

APPLICATION FOR BLANKET LICENSED FIXED EARTH STATIONS

I. OVERVIEW

The Commission has authorized Space Exploration Holdings, LLC (“SpaceX”) to launch and operate two constellations of NGSO satellites—SpaceX’s “Gen1”¹ and “Gen2”² systems. In doing so, the Commission recognized that the SpaceX NGSO systems “will bring next generation satellite broadband to Americans nationwide, including those living and working in areas traditionally unserved or underserved by terrestrial systems.”³ SpaceX has launched more than 3,800 satellites into its Gen1 and Gen2 constellations.

In this application, a sister company, SpaceX Services, Inc. (“SpaceX Services”), seeks authorization to deploy a new generation of fixed end-user earth station equipment throughout the United States and its territories with the ability to communicate with both the SpaceX Gen1 and Gen2 systems. Consistent with SpaceX’s space-station authorizations, these terminals will transmit in the 14.0-14.5 GHz band and receive in the 10.7-12.7 GHz band. The Commission’s rules specifically contemplate blanket licensing for earth stations operating in these frequency bands.⁴

The Commission has granted SpaceX Services several blanket licenses to operate end-user earth stations that communicate with SpaceX’s Gen1 NGSO constellation, and SpaceX has received temporary authority permitting these terminals to communicate with SpaceX’s Gen2

¹ See *Space Exploration Holdings, LLC*, 36 FCC Red. 7995 (2021). This authorization anticipates that Ku-band spectrum would be used for communications with subscribers.

² See *Space Exploration Holdings, LLC*, FCC 22-91 (rel. Dec. 1, 2022) (“*Gen2 Order*”).

³ *Id.* ¶ 1.

⁴ See 47 C.F.R. § 25.115(f)(2).

constellation.⁵ Since securing those authorizations, SpaceX has continued to develop and refine innovative user-terminal models, resulting in the improved design described in this application. Like their predecessors, these new units employ advanced phased-array beam-forming and digital processing technologies to make very efficient use of Ku-band spectrum resources by supporting highly directive antenna beams that point and track the systems' low-Earth orbit satellites.

The Commission has repeatedly found that granting SpaceX Services authority to operate fixed user terminals serves the public interest by bringing high-speed, low-latency broadband connectivity to consumers throughout the country, including in areas that for too long have lacked adequate connectivity options. Below, SpaceX Services discusses the enhanced service that these updated fixed user terminals will provide, as well as certain spectrum sharing issues relevant to their operation. SpaceX Services then demonstrates that, as with previous SpaceX Services user-terminal authorizations, grant of this application would serve the public interest. In fact, this new generation of user terminals will provide even more benefits to American consumers that only strengthen the public interest in granting SpaceX Services' request. Lastly, SpaceX Services provides technical information to supplement the information provided in Schedule B to Form 312 filed with this narrative application.⁶ To support its ambitious timetable for offering ever more diverse and innovative satellite broadband services to consumers throughout the country, SpaceX Services requests that the Commission grant the requested blanket license as expeditiously as possible.

⁵ See Radio Station Authorization, Call Sign E210127 (issued Nov. 10, 2021); Radio Station Authorization, Call Sign E190066 (issued Mar. 13, 2020); Radio Station Authorization, Call Sign E220009 (issued May 16, 2022). SpaceX has sought authority to add its Gen2 system as a point of communication for its existing user terminal licenses, and the Commission has granted special temporary authority for its user terminals to communicate with both its Gen1 and Gen2 systems while those underlying modifications pend.

⁶ 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.

II. THESE USER TERMINALS WILL ENHANCE SPACEX'S INNOVATIVE BROADBAND SATELLITE SERVICE BY OFFERING HIGHER PERFORMING PRODUCTS TO AMERICAN CONSUMERS

SpaceX Services' new generation of user terminals will communicate with those SpaceX satellites that are visible above the minimum elevation angle specified in the applicable space station authorization. The proposed phased array user terminal will track SpaceX's NGSO satellites passing within its field of view.

SpaceX plans to introduce two versions of its new fixed user terminal:

Version 1: Version 1 of SpaceX Services' new fixed user terminals will offer a high-performance solution for consumers that improves upon SpaceX Services' previously authorized fixed user terminal models. At the phased array's equivalent of an "antenna flange," the highest transmit power is 3.69 W while the highest EIRP for all carriers is 42.1 dBW. The antenna gain is highest at boresight (35.0 dBi and 36.4 dBi for the receive and transmit antennas, respectively) and lowest at maximum slant (32.6 dBi and 34.0 dBi for the receive and transmit antennas, respectively).⁷

Table 1 summarizes the technical specifications of Version 1 of the proposed new fixed user terminal.

Link Type	Frequency	Modulation	Emission Designator	Max EIRP
Broadband Downlink (space-to-Earth)	10.7-12.7 GHz	Up to 64 QAM	240MD7W	--
Broadband Uplink (Earth-to-space)	14.0-14.5 GHz	Up to 64 QAM	62M5D7W	42.1 dBW

Table 1. Terminal Specifications (Version 1)

⁷ For purposes of Form 312 accompanying this application, SpaceX Services has supplied the highest transmit power and EIRP figures to present worst-case conditions.

Version 2: Version 2 of SpaceX Services’ new fixed user terminals will leverage a smaller form factor than Version 1 to allow consumers to enjoy the benefits of high-speed, low-latency broadband wherever they live or work, including in rural and remote areas where mobile or portable applications are necessary. For Version 2, at the phased array’s equivalent of an “antenna flange”, the highest transmit power is 1.37 W while the highest EIRP for all carriers is 33.2 dBW. The antenna gain is highest at boresight (30.4 dBi and 31.8 dBi for the receive and transmit antennas, respectively) and lowest at maximum slant (28.0 dBi and 29.4 dBi for the receive and transmit antennas, respectively).⁸

Table 2 summarizes the technical specifications of Version 2 of the proposed new fixed user terminal.⁹

Link Type	Frequency	Modulation	Emission Designator	Max EIRP
Broadband Downlink (space-to-Earth)	10.7-12.7 GHz	Up to 64 QAM	240MD7W	--
Broadband Uplink (Earth-to-space)	14.0-14.5 GHz	Up to 64 QAM	62M5D7W	33.2 dBW

Table 2. Terminal Specifications (Version 2)

The EIRP masks for these terminals, for co-polarized and cross-polarized signals, are set forth in Exhibit A hereto. In addition, SpaceX Services has submitted with this application a radiation hazard analysis to demonstrate that these earth stations are compliant with and will not

⁸ For purposes of Form 312 accompanying this application, SpaceX Services has supplied the highest transmit power and EIRP figures to present worst-case conditions.

⁹ The Commission's rules do not require applicants to submit a maximum number of user terminals to be deployed in the Ku band because, as the Commission concluded, the number of terminals “will not significantly affect any necessary coordination.” *Comprehensive Review of Licensing and Operating Rules for Satellite Services*, 30 FCC Red. 14713, ¶ 291 (2015). However, Form 312 Schedule B requires a number of antennas to be entered. To satisfy this technical form-validation requirement, SpaceX Services has entered a value of "0" on the accompanying Form 312 Schedule B, Item E29. However, this is strictly to satisfy the form-validation requirements and is not intended to establish a maximum number of units that SpaceX Services may deploy.

result in exposure levels exceeding the applicable radiation hazard limits established by the Commission.¹⁰

III. SPECTRUM SHARING ISSUES

Fundamentally, from a spectrum-sharing perspective, SpaceX Services' latest generation user terminal is no different from user-terminal hardware that the Commission has already authorized. The Commission has allocated the Ku-band spectrum that SpaceX Services proposes to use for uplink communications (14.0-14.5 GHz) from these blanket-licensed earth stations on a primary basis only to the fixed-satellite service ("FSS"). Nonetheless, SpaceX Services recognizes that its earth station operations will be subject to certain sharing conditions. Certain portions of the 10.7-12.7 GHz downlink band are shared with other commercial and government services. Notably, the proposed SpaceX Services terminals would not transmit in those bands and thus will not cause any interference to other operators using those bands. Moreover, SpaceX has engineered its NGSO system design to achieve a high degree of flexibility to facilitate spectrum sharing with other authorized satellite and terrestrial systems. In addition, its system is capable of immediately ceasing operations in the unlikely event it is notified that harmful interference has occurred. SpaceX Services understands that its operations in the 10.7-11.7 GHz band would be authorized on an unprotected basis with respect to current and future systems operating in the fixed service.¹¹

SpaceX is aware of its obligations under its space-station authorizations to protect terrestrial and space systems in these shared bands, and has certified that it will comply with the applicable equivalent power flux-density ("EPFD") limits set forth in Article 22 and Resolution

¹⁰ The methodology used in the attached analysis, which is consistent with that required under draft FCC guidance, does not take into account important features of the electronically steerable phased-array antennas used in SpaceX Services' user terminals, which significantly reduce the power density received at any given location. As a result, the attached radiation-hazard analysis, and the duty-cycle limit that it includes, is excessively conservative for these devices, unnecessarily limiting broadband service for American consumers.

¹¹ See 47 C.F.R. § 25.115(f)(2).

76 of the ITU Radio Regulations.¹² SpaceX has also demonstrated that it will comply with the applicable PFD limits in the Ku-band set forth in the Commission’s rules and Article 21 of the ITU Radio Regulations.¹³ The Commission has found that compliance with these EPFD and PFD limits is sufficient to protect GSO systems and terrestrial systems, respectively, against unacceptable interference.¹⁴

The highly advanced and flexible capabilities of its NGSO systems, including the new fixed user terminals in this application, will allow SpaceX Service to comply with the limitations discussed above. Nonetheless, in the extremely unlikely event that harmful interference should occur due to transmissions to or from its terminals, SpaceX Services can be reached at its Starlink network operations center via phone at (360) 780-3103 or email at satellite-operators-pager@spacex.com, which links to the pagers of appropriate technical personnel with authority and ability to cease all transmissions from these user terminals on a 24/7 basis.

IV. GRANT OF THIS APPLICATION WOULD SERVE THE PUBLIC INTEREST AND PROVIDE SERVICE IN AREAS OTHERWISE UNSERVED OR UNDERSERVED BY HIGH-THROUGHPUT, LOW-LATENCY BROADBAND IN CHALLENGING ENVIRONMENTS

Since 2019, SpaceX has deployed over 3,800 satellites, sufficient to support introduction of its high-capacity, low-latency broadband services across the United States—including the most remote corners and polar regions of the country that too often get left behind. The demand for

¹² See Application for Modification of Authorization for the SpaceX NGSO Satellite System, IBFS File No. SAT-MOD-20200417-00037, Technical Attachment at 15 (Apr. 17, 2020) (“Gen1 Application”); Amendment, IBFS File No. SAT-AMD-20210818-00105 (Aug. 18, 2021) (“Gen2 Application”); 47 C.F.R. § 25.115(f)(1) (incorporating certification requirement in 47 C.F.R. § 25.146(a)(2)).

¹³ See Gen1 Application, Technical Attachment at 10-12; Gen2 Application, Technical Attachment at 10-12, 14.

¹⁴ See, e.g., *Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters*, 32 FCC Rcd. 7809, ¶ 32 (2017) (“Any NGSO FSS system operating in compliance with these [EPFD] limits is considered as having fulfilled its obligation under Article 22 of the ITU Radio Regulations not to cause unacceptable interference to any GSO network.”); 47 C.F.R. § 25.289 (same); *Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-Band Frequency Range*, 16 FCC Rcd. 4096, ¶ 42 (2000) (observing PFD limits should protect terrestrial systems in the band).

more broadband is surging and the need for connectivity has never been more important. Granting this application would serve the public interest by authorizing a new class of ground-based components for SpaceX's satellite systems that will enhance the range of broadband capabilities available throughout the United States. U.S. and worldwide demand for broadband services and connectivity continues to increase with escalating requirements for speed, capacity, reliability, and ongoing adaptations for usage. In many cases, these users lack any true high-throughput, low-latency options. To close this gap, SpaceX is deploying two 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 first- and second-generation NGSO systems. This application takes the next step by seeking authority for a new generation of user-terminal hardware that will enable even more consumers to enjoy the significant benefits of those systems. Accordingly, an expeditious grant of this application would serve the public interest.

Respectfully submitted,

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Exhibit A

