

APPLICATION FOR GATEWAY EARTH STATIONS

I. OVERVIEW

The Commission has authorized Space Exploration Holdings, LLC (“SpaceX”) to launch and operate its first-generation (“Gen1”) constellation of 4,408 non-geostationary orbit (“NGSO”) satellites (call sign S2983/S3018) using Ku- and Ka-band spectrum.¹ In May 2019, SpaceX began launching satellites to populate the Gen1 constellation. In May 2020, SpaceX filed an application to launch and operate a constellation of second-generation (“Gen2”) NGSO satellites (call sign S3069) using Ku-, Ka-, and E-band spectrum.² The Commission granted the Gen2 application in part on December 1, 2022.³ In so doing, the Commission found that granting the Gen2 application would “help to address the pressing need for improved broadband connectivity, including in unserved and underserved areas of the United States,” and “further the US leadership in space-based services, facilitating coverage globally and helping the efforts to close the digital divide around the world.”⁴

This application, filed by a sister company, SpaceX Services, Inc. (“SpaceX Services”), seeks authority to operate Ka-band gateway earth stations, which are used to deliver broadband data between the satellites of its NGSO systems and terrestrial Internet exchange points, on a blanket-licensed basis. Specifically, SpaceX Services seeks authority for deployment and operations of Ka-band gateway earth stations throughout the contiguous United States, Alaska, Hawaii, Puerto Rico, the U.S. Virgin Islands, and all other U.S. territories and possessions. Each earth station will utilize up to 40 identical 1.85-meter antennas. Consistent with SpaceX’s space station authorizations, earth stations will simultaneously communicate with up to eight Gen1 satellites and up to thirty-two Gen2 satellites and will transmit in the 28.35-29.1 GHz and 29.5-30.0 GHz bands and receive in the 17.8-18.6 GHz and 18.8-19.3 GHz bands. The Commission’s rules specifically contemplate blanket licensing for earth stations operating in these frequency bands.⁵

Below, we discuss certain spectrum sharing issues relevant to the operation of these earth stations. We then demonstrate that grant of this application would serve the public interest. Lastly, we provide technical information to supplement the information provided in Form 312.

¹ See *Space Exploration Holdings, LLC*, 33 FCC Rcd. 3391 (2018); *Space Exploration Holdings, LLC*, 36 FCC Rcd. 7995 (2021) (“*SpaceX Authorization*”), *aff’d sub nom. Viasat, Inc. v. FCC*, 47 F.4th 769 (D.C. Cir. 2022). These authorizations anticipate that Ka-band spectrum would be used for gateway communications.

² See Application for Approval for Orbital Deployment and Operating Authority for the SpaceX Gen2 NGSO Satellite System, IBFS File No. SAT-LOA-20200526-00055 (May 26, 2020); Amendment, IBFS File No. SAT-AMD-20210818-00105 (Aug. 18, 2021); Letter from William M. Wiltshire to Karl A. Kensinger, IBFS File Nos. SAT-LOA-20200526-00055 and SAT-AMD-20210818-00105, at 2 (Jan. 7, 2022).

³ See *Space Exploration Holdings, LLC*, FCC 22-91 (rel. Dec. 1, 2022) (“*Gen2 Authorization*”).

⁴ *Id.* ¶ 21.

⁵ See 47 C.F.R. § 25.115(f)(2). SpaceX Services does not seek authority to operate these earth stations in the 27.5-28.35 GHz band under this blanket license.

To support its ambitious timetable for launching satellites and deploying broadband services, SpaceX Services requests that the Commission grant the requested license as expeditiously as possible.

II. SPECTRUM SHARING ISSUES

Under the Commission's spectrum allocations and the plan adopted for the Ka-band in particular,⁶ SpaceX Services will need to share with a variety of other systems operating in its bands. Below we demonstrate that the proposed blanket-licensed earth stations will comply with all relevant sharing requirements.

A. Uplink Bands

FSS is primary throughout the 28.35-29.1 GHz band, with NGSO designated as secondary to GSO in the 28.35-28.6 GHz portion and NGSO designated as primary in the 28.6-29.1 GHz portion. FSS is co-primary with Mobile Satellite Service ("MSS") in the 29.5-30.0 GHz band, with NGSO designated as secondary to GSO.⁷

SpaceX Services makes no claim of interference protection from U.S.-licensed GSO FSS systems in the 28.35-28.6 GHz and 29.5-30.0 GHz bands. In addition, SpaceX Services will comply with the applicable equivalent power flux-density ("EPFD") limits set forth in Article 22 and Resolution 76 of the ITU Radio Regulations, which the Commission has found to be sufficient to protect GSO systems against harmful interference.⁸ SpaceX has demonstrated that its NGSO systems will comply with these EPFD limits, and doing so is a condition of its authorizations.⁹

B. Downlink Bands

The Commission has allocated the 17.8-18.3 GHz band on a primary basis to the terrestrial fixed service ("FS") and on a secondary basis for FSS. SpaceX recognizes that blanket licensing in this band is on an unprotected basis with respect to current and future FS systems.¹⁰ The 18.3-18.6 GHz band is allocated on a primary basis to FSS, with NGSO secondary to GSO and subject to international EPFD limits. The 18.8-19.3 GHz band is allocated to FSS on a primary basis, with NGSO designated as primary.

SpaceX has previously demonstrated that its NGSO systems will protect terrestrial fixed stations in the 17.8-18.6 GHz and 18.8-19.3 GHz bands, in compliance with a condition placed on

⁶ See *Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters*, 32 FCC Rcd. 7809, App. B (2017) ("NGSO Update Order").

⁷ See *id.*

⁸ See, e.g., 47 C.F.R. § 25.289 (NGSO satellite systems that comply with EPFD limits will be deemed not to cause unacceptable interference to any GSO network). SpaceX believes that the EPFD limits designed to protect GSO FSS systems will also protect GSO MSS systems in the band.

⁹ See *SpaceX Authorization*, ¶¶ 32, 97(b), (d), (e), and (l); *Gen2 Authorization* ¶¶ 31, 55, 135p; 47 C.F.R. § 25.115(f)(1) (incorporating certification requirement in 47 C.F.R. § 25.146(a)(2)).

¹⁰ See 47 C.F.R. § 25.115(f)(2).

its license.¹¹ Similarly, SpaceX has demonstrated that its NGSO systems will comply with the relevant EPFD limits in the 18.3-18.6 GHz band, which the Commission considers sufficient to protect GSO networks from unacceptable interference.¹²

III. FAA NOTIFICATION

The proposed 1.85 meter antennas are exempt from notification to the Federal Aviation Administration under Section 17.7(e)(3) of the Commission's rules because the height of the antenna is less than 6.1 meters above ground level.

IV. GRANT OF THIS APPLICATION WOULD SERVE THE PUBLIC INTEREST

Granting this application would serve the public interest by helping to speed high-capacity, low-latency broadband deployment throughout the United States by authorizing the ground-based component of SpaceX's satellite systems. U.S. and worldwide demand for broadband services and Internet connectivity continues to increase with escalating requirements for speed, capacity, and reliability and ongoing adaptations for usage. The volume of traffic flowing over the world's networks has exploded, with one report estimating that annual global Internet protocol traffic reached 1.5 zettabytes in 2017 – meaning that approximately 1,500 billion gigabytes of data were exchanged worldwide that year.¹³

Yet, as the Commission has recognized, many communities across the United States and the world still lack access to reliable broadband connectivity, preventing them from fully participating in economic, social, and civic activities.¹⁴ To help close this digital divide, SpaceX is designing, constructing, and deploying innovative, cost-effective and spectrum-efficient satellite systems capable of delivering robust broadband service to customers around the world. SpaceX has already secured U.S. authority for the space station components of its NGSO systems. SpaceX

¹¹ See *SpaceX Authorization* ¶ 52; *Gen2 Authorization* ¶ 24.

¹² See *SpaceX Authorization* ¶ 34; *Gen2 Authorization* ¶¶ 31, 54.

¹³ See Cisco Visual Networking Index: Forecast and Methodology, 2017-2022, at 1, CISCO (Nov. 26, 2018), <https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white-paper/c11-741490.html>.

¹⁴ See, e.g., *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, 33 FCC Rcd. 1660, ¶ 50 (2018) (noting that “over 24 million Americans still lack fixed terrestrial broadband at speeds of 25 Mbps/3 Mbps,” and that “the gap in rural and Tribal America remains notable: 30.7 percent of Americans in rural areas and 35.4 percent of Americans in Tribal lands lack access to fixed terrestrial 25 Mbps/3 Mbps broadband”). Internationally, the disparities between broadband access and absence are even greater, with 4.2 billion people (or 57% of the world's population) offline. See BROADBAND COMMISSION FOR SUSTAINABLE DEVELOPMENT, “Open Statement from the Broadband Commission for Sustainable Development to the UN High-Level Political Forum (HLPF)” (July 11, 2016), <http://broadbandcommission.org/Documents/publications/HLPF-July2016.pdf>. See also BROADBAND COMMISSION FOR SUSTAINABLE DEVELOPMENT, “The State of Broadband 2015,” at 8 (Sep. 2015), <http://www.broadbandcommission.org/Documents/reports/bb-annualreport2015.pdf> (“A large body of evidence has now been amassed that affordable and effective broadband connectivity is a vital enabler of economic growth, social inclusion and environmental protection.”)

Services has also been licensed to operate over 60 gateway earth stations using the antennas and spectrum involved in this application. Granting this application and authorizing a new element of the ground-based component of SpaceX's satellite system would serve the public interest by giving SpaceX Services greater flexibility to deploy earth stations where and as needed. This will both help to speed broadband deployment throughout the United States by enabling SpaceX Services to deploy gateways quickly to meet rising demand and add capacity and connectivity as needs arise, and also relieve the burden on the Commission of processing SpaceX Services' earth station applications.

Granting this application would further facilitate development of SpaceX's broadband satellite system by authorizing SpaceX Services to deploy additional earth stations rapidly and efficiently, as necessary to meet customer demand and thereby ensure high-quality service. Accordingly, an expeditious grant of this application would serve the public interest.

TECHNICAL APPENDIX

In this Technical Appendix, SpaceX Services provides additional information on the proposed operations of its gateway earth stations to supplement the data provided in Schedule B to Form 312 filed with this narrative application.¹

A. Minimum Elevation Angle

SpaceX Service's gateway earth stations will communicate only with those SpaceX satellites that are visible on the horizon above a minimum elevation angle. Generally speaking, this angle may be as low as 25 degrees. However, there will be exceptions in certain cases to achieve increased coverage. Specifically, gateway earth stations located inside the polar regions (i.e., above 62 degrees latitude) will communicate with SpaceX satellites down to a minimum elevation angle of five degrees.²

B. Antenna Patterns

SpaceX will comply with a mask similar to the one in Section 25.209(a)(3) applicable to earth station antennas operating in the 24.75-25.25 GHz and 28.35-30.0 GHz bands with geostationary satellites but will improve that pattern to -10 dBi (rather than 0 dBi) beyond 25 degrees off-axis. The mask can be stated as follows:

$29-25\log_{10}\theta$	dBi	for $2^\circ \leq \theta \leq 7^\circ$.
8	dBi	for $7^\circ < \theta \leq 9.2^\circ$.
$32-25\log_{10}\theta$	dBi	for $9.2^\circ < \theta \leq 25^\circ$.
-10	dBi	for $25^\circ < \theta \leq 180^\circ$.

Consistent with Section 25.209(a)(3), “[t]his envelope may be exceeded by up to 3 dB in 10% of the range of θ angles from ± 7 -180°, and by up to 6 dB in the region of main reflector spillover energy.”³ In addition, the half power beamwidth for the proposed antenna is 0.5 degrees at 30 GHz.

¹ To the extent relevant, SpaceX Services hereby incorporates the technical information submitted with SpaceX's space station applications. See IBFS File Nos. SAT-LOA-20161115-00118, SAT-LOA-20170726-00110, SAT-MOD-20181108-00083, SAT-MOD-20200417-00037, SAT-LOA-20200526-00055, and SAT-AMD-20210818-00105.

² These elevation angles are consistent with SpaceX's space station authorizations. See *SpaceX Authorization* ¶ 1 n.3; *Gen2 Authorization* ¶ 42.

³ 47 C.F.R. § 25.209(a)(3).