Exhibit C – Technical Appendix

1. Scope

This Technical Appendix contains technical information regarding Planet's planned Pelican fleet of non-geostationary orbit (NGSO) satellites, as required by Section 25.114 and other sections of the Part 25 rules. The Schedule S and this Technical Appendix should be used as the complete information package.[1]

2. Spacecraft Overview

The Pelican satellites are optical Earth imaging smallsats with a launch mass of no greater than 160 kg. Basic physical dimensions are 2300 mm x 1000 mm x 600 mm in the deployed configuration. There are two deployable solar arrays, each with dimensions 1000 mm x 850 mm.

Power storage is provided by Lithium-Ion battery cells, which will be recharged by the solar arrays. Each spacecraft contains a Hall Effect Thruster based electric propulsion module with xenon propellant. The satellite's attitude control system consists of magnetorquers, reaction wheels, star cameras, magnetometers, photodiodes, and rate gyros. The nominal imaging attitude will be nadir +/- 30 degrees about the X and Y axes. The Pelican satellites have an anticipated five-year operational lifetime.

3. Orbital Parameters

The Pelican satellites will be deployed into two primary orbit regimes, specifically Sun Synchronous orbits (SSO) as well as inclined orbits. For example, the first Pelican satellite will operate in SSO at an inclination of 96.7 degrees, with an expected commissioning altitude of 525 km +/- 25 km. The satellite will be commissioned and then enter a low thrust spiral from its injection orbit to its operational altitude of 325 km +/- 25 km, which will take approximately six to twelve months. The next six Pelican satellites will also operate in SSO at an inclination of 96.7 degrees, with an expected commissioning altitude between 250 km and 550 km, and then an approximately three-month transfer to their final operational altitude of 325 km +/- 25 km. The seven SSO Pelican satellites will eventually co-exist in a singular orbital plane equally phased. The remaining twenty-five Pelican satellites will also operate at an operational altitude of 325 km +/- 25 km, but at an inclination of 53 degrees in a twelve-plane, two-satellite per plane Walker constellation. The deployment and commissioning campaign for both the SSO and inclined Pelican satellites may require lowering or raising from an insertion orbit

[1] Limitations in Schedule S require supplemental explanation. For example, in the Schedule S, Planet has entered the values "0.0" and "-999.9" as placeholders for parameters that are either not relevant for the satellites or must be entered but cannot be entered correctly, including: max/min saturation flux density, antenna pointing error, and antenna rotational error. For polarization alignment relative to the equatorial plane, a placeholder of 45 was automatically populated by the Schedule S form. Given that all relevant information has been provided in the narrative, technical appendix, and Schedule S, Planet has requested a waiver of certain Schedule S requirements. *See* Modification Application Narrative at 16-17.

dictated by the launch vehicle, which could extend as high as 550 km and as low as 250 km,[2] where the difference in altitude between launch insertion and operation will be mediated by the Pelican satellite's onboard propulsion system. Planet requests the flexibility to operate with +/- 25 km variation in the 325 km proposed operational altitude for standard operational reasons, including scheduled orbit altitude maintenance, ground track management, and collision avoidance. In terms of the satellite's active service arc, all satellites are expected to be operational and have the capacity to operate during their entire orbital period. Table 1 below, and Schedule S, provide details on the orbital parameters.

Table 1. Orbital Parameters

Satellite	Orbit Epoch (utc)	Inclination (deg)	Orbital Period (s)	Perigee (km)	Apogee (km)	Argument of Perigee (deg)	Active Service Arc Begin Angle (deg)	Active Service Arc End Angle (deg)	RAAN (deg)	Initial Phase Angle (deg)	Mean Anomaly (deg)
Pelican SSO 1	2024-01-01 T00:00:00Z	96.7	5461.71	325	325	0	-90.00	90.00	266.02	0	270.01
Pelican SSO 2	2024-01-01 T00:00:00Z	96.7	5461.71	325	325	0	-90.00	90.00	266.02	51.42	135.80
Pelican SSO 3	2024-01-01 T00:00:00Z	96.7	5461.71	325	325	0	-90.00	90.00	266.02	102.84	9.12
Pelican SSO 4	2024-01-01 T00:00:00Z	96.7	5461.71	325	325	0	-90.00	90.00	266.02	154.26	251.14
Pelican SSO 5	2024-01-01 T00:00:00Z	96.7	5461.71	325	325	0	-90.00	90.00	266.02	205.68	17.48
Pelican SSO 6	2024-01-01 T00:00:00Z	96.7	5461.71	325	325	0	-90.00	90.00	266.02	257.1	319.93
Pelican SSO 7	2024-01-01 T00:00:00Z	96.7	5461.71	325	325	0	-90.00	90.00	266.02	308.52	185.26
Pelican Inclined 1	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	0	90	179.91

[2] Planet will reduce transmitter power on the satellite radios as needed to stay within the relevant power flux density limits while moving from insertion orbits to operational orbits. Edge case radio frequency analysis for the 550 km and 250 km cases is provided in Section 16, below.

Satellite	Orbit Epoch (utc)	Inclination (deg)	Orbital Period (s)	Perigee (km)	Apogee (km)	Argument of Perigee (deg)	Active Service Arc Begin Angle (deg)	Active Service Arc End Angle (deg)	RAAN (deg)	Initial Phase Angle (deg)	Mean Anomaly (deg)
Pelican Inclined 2	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	0	0	0
Pelican Inclined 3	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	0	180	359.82
Pelican Inclined 4	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	30	75	124.94
Pelican Inclined 5	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	30	255	145.54
Pelican Inclined 6	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	60	150	6.84
Pelican Inclined 7	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	60	330	347.18
Pelican Inclined 8	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	90	45	243.74
Pelican Inclined 9	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	90	225	180.01
Pelican Inclined 10	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	120	120	349.61
Pelican Inclined 11	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	120	300	13.15
Pelican Inclined 12	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	150	15	213.83
Pelican Inclined 13	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	150	195	214.92

Satellite	Orbit Epoch (utc)	Inclination (deg)	Orbital Period (s)	Perigee (km)	Apogee (km)	Argument of Perigee (deg)	Active Service Arc Begin Angle (deg)	Active Service Arc End Angle (deg)	RAAN (deg)	Initial Phase Angle (deg)	Mean Anomaly (deg)
Pelican Inclined 14	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	180	90	270.01
Pelican Inclined 15	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	180	270	90.53
Pelican Inclined 16	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	210	165	353.25
Pelican Inclined 17	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	210	345	325.55
Pelican Inclined 18	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	240	60	274.28
Pelican Inclined 19	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	240	240	167.06
Pelican Inclined 20	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	270	135	348.26
Pelican Inclined 21	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	270	315	0.16
Pelican Inclined 22	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	300	30	221.77
Pelican Inclined 23	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	300	210	193.05
Pelican Inclined 24	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	330	105	357.98
Pelican Inclined 25	2024-01-01 T00:00:00Z	53	5461.71	325	325	0	-53.00	53.00	330	285	34.91

Planet will utilize both U.S. and foreign launch opportunities as either primary or secondary payloads. Planet often takes advantage of "last minute" launch opportunities, or launch opportunities where the exact orbit or exact number of satellites to be launched is not known until very close to the launch date. To simplify the regulatory process, Planet agrees only to launch within the above-defined parameters and presents analysis for worst case scenarios within that range.

4. Telemetry, Tracking, and Command ("TT&C")

The Pelican TT&C subsystem provides for communications during on-station operations, as well as during spacecraft emergencies. The satellites use the X-band for TT&C downlink and the S-band for TT&C uplink. Details on the TT&C frequencies and channels are provided in Section 5, below. Details on the TT&C antennas are provided in Section 14, below.

TT&C operations will be conducted from all of the four earth station sites listed in Section 15 below (Svalbard, Inuvik, Lewisporte, and Keflavik) and potentially others in the future. The specific commanding and telemetry channels are listed in Schedule S and reproduced in Tables 3, 4, and 6 below for convenience. Consistent with Planet's current license, Planet will provide the FCC a list of all coordinated earth stations.[3]

The Pelican satellites will use a sufficiently unique telemetry marker at deployment to assure that their telemetry stream can be unambiguously identified.

Because the Pelican satellites will use the S- and X-band EESS frequencies for TT&C, the proposed operations meet the requirements of 47 C.F.R. § 25.202(g).[4]

Mission operations are conducted from, and the control point for the Pelican satellites, is Planet's Mission Operations Center at its headquarters in San Francisco, California.

5. Frequency Plan

The spacecraft will operate in the frequencies listed below.

Table 2. Spacecraft Frequencies

Usage	Link Direction	Frequency[5]
Primary TT&C Low Speed	Uplink (Earth-space)	2056.6 MHz

[3] *See* Planet Labs Inc., IBFS File No. SAT-MOD-20200615-00076, at Condition 2 (granted Mar. 18, 2021).

[4] As noted in the Modification Application Narrative, Planet will use the C-band FSS frequencies for image tasking commands and confirmation responses, not to control and monitor the positioning of the Pelican satellites. However, in the event that the Commission considers these image tasking-related functions as TT&C operations, Planet requests any necessary waiver of Section 25.202(g), which limits space station operators to TT&C links in the same frequency bands as their primary service operations. Modification Application Narrative at 13.

[5] The frequencies identified in this chart are representative and may change pursuant to coordination with other operators operating in the relevant frequency bands.

Usage	Link Direction	Frequency[5]
Backup TT&C Low Speed	Uplink (Earth-space)	2066.6 MHz
Primary TT&C High Speed	Uplink (Earth-space)	2086.1 MHz
Backup TT&C High Speed	Uplink (Earth-space)	2096.1 MHz
Primary TT&C	Downlink (space-Earth)	8030.0 MHz
Backup TT&C	Downlink (space-Earth)	8040.0 MHz
Primary Imagery Payload	Downlink (space-Earth)	25500 - 27000 MHz
C-band inter-satellite link for real-time tasking confirmation	Transmit (LEO to GEO)	6225 - 6425 MHz
C-band inter-satellite link for real-time tasking	Receive (GEO to LEO)	4000 - 4200 MHz

5.1 S-band

The following tables list the S-band TT&C uplink channels planned for the Pelican satellites. This information is also provided in the accompanying Schedule S but is included here for completeness. The frequencies identified are representative and may change pursuant to coordination with other operators operating in the relevant frequency bands.

Table 3. S-band TT&C High-Speed Uplink Frequency Plan

Channel ID	Bandwidth (MHz)	Center Frequency (MHz)	Polarization
SHS1 (Primary)	1.1	2086.1	RHCP
SHS2 (Backup)	1.1	2096.1	RHCP

Table 4. S-band TT&C Low-Speed Uplink Frequency Plan

Channel ID	Bandwidth (MHz)	Center Frequency (MHz)	Polarization
SLS1 (Primary)	0.2	2056.6	RHCP
SLS2 (Backup)	0.2	2066.6	RHCP

5.2 Ka-band

The following table lists the primary downlink channels planned for the Pelican satellites. This information is also provided in the accompanying Schedule S but is included here for completeness. Note that in the Schedule S, this information is associated with two different transmit beams (KAT1 and KAT2) to reflect 16 RHCP and 16 LHCP channels. The frequencies identified are representative and may change pursuant to coordination with other operators operating in the relevant frequency bands.

Table 5. Ka-band Primary Downlink Frequency Plan

Channel ID	Bandwidth (MHz)	Center Frequency (MHz)	Polarization
KA1	86.4	25552.0	RHCP
KA2	86.4	25638.4	RHCP
KA3	86.4	25724.8	RHCP
KA4	86.4	25811.2	RHCP
KA5	86.4	25897.6	RHCP
KA6	86.4	25984.0	RHCP
KA7	86.4	26070.4	RHCP
KA8	86.4	26156.8	RHCP
KA9	86.4	26243.2	RHCP
KA10	86.4	26329.6	RHCP
KA11	86.4	26416.0	RHCP
KA12	86.4	26502.4	RHCP
KA13	86.4	26588.8	RHCP
KA14	86.4	26675.2	RHCP
KA15	86.4	26761.6	RHCP
KA16	86.4	26848.0	RHCP
KA17	86.4	25552.0	LHCP
KA18	86.4	25638.4	LHCP

Channel ID	Bandwidth (MHz)	Center Frequency (MHz)	Polarization
KA19	86.4	25724.8	LHCP
KA20	86.4	25811.2	LHCP
KA21	86.4	25897.6	LHCP
KA22	86.4	25984.0	LHCP
KA23	86.4	26070.4	LHCP
KA24	86.4	26156.8	LHCP
KA25	86.4	26243.2	LHCP
KA26	86.4	26329.6	LHCP
KA27	86.4	26416.0	LHCP
KA28	86.4	26502.4	LHCP
KA29	86.4	26588.8	LHCP
KA30	86.4	26675.2	LHCP
KA31	86.4	26761.6	LHCP
KA32	86.4	26848.0	LHCP

5.3 X-band

The following table lists the TT&C downlink channels planned for the Pelican satellites. This information is also provided in the accompanying Schedule S but is included here for completeness. The frequencies identified are representative and may change pursuant to coordination with other operators operating in the relevant frequency bands.

Table 6. X-band TT&C Downlink Frequency Plan

Channel ID	Bandwidth (MHz)	Center Frequency (MHz)	Polarization
XTB1 (Primary)	0.2	8030 MHz	RHCP
XTB2 (Back Up)	0.2	8040 MHz	RHCP

5.4 C-band (Intersatellite Link)

Planet intends to use the C-band to implement a near real-time satellite image tasking capability to complement its regular tasking operations in other frequencies. Specifically, Planet requests authority to use the 4000–4200 MHz link for transmissions from three to four SES geostationary orbit (GSO) Fixed Satellite Service (FSS) satellites to the Pelican satellites (i.e., geosynchronous equatorial orbit (GEO) to LEO), and the 6225–6425 MHz link for transmission from the Pelican satellites to the GSO FSS satellites (LEO to GEO). Below, Planet describes the proposed use of the conventional C-band frequencies for image tasking and confirmation links.

The diagram shown in *Figure 1: Real-Time Tasking Flow,* provides the basic operational flow and use of the C-band links in sequential order:

1. A satellite tasking command is initiated within the Pelican mission operations center where the image tasking data is prepared, encrypted, packetized, and forwarded through the internet to an SES teleport station.
2. Through a Planet-provided real-time communications (RT-Comm) modem, the image tasking command data is modulated onto an RF carrier and upconverted to a conventional C-band uplink frequency assigned by SES and:
    a. passed to the teleport antenna,
    b. amplified and transmitted to the SES GSO C-band satellite, and
    c. translated to a conventional C-band downlink frequency assigned by SES and demodulated/decrypted by the target Pelican satellite.
3. The Pelican processes the image tasking command and generates an associated encrypted data signal confirming the receipt of the tasking command in a conventional C-band uplink frequency assigned by SES, and:
    a. transmits the confirmation data to the nearest SES GSO satellite,
    b. confirmation data signal is translated to a conventional C-band downlink frequency assigned by SES and relayed to the teleport antenna, and then passed to the RT-Comm modem.
4. The RT-Comm modem demodulates, packetizes, and routes the data through the internet back to the Pelican mission operations center.

Note that the return signal occurs only in response to and immediately following a tasking uplink and is primarily a confirmation of the receipt of the image tasking command. The tasking and confirmation operations within C-band are expected to occur up to once per orbit per spacecraft with a duration of a few minutes.

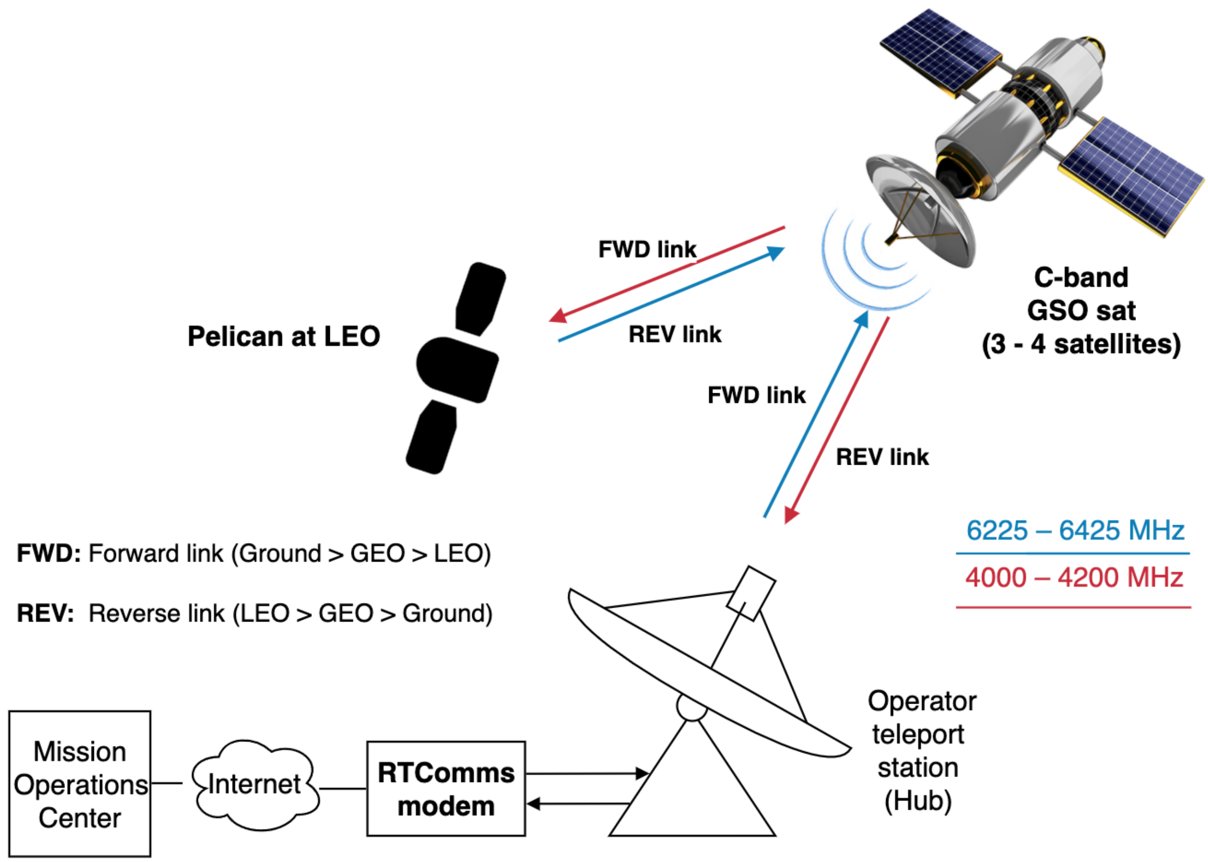

Figure 1. Real-Time Tasking Flow

The diagram in *Figure 2: Pelican to C-band GSO Satellite Communications Network*, provides an orbital concept of the Pelican fleet communicating with the SES GSO satellite network. In the sketch below, as an example, two Pelicans are receiving tasking and a third is responding with confirmation. Note that all transmissions between the NGSO and GSO satellites occur within the envelope of each of the GSO satellites' notified service area.

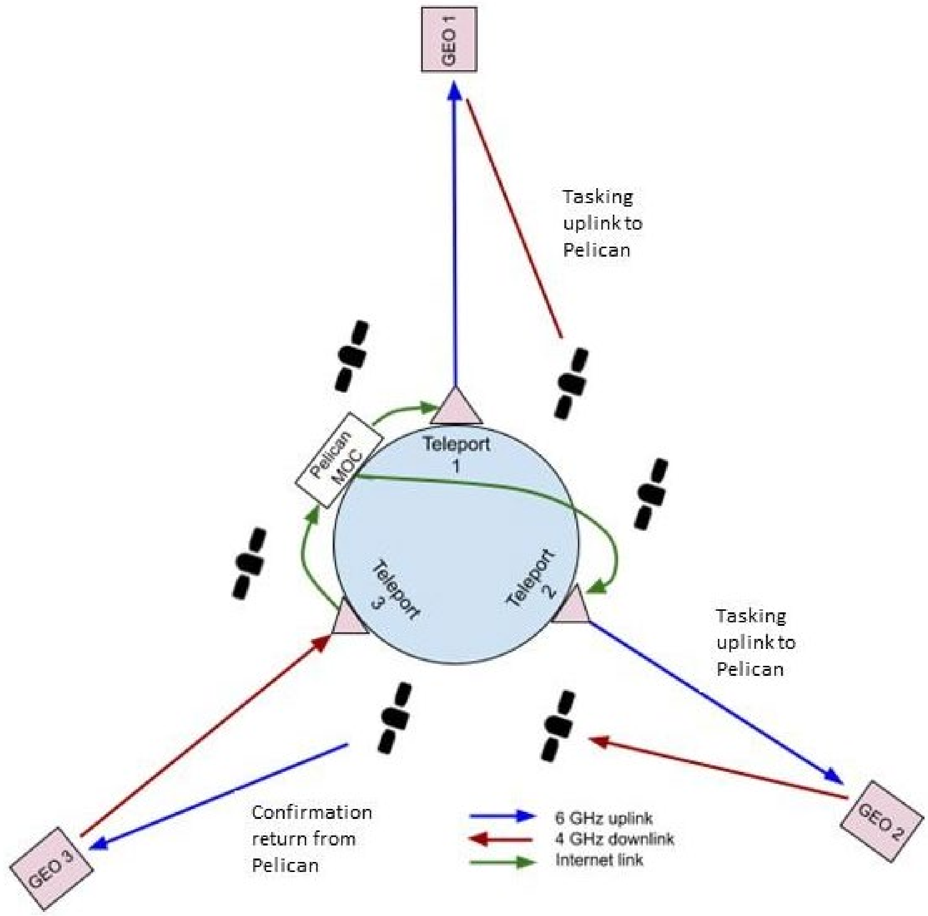

Figure 2. Pelican to C-band GSO Satellite Communications Network

The following table lists information regarding the C-band inter-satellite link channels. This information is also provided in the accompanying Schedule S but is included here for completeness. As noted in the table, SES will assign the specific channel frequencies; however, placeholder center frequency values of 4100 MHz and 6325 MHz were provided in the Schedule S form. To reflect that the satellite will have two C-band receive antennas (one high-gain antenna, one low-gain antenna), the Schedule S shows two different receive beams (and two associated channels) operating in the 4000-4200 MHz range. However, only one of these antennas will be used for reception at any one time. The low-gain broadbeam antenna will be used for slower data rates not requiring the Pelican LEO satellite to point at the relay GSO, and the high-gain antenna will be used to establish significantly faster data rates when the Pelican LEO station is able to point at and track the relay GSO satellite.

Table 7. C-band Intersatellite Link Plan

Channel ID	Direction	Bandwidth (MHz)	Frequency (MHz)	Polarization
CTB1	LEO -> GEO	2.0	6225-6425; Specific channel allocation assigned by SES	LHCP
CBC1/CBC2	GEO -> LEO	2.0	4000-4200; Specific channel allocation assigned by SES	RHCP

6. Frequency Tolerance

The frequency tolerance requirements of Section 25.202(e) that the carrier frequency of each space station transmitter be maintained within 0.002% of the reference frequency will be met.

7. Out of Band Emissions

The out-of-band emission limits of Section 25.202(f)(1), (2), and (3) will be met.

8. Frequency Reuse

Of the frequency bands where Section 25.210(f) applies, Pelican satellites will operate only C-band intersatellite links in the 4000–4200 MHz band. Planet will work with SES as its GSO partner and SES's operations will meet the requirements of Section 25.210(f).

9. Cessation of Emissions

All downlink transmissions can be turned on and off by ground telecommand, thereby achieving cessation of emissions from the satellite, as required by Section 25.207 of the FCC's rules.

10. Power Flux Density (PFD) Analysis

This section provides required PFD analyses for the target operational orbit of 325 km. The impact to PFD of edge-case commissioning orbits of 250 km and 550 km is considered in Section 16, below.

10.1 PFD at the Surface of the Earth in the 8025-8400 MHz band

Section 25.208 of the Commission's rules does not contain limits on PFD at the Earth's surface produced by emissions from NGSO EESS space stations operating in the 8025–8400 MHz band.[6]

[6] 47 C.F.R. § 25.208.

However, Table 21-4 of the ITU Radio Regulations states that the PFD at the Earth's surface produced by emissions from an EESS space station in the 8025–8400 MHz band, including emissions from a reflecting satellite, for all conditions and for all methods of modulation, must not exceed the following values:

- -150 dB(W/m²) in any 4 kHz band for angles of arrival between 0 and 5 degrees above the horizontal plane;
- -150 + 0.5(δ – 5) dB(W/m²) in any 4 kHz band for angles of arrival δ (in degrees) between 5 and 25 degrees above the horizontal plane; and
- -140 dB(W/m²) in any 4 kHz band for angles of arrival between 25 and 90 degrees above the horizontal plane.

These limits relate to the PFD that would be obtained under free-space propagation conditions. As shown in Figure 4 below, the PFDs at the Earth's surface produced by the Pelican satellite's data transmissions satisfy the PFD limits in the ITU Radio Regulations for all angles of arrival. In addition, the transmit power for the payload data transmitters is adjustable on orbit. This capability supports Planet's ability to manage the satellites' PFD levels during all phases of the mission, i.e., for all commissioning and operational altitudes.

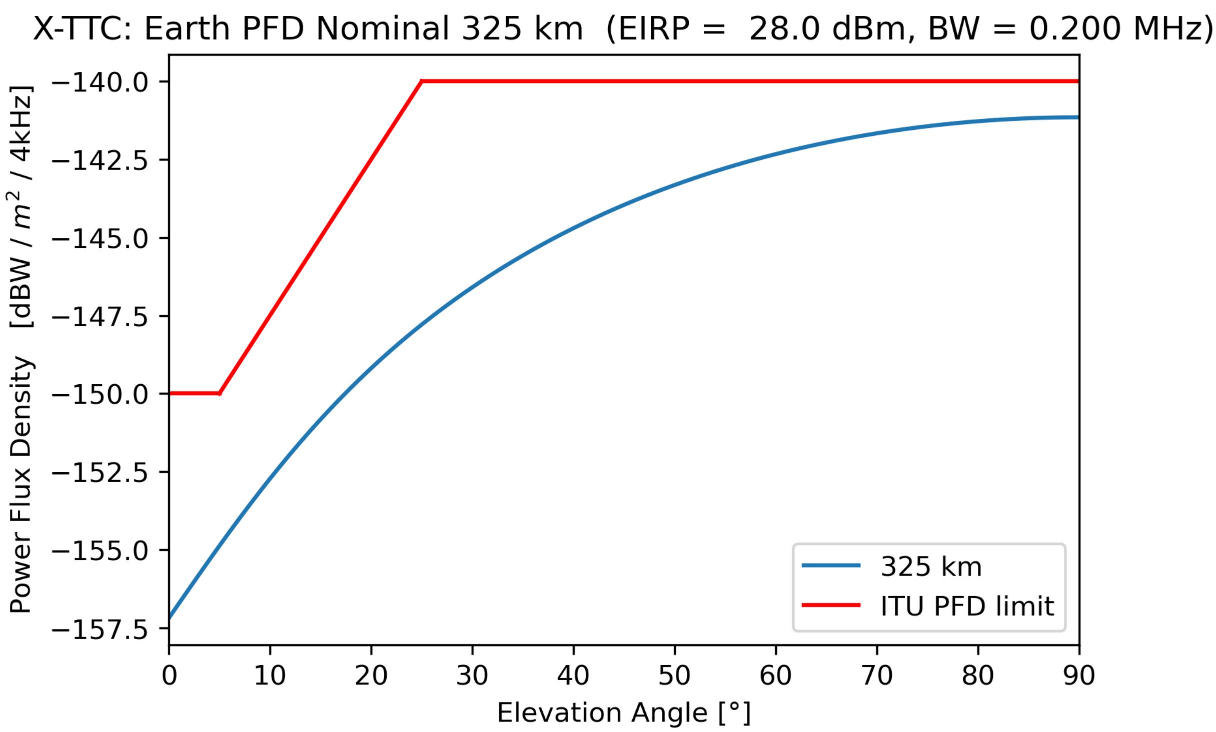

Figure 3. X-Band TT&C Maximum PFD at Earth's Surface for Nominal 325 km Operational Orbit

10.2 PFD at the Surface of the Earth in the 8400-8450 MHz Deep Space Research Band

Recommendation ITU-R SA-1157 specifies a maximum allowable interference power spectral flux-density level at the Earth's surface of -255.1 dB(W/(m²Hz)) to protect ground receivers in the deep-space research band (DSN) of 8400–8450 MHz. Planet uses a combination of baseband digital filtering (using an alpha roll-off factor of 0.5) and RF layer bandpass filtering to achieve the ITU recommended protection level for the 8400-8450 MHz band. Also, the TT&C channels with center frequency at 8030.0 MHz are just above the EESS band edge furthest away from the X-band DSN allocation.

10.3 PFD at the Geostationary Satellite Orbit in the 8025-8400 MHz Band

ITU Radio Regulation No. 22.5 specifies that in the 8025–8400 MHz frequency band, which the EESS using non-geostationary satellites shares with the fixed-satellite service (Earth-to-space) or the meteorological-satellite service (Earth-to-space), the maximum PFD produced at GSO by any EESS space station shall not exceed -174 dB(W/m²) in any 4 kHz band. The calculation below shows that the PFD produced by transmissions from the proposed Pelican EESS satellites does not exceed ITU limits even in a worst-case, hypothetical analysis.

The PFD at the GSO produced by the Pelican transmission is:

$$PFD\ [dB(W/m^2\ /\ 4\ kHz)] = EIRP\ [dBW] - 71 - 20\log10(D) - 10\log10(BW) - 24]$$

where:

- EIRP is the maximum EIRP of the transmission, in dBW;
- D is distance between the Pelican satellite and the GSO, in km; and
- BW is the symbol bandwidth of the transmission, in MHz.

The distance between a Pelican satellite and the GSO is:

- 35,786 - 325 = 35,461 km for the Pelican satellite orbit altitude of 325 km.

Under a worst-case and unlikely assumption that the Pelican satellite antenna is radiating at its peak EIRP directly toward the GSO, the data downlink transmission with a peak EIRP = -2.0 dBW[7] and a bandwidth = 0.2 MHz produces a PFD at the GSO of:

- -2.0 dBW - 71 - 20log10(35,461) - 10log10(0.2) - 24 = -181.0 dB(W/m²) in any 4 kHz band for the Pelican satellite orbit altitude of 325 km.

[7] The peak EIRP of the Pelican X-band transmitter is -2 dBW. Due to limitations in the Schedule S form, Planet entered a placeholder value of 0 dBW as the maximum transmit EIRP in the Schedule S. *See* Modification Application Narrative at 16-17 (requesting waiver of section 25.114(c) of the Commission's rules, which requires certain information to be filed in the Schedule S).

10.4 PFD at the Surface of the Earth in the 25500 – 27000 MHz band

Section 25.208(p)[8] of the Commission's rules requires that PFD at the Earth's surface produced by emissions from a space station in the EESS in the band 25500–27000 MHz, for all conditions and for all method of modulation, must not exceed the following values:

- -115 dB(W/m^2) in any 1 MHz band for angles of arrival between 0 and 5 degrees above the horizontal plane;
- -115 + 0.5(δ -5) dB(W/m^2) in any 1 MHz band for angles of arrival (δ measured in degrees) between 5 and 25 degrees above the horizontal plane; and
- -105 dB(W/m^2) in any 1 MHz band for angles of arrival between 25 and 90 degrees above the horizontal plane;

Where δ is the angle between the boresight of the victim antenna and the horizontal plane. The PFD in a reference bandwidth of 1.0 MHz may be calculated using the relationship:

$$PFD\ [dB(W/m^2)/1\ MHz)] = EIRP(dBW) - 71.0 - 20\log_{10}(D) - 10\log_{10}(BW)$$

Where:

- EIRP is the maximum EIRP of the transmission, in dBW;
- D is the distance in km between the satellite and the victim antenna (or surface area of interest); and
- BW is the symbol bandwidth of the transmission, in MHz.

These limits refer to the PFD that would be obtained under assumed free-space propagation conditions only (no excess path loss of any kind is assumed). This corresponds to worst-case conditions for our system as excess path loss at Ka-band millimeter wave frequencies for space systems never approaches zero under any practical link conditions, at any elevation angle.

PFD levels at the Earth's surface in the 25500 to 27000 MHz band are shown in Figure 4, below. In addition to the PFD for nominal 16 channel per polarization operation, the PFD for 3 channel per polarization operation is also shown. This configuration would be utilized if there was an off-nominal situation that required additional channel power for link closure.

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[8] 47 C.F.R. § 25.208(p).

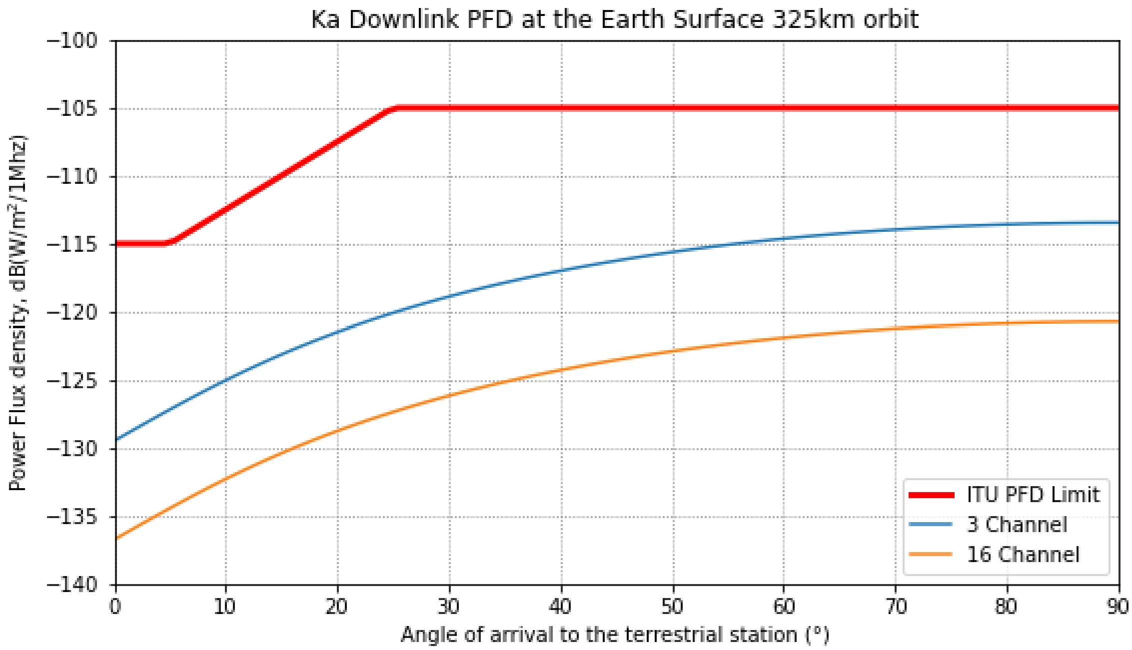

Figure 4. Ka-band Downlink Maximum PFD at Earth's Surface for Nominal 325 km Operational Orbit

10.5 PFD at the Surface of the Earth in C-band

As specified in ITU SF.358-5, the maximum permissible PFD at the Earth's surface at 6 GHz to protect terrestrial radio-relay systems is given by the mask in Figure 5 (shown as the red line). Assuming the hypothetical worst case where the Pelican C-band transmitting antenna (which employs digital spread spectrum modulation) is pointed toward Earth and transmitting, and assuming the peak gain of 3 dBi for all off-axis angles, this still results in a power density that is below the mask for all angles of arrival (shown as the blue line in Figure 5), which is compliant with the recommendation and non-interfering with terrestrial systems. Under actual operating conditions, the Pelican will transmit only when the C-band antenna on the Zenith deck is pointed away from Earth (toward space), generating a lower PFD than those presented in the PFD plot.

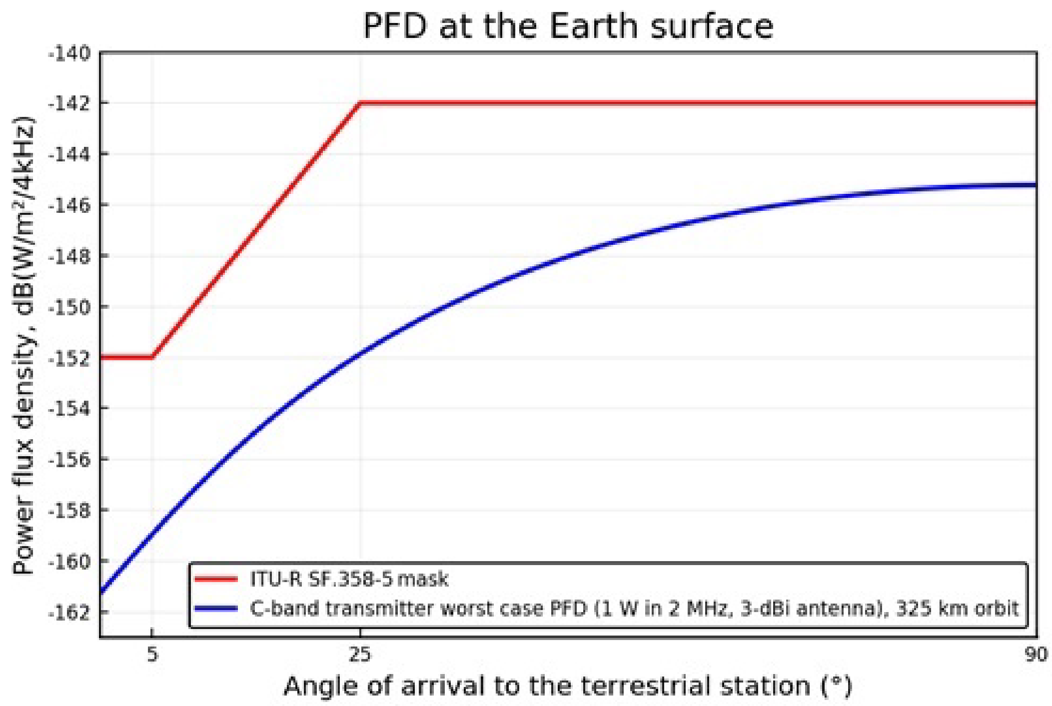

Figure 5. Maximum PFD at the Earth's Surface from the NGSO C-band Antenna for 325 km orbit

11. X-band Interference Analysis

Interference between the Pelican satellite downlinks and those of other EESS systems is very infrequent because EESS systems operating in the 8025–8400 MHz band normally transmit only in short periods of time while visible from the dedicated receiving earth stations. For interference to happen, satellites belonging to different systems would have to travel through the antenna beam of the receiving earth station and transmit at the same time. In the event of a precise alignment, interference can be avoided by coordinating the satellite transmissions so that they do not occur simultaneously.

In addition, Planet maintains coordination agreements with NASA that protect governmental space missions against harmful interference from operations of its Flock and SkySat satellites in this band. Planet also maintains coordination agreements for foreign earth stations if required by the responsible foreign administration or local authorized users of the frequency bands. Planet will apprise NASA of this application and coordinate the proposed X-band operations.

Sections 10.1 and 10.3, above, demonstrate that the Pelican satellite transmissions will meet the limits specified by the ITU for protection of the Fixed Service in the 8025–8400 MHz band, as well as the geostationary FSS satellites using this band for their uplinks.

Section 10.2, above, demonstrates that the protection criterion recommended by the ITU for deep-space research in the 8400–8450 MHz band is met.

12. Ka-band Interference Analysis

Planet acknowledges that Table of Allocations Footnote US258 provides that the 25500–27000 MHz band is allocated for non-Federal EESS (space-to-Earth) operations on a primary basis subject to a case-by-case electromagnetic compatibility analysis.[9] In order to provide sufficient protection to existing and planned Federal Space Research Service and EESS operations, Planet will coordinate with co-frequency operators and identify all relevant ground stations. Because Planet's use of this band will be limited to communications with a limited number of earth stations, compatibility with Federal and other non-Federal operations in this band should be achievable.

Planet will not claim protection from stations in the fixed (FS) and mobile services operated by other administrations.[10] Planet will comply with the most recent version of Recommendation ITU-R SA.1862 and the guidelines put forth in Recommendation ITU-R SA.1278, Annex 1 regarding the methodology for ensuring sufficient separation distances between EESS earth stations and FS stations.[11]

As demonstrated above in Section 10.4, Planet's space station transmissions in this band will meet the PFD limits contained in Section 25.208(p) of the Commission's rules.[12] Planet also acknowledges that NASA uses this band for its tracking and data relay satellite system (TDRSS) to provide communications to other spacecraft, to downlink telemetry for the Lunar Reconnaissance Orbiter and Solar Dynamics Observatory and broadband data communications from space-borne sensors.[13] In addition, the National Science Foundation (NSF) uses this band for the radio astronomy research of various spectral-lines and continuum measurements,[14] and other allocated Federal uses include EESS, FS, ISL, mobile, SRS (space-to-Earth) operations, and secondary standard frequency and time signal-satellite services. Through coordination and consultation, Planet will ensure compatibility with the aforementioned Federal operations.

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[9] 47 C.F.R. § 2.106 n.US258.

[10] *See* 47 C.F.R. § 2.106, n.5.536A.

[11] *Guidelines for Efficient Use of the Band 25.5-27.0 GHz by the Earth Exploration-Satellite Service (space-to-Earth) and Space Research Services (space-to-Earth)*, Recommendation ITU-R SA.1862, at 2 (recommends 5), (Jan. 2010), *available at* https://www.itu.int/dms_pubrec/itu-r/rec/sa/R-REC-SA.1862-0-201001-I!!PDF-E.pdf; *see also Amendment of Parts 2, 25, and 73 of the Commission's Rules to Implement Decisions from the World Radiocommunication Conference (Geneva, 2003) (WRC-03) Concerning Frequency Bands Between 5900 kHz and 27.5 GHz and to Otherwise Update the Rules in this Frequency Range*, Report and Order, 20 FCC Rcd. 6570, ¶ 88 (2005) ("*WRC-03 Order*") (noting that the addition of international footnote 5.536A in the 25.5-27 GHz band "provides a methodology for estimating needed separation distances between EESS earth stations and fixed stations, and alerts commercial remote sensing operators of the EESS downlink allocation's status in border areas" (footnote omitted)).

[12] *WRC-03 Order* ¶ 89; 47 C.F.R. § 25.208(p). Compliance with PFD should protect terrestrial Federal uses, including fixed and mobile microwave point-to-point communications links for voice, data, and video at various government facilities and laboratories, test ranges, and air traffic control facilities, and will operate in accordance with this co-primary allocation.

[13] National Telecommunications and Information Administration, Office of Spectrum Management, *Federal Spectrum Use Summary*, 30 MHz – 3000 GHz, June 21, 2010, at 71, *available at* http://www.ntia.doc.gov/files/ntia/publications/spectrum_use_summary_master-07142014.pdf.

[14] *Id.*

Planet also acknowledges that its use of the Ka-band is subject to future rules that may be established by the Commission.[15]

13. C-band Interference Analysis

Planet is seeking authority to use C-band spectrum for the Pelican network on a non-conforming basis. The proposed operations will not cause harmful interference to other authorized users of the frequencies, and Planet will accept any interference from authorized users of the spectrum. Emissions from such authorized users will not prevent the Pelican network from operating successfully.

Transmissions from teleports to the SES GSO satellites in the C-band uplink band will conform to the coordinated and authorized RF parameters of the SES GSO teleport earth station(s) and space stations. The SES GSO satellite space-to-Earth transmissions will similarly be regular emissions consistent with each space station's coordinated and licensed RF parameters.

The Pelican satellite will receive emissions in the C-band downlink band within the notified service area of the GSO beam (wide coverage global beams). Because there are no changes to the transmitting parameters of the GSO satellites, reception of these signals by the Pelican antennas will not alter the interference environment. Applicable PFD limits for the protection of terrestrial services in the C-band downlink frequencies will continue to be observed. Moreover, the Pelican satellites are not seeking protection for these signals from other users of the 4000-4200 MHz frequency band. SES has communicated that it is committed to taking appropriate actions to properly authorize its transmissions.

For the Pelican satellite space-to-space transmissions to the GSO satellites, Planet has evaluated the potential for causing harmful interference based on the requirements for standard VSAT terminals and with reference to the limits applicable to the case of an NGSO satellite emitting in the direction of the GSO and meeting the GSO satellite interference protection criteria. Table 8 below provides a summary of power density calculations relevant for the analysis.

[15] *See Use of Spectrum Bands above 24 GHz for Mobile Radio Service*, *et al.*, Third Report and Order, Memorandum Opinion and Order, and Third Further Notice of Proposed Rulemaking, 33 FCC Rcd. 5576 (2018).

Table 8. Summary of C-band Power Density Calculations

Parameter	Value		Notes
NGSO altitude	325	km	
Frequency	6.3	GHz	
3-dB Bandwidth	2.0	MHz	
Power at antenna input	1.0	W	
Antenna gain peak	3.0	dBi	
EIRP	3.0	dBW	
EIRP Density	0.0	dBW/MHz	
EIRP Density	-24.0	dBW/4KHz	
Range at 5° of elevation	1580	km km	
Closest distance to GSO	35460	km	
PFD at GSO	-186.0	dBW/m^2/4kHz	At closest approach
Max PFD at Earth's surface	-145.2	dBW/m^2/4kHz	90° elevation
PFD at Earth's surface	-159.5	dBW/m^2/4kHz	5° elevation

The Pelican space-to-space emissions will not cause interference to other authorized GSO systems because the emissions will meet two key regulatory limits:

- off-axis EIRP emission limits;
- and PFD limits at the Earth's surface.

Due to the utilization of digital spread spectrum techniques, the transmitted power density of the Pelican emission is low enough to meet the interference protection criteria established by the regulations. The Pelicans will only be transmitting in the 6225–6425 MHz band in channels assigned by Planet's GSO partner, SES. Compliance with each regulatory limit is demonstrated below.

13.1 Off-axis PFD at the GSO Arc

Emissions from the NGSO satellite transmitter meet the off-axis EIRP emission density limits at 6 GHz imposed by Section 25.218(d) of the Commission's rules, as shown in Figure 6. Assuming the antenna peak gain could be pointed in any direction relative to the GSO arc, the peak gain of 3 dBi was used for all off-axis angles. The NGSO transmitter uplink uses a digital spread spectrum modulation which results in a power density that is at least 11 dB below the mask for all off-axis angles (shown as the blue line) and as much as 40 dB below the mask on-axis. These emissions are also below the envelope of associated earth station characteristics notified and coordinated by SES.

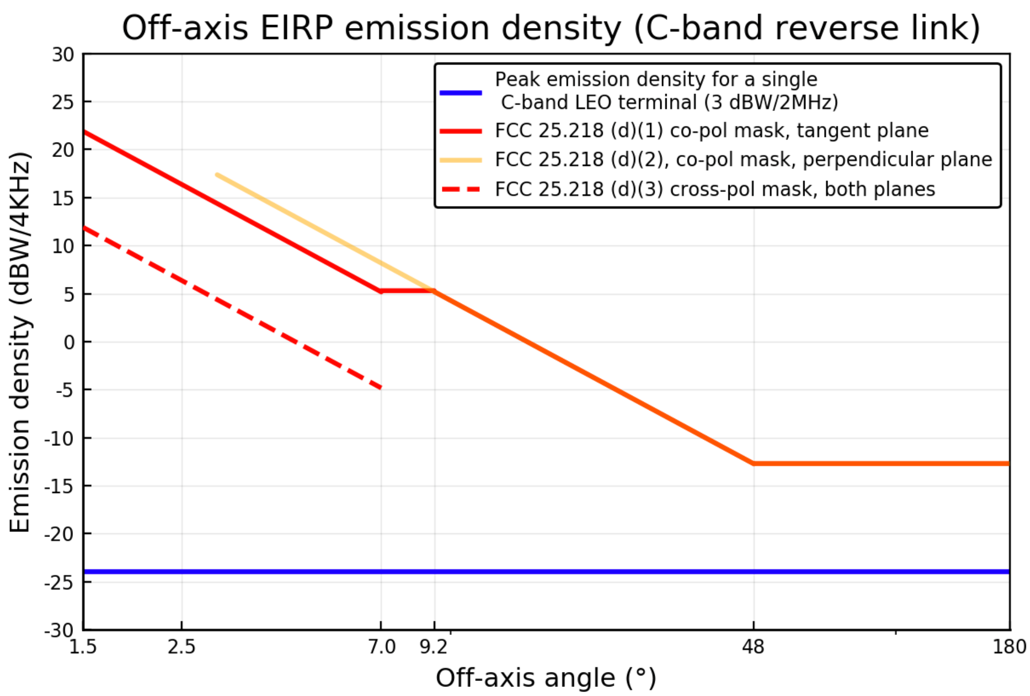

Figure 6. Off-axis EIRP Emission Density from the C-band Pelican Antenna

13.2 GSO Satellite Transmission at 4000–4200 MHz

GSO satellite C-band transmissions in the 4 GHz band (4000-4200 MHz) to the Pelican satellites will conform to the authorized and coordinated emissions within the assigned frequency and coverage areas of the GSO spacecraft. The proposed reception by the Pelican satellites does not change in any way the characteristics and operations of the GSO satellite transmissions, and accordingly, the authorized downlink transmissions will continue to abide by applicable PFD limits for the protection of terrestrial services in the band. As a result, space-to-space transmissions in the 4 GHz band will not cause harmful interference to any authorized operations. The network will also be able to operate successfully in the C-band interference environment on an unprotected basis.

13.3 Interference from other GSO Systems at 4000–4200 MHz

Planet will accept any interference from other authorized GSO systems in the C-band downlink band. The Pelican satellite in LEO carrying the real-time tasking receiver will pass under multiple C-band beams from GSO systems, and most regional beams will have power densities approximately 10 dB higher than C-band global beams: 45 dBW EIRP in a 36 MHz transponder = 60 dBm/MHz. A Pelican satellite at the center of those interfering beams would be exposed to GSO emissions of 60 dBm/MHz - 197 dB (free space loss) = -137 dBm/MHz. Because the Pelican C-band antenna maximum gain is +3 dBi, the interference density at the receiver input will be no higher than -134 dBm/MHz. Pelican C-band receiver antenna port referred noise is -114dBm/MHz, 20 dB above the interference level from a single regional C-band beam operating at 45 dBW/36 MHz pointed right at the Pelican. This also means that approximately 100 of these beams operating at the same Pelican assigned C-band frequencies would be needed to generate noticeable Pelican receiver performance degradation. Most non-global C-band beams operate at levels in the range of 40 to 45 dBW per 36 MHz, and it is expected that the Pelican LEO satellite will be exposed to significantly fewer simultaneous beams of the same frequency at any point in its orbit. As a result, transmissions from GSO systems are not expected to adversely affect the Pelican's C-band signal reception, and Planet will accept any such interference.

13.4 Interference from Terrestrial Microwave Systems at 4 GHz

Terrestrial Fixed Service (FS) stations are limited by regulation to 85 dBm EIRP[16] and 20 MHz bandwidth[17] in the 4 GHz band. Most FS stations occupy 20 MHz, so an interfering source of 72 dBm/MHz is representative of a station operating at maximum power. Also, by regulation, the C-band FS antenna should provide a minimum gain of 36 dBi with a Half-Power Beamwidth (HPBW) of 2.7°[18] (most have 2° or less). Considering that an FS antenna can be pointing at a 2° elevation, a Pelican satellite in LEO at 325 km of altitude will be at a slant range of about 1850 km if at the FS station beam center. The path loss in this situation is 170 dB, Pelican's receiver antenna in the direction of the FS is approximately -10 dBi, and the interference density at Pelican's receiver antenna port is 72 dBm/MHz - 170 dB - 10 dB = -108dBm/MHz. As noted above, the nominal receiver input referred noise density is -114dBm/MHz. This means that for a very brief time, in the event the Pelican is passing through the beam of a C-band FS station emitting on the same frequency and using the maximum allowed power in a 20 MHz channel, there will be a brief signal-to-noise ratio degradation.[19] It is estimated that the frequency of these events will be quite small, much less than 1 percent of the time.

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[16] *See* 47 C.F.R. §101.113.

[17] *See* 47 C.F.R. §101.109.

[18] *See* 47 C.F.R. §101.115.

[19] Note also that pursuant to the Commission's Order in the C-band proceeding, incumbent point-to-point Fixed Service in the 3.7-4.2 GHz band in the contiguous United States will sunset as of December 5, 2023 (and applications for new point-to-point Fixed Service operations in the 3.7-4.2 GHz band are no longer accepted for locations in the contiguous United States), further reducing the potential for harmful interference in the future. *Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, Report and Order and Order of Proposed Modification, 35 FCC Rcd. 2343, ¶ 323 (rel. March 3, 2020).

14. Satellite Antennas

The space station antenna patterns are provided in Attachment A. Schedule S, within the FCC Form 312 portion of this Application, describes in detail the technical characteristics of the proposed beams. The following provides a summary of the proposed radio frequency and parameters for each Pelican antenna.

14.1 S-band receiver antennas

- Type: Microstrip patch antenna
- Frequency: 2025 – 2110 MHz
- Gain: 2.5 dBi, RHCP
- 3-dB beamwidth: 80°
- Location: On both nadir and zenith sides

14.2 X-band TT&C transmitter antenna

- Type: Microstrip patch antenna
- Frequency: 8025 – 8400 MHz
- Gain: 5.0 dBi, RHCP
- 3-dB beamwidth: 70°
- Location: On both nadir and zenith sides

14.3 C-Band receiver antennas

The C-band receiver system comprises two antennas: a low-gain broadbeam antenna for slower data rates not requiring the Pelican LEO satellite to point at the relay GSO, and a high-gain antenna to establish significantly faster data rates when the Pelican LEO station is allowed to point at and track the relay GSO satellite.

The Pelican C-band receiver low-gain antenna has the following characteristics:

- Type: Quadrifilar helix
- Frequency: 4000 – 4200 MHz, to be assigned by GSO provider
- Gain: 3 dBi peak, see radiation pattern in Attachment A
- 3-dB beamwidth: Hemispherical toward geosynchronous orbit
- Location: On Pelican zenith deck, pointed generally to space

The Pelican C-band high-gain receiver antenna has the following characteristics:

- Type: Helical, RHCP
- Frequency: 4000 – 4200 MHz, to be assigned by GSO provider
- Gain: 12 dBi peak, see radiation pattern in Attachment A
- 3-dB beamwidth: Hemispherical toward geosynchronous orbit
- Location: On Pelican zenith deck, pointed generally to space

14.4 C-band transmitter low-gain antenna

Pelican C-band transmitter antenna has the following characteristics:

- Type: Quadrifilar helix
- Frequency: 6225 MHz – 6425 MHz, to be assigned by GSO provider
- Gain: 3 dBi peak, see radiation pattern in Attachment A
- 3-dB beamwidth: Hemispherical, towards geosynchronous orbit
- Location: On Pelican zenith deck, pointed generally to space

14.5 Ka-band Downlink Antenna

The proposed Ka band antenna on board the satellite will be a high-gain dual polarization horn array. The following provides a summary of the proposed radio frequency and antenna parameters:

- Type: Waveguide horn array
- Frequency: 25500 – 27000 MHz
- Gain: 32 dBiC, RHCP and LHCP
- 3-dB beamwidth: 4°
- Antenna location: On Pelican nadir side, pointed towards the ground station

15. Earth Stations

The Pelican satellites will rely upon some of Planet's existing earth stations, plus additional earth stations, including earth stations at locations yet to be determined. The characteristics of the anticipated earth station antennas are summarized in Table 9 below.

Table 9. Ground Station Antenna Characteristics

	S-band	X-band	Ka-band
Reflector Size	2.8 m	2.8 m	2.8 m
Downlink Band	N/A	8030 MHz; 8040 MHz	25500 – 27000 MHz
G/T (20° elevation)	N/A	25.7	31.2
Polarization	RHCP	RHCP & LHCP	RHCP & LHCP
Uplink Band	2056.6 MHz 2066.6 MHz 2086.1 MHz 2096.1 MHz	N/A	N/A
EIRP	47 dBW	N/A	N/A

Planet will initially be using four ground stations in Norway, Canada, and Iceland, with others likely to be added in the future.

Table 10. Earth Station Locations Supporting the Pelican Satellites

Name	Type	Country	Lat, Long, Alt
Svalbard	S/X/Ka band; TT&C/Payload	Norway	78.2269, 15.4166, 498 m
Inuvik	S/X/Ka band; TT&C/Payload	Canada	68.3252, -133.5623, 62 m
Lewisporte	S/X/Ka band; TT&C/Payload	Canada	49.2547 -55.0646, 46 m
Keflavik	S/X band; TT&C	Iceland	63.9585, -22.5807, 33 m

16. Analysis of Edge Case Orbits

As described in Section 3, above, the insertion orbits for the Pelican satellites will be dictated by the launch vehicle and could extend as high as 550 km and as low as 250 km. Moreover, the first Pelican satellite will have an extended commissioning period at 525 km +/- 25 km before slowly being moved into a 325 km operational orbit. In this section, Planet describes how these edge-case orbital scenarios impact its radiofrequency analysis provided above for the 325 km nominal case.

16.1 Commissioning at 550 km

At an orbit of 550 km, the PFDs at the Earth's surface for all Pelican downlinks are 4.6 dB lower when compared to the nominal 325 km orbits. On the other hand, the PFD at the GEO arc increases by only 0.06 dB when moving from a 325 km orbit to a 550 km orbit; because the GEO arc PFDs for all the links have a significantly larger margin at 325 km than 0.06 dB, operating the radio links at 550 km does not pose any interference risk from the PFD perspective. A summary of changes regarding PFD values for a 550 km orbit is presented in Tables 11 and 12.

Table 11. Earth Surface PFD Changes for 550 km Orbit Operation

Link band	Earth surface PFD margin	
	At 325 km	Change for 550 km
ISL C-band reverse	3.2 dB	4.6 dB improvement
TTC X-band downlink	1.0 dB	4.6 dB improvement
Ka-band downlinks	15.7 dB	4.6 dB improvement

Table 12. Geo Arc PFD Changes for 550 km Orbit Operation

Link band	Geo arc PFD margin	
	At 325 km	Change for 550 km
ISL C-band reverse	3.0 dB	< 0.1 dB degradation
TTC X-band downlink	7.0 dB	< 0.1 dB degradation

16.2 Commissioning at 250 km

At an orbit of 250 km, the PFDs at the Earth's surface for all Pelican downlinks are 2.3 dB higher when compared to the nominal 325 km orbit. The only link that exceeds the Earth surface PFD at 250 km when using the same operational parameters as at 325 km is the X-band TT&C downlink. When operating this link while commissioning at a 250 km orbit, its transmitter power will be reduced by the same PFD increase amount, that is 2.3 dB, to keep the same nominal 325 km orbit PFD margin. On the other hand, the PFD at the GEO arc decreases by 0.02 dB, a minute change. A summary of changes regarding PFD values for a 250 km orbit are presented in Tables 13 and 14.

Table 13. Earth Surface PFD Changes for 250 km Orbit Operation

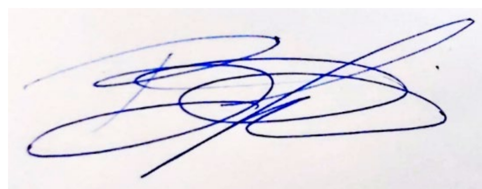
Link band	Earth surface PFD margin		Notes for operation at 250 km
	At 325 km	Change for 250 km	
ISL C-band reverse	3.2 dB	2.3 dB degradation	Continues to meet PFD requirements
TTC X-band downlink	1.0 dB	2.3 dB degradation	X-band transmitter power will be reduced by at least 2.3 dB to meet the PFD requirements
Ka-band downlink	15.7 dB	2.3 dB degradation	Continues to meet PFD requirements

Table 14. Geo Arc PFD Changes for 250 km Orbit Operation

Link band	Geo arc PFD margin	
	At 325 km	Change for 250 km
ISL C-band reverse	3.0 dB	< 0.1 dB improvement
TTC X-band downlink	7.0 dB	< 0.1 dB improvement

Technical Certificate

I, Brian Lewis, hereby certify, under penalty of perjury, that I am the technically qualified person responsible for the preparation of the engineering information contained in the technical portions of the foregoing application and the related attachments, that I am familiar with Part 25 of the Commission's rules, and that the technical information is complete and accurate to the best of my knowledge and belief.



Brain Lewis

Senior Director, Systems Engineering

Planet Labs PBC

Date: April 21, 2022

Attachment A
Space Station Antenna Patterns

C-band receiver low-gain antenna (4000 – 4200 MHz)

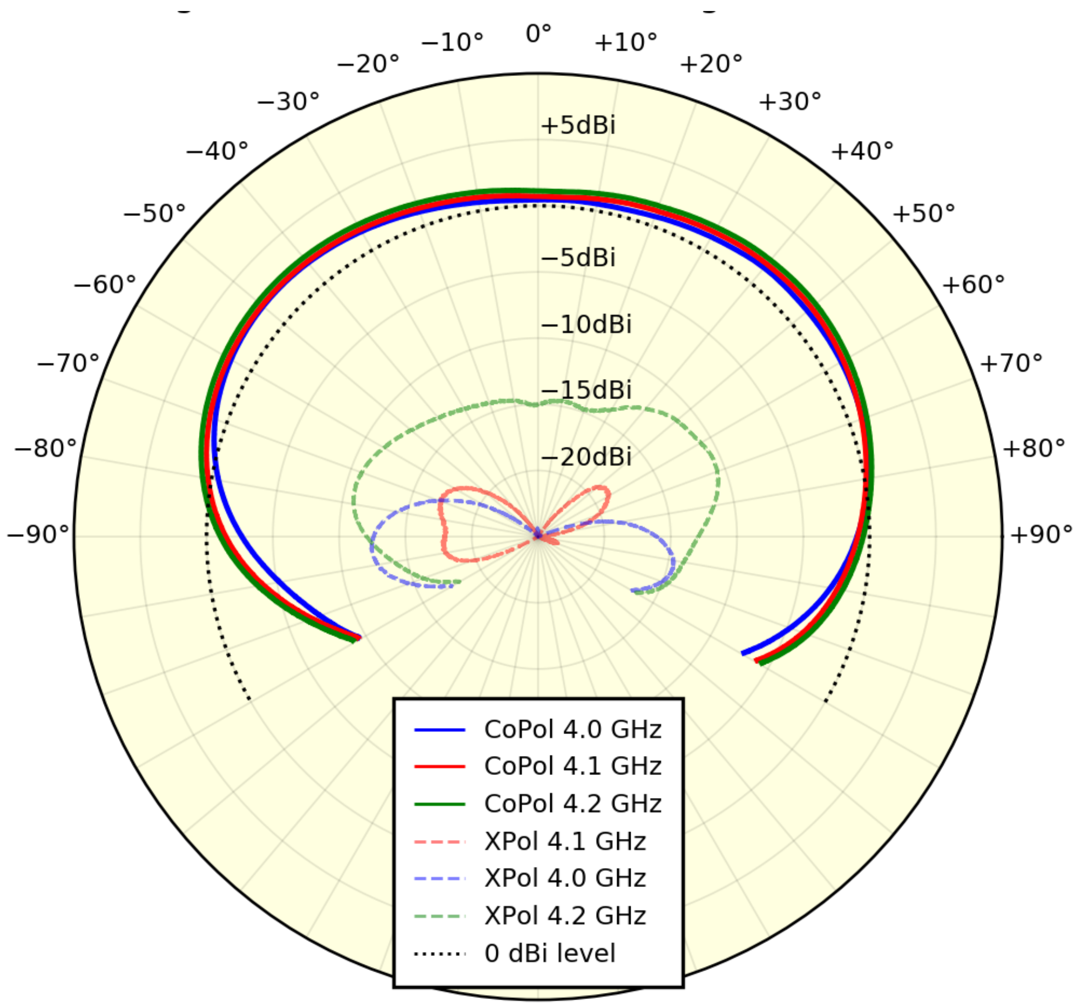


Figure 1. C-band receiver quad helix low-gain antenna pattern measurement (peak gain of 3 dBi)

C-band receiver high-gain antenna (4000 – 4200 MHz)

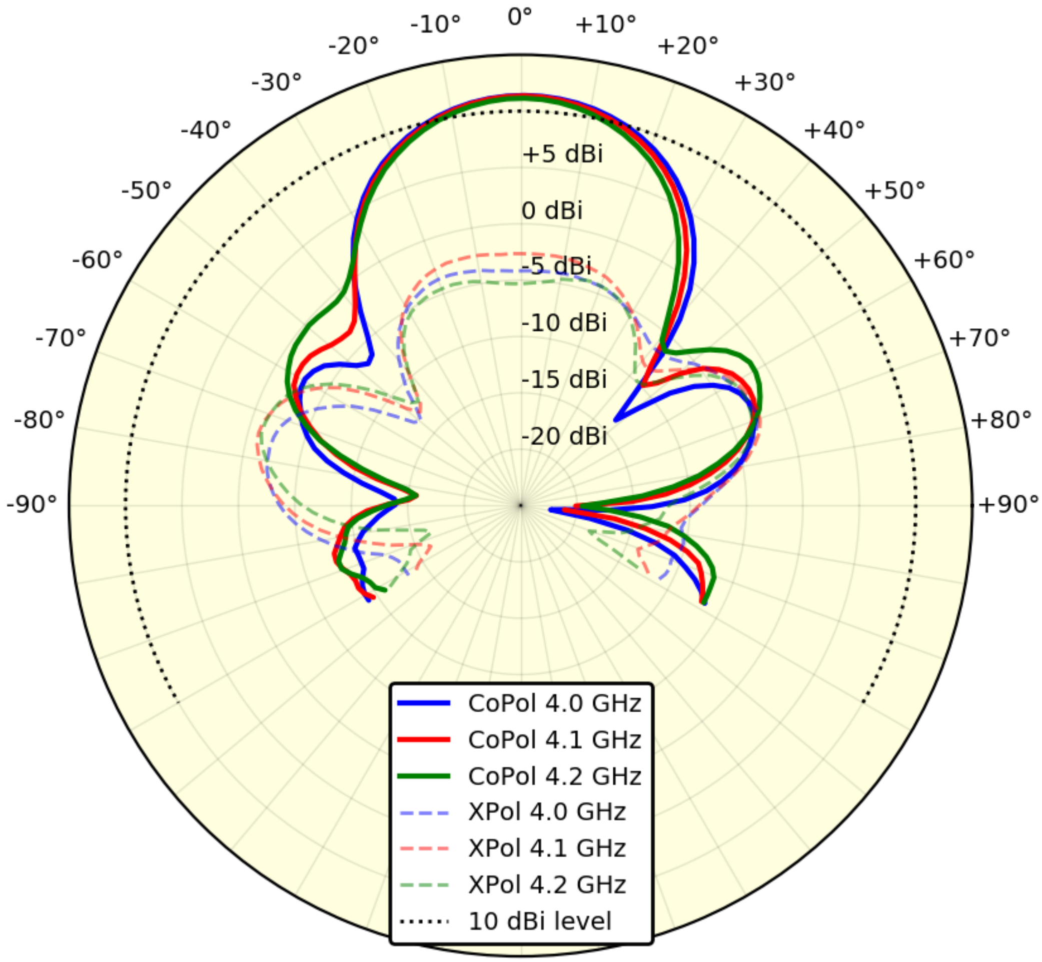


Figure 2. C-band receiver helical high-gain antenna pattern measurement (peak gain of 12 dBi)

C-band transmitter low-gain antenna (6225 – 6425 MHz)

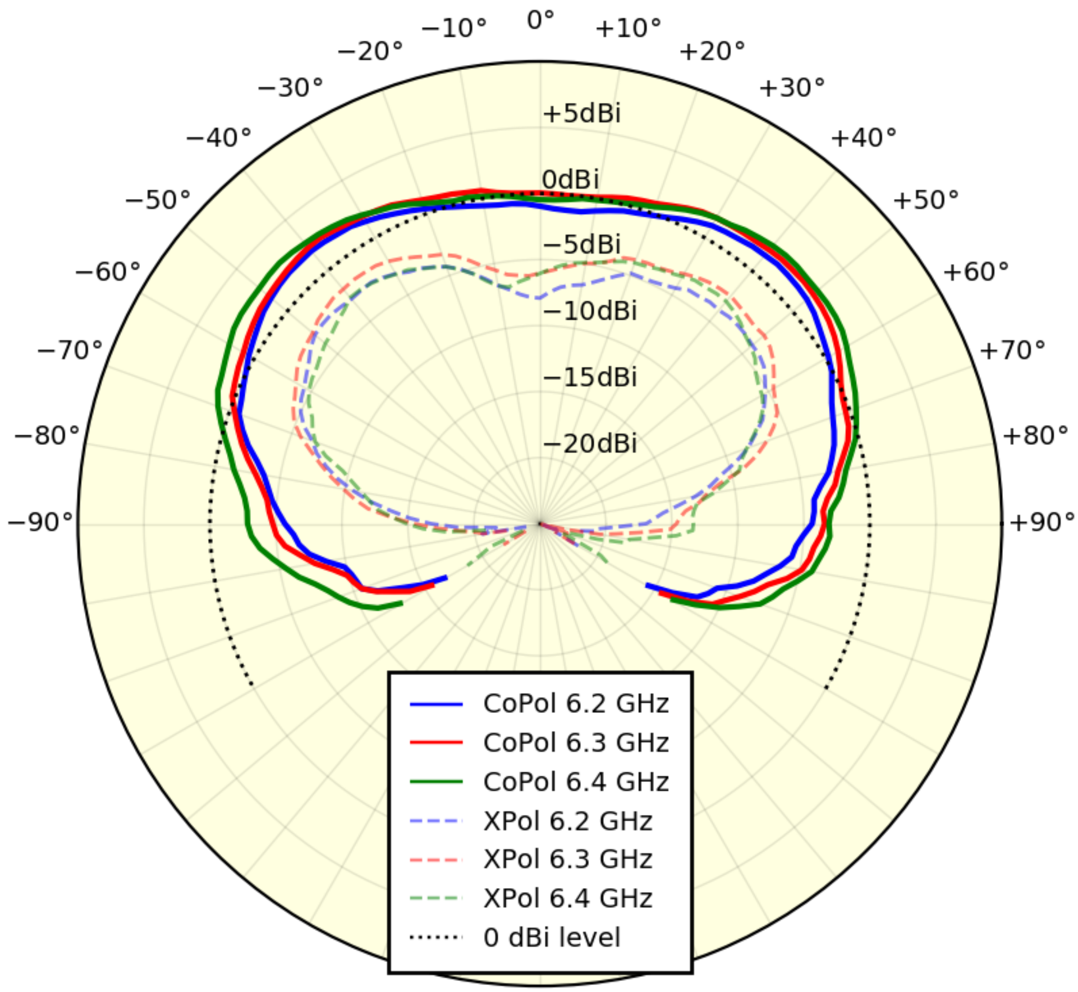


Figure 3. C-band transmitter quad helix low-gain antenna pattern measurement (peak gain of 3 dBi)

EESS S-band receiver (2025 – 2110 MHz)

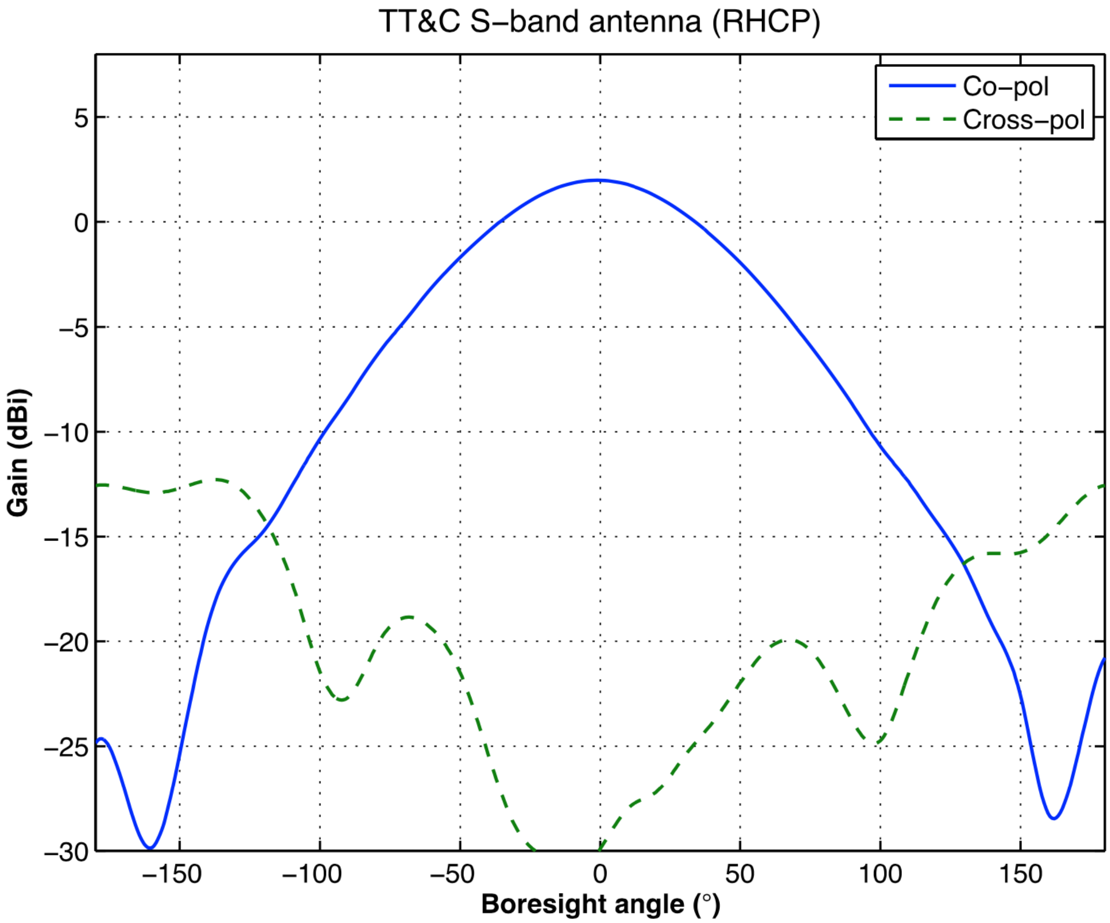


Figure 4. TT&C S-band receiver antenna pattern measurement (at 2081 MHz, applicable to other frequencies in the 2025 - 2110 MHz within ±1 dB of deviation)

EESS X-band TT&C transmitter (8025 – 8400 MHz)

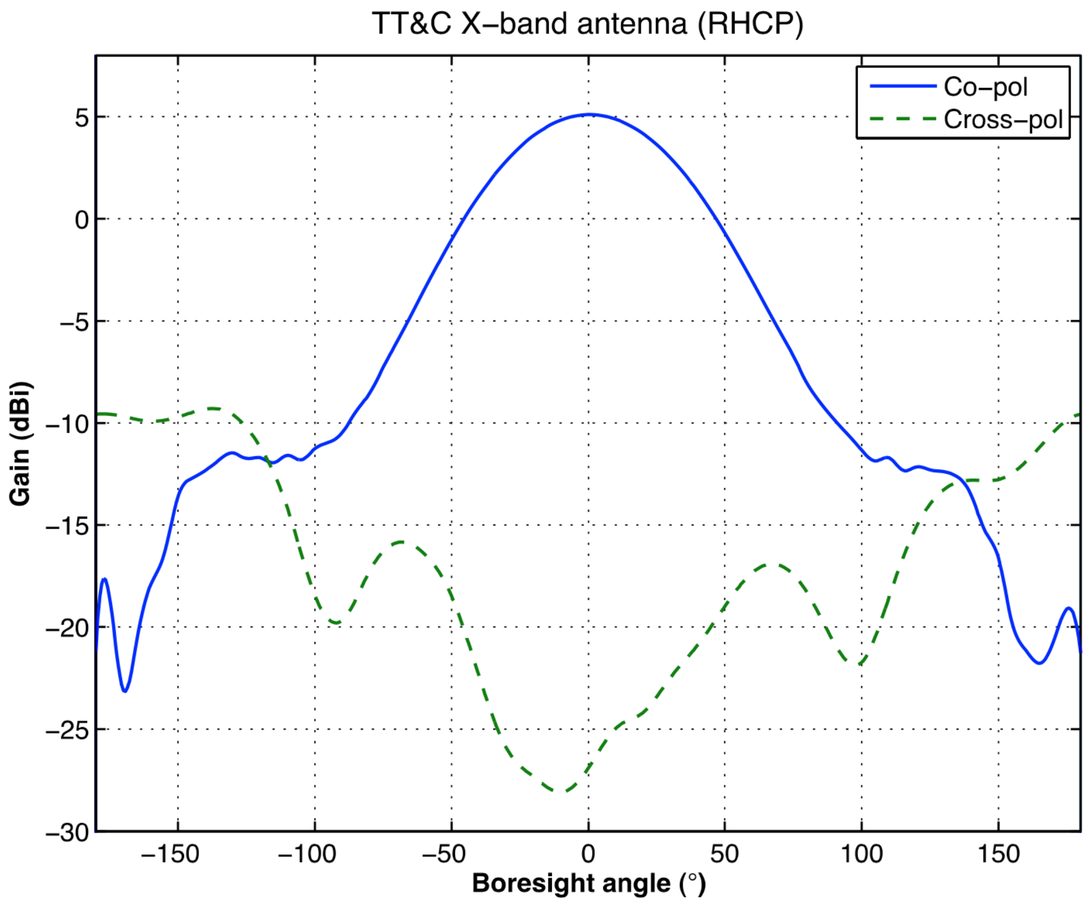


Figure 5. TT&C X-band transmitter antenna pattern measurement (at 8375 MHz, applicable to other frequencies in the 8025 - 8400 MHz within ±1 dB of deviation)

EESS Ka-band transmitter (25500 – 27000 MHz)

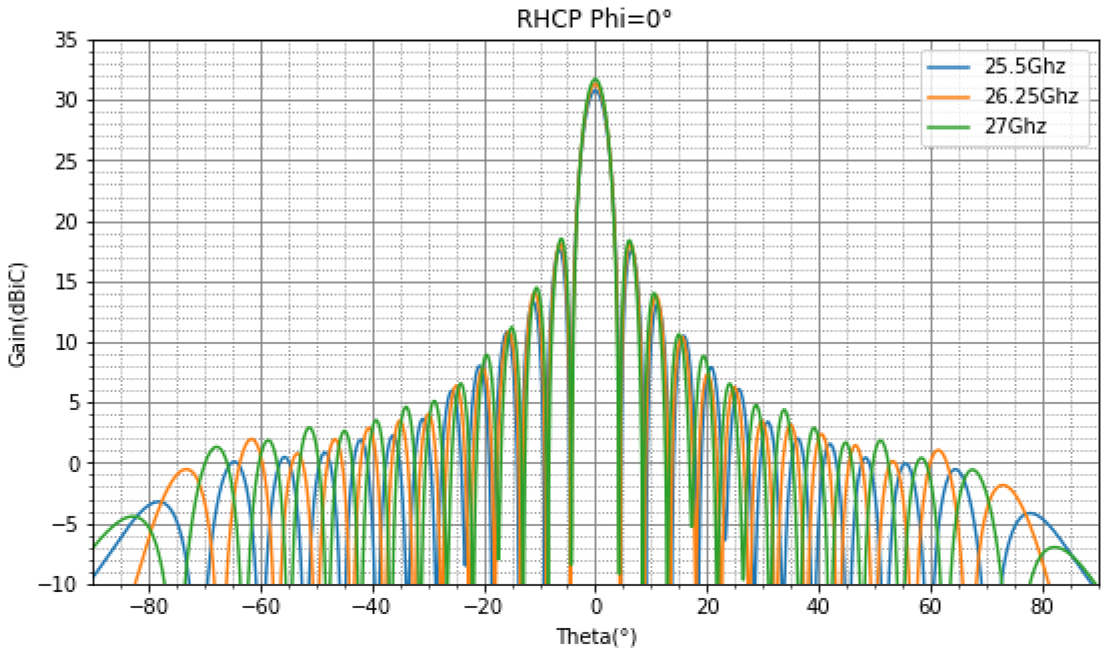


Figure 6. Downlink Ka-band transmitter RHCP antenna pattern simulation, ø cut at 0°

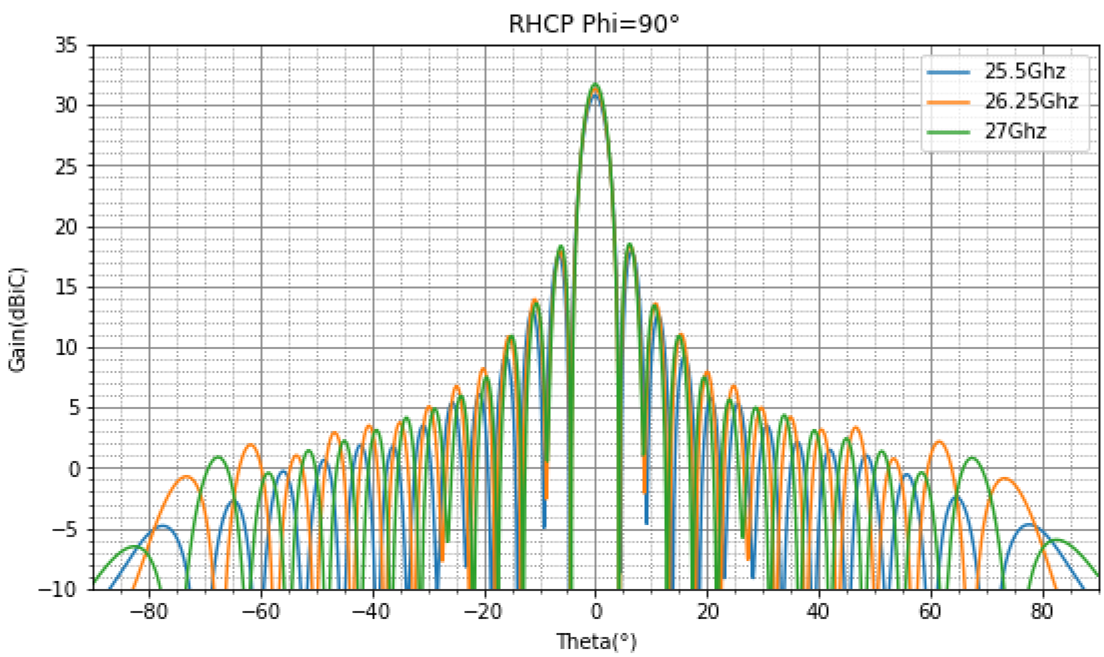


Figure 7. Downlink Ka-band transmitter RHCP antenna pattern simulation, ø cut at 90°

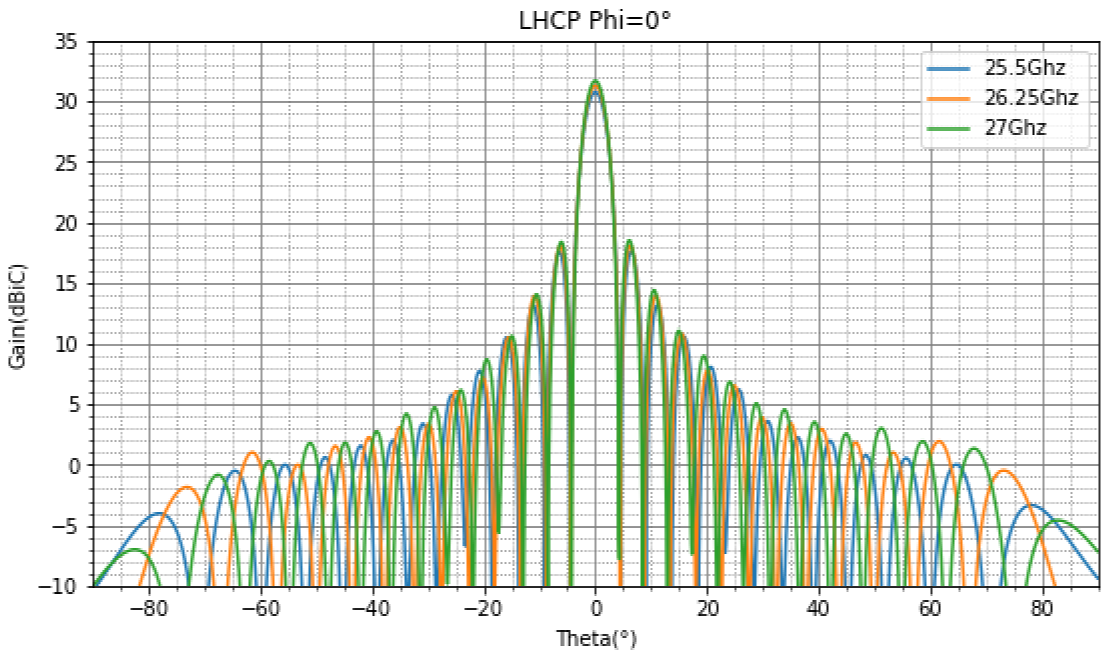


Figure 8. Downlink Ka-band transmitter LHCP antenna pattern simulation, ø cut at 0°

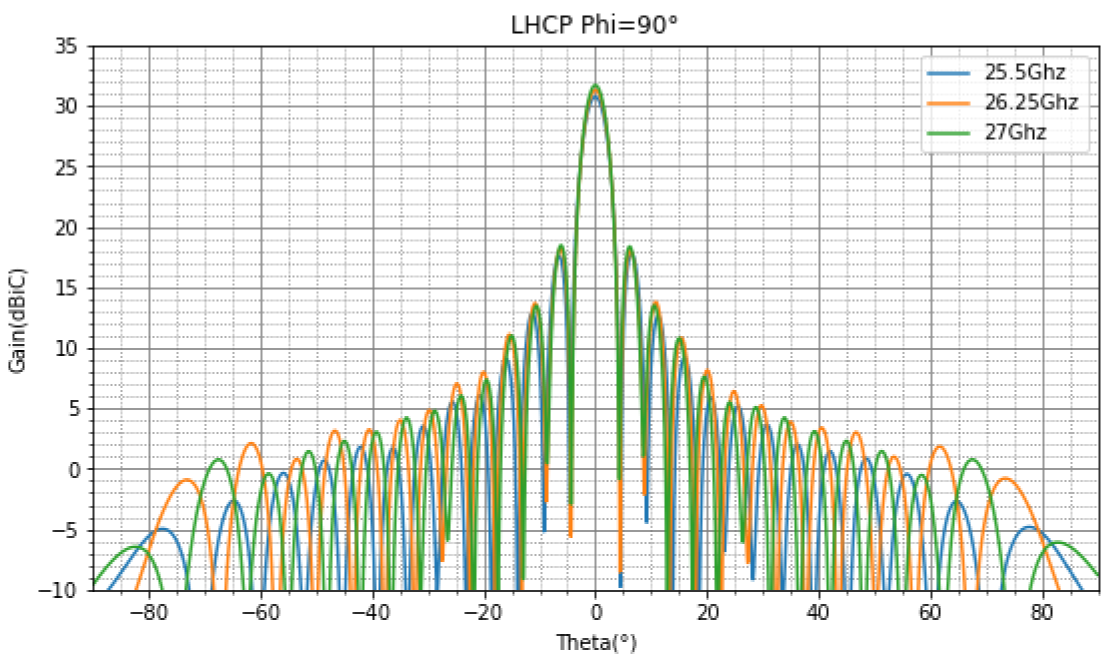
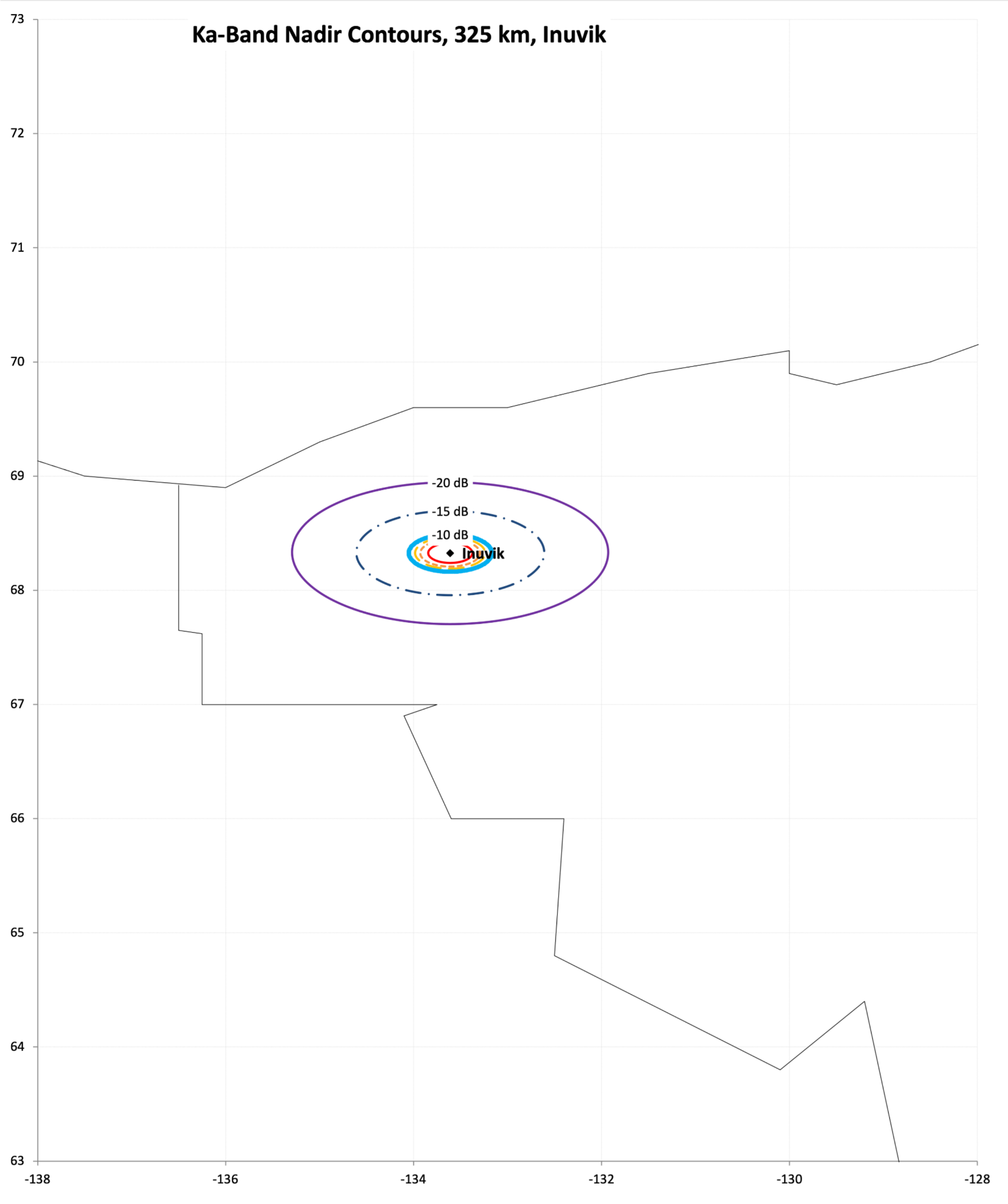


Figure 9. Downlink Ka-band transmitter LHCP antenna pattern simulation, ø cut at 90°

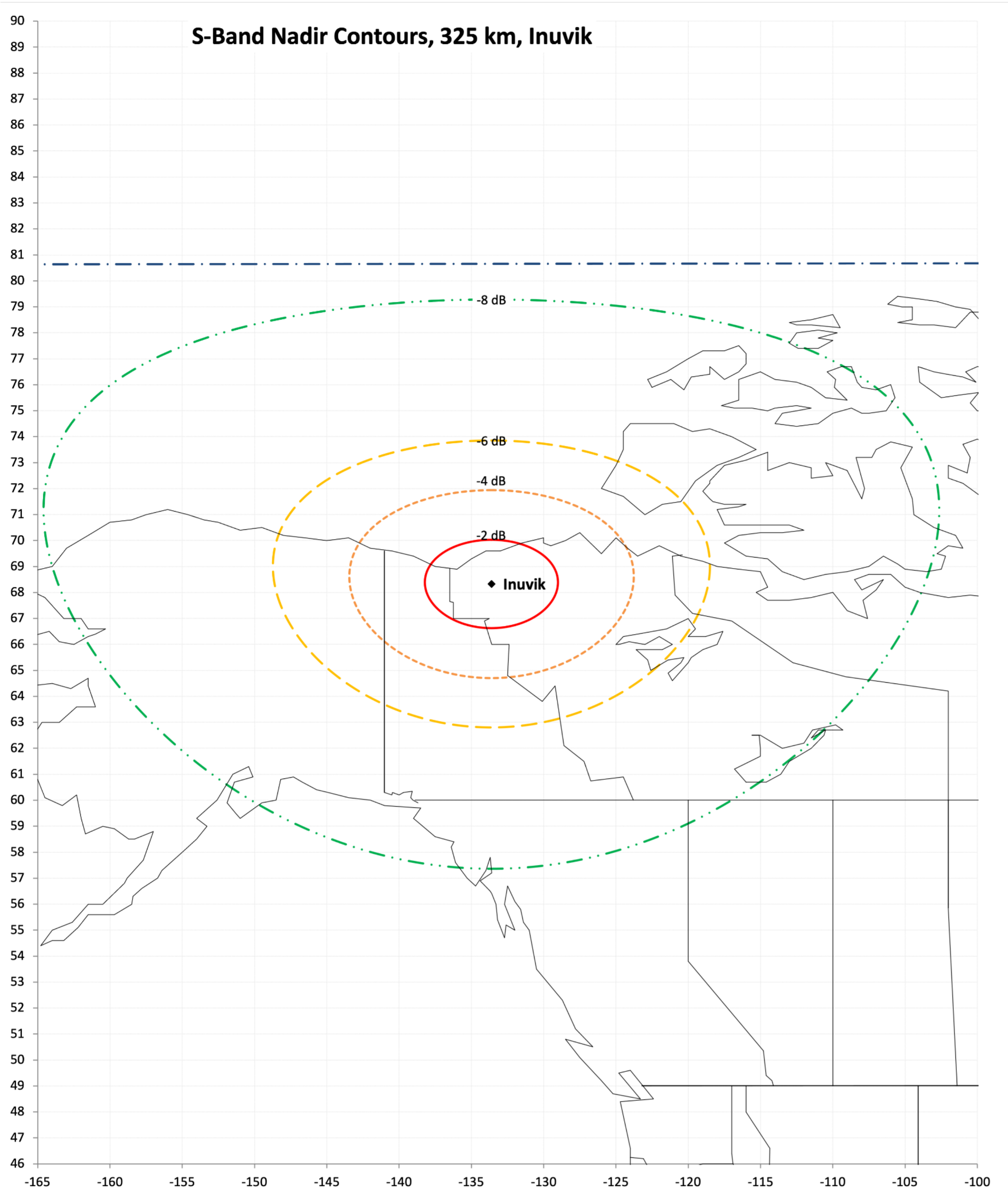
Attachment B
Predicted Gain Contours

Consistent with 47 C.F.R. § 25.114(c)(4)(vi)(B), below, Planet provides predicted antenna gain contours depicted on the surface of the earth at the anticipated initial earth station locations listed in Section 15. Planet provides contours for the nominal 325 km operational orbit. In cases where not all expected contours are visible on the map, it is because those contour lines do not intersect the planet (*i.e.*, they are greater than 180 degrees from nadir). The C-band antennas are not shown as they are pointed in the zenith direction away from the Earth and therefore will not have meaningful contours that intersect the Earth's surface.

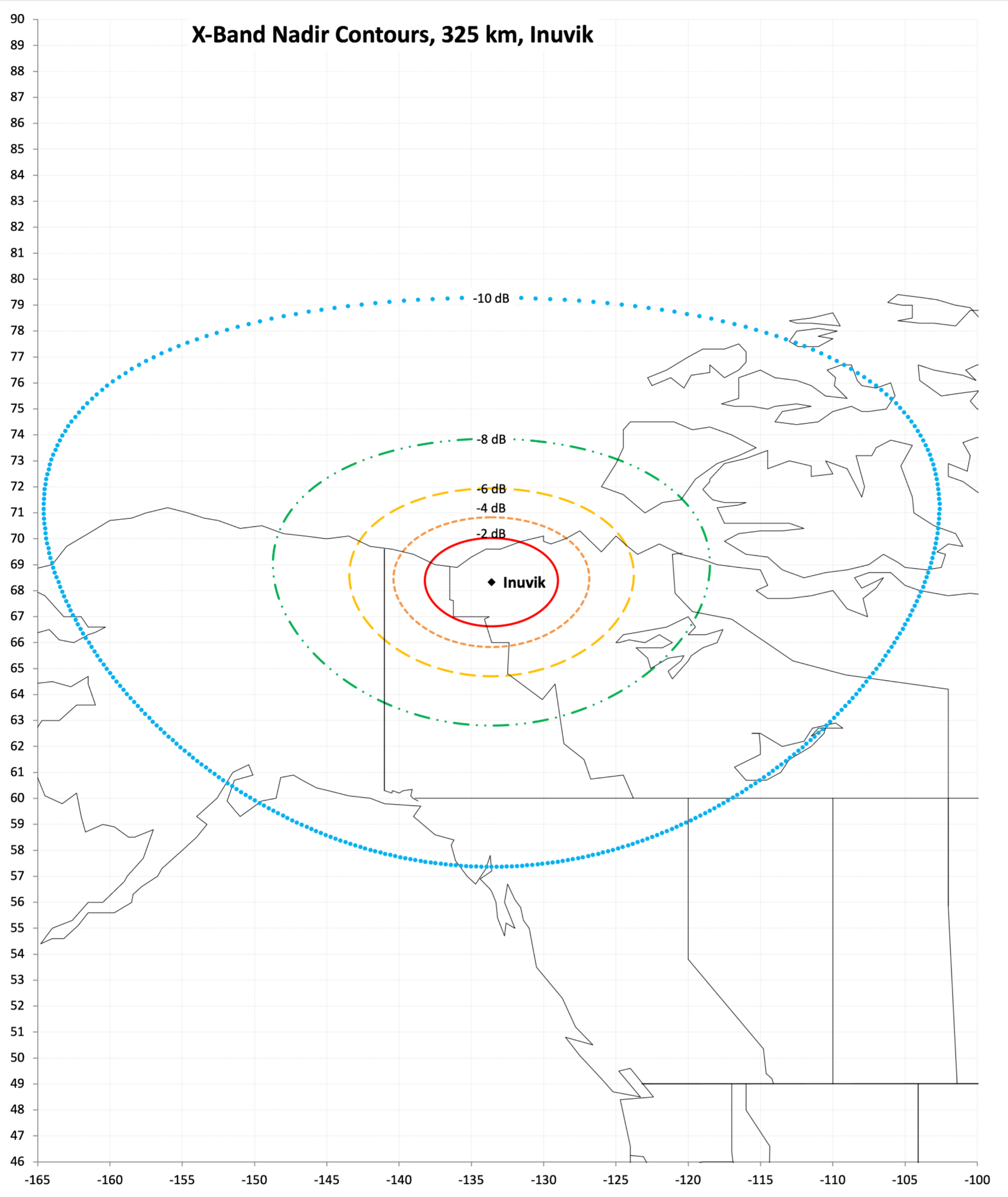
Inuvik 325 km Ka-band



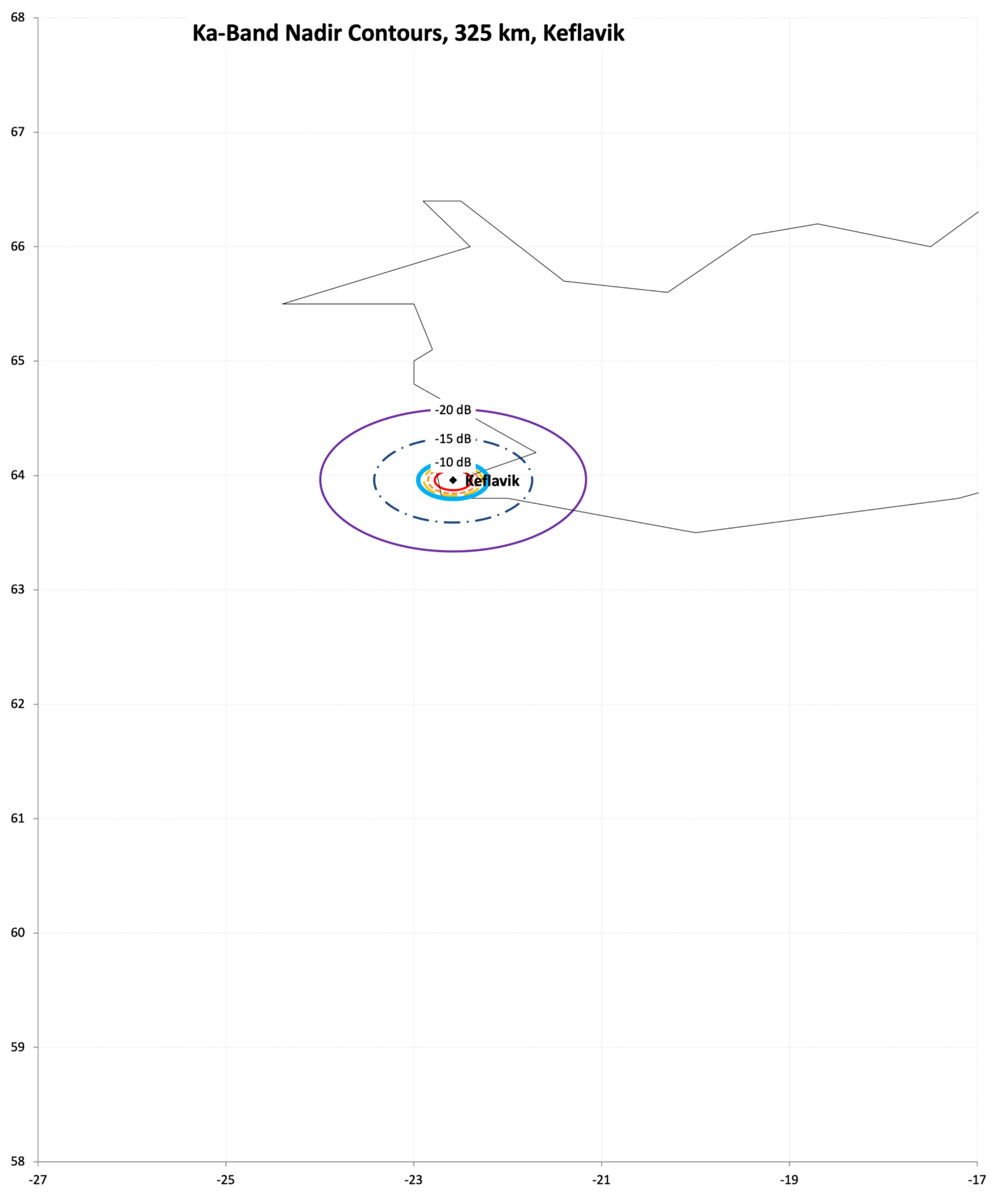
Inuvik 325 km S-band



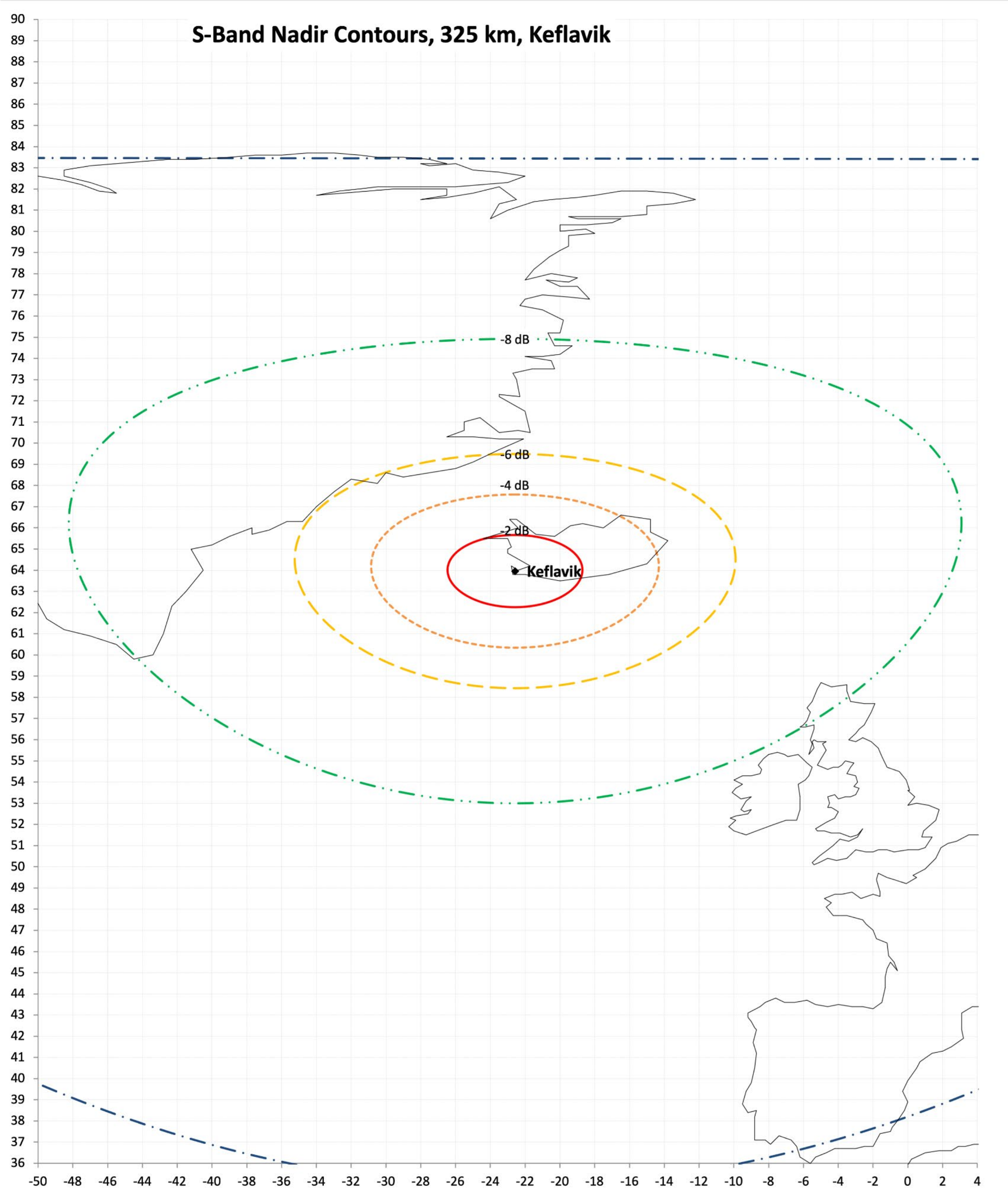
Inuvik 325 km X-band



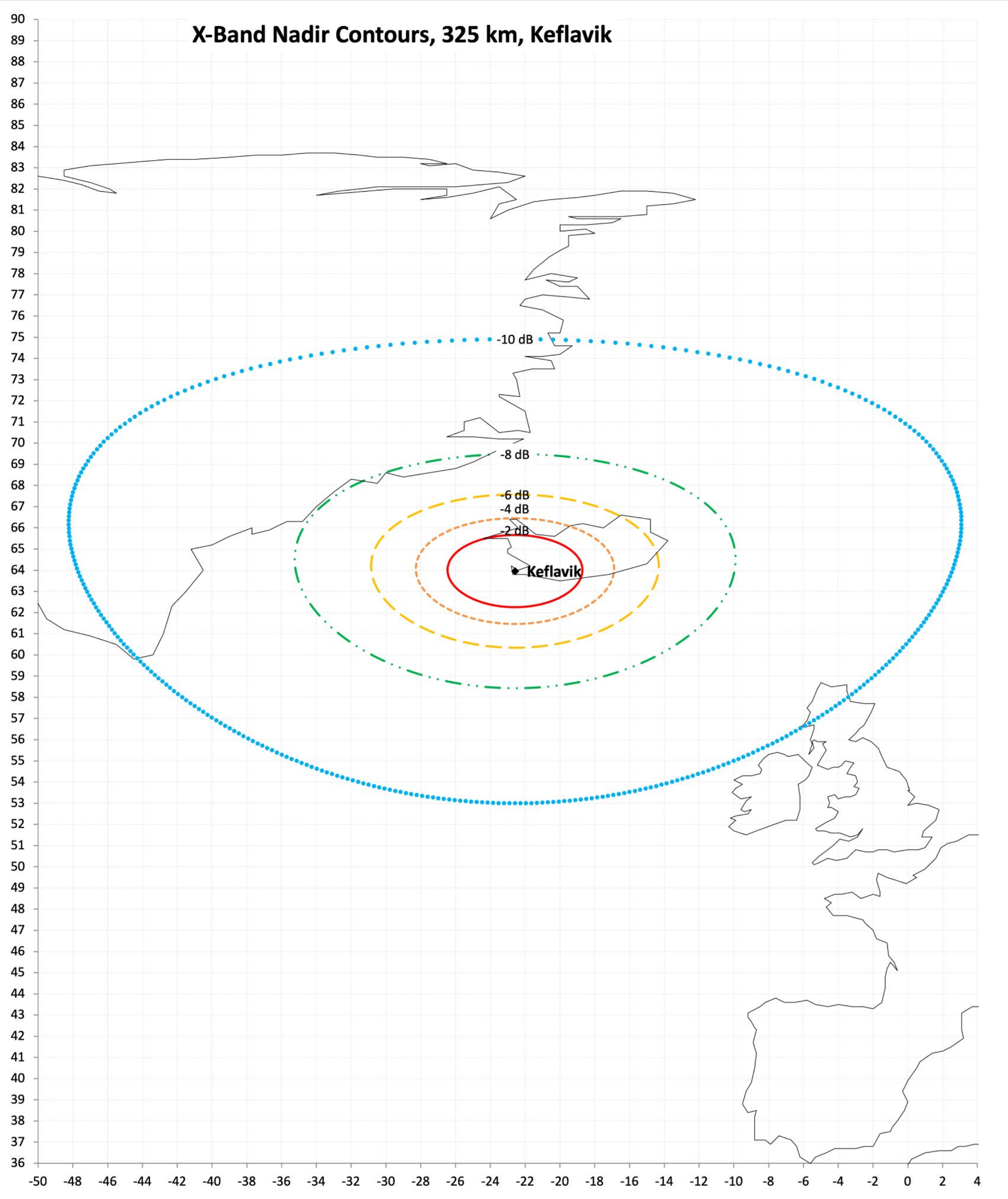
Keflavik 325 km Ka-band



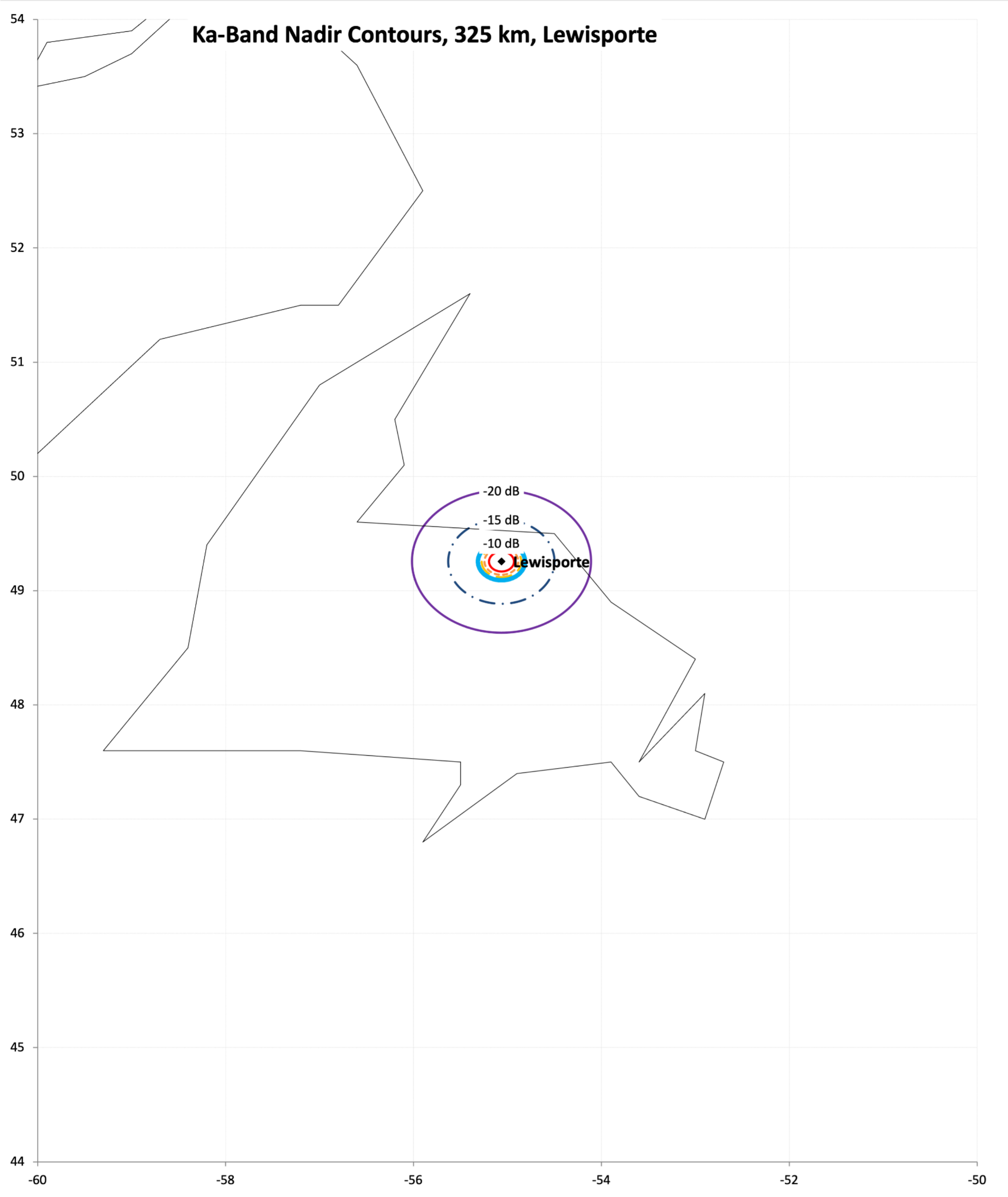
Keflavik 325 km S-band



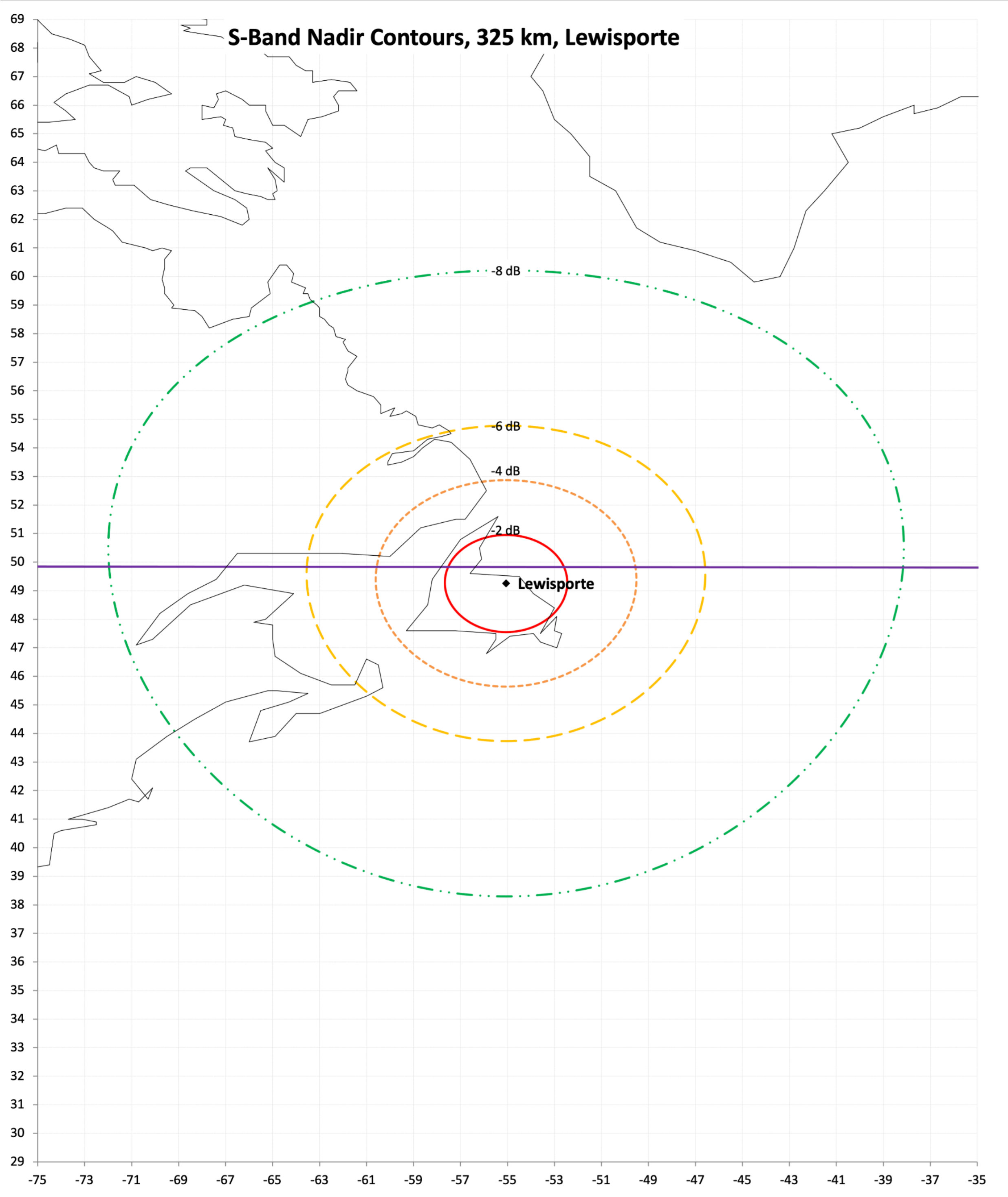
Keflavik 325 km X-band



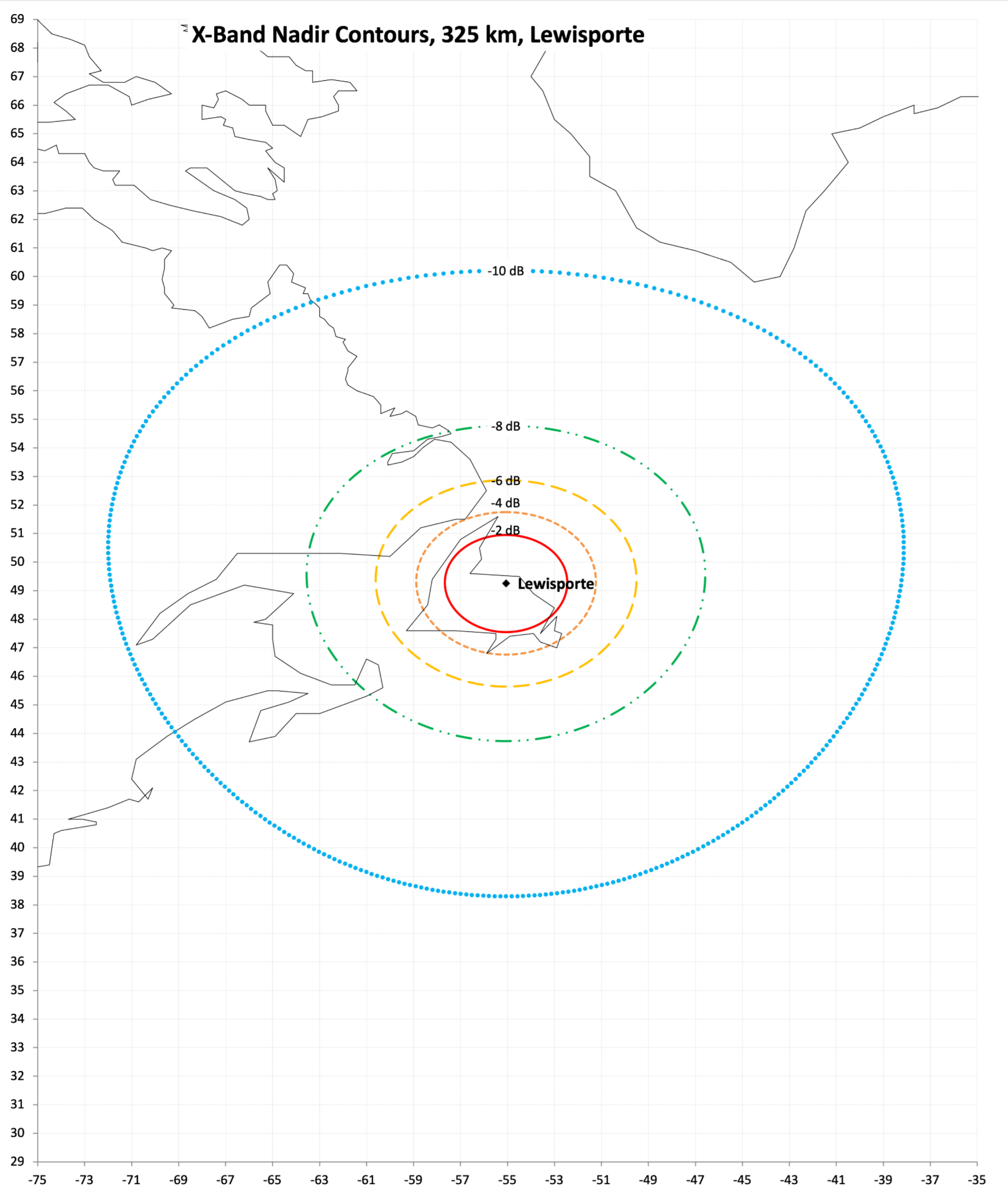
Lewisporte 325 km Ka-band



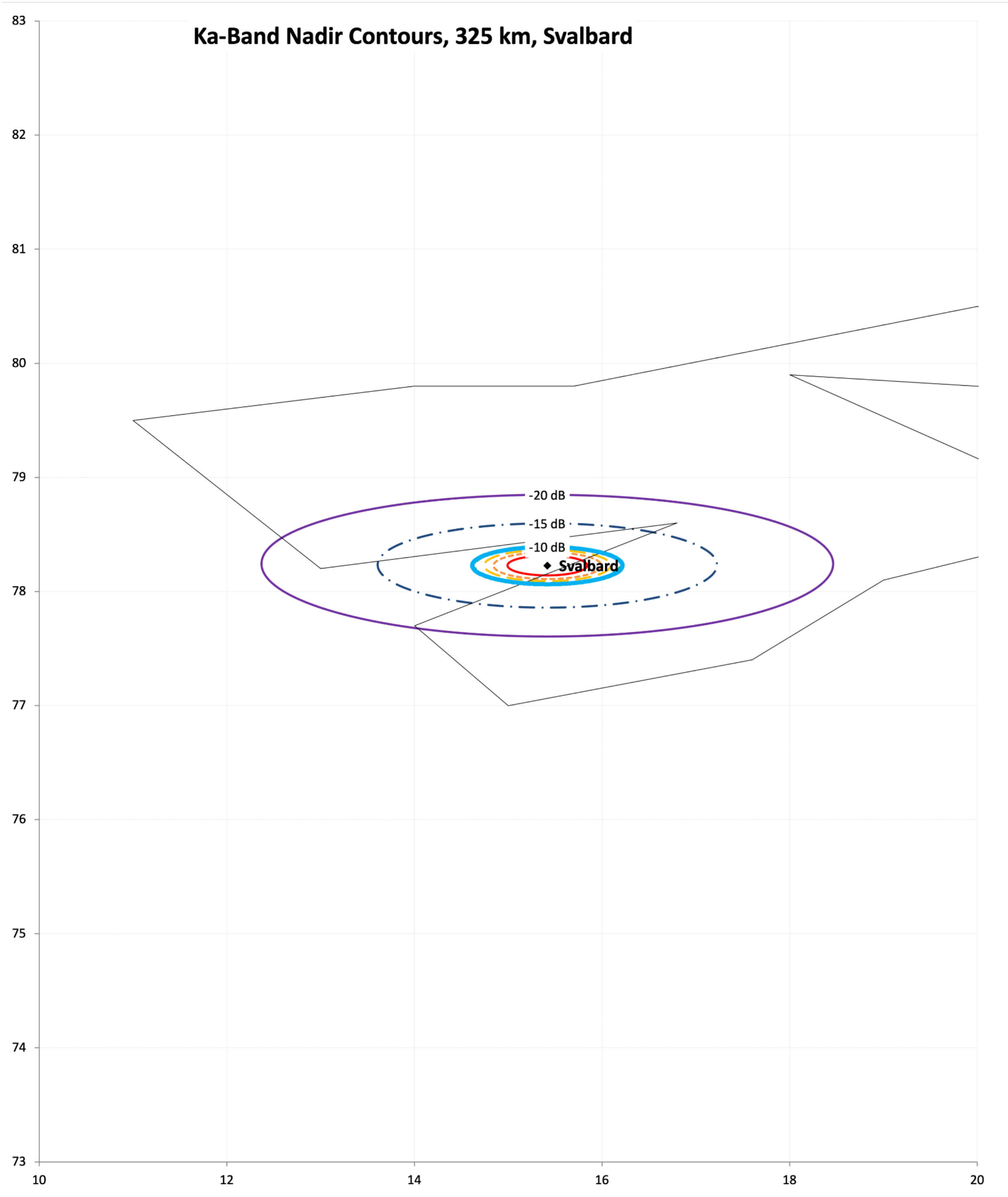
Lewisporte 325 km S-band



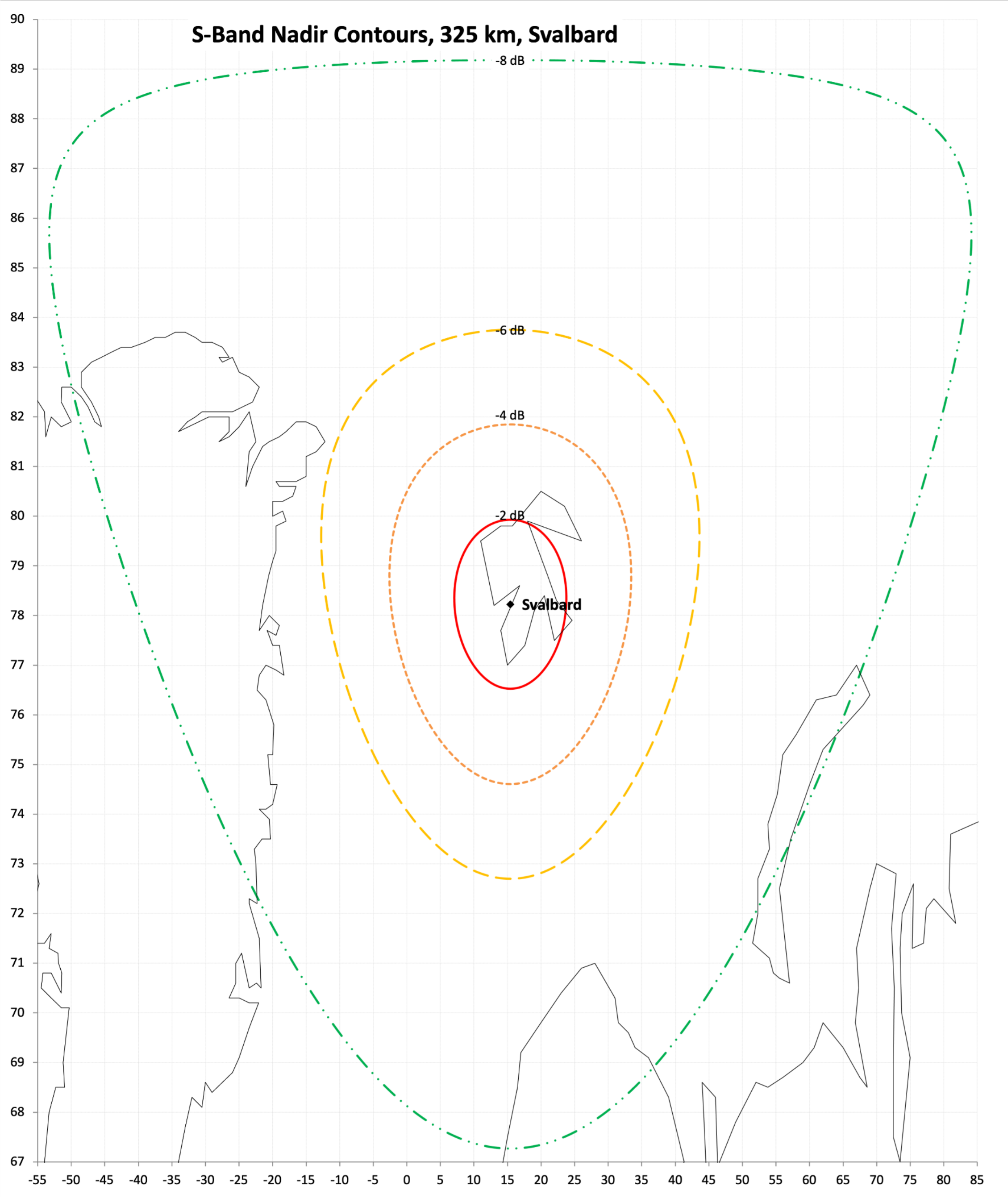
Lewisporte 325 km X-band



Svalbard 325 km Ka-band



Svalbard 325 km S-band



Svalbard 325 km X-band