Application for Special Temporary Authority

Blue Origin, LLC (Blue Origin) seeks Federal Communications Commission (Commission) authority to operate its previously-authorized DarkSky-1 (DS-1) spacecraft with modified parameters. The original application for special temporary authority for DS-1 was granted on Mar. 14, 2024, and a revised grant was issued on Sept. 25, 2024.[1] Since that time, minor changes to the mission have occurred. Accordingly, Blue Origin submits this application supplementing its previous application by:

- replacing the S-band and X-band antennas;[2]
- updating the corresponding transmit/receive antenna specifications;[3] and
- updating the mission trajectory.

Provided below are the revisions to the previously submitted information,[4] including the Power Flux Density (PFD) and Power Spectral Flux Density (PSFD) calculations, with changes denoted by **bold** text. As demonstrated below, updates to the mission trajectory and antenna parameters yield negligible differences in PFD and PSFD values, ensuring regulatory requirements are still met. The updates contemplated in this application are minor and do not alter the compliance status nor significantly alter the overall mission profile. All other aspects of the original application, including the ITU API information for the Darksky-1 network and the list of ground stations, remain the same. For these reasons, Blue Origin submits that the public interest would be served by expeditious grant of the application.

Other than the information provided here within, including the revised STA form, Blue Origin seeks no other changes to its authorization.[5]

I. Revision to Radio Frequency Plan

Table 1 was subject to a revision submitted on 21 March 2024. Please see page 2 of Appendix A for previous table. Following the recent update to the S-band and X-band antennas, further revisions to this table are now required. Updated portions of this table are reflected below. Other than the below changes, the information provided in Table 1 remains accurate.

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[1] *See* Grant, ELS File No. 0149-EX-ST-2024 (granted Mar. 14, 2024, reissued Sept. 25, 2024).
[2] *See* STA form.
[3] *See* Table 1 below.
[4] *See* ELS File No. 0149-EX-ST-2024.
[5] For ease of reference, previously submitted exhibits are submitted here within as Appendix A. Please note, the originally filed ground station exhibit and NTIA space record data form include ground stations that will no longer be used for this mission. This mission will now only use ground stations located in Mingenew, Australia, Paumalu, Hawaii, and Pendergrass, Georgia.

Table 1. Changes to Radio Frequency Plan

	Ranging Downlink	Ranging Uplink
Band	X-band	S-band
Frequency Range	8025-8300 MHz	2025-2110 MHz
Transmit Antenna Gain	**4.84** dBi	41 dBi
Transmit Antenna EIRP	**36.8** dBm	91 dBm
Receive Antenna Gain	53 dBi	**3.73** dBi
Receive Antenna G/T	31 dB/K	**-29.54** dB/K

II. Revised PFD at the Surface of the Earth in the Band 8025-8400 MHz

Please see revised **Figure 1** below for DS-1 PFD values as a function of elevation angle. Please see page 3 of Appendix A for the previous figure.

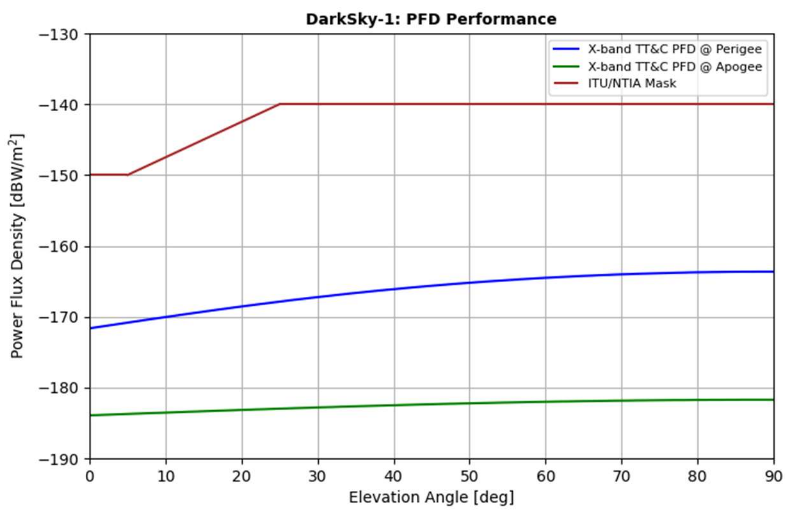

Figure 1. DS-1 PFD Performance

As shown in Figure 1 above, DS-1's PFD values are within the acceptable limits of Table 21-4 of the ITU Radio Regulations, in compliance with No. 21.16 of the ITU Radio Regulations.

III. Revised Power Flux Density at the GSO arc in the band 8025-8400 MHz

Given the replacement of the X-band antenna on the DS-1 satellite and the resulting changes in radiation patterns, we performed two key PFD calculations: one for a GSO satellite across the Earth's limb (Limb of Earth) and another for a GSO satellite directly behind DS-1 (Backlobe). The X-band antenna exhibits a symmetric, hemispherical radiation pattern, meaning peak gain could also be directed towards the GSO arc, depending on the satellite's attitude. Using the beam peak gain as a worst-case scenario for both cases, we confirm that the PFD limits are met with margin. The table below shows that the PFD produced by the transmissions from the TT&C transmitter on DS-1 does not exceed the limit in No. 22.5 of the ITU Radio Regulations under nominal operating conditions. Previous versions of this table reflected PFD compliance at apogee only. This table now includes PFD compliance at perigee, showing that the spacecraft will maintain compliance when it is closest to Earth. Please see page 4 of Appendix A for the previous table.

Table 2. Revised Power Spectral Flux Density at the Surface of the Earth in the band 8400-8450 MHz

	Limb of Earth, Apogee	Backlobe, Apogee	Limb of Earth, Perigee	Backlobe, Perigee
EIRP Density [dBW/4kHz]	**-61.05**	**-61.05**	**-61.05**	**-61.05**
Distance to GSO [km]	**66742**	**16726**	**47932**	**33596**
Spreading Loss [dB]	**167.5**	**155.46**	**164.6**	**161.5**
Max PFD in 4kHz at GSO [dB(W/m^2)/4kHz]	**-192.5**	**-180.5**	**-189.6**	**-186.6**
PFD limit in 4kHz at GSO [dB(W/m^2)/4kHz]	**-174**	**-174**	**-174**	**-174**
Margin to limit	**18.5**	**6.5**	**15.6**	**12.6**

IV. Revised Power Spectral Flux Density at the Surface of the Earth in the band 8400-8450 MHz

Blue Origin provides below revised compliance showings for Recommendation ITU-R SA-1157-1. This Recommendation specifies a maximum allowable interference PSFD at the Earth's surface to protect ground receivers in the deep-space research band operating in the 8400-8450 MHz frequencies.

Using revised power flux density (PFD) values from Section III, Blue Origin calculates a maximum PSFD at the Earth's surface of **–269.7 dB(W/m²/Hz)** at perigee and **–287.7 dB(W/m²/Hz)** at apogee, which is below the maximum allowable interference power spectral flux-density level at the Earth's surface of -255.1 dB(W/m²/Hz) at 8.4 GHz.

The maximum interference PSFD was calculated as follows:

- DS-1 maximum PFD (at the lowest transmitting altitude and including 6.1 dB of cable and splitter losses) = **-163.6 dB(W/m²· 4 kHz)** at perigee and **–181.72 dB(W/m²· 4kHz)** at apogee
- Total Attenuation at 8400 MHz relative to 8123.077 MHz (filtering and guard band) = at least 70 dB
- PSFD = PFD - 10*log(4000) - Attenuation

For the above reasons, there would be no interference to deep-space assets.

V. Revision to Narrative Mission Summary

Blue Origin makes the following updates to paragraph 3 on pg. 6 of Appendix A, Mission Summary.

> The DS-1 flight system, comprised of Blue Origin avionics equipment, is expected to be launched as a non-separable**, primary payload** on the upper stage of a National Security Space Launch-class launch vehicle ("LV") with an expected launch date in Q4 2024. The mission will be an elliptical medium Earth orbit ("MEO") of **approximately 19300 km apogee, 2400 km perigee, at an inclination of 30 degrees**.

VI. Revision to Exhibit B. Antenna Beam Information & Patterns

Following a change in the antennas, Blue Origin provides revised antenna patterns and makes the following changes to the antenna beam information provided in Exhibit B to the original application. Please see pages 14-16 of Appendix A for original antenna information.

Antenna Beam Information & Patterns

S-Band TT&C Uplink Antenna

Make / Model	**Beyond Gravity Sweden S-Band Low Gain Antenna**
Quantity	2
Purpose	TT&C Uplink
Operation Mode	Receive
Frequency (MHz)	2025 - 2100
Peak Gain (dBi)	**3.73**
Half-Power Beamwidth (degrees)	**164**
Orientation in Horizontal Plane	Hemispherical
Orientation in Vertical Plane	
Polarization	Right

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Standalone Antenna Performance</td>
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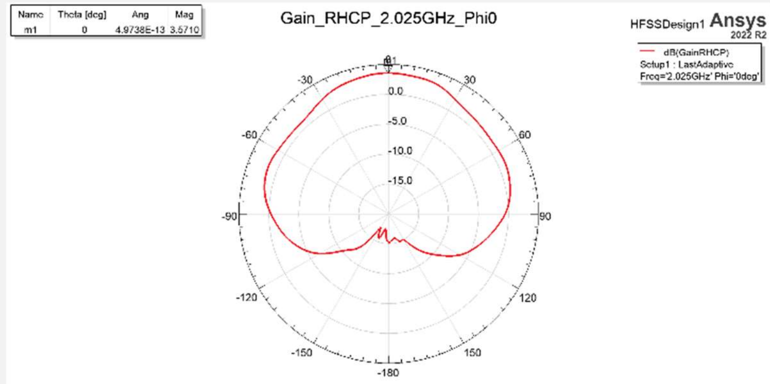

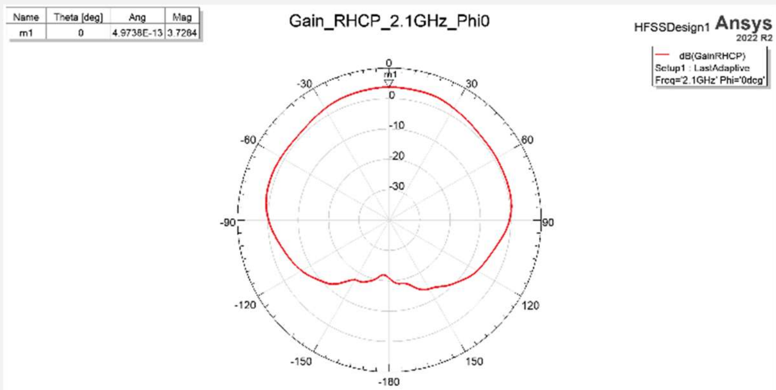

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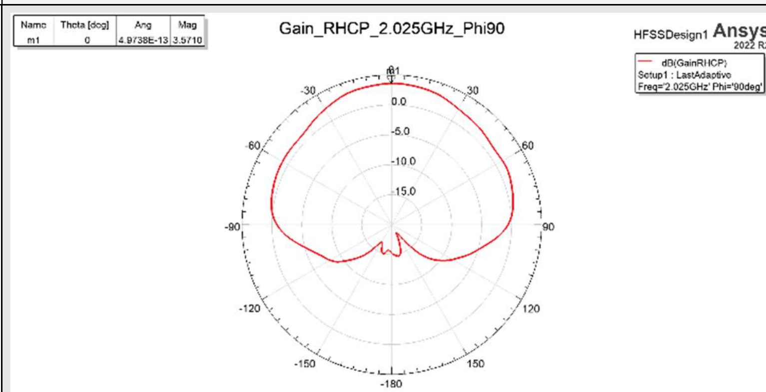

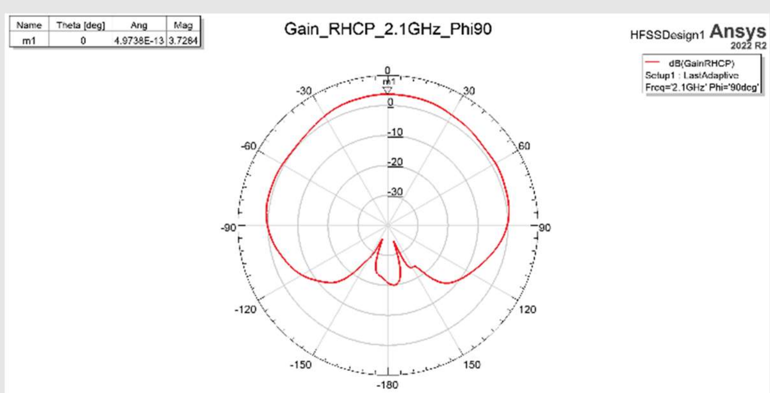

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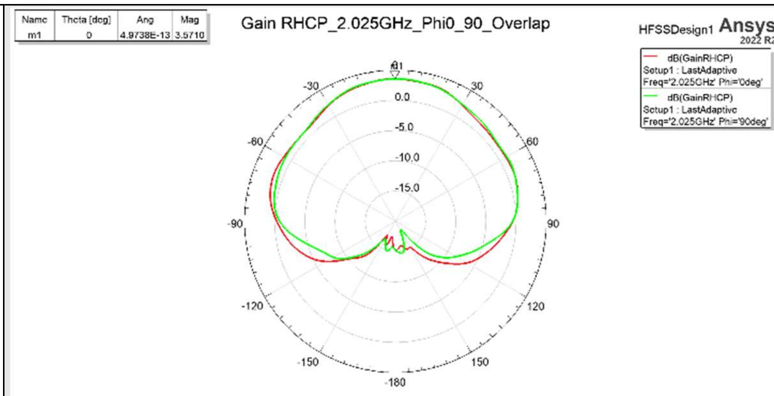
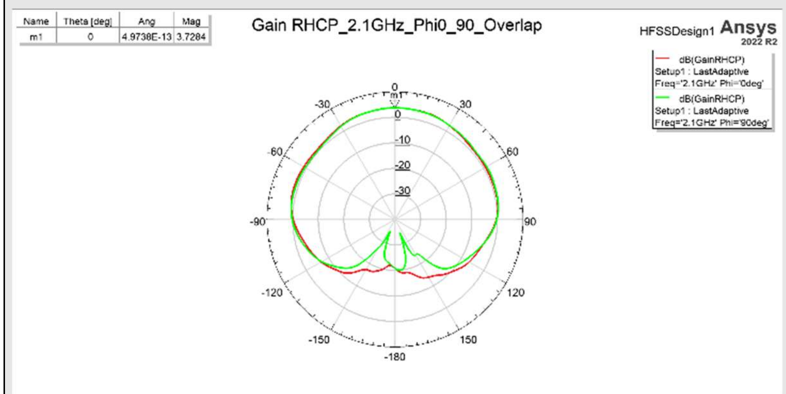
Performance of two antennas combined and mounted on DS1

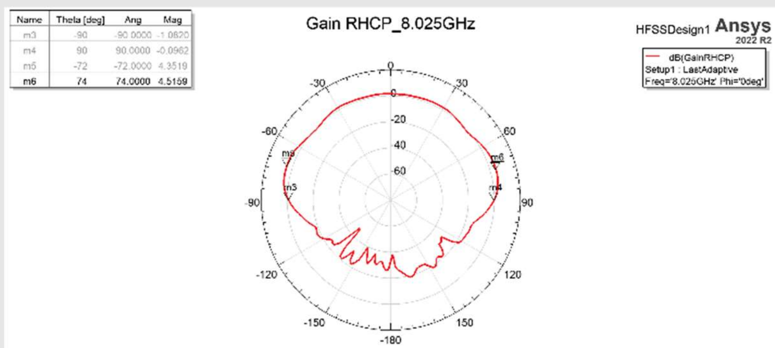


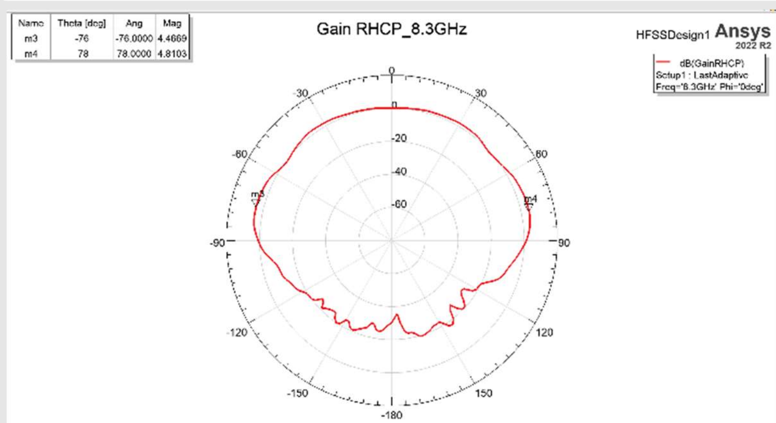


X-Band TT&C Downlink Antenna

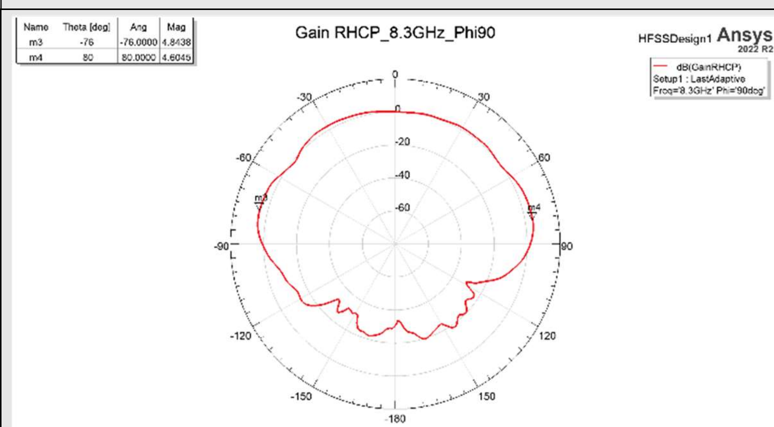
Make / Model	**Beyond Gravity Sweden X-Band Low Gain Antenna**
Quantity	2
Purpose	TT&C Downlink
Operation Mode	Transmit
Frequency (MHz)	8025-8300
Peak Gain (dBi)	**4.84**
Half-Power Beamwidth (degrees)	**102**
Orientation in Horizontal Plane	Hemispherical
Orientation in Vertical Plane	
Polarization	Right

Graphic (Phi = 0)
Standalone Antenna Performance



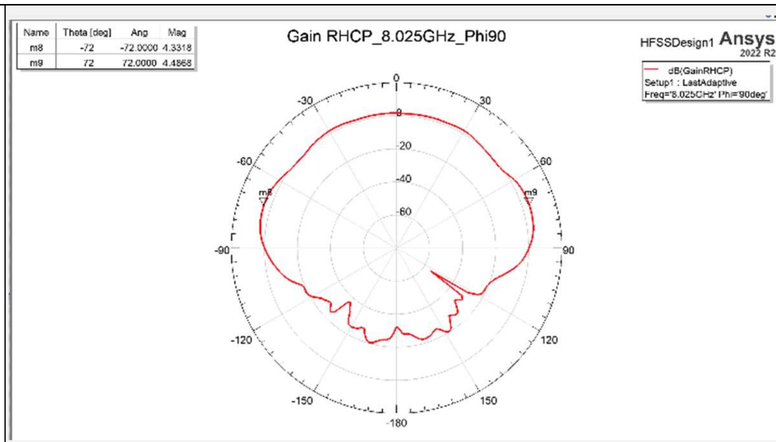


Graphic (Phi = 90)
Standalone Antenna Performance



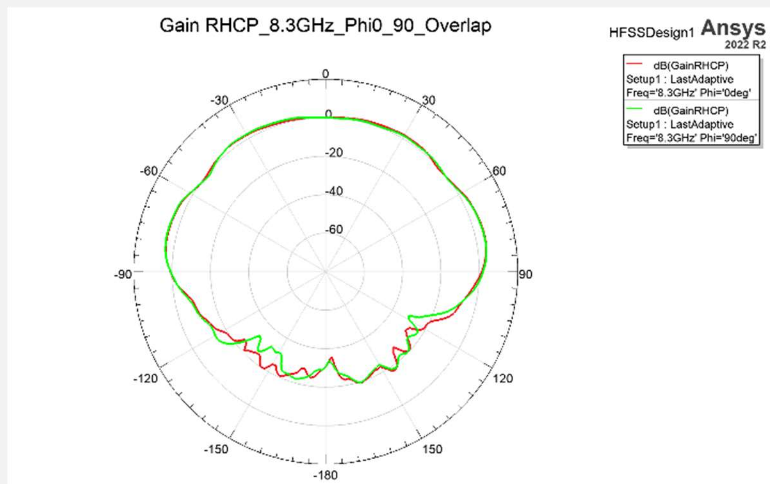
Graphic (Phi = 90)

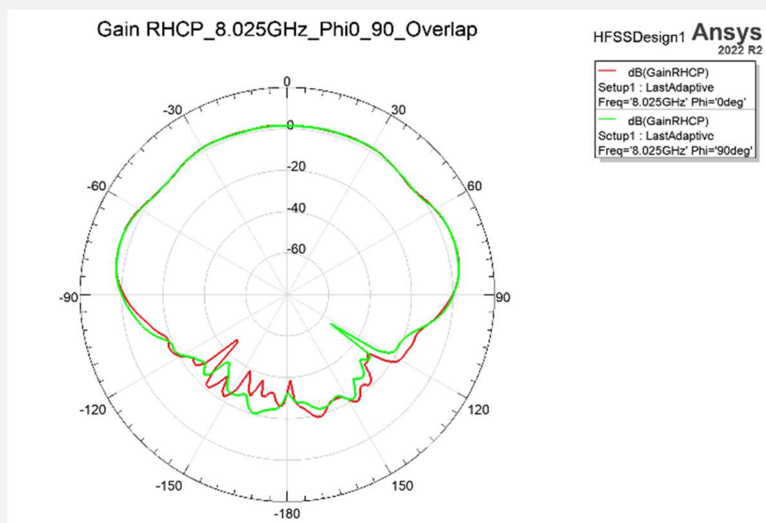
Standalone Antenna Performance (con’t)



Graphic (Phi = 0 & 90 overlap)

Performance of two antennas combined and mounted on DS1





VII. Revision to Exhibit E. NTIA Space Record Data Form

Following changes in the antennas and trajectory, as well as a reduction in ground stations, Blue Origin provides a revised Exhibit E to the original application. Please see pages 23-70 of Appendix A for the NTIA Space Record Data Form.

NTIA Space Record Data Form

NTIA requires the following data for space related experiments using government shared spectrum. For each transmit frequency, please provide the data for both ends of the transmit-receive link. Use Part A to describe the satellite to ground information. Part B is for all space to space transmit links. Part C is for all ground to space transmit links.

Part A: Space to Earth Downlink Data

Transmit Frequency: 8025-8300 MHz		
Satellite Name: DarkSky-1		
Data Field	**Data Answer**	**Description/Comments**
Polarization (XAP)	XAP = R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Orientation (XAZ)	XAZ = EC	NB= NARROWBEAM EC = EARTH COVERAGE
Antenna Dimension (XAD)	ANTENNA GAIN(dBi) 4.84 dbi BEAMWIDTH@ ½ Power 102 degrees XAD = XAD01 4.8G102B	(NTIA format (XAD), EXAMPLE, XAD01 16G030B)

Type of satellite (State = SP)	Type = Nongeostationary	Choose either: Geostationary or Nongeostationary

(City = geo or non)		
For Geostationary	Longitude = [ ]	IF ANY SATELLITES ARE GEOSTATIONARY, REPORT ITS LATITUDE AS 000000N (XLA AND/OR RLA) AND REPORT ITS LONGITUDE (XLG AND/OR RLG).
For Nongeostationary (Orbital Data)	INCLINATION ANGLE 30 degrees, APOGEE IN KILOMETERS 19300 km, PERIGEE IN KILOMETERS 2400 km, ORBITAL PERIOD IN HOURS 6 AND FRACTIONS OF HOURS IN DECIMAL .25, THE NUMBER OF SATELLITES IN THE SYSTEM 1, ORB = 0030IN19300AP02400PE0006.25H01NRT01	IF ANY SATELLITES ARE NONGEOSTATIONARY, REPORT ITS INCLINATION ANGLE, APOGEE IN KILOMETERS, PERIGEE IN KILOMETERS, ORBITAL PERIOD IN HOURS AND FRACTIONS OF HOURS IN DECIMAL, THE NUMBER OF SATELLITES IN THE SYSTEM, THEN T01, EXAMPLE, REM04 *ORB,98.0IN00510AP00510PE001.58H01NRT01, AND FOR SPACE-TO-SPACE COMMUNICATIONS WITH ANOTHER NONGEOSTATIONARY SATELLITE ADD AN ADDITIONAL *ORB FOR IT ENDING IN R01, EXAMPLE, REM05 *ORB,72.9IN03209AP00655PE013.46H01NRR01

Earth Station Data (Receiver 1) – Hawaii		
State (RSC)	RSC = Hawaii	
City Name (RAL)	RAL = Paumalu	

Latitude (DDMMSS)	Lat = 214014 N	
Longitude (DDDMMSS)	Lon = 1580208 W	

Antenna Polarization (RAP)	RAP = RAP01 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ01 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 53.6 BEAMWIDTH@ ½ Power 0.35 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 149.6 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 6meters RAD = RAD01 53.6G0.4B000-360A00149.6H006	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006
Earth Station Data (Receiver 2) – Mingenew		
State (RSC)	RSC = Australia	
City Name (RAL)	RAL = Mingenew	

Latitude (DDMMSS)	Lat = 290037 S	
Longitude (DDDMMSS)	Lon = 1152030 E	

Antenna Polarization (RAP)	RAP = RAP02 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ02 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 50.0 , BEAMWIDTH@ ½ Power 0.51 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 244 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 4 meters RAD = RAD02 50G0.5B000-360A00244H004	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006
Earth Station Data (Receiver 3) – Georgia		
State (RSC)	RSC = Georgia	
City Name (RAL)	RAL = Pendergrass	

Latitude (DDMMSS)	Lat = 341028 N	
Longitude (DDDMMSS)	Lon = 830018 W	

Antenna Polarization (RAP)	RAP = RAP03 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ03 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 51.0, BEAMWIDTH@ ½ Power 0.4 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 204.8 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 4 meters RAD = RAD03 51G0.4B000-360A00204.8H004	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Part C: Ground Stations, Earth to Space link data:

The proposed Blue Origin system will receive transmissions from Ground Stations on the following frequencies. However, in each case, these transmissions will be permitted by authorizations held by third parties. Because the Blue Origin system will not transmit on these frequencies, Blue Origin is not seeking corresponding experimental authorization to engage in these transmissions. These receive-only frequencies are listed here for informational purposes only.

- 2025-2100 MHz - Earth to Space

Earth Station Data (Transmitter 1) - Hawaii

State (XSC)	XSC = Hawaii	
City Name (XAL)	XAL = Paumalu	
Latitude (DDMMSS)	Lat = 214014 N	
Longitude (DDDMMSS)	Lon = 158208 W	
Antenna Polarization (XAP)	XAP = XAP01 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ01 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 39.4, BEAMWIDTH@ ½ Power 1.0 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 149.6 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 6 meters XAD = XAD01 39G1.4B000-360A00149.6H006	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Earth Station Data (Transmitter 2) - Mingenew

State (XSC)	XSC = Australia	
City Name (XAL)	XAL = Mingenew	
Latitude (DDMMSS)	Lat = 290037 S	
Longitude (DDDMMSS)	Lon = 1152030 E	
Antenna Polarization (XAP)	XAP = XAP02 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ02 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 35.1 , BEAMWIDTH@ ½ Power 1.9 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 244 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 4 meters XAD = XAD02 35G1.9B000-360A00244H004	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Earth Station Data (Transmitter 3) - Georgia		
State (XSC)	XSC = Georgia	
City Name (XAL)	XAL = Pendergrass	
Latitude (DDMMSS)	Lat = 341029 N	
Longitude (DDDMMSS)	Lon = 830018 W	
Antenna Polarization (XAP)	XAP = XAP03 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ03 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 38.1, BEAMWIDTH@ ½ Power 1.9 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 204.8 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 4 meters	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

	XAD = XAD03 38G1.9B000-360A00204.8H004	

Respectfully Submitted,

/s/ Kaitlyn Mahoney

KAITLYN MAHONEY
Regulatory Counsel

Appendix A. Previous Submittals

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Washington, D.C. 20004
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March 21, 2024

VIA ELECTRONIC FILING
Marlene H. Dortch
Secretary
Federal Communications Commission
45 L Street, NE
Washington, DC 20554

Re: Blue Origin, LLC
ELS File No. 0149-EX-ST-2024

Dear Ms. Dortch:

By this letter, Blue Origin, LLC ("Blue Origin"), through its counsel, revises the above-referenced pending application. Specifically, the X-band channel bandwidth required for the DarkSky-1 ("DS-1") mission is 6.01 MHz, not 1.4 MHz. Provided below are updates to the narrative to reflect this change (*i.e.*, the radio frequency plan, the power flux density ("PFD") calculations, and the power spectral flux density ("PSFD") calculation). For the same reason, Blue Origin is contemporaneously amending its application form and submitting revised ITU API files. Additionally, the revised application form has been updated to reflect a launch timeframe of 12/1/2024 to 4/1/2025 rather than Q4 2024.

Table 1. Radio frequency plan (revised March 2024)

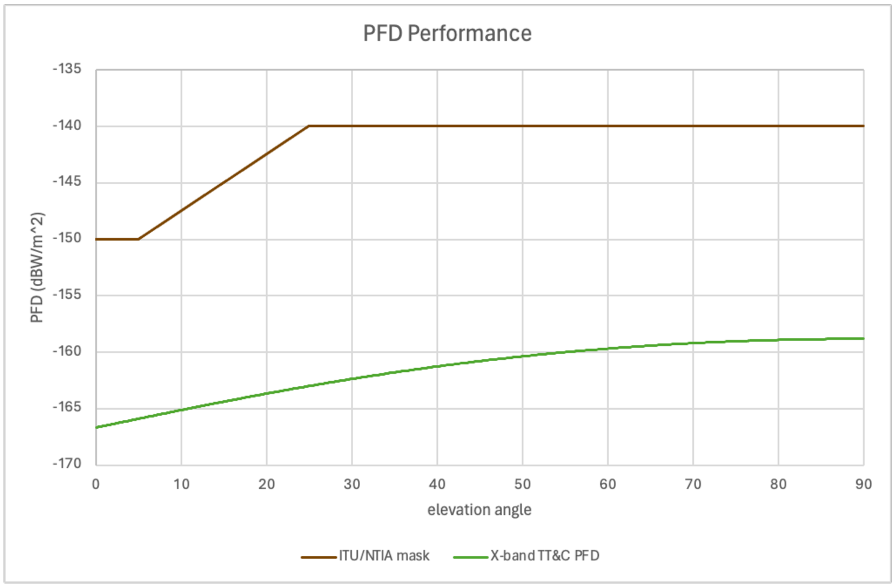
	Ranging Downlink	**Ranging Uplink**
Band	X-band	S-band
Frequency Range	8025-8300 MHz	2025-2110 MHz
Center Frequency[1]	8123.077 MHz	2040 MHz
Bandwidth	6.01 MHz	2.0 MHz
Modulation	PCM/PSK/PM + subcarrier TLM	PCM/PSK/PM + subcarrier CMD
Data Rate	2 kbps on 3 MHz subcarrier	2 kbps on 16 kHz subcarrier
Transmit RF Power	5 W per antenna (10W total)	100 W
Transmit Antenna Gain	6.98 dBi	41 dBi
Transmit Antenna EIRP	46.98 dBm	91 dBm
Receive Antenna Gain	53 dBi	7.98 dBi
Receive Antenna G/T	31 dB/K	-25 dB/K

[1] The identified center frequencies are representative frequency channels. As a result of spectrum discussions with federal spectrum managers, Blue Origin may select another channel within the identified frequency bands for its operations.

Max Transmission Duration per Pass	5 hours	5 hours
Duty Cycle	Continuous downlink	Continuous Uplink

Revised Power Flux Density at the Surface of the Earth in the band 8025-8400 MHz

Blue Origin provides below a revised Figure 1. DS-1 PFD values as a function of elevation angle.



As shown in Figure 1 above, DarkSky-1's PFD values are within the acceptable limits of Table 21-4 of the ITU Radio Regulations, in compliance with No. 21.16 of the ITU Radio Regulations.

Revised Power Flux Density at the GSO arc in the band 8025-8400 MHz

Blue Origin provides below a revised maximum PFD calculation at the GSO arc in the 8025-8400 MHz band. The calculation below shows that the PFD produced by the transmissions from the TT&C transmitter on DarkSky-1 does not exceed the limit in No. 22.5 of the ITU Radio Regulations under nominal operating conditions.

The PFD at the GSO produced by the DarkSky-1 X-band transmission is:

$$PFD = EIRPD(\phi) - 10log(4 * \pi * d^2)$$

where:

$EIRPD(\phi)$: the DarkSky-1 EIRP density in the direction of the GSO arc at off-axis angle ϕ with units in dBW/4 kHz, and,

d: the distance, in meters, between DarkSky-1 and the GSO arc.

Since the GSO arc will be visible to the DarkSky-1 satellite at many off-axis angles, two representative calculations are performed based on the nominal operating behavior of the DarkSky-1 satellite. Under nominal operations, the X-band antenna beam peak will be pointed toward the Earth such that the off-axis gain in the direction of the GSO arc will be less than the beam peak gain.[2] The limb of the Earth column represents the highest off-axis antenna gain, but maximum distance, toward the GSO arc while the backlobe represents a low off-axis antenna gain, but minimum distance toward the GSO arc. In both cases, the PFD limit is met with margin to spare.

Revised Table 1. Maximum PFD at GSO arc in 8025-8400 MHz band at three representative off-axis angles.

	Limb of Earth	Backlobe
EIRP Density [dBW/4kHz]	-16.3	-31.8
Distance to GSO [km]	68300	14789
Spreading Loss [dB]	167.7	154.4
Max PFD in 4kHz at GSO [dB(W/m^2)/4kHz]	-183.9	-186.2
PFD limit in 4kHz at GSO [dB(W/m^2)/4kHz]	-174	-174
Margin to limit	9.9	12.2

Revised Power Spectral Flux Density at the Surface of the Earth in the band 8400-8450 MHz

Blue Origin provides below revised compliance showings for Recommendation ITU-R SA-1157-1. This Recommendation specifies a maximum allowable interference PSFD at the Earth's surface to protect ground receivers in the deep-space research band operating in the 8400-8450 MHz frequencies. Blue Origin complies with this requirement by using a combination of baseband digital filtering and hardware radio frequency filtering, which is projected to provide 70 dB of filtering. Moreover, under nominal operating conditions, Blue Origin's highest band edge is more than 200 MHz below the lowest band edge for the 8400-8450 MHz band, which would result in further attenuation.

Blue Origin calculates a maximum PSFD at the Earth's surface of -264.8 dB(W/m^2 / Hz), which is below the maximum allowable interference power spectral flux-density level at the Earth's surface of -255.1 dB(W/m^2/Hz) at 8.4 GHz. The maximum interference PSFD was calculated as follows:

> DS-1 maximum PFD (at the lowest transmitting altitude and including 5 dB of cable and splitter losses) = -158.8 dB(W/m^2*4 kHz)
> Total Attenuation at 8400 MHz relative to 8123.077 MHz (filtering and guard band) = at least 70 dB
>
> PSFD = PFD - 10*log(4000) - Attenuation
> PSFD = -158.8 dB(W/m^2/4000 Hz) - 10*log(4000) dB – 70 dB
> PSFD = -264.8 dB(W/m^2/Hz)

For the above reasons, there would be no interference to deep-space assets.

Respectfully submitted,

/s/Tony Lin

Tony Lin
Counsel to Blue Origin

[2] *See* Exhibit B for the X-band antenna pattern data.

Application for Experimental License

Table of Contents

I. Mission Summary

By this application, Blue Origin, LLC ("Blue Origin") seeks Federal Communications Commission ("FCC") authorization to conduct a demonstration satellite mission, DarkSky-1 ("DS-1"). The DS-1 mission is partially funded by the United States Government, Washington Headquarters Services, under Agreement No. HQ00342190001, a 10 U.S.C. § 4022 (formerly 2371b) prototype Other Transaction award for the "Multi-Orbital Logistics" Area of Interest. Through the Defense Innovation Unit ("DIU"), the sponsoring Government entity, the Department of Defense ("DoD") is seeking commercial space logistics services to enable low cost, responsive access to orbits beyond low Earth orbit ("LEO"). Blue Origin, DIU, and the U.S. Space Force's Space Systems Command's Launch Enterprise Mission Manifest Office have selected the DS-1 mission as a pathfinder logistics mission opportunity that will demonstrate the integration of Blue Origin's first logistics flight system, with the primary objective as performing in-flight validation of the DS-1 Telemetry, Tracking, and Command ("TT&C") hardware and ground-based radiometric tracking.

The DS-1 mission will also serve as a risk reduction activity for future Blue Origin missions. The lessons learned from the DS-1 mission will be used to ultimately provide greater access to near-earth and cis-lunar space, furthering Blue Origin's vision of millions of people living and working in space for the benefit of Earth. For these reasons, Blue Origin submits that the public interest would be served by grant of the application.

The DS-1 flight system, comprised of Blue Origin avionics equipment, is expected to be launched as a non-separable, secondary payload on the upper stage of a National Security Space Launch-class launch vehicle ("LV") with an expected launch date in Q4 2024. The mission will be an elliptical medium Earth orbit ("MEO") of approximately 21000 km apogee, 2500 km perigee, at an inclination of 55 degrees. The DS-1 flight system will be independent from the LV upper stage, with separate power, communications, and avionics systems. After separation of the unrelated primary payload, the LV upper stage will send an activation signal to the DS-1 flight system but will not have any control over the operation of the DS-1 experiment. Likewise, DS-1 will not be able to control the LV upper stage. Following primary payload separation, DS-1's onboard omnidirectional antennas will be autonomously initiated to downlink via radio frequency real-time equipment health status to the ATLAS ground stations. The DS-1 mission duration will be no greater than 12 hours, concluding when the DS-1 flight system's battery is depleted. At the conclusion of the LV upper stage's mission, the LV upper stage with the DS-1 flight system will be decommissioned according to the LV managed disposal plan.

The Blue Origin DS-1 flight operators will handle operational ground control of the DS-1 flight system at Blue Origin's Orbital Launch Site in Merritt Island, Florida. For the duration of the DS-1 mission, there will be communication with the DS-1 flight system, with the DS-1 flight operators demonstrating the capabilities of the flight system. Regular communication sessions will be scheduled based on DS-1's orbital passes over the ground stations at intervals that meet mission requirements. The DS-1 flight operators will monitor the health and status of the DS-1 flight system during these passes. Additionally, the ground stations will establish an uplink carrier to support ranging as well as commanding to the DS-1 flight system, as needed. As stated above, the DS-1 flight system does not control the LV upper stage and will not be "flying" any space object. The mission is intended to demonstrate the space-to-ground interfaces between the flight system and ground, via Blue Origin avionics equipment.

Because the DS-1 system will not separate from the LV upper stage, the launch provider's Federal Aviation Administration's launch license is expected to address any orbital debris mitigation matters required by 47 C.F.R. § 5.64(b).

II. Communications Systems

The DS-1 system spacecraft will operate in the S-band (2025-2110 MHz) for space operations (Earth-to-space) and in the X-band (8025-8300 MHz) for space operations (space-to-Earth). *See* Table 1 below. Blue Origin is aware that there are federal and other operations in the S-band and X-band frequencies and intends to share information regarding its proposed operations with affected federal operators prior to operations to mitigate potential interference. Attached to this application in Exhibit B are the antenna gain contours for all the transmit and receive antenna beams.[1]

Blue Origin will operate the DS-1 mission on an unprotected and non-harmful interference basis. The Blue Origin flight operators will monitor the DS-1's transmission and adjust operations as necessary to avoid interference. Additionally, as discussed below, harmful interference is unlikely due to the (i) brief duration of the mission (i.e., less than 12 hours), and (ii) coordination of federal frequency use.

The relevant ground stations are provided as Exhibit A.

Table 1. Radio frequency plan

	Ranging Downlink	**Ranging Uplink**
Band	X-band	S-band
Frequency Range	8025-8300 MHz	2025-2100 MHz
Center Frequency[2]	8123.077 MHz	2040 MHz
Bandwidth	1.4 MHz	2.0 MHz
Modulation	PCM/PSK/PM + subcarrier TLM	PCM/PSK/PM + subcarrier CMD

[1] *See* Attachment B. For some gain contour plots, the contours at the lower gains are beyond the horizon (or do not exist) and are not shown in the plots.
[2] The identified center frequencies are representative frequency channels. As a result of spectrum discussions with federal spectrum managers, Blue Origin may select another channel within the identified frequency bands for its operations.

Data Rate	50 kbps on 1.024 MHz subcarrier	2 kbps on 16 kHz subcarrier
Transmit RF Power	5 W	100 W
Transmit Antenna Gain	6.98 dBi	41 dBi
Transmit Antenna EIRP	25 dBm	90 dBm
Receive Antenna Gain	53 dBi	7.98 dBi
Receive Antenna G/T	32 dB/K	-35 dB/K
Max Transmission Duration per Pass	5 hours	5 hours
Duty Cycle	Continuous downlink	Continuous Uplink

Blue Origin respectfully requests a waiver for Section 5.115 of the Commission's Rules, which requires that experimental stations transmit the call sign at the end of each transmission in either clear voice or Morse code. The equipment does not have the ability to do so. Also, the equipment maximizes the full duration of the downlink communication time. Blue Origin understands the intent of the rule requiring station identification is a means to allow others to trace unwanted interference and assumes that Blue Origin's planned federal frequency coordination process will reduce the likelihood of unwanted interference. As such, Blue Origin submits a waiver is warranted here.

i. 2025-2110 MHz (Earth-to-space)

The 2025-2110 MHz (Earth-to-space) band is allocated internationally and in the U.S. for Earth exploration-satellite service ("EESS") and space research for non-Federal use, subject to conditions as may be applied on a case-by-case basis and the limitation that any use may not cause harmful interference to authorized Federal and non-Federal operations.[3] The 2025-2110 MHz (Earth-to-space) band is also allocated to space operations internationally and for federal operators in the U.S.[4] The DS-1 mission spectrum use is generally consistent with the domestic and international Table of Frequency Allocations. DS-1 will operate in the 2025-2110 MHz band for space operations mostly outside the U.S. (and at two U.S. ground stations). Additionally, because the DS-1 mission is a pathfinder logistics mission aimed to help develop access to orbits beyond LEO under a U.S. Government prototype Other Transaction award, the DS-1 mission spectrum use should qualify as space research.

Moreover, use of this band can and will be coordinated with federal operators ensuring that operations will not cause harmful interference to federal operators. Additionally, sharing of spectrum will be possible because the DS-1 will operate only for a short period of time, and other satellites using these frequencies transmit and receive only in short periods of time while visible

[3] *See* 47 C.F.R. § 2.106 n.US347.
[4] *See* 47 C.F.R. § 2.106.

to a receiving/transmitting earth station main beam. For harmful interference to occur, satellites belonging to different systems would have to be visible to the earth station and transmitting or receiving using the same frequencies at the exact same time. In such an unlikely event, the resulting inline interference could be avoided by coordinating with federal satellite transmissions so that they do not occur simultaneously. Accordingly, mutual exclusivity between DS-1 and other systems using the same frequency band is unlikely.

ii. 8025-8300 MHz Downlink (space-to-Earth)

The 8025-8300 MHz (space-to-Earth) band is allocated internationally and in the U.S. for EESS on a primary basis for non-Federal use, subject to conditions as may be applied on a case-by-case basis.[5] Blue Origin would use these frequencies on an unprotected and non-harmful interference basis. Through the operational measures identified in this section, and due to the limited use of these frequencies, Blue Origin expects that its use of these frequencies will not cause harmful interference to authorized users.

Power Flux Density at the Surface of the Earth in the band 8025-8400 MHz

Table 21-4 of the ITU Radio Regulations states that the power flux density ("PFD") at the Earth's surface produced by emissions from an EESS in the 8025-8500 MHz band, for all conditions and methods of modulation, shall not exceed the following values:

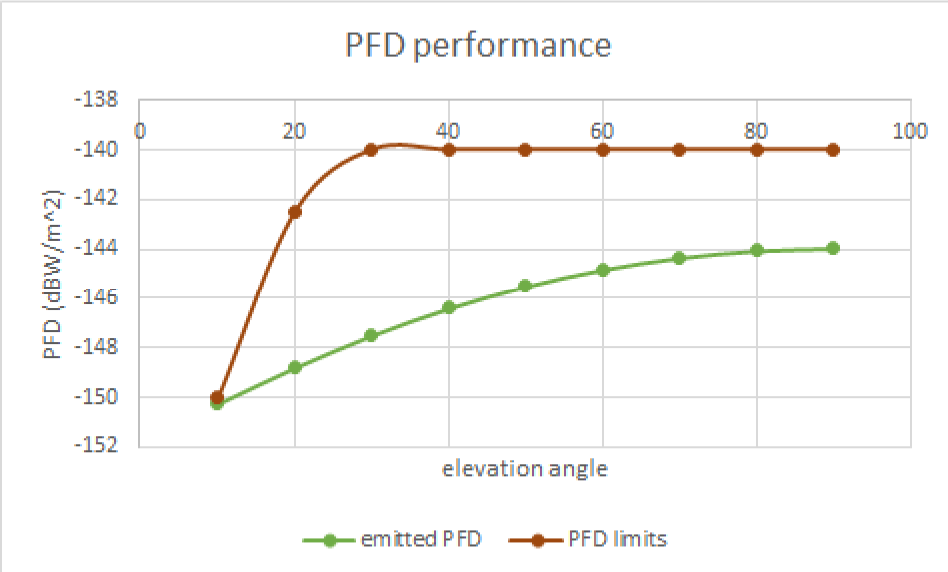
Table 2. Maximum PFD in 8025-8400 MHz band, as a function of elevation angle, in a 4 kHz bandwidth

0-5 deg	-150 dB(W/m^2)
5-25 deg	-150 + 0.5*(el – 5) dB(W/m^2)
25-90 deg	-140 dB(W/m^2)

DS-1 has the following PFD values:

Figure 1. DS-1 PFD values as a function of elevation angle

[5] *See* 47 C.F.R. § 2.106 n.US258.



As shown in Figure 1 above, DS-1's PFD values are within the acceptable limits of Table 21-4 of the ITU Radio Regulations.

Sharing with other non-Federal Systems

As explained above, shared use of these frequencies can be readily accomplished, and harmful interference is unlikely.

Exhibit A. Ground Station Exhibit

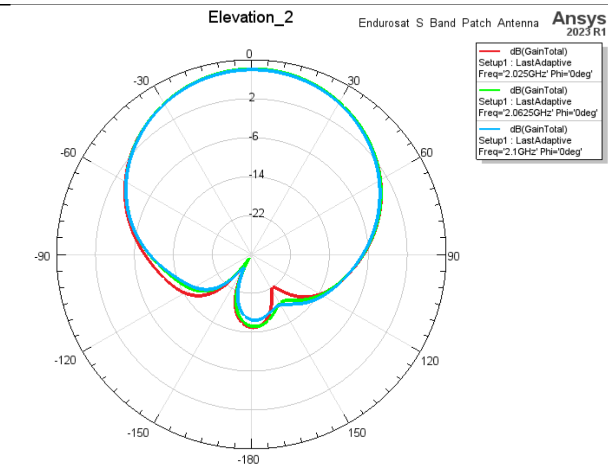
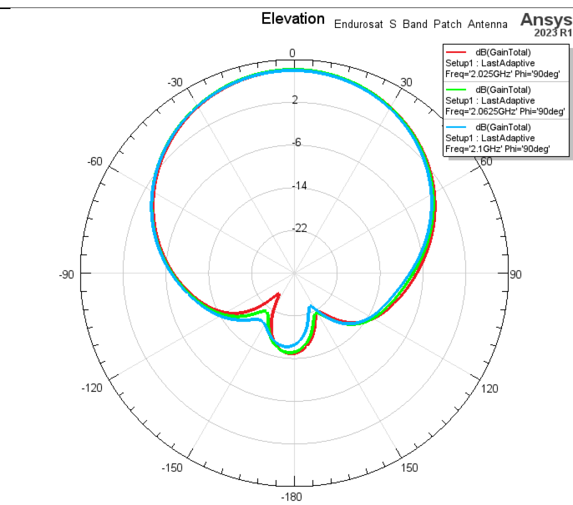
(as of April 2024)

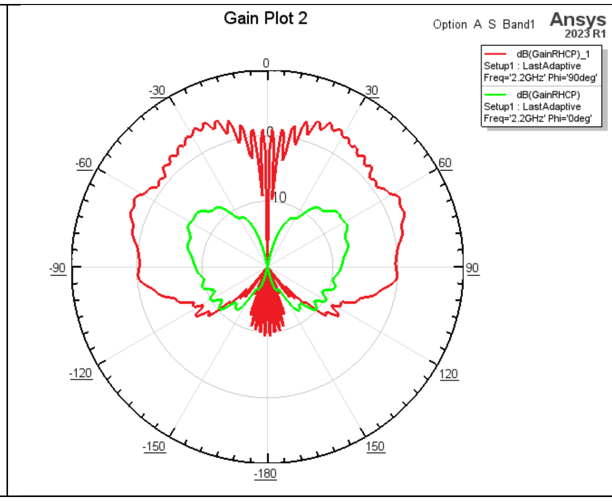
List of Ground Stations –April 2024

Name of Ground Station Licensee	**Location**	**Latitude**	**Longitude**
Atlas	Alice Springs, Australia	23° 45' 33" S	133° 52' 51" E
Atlas	Mingenew, Australia	29° 0' 37" S	115° 20' 30" E
Atlas	Paumalu, Hawaii, United States	21° 40' 14" N	158° 2' 8" W
Atlas	Kuntunsa (Accra), Ghana	5° 44' 60" N	0° 18' 22" W
Atlas	Pendergrass, Georgia, United States	34° 10' 29" N	83° 40' 18" W
Atlas	Hartebeesthoek (Pretoria), South Africa	25° 52' 48" S	27° 42' 0" E

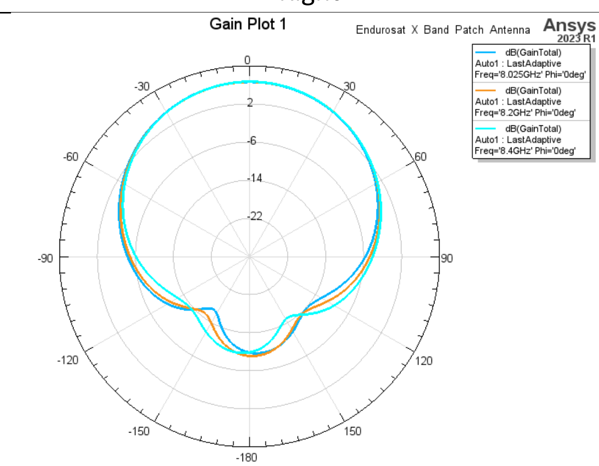
Exhibit B. Antenna Beam Information & Patterns

S-Band TT&C Uplink Antenna

Make / Model	EnduroSat ESPRTS210 00.00.00 v100
Quantity	2
Purpose	TT&C Uplink
Operation Mode	Receive
Frequency (MHz)	2025 - 2100
Peak Gain (dBi)	7.98
Half-Power Beamwidth (degrees)	70
Orientation in Horizontal Plane	Hemispherical
Orientation in Vertical Plane	
Polarization	Right
Graphic (Phi = 0) *Standalone Antenna Performance*	
Graphic (Phi = 90) *Standalone Antenna Performance*	

Performance of two antennas combined and mounted on DS1	

X-Band TT&C Downlink Antenna

Make / Model	EnduroSat ESPRTS210 00.00.00 v100
Quantity	2
Purpose	TT&C Downlink
Operation Mode	Transmit
Frequency (MHz)	8025-8300
Peak Gain (dBi)	6.98
Half-Power Beamwidth (degrees)	70
Orientation in Horizontal Plane	Hemispherical
Orientation in Vertical Plane	
Polarization	Right
Graphic (Phi = 0) *Standalone Antenna Performance*	

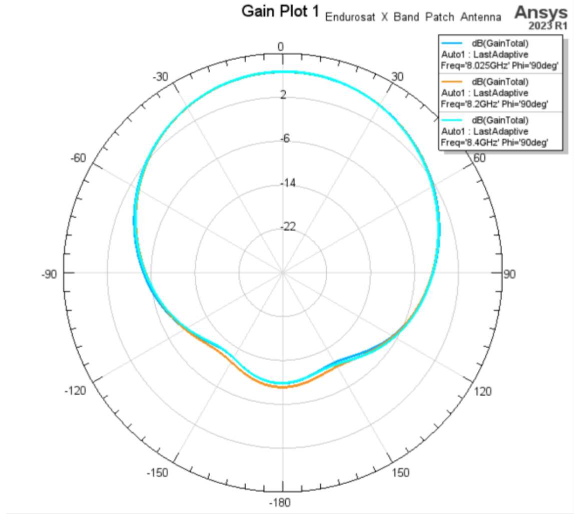
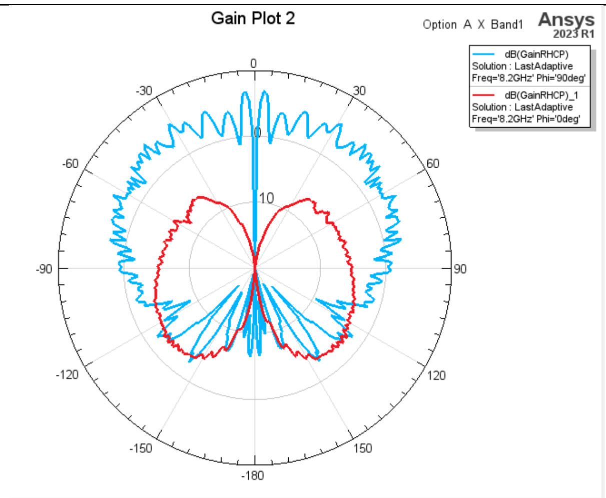
Graphic (Phi = 90) *Standalone Antenna Performance*	
Graphic (Phi = 0 & 90 overlap) *Performance of two antennas combined and mounted on DS1*	

Exhibit C. ITU Cost Recovery Letter

□□s □□M□r□□ □□□□□

March 1, 2024

Ms. Dortch
Office of the Secretary
Federal Communications Commission
45 L Street, N.E.
Washington, D.C. 20554

Subject: ITU Cost Recovery Declaration for the Blue Origin DarkSky-1 Satellite Network Operating in Non-geostationary Orbit in the Non-planned Frequency Bands. (DarkSky-1)

Reference: FCC Application File No. 0149-EX-ST-2024

Dear Ms. Dortch,

Blue Origin, LLC ("Blue Origin") is aware that in accordance with Resolution 88 of the International Telecommunication Union's (ITU) Plenipotentiary Conference (Marrakech, 2002), and ITU Council Decision 482, as modified, cost-recovery fees will apply to satellite network filings received by the Radiocommunications Bureau after November 7, 1998. As a consequence, Commission applicants are responsible for any and all fees charged by the ITU to process their satellite network filings Blue Origin hereby states that it is aware of this requirement and unconditionally accepts all cost recovery responsibilities associated with the ITU filings for the DarkSky-1 satellite network. Please address all cost-recovery inquiries, and ITU correspondence and filings, related to the DarkSky-1 satellite network to the following point of contact. We understand that should there be any change in the point of contact information, we will inform the Commission within 30 days of the foreseen event.

Point of Contact Name: Kaitlyn Mahoney
Organization Name: Blue Origin, LLC
Address: 21601 76th Ave S, Kent, WA 98032
E-Mail: legal.department@blueorigin.com
Telephone Number: 253-437-9300

Blue Origin understands that it must remit payment of any resultant cost-recovery fee to the ITU by the due date specified in the ITU invoice, unless an appeal filed prior to the due date is pending with the ITU. We fully understand that a license granted in reliance on such a commitment will be conditioned upon discharge of any such cost-recovery obligation. We also acknowledge that, in accordance with 47 C.F.R. §25.111, should we have an overdue ITU cost-recovery fee and have no appeal pending with the ITU, the Commission may dismiss any application associated with that satellite network.

Sincerely,

/s/ *Kaitlyn Mahoney*
Kaitlyn Mahoney
Blue Origin, LLC

Exhibit D. Stop Buzzer Information

STOP BUZZER INFORMATION

The Stop Buzzer contact is:

- Name and Title: Matthew Panning, Flight Operations Lead
- Phone: +1 571-222-5330
- Email: mpanning@blueorigin.com

Exhibit E. NTIA Space Record Data Form

NTIA requires the following data for space related experiments using government shared spectrum. For each transmit frequency, please provide the data for both ends of the transmit-receive link. Use Part A to describe the satellite to ground information. Part B is for all space to space transmit links. Part C is for all ground to space transmit links.

Part A: Space to Earth Downlink Data

Transmit Frequency: 8025-8300 MHz		
Satellite Name: DarkSky-1		
Data Field	**Data Answer**	**Description/Comments**
Polarization (XAP)	XAP = R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Orientation (XAZ)	XAZ = EC	NB= NARROWBEAM EC = EARTH COVERAGE
Antenna Dimension (XAD)	ANTENNA GAIN(dBi) 6.98 dbi BEAMWIDTH@ ½ Power 70 degrees XAD = XAD01 07G070B	(NTIA format (XAD), EXAMPLE, XAD01 16G030B)
Type of satellite (State = SP)	Type = Nongeostationary	Choose either: Geostationary or Nongeostationary

(City = geo or non)		
For Geostationary	Longitude = [ ]	IF ANY SATELLITES ARE GEOSTATIONARY, REPORT ITS LATITUDE AS 000000N (XLA AND/OR RLA) AND REPORT ITS LONGITUDE (XLG AND/OR RLG).
For Nongeostationary (Orbital Data)	INCLINATION ANGLE 55 degrees, APOGEE IN KILOMETERS 21000 km, PERIGEE IN KILOMETERS 2500 km, ORBITAL PERIOD IN HOURS 1 AND FRACTIONS OF HOURS IN DECIMAL .4, THE NUMBER OF SATELLITES IN THE SYSTEM 1, ORB = 0055IN21000AP02500PE0001.4H01NRT01	IF ANY SATELLITES ARE NONGEOSTATIONARY, REPORT ITS INCLINATION ANGLE, APOGEE IN KILOMETERS, PERIGEE IN KILOMETERS, ORBITAL PERIOD IN HOURS AND FRACTIONS OF HOURS IN DECIMAL, THE NUMBER OF SATELLITES IN THE SYSTEM, THEN T01, EXAMPLE, REM04 *ORB,98.0IN00510AP00510PE001.58H01NRT01, AND FOR SPACE-TO-SPACE COMMUNICATIONS WITH ANOTHER NONGEOSTATIONARY SATELLITE ADD AN ADDITIONAL *ORB FOR IT ENDING IN R01, EXAMPLE, REM05 *ORB,72.9IN03209AP00655PE013.46H01NRR01

Earth Station Data (Receiver 1) – Alice Springs		
State (RSC)	RSC = Australia	
City Name (RAL)	RAL = Alice Springs	
Latitude (DDMMSS)	Lat = 234533 S	
Longitude (DDDMMSS)	Lon = 1335251 E	

Antenna Polarization (RAP)	RAP = RAP01 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ01 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 54.6 dBi, BEAMWIDTH@ ½ Power 0.3 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 576.7 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 5 meters RAD = RAD01 55G0.3B000-360A576.7H005	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006
Earth Station Data (Receiver 2) – Awarua		
State (RSC)	RSC = New Zealand	
City Name (RAL)	RAL = Awarua	
Latitude (DDMMSS)	Lat = 463144 S	
Longitude	Lon = 1682252 E	

(DDDMMSS)		
Antenna Polarization (RAP)	RAP = RAP02 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ02 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 47.1, BEAMWIDTH@ ½ Power 0.69 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 20 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 3 meters RAD = RAD02 47G0.7B000-360A00020H003	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006
Earth Station Data (Receiver 3) – Barrow		
State (RSC)	RSC = Alaska	
City Name (RAL)	RAL = Barrow	
Latitude (DDMMSS)	Lat = 711630 N	

Longitude (DDDMMSS)	Lon = 1564822 W	
Antenna Polarization (RAP)	RAP = RAP03 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ03 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 46.8, BEAMWIDTH@ ½ Power 0.69 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 17 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 7 meters RAD = RAD03 46G0.7B000-360A00017H007	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006
Earth Station Data (Receiver 4) – Dubai [1]		
State (RSC)	RSC = United Arab Emirates	
City Name (RAL)	RAL = Dubai	
Latitude	Lat = 245638 N	

(DDMMSS)		
Longitude (DDDMMSS)	Lon = 0552108 E	
Antenna Polarization (RAP)	RAP = RAP04 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ04 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 46.5, BEAMWIDTH@ ½ Power 0.69 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 43 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 17.8 meters RAD = RAD04 47G0.7B000-360A00043H018	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006
Earth Station Data (Receiver 5) – Dundee		
State (RSC)	RSC = United Kingdom	
City Name (RAL)	RAL = Dundee	

Latitude (DDMMSS)	Lat = 562421 N	
Longitude (DDDMMSS)	Lon = 0031119 W	
Antenna Polarization (RAP)	RAP = RAP05 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ05 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 47.5, BEAMWIDTH@ ½ Power 0.69 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 67 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 4 meters RAD = RAD05 48G0.7B000-360A00067H004	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006
Earth Station Data (Receiver 6) – Hawaii		
State (RSC)	RSC = Hawaii	
City Name (RAL)	RAL = Paumalu	

Latitude (DDMMSS)	Lat = 214014 N	
Longitude (DDDMMSS)	Lon = 1580208 W	
Antenna Polarization (RAP)	RAP = RAP06 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ06 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 53.6 BEAMWIDTH@ ½ Power 0.35 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 58 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 8.6 meters RAD = RAD06 54G0.4B000-360A00058H8.6	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006
Earth Station Data (Receiver 7) – Mingenew		
State (RSC)	RSC = Australia	
City Name (RAL)	RAL = Mingenew	

Latitude (DDMMSS)	Lat = 290037 S	
Longitude (DDDMMSS)	Lon = 1152030 E	
Antenna Polarization (RAP)	RAP = RAP07 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ07 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 50.0 , BEAMWIDTH@ ½ Power 0.51 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 244 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 4 meters RAD = RAD07 50G0.5B000-360A00244H004	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006
Earth Station Data (Receiver 8) – Rwanda		
State (RSC)	RSC = Rwanda	
City Name (RAL)	RAL = Mwulire	

Latitude (DDMMSS)	Lat = 015757 S	
Longitude (DDDMMSS)	Lon = 0302351 E	
Antenna Polarization (RAP)	RAP = RAP08 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ08 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 57.1, BEAMWIDTH@ ½ Power 0.26 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 1655 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 3 meters RAD = RAD08 57G0.3B000-360A01655H003	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006
Earth Station Data (Receiver 9) – Guam		
State (RSC)	RSC = Guam	
City Name (RAL)	RAL = Harmon	

Latitude (DDMMSS)	Lat = 133049 N	
Longitude (DDDMMSS)	Lon = 1444930 E	
Antenna Polarization (RAP)	RAP = RAP09 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ09 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 46.5 , BEAMWIDTH@ ½ Power 0.69 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 139 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 6.7 meters RAD = RAD09 47G0.7B000-360A00139H6.7	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006
Earth Station Data (Receiver 10) – Finland		
State (RSC)	RSC = Finland	
City Name (RAL)	RAL = Sodankyla	

Latitude (DDMMSS)	Lat = 672205 N	
Longitude (DDDMMSS)	Lon = 0263802 E	
Antenna Polarization (RAP)	RAP = RAP10 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ10 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 53.6 , BEAMWIDTH@ ½ Power 0.35 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 181 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 10 meters RAD = RAD10 54G0.4B000-360A00181H010	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006
Earth Station Data (Receiver 11) – Sweden		
State (RSC)	RSC = Sweden	
City Name (RAL)	RAL = Ojebyn	

Latitude (DDMMSS)	Lat = 652013 N	
Longitude (DDDMMSS)	Lon = 0212534 E	
Antenna Polarization (RAP)	RAP = RAP11 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ11 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 54.6, BEAMWIDTH@ ½ Power 0.3 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 12 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 5 meters RAD = RAD11 55G0.3B000-360A00012H005	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006
Earth Station Data (Receiver 12) – Accra, Ghana		
State (RSC)	RSC = Ghana	
City Name (RAL)	RAL = Kuntunsa	

Latitude (DDMMSS)	Lat = 054460 N	
Longitude (DDDMMSS)	Lon = 0001822 W	
Antenna Polarization (RAP)	RAP = RAP12 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ12 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 54.6, BEAMWIDTH@ ½ Power 0.3 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 139 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 6.7 meters RAD = RAD12 55G0.3B000-360A00139H007	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006
Earth Station Data (Receiver 13) – Cordoba, Argentina		
State (RSC)	RSC = Argentina	
City Name (RAL)	RAL = Cordoba	

Latitude (DDMMSS)	Lat = 313127 S	
Longitude (DDDMMSS)	Lon = 0642749 W	
Antenna Polarization (RAP)	RAP = RAP13 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ13 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 51.0, BEAMWIDTH@ ½ Power 0.4 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 730 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 4 meters RAD = RAD13 51G0.4B000-360A00730H004	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006
Earth Station Data (Receiver 14) – Alaska		
State (RSC)	RSC = Alaska	
City Name (RAL)	RAL = North Pole	

Latitude (DDMMSS)	Lat = 644738 N	
Longitude (DDDMMSS)	Lon = 1473210 W	
Antenna Polarization (RAP)	RAP = RAP14 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ14 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 54.6, BEAMWIDTH@ ½ Power 0.3 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 144 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 5 meters RAD = RAD14 55G0.6B000-360A00144H005	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006
Earth Station Data (Receiver 15) – Obihiro Japan		
State (RSC)	RSC = Japan	
City Name (RAL)	RAL = Obihiro	

Latitude (DDMMSS)	Lat = 423553 N	
Longitude (DDDMMSS)	Lon = 1432715 E	
Antenna Polarization (RAP)	RAP = RAP15 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ15 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 54.6, BEAMWIDTH@ ½ Power 0.3 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 17 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 5 meters RAD = RAD15 55G0.3B000-360A00017H005	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006
Earth Station Data (Receiver 16) – Georgia		
State (RSC)	RSC = Georgia	
City Name (RAL)	RAL = Pendergrass	

Latitude (DDMMSS)	Lat = 341029 N	
Longitude (DDDMMSS)	Lon = 0834018 W	
Antenna Polarization (RAP)	RAP = RAP16 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ16 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 51.0, BEAMWIDTH@ ½ Power 0.4 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 204.8 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 4 meters XAD = XAD16 51G0.4B000-360A00205H004	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006
Earth Station Data (Receiver 17) – Pretoria, South Africa		
State (RSC)	RSC = South Africa	

City Name (RAL)	RAL = Hartebeesthoek	
Latitude (DDMMSS)	Lat = 255248 S	
Longitude (DDDMMSS)	Lon = 0274200 E	
Antenna Polarization (RAP)	RAP = RAP17 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ17 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 54.6, BEAMWIDTH@ ½ Power 0.3 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 1530 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 5 meters RAD = RAD17 55G0.3B000-360A01530H005	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006
Earth Station Data (Receiver 18) – Tolhuin, Argentina		

State (RSC)	RSC = Argentina	
City Name (RAL)	RAL = Tolhuin	
Latitude (DDMMSS)	Lat = 543033 S	
Longitude (DDDMMSS)	Lon = 670658 W	
Antenna Polarization (RAP)	RAP = RAP18 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ18 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 54.6, BEAMWIDTH@ ½ Power 0.3 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 146 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 6 meters RAD = RAD18 55G0.3B000-360A00146H006	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Earth Station Data (Receiver 19) – Shimoji-Shima, Japan		
State (RSC)	RSC = Japan	
City Name (RAL)	RAL = Shimoji-Shima	
Latitude (DDMMSS)	Lat = 244936 N	
Longitude (DDDMMSS)	Lon = 1250857 E	
Antenna Polarization (RAP)	RAP = RAP19 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ19 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 54.6, BEAMWIDTH@ ½ Power 0.3 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 9 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 5 meters RAD = RAD19 55G0.3B000-360A00009H005	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Earth Station Data (Receiver 20) – Dubai [2]		
State (RSC)	RSC = United Arab Emirates	
City Name (RAL)	RAL = Dubai	
Latitude (DDMMSS)	Lat = 221333 N	
Longitude (DDDMMSS)	Lon = 0552757 E	
Antenna Polarization (RAP)	RAP = RAP20 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ20 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 57.5, BEAMWIDTH@ ½ Power 0.2 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 39 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 9 meters	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

	RAD = RAD20 58G0.2B000-360A00039H009	
Earth Station Data (Receiver 21) – Guildford, United Kingdom		
State (RSC)	RSC = United Kingdom	
City Name (RAL)	RAL = Guildford	
Latitude (DDMMSS)	Lat = 511431 N	
Longitude (DDDMMSS)	Lon = 0003707 W	
Antenna Polarization (RAP)	RAP = RAP21 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (RAZ)	RAZ = RAZ21 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, VOO TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (RAD)	ANTENNA GAIN(dBi) 51, BEAMWIDTH@ ½ Power 0.4 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 136.7 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 5 meters	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

	RAD = RAD21 51G0.4B000-360A136.7H005	

Part C: Ground Stations, Earth to Space link data:

The proposed Blue Origin system will receive transmissions from Ground Stations on the following frequencies. However, in each case, these transmissions will be permitted by authorizations held by third parties. Because the Blue Origin system will not transmit on these frequencies, Blue Origin is not seeking corresponding experimental authorization to engage in these transmissions. These receive-only frequencies are listed here for informational purposes only.

- 2025-2100 MHz - Earth to Space

Transmit Frequency: 2025-2100 MHz		
Earth Station Data (Transmitter 1) - Alice Springs		
State (XSC)	XSC = Australia	
City Name (XAL)	XAL = Alice Springs	
Latitude (DDMMSS)	Lat = 234533 S	
Longitude (DDDMMSS)	Lon = 1335251 E	
Antenna Polarization (XAP)	XAP = RAP01 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ01 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00

Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 41 dBi, BEAMWIDTH@ ½ Power 1.43 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 576.7 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 5 meters XAD = XAD01 41G1.4B000-360A576.7H005	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006
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Earth Station Data (Transmitter 2) - Awarua		
State (XSC)	XSC = New Zealand	
City Name (XAL)	XAL = Awarua	
Latitude (DDMMSS)	Lat = 463144 S	
Longitude (DDDMMSS)	Lon = 1682252 E	

Antenna Polarization (XAP)	XAP = XAP02 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ02 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 35.4, BEAMWIDTH@ ½ Power 2.77 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 20 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 3 meters XAD = XAD02 35G2.8B000-360A00020H003	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Earth Station Data (Transmitter 3) - Barrow		
State (XSC)	XSC = Alaska	
City Name (XAL)	XAL = Barrow	

Latitude (DDMMSS)	Lat = 711630 N	
Longitude (DDDMMSS)	Lon = 1564822 W	
Antenna Polarization (XAP)	XAP = XAP03 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ03 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 35.4, BEAMWIDTH@ ½ Power 2.60 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 17 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 7 meters XAD = XAD03 35G2.6B000-360A00017H007	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Earth Station Data (Transmitter 4) - Dubai [1]

State (XSC)	XSC = United Arab Emirates	
City Name (XAL)	XAL = Dubai	
Latitude (DDMMSS)	Lat = 245638 N	
Longitude (DDDMMSS)	Lon = 0552108 E	
Antenna Polarization (XAP)	XAP = XAP04 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ04 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 35.4, BEAMWIDTH@ ½ Power 2.77 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 43 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 17.8 meters XAD = XAD04 35G2.8B000-360A00043H018	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Earth Station Data (Transmitter 5) - Dundee		
State (XSC)	XSC = United Kingdom	
City Name (XAL)	XAL = Dundee	
Latitude (DDMMSS)	Lat = 562421 N	
Longitude (DDDMMSS)	Lon = 0031119 W	
Antenna Polarization (XAP)	XAP = XAP05 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ05 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 36.2, BEAMWIDTH@ ½ Power 2.77 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 67 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 4 meters XAD = XAD05 36G2.8B000-360A00067H004	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Earth Station Data (Transmitter 6) - Hawaii		
State (XSC)	XSC = Hawaii	
City Name (XAL)	XAL = Paumalu	
Latitude (DDMMSS)	Lat = 214014 N	
Longitude (DDDMMSS)	Lon = 1580208 W	
Antenna Polarization (XAP)	XAP = XAP06 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ06 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 39.4, BEAMWIDTH@ ½ Power 1.40 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 58 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 8.6 meters XAD = XAD06 39G1.4B000-360A00058H8.6	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Earth Station Data (Transmitter 7) - Mingenew		
State (XSC)	XSC = Australia	
City Name (XAL)	XAL = Mingenew	
Latitude (DDMMSS)	Lat = 290037 S	
Longitude (DDDMMSS)	Lon = 1152030 E	
Antenna Polarization (XAP)	XAP = XAP07 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ07 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 35.1 , BEAMWIDTH@ ½ Power 1.9 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 244 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 4 meters XAD = XAD07 35G1.9B000-360A00244H004	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Earth Station Data (Transmitter 8) - Rwanda		
State (XSC)	XSC = Rwanda	
City Name (XAL)	XAL = Mwulire	
Latitude (DDMMSS)	Lat = 015757 S	
Longitude (DDDMMSS)	Lon = 0302351 E	
Antenna Polarization (XAP)	XAP = XAP08 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ08 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 44.1, BEAMWIDTH@ ½ Power 1.07 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 1655 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 3 meters XAD = XAD08 44G1.1B000-360A01655H003	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Earth Station Data (Transmitter 9) - Guam		
State (XSC)	XSC = Guam	
City Name (XAL)	XAL = Harmon	
Latitude (DDMMSS)	Lat = 133049 N	
Longitude (DDDMMSS)	Lon = 1444930 E	
Antenna Polarization (XAP)	XAP = XAP09 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ09 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 35.4 , BEAMWIDTH@ ½ Power 2.77 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 139 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 6.7 meters XAD = XAD09 35G2.8B000-360A00139H6.7	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Earth Station Data (Transmitter 10) - Finland		
State (XSC)	XSC = Finland	
City Name (XAL)	XAL = Sodankyla	
Latitude (DDMMSS)	Lat = 672205 N	
Longitude (DDDMMSS)	Lon = 0263802 E	
Antenna Polarization (XAP)	XAP = XAP10 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ10 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 39.4 , BEAMWIDTH@ ½ Power 1.40 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 181 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 10 meters XAD = XAD10 39G1.4B000-360A00181H010	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Earth Station Data (Transmitter 11) - Sweden		
State (XSC)	XSC = Sweden	
City Name (XAL)	XAL = Ojebyn	
Latitude (DDMMSS)	Lat = 652013 N	
Longitude (DDDMMSS)	Lon = 0212534 E	
Antenna Polarization (XAP)	XAP = XAP011 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ11 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 41, BEAMWIDTH@ ½ Power 1.43 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 12 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 5 meters XAD = XAD11 41G1.4B000-360A00012H005	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Earth Station Data (Transmitter 12) - Accra, Ghana		
State (XSC)	XSC = Ghana	
City Name (XAL)	XAL = Kuntunsa	
Latitude (DDMMSS)	Lat = 054460 N	
Longitude (DDDMMSS)	Lon = 0001822 W	
Antenna Polarization (XAP)	XAP = XAP12 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ12 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 41, BEAMWIDTH@ ½ Power 1.43 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 139 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 6.7 meters XAD = XAD12 41G1.4B000-360A00139H007	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Earth Station Data (Transmitter 13) - Cordoba, Argentina		
State (XSC)	XSC = Argentina	
City Name (XAL)	XAL = Cordoba	
Latitude (DDMMSS)	Lat = 313127 S	
Longitude (DDDMMSS)	Lon = 0642749 W	
Antenna Polarization (XAP)	XAP = XAP13 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ13 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 38.1, BEAMWIDTH@ ½ Power 1.9 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 730 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 4 meters XAD = XAD13 38G1.9B000-360A00730H004	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Earth Station Data (Transmitter 14) - Alaska		
State (XSC)	XSC = Alaska	
City Name (XAL)	XAL = North Pole	
Latitude (DDMMSS)	Lat = 644738 N	
Longitude (DDDMMSS)	Lon = 1473210 W	
Antenna Polarization (XAP)	XAP = RAP14 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ14 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 41, BEAMWIDTH@ ½ Power 1.43 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 144 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 5 meters XAD = XAD14 41G1.4B000-360A00144H005	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Earth Station Data (Transmitter 15) - Obihiro Japan		
State (XSC)	XSC = Japan	
City Name (XAL)	XAL = Obihiro	
Latitude (DDMMSS)	Lat = 423553 N	
Longitude (DDDMMSS)	Lon = 1432715 E	
Antenna Polarization (XAP)	XAP = XAP15 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ15 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 41, BEAMWIDTH@ ½ Power 1.43 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 17 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 5 meters XAD = XAD15 41G1.4B000-360A00017H005	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Earth Station Data (Transmitter 16) - Georgia		
State (XSC)	XSC = Georgia	
City Name (XAL)	XAL = Pendergrass	
Latitude (DDMMSS)	Lat = 341029 N	
Longitude (DDDMMSS)	Lon = 0834018 W	
Antenna Polarization (XAP)	XAP = RAP16 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ16 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 38.1, BEAMWIDTH@ ½ Power 1.9 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 204.8 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 4 meters	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

	XAD = XAD16 38G1.9B000-360A00205H004	

Earth Station Data (Transmitter 17) - Pretoria, South Africa		
State (XSC)	XSC = South Africa	
City Name (XAL)	XAL = Hartebeesthoek	
Latitude (DDMMSS)	Lat = 255248 S	
Longitude (DDDMMSS)	Lon = 0274200 E	
Antenna Polarization (XAP)	XAP = XAP17 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ17 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 41, BEAMWIDTH@ ½ Power 1.43 degrees, AZIMUTHAL RANGE 0-360 degrees,	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

	THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 1530 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 5 meters XAD = XAD17 41G1.4B000-360A01530H005	

Earth Station Data (Transmitter 18) - Tolhuin, Argentina		
State (XSC)	XSC = Argentina	
City Name (XAL)	XAL = Tolhuin	
Latitude (DDMMSS)	Lat = 543033 S	
Longitude (DDDMMSS)	Lon = 670658 W	
Antenna Polarization (XAP)	XAP = XAP18 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ18 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00

Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 41, BEAMWIDTH@ ½ Power 1.43 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 146 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 6 meters XAD = XAD18 41G1.4B000-360A00146H006	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Earth Station Data (Transmitter 19) - Shimoji-Shima, Japan		
State (XSC)	XSC = Japan	
City Name (XAL)	XAL = Shimoji-Shima	
Latitude (DDMMSS)	Lat = 244936 N	
Longitude (DDDMMSS)	Lon = 1250857 E	
Antenna Polarization (XAP)	XAP = XAP19 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ19 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF

		ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 41, BEAMWIDTH@ ½ Power 1.43 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 9 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 5 meters XAD = XAD19 41G1.4B000-360A00009H005	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Earth Station Data (Transmitter 20) - Dubai [2]		
State (XSC)	XSC = United Arab Emirates	
City Name (XAL)	XAL = Dubai	
Latitude (DDMMSS)	Lat = 221333 N	
Longitude (DDDMMSS)	Lon = 0552757 E	
Antenna Polarization (XAP)	XAP = XAP20 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR,

		J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ20 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 43.1, BEAMWIDTH@ ½ Power 0.9 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 39 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 9 meters XAD = XAD20 43G0.9B000-360A00039H009	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006

Earth Station Data (Transmitter 21) - Guildford, United Kingdom		
State (XSC)	XSC = United Kingdom	
City Name (XAL)	XAL = Guildford	
Latitude (DDMMSS)	Lat = 511431 N	
Longitude (DDDMMSS)	Lon = 0003707 W	
Antenna Polarization (XAP)	XAP = RAP21 R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR,

		T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Antenna Azimuth (XAZ)	XAZ = XAZ21 V10	THE EARTH STATION RECEIVER ANTENNA AZIMUTH (RAZ), THE MINIMUM ANGLE OF ELEVATION, V00 TO V90, EXAMPLE, RAZ01 V00
Antenna Dimensions (XAD)	ANTENNA GAIN(dBi) 38.1, BEAMWIDTH@ ½ Power 1.9 degrees, AZIMUTHAL RANGE 0-360 degrees, THE SITE ELEVATION ABOVE MEAN SEA LEVEL IN METERS 136.7 meters THE ANTENNA HEIGHT ABOVE TERRAIN IN METERS 5 meters XAD = XAD21 38G1.9B000-360A136.7H005	EXAMPLE ASSUMING NONGEOSTATIONARY, RAD01 16G030B000-360A00357H006
Satellite Station Data (Receiver 1) – DarkSky-1		
Antenna Polarization (RAP)	RAP = R	POLARIZATIONS INCLUDE : H = HORIZONTAL, V = VERTICAL, S = HORIZONTAL AND VERTICAL, L = LEFT HAND CIRCULAR, R = RIGHT HAND CIRCULAR, T = RIGHT AND LEFT HAND CIRCULAR, J = LINEAR POLARIZATION
Orientation (RAZ)	RAZ = EC	NB= NARROWBEAM EC= EARTH COVERAGE
Antenna Dimension (RAD)	ANTENNA GAIN(dBi) 7.98 dbi	(NTIA format (XAD), EXAMPLE, XAD01 16G030B)

	BEAMWIDTH@ ½ Power 70 degrees RAD = RAD01 08G070B	
Type of satellite (State = SP) (City = geo or non)	Type = Nongeostationary	Choose either: Geostationary or Nongeostationary
For Geostationary	Longitude =	IF ANY SATELLITES ARE GEOSTATIONARY, REPORT ITS LATITUDE AS 000000N (XLA AND/OR RLA) AND REPORT ITS LONGITUDE (XLG AND/OR RLG).
For Nongeostationary (Orbital Data)	INCLINATION ANGLE 55 degrees, APOGEE IN KILOMETERS 21000 km, PERIGEE IN KILOMETERS 2500 km, ORBITAL PERIOD IN HOURS 1 AND FRACTIONS OF HOURS IN DECIMAL .4, THE NUMBER OF SATELLITES IN THE SYSTEM 1, ORB = 0055IN21000AP02500PE0001.4H01NRT01	IF ANY SATELLITES ARE NONGEOSTATIONARY, REPORT ITS INCLINATION ANGLE, APOGEE IN KILOMETERS, PERIGEE IN KILOMETERS, ORBITAL PERIOD IN HOURS AND FRACTIONS OF HOURS IN DECIMAL, THE NUMBER OF SATELLITES IN THE SYSTEM, THEN T01, EXAMPLE, REM04 *ORB,98.0IN00510AP00510PE001.58H01NRT01, AND FOR SPACE-TO-SPACE COMMUNICATIONS WITH ANOTHER NONGEOSTATIONARY SATELLITE ADD AN ADDITIONAL *ORB FOR IT ENDING IN R01, EXAMPLE, REM05 *ORB,72.9IN03209AP00655PE013.46H01NRR01