

**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

COMMENTS OF 5G AMERICAS

5G Americas, the voice for 5G and LTE in the Americas, submits these comments in response to the Commission’s Further Notice of Proposed Rulemaking (“*Further Notice*”) in the above-referenced proceedings concerning service rules for flexible use of upper microwave spectrum. Currently chaired by AT&T Mobility, 5G Americas has a broad membership of leading wireless operators and vendors promoting and facilitating the seamless deployment and widespread adoption of LTE and 5G throughout the Americas.¹ 5G Americas encourages the Commission to repurpose all the remaining millimeter wave (“mmW”) bands under consideration in the above proceedings for flexible use, and supports allocating these bands solely for licensed use. Given that in July, the Commission repurposed the majority of the spectrum considered for unlicensed use, it is appropriate now to allocate the remaining bands solely for licensed use.

¹ 5G Americas Board of Governor members include AT&T, Cable & Wireless, Ericsson, HP, Intel Corporation, Kathrein, Nokia, Qualcomm, Sprint, T-Mobile USA, and Telefónica.

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1. INTRODUCTION

5G Americas has long promoted internationally harmonized spectrum for wireless service in order to promote the deployment in the Americas of wireless broadband services. 5G Americas works with regulators, technical standards bodies, and other global wireless organizations to promote truly seamless interoperability and convergence for the benefit of customers. Internationally harmonized spectrum enables economies of scale and scope that benefit consumers through more innovative and affordable services and applications. For this reason, 5G Americas has agreed to represent our Region of the Americas in the Global 5G MOU events scheduled biennially as the industry standardizes 5G over the next few years towards the target of 2020. In 2018, 5G Americas will host a Global 5G MOU Event in the Americas, and has participated in those to date in Asia and soon in Europe. 5G Americas' mission to promote the deployment of LTE and 5G throughout our Hemisphere is also manifest in the number of white papers it prepares and distributes to educate stakeholders in the evolution of the LTE family of technologies, into 5G, and developments impacting the deployment of LTE in the Americas.

5G Americas applauds the work the Commission has done to date to adopt flexible rules for upper microwave or millimeter wave ("mmW") spectrum, including in the bands that the World Radiocommunication Conference ("WRC-15") agreed to study over the current cycle. To promote internationally harmonized spectrum, 5G Americas supports the Commission's continued review of service rules for all the additional bands that the WRC-15 agreed to study. 5G Americas encourages the Commission to repurpose all of the mmW bands under review in this proceeding for flexible use. Various industry studies demonstrate that much more spectrum will be needed to realize the promise of 5G, which entails both faster mobile broadband, massive machine-type communications, and applications requiring very low-latency like connected cars

and remote surgery. 5G Americas and its member companies will participate in the studies that the International Telecommunication Union (“ITU”) working parties and task groups are undertaking on those study bands, as well as participate in 3GPP which has a study cycle aligned with the next WRC, in 2019 (WRC-19).

3GPP, with which 5G Americas is a Market Representation Partner, has committed to complete technical specifications for these ITU studies by year end 2019, to enable WRC-19 to make an informed decision on identifying IMT-2020 in the study bands. Adoption by the Commission of flexible rules for these additional study bands well before WRC-19 will best position the Americas to both lead in market deployment of 5G applications, and at WRC-19. Just as it did with the first bands for which it adopted Upper Microwave Flexible Use, in which it moved expeditiously to re-purpose certain bands for flexible use, while agreeing to return as necessary to adopt more specific technical rules as may be necessary, the Commission can do so with the additional WRC-19 study bands. It should move expeditiously to adopt flexible service rules for additional bands in the near term, before WRC-19, and consider more specific technical rules as may be necessary after the 3GPP translation process concludes in October 2020. Adoption by the Commission of flexible use rules for the additional proposed bands of mmW spectrum will serve as an effective U.S. position at CITEL, and then, as determined by CITEL, at the WRC.

5G Americas will focus on particular bands in these initial comments, but as stated above, supports the Commission repurposing each and every band currently being considered for flexible use in the captioned proceedings, and supports allocating each of the bands solely for licensed use.

II. THE 71-76 GHz AND 81-86 GHz BANDS

The 70/80 GHz bands should be considered for flexible licensed use, including mobile. They are currently used for fixed services (FS) and will likely play an important role in supporting backhaul for the evolution of LTE and 5G. Therefore, providers of any new services in the band will need to consider this current use and accommodate future expansion of fixed networks of fixed services. Fixed Services point-to-point microwave radio is a key component in today's mobile networks as well as in broadcaster, utility and public safety networks. It is essential that the current use of the band should be allowed to continue to expand. Today, point-to-point application is lightly-licensed on a first-come basis with a 10-year license period, with interference protection and renewal expectations. The attractiveness of the 70/80 GHz band (71-76 GHz paired with 81-86 GHz) is now rapidly increasing. It offers very wide bandwidth, enabling capacities in the order of 10 Gbps or more over distances of a few kilometers. It is expected that high-capacity-demand backhaul will transition from lower bands to the 70/80 GHz band, especially in support of 5G.² As more mmW spectrum bands are made available, the demand for this backhaul band will increase. Equipment is deployed today for high-capacity backhaul solutions, particularly where there is no fiber infrastructure available.

Because of the high frequency at 70/80 GHz and its losses and antenna characteristics, frequency reuse within 3 meters is deployed today for co-channel fixed facilities, making the band the ideal solution for high-capacity bandwidth links between utility poles, light standards and street level mounted nodes. Considering that today it has almost 12,000 registered links, the band cannot be said to be underutilized. Indeed, it is heavily used today for high-capacity

² See Ericsson Mobility Report, "The Need for Spectrum Harmonization," Ericsson (June 2016), <https://www.ericsson.com/mobility-report/the-need-for-spectrum-harmonization>.

solutions where lower frequencies cannot be coordinated and/or the form factor cannot be accommodated due to zoning and/or limited space requirements on buildings and towers.

We do not believe unlicensed use of the 70/80 GHz band is warranted, even under a three-tiered SAS where incumbents would be protected and new licenses have priority access. Considering that unlicensed use now has access to 14 GHz of spectrum in the expanded 60 GHz band, we do not see a compelling need to subject the 70/80 GHz band to this type of mixed use, especially in light of the passage of time since the designation of the ISM band in 57-64 GHz, and the relative sparsity of use of that unlicensed band.³ If unlicensed use of the 70/80 GHz band is considered, studies are need to ensure that unlicensed use of the band does not create a risk of interference to incumbent use, including outdoor backhaul use.

Regulations for the 70/80 GHz band should accommodate co-primary, flexible use, but should respect the fixed operations successfully deployed under current registration/licensing regime.⁴ 5G Americas disagrees with the Commission’s characterization of the band as lightly used.⁵ Moreover, the SAS is not needed in this band. The concept is new, unproven and complex. In contrast, the current coordination process for 70/80 GHz is mature, works well and there are no reports of interference for almost 12,000 paths registered.⁶ We support compatible

³ We concur with the FCC’s statement: “None of the proponents of unlicensed use in these bands has made a detailed showing that unlicensed devices would be compatible with the fixed equipment being deployed in these bands. Furthermore, we are proposing to make seven gigahertz of additional spectrum available for unlicensed use in the 64-71 GHz band.” *See Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, GN Docket No. 14-177, et al., Notice of Proposed Rulemaking, FCC 15-138, ¶ 87 (rel. Oct. 23, 2015) (“NPRM”).

⁴ The current fixed use of the band should in no way be compromised by being grandfathered. *See Use of Spectrum Bands Above 24 GHz for Mobile Radio Services*, GN Docket No. 14-177, et al., Report and Order and Further Notice of Proposed Rulemaking, FCC 16-89, ¶ 440 (rel. July 14, 2016) (“*Further Notice*”).

⁵ *Id.* at ¶ 432.

⁶ The FCC’s proposed SAS approach to the band seems somewhat incongruous considering the above points and existing and proposed uses of the band. For example, the *Further Notice* mentions an Environmental Sensing Capability (ESC) but doesn’t explain the concept in the context of sharing with Federal systems or why an ESC is even warranted.

mobile and fixed operations in the band, but suggest that more study is needed to determine coexistence of mobile with fixed services in these bands, including the development of novel mitigation techniques as well as a licensing process that accommodates flexible use and the respective differences of mobile area-based operation and point-to-point operation. In addition, sufficient study and analysis of fixed/mobile coexistence are needed to inform details of any coordination regime including respective protection zone sizes and interference considerations.

Smaller fixed antenna (38 dBi) should be allowed below a certain height above ground level (~8-15 meters) as an update of Part 101, and as has previously been proposed under waiver. Because of the structured stability limitations of telephone poles, light standards and monopoles, antenna relaxation to 38 dBi would permit wider beamwidths of ~ 2.4 degrees, opening up huge opportunities for deployment that will serve public venues with 5G backhaul services.⁷ Allowing fixed antennas of 38 dBi would be consistent with many other FCC bands, as well as regulations in other countries, e.g. recently in Canada. Existing regulations can be also improved with smaller 38 dBi fixed antennas.

⁷ Request for Waiver, Aviat Networks, Inc. (filed Apr. 5, 2013) (“Aviat Waiver Request”); Amendment to Request for Waiver, Aviat Networks, Inc. (filed Mar. 24, 2014) (“Aviat Amended Waiver Request”); CBF Networks, Inc., Request for Waiver (filed June 19, 2015) (“Fastback Request”). On November 10, 2014, Aviat and Radio Frequency Systems (RFS) asked that RFS be added as a party to the Aviat Waiver Request. *See* Letter from Mitchell Lazarus, Esq. and Cheng-yi Liu, Esq., Counsel for Aviat U.S., Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission (filed Nov. 10, 2014). Because Radio Frequency Systems asked to be added on to the Aviat Waiver Request, we address it collectively as the Aviat Waiver Request.

III. FEDERAL SHARING IN 37-37.6 GHz

A. *The Commission should clarify the operability requirement so that it does not delay introduction of services in non-shared bands.*

Regarding its requirement for operability in the 37-40 GHz band, the Commission states: “For the purposes of this [operability] requirement, for the 37 GHz and 39 GHz bands, a device operating in either band must be capable of operating across the entirety of both bands, from 37 GHz to 40 GHz (including the 37-37.6 MHz lower block).”⁸ Development of sharing requirements for the 37-37.6 band is likely to take significant time before final rules are issued. Due to the 37-40 GHz operability requirement, and the unknown impact of the eventual sharing requirements on use of the band, equipment development in non-shared portions of 37-40 GHz could be delayed. 5G Americas is of the view that the 37-40 GHz band-wide operability mandate must be independent of yet-to-be developed sharing requirements, to order to avoid equipment development delays in portions of the band not governed by sharing requirements.

In order to help clarify the requirement, 5G Americas proposes that the operability requirement should explicitly state that a device will meet the 37-40 GHz operability requirement if it is tunable across the 37-40 GHz range using at least one common air interface. This meets the spirit of the requirement for “operating across the entirety of [37-40 GHz],” but does not delay the deployment of equipment outside the shared bands. In this manner, sharing requirements will not delay additional deployment in the band.

⁸ *Further Notice* at ¶ 323.

B. A SAS is not necessary for sharing in the 37-37.6 GHz band.

Noting its adoption of rules for dynamic frequency coordination in the 3.5 GHz, the Commission seeks comment on the most appropriate coordination mechanism for the lower band segment, including possibly a Spectrum Access System (SAS).⁹ As noted above, 5G Americas believes that a SAS is a complex and unproven sharing mechanism and is not appropriate for the 37-37.6 GHz band. To date, there are no identified Federal systems in the 37-37.6 GHz band, whereas there are known radar in 3.5 GHz band. Federal and non-Federal entities are co-equal in this band, and the sharing framework can and should be much simpler than the SAS framework (which is devised for three non-equal sharing parties). 5G Americas suggests that agreed procedures for Federal and non-Federal users in cleared AWS spectrum is a more useful model, and has been proven in the marketplace.

C. The coordination framework should be as simple as possible.

To maximize deployment at 37-37.6 GHz, the Commission should begin with a simple frequency coordination framework with proven history and build from that. The opposite approach of beginning with SAS and deconstructing it to make it less complex and more applicable to 37-37.6 GHz is not appropriate since SAS is not a proven baseline framework to begin with. Industry should be allowed to develop a coordination framework in the band, based on applications stakeholders plan to deploy. 3GPP is developing a framework to determine how shared spectrum can be used. Future Federal systems should use sharing mechanisms that industry has developed. Alternatively, they can resort to earlier models of direct, manual coordination. Any features or functions added to the existing simple baseline framework should be necessary to serve all co-equal

⁹ *Id.* at ¶ 450.

sharing parties, and at reasonable implementation cost. Unnecessary or speculative functions should be rejected.

D. Co-equal federal and non-federal users should meet the same technical requirements.

The Commission asks if Federal and non-Federal users should comply with the same technical requirements.¹⁰ 5G Americas is of the view that given that Federal and non-Federal operations have co-equal rights, the technical rules governing federal operations should be the same as those governing non-federal operations. If they are not the same rules, a separate coexistence study effort covering all the combinations of different access technologies would be required, and this will unquestionably delay the introduction of service in the 37-37.6 GHz band since deployment would be challenged by additionally having to develop and finalize the higher-level sharing rules. With a simple and straightforward sharing framework as the goal, different and/or inconsistent technical operating parameters across Federal and non-Federal users should not be permitted. Consistent operating parameters should be a design mandate for the sharing framework.

E. Co-equal federal and non-federal users should use a common coordination framework.

The Commission seeks comment on how best to coordinate Federal access.¹¹ As noted above, Federal and non-Federal operators should use the same coordination mechanism. 5G Americas is of the view that standard frequency coordination practice should be used to accommodate any future Federal systems in the 37-37.6 GHz band. A common coordination framework, developed through industry consensus, would better

¹⁰ *Id.* at ¶ 452.

¹¹ *Id.* at ¶ 453.

resolve questions on authorization expiration and construction requirements than the Commission's proposal. Regarding the Commission's question on whether special enforcement mechanisms may be needed relative to Federal use in the 37-37.6 GHz band, 5G Americas notes that Federal and non-Federal systems share spectrum today without special enforcement measures. No additional measures are necessary for the band, beyond the Commission's existing enforcement mechanisms.

F. The channel size of the license should determine compatibility with adjacent bands.

The Commission asks whether it should adopt 100 MHz minimum channel increments in the 37-37.6 GHz band.¹² 5G Americas is of the view that given the 200 MHz license sizes in the adjacent bands (and the band-wide operability requirement) and the 600 MHz of available spectrum in the 37-37.6 GHz band, a 100 MHz license increment size with aggregation up to 600 MHz is a reasonable compromise between complexity and usability. The license size increment should not be variable or dynamically determined. However, the channelization deployed pursuant to the license (as opposed to the license size) should be left to individual licensees and not be specified in the rules (i.e. no restrictions), in order to permit maximum flexibility for users of this spectrum.

G. The Commission should not adopt its proposed seven day in-service requirement.

The Commission proposes that registered non-Federal sites must be put into service within seven days of coordination and that registered and coordinated sites must reassert their registration every seven days.¹³ 5G Americas believes whatever

¹² *Id.* at ¶¶ 454-455.

¹³ *Id.* at ¶ 456.

requirements are adopted for non-Federal users should also apply to Federal users since they are co-equal. However, seven days seems inappropriately short for putting sites into services since mobile sites may include the integration of multiple base stations. A mobile network intending to cover a relatively broad area could not be registered, constructed, tested, and made operational in seven days.

H. Under the co-equal access framework, federal users would not have priority access.

The Commission seeks comment on whether it should make a portion of the lower 37 GHz band segment available for priority access by Federal users.¹⁴ 5G Americas recognizes that Federal users may have important national security or critical defense purposes. However, co-equal status has a clear intuitive meaning. Ill-defined special considerations for certain Federal agencies could hold this band in limbo, undermining its market potential. If Federal users have such requirements for priority access, they should simply use another band. Beyond the NTIA “green light, yellow light” checkpoints that already exist in the 70/80 GHz coordination process (which is the recommended starting point), there should be no more Federal-specific requirements, protections, or prioritizations implemented. In particular, there can be no “on-demand priority access” in this band. That sort of requirement defies the plain meaning of “co-equal” rights, and it biases the outcome towards an SAS-like sharing framework.

However, if a Federal entity already has a link registration and a deployed network in a given geographic area, they can use their co-equal assignment whenever they choose.

¹⁴ *Id.* at ¶ 457.

I. *There is no downside to enabling secondary market rules.*

The Commission seeks comment on whether and how to apply secondary market rules to the lower 37 GHz band segment.¹⁵ Without yet knowing the details of the sharing scheme or the level of granularity in geographic assignments, it is conceivable that partitioning, disaggregation, and leasing could play a role in yielding market-based finer-granularity sharing, and therefore more intensive use of the spectrum. Such transactions could take place independently from spectrum coordination, and as such would not add complexity to the sharing scheme. Thus the Commission should permit partitioning, disaggregation, and leasing under this nascent Federal/non-Federal sharing scheme, as a means to potentially encourage further utilization via market-based mechanisms. There is no downside to permitting such transactions, even if it turns out that they are not used.

IV. “USE IT OR SHARE IT” IN 37.6-38.6 GHz

The Commission’s proposed Use or Share (UoS) mandate is predominately focused on the 37.6-38.6 GHz exclusively licensed band, also referred to as the Upper Band Segment (UBS). However, the discussion in the *Further Notice of Proposed Rulemaking* was split across two sections, and in the Section on Sharing Mechanisms, the Commission seeks comment on whether a UoS mandate could be appropriate “in geographically licensed bands such as 28 GHz and 39 GHz.”¹⁶ Aside from the 37-37.6 GHz Lower Band Segment (LBS), where the Commission has already ruled there will be a license-by-rule sharing framework, there should be no mandated sharing in any form or by any name, in any of the exclusively licensed bands. We elaborate on our reasons below.

¹⁵ *Id.* at ¶ 459.

¹⁶ *Id.* at ¶ 474.

Future Federal co-primary sharing in the 37.6-38.6 GHz UBS can be implemented through established processes for exclusion zones and negotiations with licensees. Therefore, a UoS framework is neither necessary nor advisable to enable Federal sharing in the UBS.

A. mmW 5G is a nascent market for which the Commission has recognized U.S. leadership as a national priority, and a Use-or-Share (UoS) mandate would impede that objective.

The mmW bands are a nascent spectrum market, and a new ecosystem of suppliers, providers, and use-cases must be developed. Additionally, technology research and development is proceeding with new propagation modeling and new equipment using new waveforms and antenna technologies. In short, this is not the time nor place to be adding the unnecessary complexity and uncertainty of a regulatory mandate like UoS. The Commission has recognized the importance of these bands for U.S. leadership and has proceeded throughout its mmW rulemaking at a decidedly expeditious pace. A UoS mandate is absolutely not essential to mmW 5G development, and it unnecessarily puts at risk the aforementioned leadership objectives. In other words, the Commission risks “snatching defeat from the jaws of victory.” Technology and market development for the mmW bands is best undertaken without non-essential distractions and distortions like UoS. As the Commission is aware, the historic evidence shows that regulatory mandates, where a regulator substitutes its judgment for the marketplace, are not advisable. The distortive impact of regulatory mandates are even more pronounced when they are applied to a nascent market like mmW 5G. UoS should not be pursued any further.

B. UoS received substantial opposition from the Notice of Proposed Rulemaking commenters as fundamentally unsound regardless of its implementation approach.

A UoS mandate was roundly rejected by a majority of commenters in the *Notice of Proposed Rulemaking* (“Notice”), and 5G Americas shares in that sentiment. In spite of this rejection, in the Notice, the Commission dismisses those comments without elaboration and observes, “These commenters provide very little concrete detail in their discussion of the [UoS] proposal, and generally do not address our specific questions relating to how we might implement this kind of sharing regime.”¹⁷ However, there was no perceived value in commenting on UoS implementation details when the basic proposition failed to provide clear and thorough fundamental requirements, which are further elaborated below. When considering the totality of the issues, UoS is ill-advised, regardless of the implementation approach it might follow, and it fails the Commission’s stated requirement of “[not] impacting geographically licensed uses.”¹⁸

C. UoS advocates do not make a credible case for its demand, and broad ecosystem support does not exist. Those conditions cannot lead to the posited successful outcome.

The Commission gives undue deference to the opinions of a small but predictable group of commenters who reliably advocate for mandated sharing in various forms, in every new band of spectrum. Those commenters have nothing at risk in supporting UoS, or in overselling its value or viability. They rely on vague, undocumented claims of theoretical increases in spectrum efficiency and innovation as their arguments to impose

¹⁷ *Id.* at ¶ 472.

¹⁸ *Id.* at ¶ 460.

UoS. They provide no demonstration of demand or robust ecosystem support (in fact, the majority view in the Notice comment record indicates lack of support).

This deficiency in broad ecosystem endorsement and lack of any substance beyond superficial observations is an important point because UoS advocates' arguments are being used to justify a regulatory mandate. The bar for any such mandate should be very high, and its imposition should not be taken lightly, nor based on incomplete arguments. The Commission, through its proposed UoS mandate, is putting in place the worst possible market structure, with lop-sided benefits and burdens. It is a structure that provides benefits without burdens to one side of the market ecosystem (the (unlicensed) sharing parties), and burdens with no benefits or incentives to the other side of the market ecosystem (the (exclusive licensee) parties with the mandate to share).

The Commission should feel compelled to consider the viability and full impact of the UoS mandate it is considering, and not stop its assessment after simply noting that it may enable theoretical possibilities for certain parties. The Notice comment record on UoS shows gaping holes of non-support from many of the ecosystem companies that would be necessary participants in the unlicensed sharing side of the equation. When the Commission considers the full impact, there is no other reasonable conclusion but to abandon UoS.

In the *Further Notice*, the Commission “especially seeks comment from any entity interested in using spectrum on an opportunistic basis.”¹⁹ While a demonstration of potential user interest is important, it is an incomplete and inconclusive factor; it is only a small fraction of a complete ecosystem. In seeking justifications for UoS, the

¹⁹ *Id.* at ¶ 482.

Commission should also be mindful to reject the predictable but misguided and overused justification citing the success of Wi-Fi, and the unsupportable stretch claims that the same result should be automatically extrapolated to this or other bands. The use of television spectrum “white spaces” (“TVWS”) is a relevant comparison, and many of the same parties advocating for UoS also promoted TVWS using the success of Wi-Fi as a main argument, which led to claims that TVWS would yield an even better outcome, with “innovations beyond our current imagination.”²⁰ TVWS has in fact languished as at best a niche market and this is due in no small part to the lack of a broad and deep ecosystem. The significance of a broad ecosystem endorsement—as opposed to support from a few narrowly-focused advocates—cannot be overstated. On this important point, UoS fails again.

D. Theoretical observations about sharing efficiency and innovations that might materialize through UoS are a far cry from proof that robust demand, sustainable business models, and broad ecosystem support will develop.

UoS advocates simply make theoretical observations that mandated sharing *might* produce certain vaguely-stated efficiencies or innovations. This is a far cry from the substantive proof that should be the threshold for a regulatory mandate for UoS, particularly for a *National Priority*. Theoretical arguments should not be permitted to be used to justify a mandate of UoS. Further, the existence of unused spectrum on a geographically-localized basis does not mean an unlicensed-use market will develop there. There are likely business cases and/or technology-viability reasons to explain why

²⁰ See White Paper, “Enhancing the Public Good Through Wireless Innovation: The Benefits of Globally Harmonized ‘White Spaces’ Rules,” Microsoft (Feb. 2016), <https://www.microsoft.com/en-us/research/wp-content/uploads/2016/02/spectrum-benefits-of-globally-harmonized-white-spaces-rules.pdf>.

a localized geographic region was not deployed by licensees. The unlicensed sharing parties in a hypothetical UoS sharing framework will face the same viability issues, and quite possibly the same outcome. Additionally, the unlicensed UoS users have no guarantee of continued future use of the shared spectrum; the licensee can reclaim it at any time. Callable unlicensed spectrum makes for difficult operational planning for those shared users, especially when there is an abundance of unlicensed mmW spectrum without such limitations.

In general, if sharing were to be mandated in other bands, the shared users should face a comparable build-out requirement as licensed users. Shared users should not have immunity from anti-warehousing build-out requirements. There may well be other shared users seeking access to use the spectrum in a given location.

E. UoS is a repackaged form of unlicensed as an overlay, but there is no shortage of unlicensed spectrum in mmW bands to justify such a mandate.

The UoS concept applied to exclusively licensed bands is simply unlicensed access as an overlay. Unlicensed users (including license-by-rule users who are effectively unlicensed users but with rights incrementally superior to Part 15 users) would be the only beneficiaries of such sharing. If there were demonstrated shortages or disproportionately low allocations of unlicensed spectrum access opportunities in the mmW bands, there would be cause to support increasing such opportunities. Far from a shortage or low allocation, the Commission just added 7 GHz of unlicensed Part 15 bandwidth directly adjacent to the existing 7 GHz mmW allocation, resulting in an unprecedented contiguous 14 GHz allocation for unlicensed use in the 57-71 GHz band, with the possibility of even more unlicensed allocations in the second wave of nearly 18

GHz of mmW spectrum proposed in the Further Notice. No legitimate argument can be made that any amount of spectrum made available under UoS is necessary to fulfill any unmet demand (or even a legitimate prediction of a shortage) of unlicensed mmW spectrum.

F. The 37.6-38.6 GHz upper band segment (UBS) is the only exclusive licensed mmW band without incumbent licensees in major markets, and the Commission should enable the proven exclusive licensing model without distortions from UoS.

Now that the first exclusively licensed mmW bands and band plans have been defined in the Commission's rules, the market opportunities can be better assessed. The 28 and 39 GHz bands are already licensed in most major markets, while the 37.6-38.6 GHz band represents the only greenfield mmW band available for new entrants to reach major markets under exclusive licensing. Exclusive licenses offered under competitive bidding remain a proven successful means of assigning spectrum resources to the parties that value it the most. Mandating a UoS obligation as part of the license requirements in this essentially vacant UBS risks distorting the market outcome and does not in any way contribute to the success of the licensees. The Commission should reiterate its support for the well-established value of unencumbered exclusive licenses in the mmW market and reject a UoS mandate.

G. The shared 37-37.6 GHz LBS band is fully a substitute for, and is better suited for, the types of access UoS advocates seek to enable in the UBS.

The Commission has designated the 37-37.6 GHz lower band segment (LBS) as a development band for dedicated shared, license-by-rule use, under site licensing. This

already-designated shared band would serve the same speculative use cases as the hypothetical UoS users in 37.6-38.6 GHz (UBS), and that shared LBS band has been properly isolated from impacting U.S. leadership in mmW 5G development as a dedicated band. This is yet another reason why the UoS proposal in the UBS should be rejected irrespective of the specific implementation of UoS.

H. The secondary market rules in the UBS already implement voluntary sharing; mandated sharing via UoS would undercut secondary markets.

The *Report and Order* adopted secondary market rules (leasing, partitioning, and disaggregation) for the 37.6-38.6 GHz band. This voluntary form of sharing should be the limit of sharing at this time. UoS—regardless of the specific implementation—would distort the proper functioning of secondary markets since it is a mandate-imposed simultaneously with a voluntary process to achieve a similar end. The secondary market rules permit voluntary sharing of unused geographic areas and/or spectrum sub-channels of a licensee’s spectrum, and no further rules are necessary to promote efficient use. Voluntary sharing via secondary markets also does not require development of a complex and unnecessary sharing management framework such as a customized SAS for this band. The licensee would manage and voluntarily share spectrum geographically and over frequency channels, and would be responsible for managing interference; a spectrum sharing framework is just a complex and unnecessary middleman.

Further, voluntary sharing by individual licensees saves resources from being diverted to the development of complex determinations of usage and enforcement thereof. Defining and measuring unused spectrum for UoS purposes is a particularly complex and counterproductive development effort and would create an enforcement

burden for the Commission. It would serve as a second layer of build-out requirement atop an already challenging (and not yet completely defined) first layer. Voluntary sharing by licensees requires none of those burdens, and gives better certainty to the secondary users since the terms-of-use cover well-defined durations, in contrast to UoS users.

The Commission should consider streamlining these voluntary secondary market sharing mechanisms, perhaps using certain aspects of its band manager authority, which allows partitioning and disaggregation on a self-managed basis in a manner that is potentially more streamlined than secondary market rules. The Commission could permit secondary market participants to simply notify their transactions to the Commission, with the Commission reserving the right to reject a transaction if in the public interest. Under no circumstances should mandated UoS be implemented in exclusively licensed bands prior to the expiration of the 10-year license term and a demonstrated failure to meet the associated performance requirements.

- I. The licensed ecosystem supporting these new mmW bands incurs costs, delays, and overhead from UoS that outweigh the redundant and speculative benefits.*

UoS only benefits unlicensed use, and even that benefit is speculative and redundant. UoS not only produces no tangible benefits for the exclusive licensees, it imparts a variety of encumbrances that negatively impact the licensees, investment, and supporting ecosystem. Any implementation of mandated UoS will have numerous costs, delays, and associated overhead costs. Some of these factors will have impact prior to the initial deployment of the spectrum, and others will impact the operations on an ongoing basis. For example: there would be a longer time-to-market for mmW network equipment

and devices as exclusive licensees and product vendors must wait for completion of the band-specific rules and specifications defining UoS sharing (i.e. the functions necessary for implementing UoS affect equipment and service design, costs, and deployment timelines). Moreover, there would be ongoing costs and resources required for tracking and reporting usage and availability, as well as for operating/interfacing with the sharing framework; and there would be ongoing costs and resources required to detect and resolve any interference issues with sharing parties, to detect and disable errant UoS devices, and implement rules and timelines for rescinding UoS assignments.

None of these costs or delays would be incurred in the absence of the mandated UoS sharing—regardless of how UoS might be implemented. They are all linked to the presence of a mandated sharing framework and all its associated requirements.

Combining these negative impacts of UoS with the lack of demonstrated demand, and the existence of multiple alternative unlicensed mmW bands, and the impact to U.S. 5G leadership objectives, and the opposition from a majority of the ecosystem, and the secondary market voluntary sharing alternative, it is apparent that UoS is a deeply flawed proposal, which should receive no further consideration.

V. RESTRICTIONS ON ANTENNAS

The Commission seeks further comment on whether limits on antenna height are appropriate.²¹ 5G Americas suggests the Commission allow licensees to coordinate antenna parameters to facilitate co-existence of mobile and fixed applications. Parts 24 and 27 govern licensed service area sizes of both BTA and EA, which are significantly larger than PEAs. Service Area size has a relationship to antenna height for license area border protection against interference. However, the Commission should recognize the architecture that is being deployed

²¹ See *Further Notice* at ¶ 506.

as either fixed point to point or mobility. While on one hand, 5G mobile network equipment and devices are more likely to be at street lamp post heights and street level, operators may also use parts of the band to facilitate backhaul which requires line of sight typically well above street level facilities. It is likely that both architectures will emerge and that an appropriate power level at a border would suffice in protecting the adjacent surrounding service areas.

There is also another factor material to antenna parameters: Since the proposed bands will be divided into blocks, adjacent blocks can be used to accommodate both mobility and/or backhaul within the same service area. With that in mind there are two solutions to this challenge:

1) Adjacent operators within the same service area should coordinate their respective facilities – this can mitigate both out-of-band emission or overload between disparate deployments and permit responsible licensees the freedom to use the architecture that meets their needs, e.g. ULS (Universal Licensing Services) database registration, or similar simple means for operator coordination.

2) Antenna beam tilt or lower heights should not be mandated, but instead be a tool used by operators to meet the power level at a given border and also protect the adjacent block operator. The Commission should permit licensees to work together coordinating height of facilities, beam tilt and angular discrimination as needed to protect each other in the same market, and meet the power levels at a given border to protect adjacent service areas.

VI. SHARING ANALYSIS AND MODELING INCLUDING SUITABLE PATH LOSS MODELS

In the *Further Notice*, the Commission reiterates its request for comment on issues pertaining to spectrum sharing analysis and modeling, including on antennae characteristics.²²

The antenna transmission schemes envisioned for 5G are substantially more advanced than those

²² *Id.* at ¶ 511.

used in current networks. Particularly at higher frequencies, in the mmWave range, the link-budget deteriorates due to the fact that the aperture of a specific type of antenna is proportional to the wavelength. It is possible to compensate for the decreasing aperture at higher frequencies by means of high gain beamforming techniques utilizing the available physical area of the antenna. It is likely that access points (base stations) will be elevated and typically tilt the antenna beams downwards. When the base station tilts the antenna downwards the interference signal radiated in the horizontal plane is substantially suppressed due to lower antenna gain in this direction. The higher the antenna gain the higher this suppression becomes, due to that the antenna lobe becomes more narrow. For this reason, in a sharing scenario, both the aggregate interference power and a single-beam hit-probability, relative to any far-away victim station on Earth, in air or in space, is predicted to decrease proportionally to the beamforming gain. Even with devices, high gain beamforming will probably be utilized to some extent, although it will be more material for base stations. When beamforming is utilized at both ends of the link, reduction of transmit power with increased radio frequency is possible. Though the notion appears intuitively contradictory, reduced power increasing the frequency is an effect that is commonly utilized in microwave links. The extent to which interference, in co-existence scenarios, will decrease due to beamforming, depends crucially on the spatial propagation characteristics.

In response to the Commission's request for comment, an appropriate propagation models to be used for sharing and coexistence studies, as the Commission is aware, the main relevant body for standardized modeling is ITU-R Study Group 3 (SG3). SG3 is responsible for all propagation modelling within ITU-R, and, in particular, has addressed long-range sharing use cases which are typically not addressed elsewhere. For the short-range scenarios more apt for mmW spectrum, however, other groups within ITU-R such as Working Party 5D and external

organizations such as 3GPP have already contributed, or are in the process of contributing, relevant 5G propagation modelling. Though the available short-range models developed by WP 5D largely account for mmWave frequencies up to 100 GHz, the mmWave range is largely missing in the long-range recommendations provided by SG3. The long-range propagation models provided by SG3 address the relevant scenarios:

1. *Interference between Earth stations.*
2. *Interference between Earth stations and airborne stations.*
3. *Interference between Earth stations and space stations.*

In all these scenarios, clutter loss is a vital component of the modelling. The clutter loss accounts for additional loss due to one end, or both ends, of a radio-link being embedded in local clutter. This clutter may be buildings, vegetation and other obstructing elements of the local environment. Here, the additional loss due to indoor location of either end, or both ends, of the link is treated separately and is referred to as building entry loss (BEL). Both clutter loss and building entry loss are substantial in cellular communications. Corresponding available modelling is however insufficient, particularly in the mmWave frequency range. For this purpose, SG3 is developing dedicated models to account for clutter loss and BEL to be ready in March 2017.

Regarding clutter loss, the experimental evidence is poor for the long-range scenario in the mmWave frequency range. It is however expected that sufficient measurement data will be available prior to the provisioning of final models in March 2017. The current clutter loss modeling of e.g. ITU-R Recommendation P.452 is conservative (pessimistic) for co-existence scenarios. It is bounded to maximum 20 dB clutter loss and reduces the shadowing zone below

rooftop dramatically as compared with diffraction models. It is likely that, by providing sufficient experimental evidence, substantially higher clutter loss may be modeled.

The Commission requested comment on an appropriate sharing analysis framework and technical information on transmitter, receiver, and antenna characteristics. Regarding co-existence/interference studies between the mobile service and other active as well as passive services such as fixed satellite systems (FSS) or earth-exploration satellite systems (EESS), the ITU-R has appointed a task group (TG5/1) to carry out such studies under Agenda Item 1.13 of the World Radiocommunication Conference 2019 (WRC-19). 5G Americas appreciates the Commission's participating in the work that is done in the TG5/1 while it evaluates solutions and models.

The ongoing efforts on 5G propagation modeling in 3GPP, 5GPPP (mmMAGIC), NIST etc. are very much focused on intra-system/standard characteristics. As a consequence, proper models are provided for short range only (ranges up to about 500 meters). Propagation scenarios for co-existence and sharing are typically substantially longer range. So far, little effort has been put into the long-range propagation modelling in the mmWave frequency range within the wireless communications community. For the long-range scenario, the heights of antennas, as well as the directional properties of the channel, are of crucial importance. As indicated above, there are currently substantial ongoing efforts in ITU-R SG3 to provide proper modeling for long-range terrestrial inter system interference in the mmWave frequency range. This modeling accounts for both the local clutter loss, which depends on the antenna heights above ground, and the building entry loss. Effects due to beamforming and antenna directivity depend largely on the propagation scenario. For terrestrial interference scenarios with antenna locations above the local clutter it is expected that the propagation occurs essentially in the horizontal plane. Some extent

of spread may occur due to e.g. tropospheric scattering or rain scattering. The spread in azimuth is expected to be small but may be larger as any scattering objects are located in the horizontal plane. When it comes to antennas which are embedded in the local clutter the available short range models are proposed to be used for the directional properties of the channel. In general, measurement data supporting modelling of the angle characteristics for long range interference scenarios are poor, particularly in the mmWave frequency range. It is however likely that measurement data, acquired by use of omni antennas, provide a good approximation of the signal propagation, in the case where multiple directional 5G transmitters are involved. It should be noted, however, that when elevated down-tilted directive transmit antennas are used this approximation is not valid. Propagation measurement data corresponding to such scenarios, need to account for directional characteristics in at least the elevation angle. Both aggregate and/or single link interference should be considered. In some scenarios, a single interferer might dominate. It is however important to account for the probability of interference caused by a beam being steered in the same direction as the victim Earth station.

As mentioned above, current models and alternative models lack experimental validation, particularly in the mmWave frequency range. For this reason, it is recommended, in response to the Commission's request for comment on appropriate terrain-based propagation models,²³ to revise the ITU models with clutter loss models covering the mmWave ranges. It is recommended that these models should be improved based on simulation results and experimental measurements where high gain beam-forming antennas are used both in the base station and user device.

²³ See, e.g., *id.* at ¶ 513.

VII. CONCLUSION

The Commission should repurpose all of the bands under consideration in the above-captioned proceedings for flexible use, and should do so on a solely licensed basis. UMFUS licensees can coordinate with co-equal Federal users based on successful procedures deployed in AWS spectrum. A SAS approach is not appropriate for the mmW bands under consideration in the proceedings. The Commission should also reject Use or Share (UoS) in the Upper Band Segment (UBS) of 37.6-38.6 GHz. While such a distracting scheme may have little harmful effect in the Lower Band Segment of 37-37.6 GHz, application of UoS in the UBS would threaten U.S. leadership in 5G, contrary to the Chairman's goals for this National Priority. The Commission's early adoption of secondary market rules provides sufficient incentives for efficient use of spectrum. A UoS mandate for UBS would actually undermine effective operation of secondary markets.

Respectfully submitted,



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