August 6, 2020

Marlene Dortch
Federal Communications Commission
Office of the Secretary
445 12th Street, SW
Washington, DC 20554

Re: IBFS File No. SAT-MOD-20200417-00037, Call Signs: S2983 and S3018

Dear Ms. Dortch:

SpaceX continues to dodge questions about whether its proposal will disrupt the direct broadcast satellite services of tens of millions of Americans.[1] SpaceX has failed to submit an Equivalent Power Flux Density ("EPFD") analysis to reassure the Commission and the public that SpaceX's 12.2-12.7 GHz ("12 GHz Band") non-geostationary satellite orbit fixed-satellite service operations will not generate power levels beyond what a standard co-frequency DBS reference antenna can tolerate. Through separate correspondence, DISH has requested the information, software, and native-format files necessary to conduct the type of supporting EPFD analysis that SpaceX should have already provided.

Meanwhile, SpaceX has pointed to previous favorable EPFD findings by the International Telecommunication Union as grounds for why the company's EPFD conclusions require no further analysis from the Commission.[2] The ITU submission that SpaceX cites, however, has no bearing on SpaceX's proposed system redesign.[3] The ITU has only examined EPFD compliance for one orbital plane at 550 km, not four orbital planes between 540 km and 570 km. The ITU also has evaluated a proposed system with a minimum elevation angle of at least 40 degrees, not 25 degrees. Furthermore, the favorable rating that SpaceX cited belongs to SpaceX's *Norwegian* "STEAM" filings, not the *American* "USASAT-NGSO-3" filings that are the basis for the company's U.S. space station authorization.[4] SpaceX must update all USASAT-NGSO-3 filings and submit for examination the related EPFD analyses that reflect its latest proposed system

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[1] *See* Consolidated Opposition to Petitions and Response to Comments of SpaceX, IBFS File No. SAT-MOD-20200417-00037 (filed July 27, 2020).

[2] *See id.* at 30-31.

[3] *See* Appendix.

[4] Only on Aug. 4, 2020 did SpaceX receive favorable ratings for two outdated American filings: USASAT-NGSO-3A-R and USASAT-NGSO-3B-R. *See EPFD data and EPFD examination results*, ITU, https://bit.ly/2EwcXzL (last visited Aug. 4, 2020). The two filings represent only parts of the whole SpaceX system.

design.[5] Parties, including the ITU and Commission, need time to assess this information because of SpaceX's ever-evolving design and deployment plans.[6]

Given Starlink's tighter and denser net and closer proximity to Earth, some assumptions in the EPFD downlink analysis are more important than others. One assumption that is especially important to predicting interference into DBS is the nbr_op_sat value, which captures the maximum number of satellites transmitting with overlapping frequencies to a location.[7] EPFD levels increase as more satellites transmit to a single point simultaneously. A review of other NGSO FSS applicants' and licensees' nbr_op_sat values demonstrates just how out of step SpaceX's assumed value of "one" is compared to the assumptions of others. This raises questions about the validity of SpaceX's EPFD downlink analysis.

SpaceX defends its use of an nbr_op_sat value of one based on its steerable beams.[8] But this defense is unpersuasive. Telesat, another NGSO FSS operator also deploying steerable beams, explained why: "[A] much higher value [than one] needs to be used when running the EPFD validation software in order to capture the contributions to the EPFDdown from a larger number of satellites, whether or not they are intentionally transmitting to this given location."[9] Telesat, which used an nbr_sat_op of 30,[10] explained the "EPFD validation software will determine from the orbit geometry the actual maximum number of visible satellites up to the [nbr_op_sat] provided."[11] The software and orbit geometry should decide SpaceX's true nbr_op_sat value rather than SpaceX arbitrarily deciding it is one.

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[5] How SpaceX continues to use a dual-flagged system and myriad ITU filings raises additional concerns, including how to properly evaluate aggregate interference across all SpaceX's filings and other co-frequency NGSO filings. Together, these operators must also ensure their aggregate interference into co-frequency geostationary-satellite orbit networks does not exceed aggregate-system entry power levels. *See* ITU-R Resolution 76 (WRC-15); *see also, e.g.*, *Space Exploration Holdings, LLC*, Order and Authorization, 34 FCC Rcd 12307 ¶ 19(e), (o) (2019). SpaceX has not explained how it intends to address these concerns, and the company's allusions to future disclosures cannot eliminate present-day concerns about interference to DBS subscribers.

[6] SpaceX has deployed 538 satellites on orbit since May 24, 2019, only 14 months ago. *See* 2019 and 2020 Annual Report, SpaceX, IBFS File No. SAT-LOA-20161115-00118 (filed July 1, 2019 and June 23, 2020).

[7] This important nbr_sat_op input also appears in ITU Advance Publication Information and Coordination Request filings.

[8] *See* Letter from David Goldman, Director of Satellite Policy, SpaceX, to Marlene Dortch, Secretary, FCC, IBFS File No. SAT-MOD-20200417-00037, at n.9 (filed June 29, 2020).

[9] *See* Telesat, IBFS File No. SAT-MPL-20200526-00053, Technical Information at 15 (filed May 26, 2020).

[10] *See id.*

[11] *Id.*

SpaceX seems to acknowledge as much. In its recent second-generation 30,000-satellite constellation proposal, for example, SpaceX used a value of *1,500* for the nbr_op_sat parameter.[12] Applying a similar ratio of satellites to nbr_op_sat to SpaceX's current application would imply an nbr_op_sat of more than 50, which is in keeping with the value that other, similarly situated applicants and licensees, employed. SpaceX, however, never explains the disconnect between the assumptions it used for its current generation system and the assumptions it used for its next generation system. If nothing else, SpaceX's use of a dramatically higher nbr_op_sat parameter for its next-generation system suggests that SpaceX now concedes that filings for large NGSO systems with steerable beams should contain nbr_sat_op values greater than one.

Submissions from every other 12 GHz Band NGSO FSS applicant and licensee support this view. Unlike SpaceX, they conservatively analyzed their EPFD compliance based on their system design parameters. The enclosed appendices summarize their nbr_sat_op inputs. In the 2016/2017 processing round, for example, Kepler's initial 140-satellite and Theia's 112-satellite constellation each used *four* for the nbr_op_sat, while OneWeb presented an nbr_op_sat of *forty* for its 720-satellite constellation.[13] In the 2020 processing round, OneWeb again submitted an nbr_op_sat of *forty* for its 47,844-satellite system and New Satellite Spectrum used *three* as its nbr_op_sat for its 15-satellite system.

Indeed, only two 12 GHz Band NGSO FSS operators appear to have used an nbr_op_sat value of one, and both systems involve special circumstances not remotely present in SpaceX's system. Karousel (2016/2017 processing round), for example, intends to deploy only 12 satellites globally and will operate them in highly inclined elliptical orbits such that only one satellite will be active over North America at any given point in time.[14] Kepler's second, separate system (2020 processing round), likewise will only serve high latitude areas above 55°N, which is well north of the border between the continental United States and Canada.[15] Kepler will also use low elevation angles and exclusion masks to protect GSO systems.[16] The unique configurations of these two systems make an assumed value of one for the nbr_op_sat parameter defensible for Karousel and Kepler in ways that SpaceX's Starlink system simply cannot replicate.

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[12] *See* Appendix.

[13] OneWeb's Ku-band beams appear fixed but can use progressive pitch technology to alter their coverage footprints: "While the Ku-band user beams cannot be steered, through the use of OneWeb's patent pending Progressive Pitch technology, the entire Ku-band footprint of any satellite can be moved up or down in latitude from the sub-satellite point." OneWeb, IBFS File No. SAT-LOI-20160428-00041, Technical Narrative at n.5 (filed Apr. 28, 2016).

[14] *See* Karousel, IBFS File No. SAT-LOA-20161115-00113, Application at 4 (filed Nov. 15, 2016).

[15] *See* Kepler, IBFS File No. SAT-PDR-20200526-00059, Exhibit B at 4-6 (filed May 26, 2020).

[16] Despite its low interference potential, Kepler requested a waiver "for presenting an exhaustive EPFD compliance analysis for the system, as the present EPFD limits set by Article 22 and Resolution 85 were developed in consideration of systems with much higher inherent potential for interference to GSO than the one proposed." *Id.* at 22.

In short, SpaceX's nbr_op_sat assumptions are at odds with those of every other similarly situated party and SpaceX's own filings for its next-generation system. SpaceX's outlier assumptions, coupled with the lack of supporting ITU filings and EPFD examinations for this request, demonstrate the need to review the underlying inputs before any action occurs.

SpaceX presumably should be able to demonstrate compliance with the EPFD limits quickly. If it cannot, SpaceX has access to 15 gigahertz of spectrum other than the 12 GHz Band for its planned operations.[17] Other NGSO FSS operators have demonstrated that they can successfully deploy global satellite broadband internet without the 12 GHz Band.[18] Especially at the outset of SpaceX's operations, when consumer demand will be at its nadir, a limit on use of a small fraction of the company's NGSO spectrum until SpaceX can demonstrate compliance with the only safeguard protecting tens of millions of DBS subscribers from NGSO interference represents a minimum, common-sense precaution against actual or potential injury to the public.

Insisting that SpaceX demonstrate compliance with DBS interference protections prior to authorizing a new and dramatically different configuration of roughly two-thirds of the space stations in the company's proposed 4,408 satellite constellation will help prevent interruptions to the delivery of news, entertainment, and information to tens of millions of Americans without impeding SpaceX's proposed deployment.

Please contact me with any questions regarding this submission.

Sincerely,

/s/ Jeffrey Blum

Jeffrey Blum
Executive Vice President, External and Legislative Affairs
DISH Network L.L.C.
1110 Vermont Ave NW, Suite 450
Washington, DC 20005
202-463-3703

Enclosures

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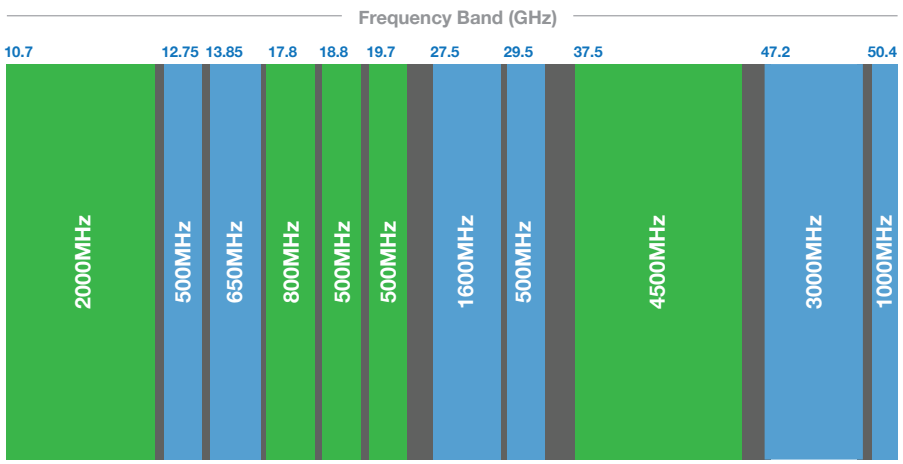
[17] Please refer to the attached visualization of SpaceX's spectrum resources.

[18] *See, e.g., Kuiper Systems, LLC Application for Authority to Deploy and Operate a Ka-band Non-Geostationary Satellite Orbit System*, Order and Authorization, IBFS File No. SAT-LOA-20190704-00057, FCC 20-102 (rel. June 30, 2020) (authorizing the NGSO FSS system to use only Ka-band frequencies); *ViaSat, Inc. Petition for Declaratory Ruling Granting Access for a Non-U.S.-Licensed Non-Geostationary Orbit Satellite Network*, Order and Declaratory Ruling, 35 FCC Rcd 4324 (2020) (permitting solely Ka-band and V-band frequencies on board the NGSO FSS system).

Spectrum Available to SpaceX Non-Geostationary Orbit Fixed-Satellite Service (NGSO FSS).

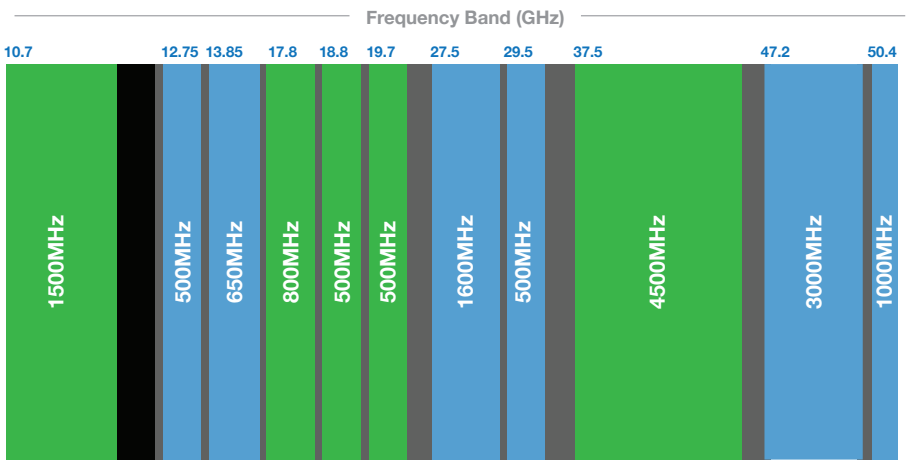
With **over 15,000 megahertz** of spectrum at its disposal, SpaceX has the significant spectrum resources necessary to provide satellite service today and in the years to come, with or without the 12 GHz band.

Total Spectrum Available for NGSO FSS



Total Spectrum: 15,550 MHz

Total Spectrum Available for NGSO FSS exclusive of 12.2-12.7 GHz (12 GHz Band)



Total Spectrum: 15,050 MHz

If the FCC were to repurpose the 12 GHz band for terrestrial 5G services, SpaceX would retain nearly 97% of all spectrum and nearly 94% of all space-to-earth spectrum made available for its proposed NGSO FSS system.

** SpaceX has been on notice that their authorization in the 12 GHz Band is subject to modification by FCC rules and policies.*

APPENDIX A
"nbr_op_sat" Inputs for First Processing Round Participants Using 12.2-12.7 GHz

Operator	Fixed or Steerable Beams for Satellites?	"nbr_op_sat" Input
Karousel[19]	Steerable	1[20]
Kepler[21]	Steerable	4
OneWeb[22]	Fixed but will use progressive pitch to alter coverage footprint[23]	40
Space Norway[24]	Fixed	0 (-90 to 55 deg. latitude) 1 (55 to 82 deg. latitude) 2 (82 to 90 deg. latitude)
SpaceX[25]	Steerable	1 (STEAM-1 (2018)) 1 (STEAM-1 (2020)) 1 (USASAT-NGSO-3 (2020))
Theia[26]	Steerable	4

[19] *See* Karousel, IBFS File No. SAT-LOA-20161115-00113, Attachment 2 December 27, 2016 Supplement Demonstration of EPFD Compliance at 1-2 (filed Dec. 27, 2016).

[20] *See supra* at p. 3.

[21] *See* Kepler, IBFS File No. SAT-PDR-20161115-00114, Technical Narrative at 8, 15-16, 25 (filed Nov. 15, 2016).

[22] *See* OneWeb, IBFS File No. SAT-LOI-20160428-00041, Technical Narrative at 7, A1-5 (filed Apr. 28, 2016).

[23] *See supra* note 13.

[24] *See* Space Norway, IBFS File No. SAT-PDR-20161115-00111, Petition for Declaratory Ruling at 2 and Attachment A at 5, 7 (filed Nov. 15, 2016); *EPFD data and EPFD examination results*, ITU, https://bit.ly/2EwcXzL (July 9, 2019 "NORSAT-H1" inputs) (last visited July 28, 2020).

[25] *See, e.g.*, SpaceX, IBFS File No. SAT-PDR-20161115-00111, Technical Attachment at 5-7 (filed Nov. 15, 2016); *EPFD data and EPFD examination results*, ITU, https://bit.ly/2EwcXzL (Nov. 27, 2018 and May 12, 2020 "STEAM-1" filing inputs and Aug. 4, 2020 "USASAT-NGSO-3A-R" filing inputs) (last visited Aug. 4, 2020).

[26] *See* Theia, IBFS File No. SAT-LOA-20161115-00121, Technical Narrative at 21 and PDF p. 62-63 (filed Nov. 15, 2016).

APPENDIX B
"nbr_op_sat" Inputs for Second Processing Round Participants Using 12.2-12.7 GHz

Operator	Fixed or Steerable Beams for Satellites?	"nbr_op_sat" Input
Kepler[27]	Steerable	1[28]
New Spectrum Satellite[29]	Steerable	3
OneWeb[30]	Phase I satellites (87.9 deg.): Fixed but will use progressive pitch to alter coverage footprint[31] Phase I satellites (55 deg.): Steerable Phase II: Steerable	40 (Phase I)[32] 40 (Phase II)[33]
SpaceX[34]	Steerable	1500 (USASAT-NGSO-3)

[27] *See* Kepler, IBFS File No. SAT-PDR-20200526-00059, Exhibit B at Table 3 (filed May 26, 2020); *e-Submission of Satellite Network Filings*, ITU, https://bit.ly/3ggWoFG (June 15, 2020 coordination request for "HOTH" filing) (last visited July 28, 2020).

[28] *See supra* at p. 3.

[29] *See* New Spectrum Satellite, IBFS File No. SAT-APL-20200526-00060, Narrative Attachment (filed May 26, 2020); *e-Submission of Satellite Network Filings*, ITU, https://bit.ly/335Xtww (Feb. 22, 2018 coordination request for "V-GEO 1" filing) (last visited July 28, 2020).

[30] *See* OneWeb, IBFS File No. SAT-MPL-20200526-00062, Phase I Technical Attachment at 9, 11, 16 and Phase II Technical Attachment at 6, 10 (filed May 26, 2020).

[31] *See supra* note 13.

[32] *See EPFD data and EPFD examination results*, ITU, https://bit.ly/2EwcXzL (Dec. 10, 2019 inputs for "L5" filing) (last visited July 28, 2020).

[33] *See EPFD data and EPFD examination results*, ITU, https://bit.ly/2EwcXzL (Aug. 6, 2019 inputs for "THEO" filing) (last visited July 28, 2020).

[34] *See, e.g.*, SpaceX, IBFS File No. SAT-LOA-20200526-00055, Technical Attachment at 5 (filed May 26, 2020); *e-Submission of Satellite Network Filings*, ITU, https://bit.ly/3hMXcTh (Oct. 7, 2019 coordination request for "USASAT-NGSO-3W-2" filing) (last visited July 28, 2020). DISH Network provides "USASAT-NGSO-3W-2" as an example but notes other identical Oct. 7, 2019 "USASAT-NGSO-3" filings exist.

CERTIFICATE OF SERVICE

I hereby certify that, on this 6th day of August, 2020, a copy of the foregoing pleading was served via First Class mail upon:

Julie N. Zoller
Andrew Keisner
Mariah Dodson Shuman
Kuiper Systems LLC
410 Terry Avenue N
Seattle, WA 98109

Nickolas G. Spina
Kepler Communications, Inc.
196 Spadina Avenue
Suite 400
Toronto, ON Canada M5T2C2

Ruth Pritchard-Kelly
WorldVu Satellites Limited
1785 Greensboro Station Place, Tower 3
McLean, VA 22102

Brian Weimer
Douglas Svor
Sheppard Mullin Richter & Hampton LLP
2099 Pennsylvania Avenue, N.W.
Suite 100
Washington, DC 20006
Counsel to WorldVu Satellites Limited

Suzanne Malloy
Petra A. Vorwig
SES Americom, Inc./O3b Limited
1129 20th Street, N.W., Suite 1000
Washington, DC 20036

Karis A. Hastings
SatCom Law LLC
1317 F Street, N.W., Suite 400
Washington, DC 20004
Counsel to SES Americom, Inc./O3b Limited

John P. Janka
Amy R. Mehlman
Viasat, Inc.
901 K Street, N.W., Suite 400
Washington, DC 20001

Christopher Murphy
Viasat, Inc.
6155 El Camino Real
Carlsbad, CA 92009

Vann Bentley
Computer and Communications Industry Association
25 Massachusetts Avenue, N.W.
Suite 300C
Washington, DC 20001

Angie Kronenberg
INCOMPAS
1100 G Street, N.W.,
Suite 800
Washington, DC 20005

Jessica B. Lyons
Michael P. Goggin
Gary L. Phillips
David L. Lawson
AT&T Services, Inc.
1120 20th Street N.W., Suite 1000
Washington, DC 20036

Ananda Martin
Spire Global, Inc.
8000 Towers Crescent Drive
Suite 1225
Vienna, VA 22182

Henry Goldberg
Joseph A. Godles
Goldberg, Godles, Wiener & Wright LLP
1025 Connecticut Avenue, N.W.
Suite 1000
Washington, DC 20036
Counsel to Telesat Canada

David Goldman
Space Exploration Technologies Corp.
1155 F Street, NW
Suite 475
Washington, DC 20004

William M. Wiltshire
Paul Caritj
Harris, Wiltshire & Grannis LLP
1919 M Street, N.W.
Suite 800
Washington, DC 20036
Counsel to SpaceX

Charity Weeden
Astroscale U.S. Inc.
1401 Lawrence Street
Suite 1600
Denver, CO 80202

/s/ Irene Rodriguez
Irene Rodriquez