From: William Wiltshire

To: Anthony Serafini
Date: January 15, 2021

Subject: Questions

Message:

Below, please find SpaceX's responses to your Dec 18, 2020 inquiry relating to this application.

() please explain how the submitted EIRP Mask referenced in dBW/40KHz will comply with the “Reference antenna beamwidth and reference radiation pattern: 4° Recommendation ITU-R S.672-4, Ls-20 specified in Table 22-2.

As ITU-R Art. 22.5D explains, “equivalent power flux-density, epfd↑[“epfd_up”], produced at any point in the geostationary-satellite orbit . . . relate to the equivalent power flux-density which would be obtained under free-space propagation conditions, into a reference antenna and in the reference bandwidth specified in Table 22-2.” Therefore, the antenna patterns referenced in Table 22-2, and specified in ITU-R Rec. ITU-R S.672-4, do not set forth limits with which SpaceX’s antenna must comply but, rather, characterize the antenna that must be assumed for the purposes of performing the required epfd_up analysis. As the provided epfd_up analysis will confirm--described below--SpaceX properly used this reference antenna pattern in its calculations.

() Please provide the antenna radiation pattern for 0.48m antenna.

The SpaceX earth station antenna has a complex antenna pattern that varies depending on steering angle. Because neither the FCC’s rules nor ITU requirements specify antenna pattern radiation or similar limits for NGSO earth station antennas, similar NGSO earth station applications have commonly been granted without the applicant’s being required to submit detailed antenna pattern information. This was the case for both SpaceX’s existing blanket authorization to deploy 1,000,000 earth stations and the prior experimental authorizations issued to SpaceX for testing at various locations within the United States and on board military aircraft. As noted above, this application seeks only to deploy ten earth stations on board seagoing platforms which will otherwise be consistent with SpaceX’s existing blanket authorization.

() With respect to the 14.0-14.5 GHz frequency band, please demonstrate and provide calculation on how the operations in the 14.0-14.5 GHz frequency band will be in compliance with the equivalent power flux-density limit (-160 dBW/m2/40 kHz) of Article 22 of the ITU Radio Regulations. ()

Section 22.5D and Table of 22-2 of Article 22 of ITU’s rules: TABLE 22-2 (WRC-03)Limits to the epfd_up radiated by non-geostationary-satellite systems in the fixed-satellite service in certain frequency bands: Frequency band epfd_up(dB(W/m2)) Percentage of time Reference Reference antenna epfdnlevel may not bandwidth (kHz) beamwidth and be exceeded reference radiation pattern 13.75-14.5 GHz -160 100 40 4° Recommendation ITU-R S.672-4, Ls-20 (Please see attachment of “RECOMMENDATION ITU-R S.672-4, Ls-20” and Section 25.103 of part 25 Rules for Equivalent Power Flux Density (EPFD). 22.5D 3) The equivalent power flux-density, epfd_up, produced at any point in the geostationary-satellite orbit by emissions from all the earth stations in a non-geostationary-satellite system in the fixed-satellite service in the frequency bands listed in Table 22-2, for all conditions and for all methods of modulation, shall not exceed the limits given in Table 22-2 for the specified percentages of time. These limits relate to the equivalent power flux-density which would be obtained under free-space propagation conditions, into a reference antenna and in the reference bandwidth specified in Table 22-2, for all pointing directions towards the Earth’s surface visible from any given location in the geostationary-satellite orbit.

Concurrently with this response, SpaceX has submitted simulation files used to demonstrate compliance with the epfd_up limits in the 14.0-14.5 GHz band. This epfd analysis confirms that SpaceX’s planned deployment of 1,000,000 earth stations in this band—which the Commission has already authorized—will comply with the relevant limits and also covers the ten earth stations requested here.