EXHIBIT A
DG Consents Sub, Inc.
Modification Application
FCC Form 312
November 2013

Description of Modification of License Application

In this Modification of License Application, DG Consents Sub, Inc. ("DG Consents") proposes two modifications of its non-geostationary satellite orbit ("NGSO") Earth Exploration-Satellite Service ("EESS") space station authorizations.[1] First, DG Consents requests authority to consolidate its EESS space stations under a single call sign. Second, DG Consents proposes to modify the orbit characteristics of one of its EESS space stations – GeoEye-1 – to change the orbital altitude of the satellite.

A. Request to Consolidate EESS Space Stations Under Single Call Sign

DG Consents first requests authority to modify its license under Call Sign S2129 to include the EESS space stations currently licensed to DG Consents under Call Sign 2348 and Call Sign 2144.[2] Four space stations – QuickBird, WorldView-1, WorldView-2 and WorldView-3 – are currently licensed under Call Sign S2129. The space stations to be moved to Call Sign S2129 are the IKONOS satellite, currently licensed under Call Sign S2144, and the GeoEye-1 and GeoEye-2 satellites, currently licensed under Call Sign S2348.

The proposed modification will place seven commonly owned space stations under one call sign, a ministerial step that comports with current operation of the space stations as a single constellation. These space stations have been owned and operated by subsidiaries of DigitalGlobe since January 31, 2013, and have been marketed as a single constellation since that date. Operating from a consolidated platform has resulted in technical efficiencies, which in turn benefits the public interest by enabling DigitalGlobe to offer customers lower cost products and services.

B. Request to Change the Orbital Altitude of GeoEye-1

DG Consents next requests authority to modify the orbit characteristics of GeoEye-1 from its present authorized altitude of 681 kilometers to a new altitude within the 590 kilometer

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[1] DG Consents is a subsidiary of DigitalGlobe, Inc. ("DigitalGlobe").

[2] DigitalGlobe acquired the EESS space station licensed under Call Sign 2348 and Call 2144 following the transfer of control of GeoEye Licencse Corp. from its then–parent company Geo Eye, Inc. to DigitalGlobe earlier this year. *See* SAT-T/C-20120817-00139. The transfer of control was consummated on January 31, 2013. On November 19, 2013, the Commission approved the pro forma assignment of the two EESS space station licenses held by GeoEye License Corp. to DG Consents. *See* SAT-ASG-20131104-00128.

to 830 kilometer range, inclusive.[3] The proposed range is consistent with the license from the National Oceanic and Atmospheric Administration ("NOAA") to operate GeoEye-1 within an orbital altitude range of 450 kilometers to 850 kilometers,[4] and is further constrained at the low end (590 kilometers versus 450 kilometers) to ensure compliance with power flux density ("pfd") limits. The baseline operating plan for the immediate future is to raise the GeoEye-1 orbit to an altitude of 770 kilometers, consistent with the pending request for special temporary authority to operate at that altitude.

As a threshold matter, DG Consents observes that the Commission has determined in previous cases involving NGSO satellites in other services that changes in orbit altitudes (and associated changes in such related parameters as inclination angles) are not considered to be major unless they increase the potential for interference.[5] Those same principles apply to the change in altitude of the GeoEye-1 satellite that DG Consents proposes in this Modification Application.

DG Consents also notes that observations the Commission previously made with respect to a pre-launch orbit altitude change for the QuickBird EESS satellite, licensed to a subsidiary of DigitalGlobe, remain true today. In May 2001, EarthWatch Incorporated (the former name of DigitalGlobe's parent corporation) sought to lower the authorized orbit altitude of QuickBird from 600 kilometers to its current 450 kilometer range. In assessing this proposed reduction, the Commission noted that "spacecraft design decisions should be left to each space station licensee, because the licensee is in a better position to determine how to tailor its system to meet the particular needs of its customer base."[6] It went on to state that where an orbit altitude change is technically efficient, permits additional entrants, and is otherwise in the public interest, the Commission will approve the change.[7]

DG Consent's current proposal meets this three-pronged standard. First, the baseline altitude change to 770 kilometers is technically efficient. The altitude change will result in more consistent revisit times as GeoEye-1 is phased in with WorldView-2, an EESS space station licensed to DG Consents under Call Sign S2129. The pfd values for the downlink bands remain within the regulatory limits established in No. 21.16 of the International Telecommunication

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[3] GeoEye License Corp. filed a request to operate at an orbital altitude of 770 kilometers under special temporary authority in advance of the instant request for permanent authority to operate at that altitude. That requests remains pending before the Commission. *See* SAT-STA-20131031-00127.

[4] *See* GeoEye 1 license to operate a private commercial space-based remote sensing system dated May 14, 2010 from National Oceanic and Atmospheric Administration.

[5] *See, e.g., Orbital Communications Corp.,* 13 FCC Rcd 10828, (¶¶ 23-24) (Int'l. Bur. 1998); *Teledesic Corp.,* 14 FCC Rcd 2261 (¶ 13) (Int'l. Bur. 1999) (changes in orbital configuration, including number of satellites, number of planes, orbit altitude and inclination angle, not considered major without increase in interference to other systems or increase in difficulty in sharing).

[6] *EarthWatch Incorporated,* 16 FCC Rcd 15985, 15986 (Int'l Bur. 2001) ("*EarthWatch Modification").*

[7] *EarthWatch Modification,* 16 FCC Rcd at 15987.

Union's Radio Regulations over the entire altitude range of 590 to 830 kilometers. Raising the altitude to the baseline 770 kilometers will, in fact, mean a reduction in pfd at the Earth's surface.

Second, nothing in this proposal has any impact on additional EESS entry into the 8025-8400 MHz band. To the extent that the altitude change may make GeoEye-1 more susceptible to interference, DG Consents commits not to claim any greater protection from harmful interference than it is entitled to claim with the satellite at an orbital altitude of 681 kilometers.

Third, the grant of this Modification Application will otherwise serve the public interest by increasing the commercial capacity of GeoEye-1, with a corresponding increase of up to 50 percent improvement in the company's ability to meet its commercial business requirements. The data generated through the enhanced operations of GeoEye-1 will continue to advance myriad public and national interests such as meteorology, national security, and improved understanding of our environment and climate. Moreover, competition in the market for commercial remote sensing data will continue to be robust.

In further support of its request for modification, DG Consents offers the information and demonstrations provided below.

1. Information Required Under Section 25.114 of the Commission's Rules

DG Consents provides the following information in accordance with Section 25.114 of the Commission's rules.[8] DG Consents provides this information only to the extent that it has changed from the information currently on file for Call Sign S2348, and hereby certifies that the remaining information has not changed.[9]

A. General Description of Overall Facilities, Operations and Services

Except for the new altitude range (and corresponding technical refinements) requested herein, GeoEye-1 will continue to be operated as currently authorized. GeoEye-1 will transmit high-resolution satellite images and telemetry using the 8025-8400 MHz band allocated to the EESS. DigitalGlobe's ground segment will send commands to GeoEye-1 using the 2025-2110 MHz band. All radio frequency communications between the modified GeoEye-1 space station and the U.S. will be via Remote Ground Terminals in Prudhoe Bay, Alaska (Call Sign E040264), Fairbanks, Alaska (Call Sign E950499), and Dulles, Virginia (Call Sign E980375.) The Commission authorizations for each of these earth stations include GeoEye-1 as a Point of Communication.

DG Consents has not finalized the orbit altitude for GeoEye-1, but is certain that the altitude will be between 590 kilometers and 830 kilometers, inclusive. Thus, for purposes of

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[8] 47 C.F.R. § 25.114.

[9] *See* 47 C.F.R. § 25.117(d)(1). No changes are proposed in this Modification Application to GeoEye-2, the second satellite currently licensed under Call Sign S2348.

demonstrating compliance with regulatory and technical provisions such as pfd limits, link budgets and predicted antenna gain contours, DG Consents includes data and showings for both 590 kilometers and 830 kilometers. Although the altitude of GeoEye-1 can thus be anywhere in the 590-830 kilometer range, DG Consents includes data for a representative or nominal altitude of 770 kilometers, which represents the altitude as proposed in the pending request for special temporary authority.

B. Schedule S

The technical characteristics of the modified GeoEye-1 satellite are detailed in the Schedule S portion of the FCC Form 312 of this Application, a copy of which is included as Attachment A hereto. DG Consents completed the electronic version Schedule S to the best of its ability since the form is more readily suited for geosynchronous communication satellites. Any discrepancies between the data in the electronic version of Schedule S and the version included in the print out in Attachment A should be resolved in favor of the print version in Attachment A.

C. Link Budgets and Power Flux Density Calculation

The modified satellite's link budgets and pfd limits at the surface of the Earth are included as Attachment B hereto. The pfds at the Earth's surface produced by GeoEye-1 data and telemetry transmissions satisfy the pfd limits in Table 21-4 of the ITU Radio Regulations.[10]

D. Predicted Gain Contours

Attachment C hereto shows the predicted gain contours required by Section 25.114(d)(3) of the Commission's rules at the three U.S. earth station sites at Prudhoe Bay, Fairbanks and Dulles. The gain contours are plotted for GeoEye-1's nominal altitude of 770 kilometers, and at the highest (830 kilometers) and lowest (590 kilometers) points of its anticipated altitude range. Attachment C depicts the contours from a 90° elevation angle.

E. Public Interest Considerations

The grant of the request to modify the orbital altitude of GeoEye-1 will permit DG Consents to increase the area coverage of the satellite and realize a more consistent "revisit" time (i.e., the time between imaging opportunities available to GeoEye-1). As noted above, this will increase the commercial capability of GeoEye-1 by up to 50 percent, thereby enhancing the ability of DigitalGlobe to serve the various and growing customer demands for its high-resolution satellite imagery services.

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[10] Section 25.208 of the Commission's Rules does not contain pfd limits at the Earth's surface produced by emissions from NGSO EESS space stations operating in the 8025-8400 MHz band.

F. Orbital Debris Mitigation

In support of this request, DG Consents offers the following showings on the orbital debris mitigation elements in Section 25.114(d)(14) of the Commission's Rules:

DG Consents confirms that GeoEye-1 will not undergo any planned release of debris during its normal operations. DG Consents also has assessed the probability of the spacecraft becoming a source of debris by collision with small debris or meteoroids of less than one centimeter in diameter that could cause loss of control and prevent post-mission disposal. DG Consents has taken steps to limit the effects of such collisions through redundancy, shielding, separation of components, and physical characteristics.

DG Consents assessed and limited the probability of accidental explosions during and after completion of mission operations. The assessment was based on possible failure modes that could result in explosions, and operational procedures were adopted to limit the probability that they occur. As part of the satellite manufacturing process, steps were taken to ensure that debris generation will not result from the conversion of energy sources on board the satellite into energy that fragments the satellite. All sources of stored energy onboard the spacecraft will have been depleted when no longer required for mission operations or post-mission disposal.

DG Consents assessed and limited the probability of the spacecraft becoming a source of debris by collisions with large debris or other operational spacecraft. DG Consents does not intend to place GeoEye-1 in an orbit that is identical to or very similar to an orbit used by other space stations during or after the orbit raising activity. This specifically includes minimizing the potential for collision with manned spacecraft. To DG Consent's understanding, only the International Space Station and China's Tiangong-1 Space Station module are presently or imminently inhabited orbiting objects. The operational altitude of the International Space Station is approximately 400 kilometers, [11] and the altitude of the Tiangong-1 space module is now approximately 382 kilometers. [12] Both facilities are significantly below the minimum possible operational orbit altitude proposed for GeoEye-1 (590 kilometers). With these measures, collisions will be able to be avoided even if there is at some future point less separation in orbits than is anticipated at a minimum today.[13]

As noted above, DG Consents requested and received favorable action from NOAA on its plan for the post-mission disposal of GeoEye-1. 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

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[11] http://www.nasa.gov/mission_pages/station/expeditions/expedition26/iss_altitude.html (last visited November 12, 2013).

[12] http://www.spacedaily.com/reports/Tiangong_1_orbiter_enters_long_term_operation_management_999.html (last visited November 12, 2013).

[13] DG Consents will take identical proactive measures with respect to any other inhabitable orbiting objects that may be introduced during the time when GeoEye-1 is in orbit.

information" as part of its examination of the debris mitigation disclosures of remote sensing satellites.[14] Accordingly, no submission regarding DG Consent's post-mission disposal plans is required or included with this application.

As a final measure, DG Consents provides in Table 1 below the information called for in Section 25.114(d)(14)(iii) of the Commission's Rules, and "discloses the accuracy – if any – with which the orbital parameters of [its] non-geostationary satellite orbit space stations will be maintained, including apogee, perigee, inclination, and the right ascension of the ascending node(s)."[15] While GeoEye-1 is still in operational condition and propellant is still available, the orbit will be maintained to within the Table 1 accuracies.

Table 1: Anticipated Ranges of Accuracy to Which GeoEye-1 Orbital Parameters Will Be Maintained

Orbital Parameters	Maintenance Accuracy
Inclination Angle	±0.2°
Apogee	±2 km
Perigee	±2 km
Right Ascension of the Ascending Node	±5°

To the extent that Section 25.114(d)(14)(iii) also calls for indication of the anticipated evolution over time of the satellite's orbit, DG Consents notes that after orbit maintenance is no longer possible, GeoEye-1's apogee and perigee altitudes will gradually decay over time due to atmospheric drag until the satellite reenters the atmosphere. During this period the inclination and right ascension of the ascending node will also drift outside of the Table 1 maintenance limits due to gravitational perturbations. Table 2 below shows predicted worst-case (shortest) propellant life and reentry times for the lowest, current and highest anticipated GeoEye-1 operational altitudes. Note the propellant life is the number of years of additional life, after the altitude change is accomplished and not the total life from launch.

Table 2: Predicted Propellant Life and Time to Reentry

Altitude	Propellant Life After Altitude Change	Time to Reentry After Propellant Depletion
590 km (shortest life)	11 years	9 years
681 km (original orbit)	25 years	25 years
770 km (baseline plan)	16 years	50 years

[14] *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).

[15] 47 C.F.R. § 25.114(d)(14)(iii).

Notes:

1. Propellant Life is calculated assuming 3-sigma launch dispersions are removed and all remaining propellant is used to maintain the orbit.

2. Time to Reentry is calculated from the point when all propulsive orbit maintenance ceases, which may occur prior to the propellant life limit.

G. Extent of Communications with GeoEye-1 During Descent to the Atmosphere

DG Consents intends to utilize GeoEye-1 for imaging services until such services are no longer possible. However, given the propellant life and lengthy reentry times shown in Table 2 above, the GeoEye-1 satellite will be decommissioned prior to dropping below 590 kilometers. No communications with the satellite during descent to the atmosphere below this altitude are required.

ATTACHMENT A

Annotated FCC Form 312, Schedule S

FCC 312
Schedule S

FEDERAL COMMUNICATIONS COMMISSION
SATELLITE SPACE STATION AUTHORIZATIONS
(Technical and Operational Description)

Page 1: General, Frequency Bands, and GSO Orbit

S1. GENERAL INFORMATION Complete for all satellite applications.

a. Space Station or Satellite Network Name: GEOEYE-1	e. Estimated Date of Placement into Service: 2/20/2009	i. Will the space station(s) operate on a Common Carrier basis? ☐ YES ☒ NO
b. Construction Commencement Date: 9/29/2004	f. Estimated Lifetime of Satellite(s): 7 Years	j. Number of transponders offered on a Common Carrier basis: 0
c. Construction Completion Date: 1/3/2007	g. Total Number of Transponders: 0	k. Total Common Carrier Transponder Bandwidth: 0 MHz
d. Estimated Launch Date: 9/6/2008	h. Total Transponder Bandwidth (No. Transponders x Bandwidth): 0 MHz	l. Orbit Type: Mark all boxes that apply. ☐ GSO ☒ NGSO

S2. OPERATING FREQUENCY BANDS Identify the frequency range and transmit/receive mode for all frequency bands inwhich this station will operate. Also indicate the nature of service(s) for each frequency band.

Frequency Band Limits					
Lower Frequency (Hz)		Upper Frequency (Hz)			
a. Numeric	b. Unit (K/M/G)	c. Numeric	d. Unit (K/M/G)	e. T/R Mode	f. Nature of Service(s): List all that apply to this band
8025	M	8400	M	T	Earth exploration satellite service
2025	M	2110	M	R	Earth exploration satellite service

S3. ORBITAL INFORMATION FOR GEOSTATIONARY SATELLITES ONLY:

a. Nominal Orbital Longitude (Degrees E/W):

b. Reason for orbital location selection:

Longitudinal Tolerance or E/W Station-Keeping:
c. Toward West: _____ Degrees
d. Toward East: _____ Degrees

e. Inclination Excursion or N/S Station-Keeping Tolerance: _____ Degrees

Range of orbital arc in which adequate service can be provided (Optional): Degrees E/W
f. Westernmost: _____ ___
g. Easternmost: _____ ___

h. Reason for service arc selection (Optional):

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S4. ORBITAL INFORMATION FOR NON-GEOSTATIONARY SATELLITES ONLY

S4a. Total Number of Satellites in Network or System: 1
S4b. Total Number of Orbital Planes in Network or System: 1
S4c. Celestial Reference Body (Earth, Sun, Moon, etc.): E
S4d. Orbit Epoch Date: 2013/09/18 14:00:00 UTC

For each Orbital Plane Provide:

(e) Orbital Plane No.	(f) No. of Satellites in Plane	(g) Inclination Angle (degrees)	(h) Orbital Period (Seconds)	(i) Apogee (km)	(j) Perigee (km)	(k) Right Ascension of the Ascending Node (Deg.)	(l) Argument of Perigee (Degrees)	Active Service Arc Range (Degrees)		
								(m) Begin Angle	(n) End Angle	(o) Other
1 Min	1	97.74	5780	614	601	335.161	90			
1 Nom	1	98.47	6006	796	779	335.161	90			
1 Max	1	98.81	6107	874	860	335.161	90			

S5. INITIAL SATELLITE PHASE ANGLE For each satellite in each orbital plane, provide the initial phase angle.

(a) Orbital Plane No.	(b) Satellite Number	(c) Initial Phase Angle (Degrees)	(a) Orbital Plane No.	(b) Satellite Number	(c) Initial Phase Angle (Degrees)	(a) Orbital Plane No.	(b) Satellite Number	(c) Initial Phase Angle (Degrees)	(a) Orbital Plane No.	(b) Satellite Number	(c) Initial Phase Angle (Degrees)
1	1	0									

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S6. SERVICE AREA CHARACTERISTICS For each service area provide:

(a) Service Area ID	(b) Type of Associated Station (Earth or Space)	(c) Service Area Diagram File Name (GXT File)	(d) Service Area Description. Provide list of geographic areas (state postal codes or ITU 3-ltr codes), satellites or Figure No. of Service Area Diagram.

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S7. SPACE STATION ANTENNA BEAM CHARACTERISTICS For each antenna beam provide:

(a) Beam ID	(b) T/R Mode	Isotropic Antenna Gain		(e) Pointing Error (Degrees)	(f) Rotational Error (Degrees)	(g) Min. Cross-Polar Isolation (dB)	(h) Polarization Switchable? (Y/N)	(i) Polarization Alignment Rel. Equatorial Plane (Degrees)	(j) Service Area ID	Transmit			Receive			Input Attenuator (dB)	
		(c) Peak (dBi)	(d) Edge (dBi)							(k) Input Losses (dB)	(l) Effective Output Power (W)	(m) Max. EIRP (dBW)	(n) System Noice Temperature (K)	(o) G/T at Max.Gain Pt. (dB/K)	(p) Min. Saturation Flux Density (dBW/m2)	(q) Max. Value	(r) Step Size
WB-L	T	26	3	1		21	N			9	10	26.7					
WB-R	T	26	3	1		21	N			9	10	26.7					
NB	T	5	-7	0		19	N			10	1	-4.5					
CMD	R	5	-7	0		19	N						290	-40	-50.1		

S8. ANTENNA BEAM DIAGRAMS For each beam pattern provide the reference to the graphic image and numerical data:
Also provide the power flux density levels in each beam that result from the emission with the highest power flux density.

(a) Beam ID	(b) T/R Mode	(c) Co- or Cross-Polar Mode ("C" or "X")	(d) GSO Ref. Orbital Longitude (Deg. E/W)	(e) NGSO Antenna Gain Contour Description (Figure / Table / Exhibit)	(f) GSO Antenna Gain Contour Data (GXT File)	Max. Power Flux Density (dBW/m2 per Reference Bandwidth*) At Angle of Arrival above horizontal (for emission with highest PFD)					
						(g) 5 Deg	(h) 10 Deg	(i) 15 Deg	(j) 20 Deg	(k) 25 Deg	(l) Reference Bandwidth* (4kHz or 1MHz)

*Use a Reference Bandwidth of 4 kHz or 1 MHz as appropriate to the FCC Rules that apply to the subject frequency band (§ 25.208).

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S9. SPACE STATION CHANNELS For each frequency channel provide:

(a) Channel No.	(b) Assigned Bandwidth (kHz)	(c) T/R Mode	(d) Center Frequency (MHz)	(e) Polarization (H,V,L,R)	(f) TT&C or Comm Channel (T or C)
WB-L	370000	T	8210	L	C
WB-R	370000	T	8210	R	C
NB	59.7	T	8394	R	T
CMD	128	R	2092.6	R	T

S10. SPACE STATION TRANSPONDERS** For each transponder provide:

(a) Transponder ID	(b) Transponder Gain* (dB)	Receive Band		Transmit Band	
		(c) Channel No.	(d) Beam ID	(e) Channel No.	(f) Beam ID

*Transponder gain between output of receiving antenna and input of transmitting antenna.
**Also complete this table for half-links such as TT&C and on-board processing. In such cases, provide the receive or transmit information, as appropriate.

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S11. DIGITAL MODULATION PARAMETERS For each digital emission provide:

(a) Digital Mod. ID	(b) Emission Designator	(c) Assigned Bandwidth (kHz)	(d) No. of Phases	(e) Uncoded Data Rate (kbps)	(f) FEC Error Correction Coding Rate	(g) CDMA Processing Gain (dB)	(h) Total C/N Performance Objective (dB)	(i) Single Entry C/I Objective (dB)
WB-L	370MG1D	370000	4	370000				9.8
WB-R	370MG1D	370000	4	370000				9.8
NB	59K7G1D	59.7	4	59.7				9.8
CMD	128KG1D	128	2	128				9.8

S12. ANALOG MODULATION PARAMETERS For each analog emission provide:

					Multi-channel Telephony									
(a) Analog Mod. ID	(b) Emission Designator	(c) Assigned Bandwidth (kHz)	(d) Signal Type* (see below)	(e) Channels per Carrier	(f) Ave. Companded Talker Level (dBm0)	(g) Bottom Baseband Freq. (MHz)	(h) Top Baseband Freq. (MHz)	(i) RMS Modulation Index	(j) Video Standard NTSC, PAL, etc.	(k) Video Noise Weight-ing (dB)	(l) Video & SCPC/FM Modulation Index	(m) SCPC/FM Compander, Preemphasis, & Noise Weight-ing (dB)	(n) Total C/N Performance Objective (dB)	(o) Single Entry C/I Objective (dB)

*Indicate whether signal is (a) FDM/FM, (b) CSSB/AM, (c) SCPC/FM, or (d) TV/FM.

S13. TYPICAL EMISSIONS For each planned type of emission provide:

Associated Transponder ID Range		Modulation ID		(e) Carriers per Transponder	(f) Carrier Spacing (kHz)	(g) Noise Budget Reference (Table No.)	(h) Energy Dispersal Bandwidth* (kHz)	Receive Band (Assoc.Transmit Stn)			Transmit Band (This Space Station)				
								(i) Assoc.Stn Max.Antenna Gain (dBi)	Assoc. Station Transmit Power (dBW)		EIRP (dBW)		Max. Power Flux Density		(p) Assoc. Stn Rec. G/T (dB/K)
(a) Start	(b) End	(c) Digital (Table S11)	(d) Analog (Table S12)						(j) Min.	(k) Max.	(l) Min.	(m) Max.	(n)dBW/m2	(o)Ref. BW** (4kHz or 1MHz)	

* For those emissions using energy dispersal, provide the bandwidth of the energy dispersal. Otherwise, leave blank.
**Use a Reference Bandwidth of 4 kHz or 1 MHz as appropriate to the FCC Rules that apply to the subject frequency band (§ 25.208).

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S14. Is the space station(s) controlled and monitored remotely? If YES, provide the location and telephone number of the TT&C control point(s). [X] YES [ ] NO

Remote Control (TT&C) Location(s):

S14a. Street Address			
1601 Dry Creek Drive, Suite 260			
S14b. City: Longmont	S14c. County: Boulder	S14d. State / Country: CO	S14e. Zip Code: 80503
S14f. Telephone Number: 303-684-4000	S14g. Call Sign of Control Station (if appropriate):		

S14a. Street Address			
S14b. City	S14c. County	S14d. State / Country	S14e. Zip Code
S14f. Telephone Number	S14g. Call Sign of Control Station (if appropriate)		

S14a. Street Address			
S14b. City	S14c. County	S14d. State / Country	S14e. Zip Code
S14f. Telephone Number	S14g. Call Sign of Control Station (if appropriate)		

S14a. Street Address			
S14b. City	S14c. County	S14d. State / Country	S14e. Zip Code
S14f. Telephone Number	S14g. Call Sign of Control Station (if appropriate)		

S14a. Street Address			
S14b. City	S14c. County	S14d. State / Country	S14e. Zip Code
S14f. Telephone Number	S14g. Call Sign of Control Station (if appropriate)		

S14a. Street Address			
S14b. City	S14c. County	S14d. State / Country	S14e. Zip Code
S14f. Telephone Number	S14g. Call Sign of Control Station (if appropriate)		

S15. SPACECRAFT PHYSICAL CHARACTERISTICS

S15a. Mass of spacecraft without fuel (kg) 1722	Spacecraft Dimensions (meters)	Probability of Survival to End of Life (0.0 - 1.0)
S15b. Mass of fuel & disposables at launch (kg) 180		
S15c. Mass of spacecraft and fuel at launch (kg) 1902	S15f. Length (m) 6.15	S15i. Payload 0.933
S15d. Mass of fuel, in orbit, at beginning of life (kg) 173.5	S15g. Width (m) 2.38	S15j. Bus 0.769
S15e. Deployed Area of Solar Array (square meters) 18.2	S15h. Height (m) 4.09	S15k. Total 0.717

S16. SPACECRAFT ELECTRICAL CHARACTERISTICS

Spacecraft Subsystem	Electrical Power (Watts) At Beginning of Life		Electrical Power (Watts) At End of Life	
	At Equinox	At Solstice	At Equinox	At Solstice
Payload (Watts)	(a) 318	(f) 318	(k) 318	(p) 318
Bus (Watts)	(b) 1306	(g) 1306	(l) 1306	(q) 1306
Total (Watts)	(c) 1624	(h) 1624	(m) 1624	(r) 1624
Solar Array (Watts)	(d) 4559	(i) 4413	(n) 3911	(s) 3786
Depth of Battery Discharge (%)	(e) 27 %	(j) 27 %	(o) 27 %	(t) 27 %

S17. CERTIFICATIONS

a. Are the power flux density limits of § 25.208 met?	☐ YES	☐ NO	☒ N/A
b. Are the appropriate service area coverage requirements of § 25.143(b)(ii) and (iii), or § 25.145(c)(1) and (2) met?	☐ YES	☐ NO	☒ N/A
c. Are the frequency tolerances of § 25.202(e) and the out-of-band emission limits of § 25.202(f)(1), (2), and (3) met?	☒ YES	☐ NO	☐ N/A

In addition to the information required in this Form, the space station applicant is required to provide all the information specified in Section 25.114 of the Commission's rules, 47 C.F.R. § 25.114.

ATTACHMENT B

Summary Information Related to GeoEye
Non-GSO EESS Remote Sensing Satellite System

GE1
370 Mbps DATA RATE DOWNLINK ANALYSIS **Dulles, VA**

Fo = 8.210 GHz **OQPSK Modulation** **590 km Altitude**

DOWNLINK PARAMETERS:

Frequency	8.21	GHz
Orbit height in km	590	km
Local elevation above hor.	5	degrees
Data rate	370	Mbps
Bandwidth (baseband)	185	MHz
Spacecraft ant. EIRP at max scan	55.8	dBm
Slant range	2304.74	km
Ground ant. G/T	27.9	dB/K
BER	5.00E-04	
Required Eb/No (without coding)	8.3	dB
Hardware imp. BER loss	-2.5	dB

LINK CALCULATION:
TOTAL POWER TO GROUND:

Satellite EIRP	55.8	dBm
Path loss	-178.0	dB
Total loss (rain, polarization, etc.)	-3.8	dB

RECEIVER SENSITIVITY:

Required Eb/No	8.3	dB
Available Eb/No	11.1	dB
DOWNLINK MARGIN	**2.8**	**dB**

ANTENNA SIZES:
Spacecraft Antenna Segment

Spacecraft dish diameter	19.7	inches
Approx. HPBW	9.0	degrees
Gain of spacecraft antenna	26.0	dBic
Loss between HPA out and ant. output	-9.0	dB
Transmitter Po	7.5	watts
EIRP of satellite system	55.8	dBm

Ground Antenna Segment

Ground antenna G/T	27.9	dB/K
System noise temperature	171.6	K (referenced at aperture)
Directivity gain ground antenna	52.3	dBic
Ground dish diameter	5.4	meters
Approx. HPBW	0.5	degrees

GE1
370 Mbps DATA RATE DOWNLINK ANALYSIS **Dulles, VA**

Fo = 8.210 GHz **OQPSK Modulation** **770 km Altitude**

DOWNLINK PARAMETERS:

Frequency	8.21	GHz
Orbit height in km	770	km
Local elevation above hor.	5	degrees
Data rate	370	Mbps
Bandwidth (baseband)	185	MHz
Spacecraft ant. EIRP at max scan	55.8	dBm
Slant range	2718.88	km
Ground ant. G/T	27.9	dB/K
BER	5.00E-04	
Required Eb/No (without coding)	8.3	dB
Hardware imp. BER loss	-2.5	dB

LINK CALCULATION:
TOTAL POWER TO GROUND:

Satellite EIRP	55.8	dBm
Path loss	-179.4	dB
Total loss (rain, polarization, etc.)	-3.8	dB

RECEIVER SENSITIVITY:

Required Eb/No	8.3	dB
Available Eb/No	10.0	dB
DOWNLINK MARGIN	**1.7**	**dB**

ANTENNA SIZES:
Spacecraft Antenna Segment

Spacecraft dish diameter	19.7	inches
Approx. HPBW	9.0	degrees
Gain of spacecraft antenna	26.0	dBic
Loss between HPA out and ant. output	-9.0	dB
Transmitter Po	7.5	watts
EIRP of satellite system	55.8	dBm

Ground Antenna Segment

Ground antenna G/T	27.9	dB/K
System noise temperature	171.6	K (referenced at aperture)
Directivity gain ground antenna	52.3	dBic
Ground dish diameter	5.4	meters
Approx. HPBW	0.5	degrees

GE1
370 Mbps DATA RATE DOWNLINK ANALYSIS Dulles, VA

Fo = 8.210 GHz **OQPSK Modulation** **830 km Altitude**

DOWNLINK PARAMETERS:

Frequency	8.21	GHz
Orbit height in km	830	km
Local elevation above hor.	5	degrees
Data rate	370	Mbps
Bandwidth (baseband)	185	MHz
Spacecraft ant. EIRP at max scan	55.8	dBm
Slant range	2847.85	km
Ground ant. G/T	27.9	dB/K
BER	5.00E-04	
Required Eb/No (without coding)	8.3	dB
Hardware imp. BER loss	-2.5	dB

LINK CALCULATION:
TOTAL POWER TO GROUND:

Satellite EIRP	55.8	dBm
Path loss	-179.8	dB
Total loss (rain, polarization, etc.)	-3.8	dB

RECEIVER SENSITIVITY:

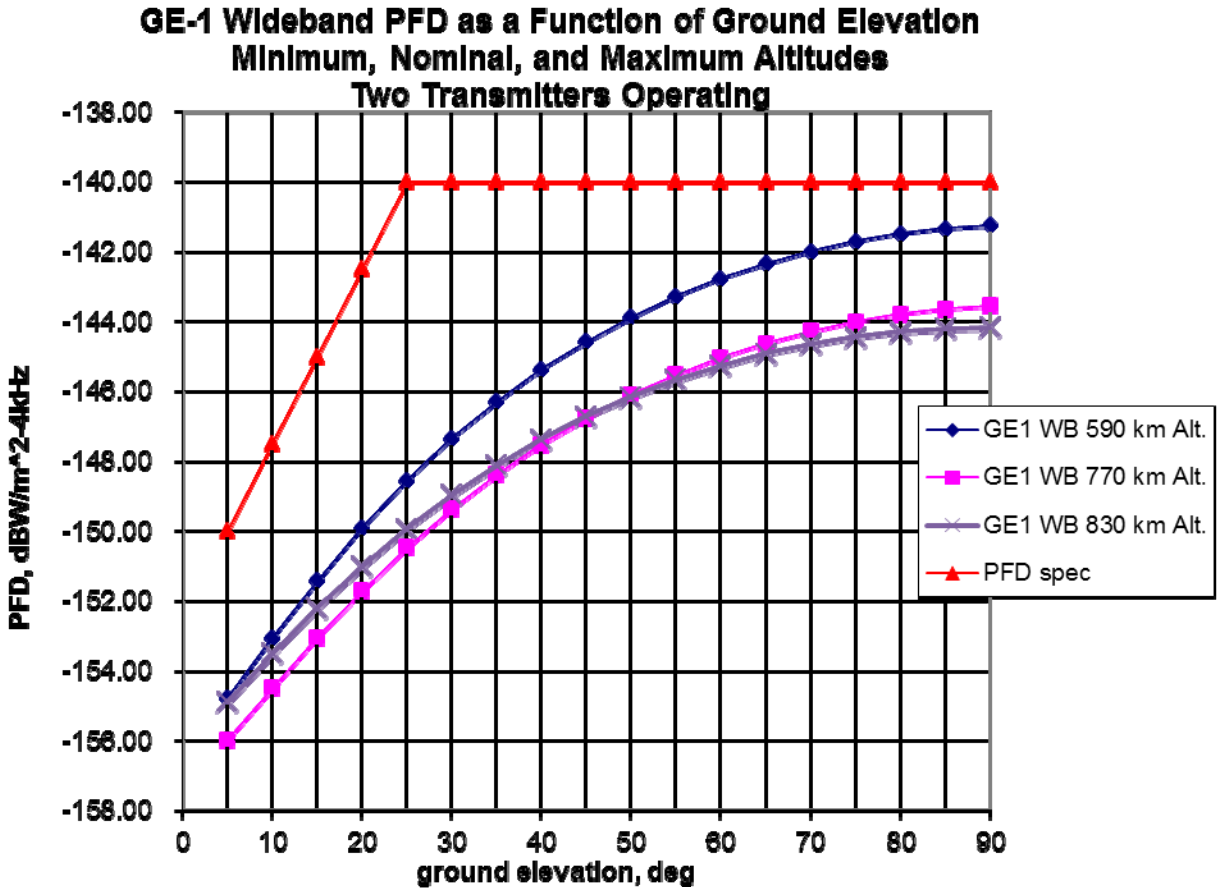
Required Eb/No	8.3	dB
Available Eb/No	9.7	dB
DOWNLINK MARGIN	**1.4**	**dB**

ANTENNA SIZES:
Spacecraft Antenna Segment

Spacecraft dish diameter	19.7	inches
Approx. HPBW	9.0	degrees
Gain of spacecraft antenna	26.0	dBic
Loss between HPA out and ant. output	-9.0	dB
Transmitter Po	7.5	watts
EIRP of satellite system	55.8	dBm

Ground Antenna Segment

Ground antenna G/T	27.9	dB/K
System noise temperature	171.6	K (referenced at aperture)
Directivity gain ground antenna	52.3	dBic
Ground dish diameter	5.4	meters
Approx. HPBW	0.5	degrees


GE-1 Wideband PFD as a Function of Ground Elevation
Minimum, Nominal, and Maximum Altitudes
Two Transmitters Operating
PFD, dBW/m^2-4kHz
-138.00
-140.00
-142.00
-144.00
-146.00
-148.00
-150.00
-152.00
-154.00
-156.00
-158.00
0
10
20
30
40
50
60
70
80
90
ground elevation, deg
GE1 WB 590 km Alt.
GE1 WB 770 km Alt.
GE1 WB 830 km Alt.
PFD spec

GE-1

TELEMETRY DOWNLINK

NADIR ANTENNA

FREQUENCY	8.394	GHz	WAVELENGTH	0.04	METERS
POWER	2.0	WATTS	5 DEG SLANT RANGE	2304.74	KM
ALTITUDE	590.0	KM			
			DATA RATE	59.7	KBPS

MARGIN

DATA 6.0 dB

ANTENNA: NADIR

PARAMETER	UNITS	VALUE
TOTAL TRANSMIT POWER	dBm	33.0
PASSIVE LOSS	dB	-15.5
S/C ANTENNA GAIN > +/-108 DEG	dBic	0.0
FREE SPACE DISPERSION LOSS	dB	-178.2
ATMOSPHERIC LOSS	dB	-2.9
GROUND STATION G/T	dB/K	27.6
TOTAL RECEIVED POWER/T	dBm/K	-136.0
BOLTZMANN CONSTANT	dBm/Hz-K	-198.6
TOTAL RECEIVED POWER/KT	dB-Hz	62.6

DATA CHANNEL

DATA POWER/KT	dB-Hz	62.6
INFORMATION RATE 32 KBPS	dB-Hz	47.8
AVAILABLE S/N	dB	14.9
REQUIRED Eb/No 1.00E-6 BER	dB	13.1
CODING GAIN	dB	4.2
AVAILABLE SIGNAL MARGIN	dB	6.0

GE-1

TELEMETRY DOWNLINK

NADIR ANTENNA

FREQUENCY	8.394	GHz	WAVELENGTH	0.04	METERS
POWER	2.0	WATTS	5 DEG SLANT RANGE	2718.88	KM
ALTITUDE	770.0	KM			
			DATA RATE	59.7	KBPS

MARGIN

DATA 4.5 dB

ANTENNA: NADIR

PARAMETER	UNITS	VALUE
TOTAL TRANSMIT POWER	dBm	33.0
PASSIVE LOSS	dB	-15.5
S/C ANTENNA GAIN > +/-108 DEG	dBic	0.0
FREE SPACE DISPERSION LOSS	dB	-179.6
ATMOSPHERIC LOSS	dB	-2.9
GROUND STATION G/T	dB/K	27.6
TOTAL RECEIVED POWER/T	dBm/K	-137.4
BOLTZMANN CONSTANT	dBm/Hz-K	-198.6
TOTAL RECEIVED POWER/KT	dB-Hz	61.2

DATA CHANNEL

DATA POWER/KT	dB-Hz	61.2
INFORMATION RATE 32 KBPS	dB-Hz	47.8
AVAILABLE S/N	dB	13.4
REQUIRED Eb/No 1.00E-6 BER	dB	13.1
CODING GAIN	dB	4.2
AVAILABLE SIGNAL MARGIN	dB	4.5

GE-1

TELEMETRY DOWNLINK

NADIR ANTENNA

FREQUENCY	8.394	GHz	WAVELENGTH	0.04	METERS
POWER	2.0	WATTS	5 DEG SLANT RANGE	2847.85	KM
ALTITUDE	830.0	KM			
			DATA RATE	59.7	KBPS

MARGIN

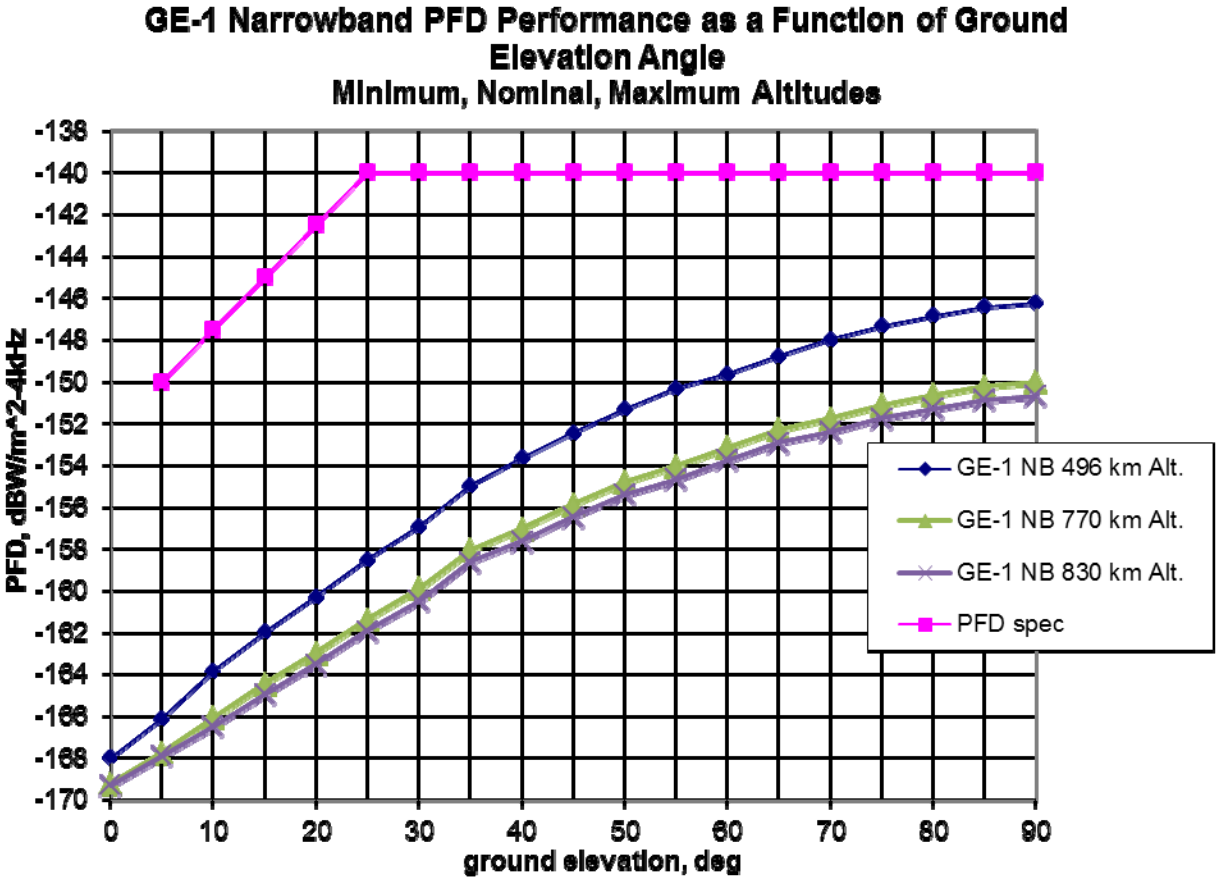
DATA 4.1 dB

ANTENNA: NADIR

PARAMETER	UNITS	VALUE
TOTAL TRANSMIT POWER	dBm	33.0
PASSIVE LOSS	dB	-15.5
S/C ANTENNA GAIN > +/-108 DEG	dBic	0.0
FREE SPACE DISPERSION LOSS	dB	-180.0
ATMOSPHERIC LOSS	dB	-2.9
GROUND STATION G/T	dB/K	27.6
TOTAL RECEIVED POWER/T	dBm/K	-137.8
BOLTZMANN CONSTANT	dBm/Hz-K	-198.6
TOTAL RECEIVED POWER/KT	dB-Hz	60.8

DATA CHANNEL

DATA POWER/KT	dB-Hz	60.8
INFORMATION RATE 32 KBPS	dB-Hz	47.8
AVAILABLE S/N	dB	13.0
REQUIRED Eb/No 1.00E-6 BER	dB	13.1
CODING GAIN	dB	4.2
AVAILABLE SIGNAL MARGIN	dB	4.1


GE-1 Narrowband PFD Performance as a Function of Ground Elevation Angle
Minimum, Nominal, Maximum Altitudes
PFD, dBW/m^2-4kHz
-138
-140
-142
-144
-146
-148
-150
-152
-154
-156
-158
-160
-162
-164
-166
-168
-170
0
10
20
30
40
50
60
70
80
90
ground elevation, deg
GE-1 NB 496 km Alt.
GE-1 NB 770 km Alt.
GE-1 NB 830 km Alt.
PFD spec

GE-1
COMMAND
UPLINK OMNI ANTENNA NOMINAL
DigitalGlobe

FREQUENCY	2.0920000	GHz			
UPLINK	51.3	dBW EIRP	WAVELENGTH	0.14	METERS
			5 DEG SLANT		
ALTITUDE	519.0	KM	RANGE	2127.2	KM
			DATA RATE	64	**KBPS**
CMD MOD INDEX	1.57	RAD	MARGIN	7.8	dB

ANTENNA: OMNI NOMINAL +/- 75 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	51.3
FREE SPACE DISPERSION LOSS	dB	-165.4
POINTING LOSS	dB	0.0
ATMOSPHERIC LOSS	dB	-1.1
S/C ANTENNA GAIN < +/- 75 DEG	dBi	-10.0
POLARIZATION LOSS	dB	-0.5
S/C LINE LOSS	dB	-4.7
TOTAL S/C RECEIVED POWER	dBm	-100.4
SYSTEM TEMPERATURE	dB-K	29.7
G/T	dB/K	-39.7
RECEIVED C/N0	dB-Hz	68.5
REQUIRED BIT ERROR RATE		1.00E-06
RECEIVED EB/N0	dB	20.4
IMPLEMENTATION LOSS	dB	-2
REQUIRED EB/N0	dB	10.6
MARGIN	dB	7.8

GE-1
COMMAND
UPLINK OMNI ANTENNA NOMINAL
DigitalGlobe

FREQUENCY	2.0920000	GHz			
UPLINK	51.3	dBW EIRP	WAVELENGTH	0.14	METERS
			5 DEG SLANT		
ALTITUDE	770.0	KM	RANGE	2718.9	KM
			DATA RATE	64	**KBPS**
CMD MOD INDEX	1.57	RAD	MARGIN	5.7	dB

ANTENNA: OMNI NOMINAL +/- 75 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	51.3
FREE SPACE DISPERSION LOSS	dB	-167.5
POINTING LOSS	dB	0.0
ATMOSPHERIC LOSS	dB	-1.1
S/C ANTENNA GAIN < +/- 75 DEG	dBi	-10.0
POLARIZATION LOSS	dB	-0.5
S/C LINE LOSS	dB	-4.7
TOTAL S/C RECEIVED POWER	dBm	-102.6
SYSTEM TEMPERATURE	dB-K	29.7
G/T	dB/K	-39.7
RECEIVED C/N0	dB-Hz	66.4
REQUIRED BIT ERROR RATE		1.00E-06
RECEIVED EB/N0	dB	18.3
IMPLEMENTATION LOSS	dB	-2
REQUIRED EB/N0	dB	10.6
MARGIN	dB	5.7

GE-1
COMMAND
UPLINK OMNI ANTENNA NOMINAL
DigitalGlobe

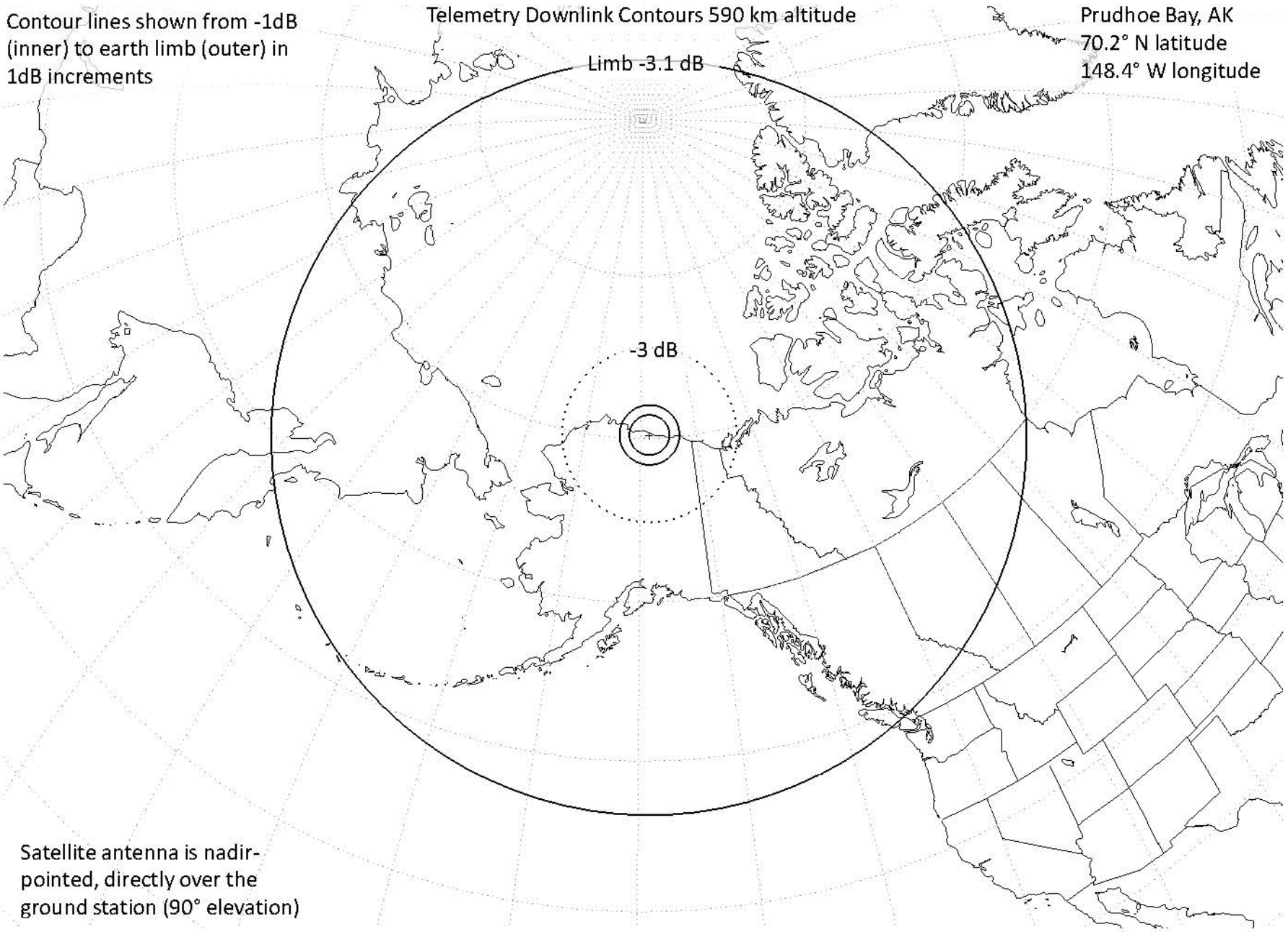
FREQUENCY	2.0920000	GHz			
UPLINK	51.3	dBW EIRP	WAVELENGTH	0.14	METERS
			5 DEG SLANT		
ALTITUDE	830.0	KM	RANGE	2847.9	KM
			DATA RATE	64	**KBPS**
CMD MOD INDEX	1.57	RAD	MARGIN	5.3	dB

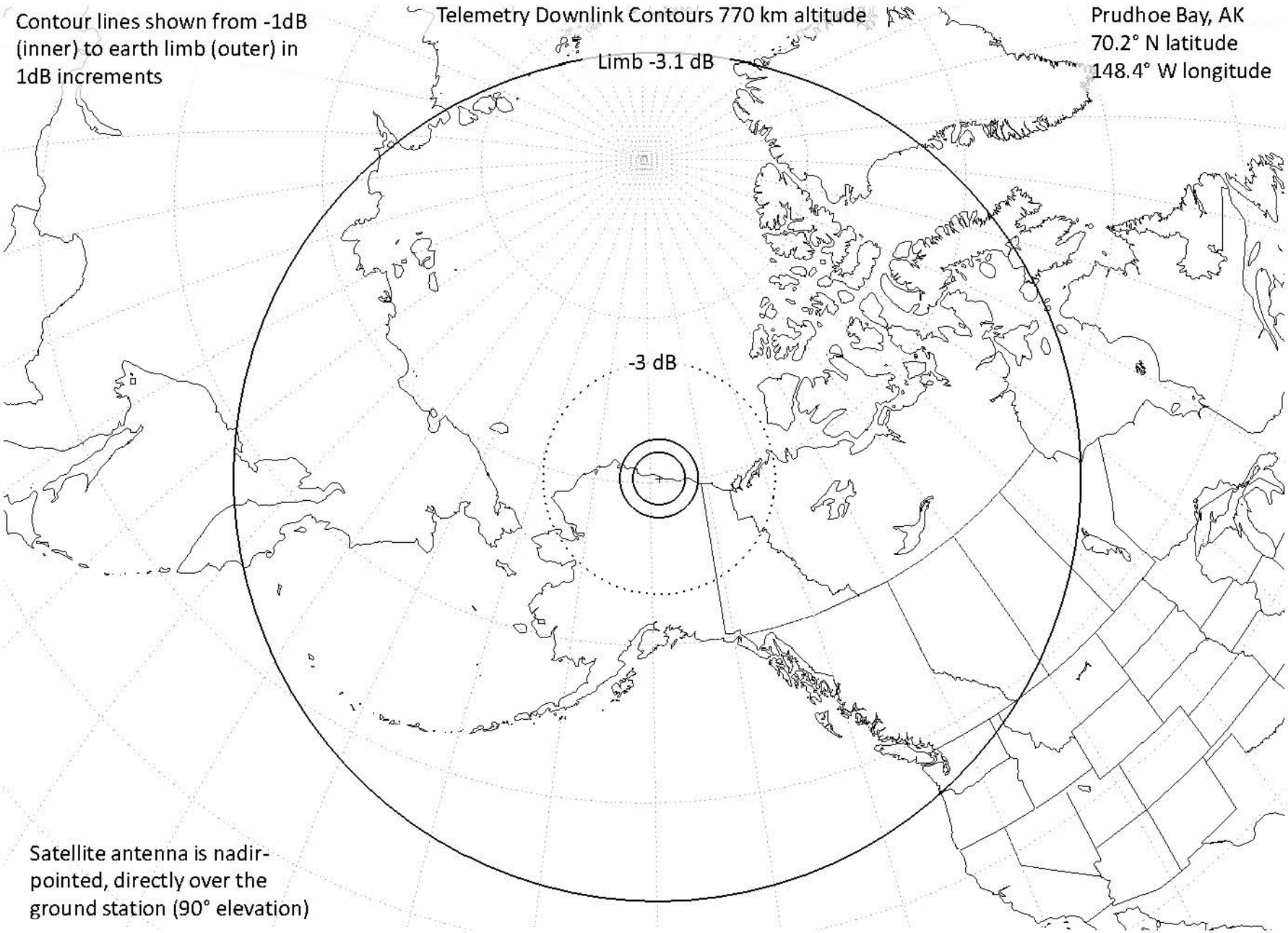
ANTENNA: OMNI NOMINAL +/- 75 DEG

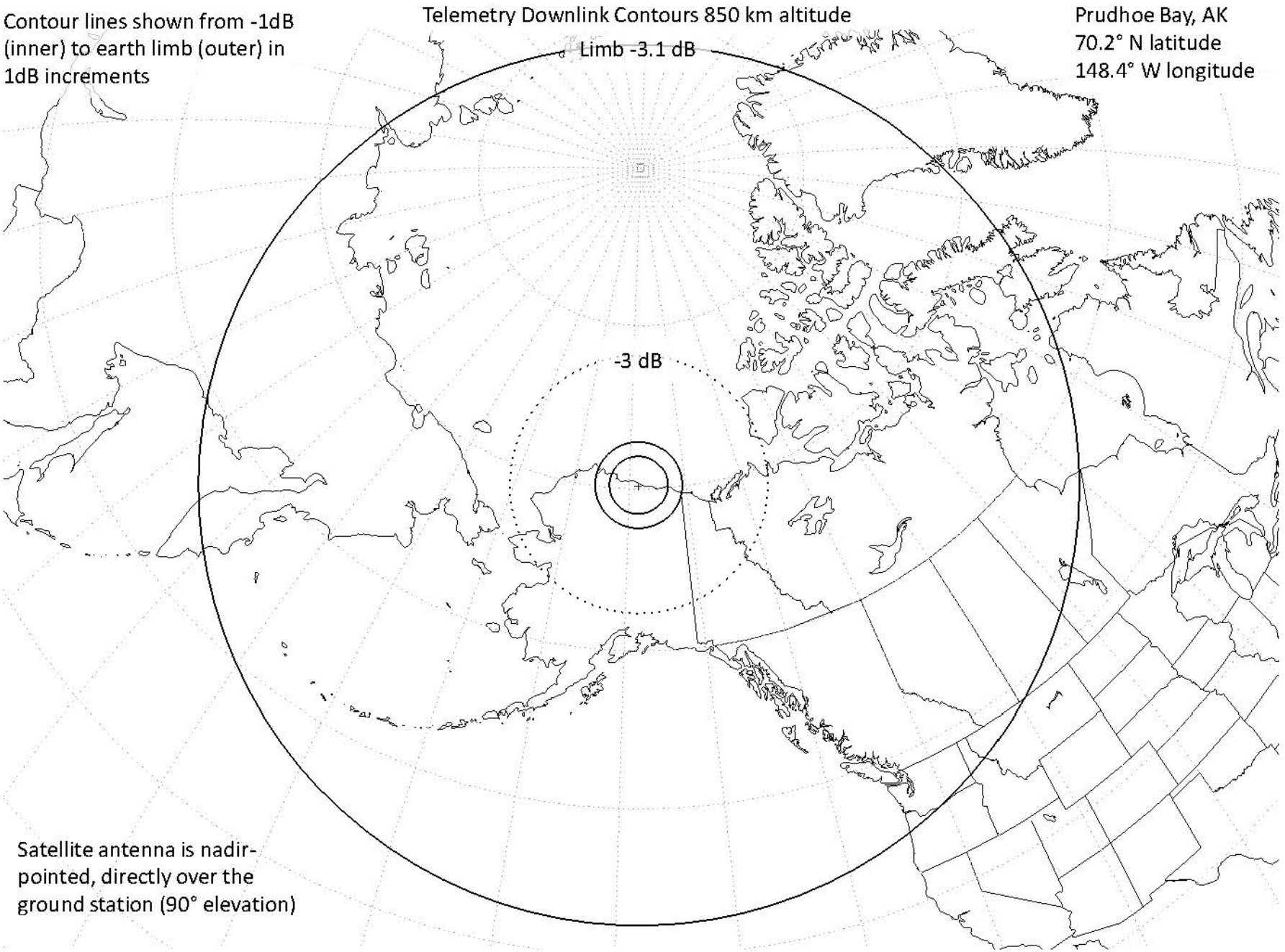
PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	51.3
FREE SPACE DISPERSION LOSS	dB	-167.9
POINTING LOSS	dB	0.0
ATMOSPHERIC LOSS	dB	-1.1
S/C ANTENNA GAIN < +/- 75 DEG	dBi	-10.0
POLARIZATION LOSS	dB	-0.5
S/C LINE LOSS	dB	-4.7
TOTAL S/C RECEIVED POWER	dBm	-103.0
SYSTEM TEMPERATURE	dB-K	29.7
G/T	dB/K	-39.7
RECEIVED C/N0	dB-Hz	66.0
REQUIRED BIT ERROR RATE		1.00E-06
RECEIVED EB/N0	dB	17.9
IMPLEMENTATION LOSS	dB	-2
REQUIRED EB/N0	dB	10.6
MARGIN	dB	5.3

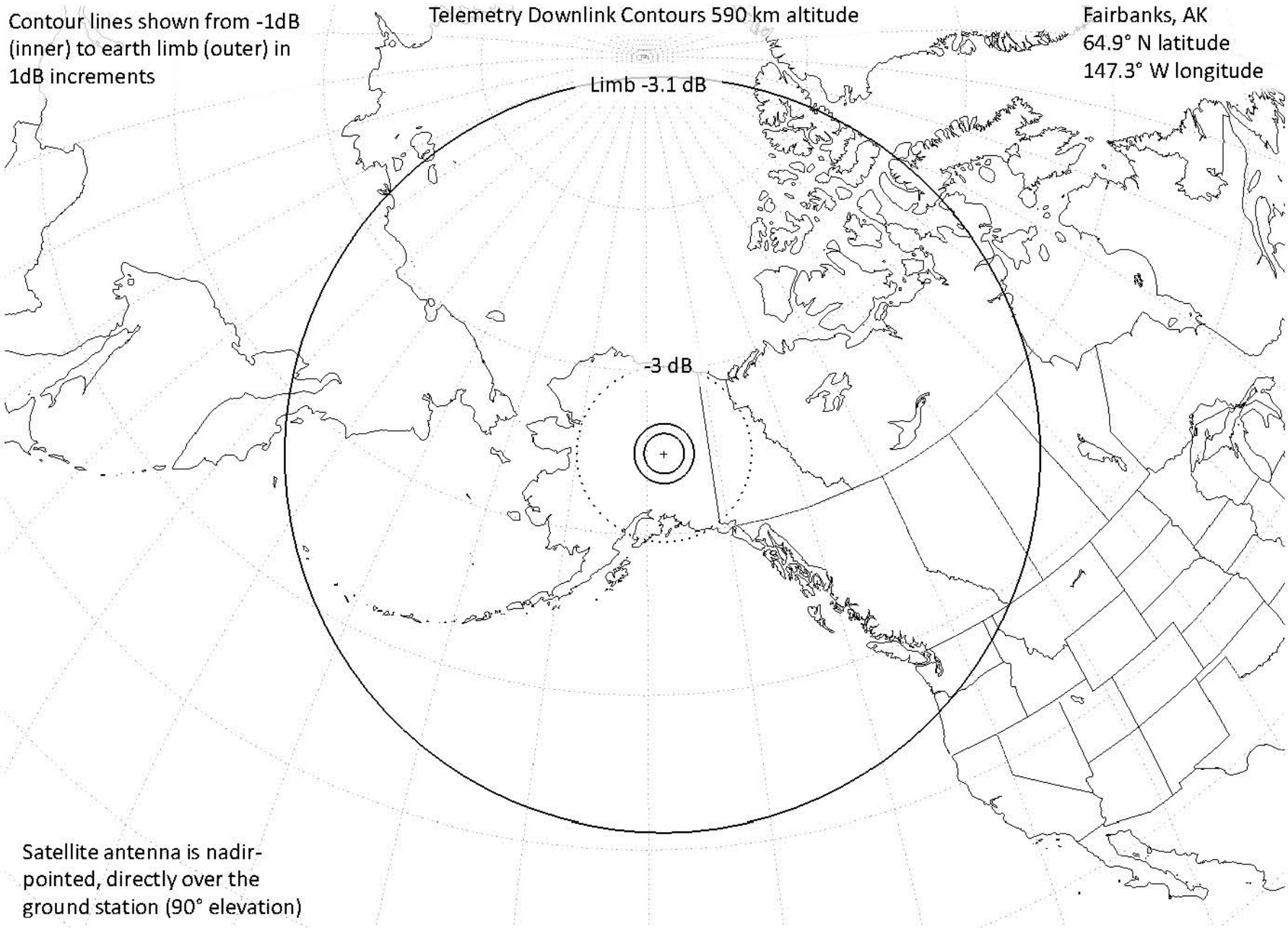
ATTACHMENT C

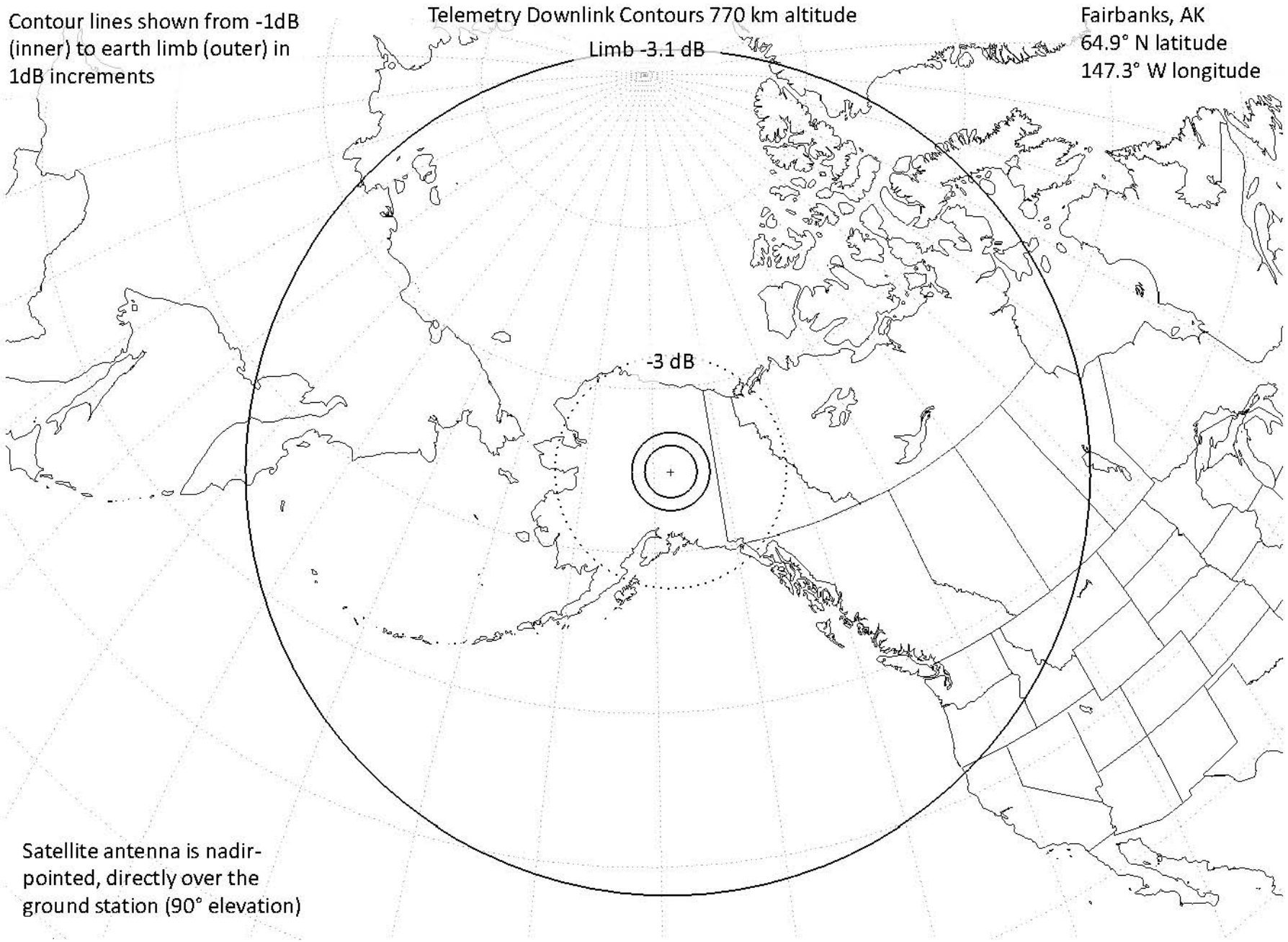
Predicted Antenna Gain Patterns

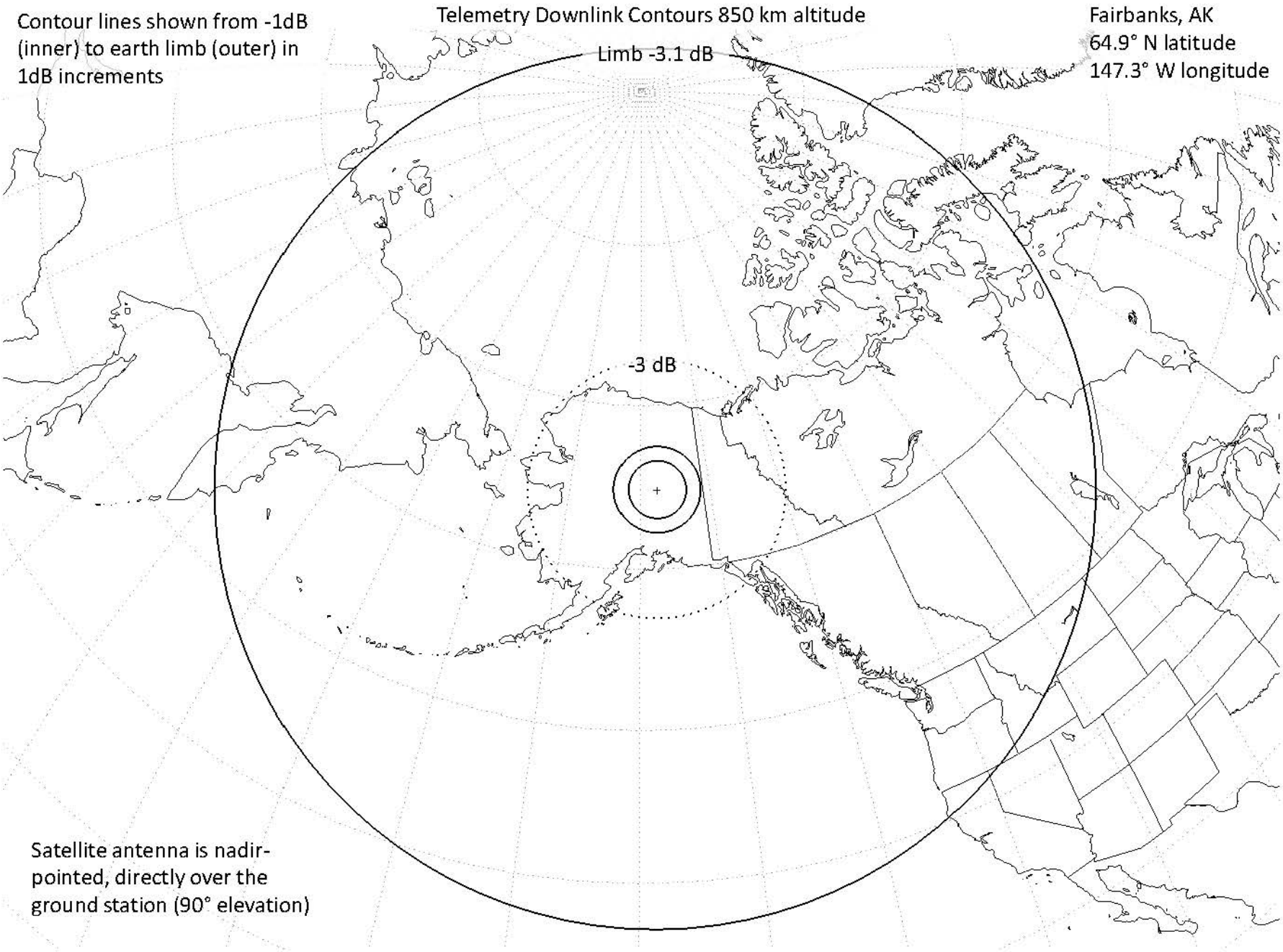

Contour lines shown from -1dB (inner) to earth limb (outer) in 1dB increments
Telemetry Downlink Contours 590 km altitude
Limb -3.1 dB
-3 dB
Prudhoe Bay, AK
70.2° N latitude
148.4° W longitude
Satellite antenna is nadir-pointed, directly over the ground station (90° elevation)

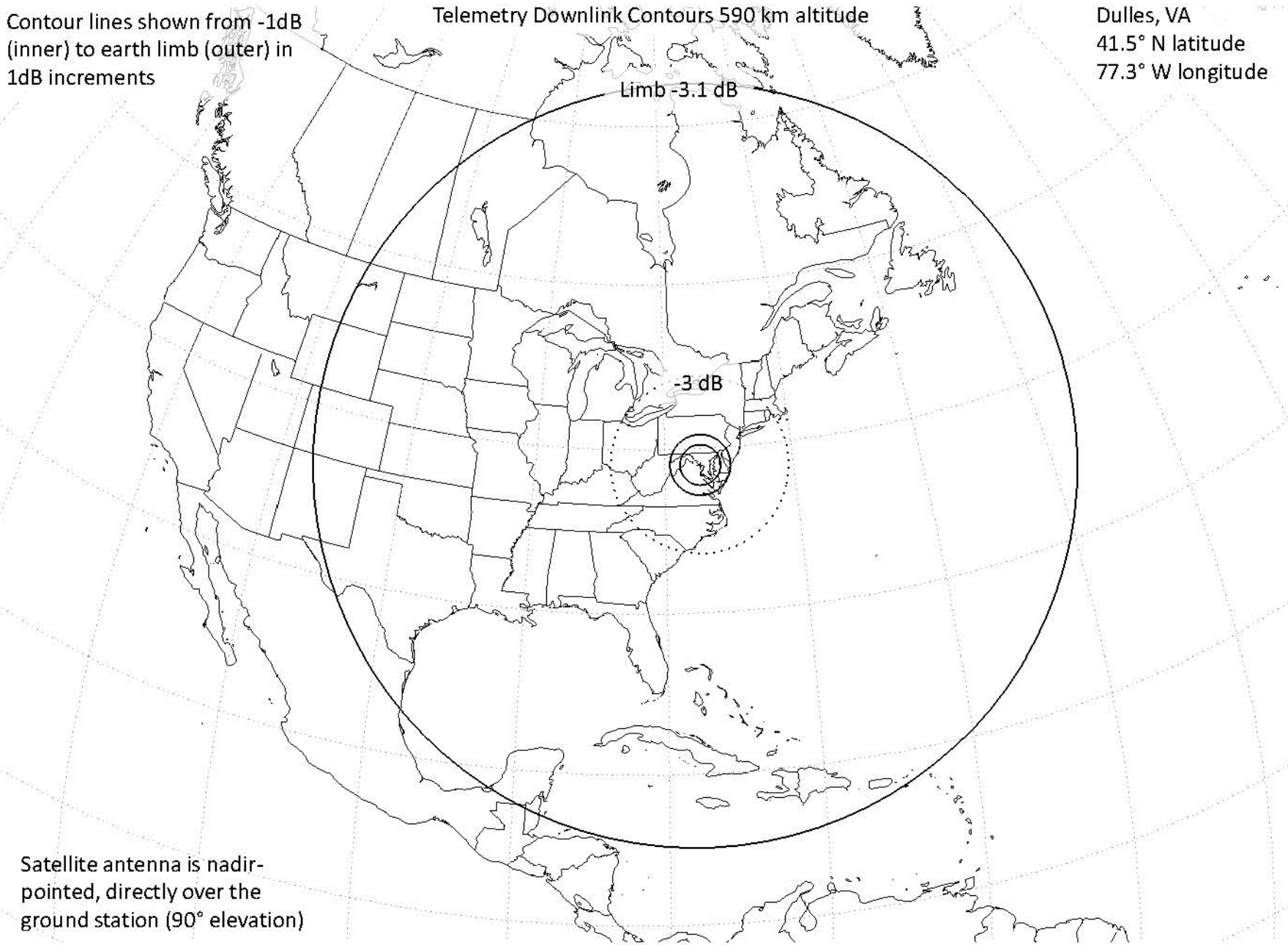

Contour lines shown from -1dB (inner) to earth limb (outer) in 1dB increments
Telemetry Downlink Contours 770 km altitude
Prudhoe Bay, AK
70.2° N latitude
148.4° W longitude
Limb -3.1 dB
-3 dB
Satellite antenna is nadir-pointed, directly over the ground station (90° elevation)

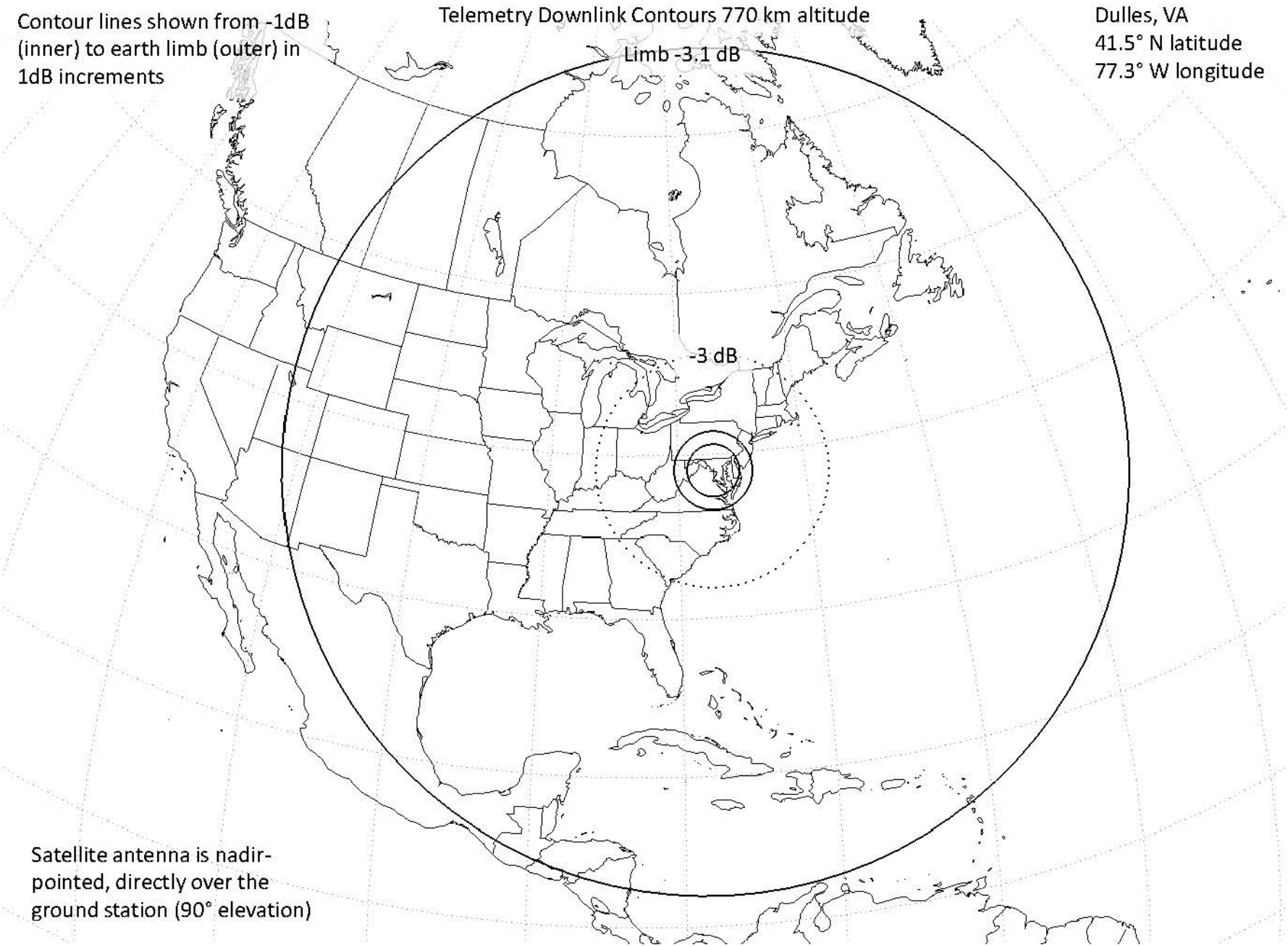

Contour lines shown from -1dB (inner) to earth limb (outer) in 1dB increments
Telemetry Downlink Contours 850 km altitude
Limb -3.1 dB
-3 dB
Prudhoe Bay, AK
70.2° N latitude
148.4° W longitude
Satellite antenna is nadir-pointed, directly over the ground station (90° elevation)


Contour lines shown from -1dB (inner) to earth limb (outer) in 1dB increments
Telemetry Downlink Contours 590 km altitude
Fairbanks, AK
64.9° N latitude
147.3° W longitude
Limb -3.1 dB
-3 dB
Satellite antenna is nadir-pointed, directly over the ground station (90° elevation)


Contour lines shown from -1dB (inner) to earth limb (outer) in 1dB increments
Telemetry Downlink Contours 770 km altitude
Limb -3.1 dB
Fairbanks, AK
64.9° N latitude
147.3° W longitude
-3 dB
Satellite antenna is nadir-pointed, directly over the ground station (90° elevation)


Contour lines shown from -1dB (inner) to earth limb (outer) in 1dB increments
Telemetry Downlink Contours 850 km altitude
Limb -3.1 dB
Fairbanks, AK
64.9° N latitude
147.3° W longitude
-3 dB
Satellite antenna is nadir-pointed, directly over the ground station (90° elevation)

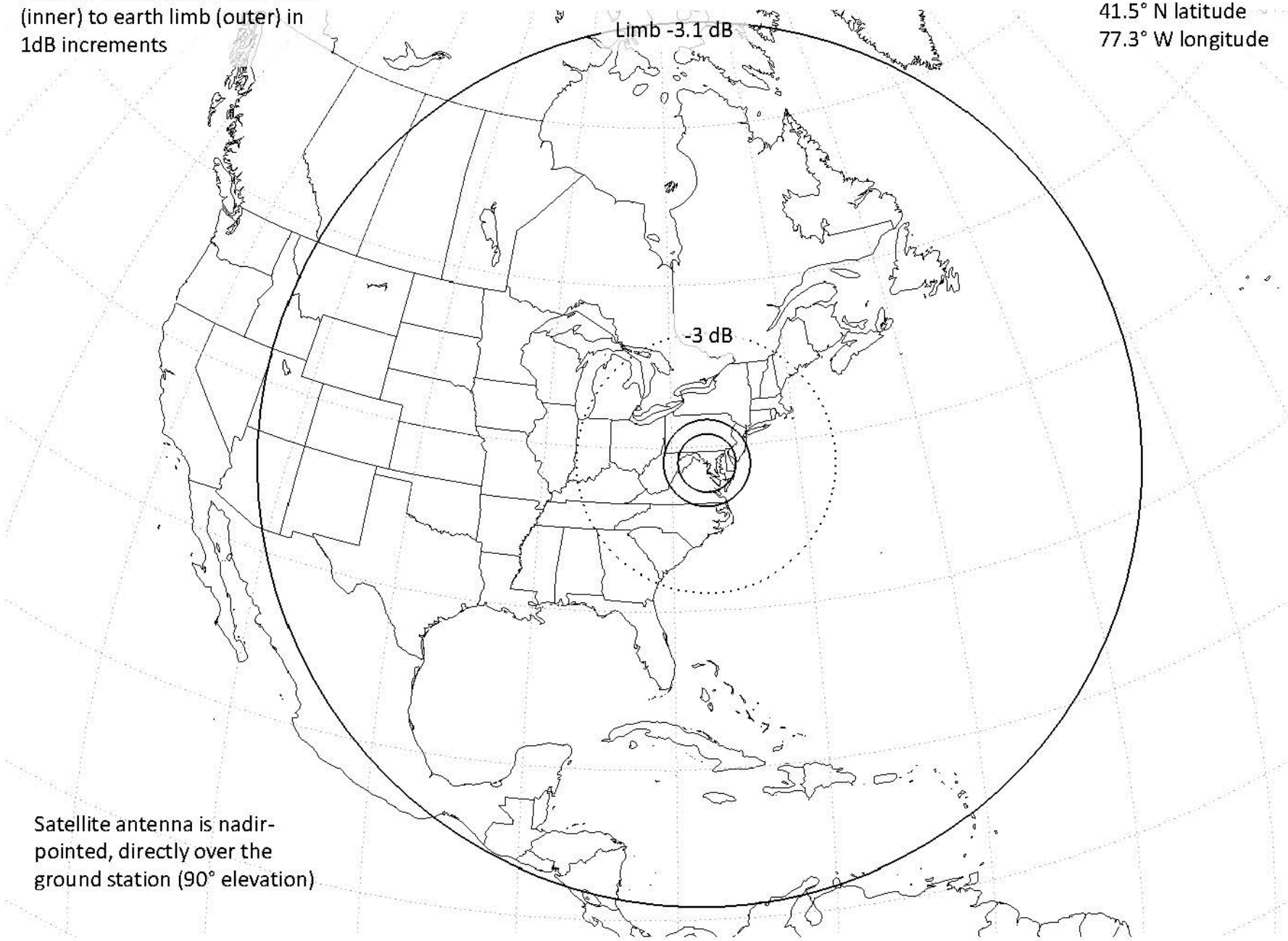

Contour lines shown from -1dB (inner) to earth limb (outer) in 1dB increments
Telemetry Downlink Contours 590 km altitude
Dulles, VA
41.5° N latitude
77.3° W longitude
Limb -3.1 dB
-3 dB
Satellite antenna is nadir-pointed, directly over the ground station (90° elevation)


Contour lines shown from -1dB (inner) to earth limb (outer) in 1dB increments
Telemetry Downlink Contours 770 km altitude
Limb -3.1 dB
-3 dB
Dulles, VA
41.5° N latitude
77.3° W longitude
Satellite antenna is nadir-pointed, directly over the ground station (90° elevation)

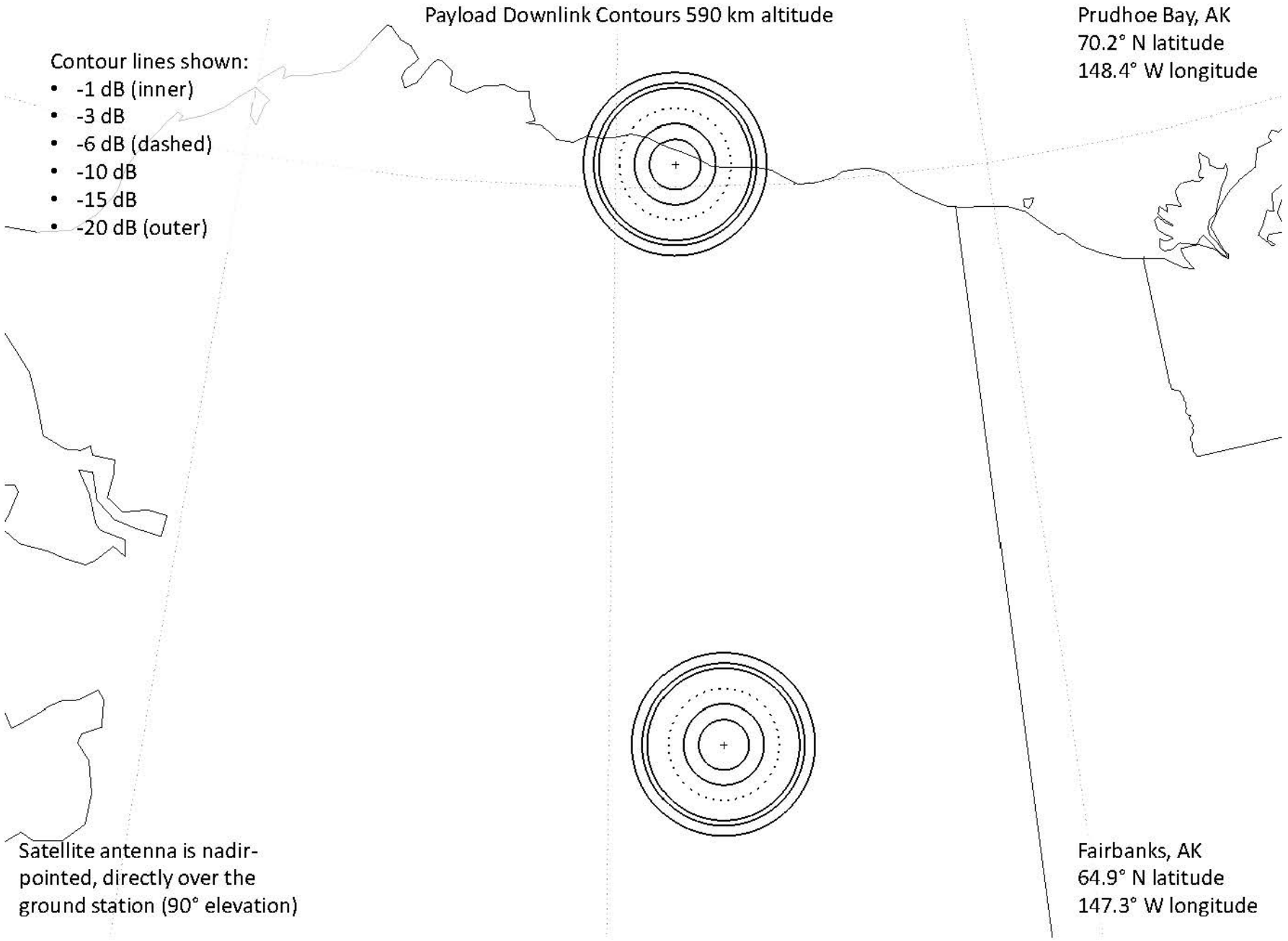
Contour lines shown from -1dB (inner) to earth limb (outer) in 1dB increments

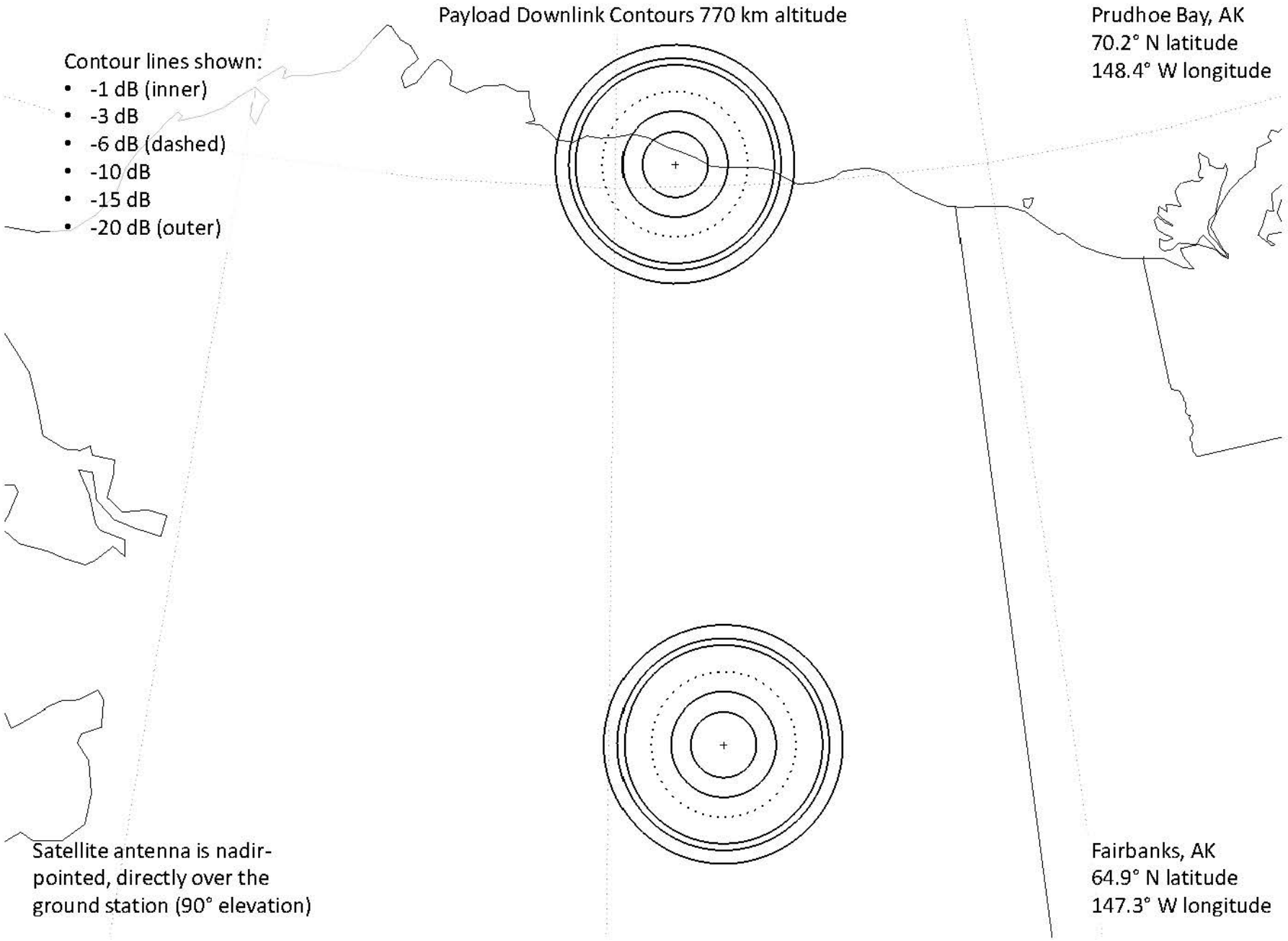
Telemetry Downlink Contours 850 km altitude

Dulles, VA
41.5° N latitude
77.3° W longitude



Satellite antenna is nadir-pointed, directly over the ground station (90° elevation)


Payload Downlink Contours 590 km altitude
Contour lines shown:
-1 dB (inner)
-3 dB
-6 dB (dashed)
-10 dB
-15 dB
-20 dB (outer)
Prudhoe Bay, AK
70.2° N latitude
148.4° W longitude
Satellite antenna is nadir-pointed, directly over the ground station (90° elevation)
Fairbanks, AK
64.9° N latitude
147.3° W longitude

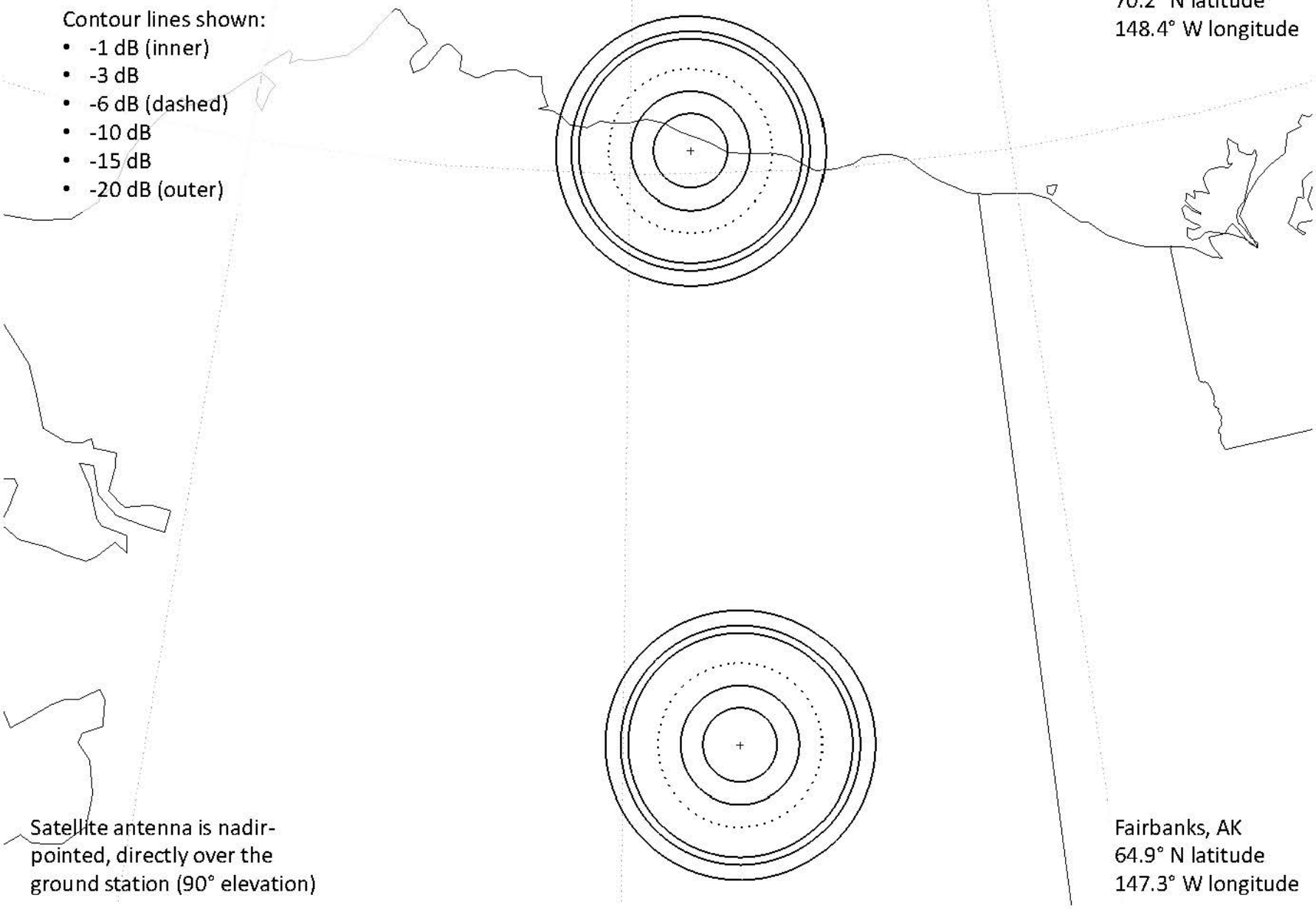

Payload Downlink Contours 770 km altitude
Contour lines shown:
• -1 dB (inner)
• -3 dB
• -6 dB (dashed)
• -10 dB
• -15 dB
• -20 dB (outer)
Prudhoe Bay, AK
70.2° N latitude
148.4° W longitude
Satellite antenna is nadir-pointed, directly over the ground station (90° elevation)
Fairbanks, AK
64.9° N latitude
147.3° W longitude

Payload Downlink Contours 850 km altitude

Contour lines shown:

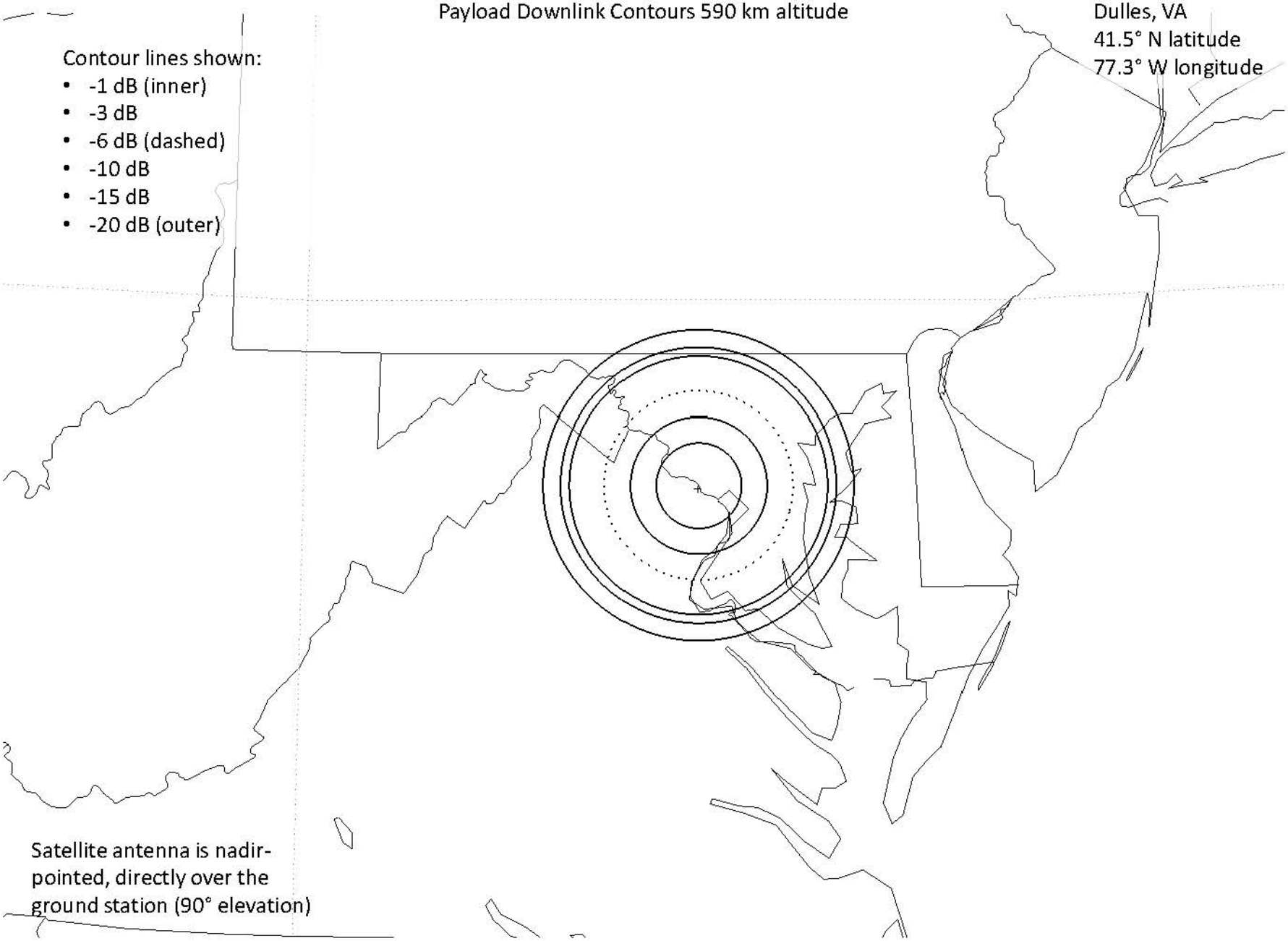
- -1 dB (inner)
- -3 dB
- -6 dB (dashed)
- -10 dB
- -15 dB
- -20 dB (outer)

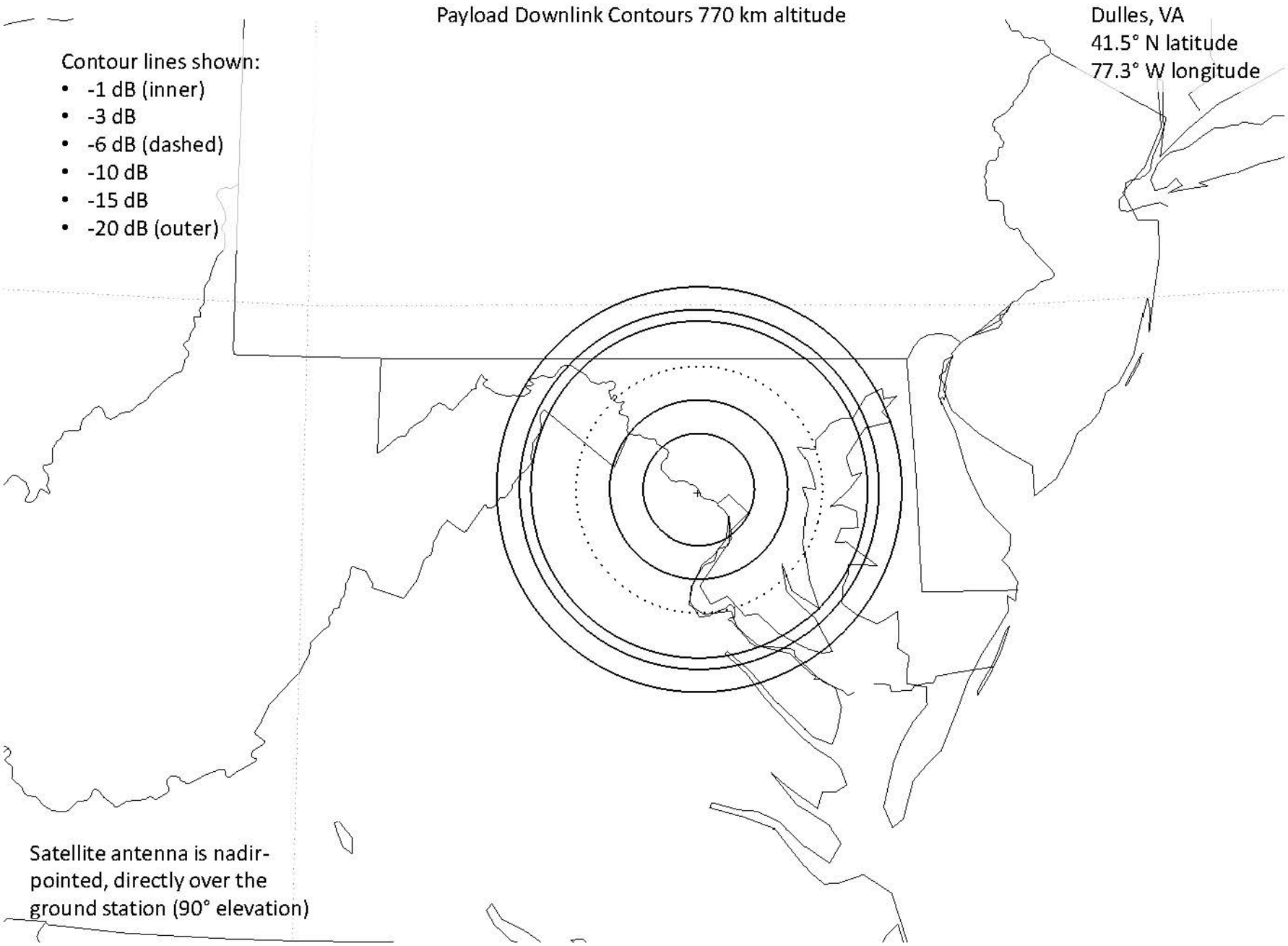
Prudhoe Bay, AK
70.2° N latitude
148.4° W longitude

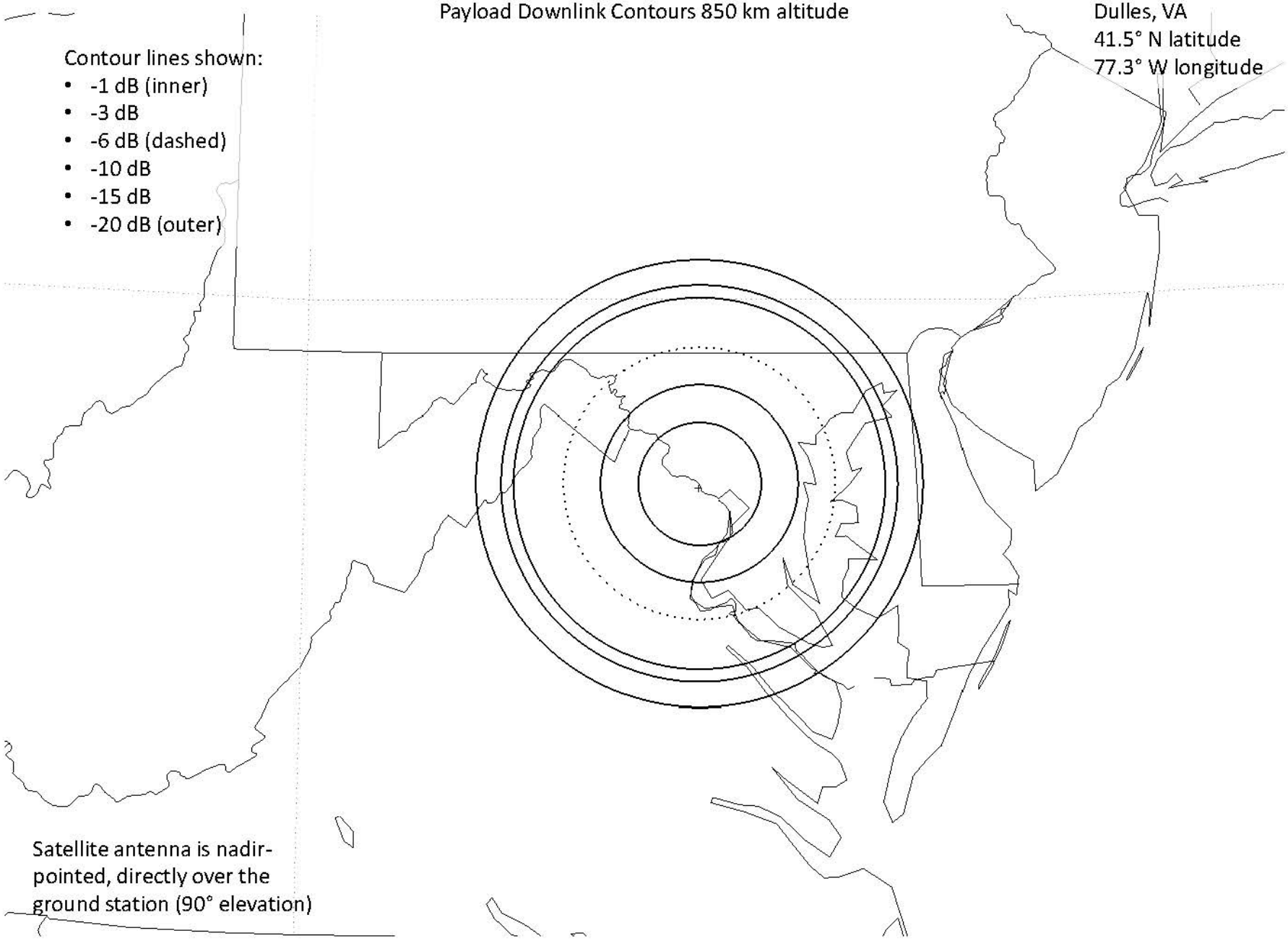


Satellite antenna is nadir-pointed, directly over the ground station (90° elevation)

Fairbanks, AK
64.9° N latitude
147.3° W longitude


Payload Downlink Contours 590 km altitude
Dulles, VA
41.5° N latitude
77.3° W longitude
Contour lines shown:
• -1 dB (inner)
• -3 dB
• -6 dB (dashed)
• -10 dB
• -15 dB
• -20 dB (outer)
Satellite antenna is nadir-pointed, directly over the ground station (90° elevation)


Payload Downlink Contours 770 km altitude
Dulles, VA
41.5° N latitude
77.3° W longitude
Contour lines shown:
• -1 dB (inner)
• -3 dB
• -6 dB (dashed)
• -10 dB
• -15 dB
• -20 dB (outer)
Satellite antenna is nadir-pointed, directly over the ground station (90° elevation)


Payload Downlink Contours 850 km altitude
Dulles, VA
41.5° N latitude
77.3° W longitude
Contour lines shown:
• -1 dB (inner)
• -3 dB
• -6 dB (dashed)
• -10 dB
• -15 dB
• -20 dB (outer)
Satellite antenna is nadir-pointed, directly over the ground station (90° elevation)

TECHNICAL CERTIFICATE

I, Jeff Culwell, 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 amendment and the related attachment, 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.

Jeff Culwell /s/

Jeff Culwell
VP Operations
DigitalGlobe, Inc.

Dated: November 25, 2013