## DESCRIPTION OF PROPOSED MODIFICATION

Terra Bella Technologies Inc. (Terra Bella)[1] operates a constellation of commercial remote sensing satellites that are licensed under the laws of the United States (FCC Call Sign S2862) and the regulations of the International Telecommunication Union (ITU) (Satellite Name USASAT-30E). Transmissions to and from the satellites in Terra Bella's network use standard communications protocols typical of other satellites operating in the Earth Exploration Satellite Service (EESS) frequency bands. USASAT-30E, or SkySat, satellites have been operating for as long as three years with no reported instances of interference with other satellite networks. Moreover, since 2016, Terra Bella has operated the S2862 SkySat constellation in accordance with a coordination agreement between Terra Bella and the National Aeronautics and Space Administration (NASA), providing further assurance of non-interference.

With this application, Terra Bella respectfully requests modification of its Commission authorization in order to launch and operate additional high-resolution imagery satellites that complement the existing SkySat system. As detailed below, the proposed additional low-Earth system launches will consist of up to six additional non-geostationary orbit (NGSO) satellites, SkySat-16 through SkySat-21. Like the previously authorized SkySat satellites, the proposed satellites will use the 8025–8400 MHz band allocated to EESS, and commands from the system's ground segment to the additional spacecraft will operate in the 2025–2110 MHz band.

On February 15, 2017, Google Inc. ("Google"), Terra Bella's immediate parent company, and Planet Labs Inc. ("Planet") submitted a joint request for authority to transfer control of Terra Bella from Google to Planet.[2] Pending approval from the Commission, Terra Bella will become a wholly-owned subsidiary of Planet. Terra Bella seeks approval of this application for modification independent of the outcome or timing of the license transfer proceeding.

Approval of this application would build on a series of prior Commission actions. In 2012, the Commission authorized the launch and operation of the first two satellites in the SkySat constellation.[3] Terra Bella successfully launched SkySat-1 on November 21, 2013, and SkySat-2 on July 8, 2014. In August 2016, the Commission approved Terra Bella's request to modify the Commission's authorization to include 13 additional

---

[1] Terra Bella was formerly known as SkyBox Imaging, Inc.

[2] *See* FCC File No. SAT-T/C-20170215-00018 (Call Sign S2862) and SES-T/C-20170215-00175 (Call Sign E130037).

[3] *See* FCC File No. SAT-LOA-2012-0322-0058. In November 2013, the National Oceanic and Atmospheric Administration (NOAA) granted Terra Bella a license to operate a private remote sensing space system consisting of up to 24 satellites (NOAA License).

satellites with specifications similar to those of SkySat-1 and SkySat-2.[4] Terra Bella successfully launched SkySat-3 on June 22, 2016,[5] and SkySat-4 through SkySat-7 on September 15, 2016. In total, seven SkySat satellites are currently operating. Terra Bella anticipates launching SkySat-8 through SkySat-15—the remaining currently authorized spacecraft in the constellation—in 2017.

SkySat-16 through SkySat-21, for which this modification is requested, are currently under construction.[6] Terra Bella anticipates launching these satellites as early as September 2018. Timely grant of this application will allow these spacecraft to be put into service and enable Terra Bella to continue to improve its cost-effective, high-resolution imaging services for customers in the U.S. and around the world, without risk of harmful interference to other protected users of the 8025–8400 MHz and 2025–2110 MHz bands.

In support of this request for modification of its authorization, Terra Bella offers the following information.

## I. Information Required Under Section 25.114(d) of the Commission's Rules

### A. General Description of Overall Facilities, Operations, and Services

The proposed addition to the Terra Bella EESS system consists of a space segment (SkySat-16 through SkySat-21) together with a ground segment comprised of a primary earth station in Fairbanks, Alaska (Call Sign E120025), other primary earth stations outside the United States,[7] and an emergency back-up earth station in Half Moon Bay, California (Call Sign E130037). As with the currently authorized satellites in the SkySat constellation, each proposed satellite is designed to receive commands from a ground station and to downlink the data that is collected by three imaging sensors and stored onboard the satellite, as well as telemetry data.

Also as with the existing spacecraft, the proposed Terra Bella satellites will be three-axis stabilized using an on-board closed-loop control system. Indeed, SkySat-16 through SkySat-21 will be nearly identical to Terra Bella's current SkySat-1 through SkySat-15 satellites.[8]

---

[4] *See* FCC File No. SAT-MOD-20150408-0019.

[5] SkySat-3 was launched pursuant to a partial grant of Terra Bella's modification request. *See* FCC File No. SAT-MOD-20150408-00019 (partial grant dated Jun. 6, 2016).

[6] Terra Bella's notification of commencement of space station construction is included as Attachment A to this Exhibit 43.

[7] The intended ground station sites outside the United States are located in Inuvik, Canada; Svalbard, Norway; Troll, Antarctica; and Tromso, Norway.

[8] The proposed Terra Bella satellites are expected to have minor, non-functional differences from earlier SkySat satellites, to accommodate different launch vehicles.

SkySat-16 through SkySat-21 are scheduled to be launched as primary payloads on a yet-to-be-determined launch vehicle.[9] The satellites are designed to operate in independent, high-inclination, circular orbits with altitudes in the range of 400 to 630 km and inclinations between 97.0° and 97.9°. In particular, the satellites are expected to operate in sun-synchronous orbits with a nominal altitude of 500 km. The orbital period for the spacecraft will range from 92.6 minutes to 97.4 minutes. With an orbit altitude of 400 km at the end of mission operations, the expected remaining orbital lifetime of the satellites would be 0.85 years. The expected remaining orbital lifetime increases to 25 years if the orbit altitude at the end of mission operations is at the maximum of 630 km. At the planned orbit altitude of 500 km, decay of the orbit to the reentry point will take approximately 6 years.

Data collected by the sensors onboard the SkySat satellites will be processed, stored, and then downlinked in the 8025–8400 MHz band while the satellites are visible from an appropriate earth station site at a minimum 5° elevation angle. The storage capacity onboard each satellite is 768 GB. For telemetry, tracking and command (TT&C) functions, the Terra Bella satellites will receive command communications from gateway earth stations using the 2025–2110 MHz band, which is authorized for use in the EESS subject to case-by-case conditions.[10] The ground segment will consist of several earth stations around the world equipped with 2.4 to 3.7 meter antennas. Command signals will be issued from the Terra Bella mission operations center in Mountain View, California, and uplinked to the satellites via the primary earth stations. Telemetry data from the satellites will be received at the primary earth stations and relayed to the Mountain View operations center.

### B. Description of Types of Services and Areas to be Served

The proposed Terra Bella EESS satellites, SkySat-16 through SkySat-21, will complement the 15 SkySat satellites that are already operational or authorized for operation, and continue to provide satellite imagery and derived information products on a non-common carrier basis to commercial customers and governments worldwide. Under the requested authorization, Terra Bella will be able to generate new and improved information that will benefit the oil and gas, agriculture, real estate, construction, natural resources, news media, and online mapping industries.

### C. Technical Description

As noted above, the communications payload onboard the proposed satellites is designed to receive commands from the associated earth stations and to downlink the data that is collected by three imaging sensors and stored onboard the satellites, as well

---

[9] The launches will conform to orbital debris and other applicable obligations.
[10] *See* 47 C.F.R. § 2.106, footnote US347.

as telemetry data that is required for operating the satellites. A block diagram of the communication payload is shown in Figure 1 below.

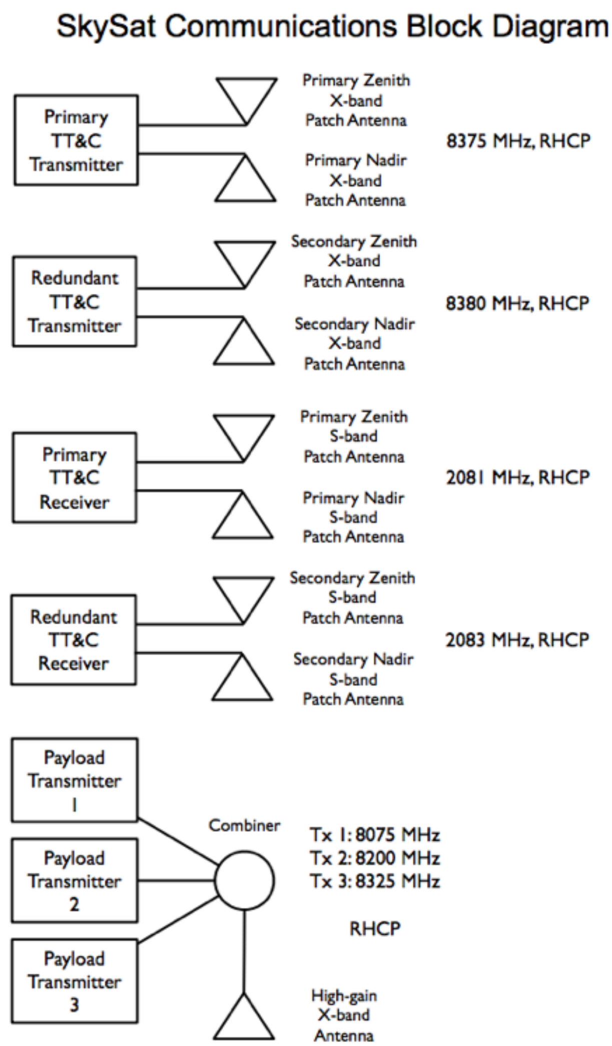



**Figure 1. Communications Payload Block Diagram**

The three transmitters operating in the 8025–8400 MHz band via a high-gain antenna are used for downlinking the data collected and stored onboard each satellite. Data collected by each of the sensors at any time during the the orbit is later downlinked by its respective data transmitter when the satellite is in view of one of the earth stations in the Terra Bella network. The data transmitters are nominally configured to downlink simultaneously, though individual operation is possible. This configuration provides data downlink redundancy: the satellite will still operate (at a reduced capacity) even if two of the three data transmitters fail. The redundant TT&C transmitters and receivers operating via low-gain antennas are used for telemetry transmission and command reception.

Schedule S, within the FCC Form 312 portion of this Application, describes in detail the technical characteristics of the proposed satellites. The proposed satellites' link budgets are included as Attachment B, and the proposed space station antenna patterns are included as Attachment C. Attachment D shows the predicted gain contours required by Section 25.114(d)(3) of the Commission's rules at each of the earth station sites from a 90° elevation angle.[11] In developing space station operational lifetime and reliability estimates, Terra Bella has relied upon its expertise in satellite design and selection of components, as well as its experience operating the SkySat constellation.

## D. Power Flux Density Calculation

### 1. Power Flux Density at the Surface of the Earth in the 8025–8400 MHz band

Commission Rule 25.208 does not contain limits on power flux density (PFD) at the Earth's surface produced by emissions from NGSO EESS space stations operating in the 8025–8400 MHz band.[12] 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° above the horizontal plane;
- -150 + 0.5(d – 5) dB(W/m²) in any 4 kHz band for angles of arrival d (in degrees) between 5° and 25° above the horizontal plane; and
- -140 dB(W/m²) in any 4 kHz band for angles of arrival between 25° and 90° above the horizontal plane.

These limits relate to the PFD that would be obtained under free-space propagation conditions. As shown in Figures 2 through 7 below, the PFDs at the Earth's surface produced by the SkySat-16 through SkySat-21 data and telemetry transmissions satisfy the PFD limits in the ITU Radio Regulations for all angles of arrival. In addition, the transmit power for both the TT&C and payload data transmitters

[11] The gain contours for SkySat-16 through SkySat-21 are plotted at the intended 500 km altitude. In several of the plots, contours beyond -8 dB or -10 dB from peak are not shown because they do not intersect with the Earth.
[12] 47 C.F.R. § 25.208.

is adjustable on orbit. This capability supports Terra Bella's ability to manage the satellites' PFD levels during all phases of the mission, i.e. for all operational altitudes.

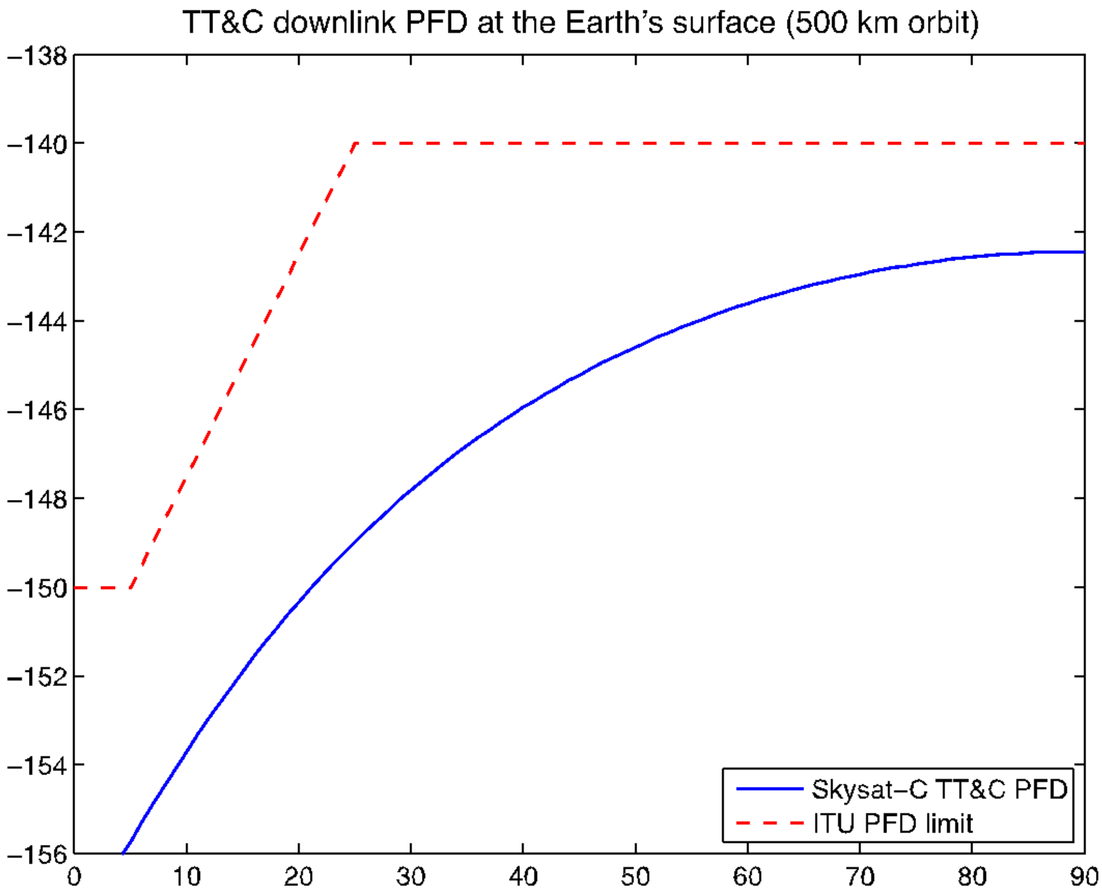



**Figure 2. PFD at Earth's surface produced by SkySat telemetry downlinks (shown for baseline 500 km orbit altitude)**

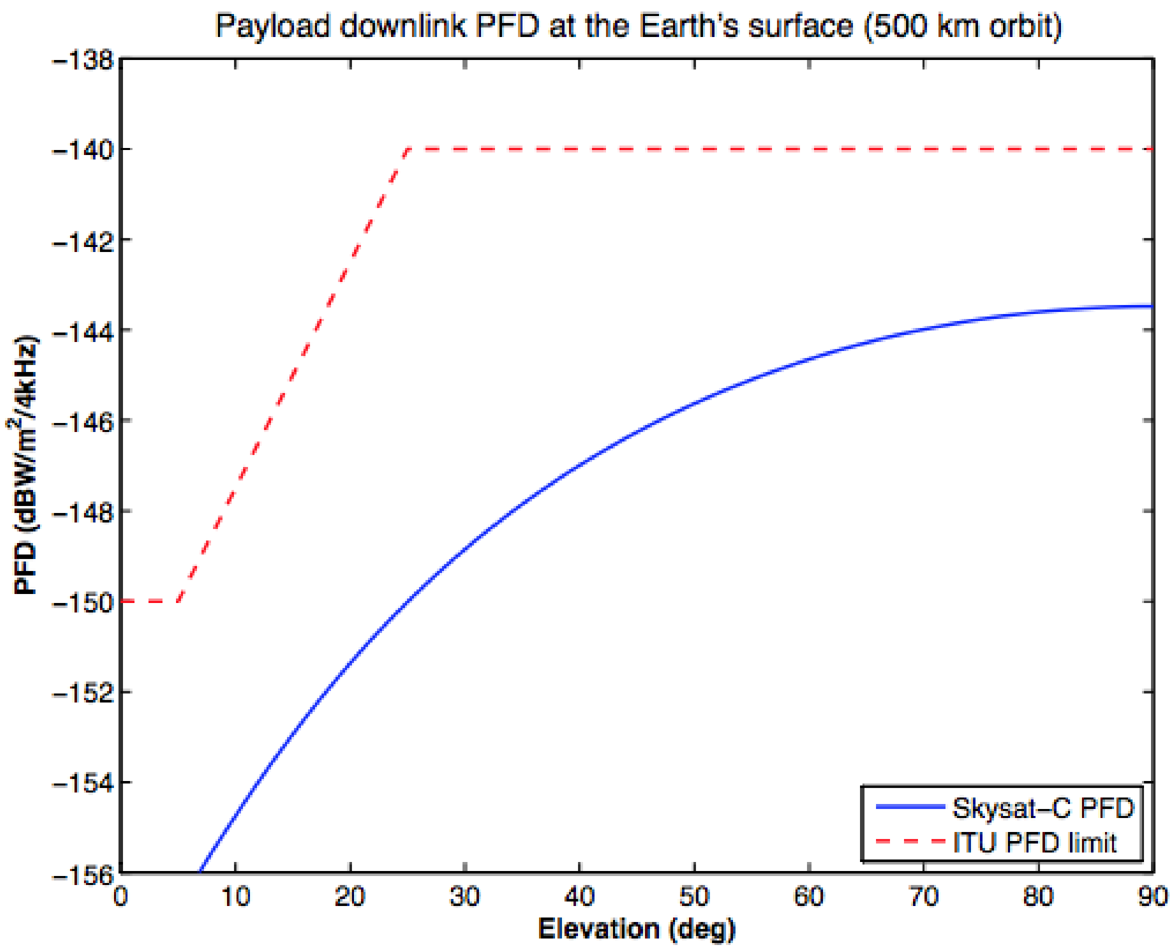



**Figure 3. PFD at the Earth's surface produced by SkySat data downlinks (shown for baseline 500 km orbit altitude)**

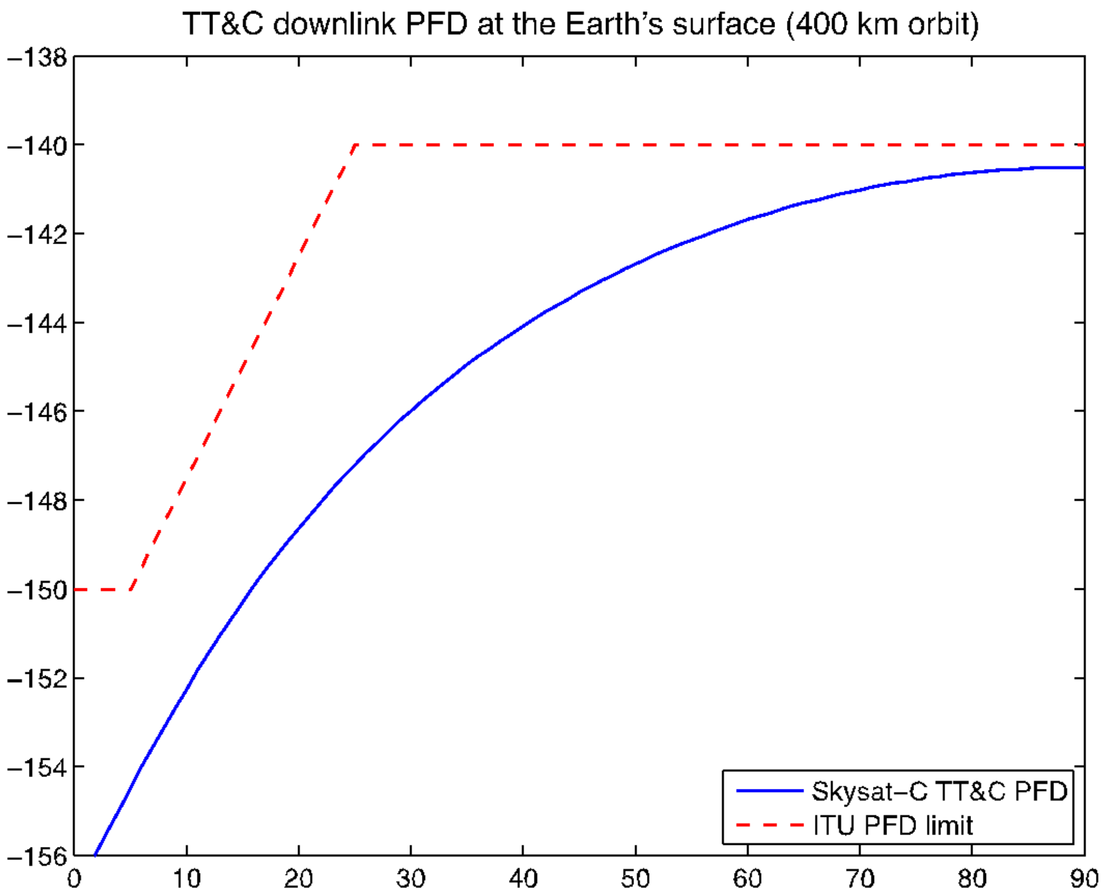



**Figure 4. PFD at the Earth's surface produced by SkySat telemetry downlinks (shown for the minimum 400 km orbit altitude)**

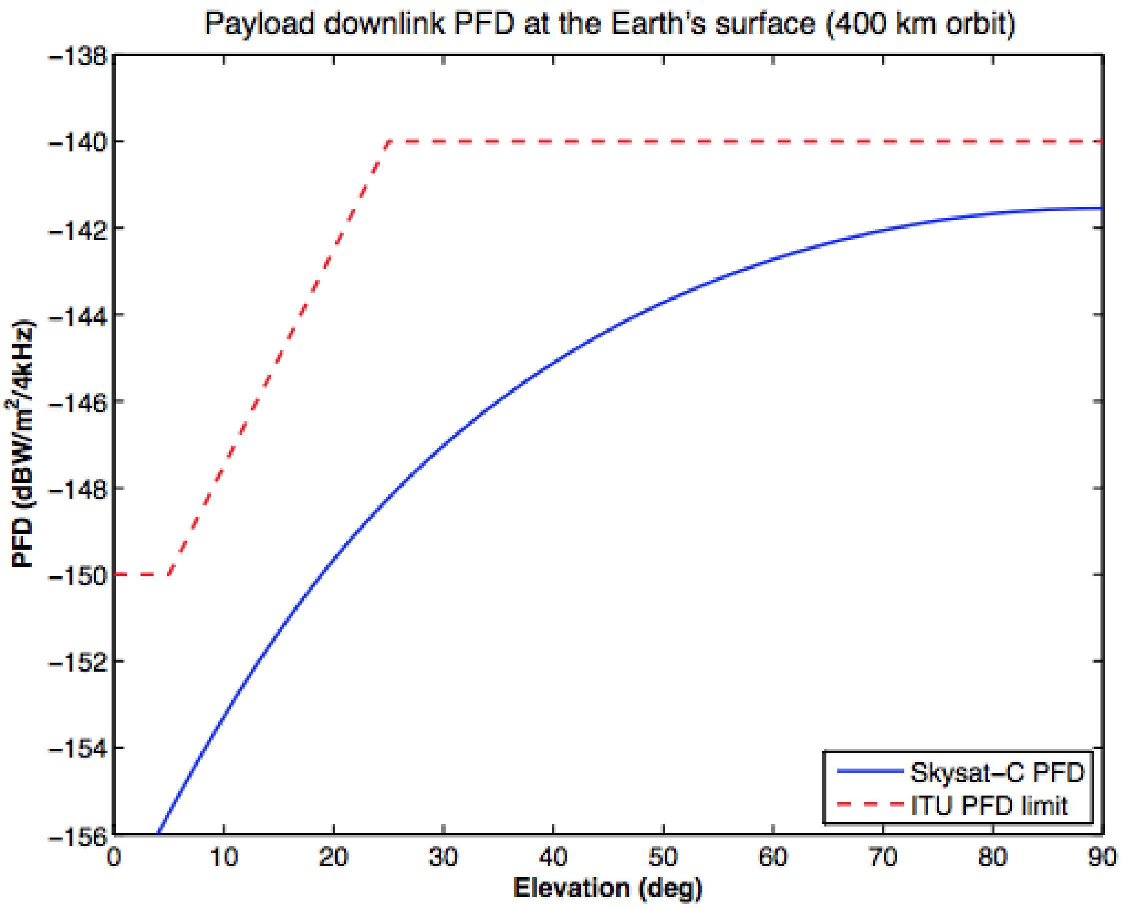



**Figure 5. PFD at the Earth's surface produced by SkySat data downlinks (shown for the minimum 400 km orbit altitude)**

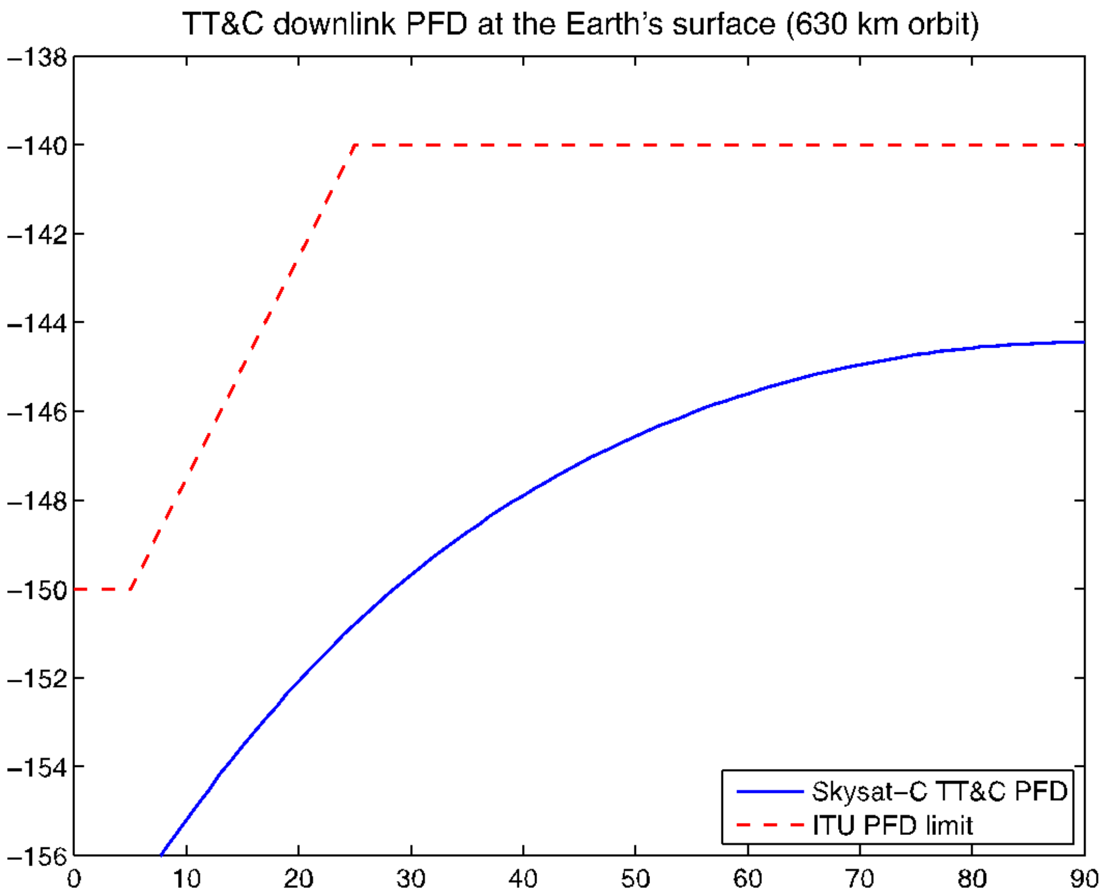



**Figure 6. PFD at the Earth's surface produced by SkySat telemetry downlinks (shown for the maximum 630 km orbit altitude)**

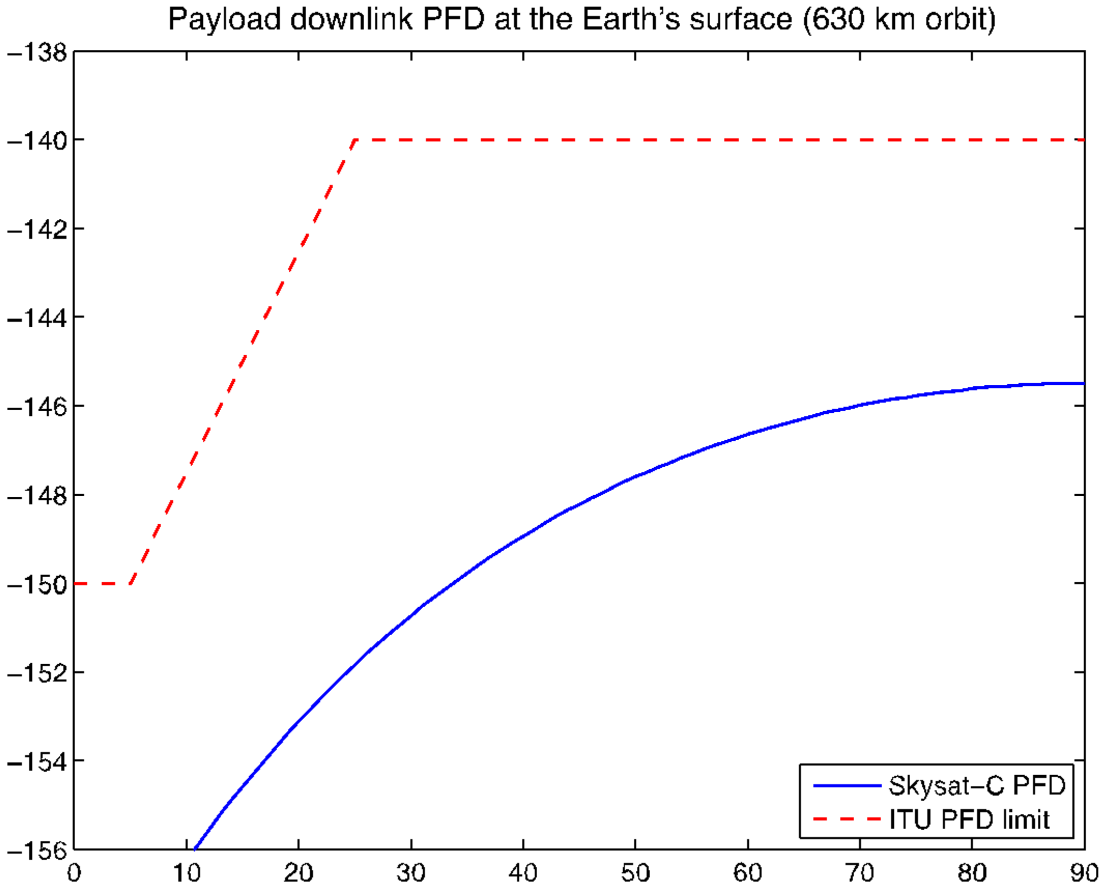



**Figure 7. PFD at the Earth's surface produced by SkySat data downlinks (shown for the maximum 630 km orbit altitude)**

### 2. Power Flux Density at the Surface of the Earth in the 8400–8450 MHz band

ITU-R Recommendation 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 of 8400–8450 MHz. Terra Bella uses a combination of digital filtering at the baseband signal (root-raised cosine filters with a roll-off factor of 0.35), a 7th-order analog baseband reconstruction filter, and bandpass RF filtering at the output of the transmitters provided by a triplexer to achieve the ITU recommended protection level for the 8400–8450 MHz band.

### 3. Power Flux Density at the Geostationary Satellite Orbit

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 the geostationary satellite orbit (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 Terra Bella EESS satellites does not exceed ITU limits even in a worst-case, hypothetical analysis.

The PFD at the GSO produced by the Terra Bella transmission is:

PFD [dB(W/m² / 4 kHz)] = EIRP (dBW) – 71 – 20log10(D) – 10log10(BW) – 24

Where:

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

The minimum possible distance between a Terra Bella satellite and the GSO is 35786 – 630 = 35156 km for the highest possible Terra Bella satellite orbit of 630 km. Under a hypothetical assumption that the Terra Bella satellite antenna is radiating at its peak EIRP directly toward the GSO, the data downlink transmission with the peak EIRP = 24.0 dBW and BW = 76 MHz produces a PFD at the GSO of -180.7 dB(W/m²) in any 4 kHz band.[13] Under the same hypothetical assumptions, the telemetry transmission from the Terra Bella satellite produces a maximum PFD at the GSO of -176.4 dB(W/m²) in any 4 kHz band, well below the ITU limit of -174 dB(W/m²).

## E. Interference Analysis

### 1. Interference between EESS systems operating in the 8025–8400 MHz band

Interference between the Terra Bella satellite downlinks and those of other EESS systems is very unlikely 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 and frequency. In the highly unlikely event of a precise

[13] The symbol bandwidth of the transmission is 76 MHz, while the assigned bandwidth of the same transmission, shown in Schedule S, is 100 MHz. This PFD calculation is the same for the 60 MHz bandwidth transmissions since the transmission power is adjusted accordingly.

alignment, interference can still be avoided by coordinating the satellite transmissions so that they do not occur simultaneously.

In addition, Terra Bella maintains a coordination agreement with NASA that protects U.S. and non-U.S. governmental space missions against harmful interference from Skysat operations in this band.[14] Terra Bella will operate the proposed additional satellites in accordance with this agreement.

#### 2. Interference with the Fixed Service and the FSS in the 8025–8400 MHz band

Sections I.D.1 and I.D.3 above demonstrate that the SkySat 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.

#### 3. Protection of deep-space research in the 8400-8450 MHz band

Section I.D.2 above demonstrates that the protection criterion recommended by the ITU for deep-space research in the 8400-8450 MHz band is met.

### F. Public Interest Considerations

The Commission's grant of this application will serve the public interest by permitting Terra Bella to launch and operate high-resolution imagery satellites that are complementary to the previously authorized SkySat-1 through SkySat-15 satellites, and will increase the temporal rate of image collection to serve daily business analytics. This will also enhance competition and expand U.S. capabilities in the market for commercial remote sensing data. Terra Bella's innovative approach—using small, lightweight, and low-cost satellites—allows the company to meet the growing demand for high-resolution imagery in a cost-effective, timely manner, and deployment of the proposed satellites will further enhance Terra Bella's EESS capabilities.

### G. Orbital Debris Mitigation

The additional SkySat satellites proposed in this modification application will not release debris during their normal operations. The spacecraft or launch vehicle will retain all separation and deployment mechanisms and any other potential source of debris.

Terra Bella has assessed and limited the possibility that the proposed space

---

[14] The agreement specifically controls the SkySat-1 through SkySat-15 spacecraft and provides guidance for the proposed SkySat-16 through SkySat-21 spacecraft.

stations could become a source of debris as a result of collision with large debris or other operational spacecraft. Terra Bella does not intend to place any of the SkySat-16 through SkySat-21 satellites in an orbit that is identical to or very similar to an orbit used by other space stations. Terra Bella will also work closely with its launch providers to ensure that the satellites are deployed in such a way as to minimize the potential for collision with any other spacecraft, specifically including manned spacecraft. To the best of Terra Bella's understanding, the International Space Station and China's Tiangong-2 Space Station module are the only presently or imminently inhabited orbiting objects. The operational altitude of the International Space Station is approximately 400 km,[15] and the altitude of the Tiangong-2 space module is approximately 393 km.[16] While both facilities are significantly below the baseline operational orbit altitude of 500 km for SkySat-16 through SkySat-21, Terra Bella will be proactive in ensuring that any risks to inhabitable orbiting objects posed by any of its SkySat satellites are mitigated. This will include coordinating with NASA to ensure protection of the International Space Station on an ongoing basis, and coordinating with the China National Space Agency with respect to Tiangong-2 and successor vehicles. Terra Bella will provide both agencies with any information they need to assess risks and ensure safe flight profiles, and with contact information for Terra Bella personnel on a 24 hours per day/7 days per week basis. Through these measures, Terra Bella will be able to avoid collisions even if, at some point in the future, there is less separation in orbits than is anticipated today.[17]

Terra Bella has also assessed the possibility of the proposed space stations becoming sources of debris by collision with small debris or meteoroids of less than 1 cm in diameter that could cause loss of control and prevent post-mission disposal. Terra Bella has taken steps to limit the effects of such collisions through shielding, the placement of components, and the use of redundant systems.

Terra Bella has assessed the possibility of accidental explosions during and after completion of mission operations through a failure mode verification analysis. As part of the satellite manufacturing process, Terra Bella has taken steps to ensure that debris generation will not result from the conversion of energy sources onboard the satellites into energy that fragments the satellites. All sources of energy onboard the spacecraft will have been depleted or safely contained when they are no longer required for mission operations or to accomplish post-mission disposal.

---

[15] *See* AstroViewerNASA, *Current Position of the ISS*, at http://iss.astroviewer.net/.

[16] *See* Chinadaily.com.cn, *Tiangong-2 space lab enters preset orbit for docking with manned spacecraft*, at http://www.chinadaily.com.cn/china/2016-09/26/content_26891749.htm.

[17] Terra Bella will take similar proactive measures with respect to any other inhabitable orbiting objects that may be introduced during the time when SkySat spacecraft are in orbit. In particular, Terra Bella notes that testing of inhabitable space objects by Bigelow Aerospace LLC may occur during the license term.

Section 25.114(d)(14)(iii) of the Commission's rules calls upon applicants to specify the accuracy with which the orbital parameters of their non-geostationary satellite orbit space stations will be maintained.[18] SkySat-16 through SkySat-21 will include propulsion systems and, as a result of regular corrective propulsive maneuvers by Terra Bella, are anticipated to remain in their planned orbits within the accuracy ranges given in Table 1 below. At end of life, the proposed SkySat satellites will be in orbits that gradually decay over time until the satellites reenter the atmosphere. At the minimum initial altitude of 400 km, the satellite will reenter the atmosphere in approximately 0.85 years; at the maximum initial altitude of 630 km, reentry will occur within 25 years.[19]

| | **SkySat Orbital Parameters Accuracy** |
|---|---|
| Inclination Angle (deg.) | +/- 0.1 |
| Apogee (km) | +/- 20 |
| Perigee (km) | +/- 20 |
| Semi-major Axis (km)[20] | +/- 1.0 |
| Right Ascension of the Ascending Node (deg.)[21] | +/- 0.25 |

**Table 1. Anticipated Orbit Maintenance Accuracy for SkySats**

Terra Bella's disclosure of the above parameters, as well as the number of space stations, the number and inclination of orbital planes, and the orbital period to be used, can assist third parties in identifying potential problems that may result from proposed operations. This information also lends itself to coordination between Terra Bella and other operators located in similar orbits.

As noted above, the proposed satellites are commercial remote sensing satellites subject to regulation by NOAA under Title 51 of the U.S. Code, as well as regulation by the Commission. Pursuant to licensing requirements codified under Section 60122(b) of Title 51,[22] Terra Bella has received favorable action from NOAA on its plan for the

[18] 47 C.F.R. § 25.114(d)(14)(iii).
[19] For SkySat-16 through SkySat-21, with a proposed orbit altitude of 500 km, decay of the orbit to the reentry point will take approximately six years.
[20] Semi-major axis will be maintained with a tight tolerance. Eccentricity will be kept small, but is expected to vary, causing fluctuations in apogee and perigee altitudes.
[21] RAAN tolerance given is relative to a rotating sun-sync orbital plane, which regresses to match the Sun's apparent motion to the Earth.
[22] *See* 51 U.S.C. § 60122(b).

post-mission disposal of its spacecraft.[23] The Commission has previously determined that "[t]o the extent that a remote sensing satellite applicant has submitted its post-mission disposal plans to NOAA for review and approval, [it] will not require submission of such information" as part of its examination of the debris mitigation disclosures of remote sensing satellites.[24] Accordingly, no submission regarding Terra Bella's post-mission disposal plans is required or included with this application.

### H. Extent of Communications with SkySat-16 through SkySat-21 During Descent to the Atmosphere

Terra Bella intends to utilize the proposed complementary Terra Bella satellites for communications services (including TT&C functions) from the point at which each satellite is placed into its operational orbit until final re-entry into the atmosphere is imminent. Reentry will be imminent at an altitude of approximately 200 km. At all altitudes down to the reentry altitude, Terra Bella will maintain the satellites' PFD at levels within the applicable ITU limits by reducing satellite transmitter power on a graduated basis as the satellite nears the Earth.[25]

## II. Additional/General Considerations

### A. Waiver Request of Modified Processing Round Rules

Terra Bella requests that this application be processed pursuant to the first-come, first-served procedure adopted for "GSO-like satellite systems" under Section 25.158 of the Commission's rules.[26] To the extent necessary to allow for such processing, Terra Bella also requests waiver of Sections 25.156 and 25.157 of the Commission's rules, which stipulate the processing of "NGSO-like satellite systems" under a modified processing round framework.[27]

The Commission previously granted waiver of the modified processing round requirement with respect to the existing SkySat-1 through SkySat-15 satellites.[28] The Commission concluded that authorizing Terra Bella to operate in its requested EESS frequency bands would not preclude other NGSO operators from operating in those

---

[23] *See* NOAA License.
[24] *See* Mitigation of Orbital Debris, 19 FCC Rcd. 11567, 11610 (2004). The Commission's decision addressed 15 U.S.C. § 5622(b)(4), which contained a licensing requirement identical to that in 51 U.S.C. § 60122(b)(4) to notify NOAA of the post-mission disposal of spacecraft. Section 60122 of Title 51 replaced Section 5622 of Title 15 effective December 18, 2010. See Pub.L. 111-314, 124 Stat. 3328 (2010).
[25] Terra Bella satellite transmitters have 256 steps of output power adjustments over the range from 0.1 to 1.5 watt output power.
[26] 47 C.F.R. § 25.158.
[27] 47 C.F.R. §§ 25.156 and 25.157.
[28] *See* IBFS File Nos. SAT-LOA-20120322-00058 and SAT-MOD-20150408-00019.

bands.[29] Given that the proposed satellites do not materially deviate in design from SkySat-1 through SkySat-15, the Commission should similarly grant Terra Bella a waiver of Sections 25.156 and 25.157 for SkySat-16 through SkySat-21.

### B. Waiver Request of Default Service Rules

Terra Bella requests a waiver of the default service rules under Section 25.217(b) of the Commission's rules.[30]

The Commission previously granted a waiver of the default service rules contained in Section 25.217(b) for SkySat-1 through SkySat-15, based on the requirement that EESS operators in the 8025–8400 MHz band are required to comply with technical requirements in Part 2 of the Commission's rules and applicable ITU regulations.[31] With respect to SkySat-1 through SkySat-15, the Commission concluded that because the technical requirements specified in Part 2 are sufficient to prevent harmful interference in the 8025–8400 MHz band, there was no need to impose additional technical requirements on operations in that band, and therefore granted the waiver request.[32] Given that the proposed SkySat-16 through SkySat-21 satellites do not materially deviate in design from SkySat-1 through SkySat-15, the Commission should similarly grant Terra Bella a waiver of the default service rules contained in Section 25.217(b) for SkySat-16 through SkySat-21.

### C. Request to Modify List of Earth Stations Approved for Transmissions

Terra Bella requests modification of Condition 6 of its authorization[33] so that this condition expressly permits space-to-earth downlink of remote-sensing and telemetry data in the 8025-8400 MHz band to all earth station locations approved for such transmissions under the existing coordination agreement between Terra Bella and NASA, or any successor agreement. Terra Bella's compliance with its NASA coordination agreement addresses concerns regarding harmful interference to protected space missions from these Terra Bella transmissions.

---

[29] *See Id.*; see also *Space Imaging, LLC*, 20 FCC Rcd. 11964, 11968 (2005) (determining such authorization does not cause harmful interference to other EESS systems currently operating in band).
[30] 47 C.F.R. § 25.217.
[31] *See* IBFS File Nos. SAT-LOA-20120322-00058 and SAT-MOD-20150408-00019.
[32] *See Id.,* DA No. 12-1520 dated September 21, 2012 (Public Notice approving SkySat-1 and SkySat-2 operations based on compliance with Part 2 and applicable ITU service rules); *see also DigitalGlobe, Inc.*, 20 FCC Rcd. 15696, 15701 (2005) (determining that compliance with Part 2 and applicable ITU service rules provides adequate interference protection to other spectrum users from space-to-Earth emissions from EESS satellites with X-band (8025–8400 MHz) feeder links).
[33] *See* Stamp Grant, IBFS File No. SAT-MOD-20150408-00019 at Condition 6 (granted Aug. 31, 2016). (limiting transmissions in the 8025-8400 MHz band to certain ground stations).

### D. Form 312, Schedule S

As required by the Commission's rules and policies, Terra Bella has completed the FCC Form 312, Schedule S submission that reflects the orbital and physical/electrical characteristics of the satellites proposed in this application. Terra Bella also refers the Commission to the link budgets in Attachment B to this Exhibit 43 for additional information regarding the performance of SkySat links.

To the best of Terra Bella's understanding, the information in Form 312, Schedule S is complete. Any additional information used to complete the application process is identified in this Exhibit.

### E. Implementation Milestones

Attachment A to this Exhibit shows under Section 25.113(f) of the Commission's rules that Terra Bella has initiated construction of SkySat-16 through SkySat-21. Terra Bella intends to supply the Commission at a later date with information sufficient to demonstrate, for these satellites, that it has satisfied the first four implementation milestones under Section 25.164(b) for NGSO systems.

### F. Request for Waiver of Bond Requirement

Terra Bella requests waiver of the bond requirement in Section 25.165(a)(1) of the Commission's rules for SkySat-16 through SkySat-21. In connection with its authorization of SkySat-4 through SkySat-15, the Commission waived the bond requirement on the grounds that Terra Bella had discharged the bond requirement associated with a prior grant of authority and warehousing concerns would be addressed by Condition 9 specifying, consistent with Section 25.161(a), that the authorization for SkySat-4 through SkySat-15 will be null and void should there be no Terra Bella satellites operating at any time during the license term.[34] Given that Terra Bella currently operates seven SkySat satellites, and in light of Condition 9, Terra Bella hereby requests that the Commission similarly grant waiver of the bond requirement in Section 25.165(a)(1) for SkySat-16 through SkySat-21.[35] Terra Bella understands that, in the absence of either a waiver of the bond requirement or a Commission

---

[34] *See* Stamp Grant, IBFS File No. SAT-MOD-20150408-00019 at Condition 9 and 10 (granted Aug. 31, 2016).

[35] *See* Letter from Craig Scheffler, Terra Bella Technologies Inc., to Marlene H. Dortch, Secretary, FCC, in FCC File No. SAT-MOD-20150408-0019 (June 30, 2016) (notifying the Commission that Terra Bella launched the SkySat-3 space station); Letter from Craig Scheffler, Terra Bella Technologies Inc., to Marlene H. Dortch, Secretary, FCC, in FCC File No. SAT-MOD-20150408-0019 (filed Oct. 4, 2016) (notifying the Commission that Terra Bella launched the SkySat-4 through SkySat-7 space stations); and Letter from Craig Scheffler, Terra Bella Technologies Inc., to Marlene H. Dortch, Secretary, FCC, in FCC File No. SAT-MOD-20150408-0019 (filed Feb. 10, 2017) (confirming that the SkySat-1 and SkySat-2 space stations are performing to specifications).

determination of milestone compliance issued with the grant of this application or within 30 days thereafter, the full amount of the bond specified in Section 25.165(a)(1) will be required.

### G. ITU Advance Publication Materials and Cost Recovery

Terra Bella has prepared the ITU Advance Publication Information submission for the proposed modification of its non-geostationary EESS system, and will provide an electronic file with this information to the Satellite Engineering Branch of the Satellite Division of the Commission's International Bureau. Terra Bella will also provide the Satellite Engineering Branch with a letter acknowledging that Terra Bella is responsible for any and all cost recovery fees associated with filings for the proposed system under ITU Council Decision 482 (modified in 2008), as it may be modified or succeeded in the future.

* * * * *

For the reasons set out above, Terra Bella respectfully requests modification of launch and operation authority as detailed herein. Terra Bella also respectfully requests a decision on this modification application substantially in advance of the anticipated September 2018 launch of SkySat-16 through Skysat-21.

## ATTACHMENT A
## NOTIFICATION OF COMMENCEMENT OF SPACE STATION CONSTRUCTION

Terra Bella Technologies Inc. (Terra Bella), pursuant to Section 25.113(f) of the Commission's rules, 47 C.F.R. § 25.113(f), hereby notifies the Commission that it has commenced construction, at its own risk, of six non-geostationary orbit (NGSO) satellites it proposes to launch and operate in the modification application to which this statement is attached. Terra Bella intends to utilize these spacecraft, which are designated SkySat-16 through SkySat-21, to further implement its NGSO Earth Exploration-Satellite Service system.

## ATTACHMENT B
## LINK BUDGETS

Figures 1 through 4 of this Attachment B depict the link budgets for SkySat-16 through SkySat-21 at their intended altitude of 500 km. Figures 5 through 8 depict the link budgets at the minimum altitude of 400 km. Figures 9 through 12 depict the link budgets for the maximum altitude of 630 km.

Note that the telemetry, tracking and command (TT&C) downlink budgets show two channel bandwidth options. The data rate and corresponding bandwidth are selectable for both channels. One is for the 256 kHz transmission bandwidth case (corresponding to transponders TTC1 and TTC2 in Schedule S) and the other is for the 512 kHz bandwidth transmission case (corresponding to transponders TTC3 and TTC4 in Schedule S). The data rate will be selected by mission operations as required for satellite health and safety. The power flux density (PFD) levels represented in Schedule S for the TTC transmitting beams present the highest PFD case occurring with the 256 kHz channel bandwidth.

Note that there are two payload data downlink link budgets presented for each altitude. One is for the 60 MHz transmission bandwidth case (corresponding to transponders PLD1, PLD2, and PLD3 in Schedule S) and the other is for the 100 MHz bandwidth transmission case (corresponding to transponders PLD4, PLD5, and PLD6 in

Schedule S). The SkySat satellites can select between 45 msps (60 MHz) and 76 msps (100 MHz) sample rates and between many modulation modes. A useful modulation rate is shown in each of the budgets and will be selected during mission operations to ensure adequate link margin. It should also be noted that the transmission power for the 100 MHz bandwidth case is higher than the 60 MHz bandwidth case by 2.3 dB, though PFD levels remain the same in the 4 kHz reference bandwidth, as shown for the PLD beam in Schedule S. The higher power and EIRP of the 100 MHz bandwidth case, rather than the power and EIRP of the 60 MHz bandwidth case, were used in order to reflect worst-case scenario results.

Section 25.114(c)(4)(v) of the Commission's rules requests the beam peak flux density at the command threshold for command beams. Schedule S includes a similar but not identical parameter. For completeness, -106.0 dBW/m$^2$ has been entered as the minimum power required to achieve reliable command receiver lock in Schedule S.

| **TT&C Downlink Analysis** | | Channel 1 | Channel 2 | |
|---|---|---|---|---|
| **General** | | | | |
| | Orbit Altitude | 500 | 500 | km |
| | Ground Elevation Angle | 5 | 5 | deg |
| | Slant range | 2078 | 2078 | km |
| **Transmission (Space Station)** | | | | |
| | Frequency | 8.375 | 8.380 | GHz |
| | Symbol rate (2) | 128 | 256 | ksps |
| | Channel Bandwidth | 256 | 512 | kHz |
| | PA Output Power | 0.8 | 0.8 | W |
| | Circuit Loss | 3.4 | 3.4 | dB |
| | Antenna Gain (1) | -5 | -5 | dBi |
| | Antenna HPBW | 70 | 70 | deg |
| | EIRP of Spacecraft | -9.4 | -9.4 | dBW |
| **Reception (Ground Station)** | | | | |
| | Free Space Loss | 177.2 | 177.2 | dB |
| | Pointing Loss | 1 | 1 | dB |
| | Polarization Loss | 1.5 | 1.5 | dB |
| | Atmospheric Loss, clear sky | 0.8 | 0.8 | dB |
| | Ground antenna gain | 43.8 | 43.8 | dBi |
| | Antenna HPBW | 1.1 | 1.1 | deg |
| | Received power at LNA input | -116.1 | -116.1 | dBm |
| | Ground System G/T (at 5 deg) | 22 | 22 | dB/K |
| | Received C/No | 60.7 | 60.7 | dBHz |
| | Received Es/No | 9.6 | 6.6 | dB |
| **Demodulator (Ground Station)** | | | | |
| | Modulation | DPSK | DPSK | |
| | Symbol rate | 128 | 256 | ksps |
| | Composite code rate | 0.50 | 0.50 | |
| | Uncoded data rate (2) | 64 | 128 | kbps |
| | Target BER | 1E-05 | 1E-05 | |
| | Demodulator Implementation loss | 0.5 | 0.5 | dB |
| | Required Es/No at target BER | 2.5 | 2.5 | dB |
| | **Link Margin** | **7.1** | **4.1** | **dB** |
| | (1) Assumes Spacecraft is nadir pointed during AOS | | | |
| | (2) The symbol rate is selectable, 128 or 256 ksps on either channel | | | |

**Figure 1. SkySat TT&C downlink (X-band) link budget for 500 km (nominal) altitude**

| Command Uplink Analysis | | Channel 1 | Channel 2 | |
|---|---|---|---|---|
| **General** | | | | |
| | Orbit Altitude | 500 | 500 | km |
| | Ground Elevation Angle | 5 | 5 | deg |
| | Slant range | 2078 | 2078 | km |
| **Transmission (Ground Station)** | | | | |
| | Frequency | 2.081 | 2.083 | GHz |
| | Symbol rate | 32 | 32 | ksps |
| | Channel Bandwidth | 124 | 124 | kHz |
| | PA Output Power (Watts) | 15.8 | 15.8 | W |
| | PA Output Power (dBW) | 12.0 | 12.0 | dBW |
| | Circuit Loss | 1.5 | 1.5 | dB |
| | Antenna Peak Gain | 32 | 32 | dBi |
| | Antenna HPBW | 4.2 | 4.2 | deg |
| | EIRP of Ground Antenna | 42.5 | 42.5 | dBW |
| **Reception (Space Station)** | | | | |
| | Atmospheric Loss, clear sky | 0.4 | 0.4 | dB |
| | Free Space Loss | 165.1 | 165.1 | dB |
| | Pointing Loss | 0.5 | 0.5 | dB |
| | Polarization Loss | 1.5 | 1.5 | dB |
| | Antenna HPBW | 70 | 70 | deg |
| | Antenna Gain (1) | -3 | -3 | dBi |
| | Circuit Loss | 0.9 | 0.9 | dB |
| | Received power at LNA input | -98.9 | -98.9 | dBm |
| **Demodulator (Space Station)** | | | | |
| | Modulation | FSK | FSK | |
| | Symbol rate | 32 | 32 | ksps |
| | Composite code rate | 1.00 | 1.00 | |
| | Uncoded data rate | 32 | 32 | kbps |
| | Target BER | 1E-05 | 1E-05 | |
| | Required Signal Level at Target BER | -107 | -107 | dBm |
| | Received Signal Level | -98.9 | -98.9 | dBm |
| | **Link Margin** | **8.1** | **8.1** | **dB** |
| | (1) Assumes Spacecraft is nadir pointed during AOS | | | |

**Figure 2. SkySat TT&C uplink (S-band) link budget for 500 km (nominal) altitude**

| **Payload Downlink Analysis** | Channel 1 | Channel 2 | Channel 3 | |
|---|---|---|---|---|
| **General** | | | | |
| Orbit Altitude | 500 | 500 | 500 | km |
| Elevation Angle | 5 | 5 | 5 | deg |
| Slant range | 2078 | 2078 | 2078 | km |
| **Transmission (Space Station)** | | | | |
| Frequency | 8.075 | 8.200 | 8.325 | GHz |
| Symbol rate | 45 | 45 | 45 | msps |
| Channel Bandwidth | 60 | 60 | 60 | MHz |
| PA Output Power | 0.8 | 0.8 | 0.8 | W |
| Circuit Loss | 4.3 | 4.3 | 4.3 | dB |
| Antenna Peak Gain | 26.7 | 26.9 | 27 | dBi |
| Antenna HPBW | 5.7 | 5.7 | 5.7 | deg |
| EIRP of Spacecraft | 21.4 | 21.6 | 21.7 | dBW |
| **Reception (Ground Station)** | | | | |
| Free Space Loss | 176.9 | 177.0 | 177.2 | dB |
| Pointing Loss | 1 | 1 | 1 | dB |
| Polarization Loss | 0.3 | 0.3 | 0.3 | dB |
| Atmospheric Loss, clear sky | 0.8 | 0.8 | 0.8 | dB |
| Ground antenna gain | 43.5 | 43.7 | 43.8 | dBi |
| Antenna HPBW | 1.1 | 1.1 | 1.1 | deg |
| Received power at LNA input | -84.1 | -83.8 | -83.7 | dBm |
| Ground System G/T (at 5 deg) | 21.7 | 21.9 | 22 | dB/K |
| Received C/No | 92.7 | 93.0 | 93.1 | dBHz |
| Received Es/No | 16.2 | 16.5 | 16.5 | dB |
| **Demodulator (Ground Station)** | | | | |
| Modulation (1) | 16APSK | 16APSK | 16APSK | |
| Symbol rate | 45 | 45 | 45 | msps |
| Composite Code rate | 0.89 | 0.89 | 0.89 | |
| Uncoded data rate | 155 | 155 | 155 | mbps |
| Target BER | 1E-10 | 1E-10 | 1E-10 | |
| Demodulator Implementation loss | 0.5 | 0.5 | 0.5 | dB |
| Required Es/No at target BER | 13.4 | 13.4 | 13.4 | dB |
| **Link Margin** | **2.8** | **3.1** | **3.1** | **dB** |

(1) The modulation and data rate is selectable on all channels to optimize link margin

**Figure 3. SkySat payload data downlink (X-band) 60 MHz bandwidth link budget for 500 km (nominal) altitude**

| **Payload Downlink Analysis** | Channel 1 | Channel 2 | Channel 3 | |
|---|---|---|---|---|
| **General** | | | | |
| Orbit Altitude | 500 | 500 | 500 | km |
| Elevation Angle | 5 | 5 | 5 | deg |
| Slant range | 2078 | 2078 | 2078 | km |
| **Transmission (Space Station)** | | | | |
| Frequency | 8.075 | 8.200 | 8.325 | GHz |
| Symbol rate | 76 | 76 | 76 | msps |
| Channel bandwidth | 100 | 100 | 100 | MHz |
| PA Output Power | 1.35 | 1.35 | 1.35 | W |
| Circuit Loss | 4.3 | 4.3 | 4.3 | dB |
| Antenna Peak Gain | 26.7 | 26.9 | 27 | dBi |
| Antenna HPBW | 5.7 | 5.7 | 5.7 | deg |
| EIRP of Spacecraft | 23.7 | 23.9 | 24.0 | dBW |
| **Reception (Ground Station)** | | | | |
| Free Space Loss | 176.9 | 177.0 | 177.2 | dB |
| Pointing Loss | 1 | 1 | 1 | dB |
| Polarization Loss | 0.3 | 0.3 | 0.3 | dB |
| Atmospheric Loss, clear sky | 0.8 | 0.8 | 0.8 | dB |
| Ground antenna gain | 43.5 | 43.7 | 43.8 | dBi |
| Antenna HPBW | 1.1 | 1.1 | 1.1 | deg |
| Received power at LNA input | -81.8 | -81.5 | -81.5 | dBm |
| Ground System G/T (at 5 deg) | 21.7 | 21.9 | 22 | dB/K |
| Received $C/N_0$ | 95.0 | 95.3 | 95.3 | dBHz |
| Received $E_s/N_0$ | 16.2 | 16.5 | 16.5 | dB |
| **Demodulator (Ground Station)** | | | | |
| Modulation (1) | 16APSK | 16APSK | 16APSK | |
| Symbol rate | 76 | 76 | 76 | msps |
| Composite Code rate | 0.89 | 0.89 | 0.89 | |
| Uncoded data rate | 262 | 262 | 262 | mbps |
| Target BER | 1E-10 | 1E-10 | 1E-10 | |
| Demodulator Implementation loss | 0.5 | 0.5 | 0.5 | dB |
| Required $E_s/N_0$ at target BER | 13.4 | 13.4 | 13.4 | dB |
| **Link Margin** | **2.8** | **3.1** | **3.1** | **dB** |

(1) The modulation and data rate is selectable on all channels to optimize link margin

**Figure 4. SkySat payload data downlink (X-band) 100 MHz bandwidth link budget for 500 km (nominal) altitude**

| **TT&C Downlink Analysis** | Channel 1 | Channel 2 | |
|---|---|---|---|
| **General** | | | |
| Orbit Altitude | 400 | 400 | km |
| Ground Elevation Angle | 5 | 5 | deg |
| Slant range | 1805 | 1805 | km |
| **Transmission (Space Station)** | | | |
| Frequency | 8.375 | 8.380 | GHz |
| Symbol rate (2) | 128 | 256 | ksps |
| Channel Bandwidth | 256 | 512 | kHz |
| PA Output Power | 0.8 | 0.8 | W |
| Circuit Loss | 3.4 | 3.4 | dB |
| Antenna Gain (1) | -5 | -5 | dBi |
| Antenna HPBW | 70 | 70 | deg |
| EIRP of Spacecraft | -9.4 | -9.4 | dBW |
| **Reception (Ground Station)** | | | |
| Free Space Loss | 176.0 | 176.0 | dB |
| Pointing Loss | 1 | 1 | dB |
| Polarization Loss | 1.5 | 1.5 | dB |
| Atmospheric Loss, clear sky | 0.8 | 0.8 | dB |
| Ground antenna gain | 43.8 | 43.8 | dBi |
| Antenna HPBW | 1.1 | 1.1 | deg |
| Received power at LNA input | -114.9 | -114.9 | dBm |
| Ground System G/T (at 5 deg) | 22 | 22 | dB/K |
| Received C/No | 61.9 | 61.9 | dBHz |
| Received Es/No | 10.9 | 7.9 | dB |
| **Demodulator (Ground Station)** | | | |
| Modulation | DPSK | DPSK | |
| Symbol rate | 128 | 256 | ksps |
| Composite code rate | 0.50 | 0.50 | |
| Uncoded data rate (2) | 64 | 128 | kbps |
| Target BER | 1E-05 | 1E-05 | |
| Demodulator Implementation loss | 0.5 | 0.5 | dB |
| Required Es/No at target BER | 2.5 | 2.5 | dB |
| **Link Margin** | **8.4** | **5.4** | **dB** |
| (1) Assumes Spacecraft is nadir pointed during AOS | | | |
| (2) The symbol rate is selectable, 128 or 256 ksps on either channel | | | |

**Figure 5. SkySat TT&C downlink (X-band) link budget for 400 km altitude**

| **Command Uplink Analysis** | Channel 1 | Channel 2 | |
|---|---|---|---|
| **General** | | | |
| Orbit Altitude | 400 | 400 | km |
| Ground Elevation Angle | 5 | 5 | deg |
| Slant range | 1805 | 1805 | km |
| **Transmission (Ground Station)** | | | |
| Frequency | 2.081 | 2.083 | GHz |
| Symbol rate | 32 | 32 | ksps |
| Channel Bandwidth | 124 | 124 | kHz |
| PA Output Power (Watts) | 15.8 | 15.8 | W |
| PA Output Power (dBW) | 12.0 | 12.0 | dBW |
| Circuit Loss | 1.5 | 1.5 | dB |
| Antenna Peak Gain | 32 | 32 | dBi |
| Antenna HPBW | 4.2 | 4.2 | deg |
| EIRP of Ground Antenna | 42.5 | 42.5 | dBW |
| **Reception (Space Station)** | | | |
| Atmospheric Loss, clear sky | 0.4 | 0.4 | dB |
| Free Space Loss | 163.9 | 163.9 | dB |
| Pointing Loss | 0.5 | 0.5 | dB |
| Polarization Loss | 1.5 | 1.5 | dB |
| Antenna HPBW | 70 | 70 | deg |
| Antenna Gain (1) | -3 | -3 | dBi |
| Circuit Loss | 0.9 | 0.9 | dB |
| Received power at LNA input | -97.7 | -97.7 | dBm |
| **Demodulator (Space Station)** | | | |
| Modulation | FSK | FSK | |
| Symbol rate | 32 | 32 | ksps |
| Composite code rate | 1.00 | 1.00 | |
| Uncoded data rate | 32 | 32 | kbps |
| Target BER | 1E-05 | 1E-05 | |
| Required Signal Level at Target BER | -107 | -107 | dBm |
| Received Signal Level | -97.7 | -97.7 | dBm |
| **Link Margin** | **9.3** | **9.3** | **dB** |
| (1) Assumes Spacecraft is nadir pointed during AOS | | | |

**Figure 6. SkySat TT&C uplink (S-band) link budget for 400 km altitude**

| **Payload Downlink Analysis** | Channel 1 | Channel 2 | Channel 3 | |
|---|---|---|---|---|
| **General** | | | | |
| Orbit Altitude | 400 | 400 | 400 | km |
| Elevation Angle | 5 | 5 | 5 | deg |
| Slant range | 1805 | 1805 | 1805 | km |
| **Transmission (Space Station)** | | | | |
| Frequency | 8.075 | 8.200 | 8.325 | GHz |
| Symbol rate | 45 | 45 | 45 | msps |
| Channel Bandwidth | 60 | 60 | 60 | MHz |
| PA Output Power | 0.8 | 0.8 | 0.8 | W |
| Circuit Loss | 4.3 | 4.3 | 4.3 | dB |
| Antenna Peak Gain | 26.7 | 26.9 | 27 | dBi |
| Antenna HPBW | 5.7 | 5.7 | 5.7 | deg |
| EIRP of Spacecraft | 21.4 | 21.6 | 21.7 | dBW |
| **Reception (Ground Station)** | | | | |
| Free Space Loss | 175.7 | 175.8 | 175.9 | dB |
| Pointing Loss | 1 | 1 | 1 | dB |
| Polarization Loss | 0.3 | 0.3 | 0.3 | dB |
| Atmospheric Loss, clear sky | 0.8 | 0.8 | 0.8 | dB |
| Ground antenna gain | 43.5 | 43.7 | 43.8 | dBi |
| Antenna HPBW | 1.1 | 1.1 | 1.1 | deg |
| Received power at LNA input | -82.8 | -82.6 | -82.5 | dBm |
| Ground System G/T (at 5 deg) | 21.7 | 21.9 | 22 | dB/K |
| Received C/No | 94.0 | 94.2 | 94.3 | dBHz |
| Received Es/No | 17.4 | 17.7 | 17.8 | dB |
| **Demodulator (Ground Station)** | | | | |
| Modulation (1) | 16APSK | 16APSK | 16APSK | |
| Symbol rate | 45 | 45 | 45 | msps |
| Composite Code rate | 0.89 | 0.89 | 0.89 | |
| Uncoded data rate | 155 | 155 | 155 | mbps |
| Target BER | 1E-10 | 1E-10 | 1E-10 | |
| Demodulator Implementation loss | 0.5 | 0.5 | 0.5 | dB |
| Required Es/No at target BER | 13.4 | 13.4 | 13.4 | dB |
| **Link Margin** | **4.0** | **4.3** | **4.4** | **dB** |
| (1) The modulation and data rate is selectable on all channels | | | | |

**Figure 7. SkySat payload data downlink (X-band) 60 MHz bandwidth link budget for 400 km altitude**

| **Payload Downlink Analysis** | Channel 1 | Channel 2 | Channel 3 | |
|---|---|---|---|---|
| **General** | | | | |
| Orbit Altitude | 400 | 400 | 400 | km |
| Elevation Angle | 5 | 5 | 5 | deg |
| Slant range | 1805 | 1805 | 1805 | km |
| **Transmission (Space Station)** | | | | |
| Frequency | 8.075 | 8.200 | 8.325 | GHz |
| Symbol rate | 76 | 76 | 76 | msps |
| Channel bandwidth | 100 | 100 | 100 | MHz |
| PA Output Power | 1.35 | 1.35 | 1.35 | W |
| Circuit Loss | 4.3 | 4.3 | 4.3 | dB |
| Antenna Peak Gain | 26.7 | 26.9 | 27 | dBi |
| Antenna HPBW | 5.7 | 5.7 | 5.7 | deg |
| EIRP of Spacecraft | 23.7 | 23.9 | 24.0 | dBW |
| **Reception (Ground Station)** | | | | |
| Free Space Loss | 175.7 | 175.8 | 175.9 | dB |
| Pointing Loss | 1 | 1 | 1 | dB |
| Polarization Loss | 0.3 | 0.3 | 0.3 | dB |
| Atmospheric Loss, clear sky | 0.8 | 0.8 | 0.8 | dB |
| Ground antenna gain | 43.5 | 43.7 | 43.8 | dBi |
| Antenna HPBW | 1.1 | 1.1 | 1.1 | deg |
| Received power at LNA input | -80.6 | -80.3 | -80.2 | dBm |
| Ground System G/T (at 5 deg) | 21.7 | 21.9 | 22 | dB/K |
| Received $C/N_0$ | 96.2 | 96.5 | 96.6 | dBHz |
| Received $E_s/N_0$ | 17.4 | 17.7 | 17.8 | dB |
| **Demodulator (Ground Station)** | | | | |
| Modulation (1) | 16APSK | 16APSK | 16APSK | |
| Symbol rate | 76 | 76 | 76 | msps |
| Composite Code rate | 0.89 | 0.89 | 0.89 | |
| Uncoded data rate | 262 | 262 | 262 | mbps |
| Target BER | 1E-10 | 1E-10 | 1E-10 | |
| Demodulator Implementation loss | 0.5 | 0.5 | 0.5 | dB |
| Required $E_s/N_0$ at target BER | 13.4 | 13.4 | 13.4 | dB |
| **Link Margin** | **4.0** | **4.3** | **4.4** | **dB** |

(1) The modulation and data rate is selectable on all channels to optimize link margin

**Figure 8. SkySat payload data downlink (X-band) 100 MHz bandwidth link budget for 400 km altitude**

| **TT&C Downlink Analysis** | | Channel 1 | Channel 2 | |
|---|---|---|---|---|
| **General** | | | | |
| | Orbit Altitude | 630 | 630 | km |
| | Ground Elevation Angle | 5 | 5 | deg |
| | Slant range | 2401 | 2401 | km |
| **Transmission (Space Station)** | | | | |
| | Frequency | 8.375 | 8.380 | GHz |
| | Symbol rate (2) | 128 | 256 | ksps |
| | Channel Bandwidth | 256 | 512 | kHz |
| | PA Output Power | 0.8 | 0.8 | W |
| | Circuit Loss | 3.4 | 3.4 | dB |
| | Antenna Gain (1) | -5 | -5 | dBi |
| | Antenna HPBW | 70 | 70 | deg |
| | EIRP of Spacecraft | -9.4 | -9.4 | dBW |
| **Reception (Ground Station)** | | | | |
| | Free Space Loss | 178.5 | 178.5 | dB |
| | Pointing Loss | 1 | 1 | dB |
| | Polarization Loss | 1.5 | 1.5 | dB |
| | Atmospheric Loss, clear sky | 0.8 | 0.8 | dB |
| | Ground antenna gain | 43.8 | 43.8 | dBi |
| | Antenna HPBW | 1.1 | 1.1 | deg |
| | Received power at LNA input | -117.3 | -117.3 | dBm |
| | Ground System G/T (at 5 deg) | 22 | 22 | dB/K |
| | Received C/No | 59.5 | 59.5 | dBHz |
| | Received Es/No | 8.4 | 5.4 | dB |
| **Demodulator (Ground Station)** | | | | |
| | Modulation | DPSK | DPSK | |
| | Symbol rate | 128 | 256 | ksps |
| | Composite code rate | 0.50 | 0.50 | |
| | Uncoded data rate (2) | 64 | 128 | kbps |
| | Target BER | 1E-05 | 1E-05 | |
| | Demodulator Implementation loss | 0.5 | 0.5 | dB |
| | Required Es/No at target BER | 2.5 | 2.5 | dB |
| | **Link Margin** | **5.9** | **2.9** | **dB** |
| | (1) Assumes Spacecraft is nadir pointed during AOS | | | |
| | (2) The symbol rate is selectable, 128 or 256 ksps on either channel | | | |

**Figure 9. SkySat TT&C downlink (X-band) link budget for 630 km altitude**

| **Command Uplink Analysis** | Channel 1 | Channel 2 | |
|---|---|---|---|
| **General** | | | |
| Orbit Altitude | 630 | 630 | km |
| Ground Elevation Angle | 5 | 5 | deg |
| Slant range | 2401 | 2401 | km |
| **Transmission (Ground Station)** | | | |
| Frequency | 2.081 | 2.083 | GHz |
| Symbol rate | 32 | 32 | ksps |
| Channel Bandwidth | 124 | 124 | kHz |
| PA Output Power (Watts) | 15.8 | 15.8 | W |
| PA Output Power (dBW) | 12.0 | 12.0 | dBW |
| Circuit Loss | 1.5 | 1.5 | dB |
| Antenna Peak Gain | 32 | 32 | dBi |
| Antenna HPBW | 4.2 | 4.2 | deg |
| EIRP of Ground Antenna | 42.5 | 42.5 | dBW |
| **Reception (Space Station)** | | | |
| Atmospheric Loss, clear sky | 0.4 | 0.4 | dB |
| Free Space Loss | 166.4 | 166.4 | dB |
| Pointing Loss | 0.5 | 0.5 | dB |
| Polarization Loss | 1.5 | 1.5 | dB |
| Antenna HPBW | 70 | 70 | deg |
| Antenna Gain (1) | -3 | -3 | dBi |
| Circuit Loss | 0.9 | 0.9 | dB |
| Received power at LNA input | -100.2 | -100.2 | dBm |
| **Demodulator (Space Station)** | | | |
| Modulation | FSK | FSK | |
| Symbol rate | 32 | 32 | ksps |
| Composite code rate | 1.00 | 1.00 | |
| Uncoded data rate | 32 | 32 | kbps |
| Target BER | 1E-05 | 1E-05 | |
| Required Signal Level at Target BER | -107 | -107 | dBm |
| Received Signal Level | -100.2 | -100.2 | dBm |
| **Link Margin** | **6.8** | **6.8** | **dB** |
| (1) Assumes Spacecraft is nadir pointed during AOS | | | |

**Figure 10. SkySat TT&C uplink (S-band) link budget for 630 km altitude**

| **Payload Downlink Analysis** | | Channel 1 | Channel 2 | Channel 3 | |
|---|---|---|---|---|---|
| **General** | | | | | |
| | Orbit Altitude | 630 | 630 | 630 | km |
| | Elevation Angle | 5 | 5 | 5 | deg |
| | Slant range | 2401 | 2401 | 2401 | km |
| **Transmission (Space Station)** | | | | | |
| | Frequency | 8.075 | 8.200 | 8.325 | GHz |
| | Symbol rate | 45 | 45 | 45 | msps |
| | Channel Bandwidth | 60 | 60 | 60 | MHz |
| | PA Output Power | 0.8 | 0.8 | 0.8 | W |
| | Circuit Loss | 4.3 | 4.3 | 4.3 | dB |
| | Antenna Peak Gain | 26.7 | 26.9 | 27 | dBi |
| | Antenna HPBW | 5.7 | 5.7 | 5.7 | deg |
| | EIRP of Spacecraft | 21.4 | 21.6 | 21.7 | dBW |
| **Reception (Ground Station)** | | | | | |
| | Free Space Loss | 178.2 | 178.3 | 178.4 | dB |
| | Pointing Loss | 1 | 1 | 1 | dB |
| | Polarization Loss | 0.3 | 0.3 | 0.3 | dB |
| | Atmospheric Loss, clear sky | 0.8 | 0.8 | 0.8 | dB |
| | Ground antenna gain | 43.5 | 43.7 | 43.8 | dBi |
| | Antenna HPBW | 1.1 | 1.1 | 1.1 | deg |
| | Received power at LNA input | -85.3 | -85.1 | -85.0 | dBm |
| | Ground System G/T (at 5 deg) | 21.7 | 21.9 | 22 | dB/K |
| | Received $C/N_0$ | 91.5 | 91.7 | 91.8 | dBHz |
| | Received $E_s/N_0$ | 14.9 | 15.2 | 15.3 | dB |
| **Demodulator (Ground Station)** | | | | | |
| | Modulation (1) | 16APSK | 16APSK | 16APSK | |
| | Symbol rate | 45 | 45 | 45 | msps |
| | Composite Code rate | 0.75 | 0.75 | 0.75 | |
| | Uncoded data rate | 130 | 130 | 130 | mbps |
| | Target BER | 1E-10 | 1E-10 | 1E-10 | |
| | Demodulator Implementation loss | 0.5 | 0.5 | 0.5 | dB |
| | Required $E_s/N_0$ at target BER | 10.7 | 10.7 | 10.7 | dB |
| | **Link Margin** | **4.2** | **4.5** | **4.6** | **dB** |

(1) The modulation and data rate is selectable on all channels to optimize link margin

**Figure 11. SkySat payload data downlink (X-band) 60 MHz link budget for 630 km altitude**

| **Payload Downlink Analysis** | Channel 1 | Channel 2 | Channel 3 | |
|---|---|---|---|---|
| **General** | | | | |
| Orbit Altitude | 630 | 630 | 630 | km |
| Elevation Angle | 5 | 5 | 5 | deg |
| Slant range | 2401 | 2401 | 2401 | km |
| **Transmission (Space Station)** | | | | |
| Frequency | 8.075 | 8.200 | 8.325 | GHz |
| Symbol rate | 76 | 76 | 76 | msps |
| Channel BW | 100 | 100 | 100 | MHz |
| PA Output Power | 1.35 | 1.35 | 1.35 | W |
| Circuit Loss | 4.3 | 4.3 | 4.3 | dB |
| Antenna Peak Gain | 26.7 | 26.9 | 27 | dBi |
| Antenna HPBW | 5.7 | 5.7 | 5.7 | deg |
| EIRP of Spacecraft | 23.7 | 23.9 | 24.0 | dBW |
| **Reception (Ground Station)** | | | | |
| Free Space Loss | 178.2 | 178.3 | 178.4 | dB |
| Pointing Loss | 1 | 1 | 1 | dB |
| Polarization Loss | 0.3 | 0.3 | 0.3 | dB |
| Atmospheric Loss, clear sky | 0.8 | 0.8 | 0.8 | dB |
| Ground antenna gain | 43.5 | 43.7 | 43.8 | dBi |
| Antenna HPBW | 1.1 | 1.1 | 1.1 | deg |
| Received power at LNA input | -83.0 | -82.8 | -82.7 | dBm |
| Ground System G/T (at 5 deg) | 21.7 | 21.9 | 22 | dB/K |
| Received C/No | 93.8 | 94.0 | 94.1 | dBHz |
| Received Es/No | 14.9 | 15.2 | 15.3 | dB |
| **Demodulator (Ground Station)** | | | | |
| Modulation (1) | 16APSK | 16APSK | 16APSK | |
| Symbol rate | 76 | 76 | 76 | msps |
| Composite Code rate | 0.75 | 0.75 | 0.75 | |
| Uncoded data rate | 220 | 220 | 220 | mbps |
| Target BER | 1E-10 | 1E-10 | 1E-10 | |
| Demodulator Implementation loss | 0.5 | 0.5 | 0.5 | dB |
| Required Es/No at target BER | 10.7 | 10.7 | 10.7 | dB |
| **Link Margin** | **4.2** | **4.5** | **4.6** | **dB** |

(1) The modulation and data rate is selectable on all channels to optimize link margin

**Figure 12. SkySat payload data downlink (X-band) 100 MHz link budget for 630 km altitude**

## ATTACHMENT C
## SKYSAT SYSTEM ANTENNA PATTERNS

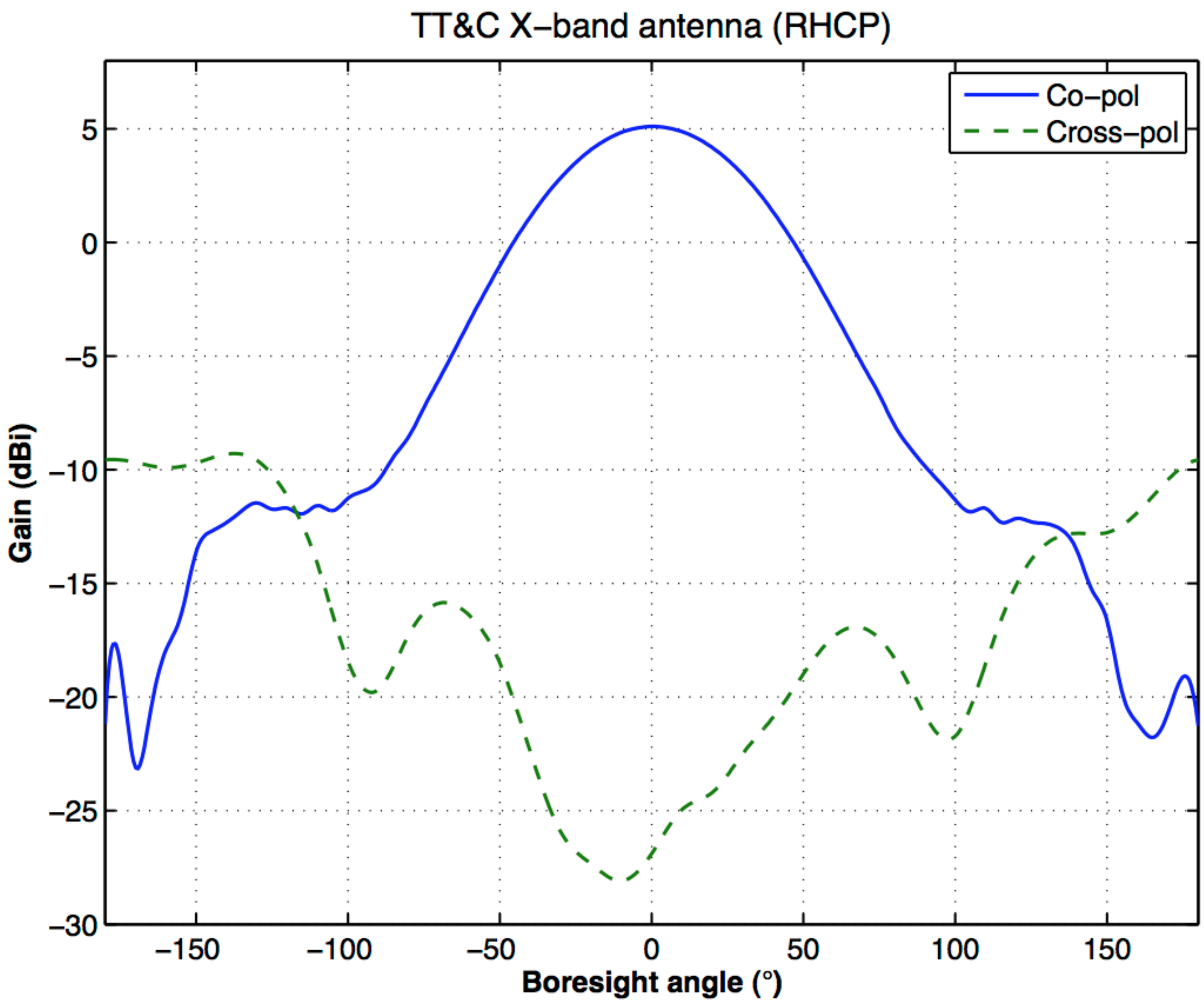



**Figure 1. SkySat TT&C Downlink (X-band) Antenna Pattern**

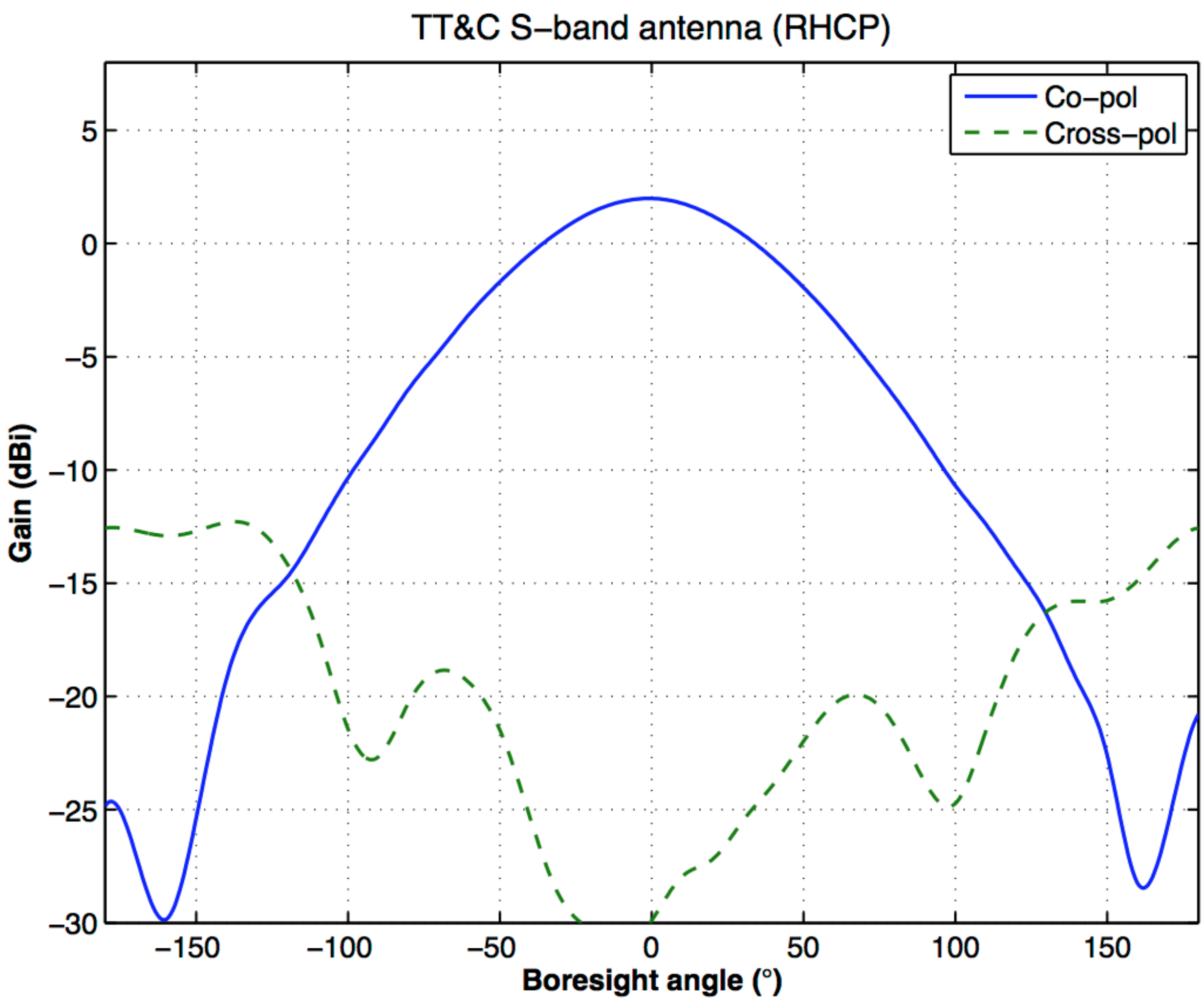



**Figure 2. SkySat TT&C Uplink (S-band) Antenna Pattern**

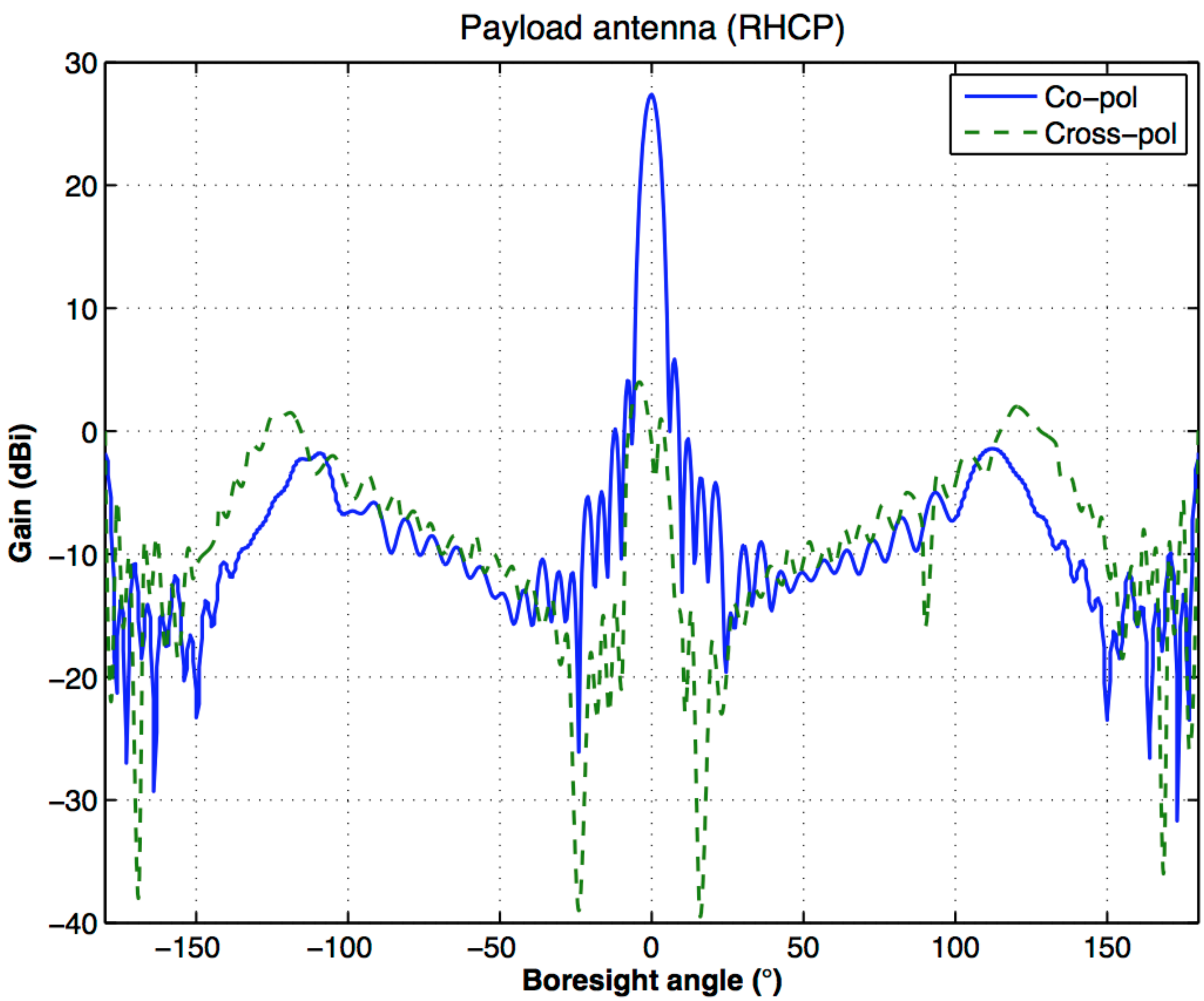



**Figure 3. SkySat Data Downlink (X-band) Antenna Pattern**

# ATTACHMENT D
# PREDICTED GAIN CONTOURS

The 36 figures in this Attachment depict the antenna gain contours over the SkySat earth stations for both the SkySat payload data downlink and the telemetry, tracking and command (TT&C) links for altitudes 400 km (minimum), 500 km (nominal), and 630 km (maximum).

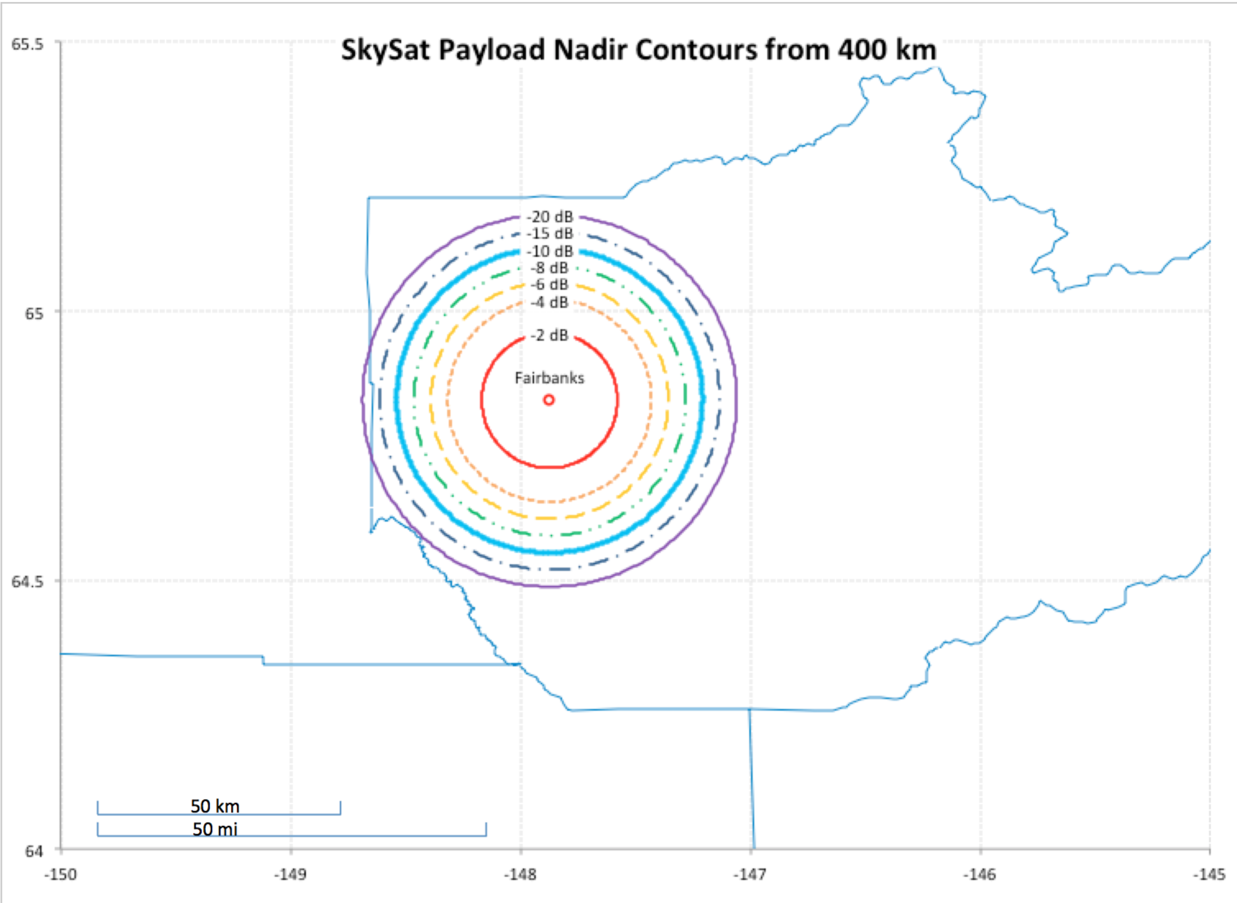
The modeled earth stations are at the following locations:

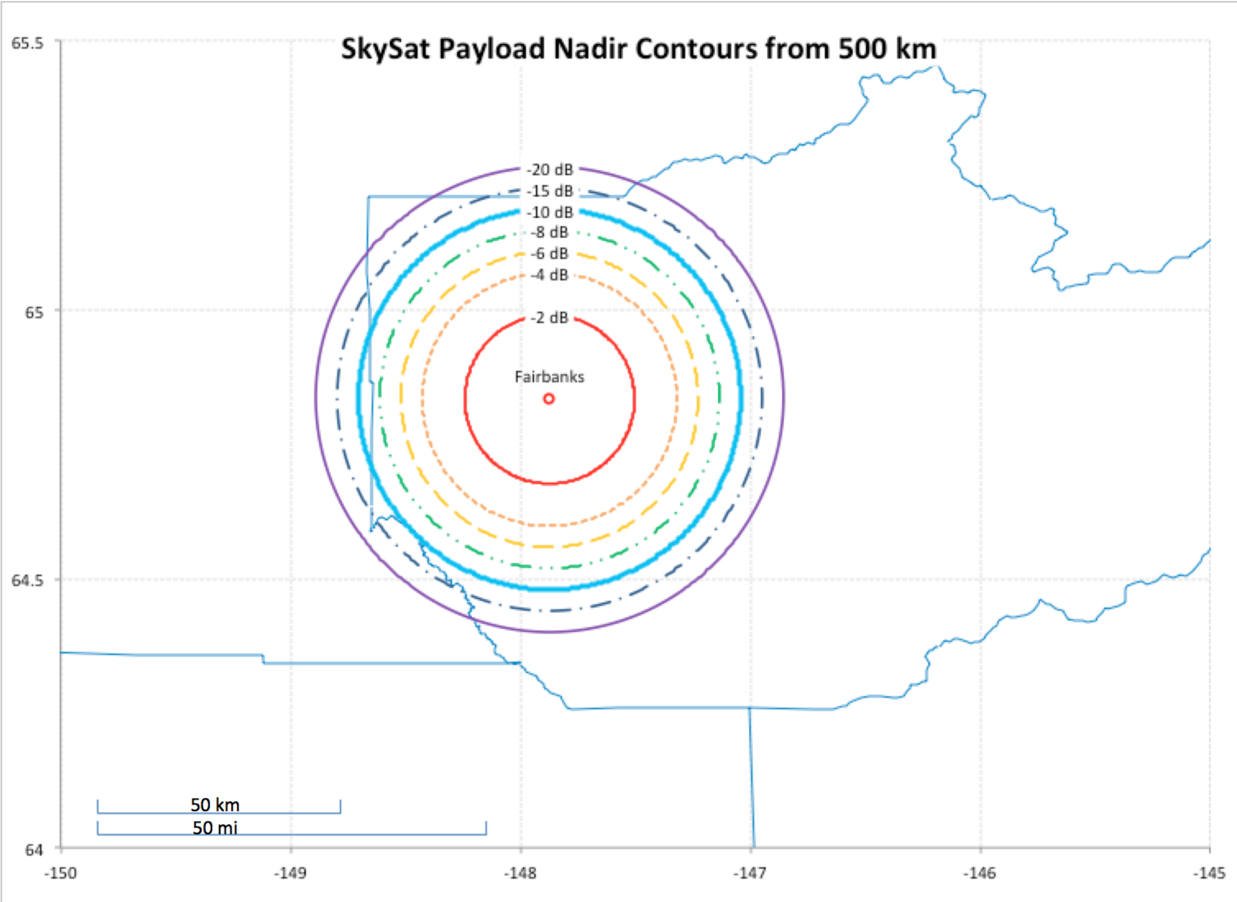
- Fairbanks, Alaska (LLA: 64.81318, -147.73313, 135m)
- Half Moon Bay, California (LLA: 37.44705, -122.43037, 26m)
- Inuvik NT, Canada (LLA: 68.32547, -133.60961, 33m)
- Svalbard, Norway (LLA: 78.22692, 15.41658, 498m)
- Tromso, Norway (LLA: 69.66196, 18.93959, 102m)
- Troll, Antarctica (LLA: -72.01120, 2.55360, 1366m)

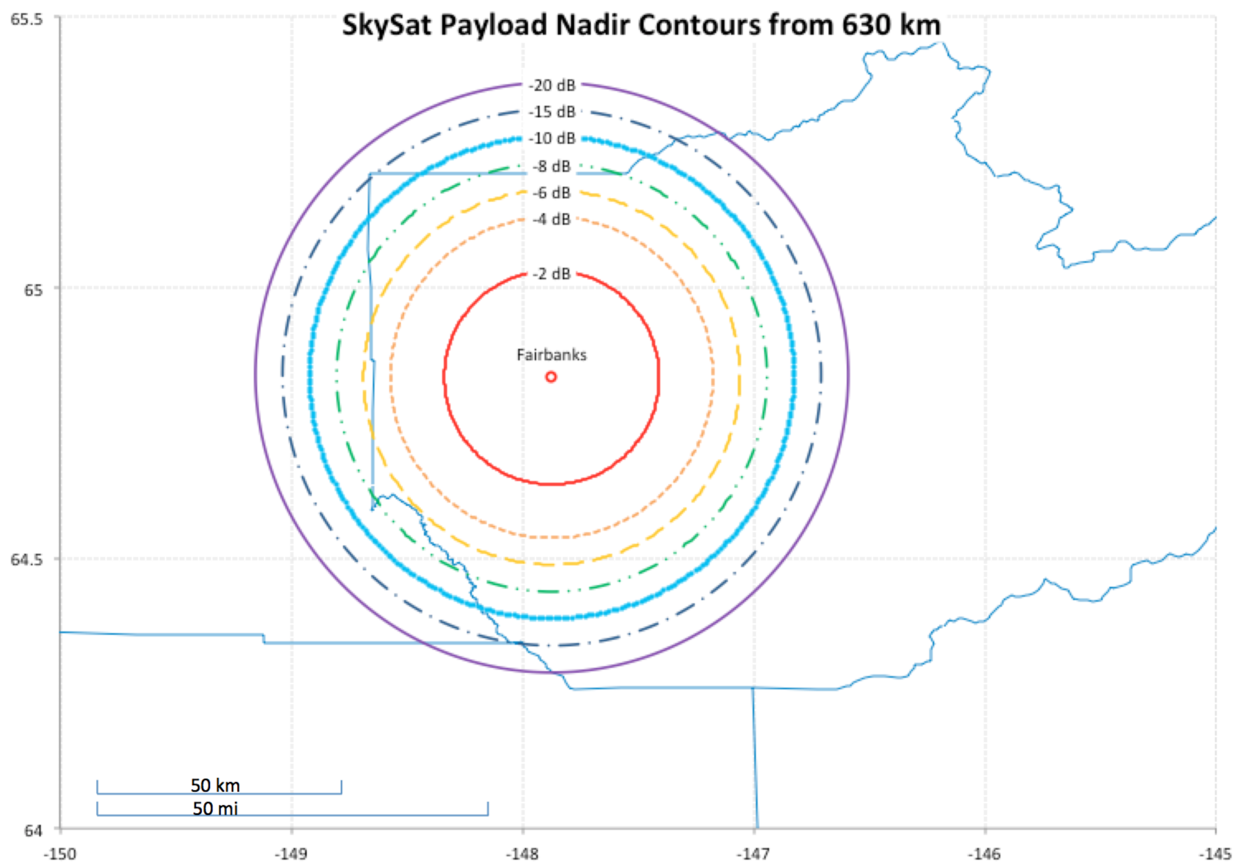
**EXHIBIT 43**

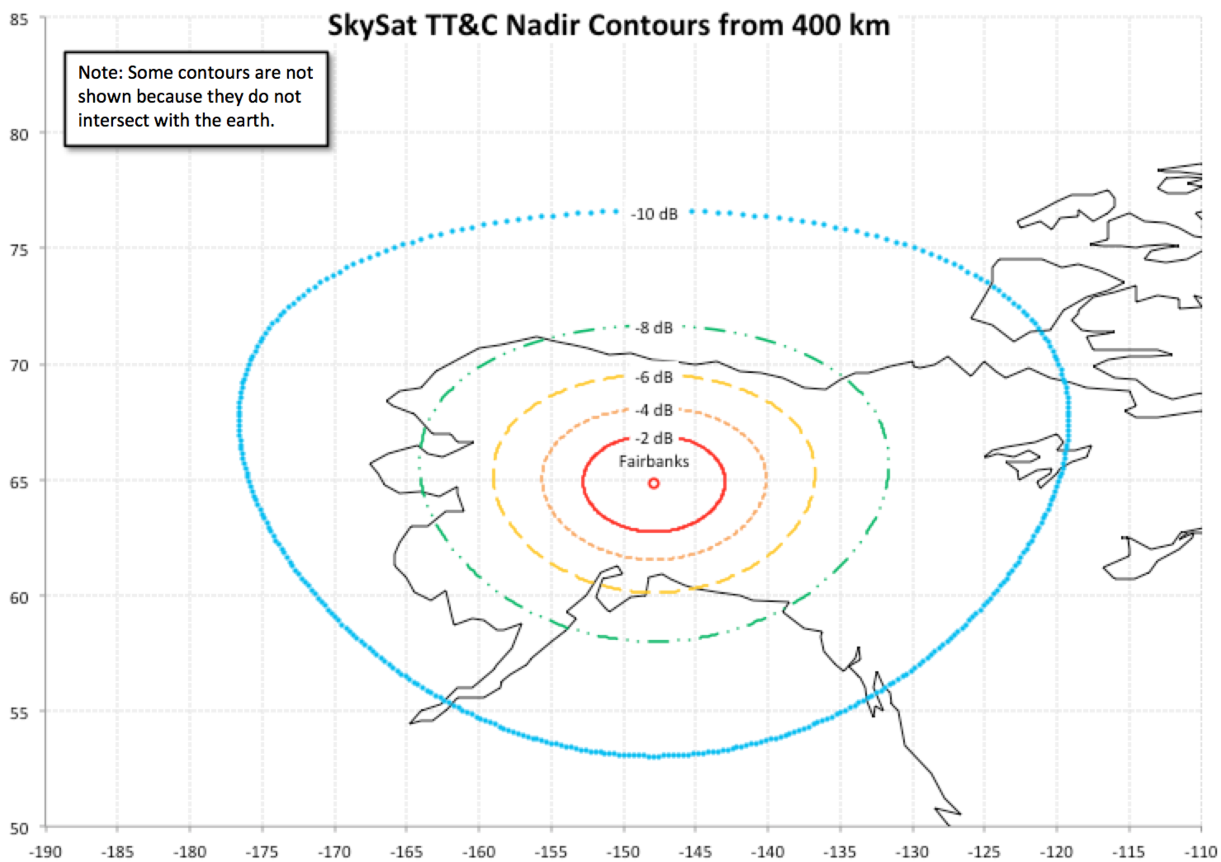
Terra Bella Technologies Inc.
Application for License Modification

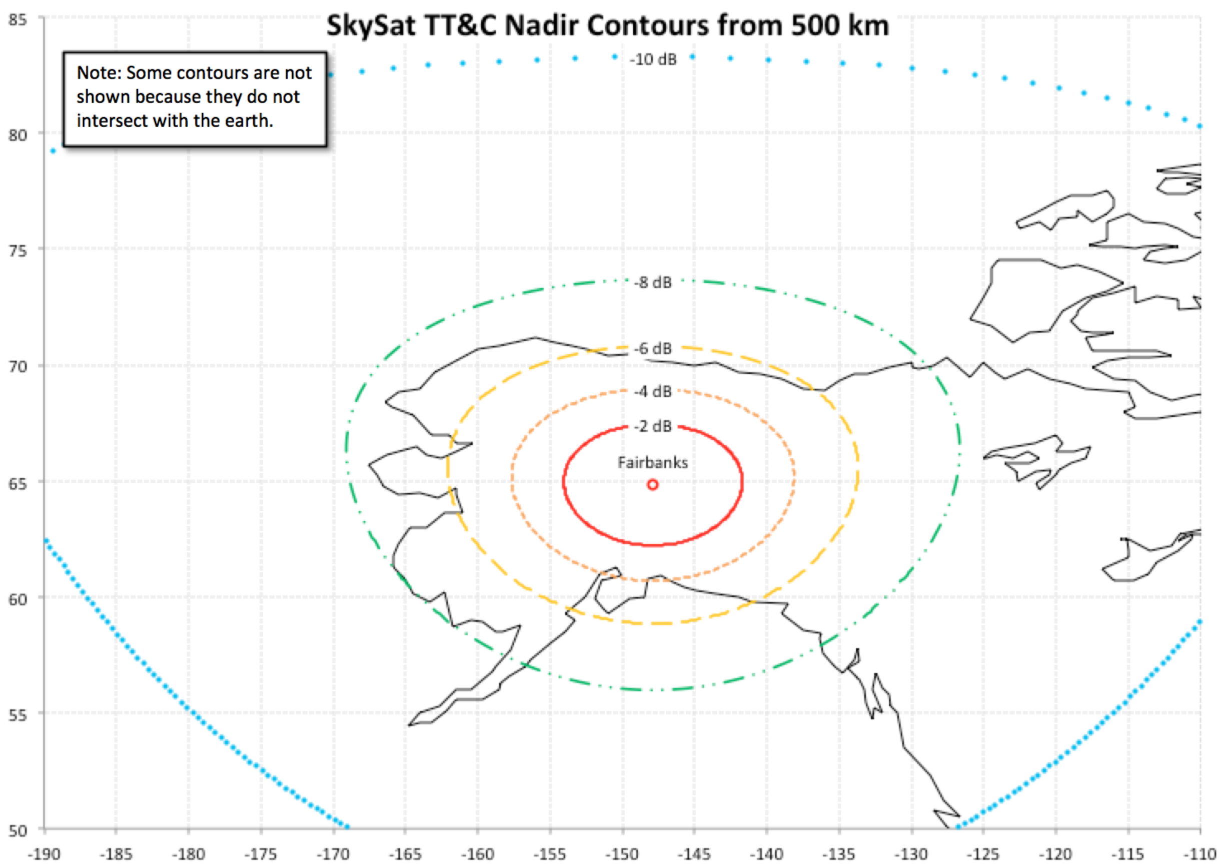
## Contours for Fairbanks, Alaska, Earth Station




SkySat Payload Nadir Contours from 500 km
-20 dB
-15 dB
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Fairbanks
50 km
50 mi
65.5
65
64.5
64
-150
-149
-148
-147
-146
-145


SkySat Payload Nadir Contours from 630 km
-20 dB
-15 dB
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Fairbanks
50 km
50 mi
65.5
65
64.5
64
-150
-149
-148
-147
-146
-145


SkySat TT&C Nadir Contours from 400 km
Note: Some contours are not shown because they do not intersect with the earth.
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Fairbanks
85
80
75
70
65
60
55
50
-190
-185
-180
-175
-170
-165
-160
-155
-150
-145
-140
-135
-130
-125
-120
-115
-110


SkySat TT&C Nadir Contours from 500 km
Note: Some contours are not shown because they do not intersect with the earth.
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Fairbanks
85
80
75
70
65
60
55
50
-190
-185
-180
-175
-170
-165
-160
-155
-150
-145
-140
-135
-130
-125
-120
-115
-110

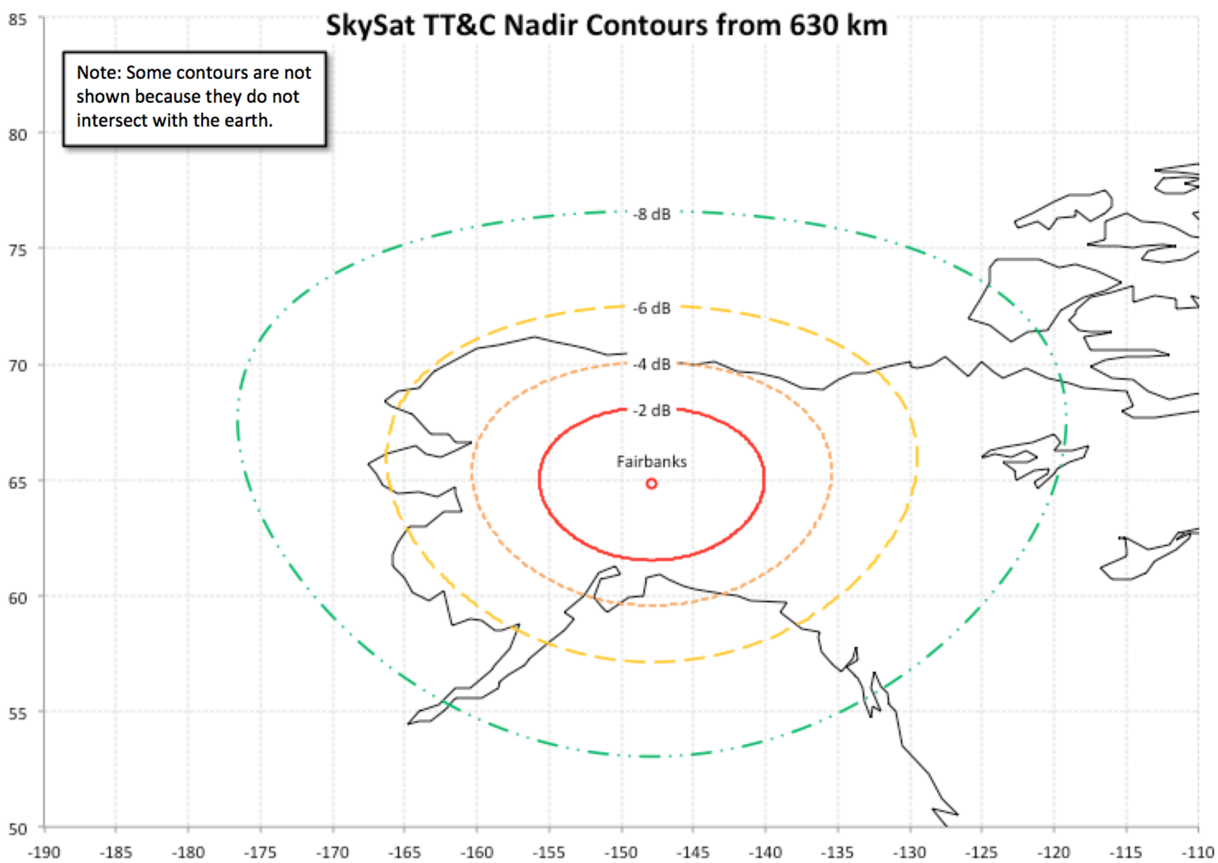
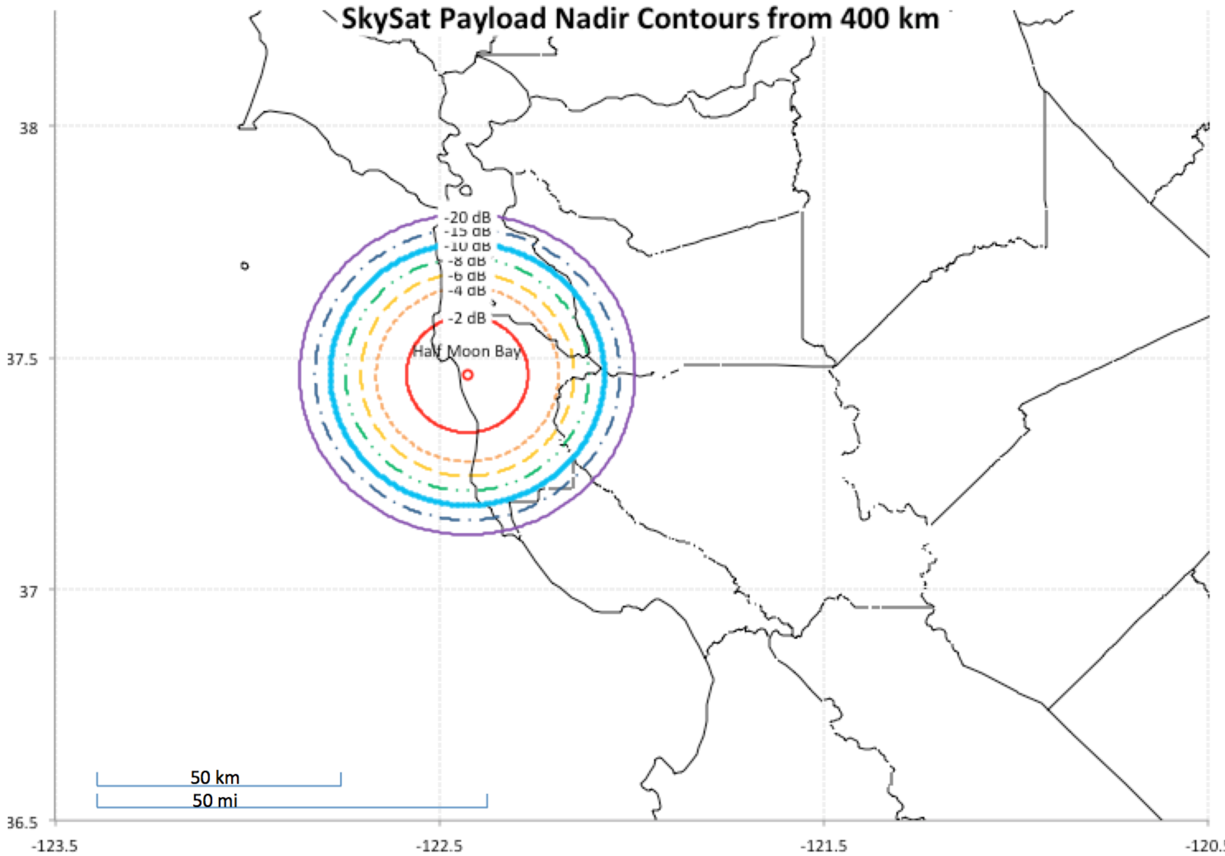
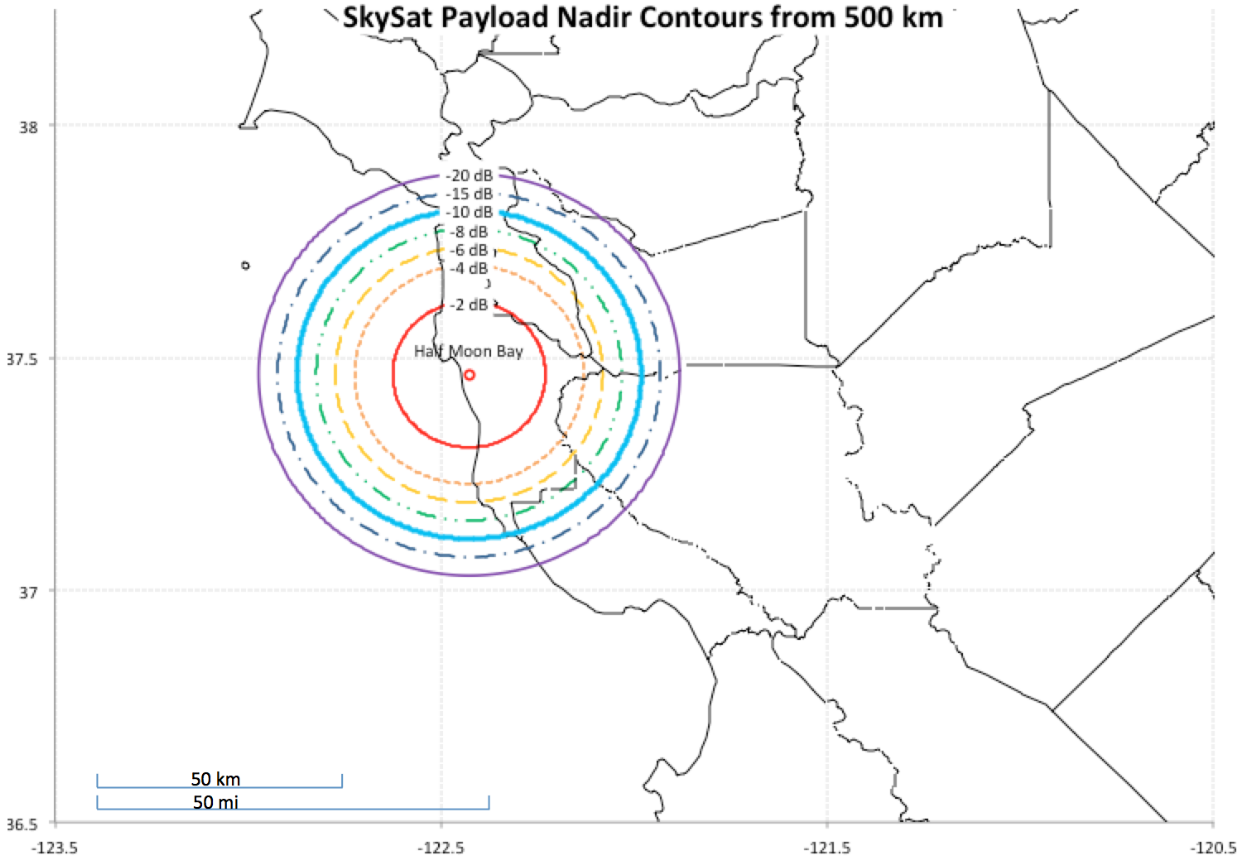

SkySat TT&C Nadir Contours from 630 km
Note: Some contours are not shown because they do not intersect with the earth.
-8 dB
-6 dB
-4 dB
-2 dB
Fairbanks
85
80
75
70
65
60
55
50
-190
-185
-180
-175
-170
-165
-160
-155
-150
-145
-140
-135
-130
-125
-120
-115
-110

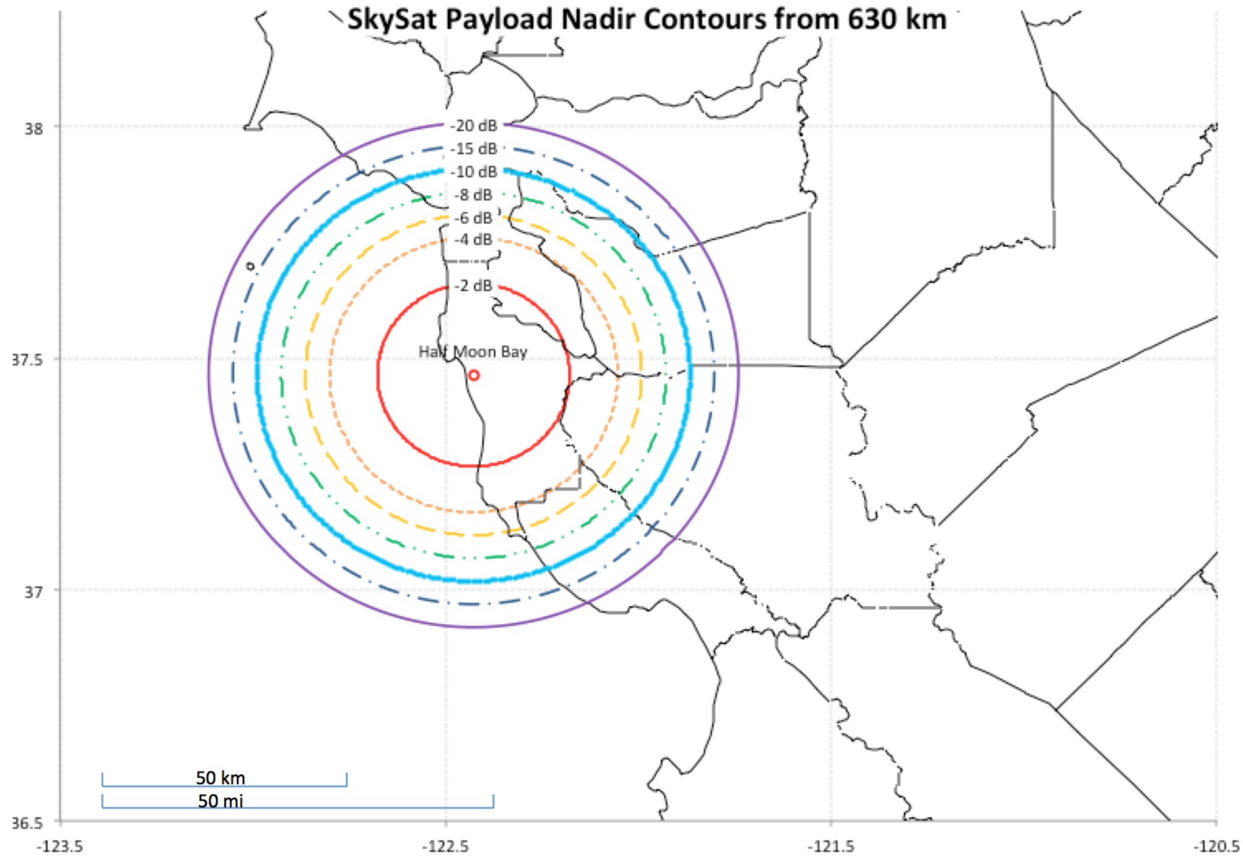
**EXHIBIT 43**

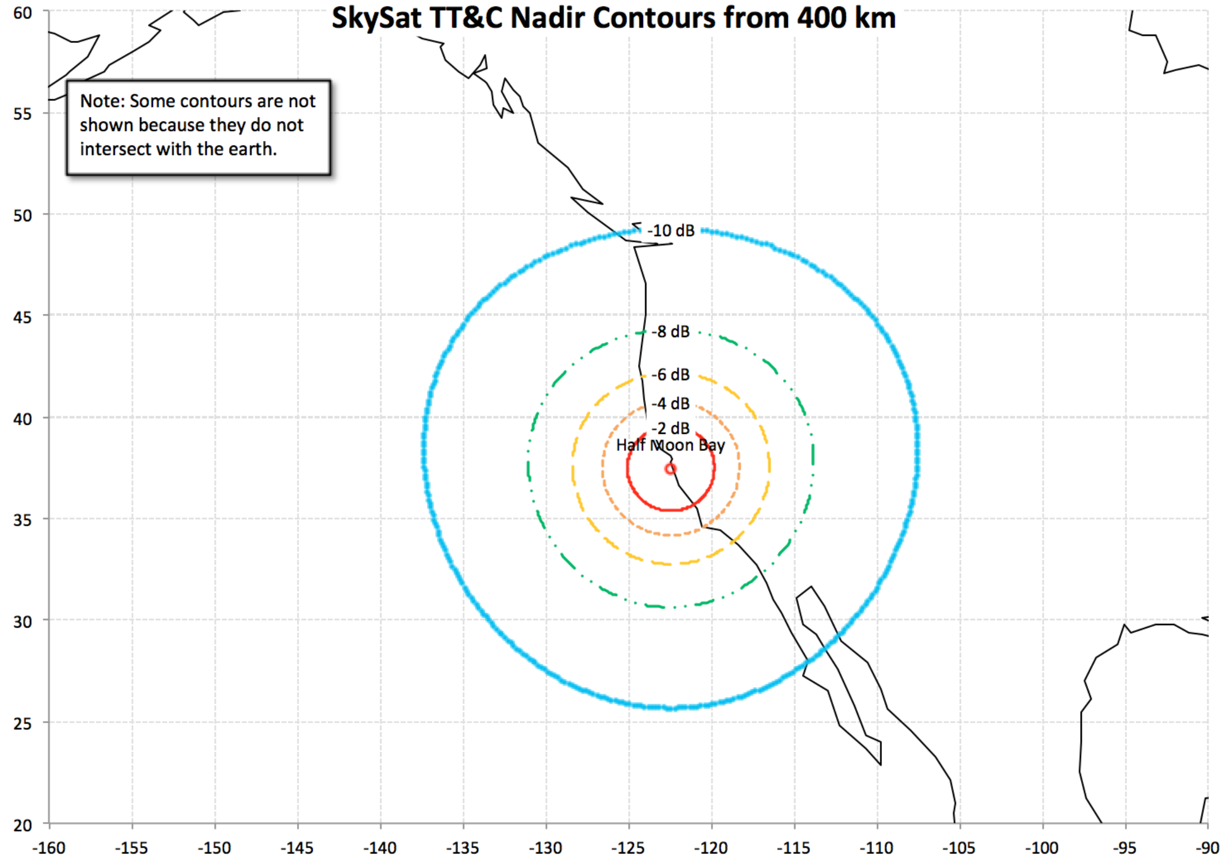
Terra Bella Technologies Inc.
Application for License Modification

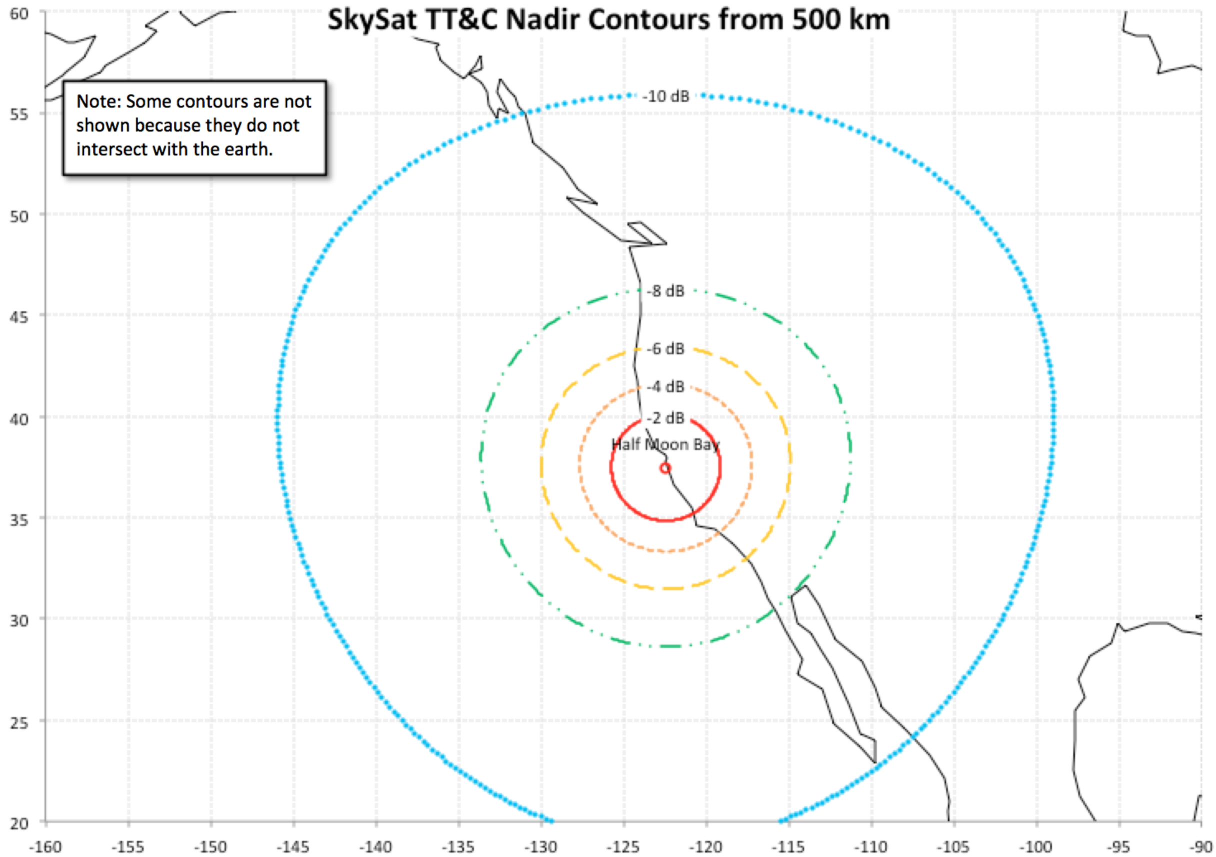
**Contours for Half Moon Bay, California, Earth Station**

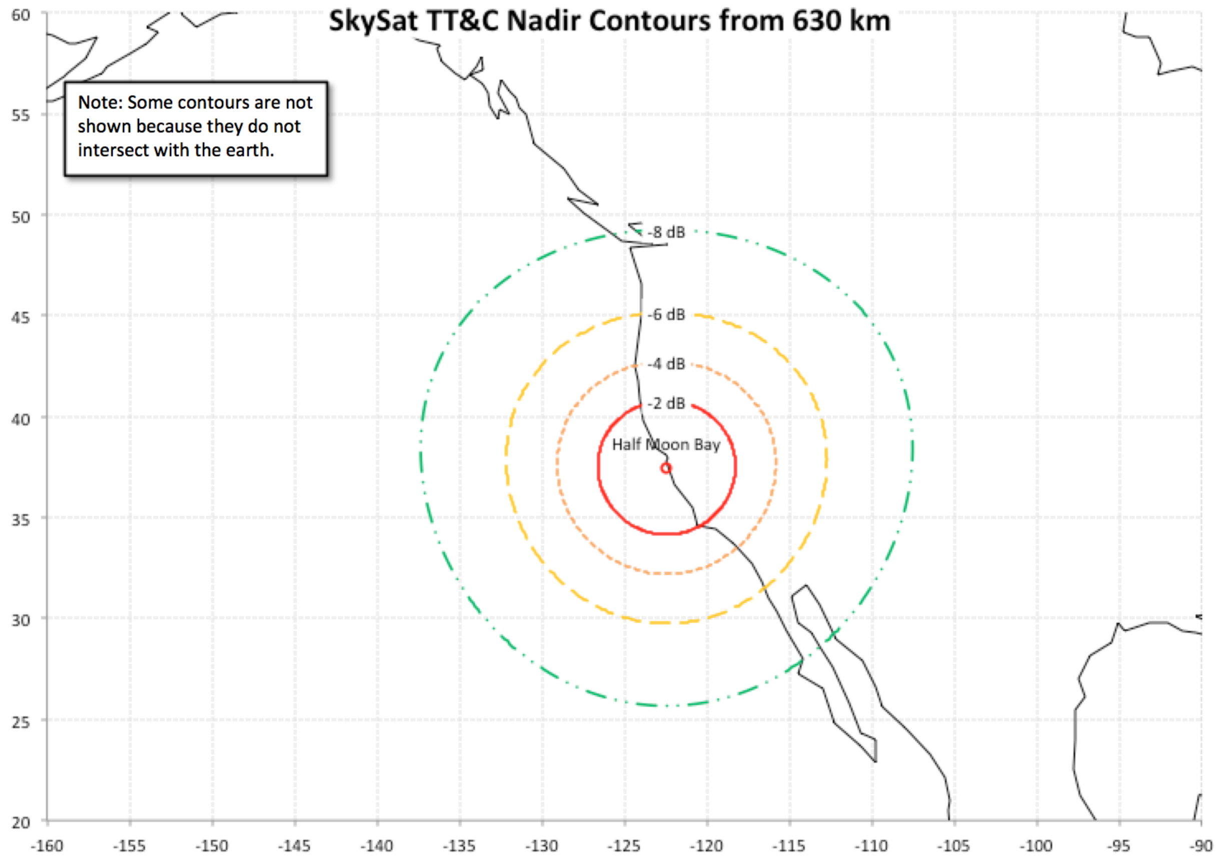



SkySat Payload Nadir Contours from 500 km
-20 dB
-15 dB
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Half Moon Bay
38
37.5
37
36.5
-123.5
-122.5
-121.5
-120.5
50 km
50 mi

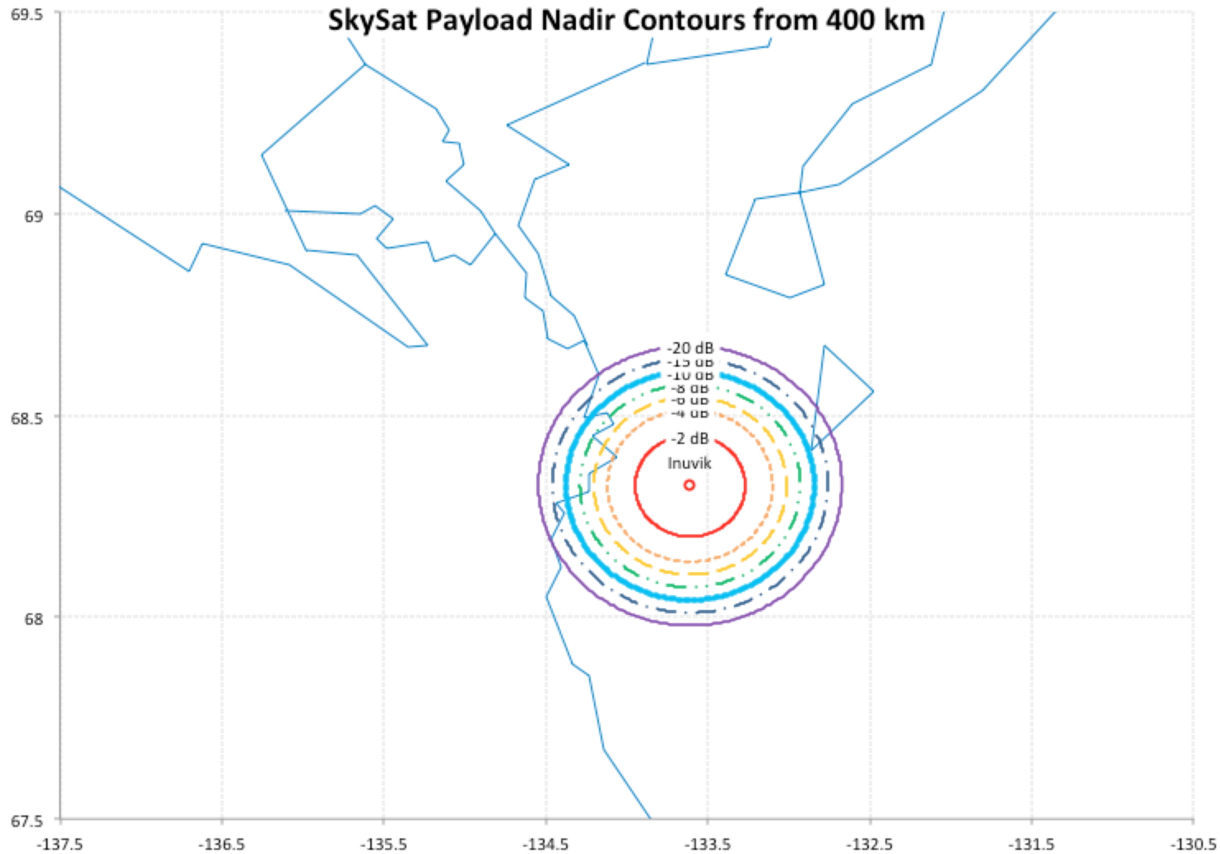

SkySat Payload Nadir Contours from 630 km
-20 dB
-15 dB
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Half Moon Bay
38
37.5
37
36.5
-123.5
-122.5
-121.5
-120.5
50 km
50 mi

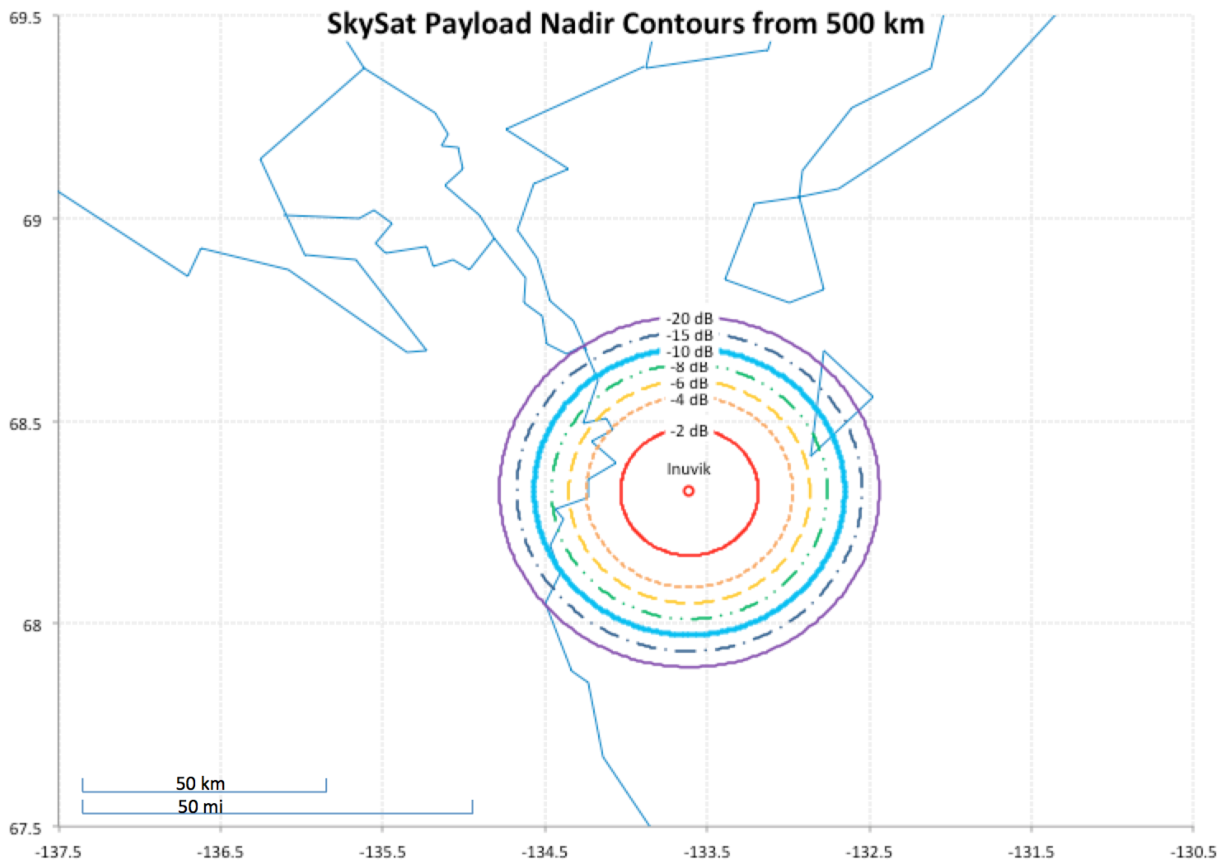

SkySat TT&C Nadir Contours from 400 km
Note: Some contours are not shown because they do not intersect with the earth.
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Half Moon Bay
60
55
50
45
40
35
30
25
20
-160
-155
-150
-145
-140
-135
-130
-125
-120
-115
-110
-105
-100
-95
-90

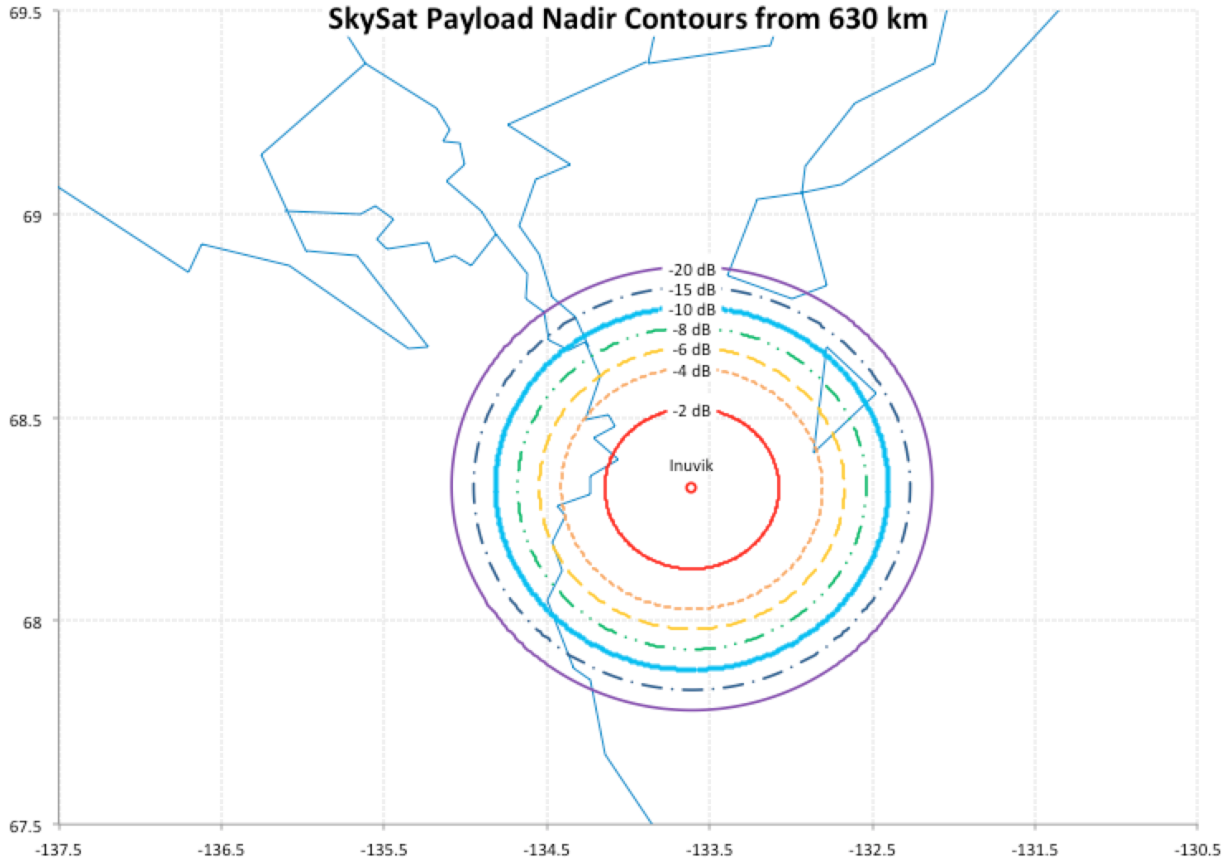

SkySat TT&C Nadir Contours from 500 km
Note: Some contours are not shown because they do not intersect with the earth.
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Half Moon Bay
60
55
50
45
40
35
30
25
20
-160
-155
-150
-145
-140
-135
-130
-125
-120
-115
-110
-105
-100
-95
-90

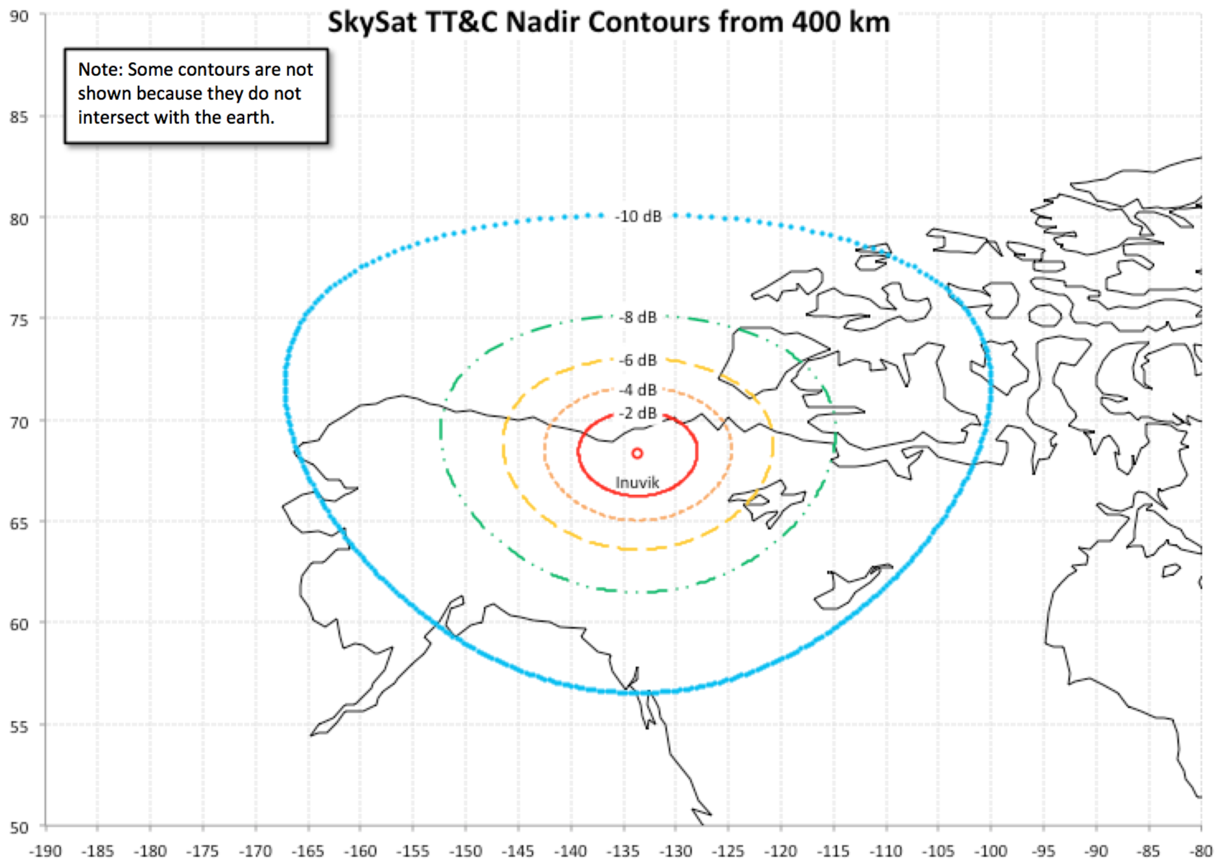

SkySat TT&C Nadir Contours from 630 km
Note: Some contours are not shown because they do not intersect with the earth.
-8 dB
-6 dB
-4 dB
-2 dB
Half Moon Bay
60
55
50
45
40
35
30
25
20
-160
-155
-150
-145
-140
-135
-130
-125
-120
-115
-110
-105
-100
-95
-90

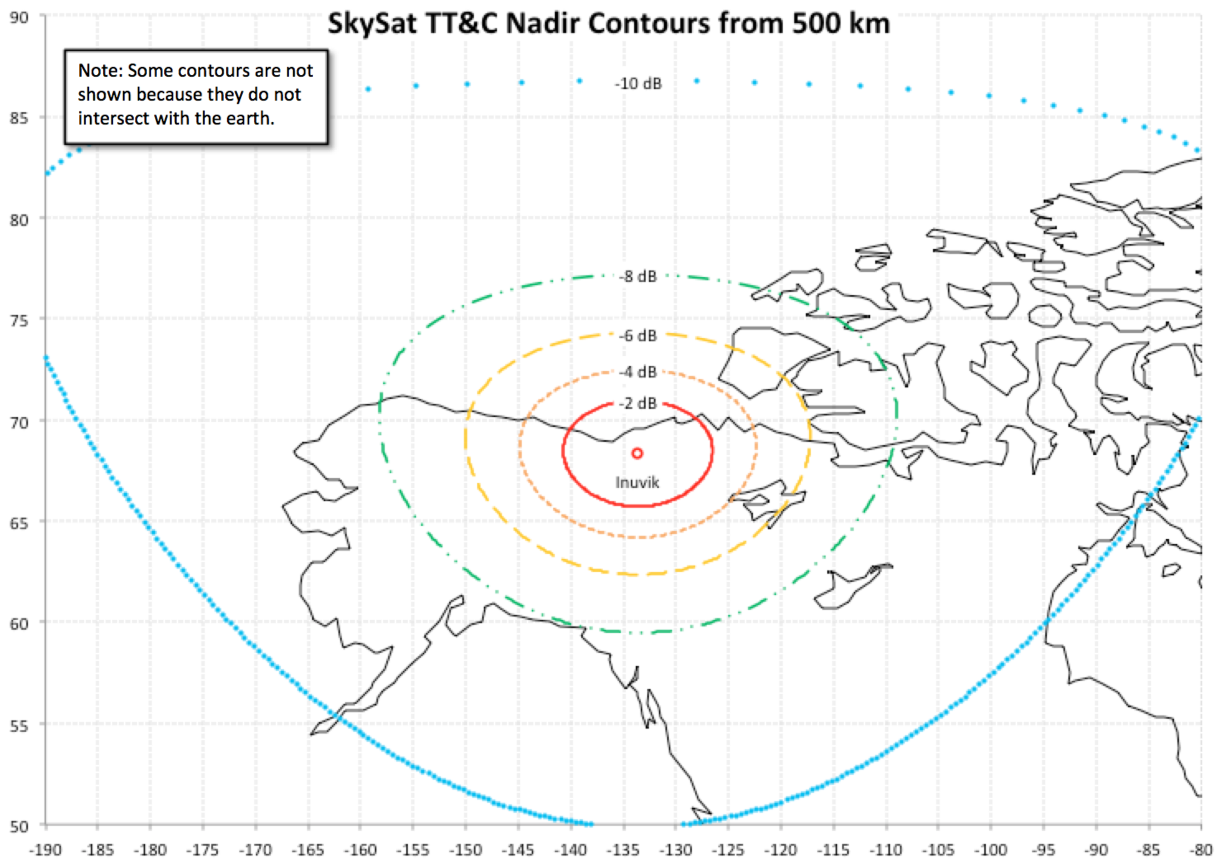
## Contours for Inuvik NT, Canada, Earth Station

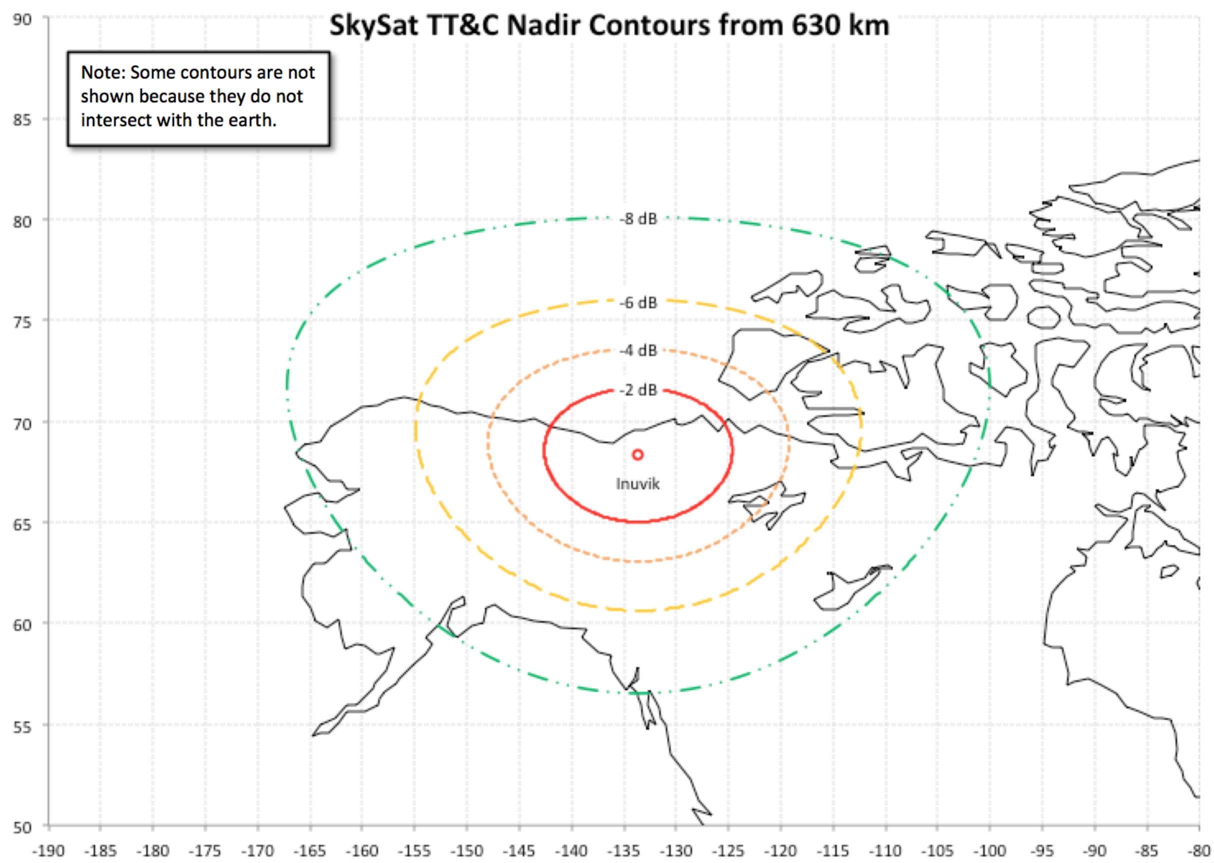



SkySat Payload Nadir Contours from 500 km
-20 dB
-15 dB
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Inuvik
50 km
50 mi
69.5
69
68.5
68
67.5
-137.5
-136.5
-135.5
-134.5
-133.5
-132.5
-131.5
-130.5

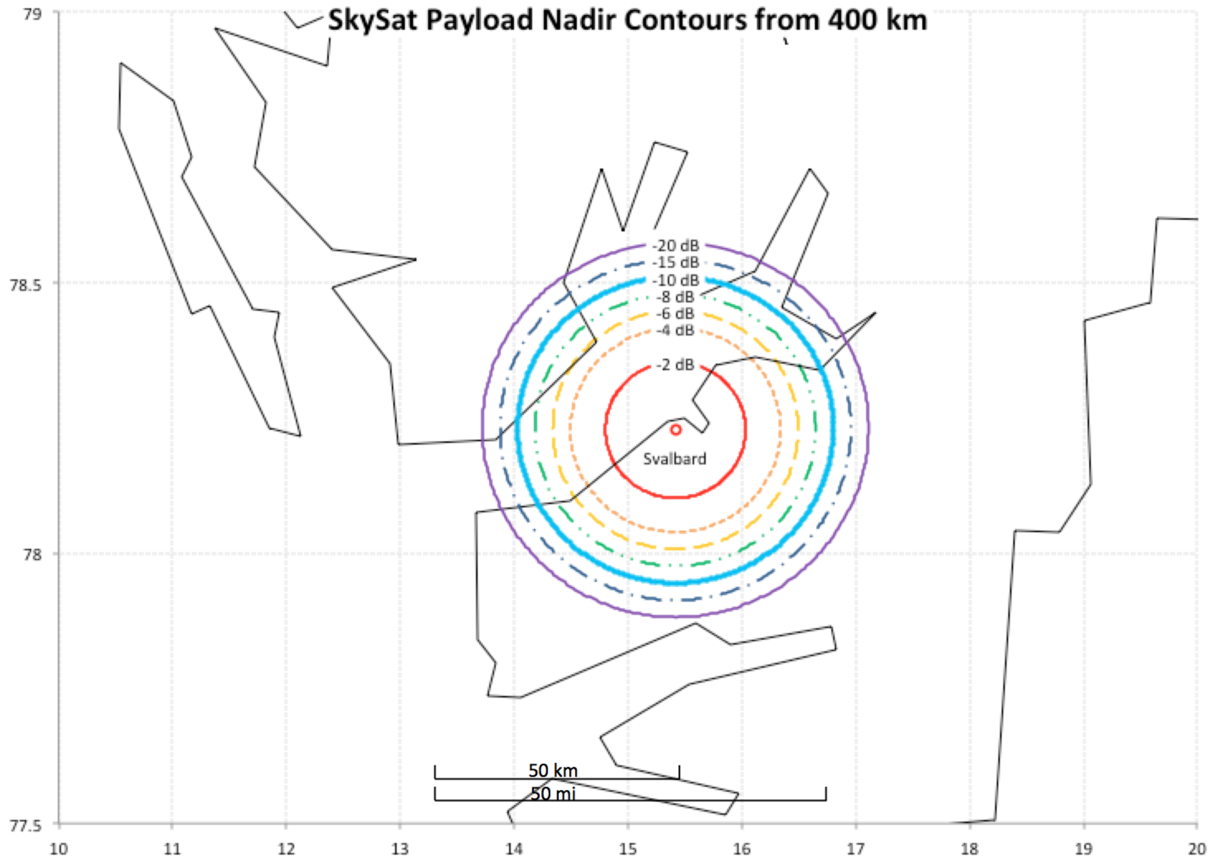

SkySat Payload Nadir Contours from 630 km
69.5
69
68.5
68
67.5
-137.5
-136.5
-135.5
-134.5
-133.5
-132.5
-131.5
-130.5
-20 dB
-15 dB
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Inuvik

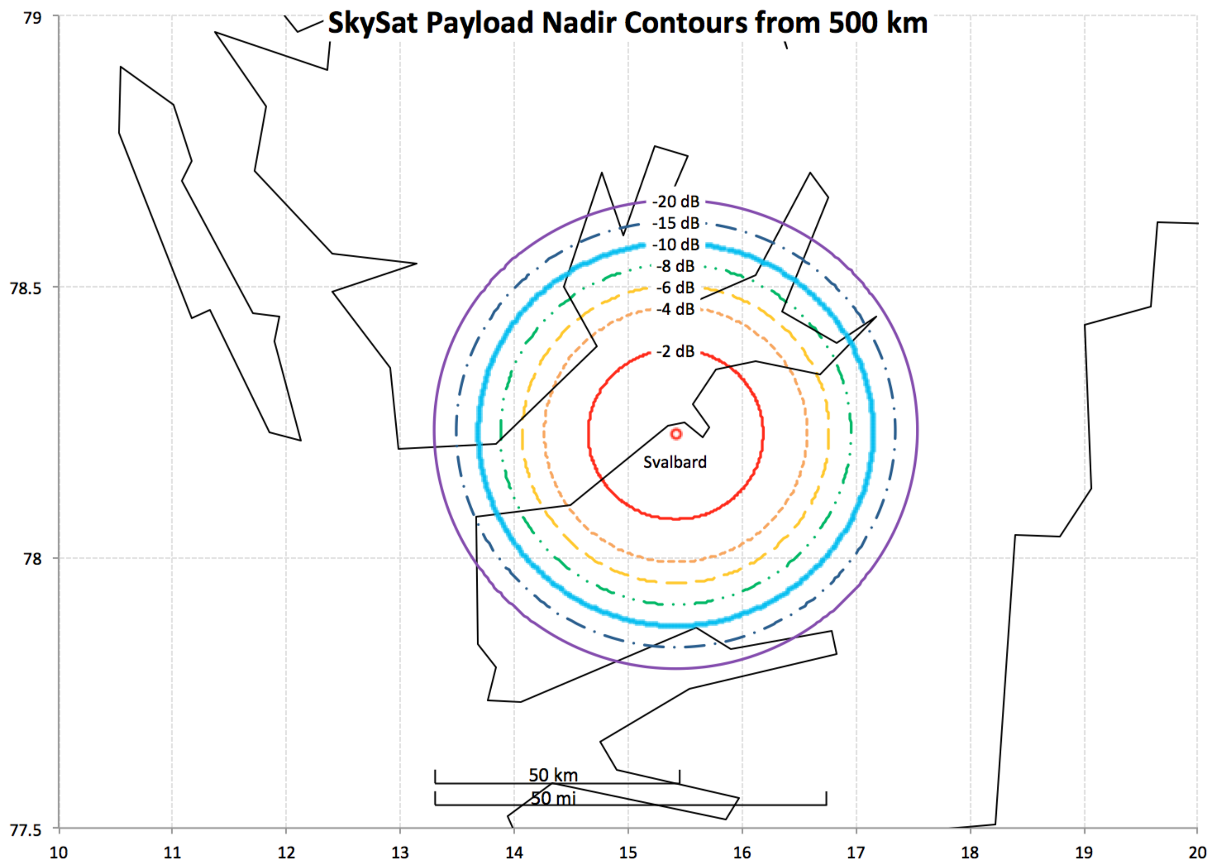

SkySat TT&C Nadir Contours from 400 km
Note: Some contours are not shown because they do not intersect with the earth.
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Inuvik
90
85
80
75
70
65
60
55
50
-190 -185 -180 -175 -170 -165 -160 -155 -150 -145 -140 -135 -130 -125 -120 -115 -110 -105 -100 -95 -90 -85 -80

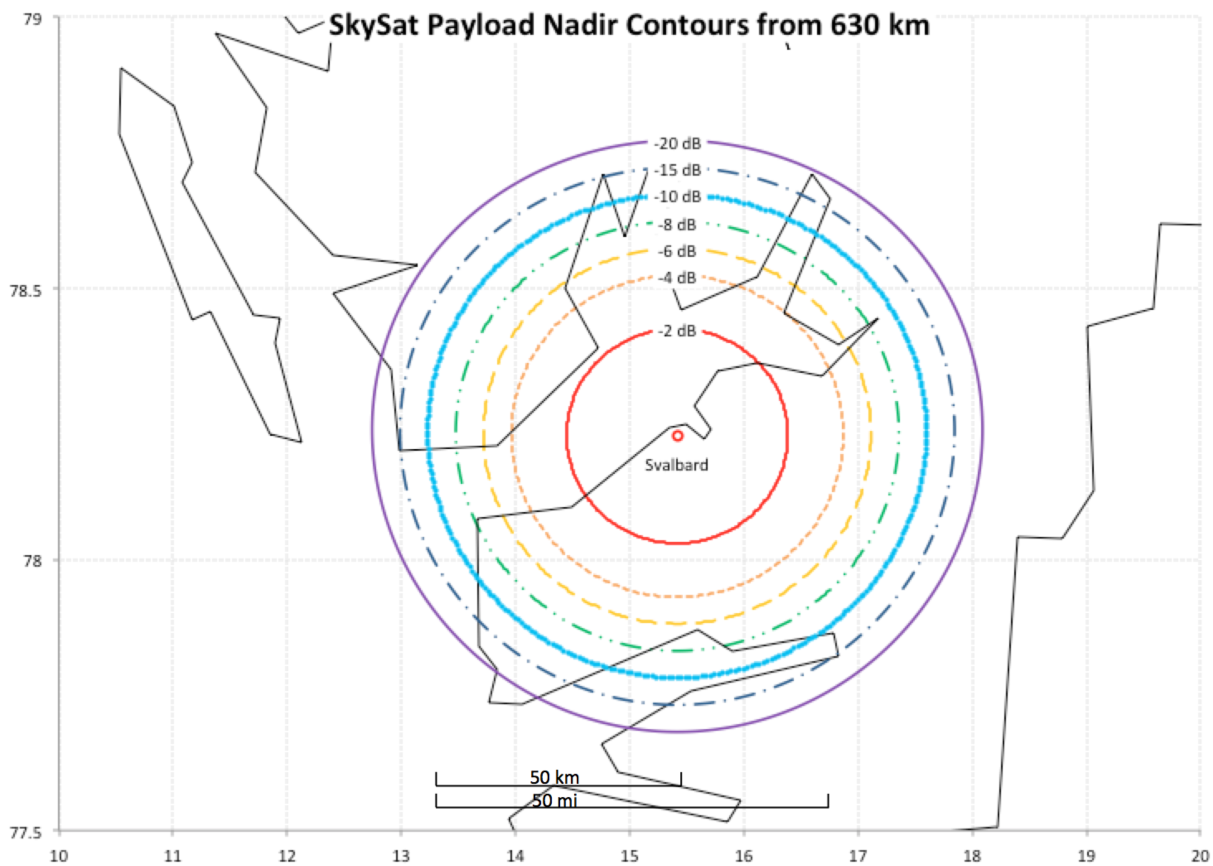

SkySat TT&C Nadir Contours from 500 km
Note: Some contours are not shown because they do not intersect with the earth.
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Inuvik
90
85
80
75
70
65
60
55
50
-190 -185 -180 -175 -170 -165 -160 -155 -150 -145 -140 -135 -130 -125 -120 -115 -110 -105 -100 -95 -90 -85 -80

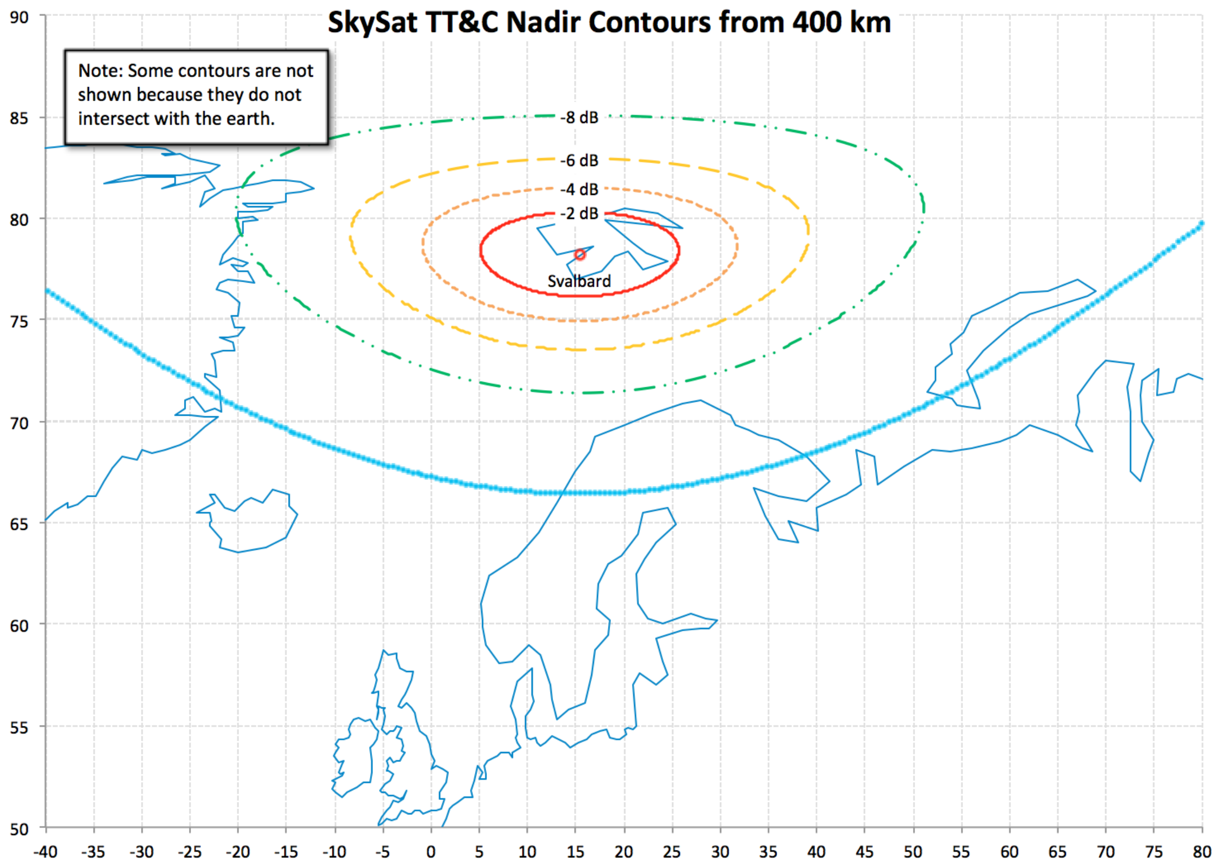

SkySat TT&C Nadir Contours from 630 km
Note: Some contours are not shown because they do not intersect with the earth.
-8 dB
-6 dB
-4 dB
-2 dB
Inuvik
90
85
80
75
70
65
60
55
50
-190
-185
-180
-175
-170
-165
-160
-155
-150
-145
-140
-135
-130
-125
-120
-115
-110
-105
-100
-95
-90
-85
-80

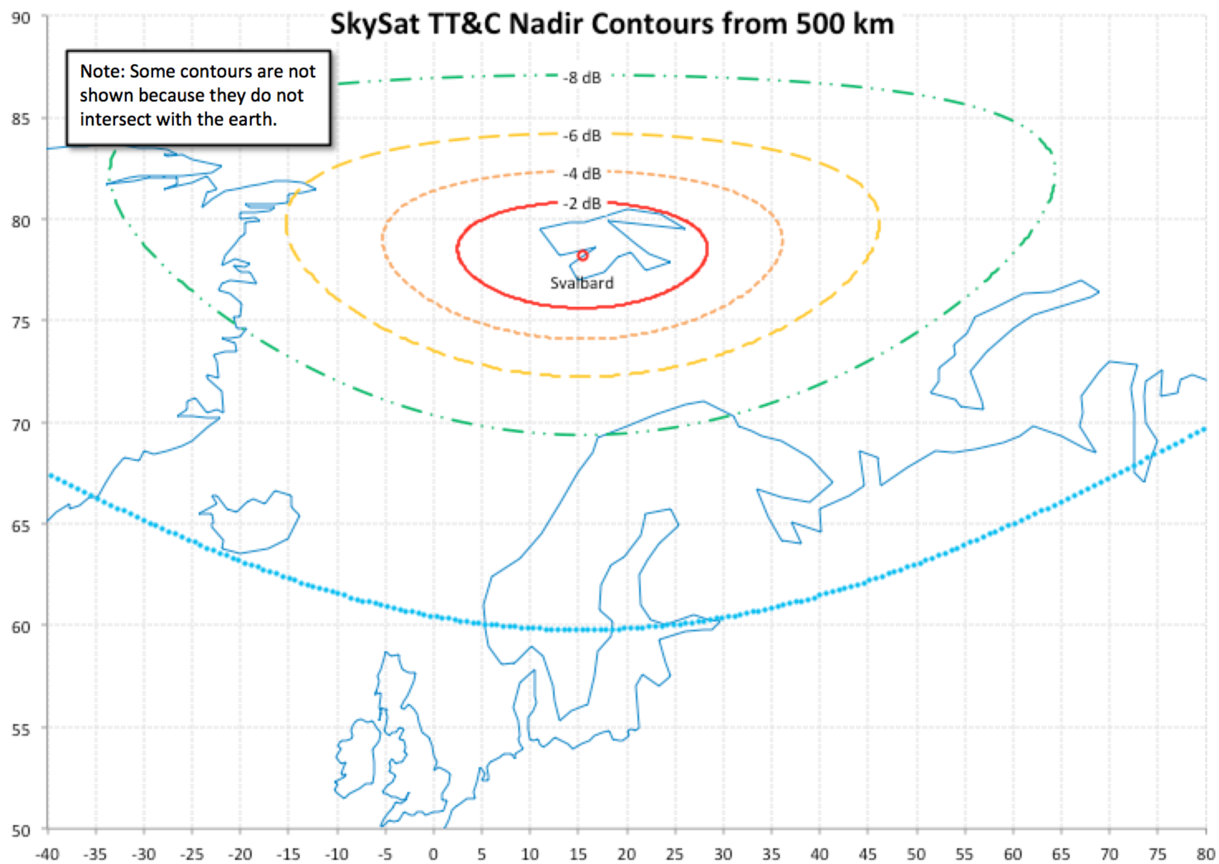
## Contours for Svalbard, Norway, Earth Station

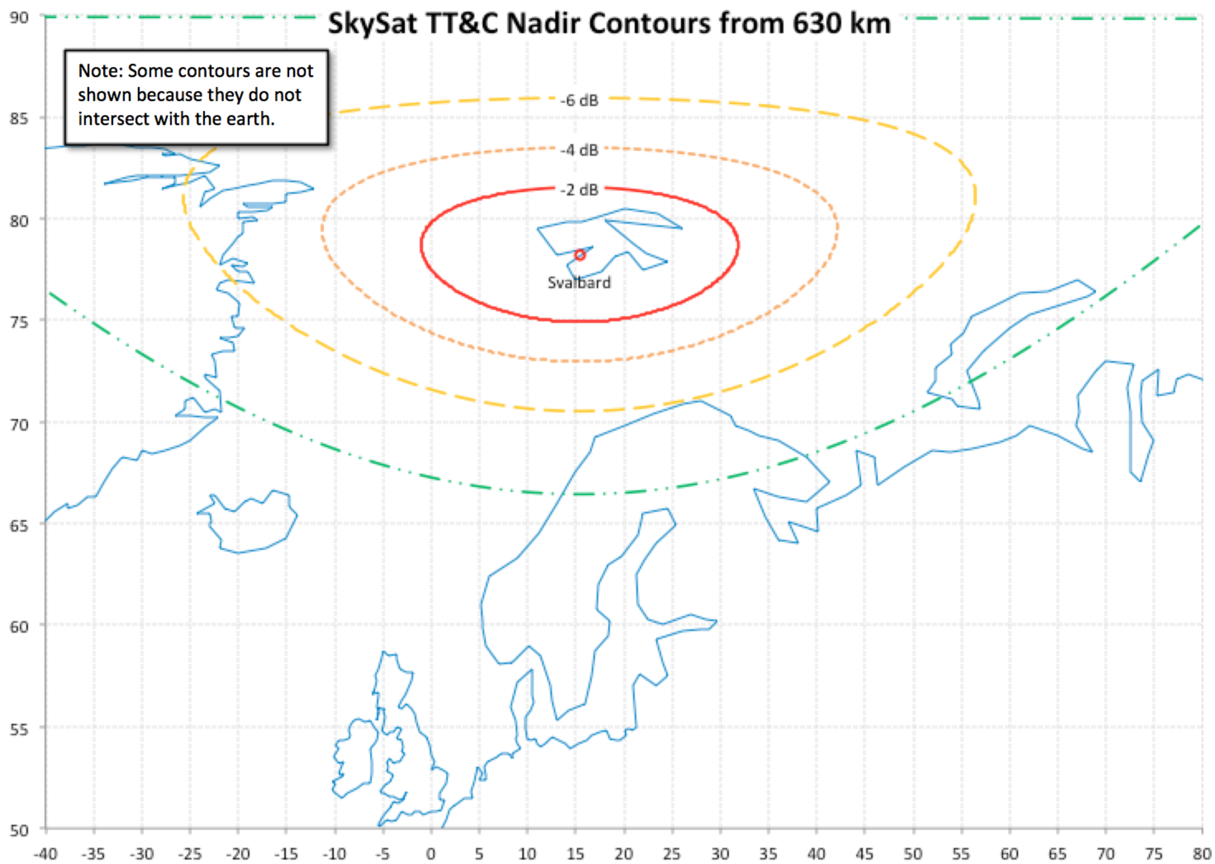



SkySat Payload Nadir Contours from 500 km
-20 dB
-15 dB
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Svalbard
50 km
50 mi
79
78.5
78
77.5
10
11
12
13
14
15
16
17
18
19
20

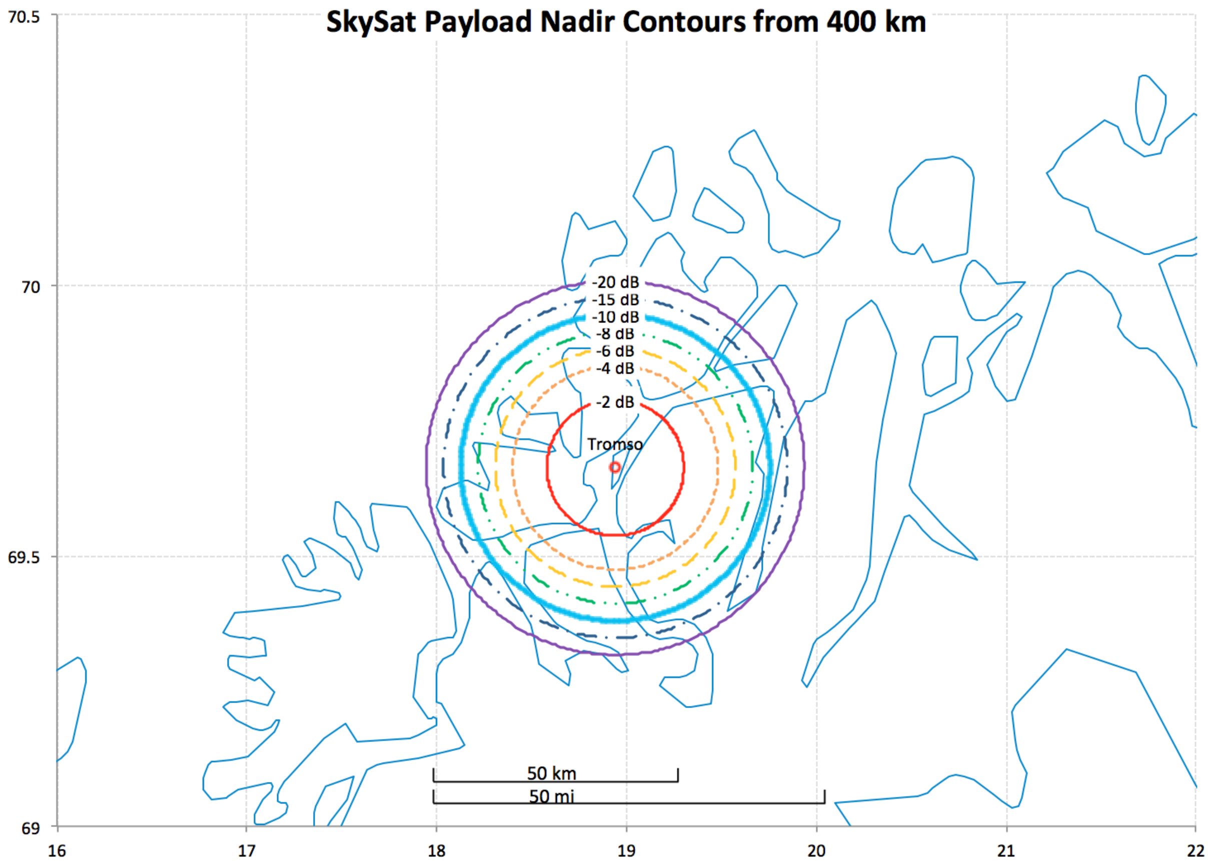

SkySat Payload Nadir Contours from 630 km
-20 dB
-15 dB
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Svalbard
50 km
50 mi
79
78.5
78
77.5
10
11
12
13
14
15
16
17
18
19
20

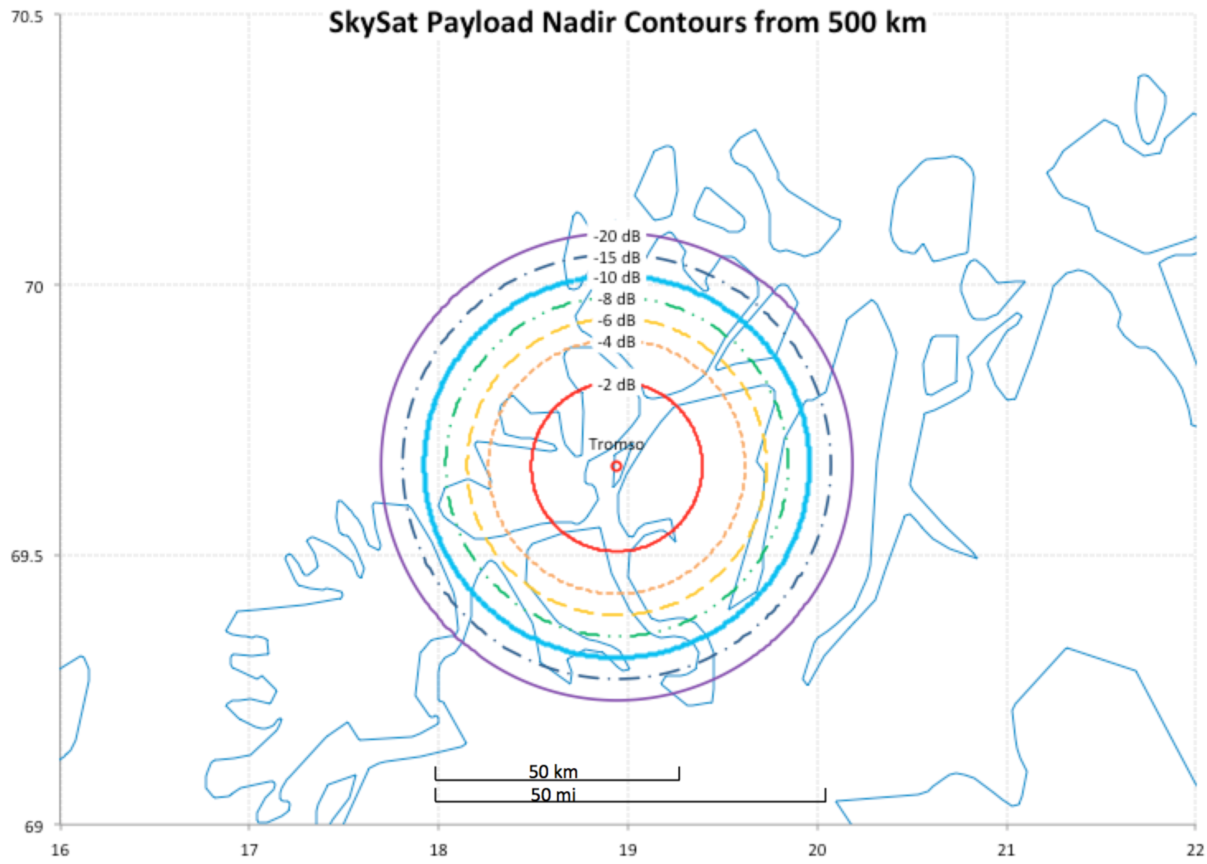

SkySat TT&C Nadir Contours from 400 km
Note: Some contours are not shown because they do not intersect with the earth.
-8 dB
-6 dB
-4 dB
-2 dB
Svalbard
90
85
80
75
70
65
60
55
50
-40
-35
-30
-25
-20
-15
-10
-5
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80

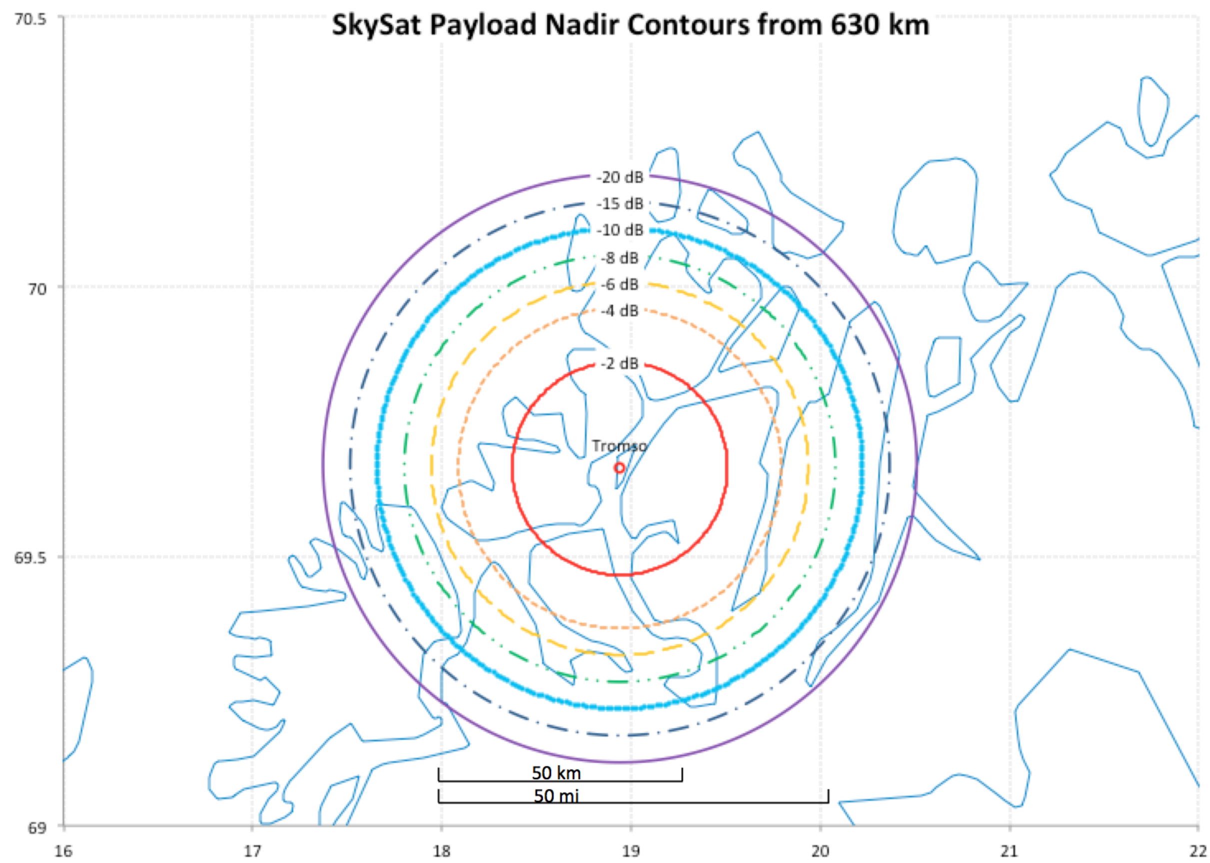

SkySat TT&C Nadir Contours from 500 km
Note: Some contours are not shown because they do not intersect with the earth.
-8 dB
-6 dB
-4 dB
-2 dB
Svalbard
90
85
80
75
70
65
60
55
50
-40
-35
-30
-25
-20
-15
-10
-5
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80

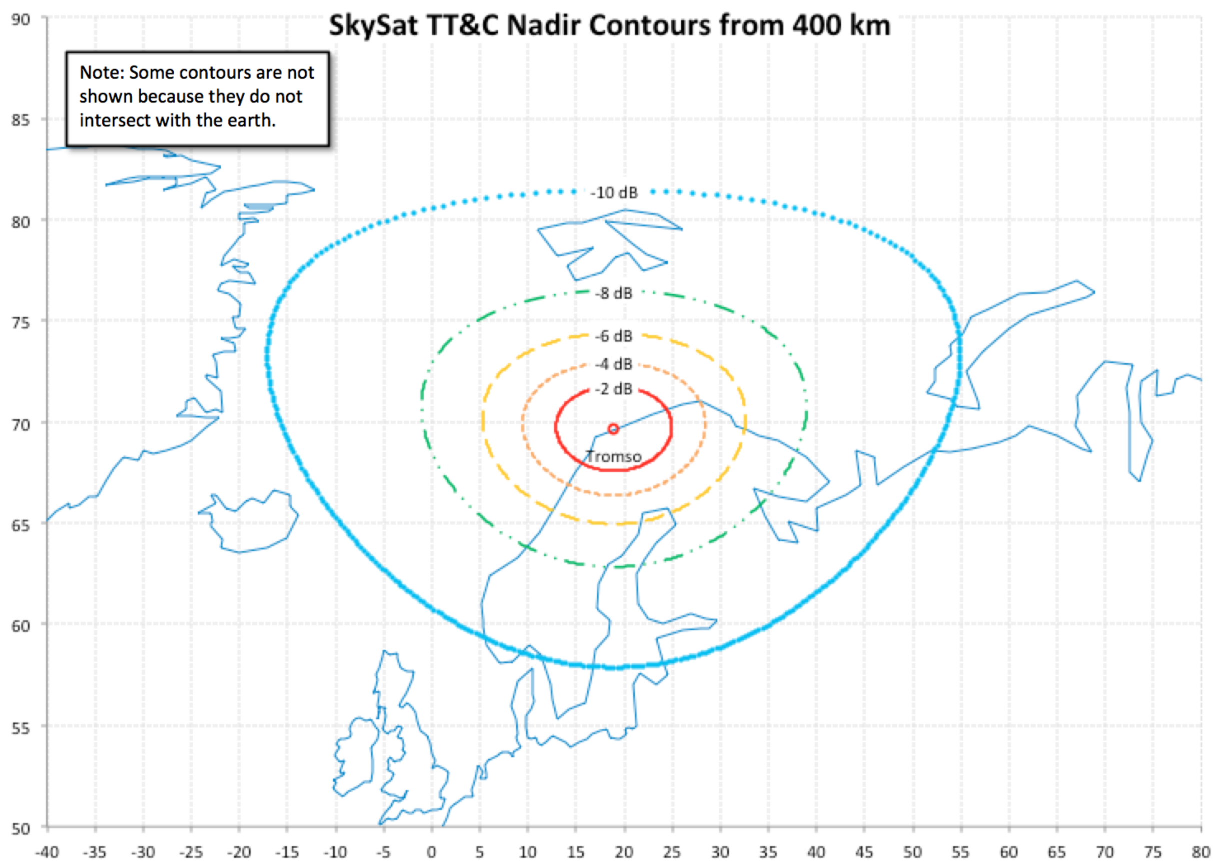

SkySat TT&C Nadir Contours from 630 km
Note: Some contours are not shown because they do not intersect with the earth.
-6 dB
-4 dB
-2 dB
Svalbard
90
85
80
75
70
65
60
55
50
-40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80

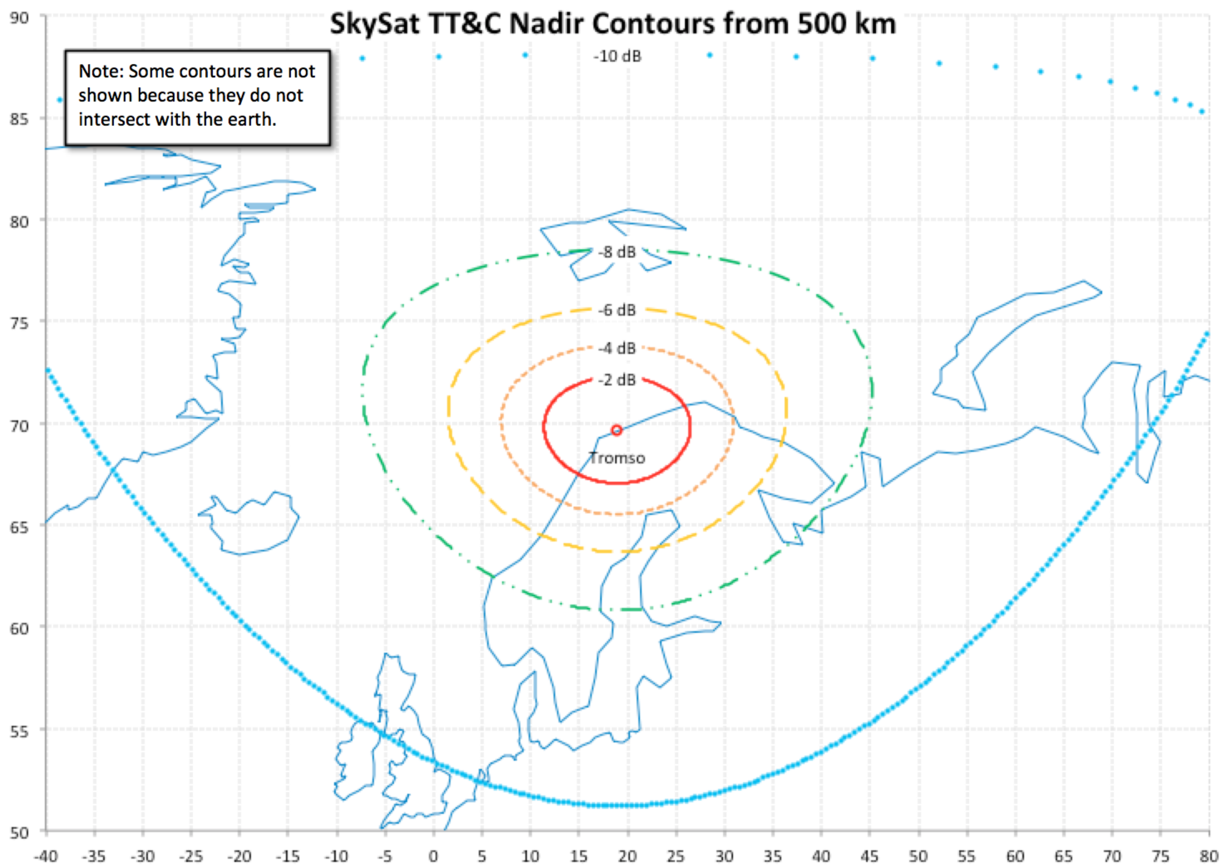
## Contours for Tromso, Norway, Earth Station

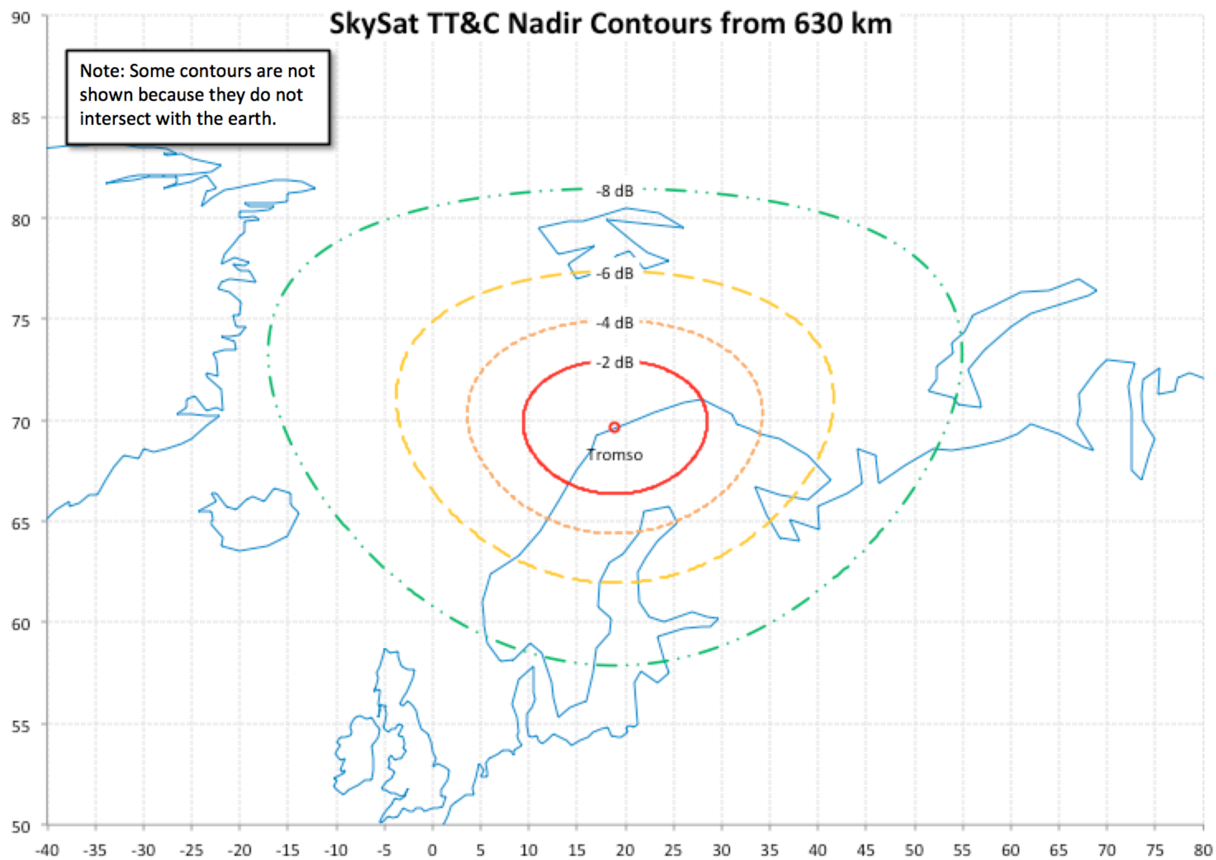



SkySat Payload Nadir Contours from 500 km
70.5
70
69.5
69
16
17
18
19
20
21
22
-20 dB
-15 dB
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Tromso
50 km
50 mi

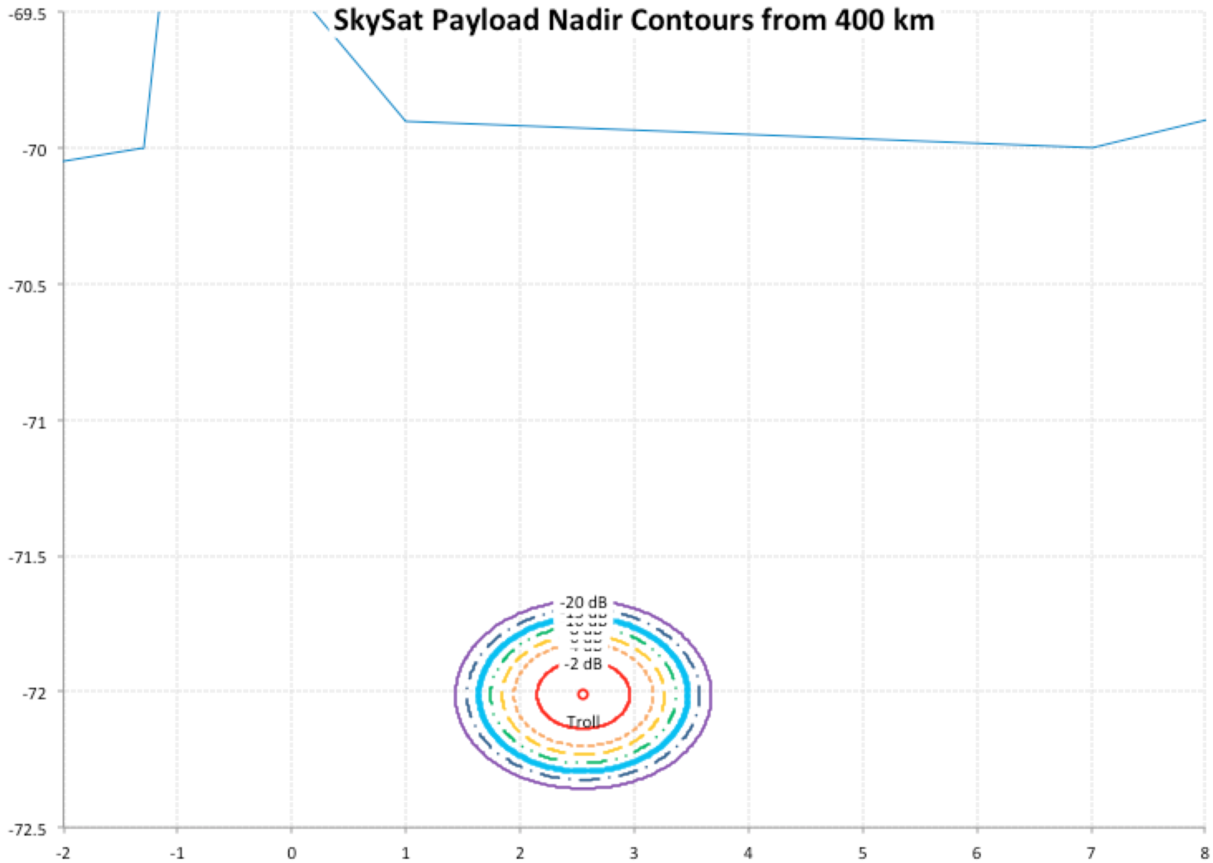

SkySat Payload Nadir Contours from 630 km
-20 dB
-15 dB
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Tromso
50 km
50 mi
70.5
70
69.5
69
16
17
18
19
20
21
22

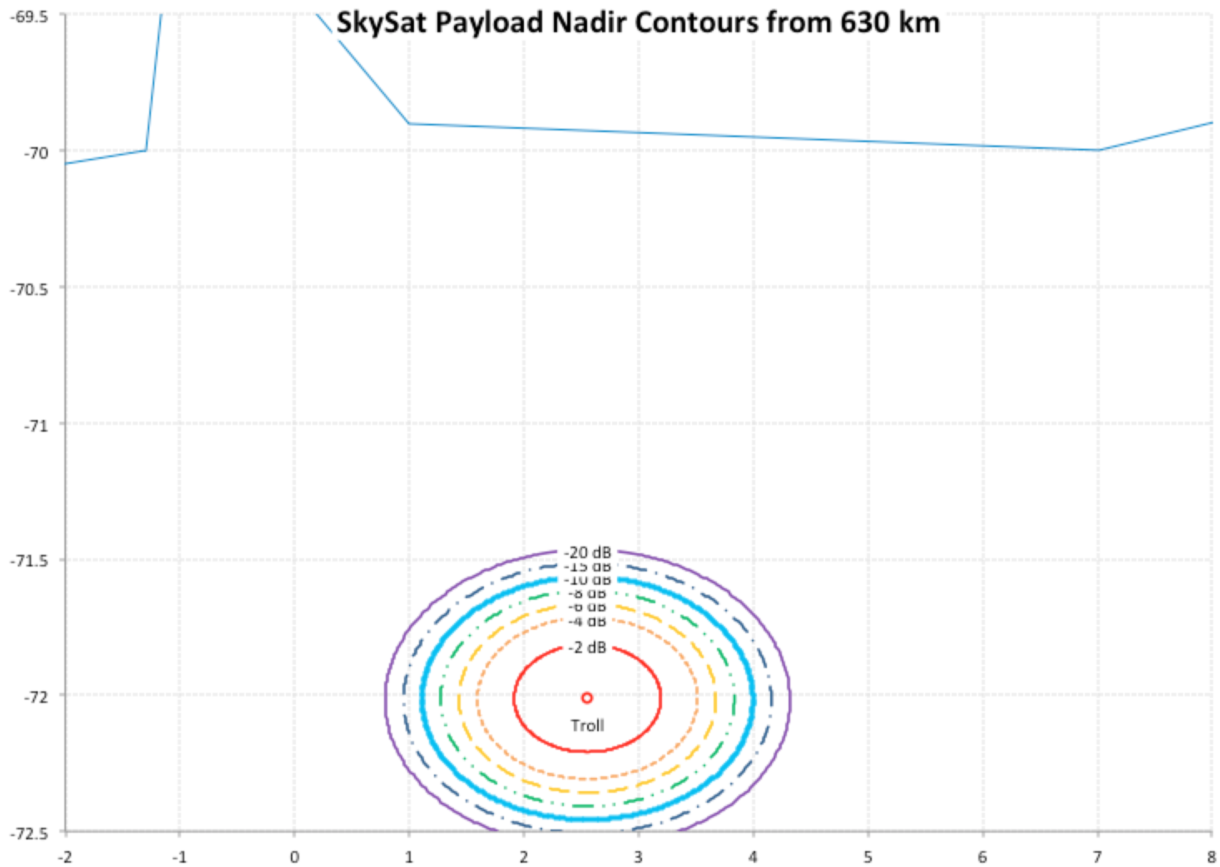

SkySat TT&C Nadir Contours from 400 km
Note: Some contours are not shown because they do not intersect with the earth.
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Tromso
90
85
80
75
70
65
60
55
50
-40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80

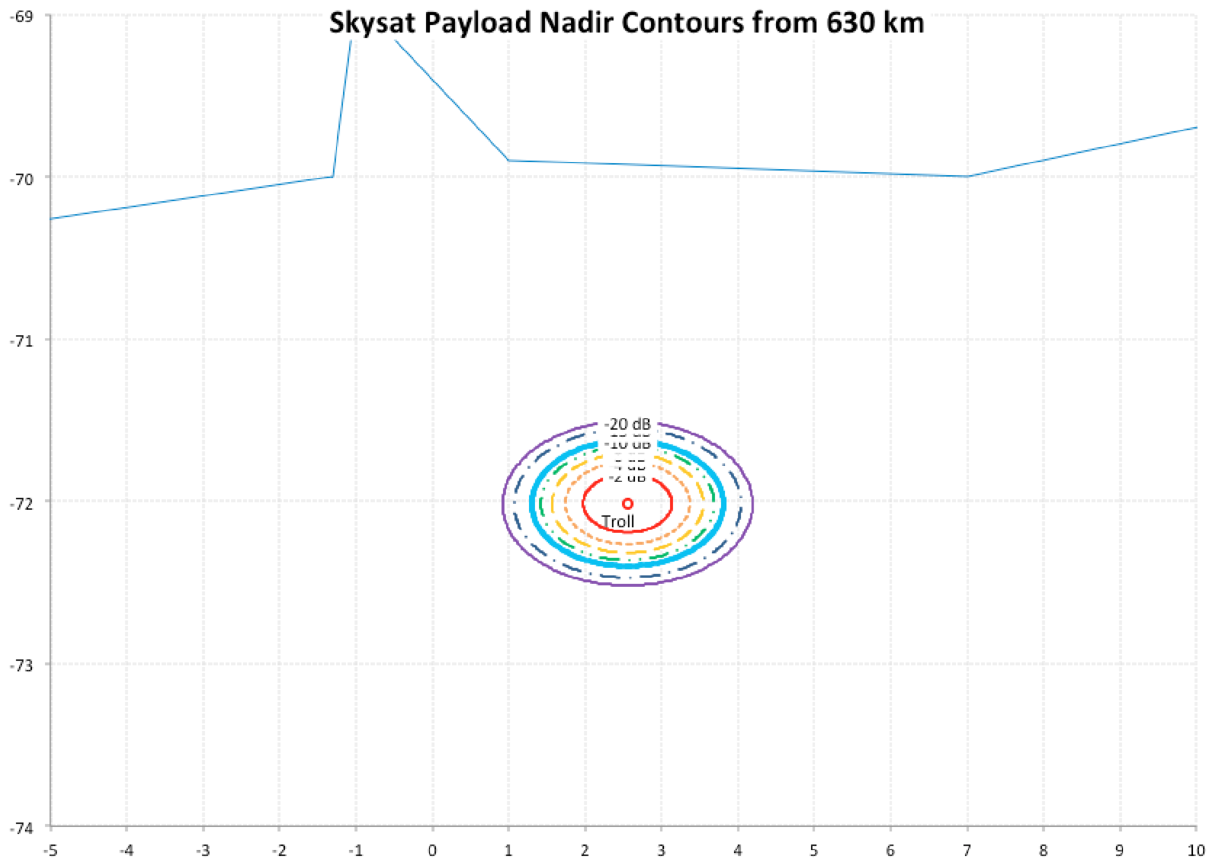

SkySat TT&C Nadir Contours from 500 km
Note: Some contours are not shown because they do not intersect with the earth.
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Tromso
90
85
80
75
70
65
60
55
50
-40
-35
-30
-25
-20
-15
-10
-5
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80

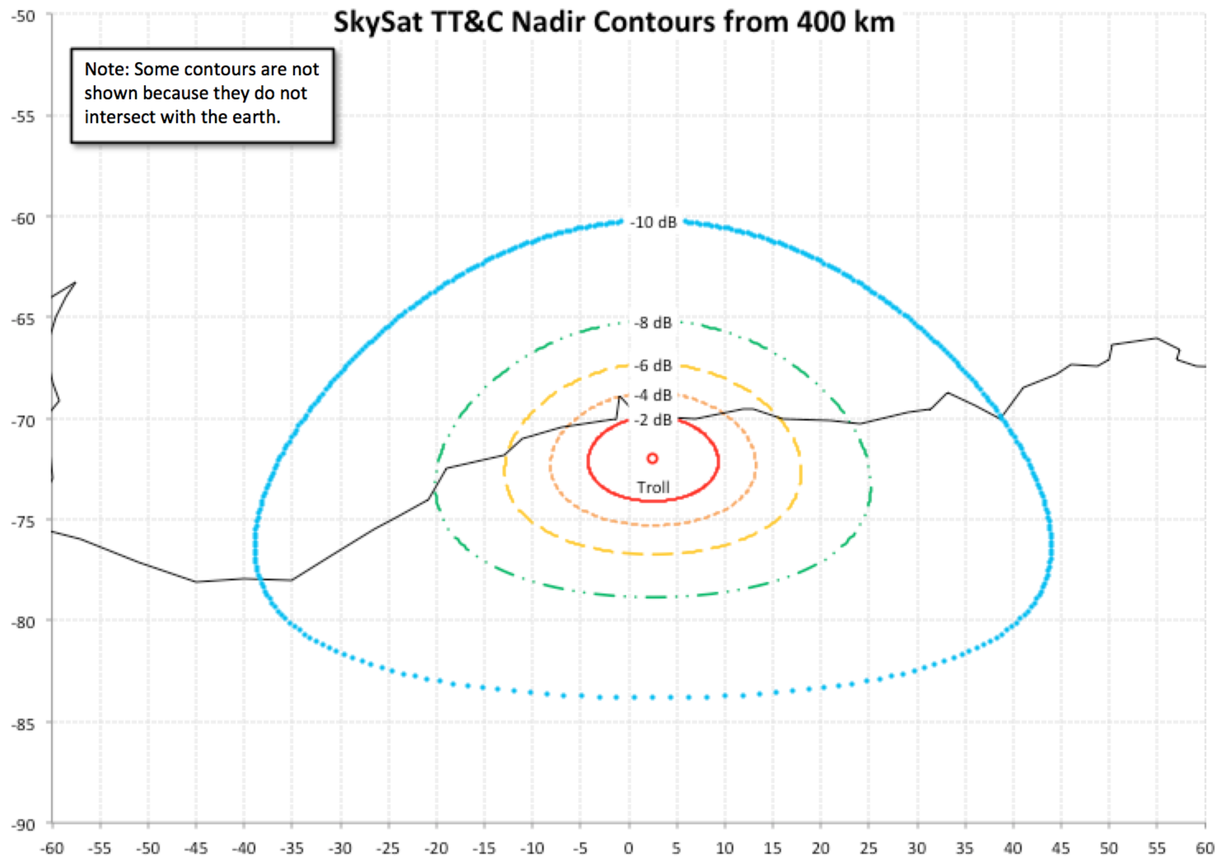

SkySat TT&C Nadir Contours from 630 km
Note: Some contours are not shown because they do not intersect with the earth.
-8 dB
-6 dB
-4 dB
-2 dB
Tromso
90
85
80
75
70
65
60
55
50
-40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80

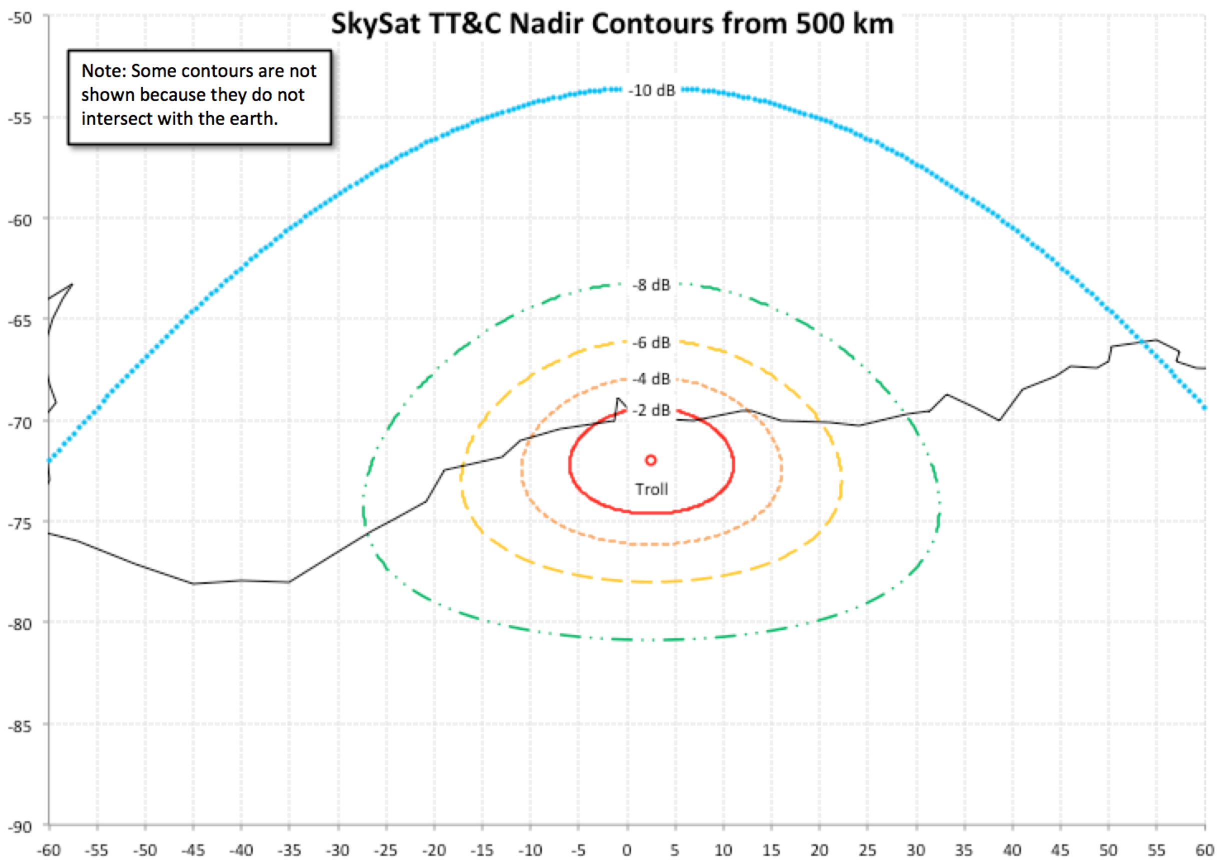
**Contours for Troll, Antarctica, Earth Station**

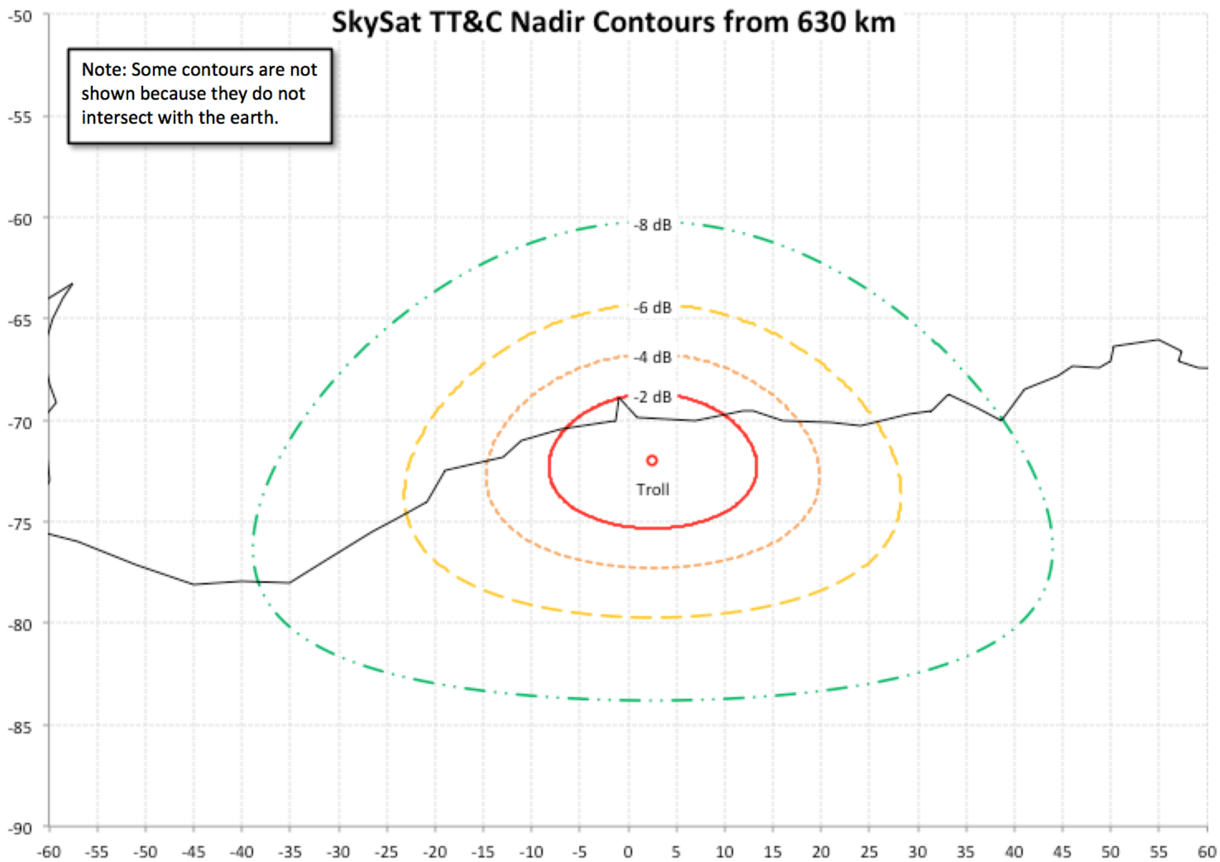



SkySat Payload Nadir Contours from 630 km
-69.5
-70
-70.5
-71
-71.5
-72
-72.5
-2
-1
0
1
2
3
4
5
6
7
8
-20 dB
-15 dB
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Troll


Skysat Payload Nadir Contours from 630 km
-69
-70
-71
-72
-73
-74
-5
-4
-3
-2
-1
0
1
2
3
4
5
6
7
8
9
10
-20 dB
Troll


SkySat TT&C Nadir Contours from 400 km
Note: Some contours are not shown because they do not intersect with the earth.
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Troll
-50
-55
-60
-65
-70
-75
-80
-85
-90
-60 -55 -50 -45 -40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60


SkySat TT&C Nadir Contours from 500 km
Note: Some contours are not shown because they do not intersect with the earth.
-10 dB
-8 dB
-6 dB
-4 dB
-2 dB
Troll
-50
-55
-60
-65
-70
-75
-80
-85
-90
-60
-55
-50
-45
-40
-35
-30
-25
-20
-15
-10
-5
0
5
10
15
20
25
30
35
40
45
50
55
60


SkySat TT&C Nadir Contours from 630 km
Note: Some contours are not shown because they do not intersect with the earth.
-8 dB
-6 dB
-4 dB
-2 dB
Troll
-50
-55
-60
-65
-70
-75
-80
-85
-90
-60 -55 -50 -45 -40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60

## TECHNICAL CERTIFICATE

I, Craig Scheffler, 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.

Craig Scheffler
*Technical Program Manager*
*Terra Bella Technologies Inc.*

## CERTIFICATE OF COMPLIANCE
## POST-MISSION DISPOSAL PLAN REQUIREMENTS

Pursuant to 47 C.F.R. § 25.114(d)(14)(iv), "[a]pplicants for space stations to be used only for commercial remote sensing may, in lieu of submitting detailed post-mission disposal plans to the Commission, certify that they have submitted such plans to the National Oceanic and Atmospheric Administration for review."[36] I, Craig Scheffler, of Terra Bella Technologies Inc., certify under penalty of perjury, that post-mission disposal plans have been submitted and approved by the National Oceanic and Atmospheric Administration (NOAA), as required by The Remote Sensing Act and NOAA's corresponding rules.[37]

Craig Scheffler
*Technical Program Manager*
*Terra Bella Technologies Inc.*

[36] 47 C.F.R. § 25.114(d)(14)(iv). *See also Mitigation of Orbital Debris*, IBM Docket No. 02-54, Second Report and Order, 19 FCC Rcd. 11567, 11610 at ¶ 104 (2004).
[37] *See* 15 U.S.C. § 5622(b)(4); 15 C.F.R. § 960.11(b)(12); and NOAA License to Operate a Private Remote Sensing Space System consisting of up to 24 satellites (effective Nov. 20, 2013).