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

In the Matter of Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band	ET Docket No. 13-49

REPLY COMMENTS OF COMCAST CORPORATION

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I. INTRODUCTION AND SUMMARY.

The record in this proceeding powerfully underscores the critical need for additional unlicensed Wi-Fi spectrum. Commenters overwhelmingly agree that the United States is facing a serious shortage of unlicensed spectrum that, if not addressed promptly, will severely constrain access to new communications technologies and degrade Americans' ability to use existing technologies they depend on more and more every day. Wi-Fi's contributions to national economic growth and consumer demand for unlicensed services are both huge and growing. But existing unlicensed spectrum designations and technical rules threaten to undermine the amazing Wi-Fi success story.

A wide variety of commenters explain that improvements in rules and policies applied to the 5 GHz band are critical to the future of wireless broadband in the United States. Manufacturers, service providers, and Internet companies all agree that the 5 GHz band is unique because (1) there are already protocols and equipment designed for use in this frequency range and (2) it is the *only* band that can support the next-generation 802.11ac "gigabit" Wi-Fi standard. For these reasons, the 5 GHz band is ideally situated to effectuate the directive in President Obama's recent Presidential Memorandum "to expedite the repurposing of spectrum and otherwise enable innovative and flexible commercial uses of spectrum, including broadband, to be deployed as rapidly as possible by . . . identifying spectrum allocated for nonfederal uses that can be made available for licensed and unlicensed wireless broadband services and devices, and other innovative and flexible uses of spectrum, while fairly accommodating the rights and reasonable expectations of incumbent users."[1] There will be no better test of the government's ability to deliver on this directive.

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[1] Office of the Press Secretary, The White House, *Presidential Memorandum—Expanding America's Leadership in Wireless Innovation*, Memorandum for the Heads of Executive

Although no party contests these facts, some commenters argue that the Commission's proposed improvements to the 5 GHz band could cause interference to certain incumbent operations or to possible future operations. Comcast is committed to working with the Commission and other 5 GHz users to design a sharing approach that "accommodate[s] the rights and *reasonable* expectations of incumbent users."[2] But the Commission must recognize that satellite use of the U-NII-1 and U-NII-4 band is extremely light and inefficient compared with what Wi-Fi would deliver to American consumers. Furthermore, Intelligent Transportation Systems ("ITS"), while potentially addressing an important need, *have not deployed a single commercial system after fifteen years*, and Congressional testimony makes it clear that *it may be decades, if ever, before ITS uses the 5 GHz band* as the Commission envisioned when it first licensed this service. Finally, the Commission should decline to give credence to the hyperbolic interference analyses submitted by certain incumbents; as described below, each is based on unrealistic assumptions and contain serious errors.

In the current spectrum environment, the Commission simply cannot afford to abandon work on a band, or indefinitely delay action—it must find the best bands for sharing and then make sharing work. The President and the Commission have recognized that in today's constrained spectrum landscape, where there is no more "greenfield" spectrum for use by growing wireless broadband services, sharing must be the New Normal. The Commission's task is therefore to identify the spectrum bands that are most underutilized and where sharing with existing operations produces the most value, compared with other bands.

Departments and Agencies (June 14, 2013), *available at* http://www.whitehouse.gov/the-press-office/2013/06/14/presidential-memorandum-expanding-americas-leadership-wireless-innovatio.

[2] *Id*. (emphasis added).

The record is clear that the 5 GHz band is the perfect candidate for additional spectrum sharing. In order for this to happen, 5 GHz users must all work together with the FCC to develop techniques and procedures to achieve this goal. But without prompt Commission action, incumbents, some of which have never actually made a commercial use of the spectrum, have no incentive to engage in such work in a timely manner. Comcast therefore joins with many other commenters in encouraging the Commission to authorize expanded U-NII access as soon as possible by:

- Harmonizing the U-NII-1 rules with the U-NII-2A rules to permit higher power and outdoor operation;
- Creating the new U-NII-4 band using the same operating parameters as U-NII-3; and
- Adopting proposed technical changes to the U-NII-3 rules, including the addition of 25 megahertz.

As soon as the Commission adopts these changes for the U-NII-1 and U-NII-4 bands, it should request timely and constructive comment from all parties on a sharing methodology that will reasonably protect licensees from harmful interference. This approach will ensure that all 5 GHz users have a strong incentive to work together to make recommendations to the Commission that will advance the overall public interest.

The Commission must act expeditiously. As the President and the Commission have recognized, economic growth depends on access to adequate spectrum. Unless the Commission adopts its 5 GHz proposals so as to support commercially reasonable Wi-Fi technologies, the overtaxed existing unlicensed bands will soon leave Americans without sufficient unlicensed spectrum resources. And without improvements to the 5 GHz band, the United States will not have a single channel that can fully support a widespread commercial deployment of 802.11ac

"gigabit" Wi-Fi. Comcast stands ready to assist the Commission, and to cooperate with other parties, to move forward now to avoid this impending spectrum crisis.

II. THE RECORD CONFIRMS THAT NEAR-TERM SCARCITY OF UNLICENSED SPECTRUM THREATENS BOTH THE CONTINUED VIABILITY OF CURRENT WI-FI SERVICES AND THE TIMELY DEVELOPMENT OF NEXT-GENERATION TECHNOLOGIES.

A broad cross-section of commenters confirms that unlicensed spectrum technologies such as Wi-Fi provide critical economic and social benefits that are threatened by spectrum congestion. The Commission must act now to make additional unlicensed spectrum available to ensure the sustainability and growth of these extremely valuable technologies.

A. Commenters Agree That Wi-Fi Is a Critical Engine for Economic Expansion That Provides Important Social Benefits.

The record is clear that Americans increasingly use unlicensed wireless broadband for an enormous variety of economically important activities—and that this reliance on unlicensed technologies is growing rapidly.[3] A recent study revealed that more than 55 percent of Americans own a smartphone, a number that will continue to grow,[4] and, as noted by the

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[3] *See* Comments of Qualcomm Incorporated at ii ("Qualcomm") ("Given the proliferation of Wi-Fi devices and services and the positive impact that Wi-Fi has had on so many facets of American life, it is important to provide sufficient spectrum for 802.11ac to support its growth."); Comments of Globalstar, Inc. at 3 ("Globalstar") ("Globalstar supports the Commission's proposed revisions to the operating rules for U-NII-2A and U-NII-3 devices, as well as the Commission's proposal to make available an additional 195 MHz of spectrum for use by U-NII devices. Once implemented by the marketplace over a multi-year process, these regulatory steps should yield additional broadband capacity and generate consumer benefits."); Comments of IEEE 802 at 9 ("IEEE 802") ("RLANs, and in particular Wi-Fi, has evolved over the past 15 years to one of the most important broadband access technologies."); Comments of Google Inc. and Microsoft Corporation at 2 ("Google and Microsoft") ("The unlicensed technology sector is large and growing rapidly, with unlicensed technologies contributing many billions of dollars to the U.S. economy."); *see also* Comments of Cisco Systems, Inc. at 10 ("Cisco"); Comments of Wi-Fi Alliance at 3 ("Wi-Fi Alliance"). Unless otherwise noted, all comment citations are to ET Docket No. 13-49, filed on May 28, 2013.

[4] Cyrus Farivar, *56 Percent of Americans Now Own Smartphones, Pew Study Finds*, ARS TECHNICA (June 5, 2013), http://arstechnica.com/business/2013/06/56-percent-of-americans-

Commission in its *Sixteenth Wireless Report*, virtually all smartphones will include Wi-Fi capability by 2014.[5] Cisco notes that tablets, laptops, and netbooks "are almost always Wi-Fi-enabled."[6] And the Information Technology Industry Council points out that consumers "access Wi-Fi networks with a wide variety of Wi-Fi enabled devices, such as wireless handsets, notebook and netbook computers, tablets, portable electronic games, media players, e-readers, televisions, and cameras"[7] all while also using Wi-Fi to connect their computers, tablets, and smartphones with other electronics, like printers, projectors, televisions, and cameras.[8] In short, as stated by Cisco, "Wi-Fi has rapidly become the way in which a wide variety of devices, including laptop and netbook computers, tablets, and smartphones (and increasingly other

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now-own-smartphones-pew-study-finds/; Aaron Smith, *Smartphone Ownership 2013*, PEW INTERNET (June 5, 2013), http://www.pewinternet.org/Reports/2013/Smartphone-Ownership-2013/Findings.aspx (presenting data showing that more than 80 percent of adults age 25-34 own a smartphone).

[5] *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 Service*, Sixteenth Report, 28 FCC Rcd. 3700, 3936 ¶ 381 (2013) ("*Sixteenth Wireless Report*") (cited by Cisco at 10); *see also* Comments of the Telecommunications Industry Association at 4-5 ("TIA") (noting that the Commission has recognized "that tablet owners are indicating a strong preference to using Wi-Fi rather than the commercial networks for connectivity" (citing *Sixteenth Wireless Report* at 3808)); Wi-Fi Alliance at 3 (same).

[6] Cisco at 10.

[7] Wi-Fi Alliance at 3; *see also* Cisco at 10.

[8] *See* Comments of the Information Technology Industry Council at 2 ("ITIC") ("Wi-Fi has historically been integrated in electronic products such as personal computers and printers, but products such as smart phones, tablets, smart TVs, and other consumer electronics that are increasing in features and functionality are driving new, heavy growth."); Cisco at 10; Wi-Fi Alliance at 3; *see also* Comments of the Consumer Electronics Association at 7 ("CEA") (noting that "over 165 million Wi-Fi enabled devices were sold in 2012" and predicting that "over 271 million such devices will be sold in the U.S. in 2016").

devices like cameras, printers, internet enabled radios, set-top boxes, televisions and even light bulbs), connect to the Internet."[9]

The integration of Wi-Fi into so many devices has resulted in huge growth in sales of Wi-Fi chipsets. Cablevision notes that "[l]ast year, manufacturers shipped over 1.5 billion WiFi chipsets,"[10] and, according to the Wi-Fi Alliance, Wi-Fi chipsets will experience "a compound annual growth rate of 16.6%" over the next four years.[11] Similarly, Cisco observes that, "while it took more than a decade for the cumulative total of Wi-Fi enabled device shipments to reach 5 billion in 2012, it is anticipated that that figure will double by 2015 and more than triple by 2017"[12]—with the Consumer Electronics Association adding that "[g]lobal sales of Wi-Fi consumer electronics devices are predicted to reach 2.8 billion units by 2017."[13]

Americans' demand for unlicensed wireless broadband is driving this growth in sales of Wi-Fi devices that, in turn, drives additional demand for unlicensed wireless access.[14] The result is that unlicensed traffic has expanded dramatically over the last several years and will continue to grow at an impressive rate. The Wi-Fi Alliance notes that, "[l]ast year, Wi-Fi carried 69 percent of total traffic generated by smartphones and tablets and was responsible for carrying 57 percent of total traffic for personal computers and laptops."[15] Over the next three years, according to ITIC, "as much as 60 percent of all mobile network traffic could be carried over

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[9] Cisco at 9.

[10] Cablevision Systems Corporation Comments at 3-4 ("Cablevision").

[11] Wi-Fi Alliance at 2; *see also* ITIC at 2.

[12] Cisco at 9.

[13] CEA at 7.

[14] *See* Cisco at 11 ("[T]he ubiquity of Wi-Fi devices whets the appetite for connectivity anytime, anywhere, and for as many devices as possible. And that appetite is driving the growing demand for Wi-Fi connectivity.").

[15] Wi-Fi Alliance at 5.

Wi-Fi and small cell networks."[16] Cisco, which tracks global network traffic in its yearly Virtual Network Index, estimates that by 2016 Wi-Fi will deliver "approximately the same volume of data as wired connections, with Wi-Fi and non-offloaded mobile data combined representing more than one-half of all IP traffic."[17]

The exceptional growth in Wi-Fi also increases the utility and reach of wireline networks. The Wi-Fi Alliance comments that, "[w]ithout Wi-Fi, the value of fixed broadband would be lower because consumers and businesses would not benefit from ubiquitous and simultaneous access throughout a home or office."[18] Moreover, as is clear from the record, Wi-Fi increases value and lowers costs for operators of licensed wireless spectrum networks by facilitating cellular offload,[19] "reduc[ing] the demands on licensed spectrum networks because many devices today have the ability to ([and] often automatically) choose to transmit and receive data using networks operating on unlicensed spectrum, where available."[20] Because Wi-Fi enables multiple users and devices to share a single connection in the home, in businesses, and in public areas like parks, sports venues, and malls,[21] it helps relieve overburdened licensed wireless networks,

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[16] ITIC at 3.

[17] Cisco at 8.

[18] Wi-Fi Alliance at 3.

[19] *See, e.g.*, Cisco at 11-12 (citing the chairman of the Small Cell Forum as noting that "Wi-Fi hotspots are proving a valuable tool for managing surging mobile data traffic."); Wi-Fi Alliance at 3 ("Without Wi-Fi, the value of fixed broadband would be lower because consumers and businesses would not benefit from ubiquitous and simultaneous access throughout a home or office."); *see also* TIA at 4-5 (noting the critical role offloading plays for licensed wireless carriers); Qualcomm at 2 (noting its commitment to ensuring "widespread availability of high speed Wi-Fi for purposes of offloading traffic from today's powerful and ubiquitous 3G and 4G cellular networks").

[20] CEA at 5.

[21] *See* ITIC at 4 ("Wi-Fi also allows multiple devices to share a single connection."); Comcast at 4-8 (pointing out that its publicly-accessible Wi-Fi network allows it to extend its fixed broadband network to accommodate users in a variety of venues).

which face their own congestion problems that have been acknowledged by wireless carriers, equipment manufacturers, and others.[22]

Unlicensed spectrum also promotes innovation and encourages investment in new technologies.[23] Commenters demonstrate that these uses of unlicensed technology translate into a consumer surplus of billions of dollars in the United States every year.[24] ITIC points out that this "extension of fixed broadband networks by use of unlicensed spectrum generates $15.5 billion of consumer surplus in the United States every year."[25] Of course, as noted by CEA, this estimated consumer surplus "is just for one particular use of one unlicensed spectrum technology."[26] More broadly, as Google and Microsoft point out:

> Unlicensed access provides a means of innovating in wireless with lesser financial burdens and fewer regulatory restrictions than those attendant to licensed spectrum. Market forces are better able to shape investment and deployment

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[22] *See* TIA at 6 (noting that "designation of additional U-NII spectrum in the 5 GHz band could provide capacity for data offload by heterogeneous networks, particularly in urban areas, airports, stadiums and similar area where congestion is a growing concern"); Qualcomm at 2 ("Qualcomm is deeply committed to . . . the widespread availability of high speed Wi-Fi for purposes of offloading traffic from today's powerful and ubiquitous 3G and 4G cellular networks."); Cisco at 12 ("[T]he Commission itself has acknowledged that offloading to '[u]nlicensed wireless networks operating in the U-NII bands . . . decreases the traffic load and helps to alleviate the congestion created by increased broadband data use on the cellular networks.'" (citing NPRM ¶ 11 n.18)); CEA at 8 ("Many wireless broadband devices such as smartphones and tablets can and do use unlicensed spectrum technologies such as Wi-Fi to transmit and receive data, helping to reduce congestion on licensed wireless networks and improving service."); *see also* ITIC at 4 ("Access to Wi-Fi also allows mobile carriers to offload traffic from congested networks, lowering their costs and expanding their service offerings. While Wi-Fi access alone will not solve the spectrum shortage, it can be an important element of the overall solution to alleviate congestion.").

[23] *See* CEA at 5; Comments of Motorola Solutions, Inc. at 3 ("MSI").

[24] *See, e.g.*, ITIC at 3 (citing Richard Thanki, *The Economic Significance of Licence-Exempt Spectrum to the Future of the Internet* (June 2012) ("Thanki")); Cisco at 11-17; Wi-Fi Alliance at 3; Cablevision at 6; Comments of the National Cable & Telecommunications Association at 3 ("NCTA"); CEA at 6.

[25] ITIC at 3 (citing Thanki).

[26] CEA at 6.

> decisions on an ongoing basis. While licensed access provides network operators the certainty they may need to invest, unlicensed access allows a larger number of participants individually to make smaller investments, and to introduce new products and services quickly and affordably.[27]

These characteristics are what make unlicensed spectrum—and commercial technologies that rely on it, such as Wi-Fi—such a powerful economic force.

The record is clear on the enormous social benefits of Wi-Fi as well. Other commenters agree with Comcast that Wi-Fi has enabled rapid restoration of communications during emergencies, natural disasters,[28] and other occasions where additional connectivity is needed because of interim high demand.[29] In addition, as the Wi-Fi Alliance notes, Wi-Fi now reaches "a variety of new sectors, including health and fitness, automotive, and smart energy."[30]

Wi-Fi in the automotive sector in particular will see tremendous growth over the next few years. The Wi-Fi Alliance notes that automotive Wi-Fi is used for applications like "network-connected navigation, vehicle analytics and safety features, Internet-based radio, and wireless connections for Internet audio/video download and streaming."[31] And according to Cisco, General Motors and AT&T are partnering to implement a program that will allow passengers to "tap into a Wi-Fi hotspot that can handle up to eight different cellphones, tablet and laptop computers and other devices."[32] Wi-Fi Alliance also notes "Wi-Fi technology is likewise serving an important public role in the medical field, with new technologies including vital sign monitoring devices that can monitor adult and pediatric patients with one portable, compact

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[27] Google and Microsoft at 2.

[28] *See* Comcast at 13-14; NCTA at 6; Cablevision at 3; Comments of Time Warner Cable at 5-6 ("TWC").

[29] *See, e.g.*, TWC at 6.

[30] Wi-Fi Alliance at 4.

[31] *Id*.

[32] Cisco at 10.

device"[33]—and health, fitness, and medical Wi-Fi devices are expected to see 39 percent growth over the five years between 2011 and 2016.[34] And while Wi-Fi is the best known unlicensed standard, the expansion of unlicensed spectrum has also enabled other communications technologies, such as "Bluetooth, ZigBee, Z-Wave, NFC, and wireless HD connections[,] technologies [that] have opened new frontiers of communications for consumers."[35]

In short, commenters universally agree that the social and economic benefits of Wi-Fi are substantial. Therefore, the increasing congestion in existing unlicensed bands—and the near-term exhaustion that is likely—represent an enormous threat to the tremendous benefits that Wi-Fi provides to virtually all Americans.

B. Americans' Rapidly Growing Reliance on Wi-Fi Puts Considerable Pressure on Existing Unlicensed Bands.

Commenters confirm that the unqualified success of Wi-Fi and other unlicensed services has placed enormous strain on existing unlicensed spectrum bands.[36] Most Wi-Fi connections today use the 2.4 GHz band,[37] which has only 83 megahertz of spectrum available for unlicensed use, and it is therefore "already reaching exhaustion in larger, high-penetration markets."[38] The record is clear that the 2.4 GHz band is already congested in some markets and will be practically unusable for broadband applications in the very near future.[39]

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[33] Wi-Fi Alliance at 4.

[34] Cisco at 11.

[35] CEA at 7.

[36] *See, e.g.*, Cablevision at 3; Cisco at 6; CEA at 4; Globalstar at 3; Google and Microsoft at 5; Comments of Motorola Mobility LLC at 9 ("Motorola Mobility"); IEEE 802 at 9; Comments of Ruckus Wireless, Inc. at 1; TWC at 2.

[37] Cisco at 6.

[38] NCTA at 8.

[39] *See, e.g.*, TIA at 8; Cisco at 6, 22 (citing Brian Williamson, Thomas Punton, and Paul Hansell, *Future Proofing Wi-Fi—The Case for More Spectrum: A Report for Cisco,* Plum

As noted by Google and Microsoft, even though current Wi-Fi technologies use the 2.4 GHz band very efficiently, this band "has become saturated during certain times of day in heavily trafficked areas such as city centers, apartment buildings, and public venues."[40] Cisco estimates that IP traffic in the United States will grow at a compound annual rate of 21 percent over the next several years, and that more than half of that traffic will occur over Wi-Fi.[41] This is causing "capacity constraints"[42] and "problematic" congestion[43] that limit the usefulness of 2.4 GHz for long-term growth. The 2.4 GHz band simply cannot accommodate the enormous growth in demand for unlicensed wireless broadband access.

Commenters also agree with Comcast that existing 5 GHz spectrum resources cannot adequately support the next-generation, 5 GHz-only 802.11ac Wi-Fi standard, which uses 160-megahertz-wide channels to achieve gigabit throughput.[44] For example, as Cisco observes, "to fully achieve the gains achievable from the wider channels available under IEEE 802.11ac, larger blocks of contiguous spectrum must be made available."[45] This is because, as the Wi-Fi Alliance notes, "[t]oday's U-NII bands do not easily accommodate the efficiencies that can be realized by using an 80 or 160 megahertz bandwidth."[46] Thus, unless the Commission adds additional U-NII spectrum in 5 GHz, it will not be able to ensure the availability of sufficient frequencies to "accommodate the wider channel bandwidths contemplated in the IEEE 802.11ac

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Consulting, (Jan. 2013), included as Attachment A to Cisco comments); TWC at 2; Cablevision at 3-4.

[40] Google and Microsoft at 3.

[41] Cisco at 7-8.

[42] *Id.* at 6.

[43] TIA at 8.

[44] *See, e.g.*, TWC at 2.

[45] Cisco at 19.

[46] Wi-Fi Alliance at 6.

standard, enabling data transmission at significantly higher rates (up to 1 GB per second) than today's Wi-Fi technologies."[47] As Cisco explains,

> [A]s the broadband industry continually improves its technology to embrace evolving use cases and the explosive growth of ubiquitous connectivity, Wi-Fi needs additional contiguous spectrum in the unlicensed 5 GHz band to reach the speeds and quality of service necessary for provision of the widely available, reliable gigabit-level service their customers inevitably will demand.[48]

Similarly, IEEE 802 emphasizes that "[h]aving spectrum available that would allow up to nine 80-megahertz wide channels or four 160-megahertz channels will ensure that the technology can meet the foreseeable demands being placed on its by users, which today include consumers, businesses and service providers."[49]

C. The Commission Must Act Now to Make Additional Unlicensed Spectrum Available.

Commenters agree that growing congestion in 2.4 GHz and the inability of existing unlicensed bands to support the 802.11ac Wi-Fi standard means that the Commission must act now to make additional spectrum available for unlicensed broadband use.[50] The need for quick action is clear from comments that cross industry lines. For example, TIA encourages the Commission to "promptly address the proposals set forth in the *NPRM* and issue appropriate changes to the 5 GHz rules and implementing procedures,"[51] and CEA recommends that "the Commission . . . move as quickly as possible to make additional unlicensed spectrum available in the 5 GHz band."[52] Google and Microsoft ask the Commission to "move forward quickly."[53]

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[47] CEA at 2-3.

[48] Cisco at 23.

[49] IEEE 802 at 2.

[50] *See, e.g.*, Cisco at i; TIA at 8; IEEE 802 at 11-12; Motorola Mobility at 9 ; MSI at 13-14; Google and Microsoft at 4; Wi-Fi Alliance at 7.

[51] TIA at 2.

[52] CEA at 3.

And Ericsson argues that "[d]elaying access to additional spectrum while deliberating *all* of the issues raised in the Notice would only serve to postpone the benefits that could be realized if the Commission defers more complex issues for resolution at a later date."[54]

Comcast agrees with the Wi-Fi Alliance: "[T]he public interest dictates that the Commission act as soon as possible to make the maximum Wi-Fi capacity available to support the advancement in Wi-Fi technology and the growth in Wi-Fi use by consumers, businesses and wireless carriers."[55]

III. THE RECORD SUPPORTS THE COMMISSION'S PROPOSALS TO ADDRESS UNLICENSED SPECTRUM SCARCITY BY ALLOWING MORE ROBUST SHARING IN THE 5 GHZ BAND.

There are no remaining open spectrum bands between 9 kHz and 6 GHz.[56] Every band has incumbent operations. Nonetheless, the Commission must make additional spectrum available to support the growth of wireless broadband and the economic benefits it delivers. Accordingly, President Obama, Congress, and the Commission recognize that spectrum sharing is imperative—and each has specifically identified the 5 GHz band as a leading candidate for such sharing. The record strongly supports this decision. Equipment makers, network operators, and Internet companies agree that the 5 GHz band is ideal for additional unlicensed use on a shared basis with federal and private incumbents.[57] While there is work to be done to allow

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[53] Google and Microsoft at 1.

[54] Ericsson at 4 (emphasis in original).

[55] Wi-Fi Alliance at 7.

[56] Bands above 6 GHz may be useful for some unlicensed line-of-sight data transfer services, such as WiGig at 60 MHz, but these bands are not useful for widespread Wi-Fi networks using available technologies.

[57] *See, e.g.*, Comments of Fastback Networks at 10 ("Fastback Networks"); ITIC at 1-4; Cablevision at 4; Motorola Mobility at 1; MSI at 1; Qualcomm at ii; Comments of the Shared Spectrum Company at 3 ("Shared Spectrum Company"); TWC at 3-7; Wi-Fi Alliance at 23.

sharing, that work can and should be done, because there is no other band where the environment holds more promise for Wi-Fi.

As many commenters observe, this is the case in part because Wi-Fi already operates in the 5 GHz band. Three Wi-Fi standards—802.11a, 802.11n, and the new 802.11ac—use 5 GHz today.[58] Manufacturers and developers can therefore leverage their existing investment in 5 GHz technologies to bring new devices to market much more quickly and at lower cost than they could were the Commission to designate a wholly new band for Wi-Fi operations. Put differently, the 5 GHz band "offers the best and likely only path" for providing "additional unlicensed spectrum for Wi-Fi services at this time."[59]

Commenters also explain that the 5 GHz band is the only band that could support next-generation 802.11ac gigabit Wi-Fi.[60] If the Commission adopts its proposals to improve the band, this will permit consumer devices to access the contiguous 160-megahertz-wide channels required to deliver such speeds.[61] Gigabit Wi-Fi will be an enormous leap forward for wireless broadband—offering consumers substantially more throughput than available using any other licensed or unlicensed standard. Google and Microsoft observe that "[i]nnovators will use this standard to improve short-range video streaming and two-way, real-time video delivery, as well as other high-bandwidth consumer applications—if the FCC designates sufficiently wide unlicensed channels.[62] IEEE agrees, noting that "[a] contiguous footprint of spectrum therefore

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[58] *See* Wi-Fi Alliance at 5.

[59] TWC at 2.

[60] *See, e.g.*, Cablevision at 4-5; Cisco at 17; CEA at 13; Ericsson at 2; Google and Microsoft at 4; ITIC at 5; Motorola Mobility at 3; MSI at 2; IEEE 802 at 11; TWC at 7.

[61] *See* Google and Microsoft at 4.

[62] *Id.* at 4.

represents an enormous gain in the ability of 802.11 RLAN devices to meet consumer demand for wireless broadband."[63]

Consumers will be unable to realize these benefits if the Commission does not make its proposed changes to 5 GHz designations and technical rules, or if it institutes rules that fail to produce 160 megahertz channels that can be used by commercial Wi-Fi networks. A wide array of commenters support the Commission's proposals to: (1) harmonize the U-NII-1 and U-NII-2A technical rules; (2) allow unlicensed operations in the U-NII-4 band using the technical rules that govern U-NII-3; and (3) harmonize the technical rules for U-NII-3 and the ISM spectrum band at 5725-5850 MHz.

A. The Commission Should Harmonize U-NII-1 and U-NII-2A Technical Rules.

Nearly all commenters support the Commission's proposal to harmonize the operational rules for U-NII-1 with those of U-NII-2A.[64] Removing the indoor-only restriction and adopting a higher power limit in U-NII-1 will benefit consumers by making this band attractive for commercial Wi-Fi networks for the first time, as well as by enabling 802.11ac devices to access a contiguous, 160-megahertz outdoor channel. For example, Cisco notes that "harmonizing the power and use conditions will permit the introduction of a wide-range of new broadband products capable of operating at higher data rates than is now possible."[65] CEA observes that "[c]onsistent rules, including rules allowing outdoor usage in the U-NII-1 sub-band, will help produce economies of scale in equipment design and manufacture, as equipment operating throughout the band will have similar constraints," and that these rules "will simplify the FCC

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[63] IEEE 802 at 11.

[64] *See, e.g.*, Cablevision at 5-6; Cisco at 54; CEA at 11; Ericsson at 5; IEEE 802 at 4; ITIC at 9-10; Motorola Mobility at 2; MSI at 13; Wi-Fi Alliance at 25; *see also* TWC at 10-11 (advocating for harmonizing U-NII-1 with U-NII-3).

[65] Cisco at 55.

certification process for 5 GHz devices, reducing costs and speeding deployment."[66] IEEE 802 points out that "[s]ervice providers and other users of the technology therefore would benefit if the U-NII-1 rules can be revised to align with U- NII-2A"[67] while the Wi-Fi Alliance notes that harmonized rules would "permit the band to be used by public hotspot and service provider WiFi networks, helping to address the explosion of mobile data traffic via offloading."[68]

The Commission created the indoor-only restriction and the current extremely low 50 mW power limit twenty years ago based on the assumption that a large number of Mobile Satellite Service ("MSS") companies would heavily use the U-NII-1 band. The Commission believed that the Big LEO band would "offer an almost limitless number of services, including ubiquitous voice and data mobile services,"[69] and that "[a] potential multi-billion dollar industry will be created" as a result of authorizing MSS service in that band.[70] Applicants promised exceptional demand, with one estimating "that by 2001 the demand for user transceivers will be 1.3 million in the United States and 4.7 million worldwide."[71] Time has proven these assumptions to be incorrect.

Today only one company, Globalstar, uses the entire 100-megahertz-wide U-NII-1 band.[72] The company was granted authorization to use this band in 1998 without having to

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66 CEA at 11.

67 IEEE 802 at 28.

68 Wi-Fi Alliance at 25.

69 *See Amendment of the Commission's Rules to Establish Rules & Policies Pertaining to A Mobile Satellite Serv. in the 1610-1626.5/2483.5-2500 MHz Frequency Bands*, Report and Order, 9 FCC Rcd. 5936 ¶ 3 (1994) ("*MSS Order*").

70 *Id.* ¶ 4.

71 *Id.*

72 Iridium also operates an MSS system, but does not require feeder links because its satellites communicate directly with one another.

acquire the spectrum through an auction or to share the spectrum using an efficiency-forcing protocol such as Wi-Fi. Globalstar uses this enormous resource for a total of just four "feeder link" facilities in the entire country. These feeder links connect Globalstar's terrestrial transport system to its satellites.[73] Globalstar has still more spectrum in other bands to serve its customers directly.

Globalstar uses its enormous spectrum holdings to serve a small customer base. It provides a narrowband service to approximately 560,000 customer terminals worldwide, of which only 100,000 receive even narrowband duplex (voice) service,[74] with the majority used for simplex service. Thirty percent of Globalstar's customers are associated with accounts that the company has suspended for non-payment, meaning that the company's small user base is, in reality, even smaller than it appears.[75] Moreover, Globalstar's active users are largely outside of the United States.[76] Clearly, the Commission's twenty-year-old prediction that overly protective

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[73] Globalstar operates a "bent pipe" communications system in which user communications are transmitted first to a satellite, then via feeder downlink frequencies to a gateway earth station, where they are routed to the recipient via the PSTN or Internet or via feeder uplink to a different satellite for eventual delivery to the recipient.

[74] *See* Petition for Rulemaking of Globalstar, Inc., RM-11685, at i (filed Nov. 13, 2012).

[75] Globalstar reported in its 2012 Annual Report that it has 562,000 subscribers. Globalstar 2012 Annual Report at 2 (Mar. 15, 2013), *available at* http://www.globalstar.com/en/index.php?cid=6062&fileLink=http://irxml.corporate-ir.net/filings/toc.data?id=8800575&sXbrl=1&compId=203507. This figure counts terminal devices, rather than unique users, and includes devices that are "subject to agreements which entitle them to use our voice or data communications services," *id.*, including subscribers whose accounts have been suspended for non-payment, *id.* at 33. As of the third quarter of 2013, as many as 29 percent of accounts were suspended for non-payment. *Id.*

[76] Globalstar indicates that it has a significant foreign subscriber base, though it is difficult to determine what percentage of terminals are used outside of the United States. It does note that it conducts most of its foreign sales in U.S. dollars; even so, nearly 30 percent of Globalstar's revenue is in foreign currency. *Id.* at 10. This suggests that Globalstar's U.S. subscriber base is not only significantly less than its total subscriber count, but is also well below its U.S. dollar-sales percentages.

unlicensed technical rules were needed because MSS would heavily use U-NII-1 is no longer valid.

Globalstar claims that if the Commission allows outdoor operation of unlicensed devices using a higher power level it will suffer harmful interference.[77] But its analysis is deeply flawed.[78] For example, Globalstar's argument presumes that all U-NII-1 devices will point directly at the sky and that its satellites will always be directly overhead, which does not comport with the actual operation of Wi-Fi devices or its own satellite constellation. Globalstar also fails to account in any way for attenuation due to foliage or intervening structures. And it ignores the effect of the earth's curvature on radio waves.[79]

In addition, Globalstar's analysis ignores Wi-Fi duty cycles and assumes that devices are constantly transmitting—even though the initial interference study performed by satellite operators in 1996 assumed a duty cycle of 10% for U-NII-1 broadband access points.[80] Globalstar also fails to take into account U-NII-1 Wi-Fi channelization, which means that the number of simultaneously operating Wi-Fi devices that can be accommodated in the band could be multiplied by a factor of four.[81] Furthermore, as Cisco observes, Globalstar's "doomsday

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[77] *See* Globalstar at 5.

[78] *See generally* Rob Alderfer, Dirk Grunwald and Kenneth Baker, *Toward Expanded Wi-Fi Access in the 5 GHz Band*, CABLELABS/University of Colorado (July 2013) (attached to the Reply Comments of the National Cable & Telecommunications Associations (filed July 24, 2013)) ("*Toward Expanded Wi-Fi Access*").

[79] *See* Globalstar, Attachment at 3; *Toward Expanded Wi-Fi Access* at 23-27.

[80] *Toward Expanded Wi-Fi Acces*s at 26-27.

[81] *See id*.

predictions" are inappropriate because its analysis relies on a power density calculation that is twice the actual power density of the unlicensed systems that are in use today.[82]

Finally, Globalstar's analysis focuses on the potential impact to the satellite uplink signal rather than on whether MSS end users on the ground would actually experience harmful interference. Globalstar's network is a "bent pipe" system. The satellite portion of the system does not perform demodulation or signal processing; rather, the satellite merely rebroadcasts the signal in the S-band down to end users with satellite phones or other devices.[83] In Globalstar's network, the uplink signal is approximately 76 times better than the downlink.[84] Because the limiting feature in Globalstar's system is the downlink, the uplink portion of the band in U-NII-1 can accommodate substantial additional interference without affecting the overall performance of the system or impacting end users.

In reality, unlicensed devices operating under the rules proposed by the FCC in the NPRM can readily coexist with Globalstar's feeder links. For example, U-NII devices operate at relatively low heights and transmit laterally—not straight up to the sky.[85] U-NII device antennas also do not have equal antenna gain across the elevation angle. At the horizon, a Wi-Fi access point signal will have path loss and attenuation because of ground clutter like foliage, telephone poles, and buildings.[86] Finally, in addition to its failure to take into account the potential impact on the downlink portion of its system, Globalstar relies on the ITU noise floor to determine at

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[82] *See* Cisco at 56 (noting that, "[a]t the time, regulators were considering the impact of 10 MHz wide 'HiperLAN' systems having twice the power density of 20 MHz wide U-NII devices that ultimately have been commercialized").

[83] *Toward Expanded Wi-Fi Access* at 28.

[84] *Id.* at 29-31.

[85] *Id.* at 23-25; *see also* Cisco at 56.

[86] *Toward Expanded Wi-Fi Access* at 25.

what level it will experience harmful interference, even though that figure itself is likely unrealistic as applied to Globalstar's network.[87]

The Commission should certainly adopt operating parameters that will enable outdoor, higher-power Wi-Fi to coexist in U-NII-1 with Globalstar's feeder links, and should do so in a timely manner. But it should not base its analysis on Globalstar's flawed model. Perhaps most importantly, the Commission should recognize that it is not in the public interest to preserve rules that essentially reserve 100 megahertz of valuable spectrum for one company's specialized, limited-use, narrowband service at the expense of today's pressing and massive wireless spectrum needs.

B. The Commission Should Harmonize U-NII-3 and U-NII-4 Technical Rules.

A wide group of commenters also support designating the new U-NII-4 band for unlicensed use and adopting technical rules that match those of U-NII-3.[88] As with the Commission's proposals to harmonize U-NII-1 with U-NII-2A, making U-NII-4 available for unlicensed use under the same rules as U-NII-3 will substantially improve unlicensed access nationwide. Because U-NII-3 is the most heavily used 5 GHz band, freeing additional U-NII spectrum immediately adjacent to this band with the same operational rules will maximize the utility of those frequencies and ensure the most efficient use of that spectrum. As Ericsson points out, harmonizing the rules between U-NII-3 and U-NII-4 will "help to ensure the introduction of devices that can utilize large very large channel sizes to deliver very high data rates."[89]

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[87] *See id.* at 26-27.

[88] *See, e.g.*, Cisco at 57; CEA at 12-13; Ericsson at 9; Fastback Networks at 11; Google and Microsoft at 6; ITIC at 9; Motorola Mobility at 2; MSI at 9; Qualcomm at iii; Shared Spectrum Company at 3; TIA at 3; Wi-Fi Alliance at 27.

[89] Ericsson at 9.

Furthermore, commenters explain that, by adopting U-NII-4 rules that match those of UNII-3, the FCC will create a full 160 megahertz 802.11ac channel for commercial indoor and outdoor gigabit Wi-Fi, spanning U-NII-3 and U-NII-4. As noted by Cisco, "[n]ot only would opening that spectrum make 75 megahertz of new spectrum available, but because that spectrum is contiguous to the U-NII-2C and U-NII-3 bands, opening it for U-NII creates a contiguous block of 455 megahertz that will accommodate substantially more wide channels than are available today—ten 40 MHz channels, five 80 MHz channels or two 160 MHz channels."[90] Without this new spectrum, however, the United States would have only one contiguous 160 megahertz channel in any band, a channel that spans U-NII-1 and U-NII-2A. And under the existing rules, even this single 160 megahertz channel would not support widespread commercial Wi-Fi operations. Under current rules it is subject to an indoor-only restriction, a very low 50 mW power limit, and a DFS requirement, rendering it practically unusable for commercial Wi-Fi.[91] Creation of the new U-NII-4 band governed by the U-NII-3 rules is therefore critical to gigabit Wi-Fi in the United States.[92]

1. Unlicensed Devices and ITS Companies Should Share the U-NII-4 Band.

The record also confirms that unlicensed devices can readily share U-NII-4 with ITS licensees. Importantly, IEEE 802, Qualcomm, and Cisco—*all of which are developing*

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[90] Cisco at 57-58. Note that even if the FCC were to harmonize the U-NII-3 and 4 bands, without making other changes, the majority of the 455 MHz referenced by Cisco would remain burdened by low power limits and/or indoor-only restrictions that render those frequency ranges practically unusable for widespread Wi-Fi networks, even if they would be available for certain specialized indoor uses. Nevertheless, the harmonized U-NII-3 and 4 bands would allow for 200 MHz of extremely useful spectrum that could accommodate a single 160-MHz wide 802.11ac channel.

[91] *See* IEEE 802 at 11.

[92] *See id.*

technology or standards for both unlicensed and ITS applications—believe sharing is not only possible but also desirable. For example, IEEE 802 states, "We strongly prefer a set of FCC rules that will allow both sets of technologies to flourish,"[93] noting that, "[s]ince both [802.11ac and 802.11p, used for Dedicated Short-Range Communications ("DSRC"),] are IEEE 802.11 based technologies, we believe that there is a way forward to address the concerns of the ITS community about potential interference to their system from commercial 802.11 devices."[94]

Similarly, Qualcomm states that "[t]here is no question that both DSRC and Wi-Fi technologies can benefit from technically viable, cost-effective, and near-term solutions"[95] and that it "is working hard to enable a solution to timely enable the implementation of DSRC safety services while expanding the commercial benefits of Wi-Fi."[96]

Cisco likewise comments that "assuring that IEEE 802.11ac can have access to the entire 5 GHz band, including U-NII-4, while at the same time assuring that DSRC emerges as a key technology for vehicular safety [will not only] maximize[] the benefits of IEEE 802.11ac by providing access to a broad swath of spectrum, but may yield a variety of economies of scale and scope."[97]

Many ITS interests also see a path to coexistence in the U-NII-4 band.[98] Toyota notes that it "remains supportive of the Commission's efforts to free up more spectrum in the 5 GHz

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[93] *Id.* at 29.

[94] IEEE 802 at 30.

[95] Qualcomm at 2.

[96] *Id.* at 5.

[97] Cisco at 63.

[98] *See, e.g.*, Comments of the Toyota Motor Corporation at 1 ("Toyota") ("Toyota is not conceptually opposed to sharing this spectrum with unlicensed U-NII devices."); Alliance of Automobile Manufacturers at v ("We stand ready to work with the Commission and other stakeholders as this proceeding evolves to address these concerns."); Comments of Intelligent

band for U-NII devices."[99] The Alliance of Automobile Manufacturers states that it is "fully committed to working with the proponents of U-NII use to evaluate the prospects for coexistence with DSRC."[100] Nevertheless, some ITS proponents argue that the Commission should delay any action related to U-NII-4 indefinitely. This would not serve the public interest. Such a delay is unnecessary, and will only increase the cost and difficulty of enabling sharing in the future. ITS and unlicensed users would be much better served by a decision *now* to create the U-NII-4 band in 5.9 GHz. Such a decision would encourage both industries to invest in the necessary technologies and standards to facilitate sharing before they expend substantial resources on actual commercial deployments.

Currently, there is no commercial 5 GHz ITS user anywhere in the entire country, and only limited, controlled tests of the technology are ongoing.[101] In other words, though the Commission allocated 75 megahertz of spectrum for DSRC almost 15 years ago, that spectrum is functionally unused for that purpose today. In contrast, most other licensed commercial services are subject to build-out requirements to ensure services are deployed to the public in a timely manner. For example, terrestrial wireless systems licensed under Part 24 and Part 27 typically must provide "substantial service" to the population in their license area within their 10-year license term, or face penalties that include automatic termination of licenses or loss of authorization to operate in unserved portions of the license area.[102] Similarly, FCC rules for

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Transportation Society of America at 36 ("ITS America") ("ITS America acknowledges . . . the expectation that similarities in the technical requirements for DSRC and U-NII devices could facilitate band sharing.").

[99] Toyota at 16.

[100] Alliance of Automobile Manufacturers at 3.

[101] NCTA at 19; *see also* Cisco at 62 (noting that DSRC has been in development for nearly 20 years and is only now nearing deployment).

[102] *See, e.g.*, 47 C.F.R. §§ 24.203, 27.14.

Direct Broadcast Satellite systems establish milestones to ensure that licensees exercise "due diligence" in constructing systems that include a requirement for satellite stations to be operational within six years of the license grant.[103]

The lack of commercial use of 5.9 GHz makes the band a particularly attractive candidate for sharing with unlicensed services, as both DSRC and U-NII-4 manufacturers have a prime opportunity to take sharing into consideration as they move forward to develop devices without undermining existing commercial investment. The Commission therefore has a unique opportunity to increase overall utility within the band by ensuring that DSRC technologies will reach maturity and come to market having been developed to operate alongside Wi-Fi.

That coexistence requires the Commission to take action now to open U- NII-4 for unlicensed use. Absent such a decision, ITS manufacturers will have no incentive to collaborate with the unlicensed industry to ensure maximum use of this valuable band. The specific technical parameters of sharing between ITS and U-NII devices will certainly require additional study, research, and cooperation, but the decision to make the 75 megahertz allocated to DSRC available for unlicensed use on a shared basis can and should be made now.

Indeed, if the Commission delays a decision on U-NII-4, it takes the risk that consumers will bear the costs of the increased expense and difficulty that will be required to make shared use of 5.9 GHz a reality. Significantly, legitimate commercial deployment of ITS systems could take decades to accomplish, potentially leaving U-NII-4 extremely underused at a time when the Commission can ill afford such inefficiency. Instead, the Commission should act to enable unlicensed use in U-NII-4 before ITS companies complete technical work and make investments in deployment that would ultimately increase the costs and deployment time needed for

[103] *See* 47 C.F.R. § 25.148.

implementation of interference mitigation techniques and technologies. Building in co-existence now is vastly preferable to retrofitting DSRC systems in the future.

2. Unlicensed Devices and Extended C-Band Satellite Companies Should Share the U-NII-4 Band.

Unlicensed technologies and C-band operators will also be able to share the 5.9 GHz band effectively. SES and Intelsat concede that the U.S. table of frequency allocations places substantial restrictions on their operations in this 75 megahertz wide band.[104] These restrictions include a prohibition on any uses other than for "international inter-continental" communications that have left the band, as the Commission rightly explained, "lightly used."[105] FCC rules also subject extended C-band facilities "to case-by-case electromagnetic compatibility analysis" rather than allowing new operations as a matter of course, as is the course in more intensively used bands.[106] In fact, the FCC's rules governing extended C-band operations note that "[i]t is anticipated that one earth station on each coast can be successfully coordinated."[107] Thus, there can be no serious dispute that extended C-band operations have not resulted in intensive use of the 5.85 - 5.925 GHz band.

SES and Intelsat argue that enabling unlicensed operations in U-NII-4 could cause interference to these limited extended C-band satellite uplink operations (as well as to more heavily used C-band uplink in adjacent spectrum) because unlicensed use would raise the noise floor.[108] This concern is unfounded. First, SES and Intelsat have not opposed terrestrial co-

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[104] *See* SES and Intelsat at 3-4.

[105] 47 C.F.R. § 2.106 Table of Allocations, footnote US 245.

[106] *Id*.

[107] 47 C.F.R. § 2.108.

[108] SES and Intelsat Comments at 3-4. Comcast is sensitive to concerns by satellite operators regarding adjacent-channel interference into that band, particularly given that Comcast's business relies on C-band satellite operations. Comcast has a strong incentive to ensure that

channel operations from DSRC devices in this band, which will similarly raise the noise floor. DSRC roadside units can transmit from 2 watts up to 30 watts in some instances[109]—*several times the maximum limit proposed by the Commission for unlicensed operations in U-NII-4*. SES and Intelsat's acceptance of DSRC activities proves that lower-power unlicensed operations can co-exist with Extended C-band operation.

In addition, as described in the U-NII-1 context above, spectrum used for satellite uplink also can accommodate outdoor Wi-Fi operations due to factors that limit the impact on the noise floor at the satellite. These factors include attenuation due to distance from the satellite and foliage or intervening structures, the fact that terrestrial Wi-Fi antennas are not directed towards the sky, and the impact of Wi-Fi duty cycles that restrict device transmission times.[110]

In a more complete analysis of satellite uplink issues than proffered by SES and Intelsat, Alderfer *et al*. accounts for these factors. That analysis concludes that adoption of the Commission's U-NII-4 technical rule proposals in UNII-1 would not cause harmful interference to Globalstar's operations in the U-NII-1 band, which rely on Low Earth Orbit (LEO) satellites. In U-NII-4, the risk of harmful interference is even smaller since SES and Intelsat's geostationary orbit (GEO) satellites orbit at over 35,000 kilometers above the earth—much farther from terrestrial Wi-Fi operations than Globalstar's LEO satellites, which are approximately 1,400 kilometers from Earth at their closest point. This fact further underscores that the FCC can enable unlicensed operations in U-NII-4 without risk of interference to FSS satellite systems. As Alderfer *et al*. explain:

U-NII operations in 5.9 GHz do not cause harmful interference into the conventional C-band, and is confident that Wi-Fi operations in U-NII-4 under the current U-NII-3 rules will not do so.

[109] 47 C.F.R. § 90.377.

[110] *See* pp. 18-19, *supra*.

> [S]atellite orbital height and distance to Wi-Fi access points in the United States would result in a much larger Earth to space path loss than seen in the MSS context. Our critique of Globalstar's narrow 'single link' MSS interference analysis indicated that they significantly underestimate the number of Wi-Fi access points that would be required to meaningfully change the noise floor at the satellite beyond ITU Recommendations. That recommendation defines the interference limit, or maximum noise floor, as a Power Flux Density (PFD) at the satellite antenna of -124 dB(W/(m2 • 1 MHz)).
>
> We can apply this same standard to a FSS satellite system, with a simple adjustment for distance and relevant atmospheric losses, and find that the spreading loss to a GEO satellite that is approximately 35786.03 km above the Earth's surface is increased by a factor of 640 times, relative to MSS. This increase in Earth to space spreading loss implies that, for the same PFD limit, *a GEO satellite can tolerate 640 times the amount of interference* as compared to a MSS LEO satellite at 1414 km above the earth's surface.[111]

Consequently, FSS satellites in the U-NII-4 band would not require any special protections from Wi-Fi operations that would share the band.

Comcast is committed to doing its part to make shared use of U-NII-4 work in everyone's interest. But the work needed to make sharing a reality will not happen if all parties do not have strong incentives to come to the table. The Commission should facilitate this goal by encouraging all parties to work together quickly, but be ready to set rules for sharing on its own if parties do not work together effectively.

IV. CONCLUSION.

President Obama, Congress, and the Commission all agree on three important elements of our national spectrum policy. First, we must find additional unlicensed spectrum to support the national economy. Second, we must increase and improve sharing in order to find this spectrum. And third, we must work to effectuate more robust sharing in the 5 GHz band between unlicensed consumer devices and existing operations.

The record in this proceeding provides the Commission with a path toward achieving all three of these goals. Commenters agree that consumer Wi-Fi demand is exploding, that existing

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[111] *Toward Expanded Wi-Fi Access* at 56-57 (emphasis added).

unlicensed spectrum designations will not support expected future growth, and that the 5 GHz band is the ideal band for expanded Wi-Fi investment and operations. The Commission should therefore move forward expeditiously to: (1) allow outdoor use and increase maximum power limit in U-NII-1; (2) permit unlicensed devices to operate in the U-NII-4 band with technical rules matching those in U-NII-3; and (3) harmonize the rules that apply to U-NII-3 and ISM spectrum band at 5725-5850 MHz. While these changes will require the Commission to devise an appropriate sharing approach that both encourages Wi-Fi investment and protects existing licensees, this is a hurdle that the Commission can and must clear. There is no better band than 5 GHz to make the Commission's spectrum sharing vision a reality, and no better time to act than now due to today's light use of the band by satellite companies and because ITS has yet to deploy. The Commission—and the nation—cannot afford to miss this chance.

Respectfully submitted,

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