

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In the Matter of)	
)	
Space Exploration Holdings, LLC)	IBFS File Nos.
Application for the SpaceX Gen2)	SAT-LOA-20200526-00055
NGSO Satellite System, As Amended)	SAT-AMD-20210818-00105
)	

COMMENTS OF KUIPER SYSTEMS LLC

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EXECUTIVE SUMMARY

Kuiper Systems LLC, a wholly owned subsidiary of Amazon.com Services LLC (collectively “Amazon”), provides comments on the license application and amendment filed by Space Exploration Holdings, LLC (“SpaceX”) for its next-generation non-geostationary orbit (“NGSO”) satellite system (the “Gen2 System”). Amazon is committed to increasing broadband access across the United States, and believes it will take multiple low Earth orbit satellite systems, in addition to technologies like fiber and wireless, to close the digital divide for all Americans. Even now that SpaceX has identified the preferred configuration for its Gen2 System, the lack of detail on SpaceX’s operational plans and technical parameters, combined with the sheer size of its system, pose serious challenges to the NGSO ecosystem. To ensure that SpaceX’s plans do not harm Amazon’s NGSO system (the “Kuiper System”), Amazon respectfully requests targeted but critical conditions on any grant of a license for SpaceX’s Gen2 System.

Specifically, Amazon proposes that any grant of SpaceX’s license includes conditions that require SpaceX to: (1) operate its Gen2 System below 580 km; (2) share certain operational information pursuant to appropriate safeguards; (3) abide by conditions imposed on other similarly situated NGSO operators; and (4) meet the applicable equivalent power flux-density (“EPFD”) limits, if necessary, through additional operational conditions.

The distinguishing feature of SpaceX’s Gen2 System is its size, which creates challenges that the Commission must address. Many of these challenges will fall heavily on Amazon, because SpaceX’s Gen2 System, as proposed, would overlap with both the physical and spectral operations of the Kuiper System. Without reasonable conditions to manage these challenges, they could translate into profound burdens on the Kuiper System and other NGSO systems, hampering their ability to compete and provide low cost, reliable, and innovative new services to U.S. consumers.

With respect to physical operations, the vast majority of Amazon’s satellites will orbit between 590 km and 630 km, with 9 km of orbital tolerance on either end of this range. SpaceX’s proposed Gen2 System, in comparison, will orbit between 340 km and 614 km, with an orbital tolerance of -50 km to +70 km. Under the terms of SpaceX’s Gen2 System license application, this means that at least hundreds—and potentially more than ten thousand—SpaceX satellites could operate at the same altitudes as the Kuiper System. The effect of this orbital overlap would be a dramatic increase in risks and other burdens on the Kuiper System.

Amazon therefore submits that the Commission should ensure physical separation between the Kuiper and Gen2 Systems by requiring SpaceX to maintain its satellite orbits at or below 580 km, including any necessary limits to its orbital tolerance. The Commission recognized the wisdom of this approach in response to SpaceX’s recent modification of its Gen1 license, in which it required SpaceX to “fly below 580 km at all times,” and applied that condition to “SpaceX’s constellation going forward.” Such a condition is all the more important here, because the number of satellites in SpaceX’s Gen2 System—and therefore the risks—are significantly greater. Additionally, placing a limit on the SpaceX Gen2 System altitude range will provide Amazon certainty against which to plan and deploy the Kuiper System.

Another consequence of the unprecedented size of SpaceX’s Gen2 System is the magnitude of spectrum coordination concerns that it poses to Amazon and other satellite operators. Each of the nearly 30,000 satellites in SpaceX’s constellation has an expansive coverage area, which will overlap with the coverage area of many other satellites. Without knowing which satellite is transmitting to which earth station (or group of earth stations in a specific area), existing and prospective NGSO system operators are left to assume that each satellite is transmitting over its entire coverage area at all times when that is not the case. They also must assume that the other

NGSO system’s earth stations could be transmitting to and receiving from any of its in-view satellites—when that is not the case, either. The consequences are that operators must act to avoid interference that exists only in theory, not in fact, thereby limiting competition and harming consumers. The size of SpaceX’s system magnifies these inefficiencies.

Thus, Amazon submits that the Commission should also require SpaceX to share operational information about where its satellite beams are positioned and which satellites are actively transmitting and receiving from each of its earth stations, sufficient to identify anticipated interference events in advance. Specifically, SpaceX should be required to share with NGSO FSS licensees using commonly authorized frequencies: (1) where its satellite beams are directed and (2) with which of its in-view satellites each of its earth stations will be actively communicating. This information would allow Amazon and others to mitigate potential interference while efficiently and reliably serving their own customers. Indeed, SpaceX itself has endorsed information sharing in other contexts.

The Commission also should promote competition and a level playing field by imposing conditions on SpaceX that match those imposed on Amazon and others. *First*, the Commission should ensure that SpaceX is subject to the same processes for verifying compliance with EPFD limits as Amazon and other operators. Specifically, the Commission should reject SpaceX’s request for a waiver of the requirement that it receive a “favorable” or “qualified favorable” finding from the ITU regarding its compliance with the ITU’s EPFD limits prior to initiation of service. *Second*, as it required of Amazon, the Commission should require SpaceX to certify that it has completed a coordination agreement with, or make a showing that it will not cause harmful interference to, any operational system licensed or granted U.S. market access in prior NGSO FSS processing rounds.

Finally, the Commission should compel SpaceX to answer the serious questions about its assertions of compliance with EPFD limits already raised by other parties in this proceeding. The Commission should review the information SpaceX used to certify compliance with EPFD limits and, if necessary, should impose conditions on SpaceX's license that ensure compliance.

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COMMENTS OF KUIPER SYSTEMS LLC

I. INTRODUCTION

Kuiper Systems LLC, a wholly owned subsidiary of Amazon.com Services LLC (collectively “Amazon”), respectfully comments on the above-captioned application and amendment¹ filed by Space Exploration Holdings, LLC (“SpaceX”) for its next-generation non-geostationary orbit (“NGSO”) satellite system (the “Gen2 System”). Amazon is committed to increasing broadband access across the United States, and believes it will take multiple low Earth orbit satellite systems, in addition to technologies like fiber and wireless, to close the digital divide for all Americans. Even now that SpaceX has identified the preferred configuration for its Gen2 System, ambiguity regarding SpaceX’s operational plans and technical parameters, combined with the sheer size of its system, pose serious challenges to the NGSO ecosystem. Managing these challenges will safeguard innovation and plans for new deployment in this burgeoning new frontier of connectivity, with U.S. consumers benefiting from the lower prices and higher quality service that competition will bring. To ensure that SpaceX’s plans do not harm the ability of other satellite

¹ See Space Exploration Holdings, LLC, Application for the SpaceX Gen2 NGSO Satellite System, IBFS File No. SAT-LOA-20200526-00055 (filed May 26, 2020) (“*SpaceX Application*”); Space Exploration Holdings, LLC, Amendment to Pending Application for the SpaceX Gen2 NGSO Satellite System, IBFS File No. SAT-AMD-20210818-00105 (filed Aug. 18, 2021) (“*SpaceX Amendment*”).

systems to compete, Amazon respectfully requests targeted but critical conditions on any grant of SpaceX's Gen2 license.

The distinguishing feature of SpaceX's Gen2 System is its size. SpaceX's Gen2 System would deploy nearly 30,000 satellites, in addition to the 11,926 satellites already authorized by the Commission for SpaceX's first-generation and V-band systems.² For context, this 41,914-satellite total is more than triple the total number of spacecraft launched by humanity to date.³ Notwithstanding SpaceX's call for a rushed decision, the Commission must carefully consider the novel challenges that the SpaceX Gen2 System will raise.

Amazon has its own ambitious plans. In July 2020, the Commission authorized Amazon to deploy 3,236 satellites,⁴ and Amazon has recently applied for an additional license that would bring this total to 7,774.⁵ Amazon intends to launch its first test satellites—KuiperSat-1 and

² See *Space Exploration Holdings, LLC, Request for Modification of the Authorization for the SpaceX NGSO Satellite System*, IBFS File No. SAT-MOD-20200417-00037, Order and Authorization and Order on Reconsideration, 36 FCC Rcd 7995 (2021) (“*Mod3 Grant*”) (approving SpaceX's modified license for 4,408 satellites using the Ku- and Ka-band); *Space Exploration Holdings, LLC, Application for Approval for Orbital Deployment and Operating Authority for the SpaceX V-band NGSO Satellite System*, IBFS File No. SAT-LOA-20170301-00027, Memorandum Opinion, Order and Authorization, 33 FCC Rcd 11434 (2018) (authorizing 7,518 satellites for SpaceX's V-band system).

³ According to one estimate, around 12,000 satellites, probes, landers, crewed spacecraft, cargo craft and space station flight elements have been launched into Earth orbit since the 1957 launch of Sputnik. United Nations, Office for Outer Space Affairs, *Online Index of Objects Launched Into Outer Space*, https://www.unoosa.org/oosa/osoindex/search-ng.jsp?lf_id= (last accessed Feb. 3, 2022).

⁴ See *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, 35 FCC Rcd 8324 (2020) (“*Kuiper System Grant*”).

⁵ See Application of Kuiper Systems LLC for Authority to Launch and Operate a Non-Geostationary Satellite Orbit System in V-band and Ku-band Frequencies, IBFS File No. SAT-LOA-20211104-00145 (filed Nov. 4, 2021) (“*Amazon V-band Application*”).

KuiperSat-2—later this year.⁶ When deployed, the Kuiper System will help close the digital divide and provide service in unserved and underserved communities around the globe.

To prevent SpaceX's Gen2 System from blocking competition from the Kuiper System and other NGSOs, there are serious challenges that the Commission must address. First and foremost, SpaceX's Gen2 System overlaps with both the physical and spectral operations of Amazon's system. Amazon's authorized satellites will orbit in a relatively narrow 58 km of altitude—between 590 km and 630 km, with 9 km of orbital tolerance on either end of this range. SpaceX's Gen2 System, by contrast, spans nearly 400 km in orbital altitude—between 340 km and 614 km, with a -50 / +70 km orbital tolerance on either end of this range.⁷ According to SpaceX's application, hundreds—and potentially more than 10,000—of these satellites could cross the same altitudes as Amazon's satellites. SpaceX's satellites will also use many of the same frequencies that Amazon is authorized to use. Consequently, although innovation has enabled space operations that are safer, more manageable, and more dynamic than ever before, the sheer scale of SpaceX's system will require conditions to manage the difficulties that SpaceX's Gen2 System will impose on other operators like Amazon.

Amazon therefore respectfully requests targeted but critical conditions that will allow both systems to safely coexist without interfering with the operations of the other: *First*, the Commission should ensure physical separation between the systems by requiring SpaceX to maintain its satellite orbits so as to operate all of its satellites at or below 580 km, just as the Commission required in granting SpaceX's third modification of its first-generation license.⁸

⁶ See Kuiper Systems LLC Request for Experimental Authorization, ELS File No. 0956-EX-CN-2021 (filed Nov. 1, 2021).

⁷ See *SpaceX Amendment*, at 5, Table 2.

⁸ See *Mod3 Grant*, at ¶ 66.

Second, the Commission should require SpaceX to share operational information about where its satellite beams are positioned and which satellites are actively transmitting and receiving from each of its earth stations, which Amazon and others can use to mitigate potential interference while efficiently and reliably serving their own customers. *Third*, the Commission should promote competition and a level playing field by imposing conditions on SpaceX that match those the Commission has imposed on Amazon and others. *Finally*, the Commission should investigate the serious concerns about the Gen2 System’s compliance with equivalent power-flux density limits (“EPFD”) that are apparent from SpaceX’s application. If further scrutiny reveals that SpaceX’s proposed system will not comply with EPFD limits, then the FCC should limit its operations so that it will.

Each of these targeted conditions will serve the public interest. Each has been endorsed, to some degree, by the Commission, SpaceX, or both. And each provides a more stable foundation upon which Amazon and SpaceX can build coexisting systems in low Earth orbit, so that both can focus on the goal of closing the digital divide.

II. THE COMMISSION SHOULD ENSURE SEPARATION BETWEEN THE SPACEX GEN2 AND KUIPER SYSTEMS

Satellites that operate at the same altitude may cross paths, requiring one to maneuver around the other. This maneuvering has real-world consequences, such as interruptions to the operations of, and expenditure of energy by, the maneuvering satellite as it diverts from its normal path. Further, even the most reliable and well-designed systems can experience satellite failures. When a satellite fails, it can remain in orbit for years while it demises, burdening other operators with the need to maneuver to avoid it. Indeed, some of SpaceX’s satellites have already failed.⁹

⁹ According to SpaceX’s recent satellite report, four of its satellites experienced disposal failures between April 2 and December 13, 2021. See Letter from David Goldman, Director of Satellite

Finally, the likelihood of conjunction¹⁰ increases substantially when hundreds or thousands of satellites from different constellations are operating at close altitudes.

Conversely, the risks and costs associated with maneuvering decrease dramatically where satellites are operating at different altitudes. There is an increasing call within the space industry for responsible and sustainable operations, including cautioning against unnecessary and avoidable overlap.¹¹ All things being equal, therefore, given today's deployed technology and policies, large constellations of satellites should orbit at altitudes a safe distance from one another.¹²

The Commission has already recognized the wisdom of this approach in response to SpaceX's recent modification of its Gen1 license.¹³ There, the Commission required SpaceX to "stay below 580 km at all times," and applied that condition to "SpaceX's constellation going

Policy, SpaceX, to Marlene H. Dortch, Secretary, FCC, IBFS File No. SAT-MOD-20200417-00037 (Dec. 13, 2021).

¹⁰ In this document, Amazon uses the term "conjunction" to describe the minimum distance event between two orbiting bodies involving significant proximity relative to their trajectory uncertainties and the term "collision" to describe physical impact between two orbiting bodies.

¹¹ See Comments of WorldVu Satellites Limited, IB Docket No. 18-313, at 3-7 (filed Apr. 5, 2019); Comments of Iridium Communications Inc., IB Docket No. 18-313, at 4 (filed Apr. 5, 2019) (calling for the Commission to "authorize only one NGSO satellite system to operate at a particular altitude"); see also Comments of the Boeing Company, IB Docket No. 18-313, at 20-21 (filed Apr. 5, 2019) (arguing the Commission must consider the impact of systems with large orbital variances on the efficient and economic use of orbital resources).

¹² Amazon does not argue that all satellite constellations must remain at separate altitudes, or that the Commission should guarantee any operator exclusive access to any altitude. Indeed, as a general matter, as SpaceX recently noted, Amazon has not objected to other, smaller constellations with altitudes overlapping with the Kuiper System. See Letter from David Goldman, Director of Satellite Policy, SpaceX, to Marlene H. Dortch, Secretary, FCC, IBFS File No. SAT-MOD-20211207-00186, at 3 (filed Jan. 10, 2022) (commenting on Amazon's orbital debris modification, where Amazon analyzed systems with very similar orbits to the Kuiper System, within 10 km of Kuiper System shell altitudes and 2 degrees inclination). Other systems that overlap with Amazon's altitudes involve many fewer satellites than SpaceX's system, both individually and in aggregate.

¹³ See *Mod3 Grant*, at ¶ 66.

forward.”¹⁴ The condition—which SpaceX accepted, and indeed itself offered¹⁵—meant that the 1,240 SpaceX satellites that would otherwise have been able to operate above that altitude would instead avoid any overlap with the Kuiper System’s authorized altitude. Doing so, the Commission found, would “limit any risk of Starlink satellites failing at higher altitudes where longer orbital decay times and marginally greater collision risk would be expected.”¹⁶

The Commission should impose the same condition on the Gen2 System. Its reasoning applies with greater force here because the number of satellites proposed—and therefore the potential risks—are substantially higher. The number of satellites in SpaceX’s system that could overlap with Amazon’s orbital altitudes has grown nearly tenfold—from the 1,240 in Gen1 to 10,548 satellites in Gen2, considering satellites in orbital planes at 525 km or higher and an orbital variance of +70/-50 km.¹⁷

Table 1 below compares the altitudes and inclinations of the SpaceX Gen2 and Kuiper Systems. For reference, Amazon’s current authorization comprises 3,236 satellites at altitudes of 590 km, 610 km, and 630 km.¹⁸

¹⁴ *Id.*

¹⁵ See Letter from David Goldman, Director of Satellite Policy, SpaceX, to Marlene H. Dortch, Secretary, FCC, IBFS File No. SAT-MOD-20200417-00037, at 3-4 (filed Dec. 4, 2020).

¹⁶ *Mod3 Grant*, at ¶ 66.

¹⁷ Since Mod3, Amazon has likewise sought authority to launch additional satellites at this altitude. See *Amazon V-band Application*.

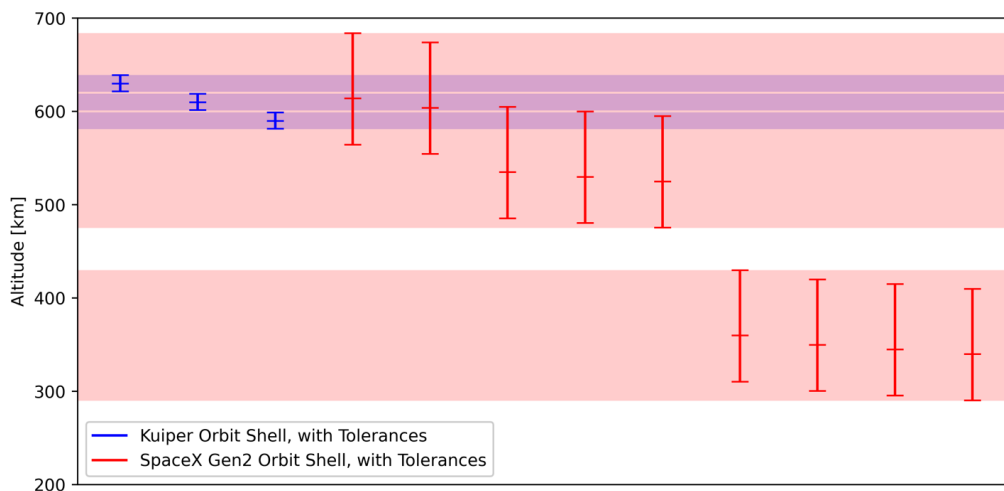
¹⁸ See *Kuiper System Grant*.

Table 1. Orbital Overlap Between the Kuiper System and the SpaceX Gen2 System

SpaceX Altitude	SpaceX Orbital Tolerance	SpaceX Minimum Altitude	SpaceX Maximum Altitude	SpaceX Overlap with Kuiper	SpaceX Satellites in Shell
[km]	[km]	[km]	[km]		
340	-50 to +70	290	410	No	5280
345	-50 to +70	295	415	No	5280
350	-50 to +70	300	420	No	5280
360	-50 to +70	310	430	No	3600
525	-50 to +70	475	595	Yes	3360
530	-50 to +70	480	600	Yes	3360
535	-50 to +70	485	605	Yes	3360
604	-50 to +70	554	674	Yes	144
614	-50 to +70	564	684	Yes	324

Figure 1 displays this overlap graphically, and shows that these Gen2 System satellites overlap with the altitudes occupied by the Kuiper System in two ways: some by virtue of their *nominal altitude* lying between the nominal altitudes of two of Amazon’s orbital shells, and others by virtue of their *orbital tolerance*. For each shell, the middle line represents the nominal altitude—the stated altitude in SpaceX’s application—and the outer lines represent the boundaries of that altitude when considering the orbital tolerance that SpaceX requests.

Figure 1: Overlap Between SpaceX Gen2 System and the Kuiper System



As proposed, the SpaceX Gen2 System poses serious challenges to the Kuiper System, as a result of both the SpaceX Gen2 satellites that would operate at the same nominal altitude range as the Kuiper System as well as the SpaceX Gen2 satellites which would operate only potentially at that altitude by virtue of their orbital tolerance. We discuss each separately below.

Nominal altitude. SpaceX's Gen2 System seeks to place 468 of its satellites at altitudes of 604 km and 614 km,¹⁹ which is nominally within the same altitude range as Kuiper System satellites. Even if SpaceX strictly maintained these altitudes with no tolerance, 468 of its satellites would orbit within a few kilometers of the Kuiper System's 610 km shell and overlap with the bounds of the Kuiper System's +/- 9 km orbital tolerance. And the wide orbital tolerance of SpaceX's Gen2 satellites means that they could freely be moved anywhere within the narrow range of altitudes of the Kuiper System. The exact burden that these satellites will impose on the Kuiper System, however, will depend on a number of variables—such as the eccentricity of SpaceX's and Amazon's orbits, and how SpaceX positions the satellites within its requested orbital tolerance. Nevertheless, Amazon's preliminary analysis suggests that even the contemplated positioning of SpaceX satellites at 604 km and 614 km could significantly increase—in some scenarios, more than double—the number of actionable close approaches and conjunctions that Amazon would need to manage, creating additional burdens and risk.

¹⁹ These satellites are at an inclination that places them in retrograde orbit. With respect to inclination, space safety risk is probabilistic, and risk can increase or diminish with differences in inclination and altitude. The preliminary analysis above reflects our analysis of SpaceX's Gen2 System as proposed. Contrary to SpaceX's assertions, *see* Letter from David Goldman, Director of Satellite Policy, SpaceX, to Marlene H. Dortch, Secretary, FCC, IBFS File No. SAT-MOD-20211207-00186, at 1-3 (Jan. 10, 2022), Amazon has not taken the position that satellites with more than a 2 degree of difference in inclination pose no risk. Amazon's preliminary analysis here measures the cumulative risk caused by the large number of SpaceX satellites in SpaceX's planned system, accounting for the fact that many are at inclinations different than Amazon's by more than 2 degrees.

To mitigate these risks, the Commission should condition any grant of the Gen2 System on lowering these satellites and requiring that they maintain an altitude at or below 580 km. The safety risks and burden to Amazon—and indeed, to SpaceX as well—far outweigh any harm to the Gen2 System caused by repositioning satellites comprising less than 2% of the SpaceX Gen2 System.

Orbital tolerance. Space safety risks dramatically multiply with the 10,080 additional satellites that could overlap with the altitudes of the Kuiper System by virtue of the ambiguity of their “orbital tolerance”—the distance that SpaceX asks the Commission to allow its satellites to freely depart from their nominal altitude. For each of its satellites, SpaceX requests an extremely large orbital tolerance of -50 km to +70 km.²⁰ To borrow a comparison used by SpaceX when opposing a similarly large orbital tolerance requested by another operator, this orbital tolerance is greater than the distance “between Washington, D.C. and Baltimore”²¹—indeed, the total orbital tolerance SpaceX seeks is roughly double that distance. This is also far greater than the orbital tolerance limited by the Commission in *Mod3* (which sought a +/- 30 km orbital tolerance),²² and the Commission can address the space safety issues here by imposing the same reasonable limitations.

Many of these satellites are far closer in inclination than those at issue in *Mod3*; indeed, 3,360 of SpaceX’s Gen2 System satellites would fly at the same inclination as 784 of Amazon’s satellites. If SpaceX were granted the orbital tolerance it requests, these 3,360 satellites at 535 km

²⁰ See *SpaceX Amendment*, Technical App’x., at 4.

²¹ Letter from William M. Wiltshire, Harris, Wiltshire & Grannis, Counsel to SpaceX, to Marlene H. Dortch, Secretary, FCC, IBFS File No. SAT-LOA-20170301-00027, at 2-3 (filed Dec. 12, 2017) (“*SpaceX Response to OneWeb*”).

²² See *Mod3 Grant*, at ¶ 4.

nominal altitude and 33 degrees inclination could be flown exactly at Kuiper’s nominal altitude of 590 km and 33 degrees inclination, which would produce periodic co-planar conditions at proximate altitudes, increasing risk between systems.

Considering similar altitudes and inclination, a SpaceX operational decision to avail itself of the flexibility it is requesting would result in a dramatic increase in risks and costs to Amazon. The risks and costs to Amazon are impossible to precisely measure without knowing, among other things, *how* SpaceX would use the flexibility it requests. Notwithstanding that uncertainty, Amazon’s preliminary analysis suggests scenarios that would impose additional, unnecessary burdens on the Kuiper System. Indeed, it is conceivable that thousands of satellites flying at or close to the altitudes of the Kuiper System could require each of Amazon’s thousands of satellites to plan for collision avoidance *multiple times per day*.

Whatever SpaceX’s plans may be, the requested parameters of its Gen2 System license would authorize a wide range of possible configurations, many of which could impose significant burdens on the Kuiper System. The cost of planning in the face of this uncertainty is its own harm. Amazon cannot and should not have to plan its deployment around another proposed system that could freely move any of its 30,000 satellites within a 120 km range. Placing some limit on this extraordinary flexibility—at least at the higher altitudes of SpaceX’s Gen2 System—would provide Amazon some certainty against which to plan the deployment of the Kuiper System.

SpaceX provides no justification to weigh against these harms, beyond asserting that the requested altitude range “provides the operational flexibility needed in light of the denser atmospheric conditions in which Starlink operates, helping to account for the significant impact of

solar cycles.”²³ Because atmospheric density increases at lower altitudes, this rationale applies most strongly to the lowest of SpaceX’s satellites, and diminishes for satellites at higher altitudes.

Indeed, Amazon, at many of the same altitudes, has a variance of only +/- 9 km.²⁴ The range requested by the SpaceX Gen2 System is likewise out of step with the flexibility requested by other NGSO licensees. Theia only sought a variance of +/- 10 km,²⁵ Viasat only sought a variance of +/- 10 km,²⁶ Audacy only sought a variance of +/- 15 km,²⁷ and Mangata has only sought a variance of +/- 15 km.²⁸ SpaceX itself requested an orbital variance of +/- 30 km for its

²³ *SpaceX Amendment*, Technical App’x, at 5.

²⁴ *See Amazon V-band Application*, Technical App’x, at 32.

²⁵ *See* Theia Holdings A., Inc. Application for Authority to Launch and Operate a Non-Geostationary Satellite Orbit System in the Fixed-Satellite Service, Mobile-Satellite Service, and Earth-Exploration Satellite Service, IBFS File No. SAT-LOA-20161115-00121, Technical Narrative, at 11 (filed Nov. 15, 2016); *Theia Holdings A., Inc. Application for Authority to Launch and Operate a Non-Geostationary Satellite Orbit System in the Fixed-Satellite Service, Mobile-Satellite Service, and Earth-Exploration Satellite Service*, IBFS File Nos. SAT-LOA-20161115-00121 and SAT-AMD-20170301-00029, Memorandum Opinion, Order and Authorization, 34 FCC Rcd 3526 (2019).

²⁶ *See* ViaSat, Inc. Petition for Declaratory Ruling Granting Access to the U.S. for a Non-U.S.-Licensed Nongeostationary Orbit Satellite Network, IBFS File No. SAT-PDR-20161115-00120, Technical Annex, at 13 (filed Nov. 15, 2016); *ViaSat, Inc. Petition for Declaratory Ruling Granting Access for a Non-U.S.-Licensed Non-Geostationary Orbit Satellite Network*, IBFS File Nos. SAT-PDR-20161115-00120 and SAT-APL-20180927-00076, Order, 35 FCC Rcd 4324 (2020) (“*Viasat Grant*”).

²⁷ *See* Letter from James Spicer, Chief Engineer, Audacy Corporation, to Marlene H. Dortch, Secretary, FCC, IBFS File No. SAT-LOA-20161115-00117, at 5-6 (Apr. 3, 2017); *Audacy Corporation Application for Authority to Launch and Operate a Non-Geostationary Medium Earth Orbit Satellite System in the Fixed and Inter-Satellite Services*, Order and Authorization, 33 FCC Rcd 5554 (2018).

²⁸ *See* Mangata Networks LLC Petition for a Declaratory Ruling Granting Access to the U.S. Market for the Mangata Networks System, IBFS File No. SAT-PDR-20200526-00054, Technical Narrative, at 27 (filed May 25, 2020).

Gen1 System, which the Commission then limited by the aforementioned maximum orbital altitude condition.²⁹

Indeed, SpaceX—rightly—challenged the only other operator that requested this degree of flexibility. In response to OneWeb’s request for buffer zone including a +/- 75 km orbital variance for OneWeb’s system,³⁰ SpaceX argued that such a variance “is a far larger orbital variance than any other NGSO applicant expects to maintain” and faulted OneWeb’s failure to justify “such a large operational range for its system.”³¹ SpaceX proposed that an orbital tolerance of +/- 25 km would be a more “reasonable and achievable level of variance.”³²

For the same reasons, the Commission should reject SpaceX’s request for an overly broad orbital tolerance—at least for its highest altitude satellites that would potentially overlap with Amazon’s own constellation. There is no reason to provide SpaceX’s Gen2 System greater orbital tolerance than SpaceX’s Gen1 System, which already exceeded industry norms. Nor is there any other reasoned basis in the record for the Commission to conclude that such a variance is appropriate.³³

²⁹ The Commission stated that “[a]s a practical matter, this will mean that SpaceX satellites in the upper altitude ranges must abide by a smaller orbital tolerance – 10 km or less for the planned operational orbit at 570 km altitude, and 20 km or less for the satellites at 560 km – in order to stay below 580 km at all times.” *Mod3 Grant*, at ¶ 66.

³⁰ See Letter from Mr. Brian D. Weimer, Sheppard Mullin, Counsel to OneWeb, to Marlene H. Dortch, Secretary, FCC, IBFS File No. SAT-LOA-20170301-00027, at 10 n.20 (filed Nov. 17, 2017) (“Space Exploration Holdings states that its satellites will span +/-30 km from the constellation center altitude, and OneWeb will extend up to 75 km from its center altitude. To account for long-term perturbations, 20 km of open space is proposed[.]”).

³¹ *SpaceX Response to OneWeb*, at 2-3.

³² *Id.* at 3.

³³ See *Motor Vehicle Mfrs. Ass’n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 42 (1983).

III. THE COMMISSION SHOULD MITIGATE INTERFERENCE CONCERNS BY IMPOSING INFORMATION SHARING REQUIREMENTS

Another consequence of the unique size of SpaceX's Gen2 System is the magnitude of spectrum coordination concerns that it poses to Amazon and other satellite operators. Each of the nearly 30,000 satellites in SpaceX's constellation raises the possibility of interference, and the cumulative probability of inline events caused by a system of this unprecedented size poses unique and immense challenges. While Amazon looks forward to coordinating with SpaceX to facilitate the deployment of both companies' NGSO FSS systems, the burden of avoiding potential interference between the two systems will fall on both operators.³⁴

There is a simple solution endorsed by both SpaceX and Amazon: sharing information about beam pointing and satellite selection. As the Commission stated in its pending proceeding to update NGSO system spectrum sharing rules, "information sharing among NGSO FSS operators is essential to their efficient use of spectrum."³⁵ Each satellite has an expansive coverage area, and in a system of nearly 30,000 satellites, the coverage area of each satellite will no doubt overlap with the coverage area of numerous other satellites. Without knowing which satellite is transmitting to which earth station (or group of earth stations in a specific area) on a timely and ongoing basis sufficient to identify anticipated interference events in advance, existing and prospective NGSO system operators are left to assume that each satellite is transmitting over its entire coverage area at all times when that is not the case.³⁶ They also must assume that the other

³⁴ See 47 C.F.R. § 25.261.

³⁵ *Revising Spectrum Sharing Rules for Non-Geostationary Orbit, Fixed-Satellite Service Systems*, IB Docket No. 21-456, Order and Notice of Proposed Rulemaking, FCC 21-123, ¶ 23 (rel. Dec. 15, 2021) ("*NGSO System Spectrum Sharing NPRM*").

³⁶ In discussing its Ku-band beams, for example, SpaceX states that "At a given frequency, only a single beam . . . typically would cover a user cell on the ground from a given satellite. Alternatively, two beams . . . can cover a single user cell on the ground at a given frequency, but

NGSO system's earth stations could be transmitting to and receiving from any of its in-view satellites—when that is not the case, either. The consequences are that operators must act to avoid interference that exists only in theory, not in fact, limiting both the efficient use of spectrum and competition. Ultimately, consumers bear the costs of this inefficiency by paying higher prices for lower quality service. It is thus essential that NGSO systems share operational information to coexist and mutually act to prevent harmful interference.

For its part, SpaceX has repeatedly referred to private coordination as the “gold standard” for spectrum sharing³⁷ and has supported Amazon's proposal that Amazon and other NGSO operators be required to share beam pointing information to facilitate operations.³⁸ SpaceX has also observed that “[a]ny delay” in updating the FCC's revised rules for NGSO system spectrum sharing, such as information sharing requirements, could “slow progress towards coordination just as systems are beginning operation.”³⁹

Amazon agrees, and the benefits here, given the scale of SpaceX's Gen2 System, would be profound. Figures 2 and 3, below, compare the possible inline interference events with and without

in this case their EIRP will be reduced by 3 dB to maintain the same PFD[.]” *Gen2 Application*, Technical App'x, at 9.

³⁷ See, e.g., Reply Comments of Space Exploration Holdings, LLC, RM-11855, at 2 (filed June 30, 2020) (“*SpaceX Spectrum Sharing Reply Comments*”) (“As many commenters agree, successful private coordination is the gold standard to ensure efficient use of the spectrum.”); Letter from David Goldman, Director of Satellite Policy, SpaceX, to Marlene H. Dortch, Secretary, FCC, RM-11855, at 1 (filed July 8, 2020) (“SpaceX stressed that private coordination between operators should be considered the gold standard for spectrum sharing, and the primary purpose for any default rules should be to drive successful coordination discussions.”).

³⁸ See, e.g., Petition for Rulemaking of Space Exploration Holdings, LLC, RM-11855, at 1-2 (filed Apr. 30, 2020) (“To facilitate operations, SpaceX supports Amazon's request that first round licensees share beam pointing information.”); *id.* at 12 (“SpaceX supports Amazon's request that earlier-round systems be required to share data on beam pointing locations to facilitate analysis of and compliance with [SpaceX's proposed efficiency] metric.”).

³⁹ *SpaceX Spectrum Sharing Reply Comments*, at 2.

information sharing. Figure 2 shows a map of the SpaceX Gen2 and Kuiper System satellites that are in-view of an earth station located at 40°N, 100°W. SpaceX stated that only one of its in-view satellites will serve any spot with a Ka-band user beam,⁴⁰ but without knowledge of which of its satellites is communicating with this earth station, Amazon would be forced to assume that any geometric alignment of the two systems' visible satellites must be considered a potential interference event. This results in over half of the in-view Kuiper System satellites being conflicted by an in-line SpaceX Gen2 satellite.

Figure 2: Map of Kuiper System In-Line Satellites with SpaceX Gen2 Satellites, without Knowledge of Active SpaceX Gen2 Satellites

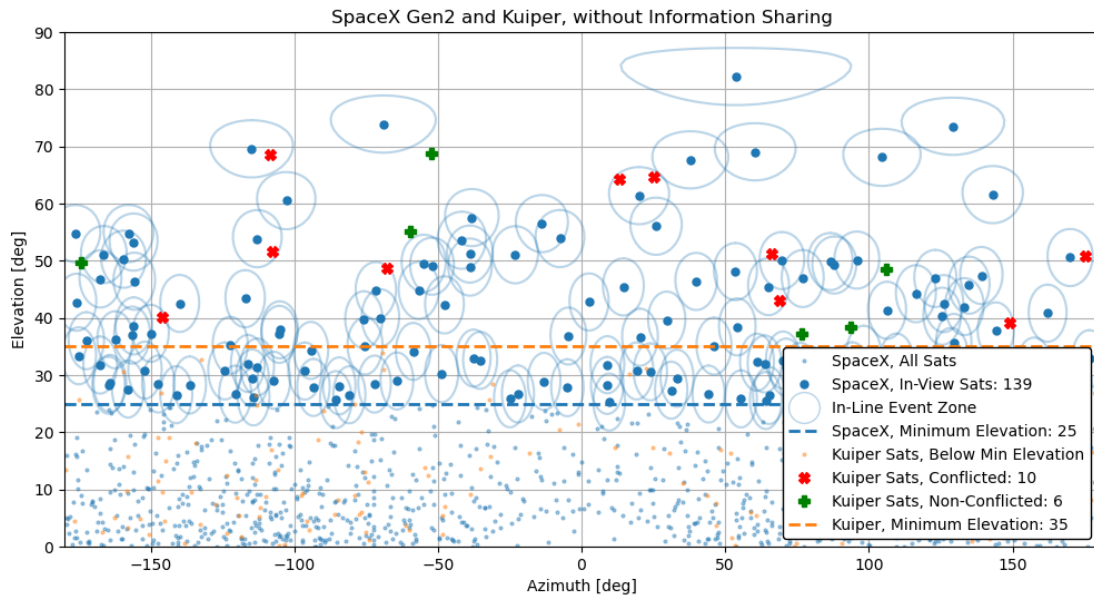
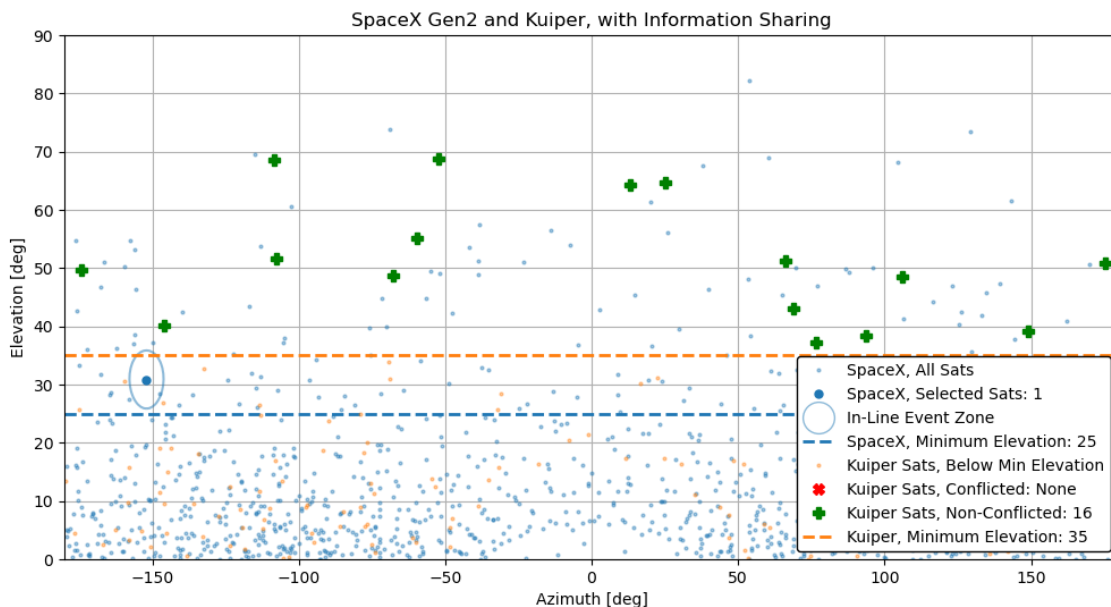


Figure 3 demonstrates the same configuration with information sharing: Where Amazon and SpaceX are able to identify the active and inactive satellites, both parties are relieved of the burden of coordinating to prevent potential interference that would not actually occur. In this

⁴⁰ *SpaceX Amendment*, Technical App'x, at A2A-3.

example, the sharing of satellite selection information resolves each of the in-line events between the in-view Kuiper System satellites and in-view SpaceX Gen2 satellites.

Figure 3: Map of Kuiper System In-Line Satellites with SpaceX Gen2 Satellites, with Knowledge of Active SpaceX Gen2 Satellites



Put simply: Information sharing enables the more efficient use of spectrum. It allows operators to focus on avoiding only those interference events that might actually come to pass, and to avoid the inefficiencies of overestimating potential interference. The size of SpaceX’s system magnifies the costs of these inefficiencies on Amazon and others. There is no reasonable basis for Amazon and others to shoulder these burdens where a simple solution exists to avoid them.

Amazon therefore requests that the Commission condition approval on SpaceX sharing Gen2 System operational information, subject to appropriate safeguards,⁴¹ on an ongoing and timely basis with NGSO FSS applicants and licensees using commonly authorized frequencies:

⁴¹ Amazon has no objection to SpaceX providing this information subject to confidentiality or non-disclosure agreements to ensure that this proprietary information is not used for any purpose other than system coordination. Amazon has already stated that it will share similar information with other operators.

- **Satellite Selection Information:** SpaceX should inform operators precisely which of its in-view satellites will be actively communicating with its earth stations. If 100 satellites are in view of an earth station, for example, but only a subset of those satellites will communicate with that earth station, distinguishing “active” from “inactive” satellites informs coordination.
- **Beam Pointing Information:** SpaceX should inform operators to which earth stations its satellite beams are directed. Although a satellite has an enormous field of view, it will transmit and receive only to and from select locations within that field of view—limiting interference risk to those locations with active satellite beam operations.

The Commission is considering the benefits of information sharing in a pending proceeding to revise Section 25.261 of the FCC’s rules.⁴² Given the size and timing of SpaceX’s Gen2 deployment, the Commission should not and need not wait for the conclusion of its rulemaking proceeding to apply this requirement here. Given SpaceX’s intention to begin launching its Gen2 satellites “as soon as March 2022,”⁴³ it is important to require the sharing of information regarding this uniquely large system so that all NGSO operators can coordinate effectively and efficiently so as to avoid harmful interference and make efficient use of spectrum.⁴⁴ Of course, the information sharing applied now as license conditions could be made expressly subject to modification based on the outcome of the future rulemaking.

IV. THE COMMISSION SHOULD IMPOSE CONDITIONS CONSISTENTLY ON SIMILARLY SITUATED OPERATORS

While in some respects the unique size of the SpaceX Gen2 System imposes unique externalities that warrant additional unique conditions, the Commission should otherwise ensure that the conditions imposed on SpaceX match those imposed on Amazon and other similarly

⁴² See *NGSO System Spectrum Sharing NPRM*, at ¶¶ 24-25.

⁴³ Letter from William Wiltshire, Harris, Wiltshire & Grannis, LLP, Counsel to SpaceX, to Karl Kensinger, Chief, Satellite Division, International Bureau, FCC, at 5 (filed Jan. 7, 2022) (“*SpaceX Response to Information Request*”).

⁴⁴ A delay in imposing information sharing requirements would hinder the full use of spectrum, and thus limit competition and harm consumers, even more than any delay in imposing a similar condition on other NGSO system operators.

situated operators. Balanced rules and conditions on similarly situated operators promote fair competition and cooperation. Disparate conditions distort the playing field, introduce uncertainty and ambiguity that ossifies the licensing process with fighting and advocacy, and make coordination among operators more difficult. Beyond being required by the Administrative Procedure Act,⁴⁵ similar treatment of similarly situated operators is necessary to further the Commission’s goal of making the licensing process faster and more efficient.⁴⁶

Amazon therefore requests that the Commission evenly apply to SpaceX’s Gen2 System the same conditions imposed on Amazon and others.

Compliance with EPFD Limits. The Commission should deny SpaceX’s request to waive its requirement that it receive a “favorable” or “qualified favorable” finding from the ITU regarding its compliance with the ITU’s EPFD limits prior to initiating service.⁴⁷ SpaceX’s progress in satisfying this requirement appears not to match its ambitious launch schedule. At the outset, SpaceX appears not to have submitted ITU filings covering the whole of its modified Gen2 System, let alone taken steps to secure a favorable finding regarding those filings’ compliance with the ITU’s EPFD limits.⁴⁸

⁴⁵ See, e.g., *ANR Storage Co. v. Fed. Energy Regul. Comm’n*, 904 F.3d 1020, 1024 (D.C. Cir. 2018) (requiring FERC to “provide some reasonable justification for any adverse treatment relative to similarly situated competitors”). See also *Motor Vehicle Mfrs. Ass’n of United States, Inc. v. State Farm Mut. Automobile Ins. Co.*, 463 U.S. 29, 43 (1983); *Shaw’s Supermarkets, Inc. v. NLRB*, 884 F.2d 34 (1st Cir. 1989).

⁴⁶ See Statement of Chairwoman Jessica Rosenworcel, *Revising Spectrum Sharing Rules for Non-Geostationary Orbit, Fixed-Satellite Service Systems*, RM-11855, FCC 21-123, at 2 (rel. Dec. 15, 2021) (noting that the Commission will “need to speed the processing of applications to keep pace with all the innovation headed our way”).

⁴⁷ See 47 C.F.R. § 25.146(c).

⁴⁸ See *SpaceX Response to Information Request*, at 8 (noting that its German ITU filing covers only 3,360 satellites using Ku- and Ka-band spectrum).

SpaceX has had ample time to prepare and submit its ITU filings and EPFD validation input data to the ITU. Yet as recently as one week ago, SpaceX suggested that it had not provided the information necessary to validate compliance with EPFD limits to other operators because it was not yet “complete.”⁴⁹ SpaceX evidently completed these calculations last Friday evening—four days before comments were due in this proceeding, and nearly six months after filing its amended application.⁵⁰ The FCC routinely rejects waiver requests necessitated by an applicant’s self-caused delay and should do the same here.⁵¹

The Commission’s rules require that an NGSO FSS operator licensed or holding a market access authorization to operate in the 10.7-30 GHz frequency range receive a “favorable” or “qualified favorable” finding by the ITU Radiocommunication Bureau regarding its compliance with applicable ITU EPFD limits prior to initiation of service.⁵² The Commission has generally required NGSO operators to share the inputs for that validation upon request as a license condition.⁵³ For its Gen1 System, SpaceX submitted to the ITU its space radiocommunication

⁴⁹ See Letter from David Goldman, Director of Satellite Policy, SpaceX, to Marlene H. Dortch, Secretary, FCC, IBFS File Nos. SAT-LOA-20200526-00055 and SAT-AMD-20210818-00105 (Feb. 2, 2022) (“*SpaceX Response to Motion for Abeyance*”).

⁵⁰ Letter from David Goldman, Director of Satellite Policy, SpaceX, to Marlene H. Dortch, Secretary, FCC, IBFS File Nos. SAT-LOA-20200526-00055 and SAT-AMD-20210818-00105 (Feb. 4, 2022) (“*SpaceX February 4 Letter*”).

⁵¹ See, e.g., *Application for Review of Specialized Mobile Radio Station WQA-505, Licensed to Texas Two-Way, Inc., Fort Worth, Texas*, Memorandum Opinion and Order, 98 FCC 2d 1300, 1303, ¶ 8 (1984), *aff’d sub nom., Texas Two-Way, Inc. v. FCC*, 762 F.2d 138 (D.C. Cir. 1985) (finding a licensee responsible for the delay resulting from interference caused by construction adjacent to construction site because site selection was an independent business decision).

⁵² 47 C.F.R. § 25.146(c).

⁵³ See, e.g., *Kuiper System Grant*, at ¶ 59(f); *Viasat Grant*, at ¶ 52(a); *Telesat Canada Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat’s NGSO Constellation*, Order and Declaratory Ruling, 32 FCC Rcd 9663, ¶ 28(b) (2017); *WorldVu Satellites Limited Petition for a Declaratory Ruling Granting Access to the U.S. Market for the OneWeb NGSO FSS System*, Order and Declaratory Ruling, 32 FCC Rcd 5366, ¶ 24(d) (2017).

stations effective isotropic radiated power (“EIRP”) mask and results databases to demonstrate compliance with Article 22 EPFD limits prior to launch. Grant of SpaceX’s Gen1 System was conditioned on the requirement to “make available to any requesting party the data used as input to the ITU-approved validation software to demonstrate compliance with applicable [EPFD] limits,”⁵⁴ which SpaceX has done upon request.⁵⁵ Amazon has done the same under the terms of its license.⁵⁶

Here, SpaceX requests a waiver of the ITU filing requirement, arguing that “the ITU is unlikely to complete its evaluation of the Gen2 System and render an EPFD finding on a timeframe that will match SpaceX’s aggressive constellation deployment schedule”⁵⁷—including first launches scheduled for March of this year. The Commission should deny this waiver request in full and impose on SpaceX the same conditions that apply to other operators. Furthermore, the Commission should require SpaceX to define the status of any EPFD input files it provides to other operators. Section 25.111(b) of the Commission’s rules requires operators to submit the input data files used for the ITU validation software.⁵⁸ In the case of the Gen2 System, where there are no ITU filings for the modification, the status of such EPFD input files is unclear.

⁵⁴ *Space Exploration Holdings, LLC, Request for Modification of the Authorization for the SpaceX NGSO Satellite System*, Order and Authorization, 34 FCC Rcd 12307, ¶ 19(p) (2019).

⁵⁵ See Letter from David Goldman, Director of Satellite Policy, SpaceX, to Marlene H. Dortch, Secretary, FCC, IBFS File No. SAT-MOD-20200417-00037, at 2 (filed June 29, 2020).

⁵⁶ See *Kuiper System Grant*, at ¶ 61 (“Kuiper must make available to any requesting party the data used as input to the ITU approved validation software to demonstrate compliance with applicable EPFD limits.”).

⁵⁷ *SpaceX Amendment*, Waiver Requests, at 4. We note that SpaceX’s application requests a waiver of Section 25.146(a), though the resulting discussion seems to make clear that it is requesting a waiver of the ITU filing requirement in Section 25.146(c). To the extent that SpaceX requests a waiver of the EPFD certification requirement, we oppose such request for the same reasons, and on the additional ground that it has failed to justify such a waiver request.

⁵⁸ 47 C.F.R. § 25.111(b).

SpaceX's requested waiver does not adequately justify a "special circumstance [that] warrant[s] a deviation from the general rule" nor explain why a waiver "would better serve the public interest than would strict adherence to the general rule."⁵⁹ *For one*, SpaceX is in no position to complain about the ITU's timeframe when SpaceX itself has not even submitted its filing information to the ITU. As SpaceX itself recently noted in opposing Amazon's own modest extension request, it "filed its original application in May 2020 and its minor amendment in August 2021."⁶⁰ Yet SpaceX was still "revising its EPFD data" even in January 2022—20 months after initially filing its Gen2 application and five months after proposing the configuration now at issue.⁶¹ SpaceX may well have avoided the necessity of a waiver by preparing and filing its information with the ITU, and its self-caused delay does not constitute a special circumstance warranting a waiver of the general rule.⁶² *For another*, waiver would (a) undermine the purpose of the rule, which is to ensure protection for GSO systems while also eliminating the need for FCC staff to duplicate the review performed by the ITU's Radiocommunication Bureau, and (b) be arbitrary, given the requirements imposed on similarly situated NGSO operators who have shown how they will protect GSO systems. The purpose of the Commission's rules governing EPFD

⁵⁹ *GE American Communications, Inc.*, Order and Authorization, 16 FCC Rcd 11038, ¶ 9 (IB 2001).

⁶⁰ SpaceX Opposition to Request for Extension of Comment Deadline, IBFS File Nos. SAT-LOA-20200526-00055 and SAT-AMD-20210818-00105, at 2 (filed Jan. 11, 2022).

⁶¹ See DISH Network Corporation Motion to Hold Proceeding in Abeyance Pending Development and Production of Information by the Applicant, IBFS File Nos. SAT-LOA-20200526-00055, SAT-AMD-20210818-00105, Ex. 1, at 1 (filed Jan. 27, 2022) ("*DISH Motion for Abeyance*").

⁶² The Commission need not decide whether the waiver SpaceX received for its 4,425-satellite Gen1 system was in error to deny the Gen2 waiver request. Given the sheer size of the Gen2 system and the increased potential for interference inherent in the almost 30,000-satellite constellation, compliance with the Commission's rules is all the more pressing in the current proceeding.

compliance applies all the more strongly to one of the largest NGSO system applications ever received by the Commission.

For Amazon, understanding the actual technical parameters under which SpaceX proposes to operate its Gen2 System, including precise power level information, is necessary for understanding the effect of SpaceX's proposed system on the spectrum sharing environment. To support efficient and effective coordination among NGSO operators, it is necessary to require SpaceX to share with requesting parties appropriate ITU filing(s) (that receive at least a "qualified favorable" finding) that contain the technical parameters, including power-flux-density and EIRP masks, needed for the Radiocommunication Bureau to conduct its technical examination of the system's ability to meet EPFD requirements.

Certifying non-interference. As with Amazon, the Commission should require SpaceX to certify that it has completed a coordination agreement with, or make a showing that it will not cause harmful interference to, any operational system licensed or granted U.S. market access in prior NGSO FSS processing rounds prior to operation. SpaceX itself has sought similar conditions on other operators that would pose an interference risk to first-round NGSO licensees.⁶³

Like Amazon's Kuiper System,⁶⁴ SpaceX's Gen2 application was submitted as part of the 2020 Ku-/Ka-band processing round.⁶⁵ As part of the 2020 processing round, the Commission's rules require that SpaceX coordinate with other licensees to "provide a measure of certainty in lieu

⁶³ See Reply of Space Exploration Holdings, LLC, IBFS File No. SAT-MPL-20200526-00056, at 2 (filed Sept. 25, 2020).

⁶⁴ See *Kuiper System Grant*, at ¶ 2.

⁶⁵ See *SpaceX Amendment*, at 2; see also *Satellite Policy Branch Information, Cut-Off Established for Additional NGSO FSS Applications or Petitions for Operations in the 10.7-12.7 GHz, 12.75-13.25 GHz, 13.8-14.5 GHz, 17.7-18.6 GHz, 18.8-20.2 GHz, and 27.5-30 GHz Bands*, Public Notice, Report No. SPB-279, DA 20-325 (rel. Mar. 24, 2020).

of adopting an open-ended requirement to accommodate all future applicants.”⁶⁶ Moreover, the Commission “stated [its] intent to set all NGSO FSS applicants and market access petitioners in a processing round on equal footing [and] that [the Commission] believe[s] coordination among NGSO FSS operators provides the best opportunity for efficient spectrum sharing[.]”⁶⁷ Thus the proposed certification would provide operational certainty to both operators from earlier processing rounds and operators like Amazon who are part of the same processing round as SpaceX.

In sum, the Commission should ensure that similarly situated licensees are treated similarly, including by imposing similar license conditions, requiring compliance with the Commission’s EPFD rules, and ensuring coordination with other licensees.⁶⁸

Multiple-application rule. The Commission has questioned whether SpaceX’s application for its Gen2 System complies with Section 25.159 of its rules, which prohibit an operator with a licensed-but-unbuilt system from seeking another license using the same frequencies,⁶⁹ “given that SpaceX has not yet completed deploying its first generation system, or reached the minimum 50%

⁶⁶ See *Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters*, Report and Order and Notice of Proposed Rulemaking, 32 FCC Rcd 7809, ¶ 61 (2017).

⁶⁷ *Kuiper System Grant*, at ¶ 49.

⁶⁸ In addition to the conditions already discussed here, the *Kuiper System Grant* requires Amazon to meet the following requirements prior to operation: coordinate operations in the 19.3-19.7 GHz and 29.1-29.5 GHz bands with prior-authorized NGSO FSS systems, ¶ 59(i); coordinate space-to-Earth operations in the 17.8-18.6 GHz, 18.8-19.3 GHz, and 19.7-20.2 GHz bands with U.S. Federal systems, ¶ 59(m); and “obtain the Commission’s approval of a modification containing an updated description of the orbital debris mitigation plans for its system,” ¶ 64. Similarly, under the *Mod3 Grant*, SpaceX’s Gen1 System must meet the following requirements prior to operation: coordinate operations in the 10.7-11.7 GHz band with the radio astronomy observatories listed in 47 C.F.R. § 2.106, n.US131, ¶ 97(c), and coordinate space-to-Earth operations in the 17.8-18.6 GHz, 18.8-19.3 GHz, and 19.7-20.2 GHz bands with U.S. Federal systems, ¶ 97(i).

⁶⁹ 47 C.F.R. § 25.159.

required by milestone rules.”⁷⁰ In response, SpaceX pointed out that the Commission’s rule “does not specify the point at which deployment of an NGSO system is sufficient to move out of the ‘unbuilt’ category.”⁷¹ Amazon agrees with SpaceX that the rule itself is ambiguous, and the Commission’s question to SpaceX suggests a reasonable interpretation of that requirement: that a system is only “built” when all of the satellites authorized under a license have been deployed. Whatever the Commission’s interpretation of that rule, it should make that interpretation plain in this proceeding, and apply it to SpaceX and others alike.

V. THE COMMISSION SHOULD ENSURE THAT SPACEX’S SYSTEM CAN COMPLY WITH EPFD LIMITS

For weeks, operators have sought information from SpaceX about the inputs it used to calculate its compliance with the ITU’s EPFD limits.⁷² And for weeks, SpaceX refused to provide this information, notwithstanding the promise in its application to provide this information to any interested party “upon request.”⁷³ The reason for SpaceX’s refusal was that the information did not exist, because SpaceX was still “revising its EPFD data to conform to the new configuration.”⁷⁴ This admission was surprising, given that SpaceX had certified compliance with the EPFD limits when it amended its license to include this new configuration, as required by the Commission’s

⁷⁰ Letter from Karl A. Kensinger, Chief, Satellite Division, FCC, to William M. Wiltshire, Harris, Wiltshire & Grannis, LLP, Counsel to SpaceX, IBFS File Nos. SAT-LOA-20200526-00055 and SAT-AMD-20210818-00105 (Dec. 23, 2021).

⁷¹ *SpaceX Response to Information Request*, at 5.

⁷² *See DISH Motion for Abeyance*.

⁷³ *See SpaceX Application*, Technical App’x, Annex 2, at A2-1 (claiming that its Gen2 “system complies with all EPFD limits applicable to its Ku-band operations. SpaceX will make the data files underlying this analysis available to interested parties upon request.”).

⁷⁴ *See DISH Motion for Abeyance*, Ex. 1, at 1 (Letter from William M. Wiltshire, Counsel to SpaceX, to Pantelis Michalopoulos, Counsel to DISH (Jan. 19, 2022)).

rules.⁷⁵ Just days before comments were due in this proceeding, SpaceX provided these data to Amazon and other operators.⁷⁶

While SpaceX urges the Commission to begin and end its investigation of SpaceX's compliance with EPFD rules with its bare certification of compliance,⁷⁷ it would be plainly unreasonable for the Commission to do so here. While relying on a certification may be appropriate in ordinary circumstances, both the size of SpaceX's proposed constellation and its previous advocacy counsel against doing so here. In Amazon's own licensing proceeding, for example, SpaceX raised similar concerns about EPFD compliance, and asked the Commission to "compel Amazon to make [the data files used to support Amazon's EPFD showing] available to all interested parties . . . to permit independent confirmation that the EPFD simulations were properly performed."⁷⁸

While Amazon is continuing to review the information that it received just days ago, it fully expects that the data will confirm what is plain from the face of SpaceX's application: SpaceX cannot meet EPFD limits for nearly 30,000 satellites at the power levels described in its application. If that turns out to be the case, the Commission should condition SpaceX's license grant accordingly, rather than authorize this clear violation of its rules.

The Commission need not look any further than SpaceX's application to find ample reason for skepticism. To see that SpaceX's claim of EPFD compliance is unreasonable on its face, the Commission need only compare the EPFD results of SpaceX's Gen1 System with the Gen2

⁷⁵ See 47 C.F.R. § 25.146(a).

⁷⁶ See *SpaceX February 4 Letter*.

⁷⁷ See *SpaceX Response to Motion for Abeyance*.

⁷⁸ *Reply of Space Exploration Holdings, LLC*, IBFS File No. SAT-LOA-20190704-00057, at 22 (filed Nov. 25, 2019).

System, as provided by SpaceX prior to submitting its amendment.⁷⁹ EPFD measures the aggregate emissions of NGSO satellites in the direction of a GSO earth station or satellite receiver, taking into account the GSO antenna receive gain discrimination. It is a complicated measurement, but is primarily a function of three things: the total number of satellites transmitting, their power levels, and any operational constraints the NGSO system employs that increase the GSO antenna gain discrimination. And yet, with nearly seven times the number of satellites,⁸⁰ much higher power levels,⁸¹ and four times the number of satellites communicating simultaneously with a given gateway location,⁸² SpaceX's Gen2 System EPFD analysis shows *lower* EPFD levels than its Gen1 system.⁸³ This is shown in Figure 4 below, which compares SpaceX's EPFD analysis results for its Ka-band gateway downlinks from its first-generation system and its Gen2 System application.

⁷⁹ *Compare SpaceX Application*, Technical App'x, Annex 2 (providing Gen2 System EPFD compliance analysis), *with* Application of Space Exploration Holdings, LLC for Modification of Authorization for the SpaceX NGSO Satellite System, IBFS File No. SAT-MOD-20200417-00037, Technical App'x, Annex 2 (filed Apr. 17, 2020) ("*Mod3 Application*") (providing Gen1 Mod3 EPFD compliance analysis).

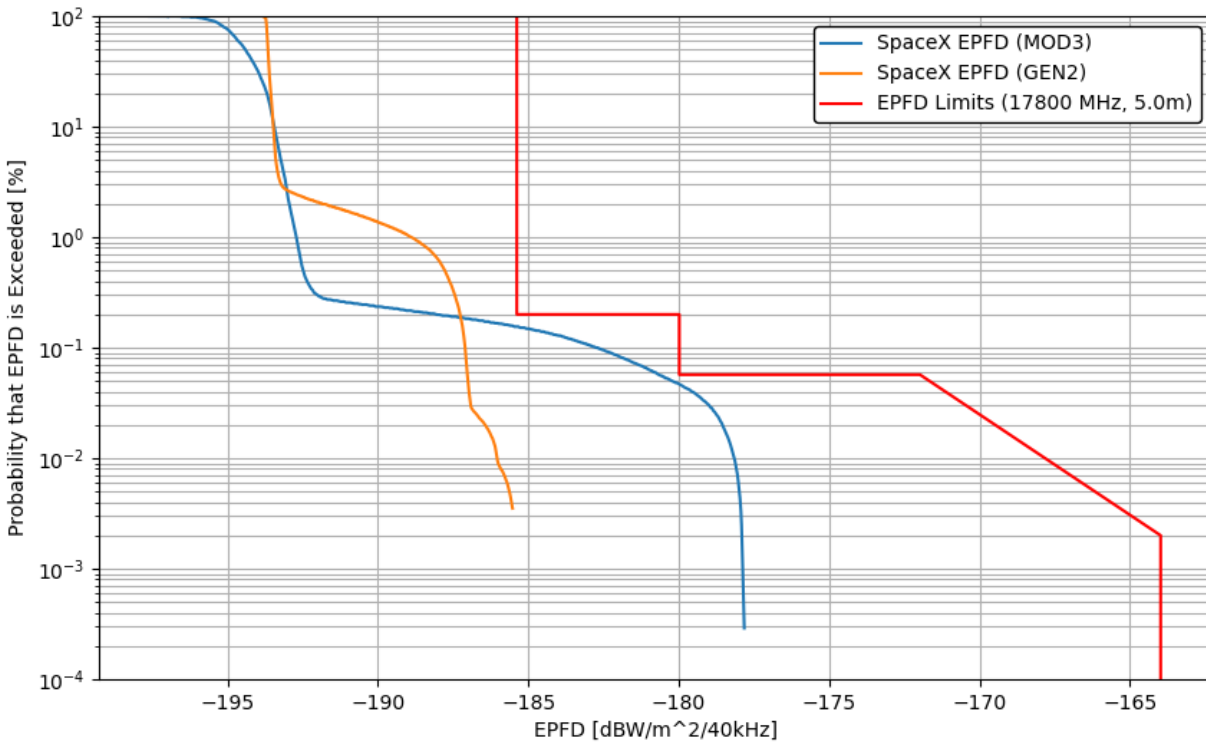
⁸⁰ SpaceX's Gen2 system will include 29,988 satellites, compared to 4,408 satellites in its Gen1 system.

⁸¹ SpaceX's Gen2 application states that its gateway downlink PFD will be -113.3 dBW/m2/MHz, 10 dB lower than its Gen1 PFD levels of -123.3 dBW/m2/MHz. *Compare SpaceX Application*, Technical App'x, at 18, Tables A.7-3 and A.7-4, *with Mod3 Application*, Technical App'x, at 10, Table A.7-2.

⁸² SpaceX's Gen2 application also states that up to thirty-two satellites will communicate with a gateway location simultaneously, while its Gen1 system is limited to 1. *See SpaceX Amendment*, Technical App'x, Annex 2A, at A2A-3.

⁸³ The same holds true for SpaceX's Ku-band user beam downlink EPFD demonstrations. *Compare Mod3 Application*, Technical App'x, Annex 2, at A2-2, *with SpaceX Application*, Technical App'x, Annex 2, at A2-2.

Figure 4: Comparison of SpaceX Gen1 and SpaceX Gen2 Downlink EPFD Results (17.8 GHz, 5m GSO Earth Station)⁸⁴



Even by SpaceX’s calculations, the EPFD levels of its Gen1 System were at the very edge of compliance. One would expect that dramatically increasing the key metrics upon which EPFD analysis relies would push it over the edge. Yet its application suggests that somehow the opposite is true. SpaceX’s calculation of EPFD compliance appears on its face to reflect an impossibility. This calls for an explanation, which SpaceX’s Gen2 System license application does not provide.

The FCC does and should ordinarily leave the task of policing compliance with Article 22 of the Radio Regulations to the ITU, while also requiring applicants proposing to operate in Ku- and Ka-band frequencies to certify that they will comply with applicable EPFD limits.⁸⁵ At the

⁸⁴ See *Mod3 Application*, Technical App’x, Annex 2, at A2-12; *SpaceX Application*, Technical App’x, Annex 2, at A2-13.

⁸⁵ See 47 C.F.R. § 25.146(a)(2). Indeed, Amazon has generally been critical of attempts to impose additional procedural requirements concerning EPFD limits. For example, Amazon has petitioned the Commission to remove a condition in its license requiring that it receive a “favorable” or “qualified favorable” finding from the ITU that explicitly indicates that the ITU considered the

same time, the Commission routinely investigates issues ordinarily left to a certification where it has reason to do so.⁸⁶ It should do so here as well, where the certification in the Gen2 System application as amended is belied by the face of the application itself, and the applicant has admitted to the absence of data supporting it at the time the certification was made.⁸⁷

If the information that SpaceX has recently provided proves what its application suggests—that it cannot meet EPFD limits while operating with the technical parameters contained in its application—the Commission should address the issue by conditioning any grant on the reduction of power levels necessary to meet these limits. To do otherwise would not only undermine the protections of EPFD limits, but would place Amazon and others that do comply with these limits at a significant competitive disadvantage. If SpaceX seeks to avoid the limitations that EPFD limits place on its system, it can and should press the Commission and the ITU to reform them. It should not, however, be allowed to simply ignore the rules designed to ensure enforcement. If the

joint effect of Amazon’s ITU filings, on the grounds that it is inconsistent with both the Commission’s rules and the conditions imposed on other operators, including SpaceX. *See* Kuiper Systems LLC Application for Modification of Authorization for the Kuiper System, SAT-MOD-20210806-00095 (filed Aug. 6, 2021). Amazon urging the fair and even application of the Commission’s EPFD rules in its license proceeding, however, is quite different than Amazon urging the Commission to look past a certification and investigate further where an application on its face suggests a violation of those rules.

⁸⁶ *See, e.g., Application of Martins & Associates, Inc.*, Order, DA 21-1198, ¶ 5 (rel. Sept. 24, 2021) (investigating whether a licensee accurately certified compliance); *Applications of Masconomet Regional School District*, Order, 31 FCC Rcd 2166, ¶¶ 12-13 (2016) (same); *CPS Telecom, Inc.*, Memorandum Opinion and Order, 2 FCC Rcd 2060, ¶ 9 (1987) (same).

⁸⁷ *See DISH Motion for Abeyance*, Ex. 1, at 1 (“As you know, SpaceX filed its original application nearly 20 months ago, and in that context offered to make the data files underlying the [EPFD] compliance analysis contained in that application available upon request. As you also know, that EPFD data is no longer relevant given SpaceX’s decision to pursue a different orbital configuration for its Gen2 System. In light of its recent determination of which amended configuration it will pursue, SpaceX is currently revising its EPFD data to conform to the new configuration.”).

FCC, however, concludes that EPFD compliance is not required within its rules, then it must make this clear and apply this change in rule to all applicants.

VI. CONCLUSION

The conditions that Amazon requests are no more than what is necessary to ensure that SpaceX's deployment does not harm Amazon's own efforts to help close the digital divide. And they are also reasonable: SpaceX itself has supported many of the measures that Amazon now requests, and any cost to SpaceX will be dramatically outweighed by the benefits to Amazon and other operators seeking to deploy their own systems. Amazon therefore respectfully urges the Commission to impose these conditions on SpaceX's license, as well as any other condition necessary to ensure SpaceX's compliance with EPFD limits.

No NGSO operator can close the digital divide alone. It will take multiple operators—Amazon, SpaceX, and others—to realize for U.S. consumers the immense promise of satellite broadband. Amazon is doing its part to provide a new and competitive service, investing and innovating to connect customers in the farthest and hardest-to-serve corners of the U.S. Setting the conditions for multiple NGSO systems to thrive will bring all of the innovation, affordability, and quality service that flourishes when customers are empowered with choice. Amazon respectfully urges the Commission to do so here.

/s/ C. Andrew Keisner

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February 8, 2022

CERTIFICATE OF SERVICE

I hereby certify that, on this 8th day of February, 2022, a copy of the foregoing pleading was served

via First Class mail upon:

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/s/Leslie Gray

Leslie Gray

AFFIDAVIT OF DAVID KAUFMAN

I, David Kaufman, am Principal, Regulatory Policy and Analysis, for Kuiper Systems LLC.

I hereby declare under penalty of perjury that I am qualified to speak on behalf of Kuiper Systems LLC. I have reviewed the preceding Comments, and the factual statements therein are complete and accurate to the best of my knowledge, information, and belief.

/s/ David Kaufman_____

David Kaufman
Principal, Regulatory Policy and Analysis
Kuiper Systems LLC

Dated: February 8, 2022