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

In the Matters of	
Use of Spectrum Bands Above 24 GHz For Mobile Radio Services	GN Docket No. 14-177
Establishing a More Flexible Framework to Facilitate Satellite Operations in the 27.5-28.35 GHz and 37.5-40 GHz Bands	IB Docket No. 15-256
Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band	RM-11664
Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 To Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services	WT Docket No. 10-112
Allocation and Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands; Allocation of Spectrum to Upgrade Fixed and Mobile Allocations in the 40.5-42.5 GHz Frequency Band; Allocation of Spectrum in the 46.9-47.0 GHz Frequency Band for Wireless Services; and Allocation of Spectrum in the 37.0-38.0 GHz and 40.0-40.5 GHz for Government Operations	IB Docket No. 97-95

REPLY COMMENTS OF THE NATIONAL CABLE & TELECOMMUNICATIONS ASSOCIATION

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REPLY COMMENTS OF THE NATIONAL CABLE & TELECOMMUNICATIONS ASSOCIATION

I. INTRODUCTION AND SUMMARY.

The record in this proceeding confirms the Commission's determinations that demand for mobile broadband continues to escalate, and that authorizing new unlicensed operations in bands above 24 GHz will be an important part of the Commission's overall strategy to meet that demand. Indeed, the latest iteration of Cisco's Visual Networking Index predicts that by 2020,

Wi-Fi will constitute 49 percent of all IP traffic (fixed and mobile), exceeding licensed mobile traffic by 43 percent.[1] Moreover, public Wi-Fi hotspots are expected to grow from 13.9 million in 2015 to 79.8 million by 2020, nearly a six-fold increase.[2]

The record strongly supports Commission action to update its millimeter wave bands strategy and rules so that these frequencies more effectively meet consumer broadband demand. Unlicensed spectrum bands have become our country's most productive and innovative spectrum resource, and commenters agree that a central part of this proceeding should be to designate new unlicensed frequencies in the bands above 24 GHz. This will allow existing high-frequency unlicensed operations room to grow and will foster the development of new unlicensed technologies.

Finally, many commenters have identified solutions for coexistence mechanisms that will allow the development of new mobile services while also protecting incumbents in shared bands. NCTA agrees with Google, Comsearch, and Federated Wireless that innovative sharing technologies such as spectrum access system databases have great potential not only to protect incumbent users, but also to promote the most efficient and intensive use of the bands above 24 GHz by enabling opportunistic unlicensed access.

Specifically, NCTA urges the Commission to adopt the following proposals, all of which garnered substantial support in the initial round of comments in this proceeding:

1. Authorize widespread consumer unlicensed use of the entire 64-71 GHz band rather than removing a portion of the band for exclusive licensed use by a small set of companies;

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[1] Cisco, *VNI Mobile Forecast Highlights, 2015-2020, United States – 2020 Forecast Highlights* (2016), http://www.cisco.com/assets/sol/sp/vni/forecast_highlights_mobile/index.html ("Cisco 2016 VNI") (follow link and select Filter by Country, United States, Device Growth Traffic Profiles, Offload Traffic).

[2] *Id.* (follow link and select Filter by Country, United States, Accelerating Network Speeds, Public WiFi Hotspots).

2. Adopt changes to 47 C.F.R. § 15.255, including increasing the average and peak effective isotropic radiated power (EIRP) limits for low-power uses by 10 dB, removing the peak transmitter conducted power limit, authorizing operations on board aircraft, and removing the publicly accessible coordination channel;

3. Expeditiously move forward with authorizing mobile services in additional bands above 24 GHz, including designating the 71-76 GHz band for unlicensed use; and

4. Maximize efficient use of the 28, 37, and 39 GHz bands by authorizing opportunistic unlicensed operations, which can protect incumbents by using a spectrum access system database.

II. THE COMMISSION SHOULD ADOPT ITS PROPOSAL TO AUTHORIZE UNLICENSED USE FROM 64-71 GHZ GOVERNED BY PART 15 RULES.

A. The Record Reflects Overwhelming Support for Making the 64-71 GHz Band Available for Unlicensed Use.

Commenters in this proceeding overwhelmingly favor designating the 64-71 GHz band for unlicensed use.[3] Chip manufacturers, technology companies, network operators, and public

[3] Comments of the Boeing Company at 11-12 (Boeing Comments); Comments of the Consumer Technology Association f/k/a the Consumer Electronics Association at 8-9 (filed Jan. 27, 2016) (CTA Comments); Comments of Facebook, Inc. at 5-6 (filed Jan. 26, 2016) (Facebook Comments); Comments of the Fixed Wireless Communications Coalition at 9-10 (filed Jan. 27, 2016); Comments of Google Inc. at 6-7 (Google Comments); Comments of IEEE 802 at 4 (filed Jan. 27, 2016) (IEEE 802 Comments); Comments of the Information Technology Industry Council at 5 (filed Jan. 27, 2016) (ITI Comments); Comment of Intel Corporation at 17-19 (filed Jan. 26, 2016) (Intel Comments); Comments of Microsoft Corporation at 5-7 (filed Jan. 27, 2016) (Microsoft Comments); Comments of the National Cable & Telecommunications Association at 3-9 (NCTA Comments); Comments of Open Technology Institute at New America and Public Knowledge at 27-29 (OTI & PK Comments); Comments of Qualcomm Incorporated at 14-15 (filed Jan. 27, 2016) (Qualcomm Comments); Comments of Straight Path Communications Inc. at 6 (filed Jan. 27, 2016); Comments of ViaSat, Inc. at ii, 21-22 (ViaSat Comments); Comments of Vubiq Networks, Inc. at 3 (filed Jan. 26, 2016) (Vubiq Comments); Comments of Wi-Fi Alliance at 4-6 (filed Jan. 27, 2016) (Wi-Fi Alliance Comments); Letter from H. Nwana, Executive Director, Dynamic Spectrum Alliance, to Marlene Dortch, Secretary, FCC, GN Docket No. 14-177, at 1-2 (filed Jan. 26, 2016) (DSA Letter); *see also* Comments of Huawei Technologies, Inc. (USA) and Huawei Technologies Co., Ltd. at 19-20 (Huawei Comments). Unless otherwise noted, all comment citations herein are to comments filed on January 28,

interest advocates agree that extending the 57-64 GHz unlicensed band to at least 71 GHz will support the expansion of existing unlicensed operations and foster the development of new and innovative wireless services. For example, Intel observes that "[t]he 64-71 GHz band is ideally situated to extend the growing demand for high capacity wireless LAN applications."[4] Similarly, Qualcomm states that "having access to greater [60 GHz unlicensed] bandwidth will support even greater data throughput connectivity."[5] The Open Technology Institute and Public Knowledge agree that "[a] wider [60 GHz unlicensed] band would support denser deployments and increased data rate capacity."[6] And the Information Technology Industry Council confirms that "permitting unlicensed operation in this band will help meet consumer demand for unlicensed spectrum that can deliver high data rates and low latency."[7]

In addition to consumer broadband use, Facebook notes that "[t]he huge demand for spectrum capacity is driving investment in [60 GHz] V-Band unlicensed technologies for wireless backhaul and other uses, particularly as the technology is evolving to allow for non-line-of-sight applications," and that "[e]xtending unlicensed access to the 64-71 GHz band would only increase such opportunities."[8] Boeing notes the importance of unlicensed spectrum for industrial applications, stating that "adding new [60 GHz unlicensed] spectrum will increase the flexibility and capacity of unlicensed operations, which have become a critical tool for industry

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2016 in GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, and IB Docket No. 97-95.

4 Intel Comments at 17.

5 Qualcomm Comments at 14.

6 OTI & PK Comments at 28.

7 ITI Comments at 5.

8 Facebook Comments at 6.

as well as end users."[9] Vubiq Networks explains that "[a]n additional 7 GHz of spectrum, creating a single 14 GHz mmWave unlicensed band, will meet the growing demand for wireless broadband services, at faster speeds than ever before," including by enabling, "point-to-point link design capable of data rates up to 50 Gbps."[10] Finally, the Wi-Fi Alliance confirms that "[e]xtending Part 15 operations to the 64-71 GHz band would . . . greatly enhance the capacity of next-generation WiGig technologies," to deliver consumer services such as instant wireless synchronization and docking between personal devices, ultrahigh-definition video streaming, cordless computing, and mobile use of headsets and other wearables, as well as enterprise services such as outdoor backhaul links and backup inter-rack connectivity for data centers.[11]

NCTA strongly agrees, and recommends that the Commission adopt its proposal to authorize unlicensed use in the 64-71 GHz band because doing so will result in several important benefits. For example, as the Commission explained, authorizing unlicensed operations in the band "will allow this band to be used in conjunction with the existing 57-64 GHz band to double the spectrum available for the next generation of unlicensed wireless broadband technologies such as ultra-high-speed audiovisual content streaming and WiGig connectivity that will offer low latency and security-protected connectivity between devices."[12] The Commission also observed "that making available a 14-gigahertz segment of contiguous spectrum in these frequencies will encourage the development of very high-speed wireless links with higher

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9 Boeing Comments at 11.

10 Vubiq Comments at 3, 5.

11 Wi-Fi Alliance Comments at 4-5.

12 *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, GN Docket No. 14-177 *et al.*, Notice of Proposed Rulemaking, 30 FCC Rcd 11878, 11899 ¶ 58 (2015) (NPRM).

connectivity, bandwidth and throughput between small cell sites to support spectral efficiency in existing communications systems as well as in future 5G systems."[13]

Commenters in this proceeding agree that the 64-71 GHz band is well-suited for unlicensed use. The Open Technology Institute and Public Knowledge note that "there are currently no licensed operations across this entire 14 GHz of spectrum, making the band particularly well suited for shared unlicensed use."[14] Vubiq Networks highlights that the low oxygen absorption in the upper 60 GHz band makes it "ideal for high speed communications links in downtown metropolitan areas due to the huge frequency re-use capability," and that an unlicensed approach in this band—without constraints on licensed station locations and antenna size—will facilitate flexible deployment.[15] The Dynamic Spectrum Alliance (DSA) anticipates that the difference in attenuation in the 64-71 GHz band as compared with the existing 57-64 GHz band "could lead to more than four times greater range for line-of-sight applications, which will lead to new, lower cost, outdoor applications," that could "help expand last mile broadband access."[16] Intel and IEEE 802 note that an IEEE 802 standards project (802.11ay) is already underway to expand and improve upon the existing 802.11ad standard for the 57-64 GHz band, but note that 802.11ay will require additional spectrum in order to achieve the higher throughputs envisioned for new 60 GHz applications.[17] Finally, as Intel has explained, failure to designate a sufficient amount of the 64-71 GHz band for unlicensed use "would diminish the

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13 *Id.* at 11965 ¶ 300.

14 OTI & PK Comments at 27.

15 Vubiq Comments at 4.

16 DSA Letter at 2.

17 Intel Comments at 17-18, IEEE 802 Comments at 4.

growth potential and limit the usage cases and the simultaneous users of high bandwidth services."[18]

As NCTA noted in its opening comments, the Commission can take several steps to ensure that unlicensed users put this spectrum to its most productive use. First, the Commission should adopt the same technical rules for use throughout the 57-71 GHz band, which will allow a broader range of unlicensed use cases to develop—including new wide-bandwidth applications—and will promote economies of scale.[19] Second, the Commission should not impose any particular channel plan (either in 57-71 GHz or in other bands where it permits opportunistic spectrum use) in order to allow flexible channel sizes and channel aggregation to support the new wide-bandwidth applications expected to develop in millimeter wave spectrum.[20] Finally, the Commission should ensure that its technical rules for 57-71 GHz (and for other bands where it permits opportunistic spectrum use) allow unlicensed users to deploy both mobile and fixed devices with varying maximum power levels for indoor, urban, suburban, and rural deployments. Adopting these basic principles to guide its approach to unlicensed technical rules in 57-71 GHz and in other millimeter wave spectrum designated for opportunistic use will allow the unlicensed industry maximum flexibility to innovate while promoting economies of scale and fostering efficient spectrum use.

B. The Record Also Supports Adjusting the Section 15.255 Rules To Produce More Efficient and Intense Use of the 57-71 GHz Band.

Commenters support pairing the Commission's proposed expansion of the millimeter wave unlicensed band with updated rules that will promote more efficient and intensive use of

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[18] Intel Comments at 18.

[19] NCTA Comments at 8.

[20] *See id.* at 9.

these frequencies. Specifically, the Commission should increase the average and peak EIRP for low-power operations by 10 dB, remove the peak transmitter conducted power limit, authorize operations on board aircraft, and remove the publicly accessible coordination channel.

EIRP limits. As NCTA noted in its opening comments, the Commission can best promote the complementary development of unlicensed technologies and their successful coexistence by adopting sufficiently high transmission power limits for low-power devices, including increasing by 10 dB the current average and peak EIRP limits for low-power unlicensed operations.[21] The record confirms this analysis.[22] For example, DSA notes that increasing the EIRP limits would "greatly expand the number of indoor use cases"[23] for 60 GHz unlicensed spectrum, while IEEE 802 believes that such a rule change "will enhance indoor performance for a variety of consumer applications."[24] Wi-Fi Alliance echoes these anticipated benefits, stating that "[t]hese higher EIRP limits would support devices with more antenna array elements and power amplifiers — promoting a greater diversity of applications, including those requiring multiple-room coverage indoors."[25]

Removal of peak transmitter conducted power limit. NCTA suggested in its opening comments that the Comission should remove the peak transmitter conducted power limit of 500 mW that appears in Section 15.255(e) of its rules. No party opposed this proposal in the opening comment round. As NCTA previously noted, removing the peak transmitter conducted

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21 *See id.* at 6-7; *see also* 47 C.F.R. § 15.255(b)(1)(i).

22 DSA Letter at 1, 3; IEEE 802 Comments at 4; Wi-Fi Alliance Comments at 8.

23 DSA Letter at 3.

24 IEEE 802 Comments at 4.

25 Wi-Fi Alliance Comments at 8.

power limit would enable additional use cases that may require signal coverage over a wider area than a single room.[26] This rule change would also provide manufacturers greater flexibility when it comes to the size, cost, and complexity of their antenna designs.[27] Consequently, the Commission should remove the 500 mW peak transmitter conducted power limit.

Removal of coordination channel. The Commission should also adopt its proposal to remove the existing section 15.255 requirement for a publicly accessible coordination channel from 57-57.05 GHz. As the Commission has recognized, there has been no industry interest in using a dedicated channel for coordination.[28] Numerous commenters, including IEEE 802, Intel, Microsoft, Qualcomm, and the Wi-Fi Alliance, agree with the Commission that such a coordination channel is unnecessary and that this 50 megahertz of spectrum could be better used for data transmission.[29]

Operation on aircraft. Commenters also generally support removing the existing prohibition on unlicensed 60 GHz operations on board aircraft.[30] Those that favor this proposal agree that the possibility of interference to radio astronomy or EESS operations[31] is extremely

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26 NCTA Comments at 7.

27 *Id.*

28 NPRM, 30 FCC Rcd at 11969 ¶ 312.

29 IEEE 802 Comments at 5; Intel Comments at 19-20; Microsoft Comments at 7-10; NCTA Comments at 5-6; Qualcomm Comments at 15; ViaSat Comments at 22; Vubiq Comments at 5; Wi-Fi Alliance Comments at 9.

30 Boeing Comments at 13-14; CTA Comments at 8-9; DSA Letter at 1, 3; IEEE 802 Comments at 5; Intel Comments at 19; Microsoft Comments at 11-14; ViaSat Comments at 22; Wi-Fi Alliance Comments at 7-8.

31 *See* Comments of the National Academy of Sciences' Committee on Radio Frequencies at 11-16 (Jan. 21, 2016) (CORF Comments); Comments of the National Radio Astronomy Observatory at 5 (filed Jan. 22, 2016).

limited, given the low-power nature of onboard wireless communications, attenuation caused by an aircraft's fuselage, and the propagation characteristics of 60 GHz spectrum.[32]

Given the strong record support for these proposals, the Commission should revise its section 15.255 rules to increase the low-power average EIRP limit to 50 dBm and the peak EIRP limit to 53 dBm throughout the 57-71 GHz band, remove the publicly accessible coordination channel, and allow unlicensed operations on board aircraft in the 57-71 GHz band. As NCTA suggested in its opening comments, the Commission should also remove the peak transmitter conducted power limit of 500 mW.

C. Studies at the ITU Regarding Possible Mobile Use of 66-76 GHz Should Not Deter the Commission from Making the Entire 64-71 GHz Band Available on an Unlicensed Basis.

The Commission has clearly identified the substantial potential benefits of designating the 64-71 GHz band for unlicensed operations, and has identified a considerable amount of other spectrum to allocate for licensed mobile operations in this proceeding—spectrum that occupies the substantially lower frequency bands that licensed carriers have insisted are important to their future operations. Nonetheless, several parties in this proceeding want the Commission to restrict even more spectrum for exclusive licensed operations instead of making it available for widespread unlicensed consumer uses. These licensed carriers and their suppliers ask the Commission to withdraw a portion of the 64-71 GHz band from the Commission's proposed unlicensed uses and allocate it for licensed operations.[33] Most of these commenters argue that,

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[32] Boeing Comments at 13-14; DSA Letter at 3; IEEE 802 Comments at 5; Microsoft Comments at 12-14.

[33] Comments of AT&T at 17 (AT&T Comments); Comments of CTIA at 17-19 (CTIA Comments); Comments of Ericsson at 19-20 (filed Jan. 26, 2016) (Ericsson Comments); Comments of Mobile Future at 16-17 (filed Jan. 27. 2016) (Mobile Future Comments); Comments of Nokia at 17-18 (filed Jan. 27, 2016) (Nokia Comments); Comments of T-

because the 66-76 GHz band appears among the numerous spectrum bands under consideration for mobile use at the World Radiocommunication Conference 2019 (WRC-19), it would promote international harmonization for the United States to restrict unlicensed operations in the 66-71 GHz band.[34] In reality, the Commission can best promote the goals of supporting innovative and efficient mobile services and international harmonization by authorizing unlicensed operations in the entire 64-71 GHz band.

First, existing unlicensed spectrum is becoming increasingly congested as demand for unlicensed services increases,[35] and the Commission must look to the next frequencies that can support unlicensed consumers with a sense of urgency. Cisco's latest Visual Networking Index predicts that by 2020, Wi-Fi will constitute 49 percent of all U.S. IP traffic (fixed and mobile), exceeding licensed mobile traffic by 43 percent,[36] while public Wi-Fi hotspots in the United

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Mobile USA, Inc. at 14-15 (filed Jan. 27, 2016) (T-Mobile Comments); Comments of Verizon at 13.

[34] CTIA Comments at 17-19; Ericsson Comments at 19-20; Nokia Comments at 17; T-Mobile Comments at 15; *cf.* AT&T Comments at 17; *see also* World Radiocommunication Conference, Resolution COM6/20 (WRC-15), *Studies on frequency-related matters for International Mobile Telecommunications identification including possible additional allocations to the mobile services on a primary basis in portion(s) of the frequency range between 24.25 and 86 GHz for the future development of International Mobile Telecommunications for 2020 and beyond*, at 426 (2015) (resolving to invite the ITU-R "to conduct and complete in time for WRC-19 the appropriate sharing and compatibility studies, taking into account the protection of services to which the band is allocated on a primary basis, for the frequency band[] . . . 66-76 GHz").

[35] *See* Cisco, *Enterprise Best Practices for Apple Devices on Cisco Wireless LAN*, at 3 (Feb. 2016), http://www.cisco.com/c/en/us/td/docs/wireless/technology/vowlan/bestpractices/EntBP-AppMobDevs-on-Wlans.pdf (stating that per "Cisco and Apple's joint recommendation, the use of the 2.4 GHz band is not considered suitable for use for any business and/or mission critical enterprise applications" due in large part to congestion); *see generally* Rob Alderfer, *WiFi Spectrum: Exhaust Looms* (May 28, 2013), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2411645.

[36] Cisco 2016 VNI (follow link and select Filter by Country, United States, Device Growth Traffic Profiles, Offload Traffic).

States are expected to grow from 13.9 million in 2015 to 79.8 million by 2020, nearly a six-fold increase.[37] All this additional Wi-Fi traffic, along with other unlicensed services, leads the economist Raul Katz to predict that Wi-Fi will generate $547 billion in economic surplus and contribute $49.78 billion to U.S. GDP annually in the coming years—but only if the Commission identifies adequate new unlicensed spectrum resources to meet growing demand.[38] Devoting the full 14 megahertz of spectrum between 57 and 71 GHz to existing unlicensed services and new unlicensed innovations will contribute to ensuring that supply remains sufficient to meet demand and that unlicensed devices and services continue to benefit the U.S. economy.

Second, the existing 60 GHz WiGig standard, 802.11ad, is already globally harmonized[39] and could be easily updated or adapted for use in the 64-71 GHz band. In fact, as Intel and IEEE 802 note, IEEE 802 already has a project underway to adapt the existing 802.11ad 60 GHz standard for new throughput, range, and use cases. This new 802.11ay standard could be completed as early as 2017.[40] The Commission can therefore promote international

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37 *Id.* (follow link and select Filter by Country, United States, Accelerating Network Speeds, Public WiFi Hotspots).

38 Raul Katz, *Assessment of the Future Economic Value of Unlicensed Spectrum in the United States*, at 4 (Aug. 2014), http://www.wififorward.org/wp-content/uploads/2014/01/Katz-Future-Value-Unlicensed-Spectrum-final-version-1.pdf.

39 *See* Wi-Fi Alliance, *WiGig® and the Future of Seamless Connectivity*, at 9 (Sept. 2013), http://www.wi-fi.org/file/wigig-and-the-future-of-seamless-connectivity-2013 ("WiGig uses the unlicensed 60 GHz band worldwide to provide data rates up to 7 Gbps."); Agilent Technologies, *Wireless LAN at 60 GHz – IEEE 802.11ad Explained*, at 4 (2013), http://cp.literature.agilent.com/litweb/pdf/5990-9697EN.pdf (showing 60 GHz unlicensed spectrum allocations where WiGig can be used in the United States, Canada, the European Union, South Korea, Japan, Australia, and China); Ian Poole, *IEEE 802.11ad Microwave Wi-Fi / WiGig Tutorial*, RADIO-ELECTRONICS.COM, http://www.radio-electronics.com/info/wireless/wi-fi/ieee-802-11ad-microwave.php.

40 Danny Kuo, *Digitimes Research: Next Generation IEEE 802.11ay standards to come in 2017*, DIGITIMES (Nov. 25, 2015), http://www.digitimes.com/news/a20151125PD203.html; *see also* IEEE 802, *Status of Project IEEE 802.11ay*, http://www.ieee802.org/11/Reports/

harmonization and economies of scale for WiGig applications by expeditiously authorizing unlicensed use in the full 64-71 GHz band.

Finally, while 802.11ay is imminent, it remains uncertain that a licensed mobile standard would ever emerge for the 66-76 GHz band—at best such a standard is years away. It also remains uncertain whether the compatibility studies underway in preparation for WRC-19 will ultimately lead International Telecommunication Union (ITU) member countries to find in 2019 that the band is suitable for International Mobile Telecommunications (IMT). In other words, although the ITU has identified 66-76 GHz as a band worthy of further study, without successful compatibility studies and a pronouncement from WRC-19 that the band can be used for IMT, the international harmonization benefits touted by wireless carriers may never materialize. Rather than wait for an ITU pronouncement on the suitability of the band for IMT that might never come, the Commission can best promote timely, efficient, and intensive use of this underutilized spectrum by authorizing unlicensed use of the band.

III. THE COMMISSION SHOULD EXPEDITIOUSLY AUTHORIZE UNLICENSED USE IN ADDITIONAL SPECTRUM BANDS ABOVE 24 GHZ.

NCTA supports requests by commenters that the Commission move forward expeditiously to authorize mobile operations in additional spectrum bands above 24 GHz. In particular, NCTA agrees that opportunistic unlicensed operations in the 71-76 GHz band could bring new mobile services to consumers while still protecting existing licensees.

A variety of commenters request that the Commission move forward with authorizing mobile use in additional frequencies not discussed at length in the NPRM. Of these bands, the

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tgay_update.htm (noting that Draft 1.0 of the 802.11ay amendment is expected to be ready by May 2017).

71-76 GHz band received particular attention on the record. Nokia, Mobile Future, Huawei, the Telecommunications Industry Association, and T-Mobile all support authorizing mobile use in the 71-76 GHz band.[41] Microsoft, Wi-Fi Alliance, and DSA specifically propose that the Commission authorize unlicensed operations in 71-76 GHz.[42] In comments on the Commission's notice of inquiry, IEEE 802 also expressed support for allowing Part 15 operations in this band.[43] Wi-Fi Alliance suggests that the 71-76 GHz band would be especially useful for unlicensed wireless backhaul,[44] while DSA anticipates benefits resulting from the proximity of this band to existing and proposed unlicensed frequencies.[45] NCTA agrees that the 71-76 GHz band holds promise for unlicensed use and that, given the strong support on the record, the Commission should proceed to authorize Part 15 unlicensed operations in the band immediately. At a minimum, the Commission should issue a further notice of proposed rulemaking proposing to designate the 71-76 GHz band for unlicensed use.

As the Commission notes, unlicensed operations would need to develop coexistence mechanisms in order to protect existing fixed operations and Federal earth stations in this band.[46] Microsoft suggests limiting unlicensed operations to indoor use as one method that could

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41 Huawei Comments at 4; Mobile Future Comments at 9; Nokia Comments at 12; Comments of the Telecommunications Industry Association at 6 n.14; T-Mobile Comments at 4, 8-9.

42 DSA Letter at 3; Wi-Fi Alliance Comments at 9-10; *see also* Microsoft Comments at 18.

43 Comments of IEEE 802 at 3-4, GN Docket No. 14-177 (filed Jan. 15, 2015).

44 Wi-Fi Alliance Comments at 9.

45 *See* DSA Letter at 3.

46 NPRM, 30 FCC Rcd at 11906 ¶ 87; *see also* 47 C.F.R. § 2.106, note US389. Radio astronomy operations also take place in the adjacent 76.0-77.5 GHz and 78.0-94 GHz bands, so adjacent channel protections may also be appropriate to protect radio astronomy licensees from harmful interference. *See* 47 C.F.R. § 2.106, note US342; *see also* CORF Comments at 18.

facilitate such coexistence.[47] Although the details of possible sharing mechanisms should be explored in further detail, NCTA notes as a general matter that unlicensed users successfully share spectrum with a variety of incumbents in a variety of frequencies and may be better able to protect incumbent users in the 71-76 GHz band than licensed mobile users.[48]

IV. THE RECORD SUPPORTS EMPLOYING SHARING TECHNOLOGIES TO MAXIMIZE EFFICIENT USE OF THE MILLIMETER WAVE BANDS.

Several commenters support the use of innovative sharing technologies such as a spectrum access system database to facilitate opportunistic and intensive use of the millimeter wave bands. As commenters have confirmed, spectrum sharing technology can promote the most efficient use of the 28, 37, and 39 GHz bands.[49] Accordingly, the Commission should adopt an opportunistic access framework for those bands, consistent with U.S. spectrum policy—which recognizes that spectrum sharing is critical to more efficient use of frequencies in today's environment—and consistent with the Commission's goal of facilitating unlicensed use even as licensees expand their networks.

Spectrum access systems and related technologies are sophisticated systems that can manage huge amounts of data in real time in order to "facilitate sharing among a wide variety of users and platforms."[50] These technologies optimize spectrum sharing in underutilized bands by preventing harmful interference to incumbent users, managing access for priority uses, and

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47 Microsoft Comments at 18.

48 *See* Comments of the National Cable & Telecommunications Association at 5-6, GN Docket No. 14-177 (filed Jan. 15, 2015).

49 *See, e.g.*, Comments of Federated Wireless, Inc. at 5 (filed Jan. 27, 2016) (Federated Wireless Comments); Comsearch Comments at 3 (filed Jan. 26, 2016); Google Comments at 4; NCTA Comments at 11-13; OTI & PK Comments at 11, 13-14.

50 *See* NPRM, 30 FCC Rcd at 11881 ¶ 2.

coordinating other users.[51] If designed correctly, these systems need not be burdensome: they should require only necessary reporting and the adoption of the common technical standards in order to facilitate a wide variety of uses.[52]

While the simpler rules in bands such as the 2.4 GHz and 5725-5850 MHz bands promote the most efficient and intensive use of unlicensed spectrum, adopting a system such as a spectrum access system for spectrum bands above 24 GHz where incumbents require additional protections will confer numerous benefits. This approach optimizes the utility of available spectrum by allowing unlicensed users to operate wherever and whenever licensees are not operating. It can also facilitate unlicensed use in areas where licensees have not yet begun to deploy their networks. And immediate access to underutilized bands offers another benefit: the unlicensed industry will have incentives to rapidly develop, test, and certify new equipment.[53] The alternative of allowing spectrum to lay fallow if licensees do not make the investments needed to bring it into use in particular communities is simply no longer an option in today's spectrum-constrained environment. The Commission should, therefore, authorize opportunistic unlicensed use of the 28, 37, and 39 GHz bands where and when licensed users are not operating, subject to coordination that protects licensees from harmful interference.

NCTA continues to support widespread opportunistic access in the 28, 37, and 39 GHz bands rather than the Commission's proposed use-or-share approach. As NCTA noted in its opening comments, the use-or-share proposal would not allow any unlicensed use for the first five years after the Commission grants a license and would allow complete displacement of

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51 *See, e.g.*, Federated Wireless Comments at 9-10 (describing protection for incumbents).

52 *See id.* at 10.

53 *See* NCTA Comments at 11.

unlicensed operations as licensees expand their networks.[54] However, whether the Commission authorizes widespread opportunistic access throughout these bands or implements a use-or-share requirement, it will need to define "used" and "unused" spectrum in order to determine where unlicensed devices may operate.[55]

In defining the spectrum that is "in use" by licensees, the Commission should adopt an engineering-focused definition that would define areas or channels actually in use by licensees. As discussed by commenters extensively in the Commission's 3.5 GHz proceeding,[56] defining use in this manner will prevent spectrum warehousing and encourage widespread, efficient opportunistic use. Whether licensees register their own in-use locations or channels in a database, supported by sound engineering analysis, or a database makes a determination based on information about actual operations, NCTA urges the Commission to define used and unused spectrum in a manner that will promote widespread and efficient opportunistic access.

V. CONCLUSION.

For the foregoing reasons, NCTA requests that the Commission (1) authorize unlicensed use of the 64-71 GHz band and not cut back on the Commission's proposal by limiting a portion of this band for exclusive licensed use; (2) adopt the section 15.255 rule changes supported by commenters (including increasing the average and peak EIRP for low-power operations by 10 dB, removing the peak transmitter conducted power limit, authorizing operations on board

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54 *Id.* at 10-11.

55 *See* NPRM, 30 FCC Rcd at 11941 ¶ 217.

56 *See, e.g.*, Comments of the Dynamic Spectrum Alliance at 2-3, GN Docket No. 12-354 (filed July 15, 2015); Comments of Google Inc. at 12, GN Docket No. 12-354 (filed July 15, 2015); Comments of Microsoft Corporation at 2-4, GN Docket No. 12-354 (filed July 15, 2015); Comments of Open Technology Institute at New America and Public Knowledge at 4-7, GN Docket No. 12-354 (filed July 15, 2015); Comments of Wi-Fi Alliance at 3, GN Docket No. 12-354 (filed July 15, 2015).

aircraft, and removing the publicly accessible coordination channel); (3) expeditiously move forward with authorizing mobile services in additional bands above 24 GHz, including designating the 71-76 GHz band for unlicensed use; and (4) maximize efficient use of the 28, 37, and 39 GHz bands by authorizing opportunistic unlicensed operations, which can protect incumbents using a spectrum access system database.

Respectfully submitted,

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