Before the
NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION
Washington, DC 20230

In the Matter of	)	
	)	
The Benefits, Challenges, and Potential Roles for	)	Docket No. 160331306-6306-01
the Government in Fostering the Advancement of	)	RIN 0660-XC024
the Internet of Things	)	

COMMENTS OF WI-FI ALLIANCE

Wi-Fi Alliance®[1/] submits these comments in response to the National Telecommunications and Information Administration ("NTIA")'s Request for Comment in the above-referenced proceeding regarding how the federal government should foster the advancement of the Internet of Things ("IoT").[2/] Wi-Fi Alliance applauds NTIA's initiative, which recognizes the importance of IoT technologies. To facilitate the sustained development of IoT, NTIA should continue to work with the Federal Communications Commission ("FCC") to make available additional spectrum on an unlicensed basis — the type of spectrum that is ideally suited to support IoT applications. Where appropriate, Congress should support those efforts by encouraging the reallocation of government spectrum for unlicensed operations and promoting policies that recognize the critical role of spectrum dedicated for unlicensed operations.

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[2/] *See The Benefits, Challenges, and Potential Roles for the Government in Fostering the Advancement of the Internet of Things*, Notice and Request for Public Comment, Docket No. 160331306-6306-01, 81 Fed. Reg. 19956 (Apr. 6, 2016) ("Request"). *See also The Benefits, Challenges, and Potential Roles for the Government in Fostering the Advancement of the Internet of Things*, Notice and Extension of Comment Period, 81 Fed. Reg. 29254 (May 11, 2016) (extending the comment deadline to June 2, 2016).

Unlocking more spectrum for unlicensed operations will help ensure that IoT devices will have the necessary capacity to communicate seamlessly as those devices become ubiquitous.

I. INTRODUCTION AND BACKGROUND

Wi-Fi Alliance is a global, non-profit industry association of approximately 700 leading companies from dozens of countries devoted to seamless interoperability. With technology development, market building, and regulatory programs, Wi-Fi Alliance has enabled widespread adoption of Wi-Fi® worldwide, certifying thousands of Wi-Fi products each year. The mission of Wi-Fi Alliance is to provide a highly effective collaboration forum for Wi-Fi matters, grow the Wi-Fi industry, lead industry growth with new technology specifications and programs, support industry-agreed standards, and deliver greater product connectivity through interoperability, testing, and certification.

Wi-Fi Alliance has participated in important, recent efforts to expand the spectrum resources available for unlicensed operations, including the FCC's rulemaking proceeding to allow additional access to portions of the 5 GHz band for unlicensed devices,[3/] creating the Citizens Broadband Radio Service in the 3.5 GHz band,[4/] expanding available spectrum for white space devices in the 600 MHz band,[5/] and increasing the spectrum available for unlicensed uses

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3/ *See Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, First Report and Order, 29 FCC Rcd. 4127 (2014) ("5 GHz Order"); *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).

4/ *See Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Report and Order and Second Further Notice of Proposed Rulemaking, 30 FCC Rcd. 3959 (2015) ("3.5 GHz Order").

5/ *See Amendment of Part 15 of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37, and Amendment of Part 74 of the Commission's Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and 600 MHz Duplex Gap; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Report and Order, 30 FCC Rcd. 9551 (2015) ("600 MHz Unlicensed Uses Order"). *See also Amendment of Part 15 of the Commission's Rules for*

like WiGig® in the millimeter wave bands.[6/] As explained further below, because unlicensed spectrum will be a critical driver in the expansion of IoT, NTIA, along with Congress and the FCC, must continue their efforts to make additional unlicensed spectrum available. Accordingly, Wi-Fi Alliance is pleased to have the opportunity to submit this response to NTIA's Request.

II. COMMENTS

A. Unlicensed Spectrum has a Critical Role in IoT.

The Request asks about the main policy issues that affect IoT and how the government should address or respond to them.[7/] It similarly asks about the technological issues that may hinder the development of IoT, identifying, among others, spectrum availability.[8/] NTIA is right to recognize spectrum availability as a key component of IoT growth. Perhaps more than in any other area, government involvement is necessary to ensure that there is sufficient spectrum — the critical link between IoT devices — to support IoT growth.

IoT technologies promise an increasingly connected world where "the most mundane items in our lives can talk wirelessly among themselves, performing tasks on command, giving us data we've never had before."[9/] The key to achieving that vision is spectrum. Spectrum links IoT devices and embedded sensors to a connected world. From buildings and road infrastructure to home appliances, medical devices, and consumer wearables, sensors incorporated in the

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Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37, and Amendment of Part 74 of the Commission's Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and 600 MHz Duplex Gap; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, Notice of Proposed Rulemaking, 29 FCC Rcd. 12248 (2014).

6/ *See Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al.*, Notice of Proposed Rulemaking, 30 FCC Rcd. 11878 (2015) ("Millimeter Wave NPRM").

7/ Request, 81 Fed. Reg. at 19958.

8/ *Id.* at 19959.

9/ Bill Wasik, *In the Programmable World, All Our Objects Will Act as One*, WIRED (May 14, 2013), http://www.wired.com/2013/05/internet-of-things-2/.

everyday require spectrum to use wireless technologies to send their collected data between each other and to remote servers for analysis.[10/] Using these data, engineers will determine the soundness of infrastructure from afar, and doctors can be alerted to urgent medical problems as they occur. If a physical, wired connection to a network were necessary, the Internet of Things and its promises would remain a far-off, futuristic dream, rather than an imminent reality.

A thriving IoT ecosystem requires spectrum supporting unlicensed uses in particular. Shared spectrum is ideal for IoT communications, which tend to be episodic, occasionally transmitting small bursts of data rather than maintaining continuous, high-speed data streams.[11/] IoT devices, especially consumer-oriented devices, need not use exclusive spectrum for their episodic transmissions. Importantly, owners and operators of IoT devices should not need to apply for an exclusive FCC license to use those devices or pay carriers to use spectrum to support IoT applications. IoT devices will share spectrum most efficiently in the unlicensed bands, in which only technical limits constrain the use of the frequencies.

Wi-Fi already plays a key role in the spectrum used to support IoT. For example, Wi-Fi enables users of Google's Nest Learning Thermostat to change their homes' target temperature, make manual adjustments to the thermostat's schedule, and see monthly energy reports from their phones and laptops.[12/] Wi-Fi also enables the speakers in a Sonos wireless speaker system or other comparable system to communicate with each other and play music in synchronization

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[10/] *See* Michael Chui, Markus Löffler, and Roger Roberts, *The Internet of Things*, MCKINSEY QUARTERLY (Mar. 2010), http://www.mckinsey.com/industries/high-tech/our-insights/the-internet-of-things; Sean Gallagher, *The Future Is the Internet of Things*, ARS TECHNICA (Oct. 29, 2015), http://arstechnica.com/unite/2015/10/the-future-is-the-internet-of-things-deal-with-it/.

[11/] *See* Matt Hamblen, *Wi-Fi for the Internet of Things Gets a Name: 'Wi-Fi HaLow'*, COMPUTERWORLD (Jan. 4, 2016), http://www.computerworld.com/article/3018510/mobile-wireless/wi-fi-for-the-internet-of-things-gets-a-name-wi-fi-halow.html.

[12/] *See Do I Need Wi-Fi to Use the Nest Learning Thermostat?*, NEST SUPPORT (last visited May 10, 2016), https://nest.com/support/article/Do-I-need-Wi-Fi-to-use-Nest.

across multiple rooms, while permitting user control from a computer or smart device.[13/] Numerous other connected devices on the market today likewise rely on Wi-Fi to provide smart home functionality to consumers.[14/] Indeed, recognizing the value of Wi-Fi for IoT devices, Wi-Fi Alliance has introduced Wi-Fi HaLow™ as the designation for products incorporating IEEE 802.11ah technology for unlicensed use of lower-frequency spectrum well-suited for IoT communications.[15/]

However, even with reliable technologies empowering IoT devices, sustained development and innovation in the IoT ecosystem requires additional unlicensed spectrum to support IoT. Insufficient spectrum supporting unlicensed uses would stifle IoT innovation. IoT already adds significant load to existing unlicensed bands supporting Wi-Fi, Bluetooth, and other technologies.[16/] Today's unlicensed bands will not support a future where everything is connected. Indeed, the FCC's Technological Advisory Council recommended in 2014 that, "[t]o stimulate IoT growth, the FCC should focus on the availability of unlicensed spectrum."[17/] A significant portion of connected devices in the IoT ecosystem (*e.g.*, connected appliances or

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13/ *See* John Falcone, *Sonos Adds Full Wi-Fi Compatibility with Latest Software Update*, CNET (Sept. 2, 2014), http://www.cnet.com/news/sonos-adds-wi-fi-compatibility-and-boost-accessory/.

14/ *See, e.g.*, Jeff Dunn, *The 10 Best Devices to Turn Your Home into a Smart Home*, BUSINESS INSIDER (Dec. 2, 2015), http://www.businessinsider.com/best-smart-home-devices-2015-12. Amazon's Echo, for instance, is a voice-controlled digital assistant like Apple's Siri, but is designed to be stationed within a home and connected to a home Wi-Fi network. Users can ask the Echo for the weather, play music from the Echo's built-in speakers, and set alarms or calendar events. Users can also control Philips Hue lightbulbs, also connected to a home Wi-Fi network, through the Echo or using a personal smart device. Belkin's WeMo Switch likewise uses Wi-Fi to allow users concerned about safety to turn devices plugged into the Switch on or off remotely. *See id.*

15/ *See Wi-Fi HaLow: Low Power, Long Range Wi-Fi*, WI-FI ALLIANCE (last visited May 10, 2016), http://www.wi-fi.org/discover-wi-fi/wi-fi-halow.

16/ *FCC Technological Advisory Council Meeting Presentation*, at 12 (June 10, 2014), *available at* https://transition.fcc.gov/bureaus/oet/tac/tacdocs/meeting61014/TACmeetingslides6-10-14.pdf ("FCC TAC Slides").

17/ *Id.* at 15. *See also* Ariel Diamond, *The Internet of Things and the Importance of Unlicensed Spectrum*, PUBLIC KNOWLEDGE (Aug. 5, 2015), https://www.publicknowledge.org/news-blog/blogs/the-internet-of-things-and-the-importance-of-unlicensed-spectrum.

structural sensors) will have device lifetimes of greater than ten years, and rapid adoption of IoT requires the advance availability of unlicensed spectrum.[18/] The availability of unlicensed spectrum for IoT, which Wi-Fi enabled devices can access, produced current successes. Congress, the FCC, and NTIA should therefore work together to find additional spectrum that can support unlicensed use by IoT devices.

B. Congress, the FCC, and NTIA Have Undertaken Important Efforts to Create Opportunities for Unlicensed Uses of Spectrum.

The Request asks what current or planned laws, regulations, and/or policies foster IoT development and deployment.[19/] The actions that Congress, NTIA, and the FCC have taken to date will foster IoT development by making additional spectrum available for IoT devices. Among other things, in 2012, Congress passed legislation that authorized the auction of broadcast spectrum. As part of its action, it noted that unlicensed operations could be used in the guard bands between various spectrum allocations, including the duplex gap between transmit and receive bands.[20/] In the same legislation, Congress required the FCC to begin a proceeding allowing unlicensed devices to operate in the 5.35-5.47 GHz band, and required NTIA to evaluate spectrum sharing technologies and risks to federal users if unlicensed devices are allowed to operate in the 5.35-5.47 GHz and 5.85-5.925 GHz bands.[21/]

The FCC also recently acted to permit greater access to unlicensed spectrum. *First*, consistent with Congressional directive, it will permit unlicensed white space device use of the

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18/ *See* FCC TAC Slides at 13-14.

19/ Request, 81 Fed. Reg. at 19958.

20/ *See* 47 U.S.C. § 1454(c); Middle Class Tax Relief and Job Creation Act of 2012 § 6407, Pub. L. No. 112-96.

21/ *See* 47 U.S.C. § 1453; Middle Class Tax Relief and Job Creation Act of 2012 § 6406, Pub. L. No. 112-96.

600 MHz band.[22/] Providing access to unlicensed use of such lower-frequency spectrum helps lay the foundation for a robust IoT ecosystem, for which the propagation characteristics of lower frequencies are especially useful.[23/] *Second*, the FCC's creation of the Citizens Broadband Radio Service in the 3.5 GHz band — enabling opportunistic shared use of the band — and the opening of the 5 GHz band for shared unlicensed use help foster IoT development.[24/]

NTIA has helped facilitate the expanded use of both of these bands. In 2010, NTIA first proposed shared commercial and federal use of the 3.5 GHz band as long as federal operations were adequately protected, and most recently released a report detailing a proposed implementation of spectrum sharing between commercial communications and federal radar operations in the band.[25/] In addition, in 2013, NTIA released a report evaluating the potential use of up to 195 megahertz of spectrum in the 5 GHz band by Unlicensed-National Information Infrastructure devices, including any potential risk to federal users.[26/] Wi-Fi Alliance commends these efforts, all of which should be maintained to help provide the spectrum resources essential for a thriving IoT ecosystem.

22/ *See generally* 600 MHz Unlicensed Uses Order.

23/ *See* Brian Barrett, *Next-Gen Wi-Fi Will Actually Connect the Internet of Things*, WIRED (Jan. 4, 2016), http://www.wired.com/2016/01/wifi-halow-internet-of-things/.

24/ *See* 3.5 GHz Order; 5 GHz Order. *See also Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, Memorandum Opinion and Order, 31 FCC Rcd. 2317 (2016).

25/ *See* Keith Gremban, *New Report Outlines Possible Roadmap to Further Sharing of the 3.5 GHz Band*, NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION (Apr. 1, 2016), https://www.ntia.doc.gov/blog/2016/new-report-outlines-possible-roadmap-further-sharing-35-ghz-band.

26/ *See* U.S. Department of Commerce, *Evaluation of the 5350-5470 MHz and 5850-5925 MHz Bands Pursuant to Section 6406(b) of the Middle Class Tax Relief and Job Creation Act of 2012* (Jan. 2013), https://www.ntia.doc.gov/files/ntia/publications/ntia_5_ghz_report_01-25-2013.pdf.

C. Additional Spectrum Should Be Allocated for Unlicensed Use.

However, more work is necessary to ensure that additional spectrum is available to support IoT applications. Congress can take a leading role in those efforts. Wi-Fi Alliance is encouraged by draft legislation that would require reallocating at least 100 megahertz for unlicensed use.[27/] The MOBILE NOW Act would also require rules to permit unlicensed services in frequencies designated as guard bands for spectrum allocated by auction; require the Government Accountability Office to study unlicensed spectrum and Wi-Fi use in low-income communities; establish a policy to make sufficient unlicensed spectrum available to meet consumer demand; develop a national plan for making additional spectrum available for unlicensed uses; and require NTIA to study spectrum in the 3 GHz and millimeter wave bands for additional potential use by unlicensed operations.[28/]

The FCC has several pending proceedings in which it can make important decisions about spectrum available for unlicensed use. For example, in evaluating use of millimeter wave band spectrum, the FCC is examining in particular whether to permit unlicensed operations on board aircraft throughout the 57-64 GHz band and whether to permit unlicensed use of the 64-71 GHz band.[29/] As Wi-Fi Alliance has advocated, the FCC should permit unlicensed operations, including on board aircraft, throughout the 57-71 GHz band.[30/] Similarly, in its proceeding governing unlicensed white space devices,[31/] the FCC should ensure that any new rules do not unnecessarily and overly burden white space devices, especially low-power, fixed white space

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27/ MOBILE NOW Act, S.2555 , 114th Cong. § 3 (2016).

28/ *Id.* §§ 4-5, 12, 16, 18-19.

29/ *See* Millimeter Wave NPRM ¶¶ 54-59, 304-306.

30/ *See* Comments of Wi-Fi Alliance, GN Docket No. 14-177, *et al.* (filed Feb. 26, 2016).

31/ *See Amendment of Part 15 of the Commission's Rules for Unlicensed White Space Devices*, Notice of Proposed Rulemaking and Order, 31 FCC Rcd. 1657 (2016).

devices.[32/] The FCC will also have an important opportunity to further open up the 5 GHz band for unlicensed use as it refreshes the record in that proceeding to examine the 5.9 GHz band in particular.[33/] In addition to acting in these pending proceedings, the FCC should investigate whether lower frequency bands like the 450-470 MHz band may be dedicated for unlicensed use to support IoT applications. IoT devices typically employ lower-power communications, and would be able to share lower frequency bands with other existing low-power operations.

NTIA likewise continues to have an important role in fostering IoT development. Through its Commerce Spectrum Management Advisory Committee ("CSMAC"), NTIA has already identified federal spectrum that can be reallocated for non-federal users and how federal spectrum can be shared with non-federal users.[34/] NTIA should continue this work, studying how it can help effect a vibrant IoT ecosystem, and should investigate what other spectrum besides the 3.5 GHz band federal users may be able to share with unlicensed operations.

Finally, in allocating further spectrum to permit IoT operations, the FCC and NTIA should coordinate with international bodies to promote uniform spectrum allocations. Harmonized spectrum allocations will facilitate the development of IoT devices that can be marketed and manufactured efficiently on a global scale. The FCC and NTIA, for instance,

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32/ *See* Comments of Wi-Fi Alliance, ET Docket No. 16-56 and RM-11745 (filed May 6, 2016).

33/ *See The Commission Seeks to Update and Refresh the Record in the "Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band" Proceeding*, Public Notice, ET Docket No. 13-49, FCC 16-68 (rel. June 1, 2016).

34/ U.S. Department of Commerce, *Identification of 15 Megahertz of Spectrum Between 1675 and 1710 MHz for Reallocation from Federal Use to Non-Federal Use Pursuant to Section 6401(a) of the Middle Class Tax Relief and Job Creation Act of 2012* (Feb. 2013), https://www.ntia.doc.gov/files/ntia/publications/1675-1710_mhz_report_to_president_02192013.pdf; Department of Commerce Spectrum Management Advisory Committee, *Streamlining Federal/Non-Federal Spectrum Sharing*, National Telecommunications & Information Administration (Sept. 19, 2008), *available at* https://www.ntia.doc.gov/report/2008/streamlining-federalnon-federal-spectrum-sharing.

should coordinate in particular with the European Commission, which has stated its congruent interest in "fostering an innovative IoT ecosystem."[35/]

II. CONCLUSION

Wi-Fi Alliance applauds NTIA's inquiry reviewing the federal government's role in facilitating IoT innovation. The success of the IoT ecosystem requires sufficient spectrum to ensure that IoT devices can send and receive information without undue delay or congestion. Wi-Fi Alliance therefore recommends that Congress, NTIA, and the FCC continue to prioritize making additional spectrum available for unlicensed operations.

Respectfully submitted,

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35/ *See The Internet of Things*, EUROPEAN COMMISSION (last visited May 10, 2016), https://ec.europa.eu/digital-single-market/en/internet-things.