

## 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, to the extent necessary, of Sections 25.157(c), 25.146(a), and various limitations in the Commission’s Schedule S software.

### 1. Waiver of Processing Round Requirements

In the ordinary course, the Commission’s rules contemplate that an application for an NGSO system authorization will trigger the initiation of a processing round for competing NGSO system applications pursuant to Section 25.157 of the Commission’s rules.<sup>4</sup> For example, Section 25.157(c) provides that an NGSO system application not filed in response to such a public notice will initiate a new processing round.<sup>5</sup>

However, not all NGSO applications must be handled within a processing round. In particular, the Commission has allowed NGSO licensees to modify the authorizations they

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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. 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, e.g.*, 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> *See id.* § 25.157(c). Relatedly, Section 25.155(b) provides that an application for an NGSO-like satellite authorization will be entitled to comparative consideration with other mutually exclusive applications only if the

received through a processing round without initiating a new processing round.<sup>6</sup> “[T]he Commission has consistently granted applications for modification of systems in satellite services when the proposed modifications present no significant interference problem and are otherwise consistent with Commission policies.”<sup>7</sup> The Commission has taken this approach in order to promote competition, flexibility, and technical innovation in the satellite services market where doing so would not disrupt the operations of other licensees.<sup>8</sup> “In contrast, if the modification application were to present significant interference problems, [the Commission] would treat the modification as a newly filed application and would consider the modification application in a subsequent satellite processing round.”<sup>9</sup>

As demonstrated in the Technical Attachment to this application, the proposed modification would not present a significant interference problem. SpaceX proposes to relocate 1,584 satellites from an operating altitude of 1,150 km to an altitude of 550 km. It will slightly decrease the number of satellites below the level previously authorized, and it will not change the inclination of the planes in which they are located. However, because these satellites will operate at lower altitude, fewer of them will be visible above the minimum elevation angle at any particular time period throughout the United States. This is a factor that the Commission has previously recognized as demonstrating that a modification will not increase interference to other NGSO systems, and thus may be granted outside of a processing round.<sup>10</sup> In addition, by operating at

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application is received by the cut-off date specified in a public notice. To the extent necessary, SpaceX seeks waiver of that provision as well.

<sup>6</sup> See, e.g., *Teledesic LLC*, 14 FCC Rcd. 2261, ¶ 5 (IB 1999) (“*Teledesic*”); *Orbital Communications Corp.*, 15 FCC Rcd. 1340 (IB 1999).

<sup>7</sup> *ICO Satellite Services GP*, 20 FCC Rcd. 9797, ¶ 11 (IB 2005).

<sup>8</sup> *Id.*

<sup>9</sup> *Teledesic*, ¶ 5.

<sup>10</sup> See *id.*, ¶ 13.

lower altitude, these satellites will be able to transmit and receive at lower EIRP levels – another factor that will reduce the potential for interference. As confirmed by the analysis provided in the Technical Attachment, these and other attributes of the proposed modification yield an outcome that will not increase interference compared to the currently authorized system.

Accordingly, under Commission precedent, nothing prevents granting the modification outside of a processing round. Nonetheless, SpaceX requests a waiver of the processing round rules (including Section 25.157(c) of the Commission’s rules) to the extent necessary for the Commission to do so.

## **2. Waiver of ITU Finding Required Under Section 25.146(a)**

As required by Commission rules, SpaceX has certified that its NGSO constellation, as modified, will comply with the applicable equivalent power flux-density (“EPFD”) limits set forth in Article 22 of the ITU Radio Regulations, which have been incorporated by reference into the Commission’s rules.<sup>11</sup> The Commission’s rules also contemplate that, prior to initiation of service, an NGSO licensee will receive a “favorable” or “qualified favorable” finding by the ITU Radiocommunication Bureau regarding its compliance with those EPFD limits.<sup>12</sup>

SpaceX’s original ITU filings were submitted several years ago, yet the ITU still has not completed its EPFD evaluation. The filing related to the proposed modification is just now being submitted to the ITU. Given the ITU’s volume of pending filings, the ITU is unlikely to render an EPFD finding on a timeframe that will match SpaceX’s aggressive constellation deployment schedule. Unless it receives a waiver of Section 25.146(a) and the condition in the SpaceX

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<sup>11</sup> See 47 C.F.R. § 25.146(a)(2).

<sup>12</sup> *Id.* at § 25.146(a)(3). This is also a condition of SpaceX’s authorization. See *Space Exploration Holdings, LLC*, 33 FCC Rcd. 148, ¶ 40n (2018) (“SpaceX Authorization”).

Authorization, it would have to postpone providing service until the ITU completes its analysis, with many gigahertz of valuable spectrum lying fallow in the interim.

There is good cause for the Commission to waive the ITU finding requirement in this case. In Annexes 1 and 2 of the Technical Attachment to this application, SpaceX has included the results of an EPFD analysis using ITU-approved software developed by Transfinite Systems to demonstrate compliance with all applicable EPFD single entry validation limits in the Ku- and Ka-bands, respectively. SpaceX will also provide the data files used for these analyses so that the Commission and any other interested party can confirm these findings. Accordingly, SpaceX requests that the Commission waive the requirement that SpaceX receive a “favorable” or “qualified favorable” finding by the ITU regarding its compliance with those EPFD limits prior to initiation of service.

### **3. Waiver of License Conditions**

In this application, SpaceX has addressed two other conditions imposed in the SpaceX Authorization. First, the Commission conditioned the authorization on submission and approval of an updated orbital debris mitigation plan prior to initiation of service.<sup>13</sup> Second, the Commission required SpaceX to obtain approval of a modification containing an updated technical showing that its operations in the 17.8-18.6 GHz and 18.8-19.3 GHz bands will protect terrestrial Fixed stations with characteristics described in Recommendation ITU-R SF.1483.<sup>14</sup> SpaceX has submitted both of the requested showings in this application, and submits that the Commission should find that the conditions have been satisfied. However, in an abundance of caution, SpaceX

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<sup>13</sup> See SpaceX Authorization, ¶¶ 15 and 40p.

<sup>14</sup> *Id.*, ¶¶ 35 and 40q.

requests that the Commission grant a waiver of those conditions if it does not find that they have been satisfied.

***a. Orbital Debris Mitigation Condition***

Maintaining a clean orbital environment is a fundamental consideration for SpaceX, which is planning to launch its Falcon 9 vehicles into orbital altitudes at least 22 times this year alone for its commercial and government customers, as well as undertaking Dragon cargo missions to the International Space Station (“ISS”) for NASA and, in 2019, Dragon Crew missions that will carry astronauts to the ISS. SpaceX is therefore leveraging its nearly two decades of technical and operational experience in cost-effectively deploying large, complex space systems for other operators to implement an aggressive and effective space-debris mitigation plan.

As demonstrated from the operations of SpaceX’s Microsat 2a and 2b experimental satellites, operating at a lower altitude offers several attractive features both during nominal operation and in unplanned scenarios. In particular, as discussed more fully in the Technical Attachment to this application, moving satellites to the proposed lower shell would yield the following five key benefits:

- Rapid, passive disposal in the unlikely event of a failed spacecraft
- Self-cleaning debris environment in general
- Reduced fuel requirements and thruster wear
- Benign ionizing radiation environment
- Fewer NGSO operators affected by the SpaceX constellation

These benefits directly address the Commission’s concerns with respect to system reliability, and in particular reliability of the method for de-orbiting spacecraft.<sup>15</sup>

Moreover, SpaceX will continue to surpass every Commission and international

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<sup>15</sup> See *id.*, ¶ 15.

requirement with respect to orbital debris mitigation. For example, its satellites will typically de-orbit in a matter of months – well less than the 25-year standard. Indeed, while SpaceX expects nearly all of its satellites to perform nominally and deorbit actively, in the unlikely event a vehicle is unable to finish its disposal maneuver, the denser atmospheric conditions at 550 km provide fully passive redundancy to SpaceX’s active disposal procedures. Thus, even assuming an extreme worst-case scenario – *i.e.*, the spacecraft fails while in the operational orbit (circular at 550 km), has no altitude control, and solar activity is at a minimum – the longest decay time is still only approximately 4.5-5 years, and much more likely to be on the order of 1-3 years. Similarly, the spacecraft’s small mass and predominantly aluminum construction make atmospheric demise a likely scenario upon re-entry, such that even applying a conservative analysis and worst-case assumptions, the total spacecraft Risk of Human Casualty rate satisfies the requirement of 1:10,000 established by NASA in NASA-STD-8719.14.

Accordingly, SpaceX submits that the Commission should find that the condition related to orbital debris has been satisfied. However, in an abundance of caution, SpaceX requests that the Commission grant a waiver of that condition if it does not find that the condition has been satisfied.

***b. Ka-Band Fixed Service Protection Condition***

In the Technical Attachments to its Original Applications, SpaceX argued that the ITU methodology for establishing the PFD limits in the 17.7-19.7 GHz band was not developed with capability to scale up for application to dynamically controlled NGSO constellations with more than 840 satellites. When it granted the SpaceX Authorization, the Commission agreed with several points raised by SpaceX, “in particular that the ITU limits were derived for constellations

up to 840 satellites and under worst case assumptions.”<sup>16</sup> Rather than grant a waiver of these PFD limits, the Commission imposed a condition under which SpaceX must file a modification application before starting operation with a technical showing that demonstrates that its operations in the 17.8-18.6 GHz and 18.8-19.3 GHz bands will protect a fixed-service station with the characteristics described in Recommendation ITU-R SF.1483.<sup>17</sup>

Accordingly, SpaceX has submitted such a showing in the Technical Attachment to this application for the SpaceX constellation as modified to include the lower shell. That analysis demonstrates that the aggregate interference-to-noise ratio complies with the ITU-established long-term limit by a significant margin, which necessarily demonstrates compliance with the less stringent short-term limits. This should come as no surprise, given that SpaceX engineered the constellation to achieve a high degree of flexibility in order to protect other authorized systems (including terrestrial networks) and facilitate spectrum sharing.<sup>18</sup> Applying these and other sharing mechanisms, SpaceX has always been confident that it can successfully coordinate its system with authorized terrestrial networks. The showing required by the Commission simply confirms that belief.

Accordingly, SpaceX submits that the Commission should find that the condition related to protection of Ka-band terrestrial systems has been satisfied. However, in an abundance of

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<sup>16</sup> *See id.*, ¶ 35.

<sup>17</sup> *See id.*

<sup>18</sup> *See, e.g.*, Original Applications, Technical Attachment at Section A.7/A.8 (discussing high elevation angles, highly-direction earth station beams, and the ability to select from multiple visible satellites for service).

caution, SpaceX requests that the Commission grant a waiver of that condition if it does not find that the condition has been satisfied.

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

As required by the Commission's rules,<sup>19</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 five 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.

First, it is impracticable to submit complete orbital parameter data for the SpaceX system using the Schedule S web form. Accordingly, SpaceX will provide a sample of that data in the electronic version of Schedule S, and deliver to the Commission a database with the complete information required on Schedule S, including orbital parameters, for inclusion in the record of this application.<sup>20</sup>

Second, 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

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<sup>19</sup> See 47 C.F.R. § 25.114(a)(1).

<sup>20</sup> Because SpaceX will provide only a portion of its orbital parameter data in the Schedule S, not all aspects of the system will be accurately captured by that software. For example, the "Total Number of Satellites in the Active Constellation" will reflect the number provided in the sample rather than the total number in the SpaceX System.



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.

Third, Schedule S requires that the maximum transmit EIRP value for a beam be greater than 0 dBW. However, the maximum transmit EIRP for SpaceX’s TT&C downlink beams are each 0 dBW or less. 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.

Fourth, Schedule S requires entry of the begin and end angle for the active service arc with respect to the ascending node for each orbital plane. All satellites in the proposed modified system, as in the currently licensed system, will be active for their entire orbital period. However, Schedule S does not permit entry of more than two digits for the active service arc end angle, making it impossible to enter the correct value of 360 degrees. Accordingly, SpaceX has entered a value of “0” to denote full-arc service.

Fifth, Schedule S limits entries for maximum EIRP for transmit beams to values greater than or equal to zero. However, some of SpaceX’s TT&C beams transmit at negative maximum EIRPs. Accordingly, it was not possible to enter the correct value in the web-based Schedule S. SpaceX has therefore entered a value of zero in the web-based form but included the correct value in the complete database of technical parameters.