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

James Reid
Dileep Srihari
Telecommunications Industry Association
1320 North Courthouse Road, Suite 200
Arlington, VA 22201

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EXECUTIVE SUMMARY

The Telecommunications Industry Association applauds the Commission for the work it has already done in the *Spectrum Frontiers* proceeding. By moving forward quickly, the recent *Report and Order* lays the groundwork for the United States to maintain its technological edge in the global race to 5G.

TIA supports the Commission's current efforts in the *Further Notice of Proposed Rulemaking* to open additional spectrum bands for mobile use. The demand for mobile broadband continues to grow, and more spectrum – especially potential globally-harmonized spectrum in the additional bands now being studied by the ITU – is essential to keep pace and promote innovation. For those reasons, TIA supports opening the 24 GHz, 32 GHz, 42 GHz, 47 GHz, and 50 GHz bands using the new UMFUS service rules, while studying the potential for co-existence between new mobile broadband and existing point-to-point backhaul operations in the 70 and 80 GHz bands.

Building on the framework established in the *Report and Order*, the additional UMFUS bands should be licensed in a combination of 200 MHz, 400 MHz, and 800 MHz blocks. A coordinated scheme built upon those three block sizes will achieve the right balance between allowing large-bandwidth applications to develop, facilitating different types of business models and applications, ensuring there are multiple licensees in each market, and establishing a robust secondary market for spectrum with relatively low transactional costs for the parties involved. In these comments, we propose specific band plans for each band that are designed to achieve these goals as quickly as possible, while also addressing potential issues regarding incumbent or neighboring allocations without the need for dedicated guard bands.

TIA has concerns, however, about imposing dynamic – and still experimental – Spectrum Access System (SAS) requirements that could raise device costs and potentially render some IoT applications unworkable, particularly when simpler frequency coordination mechanisms would suffice. Nor should the Commission expand Federal spectrum allocations at this stage.

Meanwhile, TIA understands the Commission's difficulty in establishing a unified performance requirement given the nascent state of millimeter-wave technology. Instead, multiple objectively-quantifiable paths should be established, allowing licensees the widest flexibility to select different business models and IoT applications for their spectrum while still helping the Commission implement a measurable standard for providing sufficient and appropriate service. However, imposing use-or-share requirements at this early stage would impose substantial costs on device manufacturers and licensees and could harm development of the millimeter-wave technology ecosystem.

Finally, the Commission should continue taking a light-touch approach to other licensing conditions. Mobile spectrum holdings limits remain an inappropriate tool at this early stage, and companies need to be permitted to aggregate their spectrum if technological circumstances eventually warrant doing so.

TIA once again applauds the Commission for its work thus far, and we are very encouraged by the potential for more progress in the *Further Notice of Proposed Rulemaking*.

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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 *Further Notice of Proposed Rulemaking* ("*FNPRM*")[2] in the above-captioned proceeding.

[1] TIA is the leading trade association for the information and communications technology ("ICT") industry, representing companies that manufacture or supply the products and services used in global communications across all technology platforms. TIA represents its members on

TIA greatly appreciates the work the Commission has already done in this proceeding. The rules adopted in the Spectrum Frontiers *Report and Order*[3] will help maintain U.S. technological leadership in emerging 5G and Internet-of-Things applications. The Commission made efforts to balance the interests of different stakeholders, and it has moved forward in an expeditious manner. TIA remains broadly supportive of the Commission's efforts to make additional bands of millimeter-wave spectrum available for mobile broadband use, and we look forward to continued progress by resolving the issues raised in the *Further Notice of Proposed Rulemaking*.

I. ADDITIONAL BANDS SHOULD BE OPENED FOR UMFUS SERVICES.

As the Commission has recognized, the development of 5G networks – and the technical advances expected to underlie such networks – is a national strategic priority to ensure that the U.S. remains at the forefront of technology development.[4] 5G networks will enable IoT

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the full range of policy issues affecting the ICT industry and forges consensus on industry standards. Its hundreds of member companies can be expected to be active participants in the evolving marketplace for telecommunications services using spectrum above 24 GHz. TIA previously commented in response to the prior Notice of Proposed Rulemaking ("NPRM") in this proceeding, *see* Comments of the Telecommunications Industry Ass'n, GN Docket No. 14-177 (filed Jan. 27, 2016) ["TIA NPRM Comments"], and in response to the initial *Notice of Inquiry (*"NOI"), *see* Comments of the Telecommunications Industry Ass'n, GN Docket No. 14-177 (filed Jan. 15, 2015) ["TIA NOI Comments"].

[2] Report and Order and Further Notice of Proposed Rulemaking, *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, GN Docket No. 14-177, *et al.*, FCC 16-89, 31 FCC Rcd 8014 (2016) ("FNPRM").

[3] *Id.* ("Report and Order").

[4] Statement of Chairman Tom Wheeler, 31 FCC Rcd at 8270 ("5G is a national priority"); Statement of Commissioner Jessica Rosenworcel, 31 FCC Rcd at 8275 ("The race to 5G is on … [b]ut for 5G technology to takeoff, for the United States to win this race, we need spectrum – and lots of it."); Statement of Commissioner Michael O'Rielly, 31 FCC Rcd at 8281 ("we must maintain our position as the world leader in wireless innovation").

applications in diverse vertical segments of the U.S. economy,[5] by providing information that promises to improve our lives.[6] Opening the millimeter-wave bands to mobile use will also deepen understandings about how to share spectrum between satellite and terrestrial users,[7] while creating new opportunities for dense deployments of small cells.[8] And of course, it will create opportunities for diverse new technologies.[9] Meanwhile, as the Commission itself has noted, the amount of global data traffic will continue increasing exponentially,[10] so regulators must stay ahead of the curve.

Against this backdrop, TIA supports the Commission's efforts in the *Further Notice* to open additional millimeter-wave spectrum bands for mobile use. While technologies and applications are still developing, TIA agrees that the Commission's job is to "get the spectrum out there and let the engineers help [] decide" how to use it best[11] – a principle that has already yielded remarkable results in lower bands. Thus, the five proposed bands from 24 GHz to 53 GHz should be opened to UMFUS services now. Moreover, the 70/80 GHz bands should be

[5] Statement of Chairman Tom Wheeler, 31 FCC Rcd at 8270 ("From job creation, to education, to healthcare, to energy and on down the line, these networks will unleash new innovations"); Statement of Commissioner Mignon Clyburn, 31 FCC Rcd at 8273 (discussing smart refrigerators, factory equipment self-reporting problems, and remote surgery).

[6] Statement of Commissioner Jessica Rosenworcel, 31 FCC Rcd at 8276-77 (discussing sensors in streetlights, roadside architecture, and cars; cameras in the helmets of firefighters; and sensors in urban trees to assess air quality).

[7] Statement of Chairman Tom Wheeler, 31 FCC Rcd at 8271 ("We also needed to work out sharing issues between terrestrial and satellite operators … [o]ur rules strike a balance").

[8] Statement of Commissioner Jessica Rosenworcel, 31 FCC Rcd at 8276 ("with 5G networks small cells are a big thing").

[9] Statement of Commissioner Ajit Pai, 31 FCC Rcd at 8279 (describing Google's Project Soli).

[10] FNPRM ¶ 372, 31 FCC Rcd at 8145 (citing Comments of Cisco Systemns, Inc., filed Jan. 28th, 2016 in GN Docket No. 14-177, at 3) (noting that global mobile data traffic will grow nearly tenfold between 2014 and 2019).

[11] Statement of Commissioner Ajit Pai, 31 FCC Rcd at 8279.

studied to determine the possibility of co-existence between future mobile services and the fixed point-to-point services currently used for mobile backhaul.

Importantly, all of the bands in the *Further Notice* have been identified as candidate bands for by the World Radio Conference for IMT-2020.[12] As the Commission has repeatedly recognized and as the ICT industry well knows, globally harmonized spectrum promotes efficiencies of scale, reducing costs for manufacturers, operators, and consumers alike.[13] It also creates potential opportunities for global roaming services which customers have increasingly capitalized upon in recent years.[14]

II. A COORDINATED APPROACH TO LICENSING THE UMFUS BANDS IS APPROPRIATE.

A large amount of spectrum is at issue in this proceeding. In the *Further Notice*, the Commission proposes to open 8,000 MHz of spectrum in bands between 24 GHz and 53 GHz, plus potentially another 10,000 MHz in the 70/80 GHz bands. This follows the opening of 10,850 MHz of spectrum in the 28 GHz, 37 GHz, 39 GHz, and 64-71 GHz bands in the *Report and Order*. Providing some commonalities in licensing and access rights across all of the

[12] *See* Report and Order ¶ 16, 31 FCC Rcd at 8023 (listing bands for study in time for WRC-19 for use in IMT-2020); *see also* FNPRM ¶ 372, 31 FCC Rcd at 8145 ("we believe it is now appropriate to seek comment on proposing mobile service rules for most of the bands identified at the 2015 World Radio Conference").

[13] *See, e.g.*, FNPRM ¶ 383, 31 FCC Rcd at 8148 ("[t]he existing manufacturing base and global harmonization of [the 24 GHz] band make it an attractive option for mobile use"); *id.* at ¶ 389, 31 FCC Rcd at 8149 ("[g]lobal harmonization, in turn, will promote interconnection, roaming, and interoperability") (citing Comments of Samsung Electronics America, Inc. and Samsung Research America, filed Jan. 26, 2016 in GN Docket No. 14-177, at 15).

[14] *See, e.g.*, Juniper Research, *Mobile Roaming to Represent 8% of Global Operator Billed Service Revenues by 2018* (Mar. 2014), *available at* http://www.juniperresearch.com/press-release/mobile-roaming-pr1. In recognition of the increasing importance of global roaming, last year the ITU launched the LET'S ROAM THE WORLD Initiative to help coordinate national regulatory policies and bring down costs for consumers worldwide. *See* ITU International Mobile Roaming (IMR) Resources Portal, http://www.itu.int/en/ITU-D/Regulatory-Market/Pages/Roaming_info.aspx.

UMFUS bands will help facilitate technological innovation, potentially allow devices to operate more easily in several different bands, and allow the marketplace to develop as rapidly as possible.

A. Block Sizes Should Be 200 MHz and Larger Multiples Thereof.

While considering specific band plans for licensing millimeter-wave spectrum, the Commission must balance several factors, including:

- the need for broad, contiguous spectrum
- enabling multiple licensees to operate in the same market
- the variety of potential (and unknown) applications, and
- creating an efficient secondary market to facilitate re-purposing spectrum as needed.

To achieve a desirable balance, TIA urges the Commission to generally implement minimum block sizes of 200 MHz throughout the UMFUS bands.[15] But since the technologies, applications, and business models are still developing, having a variety of block sizes is also important.[16] Therefore, the Commission should also include some 400 MHz and 800 MHz blocks in appropriate bands. Coordinated band plans that incorporate all three block sizes will enable licensees to obtain the spectrum necessary for different types of applications, allow easy combination of blocks, allow manufacturers and network architecture designers to achieve efficiencies of scale, and facilitate simpler secondary market transactions.

Meanwhile, we recognize that pre-existing circumstances in particular bands may occasionally require creating 100 MHz blocks. It may be possible for such blocks to be usefully deployed for mobile service, potentially by making modifications to a standard UMFUS radio,

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[15] *See* Report and Order ¶ 94, 13 FCC Rcd at 8052 (collecting citations on the importance of blocks being at least 200 MHz in width).

[16] TIA NPRM Comments at 30 ("TIA urges the Commission to provide licensees with wide blocks of contiguous spectrum, and to offer *multiple different widths* so that service so that service providers can secure the spectrum best suited to their particular technology and business case") (emphasis added).

by using spectrum techniques such as "half-clocking," by simply aggregating multiple 100 MHz bands at a later time, or by eventually lifting any operating restrictions that may have given rise to the 100 MHz bands in the first place (*see* Section II-C below).[17]

In these comments, we propose specific band plans for each band comprised of 200 MHz, 400 MHz, and 800 MHz blocks, with occasional use of 100 MHz blocks where specific circumstances may potentially require them. A summary of our proposals is in Table 1:

Table 1 – Summary of TIA Band Plan Proposals

Band	Frequencies	Total Bandwidth	TIA Proposal
24 GHz	24.25-24.45 GHz (lower) 24.75-25.25 GHz (upper)	200 MHz (lower) 500 MHz (upper)	1 x 200 MHz (lower) 2 x 200 MHz (upper) 1 x 100 MHz (upper)
32 GHz	31.8-33.4 GHz	1600 MHz	4 x 400 MHz
37 GHz	37-37.6 GHz (lower)	600 MHz (lower)	6 x 100 MHz
42 GHz	42-42.5 GHz	500 MHz	2 x 200 MHz 1 x 100 MHz
47 GHz	47.2-50.2 GHz	3000 MHz	2 x 800 MHz 2 x 400 MHz 3 x 200 MHz
50 GHz	50.4-52.6 GHz	2200 MHz	5 x 400 MHz 1 x 200 MHz
70/80 GHz	71-76 GHz 81-86 GHz	5000 MHz (70 GHz) 5000 MHz (80 GHz)	N/A N/A

These proposed band plans, which are described in more detail in Section II-C below, correspond well with the 200 MHz block size the Commission adopted for the 37 GHz and 39 GHz bands in the *Report and Order*, as shown in Table 2:

Table 2 – Band Plans from *Report and Order*

Band	Frequencies	Total Bandwidth	Report and Order
28 GHz	27.5-28.35 GHz	850 MHz	2 x 425 MHz
37 GHz	37.6-38.6 GHz (upper)	1000 MHz (upper)	5 x 200 MHz
39 GHz	38.6-40 GHz	1400 MHz	7 x 200 MHz
64-71 GHz	64-71 GHz	7000 MHz	unlicensed

[17] *See also* FNPRM ¶ 455, 31 FCC Rcd at 8172 (observing that some commenters believe services could be offered in 100 MHz blocks if necessary).

Finally, we recognize that other block size proposals could also work. However, the Commission should always recognize that it must balance the desirability for larger block sizes to support more robust capabilities with its other policy goals, including the opportunity for multiple licensees in a band where possible.

B. Guard Bands Are Not Necessary.

In several cases, the Commission seeks information regarding the appropriateness of guard bands to protect specific adjacent services.[18] Certainly, more information regarding the specific nature of such services is required. But as a general matter, it should be possible to carefully craft UMFUS operating rules – via geographic coordination or other means – to enable UMFUS operations in bands adjacent to services that *may* require special protection such as radio astronomy or certain passive operations.

Therefore, guard bands should generally not be included in the band plans, particularly if doing so would frustrate the objective of constructing a coordinated block system built from 200 MHz, 400 MHz, and 800 MHz blocks. Nevertheless, the specific band plans presented below occasionally incorporate some "provisional" features, potentially including the placement of 100 MHz blocks at the lower and upper ends of a particular band. Such modified plans could provide workable options to avoid harmful interference while being consistent with overall block scheme, assuming that the Commission eventually deems such protections to be necessary.

[18] FNPRM ¶ 398, 31 FCC Rcd at 8152 (seeking comment on guard bands to protect services adjacent to the 32 GHz band); *id.* at ¶¶ 405-6, 31 FCC Rcd at 8154 (42 GHz band); *id.* at ¶ 416, 31 FCC Rcd at 8156-57 (47 GHz band); *id.* at ¶ 423, 31 FCC Rcd at 8158 (50 GHz band).

C. TIA's Proposals for Licensing Specific Bands.

1. 24 GHz Bands

TIA supports the Commission's proposal to add fixed and mobile allocations in both the 24.25-24.45 ("24 GHz Lower Band") and the 24.75-25.25 MHz ("24 GHz Upper Band") bands on a co-primary basis, and to authorize operations under the new UMFUS rules.[19] As the Commission notes, the existing satellite use of this band is very limited,[20] thus the existing coordination procedures for satellite operations in in the 25.05-25.25 GHz bands should suffice. TIA recommends converting existing licensees to UMFUS and repacking such licensees into the new band plan if necessary, with an appropriate transition period. These issues may be easier for the Commission to resolve now while the band still remains relatively unused.

Consistent with the overall approach described in Section II-A above, TIA supports the Commission's plan to license the 24 GHz lower band as a single 200 MHz block.[21] However, the Commission should license the 24 GHz upper band as two 200 MHz blocks and one 100 MHz block, rather than as two 250 MHz blocks. Moreover, to further minimize any potential conflict with existing licensees – and possibly reduce the amount of re-packing necessary – the upper band should be specifically licensed as follows: 24.75-24.85 GHz (100 MHz), 24.85-25.05 GHz (200 MHz), and 25.05-25.25 GHz (200 MHz).

2. 32 GHz Band

TIA supports the Commission's proposal to add fixed and mobile service allocations in the 32 GHz band.[22] As the Commission notes, the WRC-15 conference endorsed studying the

[19] *Id.* ¶ 383, 31 FCC Rcd at 8148.

[20] *Id.* ¶¶ 379, 384, 385, 31 FCC Rcd at 8146, 48.

[21] *Id.* ¶ 385, 31 FCC Rcd at 8148.

[22] *Id.* ¶ 389, 31 FCC Rcd at 8149.

band, which may lead to a globally-harmonized allocation during WRC-19.[23] We believe that the challenges regarding protection for in-band incumbent or adjacent radionavigation, radio astronomy, and ISS can be overcome through a variety of means. As a general matter, TIA agrees that such operations can be protected through the use of carefully crafted operating requirements and/or a well-crafted band plan.[24]

TIA disagrees, however, with Echodyne's claim that it is unlikely the 32 GHz band could be made available for mobile use.[25] Currently, there are no non-Federal licensees in the band despite an existing allocation for non-Federal radionavigation service from 32.3-33.4 GHz.[26] While the Commission may certainly proceed cautiously in crafting service rules, hypothesized developments in radionavigation cannot be a basis for blocking action entirely.

Consistent with the overall approach described in Section II-A above, TIA supports licensing the band as four 400 MHz blocks. However, to the extent the Commission ultimately determines that interference issues actually pose significant challenges in portions of the band, a modified band plan could mitigate or prevent future interference issues. Recognizing the Commission's iterative approach to this proceeding, a modified provisional plan would potentially permit new services to proceed sooner and/or under less stringent operating rules in those portions of the band posing fewer current challenges, even while other interference coordination issues are being resolved. Table 3 shows a potential approach:

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[23] *Id.*

[24] *Id.* ¶ 397, 31 FCC Rcd at 8152 (quoting ESOA Comments at 9).

[25] *Id.* ¶ 391, 31 FCC Rcd at 8150 (citing Echodyne Comments at 1060).

[26] *Id.* ¶ 386, 31 FCC Rcd at 8148-49.

Table 3 – Proposed 32 GHz Band Plan

Band	Incumbent Service	Incumbent Service	Provisional	Optimal
< 31.8 GHz	Radio astronomy	N/A	N/A	N/A
31.8-32.2 GHz	Radionavigation (Federal)	Space Research (Goldstone CA only)	100 MHz* 100 MHz** 200 MHz**	400 MHz
32.2-32.3 GHz			100 MHz**	400 MHz
32.3-32.6 GHz	Radionavigation (non-Federal)	Inter-Satellite Service	100 MHz** 200 MHz**	
32.6-33.0 GHz			400 MHz	400 MHz
33.0-33.4 GHz		N/A	400 MHz	400 MHz

* -- more stringent protection for radio astronomy if necessary
** -- could be combined into larger 200 or 400 MHz block(s)

3. 37 GHz Lower Band Segment

The Commission should not allow Federal users to claim priority access to 200 MHz of the 600 MHz lower band segment.[27] To begin with, the Commission opened the 37 GHz band in the first place because there are a "limited number" of Federal uses needing protection,[28] so granting additional protections for Federal uses is unsupported in the record. Moreover, since the 37 GHz band has now been designated for shared use anyway in the *Report and Order*, any hypothesized "critical defense or national security mission[s]" seem unlikely to develop here for tactical reasons, removing that as a justification for granting additional priority at this point. And of course, granting special Federal priority in any block of spectrum raises uncertainties for non-Federal licensees and may make deployments in this band segment less economical.

If the Commission's proposal for federal priority is adopted, only 400 MHz would be available to non-Federal licensees on an unrestricted basis in this band segment. Due to the resulting uncertainty, using 100 MHz blocks for this segment (with possibility for aggregation) may be appropriate to ensure an appropriate number of unimpaired licenses in each market.

[27] *Id.* ¶ 457, 31 FCC Rcd at 8172.

[28] Report and Order ¶ 101, 31 FCC Rcd at 8056.

However, if the Commission abandons its proposal for Federal priority access – as it should – then creating three 200 MHz blocks may be more appropriate.

4. 42 GHz Band

TIA supports the Commission's proposal to authorize fixed and mobile service operations in the 42 GHz band under the UMFUS rules.[29] Consistent with the approach from Section II-A above, the Commission should license the spectrum as follows: 42.0-42.2 GHz (200 MHz), 42.2-42.4 GHz (200 MHz), and 42.4-42.5 GHz (100 MHz). If the Commission eventually determines it to be necessary, the top 100 MHz may be subject to more stringent operating rules to protect adjacent radio astronomy operations in the 42.5-43.5 GHz band.

However, TIA does not support adding a completely new Federal allocation in the 42 GHz band.[30] The Commission's proposal is unsupported by any information in the record thus far, and it is unclear why the Commission would now establish such an allocation. But to the extent the Commission nevertheless adopts this approach, it should implement the simplest possible methods of sharing rather than a SAS-based approach (*see* Section III below).

5. 47 GHz Band

TIA supports the Commission's proposal to authorize fixed and mobile operations in the 47 GHz band under the UMFUS rules. As the Commission describes, the 47.2-48.2 GHz segment was previously designated for wireless operations in 1999 although no terrestrial service rules were established at that time.[31] In the same proceeding, the 48.2-50.2 GHz segment was

[29] FNPRM ¶ 403, 31 FCC Rcd at 8154.

[30] *Id.* ¶ 407, 31 FCC Rcd at 8155.

[31] *Id.* ¶ 408, 31 FCC Rcd at 8155 (citing *V-Band First Report and Order*, 13 FCC Rcd 24649, FCC 98-336 (1999)).

designated for FSS operations[32] alongside a co-primary Federal allocation, however no authorized Federal or non-Federal operations currently exist.[33]

Against this backdrop, TIA supports the Commission's proposal to allow one FSS earth station in the 48.2-50.2 GHz segment to operate on a co-primary basis within each PEA, subject to the conditions and limitations in other bands, similar to the 28 GHz framework.[34] Regarding sharing between FSS user equipment and terrestrial operations, the Commission should not adopt a SAS approach (*see* Section III below). Instead, the Commission should either adopt a first-come, first-served approach to interference protections or consider market-based mechanisms.

Meanwhile, TIA does not support the Commission's proposal for six 500 MHz blocks. Instead, with 3,000 MHz of contiguous spectrum available, the Commission should adopt a band plan that includes some larger 800 MHz blocks, as well as 400 MHz and 200 MHz blocks. Furthermore, radio astronomy operations in the 48.04-49.04 GHz band can eventually be protected by means of well-crafted service rules and/or potential exclusion zones. Nevertheless, and subject to further information about other spectrum uses in the band, TIA proposes a band plan in Table 4 that would maximize unrestricted utility for as many UMFUS blocks as possible while creating room to address potential interference issues:

[32] *Id*.

[33] *Id.* ¶ 411, 31 FCC Rcd at 8155.

[34] *Id.* ¶ 412, 31 FCC Rcd at 8156.

Table 4 – Proposed 47 GHz Band Plan

Band	Service	Service	Service	Provisional	Optimal
47.2-48.2 GHz	Designated for wireless High-altitude platform stations (47.2-47.5 & 47.9-48.2 GHz)	BSS feeder links		800 MHz 200 MHz	800 MHz 200 MHz
48.2-48.8 GHz	Designated for FSS plus federal allocation			200 MHz 400 MHz	200 MHz 400 MHz
48.8-49.2 GHz			Radio astronomy (48.94-49.04 GHz)	100 MHz 200 MHz* 100 MHz	400 MHz*
49.2-50.2 GHz				800 MHz 200 MHz	800 MHz 200 MHz

* more stringent protection for radio astronomy if necessary

6. 50 GHz Band

TIA supports authorizing fixed and mobile operations in the 50 GHz band under the UMFUS rules.[35] As with other bands involving federal allocations, TIA supports using the simplest possible service rules to coordinate sharing (*see* Section III below).

With 2200 MHz of spectrum available, the Commission should create five blocks of 400 MHz each plus one block of 200 MHz, consistent with the approach described in Section II-A above. Guard bands to protect passive services on either side of this band are unnecessary, but to the extent that any special operating restrictions in certain blocks are deemed necessary to protect either the lower adjacent or upper adjacent bands, the 200 MHz block should be placed at that end of the 50 GHz band (or two 100 MHz blocks on either end) to ensure that the larger 400 MHz blocks can operate without restrictions.

[35] *Id.* ¶ 420, 31 FCC Rcd at 8157

D. The 71-76 GHz and 81-86 GHz Bands Should Be Studied.

TIA agrees that with appropriate planning, it may be possible to use the 71-76 and 81-86 GHz bands to provide mmW mobile services.[36] However, it is essential that the established use of these bands for fixed point-to-point links should be permitted to thrive – and expand – since such links are critical for mobile backhaul applications. Indeed, the attractiveness of these bands for mobile backhaul is now rapidly increasing. They offer very wide bandwidth, enabling capacities on the order of 10 Gbps or more over distances of a few kilometers.[37]

While the prospect of mobile service in the bands is enticing, at present there are no studies showing that sharing between mobile and fixed point-to-point uses are possible. And while envisioned changes may bring the bands "into a realm that is at least potentially compatible" with both uses,[38] the Commission's analysis cannot substitute for more empirical evidence. Therefore, TIA urges the Commission to study (and encourage studies of) the potential for co-existence between mobile applications and point-to-point backhaul links. And while the Commission may be correct that sufficient coordination would occur when both types of operations are conducted by the same entity,[39] such testing should also encompass co-existence between different entities.

Regardless, the Commission should not disrupt a coordination system that is working well by attempting to establish a SAS. As the Commission itself observes, the existing "green-light / yellow-light" system has been effectively used in these bands for over a decade, the

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[36] *Id.* ¶¶ 436-437, 31 FCC Rcd at 8164.

[37] *See* Ericsson, *The Need for Spectrum Harmonization* (June 2016), at 2, https://www.ericsson.com/res/docs/2016/mobility-report/emr-june-2016-the-need-for-spectrum-harmonization.pdf

[38] FNPRM ¶ 436, 31 FCC Rcd at 8164.

[39] *Id.* ¶ 437, 31 FCC Rcd at 8164.

necessary technical data is already available in existing databases, and an automated system for Federal coordination has been operating successfully for years.[40] The agency should not prematurely implement a solution that lacks a problem, and certainly not before the viability of fixed-mobile co-existence has not yet been empirically established. Instead, TIA would support retaining the current first-in-time principle for coordination.

Finally, the Commission should not permit unlicensed indoor-only use in these bands.[41] At such an early stage, additional studies are still needed before *any* mobile applications can be permitted, let alone unlicensed use. Moreover, the risk for interference to outdoor backhaul from indoor uses needs more study before implementation. At least for now, the availability of 14 GHz of contiguous unlicensed millimeter-wave spectrum between 57-71 GHz is quite sufficient. However, if any indoor licensed use is eventually allowed, it should be registered in some manner to not only protect Federal users, but also to protect outdoor backhaul use.

III. FREQUENCY COORDINATION SHOULD UTILIZE THE SIMPLEST POSSIBLE METHODS.

TIA appreciates the Commission's ongoing efforts to develop new mechanisms for spectrum sharing in lower bands where spectrum is increasingly scarce. However, TIA believes that spectrum sharing and coordination in the millimeter-wave bands should be implemented using the simplest means necessary to enable non-Federal use of the bands.

As the Commission well knows, millimeter-wave mobile technologies are still in their nascent stage.[42] So a significant danger exists that layering on complicated and unnecessary

[40] *Id.* ¶ 439, 31 FCC Rcd at 8165.

[41] *Id.* ¶ 440, 31 FCC Rcd at 8167-68.

[42] Report and Order ¶ 1, 31 FCC Rcd at 8017 ("*recent technological breakthroughs* have newly enabled advanced mobile services in these bands") (emphasis added); *id.* at ¶ 15, 31 FCC Rcd at 8022 (describing recent technological developments including field trials in 2016).

coordination requirements at the outset may stifle development of the bands, undercutting the Commission's primary goal in this proceeding. This is particularly true since the future of millimeter-wave and Internet-of-Things use cases and business models remains unknown. Indeed, prematurely imposing complicated coordination mechanisms could render some potential new applications completely impossible, or at least not cost-effective, for deployment in certain bands.

Specifically, TIA has significant concerns regarding the use of spectrum access systems (SAS) in the millimeter-wave bands. To begin with, the SAS model recently adopted for the 3.5 GHz band still remains untried, and the fact that several parties have filed applications to become SAS administrators cannot be cited as evidence that the system will actually work well in practice.[43] Moreover, the 3.5 GHz band involved dynamic sharing between three access levels – federal incumbent users, priority access licensees (PALs), and general authorized access (GAA). This three-tier sharing scenario does not often present itself in the bands under consideration here, so the Commission simply has *no need* to mandate SAS solutions. And insofar as developed for 3.5 GHz, a SAS requirement may ultimately drive particular business models – but the Commission should not pick winners and losers without a clear justification for doing so.

As the Commission itself recognizes, the sharing environment in many of the bands under consideration in the *Further Notice* is relatively straightforward. For example, the 37 GHz band lower segment includes limited incumbent users, with Federal and non-federal users often having co-equal rights in the band,[44] while other bands have no current Federal uses at all.[45]

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[43] FNPRM ¶ 440, 31 FCC Rcd at 8165.

[44] *Id.* ¶ 449, 31 FCC Rcd at 8170-71.

[45] *Id.* ¶ 380, 31 FCC Rcd at 8146 (no Federal allocations in 24 GHz bands); *id.* at ¶ 400, 31 FCC Rcd at 8153 (no Federal allocations in 42 GHz band); *id.* at ¶¶ 408, 416, 31 FCC Rcd at 8155,

Therefore, simpler coordination mechanisms, such as traditional database-driven frequency coordination and/or first-in-time prioritization (as in the well-functioning 70/80 GHz bands) should be adopted instead. This will enable devices with lower cost and lower power consumption to be deployed in the band, as well as giving rise to different business models that may be more conducive to Internet-of-Things applications.

Finally, TIA agrees it may be often appropriate for both Federal and non-Federal users to comply with the same or similar technical requirements where possible,[46] and potentially to rely upon the same coordination mechanism.[47] This should be possible in the 37 GHz band, or certainly in the various bands where no Federal deployments yet exist. Unifying technical requirements would be consistent with an increased recognition that Federal and non-Federal users must work together to achieve more optimal spectrum utilization, albeit still using the simplest possible means. Such commonalities may be more difficult to achieve if the Commission were to adopt a SAS approach.

IV. PERFORMANCE REQUIREMENTS SHOULD ACCOUNT FOR EMERGING INTERNET-OF-THINGS APPLICATIONS.

A. Any Metrics Should Be Objective and Include Multiple Paths for Fulfillment.

TIA appreciates the Commission's acknowledgment that traditional performance metrics may not be effective in accommodating new and innovative services that may develop in the millimeter-wave bands.[48] As the Commission has recognized, developing a single unified metric

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8156 (no Federal allocation from 47.4-48.2 GHz, and an allocation but no currently authorized operations from 48.2-50.2 GHz).

[46] *Id.* ¶ 452, 31 FCC Rcd at 8171.

[47] *Id.* ¶ 453, 31 FCC Rcd at 8171.

[48] *Id.* ¶ 465, 31 FCC Rcd at 8174.

can be challenging since the nature of IoT and M2M applications is still emerging.[49] Indeed, true machine-to-machine communication may mean that network operators themselves may be unaware of the precise nature of all communications within the ambit of a particular license. Moreover, some applications may require large numbers of devices to be deployed densely in small areas, while others may achieve "meaningful service" using a small number of devices in a large area. Indeed, the potential use cases for IoT encompass a wide cross section of the economy, including logistics / supply chain, asset management, agriculture, connected vehicle and transportation, smart cities, health care, natural resources, etc.[50]

Since developing any *single* metric will be difficult or impossible, the Commission should instead provide licensees with multiple, objectively quantifiable performance benchmarks by which they can demonstrate that spectrum is being put to good use.[51] For example, establishing *three* different metrics – number of devices connected, volume of data transmitted, and number of sessions initiated – and then allowing licensees to demonstrate compliance with any of the three, would give licensees the flexibility necessary to implement radically different

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[49] Report and Order ¶ 203, 31 FCC Rcd at 8088 (finding that a unified metric "would not provide the flexibility necessary to support innovative uses of the spectrum," "would favor one deployment approach over another," and might also "deter investment and deployment in these bands").

[50] *See, e.g.*, Qualcomm, *Leading the World to 5G*, at 4-6 (Feb. 2016), *available at* https://www.qualcomm.com/media/documents/files/qualcomm-5g-vision-presentation.pdf (mentioning tactile Internet, virtual reality, wearables/fitness, utility metering, robotics, aviation, etc.); Nokia, *5G Masterplan – Five Keys to Create the New Communications Era*, at 16, *available at* http://info.networks.nokia.com/5GMasterplan_01.LP.html (augmented gaming, self driving, waste management, etc.); Samsung, *5G Vision*, at 2-3 (2015), *available at* http://www.samsung.com/global/business-images/insights/2015/Samsung-5G-Vision-0.pdf (Smart Home, Fitness & Healthcare, Smart Store, Smart Office, Connected Car); Verizon, *Reengineering the world*, available at http://www.verizonenterprise.com/resources/infographic/ig_som-iot-infographic_en_xg.pdf (diagram of many scenarios).

[51] TIA NPRM Comments at 27.

business plans. Alternatively, combining reporting on the number of devices served with reporting regarding the general type or nature of the connected devices may allow the agency to gradually develop a more useful corpus of data from which more sophisticated assessments may eventually be developed.

Moreover, premature enforcement of any performance requirements will tend to drive the millimeter-wave bands towards use cases for which equipment is available at the time when performance must be shown, rather than the highest and best use.[52] Since the technologies are not mature, the Commission should ensure that any performance requirements do not skew the market or chill innovation. Therefore, the Commission should not measure performance of UMFUS licensees until the expiration of their initial license term.[53]

B. Use It or Share It Requirements Will Hinder Innovation.

For similar reasons, the Commission should not adopt a "use-or-share" regime for the UMFUS bands. Given the nascent state of current technology, it is likely that many use cases will not be deployed into the UMFUS bands until the initial license term is well underway. As TIA has previously stated, the Commission does no one any favors when it encourages the deployment of new services on a secondary basis that are likely to be short-lived.[54] 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.[55]

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[52] *Id.* at 26.

[53] *Id.* at 26-27.

[54] *Id.* at 26 n. 56.

[55] *Id.*

Indeed, a use-or-share system could impose significant costs on licensees and device manufacturers. Licensees would incur costs to address potential interference issues, to identify harmful interference from errant devices attempting to use "shared" spectrum, and to implement the sharing system. Additional tracking and usage reporting would be required, along with any actual costs related to the sharing mechanism itself. And delays in implementing band-specific rules for such sharing could lengthen product development cycles as sharing requirements are ascertained and implemented.

In contrast, if a licensee does not intend to use its UMFUS spectrum, secondary market transactions will be available under current rules to allow use. And if the Commission adopts a coordinated approach to band plans as proposed above, a large amount of spectrum should become available in a marketplace with relatively low transfer costs that would otherwise harm liquidity. 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.

V. RESTRICTIVE OR UNCLEAR LICENSE CONDITIONS WOULD HARM NASCENT MMWAVE DEPLOYMENTS.

TIA urges the Commission to refrain from adopting restrictive licensing policies that, while perhaps more justifiable in lower bands, are simply not suitable for these bands at the present time.

A. Mobile Spectrum Holdings Limits Could Impede New Technologies.

We continue to agree with the Commission's original conclusion in the NPRM that mobile spectrum holdings limits would be premature absent a conclusion that the spectrum is

truly "suitable" and "available" for mobile services.[56] Moreover, adopting a coordinated approach to band plans, as proposed above, should greatly mitigate any concerns regarding spectrum concentration. The *Further Notice* proposes to make a large amount of spectrum available, and a coordinated scheme built on 200 MHz blocks should allow a robust secondary market to develop with relatively lower transaction overhead costs (re-provisioning equipment etc.) when spectrum is transferred between licensees.

Aside from legal or other policy considerations, however, imposing spectrum aggregation limits could also hinder technology developments in the bands. As TIA has stated, technologies for using millimeter-wave spectrum remain at the nascent stage of technological development, even as a vast array of potential use cases continues taking shape. For example, it is conceivable that operation of lower power, wider-band technologies – or even ultra-wideband-like operations – might ultimately gain some traction in the marketplace if allowed to develop without regulatory interference. Imposing rules limiting the amount of spectrum available to a single licensee could curtail development of such technology.[57]

If and when there is a market failure, the Commission can revisit the matter. Until then, it should allow technologists the widest panoply of options without artificially capping the amount of spectrum.

B. Continuous Broadcast of Station IDs Could Restrict Potential Applications.

The Commission should not require digital station identification by licensees, nor require that such identification be continuously broadcast by licensed equipment. Doing so could significantly affect device design by increasing power requirements, potentially impeding

[56] TIA Ex Parte Letter, filed July 7, 2016 in GN Docket No. 14-177, at 2 (citing TIA NPRM Comments at 28; NPRM ¶ 192).

[57] *Id.* at 2-3.

innovative applications that may be possible only through deploying low-duty-cycle devices. Instead, TIA believes that telecommunications standards bodies are better positioned to address this issue.

C. Manufacturers Need Guidance Regarding RF Exposure.

TIA re-iterates that the Commission should continue moving forward on RF exposure issues for the millimeter-wave bands, including through the KDB guidance process, to ensure that manufacturers have sufficient information to begin producing equipment without undue delays.[58] TIA looks forward to further collaboration with the Commission's Office of Engineering and Technology ("OET") regarding this issue.

[58] *See* TIA NPRM Comments at 34-35.

VI. CONCLUSION

The Commission continues to show extraordinary leadership in making the millimeter-wave bands available in response to emerging use cases and technological innovations. Due to this leadership, the United States is at the forefront of efforts around the world to bring these bands to the marketplace. But for the nation 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. The *FNPRM* offers the Commission to build on its positive work by opening more bands in a coordinated manner, although it 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.

Respectfully submitted,

TELECOMMUNICATIONS INDUSTRY ASSOCIATION

By: */s/ James Reid*

James Reid
Dileep Srihari
Telecommunications Industry Association
1320 North Courthouse Road, Suite 200
Arlington, VA 22201

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