



Request for Special Temporary Authority

0566-EX-ST-2021

SpaceX requests Special Temporary Authority to operate a single user terminal within 5 km of Boca Chica Village, TX (26.00°N, -97.16°W) on an experimental basis at altitudes not to exceed 12.5 km. The authority requested herein will be sharply limited in duration: SpaceX requests to operate under this STA for a period of only 60 days, beginning on April 20, 2020, or the date on which the STA requested herein is granted, whichever is later. These operations will only occur on the ground or during test flights of durations not to exceed eight minutes. This user terminal will be electrically identical to earth stations already authorized under SpaceX's blanket earth station authorization¹ as well as its pending application for experimental authorization to operate a limited number of user terminals aboard aircraft.²

Consistent with SpaceX's space station authorization,³ this earth station will transmit in the 14.0-14.5 GHz band and receive in the 10.7-12.7 GHz band. These bands are available for use by earth stations in motion communicating with NGSO FSS systems.⁴ The Commission has allocated the Ku-band uplink band (14.0-14.5 GHz) that SpaceX proposes to use for this earth station on a primary basis only to FSS. Certain portions of the 10.7-12.7 GHz downlink band are shared with other commercial and government services. However, because this earth station would not transmit in 10.7-12.7 GHz, it will not cause any interference to other operators in that band.

SpaceX will, at all times, comply with its obligations to protect terrestrial and space systems in these shared bands. In particular SpaceX will comply with the applicable equivalent power flux-density ("EPFD") limits set forth in Article 22 and Resolution 76 of the ITU Radio Regulations and the applicable power flux-density ("PFD") limits set forth in the Commission's rules and Article 21 of the ITU Radio Regulations, which are most relevant to

¹ See Radio Station Authorization, IBFS File No. SES-LIC-20190211-00151 (granted Mar. 13, 2020) (call sign E190066). The Commission's rules specifically contemplate blanket licensing for earth stations operating in these frequency bands. See 47 C.F.R. § 25.115(f)(2). The overall height of these antennas above ground level (or above existing structures) will not exceed six meters.

² See, e.g., Application for Experimental Authorization, ELS File No. 0388-EX-CN-2019 (granted Aug. 27, 2019); Application for Experimental Authorization, ELS File No. 0955-EX-CN-2020 (filed Nov. 6, 2020).

³ See *Space Exploration Holdings, LLC*, 33 FCC Rcd. 3391 (2018) ("*SpaceX Authorization*"); *Space Exploration Holdings, LLC*, 34 FCC Rcd. 2526 (IB 2019).

⁴ See 47 C.F.R. § 25.202(a)(10)(ii).

this application.⁵ The Commission has found that compliance with these EPFD and PFD limits is sufficient to protect GSO systems and terrestrial systems, respectively, against harmful interference.⁶ SpaceX will protect these systems from harmful interference by ensuring that its experimental user-terminal operations do not cause the SpaceX user-terminal network taken as a whole to exceed these EPFD and PFD limits. The earth station will be self-monitoring and, should a condition occur that causes it to exceed EIRP, EIRP density or off-axis EIRP mask limits included in the licensing conditions for the FSS NGSO network that it is using as a point of communication in the 14-14.5 GHz band, the terminal will automatically cease transmissions within 100 milliseconds and not resume transmissions until the condition that caused the experimental terminal to exceed those limits is corrected.

In addition, SpaceX recognizes that its earth station operations will be subject to certain other sharing conditions.⁷ Operations will not occur within radio line of sight of NASA TDRS facilities and will not operate in the 14.47-14.5 GHz band within radio line of sight of radio astronomy observatories.⁸

SpaceX is confident that the highly advanced and flexible capabilities of its NGSO system, including the earth stations proposed by SpaceX herein, will be able to comply with the limitations discussed above. Nevertheless, in the extremely unlikely event that harmful interference should occur due to transmissions to or from its earth stations, SpaceX will take all reasonable steps to eliminate the interference. Should an issue arise, SpaceX can be reached at:

Starlink Network Operations Center
satellite-operators-pager@spacex.com
+1 (360) 780 - 3103

⁵ See *SpaceX Authorization*, ¶¶ 40(b), (d), and (e); 47 C.F.R. § 25.115(f)(1) (incorporating certification requirement in 47 C.F.R. § 25.146(a)(2)).

⁶ See, e.g., *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, ¶ 77 (2000) (concluding that implementation of EPFD limits “will adequately protect GSO FSS networks”); 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); *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). In addition, pursuant to Section 25.115(i), SpaceX Services hereby certifies that it is planning to use a contention protocol (TDMA/FDMA), and such protocol usage will be reasonable.

⁷ See, e.g., 47 C.F.R. §§ 25.115(f)(2); 25.208(o); 101.1409; 2.106 n.5.487A; and 2.106 n.342.

⁸ See 47 C.F.R. § 25.228(j)(1) and (3). See also *SpaceX Authorization*, ¶ 37 (requiring SpaceX to take note of NASA TDRS facilities at three locations).

SpaceX's user terminal will communicate only with those SpaceX satellites that are visible on the horizon above a minimum elevation angle of 25 degrees. The proposed flat phased array user terminal will track SpaceX's NGSO satellites passing within its field of view. As the terminal steers the transmitting beam, it automatically changes the power to maintain a constant level at the receiving antenna of its target satellite, compensating for variations in antenna gain and path loss associated with the steering angle. At the phased array's equivalent of an "antenna flange," the highest transmit power (4.06 W) occurs at maximum slant, while the lowest transmit power (0.76 W) occurs at boresight. Similarly, the highest EIRP for all carriers (38.2 dBW) occurs at maximum slant and the lowest level (33.4 dBW) occurs at boresight. Conversely, the antenna gain is highest at boresight (33.2 dBi and 34.6 dBi for the receive and transmit antennas, respectively) and lowest at maximum slant (30.6 dBi and 32.0 dBi for the receive and transmit antennas, respectively). For purposes of Form 442 accompanying this application, SpaceX has supplied the higher transmit power figures and lower gain figures in order to present worst-case conditions.

For reference, Table 1 summarizes the technical specifications of SpaceX's proposed earth station terminals.

Link Type	Frequency	Modulation	Emission Designator	Maximum EIRP	Half Power Beamwidth
Broadband Downlink (space-to-Earth)	10.7-12.7 GHz	Up to 64 QAM	240MD7W	N/A	3.5° (boresight) 5.5° (at slant)
Broadband Uplink (Earth-to-space)	14.0-14.5 GHz	Up to 64 QAM	60M0D7W	38.2 dBW	2.8° (boresight) 4.5° (at slant)

Table 1. User Terminal Specifications

The EIRP masks for the proposed earth station, for co-polarized and cross-polarized signals, are set forth below. In addition, SpaceX has attached hereto a radiation hazard analysis to demonstrate that the earth station is compliant with and will not result in exposure levels exceeding the applicable radiation hazard limits established by the Commission.

