Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Use of Spectrum Bands Above 24 GHz For Mobile Radio Services	)	GN Docket No. 14-177
	)	
Establishing a More Flexible Framework to Facilitate Satellite Operations in the 27.5-28.35 GHz and 37.5-40 GHz Bands	)	IB Docket No. 15-256
	)	
Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band	)	RM-11664
	)	
Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 To Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services	)	WT Docket No. 10-112
	)	
Allocation and Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands; Allocation of Spectrum to Upgrade Fixed and Mobile Allocations in the 40.5-42.5 GHz Frequency Band; Allocation of Spectrum in the 46.9-47.0 GHz Frequency Band for Wireless Services; and Allocation of Spectrum in the 37.0-38.0 GHz and 40.0-40.5 GHz for Government Operations	)	IB Docket No. 97-95

COMMENTS OF INMARSAT, INC.

Giselle Creeser
Director, Regulatory

M. Ethan Lucarelli
Director, Regulatory and Public Policy

INMARSAT, INC.
1101 Connecticut Ave. N.W., Suite 1200
Washington, D.C. 20036
(202) 248-5150

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COMMENTS OF INMARSAT, INC.

Inmarsat, Inc. ("Inmarsat") respectfully submits these comments in response to the Federal Communications Commission's ("Commission") Further Notice of Proposed Rulemaking ("*FNPRM*") in the above-captioned proceeding.[1] The *FNPRM* builds on the

[1] *Use of Spectrum Bands Above 24 GHz for Mobile Radio Services*, Report and Order and Further Notice of Proposed Rulemaking, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, FCC 16-89 (rel. Jul. 14, 2016) ("*Spectrum*

Commission's *Spectrum Frontiers Report and Order*[2] and explores how best to leverage additional spectrum bands above 24 GHz to promote advanced wireless communications. As discussed herein, in examining the options for utilizing higher frequency band spectrum, the Commission should recognize and facilitate the critical role that satellite services will play in their traditional and growing markets as well as within the fifth generation ("5G") wireless ecosystem.

I. INTRODUCTION AND SUMMARY

5G will support dramatic gains in capacity, connections for billions of devices, and unparalleled individual user experiences. 5G will drive the evolution of the Internet itself, powering the Internet of Things ("IoT") and bringing together disparate networks into one unified framework. This next generation of technology will diffuse intelligence, communication capabilities, and processing power across networks and mobile devices, empowering even the smallest of connected devices to run rich content and services. In short, 5G networks will drive realization of the hyper-connected Internet of everything world. And there will be no 5G future without globally available, advanced satellite broadband services.

Achieving the Commission's 5G vision will require a holistic approach that recognizes satellite services as an essential component and driver of global and inclusive 5G deployment. Building 5G networks will require supporting massive capacity and ubiquitous connectivity. Satellites will play a critical role alongside and in conjunction with terrestrial systems to enable the coverage and performance targeted by 5G networks. Satellites will address some of the

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Frontiers R&O and FNPRM").

[2] *Id.*

potential challenges for terrestrial networks by offering improved reliability, seamlessness, and versatility in areas urban as well as remote, on land, in the air, and at sea.

Beyond their role in the 5G ecosystem, satellite operators have a range of existing markets and services upon which they continue to build and innovate. Whether 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, broadband services (with greater performance than terrestrial systems) in the skies and at sea, or innovative information and entertainment offerings delivered to millions of American households, satellite communications touch nearly everyone's lives, often in ways that are not transparent to consumers. Current and future generations of satellite communications systems will expand these services, bringing new offerings and competition to existing markets.

Recognition of the critical role of satellite services for 5G and beyond should inform the Commission's assessment of the *FNPRM* proposals. The *FNPRM* proposes opening a number of current satellite bands to the Upper Microwave Flexible Use Service ("UMFUS"). As discussed herein, spectrum sharing with UMFUS can be achieved in some circumstances, so long as appropriate protections are put in place for satellite systems. In pursuing this path, however, it is critical that the Commission act deliberatively and avoid cannibalizing satellite spectrum or adopting short-sighted policies that ultimately will hinder 5G deployment and adoption. The Commission must first recognize as a fundamental principle that spectrum availability is not zero-sum. A successful regulatory regime cannot seek to add more capacity to terrestrial wireless networks simply by reducing available capacity for satellite services. Spectrum is too critical a resource not to be used in increasingly creative and intensive ways.

Rather than undermining satellite growth, the Commission should ensure sufficient spectrum availability and interference protection for current and future satellite systems. In any new band opened to UMFUS, the Commission should preserve any primary satellite allocations, and should consider opening the band to diverse satellite operations, at a minimum on a secondary basis, should there be no preexisting satellite allocation. In addition, given the vastly different characteristics of each of the proposed bands, including incumbent uses, adjacent services, and propagation characteristics, the Commission should individually examine the utility of each band for addressing future spectrum needs without predetermining technical rules and licensing regimes. In some cases, the best approach may be to introduce UMFUS on a secondary basis, if at all. In other bands, co-primary sharing between Fixed Satellite Service ("FSS") and UMFUS may be appropriate, based on a framework for mutual protection. In any event, however, the rules adopted in the *Spectrum Frontiers Report and Order* for the 28 GHz, 37-40 GHz, and 64-71 GHz bands, including the license areas for these bands, should not be applied reflexively to the additional bands proposed in the *FNPRM* without careful consideration.

II. COMMISSION ACTION IN THIS PROCEEDING SHOULD REFLECT A FORWARD-LOOKING APPROACH TO SPECTRUM MANAGEMENT THAT MAXIMIZES EFFICIENCY AND FLEXIBILITY FOR THE FUTURE—FOR SATELLITE SERVICES AS WELL AS TERRESTRIAL

It is a moment of revolutionary innovation in the satellite industry. New satellite broadband systems have been launched by numerous operators in recent years, including Inmarsat, Intelsat, ViaSat, O3b, EchoStar, and others. Equally importantly, each of these operators, and many more, are investing heavily in developing and deploying future systems that will bring even more capacity and innovation to the market. In some ways, the satellite industry is developing along similar lines to terrestrial wireless—demand is driving the development of greater broadband performance, increased mobility, more advanced devices, and lower prices.

What might once (mistakenly) have been considered by some to be an expensive, niche service with appeal to limited market segments, undeniably is evolving into a dynamic, fully-realized competitor and complement to terrestrial broadband solutions.

Satellite technology will be a key component to achieving the Commission's next generation communication goals, not just in rural and remote areas, but also in the densest urban environments, in the air, and at sea. The *Spectrum Frontiers Report and Order* was only the latest in a long line of Commission actions over recent years making available substantial spectrum resources for terrestrial wireless use, which have yet to be exploited by the wireless industry. At the same time, the satellite industry charges forward with developing and deploying new services in frequency bands that until recently were completely disregarded by the terrestrial wireless industry. As the Commission continues performing its spectrum management mission, it should take a careful, deliberative, technology neutral approach with respect to each new frequency band under consideration, ensuring that its actions promote efficiency and maximize public benefits, including by protecting and promoting satellite services.

A. Satellite Services Will Be Key to the Innovative, Always-On Wireless Ecosystem of the Future

Some discourse in the U.S. and elsewhere refers to "5G" as if it is little more than a direct extension or evolution of contemporary terrestrial mobile services. This concept is based on a fallacy: 5G is not a single technology, set of frequency bands, or business model. In fact, like each of the previous wireless generations, 5G refers instead to a new wireless connectivity paradigm—and satellite connectivity will play diverse and integral roles in the 5G paradigm. The only way the U.S. is going to be a world leader in 5G—as well as accomplish its broadband deployment goals, promote the development of the Internet of Things, provide mission critical communications capabilities to government, enterprise, and consumer users, and continue to

drive global innovation—is to ensure the continued availability of ample protected spectrum for satellite growth.

First generation wireless introduced mobile voice service. 2G was about affordable ubiquitous voice coverage and the beginning of text. With 3G, text became ubiquitous, (slow) Internet access on the phone became a reality, and the world saw the first smart phones. 4G has been about real broadband performance in a mobile device, social media, video, and the explosion of the app ecosystem. While the 5G paradigm has yet to be fully defined, we know that 5G will be focused on a seamless user experience and connectivity across a diversity of devices, transmission technologies, and frequency bands. A network of systems leveraging the latest connectivity solutions along with innovations like network virtualization, 5G will create a reality in which a consumer's phone, watch, car, house, and nearly any other object or device will be connected and interconnected all the time—possibly without her even knowing or caring which underlying network she is using at the moment.

Pursuant to this vision, there is no 5G future without satellite. Satellite connectivity, with its ubiquity, reliability, versatility, and increasing capacity, will be essential to creating this seamless connectivity experience. To identify just a few examples of how satellite communications will be inextricable from the 5G ecosystem:

- Satellite broadband systems will deliver high-bandwidth content and services directly to homes, planes, and people on the move, either competing directly with terrestrial broadband systems, or off-loading congestion from terrestrial wireless networks;
- High throughput satellite systems will provide backhaul and network capacity for microcells and other wireless access points extending the range of 5G networks far beyond where terrestrial systems will ever deploy;
- Satellite data broadcast solutions can send over-the-air updates simultaneously to entire fleets of connected cars and other devices, efficiently ensuring security and stability; and

- Global navigation satellite services ("GNSS"), in some cases with augmentation from commercial satellite systems, will provide essential network timing and location services essential to creating a seamless network experience.

Additionally, satellite connectivity, whether as a backhaul solution or as the access network for connected devices, will be an essential underlying platform for IoT devices, enabling multitudes of devices to remain connected to the overall system, including through low-power, low-bandwidth signaling that avoids congestion on terrestrial systems. As Inmarsat explained recently in comments submitted to the National Telecommunications and Information Administration ("NTIA"), satellite services will be key to unleashing the benefits and value of IoT in the near- and mid-term future.[3] Indeed, mobile satellite service ("MSS") operators have been enabling the IoT reality for years through M2M applications that drive efficiency in numerous critical industries, promote scientific and environmental research, and enable businesses to track, manage, and optimize resources across the globe.

Beyond 5G and IoT, satellite communications will continue to perform and build upon their longstanding role as the backbone for mission critical connectivity across government, industrial, and consumer sectors. Whether in the form of safety of life communications to planes and ships, cutting edge mobile broadband solutions for consumer and government users, connecting the unconnected, making possible the electronic newsgathering and content distribution that brings information and entertainment to every American, or countless other applications, satellite communications play an integral role in modern society. The rampant innovation underway in the industry is only going to increase the relevance of satellite

[3] Comments of Inmarsat, Inc., In the Matter of The Benefits, Challenges and Potential Roles for the Government in Fostering the Advancement of the Internet of Things, NTIA Docket No. 160331306-6306-01 (June 2, 2016) *available at* http://www.ntia.doc.gov/files/ntia/publications/inmarsat_comments_on_ntia_iot_public_notice_final.pdf.

communication in everyday life, but as with any other sector, its productivity depends on access to essential resources.

Realizing the vision of an integrated, highly-reliable, ubiquitous 5G ecosystem will be impossible without ample protected satellite spectrum. Delivering the diverse satellite solutions described above will depend upon having substantial spectrum resources to support both satellite user terminal and gateway operations. Moreover, use of this spectrum cannot be unduly restricted in terms of geography, power levels, or mobility, otherwise the capacity and seamlessness at the heart of the Commission's vision for next generation communications will be simply out of reach.

Viewed in this light, approaching spectrum management as a process of mediating zero-sum struggles between satellite and terrestrial systems over the same resources is unconstructive. It would be short-sighted to cannibalize one service for the sake of the other—especially when technology, deployment scenarios, and business models provide no evidence that this is necessary. Instead, forward-looking spectrum management solutions should focus on promoting coexistence and enabling all technologies to develop and thrive. Where spectrum sharing is possible, resources should be shared in a way that maximizes efficiency. However, policy decisions should be made with the understanding that satellite connectivity will be as essential to the communications ecosystem moving forward as new terrestrial networks, and thus the former should not be compromised in favor of the latter. Sufficient spectrum should be preserved to enable each technology to flourish without undue hindrance. As a matter of policy, the Commission should start from the presumption that in every new band it opens to UMFUS, it should also include co-primary FSS, and continue its analysis from there based on the specifics of the band.

B. The Commission Has Been Extremely Successful in Opening Up Spectrum for Terrestrial Wireless; Now It is Time for the Wireless Industry to Deploy

In exploring spectrum and technical requirements for next generation systems, the Commission should act deliberatively and keep pace with market realities. In recent years, the Commission has secured troves of low-band, mid-band, and high-band spectrum for terrestrial wireless use. Much of this spectrum has yet to be deployed commercially by the wireless industry. The time required for the wireless industry to research, develop, and deploy available and soon to be available spectrum resources creates much-needed space for the Commission to act deliberatively in the instant proceeding. While now is the time to begin examining the potential uses of higher frequency spectrum, acting with undue urgency simply to make even more spectrum available for terrestrial operations could hasten the Commission down a short-sighted path and threaten the future deployment and global harmonization of higher band spectrum for terrestrial and satellite services.

The Commission has been extremely successful in opening up spectrum for terrestrial wireless use. In February 2014, the Commission auctioned 10 MHz of H Block spectrum in the 1.9 GHz band for terrestrial fixed or mobile wireless use.[4] In January 2015, the Commission auctioned 65 MHz of high-band spectrum in the Advanced Wireless Service-3 ("AWS-3") band, generating approximately $45 billion in gross bids from 31 bidding entities.[5] Most recently, the Commission's *Spectrum Frontiers Report and Order* authorized terrestrial wireless operations in the 27.5-28.35, 37-40, and 64-71 GHz bands.[6]

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[4] *See Auction of H Block Licenses in the 1915-1920 MHz and 1995-2000 MHz Band Closes; Winning Bidder Announced for Auction 96*, Public Notice, 29 FCC Rcd 2044 (2014).

[5] *See Auction of Advanced Wireless Services (AWS-3) Licenses Closes, Winning Bidders Announced for Auction 97*, Public Notice, 30 FCC Rcd 630 (2015).

[6] *Spectrum Frontiers R&O and FNPRM* at ¶ 4.

Moreover, additional spectrum already is in the pipeline. The Commission's 600 MHz Incentive Auction, which currently is underway, has the potential to make available significant amounts of low-band spectrum currently used for over-the-air television broadcasting.[7] In addition, the Commission recently finalized the regulatory structure for the 3.5 GHz band, which will soon make available 150 MHz of spectrum for a variety of wireless uses.[8]

Given these developments, it is unsurprising that even the nation's Tier 1 wireless carriers have expressed satisfaction with their spectrum positions. AT&T has noted that building out its existing spectrum holdings will be sufficient to increase network capacity and help meet users' increasing data demands.[9] Verizon Wireless recognized that the company "has enough spectrum to handle consumer demand for mobile broadband capacity for the next few years," due largely to its spectrum acquisitions in the Commission's AWS-3 auction.[10] In explaining its decision to sit out the Incentive Auction, Sprint stated that the company "has the spectrum it needs to deploy its network architecture of the future."[11] T-Mobile, in turn, continues to boost its low-band spectrum holdings through the secondary market.[12]

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[7] *See Broadcast Auction Scheduled to Begin March 29, 2016; Procedures for Competitive Bidding in Auction 1000, Including Initial Clearing Target Determination, Qualifying to Bid, and Bidding in Auctions 1001 (Reverse) and 1002 (Forward)*, Public Notice, 30 FCC Rcd 8975 (2015).

[8] *See Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Order on Reconsideration and Second Report and Order, 31 FCC Rcd 5011 (2016).

[9] Mike Dano, FierceWireless, *AT&T CFO: Our 40 MHz of Unused Spectrum Will 'Dramatically Improve Our Capacity'* (Aug. 9, 2016) *available at* http://www.fiercewireless.com/wireless/at-t-cfo-our-40-mhz-unused-spectrum-will-dramatically-improve-our-capacity.

[10] Marguerite Reardon, c|net, *Verizon Says It Has Enough Wireless Spectrum, But Is It Just a Stalling Tactic?* (Feb. 17, 2015) *available at* https://www.cnet.com/news/verizon-says-it-has-enough-wireless-spectrum-but-is-it-just-a-stalling-tactic/.

[11] Marguerite Reardon, c|net, *What Sprint's Decision to Sit Out the Next Wireless Auction Really* Means (Sep. 29, 2015) *available at* https://www.cnet.com/news/what-sprints-decision-to-

The inability so far for bids in the Commission's 600 MHz Incentive Auction to reach the clearing target confirms these assessments. Stage 1 of the auction cleared a total of 126 MHz of spectrum, with up to 100 MHz of spectrum available for bid. However, forward bidding in stage 1 of the auction topped out at $23 billion, well short of the $88 billion target.

The *FNPRM's* apparent intent to move quickly to push even more spectrum into the pipeline for terrestrial wireless must be considered against this backdrop.[13] Much of the spectrum already available for terrestrial wireless—including the AWS-3 and AWS-4 bands—has yet to be constructed. Even Multichannel Video and Data Distribution Service ("MVDDS") licenses granted more than a decade ago have not been deployed by licensees.[14] Spectrum bands that were opened for terrestrial wireless use only recently, such as the 28 GHz, 37-40 GHz, and 64-71 GHz bands, and additional bands that soon will be available, such as the 600 MHz and 3.5 GHz bands, are not likely to be constructed for many years to come.

The Commission should allow the wireless industry an opportunity to realize the benefits of its available and soon to be available spectrum resources as it carefully considers the complexities of deployment over higher band spectrum. Identifying, developing, and bringing to market a new frequency band is a multi-year process requiring substantial infrastructure investment. As the *FNPRM* recognizes, there are many challenges that must be overcome before

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sit-out-the-upcoming-wireless-auction-really-means/.

[12] Ray Sheffer, Market Realist, *What T-Mobile's Spectrum Deal with AT&T Means for Coverage Growth* (Jun. 1, 2016) *available at* http://marketrealist.com/2016/06/t-mobiles-spectrum-deal-att-means-coverage-growth/.

[13] The Commission notes that it is acting quickly—"more quickly than most of our counterparts around the world." *Spectrum Frontiers R&O and NPRM* at ¶ 1.

[14] *See In re Requests of Ten Licensees of 191 Licenses in the Multichannel Video and Data Distribution Service for Waiver of the Five-Year Deadline for Providing Substantial Service,* Order, 25 FCC Rcd 10097 (Jul. 28, 2010) ("*MVDDS Extension Order*").

the Commission can authorize service in the proposed bands.[15] The Commission—and the public—will be better served by carefully considering the utility of various bands and uses, including evaluating competing proposals, before delving into the specifics of technical rules and licensing regimes.

C. Each of the Frequency Bands Considered in the *FNPRM* Requires Individual Consideration

The Commission's consideration of technical rules and licensing regimes in the *FNPRM* is premature and requires further deliberation. For the additional bands under consideration, the *FNPRM* proposes to use the same licensing and service rules adopted for the 28 GHz and 37-40 GHz bands in the *Spectrum Frontiers Report and Order*, without further analysis of the appropriateness of those rules.[16] This "one-size-fits-all" approach is flawed. Technical service rules must be developed for the particular characteristics of each frequency band selected for next generation services. Similarly, licensing regimes should be responsive to the needs within a specific band.

It is virtually axiomatic that different frequency bands have vastly different requirements based on incumbent uses, adjacent services, propagation characteristics, and other factors. For example, in higher frequency ranges, the likely topography of terrestrial wireless deployment increasingly focuses on smaller deployments facilitating spectrum reuse, thereby enabling easier geographic separation and making spectrum less suitable for wide-area terrestrial coverage. Yet, the *FNPRM* proposes to use the same geographic area licensing used in lower frequency bands, with Partial Economic Areas ("PEAs") as the license area for the additional bands.[17] There is no

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15 *Spectrum Frontiers R&O and FNPRM* at ¶ 374.

16 *Spectrum Frontiers R&O and FNPRM* at ¶ 375.

17 *Id.*

reason to assume that PEAs, or even counties, are the appropriate licensing area for the localized services that likely will be deployed terrestrially in bands above 24 GHz.[18]

The Commission should examine the specific characteristics and utility of proposed bands for addressing future spectrum needs without predetermining technical rules and licensing regimes. Further, the Commission should focus on enabling efficient use by both satellite and terrestrial users, while also being realistic about the services that are most likely to be deployed in practice and where those services will be needed. There is no need to make premature determinations regarding the proposed bands at this early juncture.

III. THE COMMISSION SHOULD MAXIMIZE FLEXIBILITY FOR FUTURE INNOVATIVE SATELLITE OPERATIONS

Satellite operators continue to develop new and innovative services, including high-speed broadband connectivity comparable to terrestrial fiber networks, direct-to-home services, and advanced mobile satellite communications.[19] These services remain a critical component of the nation's communications infrastructure. As explained by Commissioner Clyburn following her recent visit to New Mexico and Navajo Nation, "[a]ccess to robust, affordable advanced telecommunications services, ought to be available to everyone—no matter who they are, no

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[18] For example, the Commission adopted census tracts as the appropriate geographic license size for Priority Access Licenses in the 3.5 GHz band. *Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Report and Order and Second Further Notice of Proposed Rulemaking, 30 FCC Rcd 3959, ¶ 96 (2015).

[19] For example, Inmarsat's Global Xpress network is capable of bringing broadband at speeds of up to 50 Mbps and was built to deliver worldwide mobility to users in the air, on land, and at sea. ViaSat presently offers 25/3 Mbps speeds in several parts of the U.S. and anticipates increasing both speed and coverage following deployment of new satellites in 2017. *Comments of ViaSat, Inc*., GN Docket No. 16-245, at 2 (filed Sept. 6, 2016). Several large service providers rely on O3b Limited to provide high-speed, low latency middle-mile connectivity. *Comments of O3b Limited*, GN Docket No. 16-245, at 1 (filed Sept. 6, 2016).

matter where they live."[20] Yet one in ten Americans still lack access to high-speed broadband according to the Commission's 2016 Broadband Progress Report.[21] Satellite operators will be a critical part of the solution—offering connectivity where terrestrial networks are unreliable or simply cannot reach, whether on land, in the air, or at sea.

To bridge the digital divide and support a robust and competitive marketplace, the Commission should therefore pursue policies that allow for flexible use of spectrum by satellite operators. In addition to identifying the importance of providing "great flexibility to companies that can use the spectrum in expansive ways," Chairman Wheeler has emphasized the need to "balance the needs of various different types of users in these bands through effective sharing mechanisms" and "take steps to promote competitive access to this spectrum."[22] This must include protections for satellite services as well. Several bands the Commission now considers in its *FNPRM* are allocated for satellite use,[23] and satellite operators have made significant investments in developing new services and technologies for this spectrum. At a minimum, the Commission should authorize FSS earth station use in all UMFUS bands on a coordinated basis. It should also be mindful of protecting existing and promoting development of future satellite

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[20] Commissioner Mignon Clyburn, *Tackling the Connectivity Challenges of Rural America: My Journey to New Mexico and Navajo Nation*, FCC Blog (Aug. 15, 2016), *available at* https://www.fcc.gov/news-events/blog/2016/08/15/tackling-connectivity-challenges-rural-america-my-journey-new-mexico-and.

[21] *2016 Broadband Progress Report*, 31 FCC Rcd 699, ¶ 4 (2016) (finding that 39 percent of Americans in rural areas and 41 percent of Americans in tribal land lack access to advanced telecommunications capability).

[22] Chairman Tom Wheeler, *Unleashing Next-Generation Networks*, FCC Blog (June 23, 3016), *available at* https://www.fcc.gov/news-events/blog/2016/06/23/unleashing-next-generation-networks.

[23] The Commission has authorized FSS in the 37.5-70 GHz band, BSS in the 40-42.5 GHz band, FSS in 47.2-50.2 GHz band, and both FSS and MSS in the 50.4-51.4 GHz band. *See* 47 C.F.R. § 2.106.

operations in spectrum bands above 24 GHz, which play an essential role in the nation's communications infrastructure.

A. 37.5-40 GHz Band

The 37.5-40 GHz band is critical to supporting satellite services, both through individually licensed earth stations and blanket deployment of end-user terminals. As the Commission observes, "[c]urrently, satellite earth station facilities in the 37.5-40 GHz band may not be ubiquitously deployed and may not be used to serve individual consumers."[24] Inmarsat agrees with the Commission's proposal to repeal this prohibition.[25] With existing spectrum sharing systems, there is no reason that FSS user terminals cannot operate alongside UMFUS operations. UMFUS services are likely to be highly localized, indoor-type deployments, which would be compatible with most FSS user terminal operations. It is highly unlikely that satellite downlink emissions in this band would interfere with such UMFUS operations. It is also unlikely, for example, that aeronautical and maritime terminals would suffer interference from UMFUS operations. Boeing has presented several interference analyses between FSS and terrestrial wireless in the 37.5-40 GHz band, which demonstrate the two services may operate alongside one another with appropriate safeguards.[26] As Boeing has explained, "satellite systems can successfully operate in the 37.5-40 GHz band using the higher space-to-earth power flux density limits maintained by the International Telecommunication Union without causing

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24 *Spectrum Frontiers R&O and FNPRM* at ¶ 500.

25 *Id*.

26 *See* Boeing Ex Parte Letter, GN Docket No. 14-177, at 1 (filed June 6, 2016).

appreciable interference to future UMFU systems."[27] The Commission should therefore allow FSS earth station operations in the 37 GHz band alongside UMFUS operations.

Moreover, in the interest of providing for flexible use of spectrum, the Commission should authorize higher power-flux density operations by FSS satellites than permitted under the existing rules. As the Commission recognizes, "Boeing has submitted a study which shows that coexistence is possible, even at the higher PFD level," which "suggests that terrestrial mobile units might be able to suppress interfering signals from satellites if the signals arrive at sufficiently high angles of elevation."[28] As the record continues to develop in this area, the Commission should continue to seek additional flexible solutions for spectrum use.

B. 42-42.5 GHz Band

As recognized by the Commission in the *FNPRM*, the 42-42.5 GHz band is a major focus for near-term FSS service link operations.[29] User terminals in this band must therefore be protected from any future UMFUS deployments. Given the challenges with protecting ubiquitously deployed primary FSS terminals, and the presence of RAS in the adjacent 42.5-43.5 GHz band, it may prove too difficult to authorize this spectrum for UMFU services. In fact, the Commission appropriately declined to propose new service rules for the 42-42.5 GHz band in its Notice of Proposed Rulemaking in this proceeding for this very reason.[30] Should the Commission nevertheless decide to further consider this band for UMFUS, it should, at a

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27 *Id.*

28 *Spectrum Frontiers R&O and FNPRM* at ¶ 498.

29 *See Spectrum Frontiers R&O and FNPRM* at ¶ 401.

30 *Id.* ("In the NPRM, we declined to propose service rules for the band at the time due to concerns that we would be unable to adequately protect the RAS in the adjacent 42.5-43.5 GHz band, and because we found the band already encumbered by pending proposals to place both FS and FSS operations in the band.") (internal citations omitted).

minimum, also make the spectrum available for individually licensed FSS earth station operations.

C. 47.2-50.2 GHz Band

There is no justification for restricting satellite use in the 47 GHz band. As the Commission notes, 47.2-50.2 GHz is designated as a FSS uplink band intended for pairing with the 40-42 GHz downlink band and used by FSS user terminals.[31] The satellite industry is actively experimenting in this spectrum—including Inmarsat's launch in 2013 of a 48 GHz payload on its Alphasat satellite—and developing plans for future use of the 47.2-50.2 GHz band for innovative FSS. The Commission should therefore protect FSS operators' ability to deploy blanket-licensed user terminals and individually-licensed earth stations on a primary basis throughout the 47.2-50.2 GHz band. Should this band be opened to UMFUS operations, it must be done in a way that promotes continued growth of satellite operations in the band, including through protections against harmful aggregate interference from the UMFUS.

As previously discussed, there is no reason to assume that the sharing framework adopted for the 28 GHz band would be appropriate here—let alone the more onerous sharing framework the Commission proposes for the 47.2-50.2 GHz band.[32] Although the Commission suggests adopting the sharing framework implemented for the 28 GHz band (which permits no more than *three* earth station locations per *county*), the agency proposes to only permit "*one* location where FSS earth stations can be located on a co-primary basis" in each *PEA*.[33] This misapplication of a

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[31] *Id.*at ¶ 408.

[32] *See id.* at ¶ 412 ("Specifically, in each PEA, we propose that there can be one location where FSS earth stations can be located on a co-primary basis, subject to the conditions and limitations we have adopted in other bands.").

[33] *Id.* at ¶¶ 54, 412 (emphasis added).

misstatement of the 28 GHz band rules adopted in the very same document as the *FNPRM* illustrates clearly the need to use more studied deliberation for each frequency band.

Permitting only one co-primary, individually licensed earth station in each PEA would be overly prescriptive and without cause. First, PEAs are wholly irrelevant to potential future deployment of terrestrial services in the 47 GHz band, as terrestrial deployments—should they be authorized—likely would be even more localized than services in the 28 GHz band. Second, although the Commission should decline to limit FSS operations in this important band at all, restricting deployment to one location within each PEA would be completely arbitrary and unnecessary. Even at 28 GHz, FSS operators are permitted to deploy individually licensed earth stations in three locations.[34]

The Commission did not evaluate the 47.2-50.2 GHz band in the NPRM,[35] and to date there have been no substantive demonstrations, modeling of 5G systems, or even concrete plans to do so submitted on the record. By contrast, as far back as 2013, Inmarsat launched Alphasat, at substantial cost and risk, which continues to conduct experimental Earth-to-space operations in the 47 GHz band.[36] And Inmarsat, like others in the satellite industry, has plans for future robust use of these frequencies. Although this band has been identified for further study by WRC-15, evaluation of this spectrum is only just beginning, and should be permitted to play out before taking any steps to introduce new terrestrial services to the band. Should the Commission nonetheless decide to allow UMFUS deployment in the 47 GHz band, it should only do so on a

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[34] *Id.* at ¶ 54.

[35] *See id.* at ¶ 409.

[36] *See* Inmarsat, *Alphasat and the I-4s*, *http://www.inmarsat.com/about-us/our-satellites/inmarsat-4/* (describing new capabilities offered by Alphasat, including access to 50 percent more L-band spectrum and nearly 20 percent more mobile communication channels).

secondary basis and subject to not limiting FSS deployment and specific protections for FSS operations, including protection from aggregate interference to the satellite receiver.

D. 50.4-52.6 GHz Band

The Commission has allocated the 50.4-51.4 GHz band on a primary basis for FSS and MSS[37] and it is essential that the Commission avoid unnecessarily restricting existing flexibility to deploy satellite services in this band. Like the 47 GHz band, the Commission did not evaluate the 50 GHz band in the NPRM,[38] and further study of the spectrum in preparation for WRC-19 is still in the early stages. Expedited action to authorize UMFUS operations without further study and meaningful consideration could unnecessarily harm critical satellite uses of the spectrum. Therefore, if the Commission decides in this proceeding to introduce UMFUS into the band, the new mobile operations should be secondary to FSS operations.

The Commission recently sought comment on a proposal from Boeing to expand the FSS uplink allocation into the 50.4-51.4 and 51.4-52.4 GHz bands to complement the important 47.2-50.2 GHz allocation.[39] That Petition warrants careful consideration by the Commission, as increasing the amount of available FSS uplink spectrum will be the key to fulfilling the promise of satellite to facilitate the 5G broadband and IoT future. It may be most prudent for the Commission, therefore, to defer action on the 50 GHz band in this proceeding pending final determination of Boeing's request.

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37 *See* 47 C.F.R. § 2.106.

38 *See Spectrum Frontiers R&O and FNPRM* at ¶ 419.

39 *Allocation and Authorization of Additional Spectrum for the Fixed-Satellite Service in the 50.4-51.4 GHz And 51.4-52.4 GHz Bands*, Public Notice, RM-11773 (Sept. 16, 2016).

IV. SATELLITE OPERATIONS SHOULD ENJOY THE BENEFITS OF THE COMMISSION'S PROPOSED USE-OR-SHARE REGIME

In the *FNPRM*, the Commission seeks comment on the possibility of implementing a "use-or-share" regime in the UMFUS bands.[40] Inmarsat agrees with the Commission that the UMFUS bands are good candidates for sharing in many scenarios "given the propagation characteristics, and high potential re-use, of the mmW spectrum."[41] Should the Commission adopt a "use or share" approach in these bands, it should extend the benefits of that approach to satellite systems—both in terms of allowing opportunistic use of unused spectrum and in terms of protecting satellite licensees from harmful interference.

Areas in which UMFUS licensees are not providing service should be available for FSS use. There are many circumstances under which deployment of an FSS terminal, even on a secondary or temporary basis, could be an efficient use of unused spectrum without impeding on the licensed UMFUS operator's deployment. For example, industrial, enterprise, maritime, aeronautical, or other remote users outside the deployment area of UMFUS licensees could benefit from FSS user terminals with minimal impact on terrestrial operations. Accordingly, in any band where the Commission adopts a "use or share" approach on a secondary or lower priority basis for opportunistic UMFUS operations, it also should permit FSS operation in the band on the same terms.

Whether or not the Commission permits FSS to benefit from a "use or share" regime in the UMFUS bands, any "use or share" regime must ensure satellite licensees are protected from interference, including harmful aggregate interference caused by opportunistic UMFUS operations. At a minimum, any shared use of UMFUS spectrum must be carefully monitored

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40 *Spectrum Frontiers R&O and FNPRM* at ¶¶ 474-82.

41 *Id.* at ¶ 474.

and controlled in order to ensure protection of transmissions from licensed earth stations authorized pursuant to Section 25.136 of the Commission's rules.[42] Even under the Commission's proposed rules, such transmissions maintain their priority in these bands.

V. CONCLUSION

The Commission's policies for higher band spectrum should maximize efficiency and flexibility for both satellite and terrestrial services. Spectrum sharing often will ensure additional spectrum resources for both services; however, the Commission must ensure that satellite licensees have access to sufficient spectrum and are appropriately protected from interference. A forward-looking approach that recognizes and facilitates the important role of satellites in next generation systems will ensure that the full vision for 5G is realized.

Respectfully submitted,

INMARSAT, INC.

By: */s/ Giselle Creeser*

Giselle Creeser
Director, Regulatory

M. Ethan Lucarelli
Director, Regulatory and Public Policy

INMARSAT, INC.
1101 Connecticut Ave. N.W., Suite 1200
Washington, D.C. 20036
(202) 248-5150

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[42] 47 C.F.R. § 25.136.