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

In the Matter of	)	
	)	
Space Exploration Holdings, LLC	)	IBFS File No. SAT-MOD-20200417-00037; Call Signs S2983 and S3018
	)	
Request for Modification of the Authorization for the SpaceX NGSO Satellite System	)	

ORDER AND AUTHORIZATION

Adopted: January 8, 2021 **Released: January 8, 2021**

By the Chief, International Bureau:

I. INTRODUCTION

1. In this Order and Authorization (Order), we grant in part and defer in part the application[1] of Space Exploration Holdings, LLC (SpaceX) for a further modification of its license for its non-geostationary orbit (NGSO) fixed-satellite service (FSS) constellation of 4,425 satellites using Ku- and Ka-band spectrum.[2] Specifically, we grant the request with respect to ten satellites, previously authorized for altitudes in the 1,100-1,300 km range, to instead be deployed and operated at an altitude of 560 km and an inclination of 97.6□.[3] Grant of authority to deploy and operate these ten satellites at 560 km, as conditioned, will facilitate development and testing of SpaceX's broadband service in high latitude geographic areas, where SpaceX has expressed an intention to provide service to areas underserved or unserved by terrestrial systems, including to Federal broadband users.[4]

II. BACKGROUND

2. SpaceX's license, taking into account prior modifications, specifies a lower "shell" of 1,584 satellites at altitudes of 550 km and an upper "shell" of 2,825 satellites in the 1,100-1,300 km

[1] *See* Space *Exploration Holdings, LLC, Request for Modification of the Authorization for the SpaceX NGSO Satellite System,* IBFS File No. SAT−MOD−20200417−00037, filed Apr. 17, 2020 (Third Modification Application).

[2] *See Space Exploration Holdings, LLC, Application for Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System*, Memorandum Opinion, Order and Authorization, 33 FCC Rcd 3391 (2018) (SpaceX Authorization).

[3] *See* Letter from Gardner Foster, Principal, Satellite Policy, Space Exploration Technologies Corp., to Marlene H. Dortch, Secretary, FCC (filed Jan. 5, 2021) (stating that the forthcoming Transporter-1 mission will include ten Starlink satellites for operation in polar orbits). We defer action on the remainder of SpaceX's modification request, including requests to (1) reduce the number of satellites in its constellation from 4,409 to 4,408; (2) lower the specified altitude of 2,814 satellites in the "upper shell" of its constellation from altitudes of 1,100-1,300 km to altitudes of 540-570 km; and (3) provide a blanket authorization for all launch and early orbit phase operations, payload testing during orbit-raising, and operations during deorbit of its satellites.

[4] *See* Letter from David Goldman, Director of Satellite Policy, Space Exploration Technologies Corp., to Marlene H. Dortch, Secretary, FCC at 2 (filed Nov. 17, 2020) (SpaceX November 17 Letter).

range.[5] SpaceX has deployed over 900 satellites for operation in the lower shell.[6]

3. On April 17, 2020, SpaceX filed the Third Modification Application proposing to reduce the total number of satellites in its constellation from 4,409 to 4,408 and to lower the specified altitude for the 2,824 satellites in the upper shell of its system from 1,100-1,300 km to 540-570 km. SpaceX does not propose any changes to the Ku- and Ka-band frequencies specified in its license.[7] On June 12, 2020, the Third Modification Application was accepted for filing.[8] A number of Petitions to Deny or Defer and other filings were submitted in response to the Third Modification Application.[9]

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[5] *See* Space *Exploration Holdings, LLC, Request for Modification of the Authorization for the SpaceX NGSO Satellite System*, Order and Authorization, 34 FCC Rcd 2526 (IB 2019) (*SpaceX First Modification Order*), reconsideration requests granted in part, denied in part, and dismissed, *Space Exploration Holdings, LLC, Request for Modification of the Authorization of the SpaceX NGSO System*, Memorandum Opinion and Order, 35 FCC Rcd 5649 (IB 2020); *Space Exploration Holdings, LLC, Request for Modification of the Authorization for the SpaceX NGSO Satellite System*, Order and Authorization, 34 FCC 12307 (IB 2019) (*SpaceX Second Modification Order*).

[6] *See* SpaceX, *Updates, Starlink Mission*, (Nov. 24, 2020), https://www.spacex.com/updates/starlink-mission-11-24-2020/index.html (announcing launch of additional Starlink satellites on November 24, 2020); Jeff Foust, *SpaceX sets new Falcon 9 reuse milestone on Starlink launch*, SpaceNews (Nov. 24, 2020) (stating that SpaceX has now launched 955 Starlink satellites).

[7] *See* Third Modification Application, Frequency Bands Requested at 1. SpaceX's authorized frequencies are as follows: 10.7-12.7 GHz (space-to-Earth), 12.75-13.25 GHz (Earth-to-space), 13.85-14.5 GHz (Earth-to-space), 17.8-18.6 GHz (space-to-Earth), 18.8-19.3 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 27.5-29.1 GHz (Earth-to-space), and 29.5-30 GHz (Earth-to-space). *Id.*

[8] *See* Policy Branch Information, Space Stations Accepted for Filing, Public Notice, Report No SAT-01472 (IB Sat. Div. Jun. 12, 2020).

[9] *See e.g.*, Opposition and Motions of The Balance Group (filed May 26, 2020) as amended by Errata of The Balance Group (filed May 27, 2020) (The Balance Group Opposition); Letter from V. Noah Campbell, RS Access, LLC., to Marlene H. Dortch, Secretary, FCC (filed June 11, 2020) (RS Access Letter); Letter from Jeffrey Blum, Executive Vice President External and Legislative Affairs, DISH Network, LLC., to Marlene H. Dortch, Secretary, FCC (filed June 16, 2020) (DISH Letter); Letter from Charity Weeden, Vice President Global Space Policy, Astroscale U.S. Inc., to Marlene H. Dortch, Secretary, FCC (filed June 30, 2020) (Astroscale Letter); Letter from Christopher J. Murphy, Associate General Counsel, Viasat, Inc., to Marlene H. Dortch, Secretary, FCC (filed July 2, 2020) (Viasat July 2 Response to SpaceX); Petition to Deny or Defer of Viasat, Inc. (filed July 13, 2020) (Viasat Petition); Petition to Deny or Defer of SES Americom, Inc. and O3b Limited (filed July 13, 2020) (SES/O3b Petition); Petition to Deny of Kepler Communications, Inc. (filed July 13, 2020) (Kepler Petition); Petition to Deny and Comments of Kuiper Systems, LLC. (filed July 13, 2020) (Kuiper Petition); Comments of AT&T Services, Inc. (filed July 13, 2020) (AT&T Comments); Letter from Vann Bentley, Policy Counsel, Computer & Communications Industry Association, to Marlene H. Dortch, Secretary, FCC (filed July 13, 2020) (CCIA/INCOMPAS Letter); Letter from Jeffrey Blum, Executive Vice President, External and Legislative Affairs, DISH Network, LLC., to Marlene H. Dortch, Secretary, FCC (filed July 14, 2020) (DISH July 14 Response to SpaceX); Letter from Bruce E. Fox, Go Long Wireless, to Marlene H. Dortch, Secretary, FCC (filed Aug. 14, 2020) (MVDDS Licensees Letter); SpaceX November 17 Letter; Ex Parte Presentation of Viasat, Inc. (filed Nov. 19, 2020) (Viasat November 19 Ex Parte); Ex Parte Presentation of SES Americom and O3b Limited (filed Nov. 23, 2020) (SES/O3b November 23 Ex Parte); Ex Parte Presentation of Kuiper Systems, LLC (filed Nov. 24, 2020) (Kuiper November 24 Ex Parte); Letter from Sean Williams, Director of Government Affairs, Pacific Dataport, Inc., to Marlene H. Dortch, Secretary, FCC (filed Nov. 25, 2020) (Pacific Dataport Letter); Ex Parte Presentation of Kuiper Systems, LLC (filed Dec. 3, 2020) (Kuiper December 3 Ex Parte); Letter from Nickolas G. Spina, Director of Regulatory Affairs, Kepler Communications, Inc., to Marlene H. Dortch, Secretary, FCC (filed Dec. 4, 2020) (Kepler December 4 Letter); Ex Parte Presentation of Space Exploration Holdings, LLC (filed Dec. 4, 2020) (SpaceX December 4 Ex Parte); Letter from Jacob Calderwood to Marlene H. Dortch, Secretary, FCC (filed Dec. 5, 2020); Ex Parte Presentation of Space Exploration Holdings, LLC (filed Dec. 7, 2020) (SpaceX December 7 Ex Parte); Letter from Amy R. Mehlman, Vice President U.S. Government Affairs and Policy, Viasat, Inc., to Marlene H. Dortch, Secretary, FCC (filed Dec. 8, 2020) (Viasat (continued….)

4. On November 17, 2020, SpaceX submitted a letter requesting the Bureau expedite grant of the Third Modification Application, through a partial grant if necessary, in order to facilitate deployment of 348 Starlink satellites into sun synchronous polar orbits at the lower altitude.[10] Specifically, SpaceX requests that the satellites be authorized to operate at an altitude of 560 km, plus or minus 30 km, but with a typical operational range that would be much less than 30 kilometers.[11] SpaceX has also stated that it can operate its constellation safely under 580 km.[12] According to SpaceX, the polar orbit satellites would be used "to initiate its service to some of the most remote regions of the country," including to Federal broadband users for which there could be significant national security benefits.[13] SpaceX stated it would operate these satellites on a non-harmful interference basis with respect to other licensed spectrum users until the Commission has ruled on its modification in full.[14] Viasat, SES/O3b, Kuiper, Kepler, and Pacific Dataport Inc. objected to this request for expedited or partial grant,[15] and Jacob Calderwood, an elementary school music teacher in Utqiagvik, Alaska, submitted a letter supporting SpaceX's request.[16]

III. DISCUSSION

5. After review of the record, we conclude that a partial grant of the Third Modification Application with respect to no more than ten satellites to be included in an upcoming polar launch will serve the public interest, subject to the requirements and conditions specified herein. We find that partial grant of ten satellites will facilitate continued development and testing of SpaceX's broadband service in high latitude geographic areas in the immediate term pending later action to address arguments in the record as to both grant of the modification as a whole and the full subset of polar orbit satellites. Viasat argues that an upcoming launch opportunity is not a valid reason for the Commission to grant the application "prematurely;"[17] however, we conclude that the deployment of ten satellites that are part of the most immediate upcoming launch, as conditioned herein, does not present concerns in connection with the issues raised by commenters. We decline to delay deployment of this small subset of satellites, which have the potential to contribute to the ongoing development of service at higher latitudes. Below, we address the various issues raised by petitioners and commenters on the Third Modification Application as they relate to the ten satellites addressed in this Order.

6. *Interference into NGSO Systems***.** Several operators express concerns that SpaceX's constellation, as modified, would increase interference into other NGSO systems. Kuiper, Viasat, Kepler, and Pacific Dataport, Inc. argue that the Bureau should not even partially grant SpaceX's modification,

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December 8 Letter); Viasat Inc, Petition Pursuant to Section 1.1307(c) (filed Dec. 22, 2020) (Viasat December 22 Petition).

[10] *See* SpaceX November 17 Letter at 2-3 (specifying six orbital planes with 58 satellites in each, at 560 km altitude).

[11] *See* Letter from David Goldman, Director of Satellite Policy, Space Exploration Holdings LLC to Marlene H. Dortch, Secretary, FCC at 2 (filed Sept. 3, 2020) (SpaceX September 3 Letter). SpaceX subsequently agreed that all operations would take place below 580 km once Kuiper deploys satellites into the immediately adjacent higher altitude shell, above 580 km, in which Kuiper plans to operate. SpaceX November 17 Letter at 1-2.

[12] *See, e.g.*, SpaceX December 4 Ex Parte at 4.

[13] SpaceX November 17 Letter at 2.

[14] *Id.* at 2.

[15] *See* Viasat November 19 Ex Parte; Viasat December 8 Letter; SES/O3b November 23 Ex Parte; Kuiper November 24 Ex Parte; Kuiper December 3 Ex Parte; Kepler December 4 Letter; Pacific Dataport Letter.

[16] *See* Letter from Jacob Calderwood to Marlene H. Dortch, Secretary, FCC (filed Dec. 5, 2020).

[17] Viasat November 19 Ex Parte at 4-5.

given the interference concerns expressed on the record.[18] Petitioners and commenters are generally concerned that there will be an increase in the number of in-line events between SpaceX's system, as proposed in the Third Modification Application, and other NGSO systems because of SpaceX's operations at lower antenna elevation angles, the increase in the number of satellites communicating with each gateway earth station simultaneously, and the need for additional earth stations.[19] SES/O3b state that any partial grant of the Third Modification Application to accommodate SpaceX's launch schedule should be on a non-harmful interference basis.[20] Most recently, Kuiper has argued that the Commission could afford SpaceX partial relief in light of its upcoming launch opportunity while further evaluating the record as to the Third Modification Application more broadly.[21]

7. We find that a grant of authority for ten satellites in a single orbital plane does not implicate the harmful interference concerns that are alleged with respect to either the full 2,824 satellites included in the Third Modification Application or the 348 satellites included in all six orbital planes of its polar shell.[22] With grant of ten satellites, the interference concerns driven by increases in number of satellites and need for additional earth stations are not implicated. In any event, SpaceX has indicated that it will operate these satellites on a non-harmful interference basis during the period prior to a ruling on its full modification,[23] and we condition this grant accordingly, noting that the status of these ten satellites with respect to protection from harmful interference will be further addressed as part of the broader modification request. SpaceX may operate its earth station antennas consistent with its current authorization.[24] Moreover, we defer the decision on a permanent reduction in SpaceX's antenna elevation angles, along with other interference concerns raised by petitioners and commenters, to a future decision where they will be analyzed in connection with the broader request.

8. *Interference into Geostationary satellite orbit (GSO) Systems.* DISH, AT&T, SES/O3b, and Viasat argue that the Third Modification Application would increase SpaceX's equivalent power flux density (EPFD) emissions into GSO systems, including Direct Broadcast Satellite (DBS) receivers.[25] Here again, we are only granting SpaceX authority to deploy ten satellites at 560 km, operating on a non-harmful interference basis, and we find these additional satellites will not have the impact these petitioners and commenters are concerned about for the full 2,824 satellites SpaceX originally requested. Notably, none of the GSO system operators have made any specific allegations that substantial harmful interference may result from a partial grant of the Third Modification Application as authorized by this order, and we would find it difficult to give credence to such a claim based on SpaceX's commitment to

[18] *See* Kuiper November 24 Ex Parte; Viasat November 19 Ex Parte; Kepler Petition at 3-11; Pacific Dataport Letter.

[19] See Kepler Petition at 3-11; Viasat July 2 Response to SpaceX at 1; OneWeb Comments at 8-15; Kuiper Petition at 13-15, 17-20, 23-26; SES/O3b Petition at 6-10. To the extent that these issues overlap with concerns that have been raised in the Third Modification Application record vis-à-vis processing rounds, we defer analysis to a future decision.

[20] *See* SES/O3b November 23 Ex Parte at 1.

[21] Letter from Mariah Dodson Shuman, Kuiper Systems LLC, to Marlene H. Dortch, Secretary, FCC (filed Dec. 23, 2020) (Kuiper December 23 Ex Parte).

[22] *See* Kuiper November 24 Ex Parte at 2-3; Kuiper December 23 Ex Parte at 1-2.

[23] SpaceX November 17 Letter at 2.

[24] *See* SpaceX December 4 Ex Parte at 1. SpaceX is currently operating with antenna elevation angles as low as 25□ on an interim basis during deployment of its first 1,584 satellites. *See generally* SpaceX First Modification Order; *See also* Space Exploration Holdings, LLC., *Request for Modification of the Authorization for the SpaceX NGSO Satellite System*, IBFS File No. SAT-MOD-20181108-00083, Technical Information at 5, Legal Narrative at 9, n.1 (filed Nov. 8, 2018).

[25] *See* DISH Letter at 1; AT&T Comments at 3; SES/O3b Petition at 15-17; Viasat Petition at 37-44.

operate the satellites on a non-harmful interference basis. We are also not authorizing SpaceX to permanently reduce its elevation angles in this order, which should allay these operators' concerns. We defer resolution of this issue to a future decision addressing SpaceX's broader requests. As SpaceX has yet to receive a favorable or qualified favorable finding from the ITU, we will continue to condition SpaceX's authorization to require SpaceX to provide the underlying data for its EPFD analysis to any interested party.

9. *Multichannel Video Distribution Data Service (MVDDS).* RS Access, CCIA and INCOMPAS, DISH, and the MVDDS Licensees argue that grant of the Third Modification Application would hinder the Commission's ability to authorize 5G services in the 12.2-12.7 GHz band, for which a rulemaking petition is pending before the Commission.[26] We condition this partial grant on conformance with future Commission rulemakings.[27] Given the limited nature of this authorization and this condition, we defer any additional discussion of these issues to a future decision on the remainder of the Third Modification Application.

10. *Orbital Debris*. Viasat, Kepler, Kuiper, and Pacific Dataport, Inc. object to SpaceX's request for partial grant of the Third Modification Application based on concerns related to orbital debris and space safety.[28] Viasat and Kepler maintain that SpaceX's spacecraft failure rates and resulting collision risk from uncontrolled satellites raise concerns that must be resolved before any license modification can be granted.[29] In its petition on the full modification, Viasat calculated that SpaceX's satellites had a failure rate of 1.9 percent in July 2020 and extrapolated these numbers to conclude that SpaceX satellites would have a failure rate of 22.8 percent over their entire lifespans.[30] Using more recent data, Viasat alleges that of the 833 satellites SpaceX has launched during or after November 2019, 10 (or 1.2%) have deorbited and 11 (or 1.3%) are not maneuvering.[31]

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[26] *See* RS Access Letter at 1-2, 4-6 (citing Petition for MVDDS 5G Coalition for Rulemaking, RM-11768 (filed Apr. 26, 2016)); CCIA/INCOMPAS Letter at 1; DISH July 14 Reply to SpaceX at 1, 5-6; MVDDS Licensees Letter at 1, 5. These commenters argue that the requested modification, including proposed lower elevation angles and proposed doubling of the number of satellites communicating with each gateway earth station simultaneously, would make sharing between terrestrial 5G services and SpaceX's constellation impossible.

[27] *See infra* para. 19.u; SpaceX Authorization, 33 FCC Rcd at 3399, 3401-02 para. 17 ("we note that, as with the *OneWeb Order*, *Telesat Canada Order*, and *Space Norway Order*, grant of the SpaceX application will not prejudge any decision, including a contrary action in any future rulemaking proceeding."), nn.65, 88 (2018).

[28] *See* Viasat November 19 Ex Parte; Kepler December 4 Letter; Kuiper November 24 Ex Parte; Pacific Dataport Letter.

[29] *See* Viasat November 19 Ex Parte at 1-3, 5-6; Kepler December 4 Letter at 3-4. *See also* Viasat Petition at 13-14, 21-22; Kuiper Petition at 2-4; OneWeb Comments at 7; Astroscale Letter at 7-8; Letter from Suzanne Malloy, Vice President, Regulatory Affairs, SES Americom, Inc. and O3b Limited, to Marlene H. Dortch, Secretary, FCC, Attach. at 3 (filed Nov. 17, 2020) (SES/O3b November 17 Ex Parte). According to Viasat and Kepler, the Commission does not have enough information on the maneuverability of SpaceX's satellites. Viasat Petition at 20; Kepler Petition at 13-15.

[30] Viasat Petition at 15.

[31] Viasat November 19 Ex Parte at 2 (citing Jonathan's Space Report | Space Statistics, https://planet4589.org/space/stats/megacon/starbad.html (last visited Dec. 29, 2020). According to Dr. McDowell's latest analysis, 10 SpaceX satellites out of 893 included in launches 2-16, or 1.1%, are purportedly not maneuvering. *Id.* Dr. McDowell's interpretation of this data is that, as of September 20, 2020, the upper bound of the Starlink failure rate would be 2.6 percent. *See* Letter from Dr. Jonathan McDowell, Harvard & Smithsonian Center for Astrophysics at 1 (filed Sept. 21, 2020) (McDowell Letter).

11. Kuiper and Kepler raise a somewhat different concern about operations of SpaceX satellites in any altitude range that overlaps their current or planned operational altitudes.[32] Although SpaceX has agreed to operate so that none of its satellites will fly higher than 580 km once Kuiper launches its first satellite,[33] Kuiper argues that SpaceX should be required to maintain operations below 580 km immediately.[34] Kepler argues that SpaceX has not addressed its concerns associated with Kepler's and SpaceX's systems operating in the same orbital altitudes.[35] According to Kepler, SpaceX's plan to "inject its first tranche of polar satellites into the 560 km orbit from the same launch vehicle" as eight new Kepler satellites that will operate at 575 km "is an unjustifiable risk Kepler should not be exposed to . . . ."[36]

12. We find that this partial grant of authority to modify SpaceX's authorization as it relates to deployment of only ten satellites at 560 km does not implicate the larger concerns raised by commenters associated with large numbers of satellites operating at altitudes in the 540-570 km range. Given the limited nature of this authorization, we find that any cumulative debris associated with this approval would be low and defer resolution of the orbital debris and space safety issues raised by the full modification, including those concerning the cumulative risk of its full constellation and replacement satellites. We note that for the ten satellites included in this partial modification, only one satellite would fail, even assuming a failure of the maneuver capabilities for ten percent of these satellites, a rate higher than the 8.4% suggested most recently by Viasat—a rate that, we would note, is much higher than the failure rate suggested by Dr. McDowell using the same data.[37] Moreover, any failed satellite can be expected to experience sufficiently rapid orbital decay and re-entry into the atmosphere so as to present little risk of long-term effect on the orbital debris environment.[38] We conclude that the addition of these ten satellites is unlikely to have any significant incremental effect on the operations of other satellites in the relevant orbital altitudes, such as those of the Kepler system, particularly given that SpaceX is undertaking active collision avoidance measures for all satellites that it maintains under control.[39] Furthermore, as SpaceX is prepared to operate all its satellites at or below 580 km, thereby avoiding overlap with the planned Kuiper system,[40] we will condition this grant to require it to do so immediately.[41]

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[32] *See* Kuiper November 24 Ex Parte at 1-2; Kepler December 4 Letter at 2-3. Viasat and Astroscale similarly express concerns about the collision risk posed by SpaceX's system, especially given the congested nature of the 540-570 km orbital altitude. *See* Viasat Petition at 9-11; Astroscale Letter at 5-7.

[33] *See* SpaceX November 17 Letter at 1-2.

[34] *See* Kuiper November 24 Ex Parte at 1-2; Kuiper December 3 Ex Parte at 1-2.

[35] Kepler December 4 Letter at 2-3, 5-6.

[36] Kepler December 4 Letter at 5-6.

[37] *Compare* Viasat November 19 Ex Parte at 2 *with* McDowell Letter at 1. Although we anticipate additional analysis of these issues and make no determination here, it appears that in some instances posited failure rates may include instances of satellite failures that do not result in loss of maneuverability, or where a satellite is removed from orbit due to other mission-related issues. In neither such case does the satellite failure result in long-term collision risk.

[38] *See* SpaceX December 4 Ex Parte at 3, Table I.

[39] Kepler currently has five satellites in a near-polar orbit and intends to launch eight additional satellites on the same Transporter-1 mission as the ten Starlink satellites authorized under this order. Given the limited number of satellites at issue here, and propulsion capabilities of the Starlink satellites, there are no particularized concerns presented by the upcoming deployment with respect to collision risk as between the SpaceX and Kepler satellites.

[40] *See* SpaceX November 17 Letter at 2-3 (stating that after engaging Amazon in discussions about physically coordinating their systems, SpaceX is now prepared to operate all its satellites with orbital tolerances that would restrict them to altitudes of 580 km or below once Amazon launches the first satellite in its 590 km altitude orbital shell); Kuiper November 24 Ex Parte at 1-2 (stating that SpaceX has indicated that its capable of operating its

(continued….)

13. *Other matters*. We decline at this time to address other matters which are not raised by this partial grant. For example, The Balance Group states that under the Administrative Procedure Act (APA), The National Environmental Policy Act (NEPA), Regulatory Flexibility Act (RFA), Secure 5G and Beyond Act, Radiation Hazard Report obligations, the Constitution and Convention of the International Telecommunication Union, and other similar cross-governmental obligations, the Commission must "conduct a detailed review" of the Third Modification Application.[42] Since we are only granting SpaceX's request as to 10 of the 2,824 satellites included in the Third Modification Application, our action today is not nearly as "massive in scope" as the full modification (and which The Balance Group alleges would be the justification for a more detailed review pursuant to these authorities).[43]

14. We similarly decline at this juncture to require SpaceX, pursuant to the National Environmental Policy Act (NEPA), to prepare an environmental assessment for the ten satellites included in this partial grant. Viasat argues that the Commission is obligated under NEPA to consider the environmental impacts of SpaceX's Third Modification Application, including consideration of impacts associated with satellite launch and atmospheric reentry, light pollution in the night sky, and orbital debris resulting from potential collisions.[44] As Viasat notes, NEPA applies to "major Federal action[s] significantly affecting the quality of the human environment," and the Commission (as directed by the Council on Environmental Quality through implementing regulations) has categorically exempted from NEPA review all Commission actions except those involving special locations (such as wildlife preserves or historic sites), high-intensity lighting, and those resulting in human exposure to excessive radiofrequency levels.[45] Under the Commission's rules, parties may petition a reviewing bureau to consider the environmental concerns associated with an action that is otherwise categorically excluded and, "[i]f the Bureau determines that the action may have a significant environmental impact, the Bureau will require the applicant to prepare an [environmental assessment] . . . ."[46] Here, both Viasat and The Balance Group have alleged a significant environmental impact only as to the full modification.[47] We therefore defer consideration of these potential concerns to a future decision addressing SpaceX's broader requests.

15. Finally, Kuiper suggests that, rather than a partial grant of the Third Modification Application, the Bureau could grant SpaceX special temporary authority to deploy and conduct initial

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system without exceeding 580 km and has not demonstrated why such a condition should not be effective immediately).

[41] Should SpaceX need to conduct operations with its currently authorized satellites above an altitude of 580 km in the future, such a request may be addressed by special temporary authority.

[42] The Balance Group Opposition at 13.

[43] *Id*.

[44] *See generally* Viasat December 22 Petition. As noted above, The Balance Group also argues that the full modification application requires NEPA processing. The Balance Group Opposition at 13.

[45] Viasat December 22 Petition at 5-7. Actions that are not listed in sections 1.1307(a) or (b) of the Commission's rules are considered "categorically excluded" from environmental processing, unless a petition is filed demonstrating the need for environmental review or Commission staff on its own motion decides that such review is warranted. 47 CFR §§1.1306(a), 1.1307 (a)-(d).

[46] 47 CFR § 1.1307(c).

[47] *See, e.g.*, Viasat December 22 Petition at ii ("the Commission must carefully consider the environmental risks associated with thousands of satellites launching through the atmosphere and then reentering it in a short period of time"); *id.* at 8 ("SpaceX's proposal to lower the orbital altitude of nearly 3,000 satellites is likely to have a significant effect on the environment in at least three main ways.").

operations with its satellites proposed for the 560 km orbital shell.[48] The operations contemplated by SpaceX for the ten satellites addressed today are not temporary in nature, as they can reasonably be expected to continue for the full mission life-time of the satellites. Under these circumstances, a grant of special temporary authority would not be appropriate.[49] We find a partial grant of the Third Modification Application to allow SpaceX to operate ten satellites in one orbital plane at 560 km to be the most appropriate course of action and also to be in the public interest, as it will permit SpaceX to continue development and testing of its Starlink Internet service with the goal of providing broadband connectivity to underserved and unserved areas.

16. *Waiver Request*. As part of our grant, we also address SpaceX's waiver request.[50] Generally, the Commission may waive any rule for good cause shown.[51] Waiver is appropriate where the particular facts make strict compliance inconsistent with the public interest.[52] In making this determination, we may take into account considerations of hardship, equity, or more effective implementation of overall policy on an individual basis.[53] Waiver is therefore appropriate if special circumstances warrant a deviation from the general rule and such deviation will serve the public interest.[54]

17. As required by the Commission's rules, SpaceX submitted a completed Schedule S for its application, which contains certain technical information in a prescribed form.[55] SpaceX has found that it cannot accurately describe its system in certain respects due to limitations in Schedule S itself.[56] SpaceX cites four limitations in Schedule S that affected how the Schedule S was completed: (1) the impracticability of submitting complete orbital parameter data for the SpaceX system using the Schedule S web form; (2) the inability to enter "not applicable" for section 25.114(c)(4)(v), which requires both the minimum and maximum saturation flux density (SFD) values for each space station receive antenna that is connected to transponders; (3) the inability to enter the maximum EIRP for transmit beams for values less than zero; and (4) the inability to enter the begin and end angle for the active service arc with respect to the ascending node for each orbital plane if that angle consists of more than two digits.[57] Given that SpaceX has implemented a workaround for each of these limitations to allow entry of the required

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[48] *See* Kuiper December 3 Letter at 2; *see also* Letter from Mariah Dodson Shuman, Corporate Counsel, Kuiper Systems LLC, to Marlene H. Dortch, Secretary, FCC at 1-2 (filed Dec. 23, 2020). Viasat objects to grant of special temporary authority on the grounds that it is unjustified given the orbital debris and interference concerns on the record. *See* Viasat December 8 Letter at 2. Viasat also argues there is no need for a partial grant of SpaceX's modification application as SpaceX has authority to launch 2,825 satellites at higher altitudes, which includes satellites that would provide service to polar regions. *Id.* at 3. This argument does not acknowledge that the authorization for these satellites could not be utilized until a favorable determination on a debris mitigation plan, and that SpaceX is seeking to lower the proposed altitude for these satellites precisely due to considerations of long-term orbital debris effects from operations at the higher altitude.

[49] A grant of special temporary authority in this case would be limited by statute to 180 days. *See* 47 U.S.C. § 309(f).

[50] *See* Third Modification Application, Waiver Requests at 1.

[51] 47 CFR § 1.3.

[52] *Northeast Cellular Tel. Co. v. FCC*, 897 F.2d 1164, 1166 (D.C. Cir. 1990).

[53] *WAIT Radio v. FCC*, 418 F.2d 1153, 1159 (D.C. Cir. 1969), *cert. denied*, 409 U.S. 1027 (1972); *Northeast Cellular*, 897 F.2d at 1166.

[54] *Northeast Cellular*, 897 F.2d at 1166.

[55] *See* Third Modification Application, Schedule S.

[56] *Id.*, Waiver Requests at 1.

[57] *Id.*, Waiver Requests at 1-2.

information,[58] we find that a waiver of the requirement to complete certain aspects or fields of Schedule S is warranted.

IV. ORDERING CLAUSES

18. Accordingly, IT IS ORDERED, that the Third Modification Application filed by Space Exploration Holdings, LLC (SpaceX), IS GRANTED IN PART with respect to ten satellites at an inclination of 97.6 degrees, and DEFERRED IN PART, as set forth in this Order and Authorization, pursuant to section 309(a) of the Communications Act of 1934, as amended, 47 U.S.C. § 309(a).

19. IT IS FURTHER ORDERED that this authorization is subject to the following requirements and conditions:[59]

a. SpaceX must timely provide the Commission with the information required for Advance Publication, Coordination, and Notification of the frequency assignment(s) for this constellation, including due diligence information, pursuant to Articles 9 and 11 of the ITU Radio Regulations. This authorization may be modified, without prior notice, consistent with the coordination of the frequency assignment(s) with other Administrations. *See* 47 CFR § 25.111(b). SpaceX is responsible for all cost-recovery fees associated with the ITU filings. 47 CFR § 25.111(d).

b. Operations in the 10.7-11.7 GHz (space-to-Earth) frequency band are authorized up to the applicable power flux-density limits in 47 CFR § 25.208(b), and up to the equivalent power flux-density requirements of Article 22 of the ITU Radio Regulations, as well as Resolution 76 (Rev. WRC-15) of the ITU Radio Regulations.

c. In the 10.7-11.7 GHz band, operations must be coordinated with the radio astronomy observatories listed in 47 CFR § 2.106, n.US131, to achieve a mutually acceptable agreement regarding the protection of the radio telescope facilities operating in the 10.6-10.7 GHz band. For the purposes of coordination with these listed facilities or the National Radio Quiet Zone, correspondence should be directed to the National Science Foundation Spectrum Management Unit (Email: esm@nsf.gov).

d. Operations in the 11.7-12.2 GHz (space-to-Earth) frequency band are authorized up to the power flux-density limits in Article 21 of the ITU Radio Regulations, and up to the equivalent power flux-density requirements of Article 22 of the ITU Radio Regulations, as well as Resolution 76 (Rev. WRC-15) of the ITU Radio Regulations.

e. Operations in the 12.2-12.7 GHz (space-to-Earth) frequency band are authorized up to the power flux-density limits in 47 CFR § 25.208(o) and Article 21 of the ITU Radio Regulations, and up to the equivalent power flux-density requirements of Article 22 of the ITU Radio Regulations, as well as Resolution 76 (Rev. WRC-15) of the ITU Radio Regulations.

f. Operations in the 12.75-13.25 GHz (Earth-to-space) frequency band must be in accordance with footnote 5.441 to the U.S. Table of Frequency Allocations, 47 CFR § 2.106, n. 5.441, which states that operations in this band are subject to application of the provisions of No. 9.12 for coordination with other non-geostationary-satellite systems in the fixed-satellite service. Non-geostationary-satellite systems in the fixed-satellite service shall not claim protection from geostationary-satellite networks in the fixed-satellite service operating in accordance with the Radio Regulations. Non-geostationary-satellite systems in the fixed-satellite service in the 12.75-13.25 GHz (Earth-to-space)

[58] *Id.*

[59] The conditions here replicate the full set of conditions applicable to SpaceX operations as specified in prior orders, except that new conditions have been specified at paragraphs 18.r and s, and the condition at paragraph 18.t has been modified to reflect today's action. We also note that SpaceX has previously satisfied some of these conditions.

frequency band shall be operated in such a way that any unacceptable interference that may occur during their operation shall be rapidly eliminated.

g. Operations of non-geostationary-satellite systems in the 12.75-13.25 GHz (Earth-to-space) frequency band are restricted to individually licensed earth stations in accordance with footnote NG57 to the U.S. Table of Frequency Allocations, 47 CFR § 2.106, NG57. In the 13.85-14.5 GHz (Earth-to-space) frequency band reception is permitted for levels up to the equivalent power flux-density requirements of Article 22 of the ITU Radio Regulations.

h. In the 14.47-14.5 GHz band, operations are subject to footnote US342 to the U.S. Table of Frequency Allocations, 47 CFR § 2.106, US342, and all practicable steps must be taken to protect the radio astronomy service from harmful interference.

i. Space-to-Earth operations in the 17.8-18.6 GHz, 18.8-19.3 GHz, and 19.7-20.2 GHz frequency bands must complete coordination with U.S. Federal systems, in accordance with footnote US334 to the United States Table of Frequency Allocations, 47 CFR § 2.106, prior to being used. The use of space-to-Earth operations in the 17.8-18.6 GHz, 18.8-19.3 GHz, and 19.7-20.2 GHz bands must be in accordance with any signed coordination agreement between SpaceX and U.S. Federal operators. Two weeks prior to the start of any operations in the 17.8-18.6 GHz, 18.8-19.3 GHz, and 19.7-20.2 GHz bands, SpaceX must provide contact information for a 24/7 point of contact for the resolution of any harmful interference to Jimmy Nguyen, Email: Jimmy.Nguyen@us.af.mil.

j. Operations in the 18.8-19.3 GHz (space-to-Earth) frequency band are authorized up to the power flux-density limits in Article 21 of the ITU Radio Regulations.

k. In the 27.5-28.6 GHz and 29.5-30 GHz (Earth-to-space) frequency bands reception is permitted at levels up to the applicable equivalent power flux-density requirements of Article 22 of the ITU Radio Regulations.

l. Operations in the 27.5-28.35 GHz (Earth-to-space) frequency band are secondary with respect to Upper Microwave Flexible Use Service (UMFUS) operations, except for FSS operations associated with earth stations authorized pursuant to 47 CFR § 25.136 and will comply with any determinations set forth in the Spectrum Frontiers proceeding.

m. Operations in the 28.35-28.6 GHz and 29.5-30 GHz (Earth-to-space) frequency bands are on a secondary basis with respect to GSO FSS operations.

n. Under 47 CFR § 25.146(a), SpaceX must receive a favorable or "qualified favorable" finding in accordance with Resolution 85 (WRC-03) with respect to its compliance with applicable equivalent power flux-density limits in Article 22 of the ITU Radio Regulations and, in case of an unfavorable finding, adjust its operation to satisfy the ITU requirements.

o. SpaceX must cooperate with other NGSO FSS operators in order to ensure that all authorized operations jointly comport with the applicable limits for aggregate equivalent power flux-density in the space-to-Earth direction contained in Article 22 of the ITU Radio Regulations, as well as Resolution 76 (WRC-03) of the ITU Radio Regulations.

p. SpaceX must make available to any requesting party the data used as input to the ITU-approved validation software to demonstrate compliance with applicable Equivalent Power Flux Density (EPFD) limits.

q. When conducting coordination with other NGSO FSS systems, taking into account section 25.261, SpaceX cannot claim more protection to any of its Ku-band gateway earth stations than the protection to which a SpaceX user terminal at the same location would be entitled.

r. SpaceX must operate the ten satellites authorized in a single orbital plane at an inclination of 97.6 degrees on a non-harmful interference basis, i.e. SpaceX must not cause harmful interference and must accept any interference received, pending a ruling on the portion of its modification application,

IBFS File No. SAT-MOD-20200417-00037, deferred in this order. In the event of any harmful interference under this grant, SpaceX must immediately cease operations upon notification of such interference and inform the Commission, in writing, of such an event.

s. SpaceX must maintain satellite orbits so as to operate all of its satellites at or below 580 km.

t. Upon finalization of its space station design and prior to initiation of service, SpaceX must seek and obtain the Commission's approval of a modification containing an updated description of the orbital debris mitigation plans for its system for any satellites other than those that will be operated at an altitude of 550 km, as addressed in a prior modification, or the satellites planned to operate at 560 km, addressed in this partial grant.

u. This authorization is subject to modification to bring it into conformance with any rules or policies adopted by the Commission in the future. Accordingly, any investments made toward operations in the bands authorized in this order by SpaceX in the United States assume the risk that operations may be subject to additional conditions or requirements as a result of any future Commission actions.

v. IT IS FURTHER ORDERED that SpaceX is subject to the rules regarding the sharing of ephemeris data in section 25.146(e) of the Commission's rules, 47 CFR § 25.146(e).

20. IT IS FURTHER ORDERED that this authorization is also subject to the following requirements:

a. SpaceX must post a surety bond in satisfaction of 47 CFR §§ 25.165(a)(1) & (b) no later than **April 30, 2018**,[60] and thereafter maintain on file a surety bond requiring payment in the event of a default in an amount, at minimum, determined according to the formula set forth in 47 CFR § 25.165(a)(1); and

b. SpaceX must launch 50 percent of the maximum number of proposed space stations, place them in the assigned orbits, and operate them in accordance with the station authorization no later than **March 29, 2024**, and SpaceX must launch the remaining space stations necessary to complete its authorized service constellation, place them in their assigned orbits, and operate each of them in accordance with the authorization no later than **March 29, 2027**. 47 CFR § 25.164(b).[61]

21. Failure to post and maintain a surety bond will render this grant null and void automatically, without further Commission action. Failure to meet the milestone requirements of 47 CFR § 25.164(b) may result in SpaceX's authorization being reduced to the number of satellites in use on the milestone date. Failure to comply with the milestone requirement of 47 CFR § 25.164(b) will also result in forfeiture of SpaceX's surety bond. By April 15, 2024, SpaceX must either demonstrate compliance with its milestone requirement or notify the Commission in writing that the requirement was not met. 47 CFR § 25.164(f).

22. IT IS FURTHER ORDERED that operations must comply with spectrum sharing procedures among NGSO FSS space stations specified in 47 CFR § 25.261 with respect to any NGSO system licensed or granted U.S. market access pursuant to the processing rounds initiated in Public

[60] We note that SpaceX filed the required bond on April 23, 2018 and filed a rider to that bond on March 25, 2019 that increases the maximum penal sum of the original surety bond in compliance with the Commission's rules and the terms of SpaceX's authorization.

[61] We note that the *NGSO FSS Order* modified section 25.164(b) to offer additional flexibility and requires launch and operation of 50 percent of an authorized system within six years of grant and the remaining satellites within nine years of grant.

Notice, DA 16-804 and Public Notice, DA 17-524. Spectrum sharing between SpaceX's operations and operations of NGSO systems granted U.S. market access, where such operations do not include communications to or from the U.S. territory, are governed only by the ITU Radio Regulations and are not subject to section 25.261.

23. IT IS FURTHER ORDERED that the request for waiver of the requirement to complete certain aspects or fields of Schedule S IS GRANTED for the reasons set forth herein.

24. IT IS FURTHER ORDERED that this grant-in-part of the Third Modification Application is without prejudice to any action on the remainder of the requests in SpaceX's Third Modification Application, including with respect to the issues raised in the record of this proceeding not otherwise addressed herein.

FEDERAL COMMUNICATIONS COMMISSION

Thomas P. Sullivan
Chief, International Bureau