

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
)	

REPLY COMMENTS OF THE SATELLITE INDUSTRY ASSOCIATION

Tom Stroup
President
Satellite Industry Association
1200 18th Street N.W., Suite 1001
Washington, D.C. 20036
(202) 503-1560

October 31, 2016

SUMMARY

Many of the higher bands identified for consideration in the *Further Notice* have existing co-primary allocations for the Fixed-Satellite Service (“FSS”) and are essential to the growth of the satellite industry. The satellite industry, in turn, plays a key role in the U.S. broadband ecosystem and is critical to achieving the longstanding goal of nationwide deployment of high-speed advanced communications services, ensuring that all Americans have access to equally high quality, affordable, and competitive broadband. Given the importance of FSS for true nationwide broadband connectivity, the recent opening of more than 10 GHz of spectrum for terrestrial networks, and the fact that 5G is still in the planning stages, there is no record on which to make informed judgments about how much, if any, additional millimeter wave (“mmW”) spectrum should be opened for terrestrial 5G. The proposed spectrum designations and service rules that favor mobile terrestrial wireless over the FSS are unwarranted and unnecessary.

As the lower satellite bands become saturated, the mmW bands have become critical growth bands for satellite services, in particular for the provision of broadband. Any plan for the mmW spectrum—not to mention nationwide broadband connectivity—must provide adequate spectrum, both exclusive and shared, and deployment flexibility to ensure that FSS can continue to expand to provide more customers with next generation access to broadband across the United States. The best sharing mechanisms may vary from band to band, and sharing may not be appropriate in all bands. The Commission’s overall goal should be to ensure that access to mmW spectrum is not a barrier when satellite and terrestrial service providers alike are ready to invest in launching new communications systems for 5G and other critical services, including those supporting safety of life services.

Opponents of the satellite industry’s proposal for satellite end user downlinks in the 37/39 GHz band appear to misinterpret the technical analysis supporting co-existence between FSS end user terminals and UMFUS devices in this band. The satellite industry proposes to employ the simplest form of spectrum sharing possible: end user terminals will only receive signals from spacecraft in this band. Through opportunistic receive operations in this band, this proposal completely avoids the risk of interference into UMFUS devices, and renders the nature of the spectrum use—widely deployed end user FSS earth stations—irrelevant. Analysis submitted by Boeing has shown that the much more distant emissions from FSS space stations operating at the pfd limits contained in the Radio Regulations of the International Telecommunication Union (“ITU”) will also not create a risk of interference to UMFUS base stations or user devices. Thus, there is no reason not to permit widely-deployed end user FSS terminals to receive signals from spacecraft in the 37/39 GHz bands.

As SIA explained in its comments, the Commission has previously designated the 40.0-42.0 GHz and 48.2-50.2 GHz bands on a primary basis for FSS operations, noting the need for FSS to be able to operate in its own spectrum, unimpeded by terrestrial operations, and to provide certainty for business planning. These two bands currently may be used for ubiquitously-deployed satellite user terminals. That is, today, any number of earth stations can be located anywhere, on a primary, protected basis in this band, and without being constrained by current or future terrestrial operations. These bands are vital for the V-band FSS networks being planned for the near term.

It is crucial to maintain the primary FSS designation in the 40.0-42.0 GHz band. In other words, satellite operators should continue to be able to deploy in this band unimpeded by wireless operations. Advocates for UMFUS in this band overlook several significant factors,

including that the 40.0-42.0 GHz band is an essential baseline, or core, band for FSS services operating opportunistically in other frequencies shared with UMFUS. For these reasons, the Commission wisely excluded the 40.0-42.0 GHz band from the scope of the *Further Notice*, and it should continue to decline invitations by some parties to consider allowing UMFUS in the 40.0-42.0 GHz band.

The frequencies from 47.2-50.2 (“47”) GHz band are a critical uplink band for satellite operations. Broadband satellite systems must have unfettered primary access in the 47 GHz band, particularly with respect to the 48.2-50.2 GHz portion of the band that currently is designated primarily for FSS and not for terrestrial service, and is set aside for the operation of transmitting satellite end user terminals that will be deployed ubiquitously to customer locations. Treating the entire 47 GHz band on the terms proposed in the *Further Notice* would impose an untenable restraint on the development of next-generation satellite networks and their ability to serve consumer needs. Satellite operators should be able to broadly deploy user terminals in this band.

In both the 47 GHz and 50.4-52.4 (“50”) GHz bands, satellite operators need flexibility to place individually licensed earth stations where they are needed. Because these bands constitute greenfield spectrum, SIA urges the Commission not to impose the same type of “three earth stations per license area” framework adopted for the 28 GHz Band. Proposals for “sharing” with terrestrial wireless that impose *ex ante* limits on the number or location of individually licensed earth stations would impose an unwise and unnecessary choice between two valuable services. Given the importance of this contiguous spectrum to FSS operations, and the importance of high-speed satellite services to the Commission’s broadband deployment goals, the Commission should take the time required to fully study the various sharing opportunities and measure the

rollout of UMFUS in other bands opened up by the *Report and Order* before proceeding with rules for deployment of UMFUS in additional mmW spectrum.

Substantial sharing possibilities with potential UMFUS operations in this band nevertheless exist. For instance, UMFUS devices could employ indoors-only uses. Fortunately, such an approach appears to be compatible with identified use cases expected for UMFUS. The alternative proposal of band segmentation is not a desirable option because FSS requires access to the entire 3 GHz bandwidth of the 47 GHz band for uplinks, as well as access to the 50 GHz band.

The satellite industry, and indeed nearly every other party in this proceeding other than the wireless industry, support the use of performance requirements and use-or-share rules to promote timely deployment and deter spectrum warehousing by terrestrial licensees in any bands addressed in this proceeding that are available for terrestrial operations on a primary basis, and satellite operations on a secondary basis. The geographic license area, performance requirements, and use-or-share rules are interrelated tools that the Commission should use together to achieve its spectrum management and service goals for the mmW spectrum.

CONTENTS

I.	THE FURTHER NOTICE COMMENTS DEMONSTRATE THE NEED TO ENSURE THAT SATELLITE SYSTEMS HAVE ACCESS TO SUFFICIENT SPECTRUM TO MAKE VERY HIGH DATA RATE BROADBAND SERVICES AVAILABLE NATIONWIDE.....	4
II.	OPPONENTS OF OPPORTUNISTIC SATELLITE END USER DOWNLINKS IN THE 37/39 GHZ BAND MISCHARACTERIZE THE ABILITY TO CO-EXIST	7
III.	THE COMMISSION MUST ENSURE UNFETTERED USE OF THE 40.0-42.0 GHZ BAND BY BROADBAND SATELLITE SYSTEMS.....	10
IV.	SATELLITE END USER TERMINALS REQUIRE ACCESS TO UPLINK SPECTRUM IN THE 47 GHZ BAND AND GEOGRAPHIC FLEXIBILITY TO LOCATE USER TERMINALS.....	12
V.	SATELLITE COMMENTERS HAVE MADE STRONG PROPOSALS FOR SHARING BETWEEN UMFUS AND SATELLITE EARTH STATIONS IN THE 50 GHZ BAND.....	14
VI.	THE COMMISSION SHOULD REVISE ITS RULES TO FACILITATE SATELLITE UPLINK OPERATIONS IN THE 24 GHZ BAND	17
VII.	THE COMMISSION SHOULD DISREGARD THE RECENT TECHNICAL ANALYSIS CLAIMING TO SHOW POTENTIAL FOR SATELLITE EARTH STATION INTERFERENCE IN THE 28 GHZ BAND	18
VIII.	TERRESTRIAL PERFORMANCE REQUIREMENTS AND USE-OR-SHARE RULES ARE NECESSARY TO PROMOTE TIMELY DEPLOYMENT AND PREVENT SPECTRUM WAREHOUSING.....	19
IX.	CONCLUSION.....	22

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

REPLY COMMENTS OF THE SATELLITE INDUSTRY ASSOCIATION

The Satellite Industry Association (“SIA”)¹ hereby submits these reply comments in response to the Commission’s Further Notice of Proposed Rulemaking (“*Further Notice*”) in the above referenced proceeding.²

¹ These reply comments are supported by all SIA members except for DIRECTV, which abstains from participation.

The record in this proceeding demonstrates that the new proposed allocations and designations for mobile terrestrial wireless under consideration in the *Further Notice* would be premature and unduly disrupt the plans of the satellite industry for new broadband networks operating in the V-band. The *Further Notice* states that its objective is to make multiple bands available for the wide variety of services being offered.³ The proposals in the *Further Notice*, however, would designate bands for services that are still in the nascent stages of technology development, which encourages leaving spectrum underused for the foreseeable future and introduces inefficiencies in spectrum use and geographical deployment.

Many of the bands identified for consideration in the *Further Notice*, including 24 GHz, 47 GHz, 50 GHz, and 70/80 GHz, have existing co-primary allocations for the Fixed-Satellite Service (“FSS”). Satellite operators and manufacturers have demonstrated in the record that this spectrum is critical to support numerous next-generation, high-throughput broadband satellite systems, which will support 5G and other vital services. Accordingly, satellite operators must

SIA is a U.S.-based trade association providing representation of the leading satellite operators, service providers, manufacturers, launch services providers, and ground equipment suppliers. Since its creation twenty-one years ago, SIA has advocated on behalf of the U.S. satellite industry on policy, regulatory, and legislative issues affecting the satellite business. SIA Executive Members include: The Boeing Company; DIRECTV; EchoStar Corporation; Intelsat S.A.; Iridium Communications Inc.; Kratos Defense & Security Solutions; L-3 Electron Technologies, Inc.; Ligado Networks; Lockheed Martin Corporation; Northrop Grumman Corporation; OneWeb; SES Americom, Inc.; Space Exploration Technologies Corp.; SSL; and ViaSat, Inc. SIA Associate Members include: ABS US Corp.; Artel, LLC; COMSAT Inc.; DigitalGlobe Inc.; DRS Technologies, Inc.; Eutelsat America Corp.; Global Eagle Entertainment; Glowlink Communications Technology, Inc.; Hughes; iDirect Government Technologies; Inmarsat, Inc.; Kymeta Corporation; O3b Limited; Panasonic Avionics Corporation; Planet Labs Inc.; TeleCommunication Systems, Inc.; Telesat Canada; TrustComm, Inc.; Ultisat, Inc.; and XTAR, LLC.

² Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, GN Docket No. 14-177, *Report and Order and Further Notice of Proposed Rulemaking*, FCC 16-89 (Jul. 14, 2016) (“*Further Notice*” or “*Report and Order*”).

³ *Id.*, ¶¶ 4, 7.

have continued access to these bands to bring the benefits of satellite broadband services to United States users.

In contrast, the comments by the wireless industry indicate that there are currently no planned uses for the bands above 40 GHz, let alone technologies far enough along in the development stages for deployment in the near future to be considered feasible or realistic. The *Further Notice* submissions do not provide any evidence of terrestrial mobile services that are readily deployable in these upper bands, nor of any agreed upon set of technical standards by which to define these integrated services. Without a demonstration that the wireless industry is prepared to make immediate, effective, and intensive use of the spectrum above 40 GHz, the record does not show that more spectrum allocations or designations are necessary, or even moderately helpful, to enabling the advancement of 5G.

Given the disparity between actual FSS systems currently being designed and built for operation in the millimeter wave (“mmW”) bands and the lack of tangible technologies, business plans, or investment to demonstrate future terrestrial wireless use, the redesignation of spectrum in these bands for terrestrial purposes at this juncture is not supportable. More importantly, the current regulatory environment does not foreclose terrestrial use of portions of the V-band should wireless operators opt to design their 5G systems based on the characteristics of the high mmW frequencies; it merely requires them to coordinate and protect primary and secondary operations in certain bands from any harmful interference that their new services may generate. Thus, the Commission should refrain from redesignating any more spectrum for terrestrial purposes in the V-band until there is a demonstrable need to meet the demands for a particular terrestrial application.

I. THE FURTHER NOTICE COMMENTS DEMONSTRATE THE NEED TO ENSURE THAT SATELLITE SYSTEMS HAVE ACCESS TO SUFFICIENT SPECTRUM TO MAKE VERY HIGH DATA RATE BROADBAND SERVICES AVAILABLE NATIONWIDE

As the Ka-band and other current satellite bands have become increasingly saturated, the satellite industry is designing and constructing hardware to use the 37.5-52.4 GHz (“V-band”) range as the primary growth band for a new generation of satellite services. In order to continue to fulfill their varied and important role, and to expand their capabilities to meet future needs, satellite operations require access to new spectrum, both exclusive and shared.

Satellite services today meet a range of customer needs, both in parallel with terrestrial services and in places where terrestrial service cannot or will not go. For example, ViaSat and EchoStar provide broadband service to approximately two million residential and business customers, as well as government, public safety, educational, and healthcare users.⁴ O3b currently uses the mmW bands to provide high capacity, low latency fiber-like broadband connectivity, which not only enables 3G/4G/LTE offerings where traditional terrestrial networks do not reach but also provides mobile backhaul for terrestrial operators.⁵

Satellite service is particularly valuable “on the move,” serving vehicles, vessels at sea, and aircraft. ViaSat uses mmW spectrum to provide high speed, video-capable broadband to commercial and government aircraft in flight.⁶ Satellite services are also a key input to terrestrial

⁴ Comments of Echostar Satellite Operating Corporation and Hughes Network Systems, LLC, GN Docket No. 14-117, at 3 (Sep. 30, 2016).

⁵ Comments of O3b Limited, GN Docket No. 14-117, at 3 (Sep. 30, 2016) (“*O3b Comments*”).

⁶ Comments of ViaSat, GN Docket No. 14-177 at 2 (Sep. 30, 2016) (“*ViaSat Comments*”).

wireless, providing high-capacity traffic offloading, backhaul, and other networking capabilities that enable current 4G operations and will be critical to the deployment of future 5G services.⁷

Satellites also provide “mission critical safety services for government and public safety officials, highly reliable machine-to-machine (“M2M”) communications relied upon by diverse scientific and industrial sectors,” and broadband service and entertainment offerings to millions of American businesses and households, all delivered with service quality equal to or greater than that offered by terrestrial systems.⁸

Finally, as Boeing notes, current and future satellite services will “provide much needed assurance that mmW spectrum will be used expeditiously to serve all Americans...and not just those ‘in densely populated areas.’”⁹ One of satellite’s greatest strengths is that it provides service widely and equally, making it a critical tool in the Commission’s efforts to fulfill its statutory mandate of encouraging the deployment of advanced telecommunications capability “to all Americans.”¹⁰ The concept of “Fifth Generation” service is necessarily broader than terrestrial wireless. As Inmarsat explains, 5G is not a “single technology, set of frequency bands, or business model.”¹¹ Instead, 5G refers to an integrated ecosystem of always on, ubiquitously

⁷ *Id.*

⁸ Comments of Inmarsat, Inc., GN Docket No. 14-177, at 3 (Sep. 30, 2016) (“*Inmarsat Comments*”).

⁹ Comments of The Boeing Company, GN Docket No. 14-177, at 4 (Sep. 30, 2016) (“*Boeing Comments*”) (citing Letter from Brian M. Josef, Assistant Vice President, Regulatory Affairs, CTIA, GN Docket No. 14-177, at 2 (May 24, 2016)).

¹⁰ 47 U.S.C. § 1302(a); *see* Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act, GN Docket No. 15-191, 2016 Broadband Progress Report, FCC 16-6, ¶ 1 (Jan. 29, 2016).

¹¹ *Inmarsat Comments* at 5.

available, high-speed connectivity. Satellite connectivity using mmW spectrum will play a diverse and integral role in extending the 5G paradigm beyond the customers and locations that have been reached by 4G.

This vision for the role of satellite communications is consistent with, and indeed complementary to, the role of terrestrial wireless in 5G. The uncomfortable truth for the wireless industry is that the record in this proceeding evidences no clear plan or vision for how this higher band spectrum will be used terrestrially. As CTIA has explained, “many questions remain about how the millimeter wave bands will ultimately be put to use.”¹² And Qualcomm put it more bluntly when it stated that “it is currently unknown how licensees will use their new flexible use rights.”¹³

To the extent that terrestrial wireless technology will be deployed in these bands, proponents acknowledge that terrestrial services in mmW spectrum are likely to be used for overlay capacity in densely populated areas, not to create nationwide coverage. Comments in response to the *Further Notice* underscore the limited coverage contemplated for UMFUS. For terrestrial wireless, CTIA explains that “the primary opportunity for mmW deployment is in areas with the greatest population density.”¹⁴ CTIA states that mmW bands “will help strengthen 5G network capacity,” likely where demand is high and re-use can be maximized, but “mid- and low-band spectrum will continue to drive network coverage.”¹⁵ Comments from Qualcomm

¹² Comments of CTIA, GN Docket No. 14-177, at 19 (Sep. 30, 2016) (“*CTIA Comments*”).

¹³ Comments of Qualcomm Incorporated, GN Docket No. 14-177, at 15 (Sep. 30, 2016) (“*Qualcomm Comments*”).

¹⁴ See Letter from Scott K. Bergmann (CTIA) to Marlene H. Dortch, GN Docket No. 14-177, at 2 (May 20, 2016).

¹⁵ *CTIA Comments* at 3.

confirm this approach, noting that “5G operations in spectrum bands above 24 GHz will provide ultra-high-speed service in high-traffic areas, supplementing 5G and 4G services that use sub-6 GHz spectrum to provide coast-to-coast connectivity.”¹⁶

The comments of terrestrial wireless and satellite providers show that the substantial demand for increased broadband capacity in some areas and coverage in the rest of the nation cannot be met by any one technology. Terrestrial services using mmW spectrum may provide substantial and impressive capacity improvements in the densest population centers, but simply will not push these advances far out into many suburban areas, or the rural, remote, and tribal areas that have consistently been the last to receive the benefits of modernizing infrastructure. To achieve the full promise of a 5G future, the Commission’s plan for these bands must accommodate the needs of satellite, maritime and airborne platform, and terrestrial wireless operators, which can be accomplished through reasonable and equitable sharing approaches in certain portions of this spectrum, as detailed above. The Commission can and should take advantage of the relevant technical characteristics of terrestrial wireless, airborne platforms, and satellite networks and the potential for enhanced spectral efficiencies by supporting opportunities for reasonable and equitable sharing strategies in certain portions of the V-band that can maximize service and extract the most utility from limited spectrum.

II. OPPONENTS OF OPPORTUNISTIC SATELLITE END USER DOWNLINKS IN THE 37/39 GHZ BAND MISCHARACTERIZE THE ABILITY TO CO-EXIST

Comments by some parties appear to misunderstand or mischaracterize the satellite industry’s proposal for the opportunistic operation of satellite end user downlinks in the 37/39 GHz bands. The proposal takes advantage of the simplest form of spectrum sharing possible:

¹⁶ *Qualcomm Comments* at 4.

end user terminals will only *receive* signals in this band. Because the end user terminals will not transmit in the 37/39 GHz band, it is physically impossible for end user terminals to cause harmful interference to (or be detected at all by) UMFUS user devices or base stations. SIA therefore urges the Commission to adopt opportunistic receive-only access by end user terminals in the 37/39 GHz band.

It is worth repeating: receive operations of end user terminals will not and cannot generate any potential for interference to UMFUS handsets or base stations. Nor will UMFUS operations be affected by the much more distant transmissions from FSS satellites, which appears to be of concern to Ericsson.¹⁷ As Boeing has explained, “[t]he same narrow beamforming that makes UMFUS communications possible in mmW spectrum facilitates sharing with satellite earth station receivers.”¹⁸ Boeing has also shown that multiple satellite systems can operate space-to-earth transmissions in the 37/39 GHz band using aggregate efd restrictions to prevent appreciable interference into UMFUS systems.¹⁹

SIA members have explained that the existing pfd limit in the FCC’s rules on satellite downlinks in the 37/39 GHz band was based on the state of terrestrial fixed service technology more than 15 years ago, and well before the concept of 5G ever arose. Moreover, the mobile services contemplated for 5G are vastly different than the fixed service antenna technology that appears to have driven the existing pfd limit. Namely, 5G terrestrial service antennas will operate with very low gain and will utilize MIMO techniques with adaptive beam forming and nulling capabilities. Moreover, 5G fixed base stations typically will be pointed downward and

¹⁷ Comments of Ericsson, GN Docket No. 14-177, at 20 (Sep. 30, 2016) (“*Ericsson Comments*”).

¹⁸ *Boeing Comments* at 23.

¹⁹ *Id.* at 35-50.

away from satellite downlinks, and any alignment of co-frequency mobile antennas with satellite downlinks would be fleeting.

Therefore, it seems highly likely that mobile 5G terrestrial operations could tolerate pfd levels higher than those in the existing FCC rules for the 37/39 GHz band segment. Based on analysis using 5G terrestrial system characteristics provided by the mobile wireless industry in this proceeding, ViaSat and Boeing have detailed how pfd levels consistent with the worldwide standard that are less restrictive than those the FCC currently applies in the 37/39 GHz band segment would be fully compatible with 5G and other new mobile wireless services.

On the other hand, higher pfd limits could be critical to facilitating the deployment of a wider range of satellite networks and services at 37/39 GHz and enable more intensive use of spectrum without inhibiting 5G terrestrial deployment. Thus, neither receiving end user earth stations nor transmitting satellites will create a risk of interference to UMFUS base stations or user devices in the 37/39 GHz band.

Certain terrestrial wireless industry commenters do appear to recognize this. Ericsson acknowledges that “FSS user equipment would have no expectation of interference protection, and thus in theory would not burden primary terrestrial users and let the secondary user accept the risk of interference.”²⁰ Ericsson notes, however, that receiving FSS end user terminals may suffer interference from UMFUS operations. The satellite industry has substantial experience and well tested techniques for operating in uncertain spectral environments. As Boeing explained, mitigations such as “satellite diversity, physical screening, [and] directional nulling” are standard spectrum sharing techniques that work both among satellite users and with

²⁰ *Ericsson Comments* at 20.

terrestrial sources of interference.²¹ Other commenters have acknowledged that this approach is feasible and beneficial. Huawei concurs that “sharing among both common and disparate services” will require the “willingness of all parties to take coordinated action to share spectrum assignments” and that techniques such as “beamforming, antennas and power-control, and dynamic operation...will ensure the continuing enablement of new services and opportunities without a universal need for exclusivity in all spectrum assignments.”²²

SIA therefore urges the Commission to remove the prohibition on satellite end user terminals that exists in footnote 3 of Section 25.202(a)(1) of the Commission’s rules and permit end user FSS terminals to receive signals in the 37/39 GHz band. Through this simple “opportunistic use” spectrum sharing strategy, FSS and UMFUS can both make intensive use of the 37/39 GHz band, maximizing the value of this limited resource and bringing the most service to the most people.

III. THE COMMISSION MUST ENSURE UNFETTERED USE OF THE 40.0-42.0 GHz BAND BY BROADBAND SATELLITE SYSTEMS

The Commission has repeatedly emphasized that the 40.0-42.0 GHz band is a core growth band for satellite services,²³ and satellite system operators are already planning systems

²¹ *Boeing Comments* at 23.

²² Comments of Huawei Technologies, Inc. (USA) and Huawei Technologies Co., Ltd., GN Docket No. 14-177, at 9 (Sep. 30, 2016) (“*Huawei Comments*”).

²³ *See, e.g.*, 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, IB Docket No. 97-95, Report and Order, FCC 98-336 ¶¶ 32 (1998); 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, IB Docket No. 97-95, Second Report and Order, FCC 03-296 ¶ 14 (2003) (“*V Band Second Report and Order*”) (consolidating FSS spectrum in the 40.0-42.0 GHz bands to promote FSS deployment and development in the band).

that will operate in this spectrum.²⁴ The Commission appears to have recognized the importance of ensuring that the 40.0-42.0 GHz band is kept available for broadband satellite systems, and has wisely excluded the 40.0-42.0 GHz band from the scope of the *Further Notice*. Therefore, calls by some parties to consider allowing UMFUS in the 40.0-42.0 GHz band are clearly outside the scope of the current proceeding and the Commission should focus on FSS in this band.

Nonetheless, SIA feels the need to substantively address the comments of several terrestrial wireless industry commenters, who have suggested that, if sharing is feasible between UMFUS and satellite earth station receivers in the 37/39 GHz band, such sharing likely could work in the 40.0-42.0 GHz band on the same terms.²⁵ These arguments overlook the critical importance of the 40.0-42.0 GHz band for satellite services.

The 40.0-42.0 GHz band serves as a necessary core band for satellite systems to use for both user terminals and individually licensed earth stations at times and locations where 37/39 GHz frequencies are unavailable. In the 37/39 GHz band, SIA has proposed only opportunistic access by the receive operations of FSS user terminals,²⁶ meaning that FSS user terminals may be able to successfully receive their desired transmissions in many co-frequency conditions involving nearby UMFUS operations, but they would not be able to function successfully in all co-frequency configurations. In those situations in which satellite earth stations will not be able to receive 37/39 GHz band signals successfully, satellite operators must be able to switch those

²⁴ *ViaSat Comments* at 15.

²⁵ See *CTIA Comments* at 13, *Ericsson Comments* at 11, *Huawei Comments* at 6; Comments of T-Mobile, GN Docket No. 14-177, at 5 (Sep. 30, 2016) (“*T-Mobile Comments*”), Comments of Straight Path Communications Inc., GN Docket No. 14-177, at 5-6 and 7 (Sep. 30, 2016).

²⁶ Existing rules similarly permit the non-interference-protected operation of earth stations in the 37/39 GHz band. See *Report and Order*, ¶ 58; see also *id.* at Appendix A, 47 C.F.R. § 25.136(a), (b).

earth stations to other frequencies in which they can reliably receive service on a primary and unfettered basis in order to avoid service interruptions to subscribers. The current terms for satellite use of the 40.0-42.0 GHz band provide this assured capacity.

SIA therefore reiterates that the Commission has repeatedly declared that the 40.0-42.0 GHz band is a core growth band for satellite services and acted on this designation by excluding the 40.0-42.0 GHz band from the *Further Notice*. Attempts to revisit this matter should not be addressed, and the Commission should continue its focus on FSS in this band.

IV. SATELLITE END USER TERMINALS REQUIRE ACCESS TO UPLINK SPECTRUM IN THE 47 GHz BAND AND GEOGRAPHIC FLEXIBILITY TO LOCATE USER TERMINALS

As SIA detailed in its Comments, the Commission has previously designated the 48.2-50.2 GHz and 40.0-42.0 GHz bands for FSS operations, noting the need for FSS to be able to operate in its own spectrum, unimpeded by terrestrial operations, and to provide certainty for business planning purposes. ITU footnote 5.516B identifies two gigahertz of uplink spectrum for high-density FSS operations in the V-band, 48.2-50.2 GHz (Earth-to-space), paired with 40.0-42.0 GHz (space-to-Earth). The *Further Notice* acknowledges this international identification and recognizes that the 48.2-50.2 GHz band is intended to be used in conjunction with the 40.0-42.0 GHz band for V-band FSS operations. Indeed, some SIA members have been making next-generation system plans based on these longstanding primary satellite designations under the Commission's existing band plan. SIA also emphasized that the 47.2-48.2 GHz band immediately adjacent to this range is also allocated for FSS Earth-to-space operations in the United States and internationally, and provides valuable spectrum capacity and additional sharing capabilities for FSS operators. Thus, SIA requested that the Commission consider the

entire range of 47.2-50.2 (“47”) GHz in evaluating ways to address FSS end user uplink operations in the V-band.

In other words, the 47 GHz band, together with the 40.0-42.0 GHz band, provide an allocation pairing that is intended to ensure sufficient spectrum and regulatory certainty to promote satellite investment and deployment.²⁷ This investment is already well underway. In 2013, Inmarsat launched its Alphasat satellite, which included experimental 48 GHz capabilities.²⁸ O3b “has long planned to use the entire 47 GHz Band for gateways to support growth of its global system beyond the capacity it can provide with beams in the available Ka-band spectrum—and well before the Commission’s decisions in the Report and Order.”²⁹ Boeing recently applied for authority to launch and operate a next generation NGSO system in the V-band, which will communicate with ubiquitously deployed transmitting end user terminals to provide speeds well in excess of the Commission’s current broadband benchmark of 25 mbps down/3 mbps up.³⁰ Additional concrete proposals are likely once the Commission initiates a V-band NGSO processing round. These systems represent not only substantial investment in this spectrum but also a critical element of the nation’s high speed broadband infrastructure.

The continued growth of the satellite industry depends on access to sufficient uplink spectrum in the V-band for end user uplinks as well as aggregation and interconnection facility uplinks—namely the entire 3 GHz range of the 47 GHz band as well as 2 GHz in the 50 GHz

²⁷ *Report and Order*, ¶ 58.

²⁸ *Inmarsat Comments* at 17.

²⁹ *O3b Comments* at 5.

³⁰ Application of The Boeing Company for to Launch and Operate a Non-Geostationary Low Earth Orbit Satellite System in the Fixed Satellite Service, IBFS File No. SAT-LOA-20160622-00058 (Jun. 22, 2016).

band. SIA therefore strongly recommends that the Commission explore compatible UMFUS applications such as indoor-only uses in the 47 GHz band, in lieu of a band segmentation approach such as that proposed in the *Further Notice*.³¹ An indoor proposal appears to be compatible with some of the potential use cases expected for UMFUS. As Huawei notes, “studies have confirmed the usefulness of mmW channels for indoor communications, particularly for offices and malls.”³² Other studies have shown that even widespread and intensive use of UMFUS indoors would still preserve useful spectrum for FSS outdoors because “30 GHz is a breakpoint with respect to radio signal penetration through walls from outdoors to indoors.”³³ Such an approach would permit greater spectrum flexibility by FSS and UMFUS operators, and would result in more intensive use of the spectrum as FSS and UMFUS are able to leverage their differing but complementary use cases to share more spectrum at more locations.

V. SATELLITE COMMENTERS HAVE MADE STRONG PROPOSALS FOR SHARING BETWEEN UMFUS AND SATELLITE EARTH STATIONS IN THE 50 GHZ BAND

As SIA has repeatedly explained, the continued growth of satellite services requires spectrum policies that permit satellite operators to place individually licensed earth stations where they are needed. Proposals for “sharing” with terrestrial wireless that impose *ex ante* limits on the number or location of individually licensed earth stations would impose an unwise and unnecessary choice between two critical services. Satellite and terrestrial operators can share spectrum and both make productive use of this valuable resource under an appropriate regulatory regime that employs reasonable and equitable sharing terms. Indeed, commenters

³¹ *Further Notice*, ¶ 414.

³² *Huawei Comments* at 12.

³³ Comments of Microsoft Corporation, GN Docket No. 14-177, at 11 (Sep. 30, 2016).

from the FSS industry and terrestrial wireless have identified several reasonable sharing procedures that can expand the frequency ranges available to both services in the 50 GHz band.

As ViaSat notes, the “nascent” nature of 5G satellite and terrestrial technology in this part of the radio spectrum and the lack of refined propagation studies and models for these frequencies means that there is substantial technical work necessary to establish reliable compatibility assessments.³⁴ At the same time, however, the broad concepts of multiple spectrum sharing strategies are already known, and the Commission should focus its study on the following elements of a sharing strategy, which are conducive to continued growth of satellite services and UMFUS.

The Commission should not adopt strict limits on the number of earth stations per county or Partial Economic Area (“PEA”) in either the 47 or 50 GHz bands. This approach is needlessly restrictive of the deployment of earth stations. Various satellite operators have suggested potential alternatives. In exploring satellite and terrestrial wireless sharing in these bands, ViaSat urges the Commission to give careful consideration, conduct testing, and run simulations based on real-world assumptions before developing any terrestrial wireless/satellite sharing rules in the Further Notice bands. Inmarsat agrees that “permitting only one co-primary, individually licensed earth station in each PEA would be overly prescriptive and without cause.”³⁵ Notably, the 0.1 percent standard was adopted based on the unique conditions of the 28 GHz band,³⁶ and it certainly is not appropriate for the 48.2-50.2 GHz band, which is the core remaining spectrum designated for ubiquitously deployed transmitting earth stations and in which terrestrial service is

³⁴ *ViaSat Comments* at 10.

³⁵ *Inmarsat Comments* at 18.

³⁶ *See Report and Order*, ¶ 43.

not authorized. Boeing's analysis of its planned gateway locations has determined that, even with a large gateway count, required FSS gateway-to-UMFUS exclusion zones will affect less than 0.1 percent of the total population of the United States.³⁷ The necessary distribution of Boeing's gateways within counties or PEAs, however, exceeds the 0.1 percent limitation in many of those low-density counties or PEAs where 0.1 percent of the population consists of a relatively small number of people.

CTIA has called on the satellite industry to demonstrate "how the 50 GHz band could be used for satellite uplink services without causing harmful interference to 5G services."³⁸ In support of the various sharing strategies discussed above, Boeing provided the requested analysis in its comments on the *Further Notice*. As Boeing explained, its analyses over a range of possible assumptions produce potential exclusion zones from less than 1 kilometer to 5 kilometers based on propagation and line-of-sight conditions, for various interference to noise (I/N) ratios up to 0 dB.³⁹ Even this broad range of assumptions, however, shows that there is substantial opportunity for coexistence through reasonable accommodations.

Other terrestrial wireless advocates indicate that sharing in the 50 GHz bands is feasible, and support various strategies. In contrast, the segmentation proposal to "divide[] the band in two pieces where terrestrial and FSS are assigned priority in a predetermined manner could lead to inefficiencies where spectrum resources lie fallow."⁴⁰ Qualcomm recommends that the Commission "take advantage of the unique characteristics of millimeter wave RF propagation and

³⁷ *Boeing Comments* at 20.

³⁸ *CTIA Comments* at 13-14.

³⁹ *Boeing Comments* at 17-22.

⁴⁰ *Id.* at 9-10.

novel interference conditions...to enable successful spectrum sharing with satellite operations.”⁴¹ Lockheed Martin “urge[d] the Commission to avoid actions that constrain the development of these frequency bands” for a variety of different uses, including airborne platforms.⁴² SIA agrees that a categorical segmentation may not be needed in all bands and, subject to further study and appropriate sharing rules (including protection of satellites from aggregate uplink interference in bands shared with satellite Earth-to-space links), may not be needed in any of the mmW bands. The Commission and the FSS and wireless industries can do better after due study, as detailed above.

VI. THE COMMISSION SHOULD REVISE ITS RULES TO FACILITATE SATELLITE UPLINK OPERATIONS IN THE 24 GHz BAND

Similarly, as SIA stated in its comments, the 24.75-25.25 GHz band should be preserved for primary use by BSS feeder links and FSS earth stations with characteristics similar to BSS feeder links that operate subject to the same technical rules (collectively “24 GHz earth stations”). SIA demonstrated that such earth stations should not be required to limit their operations in order to protect future mobile terrestrial operations. Instead, introduction of UMFUS facilities should be allowed on a secondary basis or at most as co-primary subject to a common sense sharing framework that does not unduly constrain deployment of new earth stations.

To facilitate access by these satellite facilities and increase use of the available spectrum, the Commission should also revise Section 25.203(l) of its rules to allow 24 GHz earth stations to apply to operate anywhere in the United States, including areas subject to a terrestrial

⁴¹ *Id.* at 10.

⁴² Comments of Lockheed Martin, GN Docket No. 14-177, at 4 (Sep. 30, 2016) (“*Lockheed Martin Comments*”).

geographic license, as long as the earth station operator coordinates with existing fixed terrestrial operations.

Specifically, SIA proposes the following changes to Section 25.203(l):

(1) Applicants for feeder link earth station facilities operating in the 25.05-25.25 GHz band ~~may be licensed only in Economic Areas where no existing FS licensee has been authorized,~~ and shall coordinate their operations with 24 GHz fixed service operations if the power flux density of their transmitted signal at the ~~boundary of the site of a constructed and operational fixed service facility license area~~ is equal to or greater than -114 dBW/m^2 in any 1 MHz.

(1) When uplink adaptive power control is used, the EIRP used for calculation of the power flux density level should be the maximum possible, taking into account the adaptive power increase.

(2) The power flux density levels should be calculated based on the actual off-axis gain characteristics of the earth station antenna, and should assume free space propagation conditions.

(3) When determining whether the power flux density threshold limit is exceeded at the 24 GHz FS ~~boundary~~ operational facility licensing boundary, a feeder link earth station applicant must take into account not only the transmissions from its own antenna(s), but also those from any previously authorized feeder link earth stations. Thus, if the cumulative power flux density level at the FS ~~operational facility license boundary~~ operational facility licensing boundary is in excess of $-114 \text{ dBW/m}^2/\text{MHz}$, the earth station applicant must either modify its proposed operations such that this value is not exceeded, or enter into coordination with the affected FS licensee.

These changes will protect fixed terrestrial deployments while allowing 24 GHz earth stations to use otherwise fallow spectrum that is already allocated for primary satellite operations. Furthermore, the coordination criteria rely on the signal strength standards previously approved by the Commission to ensure adequate protection of fixed operations.

VII. THE COMMISSION SHOULD DISREGARD THE RECENT TECHNICAL ANALYSIS CLAIMING TO SHOW POTENTIAL FOR SATELLITE EARTH STATION INTERFERENCE IN THE 28 GHz BAND

Nokia recently submitted data on existing Ka-band earth stations in an attempt to re-litigate issues resolved in the *Report and Order*.⁴³ The Nokia analysis, however, is fundamentally flawed. Most significantly, the earth stations included in Nokia’s submission are not representative of the earth stations on which the recently-adopted 27.5-28.35 GHz band sharing rules are based. Those earth stations have yet to be deployed. Thus, the legacy technology that is the subject of Nokia’s measurements is not relevant to Nokia’s apparent attempt to raise questions about the Commission’s FSS-UMFUS spectrum sharing framework in the 27.5-28.35 GHz segment adopted in the *Report and Order*. Therefore, it is wholly irrelevant to any issues in the *Further Notice*.

VIII. TERRESTRIAL PERFORMANCE REQUIREMENTS AND USE-OR-SHARE RULES ARE NECESSARY TO PROMOTE TIMELY DEPLOYMENT AND PREVENT SPECTRUM WAREHOUSING

Predictably, most wireless commenters argue against performance requirements and use-or-share obligations. All of these arguments fail to account for the impact ineffective or non-existent performance requirements will have on spectrum use. O3b’s comments to the *Further Notice*, for example, observed that UMFUS’ limited geographic coverage in the mmW bands requires that performance requirements focus on the areas in which spectrum is unused by the licensee rather than the intensity of the use in areas actively served.⁴⁴ Facebook urges the Commission to adopt “meaningful and enforceable buildout requirements for all of the millimeter wave spectrum bands to ensure that licensed *spectrum is not underutilized*.”⁴⁵

⁴³ See Comments of Nokia, GN Docket No. 14-177 *et al.*, at 16-19, Appendix 2 (Sep. 30, 2016).

⁴⁴ See *O3b Comments* at 11-12.

⁴⁵ Comments of Facebook, Inc., GN Docket No. 07-117, at 7 (Sep. 30, 2016) (“*Facebook Comments*”) (*emphasis added*).

Qualcomm observes that “the core goal of a performance requirement is to ensure that wireless services are being provided and that *the spectrum does not lie fallow*.”⁴⁶

The proposed performance metrics may leave vast areas completely unserved—even in suburbs close to urban areas. Many commenters and the Commission itself have recognized that 5G terrestrial service is likely to be concentrated in urban areas of higher population.⁴⁷ Such limited deployment on an exclusive basis would fail to meet the requirements of Sections 307(b) and 309(j), affirmatively subverting a longstanding core national policy for radio communications.⁴⁸ The adverse impact of needlessly blocking otherwise productive use of the spectrum is apparent.

The arguments wireless industry stakeholders raise in opposition to use-or-share rules all revolve around illusory complications and speculative threats to efficiency. Some commenters argue that performance requirements and use-or-share rules are unnecessary because the secondary market rules will ensure that spectrum is used efficiently.⁴⁹ Those rules, however, neither assure that service will be provided nor ensure that willing providers will be able to access unused spectrum when they need it because there would not be a mechanism in place to quickly open up unused spectrum for other services. Others argue that UMFUS licensees need

⁴⁶ *Qualcomm Comments* at 14 (*emphasis added*).

⁴⁷ Qualcomm, for example, observes that most deployments in these bands are likely to be densified collections of small cells. *See Qualcomm Comments* at 13; *see also CTIA Comments* at 8; Comments of TIA, GN Docket No. 14-177, at 3, 18 (Sep. 30, 2016); Comments of AT&T, GN Docket No. 14-177, at 5-6 (Sep. 30, 2016).

⁴⁸ *See also* 47 U.S.C. 307(b). The original enactment of the Communications Act of 1934 required the Commission to distribute “licenses, frequencies, hours of operation and of power” among states and communities “to provide a fair, efficient and equitable distribution of radio service to each of the same.” *Id.*

⁴⁹ *See, e.g., Ericsson Comments* at 19; Comments of 5G Americas, GN Docket No. 14-177, at 14 (Sep. 30, 2016).

“certainty,”⁵⁰ even though the performance requirements adopted in the *Report and Order* are perhaps the most flexible and forgiving the Commission has ever imposed on licensees. Many of the same commenters argue that performance requirements and use-or-share rules may drive licensees to deploy inefficiently or rush to deploy⁵¹ or would limit “flexibility” and “innovation.”⁵²

Some wireless stakeholders argue that the still-to-be defined use cases for the mmW bands make it difficult or impossible to determine when spectrum is “in use.”⁵³ But these arguments have no technical foundation. They proceed from the notion that a licensee may be using enough spectrum in some places some of the time to justify precluding others from spectrum it does not use at all.⁵⁴ In fact, given the rapid attenuation of signals in the mmW bands, determining whether spectrum is actually being used is a straightforward technical task.

The question of who may access spectrum in areas unused by UMFUS licensees, and the rules for use, might vary based on considerations unique to each band. In any bands in which satellite uplinks are authorized to provide uplinks, use-or-share access must be conditioned on clear rules to protect satellites from uplink interference. In the 28 GHz band, use-or-share access

⁵⁰ *Ericsson Comments* at 19.

⁵¹ *CTIA Comments* at 20.

⁵² *Comments of Mobile Future*, GN Docket No. 14-177, at 2, 5-6 (Sep. 30, 2016).

⁵³ *CTIA Comments* at 20-21. CTIA further argues that there is no evidence that sharing will work in these bands. This is critical given that policy is for productive use of spectrum and the record reflects widespread agreement that UMFUS licensees are likely to leave large areas unserved in any scenario.

⁵⁴ *Cf.* *Comments of NCTA*, GN Docket No. 14-177, at 19 (Sep. 30, 2016) (arguing that “[t]he Commission should not “set some level at which a subdivision of a license area would be declared ‘used’ in its entirety and off-limits to opportunistic use” in an effort to allow a licensee room to expand its deployments).

must be restricted, at least initially, to FSS, for reasons explained in several of the *Further Notice* comments, including those of the SIA and O3b.⁵⁵ Any non-FSS use-or-share access must protect FSS and not restrict FSS deployment. Many of the commenters supporting use-or-share access to the UMFUS band advocate for a spectrum access system (“SAS”) or other dynamic sharing solutions.⁵⁶ Whether or not SAS-based sharing is appropriate must be determined for each band on a case-by-case basis. For the reasons explained in SIA’s comments, use of the 28 GHz band for purposes other than UMFUS and FSS, whether on an SAS basis or otherwise, must be conditioned on preventing interference to satellite receivers.

IX. CONCLUSION

Many of the higher bands identified for consideration in the Further Notice, namely the 24 GHz, 47 GHz, 50 GHz, and 70/80 GHz bands, have existing co-primary allocations for the FSS and are critical to the growth of the FSS. Satellite operators have invested billions of dollars into developing high data rate FSS technologies using many of these bands, which will be key to the Commission’s goal of achieving nationwide deployment of high-speed broadband. Given the importance of FSS service to broadband deployment, the fact that 5G wireless remains in a nascent stage, and the lack of any current terrestrial wireless operations or commercially available terrestrial wireless technology in many of these bands, SIA requests that the

⁵⁵Comments of the Satellite Industry Association, GN Docket No. 14-177, at 18 (Sep. 30, 2016); *O3b Comments* at 19-21. Qualcomm acknowledges that the unique characteristics of millimeter wave band propagation allows the Commission to permit successful sharing between terrestrial and satellite operation. *Qualcomm Comments* at 9-10.

⁵⁶ NCTA, for example, states that use-or-share access could be implemented using a database. *See NCTA Comments* at 17-18.

Commission take the time required to fully study the sharing opportunities before proceeding with rules for the deployment of UMFUS in additional mmW spectrum.

Respectfully submitted,

THE SATELLITE INDUSTRY ASSOCIATION

By: /s/ Tom Stroup
Tom Stroup
President
Satellite Industry Association
1200 18th Street N.W., Suite 1001
Washington, D.C. 20036
(202) 503-1560

October 31, 2016