TESTIMONY OF
THOMAS F. NAGEL
SENIOR VICE PRESIDENT
COMCAST CORPORATION

BEFORE THE
U.S. HOUSE COMMITTEE ON ENERGY AND COMMERCE
SUBCOMMITTEE ON COMMUNICATIONS AND TECHNOLOGY

HEARING ON

"CHALLENGES AND OPPORTUNITIES IN THE 5 GHZ SPECTRUM BAND"

NOVEMBER 13, 2013

Mr. Chairman and Members of the Subcommittee:

Thank you for inviting me to testify today. I am the Senior Vice President of Strategic Initiatives at Comcast Corporation ("Comcast"), where I have worked since 2002. In my current role, I am responsible for leading the strategic development of Comcast's wireless services and products.

Comcast believes that the 5 GHz band has enormous potential to support continued growth in unlicensed wireless services, including the next generation of Wi-Fi. The 5 GHz band is a platform for technological innovation, investment, and economic growth. With access to additional 5 GHz spectrum and improved Federal Communications Commission ("FCC") rules, our industry will be able to use this band to meet growing consumer demand for wireless data services.

Over the last few years, Comcast has implemented an innovative strategy to provide broadband services to our customers outside the home using our Wi-Fi network to deliver wireless services that operate over the 2.4 GHz and 5 GHz bands. We have deployed a network of nearly 350,000 Xfinity WiFi access points throughout our footprint, accessible for no additional charge to qualified Comcast broadband customers via any Wi-Fi-enabled device. Our customers have embraced this service, logging on more than four million times and transferring more than 70 terabytes (or 70,000 gigabytes) of data every week. And we are partnering with other cable companies to offer one of the country's largest networks of Wi-Fi access points, giving our customers access to more than 100,000 additional access points around the country. This substantial investment allows us to successfully extend our existing network in ways that make it more flexible, more interoperable, and more convenient for our customers. But continued investment and innovation depends on access to additional unlicensed spectrum resources.

Our experience confirms that unlicensed technologies are a central component of the wireless landscape, and are among the most popular methods consumers use to access the Internet. Unlicensed spectrum provides a platform for devices and services that contribute tens of billions of dollars of value to the nation's economy every year. Americans' demand for wireless data services continues to grow, regardless of whether they are at home or on the go, and unlicensed services like Wi-Fi play a key role in meeting that demand. In addition, unlicensed services serve as critical sources of connectivity in times of crisis when licensed wireless networks may

not be able to support heavy traffic loads or are otherwise unavailable, such as when Comcast's Wi-Fi networks facilitated communications in the aftermath of Hurricane Sandy last year and the attack at the Boston Marathon earlier this year.

Our nation's spectrum policy must reflect these realities by addressing the current and future challenges to the continued growth of unlicensed services. As FCC Chairman Wheeler said just last week, "[w]e must make sure that unlicensed spectrum is a key part of whatever set of decisions that we make . . . [because] . . . [u]nlicensed spectrum has been and must continue to be the catalyst for innovation."[1]

It is undisputed that the future of Wi-Fi is in the 5 GHz band. The core challenge we face today is that Wi-Fi spectrum in the 2.4 GHz band has become highly congested, especially in densely populated urban areas. This makes it harder for service providers to deliver the wireless broadband services that consumers and businesses expect and, in many cases, need. Solving this problem requires a balanced approach. The FCC should allocate additional spectrum in the 5 GHz band for unlicensed use *and* remove regulatory roadblocks that limit the efficient use of already-allocated unlicensed spectrum, such as unnecessary indoor-only restrictions, power limitations, and other technical requirements that act as barriers.

Making additional spectrum available for Wi-Fi in the 5 GHz band and making that band more usable are also essential to deploying gigabit Wi-Fi in the United States. Gigabit Wi-Fi depends on the newest Wi-Fi standard – 802.11ac – which requires wider channels than current unlicensed bands can support. We have urged the FCC to allow higher power levels and outdoor use in the U-NII-1 band and to open the U-NII-2b and U-NII-4 bands for unlicensed operations. Doing this would ease congestion in other bands and ensure that the United States has unlicensed bands large enough to support gigabit Wi-Fi. The 5 GHz band is uniquely important to the future of Wi-Fi because many devices are already compatible with 5 GHz Wi-Fi technologies. Simply put, there are no other suitable spectrum bands that could realistically support the next generation of Wi-Fi.

Allocating additional spectrum to unlicensed services does not mean that incumbent users of the 5 GHz band must be displaced. Technical studies submitted to the FCC are clear that the FCC can move ahead in ways that will allow effective sharing of the spectrum, particularly in the U-NII-1 and U-NII-4 bands. While incumbent users are entitled to protection from harmful interference, they should not be allowed to block forward progress – especially when such incumbents have not yet deployed commercially available services. In an era of spectrum scarcity and increasingly efficient wireless technologies, the country cannot afford to allow huge swaths of spectrum to remain unused or underused because incumbents refuse to share or refuse to work together to make more efficient use of spectrum. Unlicensed services like Wi-Fi are designed to *share* spectrum with other users, and technological solutions can permit Wi-Fi and other unlicensed technologies to co-exist with incumbent users without undermining incumbents' use of the spectrum.

Congress understands this and embraced a balanced spectrum policy that took a significant step toward addressing the challenges facing both licensed and unlicensed wireless services when it

[1] *See* Kate Tummarello, *FCC Chief Touts Importance of Wi-Fi Airwaves*, Hillicon Valley (Nov. 8, 2013), http://thehill.com/blogs/hillicon-valley/189697-fcc-chief-touts-importance-of-wi-fi-airwaves.

passed the Middle Class Tax Relief and Job Creation Act of 2012, which paved the way for action in the 5 GHz band. Comcast applauds Congress for passing this landmark legislation, and we appreciate the efforts of the FCC, National Telecommunications and Information Administration ("NTIA"), and other interested parties.

We ask now that Congress encourage the FCC and NTIA to expeditiously adopt new rules before existing unlicensed bands become completely saturated. Timely action will promote investment in this band and enable the development of the next generation of unlicensed technologies.

I. UNLICENSED 5 GHz SPECTRUM PROVIDES A PLATFORM FOR INVESTMENT, INNOVATION, AND ECONOMIC GROWTH.

Consumers today expect access to content and information anytime, anywhere, and on any device, and unlicensed spectrum has been a key catalyst to this revolution. The explosive growth of services and devices using unlicensed spectrum, including Wi-Fi, Bluetooth, RFID, and smart grid applications, among many others, has been remarkable. These services have greatly benefitted consumers, created billions of dollars of economic value, created and supported millions of jobs, and provided a platform for even more innovation and investment.[2] Wi-Fi in particular is now a part of most Americans' daily lives and a service upon which consumers and businesses – including mobile network operators – increasingly rely for cost-effective and robust wireless broadband access to the Internet. In light of the extremely positive economic and societal effects of unlicensed services, it is no surprise that there is widespread consensus among policymakers,[3] industry,[4] and other interested parties[5] that unlicensed services must continue to

---

[2] The unlicensed model reduces regulatory and economic barriers to use of the spectrum, thereby "encouraging a deluge of technological and business model innovation" and turning unlicensed spectrum "into the most economically productive radio spectrum in the world." Richard Thanki, *The Power of the Unlicensed Economy*, AllThingsD, July 10, 2012, *available at* http://allthingsd.com/20120710/the-power-of-the-unlicensed-economy/ ("*Thanki 2012 Paper*").

[3] *See, e.g.*, Presidential Memorandum: Unleashing the Wireless Broadband Revolution (June 28, 2010) (ordering the Secretary of Commerce to make spectrum available for, *inter alia*, "shared access by commercial and Government users in order to enable licensed *or unlicensed* wireless broadband technologies to be deployed.") (emphasis added) , *available at* http://www.whitehouse.gov/the-press-office/presidential-memorandum-unleashing-wireless-broadband-revolution; Press Release, Energy & Commerce Comm., U.S. House of Representatives, *Walden, Latta Welcome Progress on Efforts to Increase Unlicensed Spectrum* (Jan. 10, 2013), *available at* http://energycommerce.house.gov/press-release/walden-latta-welcome-progress-efforts-increase-unlicensed-spectrum; Press Release, FCC, *Statement from FCC Chairman Julius Genachowski on House Passage of Voluntary Incentive Auction Legislation* (Dec. 13, 2011) ("Unlicensed spectrum stimulates innovation, investment, and job creation in many ways, including by providing start-ups with quick access to a testbed for spectrum that is used by millions, bringing new technologies to consumers in a rapid fashion."); *Unlicensed Operation in the TV Broadcast Bands*, Second Report and Order and Memorandum Opinion and Order, 23 FCC Rcd. 16807 (2008) (Statement of Commissioner Robert McDowell) ("Robust unlicensed use of white spaces will give nimble entrepreneurs the freedom to disrupt the market in positive and constructive ways that will force incumbents to keep pace with this new revolution.").

[4] *See, e.g.*, Comments of Motorola Solutions, Inc., ET Docket No. 13-49, at 8 (May 28, 2013) ("There is a well-documented need for additional wireless broadband spectrum, and unlicensed spectrum in particular is a key driver of innovation and economic development."); Comments of Time Warner Cable, Inc., ET Docket No. 13-49, at 4 (May 28, 2013) ("TWC believes that a robust Wi-Fi capability provides an important complement to its existing wireline broadband network to enable its subscribers to access the Internet anywhere, anytime, on any device."); Reply Comments of Sprint Nextel Corp., WT Docket No. 12-4, at 10 (Mar. 26, 2012) ("Wi-Fi networks that are

be a key component of wired and wireless broadband Internet access services. Comcast has first-hand experience with the tremendous value these services offer to consumers.

A. Comcast's Xfinity WiFi Service Uses Unlicensed Spectrum to Deliver Fast, Reliable Wireless Broadband Access.

Comcast's residential and business customers have long used Wi-Fi routers in their homes and businesses to enhance the value of their wired high-speed Internet service. Over the last few years, Comcast has invested significant human and capital resources to bring that experience *outside* the home by deploying a robust Wi-Fi network that enables our customers to enjoy wireless Internet access on the go. Today, Comcast makes Xfinity WiFi available in several cities throughout the country for any consumer to access on a pay-per-use basis, and access is included for no additional charge for qualifying Xfinity Internet customers.

Comcast's efforts are really only beginning. In 2012, we expanded the Xfinity WiFi network from approximately 5,000 access points to more than 25,000 access points. So far this year, that number has increased to nearly 350,000 access points, as we have ramped up the deployment of our network, enhancing the service in existing areas and expanding into several new regions, including Washington, D.C. We are rolling out a new neighborhood hotspot initiative that has the potential to add millions of additional Wi-Fi access points throughout our footprint, thereby significantly enhancing consumers' ability to stay connected.[6] Through our CableWiFi partnership with other cable operators, our customers have access to more than 100,000 additional access points throughout the country for no additional charge.[7] Importantly, all of our outdoor access points – and all the outdoor access points installed by our cable partners – include the ability to access the 5 GHz band.

Usage of Xfinity WiFi has grown dramatically as we have expanded its footprint. There are now more users of the Xfinity WiFi service than ever before, and they are doing more, more often, with more devices, for longer. In fact, our Wi-Fi network now carries between 70-90 terabytes of data every week, which roughly equates to a staggering 300,000 gigabytes of data every month. We support more than four million user sessions every week, and these figures are steadily increasing. Comcast now records more Wi-Fi user sessions in a single month than it did in the first two-and-a-half years of the Xfinity WiFi project.

---

easily – even seamlessly – accessible by customers of wireless carriers can provide users with advantages of higher-speed connections without wireless data limits."); Joint Comments of Google, Inc. & Microsoft, Inc., GN Docket No. 12-268, at 1 (Jan. 25, 2013) ("[B]usinesses depend on access to robust licensed services as well as access to robust unlicensed spectrum resources. One without the other simply will not allow U.S. businesses to meet accelerating consumer demand for wireless products and services.").

5 *See, e.g.*, Mark Cooper, *Efficiency Gains and Consumer Benefits of Unlicensed Access to the Public Airwaves* 7 (Jan. 2012), *available at* www.markcooperresearch.com/SharedSpectrumAnalysis.pdf ("The unlicensed model has succeeded in supporting a large amount of economic activity in the wireless broadband space by bringing new and unique services to the market, increasing the value of broadband service by extending it to additional devices, and providing a lower cost, more efficient avenue to deliver data to consumers.").

6 Tom Nagel, "The Evolution of Xfinity WiFi," ComcastVoices.com (June 10, 2013).

7 *See generally* CableWiFi™, http://www.cablewifi.com/ (last visited Sept. 27, 2013).

B. Unlicensed Services Add Significant Value to Mobile and Fixed Broadband Services and the National Economy.

Comcast's experience is consistent with the growing body of data showing that unlicensed services create huge benefits both for consumers and broadband providers and support significant growth in the economy as a whole.

According to a 2012 study, "a variety of approaches all point toward economic benefits [from unlicensed technologies] at least in the tens of billions of dollars a year."[8] A separate 2012 study concluded that the extension of fixed broadband networks using unlicensed spectrum generates approximately $15.5 billion of consumer surplus in the United States every year.[9] And the value of in-home Wi-Fi, hospital Wi-Fi, and RFID tags "together may generate $16-37 billion per year in economic value for the U.S. economy over the next 15 years."[10] By some accounts, unlicensed services contribute upwards of $50 billion in annual economic growth.[11]

Unlicensed spectrum also adds value as a key complement to licensed wireless technologies, particularly as part of the solution to the rising demand for licensed spectrum caused by increased mobile wireless broadband traffic. According to Cisco, traffic on licensed mobile wireless networks increased 70 percent last year, rising from 520 petabytes per month in 2011 to over 885 petabytes per month in 2012.[12] Cisco expects that tremendous rate of annual growth to continue for at least the next four years.[13] Many mobile wireless broadband providers have come to recognize that, to keep up with consumers' increasing demand, they will need to rely on unlicensed services to carry some of the load. As Sprint has explained,"[o]ne of the most effective methods of increasing the capacity of wireless data systems is moving data traffic, whenever possible, from the licensed spectrum of commercial mobile carriers to unlicensed spectrum, such as that now used for Wi-Fi."[14]

---

[8] Paul Milgrom et al., *The Case for Unlicensed Spectrum* ¶ 42 (Oct. 12, 2011), *available at* www.stanford.edu/~jdlevin/Papers/UnlicensedSpectrum.pdf.

[9] Richard Thanki, *The Economic Significance of License-Exempt Spectrum to the Future of the Internet*, Annex 2 (June 2012), *at* http://research.microsoft.com/en-us/projects/spectrum/economic-significance-of-license-exempt-spectrum-report_thanki.pdf.

[10] Richard Thanki, *The Economic Value Generated by Current and Future Allocations of Unlicensed Spectrum*, Final Report, Perspective Associates 42 (Sept. 28, 2009), *available at* http://spectrumbridge.com/Libraries/White_Space_Primer/whitespaces-microsoft-study.sflb.ashx.

[11] *See, e.g.*, *Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, Notice of Proposed Rulemaking, 28 FCC Rcd. 1769 (2013) (Statement of Commissioner Mignon Clyburn).

[12] *See* Cisco, *Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2012-2017*, at 1 (Feb. 6, 2013) ("*2013 Cisco Forecast*"), http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.pdf.

[13] *See id.* at 3.

[14] Comments of Sprint Nextel Corp., WT Docket No. 12-4, at 5 (Feb. 21, 2012); *see also* Comments of Ericsson, ET Docket No. 13-49, at 2 (May 28, 2013) (discussing importance of technologies that "enable mobile operators to deliver supplemental small cell or stand-alone Wi-Fi" using unlicensed technologies).

The beneficial impact on licensed wireless providers and their customers resulting from Wi-Fi is staggering. The amount of mobile data offloaded to Wi-Fi networks is projected to reach 21 exabytes (or 21 *billion* gigabytes) by 2017.[15] One study concluded that, "[i]n the absence of Wi-Fi, cellular operators would need to construct up to 450,000 new radio base stations to serve increased smartphone data traffic. This could cost *$93 billion* – subjecting smartphone and tablet users to significantly higher network charges or greatly diminished service."[16]

There are also positive societal benefits associated with Wi-Fi services that are not as easily quantified, but are readily apparent. This was convincingly demonstrated by Comcast's experience during the chaotic aftermath of Hurricane Sandy last year, and after the events at the Boston Marathon earlier this year. Following Sandy, mobile wireless service was unavailable for large portions of the affected areas.[17] In the aftermath of the storm, Comcast made approximately 20,000 Xfinity WiFi access points in ten hard-hit states and the District of Columbia available at no charge to anyone who needed them to communicate with family or friends, or otherwise to get important recovery information. Comcast recorded more than 250,000 individual sessions during that period, supporting tens of thousands of unique users while also adding a special functionality to permit non-Comcast subscribers to maintain their connection without having to refresh their credentials. Likewise, in the immediate aftermath of the attack at the Boston Marathon, commercial mobile wireless networks were overloaded,[18] but Comcast opened its network to anyone – including non-Comcast subscribers – with a Wi-Fi-enabled device to establish communications with loved ones, leading to significantly increased usage of our Xfinity WiFi network in Boston and the surrounding communities. In each instance, we opened our Wi-Fi network in full cooperation with federal, state, and local officials as they looked for ways to ease the burdens on affected individuals and public safety officials.

Comcast has opened its Xfinity WiFi network during non-emergencies as well. For example, during the 2012 Summer Olympics, Comcast offered complimentary access to thousands of indoor and outdoor access points in the greater Philadelphia area, allowing anyone with a Wi-Fi-enabled device to follow the Olympic programming from London.[19] Comcast also has offered complimentary access at Xfinity WiFi access points along the New Jersey shore, enabling consumers to conveniently surf the Web, share photos, access social media, and stream music, TV, and movies.[20]

---

15 *See 2013 Cisco Forecast* at 3.

16 *Thanki 2012 Paper* (emphasis added).

17 *See, e.g.*, Brendan Sasso, *FCC Says Hurricane Sandy Knocked Out 25 Percent of Cell Towers in Its Path*, The Hill (Oct. 30, 2012), *available at* http://thehill.com/blogs/hillicon-valley/technology/264915-fcc-hurricane-sandy-knocked-out-25-percent-of-cell-towers.

18 *See, e.g.*, Chloe Albanesius, *FCC Probes Post-Bombing Cell Phone Congestion in Boston*, PC Magazine (Apr. 17, 2013), *available at* http://www.pcmag.com/article2/0,2817,2417891,00.asp.

19 *See* J.T. Ramsay, Comcast Voices Blog, *Comcast Celebrates Live Streaming of the 2012 Olympics Games Through NBCOlympics.com, Offers Free Access to Xfinity WiFi Hot Spots* (July 25, 2012), http://corporate.comcast.com/comcast-voices/comcast-celebrates-live-streaming-of-the-2012-olympic-games-through-nbcolympicscom-offers-free-acces.

20 *See* Joshua Palau, Comcast Voices Blog, *Comcast Creates Lasting Memories this Memorial Day* (May 22, 2013), http://corporate.comcast.com/comcast-voices/12542; J.T. Ramsay, Comcast Voices Blog, *Surfing at the*

During emergencies and non-emergencies alike, Wi-Fi networks offer a unique opportunity for consumers to communicate and stay connected because of the accessible nature of unlicensed spectrum and unlicensed services. Almost every mobile device is now equipped with a Wi-Fi radio, so almost everyone can access a Wi-Fi network, regardless of the identity of his or her underlying licensed mobile carrier. Mobile wireless providers simply cannot offer access to everyone, even if they wanted to, because of the closed nature of their networks and the licensed spectrum regime. As a result, in many respects, Wi-Fi has become the interoperable communications standard for consumers.

II. SOUND SPECTRUM POLICY MUST BE DESIGNED TO ENCOURAGE THE CONTINUED GROWTH OF WI-FI BY MAKING ADDITIONAL 5 GHZ SPECTRUM AVAILABLE FOR UNLICENSED USE AND BY REMOVING UNNECESSARY REGULATORY BARRIERS.

Although the benefits and importance of unlicensed services like Wi-Fi are clear, there are significant challenges that threaten to impair the growth and development of such services. To meet growing consumer demand and expectations for robust Wi-Fi services, all critical stakeholders – including Congress, the FCC, NTIA, incumbent licensees of the 5 GHz band, and Internet service providers – must address the remaining obstacles in a timely manner.

Comcast has identified two primary objectives that policymakers must achieve to remove the barriers that stand in the way of further growth and innovation in unlicensed services. First, the government must designate new 5 GHz band spectrum for unlicensed use. Because unlicensed services like Wi-Fi are designed to share spectrum with other users, allocating more spectrum to unlicensed often can be achieved without causing harmful interference to incumbents. Second, the government must remove unnecessary regulatory barriers that impede the efficient and intensive use of existing 5 GHz spectrum resources. We believe these are common sense, straightforward approaches that will facilitate the continued growth and vitality of wireless broadband and will return to the public significant benefits in the form of innovation, investment, and economic growth.

In pursuing these objectives, it is important that the FCC not delay acting in those areas where it is able to make a decision more quickly. The FCC has compiled a thorough record in response to its Notice of Proposed Rulemaking ("NPRM"),[21] and we strongly urge the FCC to seize the opportunity to act without further delay with regard to the 5 GHz Unlicensed National Information Infrastructure-1 ("U-NII-1") sub-band where the record is complete. As Commissioner Pai has stated, "To keep the ball rolling on this [5 GHz proceeding], we should tackle some of the less contentious issues this year."[22] Commissioner Rosenworcel also has

---

Shore Just Got Easier (July 1, 2011), http://corporate.comcast.com/comcast-voices/surfing-at-the-shore-just-got-easier.

[21] *Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, Notice of Proposed Rulemaking, 28 FCC Rcd. 1769 (2013) ("*FCC 5 GHz Notice*").

[22] *A Review of the President's Fiscal Year 2014 Funding Request and Budget Justification for the FCC: Hearing Before the Subcomm. on Fin. Servs. and Gen. Gov't of the S. Comm. on Appropriations*, 113th Cong. (Sept. 11, 2013) (statement of Ajit Pai, Commissioner, FCC), at 3, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-323237A1.pdf.

specifically said it is time "to seize this opportunity" to "expand [flexible rules] to this lower portion of the 5 GHz band."[23] And Commissioner Clyburn has correctly noted that "[t]he sooner we solve these issues, the sooner American innovation can show leadership in developing this band for unlicensed services."[24]

A. A Shortage of Usable Spectrum Hampers the Growth of Unlicensed Services.

Comcast's experience shows that there is significant congestion in existing unlicensed bands that threatens to stifle economic growth and wireless innovation. Because of this congestion, the core unlicensed spectrum band is already heavily saturated in many densely populated communities. Simply put, congestion in the 2.4 GHz band will make it increasingly difficult for providers to deliver the kinds and quality of service that consumers have come to expect.[25]

The congestion problems in the 2.4 GHz band are well documented. Commissioner Clyburn has pointed out that the 2.4 GHz band is particularly congested in major cities.[26] Former FCC Chairman Genachowski observed that "Wi-Fi congestion is a very real and growing problem."[27] And former FCC Commissioner McDowell noted, "The spectrum that is used for unlicensed Wi-Fi is also experiencing congestion, which will only increase in the coming years if we do not make appropriate bands, like the 5 GHz band, more attractive for investment and innovation."[28] A paper recently published by CableLabs, a cable industry non-profit research and development consortium, detailed the spectrum shortage issues:

> [A]ny reasonable extrapolation of known trends leads to the conclusion that WiFi spectrum exhaust is a matter of "when," not "if". . . . In the absence of new WiFi spectrum, it is likely that wireless broadband consumers will experience reduced performance. This poses a risk to continued growth of the wireless broadband ecosystem, a central element of technology and economic policy in the United States.[29]

---

[23] Statement of Jessica Rosenworcel, Commissioner, FCC, *Revision of Part 15 of the Commission's Rules Regarding Operation in the 57-64 GHz Band* (Aug. 9, 2013), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-13-112A3.pdf.

[24] *FCC 5 GHz Notice* (Statement of Commissioner Mignon Clyburn).

[25] "WiFi congestion will only accelerate as the number of wireless devices continues to grow. Without additional spectrum, wireless consumers are likely to experience reduced performance, threatening the future of the wireless ecosystem." Dirk Grunwald & Kenneth Baker, *FCC Broadcast Incentive Auction: A Band Plan Framework for Maximizing Spectrum Utility* 11 (2013) (attached to Reply Comments of Nat'l Cable and Telecomms. Ass'n, GN Docket No. 12-268 (Mar. 12, 2013)); *see also* InterDigital, *Dynamic Spectrum Management* 8 (Oct. 2012), *available at* http://www.interdigital.com/wp-content/uploads/2012/10/InterDigital-DSM-White-Paper_Oct2012.pdf ("Wi-Fi currently operates in the unlicensed bands 2.4 and 5.0 GHz. . . . Wi-Fi bands are often congested, particularly in high traffic public areas.").

[26] *FCC 5 GHz Notice* (Statement of Commissioner Mignon Clyburn).

[27] *FCC 5 GHz Notice* (Statement of Chairman Julius Genachowski).

[28] *FCC 5 GHz Notice* (Statement of Commissioner Robert McDowell).

[29] *See* Rob Alderfer, CableLabs, *WiFi Spectrum: Exhaust Looms* 5 (May 28, 2013) (included as Attachment A to Comments of Nat'l Cable & Telecomms. Ass'n, ET Docket No. 13-49 (May 28, 2013)) ("*WiFi Spectrum: Exhaust Looms*").

Essentially, there are so many devices using unlicensed spectrum in the 2.4 GHz band in certain locations that the result is significantly reduced Wi-Fi performance.[30] Further growth in data consumption via unlicensed technologies simply cannot occur unless service providers have access to more unlicensed spectrum. Time is of the essence.

B. CHANGES TO THE 5 GHZ BAND ARE CRITICAL TO ENSURING THE CONTINUED VIABILITY OF WI-FI.

Congress understands the potential of the 5 GHz band to address these challenges. The Spectrum Act directed the FCC to launch a proceeding to modify Part 15 of the FCC's rules to allow U-NII devices to operate in the 5.350-5.450 GHz band, and directed the NTIA to begin the process of allowing more intense sharing of the 5.350-5.450 GHz and 5.850-5.925 GHz bands between incumbent users and unlicensed services like Wi-Fi.[31] On February 20, 2013, the FCC issued an NPRM that would allow unlicensed devices to share these bands with existing users, and, critically, would update and improve the rules that govern the existing 5 GHz unlicensed bands.[32] Comcast commends Congress, NTIA, and the FCC for taking the necessary and significant first steps toward ensuring the availability of sufficient spectrum to encourage the continued growth, development, and proliferation of unlicensed wireless services.

As Comcast explained in our comments to the FCC, the 5 GHz band represents a crucial resource as the FCC works to alleviate the dramatic shortage in spectrum available for unlicensed services.[33] In addition, the 5 GHz band is the only band available for unlicensed services that can accommodate sufficiently wide channels to allow providers like Comcast to deploy the next generation of Wi-Fi. This standard will allow dramatically faster broadband speeds, potentially up to or in excess of one gigabit per second.[34] In contrast to networks using prior standards, Wi-Fi networks operating on the 802.11ac standard will support multiple data-intensive uses, such as several users simultaneously streaming HD videos, without any appreciable degradation in quality.[35] To realize its potential, however, this standard requires 160 megahertz-wide channels – far wider than channels currently available with reasonable operating rules in any of the spectrum bands used for unlicensed use.

Unfortunately, the rules that currently govern the 5 GHz band significantly undermine investment today and prevent providers from realizing the wide-band channels we will need to

---

30 *See, e.g.*, John Cox, *Wi-Fi Devices Crowd 2.4 GHz Band; IT Looks to 5 GHz Band*, Network World (Oct. 24, 2011), http://www.networkworld.com/news/2011/102411-wifi-unbalanced-252237.html ("'The 2.4 GHz band is congested, a symptom of the number of devices that only operate on that band, and the limitation of its [only] three non-overlapping channels.'").

31 *See* Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No 112-96, § 6406, 126 Stat. 156, 231 (2012) (*codified at* 47 U.S.C. § 1453) ("Spectrum Act"). U-NII devices are designed to provide short-range, high-speed wireless networking capability.

32 *See FCC 5 GHz Notice*.

33 *See* Comments of Comcast Corp., ET Docket No. 13-49 at 14-17 (May 28, 2013) ("*Comcast 5 GHz Comments*").

34 *See* Cisco, *801.11ac: The Fifth Generation of Wi-Fi Technical White Paper*, 3 (Aug. 2012), *available at* http://www.cisco.com/en/US/prod/collateral/wireless/ps5678/ps11983/white_paper_c11-713103.pdf.

35 *See id.* at 4.

support 802.11ac.[36] Specifically, power levels are prohibitively low in some parts of the band. Rules unnecessarily prevent any outdoor use of a large part of the band where there are no government incumbents. And government operations in another part of the band result in rules that require the use of cumbersome "listen-before-talk" technologies (also called Dynamic Frequency Selection, or "DFS"). As a result, there is only a fraction of the current 5 GHz band that providers can use for consumer Wi-Fi networks.

Fortunately, the FCC has proposed changes to its 5 GHz rules that would make the band far more attractive to investment and build-out of unlicensed services without causing harmful interference to incumbent users.[37] In the comments we filed with the FCC this summer, Comcast supported the FCC's proposals to: (1) harmonize the 5 GHz U-NII-1 and U-NII-2 bands by removing an indoor-only restriction and increasing allowable power levels in the U-NII-1 band; (2) harmonize the U-NII-3 and the new U-NII-4 bands by setting the technical rules in U-NII-4 to match those of U-NII-3; and (3) update technical protections for government operations in the U-NII-2 bands but not extend DFS to either the U-NII-1 or U-NII-4 bands.[38]

These proposals have received widespread support from a broad range of stakeholders, including both industry and public interest groups, because they enable more effective spectrum sharing in the 5 GHz band.[39] Importantly, if the FCC moves ahead, devices operating in the 5 GHz band will continue to be subject to the FCC's rules prohibiting U-NII devices from creating harmful interference to existing users. Comcast's position has always been that the FCC should adopt rules that protect incumbent operations while allowing commercially reasonable unlicensed operations.

As Congress and the Administration have recognized, this kind of spectrum sharing, where technically feasible, maximizes the efficient use of spectrum and permits the simultaneous delivery of multiple services that provide significant public benefits.[40] The 5 GHz band is an ideal band to implement this approach. However, Congress and the FCC must not allow incumbents to block needed improvements to the rules. With consumer demand for wireless broadband increasing, the importance of wireless services to the economy growing, and the emergence of far more efficient technologies, we simply cannot allow incumbent intransigence to leave huge bands unused or underutilized. We will protect existing users from harmful interference. But we cannot afford to allow unnecessary delay. Congress and the FCC should

---

[36] *See WiFi Spectrum: Exhaust Looms* at 21 (noting that "the full benefit of 802.11ac cannot be realized under the current terms of access to 5 GHz [spectrum]").

[37] *See FCC 5 GHz Notice* ¶¶ 26-28.

[38] *See Comcast 5 GHz Comments* at 21-22 (May 28, 2013) (setting forth the five principles that the FCC should adopt as it moves forward with the 5 GHz proceeding).

[39] *See, e.g.*, Comments of Nat'l Cable & Telecomms. Ass'n, ET Docket No. 13-49, at 12-23 (May 28, 2013); Comments of Wireless Internet Serv. Providers Ass'n, ET Docket No. 13-49, at 6-12 (May 28, 2013); Comments of Consumer Elecs. Ass'n, ET Docket No. 13-49, at 12-14 (May 28, 2013); Comments of Cisco Systems, Inc., ET Docket No.13-49, at 41-56 (May 28, 2013).

[40] *See* Executive Office of the President, President's Council of Advisors on Science and Technology, Report to the President: Realizing the Full Potential of Government-Held Spectrum to Spur Economic Growth at vi (July 2012) ("The essential element of this new Federal spectrum architecture is that the norm for spectrum use should be sharing, not exclusivity.").

not allow incumbents to refuse to adjust their systems where flexibility would allow substantially more intense use of spectrum.

With this in mind, Comcast has urged the Commission to move ahead with improvements to each individual 5 GHz sub-band as soon as it has the information it needs to devise new rules for that band. For example, in a major development, NTIA and the Department of Defense ("DOD") recently announced in a letter to the FCC that the government had determined that it did not require access to the U-NII-1 band as part of the process of making the 1755 MHz band available for auction.[41] As a result, the FCC now has a complete record on the U-NII-1 band and can issue a decision to allow outdoor operations and a higher power level. These two improvements would convert U-NII-1 from a band that Comcast and other providers simply cannot use today because of FCC regulations into a powerful tool to meet consumer broadband needs.

The record is clear that the Commission can make these two changes without causing harmful interference to the one incumbent user of this band. With DOD's announcement that it does not need to use the spectrum, the only U-NII-1 incumbent is Globalstar, a mobile satellite services provider. While Globalstar's operations are certainly important, it does not make sense for our country to reserve 100 MHz for the private use of a single company that uses it for four feeder link locations in the entire country, serving a very small group of customers with a highly specialized satellite handset service – *especially when the record shows that the FCC's proposed rule changes would allow Globalstar and Wi-Fi to share without any harmful interference.*

In weighing the benefits of moving forward, it is important to remember that a substantial number of existing Wi-Fi devices can already access this band. So, with just a software update and revised FCC rules, we could double the amount of 5 GHz spectrum available for commercially viable Wi-Fi deployment that consumers could access almost immediately. We should move ahead on opening the U-NII-1 band for unlicensed use without further delay.

Comcast is also enthusiastic about the FCC's proposals for the U-NII-4 band. Regarding the U-NII-4 band, the record is clear that unlicensed services like Wi-Fi can co-exist with incumbent satellite operations without causing harmful interference. The FCC has also assigned licenses in this band for the Dedicated Short-Range Communications ("DSRC") service. This service eventually intends to enable vehicle-to-vehicle and vehicle-to-infrastructure ("V2V" and "V2I") wireless automotive communications applications.[42] Comcast and other interested parties have reached out to DSRC interests to discuss how to work together to implement sharing methodologies without delay. We are committed to finding an approach that will both protect DSRC and allow commercially reasonable Wi-Fi deployment. Although the FCC allocated this spectrum to DSRC well over a decade ago, DSRC is still not commercially available. As a consequence, this is a golden opportunity to design both Wi-Fi and DSRC use of the band to allow sharing that will produce the best overall result. Equipment vendors that serve both

---

[41] *See* Letter from Teresa Takai, Chief Info. Officer, DOD, to Lawrence Strickling, Asst. Sec'y for Commc'ns & Info., U.S. Dep't of Commerce, at 1 (Jul. 17, 2013), attached to Letter from Karl Nebbia, Assoc. Adm'r, Office of Spectrum Mgmt., U.S. Dep't of Commerce, NTIA, to Julius Knapp, Chief, Office of Eng'g and Tech., FCC (Jul. 22, 2013).

[42] *See generally* DSRC: The Future of Safer Driving Fact Sheet, Research & Innovative Tech. Admin., Dep't of Transp., http://www.its.dot.gov/factsheets/dsrc_factsheet.htm (last visited Sept. 27, 2013).

industries, including Qualcomm and Cisco, have suggested promising paths toward an efficient sharing solution. But finding the right result will require flexibility on both sides. We are willing to be flexible to achieve this goal, and we hope that DSRC interests will be flexible as well.

To that end, policymakers should be asking probing questions of the DSRC community, such as: When will this technology actually be available to consumers? How much of the U-NII-4 licensed spectrum is actually necessary for V2V and V2I technologies? Are there other technologies such as radar that may be more effective, more cost effective, and/or more readily available than V2V and V2I technologies? While these yet-to-be-commercially-adopted technologies may sound appealing, the reality is that we can no longer afford to delay in putting this spectrum to use for consumers. So sharing this band with Wi-Fi is the best way to ensure intense use of the band while DSRC technologies continue to develop.

III. CONCLUSION

The future of wireless is bright, and Comcast is very excited to be a part of that future. Consumer demand for wireless services – licensed and unlicensed – continues to grow at unprecedented rates, creating new opportunities to provide innovative technological solutions and drive economic growth. Unlicensed wireless services in particular have proven to be an invaluable part of the wireless ecosystem, dramatically enhancing the value of licensed wireless and fixed broadband services.

All indications are that the trends toward heavier reliance on unlicensed services will continue well into the future. Congress, the FCC, and NTIA have made important strides by addressing the substantial policy challenges raised by this rapid technological development. Continued growth in this area will require more spectrum to address the critical shortages that are already occurring in many locations around the country. It will also require a reevaluation of the regulations that govern unlicensed operations, especially in the 5 GHz band. The FCC's current 5 GHz proceeding is a welcome development, but the FCC, NTIA, and other stakeholders need to move expeditiously to ensure that spectrum finds its way to the marketplace in a timely manner.

Comcast is firmly committed to engaging with Congress, the Administration, and the FCC as they continue to evaluate our nation's spectrum policy and to implement solutions that will produce even greater economic and technological growth and benefits for consumers.

Thank you for the opportunity to testify today.