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

In the Matter 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
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I. INTRODUCTION AND SUMMARY

Comments submitted in response to the Federal Communications Commission's (Commission) Report and Order and Further Notice of Proposed Rulemaking (*Order & FNPRM*) strongly support authorizing mobile services in additional millimeter wave frequencies. With a few modifications, discussed below, NCTA – The Internet & Television Association (NCTA) is confident that the Commission's approach will both spur investment and innovation in 5G millimeter wave services in the United States and serve as a model for other regulators around the world.

The majority of commenters agree that the Commission should authorize mobile services in the 70-80 GHz range, but disagree on the licensing regime that should govern these bands. A variety of commenters agree with NCTA that designating additional spectrum in the 70/80 GHz bands for unlicensed use would extend the benefits of unlicensed services in the adjacent 57-71 GHz range and would simplify coexistence with incumbent users. Licensed users, however, oppose unlicensed use of these bands. These companies argue that the Commission has already designated sufficient millimeter wave spectrum for unlicensed use—more than it has allocated for licensed use.

The propagation characteristics of the high-band spectrum designated by the Commission for unlicensed differ substantially from the characteristics of the lower 28, 37, and 39 GHz bands that the Commission has allocated primarily for licensed use. The carriers' apples-to-oranges comparison therefore holds little value in informing the Commission's decision on how to achieve a balanced spectrum policy in the millimeter wave bands. Moreover, given the escalating demand for existing unlicensed services and industry forecasts suggesting that 5G networks will rely heavily on both unlicensed and licensed spectrum, the carriers have no basis

to suggest that the Commission's work is done on designating additional millimeter wave spectrum for unlicensed use.

The record also strongly supports the Commission's proposal to license the 32 GHz band pursuant to many of the rules it has adopted for other Upper Microwave Flexible Use Service (UMFUS) bands. NCTA, mobile network operators, and equipment manufacturers agree that because of its proximity to other UMFUS bands, the 32 GHz band presents a prime opportunity to extend the benefits of licensed 5G services to additional consumers. The vast majority of commenters express optimism that the sharing challenges in this band are surmountable—and the record describes a variety of mitigation mechanisms that could protect incumbent operations from harmful interference.

The Commission also should not require mobile network operators in the lower 37 GHz band to put their registered and coordinated sites into service within seven days. This short timeframe would require network operators to invest significant time and resources in permitting and other activities even before coordination takes place, which could significantly depress interest and investment in lower 37 GHz mobile operations.

II. THE RECORD SUPPORTS DESIGNATING ADDITIONAL SPECTRUM IN THE 70/80 GHZ BANDS FOR UNLICENSED USE

A. The Commission Should Not Conclude that 14 Gigahertz Is "Sufficient" Millimeter Wave Spectrum for Unlicensed Uses on the Basis of Apples-to-Oranges Comparisons by Licensed Mobile Interests

Mobile network operators and their allies argue that the Commission should not designate any more millimeter wave spectrum for unlicensed use because it already provided access to

more unlicensed spectrum than licensed spectrum so far in this proceeding.[1] As those licensed interests themselves have argued, however, spectrum bands are not fungible and propagation characteristics matter.[2] A balanced spectrum policy for licensed and unlicensed uses of the millimeter wave bands cannot be based on apples-to-oranges comparisons among various frequencies.

The Commission has wisely designated additional spectrum for unlicensed use in this proceeding in the extremely high frequency 64-71 GHz band.[3] As NCTA and others have discussed on the record, this band will be useful for a variety of existing and innovative new unlicensed services, including WiGig (IEEE 802.11ad) and WirelessHD for high speed, short range services like video streaming, wireless docking, and wireless file transfers.[4] Nevertheless, this spectrum is not comparable to the lower band spectrum that the Commission made available for licensed use in this proceeding. The mobile carriers focused their advocacy efforts on access to lower band spectrum in the 28, 39, and 37 GHz bands because the propagation there is better

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[1] Comments of CTIA at 3, 10 (CTIA Comments); Comments of T-Mobile USA, Inc. at 2-3 (T-Mobile Comments). Unless otherwise noted, all comment citations herein are to comments filed in GN Docket No. 14-177, IB Docket Nos. 15-256 & 97-95, RM-11664, and WT Docket No. 10-112 on September 30, 2016.

[2] Comments of CTIA, GN Docket No. 14-177 et al., at 7 (filed Jan. 28, 2016).

[3] *Use of Spectrum Bands Above 24 GHz for Mobile Radio Services, et al.*, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014, 8062-63 ¶ 125 (2016) (*Order & FNPRM*).

[4] *See* Reply Comments of the National Cable & Telecommunications Association, GN Docket No. 14-177 et al., at 4-6 (filed Feb. 26, 2016) (describing the record support for authorizing unlicensed use of the 64-71 GHz band and possible uses for the band); Comments of NCTA-The Internet and Television Association at 6-7 (NCTA Comments).

than at higher frequencies. The carriers therefore compare apples-to-oranges when they suggest that the Commission has already designated more unlicensed spectrum in this proceeding than it has made available for licensed use.

Advocates for licensed use of the 70/80 GHz bands also claim that 14 gigahertz of unlicensed millimeter wave spectrum (in the 57-71 GHz band) is sufficient to support unlicensed 5G services.[5] They do not substantiate this claim with any evidence that demand for licensed mobile 5G services will exceed demand for unlicensed 5G. On the other hand, NCTA and many commenters in this proceeding have highlighted skyrocketing demand for existing unlicensed services and growing demand for additional unlicensed frequencies. Mobile carriers themselves seek to expand their operations into unlicensed spectrum bands,[6] and industry experts anticipate additional convergence between licensed and unlicensed networks as part of the 5G ecosystem,[7] further increasing demand for additional unlicensed 5G spectrum.

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[5] Comments of 5G Americas at 7 (5G Americas Comments); Comments of Ericsson at 15 (Ericsson Comments); Comments of the Telecommunications Industry Association at 15 (TIA Comments); Comments of Qualcomm Incorporated at 12 (Qualcomm Comments).

[6] *See, e.g.*, Diana Goovaerts, *Verizon "Eager" to Deploy LTE-U in Wave of Coexistence Plan's Release*, Wireless Week (Sept. 23, 2016), https://www.wirelessweek.com/blog/2016/09/verizon-eager-deploy-lte-u-wake-coexistence-plans-release; Aricent, *Aricent Technologies Launches LTE Licensed Assisted Access and LTE Wi-Fi Aggregation Solutions for Improved Wireless Coverage as Part of Aricent's Next-Generation of Wireless Offerings*, Press Release (Sept. 14, 2016), https://www.aricent.com/news/aricent-technologies-launches-lte-licensed-assisted-access-and-lte-wi-fi-aggregation-solutions.

[7] Qualcomm Comments at 3 ("The fundamental building block for 5G services will be a new air interface that . . . operates in both unlicensed and licensed spectrum, both exclusive use and shared spectrum."); NCTA Comments at 5-6 (citing sources predicting 5G network convergence through combining unlicensed and licensed spectrum resources).

The Commission should therefore reject unsupported claims that 14 gigahertz is in any way "sufficient" millimeter wave spectrum for unlicensed and instead look to the solid record developed by commenters in this proceeding who highlight the importance of additional unlicensed spectrum for 5G. On the basis of that record, the Commission should authorize some form of unlicensed use in the 70/80 GHz bands.

B. Many Commenters Support Designating Additional Spectrum in the 70/80 GHz Bands for Unlicensed Use

NCTA and many other commenters agree that the Commission should authorize unlicensed use in the 70/80 GHz bands.[8] Microsoft sees an "emerging opportunity for global economies of scale that will favor radios and other components that can operate across the 60 GHz and 70 GHz bands."[9] The Open Technology Institute at New America and Public Knowledge state that "[a]uthorizing unlicensed secondary access outdoors and indoors would be particularly beneficial in the 71-76 GHz band that is contiguous to the existing unlicensed band at 57-71 GHz already in use for wide-channel WiGig connectivity."[10] The Dynamic Spectrum Alliance (DSA) supports indoor unlicensed use in the 70/80 GHz bands, noting that "[s]ince

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[8] Dynamic Spectrum Alliance Initial Comments in FCC's Spectrum Frontiers FNPRM at 7-9 (DSA Comments); Comments of Microsoft Corporation at 5-11 (Microsoft Comments); Comments of Open Technology Institute at New America and Public Knowledge, at 19-22 (OTI & PK Comments); *see also* Comments of Fastback Networks at 3 (noting that the existing licensing scheme could accommodate future unlicensed use) (Fastback Comments); Comments of the Fixed Wireless Communications Coalition at 12 (noting that FWCC does not oppose indoor unlicensed use at low power levels) (FWCC Comments); Comments of Micronet Communications, Inc. at 4 (supporting indoor, low power unlicensed use) (Micronet Comments).

[9] Microsoft Comments at 8.

[10] OTI & PK Comments at 21-22.

most high-capacity broadband use is indoors, the availability of greater capacity on an open and unlicensed basis inside every building would serve the public interest."[11]

Although commenters propose different approaches to unlicensed use of the 70/80 GHz bands, all appear to agree that indoor-only, low power unlicensed operations pose little or no risk to incumbents[12]—even if NCTA believes that the Commission could go farther. At a minimum, then, the Commission should authorize indoor-only unlicensed use throughout 70/80 GHz.[13]

The record also reflects significant support for retaining the Commission's Part 101 light licensing rules for fixed point-to-point uses.[14] The Commission can continue this successful model while promoting unlicensed innovation through an unlicensed underlay of indoor, low-power users. This would promote more intensive spectrum use in these "lightly used" bands, especially in the "green field" areas outside of the 16 counties where 73 percent of all registered point-to-point links are deployed.[15]

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[11] DSA Comments at 8.

[12] DSA Comments at 8; Microsoft Comments at 9; OTI & PK Comments at 21; *cf.* FWCC Comments at 11-12; Micronet Comments at 4.

[13] NCTA disagrees with commenters who suggest that the Commission should enforce any indoor-only rule by adopting an AC power requirement, as it has done for unlicensed devices operating in the 92-95 GHz band. *See* DSA Comments at 8-9; Microsoft Comments at 11; OTI & PK Comments at 21-22; *see also* 47 C.F.R. § 15.257(a)(1). This requirement would tether innovative new devices to the wall with a cord, foreclosing truly mobile use cases.

[14] Comments of Anova Technologies, LLC at 2; Comments of Collinear Networks, Inc. on the Further Notice of Proposed Rulemaking, at i, 5; CTIA Comments at 14; Ericsson Comments at 15; Fastback Comments at 2-3; Comments of Google Inc. and Google Fiber Inc. at 2.

[15] *See Order & FNPRM*, 31 FCC Rcd at 8161 ¶ 432.

In addition to indoor unlicensed, the Commission should also authorize outdoor unlicensed use of at least a portion of the 70/80 GHz bands. For instance, as Microsoft has suggested, the Commission could adopt Part 15 rules for indoor/outdoor operations in the 70 GHz band using a geolocation database while adopting indoor-only unlicensed rules for the 80 GHz band.[16] Even if it does not adopt rules for outdoor unlicensed operations at this time, the Commission should explicitly state its willingness to consider such rules in the future as industry becomes more familiar with the shared RF environment in these bands.

III. THE RECORD SUPPORTS AUTHORIZING LICENSED MOBILE USE OF THE 32 GHZ BAND WITH MITIGATION MEASURES APPROPRIATELY TAILORED TO PROTECT INCUMBENTS

A. The Record Overwhelmingly Supports Authorizing Mobile Use of the 32 GHz Band

Nearly every commenter to address the issue supports the Commission's proposal to authorize mobile use of the 32 GHz band pursuant to most of the same operational and technical rules that it has adopted for other licensed millimeter wave spectrum.[17] Commenters note that the proximity of the 32 GHz band to other UMFUS bands already licensed by the Commission

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[16] Microsoft Comments at 5-11.

[17] Comments of AT&T at 9 (AT&T Comments); Comments of the Consumer Technology Association f/k/a the Consumer Electronics Association at 3, 4-5; CTIA Comments at 10; Ericsson Comments at 10-11; Comments of Facebook, Inc. at 4; FWCC Comments at 4-5; Comments of Huawei Technologies, Inc. (USA) and Huawei Technologies Co., Ltd. at 5-6 (Huawei Comments); Comments of Mobile Future at 3; Comments of Nokia at 5-6, 7; Qualcomm Comments at 8; Comments of Samsung Electronics America, Inc. and Samsung Research America at 3, 4-5 (Samsung Comments); Comments of Straight Path Communications Inc. at 3; TIA Comments at 8-9; T-Mobile Comments at 11; Verizon's Comments on Further Notice at 1, 3 (Verizon Comments).

will "accelerate technology development" by "minimiz[ing] the number of bands user equipment will need to support,"[18] and providing a "tuning range solution together with [the 28 GHz] band."[19]

Echodyne, a company developing radar technology for use in the millimeter wave bands, is the only commenter to oppose terrestrial mobile operations in 32 GHz. Echodyne claims that shared use between aeronautical radar and 5G terrestrial services is "improbable," but fails to provide technical information or detailed analysis to support its claims.[20] Moreover, Echodyne acknowledges that it "has yet to build and test devices operating in the 32 GHz band" and that its products envisioned for 32 GHz are still in the design phase.[21] The Commission should not indefinitely stifle 5G innovation in the 32 GHz band in order to protect operations that do not yet exist in any meaningful way.[22] Instead, the Commission should act expeditiously on a record replete with support and authorize mobile use of the 32 GHz band. Because non-Federal radar technology remains in the developmental phase, now is the time for radar technology developers and nascent 5G services to build sharing approaches into their system designs at the outset.

The record supports the extension of many of the new Part 30 UMFUS technical rules to the 32 GHz band. Verizon states that harmonizing the rules for the 32 GHz band with those

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[18] Samsung Comments at 4-5.

[19] Ericsson Comments at 10.

[20] Comments of Echodyne Corp. at 5.

[21] *Id.*

[22] *See* TIA Comments at 9 ("While the Commission may certainly proceed cautiously in crafting service rules [for the 32 GHz band], hypothesized developments in radionavigation cannot be a basis for blocking action entirely.").

adopted for the 28 and 37-40 GHz bands would help to "repurpose those [new] bands quickly and to facilitate synergies with nearby spectrum."[23] Similarly, Huawei supports the adoption of similar technical rules across the millimeter wave bands to "enable common equipment development and deployment," which, in turn, would facilitate equipment economies of scale and interoperability.[24]

Although NCTA supports the harmonization of technical and operational rules across licensed UMFUS bands including 32 GHz, it urges the Commission not to extend the cybersecurity reporting requirement set forth in Section 30.8 of the UMFUS rules to the 32 GHz band or to other bands under consideration in this proceeding. In its *Order & FNPRM*, the Commission adopted a requirement that UMFUS licensees file—before they begin operations—a public description of the cybersecurity plans for their 5G networks, signed by a senior executive.[25] A variety of commenters have expressed their concerns about this approach.[26] NCTA opposes this reporting requirement for two reasons. First, requiring licensees to file public statements about their cybersecurity practices would not decrease but rather would

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[23] Verizon Comments at 1.

[24] Huawei Comments at 7.

[25] *Order & FNPRM*, 31 FCC Rcd at 8104-06 ¶¶ 262-65, 8206-07.

[26] AT&T Comments at 14-16; CTIA Comments at 10-11 & n.28; Letter from Rebecca Murphy Thompson, EVP & General Counsel, Competitive Carriers Association, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 14-177, at 6 (filed July 7, 2016) (describing conversation regarding cybersecurity with legal advisors to Commissioners Rosenworcel and O'Rielly); *see also* Letter from Charla M. Rath, Vice President—Wireless Policy Development, Verizon, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 14-177, at 2 (filed July 7, 2016).

increase security threats to 5G networks. Even high-level information may unintentionally disclose a vulnerability that bad actors could use to disrupt critical 5G services. Second, if the public information submitted by network operators is truly so generic and high-level as to thwart would-be exploiters, that information would be of limited utility to the Commission in evaluating whether licensees have in fact "engage[d] in the development of security measures at an earlier stage" or in "identifying security risks, including areas where more attention to security may be needed."[27] The Commission should not extend this requirement of questionable utility to additional millimeter wave bands.

B. Commenters Suggest a Variety of Mitigation Approaches to Protect 32 GHz Incumbents

Given overwhelming record support for authorizing licensed mobile use of the 32 GHz band, the question is not whether the Commission should adopt its proposal, but how it can do so while protecting incumbent co-channel Federal radar and space research operations and adjacent channel radio astronomy and Earth Exploration Satellite Service users. Commenters agree that licensed mobile users can successfully protect incumbents from harmful interference and suggest several methods for doing so.

Qualcomm suggests that geographic coordination could be used to protect deep space research and adjacent passive band operations.[28] T-Mobile agrees that coordination or exclusion zones could be used to protect adjacent radio astronomy services, and contends that exclusion

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[27] *Order & FNPRM*, 31 FCC Rcd at 8104 ¶ 262.

[28] Qualcomm Comments at 8.

zones and geographic separation should be sufficient to protect in-band federal radar.[29] The Telecommunications Industry Association (TIA) states that the Commission can protect incumbents through the use of carefully crafted operating requirements for new entrants and/or a well-crafted band plan.[30] Federated Wireless suggests the use of a Spectrum Access System database to protect radar and space research incumbents, much as the Commission has adopted for use in the 3.5 GHz band.[31]

T-Mobile cautions against the use of guard bands to protect adjacent services, arguing that their use in these circumstances would prove both "inefficient and overprotective."[32] Ericsson agrees that guard bands to protect passive services should be considered only if other mitigation techniques would be inadequate.[33] Similarly, TIA argues that guard bands "should generally not be included in the band plans" as incumbents can likely be protected through "geographic coordination or other means" codified in the operational rules for mobile use of the band.[34]

NCTA agrees that operational rules such as out-of-band emissions limits and/or geographic separation requirements could potentially protect adjacent incumbents and co-

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[29] T-Mobile Comments at 12-13.

[30] TIA Comments at 9.

[31] Comments of Federated Wireless at 20-21.

[32] T-Mobile Comments at 7, 13.

[33] Ericsson Comments at 10-11.

[34] TIA Comments at 7.

channel space research operations from harmful interference.[35] NCTA also agrees that guard bands to protect adjacent operations should be a last resort, as they would occupy valuable spectrum real estate without accommodating any productive use of those frequencies. Although industry needs more information on the technical characteristics of federal radar operations in the band to identify appropriate mitigation techniques—as Ericsson and T-Mobile acknowledge[36]—the record reflects confidence that existing coexistence options (such as geographic coordination or exclusion) or options under development (such as a database approach) can facilitate sharing. Various approaches to sharing and compatibility can be more fully explored during the lead up to World Radiocommunication Conference 2019 as sharing studies are developed for the band.[37]

IV. THE COMMISSION SHOULD NOT REQUIRE LICENSEES IN THE LOWER 37 GHZ BAND TO PUT SITES INTO SERVICE WITHIN SEVEN DAYS

The Commission has proposed "that registered non-Federal sites [in the lower 37 GHz band] must be put into service within seven days of coordination and that registered and coordinated sites must reassert their registration every seven days."[38] As other commenters have discussed,[39] seven days does not provide network operators with sufficient time to put sites into service. In order to put a mobile network into service, a network operator must obtain mounting

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[35] NCTA Comments at 15-16.

[36] Ericsson Comments at 11 (noting that "more study is needed" on sharing and compatibility issues); T-Mobile Comments at 13.

[37] *See* Ericsson Comments at 11.

[38] *Order & FNPRM*, 31 FCC Rcd at 8172 ¶ 456.

[39] *See, e.g.*, 5G Americas Comments at 12-13; Comments of Intel Corporation at 14 (Intel Comments); T-Mobile Comments at 22.

rights, purchase and install backhaul, deliver power to the site, and obtain the proper permits, in addition to testing the network. As others have pointed out, one mobile site can integrate multiple base stations, further complicating the process.[40] A mobile network operator would not be able to accomplish all of these tasks in seven days, meaning that the operator would be required to invest significant time and resources to engage in these activities even before registration and coordination. In other words, a seven-day in-service rule would require significant investment at a very early stage before successful coordination is assured, which could depress investment in lower 37 GHz networks. The Commission should allow a reasonable period—at least 120 days—to engage in permitting, siting, and testing activities after coordination.

In addition, the Commission's proposal to require reassertion of a network operator's registration every seven days would almost certainly require the use of an automated database, foreclosing other potential options for frequency coordination in the lower band. The Commission should ensure that any registration renewal requirement is consistent with whatever frequency coordination mechanism it ultimately adopts.

V. CONCLUSION

The record in this proceeding supports numerous proposals by the Commission for enabling the development of 5G mobile services in additional millimeter wave bands. Acting on that record, the Commission should: (1) designate the 70/80 GHz bands for indoor, low-power unlicensed use while leaving open the possibility for outdoor use in the future; (2) authorize

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[40] 5G Americas Comments at 13; Intel Comments at 14.

licensed use of the 32 GHz band; and (3) allow a reasonable amount of time after coordination for 37 GHz network operators to put their sites into service.

Respectfully submitted,

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