

MODIFICATION TO SPACEX GEN2 NON-GEOSTATIONARY SATELLITE SYSTEM

ATTACHMENT A TECHNICAL INFORMATION TO SUPPLEMENT SCHEDULE S

A. 1 OVERALL DESCRIPTION

The Commission has authorized SpaceX to use Ku-, Ka-, V-, E- and W-band frequencies on its Gen2 satellites to deliver high-speed, low-latency broadband service to consumers around the world.¹ SpaceX requests authorization for its Gen2 constellation to use key frequencies in the Ku- and V-bands: 12.70-13.25 GHz (downlink), and 42.0-42.5 GHz (downlink within the U.S.). In its *Spectrum Abundance* proceeding, the Commission proposed authorizing downlink FSS in this greenfield spectrum because of advances in satellite technology and explosive growth in broadband demand.² Consistent with the Commission’s goals, SpaceX requests authority to leverage these spectrum resources to enhance the coverage, capacity, and reliability of Gen2 service for millions of Americans.

This Technical Attachment updates technical information submitted with the Gen2 Upgrade Applications³ to reflect the proposed parameters of the Gen2 Modification to add the 12.70-13.25 GHz and 42.0-42.5 GHz bands for downlink FSS. This attachment includes updates to the previous Technical Attachments only where the proposed Gen2 Modification would result in a material change.

¹ See *Space Exploration Holdings, LLC*, DA 26-36 (SB rel. Jan. 9, 2026). Under this authorization, SpaceX is already authorized to operate in the 12.7-13.25 GHz band for uplink operations and in the 42.0-42.5 GHz band for downlink operations outside the U.S.

² See *Satellite Spectrum Abundance*, 40 FCC Rcd 3794 (2025) (“*Spectrum Abundance NPRM*”).

³ See Application for Modification of Application for the SpaceX Gen2 NGSO Satellite System, ICFS File No. SAT-MOD-20241011-00224 (filed Oct. 11, 2024); Amendment, ICFS File No. SAT-AMD-20241017-00228 (filed Oct. 17, 2024) (“Gen2 Upgrade Amendment”) (collectively, “Gen2 Upgrade Applications”).

A. 2 ORBITAL PARAMETERS AND RELATED CHANGES

- ***Orbital configuration.*** This application includes no change to the orbital configuration of Gen 2 Upgrade system.
- ***Spectrum authorizations.*** The modified Gen2 system will use additional frequency bands in extended Ku-band and V-band for downlink for communications between satellites and earth stations as set forth in Table A.2.1.

Gen2 additional frequencies. SpaceX requests authority to communicate with earth stations in the following frequencies in downlink.

Transmission Direction	Frequency Ranges
Satellite to Earth Station	12.7-13.25 GHz 42.0-42.5 GHz (within the U.S.)

Table A.2.1: Additional Gen2 Frequencies

A. 3 PREDICTED SPACE STATION ANTENNA GAIN CONTOURS

A.3. 1 Extended Ku-Band Beams

The space station extended Ku-band transmit beams will be very similar to the Ku-band beams in the Gen2 Upgrade Applications with only slight scaling due to frequency change. SpaceX seeks to transmit in the 12.7-13.25 GHz band with a minimum gain of 34.9 dBi and a maximum gain of 48.9 dBi at boresight.

The antenna beam contours provided in Schedule S include the downlink beams and both the minimum and maximum gain for operations at 340 km and 614 km at nadir and at 25°, 45°, and maximum slant away from nadir, which are representative of the contours for satellites throughout the proposed operating altitudes. These contours are practically the same as the Ku-

band downlink beam in Gen2 Upgrade Applications. As illustrated in Figure A.3.1-1 below with respect to operations at 340 km altitude, as the transmitting beam is steered, the power is adjusted to maintain a constant maximum PFD at the surface of the Earth (to the extent allowed by applicable PFD limits), compensating for variations in antenna gain and path loss associated with the steering angle.

SpaceX seeks to operate with a flexible set of technical parameters in the band, including the ability to use any number of co-frequency beams transmitted to or from a particular location, that is consistent with the modernized sharing criteria and considerations included in its Gen2 Upgrade Applications. But SpaceX will adjust its operating parameters as needed to comply with any applicable rules subject to any waiver requests in this application that the Commission grants.

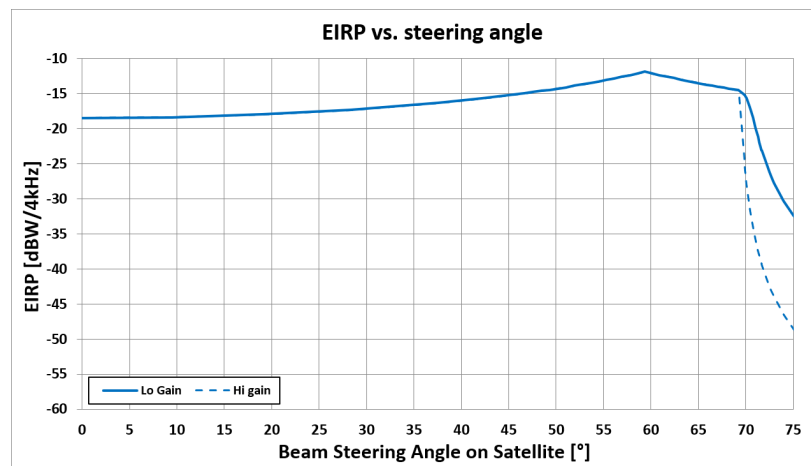


Figure A.3.1-1: EIRP Density Variation by Beam Steering Angle (340 km)

The maximum equivalent isotropically radiated power (“EIRP”) density for the minimum nominal altitude shell at 340 km is same as the Ku-band in Gen2 Upgrade Applications.

A.3. 2 V-Band Beams

The space station extended V-band transmit beams in 42-42.5 GHz will be the same as

those in the Gen2 Upgrade Applications and for brevity are not repeated here.⁴

A.3.3 Representative Beams

Table A.3.3.1 shows the mapping of space station transmit beams in the Schedule S at three different representative operating altitudes.

Altitude [km]	Beams
340	TX001-TX012
475	TX101-TX112
614	TX301-TX312

Table A.3.3.1. Tx Beams Mapping in Schedule S

A.4 PFD LIMITS

SpaceX provides the PFD calculation for the proposed extended Ku-band downlink, both at maximum slant and at nadir, which are unchanged from Ku-band downlink in the Gen2 Upgrade Applications. The PFD calculations in the requested V-band downlink beams are the same as in the Gen 2 Upgrade Applications.⁵ In each case, the table reflects operations at the lowest relevant altitude, maximum PFD scenario without considering any of the operational constraints discussed above. Because SpaceX's satellite downlink transmit power remains adjustable on orbit, SpaceX will manage the satellites' PFD levels during all phases of the mission, as needed.

⁴ See Gen2 Upgrade Amendment, Technical Attachment at 13-15.

⁵ See *id.* at 20.

	Nadir	25° ES elev	10° ES elev
EIRP density [dBW/Hz]	-54.5	-47.9	-50.5
EIRP in 4kHz [dBW/4kHz]	-18.5	-11.9	-14.5
EIRP in 1MHz [dBW/MHz]	5.5	12.1	9.5
Distance to Earth [km]	340.0	727.7	1275.6
Spreading loss [dB]	121.6	128.2	133.1
PFD in 4 kHz [dB(W/m ² /4kHz)]	-140.1	-140.1	-147.6
PFD in 1 MHz [dB(W/m ² /1MHz)]	-116.1	-116.1	-123.6

Table A.4-1: PFD at the Surface of the Earth Produced by Ku-Band Antenna (340 km)

	Nadir	25° ES elev	5° ES elev
EIRP density [dBW/Hz]	-49.5	-43.4	-47.7
EIRP in 4kHz [dBW/4kHz]	-13.5	-7.4	-11.7
EIRP in 1MHz [dBW/MHz]	10.5	16.6	12.3
Distance to Earth [km]	604.0	1220.5	2338.7
Spreading loss [dB]	126.6	132.7	138.4
PFD in 4 kHz [dB(W/m ² /4kHz)]	-140.1	-140.1	-150.1
PFD in 1 MHz [dB(W/m ² /1MHz)]	-116.1	-116.1	-126.1

Table A.4-2: PFD at the Surface of the Earth Produced by Ku-Band Antenna (604 km)

A.4.1 PFD Limits in the Ku-Band

No PFD limit is currently codified for extended Ku-band in 12.7-13.25 GHz. SpaceX's Gen2 system will operate in the 12.7-13.15 GHz band with the same PFD masks applicable to 10.7-12.7 GHz.

A.4.2 PFD Limits in the V-Band

SpaceX will operate consistent with PFD limits in the V-band (42.0-42.5 GHz) authorized for the Gen2 system.⁶

A.5 INTERFERENCE MITIGATION

SpaceX's proposed downlink operations in 12.7-13.25 GHz can fully protect limited

⁶ See *id.* at 25-28.

terrestrial deployments and earth station operations in the band from harmful interference.

SpaceX's proposed downlink operations in 42.0-42.5 GHz in the United States will be same as those the Commission approved for operations outside the United States in the band. In addition, SpaceX certifies that its operations in the 42.0-42.5 GHz band will comply with the applicable ITU Article 22 EPFD downlink limits and Resolution 770.

A. 6 COORDINATION WITH U.S. GOVERNMENT NETWORKS

The characteristics of the proposed system, including adjustable satellite downlink transmit power and adaptable number of co-frequency beams transmitted to or from a particular location, will facilitate an operational approach that will allow equitable sharing of this spectrum with government systems. SpaceX has reached agreement with various U.S. government agencies for the operation of its first-generation system and will continue to coordinate the proposed upgraded Gen2 system with all applicable government systems and scientific missions operating in these portions of the Ku-band and V-band.

A.7 ITU FILINGS FOR SPACEX

SpaceX has not yet submitted system information for ITU publication. SpaceX will submit information relevant for its ITU filing at the appropriate time and will accept consequent ITU cost-recovery responsibility for the filing.