE PAPER QUESTIONS

Question 1:

As discussed in white paper #1 on Modernizing the Communications Act, the telecommunications industry has experienced a great deal of convergence in recent years. One result is that the current licensing structure at the FCC may no longer be the most efficient or appropriate method to maximize spectrum use. The FCC is responsible for licensing spectrum for a number of services, including public safety, fixed and mobile wireless, broadcast television and radio, and satellite. Although many of the processes are the same among these services, the licensing authority is housed in disparate bureaus. What structural changes, if any, should be made to the FCC to promote efficiency and predictability in spectrum licensing?

It is not clear that superimposing another regulatory layer – *e.g.*, a “spectrum bureau” – would improve agency efficiency. Instead, the adoption of consistent spectrum management policies by every FCC bureau likely would promote efficiency and predictability in spectrum licensing to a greater extent. Certain spectrum will obviously retain special requirements and rules (*e.g.*, broadcast spectrum). But the treatment of most other spectrum, particularly spectrum licensed for CMRS, can be made both more flexible as to permitted uses and more uniform from the standpoint of regulatory requirements. In this respect, U.S. Cellular supports the FCC’s current policies, and ongoing efforts, regarding wireless operations regulated under Part 27 of its rules.

Question 2:

Spectrum users are allowed to operate without an FCC license – subject to certain technical rules – in spectrum that is designated as “unlicensed.” In 1985, the FCC opened up frequency bands, including the 2.4 GHz band, for unlicensed communications, and has since allocated other bands specifically for unlicensed operators. Users of unlicensed spectrum do not have exclusive use rights and are subject to interference by others. While operators do not need a license, they must abide by other regulatory safeguards, including authorization of equipment, accepting any interference and not causing harmful interference to others, and ceasing operations upon FCC notification.

There is vigorous debate over the appropriate role for unlicensed spectrum in the wireless ecosystem, particularly following the passage of the Spectrum Act. The Act requires the FCC to auction all spectrum made available by the incentive auction, but allows for unlicensed use in guard bands. Some contend that there is an ample amount of unlicensed spectrum available and that assigning spectrum via exclusive licensing is the most effective, efficient, and economically

responsible way to allocate spectrum. Others argue that repurposed spectrum should be allocated for unlicensed use for similar reasons. What role should unlicensed spectrum play in the wireless ecosystem? How should unlicensed spectrum be allocated and managed for long-term sustainability and flexibility?

Low band spectrum that is unimpaired should not be allocated for unlicensed operations because there is a scarcity of spectrum available for licensed use below 3 GHz, which is generally considered the upper frequency limit for CMRS. In contrast, the FCC currently has active proceedings with respect to new and expanded unlicensed operations in the 5 GHz and 3.5 GHz bands. Combined, these proceedings could make as much as 345 megahertz of additional spectrum available for unlicensed uses. It is particularly important to prioritize licensed over unlicensed allocations below 1 GHz because the propagation characteristics of this spectrum causes signals to travel further, and thus allows comparable geographic coverage with fewer cell sites. For this reason, spectrum below 1 GHz is critical for providing wireless broadband services in rural areas, where network deployments otherwise may be prohibitively expensive.

On the other hand, the signals of most unlicensed equipment are not even designed to travel any significant distance, meaning unlicensed operations have limited potential to economically increase broadband access in rural areas. For instance, the small cells contemplated for the 3.5 GHz band are low-powered base stations intended to cover targeted indoor or localized outdoor areas, and the Wi-Fi networks operating in the 5 GHz band provide short-range wireless connections that are typically used in conjunction with a wired or CMRS broadband Internet service. Moreover, higher frequency spectrum bands are well-suited for unlicensed operations. For instance, the most recent Wi-Fi standard (IEEE 802.11ac) is a 5 GHz band-only technology, and the 5 GHz band is internationally harmonized for unlicensed use. In addition, the reduced signal range of Wi-Fi or small cell networks, as well as other high band operations due to the limited propagation characteristics of this spectrum, enables greater sharing

opportunities because it allows disparate systems to operate in closer proximity than in lower frequency bands.

This is not to say that unlicensed spectrum does not benefit the public. For instance, in addition to providing consumers with robust Wi-Fi connectivity, unlicensed spectrum can be used by wireless carriers to offload data traffic in order to alleviate network congestion, and unlicensed small cells can be used to provide wireless connectivity in areas that present capacity and coverage challenges for traditional wide-area macrocell networks. These unlicensed operations do not, however, require low band spectrum, while CMRS networks cannot operate without access to a sufficient amount of low band spectrum.

Question 3:

Spectrum sharing is one proposed technological solution that addresses the issue of spectrum scarcity and encourages efficiency. There are multiple ways to share spectrum, including geographic sharing, temporal sharing, and sharing through dynamic spectrum access. In July 2012, the President's Council of Advisors on Science and Technology (PCAST) issued a report on ways to realize the full potential of government held spectrum. The report concluded that sharing is the most efficient way to utilize spectrum and directed the Secretary of Commerce to immediately identify 1,000 MHz of federal spectrum for shared use. However, others assert that spectrum sharing is only part of the solution to spectrum scarcity and that clearing unused or underused federal for exclusive commercial use is a vital part of any strategy for maximizing spectrum resources. In order to enable this sort of reallocation, bipartisan legislation has been introduced in the House that would allow government spectrum users an option to relinquish spectrum and receive a portion of net auction revenues instead of relocation costs, a structure similar to that of the broadcast television spectrum incentive auctions. What should be done to encourage efficient use of spectrum by government users?

Government users should continue to evolve their technologies similar to the private sector approach. Greater efficiency will enhance their mission capable systems while ensuring they are good stewards of a very precious, finite resource. We believe the Act should require government users to meet specific performance metrics in order to evaluate whether their spectrum footprint could be reduced. NTIA should develop best practices and testing metrics for agencies to incorporate into their systems. If government users fail to meet these standards,

NTIA should have the authority to assess fines. U.S. Cellular also supports the legislative proposal to permit government users to relinquish spectrum in exchange for a portion of the auction revenues.

Question 4:

Given the enormous economic benefits of innovation spurred by commercial spectrum availability, both the government and the private sector are concerned with making more spectrum available to meet commercial demand. When discussing available resources, the FCC considers spectrum to be “currently available” if providers have the legal authority to build out and provide services using that band, or “in the pipeline” if it is not currently available for commercial services but there are government plans to make it available to commercial providers within the next three years. Congress and the FCC have worked to increase the amount of spectrum available to commercial providers, including through the provisions for auctions and relocation in the Middle Class Tax Relief and Job Creation Act. What other steps can be taken to increase the amount of commercially available spectrum?

U.S. Cellular strongly supports expanded incentives for federal agencies to make additional spectrum available – in particular, spectrum that can be reallocated for exclusive non-federal use. We note that the Spectrum Act expresses a clear Congressional preference for reallocating federal spectrum for exclusive, non-federal use by directing NTIA, when evaluating frequency bands, to “give priority to options involving reallocation of the band for exclusive non-Federal use and [to] choose options involving shared use only when it determines ... that relocation of a Federal entity from the band is not feasible because of technical or other cost constraints.”¹ The proposals in a recent paper co-authored by the Institute for Defense Analyses and the Science & Technology Policy Institute² regarding incentivizing federal agencies to share or relinquish spectrum through short-term leases and prioritizing shared access to spectrum, as well as the PCAST report’s spectrum “superhighways” proposal, raise complex challenges that

¹ Spectrum Act, §6701(a)(3) (codified at 47 U.S.C. 923(j)(1)).

² See Institute for Defense Analyses and Science & Technology Policy Institute, *A Review of Approaches to Sharing or Relinquishing Agency-Assigned Spectrum*, IDA Paper P-5102 (Jan. 2014) (available at www.ida.org/upload/stpi/pdfs/p5102final.pdf).

are unlikely to ensure the efficient use of spectrum by federal users, and likely will not lead to additional spectrum being made available on an exclusive-use basis for CMRS providers.

Question 5:

In order to issue spectrum licenses, the Communications Act requires the FCC to make an affirmative finding that granting the license serves the public interest, convenience, and necessity. Moreover, the Act prohibits the FCC from basing its finding on the expectation of auction revenues. Should the Act permit the FCC to use expected auction revenue as the basis for a public interest finding? What criteria should the FCC consider as part of its analysis?

The granting of a license is based on the FCC's judgment that a given applicant has met the licensing requirements of the Act and the FCC's rules and that the grant will serve the public interest, convenience, and necessity. This judgment typically is noncontroversial, and is made after an applicant has fulfilled the FCC's licensing requirements for the particular license in question, including winning a spectrum auction.

The criteria to be applied in conducting auctions also are statutory in nature and open-ended. As noted by the FCC in 1994, the applicable auction criteria are as follows:

Under Section 309(j)(2)(B) of the Communications Act, the Commission must determine that use of a system of competitive bidding will promote the objectives described in Section 309(j)(3), which, in addition to those in Section 1 of the Communications Act, are

- (A) the development and rapid deployment of new technologies, products, and services for the benefit of the public, including those residing in rural areas, without administrative or judicial delays;
- (B) promoting economic opportunity and competition and ensuring that new and innovative technologies are readily accessible to the American people by avoiding excessive concentration of licenses and by disseminating licenses among a wide variety of applicants, including small businesses, rural telephone companies, and businesses owned by members of minority groups and women;
- (C) recovery for the public of a portion of the value of the public spectrum made available for commercial use and avoidance of unjust enrichment through the methods employed to award uses of that resource; and
- (D) efficient and intensive use of the electromagnetic spectrum.³

³ *Implementation of Section 309(j) of the Communications Act – Competitive Bidding*, Second Report and Order, 19 FCC Rcd 2348, 2349 (1994) (internal citation omitted).

Recovery for the public of a portion of the value of the spectrum auctioned is thus one auction criterion, but not the only one. Moreover, even that criterion does not require the FCC to recover all of the value of the auctioned spectrum, but only a “portion” of it.

Thus, the FCC, in designing auctions, has substantial flexibility in determining how best to serve all of the specified public interest objectives. The application of the statute’s auction criteria can also vary in different auction contexts. For example, in 2013, the FCC’s Wireless Bureau noted that:

[A] focus on maximizing revenues misstates the Commission’s goal of obtaining ‘a portion of the value’ of the spectrum and disregards the many other purposes behind the competitive bidding rules, including the objective of producing a fair and efficient auction.⁴

Question 6:

The FCC’s existing process manages spectrum use through allocation and assignment – bands are allocated for specific services or classes of users, and licenses for use of specific portions of spectrum are assigned to entities. Many of the existing allocations were made because certain spectrum bands are better suited for certain uses. However, changes in technology have changed assumptions over the years. While restrictions have eased in recent years, there are still certain limited-use spectrum licenses. Flexible use licenses permit licensees to use their spectrum for any service, including wireless, broadcast, or satellite services. Should all FCC licenses be flexible use? In what instances should the Commission exercise control over the service offered? How can the Act enable better use of spectrum, either flexible or specified?

In our view, “flexible use” is not, at present, a major problem for most wireless carriers. All mobile services but SMR are or will be licensed under either Part 22 (cellular), Part 24 (PCS) or Part 27 (700 MHz, AWS, BRS, EBS, 600 MHz) of the FCC’s Rules. Section 22.901(a) provides that cellular systems may provide either mobile or fixed service, and that the mobile service provided may be of any type. Similarly, Section 24.3 allows PCS licensees to provide “any” mobile service on their assigned spectrum, and these licensees may provide “fixed”

⁴ *Barry P. Lunderville*, Memorandum Opinion and Order, 28 FCC Rcd 665, 674 (2013) (internal citation omitted).

services on a co-primary basis with mobile services. Part 24 licensees cannot, however, provide “broadcasting” services, though few if any have wished to. Section 27.2(a) permits licensees in Part 27 frequency bands to provide any service for which these frequency bands are allocated. None of these rules have proven to be a barrier to the expansion of wireless service. Obviously, any radio service is subject to technical requirements, which are necessary to avoid harmful interference, customer “capture,” and other problems inherent in dealing with RF radiation.

U.S. Cellular supports the evolution toward flexibility in the wireless services discussed above. We take no position on increased “flexibility” in other services such as satellite and broadcast. Those subjects raise other issues which should be reviewed carefully by Congress and the FCC.

Question 7:

Finite supply and ever increasing demand have created the scarcity around which the FCC’s regulatory controls are based. The FCC has placed limitations on spectrum holdings in a number of ways. In mobile wireless, the Commission has implemented policies that included the cellular cross-interest rule, the Personal Communications Service (PCS) cross-ownership rule, and the Commercial Mobile Radio Services spectrum cap. Currently, the Commission conducts a case-by-case analysis of spectrum aggregation for each entity. The two-part “spectrum screen” first analyzes changes in market concentration that would result from the proposed transaction, and then examines the amount of spectrum that is suitable and available on a market-by-market basis. Prompted by the passage of the Middle Class Tax Relief and Job Creation Act, the FCC initiated a proceeding to review existing policies regarding mobile spectrum holdings to determine whether they still satisfy the statutory goals of promoting competition and avoiding excessive concentration of licenses, given changes in technology, spectrum availability, and the overall marketplace.

The FCC has considered other tools to try and enhance competition within the wireless services market. Among these are spectrum “set-asides,” where blocks of spectrum are reserved for a particular type of bidder; bidding credits, which provide a discount on winning bids to small businesses or to specific groups like women and minorities to encourage bidding; and auction design, including reserve prices, package bidding, and proposed restrictions on bidder eligibility. Given the complexity of spectrum auctions, these policies have been criticized for altering the playing field and distorting outcomes. What principles should Congress and the FCC consider when addressing spectrum aggregation limits? How has the converging marketplace and growing demand for services changed the discussion of spectrum aggregation?

We believe that current law appropriately balances competing interests and that the FCC has the statutory tools it needs to ensure appropriate spectrum allocation rules.

Question 8:

The FCC further promotes efficient use of spectrum through the build-out requirements and operating rules attached to licenses. Build-out rules require licensees to construct and activate infrastructure within a certain timeframe, or risk losing that license. The operating rules require some licensees to return a license if not used for any 12-month period after construction, promoting the active and continual use of spectrum. These provisions help to ensure that spectrum that is not fully utilized becomes available to those who will put it to dynamic use. Should the Act promote competitive and efficient use of spectrum in this way? How effective is the current Act in doing so? How effectively has the FCC used the tools at its disposal to encourage competition?

Build-out rules are very important to ensure that licensees carry out their service obligations. Overly stringent performance requirements, however, are unnecessarily burdensome, and uniquely harm small and regional carriers. Unlike the largest carriers, these carriers lack extensive economic resources and existing networks and infrastructure. In addition, because smaller carriers are more likely to serve rural areas, they lack the economies of scope and scale possessed by carriers serving urban areas. The Act should encourage rural network deployment with an understanding of the challenges small carriers face when serving rural communities. Differentiating between urban and rural build-out rules would give recognition to these challenges.

Question 9:

As discussed above, interference can pose a major problem to efficient and full use of spectrum by providers. The FCC sets limits on transmissions, but doesn't regulate the receivers used by wireless devices to receive wanted signals and eliminate the noise coming from the other surrounding spectrum bands. Underperforming receivers can prevent a device from operating properly. While the FCC has used tools like guard bands to mitigate the potential for interference, recent examples of receiver overload have shown that these efforts may not be enough as demand for spectrum increases but resources become more and more constrained. Some have proposed receiver standards as a solution, but others argue that such a step could result in over-engineering and higher consumer prices. What is the best balance between mitigating interference concerns and avoiding limiting flexibility in the future? Can engineering and forward-looking spectrum strategies account for the possibility of unanticipated technologies and uses in adjacent spectrum bands? How do we promote flexibility without unreasonably

increasing the cost of services and devices? Does the Act provide the FCC tools to address this problem?

U.S. Cellular supports the continuation of the voluntary industry interference mitigation policies that have been successfully implemented by the wireless industry under the FCC's exclusive licensing policies without any need for intrusive oversight and burdensome regulatory intervention. We do, however, see a possible need for the FCC to consider new spectrum interference mitigation approaches covering new spectrum sharing models, such as Dynamic Sharing (*i.e.*, networks where allocated frequencies are not fixed), Opportunistic Sharing (*i.e.*, networks where unoccupied spectrum can be used by other users) and Heterogeneous Services (*i.e.*, networks where non-homogeneous services can occupy the same frequencies). We also believe that the FCC should convene a multi-stakeholder group to examine the issues raised in the white paper written by its Technological Advisory Council regarding receiver performance issues, as well as the overall interference limits approach proposed in that white paper.

Question 10:

The other governing body of domestic spectrum use is the National Telecommunications and Information Administration (NTIA), which has the authority to assign spectrum frequencies to all federal government owned or operated radio stations under section 305 of the Communications Act. NTIA manages the federal government's use of spectrum, in coordination with the FCC. Distinctions between "federal" or "non-federal" bands of spectrum are administrative creations made through agreements between the FCC and NTIA. The Spectrum Act required NTIA to work with the FCC to identify specific bands for release to commercial use and how to repurpose resources from federal to commercial use, with priority given to options that assign spectrum for exclusive, non-federal use through competitive bidding. In a report on reducing duplication in the federal government, GAO identified spectrum management as 'fragmented' between NTIA and the FCC and urged coordination. What role should NTIA play in the licensing and management of spectrum? Is their current role appropriate and necessary, given the potentially duplicative functions of the FCC and NTIA in spectrum allocation and assignment?

U.S. Cellular supports an expanded role for NTIA, as a spectrum stakeholder, to act on the directives set forth in the President's June 2013 memo⁵ regarding market-based or other approaches designed to give agencies greater incentives to share or relinquish spectrum. These approaches have the potential to increase the capacity and geographic reach of wireless broadband networks by making additional federal spectrum available to commercial wireless providers. Rather than provide federal agencies with greater rights, such as quasi-ownership of their spectrum authorizations, federal spectrum management should remain subject to the centralized authority of NTIA.

⁵ See Memorandum for the Heads of Executive Departments and Agencies, *Expanding America's Leadership in Wireless Innovation* (rel. Jun. 14, 2013), published at 78 Fed. Reg. 37431 (June 20, 2013).



April 25, 2014

Congressman Fred Upton
Chairman
House Committee on Energy and Commerce
2125 Rayburn House Office Building
Washington, DC 20536

Congressman Henry Waxman
Ranking Member
House Committee on Energy and Commerce
2125 Rayburn House Office Building
Washington, DC 20536

Dear Chairman Upton and Ranking Member Waxman,

We are writing you today to provide the House Committee on Energy and Commerce with comments regarding spectrum for the upcoming update on the Communications Act. The United States Hispanic Chamber of Commerce (USHCC) advocates on behalf of nearly 3.2 million Hispanic-owned businesses that together contribute in excess of \$468 billion to the American economy each year. We thank you for allowing the USHCC to share its perspectives with the Committee.

With Hispanics 16 percent more likely than non-Hispanics to access the internet from a mobile device, and innumerable businesses - small and large - dependent on wireless services for their communication needs, cultivating the most efficient spectrum policy possible is critically important for our membership and the country. The USHCC advocates for the expeditious identification and auction of more underutilized spectrum held by government agencies as well as fair, transparent incentive auctions to repurpose the spectrum for commercial use. The USHCC also supports continued investment in spectrum sharing technology and a balanced approach to designating the freed spectrum for licensed and unlicensed use.

As acknowledged in the Middle Class Tax Relief and Job Creation Act of 2012, it is of vital importance that commercial holdings of spectrum be expanded to meet our nation's growing demand for wireless services. The USHCC applauds the National Telecommunications and Information Administration's work to identify spectrum that can be repurposed for nongovernmental use. The more access our nation's businesses have to spectrum the more potential they have to continue to innovate.

The USHCC supports incentive auctions that are fair, competitive, and transparent. Only by keeping these incentive auctions competitive, can we properly incentivize government agencies and smaller private holders to sell their spectrum and ensure they are rightly compensated. Regulation may hinder potential bidders from freely competing for spectrum, thus stunting the revenue generated at these

auctions. This has the potential to discourage agencies from auctioning off their spectrum in the future, which will not only poses an obstacle in meeting the White House's goal to free up 500MHz of government-held spectrum, but also prevents businesses from getting the spectrum they need to continue to innovate.

Sharing of spectrum between public and private entities may also offer promise for generating space for industry innovation and consumer use. While the NTIA explores the ability and effectiveness of such an arrangement, USHCC is optimistic given the recommendations of the President's Council of Advisors on Science and Technology which estimate this may allow for an additional commercial-use allocation of 1000 MHz.

In order to meet our nation's growing demand for wireless services, we must further invest in developing spectrum sharing technologies. The USHCC commends the \$100 million public investment in this effort, and calls for a continued commitment in the field. The limited availability of spectrum will make these efforts essential for adapting over the medium and long term.

The USHCC supports a balanced approach to allocating licensed and unlicensed spectrum. Both licensed and unlicensed spectrum is necessary to provide wireless consumers with the services they need and the stable and efficient distribution of this finite resource.

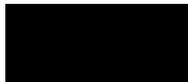
Trends suggest that America's future innovation will be closely correlated with our capacity to utilize wireless technology. Therefore, we have a responsibility to ensure that our spectrum policy benefits consumers, businesses, technological advancement, and high-speed internet access. We must make sure to cultivate the healthiest wireless ecosystem possible.

Thank you for your consideration of this very important issue. We look forward to working together in these coming months to meet the spectrum needs of consumers and businesses.

Respectfully submitted,



Marc Rodriguez
Chairman of the Board
USHCC



Javier Palomarez
President & CEO
USHCC



Center for Technology, Innovation and Competition



<http://www.law.upenn.edu/academics/institutes/ctic/>

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COMMENTS OF CHRISTOPHER S. YOO

**John H. Chestnut Professor of Law, Communication, and Computer & Information Science and
Founding Director, Center for Technology, Innovation and Competition,
University of Pennsylvania**

Comments on “Modernizing U.S. Spectrum Policy”

Before the Committee on Energy and Commerce of the U.S. House of Representatives

April 25, 2014

Thank you to the members of the House Energy and Commerce Committee for beginning the process of updating the laws governing the communications and technology sector. This forward-looking initiative is a testament to this Committee’s leadership on these issues and should provide important benefits to the entire country.

Per the most recent white paper, I am offering my thoughts on modernizing U.S. spectrum policy. In particular, I draw on the insights of the experiences in other countries.

The Hazards of Spectrum Caps

The experience of other countries’ attempts use of spectrum caps in past auctions stands as a stark warning of the dangers of using auctions to stimulate competition from new entrants. For example, the Netherlands imposed spectrum caps in their April 2010 auction of the 2.6 GHz

spectrum in an attempt to create three new mobile broadband providers. Not only did the introduction of spectrum caps delay the auction by over a year. Only two new entrants entered the auction, and some blocks did not receive any bids at all (such as the 69.7MHz of unpaired TDD spectrum). The auction generated a disappointing €2.7 million, over one hundred times less than the 2.6 GHz auction in Sweden, forty to sixty times less than the equivalent auctions in France, Belgium, Italy, and Spain, and fifteen to thirty times less than the equivalent auctions in Portugal, Germany, and Norway. Moreover, of the two new entrants, one has yet to launch service (Tele2) and the other (Ziggo, the Netherlands's incumbent cable operator) has targeted its service exclusively at the business market.

Indeed, U.S. policymakers need not look beyond our borders to appreciate the impact of putting restrictions on auctions. They need only look at the unsuccessful attempt to design the 2008 700 MHz auction to stimulate new entry. Some estimate that the various encumbrances placed on this auction reduced auction proceeds by as much as \$5 billion.

The Importance of Spectrum Flexibility

The experience in other countries also underscores the importance of giving spectrum license holders the flexibility in the technologies they deploy. One of the consistent determinants of early LTE coverage in Europe was giving permission to wireless providers to redeploy their 1.8 GHz spectrum originally allocated to this second-generation technology known as GSM to the fourth-generation technology known as LTE.

Flexibility has its limitations, however. The amount of useable bandwidth in any area depends in no small part on the amount of interference being generated by others using the same frequencies in adjacent areas as well as those using different frequencies in the same area. Moreover, Shannon's Law shows that the carrying capacity of any part of the spectrum depends

on the signal-to-noise ratio. Although the formal proof of this principle is somewhat complex, the intuitions underlying this insight are relatively simple. Consider a conversation at a cocktail party. As the background noise increases, guests have to speak more slowly and loudly in order to be intelligible, thereby lowering the effective throughput rate for communication. One guest's increase in speaking volume is perceived by all of the other guests as noise, who then must respond by increasing their volume and slowing their communication rate. Once the total number of speakers passes a certain threshold, any further communication becomes completely impossible.

One basic insight is that low-power users are more susceptible to being drowned out by interference than high-power users. The amount of usable bandwidth thus depends not just on how the license holder is using its spectrum; it also depends on how other nearby users are using the spectrum as well. The fact that carrying capacity is jointly determined by both users means that spectrum flexibility can have some downsides, as shifting usage to a more high-powered use can have a bigger adverse impact on others.

The Ambiguity of Spectrum Below 1 GHz

Spectrum below 1 GHz (including spectrum in the 700 MHz and 800 MHz bands) are often called beachfront spectrum because of their excellent propagation characteristics that allow signals in these frequencies to carry for long distances and to penetrate building walls. This often leads to call for giving spectrum above 1 GHz less weight when calculating spectrum caps.

The experience in other countries reveals that this approach is too simplistic. The strong propagation characteristics of the frequencies below 1 GHz make them excellent for providing rural service, as a single tower can provide a large geographic area with good service. In urban areas, however, the picture is quite different. In dense urban areas, the high density of users

requires the deployment of larger number of towers operating at much lower power so as to serve a much more limited geographic area without interfering with adjacent areas. In these areas, the propagation characteristics of spectrum below 1 GHz are too good, as even low-power deployments in the 700 MHz spectrum create a large degree of interference.

The implication is that no one area of the spectrum is inherently superior. Instead, this suggests that wireless providers need to hold a variety of spectrum assets operating in different ranges, depending on the geography. In other words, the value of particular spectrum depends on the intensity of usage and the nature of the other spectrum held by the same company and cannot be determined in a vacuum.

The Growing Demand for Spectrum

Perhaps the most striking development of the past decade is the tremendous increase in the demand for spectrum. The deployment of smartphones, tablets, and a wide array of new wireless devices has caused mobile bandwidth to skyrocket. The growing popularity of these devices suggests that this demand is unlikely to abate any time soon. Indeed, Cisco estimates that mobile data traffic grew by 80% in 2013 and predicts that it will continue to grow by an average of over 60% each year for the next five years.

It is thus imperative that policymakers continue to make additional spectrum available, both by reallocating underused private bands and by obtaining spectrum from the government. The well-being of our economy and the welfare of our citizens depend upon it.

Conclusion

I hope that these thoughts will prove helpful to the Committee during its deliberations on these important issues. Please feel free to contact me if there is any way I can be of assistance.

Response to Committee White Paper

The Utilities Telecom Council (UTC)¹ hereby responds to the House Energy and Commerce Committee White Paper #2, “Modernizing U.S. Spectrum Policy”. UTC believes that there are several issues that the Committee should be considering as part of the Communications Act update. The utility industry is investing billions of dollars in grid modernization technologies that will improve the reliability, security and efficiency of their energy and water services. These technologies need reliable communications with greater capacity and wider coverage in order to support two-way, real-time connectivity all across utility service territories. Wireless is a key component for communications to support grid modernization technologies; and suitable spectrum is needed to support the necessary capacity and coverage requirements. Congress can promote grid modernization by providing access to the spectrum that utilities need.

With that as backdrop, UTC responds to the following questions posed in the Spectrum White Paper:

1. As discussed in white paper #1 on Modernizing the Communications Act, the telecommunications industry has experienced a great deal of convergence in recent years. One result is that the current licensing structure at the FCC may no longer be the most efficient or appropriate method to maximize spectrum use. The FCC is responsible for licensing spectrum for a number of services, including public safety, fixed and mobile wireless, broadcast television and radio, and satellite. Although many of the processes are the same among these services, the licensing authority is housed in disparate bureaus. What structural changes, if any, should be made to the FCC to promote efficiency and predictability in spectrum licensing?

Utilities currently share spectrum with various different and often incompatible other users in the Part 90 land mobile bands. Not only does this mean increased interference but also congestion, particularly in urban areas. These problems are the direct result of spectrum refarming policies that consolidated frequencies in the Power Radio service pools with other frequencies in the Industrial/Business pool. While spectrum refarming may make more efficient use of spectrum, the problems of interference and congestion that it created for communications by utilities raise questions whether efficiency should be better balanced against public safety and national security considerations. For utilities clearly provide an important role in maintaining public safety and national security based on the reliability of the essential services that they provide. Utilities should have a spectrum home that is free from interference and congestion. They should not be subject to

¹ Established in 1948 and based in Washington, DC, UTC is the international association for the telecom and information technology interests of electric, gas and water utilities and other critical infrastructure industries (CII). UTC's members use communications in support of the safe, reliable and secure delivery of essential energy and water services to the public at large. Some of UTC's members also provide communications including broadband services to rural areas. Finally, UTC's members also help others provide these services by offering wireless collocation and wholesale fiber optic services, as well as access to pole attachments. As such, UTC advocates for policies that promote access to spectrum by utilities and other CII, as well as for policies that promote the ability of utilities and CII to provide communications, including broadband services, and wireless collocation and wholesale fiber services.

interference and congestion simply because it may make more efficient use of spectrum. The risk to mission critical communications outweighs the benefit in terms of spectral efficiency. Thus, separating utility services from other users in the land mobile bands and providing a spectrum home would serve to promote energy reliability and security, which is clearly in the public interest. Moreover, this illustrates how there may be valid reasons for having separate bureaus for different services, reflecting the unique nature of certain services and the relative importance that these services have to society. In that regard, given the important public safety and national security role that utilities play, UTC believes that it would be appropriate for their communications services to be brought under the auspices of the Public Safety and Homeland Security Bureau at the FCC.

2. There is vigorous debate over the appropriate role for unlicensed spectrum in the wireless ecosystem, particularly following the passage of the Spectrum Act. The Act requires the FCC to auction all spectrum made available by the incentive auction, but allows for unlicensed use in guard bands. Some contend that there is an ample amount of unlicensed spectrum available and that assigning spectrum via exclusive licensing is the most effective, efficient, and economically responsible way to allocate spectrum. Others argue that repurposed spectrum should be allocated for unlicensed use for similar reasons. What role should unlicensed spectrum play in the wireless ecosystem? How should unlicensed spectrum be allocated and managed for long-term sustainability and flexibility?

Utilities currently use unlicensed as well as licensed spectrum to meet their communications needs. While UTC believes that utilities need access to additional licensed spectrum that is suitable to meet their increased communications demands, UTC would support access to additional unlicensed spectrum to supplement and support utility communications requirements. Unlicensed spectrum provides high bandwidth capacity that utilities need. Although it is lower power and secondary to other primary licensed operations, unlicensed spectrum can provide a flexible resource by which utilities can support certain applications, particularly those that are not mission critical. As such, UTC would support increased availability of unlicensed spectrum – in addition to access to additional licensed spectrum for utilities.

3. Spectrum sharing is one proposed technological solution that addresses the issue of spectrum scarcity and encourages efficiency. There are multiple ways to share spectrum, including geographic sharing, temporal sharing, and sharing through dynamic spectrum access. In July 2012, the President's Council of Advisors on Science and Technology (PCAST) issued a report on ways to realize the full potential of government held spectrum. The report concluded that sharing is the most efficient way to utilize spectrum and directed the Secretary of Commerce to immediately identify 1,000 MHz of federal spectrum for shared use. However, others assert that spectrum sharing is only part of the solution to spectrum scarcity and that clearing unused or underused federal for exclusive commercial use is a vital part of any strategy for maximizing spectrum resources. In order to enable this sort of reallocation, bipartisan legislation has been introduced in the House that would allow government spectrum users an option to relinquish spectrum and receive a portion of net auction revenues instead of relocation costs, a structure similar to that of the broadcast television spectrum incentive auctions. What should be done to encourage efficient use of spectrum by government users?

UTC supports spectrum sharing as a means of meeting the communications needs of utilities. Spectrum sharing may provide access to spectrum in the near term at lower cost and disruption to existing operations than reallocation and relocation of incumbent operations. In that regard, UTC also supports legislation that would create incentives to share spectrum, as well as relinquish and clear spectrum. UTC looks forward to working with the Committee to include provisions in the pending incentives legislation that would create such incentives.

4. Given the enormous economic benefits of innovation spurred by commercial spectrum availability, both the government and the private sector are concerned with making more spectrum available to meet commercial demand. When discussing available resources, the FCC considers spectrum to be “currently available” if providers have the legal authority to build out and provide services using that band, or “in the pipeline” if it is not currently available for commercial services but there are government plans to make it available to commercial providers within the next three years. Congress and the FCC have worked to increase the amount of spectrum available to commercial providers, including through the provisions for auctions and relocation in the Middle Class Tax Relief and Job Creation Act. What other steps can be taken to increase the amount of commercially available spectrum?

UTC supports efforts to make more spectrum available for utility operations. In that regard, UTC emphasizes that as more spectrum is made available for commercial services, that policymakers ensure that some of that spectrum is made available for utilities. UTC is concerned that utilities may not have a meaningful opportunity to access spectrum that is made available for commercial services, if there is no designation for some of that spectrum to be made available for utilities. Utilities face significant challenges accessing spectrum through auctions due to costs and geographic areas that are not tailored to utility service territories. UTC looks forward to working with the Committee to develop policies that would promote access by utilities to spectrum that is made available for commercial services.

5. In order to issue spectrum licenses, the Communications Act requires the FCC to make an affirmative finding that granting the license serves the public interest, convenience, and necessity. Moreover, the Act prohibits the FCC from basing its finding on the expectation of auction revenues. Should the Act permit the FCC to use expected auction revenue as the basis for a public interest finding? What criteria should the FCC consider as part of its analysis?

For the reasons stated above, UTC supports granting licenses in the public interest. UTC is concerned that permitting the FCC to use expected auction revenues as the basis for a public interest finding could distort public policies and prevent access to necessary spectrum by utilities.

6. The FCC’s existing process manages spectrum use through allocation and assignment—bands are allocated for specific services or classes of users, and licenses for use of specific portions of spectrum are assigned to entities. Many of the existing allocations were made because certain spectrum bands are better suited for certain uses. However, changes in technology have changed assumptions over the years. While restrictions have eased in recent years, there are still certain limited-use spectrum licenses. Flexible use licenses permit licensees to use their spectrum for any service, including wireless, broadcast, or satellite services. Should all FCC licenses be flexible use? In what instances should the Commission exercise control over the service offered? How can the Act enable better use of spectrum, either flexible or specified?

UTC recognizes that technologies have enabled more opportunistic uses of spectrum. Despite these technological advancements, UTC believes that there are still valid reasons for allocations of spectrum to certain services. UTC supports flexible rules for licensing, but not at the risk of causing interference and congestion to utility operations. UTC submits that such interference and congestion is demonstrably contrary to the public interest in the reliability of energy and water services that are supported by utility communications networks.

7. The FCC has considered other tools to try and enhance competition within the wireless services market. Among these are spectrum “set-asides,” where blocks of spectrum are reserved for a particular type of bidder; bidding credits, which provide a discount on winning bids to small businesses or to specific groups like women and minorities to encourage bidding; and auction design, including reserve prices, package bidding, and proposed restrictions on bidder eligibility. Given the complexity of spectrum auctions, these policies have been criticized for altering the playing field and distorting outcomes. What principles should Congress and the FCC consider when addressing spectrum aggregation limits? How has the converging marketplace and growing demand for services changed the discussion of spectrum aggregation?

UTC supports spectrum aggregation limits in order to preserve and promote competition and access in communications markets. Moreover, set-asides may promote opportunities for access that would otherwise not be available to certain bidders that could not afford to compete in spectrum auctions, even though the public interest would be served if these bidders were able to access spectrum. Therefore, Congress should carefully consider the public interest impact of eliminating or restricting the Commission’s authority to adopt rules that would provide access to spectrum to serve the public interest.

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April 25, 2014

The Honorable Fred Upton
U.S. Representative for the 6th District of Michigan
2183 Rayburn House Office Building
Washington, D.C. 20515

The Honorable Greg Walden
U.S. Representative for the 2nd District of Oregon
2182 Rayburn House Office Building
Washington, DC 20515

Re: WISPA Response to Modernizing U.S. Spectrum Policy Whitepaper

Dear Representatives Upton and Walden:

The Wireless Internet Service Providers Association (WISPA) appreciates the opportunity to respond to certain questions presented in the House Energy and Commerce Committee's April 1, 2014 white paper on modernizing U.S. spectrum policy.

As background, WISPA is the trade association representing the interests of the fixed-wireless industry. WISPA is comprised of more than 800 wireless Internet service providers (WISPs) that provide fixed wireless broadband service to millions of consumers and businesses in rural areas, in the vast majority of cases without federal universal support. WISPs rely primarily on unlicensed spectrum in the 900 MHz, 2.4 GHz, and 5 GHz bands and "lightly licensed" spectrum in the 3650-3700 MHz band to deliver last-mile service, and use a combination of unlicensed and licensed links and fiber for backhaul and point-to-point connectivity. Some WISPs have added fiber technology to their fixed wireless networks, either as middle-mile or last-mile connections. As such, WISPA is well-qualified to respond to questions concerning the future of spectrum policy in the United States.¹

In response to *Question #2*, WISPA believes that unlicensed spectrum has and will continue to have a necessary and critical role in the American economy and to the provision of fixed and mobile wireless services to consumers. Congress should continue to explore ways in which it can make more licensed and unlicensed spectrum available for commercial purposes.

¹ Please note that WISPA is not providing written responses to Questions 1 and 7.

A recent report by Raul Katz (Katz Report) estimates the economic value of unlicensed spectrum to be \$140 billion and the aggregate economic surplus to be \$222 billion.² The Katz Report discusses the value of unlicensed spectrum that is created across four dimensions: (1) complementing wireline and cellular technologies to enhance their effectiveness; (2) providing an environment conducive to developing alternative technologies, which expands consumer choice; (3) enabling the launch of innovative business models; and (4) expanding access to services beyond what is economically optimal for licensed bands.³ WISPs are relevant to each of these four dimensions.

With respect to the WISP market, the Katz Report makes several important conclusions. First, approximately five percent (5%) of U.S. households can only obtain non-mobile broadband services from a WISP, an amount that grew by ten percent (10%) between 2008 and 2011. WISPA believes that this trend is continuing as WISPs continue to invest in expanding their networks and as their subscriber bases grow.

The Katz Report also conservatively estimates the number of WISP subscribers at 3,000,000 with a monthly average revenue per user (ARPU) of \$39.99. This yields total annual revenues of \$1.439 billion, an amount that is probably underestimated by about \$1 billion when additional subscribers and higher ARPU are considered. A recent informal survey of WISPA members suggests that the average ARPU is more accurately between \$45.00 and \$50.00 per month.

The most significant benefits of unlicensed spectrum to WISPs are its low acquisition and deployment costs. Under Part 15 of its rules, the Federal Communications Commission (FCC) regulates devices but does not assign spectrum for exclusive use in a particular geographic area. Accordingly, WISPs can quickly deploy service by acquiring equipment without incurring spectrum acquisition costs. This reduces investment, lowers barriers to entry, and accelerates the availability of broadband service. WISPs have generally managed to coordinate their networks to avoid interference with each other and with other unlicensed devices, and have proved to be proficient at sharing spectrum in ways that enable delivery of reliable fixed broadband services.

The rapid expansion of broadband service in rural America and the explosion of other unlicensed services such as Wi-Fi would not have been possible without unlicensed spectrum. Without unlicensed spectrum, consumers in many rural areas would continue to lack access to fixed broadband services because wireline technologies such as fiber, DSL, and cable cannot be cost-effectively deployed in sparsely populated rural areas. Further, devices and services such as Wi-Fi and tablets that rely on unlicensed spectrum either as primary access or for data offloading would not be available or would cost significantly more. And in all cases, unlicensed spectrum relieves congestion and reduces “noise” in licensed bands, which improves the customer experience and enables more consumers to use wireless devices and services.

² Katz, Raul “Assessment of the Economic Value of Unlicensed Spectrum in the United States,” Telecom Advisory Services, LLC (February 2014) (Katz Report).

³ *See id.* at 6.

Recent history shows that licensed and unlicensed services are complementary and not competing. Many WISPs use microwave links licensed under Part 101 of the FCC's rules for backhaul and connectivity to the Internet. Others have combined their unlicensed last-mile offerings with licensed offerings where spectrum in the 2.5 GHz has been available for acquisition or lease. Accordingly, Congressional policies and FCC rules must continue to offer a balance between licensed and unlicensed spectrum if our Nation's need for affordable broadband services is to be met in a reasonable and timely manner. A spectrum regime that calls for only auctioned and licensed spectrum is economically sub-optimal.

In response to *Question #3*, WISPA urges Congress to initiate a comprehensive review of the use of spectrum by government agencies. A spectrum audit would help determine whether and to what extent unused or underutilized government spectrum can be cleared, consolidated with other government users or shared with commercial users. WISPA notes that the Middle Class Tax Relief and Job Creation Act (Spectrum Act) identified 195 megahertz in the 5 GHz band for study by the National Telecommunications and Information Administration (NTIA) and the FCC to determine the feasibility of spectrum sharing.

WISPA also encourages Congress to adopt H.R. 3674, which incent federal agencies to evaluate their spectrum needs and to receive a portion of the auction proceeds to relocate. As a complement to a spectrum audit and re-assignment of government spectrum to the commercial sector, Congress should also consider the proposal of the Technology Policy Institute, which would allow government agencies to lease spectrum in much the way that the General Services Administration leases and subleases government property.⁴

In response to *Question #4*, WISPA notes its deep concern over the FCC's lenient build-out rules that enable licensees to hold spectrum for long periods of time without being required to construct or operate and without being required to make their unused spectrum available to others, especially in rural areas.

The FCC typically requires licensees that acquired their licenses through competitive bidding to meet "substantial service" requirements at the end of their license terms and, in some cases, to meet interim construction milestones before the end of the license terms. The specific requirements vary among the radio services, but the FCC has established "safe harbors" based on the percentage of population or area covered, the provision of specialized services or the provision of unique services not offered by others in the market.⁵

These rules make it relatively easy for licensees to focus their build-out on high-density urban markets – indeed, the rules *encourage* such behavior. There is no requirement for service to rural portions of licensed areas, and no penalty for a licensee that fails to build out to rural

⁴ See <https://www.techpolicyinstitute.org/news/show/23603.html> (last visited April 14, 2014).

⁵ See "Spectrum Management: FCC's Use and Enforcement of Buildout Requirements," GAO-14-236 (February 2014) (GAO Report). Notably, the GAO Report only included five services: broadband PCS, 220 MHz Phase II, 39 GHz, fixed microwave and private land mobile. WISPA was not one of the associations contacted to help prepare the GAO Report.

areas. As a result, rural markets are almost always the last to be covered, and in some cases may never see such services commercially deployed.

As discussed in the GAO's "Spectrum Management: FCC's Use and Enforcement of Buildout Requirements" (the "GAO Report"), there is consensus that buildout requirements are necessary and that any buildout requirements should be enforced. WISPA generally agrees with those stakeholders that state that the buildout rules encourage licensees to provide coverage in a timely manner and prevent the warehousing of spectrum, but believes that the level of commercial service that license holders actually provide is often lacking.⁶ WISPA also believes that the buildout rules provide an exceptionally long time for licensees to comply and focus on the most population or the largest area covered, without any requirement to serve rural areas that have relatively less population that is more sparsely distributed.

WISPA also agrees with those stakeholders that stated that buildout requirements are not effective at promoting services to rural areas.⁷ While geographic requirements are theoretically better at encouraging buildout to rural markets than population-based "safe harbors," the reality is that licensees will choose the easiest way to meet the requirement, and building a few base stations in urban areas will always be preferred over building many base stations in rural areas. Because the "safe harbors" provide licensees with a choice, licensees most often neglect rural areas to satisfy their buildout requirements. As one example, licensees in the Broadband Radio Service (BRS) and the Educational Broadband Service (EBS) were required to meet buildout requirements in 2011. In the vast majority of cases involving BRS and EBS stations where spectrum was leased for commercial purposes, the licensees met the buildout requirement by demonstrating coverage – but not actual service – to a percentage of the population, often in the urban core.

WISPA offers several ways in which such "legal warehousing" can be mitigated and service to rural areas can be accelerated. First, the FCC could adopt more stringent buildout requirements. Current "substantial service" rules look to the degree of coverage that a licensee provides at a single point in time, without any requirement that the licensee provide continuing service over time. This "snapshot" approach fosters a "license saver" environment in which the licensee does nothing for ten years and then, at the eleventh hour, constructs modest facilities that have little or no commercial application. Eliminating this practice through stricter buildout rules would be a positive step.

Second, the FCC could encourage licensees to build out to rural areas. As an example, the FCC could adopt rules stating that, for every "x" number of transmitters deployed in defined urban areas of a geographic license, the licensee would be required to deploy "y" number of transmitters in defined rural areas of that license. This will help ensure that deployment of facilities in rural areas does not lag behind deployment in more densely populated areas. In addition, the FCC could consider increasing the power limits for rural areas, or even establishing separate technical rules for rural areas, to make buildout in such areas more economical.

⁶ See *id.* at 25-26.

⁷ See *id.*

Third, the FCC's buildout rules can incorporate a "use it or lose it" policy in which a licensee would lose the portion of its license where it chose to not build out within a specified time period. The unserved area would then be available for re-licensing in which the previous licensee would be ineligible to participate. One potential problem with this approach would be that licensees could acquire the license without any intent to build out in a rural area, and it would take several years for the FCC to re-license the spectrum.

Fourth, the FCC could adopt a "use it or share it" policy in which opportunistic unlicensed use would be permitted in areas where the licensee had chosen to not deploy. Such unlicensed use would of course be subject to rules providing incumbents interference protection and regulated by spectrum sharing techniques such as a Spectrum Access System, dynamic frequency selection, exclusion zones, and other methods appropriate for incumbent protection. There are several services where licensees met the relatively lenient buildout requirements but did not, after several years, deploy services beyond the urban core, leaving vast rural areas unserved. A WISP could offer service on a non-interfering basis until such time, if ever, the licensee elected to serve the area. As stated in the report that first espoused the "use it or share it" approach, "[u]nused spectrum capacity can be made available more rapidly by developing more explicit band-by-band conditions for opportunistic access on a secondary basis that ensure primary users protection from harmful interference."⁸ A "use it or share it" approach "may also motivate the licensee to extend service into that area earlier than it would have otherwise. The fact that other firms, possibly even competitors, are making valuable use of its fallow spectrum could encourage a licensee to make greater efforts to arrange secondary market transactions."⁹

WISPA appreciates that these proposals may theoretically discourage participation in competitive bidding or reduce the prices that bidders may be willing to pay for licenses. However, WISPA believes that the benefits of encouraging buildout of commercial facilities in rural areas, greater participation in FCC spectrum auctions and opportunistic use of fallow spectrum would far outweigh any potential changes to the current environment.

In response to *Question #5*, WISPA believes that the FCC should *not* be permitted to use expected auction revenue as the basis for a public interest finding. Auction revenues provide a short-term economic benefit and, coupled with very modest buildout requirements, encourage legal spectrum warehousing. It is acceptable for auction rules to favor those bidders that demonstrate the "highest and best" use, but too often that use excludes real service.

In response to *Question #6*, WISPA believes that policies should encourage flexible use, interoperable equipment and technical standards. In adopting technical rules for a particular spectrum band, the FCC should not prescribe particular uses. As one example, in the 5 GHz band, the FCC has adopted rules that will enable the deployment of facilities using the new 802.11ac Wi-Fi standard, but will not preclude higher-power uses that can support different

⁸ Calabrese, Michael A., "Use it or Share it: Unlocking the Vast Wasteland of Fallow Spectrum," Open Technology Institute/Wireless Future Project, New America Foundation (September 2011).

⁹ *Id.* at 15.

business models. This approach will encourage both the development of standard-based equipment as well as equipment that can deliver additional value-added service , with marketplace forces driving innovation.

In response to *Question #8*, WISPA incorporates its response to Question #4. With respect to operating rules, WISPA encourages the FCC to enforce its rules regarding discontinuance of service. More importantly, WISPA believes that any spectrum reclaimed as a result of a licensee’s decision to cease providing service should be quickly re-licensed. Such re-licensing could be accomplished through a competitive bidding process administered by third parties. By relying on third parties to conduct competitive bidding, spectrum would not be laying fallow in the FCC’s “spectrum bank” for an indefinite period of time until the FCC, not the market, determines when to make the spectrum available.

In response to *Question #9*, it is WISPA’s position that improvement of equipment over time benefits everyone. Older equipment – that which is no longer in use and/or has demonstrated problems – should be sunset. Other equipment should be replaced at a normal equipment replacement rate; however, if this time period is too short, it will impact the cost to the consumer significantly. It is important that an appropriate balance be struck between mandatory equipment upgrades and the cost to the consumer.

In response to *Question #10*, WISPA believes that the current bifurcated system where the National Telecommunications Infrastructure Agency (NTIA) and the FCC each have authority over certain aspects of spectrum policy creates a regulatory overhead that puts our country at a disadvantage vis-à-vis countries that do not have a bifurcated system. Therefore, WISPA supports consideration of regulatory schemes that would eliminate this overhead and streamline spectrum management.

Please feel free to reach out to WISPA for any additional information or support that you desire. If you have any questions or would like to discuss further, please feel free to contact me at [REDACTED]

Respectfully submitted,

[REDACTED]

WISPA Legislative Committee Chair
www.wispa.org

cc: David Redl
Ray Baum
Shawn Chang

April 25, 2014

The Honorable Fred Upton
Chairman
Committee on Energy and Commerce
House of Representatives
Washington, DC 20515

The Honorable Henry Waxman
Ranking Member
Committee on Energy and Commerce
House of Representatives
Washington, DC 20515

The Honorable Greg Walden
Chairman
Communications and Technology Subcommittee
Committee on Energy and Commerce
House of Representatives
Washington, DC 20515

The Honorable Anna Eshoo
Ranking Member
Communications and Technology Subcommittee
Committee on Energy and Commerce
House of Representatives
Washington, DC 20515

Dear Chairmen Upton and Walden, Ranking Members Waxman and Eshoo:

XO Communications and its affiliate Nextlink Wireless (hereinafter referred to as XO) welcomes the opportunity to respond to the Committee on Energy and Commerce's inquiries regarding spectrum policy. XO is a facilities-based provider of telecommunications and information services to business and wholesale customers in major markets throughout the United States. XO is also a microwave licensee in the Local Multipoint Distribution Service (LMDS) and 39 Gigahertz (GHz) spectrum bands and has active links in the Common Carrier bands of 11, 18 and 23 GHz. XO's microwave spectrum allows for wireless links at speeds up to 1 Gigabit per second (Gbps) between radios up to several miles apart. XO uses this spectrum for the provision of high capacity service to commercial buildings, schools, hospitals, government facilities, and ports as well as wireless backhaul from cellular towers. The benefits of these bands are their rapid deployment, scalability and high throughput, but there are line of sight constraints that limit the use of this spectrum in areas of geographic diversity for both urban and rural markets. Under the rules of the Federal Communications Commission ("FCC"), XO's geographic licenses (LMDS and 39 GHz) can only be used for fixed point to point or point to multi-point operations, and the Common Carrier spectrum that XO has licensed can only be issued on a per link basis for fixed point to point connections.

As the Committee deliberates on any prospective change to U.S. Spectrum Policy, XO believes the inclusion of microwave spectrum in this analysis is warranted since these bands play an increasingly vital role in our broadband infrastructure. XO supports initiatives to increase the commercial availability of spectrum, and here identifies two changes that can help achieve those ends:

I. Fair, Uniform Treatment of Neighboring Microwave Bands

The FCC's current rules and policies treat license holders in neighboring microwave bands unequally despite the similar characteristics of these spectrum bands. As mentioned above, XO is a

licensee for both geographic area (LMDS and 39 GHz) and per link (Common Carrier) spectrum, so it has witnessed firsthand the disparate treatment of these bands and how that treatment affects the wireless marketplace. While geographic area licenses and per link licenses are both subject to build out requirements, the consequence of non-compliance for these licenses is dramatically different. If a provider has not reached its substantial service threshold in the LMDS or 39 GHz bands, it is required to forfeit its license. For a geographic area licensee that has won and paid for an entire geographic license at auction, the costs of forfeiture are material and significant. Meanwhile, when this penalty is applied to a link in the Common Carrier band, the effect is de minimis, since Common Carrier links are ostensibly given away for free.¹

The disparate treatment of similar microwave bands (LMDS/39 GHz v. Common Carrier) permits arbitrage in the Common Carrier bands, since a licensee can acquire Common Carrier links, elect not to build, relinquish those licenses at the end of eighteen months (when a substantial service showing is required), re-apply immediately for the relinquished links, and repeat the process. The result of this unsavory practice is that new licenses are not issued to those parties that wish to provide competing service in these bands, as the incumbent licensee is in effect “warehousing” swaths of spectrum that could provide increased broadband capacity and competition. This is of particular concern in geographic areas where there are preferred transmission routes that provide optimal transmission speeds, but where any deviation from that route would slow the speeds to unworkable and uncompetitive levels. It is as if a railroad purchased options on ALL of the possible lower altitude paths through a mountain range, forcing all other competitors to take difficult, if not impossible, routes over the mountains because they are locked out of the passes.

One solution to this problem would be to increase the opportunity cost for such a practice. This could be achieved by any or all of the following: adding a spectrum fee to reflect the value and size of the license,² shortening the term of the license so that there is greater turnover,³ or changing the licensing mechanism for this spectrum to geographic area licensing (as in the LMDS and 39 GHz bands). All of these measures would address the present warehousing problem as well as generate revenue for the U.S. Treasury commensurate with the actual market value of the asset.

II. Licensees Should Have Increased Spectrum Flexibility

XO has a significant investment in LMDS and 39 GHz spectrum and is constantly seeking ways to leverage those assets for the provision of high value services. Since both of these bands are licensed

¹ Present assignment of Common Carrier licenses is on a first come, first served basis after the applicant clarifies that the proposed route will not cause interference with incumbent licensees. There is no fee for the spectrum, but there is a nominal FCC application fee to cover administrative costs.

² The cost for a Common Carrier license does not vary based on size. A 30 MHz or 80 MHz license is assessed the same application fee, and there are no requirements that a licensee use the entirety of the band they have licensed.

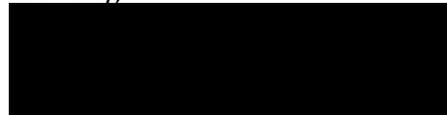
³ Common Carrier licenses are issued for ten year periods.

geographically, the restriction that they only be used for fixed point to point and point to multi-point connections limits their utilization and deployment. These use restrictions appear to flow from concerns about harmful interference, but those concerns are shortsighted as the license areas in question cover significant geographic swaths. This broad coverage effectively makes licensees the “band manager” for those areas. As such, they are properly incentivized to minimize interference to facilitate the full utilization of their investment, as any interference generated would only be harmful to themselves. If these interference concerns are focused on the effects on neighboring spectrum, then licensees can establish guard bands or take other measured steps to mitigate any harmful interference and protect other licensees’ rights. Clearly, technology advancements have decreased the risk of harmful interference.

As more and more Americans increase their wireless consumption, there is a constant search for new spectrum opportunities. Such efforts include the testing of microwave spectrum in the LMDS band for 5G mobile use. While 5G may still be nascent technology, it holds great promise for meeting growing demand for mobile wireless data and faster speeds. However, the undue restrictions on mobile LMDS deployments could preclude the use of this additional spectrum to help shoulder the increasing wireless data burden. Greater spectrum flexibility would spur additional research and development into equipment for these bands and signal to equipment manufacturers that they have a green light to invest in innovative new technologies. In fact, developments like prospective 5G use should underscore the need to review the status of other microwave bands (like the Common Carrier bands mentioned above), to ensure that licensing determinations made years ago do not chill future wireless broadband investments.

Indeed, the longtime approach of simply giving spectrum away in the Common Carrier bands rather than auctioning those frequencies limits market forces and prevents the full and efficient usage of this spectrum. XO supports a modernization of spectrum policy to rationalize the assignment of all microwave spectrum and eliminate undue restrictions on the appropriate use of these bands. Such modernization and greater flexibility will eliminate chilling effects on investment and innovation and greatly benefit consumers who receive new and exciting services. The U.S. Treasury would also benefit from these changes. XO looks forward to working with the Committee as these policy deliberations continue and stands ready to provide further views on appropriate solutions.

Sincerely,

A large black rectangular redaction box covering the signature of Patrick Thompson.

Patrick Thompson
Director, Legislative Affairs
XO Communications