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 37.5-40.0 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 ECHOSTAR SATELLITE OPERATING CORPORATION, HUGHES NETWORK SYSTEMS, LLC, AND ALTA WIRELESS, INC.

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SUMMARY

It is rare for a spectrum issue before the Commission to present an intuitively attractive and straightforwardly implemented "win-win" solution. Fortunately, because of the nature of the spectrum at issue and the varying use cases for it, this proceeding does just that. The Commission should move expeditiously to seize the opportunity.

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In their opening Comments, EchoStar Satellite Operating Corporation ("ESOC"), Hughes Network Systems, LLC ("Hughes"), and Alta Wireless, Inc. ("Alta" and collectively, "EchoStar") demonstrated the crucial role satellites play in expanding the reach of broadband capabilities to millions of U.S. customers, supporting first responders, and providing connectivity in emergency and other situations where terrestrial facilities have been compromised. EchoStar also showed how some of the Commission's proposals in this proceeding, however well intentioned, would undermine years of effort and billions of dollars of investment by satellite operators in developing the frequency bands above 24 GHz. These are real systems providing service to real U.S. broadband consumers. By contrast, the standards for so-called Fifth Generation ("5G") mobile services are still under development, with deployment of actual systems still at least several years away. The Commission should not sacrifice existing FSS services in a rush to promote future 5G services.

Yet, recognizing the potential benefits of 5G services, EchoStar does not seek to block their deployment. Rather, it has made alternative proposals that would capitalize upon: (1) the limited propagation characteristics of this high-band spectrum; and (2) the differing characteristics of Fixed Satellite Services ("FSS") and 5G mobile services, in order to craft a regime that would protect the interests of satellite operators and the

significant U.S. customer base for their services while still enabling more intensive and flexible use of spectrum by terrestrial mobile systems. Specifically, EchoStar proposes that the Commission adopt a three-pronged regime for deployment of FSS gateway earth stations using spectrum in the 28 GHz, 37 GHz, and 39 GHz bands, under which: (1) FSS gateways are given co-primary status with fixed and mobile services; (2) gateways would only be deployed on a primary basis outside of the downtown urban cores of the 30 (or so) largest U.S. cities; and (3) operations within a specified power flux-density limit would not require coordination. Such an approach will enable FSS operators to continue to develop these bands without fear that their investment will be stranded, but will also leave a large portion of the country – including the dense urban areas of most interest to 5G systems – available for deployment of mobile services.

Those commenters focused on mobile services, however, were decidedly less accommodating. They would essentially leave FSS in an exposed position, subject to the vagaries of a licensing and negotiating regime that is stacked against them. It is ironic that, while commenters who favor mobile use of these bands argue that 5G interests need certainty in order to attract the investment necessary to develop and deploy innovative systems, they fail to recognize that FSS operators need certainty for precisely the same reasons. Indeed, if anything, FSS operators' need for certainty is even greater, given that they currently provide service to millions of U.S. consumers, and that satellite infrastructure takes many years to develop, construct, and launch, and is designed to remain in service for 15 years or more.

In these reply comments, EchoStar rebuts the argument that FSS operators using the 28 GHz band have no reasonable expectation of protection against incoming mobile services. In fact, Commission policy has consistently been to the contrary. EchoStar then elaborates on the

reasons why requiring FSS operators to purchase spectrum rights at auction or in the secondary market to achieve quasi-co-primary status is both bad policy and contrary to law. The three-pronged regime proposed by EchoStar would better enable FSS and 5G systems to share the bands above 24 GHz to achieve a "win-win" result that would make intensive use of these valuable national resources for the benefit of U.S. consumers.

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REPLY COMMENTS OF ECHOSTAR SATELLITE OPERATING CORPORATION, HUGHES NETWORK SYSTEMS, LLC, AND ALTA WIRELESS, INC.

EchoStar Satellite Operating Corporation ("ESOC"), Hughes Network Systems, LLC ("Hughes"), and Alta Wireless, Inc. ("Alta" and collectively, "EchoStar") hereby reply to the

comments filed in response to the Commission's Notice of Proposed Rulemaking (the "*Notice*")[1] in this proceeding. In its Comments,[2] EchoStar discussed the years of effort and significant investment by satellite operators in developing the frequency bands above 24 GHz, as well as the ways in which several of the proposals in the *Notice* for a new Upper Microwave Flexible Use ("UMFU") service would undermine those efforts. EchoStar also made alternative proposals that would capitalize upon the propagation characteristics of high-band spectrum and the differing characteristics of Fixed Satellite Services ("FSS") and so-called Fifth Generation ("5G") mobile services in order to craft a regime that would both protect the interests of satellite operators and the significant U.S. customer base for their services while still enabling more intensive and flexible use of spectrum by terrestrial mobile systems.

In these reply comments, EchoStar discusses four topics. First, it summarizes the record evidence of both substantial FSS investment and operations in the bands at issue in this proceeding, and the nascent status of 5G technology, to demonstrate that the former should not be sacrificed for the benefit of the latter. Second, EchoStar rebuts the argument that FSS operators using the 28 GHz band have no reasonable expectation of protection against incoming mobile services. In fact, Commission policy has consistently been to the contrary. Third, EchoStar elaborates on the reasons why requiring FSS operators to purchase spectrum rights at auction or in the secondary market to achieve quasi-co-primary status is both bad policy and contrary to law. Lastly, EchoStar discusses proposals that would better enable FSS and 5G

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1 *See Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al.*, Notice of Proposed Rulemaking, 30 FCC Rcd. 11878 (2015) ("*Notice*").

2 *See* Comments of EchoStar Satellite Operating Corporation, Hughes Network Systems, LLC, and Alta Wireless, Inc., GN Docket No. 14-177 et al. (Jan. 27, 2016) ("EchoStar Comments"). Unless otherwise stated, all citations herein to comments relate to filings made in this proceeding.

systems to share the bands above 24 GHz to achieve a "win-win" result that would make intensive use of these valuable national resources for the benefit of U.S. consumers.

A. THE COMMISSION MUST NOT SACRIFICE A DYNAMIC AND THRIVING SATELLITE INDUSTRY FOR THE BENEFIT OF AN UNDEFINED TERRESTRIAL MOBILE TECHNOLOGY

The Commission has long recognized the critical role that satellites play in the nation's communications landscape. "Satellite technology is used to provide communication services throughout the United States and the world and is particularly important for communication in remote areas that are unserved or underserved by terrestrial communication facilities. Satellites also provide connectivity for first responders in emergencies and natural disasters."[3] Commenters in this proceeding confirm this conclusion.

For example, EchoStar discussed Hughes's role in helping rural schools across the country to bridge the digital divide and providing Internet and voice services to communities during natural disasters and emergencies, such as Hurricane Sandy, when terrestrial and wireless networks have failed or are unreliable.[4] O3b Limited's system of non-geostationary orbit ("NGSO") satellites offers low-latency, high-throughput connectivity to Internet service providers, telecom operators, large enterprises, and governments in locations unserved or underserved by other broadband systems, such as American Samoa.[5] Inmarsat provides broadband to ships and planes, transportation safety services, and secure battlefield communications, and also enables terrestrial networks to widen their reach by providing high-

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3 *Comprehensive Review of Licensing and Operating Rules for Satellite Services,* 28 FCC Rcd. 12403, ¶ 2 (2013).

4 *See* EchoStar Comments at 5.

5 *See* Comments of O3b Limited at 2, 4-5 ("O3b Comments").

bandwidth backhaul in remote environments.[6] As summed up by Boeing, "[t]here is simply no replacement for the reach, seamless coverage, reliability, and flexibility of satellite services."[7]

As the record in this proceeding also demonstrates, the satellite industry has invested many years and billions of dollars in developing systems that depend upon spectrum above 24 GHz, including bands at issue here. Hughes currently provides broadband services to approximately one million customers in North America using two satellites operating in the Ka-band (including the 28 GHz band), and is scheduled to launch later this year an even more advanced satellite that will provide much greater broadband capacity and significantly higher speeds in the 28 GHz band to U.S. consumers, including those in the most rural and remote areas of the country.[8] ViaSat currently operates one satellite that uses 28 GHz spectrum, has received Commission authorization for two more scheduled for launch in the next few years, and has recently applied for authorization for another three even more advanced satellites that use this band.[9] ViaSat states that the first two of these third-generation satellites "will deliver more than twice the total network capacity of the approximately 400 commercial communications satellites in space today – *combined*."[10] O3b has launched a global constellation of twelve NGSO satellites that operate in this band, and has constructed nine gateways and a Network Operations

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6 *See* Comments of Inmarsat Mobile Networks, Inc. at 2-3 ("Inmarsat Comments").

7 Comments of The Boeing Company at 3.

8 *See* EchoStar Comments at 4.

9 *See* Comments of ViaSat, Inc. at 4-5 ("ViaSat Comments"). *See also* IBFS File Nos. SAT-LOI-20160208-00014, -00015, and -00016 (filed Feb. 8, 2016).

10 Press Release, "ViaSat Unveils First Global Broadband Communications Platform to Deliver Affordable, High-Speed Internet Connectivity and Video Streaming to All" (Feb. 9, 2016) (emphasis in original), *available at* http://investors.viasat.com/releaseDetail.cfm?ReleaseID=954123.

Center, each of which represents a multi-million dollar investment.[11] Inmarsat recently launched three high-throughput satellites and completed construction of a gateway earth station in Lino Lakes, Minnesota, as part of its $1.5 billion Global Xpress program, and also launched a satellite with which it will explore commercial use of the Q/V-band.[12]

These are real systems providing service to real U.S. broadband consumers. By contrast, 5G mobile service is still being defined. Its proponents envision any number of capabilities that could be supported by high-band spectrum, but the standards for 5G technology are still under development, with commercial deployment of actual systems still at least several years away.[13] As summarized by the Information Technology Industry Council ("ITIC"), 5G "would be better described as a set of capabilities rather than a clearly defined technology as standards have not been formalized."[14]

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11 *See* O3b Comments at 2-3.

12 *See* Inmarsat Comments at 2-3, 9-10. SES is also scheduled to launch in 2017 a high-throughput satellite with feeder link spectrum in this band, and recently filed for authority to operate six gateway earth stations in support, requiring a commitment of hundreds of millions of dollars. *See* Comments of SES Americom, Inc. at 3-4 ("SES Comments").

13 *See, e.g.,* Comments of Cisco Systems at 8 ("Cisco Comments") ("It is essential to remember that mobile use of the mmW bands is in its infancy and will require development of new technologies for new business cases."); Comments of T-Mobile USA, Inc. at 20 ("T-Mobile Comments") ("It is unclear how 5G technologies will develop – 5G air interfaces are still in the research phase, and there may be different air interface standards for different use cases.). *See also Notice*, ¶ 13 ("additional work is required to complete the necessary research and development; negotiate mutually harmonized standards, consider frequency allocations and regulatory frameworks; and build or modify manufacturing facilities and processes required to supply necessary system components").

14 Comments of the Information Technology Industry Council at 2 ("ITIC Comments"). Indeed, the technology is in such a state of flux that in its recent application for an experimental authorization to test 5G equipment, AT&T had to seek a waiver of the Commission's application requirements because it was unable to provide some of the most basic technology information related to its proposed operations. *See* AT&T Services, Inc., ELS File No. 0068-EX-PL-2016, Exhibit II (Feb. 4, 2016) (seeking waiver with respect to information on mean peak, frequency tolerance, and antenna orientation in the horizontal plane).

In these circumstances, logic dictates that the newly-allocated service, whose standards are not yet set and which has not yet been deployed anywhere, should be required to accommodate the existing service, which has deployed assets worth billions of dollars whose designs cannot be changed and is currently providing services that U.S. consumers rely upon. That is one of the stated goals of this proceeding,[15] as well as the official policy of the United States government.[16] It is also the consensus of the international community, which, in considering future mobile allocations for spectrum above 24 GHz for the next World Radio Conference, will take into account "the need to protect existing services and to allow for their continued development when considering frequency bands for possible additional allocations to any service," while also recognizing that "any identification of frequency bands for [mobile services] should take into account the use of the bands by other services and the evolving needs of these services," and that "there should be no additional regulatory or technical constraints imposed to services to which the band is currently allocated on a primary basis."[17]

Were the Commission to prioritize mobile services over FSS, it would impose significant burdens on operators and their U.S. and global customers. Uplink and downlink beams on FSS spacecraft that are in-orbit or nearing completion are fixed. As a result, FSS operators cannot

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[15] *See, e.g., Notice,* ¶ 22 ("mobile use in mmW bands should be compatible with existing incumbent license assignments and uses. Current licensees that choose to continue their existing, authorized services should be able to do so."); ¶ 44 (expressing intent "not to favor mobile service over fixed or satellite service").

[16] *See, e.g.*, Executive Office of the President, *National Space Policy of the United States of America*, at 9 (2010) (requiring the U.S. government to (1) "[s]eek to protect U.S. global access to, and operation in, the radiofrequency spectrum and related orbital assignments required to support the use of space by . . . U.S. commercial users;" and (2) "[s]eek to ensure the necessary national and international regulatory frameworks will remain in place over the lifetime of the system"), *available at* http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf.

[17] *See* Provisional Final Acts, World Radio Conference 2015, Resolution COM 6/20 (WRC-15), *available at* https://www.itu.int/dms_pub/itu-r/opb/act/R-ACT-WRC.11-2015-PDF-E.pdf. Significantly, the World Radio Conference expressly rejected a proposal to study the 27.5-29.5 GHz band for IMT services. *See id.*, Resolution COM 6/20 (WRC-15).

simply move gateway earth stations if they are unable to secure a license or negotiate an arrangement to accommodate new terrestrial services. Moreover, if spectrum in the 28 GHz, 37 GHz, and 39 GHz bands are no longer reliably available to FSS systems, FSS operators will face significant capacity constraints in meeting existing customer demand, to say nothing of the fast-accelerating growth in such demand.

For example, if Ka-band gateway earth station uplinks are restricted to the unshared portion of the band (*i.e.*, 28.35-28.6/29.25-30.0 GHz) to the exclusion of the 850 MHz of spectrum in the 28 GHz band, an FSS operator would have to deploy nearly twice as many gateways in order to support the same amount of bandwidth – increasing dramatically the cost and resources required to meet consumer demand. This problem is further exacerbated by the fact that VSAT service links are also located in a portion of the unshared band, which makes that spectrum effectively unavailable for use by gateways. Although in theory FSS gateways could use other, higher bands above 39 GHz, the necessary equipment does not yet exist and would have to be developed. Moreover, the poorer propagation characteristics of these bands would require deployment of diverse gateways in order to achieve the same level of availability as non-diverse sites using 28 GHz spectrum, as well as a more robust backhaul network for this traffic. Thus, all of these alternatives would significantly increase costs, introduce additional complexity, and require time to develop and deploy – and would not address the pressing need for additional spectrum to support the increasing demand for greater satellite broadband capacity.

It is ironic that many commenters argue for swift action in this proceeding because 5G interests need certainty in order to attract the investment necessary to develop and deploy this technology – yet ignore the fact that the same is true for satellite systems. For example, the ITIC asserts that "[m]oving expeditiously with this rulemaking will promote continued U.S. leadership

in mobile communications by providing certainty for researchers and reducing risk for private sector investment."[18] Similarly, the Telecommunications Industry Association argues that "[a]doption of service rules in 2016 for the bands addressed in the *NPRM* will provide equipment manufacturers and service providers regulatory certainty that, if done correctly, will spur investment and innovation."[19] Yet satellite operators need regulatory certainty and assured access to spectrum for precisely the same reasons. Indeed, if anything, their need for certainty is even greater, given that satellite infrastructure takes many years to develop, construct, and launch, and is designed to remain in service for 15 years or more.[20]

B. Based on Commission Pronouncements, Satellite Operators Reasonably Expected Not to be Secondary to Mobile Services in the 28 GHz Band

As discussed in EchoStar's Comments, the introduction of mobile services will upset the reasonable expectations of satellite operators with respect to the interference environment in the spectrum above 24 GHz.[21] This is particularly true in the 28 GHz band, where satellite operators have invested billions of dollars and years of effort to develop and launch satellites and deploy

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[18] ITIC Comments at 2.

[19] Comments of The Telecommunications Industry Association at 3 ("TIA Comments"). *See also id.* at 17 ("it is critical to provide the terrestrial wireless carriers with the regulatory certainty exclusive licensing provides – regulatory certainty that they need to invest in the development and deployment of infrastructure and devices that support use of the mmW bands as an adjunct to their existing facilities"); T-Mobile Comments at 3 (urging prompt adoption of rules because "[l]icensed operations help guarantee reliable service and encourage greater investment and technical innovation by providing carriers with needed certainty").

[20] The Commission has recognized satellite operators' need for certainty. *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*, 18 FCC Rcd. 25428, ¶ 54 (2003) ("We recognize that both Government and commercial systems must remain sufficiently sure of their access to orbital and spectrum resources if they are to proceed with research, development and production of their planned space-station systems.").

[21] *See* EchoStar Comments at 18-19. *See also* Inmarsat Comments at 6-7 (discussing potential disruption from mobile services).

gateway earth stations to meet the demands of U.S. consumers for additional broadband capacity. Yet commenters that favor terrestrial mobile usage assert that satellite operators should have had no such expectations, and therefore the Commission should feel free to place satellite investments at risk by making FSS secondary to new mobile services.[22]

Those who question satellite operators' expectations are demonstrably wrong. The U.S. has allocated FSS on a co-primary basis in the 28 GHz band.[23] By rule, FSS has been designated as secondary to LMDS – *but only to LMDS*. This is clearly set forth in the Commission's rules – which state that "FSS is secondary to LMDS in this band"[24] – as is the fact that LMDS is limited to fixed point-to-point or point-to-multipoint systems.[25] Moreover, as ViaSat pointed out, at the same time that the Commission designated LMDS as having "licensing priority" in the band, it also designated the FSS as having "licensing priority vis-à-vis *any third service allocated domestically or internationally in the band*."[26] Then as now, the U.S. allocations in this band included terrestrial mobile service. Accordingly, the Commission has, for the last two decades, clearly given licensing priority to FSS over all terrestrial services other than LMDS, *including terrestrial mobile services*.

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22 *See, e.g.*, Cisco Comments at 5-6; Comments of CTIA at 32; Comments of Samsung Electronics America, Inc. and Samsung Research America at 22 ("Samsung Comments"); TIA Comments at 8-9; T-Mobile Comments at 16.

23 *See* U.S. Table of Frequency Allocations, 47 C.F.R. § 2.106.

24 *See* 47 C.F.R. § 25.202(a)(1) n.2.

25 *See* 47 C.F.R. § 101.3 (defining an LMDS system as "[a] fixed point-to-point or point-to-multipoint radio system" consisting of hub stations and subscriber stations).

26 *See* ViaSat Comments at 11 (quoting *Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed-Satellite Services*, 11 FCC Rcd. 19005, ¶ 44 (1996) (emphasis added)).

It is true that the Commission once suggested that LMDS operators could someday be given authority to provide mobile services as well.[27] However, even then, it was clear that such a change would only be undertaken after full evaluation in a rulemaking and only with sufficient record evidence in support.[28] Moreover, the Commission did not indicate that if such a modification were adopted, mobile services would be given priority over FSS. To the contrary, the one prior example cited at that time by the Commission[29] in which it had adopted a flexible licensing regime that added mobile authorization to a fixed license included significant restrictions in order to protect incumbent services in the band. In that case, involving the Interactive Video and Data Service ("IVDS"), the Commission "recognize[d] that allowing unrestricted mobile operations promotes flexibility within the service, but it also increases the interference potential with respect to the operations of licensees in other services."[30] Accordingly, the Commission imposed a 100 milliwatt power limit, a very limited duty cycle (5 seconds per hour) for mobile IVDS equipment, and a prohibition on certain mobile-to-mobile communications to protect incumbent users of the band.[31] Accordingly, the possibility of mobile

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[27] *See Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed-Satellite Services*, 12 FCC Rcd. 12545, ¶ 207 (1997).

[28] *Id.*

[29] *See id.*, n. 323. The footnote cites a second order as well, but in that case it was adding authority to provide fixed services to existing mobile licenses. *See Amendment of the Commission's Rules to Permit Flexible Service Offerings in the Commercial Mobile Radio Service*, 11 FCC Rcd. 8965 (1996).

[30] *Amendment of Part 95 of the Commission's Rules to Allow Interactive Video and Data Services Licensees to Provide Mobile Service to Subscribers*, 11 FCC Rcd. 6610, ¶ 18 (1996), *recon. denied*, 13 FCC Rcd. 19064 (1998).

[31] *See id.*, ¶¶ 18, 22, and 28.

operations in the future does not undercut the clear statement that FSS would have priority over any other service allocated in the band.

As if to underscore this fact, this Commission policy is also reflected in the licenses granted to FSS operators. For example, the license granted to Hughes for its EchoStar XIX satellite includes a condition noting that LMDS has been designated as primary in the 28 GHz band, and that "Hughes must accept any interference from authorized LMDS operations" and "Hughes must not cause harmful interference to LMDS stations authorized" in the band.[32] Authorizations issued to ViaSat and O3b for operations in the 28 GHz band similarly make clear that FSS in that portion of the Ka-band are secondary *with respect to LMDS*, and not to terrestrial services more generally.[33]

As noted above, LMDS is limited to fixed service only. LMDS is now a fairly mature service, and FSS operators have been able to work around fixed links to deploy the relatively few gateway earth stations needed to date in the 28 GHz band. The introduction of new mobile services in this band would disrupt this stable interference environment if – contrary to the Commission's existing rules and the statements made at the time of their adoption – FSS systems were made secondary to mobile systems as well. Based on the Commission's actions over the last two decades, FSS operators reasonably expected that such would not be the case. The Commission should honor its past pronouncements and the expectations they created.

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[32] *See* Stamp Grant, IBFS File No. SAT-MOD-20141210-00127, Condition 7 (June 23, 2015).

[33] *See* Stamp Grant, IBFS File No. SAT-LOI-20080107-00006, Condition 2 (Aug. 18, 2009) (ViaSat 1); Stamp Grant, IBFS File No. SAT-LOI-20130319-00040, Condition 12 (Dec. 12, 2013) (ViaSat 70º W.L.); Stamp Grant, IBFS File No. SAT-LOI-20140204-00013, Condition 11 (June 18, 2014) (ViaSat 89º W.L.; Stamp Grant, IBFS File No. SAT-LOI-20141029-00118, Condition 8 (Jan. 22, 2015) (NGSO system).

C. THE USE OF AUCTIONS IN THIS CONTEXT WOULD BE BOTH BAD LAW AND BAD POLICY

Very few commenters seriously considered the advisability and legality of auctioning the spectrum at issue in this proceeding. Most of them simply accepted the Commission's assertion that the auction would not run afoul of the ORBIT Act's prohibition against auctioning satellite spectrum because only terrestrial licenses would be available, and blithely assumed that market forces would sort out allocation issues and ensure that the spectrum is put to its best use.[34] Yet those that (like EchoStar) took a harder look reached a very different conclusion: that the use of auctions in this context is both bad law and bad policy.[35]

The *Notice* asserts that auctioning UMFU licenses would not run afoul of the ORBIT Act's prohibition because "an FSS provider taking advantage of this flexibility would be acquiring a terrestrial license, for terrestrial operations, that also has the effect of protecting a gateway in the service area by virtue of the right to exclude conferred through the license."[36] Because the Commission also proposes to impose performance requirements on UMFU licensees, one of two things must be true: either (1) UMFU licensees can only meet those requirements by deploying terrestrial systems, or (2) satellite operators that hold UMFU licenses solely to protect their FSS operations can meet those requirements by deploying earth stations.

If it is the former, then satellite operators would be obligated to build out terrestrial facilities that they do not want. It is instructive to review the results when the Commission

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[34] *See, e.g.*, Comments of Ericsson at 21-22 ("Ericsson Comments"); Comments of Intel Corporation at 5-6 ("Intel Comments"); ITIC Comments at 6; Comments of Verizon at 23 ("Verizon Comments").

[35] *See, e.g.*, O3b Comments at 17-18; SES Comments at 7.

[36] *Notice*, ¶ 134. The Commission also made clear that earth stations would still require a license to operate under Part 25 of the Commission's rules. *Id.*

previously adopted this same regime – in the 39 GHz band, which was auctioned prior to enactment of the ORBIT Act. FSS operators were allowed to deploy gateway earth stations in the band, but only if they obtained at auction the 39 GHz license in the area where the earth station would be located, or if they entered into an agreement with the corresponding 39 GHz licensee.[37] When the Commission held its auction of 39 GHz licenses over a decade ago, one satellite operator (TRW) acquired 100 licenses.[38] The Commission held that TRW would have to comply with the build-out and other requirements imposed on terrestrial service licensees.

> All operations under a 39 GHz EA license, including future operations of any FSS earth stations, must comply with the Part 101 rules governing the operation of the 39 GHz band. With regard to coordination, the same criteria as applied to terrestrial stations would be applied to earth stations . . . . Furthermore, an EA licensee, whether providing terrestrial or FSS earth station operations, must demonstrate substantial service at the time of its license renewal.[39]

Given these requirements, it is not surprising that TRW never developed any of the 39 GHz licenses it purchased at auction.[40] The dual licensing regime appears to have deterred other FSS operators as well, as there are no U.S. space stations or earth stations authorized in this band.

Commission staff has informally advised that FSS operators that use UMFU licenses to protect earth station operations will not have to deploy terrestrial systems to meet performance requirements.[41] This would seem to be confirmed by the fact that the *Notice* seeks comment on

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37 *See* 47 C.F.R. § 25.202(a)(1) n.3.

38 *See TRW Inc.*, 16 FCC Rcd. 5198 (WTB 2001) ("*TRW*").

39 *Id.* ¶ 12. *See also Amendment of the Commission's Rules Regarding the 37.0-38.6 GHz and 38.6-40.0 GHz Bands*, 19 FCC Rcd. 8232, ¶ 75 (2004) (confirming that "the Wireless Bureau has addressed precisely how the Part 101 Rules would be applied to a satellite earth station licensee that obtains a Part 101 license").

40 TRW's 39 GHz licenses were canceled in March 2012 for failure to meet the performance milestones imposed on terrestrial operations under Part 101. *See, e.g.*, Call Signs WPSE673-681.

41 *See* Letter from the Satellite Industry Association to Marlene H. Dortch, GN Docket No. 14-177, at 2 (filed Dec. 22, 2015) (recounting discussion of technical issue with the staff).

how best to incorporate satellite operations into a unified metric to be used to determine compliance with such requirements.[42] But if earth station operations are sufficient to satisfy UMFU performance requirements, then the UMFU license patently does not relate solely to terrestrial spectrum use. If that is the case, then auctioning UMFU licenses would run afoul of the ORBIT Act. The Commission cannot have it both ways.

Yet even putting legality aside, auctioning this spectrum would be bad spectrum policy. Congress promulgated the ORBIT Act because successive spectrum auctions in countries served by U.S.-owned global satellite service providers could threaten the viability of satellite services.[43] In other words, if the Commission auctions licenses in the spectrum bands above 24 GHz and satellite operators must acquire such licenses to ensure the ability to operate their earth stations, nothing would prevent regulators in other countries from doing the same thing. As Congress recognized,

> [t]his problem would be compounded by the fact that the multi-year period required for design, construction and launch of global and international satellite systems usually requires service providers to invest substantial resources well before they obtain all needed worldwide licenses and spectrum assignments. The uncertainty created by spectrum auctions could disrupt the availability of capital for such projects, and significantly reduce the available benefits offered by global and international satellite systems.[44]

Plainly stated, requiring satellite operators to acquire licenses at auction to protect their operations puts those operations at significant risk. Given the crucial role satellite

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42 *Notice*, ¶ 211.

43 Report of Committee on Commerce, Communications Satellite Competition and Privatization Act of 1998, H.R. REP. NO. 105-494, pt. 2, at 64-65 (1998).

44 *Id.*

systems play in the nation's communications infrastructure, such an outcome cannot serve the public interest.

This problem would be exacerbated if the Commission were to adopt the proposals of many terrestrial wireless commenters that UMFU licenses cover much larger areas, such as Economic Areas ("EAs") or Basic Trading Areas ("BTAs").[45] As EchoStar demonstrated in its Comments, gateway earth stations affect only a very limited area – on the order of a 200 meters radius for 28 GHz operations and 2 km for 39 GHz operations.[46] By contrast, each EA and BTA covers many thousands of square kilometers.[47] Given this mismatch, as O3b argued, "an mmW auction model in which FSS operators compete with mobile operators for geographic blocks would always strongly favor the mobile bidders," but this "does not imply that mobile is a higher and better use" – only that it is more suited to an auction regime.[48] It would be no reflection of how highly FSS operators value the use of this spectrum if they were unwilling to purchase entire BTAs or EAs to protect an area with a radius of 200 meters to 2 km. Rather, as the Fixed Wireless Communications Coalition forthrightly admits, its proposal

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45 *See, e.g.*, Cisco Comments at 11; Ericsson Comments at 9-10; Intel Comments at 8; Comments of Nokia at 18; Verizon Comments at 10.

46 *See* EchoStar Comments at 16, 28. ViaSat provided similar calculations to show that the affected area would have a radius of less than 160 meters. *See* ViaSat Comments at 13-14.

47 There are 176 EAs and 493 BTAs in the United States. *See Notice*, ¶ 110. According to the U.S. Census Bureau, the total area of the United States is approximately 9.86 million square kilometers. *See* U.S. Census Bureau, "State Area Measurements and Internal Point Coordinates," *available at* https://www.census.gov/geo/reference/state-area.html. Accordingly, on average, each EA contains approximately 56,000 square kilometers and each BTA contains approximately 20,000 square kilometers.

48 O3b Comments at 18.

to use these larger licensing areas renders the Commission's suggestion that satellite operators acquire UMFU licenses "impractical as a general solution."[49]

Some commenters argue that satellite operators should easily be able to acquire the rights they need in the secondary spectrum market.[50] However, given the uncertainty surrounding business cases for 5G deployment, UMFU licensees may not be willing to negotiate until service parameters and requirements are fully defined, which could extend debilitating uncertainty for years. Moreover, an FSS operator that has already invested millions of dollars to build a gateway for a satellite with established and non-movable beams would have no choice but to pay whatever price a terrestrial operator holding the UMFU license in the area demanded. This is not a "market-based" negotiation – it is a hostage situation.

Conversely, other commenters argue that satellite operators that buy UMFU licenses at auction would be able to recoup their investment by partitioning their licenses to allow others to operate in the portion of their licensed area that they do not need.[51] As discussed above, the area needed to safeguard gateway earth station operations is very small. Since terrestrial operators would know that the FSS operator had no use for the spectrum in most of its licensed area, recovering the price paid at auction seems highly unlikely. More fundamentally, the Commission should not force FSS operators into the

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[49] Comments of the Fixed Wireless Communications Coalition at 14.

[50] *See, e.g.*, Cisco Comments at 6; TIA Comments at 13; Verizon Comments at 24. *But see* ViaSat Comments at 16 (requiring FSS operators to acquire partitioned spectrum rights "would allow terrestrial licensees (and particularly the existing LMDS licensees), many of whom could be competitors of satellite broadband operators, to become gatekeepers to any satellite operations in the 28 GHz Band when such earth stations can be deployed with a negligible impact on 5G deployment").

[51] *See, e.g.*, TIA Comments at 13; Verizon Comments at 23.

business of spectrum management simply to achieve regulatory certainty for earth station operations.

D. WITH THE RIGHT RULES, FSS AND 5G SYSTEMS SHOULD BE ABLE TO SHARE THE SPECTRUM ABOVE 24 GHZ

As EchoStar demonstrated in its initial Comments, the area in which mobile systems and FSS gateway earth stations would affect one another is very small. The Commission has similarly recognized that, because of "the unique characteristics of bands above 24 GHz," mobile base stations "in bands above 24 GHz will likely have very small coverage areas" and "will likely have limited geographic coverage even in the aggregate."[52] Accordingly, it would appear that the two services should be able to share spectrum on a co-primary basis without unduly limiting the development of either one – a true "win-win" situation – so long as the Commission adopts appropriate rules. Below we discuss EchoStar's proposals.

1. The 28 GHz Band

In the 28 GHz band, the Commission should elevate all FSS gateway earth stations to co-primary status with fixed and mobile operations in the band – a status consistent with the existing U.S. Table of Allocations.[53] This would have the effect of "grandfathering" gateways that are licensed prior to a UMFU auction. After a UMFU auction has been held, FSS operators that wish to deploy additional gateway earth stations in a terrestrial licensee's area should be required to engage in the sort of standard coordination process used in other frequency bands among co-primary services. For

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[52] *Notice*, ¶ 11.

[53] EchoStar also supports allowing deployment of FSS user terminals in this band on a secondary, non-harmful interference basis.

example, as EchoStar discussed, because of the relatively small number of gateway earth stations that are required to operate an FSS system, one simple approach to sharing would be a first-in-time, first-in-right regime, similar to those the Commission has adopted in numerous other contexts.[54]

To facilitate the coordination process, EchoStar proposes that the Commission adopt two criteria for gateway deployment that will ensure the 28 GHz band is used as efficiently as possible, shared by both FSS and 5G services. EchoStar recognizes that 5G deployments will likely be most robust in large urban centers. However, FSS operators need access to urban infrastructure in order to provide their services, including to the most rural portions of the country. Accordingly, the Commission can strike an appropriate balance by limiting deployment by FSS operators, on a primary basis, of gateways in the largest urban cores. For this purpose, the Commission should – except to the extent an operator is adding an antenna to an existing gateway earth station facility to enable communications with an existing or new FSS satellite operating in the 28 GHz band, or the gateway operates on a secondary basis – permit such deployments except in the urban cores of the 30 (or so) largest U.S. cities.[55] Second, the Commission should adopt appropriate interference protection criteria that FSS gateways must satisfy in order to deploy in a new area. For this purpose, Exhibit 1 attached hereto uses technical data in the record of this proceeding to calculate a power flux-density ("PFD") level (-57 $dBm/m^2/MHz$) that would act as a coordination trigger. If a proposed gateway would not

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54 *See, e.g.*, EchoStar Comments at 21-22 and n.54.

55 EchoStar plans to provide further details on what would constitute an urban core for this purpose in a subsequent filing.

exceed that PFD level at the location of any deployed UMFU mobile base station, no coordination would be necessary and deployment could proceed.[56] If that PFD level would be exceeded, the FSS operator would need to reach a coordination arrangement with the UMFU licensee.

Once an FSS gateway has been grandfathered, satisfied the coordination trigger, or completed the coordination process, UMFU licensees would have to take FSS operations into consideration in designing their terrestrial networks. Such an approach will enable FSS operators to continue to develop this band without fear that their investment will be stranded, but will also leave a large portion of the country – including the dense urban areas of most interest to 5G systems – available for deployment of mobile services.

It is notable that the proposal to make FSS gateway operations co-primary in the 28 GHz band was supported not only by satellite operators, but also by AT&T.[57] AT&T recognizes that "the number of FSS stations is finite" and "these gateways do not need to be located in dense urban areas – the areas where the initial 5G use cases have been developed," and as a result 5G services will be able to coordinate around FSS gateways "to ensure that neither operator suffers interference."[58] Moreover, as SES points out, "each [gateway] earth station typically costs several million dollars to develop, ensuring

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[56] To the extent that some areas fail to attract bidders for 28 GHz UMFU licenses, FSS operators would be free to deploy gateways since there would be no UMFU base stations of concern.

[57] *See* Comments of AT&T at 12-13 ("AT&T Comments"); Comments of the Global VSAT Forum at 6; Inmarsat Comments at 11; SES Comments at 8-12; ViaSat Comments at 15.

[58] AT&T Comments at 12, 13.

that a satellite operator will only build stations that it will use."[59] Given these factors, and a limitation to deployment in "rural" counties, there is no reason to believe that granting co-primary status to FSS would have a negative effect on 5G deployment.

2. The 37 GHz and 39 GHz Bands

With respect to the 37 GHz and 39 GHz bands, EchoStar agrees with many commenters who suggested that the Commission should simply combine the bands to create a single band from 37.0-40.0 GHz.[60] The Commission would then have three gigahertz of contiguous spectrum that could be used to satisfy the needs of both 5G and FSS interests by adopting a regime that matches the operational and geographic characteristics of the various services to optimize the productive use of this valuable spectrum.

Specifically, the Commission should make FSS gateways, fixed, and mobile services co-primary in the band – consistent with the U.S. Table of Allocations.[61] As in the 28 GHz band, this would effectively grandfather gateway earth stations that are licensed prior to a UMFU auction. Gateways proposed in a licensed area after a UMFU auction would (except as applied to grandfathered facilities or secondary operations) once again be limited to deployment outside a number of urban cores (as discussed above), and a specified PFD trigger for coordination would need to apply. However, because FSS receives in this band, it is gateways that need protection against interfering signals from

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59 SES Comments at 13.

60 *See, e.g.*, Ericsson Comments at 8; Intel Comments at 16; Samsung Comments at 14; TIA Comments at 19, 34; Verizon Comments at 6-7.

61 Fixed, Mobile, and FSS are co-primary throughout this band in the U.S., except that FSS has no allocation in the 37.0-37.5 GHz portion. EchoStar also supports allowing deployment of FSS user terminals in this band on a secondary, non-harmful interference basis. *See* EchoStar Comments at 30-31.

UMFU mobile base stations. Thus, FSS operators could be licensed to deploy a gateway earth station in any area outside the designated urban cores. Thereafter, no UMFU base station could be placed in a location that would exceed the PFD trigger at the FSS gateway station location, either individually or in the cumulative effect of all UMFU base stations in the area, without prior coordination with the FSS operator. For this purpose, Exhibit 2 attached hereto derives that PFD trigger level (-73 dBm/m^2/MHz) based on the standard satellite protection criterion of a 6% increase in noise floor. Given the limited area over which such a PFD trigger would be relevant, there is no reason to believe that making FSS gateways and mobile services co-primary in the band outside of certain urban cores would have an adverse effect on 5G deployment.

* * *

Given the characteristics of spectrum above 24 GHz and of the satellite and terrestrial systems that will use it, all of these services should be able to share the bands efficiently and productively. EchoStar urges the Commission to adopt rules that allow both FSS and 5G systems to flourish, yet do not unduly tip the scale for the benefit of new and undefined mobile services at the expense of more established satellite services.

Respectfully submitted,

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EXHIBIT 1

Power Flux-Density Coordination Trigger for 28 GHz

PFD trigger for 28 GHz: -57 dBm/m^2/MHz

In order to calculate the PFD limit necessary to protect 5G operations from FSS gateway earth station transmissions, we begin with the protection criteria used in the *ex parte* presentation submitted in this proceeding by Samsung.[1] Specifically, the receiver sensitivity for a base station in 28 GHz is taken as -97 dBm (line 20 in the Annex for the case "28 GHz Uplink") in an occupied bandwidth of 56.25 MHz. This value corresponds to a value of -114.5 dBm/MHz.

Using the required Signal-to-Interference-and-Noise Ratio (SNIR) of -10 dB and a receiver implementation margin of 2 dB from Samsung's submission, we calculate the Acceptable Interference + Noise level as -106.50 dBm/MHz (-114.50 – (-10) – 2 = -106.50). From this, we must subtract the thermal noise density in order to get the acceptable interference level. Samsung assumes a thermal noise density of -174 dBm/Hz, which corresponds to -114 dBm/MHz. With the subtraction of Thermal noise density, we calculate the acceptable interference as -107.35 dBm/MHz.

To translate the acceptable interference level into a PFD value (in dBm/m^2/MHz), we must add the gain of a square meter antenna ($4\pi/\lambda^2$). This gain is 50.39 dB for 28 GHz.

Therefore, the PFD limit in 28 GHz to protect 5G operations equals to -56.96 dBm/m^2/MHz (-107.22+50.39).

The table below shows the calculation in detail:

Item	Description	Value	Calculation
1	5G Receiver sensitivity [dBm/MHz]	-114.50	(1) = -97 - 10*log(56.25)
2	Required SNIR [dB]	-10.00	
3	Receiver implementation margin [dB]	2.00	
4	Acceptable Interference + Noise level [dBm/MHz]	-106.50	(4) = (1) – (2) – (3)
5	Thermal noise density [dBm/Hz]	-174	
6	Thermal noise density [dBm/MHz]	-114	(6) = (5) + 10*log(10^6)
7	Acceptable interference [dBm/MHz]	-107.35	(7) = (4) – (6)
8	**PFD limit [dBm/m^2/MHz]**	**-56.96**	(8) = (7) + 50.39

[1] Letter from Robert Kubik to Marlene H. Dortch, GN Docket No. 14-177, Appendix (Aug. 28, 2015) ("Samsung Aug. 28 Ex Parte").

EXHIBIT 2

Power Flux-Density Coordination Trigger for 39 GHz

PFD trigger for 39 GHz: -73 dBm/m^2/MHz

The PFD limit necessary to protect FSS gateways from mobile base station transmissions in the 39 GHz band is derived from the protection criteria of 6% increase in noise floor, which is the well-accepted metric used for the protection of satellite and earth station receivers. Consistent with the figures in the Samsung Aug. 28 Ex Parte, we assume the thermal noise density to be -174 dBm/Hz, which can be converted to -114 dBm/MHz. A 6% increase in noise floor corresponds to -12.22 dB (10*log(0.06)). From this, we calculate the acceptable interference level to be -126.22 dBm/MHz (-114 + (-12.22) = -126.22).

To translate the acceptable interference level into a PFD value (in dBm/m^2/MHz), we must add the gain of a square meter antenna ($4\pi/\lambda^2$). This gain is 53.27 dB for 39 GHz.

Therefore, the PFD limit in 39 GHz to protect FSS earth stations equals -72.95 dBm/m^2/MHz (-126.22+53.27 = -72.95). It is important to note that this PFD limit applies to the cumulative interference from all 5G base stations that are near an FSS gateway.

The table below shows the calculation in detail:

Item	Description	Value	Calculation
1	Thermal noise density [dBm/Hz]	-174	
2	Thermal noise density [dBm/MHz]	-114	(2) = (1) + 10*log(10^6)
3	6% increase of noise floor [dB]	-12.22	(3) = 10*log(0.06)
4	Acceptable interference level [dBm/MHz]	-126.22	(4) = (2) + (3)
5	**PFD limit [dBm/m^2/MHz]**	**-72.95**	(5) = (4) + 53.27