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 Operations	)	IB Docket No. 97-95

COMMENTS OF
THE TELECOMMUNICATIONS INDUSTRY ASSOCIATION

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EXECUTIVE SUMMARY

The record developed in response to the *Notice of Inquiry* ("*NOI*") establishes the expanding demand for additional spectrum that can not only serve traditional mobile broadband applications, but also meet a variety of other demands. Although spectrum above 24 GHz will not be the sole solution to the almost insatiable demand for spectrum-based broadband services, the potential availability of large contiguous swaths of spectrum above 24 GHz makes the millimeter wave ("mmW") bands ideal for meeting those needs that can be addressed within the limits imposed by propagation characteristics and the state of technology.

Whether considering access models, licensed service area sizes, channelization plans, technical rules, performance requirements, or any of the other elements that constitute a robust set of service rules, the Commission must ensure that there remains flexibility for market forces to drive the technological evolution, that regulation not chill innovation, and that ample time is afforded for the marketplace to evolve without regulatory interference. Adoption of service rules in 2016 for the bands addressed in the *NPRM* will provide equipment manufacturers and service providers regulatory certainty that, if done correctly, will spur investment and innovation. But in moving forward at this early stage, the Commission must avoid adopting service rules that directly or indirectly encourage specific marketplace outcomes.

The service rules for the 28 GHz, 37 GHz, and 39 GHz bands should provide for flexible terrestrial use. The Commission's proposed marketplace approach should enable efficient investment in and deployment of fifth generation ("5G") terrestrial wireless services, while preserving opportunities for next-generation high-capacity broadband satellite services. Fixed Satellite Service ("FSS") licensees should be permitted to continue existing operations and to add FSS user stations in the 37 GHz and 39 GHz bands on a secondary basis. They should, at their sole election, be permitted to operate solely on a secondary basis, or enter into private agreements with terrestrial licensees that provide greater flexibility, or secure terrestrial operating rights that allow them to operate without interference to or from other terrestrial users. Other, more regulatory approaches to co-existence would be unnecessarily burdensome and deter investment.

The UMFUS bands should be licensed on an exclusive basis. Exclusive UMFUS licenses will provide the regulatory certainty necessary to spur investment and innovation, bringing about the most effective and efficient use of the 28, 37, and 39 GHz bands. The Commission should abandon its proposed hybrid licensing scheme for the 37 GHz band and instead auction that spectrum on an exclusive basis. That approach will overly-complicate operations in the band and deter investment. Those premises occupants who desire to deploy their own private network facilities should be free to enter into appropriate arrangements with the terrestrial license holder.

Rather than license the UMFUS bands on a county-by-county basis, the Commission should retain the BTA and EA licensing approaches currently in place for the 28 GHz and 39 GHz bands, and extend the EA approach to the 37 GHz band that is adjacent to the 39 GHz band. These units are small enough that regional providers can access the market, yet large enough that service providers can achieve sufficient economies of scale. Ultimately, county-by-county licensing would hinder investment in the UMFUS bands and chill innovation.

The Commission should adopt licensing rules that reflect the uncertainties inherent in the mmW bands. A ten-year license term, coupled with an expectation of renewal upon satisfaction of reasonable performance requirements, strikes an appropriate balance between granting the marketplace time to develop, and avoiding spectrum warehousing. Performance requirements must give licensees time to deploy technologies and equipment – the Commission should not measure performance of UMFUS licensees until the expiration of their initial license. Moreover, performance benchmarks need to be carefully tailored to reflect that the UMFUS bands will likely be extensively used for machine-to-machine and Internet of Things applications, where the nexus between where people reside and where links operate may not be significant.

The mmW technical rules should be designed to provide licensees with maximum flexibility. The Commission should adopt its proposal to continue licensing the 28 GHz band as a single 850 MHz wide block; the 37 GHz and 39 GHz bands should be licensed in fifteen unpaired blocks of 200 MHz of contiguous spectrum each. The Commission should place no limits on spectrum aggregation in the mmW bands. While Division Duplex ("TDD") appears to be the current frontrunner among possible duplexing mechanisms for the mmW bands, there are technologies and use cases that call for the use of FDD or other duplex schemes (such as "Any Division Duplexing" or downlink only, as a supplement to other spectrum). The Commission should continue its current policy in the 28 GHz and 39 GHz bands of not requiring or prohibiting any duplex scheme, and should extend that policy to the 37 GHz band.

The proposed power limits for the UMFUS bands should be modified. The maximum permissible EIRP for fixed and base stations should be increased to 82 dBm/100 MHz, with an EIRP of 85dBm/100 MHz permitted in rural areas. In addition, the Commission should create a new power category for customer premises equipment that is transportable, but not intended for use while in motion. That power limit should exceed the +43 dBm maximum EIRP permitted for mobile stations. In addition, the EIRP power levels in proposed Section 30.202 must be adjusted to accommodate over-the-air measurement techniques for smart arrays. Standard EIRP is not a proper metric for capturing the unwanted emission in advanced antenna arrays with multiple simultaneous users and beams.

Proposed Section 30.203, which establishes limits on unwanted emissions, must be modified to eliminate the unintended prejudice against wider channels, to reflect Total Radiated Power as the appropriate metric for measuring compliance.

While the Commission's ongoing proceeding examining RF exposure rules and policies is a long-term vehicle for necessary reforms, mmW bands present challenges that can be addressed in the interim for the UMFUS bands. The Commission should consider adopting IEEE C95.1-2005, as updated by IEEE C95.1a-2010, as the applicable RF exposure standard for UMFUS as it applies to this procedure outside of the RF Exposure NOI. If the Commission does not address PD limits here, it should issue guidance through the Knowledge Database system to provide manufacturers greater clarity on what measurement and assessment methods will be used.

This proceeding is not the appropriate place for adopting rules addressing network security issues. Marketplace forces and existing private sector and government efforts will lead service providers and device manufacturers to build into their offerings the security features that

consumers demand. To the extent that the Commission finds in the future that the marketplace is failing to provide sufficient security, and that security issues require regulatory intervention, the Commission instead should issue a notice of inquiry of general applicability that examines the issues not from a mmW perspective, but from the perspective of networks that may include mmW bands along with other wired and wireless transport vehicles.

The Commission has shown extraordinary leadership in making the mmW bands available in response to emerging use cases and technological innovations. In considering the issues raised by the *NPRM*, the Commission should err on the side of providing manufacturers and licensees both the flexibility for the market to evolve free from regulatory intervention and the time needed for the marketplace to mature.

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COMMENTS OF
THE TELECOMMUNICATIONS INDUSTRY ASSOCIATION

The Telecommunications Industry Association ("TIA")[1] hereby submits its initial comments in response to the Commission's *Notice of Proposed Rulemaking* ("*NPRM*") in this proceeding.[2]

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[1] Since 1924, TIA has enhanced the business environment for broadband, mobile wireless, information technology, networks, cable, satellite, and unified communications through standards development, advocacy, tradeshows, business opportunities, market intelligence, and

The record developed in response to the *Notice of Inquiry* ("*NOI*") establishes beyond question the expanding demand for additional spectrum that can not only serve traditional mobile broadband applications, but also meet a variety of other demands, such as backhaul and fixed point-to-point or point-to-multipoint applications in connection with the Internet of Things and machine-to-machine communications. Although (as discussed below), spectrum above 24 GHz will not be the sole solution to the almost-insatiable demand for spectrum-based broadband services in the United States, the potential availability of large contiguous swaths of spectrum above 24 GHz makes the millimeter wave ("mmW") bands ideal for meeting those needs that can be addressed within the limits imposed by propagation characteristics and the state of technology.

The *NPRM* has it right – the Commission's goal in this proceeding should be "to develop flexible rules that will accommodate a wide variety of current and future technologies" while "encourag[ing] innovation in the development of advanced wireless services using the mmW bands."[3] Moreover, as the Commission acknowledges, the use of mmW bands by mobile service providers "should be compatible with existing incumbent license assignments and uses," and "[c]urrent licensees that choose to continue their existing, authorized services should be able to

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worldwide environmental regulatory analysis. Its hundreds of member companies manufacture or supply the products and services used to provide broadband and broadband-enabled applications, and can be expected to be active participants in the evolving marketplace for telecommunications services using spectrum above 24 GHz. In furtherance of its members interest in the future uses of the spectrum above 24 GHz, TIA commented in response to the *Notice of Inquiry (*"NOI") that commenced this proceeding. *See* Comments of Telecommunications Industry Ass'n, GN Docket No. 14-177 (filed Jan. 15, 2015) ["TIA *NOI* Comments"].

[2] Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, *Notice of Proposed Rulemaking*, 30 FCC Rcd 11878 (2015) ["*NPRM*"].

[3] *Id.* at 11881 ¶ 3.

do so."[4] The comments submitted in response to the *NOI* suggest myriad ways in which the mmW bands can be deployed in the future to meet a wide range of fixed and mobile use cases.[5] But which of these visions will actually come to pass is an open question today, and likely will be an open question for some time.

Whether considering access models, licensed service area sizes, channelization plans, technical rules, performance requirements, or any of the other elements that constitute a robust set of service rules, the Commission must ensure that there remains flexibility for market forces to drive the technological evolution, that regulation not chill innovation, and that ample time is afforded for the marketplace to evolve without regulatory interference.[6] The Commission is to be applauded for considering mmW service rules, notwithstanding the many unanswerable questions that remain about how the mmW bands ultimately will be used. Adoption of service rules in 2016 for the bands addressed in the *NPRM* will provide equipment manufacturers and service providers regulatory certainty that, if done correctly, will spur investment and innovation. But in moving forward at this early stage, the Commission must avoid adopting service rules that directly or indirectly encourage specific marketplace outcomes. Particularly since so many use cases and technologies for the mmW bands are in their nascent stages, the Commission must take

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[4] *Id.* at 11887 ¶ 22.

[5] *See, e.g.*, TIA *NOI* Comments at 5-6 ("While the future of technology is very difficult to predict, future wireless networks are likely to rely upon some combination of new spectrum, leveraging existing spectrum, heterogeneous approaches, the use of small cells, and increased spectrum sharing.").

[6] *See* Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, *Notice of Inquiry*, 29 FCC Rcd 13020, 13025 ¶ 13 (2014) ["*NOI*"].

care to avoid picking winners and losers (either intentionally or inadvertently), leaving that task to the marketplace.[7]

In crafting new rules for the mmW bands, the Commission must recognize the continued importance of the existing services in those bands.[8] As TIA has previously noted, satellite and other operations are currently active or planned in these bands.[9] As discussed below, the need to reconcile the use of these bands by a variety of valuable services recommends adoption of the proposed flexible market mechanisms to ensure that this spectrum is put to the highest and best use.

Two additional points should be made before turning to TIA's specific comments. First, although these comments will focus on service rules for the 27.5-28.35 GHz ("28 GHz"), 37-38.6 GHz ("37 GHz") and 38.6-40 GHz ("39 GHz") bands that the *NPRM* proposes to assign to the new Upper Microwave Flexible Use Service ("UMFUS")[10] and that are most appropriately regulated by a traditional exclusive licensing model that facilitates innovation and deployment,

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[7] As TIA has previously noted, "flexible use policies consistent with baseline technical rules that are technology-neutral have proven to be the best approach." TIA *NOI* Comments at 2. Tailoring the service rules for any of the bands under consideration in the *NPRM* for a particular use case risks repeating the unfortunate history of the Local Multipoint Distribution Service ("LMDS") mmW band – rules designed to promote local telephony and multichannel video offerings proved misguided, no such services were deployed widely in the band, and yet the rules hampered the deployment of alternative services.

[8] *See NPRM*, 30 FCC Rcd at 11886-87 ¶ 18 (noting broad support for considering incumbent uses of the mmW bands in determining their suitability for mobile use).

[9] TIA *NOI* Comments at 3. In particular, satellite operators rely on mmW spectrum to provide consumers with direct-to-home video; to make MSS services available; and to fulfill the competitive broadband needs of consumers, aircraft, cars and ships. Incumbent licensees also use the above 24 GHz bands to provide critical connectivity for government, military and first responders, especially in remote areas and in the aftermath of natural disasters or other emergencies that compromise terrestrial and mobile voice and data services.

[10] TIA has no objection to combining the rules primarily applicable to the UMFUS bands – 28 GHz, 37 GHz and 39 GHz – under a new Part 30. *See NPRM*, 30 FCC Rcd at 11930 ¶¶ 177-78. Doing so will avoid adding additional complexity to Part 101 (where the current rules governing the 28 GHz and 39 GHz bands reside) and will facilitate a more streamlined regulatory scheme.

TIA is pleased that, consistent with TIA's prior advocacy in this proceeding,[11] the Commission is proposing a mix of licensed and unlicensed spectrum access models for the spectrum above 24 GHz. Both licensed and unlicensed spectrum have critical roles to play in meeting future broadband needs, and the Commission is to be applauded for providing industry with an effective mix.

Second, while the mmW bands hold great promise for meeting the ever-increasing demand for connectivity amongst people and things, particularly in those situations where demand is concentrated and small cells will be viable, adoption of mobile service rules for the 28 GHz, 37 GHz and 39 GHz bands will not obviate the continuing need to free lower band spectrum for mobile services. Increasing demand for mobile connectivity is occurring in many circumstances where the propagation limitations of the mmW bands preclude those bands from being a practical solution.[12] The lower spectrum bands remain essential to meeting the growing demand for spectrum-based services because their superior propagation characteristics allow the ubiquitous service that cannot be provided in the mmW bands. The Commission already has recognized that "[t]his proceeding is not a substitute for our efforts to make additional lower frequency spectrum available for mobile services, but rather a supplement to those efforts." [13] The Commission must continue its efforts, alone and in concert with the National Telecommunications and Information Administration, to identify and free additional lower band

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[11] *See* TIA *NOI* Comments at 3.

[12] *Id.* at 6-7.

[13] *NOI*, 29 FCC Rcd at 13021 ¶ 2.

spectrum for mobility, especially spectrum below 6 GHz, at the same time it moves forward with the mmW bands.[14]

I. THE SERVICE RULES FOR THE 28 GHZ, 37 GHZ AND 39 GHZ BANDS SHOULD PROVIDE FOR FLEXIBLE USE.

The *NOI* in this proceeding put it succinctly – "[t]he Commission has a long standing practice of adopting flexible service rules," the Commission has "eschewed mandating the use of specific technologies or standards, preferring instead to let innovation and market competition drive the direction of technological development," and the Commission consistently has sought "to put in place regulations that can accommodate future technological advances."[15] With those time-tested principles as its guideposts, now is the time for the Commission to adopt flexible service rules that will permit fixed and mobile use of the 28 GHz, 37 GHz and 39 GHz bands, in accordance with the current allocation of those bands for Fixed and Mobile services.[16]

A. SERVICE RULES IMPLEMENTING EXISTING MOBILE ALLOCATIONS IN THE 28 GHZ, 37 GHZ AND 39 GHZ BANDS CAN ENABLE OPERATION OF EXISTING AND NEW SERVICES.

The record developed in response to the *NOI* establishes that substantial public interest benefits will flow from adoption of service rules permitting mobile use of the mmW bands in meeting the growing demand for connectivity, and that record need not be repeated here.[17] The

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[14] In addition, the Commission should continue pursuing the other spectrum bands above 24 GHz that were identified as candidate bands in the *NOI*, including but not limited to the 24.25-24.45 GHz, 25.05-25.25 GHz, 29.1-29.25 GHz, 31-31.3 GHz, 42.0-42.5 GHz, 57-64 GHz, 71-76 GHz and 81-86 GHz bands. The criteria used by the Commission in the *NPRM* to evaluate the suitability of spectrum for mmW mobile service were appropriate for identifying the highest priority bands. That other mmW bands do not meet all of the criteria, however, should not preclude further consideration of those bands.

[15] *Id.* at 13021 ¶ 3.

[16] *See* 47 C.F.R. § 2.106.

[17] *See NPRM*, 30 FCC Rcd at 11882 ¶¶ 5-6. *See also* Comments of Qualcomm Inc., GN Docket No. 14-177, 2-3 (filed Jan 15, 2015); Comments of Ericsson Inc., GN Docket No. 14-177, 2-4

principal argument advanced against adopting service rules to implement the existing Mobile service allocations in 28 GHz, 37 GHz and 39 GHz bands has been that doing so will preclude fixed satellite service ("FSS") usage of those bands. While satellite services provide many public interest benefits, the potential impact on satellite services of introducing mobile services in the 28 GHz, 37 GHz and 39 GHz bands does not warrant restricting those bands terrestrially only to fixed services.

1. PRIVATE ARRANGEMENTS FACILITATE SHARING WITHOUT IMPOSING "ONE SIZE FITS ALL" REQUIREMENTS THAT OFTEN PROVE UNNECESSARILY BURDENSOME AND DETER INVESTMENT.

The *NPRM* seeks comment on a flexible, spectrally efficient, marketplace approach to facilitate sharing.[18] As the *NPRM* emphasizes, the 28 GHz, 37 GHz and 39 GHz bands already have terrestrial Mobile allocations; the lack of mobile technology capable of operating in the mmW bands is responsible for the current lack of mobile service rules.[19] The Commission's

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(filed Jan. 15, 2015); Comments of Intel Corp., GN Docket No. 14-177, 2-4 (filed Jan. 15, 2015) ["Intel *NOI* Comments"].

[18] *See NPRM*, 30 FCC Rcd at 11922-25 ¶¶ 147-58. Proposals for spectrum access systems, beacon signaling, and active signal cancelling are advanced in connection with the Commission's solicitation of comment on allowing FSS user stations to be deployed in the 28 GHz band. *See id.* In each case, substantial operational and economic burdens would be placed on the terrestrial licensee to facilitate the ability of secondary satellite users to expand their services. Prospective mmW use cases, however, may not necessarily support such additional burdens. While interference mitigation techniques such as a spectrum access system, signal beacons and active signal cancelling may prove to be viable under some scenarios, the best course is for the Commission to leave it to private negotiations between the co-primary terrestrial licensee and the secondary FSS licensee to identify whether there are tools that will permit sharing and, if so, how the cost of implementing those tools is to be borne by the FSS beneficiary.

[19] *See* Rulemaking To Amend Parts 1, 2, 21, and 25 Of the Commission's Rules to Redesignate The 27.5 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, 12637 ¶ 207 (1997) ["*LMDS Second Report and Order*"]; Amendment of the Commission's Rules Regarding the 37.0-38.6 GHz and 38.6-40.0 GHz Bands, *Report and Order and Second Notice of Proposed Rule Making*,

marketplace approach should enable efficient investment in and deployment of fifth generation ("5G") terrestrial wireless services, while preserving opportunities for next-generation high-capacity broadband satellite services.

The Commission's current prioritization of terrestrial use over FSS in the 28 GHz band clearly has not precluded FSS use of the band. Although FSS in the 28 GHz band is on a secondary basis to LMDS operations,[20] as of January 25, 2016 there are 44 gateway earth stations licensed in the band to operate on a secondary basis, with two additional secondary FSS gateway earth station application pending.

FSS licensees have been willing to invest substantial sums in the deployment of 28 GHz FSS gateways, notwithstanding their secondary status. In some cases, that has been driven by the location of the gateway earth stations in suburban and rural locations where terrestrial operators were not providing mmW service. In other cases, private agreements between secondary FSS gateway licensees and co-primary terrestrial LMDS operators have provided the FSS licensee with greater operational freedom than would otherwise be the case given its secondary status.[21] If the Commission adopts 28 GHz and 39 GHz band mobile service rules,

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12 FCC Rcd 18600, 18638-39 ¶ 82 (1997) ["*39 GHz Report and Order*"]. *See also NPRM*, 30 FCC Rcd at 11890 ¶ 26.

[20] *See* 47 C.F.R. § 25.202. Indeed, when the Commission first adopted the LMDS rules, it considered and rejected a proposal that protection be offered to FSS gateways in the 28 GHz band, clearly stating that such an approach would be "inconsistent with the designation of FSS for secondary licensing priority in the 27.5-28.35 GHz band and potentially deprives LMDS of its domestic priority designation." *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 and Fourth Notice of Proposed Rulemaking*, 11 FCC Rcd 19005, 19026 ¶ 48 (1996).

[21] Other elements may also come into play, such as the use of berms or other techniques to limit the ability of terrestrial receivers to "see" the signals of gateway FSS earth stations.

there is no reason to believe that the terrestrial licensees will be unwilling to enter into market-based arrangements with FSS licensees in the future.

TIA has previously espoused that "[i]n cases where band sharing is technically and economically possible, policies must advance good engineering practice to best support an environment that protects those with superior spectrum rights from harmful interference."[22] Beyond just geographic separation, there are a wide range of tools available to engineers in the design, location and operation of facilities (both FSS gateways and terrestrial networks) to avoid interference. In the absence of a showing of a significant market failure, private arrangements between terrestrial and FSS licensees should be assumed to be the most efficient mechanism for bringing those tools to bear when and where appropriate, without imposing unnecessary burdens on other licensees that do not benefit from use of such tools.[23]

The *NPRM* solicits comments on a variety of highly-regulatory proposals that purportedly would facilitate spectrum sharing between terrestrial and FSS operators but which, in practice, impose unnecessary burdens on terrestrial licenses and are not as efficient as the marketplace mechanisms the Commission has proposed elsewhere.[24] To facilitate the possible

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[22] TIA *NOI* Comments at 2.

[23] For example, the Commission suggests active signal cancelling as a mechanism that might be deployed to reduce the interference that FSS might cause to terrestrial service providers. *See NPRM*, 30 FCC Rcd at 11925 ¶¶ 157-58. Even if one assumes that active signal cancelling would be an effective mechanism to facilitate sharing (and that is not an assumption the Commission should be making given the nascent state of that technology), it likely would not be an appropriate solution in many cases. For example, a 28 GHz FSS licensee seeking to add a gateway earth station in a rural area the 28 GHz terrestrial licensee does not intend to serve does not require active signal cancelling to meet its obligation to avoid interference. Thus, there is no reason why the Commission should require all terrestrial licensees to employ active signal cancelling and/or impose the economic burden of such technology on all FSS licensees when the operational and economic burdens are unnecessary to avoid interference. The better approach is to let the parties, on a case-by-case basis, evaluate the options and choose those that are best suited to the particulars of the situation.

[24] *See id.* at 11922-27 ¶¶ 148-65.

deployment of fixed FSS user stations, comment is sought on imposing spectrum access system, beaconing, or active signal cancelling requirements on terrestrial licensees.[25] As noted previously,[26] those tools will impose substantial operational or economic burdens on the terrestrial licensee. Yet, those operational and economic costs most often will be for naught, as geographic separation or other, less burdensome tools are sufficient to promote sharing. Private arrangements best allow the parties to minimize those burdens based on their particular technologies and use cases and to allocate the costs of sharing appropriately. Simply put, the marketplace is working to allow FSS use of the UMFUS spectrum notwithstanding its secondary status, and there is no reason for the Commission to interfere with highly regulatory, intrusive requirements that are not justified by any record.

For example, the Commission suggests beacon signaling as a mechanism that might be deployed to reduce the interference that FSS might cause to terrestrial service providers.[27] Even if beacon signaling could be an effective mechanism to facilitate sharing (and it is premature to make that assumption given the many possible use cases in the UMFUS bands), it likely would not be an appropriate solution in many cases. A secondary 28 GHz FSS licensee seeking to operate in a geographic area the 28 GHz terrestrial licensee does not intend to serve does not require beacon signaling to meet its obligation to avoid interference to terrestrial users. Thus, there is no reason why the Commission should require all terrestrial licensees to employ beacon signaling and/or impose the economic burden of such technology on all FSS licensees when the operational and economic burdens are unnecessary to avoid interference in many cases. The

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[25] *See id.* at 11923-24 ¶¶ 150-55, 11925 ¶ 157-58, 11926-27 ¶ 163.

[26] *See supra* note 23.

[27] *See NPRM*, 30 FCC Rcd at 11924 ¶ 154-55.

better approach is to let the parties, on a case-by-case basis, evaluate the options and choose those that are best suited to the particulars of the situation.

Similarly, although the *NPRM* recognizes that in the 37 GHz and 39 GHz bands there is no potential for interference from FSS to terrestrial use, it nonetheless proposes to oblige terrestrial licensees to engage in extensive data collection and sharing so FSS operators can "adapt their user equipment deployment plans to take into consideration the presence of interference generated by terrestrial stations."[28] Given the anticipated dense deployment of UMFUS facilities, collecting the specific data that would be required under draft Section 30.205 would be time-consuming and expensive. It is reasonable to require terrestrial licensees in the UMFUS bands to provide appropriate information to FSS licensees so those FSS licensees can protect meet their obligations to protect terrestrial providers and take appropriate steps to avoid interference to their operations.[29] However, the Commission should assure that the information-sharing requirements are narrowly-tailored and do not impose a burden on UMFUS terrestrial service providers that is out of proportion to the operational benefit a secondary FSS licensee might realize.

2. FSS LICENSEES SHOULD BE PERMITTED TO ACQUIRE TERRESTRIAL OPERATING RIGHTS THROUGH AUCTIONS OR SECONDARY MARKETS.

Moreover, private arrangements can be supplemented by a flexible licensing marketplace along the lines suggested in the *NPRM*,[30] allowing FSS earth station licensees to acquire

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[28] *Id.* at 11927 ¶ 164.

[29] Indeed, the Commission should require that any FSS licensee that deploys service that is subject to displacement upon the launch of UMFUS service employ frequency agile equipment that is capable of immediately switching to some other band. In no case should terrestrial deployments suffer interference, or be delayed to avoid interference, because an FSS licensee has chosen to deploy under secondary limits.

[30] Although TIA supports allowing FSS licensees to acquire terrestrial licenses and thereby gain the functional equivalent of co-equal status, secondary licensees should not be given priority to

terrestrial operating rights and thereby isolate their satellite operations from third-party terrestrial uses.[31] TIA supports the Commission's proposal to permit FSS licensees who choose not to rely on secondary status (or the functional equivalent thereof) or secondary status supplemented by privately negotiated arrangements to directly secure terrestrial band licenses, either through auction or secondary market transactions, for such geographic area as is necessary for the FSS earth station to operate without interference to terrestrial users. Although the essentially secondary nature of FSS would not change, and FSS licensees would have no obligation to secure terrestrial operating rights, any FSS licensee that chooses to do so could assure, through terrestrial license acquisition, that no terrestrial operations cause interference to FSS or that no terrestrial operations suffer interference from FSS.

As discussed below, the use of Basic Trading Areas ("BTAs") and Economic Areas ("EAs") should be continued for licensing of the 28 GHz band and the 37 GHz and 39 GHz bands, respectively. Yet, the availability of partitioning as proposed in the *NPRM*[32] will allow

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secure terrestrial licenses at no cost. *See id.* at 11920-21 ¶ 140. Terrestrial spectrum should be put to its highest and best use, and giving terrestrial licenses at no cost to secondary FSS licensees rather than awarding by auction is the antithesis of a marketplace-based regulatory regime. While FSS gateways may be desired in areas where there is currently no terrestrial licensee, the solution is for the Commission to quickly adopt mmW service rules in this proceeding and auction to available 28 GHz, 37 GHz and 39 GHz band spectrum so as to provide a partner for negotiations over FSS deployment.

[31] If the Commission moves forward with this sort of approach, it should modify proposed Section 30.105(a) to provide that actual operation of an FSS facility within an FSS licensees terrestrially-licensed geographic service area satisfies performance requirements associated with the terrestrial license and entitles the licensee to a renewal expectancy on the same basis as a terrestrial licensee that meets the performance requirements through the provision of terrestrial services. *See id.* at 11940 ¶ 211. If the Commission requires FSS licensees to acquire their spectrum access rights in the marketplace (rather than through a no-cost pre-auction licensing opportunity) and affords FSS licensees the same leasing and partitioning rights as all other licensees, marketplace forces should yield the most efficient use of the spectrum possible – FSS licensees appear to have little incentive to preclude terrestrial services in geographic areas where sharing is feasible if permitting such use can reduce FSS spectrum costs.

[32] *See id.* at 11944 ¶ 232.

FSS licensees who require smaller terrestrial licenses (because, for example, they are seeking to deploy just a few isolated gateway earth stations and not more ubiquitous user stations) to tailor their license area to their needs. They will be able to do so by either securing the terrestrial license for the larger area and partitioning off all but what they need, or entering into a secondary market transaction with the terrestrial licensee to partition off the area needed by the FSS licensee.

Similarly, spectrum leasing provides a mechanism by which FSS licensees can secure the equivalent of co-primary status in the 28 GHz, 37 GHz and 39 GHz bands. The Commission's leasing regime has been "designed to promote more efficient, innovative and dynamic use[s] of spectrum, expand the scope of available wireless services and devices, enhance economic opportunities for accessing spectrum, and promote competition among providers."[33] Just as an FSS licensee should be permitted to secure a terrestrial license and thus gain the functional equivalent of co-primary status, it should be permitted to lease exclusive operating rights in a licensed service area and secure the same benefit. Thus, the Commission should adopt its proposal to extend its traditional spectrum leasing rules to these bands, and encourage FSS licensees to explore possible leasing arrangements with terrestrial licenses or to lease to third parties any spectrum they secure but do not have immediate need for.

3. FSS LICENSES SHOULD BE PERMITTED TO OPERATE FSS USER STATIONS IN THE 37 GHZ AND 39 GHZ BAND ON A SECONDARY BASIS.

The *NPRM* solicits comment on permitting the deployment of non-Federal FSS user equipment in the 37.5-40 GHz band.[34] Because, as noted in the *NPRM*, FSS use in this band is

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[33] *Id.* at 11946 ¶ 238 (citation omitted).

[34] *See id*. at 11927 ¶ 164.

restricted to space-to-earth transmissions,[35] no harm to UMFUS will arise from allowing FSS operators to deploy FSS user equipment in the band on a secondary basis. However, it must be clear that the FSS user who elects to deploy service to FSS user stations in the 37 and 39 GHz bands is obligated to accept interference from current and future UMFUS licensees, and that UMFUS licensees have no obligation to cure any interference that may arise from operation of an FSS user station in proximity to an UMFUS deployment. Of course, as discussed above, those FSS licensees that choose to deploy user stations in the 37 GHz and 39 GHz band should be free to either operate purely on a secondary basis, to secure private arrangements with terrestrial licensees to assure greater operational flexibility than secondary status alone affords, or secure terrestrial operating rights that will allow them to control directly whether FSS user stations cause objectionable interference to any terrestrials uses they authorize.

Moreover, the Commission must take care not to impose burdensome obligations on UMFUS licensees to facilitate secondary use in the band by FSS user terminals. While the *NPRM* suggests that some information sharing by terrestrial licensees could permit FSS to "adapt their user equipment deployment plans to take into consideration the presence of interference generated by terrestrial stations,"[36] for the reasons noted above the Commission should only impose information sharing requirements that are narrowly-tailored and do not impose a burden on UMFUS terrestrial service providers that is out of proportion to the operational benefit to the FSS licensee.

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[35] *See id.*

[36] *Id.*

B. THE RESULTS OF WRC-15 SHOULD NOT DETER THE U.S. FROM PROCEEDING WITH ADOPTING MOBILE SERVICE RULES FOR THE 28 GHZ BAND.

The Commission should reject any suggestion that the failure of WRC-15 to agree to the 28 GHz band as a candidate band for International Mobile Telecommunications ("IMT") should preclude the United States from moving forward with fully implementing the existing global Fixed and Mobile allocations. Chairman Wheeler will prove prescient with his prediction that, as the United States move forward with the 28 GHz band an international consensus will develop.[37] Global harmonization is a meritorious goal and should be pursued when possible, but as the Commission has acknowledged, "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."[38]

C. FLEXIBLE USE RIGHTS SHOULD BE EXTENDED TO INCUMBENTS.

While the spectrum proposed for UMFUS generally should be assigned using traditional auction mechanisms, TIA agrees with the Commission's proposal to permit existing licensees in the 28 GHz and 39 GHz bands to provide mobile services, along with their presently authorized fixed service offerings. Such an approach will result in the most efficient use of the spectrum licensed to incumbents, as well as likely expedite the provision of service to the public in the two bands.

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[37] *See* FCC, Statement of Tom Wheeler, Chairman, Presentation on the outcomes if the International Telecommunication Union's World Radio Conference that took place in November (Dec. 17, 2015). *See also* FCC, Statement of Jessica Rosenworcel, Commissioner, International Bureau Presentation on World Radiocommunication Conference 2015 (WRC-15) (Dec. 17, 2015) (the Commission "should not be deterred by the failure to include the 28 GHz band in this list. We have a global primary mobile allocation in this band—and we should continue to explore this spectrum frontier *now*. Because the race to 5G is on and the United States should lead the way.").

[38] *NPRM*, 30 FCC Rcd at 11892 ¶ 32.

While coexistence of fixed and mobile services is certainly possible when using different frequencies or serving different areas, providing fixed and mobile services in the same area using the same spectrum can be challenging depending on the use cases and technologies employed. The *NPRM* correctly finds that affording incumbents flexibility to provide either or both types of service alleviates "concerns about compatibility between fixed and mobile uses because a single licensee will be able to coordinate fixed and mobile operations while avoiding interference."[39] An overlay license, permitting one licensee to provide mobile services on a given band in a given area, while a second licensee provides fixed services in the same spectrum in the same area is an invitation to disaster because of the close coordination that is necessarily required for fixed and mobile services to coexist in the same area on a co-channel basis. At best, the spectrum will be used inefficiently because of the compromises required for both licensees to avoid interference to one another, and at worst the Commission will find itself constantly refereeing interference disputes. In contrast, allowing incumbents to provide fixed and mobile services as advocated in the *NPRM* will allow the existing market for high-speed fixed wireless services to continue to be served, while providing a path for deployment of mobile services at such time as cost-effective mobile technology is available.

Moreover, affording incumbent licensees flexible use rights will be consistent with Commission precedent,[40] and consistent with commitments the Commission made when adopting the existing fixed service rules for the 28 GH and 39 GHz bands. In both cases, the

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[39] *Id.* at 11895 ¶ 43.

[40] Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems, *First Report and Order and Memorandum Opinion and Order*, 16 FCC Rcd 17222, 17223 ¶ 2 (2001); Amendment of the Commission's Rules To Permit Flexible Service Offerings in the Commercial Mobile Radio Services, *First Report and Order and Further Notice of Proposed Rule Making*, 11 FCC Rcd 8965, 8966 ¶ 1 (1996) (allowing CMRS licensees to begin providing fixed wireless services).

Commission made clear that while it was not adopting mobile serve rules despite the allocation for Mobile service, its doing so was driven by the lack of mobile technology at the time and that it would revisit mobility as technology evolves.[41] With the advances in technology spelled out in the record developed in response to the *NOI*, now is the time to provide incumbent licensees the promised mobile authority.

II. THE UMFUS BANDS SHOULD BE LICENSED ON AN EXCLUSIVE BASIS.

In determining how access to the mmW bands should be governed, the Commission "must assign rights in a way that maximizes the utility of the spectrum, minimizes the potential for interference among co- and adjacent-channel users, and allows flexibility for licensees to meet the needs of their end users."[42] Exclusive use licensing of the bands proposed for UMFUS will facilitate the most effective and efficient use of the 28 GHz, 37 GHz and 39 GHz bands.

A. EXCLUSIVE TERRESTRIAL LICENSING OF UMFUS WILL PROVIDE THE REGULATORY CERTAINTY NECESSARY TO SPUR INVESTMENT AND INNOVATION.

Although many questions remain as to how the mmW bands will be deployed, the record developed in response to the *NOI* establishes that the UMFUS bands are likely to be used by today's wireless carriers for small cell supplementary deployments in areas where carriers face spectrum scarcity. For this to occur, however, it is critical to provide the terrestrial wireless carriers with the regulatory certainty exclusive licensing provides – regulatory certainty that they need to invest in the development and deployment of infrastructure and devices that support use of the mmW bands as an adjunct to their existing facilities. As the *NPRM* recognizes, there is much work to be done by industry to bring mmW to market, and the regulatory certainty that

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[41] *See LMDS Second Report and Order*, 12 FCC Rcd at 12637 ¶ 207; *39 GHz Report and Order*, 12 FCC Rcd at 18638-39 ¶ 82. *See also NPRM*, 30 FCC Rcd at 11890 ¶ 26.

[42] *NOI*, 29 FCC Rcd at 13045 ¶ 89.

comes with exclusive licensing should spur the undertaking of that work. Exclusive use terrestrial licensing will maximize much-needed upfront investment and further research and development by equipment manufacturers, system developers, commercial network operators and others. Without the certainty inherent in granting terrestrial licensees exclusive spectrum rights, investment in the UMFUS bands could be hindered, and innovation ultimately stifled.

Moreover, the 28 GHz and 39 GHz bands are already exclusively licensed. While TIA does not suggest that those bands have been unqualified success stories, the light use of the band has primarily been caused by the lack of cost-effective equipment capable of meeting the challenges imposed by mmW propagation limits and not the access regime. Maintaining the exclusive rights for these licensees avoids the host of thorny questions that would have to be addressed were the Commission to impose a different regulatory model on the UMFUS bands.

B. THE COMMISSION SHOULD ABANDON THE PROPOSED HYBRID LICENSING SCHEME FOR THE 37 GHZ BAND AND INSTEAD AUCTION THE SPECTRUM FOR EXCLUSIVE LICENSED USE.

The Commission should not adopt the hybrid licensing scheme proposed in the *NPRM* for the 37 GHz band, and should instead auction geographic, exclusive use licenses.[43] The *NPRM*'s proposal to grant local operating rights by rule to "premises occupants" would unnecessarily break up a potential 3 GHz contiguous block of spectrum, without any real evidence that property owners would deploy the type of networks envisioned in the *NPRM*, and would undermine the utility of the 37 GHz band. Valuable spectrum would likely lay fallow in the possession of premises occupants with no desire to utilize it, ultimately depriving consumers access to the spectrum and frustrating efforts to develop mmW networks and services in the

[43] *See NPRM*, 30 FCC Rcd at 11909-11 ¶¶ 99-106.

United States. The Commission should instead auction geographic, exclusive use licenses in the 37 GHz band, just as it should do for the 28 GHz and 39 GHz bands.

First, the hybrid licensing scheme would unnecessarily divide what could otherwise be 3 GHz of contiguous spectrum between 37 GHz and 40 GHz. The Commission recognizes in the *NPRM* that, "virtually all commenters agree that it will be easier to accommodate mobile use in wider bands" and prioritizes authorizing wide swaths of spectrum for mobile use. Because the Commission also proposes in the *NPRM* to authorize mobile operations in the 38.6-40 GHz band, it therefore has a unique opportunity to create a very large swath of spectrum by simply extending the same rules from 37 GHz to 40 GHz. Moreover, the 37 GHz band is particularly valuable as the only UMFUS band without any existing commercial operations. Any Commission decision that would separate a relatively unencumbered, wide swath of spectrum should be subject to a particularly compelling justification. The uncertain prospect of privately deployed networks for enterprise and industrial applications as proposed in the *NPRM* simply does not pass the test.

The record developed in response to the *NOI* is devoid of any evidence that "premises occupants" wish to deploy private "networks that can provide 5G communications for advanced enterprise and industrial applications," and the *NPRM* fails to cite to any evidence establishing such a demand [44] While one might argue that the prospect of few premises occupants utilizing 37 GHz spectrum would nonetheless create an open playing field for operators seeking to use it for 5G services, in reality the uncertainty created by the proposed rule would likely discourage operator use, as operators would not be able to predict when and where interference could occur.

[44] *Id.* at 11909 ¶ 100.

The *NPRM* states that local mmW deployments will carry the burden of requiring "permission of the property owner for siting, installation, backhaul, etc.,"[45] but that statement is true of all UMFUS deployments, and not just those in the 37 GHz band. Commercial service providers and property owners will have to work together to assure UMFUS coverage within buildings. Moreover, the *NPRM* does not address the far greater challenges that adopting the hybrid proposal would create. In the likely event that many premises occupants do not wish to deploy their own networks, providers seeking to buy or lease those spectrum rights would face the unmanageable task of negotiating individual agreements with each individual "premises occupant." That challenge would likely be so great that the spectrum would instead remain unused.

In addition, the hybrid proposal could create serious interference challenges and undermine incentives to invest in the band. The *NPRM* assumes that "[t]he inherent short-range characteristics of millimeter wave spectrum . . . might also facilitate natural coexistence between a private, local area network, and a more traditional commercial wide area network."[46] But that assumption is misplaced. While it is true that signals in the mmW spectrum propagate over shorter distances than in lower frequency bands, signals will not simply stop at the property line. A commercial provider that wishes to provide service to consumers passing on the sidewalk may not be able to ensure that its signal does not interfere with a network in a nearby building, and a "premises occupant" that has deployed a private network may not be able to ensure that its signal does not interfere with services offered just outside. One operator, or both, would likely have to engage in power backoff to prevent interference, which would thus degrade the utility of that network. These types of complex interference challenges create uncertainty about the ability to

[45] *Id.* at 11910 ¶ 101.

[46] *Id.* at 11909 ¶ 100.

provide service, and therefore diminish the incentive to invest in technology to deploy in the band. The interference and logistical challenges presented by the hybrid proposal would severely limit the types of devices and networks that could exist in the band. As TIA urges throughout this pleading, the Commission must remain focused on adopting technology neutral rules that provide the flexibility for innovation and investment necessary to fully realize the potential of the next generation of networks.

Moreover, the marketplace provides an opportunity for those premises occupants who desire to develop private wireless networks without the risks associated with unlicensed spectrum to do so. A premises owner should be free to enter into a spectrum lease for its premises. Or, the premises owner could secure its own license through a partitioning arrangement with the license holder. In either case, the parties would be free to address the spectrum coordination issues noted above. Because the number of premises occupants interested in developing private networks appears to be relatively low, it is far more efficient to have those entities come to licensees before deploying service, rather than having licensees have to reach arrangements with millions of premises occupants before deploying services that cross property boundaries.

For these reasons, the Commission should auction geographic, exclusive use licenses for the 37 GHz band in place of adopting the hybrid licensing scheme proposed in the *NPRM*. Auctions have proven to be an effective method of distributing spectrum to those that have the technical and financial ability, as well as the demonstrated desire, to deploy the spectrum. The Commission should not abandon its successful policy of auctioning spectrum in favor of an experiment that would give away spectrum rights to many who have no intention of ever putting the spectrum to use.

III. BTAS AND EAS SHOULD BE THE GEOGRAPHIC UNITS FOR LICENSING THE 28 GHZ BAND AND THE 37 GHZ AND 39 GHZ BANDS, RESPECTIVELY.

The Commission should abandon its proposal to license the UMFUS bands on a county-by-county basis; instead, it should retain the BTA and EA licensing approaches currently in place for the 28 GHz and 39 GHz bands, and extend the EA approach to the 37 GHz band that is adjacent to the 39 GHz band. As the agency itself has said, EAs and BTAs represent "the best balance of competing considerations,"[47] as they are small enough that regional providers can access the market, and yet large enough that service providers can achieve sufficient economies of scale. Ultimately, county-by-county licensing would hinder investment in the UMFUS bands and chill innovation.

BTAs and EAs were adopted for the 28 GHz and 39 GHz bands after thorough consideration of other possibilities, including smaller geographic units.[48] As the Commission previously acknowledged, EAs "create opportunities for a variety of bidders, including small and regional providers, to acquire licenses."[49] Given that EAs are larger than BTAs, the Commission's statement that the former allow smaller competitors access tellingly indicates the latter do, as well. Moreover, EAs and BTAs not only facilitate access by smaller operators, but

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[47] Amendment of Parts 21 and 74 of the Commission's Rules With Regard to Filing Procedures in the Multipoint Distribution Service and the Instructional Television Fixed Service, *Report and Order*, 10 FCC Rcd 9589, 9604-05 ¶ 26 (1995) (referencing BTAs).

[48] Amendment of the Commission's Rules Regarding the 37.0-38.6 GHz and 38.6-40.0 GHz Bands, *Memorandum Opinion and Order*, 14 FCC Rcd 12428, 12452-53 ¶ 46 (1999); *LMDS Second Report and Order*, 12 FCC Rcd at 12605 ¶ 136.

[49] Service Rules for the 698-746, 746-762 and 777-792 MHz Bands, *Second Report and Order*, 22 FCC Rcd 15289, 15325-26 ¶ 87 (2007) (addressing EAs); *see also* Service Rules for Advanced Wireless Services H Block – Implementing Section 6401 of the Middle Class Tax Relief and Job Creation Act of 2012 Related to the 1915-1920 MHz and 1995-2000 MHz Bands, *Report and Order*, 28 FCC Rcd 9483, 9500-01 ¶ 39 (2013) ("licensing . . . using EAs will facilitate access to spectrum for both small and large carriers . . . EAs are small enough to provide spectrum access opportunities to such [small] carriers").

they also "afford licensees greater economies of scale than smaller geographic service areas," thus providing an economic base for successful deployment.[50]

On the other hand, a county-by-county licensing scheme would not, as suggested in the *NPRM*, assist deployment in rural areas by "limiting" performance requirements.[51] Indeed, just the opposite may be true. Using the UMFUS bands in rural areas will be a challenge, as the propagation characteristics are less than ideal for serving widely-dispersed demand. If counties are used as the basis for licensing, and thus performance evaluation, service providers will be unwilling to meet any demand for service in a rural county unless and until it is confident that there will be sufficient demand to meet the Commission's performance requirements. On the other hand, if performance is evaluated over a larger BTA or EA, it is more likely that service providers will be willing to meet isolated demands for service in rural areas because demand in urban counties will satisfy the performance requirements.

Licensing the UMFUS bands by county also would impose significant transaction costs and burdens on licensees. Potential service providers would find it difficult to cobble together sufficient geographically contiguous licenses to provide a viable service, and combinatorial bidding (which has never been tested with as many combinations as would be required for a UMFUS auction) would have to be used in any auction process to assure that the bands not be Balkanized to the extent that they are of little use to service providers. In addition, it would dramatically increase the need for frequency coordination agreements between neighboring licensees seeking to avoid interference because of the dramatic increase in the potential number of neighboring license areas county-based licensing allows.

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[50] *LMDS Second Report and Order*, 12 FCC Rcd at 12606.

[51] *See NPRM*, 30 FCC Rcd at 11937 ¶¶ 200-01.

Given the nascence of the proposed uses in question, escalating the cost of market participation at a time when business models are not set in stone risks deterring interested parties from investing. The *NPRM* falsely assumes that as licensees seek to avoid interference, coverage will be "measured in meters, not kilometers"[52] – and consequently underestimates the amount and costs of coordination between adjacent licensees. A county-based licensing scheme would necessitate the negotiation of a far greater raw number of agreements. While mechanisms such as auctions and the secondary market could assist in the consolidation of licenses, the Commission has previously found that "these options may result in unproductive regulatory and transaction costs for the Commission and applicants" and, with specific reference to the 28 GHz band that "[t]he use of BTAs alleviates these problems and ensures that LMDS providers can deliver services to the marketplace in a timely and efficient manner."[53] The Commission has the opportunity in this proceeding to avoid engendering these costs altogether.

For these reasons, the Commission should continue to use BTAs and EAs for licensing in the 28 GHz and 39 GHz bands, and extend EA licensing to the 37 GHz band, to maximize the deployment of service offerings using the UMFUS spectrum.

IV. LICENSING RULES MUST REFLECT THE UNCERTAINTIES ASSOCIATED WITH THE MMW BANDS.

In setting the terms of new licenses for the 28 GHz, 37 GHz and 39 GHz bands, in establishing performance requirements, and in considering aggregation limits, the Commission must remain cognizant of the marketplace challenges faced by equipment manufacturers and service providers that might potentially deploy in these bands. The Commission acknowledged in the *NOI* that before the technologies currently under development can be deployed,

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[52] *Id.* at 11912 ¶ 111.

[53] *LMDS Second Report and Order*, 12 FCC Rcd at 12605 ¶ 136.

"additional work is required to complete the necessary research and development; negotiate mutually harmonized standards, consider frequency allocations and regulatory frameworks; and build or modify manufacturing facilities and processes required to supply necessary system components."[54] While expedited resolution of the issues presented in the *NPRM* will in some respects help clear the way for these challenges to be addressed, there is much work to do and progress will not occur overnight.

A. THE COMMISSION SHOULD ESTABLISH A TEN YEAR LICENSE TERM AND AN EXPECTATION OF RENEWAL FOR UMFUS LICENSES.

As a result, the Commission must take care to set UMFUS license terms in a manner that accommodates the realities of the 28 GHz, 37 GHz and 39 GHz bands. The Commission should afford licensees in the bands a ten year term as proposed in the *NPRM*,[55] with an expectation of renewal if they provide the level of service required under the performance requirements. Particularly given how much work remains to be done before widespread use of these bands can reasonably be expected, a shorter license term likely would drive away potential licensees because of the uncertainty of whether marketplace demand will allow deployment within the first few years post-auction. A ten year term, coupled with an expectation of renewal upon satisfaction of reasonable performance requirements, strikes an appropriate balance between allowing the marketplace to develop and avoiding spectrum warehousing.

B. PERFORMANCE METRICS SHOULD BE DESIGNED TO NOT SKEW THE EVOLVING MARKETPLACE.

By the same token, performance requirements must be set so that licensees have time to deploy technologies and equipment that best serve marketplace demand. Equipment manufacturers share the Commission's desire to avoid warehousing, but overly-aggressive

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[54] *NOI*, 29 FCC Rcd at 13025 ¶ 13 (citation omitted).

[55] *See NPRM*, 30 FCC Rcd at 11915 ¶ 121.

performance requirements will tend to drive these bands to those use cases for which equipment is available when performance must be shown, rather than the highest and best use. While it may be appropriate in situations involving more mature services to impose performance benchmarks prior to the expiration of the license terms, where (as here) the Commission is developing service rules long before technologies and use cases have been determined, the Commission should make sure that performance requirements do not skew the market and chill innovation. To that end, the Commission should not measure performance of UMFUS licensees until the expiration of their initial license term.[56]

Moreover, as the Commission contemplates possible performance requirements, the Commission should strongly consider supplementing traditional metrics, such as geographic coverage or coverage of persons (measured at their residences), with additional metrics that reflect the nature of the UMFUS bands. While existing metrics have made sense for lower band services where coverage tends to be ubiquitous and subscribers are looking for service that includes their residences, the same is not going to be true of the mmW bands. There, for example, meritorious machine-to-machine/Internet of Things deployment may take place in

[56] For similar reasons, the Commission should not adopt a "use-or-share" regime for the UMFUS bands. *See id.* at 11941 ¶¶ 215-17. Given the nascent state of current technology, it is likely that many use cases will not be deployed into the UMFUS bands until well into the initial license term. While TIA appreciates that the *NPRM* proposes that those sharing would do so on a secondary basis (*see id.* at 11941 ¶ 216), the Commission does no one any favor when it encourages the deployment of new services on a secondary basis that are likely to be short-lived. At best, consumers become frustrated when they lose their secondary service, and at worst the Commission and parties become embroiled in disputes over the secondary provider's obligation to vacate the spectrum. Where a licensee does not intend to use its UMFUS spectrum, secondary market transactions are available under current rules to allow use. Thus, the better approach is to refrain from any "use or share" policy at the present time, subject to the possibility that the Commission will revisit the issue after initial license terms expire and there is a record on actual mmW spectrum use.

ways that small cells do not provide vast geographic coverage and the machines being connected are not necessarily located where there is dense residential population.

While the *NPRM* solicits comment on whether there can be a single metric,[57] that moves the discussion in the wrong direction. Rather, to fully encompass the wide range of use cases that may find homes in the UMFUS bands and to avoid driving the marketplace in any particular direction, the Commission should avoid any "one size fits all" solution and instead provide licensees multiple performance benchmarks by which they can demonstrate their spectrum is being put to good use.[58] For example, in addition to traditional metrics, the Commission should consider providing a safe harbor based on the number of connections in the geographic service area as a means for recognizing the increasing importance of machine-to-machine and Internet of Things connectivity.

The Commission's very flexible "substantial service" standard coupled with safe harbors (which currently applies to the 28 GHz and 39 GHz bands under Section 101.1413 of the Rules) has fallen out of favor because of its lack of precision.[59] However, given the uncertainties regarding UMFUS use cases and the potential for novel niche services to evolve, the Commission should authorize the Wireless Telecommunications Bureau to flexibly evaluate the performance of innovative UMFUS offerings that do not squarely fit within the metrics that are

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[57] *See id.* at 11939 ¶ 205.

[58] We recognize that the Commission's general "substantial service" standard (which currently applies to the 28 GHz and 39 GHz bands under Section 101.1413 of the Rules) – "service which is sound, favorable, and substantially above a level of mediocre service which might minimally warrant renewal" – has fallen out of favor because of its lack of precision. However, given the uncertainties regarding UMFUS use cases and the availability of technology, applying that standard to the UMFUS bands, coupled with safe harbors, may be the best way to provide flexibility for the Commission to evaluate performance under the first UMFUS terms.

[59] *See, e.g.*, Amendment of Part 27 of the Commission's Rules to Govern the Operation of Wireless Communications Services in the 2.3 GHz Band, *Order on Reconsideration*, 27 FCC Rcd 13651, 13702 ¶¶ 124-26 (2012).

otherwise available for measuring performance, and should encourage the issuance of declaratory rulings in advance so that licensees will know, before deploying innovative services, that their licenses will not be jeopardized by doing so. To do otherwise risks deterring innovative offerings that, because of their nature, do not meet whatever benchmarks are adopted.

C. THE COMMISSION SHOULD NOT IMPOSE LIMITS ON SPECTRUM AGGREGATION APPLICABLE TO THE MMW BANDS.

The Commission is correct in its assessment that, given the uncertainty surrounding how the mmW bands will be utilized in the provision of mobile broadband services, it is premature to find that they are "suitable" and "available" spectrum for the provision of mobile telephony or broadband services in the near term, and thus the mmW bands should not be included in the spectrum screen or otherwise subject to aggregation limits. [60]

As laid out in detail in the *NPRM*, the Commission has justified spectrum aggregation limits as appropriate where necessary to assure that competitors have spectrum inputs necessary to succeed.[61] Spectrum must be "suitable" and "available" for use in mobile telephony or broadband services. To make that determination, the Commission examines a range of relevant considerations, including the characteristics of the spectrum, the likely timing of availability and the availability of alternative spectrum.[62]

At this time, given the nascent state of most technologies that could be employed for mobile service in the UMFUS bands and the vast array of potential use cases, it would be premature for the Commission to conclude that access to mmW spectrum is suitable or available for mobile services. At present, it would be a stretch for the Commission to conclude that

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[60] *See NPRM*, 30 FCC Rcd at 11934-35 ¶ 192.

[61] *See id.* at 11933-34 ¶¶ 190-92, *citing* Policies Regarding Mobile Spectrum Holdings, *Report and Order*, 29 FCC Rcd 6133 (2014) ["*Mobile Spectrum Report and Order*"].

[62] *See Mobile Spectrum Report and Order*, 29 FCC Rcd at 6193 ¶ 144.

UMFUS spectrum is an essential input to the offering of a competitive service, and whether that ever proves to be the case will depend on a wide range of factors that are unknown and unknowable at present.[63] It may become the case that access to UMFUS spectrum will be necessary to compete in the mobile marketplace, and if that appears to be the case, the Commission can always revisit the issue at the appropriate time. But at present, UMFUS simply is not suitable or available for mobile service offerings.

V. THE MMW BAND TECHNICAL RULES SHOULD BE DESIGNED TO PROVIDE LICENSEES WITH MAXIMUM FLEXIBILITY.

A. THE 28 GHZ BAND SHOULD BE LICENSED AS A SINGLE BLOCK, WHILE THE 37 GHZ AND 39 GHZ BANDS SHOULD BE LICENSED AS FIFTEEN 200 MHZ WIDE BLOCKS.

The *NPRM* acknowledges the broad consensus among participants in this proceeding that at mmW frequencies, wide bands are preferable to accommodate the range of services being contemplated.[64] While some spectrum fragmentation can be overcome through the use of carrier aggregation technologies, those technologies do not yet provide the same level of spectrum efficiency as is achieved when wide blocks of contiguous spectrum are used.[65] Just as the

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[63] In recently determining that it was premature to add the 3550-3700 MHz band to the spectrum screen, the Commission specifically cited to "the range of technologies and heterogeneous business models that may operate in this environment" to justify its conclusion that the band should be excluded from the screen. *See* Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band, *Report and Order and Further Notice of Proposed Rulemaking*, 30 FCC Rcd 3959, 3998 ¶ 117 n.276 (2015).

[64] *See NPRM*, 30 FCC Rcd at 11914 ¶ 116-18.

[65] *See, e.g.*, Comments of Samsung Electronics America, Inc. and Samsung Research America, GN Docket No. 14-177, at 30 (filed Jan. 15, 2015). *See also* TIA *NOI* Comments at 3 ("As the Commission explores various millimeter-wave bands for mobile broadband applications, it should pay particular attention to the need for larger bandwidths. In particular, the agency should prioritize any opportunities for providing large blocks of contiguous spectrum. Carrier aggregation under LTE is always becoming more difficult, and aggregation of spectrum from several hundred MHz to even 1 GHz may be essential to promote next-generation wireless networks."); Intel *NOI* Comments at 23-24 ("carrier aggregation across even a few bands has already introduced substantial complexity for RF design (due to requirements for sharp filters,

Commission has focused the *NPRM* on those bands with the most contiguous bandwidth, it should now make certain that licenses deliver the wide blocks of contiguous spectrum that licensees will need. Thus, TIA urges the Commission to provide licensees with wide blocks of contiguous spectrum, and to offer multiple different widths so that service providers can secure the spectrum best suited to their particular technology and business case.

TIA agrees with the Commission's proposal to continue licensing the 28 GHz band as a single 850 MHz wide block,[66] and suggests licensing the 37 GHz and 39 GHz bands as fifteen unpaired blocks of 200 MHz of contiguous spectrum each (subject to the rights of incumbent 39 GHz band licensees, a topic discussed below). To provide licensees with the maximum flexibility to acquire the specific mmW spectrum rights that best meet marketplace needs, the Commission should place no limits on spectrum aggregation in the mmW bands and should continue its existing policy of permitting unfettered spectrum disaggregation.[67] Providing licensees with this sort of flexibility to match their spectrum access to their needs "could facilitate the efficient use of spectrum by enabling licensees to make offerings directly responsive to market demands for particular types of services, increasing competition by allowing new entrants to enter markets, and expediting provision of services that might not otherwise be provided in the near term."[68]

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blocking characteristics, etc.), as well as standardization and testing of various band combinations. Such challenges are more severe at higher frequencies. Therefore non-contiguous band allocations at higher frequencies are less desirable.").

[66] *See NPRM*, 30 FCC Rcd at 11913 ¶ 116.

[67] *See id.* at 11944 ¶ 232.

[68] *Id.*, *citing* Geographic Partitioning and Spectrum Disaggregation by Commercial Mobile Radio Service Licensees, *Report and Order and Further Notice of Proposed Rulemaking*, 11 FCC Rcd 21831, 21833 ¶ 1 (1996). The Commission has justified spectrum aggregation limits as appropriate where necessary to assure that competitors have spectrum inputs necessary to succeed. *See Mobile Spectrum Report and Order*, 29 FCC Rcd at 6143-44 ¶ 17. At this time,

Although, as discussed below, there may be demand for non-contiguous spectrum capable of supporting Frequency Division Duplex ("FDD") technology, unpaired channelization as proposed by TIA will result in the wide channels that are most likely to be required for viable services to develop in the mmW bands. Of course, any licensee that chooses to utilize technology that requires non-contiguous spectrum will be free to secure it under the flexible approach TIA envisions – either through securing multiple 200 MHz blocks in the 37/39 GHz auction, through disaggregation transactions, or through secondary market license assignments or leasing.

B. LICENSEES SHOULD HAVE THE FLEXIBIILTY TO SELECT FROM AMONG TDD, FDD AND ANY OTHER DUPLEX SCHEME.

The record developed in response to the *NOI* establishes that while Division Duplex ("TDD") appears to be the current frontrunner among possible duplexing mechanisms for the mmW bands, there are technologies and use cases that call for the use of FDD or other duplex schemes (such as "Any Division Duplexing" or downlink only, as a supplement to other spectrum).[69] Once again, neither industry nor the Commission possesses a sufficiently accurate crystal ball to predict which of these technologies will be deployed above 24 GHz. Thus, the Commission should adopt its proposal to continue its current policy in the 28 GHz and 39 GHz bands of not requiring or prohibiting any duplex scheme, and to extend that policy to the 37 GHz band.[70]

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given the uncertainty surrounding how the mmW bands will be used, it would be premature for the Commission to conclude that access to mmW spectrum is a critical input for a service provider.

[69] *See NPRM*, 30 FCC Rcd at 11954-55 ¶¶ 268-69. *See also* Intel *NOI* Comments at 24-25.

[70] *See NPRM*, 30 FCC Rcd at 11955 ¶ 270.

C. THE COMMISSION SHOULD MODIFY THE PROPOSED POWER LIMITS FOR THE UMFUS BANDS.

In adopting final UMFUS rules, the Commission should modify proposed Section 30.202 of the Rules establishing power limits. While TIA concurs with the proposed +85 dBm EIRP limits for point-to-point and +43 dBm EIRP for mobile, the maximum permissible EIRP for fixed and base stations set forth in proposed Section 30.202(a)(1) should be increased to 82 dBm/100 MHz, with an EIRP of 85dBm/100 MHz permitted in rural areas. Doing so will place the UMFUS base station power level on par with the fixed service operations, as well as on a level similar to that allowed in higher bands.[71]

In addition, the Commission should modify the power limits in proposed Section 30.202 to provide a new power category for customer premises equipment that is transportable, but not intended for use while in motion. That power limit should exceed the +43 dBm maximum EIRP permitted for mobile stations. Finally, the EIRP power levels in proposed Section 30.202 must be adjusted to accommodate over-the-air measurement techniques for smart arrays. Standard EIRP is not a proper metric for capturing the unwanted emission in advanced antenna arrays with multiple simultaneous users and beams.

D. THE COMMISSION SHOULD REVISE ITS PROPOSED BANDWIDTH DEPENDENT UNWANTED EMISSION LIMIT.

Proposed Section 30.203(a) of the rules would require that emissions outside a licensee's frequency block be attenuated below the transmitter power in EIRP by 43+10log(P) dB, while proposed Section 30.203(b) addresses resolution bandwidth to be employed in evaluating compliance. The Commission should reconsider the specific language of proposed Section 30.203(b) that imposes bandwidth-dependent unwanted emission requirements at the first MHz

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[71] *See* 47 C.F.R. § 15.255.

adjacent to the licensed block. The requirement discriminates against broadband systems. This clearly is an unintended consequence given that the object of this proceeding is to identify spectrum most amenable to broadband use – one of the benefits of mmW bands is that carrier bandwidth that can be in excess of 100 MHz. As a result of how proposed Section 30.203 is formulated, the unwanted emission attenuation requirement for a 100 MHz carrier is 10 dB more stringent that for a 10 MHz carrier. However, the power spectral density per MHz – the more accurate measure of potential interference to adjacent spectrum – is the same between these two carriers.

In addition, instead of using EIRP as proposed in the *NPRM*, Total Radiated Power ("TRP") should be used as the metric for measuring compliance with emission limits. TRP has the benefit of capturing all modes of operation including multi-beam, and thus is the more appropriate metric for measuring the performance of advanced antenna array systems. .

To reflect these proposed modifications, the Commission should revise proposed Section 30.203 to read as follows:

§ 30.203 Emission Limits.

(a) The power of any emission outside a licensee's frequency block shall be attenuated below the total transmitter power (P) in Total Radiated Power or sum of conducted emissions by at least 43 + 10 log10 (P) dB. In the one MHz immediately outside and adjacent to the frequency block the attenuation shall be 43 + 10 log10 (P) dB/30 kHz while for other frequencies the attenuation of 43 + 10 log10 (P) dB/MHz shall apply.

(b) (1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of 30 kHz shall be employed.

(2) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

VI. RF EXPOSURE RULES AND PROCEDURES NEED TO BE UPDATED TO ENABLE MMW DEPLOYMENT.

While the Commission's ongoing proceeding examining RF exposure rules and policies is a long-term vehicle for necessary reforms,[72] the mmW bands present challenges – due in part to the transition in exposure metrics at 6 GHz from Specific Absorption Rate ("SAR") to power density ("PD") – that can be addressed in the interim for the UMFUS bands.

Restrictions on PD currently are provided by the Commission (for general public exposure), as well as two major international standard-setting organizations – ICNIRP[73] and IEEE (in C95.1-2005[74] and C95.1a-2010[75]). The Commission's regulations and the two international standards vary greatly, and, as noted above, the Commission is currently re-evaluating its general public exposure rules for RF in a separate proceeding. That proceeding is much-needed; the current FCC exposure limits are based on outdated 25-year-old science, derived from the ANSI/IEEE C95.1-1992 Standard[76] and the NCRP's 1986 report on Biological Effects of RF Fields.[77]

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[72] *See* Reassessment of Federal Communications Commission Radiofrequency Exposure Limits and Policies, *First Report and Order, Further Notice of Proposed Rule Making and Notice of Inquiry*, 28 FCC Rcd 3498 (2013).

[73] INTER'L COMM'N ON NON-IONIZING RADIATION PROTECTION, *Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (Up to 300 GHz)*, 74 Health Physics 494 (Apr. 1998).

[74] IEEE C95.1- 2005 (Apr. 2006) ("Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz").

[75] IEEE C95.1a- 2010 (Mar. 2010) ("Amendment 1: Specifies Ceiling Limits for Induced and Contact Current, Clarifies Distinctions between Localized Exposure and Spatial Peak Power Density").

[76] IEEE C95.1-1991 was adopted by ANSI in 1992, forming the ANSI/IEEE C95.1-1992 standard.

[77] *See* 47 C.F.R. § 2.1093(d) ("The limits to be used for evaluation are based generally on criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate ('SAR') in Section 4.2 of 'IEEE Standard for Safety Levels with Respect to Human

Notwithstanding that ongoing proceeding, prompt action is needed to adopt IEEE C95.1-2005, as updated by IEEE C95.1a-2010, as the applicable RF exposure standard for UMFUS as it applies to this procedure outside of the RF Exposure NOI. This standard reflects the well-established research on RF exposure, particularly in the mmW bands, and adopting it for the Commission's regulatory purposes would ensure that the Commission's RF exposure limits applicable for the mmW bands are can support useful mobile applications.

However, if the Commission elects not to address PD limits in this proceeding, manufacturers still require greater clarity on what measurement and assessment methods will be used to determine device compliance at these higher frequencies. Early guidance on this is critical for manufacturers, who must incorporate relevant factors into device designs and establish compliance in a timely fashion, in order to bring their products to market in cost-effective manner. The Commission should therefore consider addressing guidance on RF exposure in this proceeding through Knowledge Data Base ("KDB") guidance notes, as it has done on previous issues addressing RF exposure where rules or standards had not yet been adopted.

VII. RULES ADDRESSING NETWORK SECURITY ISSUES SHOULD BE CONSIDERED IN A MORE APPROPRIATE PROCEEDING.

The *NPRM* seeks comment on "how to ensure that effective security features are built into key design principles for all mmW band communications devices and networks."[78] However, this wide-ranging inquiry requires a broader focus than can be achieved in this

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Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz' . . . These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in 'Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields,' NCRP Report No. 86, Section 17.4.5. Copyright NCRP, 1986 . . . .").

[78] *NPRM*, 30 FCC Rcd at 11952 ¶ 260.

proceeding. Make no mistake – TIA's members are actively engaged in a wide range of efforts to assure that network and device security is preserved to the maximum extent feasible. However, as the *NPRM* acknowledges, the mmW bands are most likely being used in conjunction with a range of other wired and wireless solutions, rather than as stand-alone networks.[79] As a result, a more expansive evaluation, not focused solely on the mmW band, may be appropriate.

Given that UMFUS networks likely will rarely operate in the mmW bands on a stand-alone basis, it would be ill-advised for the Commission to adopt new mmW-specific security rules in this proceeding. Indeed, marketplace forces and existing private sector and government efforts will lead service providers and device manufacturers to build into their offerings the security features that consumers demand. To the extent that the Commission finds in the future that the marketplace is failing to provide sufficient security, and that security issues require regulatory intervention, the Commission instead should issue a notice of inquiry of general applicability that examines the issues not from a mmW perspective, but from the perspective of networks that may include mmW bands along with other wired and wireless transport vehicles.

To do otherwise risks adoption of restrictions on mmW that, at best, leave other elements of networks vulnerable and, at worst, could preclude better solutions when networks as a whole are evaluated. It also risks creating investment-chilling regulatory inconsistency; a mmW-specific security regime would disincent investment in the very bands the Commission is attempting to promote with this proceeding. And, particularly given the nascent state of mmW technology, requiring that security be built into mmW equipment, rather than other parts of the network, could skew the sorts of services that can use the UMFUS. The Commission's pro-

[79] *See id.* at 11883 ¶ 8, 11899 ¶ 58.

flexibility, technology-neutral policies suggest that the better approach is to allow the marketplace to work, freeing network operators to provide security through the mechanisms that best fit their business plans and technology choices.

VIII. CONCLUSION.

The Commission has shown extraordinary leadership in making the mmW bands available in response to emerging use cases and technological innovations. The United States is at the forefront of efforts around the world to bring these bands to the marketplace, but to remain there the Commission must take great care in this proceeding to avoid rules that pick winners and losers or that chill investment and innovation. In considering the issues raised by the *NPRM*, the Commission should err on the side of providing manufacturers and licensees both the flexibility for the market to evolve free from regulatory intervention and the time needed for the marketplace to mature. Adoption of the proposals advanced above will move the UMFUS bands in the right direction.

Respectfully submitted,

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