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Marlene Dortch
Secretary
Federal Communications Commission
45 L Street NE
Washington, DC 20554

Re: IBFS File No. SAT-MOD20200417-00037; Expanding Flexible Use of the 12.2-12.7 GHz Band, WT Docket No. 20-443

Dear Ms. Dortch:

DISH Network Corporation ("DISH") provides this response to letters filed by Space Exploration Holdings, LLC ("SpaceX") on March 8, 9, and 16, 2021.[1] SpaceX's most recent filings, like the ones before it, attempt to obfuscate the issues rather than respond to the technical analysis provided by DISH. SpaceX continues to fail to refute the conclusion of DISH's expert engineer, Marc Dupuis, that SpaceX will realistically focus more than one 12 GHz satellite beam in the same area to meet demand (Nco of 2 or more), and that it will likely violate the Equivalent Power Flux Density ("EPFD") limits adopted by both the International Telecommunication Union ("ITU") and the Commission for the protection of millions of DBS customers receiving service in the 12 GHz band.[2] DISH therefore reiterates its request that any grant of SpaceX's Third Modification exclude the 12 GHz frequencies.

Three filings later, SpaceX has still refused to answer the simple question underlying the interference concerns that DISH's analysis has presented to date: does SpaceX commit that it will not use more than one satellite beam using the same frequency in the same area? DISH has already called upon the Commission to ask certain questions of all NGSO proponents to aid in developing the record of the 12 GHz rulemaking,[3] and requests that this question be asked

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[1] Letter from David Goldman, SpaceX, to Marlene Dortch, FCC, IBFS File No. SAT-MOD20200417-00037 (March 8, 2021) ("SpaceX March 8 Letter"); Letter from David Goldman, SpaceX, to Marlene Dortch, FCC, IBFS File No. SAT-MOD20200417-00037; WT Docket No. 20-443 (March 9, 2021) ("SpaceX March 9 Letter"); Letter from David Goldman, SpaceX, to Marlene Dortch, FCC, IBFS File No. SAT-MOD20200417-00037 (March 16, 2021) ("SpaceX March 16 Letter").

[2] *See* Letter from Jeff Blum, DISH, to Marlene Dortch, FCC, IBFS File No. SAT-MOD20200417-00037; WT Docket No. 20-443 (Feb. 15, 2021) (attaching *EPFD Assessment of SpaceX into DISH Ku-band GSO Networks*) ("Feb. 15 Study"). *See also* ITU RR R.R. 22.5I, 22.5C; 47 C.F.R. § 2.106 n. 5.487A.

[3] *See* Letter from Pantelis Michalopoulos, Counsel for DISH, to Marlene Dortch, FCC, WT Docket No. 20-443; IBFS File No. SAT-MOD20200417-00037; WC Docket No. 09-197 (Feb. 21, 2021).

specifically of SpaceX, as it is important to understanding the full harm SpaceX's proposed Third Modification will have on DISH's DBS customers.

However, whether SpaceX uses more than one satellite beam in the same area is far from dispositive on the issue of the proposed modification's effects on DISH. In fact, analysis being conducted by DISH shows that, even with one beam serving one area at a time (Nco=1), the Starlink system likely exceeds the EPFD limits. In this letter, DISH presents results demonstrating this exceedance in the Phoenix area, and plans to submit a more detailed analysis covering additional areas. But the question matters because, if SpaceX does use multiple co-frequency overlapping beams, it will violate these limits to a significantly greater extent. In February, DISH submitted a thorough analysis by Mr. Dupuis, based on SpaceX's own data, making that showing.[4] SpaceX still has not directly disputed the premise, methodology, or conclusions of Mr. Dupuis. SpaceX simply states that Mr. Dupuis should not have made an assumption about its operations, but refuses to describe in detail how it will actually operate.

As Mr. Dupuis explained: SpaceX's Starlink system, as proposed to be modified, "will realistically require more than one of the system's co-frequency beams, contrary to SpaceX's one-beam-at-a-time claim, and these converged beams would likely exceed EPFD limits and have a detrimental impact on the receive dishes of DISH customers and the uplinks of many DISH satellites."[5] This analysis was premised on the expectation that SpaceX would seek to meet demand for its service by focusing multiple co-frequency beams on the same area from multiple satellites. Indeed, SpaceX's pending modification of its earth station authorization from one million to five million authorized units "due to the extraordinary demand for access to the Starlink non-geostationary orbit satellite system"[6] only provides further support for the conclusions in Mr. Dupuis' report.

In response, SpaceX continues to be silent on this important point, and instead attempts to change the subject, harping on the unremarkable point that the expert testimony submitted by DISH is not *pro bono*. The company states: "SpaceX simply will not operate as DISH and its paid consultant hypothesize. Instead, it will comply with the terms of its license."[7] But will SpaceX commit to using one beam at a time? SpaceX does not say; instead, SpaceX complains that "DISH totally rejects the possibility that SpaceX plans to operate consistent with that parameter [Nco of 1 or 1 beam at a time]."[8] SpaceX fails to clarify whether the possibility is reality, whether in fact it has such a plan, and whether it will operate consistent with that parameter. And, even if it were to finally say that it will do so, what would it mean to operate "consistent with" an Nco of 1? Does SpaceX take the position that, if it focuses many beams on the same area, and nevertheless the EPFD limits are not exceeded in its judgment, this amounts

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[4] *See* Feb. 15 Study.

[5] Feb. 15 Study at 1.

[6] Narrative, SpaceX Services, Inc., Application for Modification of Blanket Earth Station Authorization, IBFS File No. SES-MOD-20200731-00807 (July 31, 2020).

[7] SpaceX March 9 Letter at 2.

[8] *Id*.

to operating "consistent with" that parameter? Given the significant risk of exacerbating interference to DISH's DBS customers, SpaceX should answer without further evasion.

Similarly, SpaceX continues its oblique strawman challenge against the premise of Mr. Dupuis' report, not on the ground that it is incorrect, but on the ground that Mr. Dupuis is somehow not entitled to rely on it. SpaceX thus asserts that Mr. Dupuis' study "would have used different parameters" than SpaceX had submitted to the Commission and that "[t]hird parties do not get to tell applicants how they must operate their satellite systems."[9] As SpaceX adds sanctimoniously, "this is not the test."[10] But *this* is the test: will SpaceX commit that it will not use multiple co-frequency beams at a time in the same area? As mentioned, DISH believes that even that commitment would not ensure that SpaceX's system would be in compliance with the EPFD limits. But the threshold question of beam overlap remains central to understanding the full impact of SpaceX's proposed Third Modification.

SpaceX also states, without foundation, that "DISH clearly does not like the internationally agreed upon EPFD limits or the way in which the ITU and the Commission apply them,"[11] To the contrary: DISH's very point is that both the limits and the correct manner of their application are essential. But submitting a system whose beams do not overlap on paper and protecting the flexibility to deviate from this paper submission is not the way in which the ITU and the Commission apply these limits; it is the way in which SpaceX has attempted to apply them.[12] While SpaceX criticizes DISH for using "different parameters" than it has submitted, it accurately describes DISH's conclusion and SpaceX still offers no objection to it: "using those parameters could violate EPFD limits."[13] It would indeed. The implication from these evasions is that SpaceX wants to retain the flexibility to focus many beams using the same frequency on the same area.

And the evasion continues in SpaceX's March 16 letter, where it protests that its use of an Nco of 1 is "not just an analytical input for analysis, but actually reflects the way SpaceX operates its system."[14] SpaceX's hedging is at work once again. "[N]ot just an analytical input for analysis" means that, whatever else the use of Nco=1 is, it *was* intended by SpaceX as an analytical input. But does SpaceX commit to use only one 12 GHz beam in any area at a time? Will it do so if demand requires a second, tenth, or fortieth beam? And what does SpaceX say to

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[9] *Id*.

[10] *Id.*

[11] *Id*.

[12] Indeed, the ITU rule cited by SpaceX states an NGSO operator will be in compliance with its non-interference obligations only if power limits radiated by the NGSO FSS system "do not exceed the operational and additional operational limits" and that any NGSO FSS system "which radiates EPFDdown into any operating geostationary fixed-satellite service earth station at levels in excess of the operational or additional operational limits . . . shall be considered to be in violation of its obligations." ITU Radio Reg. No. 22.5I. The rule does not create some presumption that the limits will not be exceeded if a paper submission assumes a system that will not exceed them.

[13] SpaceX March 9 Letter at 2.

[14] SpaceX March 16 Letter at 2.

Mr. Dupuis' conclusion that, assuming a beam with a capacity of 200 to 300 Mbps, each beam can support no more than 50 to 100 users requesting services and no more than 10 active users?[15] Nothing. Of course, SpaceX has likely not yet had to meet surging demand in any area.

In addition, even an Nco of 1 is not a cure. The NGSO system expert retained by DISH, Mr. Dupuis, has also found that, even with a single beam transmitting to chosen locations within the United States (Nco=1), and ignoring the impact of sidelobes from all other co-frequency beams from satellites located outside the GSO exclusion zone, the Starlink system will exceed EPFD limits for certain antenna sizes, namely the commonly used 45 cm and 60 cm BSS antennas. Instead of using the pre-defined simulator parameters used by the Radiocommunication Bureau to identify the worst-case DBS dish locations, which do not work well for complex constellations such as the Starlink system, Mr. Dupuis used real-world locations and assessed the EPFD levels that would be experienced on the ground based on the signal of a DISH satellite location of 119° W.L. The chart below provides Mr. Dupuis' findings for the Phoenix area:

	Result	Figure	Excess (positive numbers) EPFD (dB)		
Run GSO Rx ES	Nco = 1		P=100%	P=10%	P=0.001%
EPFDdn BSS 0.3m	PASS				
EPFDdn BSS 0.45m	FAIL	7	5.0	2.0	-7.2
EPFDdn BSS 0.6m	FAIL	8	3.5	3.0	-9.7
EPFDdn BSS 0.9m	PASS				
EPFDdn BSS 1.2m	FAIL	9	1.0	-0.4	-13.5
EPFDdn BSS 1.8m	PASS				
EPFDdn BSS 2.4m	PASS				
EPFDdn BSS 3m	PASS				
EPFDdn FSS 0.6m	PASS				
EPFDdn FSS 1.2m	FAIL	10	1.0	-0.3	-13.5
EPFDdn FSS 3m	PASS				
EPFDdn FSS 10m	PASS				

Thus, transmission from even one beam of the Starlink system (Nco=1) will exceed EPFD limits by as much as 5 dB. Mr. Dupuis is also expanding the analysis to other geographic locations in the states of Florida, Kansas, New York, and Washington. DISH will soon submit Mr. Dupuis' detailed analysis.

With respect to SpaceX's March 8 letter which focuses on terrestrial 5G use of the 12 GHz band, SpaceX argues that the MVDDS licensees "cannot explain why SpaceX's modification would make any difference to their plans" because other authorized NGSO systems propose wider beams at lower elevation angles.[16] But this argument is flawed. First, it is SpaceX's attempt to distract from its own conduct by pointing to the conduct of others. Second, DISH is not trying to single out any particular NGSO system. As part of the 12 GHz

[15] Feb. 15 Study at 21-22.

[16] SpaceX March 8 Letter at 2.

rulemaking, DISH has proposed that the Commission address questions to all NGSO systems, as applicable.[17] But, no other NGSO system has commenced operations to the same extent as SpaceX, and no one other than SpaceX has commenced providing service in the U.S. The concerns about interference from SpaceX are therefore more acute and immediate. And SpaceX's actual use of the 12 GHz band has generated data unavailable from other systems—data that need to be evaluated by the Commission. Third, SpaceX continues to avoid the antecedent question: before even starting to discuss the effect of its modification on MVDDS, it is essential to assess its effect on DBS, a service with which NGO FSS is prohibited from interfering.[18] In that respect, Mr. Dupuis' analysis concludes that much of the detrimental impact from the Starlink system on DBS is the direct result of the proposed modifications: "[the] [m]odification will cause more interference into GSO networks than the already-authorized NGSO system" due to "[t]he combined effect of the reduced altitude and extended service area (reduced minimum elevation angle)."[19]

SpaceX's next point is that the MVDDS 5G Coalition argued almost five years ago that sharing between 5G mobile services and NGSO systems is not feasible.[20] But SpaceX says nothing about the intervening technical advances and the recent experience with NGSO system operations. Since 2016, innovations including multiple input multiple output antennas to make use of higher-frequency spectrum, channel bonding to better integrate discrete bands of spectrum across large ranges of frequency, and dynamic spectrum sharing to increase efficiency associated with moving to 5G networks all may have increased the degree to which NGSO FSS and 5G service can coexist.[21] DISH is assisting in a thorough analysis of the feasibility of sharing between 5G and NGSO services, to be submitted as part of comments in response to the 12 GHz rulemaking.

Chairwoman Rosenworcel has stressed the critical importance of a "fact-based record."[22] And President Biden has made clear that "science, facts, and evidence are vital to addressing policy and programmatic issues across the Federal Government" and therefore, "it is the policy of my Administration to make evidence-based decisions guided by the best available science and data."[23] DISH has provided fact-based analysis in the record to help the Commission decide

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[17] *See* Letter from Pantelis Michalopoulos, Counsel for DISH, to Marlene Dortch, FCC, WT Docket No. 20-443; IBFS File No. SAT-MOD20200417-00037, WC Docket No. 09-197 (Feb. 23, 2021).

[18] Under international footnote 5.487A, NGSO FSS in the 12 GHz band "shall be operated in such a way that any unacceptable interference that may occur during their operation shall be rapidly eliminated." ITU RR 5.487A; 47 C.F.R. § 2.106 n. 5.487A.

[19] Feb. 15 Study at 10-11.

[20] SpaceX March 8 Letter at 2.

[21] *See* Expanding Flexible Use of the 12.2-12.7 GHz Band, *Notice of Proposed Rulemaking*, WT Docket No. 20-443, at ¶ 28 (Jan. 15, 2021) ("12 GHz NPRM") (citing DISH comments).

[22] Open RAN Policy Coalition, *How Will an Open RAN Facilitate a Diverse, Competitive and Secure Ecosystem for 5G and Beyond?*, YouTube, at 5:48-6:38 (Mar. 9, 2021), https://youtu.be/_etskf-VMCM.

[23] *Memorandum on Restoring Trust in Government Through Scientific Integrity and Evidence-Based Policymaking*, White House (Jan. 27, 2021), https://www.whitehouse.gov/briefing-room/presidential-

these important issues. SpaceX has thus far failed to refute this analysis, or provide any fact-based demonstrations in support of its request.

For these reasons, any grant of SpaceX's Third Modification should exclude the 12 GHz band.

Respectfully submitted,

/s/ Jeffrey H. Blum
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