

## QUESTION 7: PURPOSE OF EXPERIMENT

### NARRATIVE SUMMARY

SpaceX requests Special Temporary Authority to operate two (2) mobile ground-based user terminal within 300 km of Redmond, Washington (47.6941°N, 122.0327°W) on an experimental basis. The authority requested herein will be 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. One user terminal will be electrically identical to earth stations already authorized under SpaceX's blanket earth station authorization and one will be a new user terminal type.

On March 29, 2018, the Commission granted SpaceX's application for authority to launch and operate a constellation of non-geostationary orbit ("NGSO") satellites designed to provide high-speed, high-capacity, low-latency broadband services in the United States and around the world.<sup>1</sup> SpaceX has successfully launched more than 1400 Starlink satellites to date. The Commission has previously granted SpaceX an experimental authorization to demonstrate the ability of SpaceX's NGSO system to transmit and receive information between both fixed sites on the ground and earth stations aboard moving vessels and aircraft.<sup>2</sup>

Like those previously authorized, the tests requested here are designed to demonstrate the ability to transmit to and receive information from a moving vehicle on the ground. Nothing about these experiments will change the operation of SpaceX spacecraft, which will continue to operate as authorized. As discussed below, these proposed operations will not adversely affect any other authorized spectrum user, including geostationary orbit ("GSO") satellite systems.

SpaceX will analyze the data link performance and installation options for the mobile user terminals. In order to complete the link with its satellites, SpaceX will use gateway earth stations authorized by the Commission for communications with the Starlink system. Communications with the satellites will be limited to a minimum elevation of 25 degrees above the horizon at all times during testing. Supplemental information on the new terminal performance characteristics can be found in Exhibit 1 of the subject application.

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<sup>1</sup> See *Space Exploration Holdings, LLC*, 33 FCC Rcd. 3391 (2018). The Commission has since granted two modifications to the license. See *Space Exploration Holdings, LLC*, 34 FCC Rcd. 2526 (IB 2019); *Space Exploration Holdings, LLC*, DA 19-1294 (rel. Dec. 19, 2019).

<sup>2</sup> See Experimental Authorization, ELS File Nos. 0388-EX-CN-2019, 0773-EX-CN-2020 and 0515-EX-CN-2019.

## Equivalent Power Flux Density at the Geostationary Satellite Orbit in the Ku- Bands

Consistent with SpaceX's space station authorization, 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.<sup>3</sup> 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 has engineered its satellite system to achieve a high degree of flexibility to facilitate spectrum sharing with other authorized satellite and terrestrial systems.

SpaceX is aware of its obligations under its authorization to protect terrestrial and space systems in these shared bands, particularly 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.<sup>4</sup> 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.<sup>5</sup> SpaceX complies with these EPFD and PFD limits by enforcing elevation limits, GSO avoidance angles and transmit EIRP masks on its terminals. The experimental earth stations in this application will comply with the same limits as the terminals covered under SpaceX's blanket license.

The EIRP masks for the new and existing user terminal type, for co-polarized and cross-polarized signals, are set forth below. Each experimental earth station in the 14-14.5 GHz band will be self-monitoring and, should a condition occur that causes them to exceed EIRP, EIRP density and off-axis EIRP mask limits included in the licensing conditions for the FSS NGSO network that it is using as a point of communication, the experimental 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.

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<sup>3</sup> See 47 C.F.R. § 25.202(a)(10)(ii).

<sup>4</sup> 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)).

<sup>5</sup> 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.

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:

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