

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 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 Operation)	IB Docket No. 97-95

REPLY COMMENTS OF T-MOBILE USA, INC.

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REPLY COMMENTS OF T-MOBILE USA, INC.

T-Mobile USA, Inc. (“T-Mobile”)^{1/} submits these reply comments in response to the comments of other parties in the above-referenced proceedings in which the Commission

^{1/} T-Mobile USA, Inc. is a wholly-owned subsidiary of T-Mobile US, Inc., a publicly traded company.

examines the potential use of spectrum in the bands above 24 GHz for the deployment of fifth generation (“5G”) mobile wireless technologies.^{2/}

I. INTRODUCTION AND SUMMARY

T-Mobile commends the Commission’s efforts in this proceeding to ensure that additional spectrum resources are available to meet the ever-increasing demands on terrestrial wireless networks for greater speed and capacity and the technological developments that will help address those requirements. As the majority of the comments demonstrate, the Commission should adopt rules governing the bands targeted in the *NPRM* and should consider rules for additional bands, with a focus on making spectrum available on terms that will encourage adoption, investment, and innovation. Consistent with T-Mobile’s comments, others supported the Commission taking the following actions:

- Authorizing the 28 GHz band for mobile use.
- Considering additional bands as part of this proceeding.
- Fully licensing the 37 GHz band and harmonizing the rules for this band with those for the 39 GHz band.
- Designating a portion of the 64-71 GHz band for licensed use.
- Issuing multiple 28 GHz licenses, rather than one 850 megahertz block license.
- Refraining from adopting untested use and sharing schemes – such as a Spectrum Access System (“SAS”).
- Adopting a license term of ten years for licenses in the millimeter wave bands.

^{2/} *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services; Establishing a More Flexible Framework to Facilitate Satellite Operations in the 27.5-28.35 GHz and 37.5-40 GHz Bands; Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band; Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band; 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*, Notice of Proposed Rulemaking, 30 FCC Rcd. 11878 (2015) (“*NPRM*”).

- Considering elimination of construction-based performance requirements for licensees in the millimeter wave bands.

T-Mobile agrees with others who recommended that the Commission also take the following actions:

- Consider adopting a pre-auction channel “swap” period during which 39 GHz licensees may, if they so chose, exchange 50 megahertz Economic Area (“EA”)-based spectrum blocks within an EA for blocks where there is no incumbent EA licensee.
- Refrain from overprotecting Radio Astronomy Service (“RAS”) and the Earth Exploration Satellite Service (“EESS”) by setting protection criteria at this time.

Last, should the Commission decide to issue county-based licenses, it should refrain from deciding the issue of package bidding at this time and instead consider the issue in a later proceeding designed to address auction rules for the affected bands.

II. THE PROPOSED BANDS ARE APPROPRIATE FOR MOBILE USE AND THE COMMISSION SHOULD ALSO CONSIDER THE USE OF ADDITIONAL BANDS

A. The Commission Should Authorize The 28 GHz Band For Mobile Use

A majority of commenters agree with T-Mobile that the Commission should authorize mobile use in the 28 GHz and 39 GHz bands.^{3/} In contrast, some commenters assert that the

^{3/} See, e.g., Comments of T-Mobile USA, Inc., GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 9 (filed Jan. 27, 2016) (“T-Mobile Comments”) (“The Commission should adopt its proposal to authorize existing 28 GHz and 39 GHz licensees for mobile use[.]”); Comments of Verizon, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 2 (filed Jan. 28, 2016) (“Verizon Comments”) (“The Commission should promptly adopt its plan to allow existing 28 GHz and 39 GHz licensees to use their licenses for mobile services, and to auction the spectrum in those bands not currently licensed.”); Comments of CTIA, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 14 (filed Jan. 28, 2016) (“CTIA Comments”) (“CTIA supports the Commission’s proposed licensing rules for the 28 and 39 GHz bands[.] . . . For the 28 and 39 GHz bands, the Commission has proposed rules for an Upper Microwave Flexible Use Service under which licensees would be authorized to provide any form of fixed or mobile service.”); Comments of Mobile Future, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 10 (filed Jan. 27, 2016) (“Mobile Future Comments”); Comments of AT&T, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 3-4 (filed Jan. 28, 2016)

Commission should refrain from authorizing the 28 GHz band for terrestrial mobile use because the band was not on the list of bands designated at WRC-2015.^{4/} The Commission already rejected this rationale as a basis not to proceed with 28 GHz mobile services rules. As it noted in the *NRPM*, “not every country will be able to designate exactly the same bands for similar uses because they will have a different needs and incumbent uses[,]” thus making it occasionally necessary to designate spectrum on a regional basis.^{5/} In this case, WRC-2015 did not reject the use of the 28 GHz band for mobile wireless – it merely declined to designate it for study. In fact, other countries have begun to examine the use of the 28 GHz band – South Korea and Japan

(“AT&T Comments”); Comments of PCIA – The Wireless Infrastructure Association, GN Docket No. 14-177, 8-9 (filed Jan. 26, 2016); Comments of Straight Path Communications Inc., GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 14 (filed Jan. 27, 2016) (“Straight Path Comments”); Comments of XO Communications, LLC, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 14 (filed Jan. 28, 2016) (“XO Communications Comments”); Comments of the Information Technology Industry Council, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 4-5 (filed Jan. 27, 2016) (“Information Technology Industry Council Comments”); Comments of the Consumer Technology Association, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 10 (filed Jan. 27, 2016); Comments of the Telecommunications Industry Association, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 15-16 (filed Jan. 27, 2016) (“Telecommunications Industry Association Comments”); Comments of Samsung Electronics America, Inc. and Samsung Research America, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 3 (filed Jan. 26, 2016) (“Samsung Comments”); Comments of Ericsson, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 5-6 (filed Jan. 26, 2016) (“Ericsson Comments”); Comments of Cisco Systems Inc., GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 5 (filed Jan. 28, 2016) (“Cisco Systems Comments”); Comments of Intel Corporation, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 2-3 (filed Jan. 26, 2016) (“Intel Corporation Comments”); Comments of QUALCOMM Incorporated, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 7 (filed Jan. 27, 2016) (“QUALCOMM Incorporated Comments”).

^{4/} See Comments of EMEA Satellite Operators Association, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 2 (filed Jan. 27, 2016); Comments of Global VSAT Forum, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 2 (filed Jan. 2, 2016); Comments of Avanti Communications Group plc, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 2-5 (filed Jan. 2, 2016).

^{5/} *NRPM* ¶ 32; see also T-Mobile Comments at 5.

have reportedly already begun tests in this band.^{6/} As Commissioner Rosenworcel recently stated, this is not “the time to hold back.”^{7/} Because the International Telecommunications Union may revisit its decision to evaluate the 28 GHz band in the future, the Commission can and should take a leadership position by adopting rules for the band to support terrestrial wireless operations that the rest of the world can follow.

Even if the band does not ultimately become internationally harmonized, it should still be designated in the United States to meet terrestrial wireless demands. The band has been allocated domestically for fixed operations on a primary basis, and the Commission contemplated that when technology matured, a mobile allocation would be added.^{8/} The substantial and ongoing growth of terrestrial wireless is real and verifiable,^{9/} and it is appropriate for the Commission to expand the current terrestrial allocation for the band to cover mobile applications.

^{6/} Dan Jones, *FCC's Rosenworcel Urges US to 'Go It Alone' With 28GHz for 5G*, LIGHTREADING (Feb. 13, 2016), <http://www.lightreading.com/mobile/5g/fccs-rosenworcel-urges-us-to-go-it-alone-with-28ghz-for-5g/d/d-id/721071>.

^{7/} *Id.*

^{8/} *Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies For Local Multipoint Distribution Service and For Fixed Satellite Services*, Second Report and Order, Order on Reconsideration and Fifth Notice of Proposed Rulemaking, 12 FCC Rcd. 12545, ¶ 207 (1997) (“Although LMDS is allocated as a fixed service, we know of no reason why we would not allow mobile operations if they are proposed and we obtain a record in support of such an allocation.”).

^{9/} *See, e.g.*, CISCO, CISCO VISUAL NETWORKING INDEX: GLOBAL MOBILE DATA TRAFFIC FORECAST UPDATE, 2014–2019, at 2-4 (2015), http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.pdf (finding that global mobile data traffic grew 74 percent in 2015, that mobile data traffic has grown 4,000-fold over the past 10 years, and that global mobile data traffic will increase nearly 8-fold between 2015 and 2020).

Further, contrary to, among others, O3b Limited's suggestion, allowing mobile use will not lead to stranded investment by satellite companies in the 28 GHz band.^{10/} Satellite companies cannot now claim that lack of access to the 28 GHz band will deprive them of capacity on which they relied for future growth. The Commission correctly discounted this argument in the *NPRM*, noting that "authorizing mobile use would not deprive FSS operators of any reasonable expectations they had of access to spectrum."^{11/} Satellite use of the band has always been on a limited basis,^{12/} and satellite users undertook operations in this band at their own risk. When the Commission authorizes the band for terrestrial mobile use, satellite companies may continue to operate on a secondary basis, on the exact same terms they do now.

Moreover, the Commission has provided satellite operators a path to primary status in the band – by purchasing exclusive rights at auction, or purchasing or leasing exclusive rights through the secondary market. There is no reason to reject that path merely because a satellite operator may only need protection within a subset of the licensed area.^{13/} If a satellite operator

^{10/} See, e.g., Comments of O3b Limited, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 12-13 (filed Jan. 28, 2016) ("O3b Limited Comments"); Comments of Inmarsat Mobile Networks, Inc., GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 4 (filed Jan. 28, 2016).

^{11/} *NPRM* ¶ 31.

^{12/} See *Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services*, First Report and Order, 11 FCC Rcd. 19005, ¶ 45 (1996) ("At 27.5 - 28.35 GHz we designate 850 MHz for LMDS on a primary basis. GSO/FSS or NGSO/FSS systems will be permitted on a non-interference basis to the LMDS systems in the 850 MHz band segment, for the purpose of providing limited gateway-type services."); 47 C.F.R. § 2.106; see also *NPRM* ¶ 124.

^{13/} See Comments of the Satellite Industry Association, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 15 (filed Jan. 28, 2016) ("To prevail in an auction, however, an FSS operator would have to bid a market-clearing price for an *entire county* to protect an earth station that would affect only a tiny portion of the licensed area.") (emphasis in original).

needs only a portion of a license won at auction, it can simply sell the rest on the secondary market as wireless operators routinely do today.

B. The Commission Should Consider Mobile Use Of Additional Millimeter Wave Bands

Because of the documented need for additional capacity for mobile wireless operations and the length of time the process of making spectrum available takes, T-Mobile strongly urged the Commission to evaluate additional millimeter wave bands for mobile wireless use now,^{14/} suggesting that the Commission consider those bands originally mentioned in the Notice of Inquiry, those designated by the Inter-American Telecommunications Commission for consideration at WRC-15, and those designated at WRC-15 for additional study.^{15/} Commenters strongly supported T-Mobile's request. For instance, CTIA states that "[t]he four criteria identified by the Commission [for evaluating millimeter wave bands] . . . should not serve to artificially limit consideration of candidate bands. . . . The Commission should not foreclose use of spectrum bands with less than 500 megahertz of contiguous spectrum, for example, as these bands could nonetheless be developed for 5G services."^{16/} Mobile Future also stressed that while "[t]he criteria used by the Commission to evaluate the suitability of spectrum for mmW mobile service were useful for identifying the spectrum on which the Commission could focus initially and presumably reallocate promptly . . . [t]o the extent other bands above 24 GHz do not meet all

^{14/} T-Mobile Comments at 4-8.

^{15/} See T-Mobile Comments at 6; see also *Use of Spectrum Bands Above 24 GHz for Mobile Radio Services*, Notice of Inquiry, 29 FCC Rcd. 13020 (2014); WORLD RADIOCOMMUNICATION CONFERENCE (WRC-15), PROVISIONAL FINAL ACTS, at 426 (2015), http://www.itu.int/dms_pub/itu-r/opb/act/R-ACT-WRC.11-2015-PDF-E.pdf; *NPRM ¶¶* 10, 13.

^{16/} CTIA Comments at 10-11.

of the criteria . . . it should not preclude further consideration of those bands.”^{17/} In fact, as highlighted by 4G Americas, “many of the bands ‘left on the cutting room floor’ in the NPRM have been teed-up as bands that will be studied for possible identification for IMT 2020 at WRC-19.”^{18/}

Recent developments suggest that at least one of the millimeter wave bands that the Commission proposes for 5G mobile use will be extensively licensed to an existing national wireless carrier.^{19/} Millimeter wave spectrum must be available for current providers and future entrants. Accordingly, consistent with the views of an overwhelming number of commenters, the Commission should take steps now to evaluate additional bands,^{20/} to ensure the availability

^{17/} Mobile Future Comments at 9-10.

^{18/} Comments of 4G Americas, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 16 (filed Jan. 26, 2016) (“4G Americas Comments”) (“Given the overlap in bands, the importance of innovation, and the goal of maintaining U.S. leadership in 5G development” the Commission should “reevaluate in future proceedings the bands from the 2014 NOI that have been removed from the [NPRM .]”).

^{19/} Press Release, Verizon, Verizon Continues Focus on Network Superiority with Agreement to Purchase XO Communications’ Fiber Business (Feb. 22, 2016), <http://www.verizon.com/about/news/verizon-continues-focus-network-superiority-agreement-purchase-xo-communications-fiber> (describing a transaction between Verizon and XO Communications pursuant to which Verizon will “lease available XO wireless spectrum, with an option to buy XO’s entity that holds its spectrum by year-end 2018”).

^{20/} See, e.g., Comments of FiberTower Spectrum Holdings, LLC, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 3-5 (filed Jan. 27, 2016) (arguing that the Commission should provide flexible use optionality to the licensed 24 GHz band); Comments of the National Cable & Telecommunications Association, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 18 (filed Jan. 28, 2016) (“NCTA Comments”) (“NCTA urges the Commission to move forward expeditiously by issuing a further notice of proposed rulemaking exploring technical rules for mobile services in [the 24 GHz, 29/31 GHz, 32 GHz, 42 GHz, 71-76 GHz/81-86 GHz bands, as well as bands above 86 GHz.]”); Information Technology Industry Council Comments at 7 (stating that Commission should consider additional spectrum between 6 GHz and 24 GHz, and above — in particular, 24.25-27.5 GHz and 71-72.5 GHz); Telecommunications Industry Association Comments at 6 (contending that the Commission should continue pursuing the spectrum bands above 24 GHz that were identified as candidate bands in the NOI); Samsung Comments at 11; Comments of Nokia, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 11-14 (filed Jan. 27, 2016) (“Nokia Comments”); Comments of Huawei Technologies, Inc. and Huawei Technologies Co., Ltd, GN Docket No. 14-177, IB Docket No. 15-256,

of millimeter wave spectrum. The Commission should therefore at least issue a further notice of proposed rulemaking on the bands T-Mobile identified in its comments.

III. THE COMMISSION SHOULD DEVOTE A PORTION OF THE 64-71 GHZ BAND TO LICENSED USE AND MAXIMIZE THE USE OF THE 28 AND 37 GHZ BANDS

Some of the 64-71 GHz Band Should Be Licensed.

As T-Mobile stated in its comments, the Commission's proposed plan for the 64-71 GHz band would result in significantly more unlicensed than licensed millimeter wave spectrum, despite the fact that licensed spectrum is the base component of mobile networks, encourages greater investment, and spurs technical innovation.^{21/} Commenters agree with T-Mobile that the Commission should make at least some of the proposed unlicensed 64-71 GHz spectrum available for licensed operations.^{22/} Verizon, for instance, recognizes that the "amount of licensed spectrum in . . . upper frequencies is low, whereas there are substantial blocks (e.g., 56-64 GHz, 92-95 GHz) of upper-frequency spectrum already dedicated to unlicensed use. Assigning some of the 64-71 GHz to licensed uses may help achieve a better balance."^{23/} Further, Ericsson notes that "following a licensed approach for 66–71 GHz would provide a 5

RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 20-21 (filed Jan. 28, 2016); Comments of Microsoft Corporation, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 18 (filed Jan. 27, 2016); Comments of Wi-Fi Alliance, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 10 (filed Jan. 27, 2016); Comments of the Dynamic Spectrum Alliance, GN Docket No. 14-177, 1, 3 (filed Jan. 26, 2016).

^{21/} See T-Mobile Comments at 14.

^{22/} See T-Mobile Comments at 14-15; see also Nokia Comments at 17-18 (contending that the amounts of licensed and unlicensed use should be more balanced and that the Commission should allocate 64-66 GHz band for unlicensed use and 66-71 GHz band for licensed use); Mobile Future Comments at 17 (stating that the Commission should make the 64-66 GHz band available for unlicensed use and the 67-71 GHz band available for licensed use); CTIA Comments at 17 (stating that the Commission should make the 64-66 GHz band available for unlicensed use and the 67-71 GHz band available for licensed use).

^{23/} Verizon Comments at 13.

GHz contiguous band that could support multiple licensed carriers employing very large contiguous blocks of spectrum on the order of 500 MHz[.]” and moreover, “[e]mploying licensed usage in the 66–71 GHz band would position the U.S. for a leadership role in developing innovative applications and services that would benefit from a large allocation of licensed spectrum[.]”^{24/} Similarly, AT&T stresses that “expanding unlicensed uses in the entire [64-71 GHz] block of spectrum would be contrary to the important principle of promoting international harmonization” and that “[l]icensing [the 66-76 GHz] portion of this band would be consistent with global allocations, promoting economies of scale and globally accessible services.”^{25/}

The 37 GHz Band Should Be Licensed.

T-Mobile also asserted that the Commission should fully license the 37 GHz band and harmonize the rules for the 37 GHz band with those for the 39 GHz band.^{26/} Commenters agree with these suggestions.^{27/} AT&T explains that, as “5G networks and services will rely in part on large contiguous blocks of spectrum characterized by wide channel bandwidth . . . adopting the same licensing regime for both the 37 GHz and 39 GHz bands . . . will ensure that 5G systems

^{24/} Ericsson Comments at 19-20.

^{25/} AT&T Comments at 17.

^{26/} See T-Mobile Comments at 9, 12.

^{27/} See, e.g., 4G Americas Comments at 14 (“4G Americas proposes that the FCC combine the 37 and 39 GHz bands to make a single contiguous band of 3 GHz.”); Ericsson Comments at 8 (“The 37 and 39 GHz bands should be combined into a single 3-GHz-wide band, and not segregated into two bands with differing rules and eligibility restrictions.”); Nokia Comments at 16 (“Aggregating the adjacent 37 GHz and 39 GHz bands under a single consistent licensing framework would provide 3 GHz of contiguous spectrum that could be leveraged to provide 5G services using large blocks of spectrum.”); QUALCOMM Incorporated Comments at 8 (“[P]romulgating similar technical and service rules for the 37 GHz and 39 GHz bands would be a much more effective way to realize the deployment efficiencies in these new mobile bands.”).

have access to the contiguous spectrum they need to thrive.”^{28/} In addition, Verizon states that combining these bands would allow equipment manufacturers to “achieve economies of scale [by] producing equipment that operates on standardized channel across the entire band[,]” “would facilitate major efficiencies for operators[,]” and “would be ideal for future high bandwidth applications such as video distribution.”^{29/}

As noted above, at least one national wireless carrier has taken steps to secure the use of an extensive amount of millimeter wave spectrum, potentially limiting the amount of licensed spectrum available for others.^{30/} Verizon’s likely extensive holdings in the 28 GHz band is even more reason for the Commission to consider fully licensing the 37 GHz band through an auction instead of compromising licensed access to the band through the proposed hybrid scheme. Similarly, the Commission should make part of the 64-71 GHz band available for licensed use. Taking both of these steps will facilitate others’ access to millimeter wave spectrum. While the Commission has asked whether it should impose spectrum aggregation limits in the millimeter wave bands,^{31/} the better approach for now is to ensure a sufficient supply of licensed spectrum. However, the Commission should monitor future spectrum aggregation to ensure that there is a competitive marketplace for millimeter wave band spectrum and take action if necessary to ensure reasonable access to the spectrum.

^{28/} AT&T Comments at 16.

^{29/} Verizon Comments at 7.

^{30/} Press Release, Verizon, Verizon Continues Focus on Network Superiority with Agreement to Purchase XO Communications’ Fiber Business (Feb. 22, 2016), <http://www.verizon.com/about/news/verizon-continues-focus-network-superiority-agreement-purchase-xo-communications-fiber> (describing a transaction between Verizon and XO Communications pursuant to which Verizon will “lease available XO wireless spectrum, with an option to buy XO’s entity that holds its spectrum by year-end 2018”).

^{31/} See *NPRM* ¶¶ 190-191.

The Commission Should Issue Multiple 28 GHz Licenses.

With respect to the 28 GHz band, T-Mobile stated that the Commission should not adopt its proposal to make the 850 megahertz of spectrum available as a single block.^{32/} Block sizes must be proportional to the amount of spectrum available, take into consideration a band's location in the spectrum and promote in-band competition where possible.^{33/} CTIA and 4G Americas, for example, urge the Commission to license the 28 GHz band as three 200 megahertz blocks and one 250 megahertz block.^{34/} T-Mobile agrees with commenters urging the Commission to make multiple licenses available at auction in the 28 GHz band – although existing licensees should be permitted to maintain their entire spectrum holdings – as this would promote competition and innovation in the band.^{35/}

Untested Use and Licensing Schemes Should Not Be Adopted in the Millimeter Wave Bands.

The Commission should reject suggestions to impose untested licensing or spectrum access schemes in the millimeter wave bands. A few commenters – for example, Google, the Open Technology Institute at New America and Public Knowledge – suggest that millimeter wave spectrum, such as the spectrum in the 37 GHz band, should be available through an SAS or similar access mechanism.^{36/} T-Mobile strongly disagrees with this proposal. Unlike the rationale for use of an SAS in the 3.5 GHz band, there is no need to protect incumbent federal

^{32/} See T-Mobile Comments at 11.

^{33/} See T-Mobile Comments at 11.

^{34/} See CTIA Comments at 21; 4G Americas Comments at 15.

^{35/} See T-Mobile Comments at 11.

^{36/} See Comments of Google Inc., GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, 1-4 (filed Jan. 28, 2016); Comments of Open Technology Institute at New America and Public Knowledge, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, 11 (filed Jan. 28, 2016) (“Open Technology Institute and Public Knowledge Comments”).

radar operations in millimeter wave bands. Moreover, the type of protection that may be required in the millimeter bands – for fixed operations – can be achieved with a far less burdensome and complicated approach than SAS. The Commission itself proposes two alternative means to protect FSS stations.^{37/} The Commission should not import the SAS concept – required in one band – to another where it is not needed. Moreover, as T-Mobile highlighted in its comments, an SAS is an untested concept, and there are currently no SAS or similar database-driven operations.^{38/} No additional spectrum should be made available through such a mechanism until it has proven effective in the 3.5 GHz band.

Similarly, the Commission should not, as suggested by Public Knowledge and the Open Technology Institute at New America, make the 28, 37 and 39 GHz bands available for indoor-only use on an unlicensed basis or license-by-rule basis.^{39/} It also should not allow “opportunistic unlicensed operations” in these bands, as NCTA recommends,^{40/} or adopt a “use it or share it” approach.^{41/} Each of these approaches would limit flexibility, use cases, and technology development. Moreover, a “use it or share it approach” would inhibit spectrum planning, “inject[ing] unnecessary complexity into the already arduous task of deploying 5G networks.”^{42/}

^{37/} See *NPRM* ¶¶ 154-156.

^{38/} See T-Mobile Comments at 17.

^{39/} Open Technology Institute and Public Knowledge Comments at 9-10.

^{40/} NCTA Comments at 11-13.

^{41/} See Comments of Facebook, Inc., GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, 6-7 (filed Jan. 26, 2016) (arguing that the Commission should adopt a “use it or share it” requirement that would require licensees to make available any unused spectrum after five years).

^{42/} AT&T Comments at 21; see also XO Communications Comments at 29-31 (stating that a “use it or share it” policy would increase the risk of harmful interference and add significant time and expense to deployment efforts); QUALCOMM Comments at 14 (stating that a “use it or share it” approach “would introduce uncertainty at this critical stage and could deter the investments necessary to make millimeter wave mobile deployments successful”).

IV. LICENSING TERMS AND REQUIREMENTS

License Term.

T-Mobile's comments supported a ten year license term with flexible performance requirements as the most effective way to encourage investment and innovation.^{43/} In contrast, comments submitted by Open Technology Institute at New America and Public Knowledge, and by O3b Limited, support shorter license terms.^{44/} However, most commenters agree that the typical 10 year license term – or greater – is more appropriate.^{45/} For instance, Verizon states that “given the need for certainty and the costs of network densification[,]” license terms should be at least ten years and potentially longer.^{46/} AT&T also notes that, if “the [5G] standards process is delayed, longer initial license terms may be necessary to allow licensees sufficient time to develop the spectrum and realize a return on investment.”^{47/} And as recognized by Cisco Systems, “given that technology for the [Upper Microwave Flexible Use Service] bands is in its infancy, interest in the bands will only be spurred if the Commission assures that licensees will have adequate time for the technology to evolve, for standards-setting activities to take place, and for deployment to occur.”^{48/}

^{43/} T-Mobile Comments at 10 n.40, 18-19.

^{44/} See Open Technology Institute and Public Knowledge Comments at 23 (proposing 3 year term); O3b Limited Comments at 26-27 (proposing a 5 year term).

^{45/} See, e.g., AT&T Comments at 19-20; Verizon Comments at 10; CTIA Comments at 22; Mobile Future Comments at 13; XO Communications Comments at 22; Telecommunications Industry Association Comments at 25; Nokia Comments at 5, 19; Cisco Systems Comments at 10; Intel Corporation Comments at 23; QUALCOMM Incorporated Comments at 11; Comments of High Tech Spectrum Coalition, GN Docket No. 14-177, 4-5 (filed Jan. 28, 2016).

^{46/} AT&T Comments at 19-20.

^{47/} Verizon Comments at 10.

^{48/} Cisco Systems Comments at 10.

As T-Mobile as stated previously,^{49/} the massive success and growth of the wireless industry has been built on licensees' access to spectrum that they can incorporate into their networks on a long-term basis. A ten year license term coupled with a renewal expectancy has served well in the context of other wireless services, leading to robust markets, substantial investment, and the development of new technologies. In contrast, without the ability to use spectrum on a longer-term basis, including a renewal expectancy, licensees will lack certainty as to whether they will have access to the spectrum they use to serve their customers, which will deter investment and innovation in the band.

Size of Geographic Licenses.

T-Mobile stresses that the Commission must consider multiple competing factors in determining the appropriate geographic size for licenses.^{50/} For instance, although licensing millimeter spectrum on a county basis matches the Commission's expectation that it will be used for small-cell applications and predictions that it may at least initially be used to supplement capacity, as T-Mobile's comments make clear, T-Mobile agrees with Verizon that county-level licenses could prove administratively complex and burdensome.^{51/} It therefore does not object to licensing the spectrum over larger geographic areas, such as Partial Economic Areas, in order to reduce the transactional costs of obtaining and maintaining potentially thousands of licenses. However, if the Commission decides to issue licenses on a county basis, it should refrain from deciding the issue of package bidding at this time and instead consider the issue in a later proceeding designed to address auction issues for the affected spectrum.

^{49/} See, e.g., Response of T-Mobile USA, Inc., GN Dkt. No. 12-54, 3 (filed Oct. 19, 2015).

^{50/} See T-Mobile Comments at 9-10;

^{51/} See T-Mobile Comments at 9-10; Verizon Comments at 12.

Spectrum Swap at 39 GHz.

T-Mobile also supports Straight Path’s proposal that the Commission consider adopting a “pre-auction channel ‘swap’ period during which 39 GHz licensees could exchange 50 megahertz EA-based spectrum blocks within an EA for blocks where there is no incumbent EA licensee[.]” which “would allow licensees to consolidate current fragmented channels and secure authorizations for larger, contiguous spectrum blocks.”^{52/} Straight Path’s proposal is consistent with T-Mobile’s position that the existing 39 GHz channelization scheme is inappropriate for what is expected to be the dominant use of the 39 GHz band – time division duplex technology.^{53/} However, should the Commission adopt Straight Path’s proposal, it should ensure that participation in any spectrum “swap” is voluntary for incumbent licensees in order to preserve licensees’ technological expectations.

Performance Requirements.

Because it is not clear how technologies in the millimeter wave bands will develop, T-Mobile’s comments urged the Commission to consider eliminating construction-based performance requirements and developing alternative metrics for demonstrating use.^{54/} T-Mobile also proposed that the Commission consider imposing a “warehousing” fee by which licensees would be required to continue to pay for spectrum not in use.^{55/} Commenters agree that the Commission should adopt flexible performance requirements at a later date. As AT&T notes, the Commission should not adopt performance requirements at this time, as “5G’s groundbreaking services and technologies coupled with the unique characteristics of mmW band

^{52/} Straight Path Comments at 25.

^{53/} T-Mobile Comments at 19.

^{54/} T-Mobile Comments at 18-19.

^{55/} T-Mobile Comments at 18-19.

spectrum may require a totally new kind of performance requirement[.] . . . Indeed, the Commission may need to think creatively, beyond traditional metrics, to design performance requirements suitable for 5G deployments.”^{56/}

V. PROTECTION OF EESS AND RAS

T-Mobile recognizes the need to protect federal RAS and the EESS from harmful interference. However, the proposals of the National Radio Astronomy Observatory (“NRAO”) and the National Academy of Sciences through its Committee on Radio Frequencies (“CORF”) are overprotective and should not be adopted.

NRAO asks that the Commission prevent mobile service applications from transmitting in the direction of radio astronomy stations while within direct line of sight of them.^{57/} CORF asks that the Commission (1) consider a guard band greater than 100 megahertz in the 37.0-38.6 GHz band; (2) protect RAS sites in the 36.43-36.5 GHz band by excluding unlicensed devices operating in this band within 30 kilometers of them, and by exclusion or coordination of licensed fixed transmitters within 30 kilometers or line-of-sight to the RAS observatory; (3) account for aggregate interference from multiple transmitters in the 64-71 GHz band when setting exclusion

^{56/} AT&T Comments at 22. The Commission should specifically consider eliminating traditional geography or population based performance metrics. *See also* Mobile Future Comments at 15-16 (“If the Commission concludes that performance requirements are appropriate, however, any such requirements should provide licensees with maximum flexibility in demonstrating construction and use of spectrum. Given the nascent state of mmW technology, the wide variety of possible use cases, and the unique difficulties for licensees operating in these bands, the Commission should avoid adopting specific performance metrics that could force licensees to forego innovative technologies and uses in favor of services and networks designed simply meet those metrics.”); Ericsson Comments at 10-11 (“Given that there is considerable uncertainty at this time as to how the mmW bands will be employed and how and where facilities should best be deployed, the best course of action would be to refrain from imposing strict performance requirements and exercise restraint. Any performance metrics that are adopted need to be flexible to reflect the considerable diversity of 5G applications.”); 4G Americas Comments at 9-11.

^{57/} Comments of the National Radio Astronomy Observatory, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 3 (filed Jan. 22, 2016).

or coordination zones; (4) leave untouched the protections presently available to the primary allocations to RAS at 76.0-77.5 GHz and 78.0-94 GHz; and (5) enable wide guard bands to protect the primary allocation to EESS at 86-92 GHz.^{58/}

These proposals are overly conservative and will hinder growth and innovation in the millimeter wave bands. T-Mobile agrees with CTIA that “the Commission can best balance the needs of Federal and commercial users by adopting stringent, but small, coordination zones.”^{59/} However, “overly conservative coordination zones will inhibit the value of licensed spectrum rights and diminish the investment incentives and certainty associated with these rights.”^{60/} In any event, as CTIA notes, NTIA – whose Commerce Spectrum Management Advisory Committee has a sub-committee studying issues associated with bi-directional sharing – is likely to provide recommendations this year based upon feedback from Federal spectrum users.^{61/} Accordingly, the Commission should add a mobile allocation to the millimeter wave bands as proposed and defer action on the appropriate level of interference protection for EESS operations above 37 GHz and RAS operations, if any, until the sub-committee completes its work. This approach is similar to the action the Commission took when it permitted use of the 3.5 GHz band – by first making the spectrum available and later determining the appropriate protection level for incumbent operations.

^{58/} Comments of National Academy of Sciences Committee on Radio Frequencies, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, 16-19 (filed Jan. 22, 2016).

^{59/} CTIA Comments at 33.

^{60/} CTIA Comments at 33.

^{61/} CTIA Comments at 34.

VI. CONCLUSION

Based on the ever-expanding need for terrestrial mobile spectrum, it is essential that the Commission take action soon to allow full mobile use of the millimeter wave bands. In so doing, the Commission should take the steps T-Mobile proposed in its initial comments and has suggested above to encourage the greatest amount of investment and innovation in the bands.

Respectfully submitted,

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