

## WAIVER REQUESTS

Pursuant to Section 1.3 of the Commission’s rules, the Commission may waive its rules for good cause shown.<sup>1</sup> “Waiver is appropriate if special circumstances warrant a deviation from the general rule and such deviation would better serve the public interest than would strict adherence to the general rule,” including “more effective implementation of overall policy.”<sup>2</sup> In determining whether waiver is appropriate, the Commission should “take into account considerations of hardship, equity, or more effective implementation of overall policy.”<sup>3</sup> As shown below, there is good cause for the Commission to grant a waiver of Sections 25.157(e), 25.164(b), 25.145(c)/25.146(i), and, to the extent necessary, restrictions on SpaceX’s proposed use of the 19.7-20.2 GHz and 29.3-29.5 GHz bands for NGSO operations in the U.S. and various limitations in the Commission’s Schedule S.

### **1. Waiver of Band Segmentation Requirements in Section 25.157(e)**

In response to the filing of several applications for NGSO system authorizations, the Commission has initiated processing rounds for competing NGSO system applications pursuant to Section 25.157 of the Commission’s rules.<sup>4</sup> In any such a processing round, the Commission’s rules establish certain band segmentation procedures if there is not sufficient spectrum available to accommodate all qualified applicants.<sup>5</sup> However, band segmentation appears to be inconsistent

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<sup>1</sup> 47 C.F.R. § 1.3. See also *WAIT Radio v. FCC*, 418 F.2d 1153 (D.C. Cir. 1969), *cert. denied*, 409 U.S. 1027 (1972); *Northeast Cellular Telephone Co., LP v. FCC*, 897 F.2d 1164 (D.C. Cir. 1990).

<sup>2</sup> *GE American Communications, Inc.*, 16 FCC Rcd. 11038, ¶ 9 (IB 2001).

<sup>3</sup> *WAIT Radio*, 418 F.2d at 1159.

<sup>4</sup> See Public Notice, “Applications Accepted for Filing; Cut-Off Established for Additional NGSO-Like Satellite Applications or Petitions for Operations in the 12.75-13.25 GHz, 13.85-14.0 GHz, 18.6-18.8 GHz, 19.3- 20.2 GHz, and 29.1-29.5 GHz Bands,” 32 FCC Rcd. 4180, 4183 (IB 2017).

<sup>5</sup> 47 C.F.R. § 25.157(e).

with the “avoidance of in-line interference events” approach that the Commission adopted for Ku- and Ka-band NGSO systems over a decade ago and that was recently reaffirmed as applicable by the International Bureau.<sup>6</sup> For the reasons discussed below, SpaceX submits that the in-line avoidance approach would better serve the public interest and requests that the Commission waive the band segmentation requirements of Section 25.157(e) to the extent necessary.

As demonstrated in the Technical Attachment, the NGSO system proposed by SpaceX has advanced capabilities that give it the flexibility to share spectrum efficiently and equitably. These features include a large number of narrow, steerable satellite beams, satellite diversity to allow service from more than one satellite to any user location, and earth stations with directional antennas. Just as these system characteristics will enable SpaceX to comply with the avoidance of in-line events regime in bands where that regime is already applicable, so too will SpaceX be able to use these same characteristics to share spectrum with other NGSO systems.

The Commission recently granted a waiver of the band-splitting requirement of Section 25.157(e) in a nearly identical situation. OneWeb sought authority to provide service in the U.S. from an NGSO system operating throughout the Ku- and Ka-bands, including in spectrum not subject to the avoidance of in-line events regime. The Commission concluded, based on the technical evidence in the record, that OneWeb would be able to share with other NGSO systems. It specifically noted the use of earth stations with directional antennas, which would permit the system to avoid in-line events. Accordingly, the Commission found that granting a waiver would not undermine the purpose of the band-splitting rule, which assumes that NGSO systems cannot

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<sup>6</sup> See *International Bureau Provides Guidance Concerning Avoidance of In-Line Interference Events Among Ku-Band NGSO FSS Systems*, 30 FCC Rcd. 11534 (IB 2015) (“*Clarification PN*”) (clarifying that the criteria for avoidance of in-line interference events for Ku-band NGSO systems would be applied in the same manner as they are for Ka-band systems under Section 25.261 of the Commission’s rules).

share frequencies without causing harmful interference, while such a waiver would avoid an inefficient use of scarce spectrum resources.<sup>7</sup>

The Commission has also proposed to extend the avoidance of in-line events regime to almost all of the additional bands requested by SpaceX.<sup>8</sup> It should not now revert to imposing the automatic band segmentation approach upon the participants in the current NGSO processing round while that proposal is under consideration. Rather, the Commission should waive the band segmentation requirements of Section 25.157(e) to the extent necessary. Successful coordination among NGSO systems will yield much more productive use of valuable spectrum and orbital resources than would a simple band segmentation approach. To this end, SpaceX has designed its system with advanced technology and operational flexibility to coordinate responsibly and thus facilitate spectrum sharing. Only systems with inflexible technologies pose a problem in this respect, which the Commission will need to address.

## **2. Partial Waiver of Final Implementation Milestone in Section 25.164(b)**

Section 25.164(b) of the Commission's rules provides that the recipient of an initial license for an NGSO satellite system "must launch the space stations, place them in the assigned orbits, and operate them in accordance with the station authorization no later than six years after the grant of the license," unless a different schedule is established by the Commission.<sup>9</sup> The Commission has established such milestone requirements for satellite system implementation in order to deter warehousing, which in this context "refers to the retention of preemptive rights to use spectrum

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<sup>7</sup> See *WorldVu Satellites Ltd.*, FCC 17-77, ¶¶ 17-18 (rel. June 23, 2017).

<sup>8</sup> See *Updates to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters*, 31 FCC Rcd. 13651, ¶ 23 (2016) ("*NGSO NPRM*") (proposing to extend Section 25.261 to all requested bands except 18.6-18.8 GHz).

<sup>9</sup> 47 C.F.R. § 25.164(b).

and orbital resources by an entity that does not intend to bear the cost and risk of constructing, launching, and operating an authorized space station, is not fully committed to doing so, or finds out after accepting the license that it is unable to fulfill the associated obligations.”<sup>10</sup> The rules are intended to offset the incentives for warehousing that could harm both competition and consumers, while also encouraging the rapid deployment of new spacecraft and the optimal utilization of scarce orbital and spectrum resources.<sup>11</sup>

SpaceX proposes to launch and operate a constellation of over 4,400 satellites, divided into an Initial Deployment of 1,600 satellites and a Final Deployment of 2,825 satellites. Final deployment of all of these satellites is not necessary to commence delivery of broadband services, nor is it necessary to demonstrate SpaceX’s intention to utilize the granted orbital and spectrum resources. Completing the full constellation over a six-year period would require a launch cadence of more than 60 satellites per month, beginning on the day the Commission grants a license. This is an aggressive pace even for a company like SpaceX, which has demonstrated considerable launch capabilities.

In these circumstances, the Commission should grant a limited waiver to apply its implementation milestone requirement to the Initial Deployment of the SpaceX System, to the extent necessary. A waiver structured in this way clearly would not undermine the purpose of the milestone requirements, as it would not result in, facilitate, or encourage spectrum warehousing.<sup>12</sup> Within the time allotted for the Initial Deployment, SpaceX will manufacture, launch and bring

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<sup>10</sup> *Comprehensive Review of Licensing and Operating Rules for Satellite Services*, 30 FCC Rcd. 14713, ¶ 53 (2015) (“Part 25 Second R&O”).

<sup>11</sup> *Id.* See also, e.g., *Amendment of the Commission’s Space Station Licensing Rules and Policies*, 18 FCC Rcd. 10760, ¶ 173 (2003); *TerreStar Networks, Inc.*, 22 FCC Rcd. 17698, ¶ 6 (IB 2007).

<sup>12</sup> See, e.g., *EchoStar Satellite Corp.*, 18 FCC Rcd. 15875, ¶ 9 (IB 2003); *Astrolink Int’l LLC*, 17 FCC Rcd. 11267, ¶ 6 (IB 2002).

into service more satellites than any other company currently has in operation. Additionally, it will begin providing commercial broadband services in the U.S. and globally once it has deployed the first 800 satellites of its constellation (32 planes with 25 satellites per plane), and continuously thereafter as additional satellites are launched and the constellation is replenished. Designing, constructing, and deploying these assets will require a very significant investment of resources – considerably more than reasonably sufficient to demonstrate that the company is “fully committed” to bearing the cost and risk of operating its authorized system.<sup>13</sup>

### **3. Waiver of Geographic Service Requirements in Sections 25.145(c) and 25.146(i)**

Section 25.145(c) and Section 25.146(i) establish geographic coverage requirements for NGSO systems operating in the Ka-band and Ku-band, respectively. They are essentially the same for both frequency bands, and require the applicant to demonstrate that:

- (1) the proposed system is capable of providing Fixed-Satellite Service on a continuous basis throughout the fifty states, Puerto Rico and the U.S. Virgin Islands; and
- (2) the proposed system is capable of providing Fixed-Satellite Services to all locations as far north as 70° North Latitude and as far south as 55° South Latitude for at least 75 percent of every 24-hour period.

Once fully deployed, the SpaceX System will satisfy these requirements, as it will provide full-time coverage to virtually the entire planet. The Initial Deployment, however, will cover most but not all of the area required. Specifically, the Initial Deployment will provide continuous FSS service from approximately 60° North Latitude to 60° South Latitude. This is sufficient to cover the contiguous United States, Hawaii, Puerto Rico, and the U.S. Virgin Islands, as well as the southernmost areas covered by the rule. However, the system will not provide continuous

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<sup>13</sup> See *Part 25 Second R&O*, ¶ 53.

coverage to the northernmost areas covered by the rule (*e.g.*, the 60° to 70° North Latitudes in upper Alaska) until service from one of the more inclined orbital constellations is activated.

SpaceX has requested above a partial waiver of the final system implementation milestone such that it would apply to the Initial Deployment only. Although SpaceX fully expects to meet all coverage requirements at Final Deployment, out of an abundance of caution, SpaceX requests a corresponding waiver of the geographic service requirements for the operation of the Initial Deployment specifically,<sup>14</sup> to the extent the Commission deems such a waiver necessary.

#### **4. Waiver of the Ka-band Plan in the 19.7-20.2 GHz and 29.3-29.5 GHz Bands**

SpaceX proposes to use the 19.7-20.2 GHz band for downlink transmissions from its satellites to a relatively small number of individually-licensed earth stations. Both domestically and internationally, this band is allocated to FSS on a co-primary basis. Under the Commission's Ka-band Plan,<sup>15</sup> however, this spectrum has been designated for primary use by GSO FSS systems, with no secondary designation for NGSO FSS operations.<sup>16</sup> Accordingly, SpaceX seeks a waiver of that restriction to permit use of this spectrum for operations in the U.S. on a non-interference basis relative to GSO FSS operations.

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<sup>14</sup> The Commission granted a similar waiver to O3b Limited ("O3b") permitting its Ka-band NGSO FSS system to access the U.S. market, finding that waiver was appropriate because "due to look angle constraints, there is a limitation on the northernmost and southernmost latitudes that can be served by its system." *See* O3b Limited, Stamp Grant, IBFS File Nos. SAT-LOI-20141029-00118 and SAT-AMD-20150115-00004, at condition 14 (Call Sign S2935) (Jan. 22, 2015). Thus, the Commission balanced the NGSO satellite operator's constellation design decision with the policy desire to maximize coverage. To the extent necessary, it should do the same in this case as well.

<sup>15</sup> The Commission issued a series of related orders in CC Docket No. 92-297 and IB Docket No. 98-172 establishing a designation plan for use of the Ka-band by non-Federal users, which is referred to herein as the "Ka-band Plan." *See Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band*, 11 FCC Rcd. 19005 (1996), *modified*, 12 FCC Rcd. 22310 (1997); *Redesignation of the 17.7-19.7 GHz Frequency Band*, 15 FCC Rcd. 13430 (2000) ("*18 GHz Order*").

<sup>16</sup> *See 18 GHz Order*, ¶¶ 55-58. The original Ka-band Plan included a secondary allocation for NGSO FSS operations in this band, which the Commission has proposed to restore. *See NGSO NPRM*, ¶ 10.¶

The Commission has granted similar waivers to NGSO systems based on their demonstrated ability to comply with the limits on downlink equivalent power flux-density limits (EPFD<sub>down</sub>) developed by the ITU.<sup>17</sup> SpaceX's waiver request is consistent with these precedents. As shown in the Technical Attachment,<sup>18</sup> SpaceX will operate downlink transmissions in this band within the EPFD<sub>down</sub> limits.<sup>19</sup> The ITU considers an NGSO FSS system that meets these EPFD limits to be fully coordinated with respect to any GSO FSS network, and any interference by the NGSO FSS system into the GSO FSS network is acceptable.<sup>20</sup>

SpaceX also proposes to use the 29.3-29.5 GHz uplink band for uplink transmissions. Both domestically and internationally, this band is allocated to FSS on a co-primary basis. Under the Commission's Ka-band Plan, however, this spectrum has been designated for primary use by GSO FSS systems and by NGSO systems for feeder links in the Mobile-Satellite Service ("MSS").<sup>21</sup> Accordingly, SpaceX seeks a waiver of that restriction to permit use of this spectrum for operations in the U.S. on a non-interference basis relative to primary licensed operations. To date, the MSS designation remains unused. In order to facilitate satellite use of this spectrum, the Commission has proposed to permit NGSO FSS systems to operate in the 29.3-29.5 GHz band on an unprotected, non-interference basis with respect to GSO FSS networks – the same status that SpaceX requests here.<sup>22</sup> SpaceX recognizes that Iridium Constellation LLC ("Iridium") operates

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<sup>17</sup> See *Northrop Grumman Space & Missions Systems Corp.*, 24 FCC Rcd. 2330, ¶¶ 74-75 (IB 2009); *contactMEO Communications, LLC*, 21 FCC Rcd. 4035, ¶¶ 25-26 (IB 2006) ("*contactMEO*").

<sup>18</sup> See Technical Attachment, Section A.7.1.2 and Annex 2.

<sup>19</sup> See ITU Radio Regs., Nos. 22.5C and 22.5F.

<sup>20</sup> See ITU Radio Regs., No. 22.5I. See also *contactMEO*, ¶ 26.

<sup>21</sup> See 47 C.F.R. § 25.202(a)(1) n.5.

<sup>22</sup> See *NGSO NPRM*, ¶ 13.

a NGSO MSS feeder links in the adjacent 29.1-29.3 GHz band, and will coordinate with Iridium to ensure that its ongoing operations in that band are protected.

In considering requests for non-conforming spectrum uses, the Commission will generally grant such waivers when there is little potential for interference into any service authorized under the Table of Frequency Allocations and when the non-conforming operator accepts any interference from authorized services.<sup>23</sup> SpaceX acknowledges that it has no protection against interference from GSO FSS networks serving the U.S. in these bands. Its compliance with the relevant EPFD limits in the 19.7-20.2 GHz band ensure that no harmful interference will result from operation of the SpaceX System. In addition, SpaceX will apply similar spectrum sharing strategies to its operations in the 29.3-29.5 GHz bands to protect other licensed systems. Accordingly, waiver of the Ka-band Plan is warranted here.

## **5. Waiver of Limitations in Schedule S**

As required by the Commission's rules,<sup>24</sup> SpaceX has submitted with this application a completed Schedule S, which contains certain technical information in a prescribed form. However, SpaceX has found that it cannot accurately describe its system in certain respects due to limitations in Schedule S itself. Below we discuss four aspects of the SpaceX System that fall into this category as well as how the Schedule S was completed in light of these limitations. To the extent necessary, SpaceX requests that the Commission waive these aspects of Schedule S in light of these limitations.

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<sup>23</sup> See, e.g., *Fugro-Chance, Inc.*, 10 FCC Rcd. 2860, ¶ 2 (Int'l Bur. 1995) (authorizing non-conforming MSS in the C-band); *Motorola Satellite Communications, Inc.*, 11 FCC Rcd. 13952, ¶ 11 (IB 1996) (authorizing service to fixed terminals in bands allocated to the mobile-satellite service). Because these bands are allocated for FSS, SpaceX's proposed use is not actually non-conforming, but the context is similar.

<sup>24</sup> See 47 C.F.R. § 25.114(a)(1).



First, Section 25.114(c)(4)(v) requires both the minimum and maximum saturation flux density (“SFD”) values for each space station receive antenna that is connected to transponders. The concept of SFD only applies to “bent pipe” satellite systems, and thus is not relevant to the SpaceX System. However, the Schedule S software does not allow an entry of “not applicable.” Instead, it requires a numerical entry for SFD, which must be different for the maximum and minimum values. In order to accommodate this requirement, SpaceX has entered values of “0” and “-0.1” in Schedule S with respect to these parameters.

Second, Schedule S requires that the maximum transmit EIRP density value for a beam be greater than 0 dBW. However, the maximum transmit EIRP density for the Ku-band TT&C downlink beams on the SpaceX System is a negative value: -6.67 dBW. In order to accommodate this limitation, SpaceX has entered a value of “0” in Schedule S with respect to this parameter, and stated the correct value in its Technical Attachment.

Third, Schedule S requires that the maximum PFD value for any given angle of arrival for NGSO systems operating in the 12.2-12.7 GHz band be greater than -200.0 dBW/m<sup>2</sup>/BW. Although the Schedule S instructions indicate that the permissible range for this parameter is between -1000 and -50 dBW/m<sup>2</sup>/BW, the validation functions built into the form itself require the higher minimum value of -200.0 dBW/m<sup>2</sup>/BW. The maximum PFD value for SpaceX’s Ku-band TT&C downlink beam, identified on the Schedule S as TTD3, is -200.2 dBW/m<sup>2</sup>/4kHz at angles of arrival between 0 and 1 degrees. In order to accommodate this limitation, SpaceX has entered a value of “-200.0 dBW/m<sup>2</sup>/4kHz” in Schedule S with respect to this parameter.

Fourth, SpaceX will provision to launch up to two extra spacecraft per plane to replenish the constellation in the event of on-orbit failures. If a case arises wherein a spare is not immediately needed, it will remain dormant in the same orbit and will perform station-keeping and debris

avoidance maneuvers along with the rest of the active constellation. Because these spare satellites will not operate their communications payloads, and the TT&C facilities communicate in turn with a fixed number of satellites at all times, the addition of spare satellites will not affect the PFD and EPFD analyses for TT&C operations presented in this application. Unfortunately, Schedule S does not have a means to reflect this sort of system architecture for spare satellites. Thus, for purposes of this application, SpaceX hereby identifies the location of its spare satellites as sharing the location of the active satellite in each plane with the minimum mean anomaly in that plane at the orbit epoch date and/or the location 180° away. SpaceX will continue to optimize the arrangement of its spare satellites and alert the Commission should its plans change in the future.