Henry Gola
202.719.7561
hgola@wileyrein.com

VIA IBFS

November 26, 2018

Federal Communications Commission
International Bureau
445 12th St SW
Washington, DC 20554

Re: DG Consents Sub, Inc., SAT-MOD-20180918-00073, Call Sign S2129

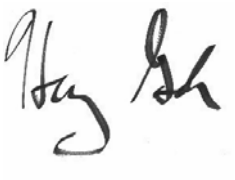
To Whom It May Concern:

By this letter, DG Consents Sub, Inc. ("DigitalGlobe") appends the following documents to its above-captioned modification to add twelve new WorldView-Legion satellites to its constellation:

- Attachments A and B: Antenna beam plots
- Attachments C and D: Link budgets
- Attachment E: Signal spectrum plots
- Attachment F: PFD vs. elevation angle plots

Please contact me with any questions.

Best regards,



Henry Gola
Wiley Rein LLP
Counsel to DG Consents Sub, Inc.

Attachment A

Antenna Beam Patterns for Inclined Orbits

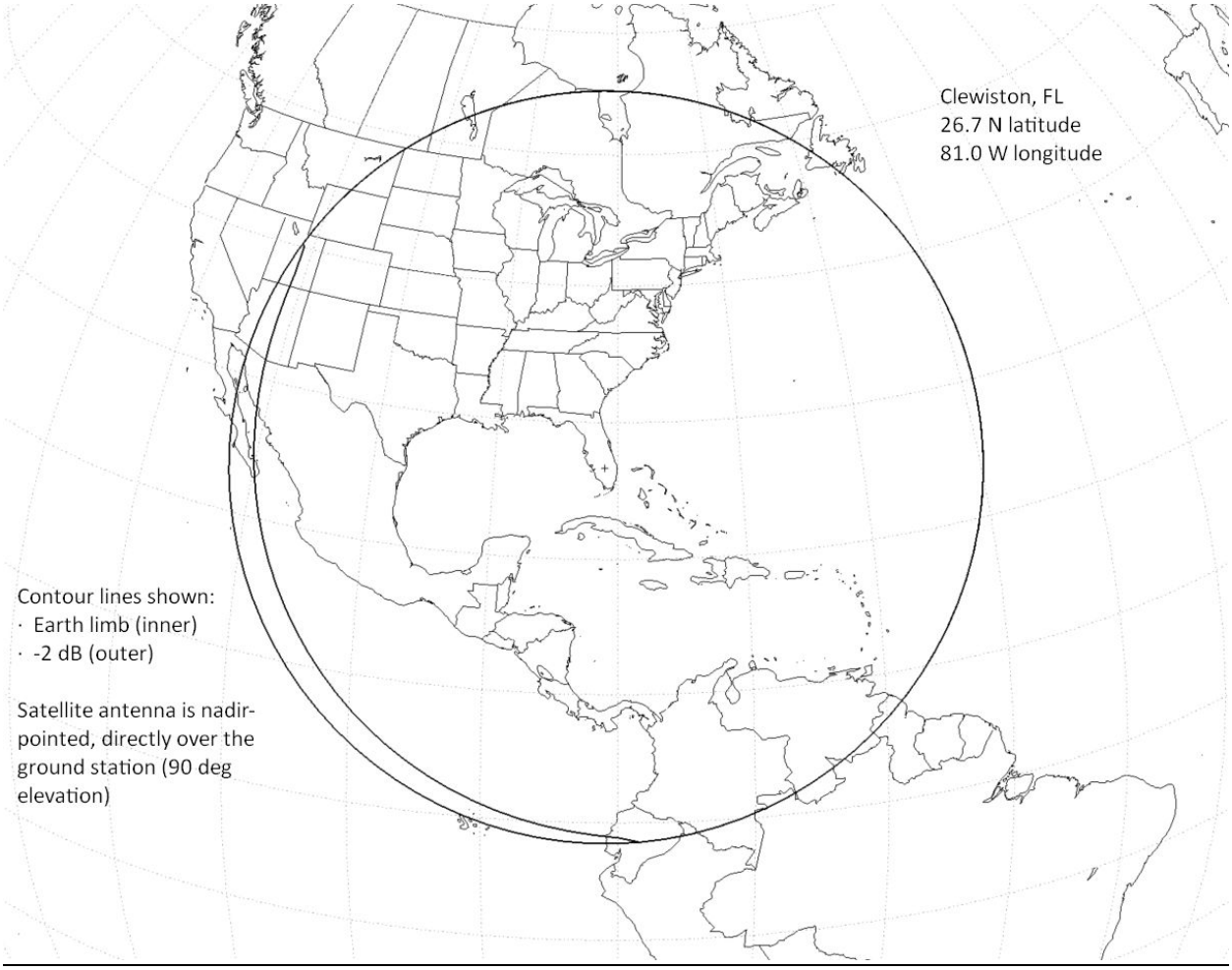
Narrowband Downlink Contours: 450 km Altitude (1 of 12)

Clewiston, FL

Narrowband Downlink Contours: 450 km Altitude (2 of 12)

Green River, WY

Narrowband Downlink Contours: 870 km Altitude (3 of 12)



Clewiston, FL

Narrowband Downlink Contours: 870 km Altitude (4 of 12)

Green River, WY

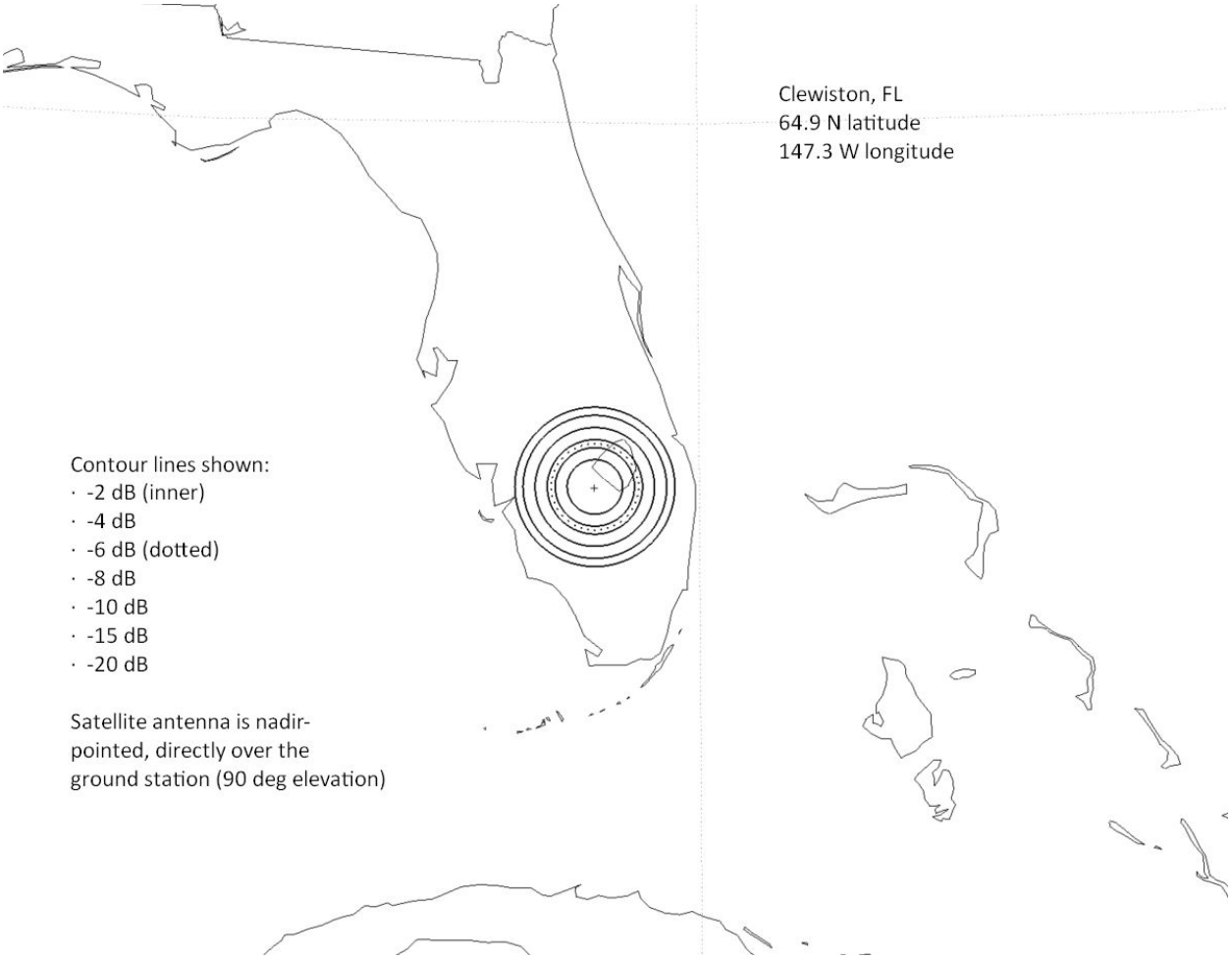
Narrowband Downlink Contours: 518 km Altitude (5 of 12)

Clewiston, FL

Narrowband Downlink Contours: 518 km Altitude (6 of 12)

Green River, WY

Wideband Downlink Contours: 450 km Altitude (7 of 12)

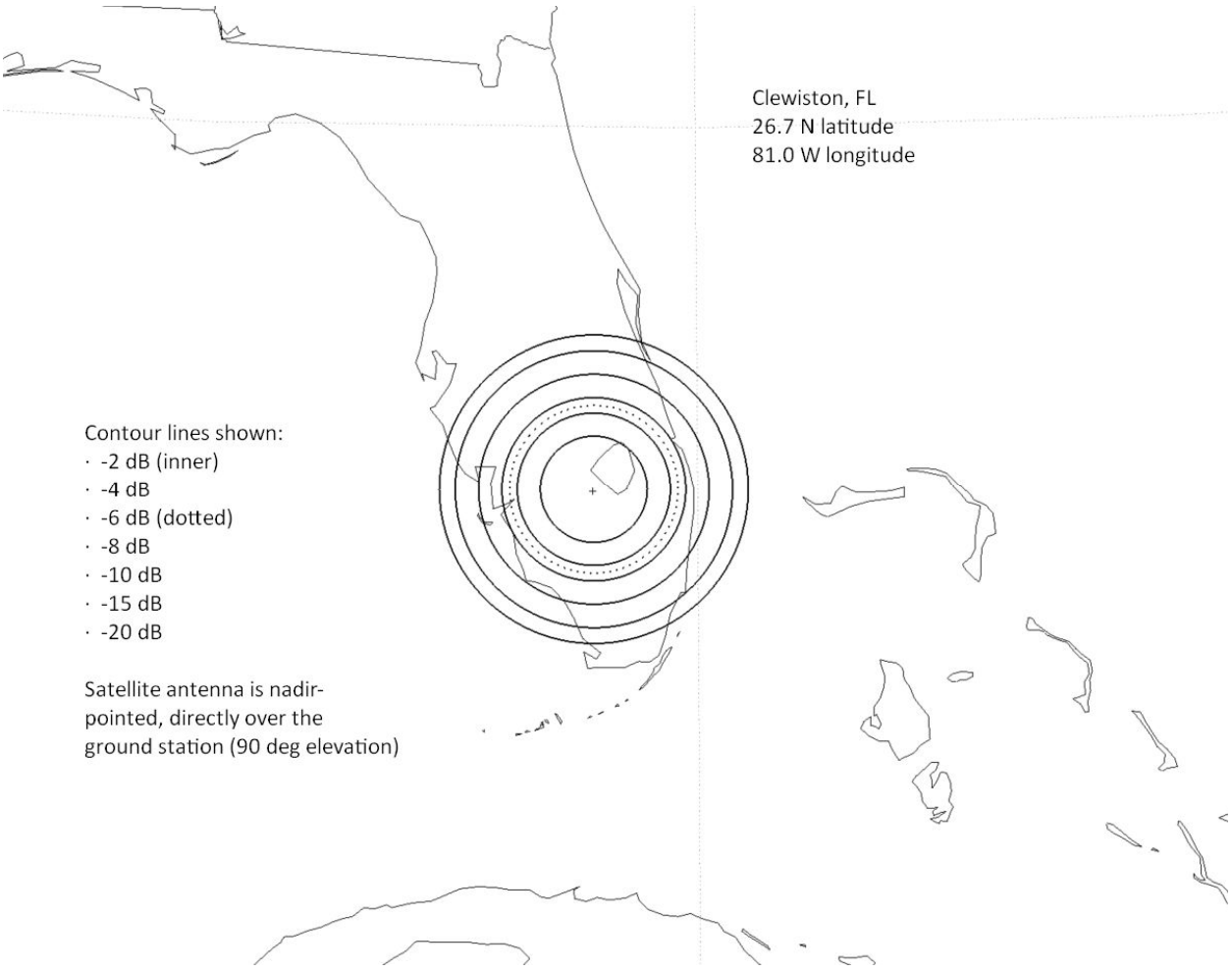


Clewiston, FL

Wideband Downlink Contours: 450 km Altitude (8 of 12)

Green River, WY

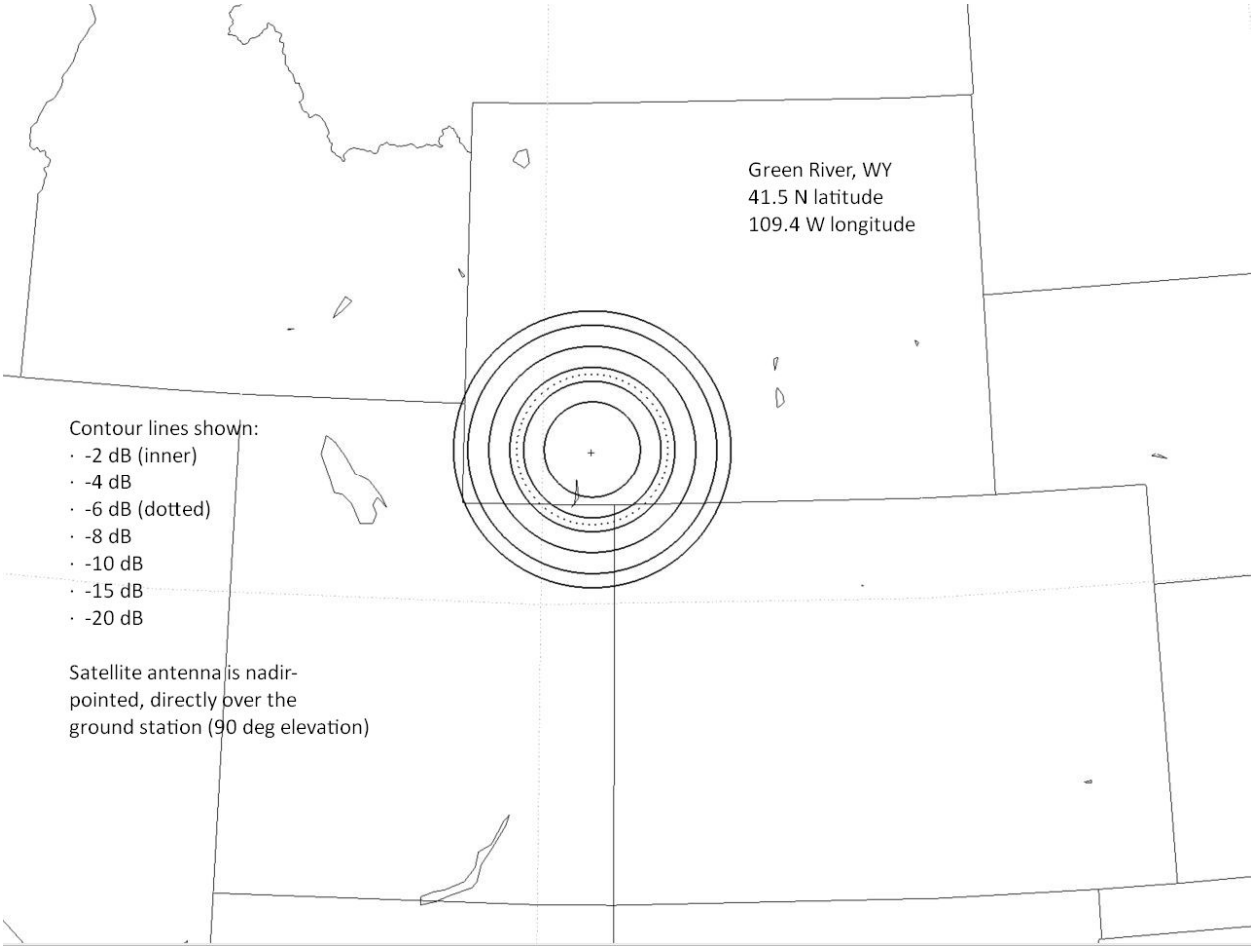
Wideband Downlink Contours: 870 km Altitude (9 of 12)



Clewiston, FL

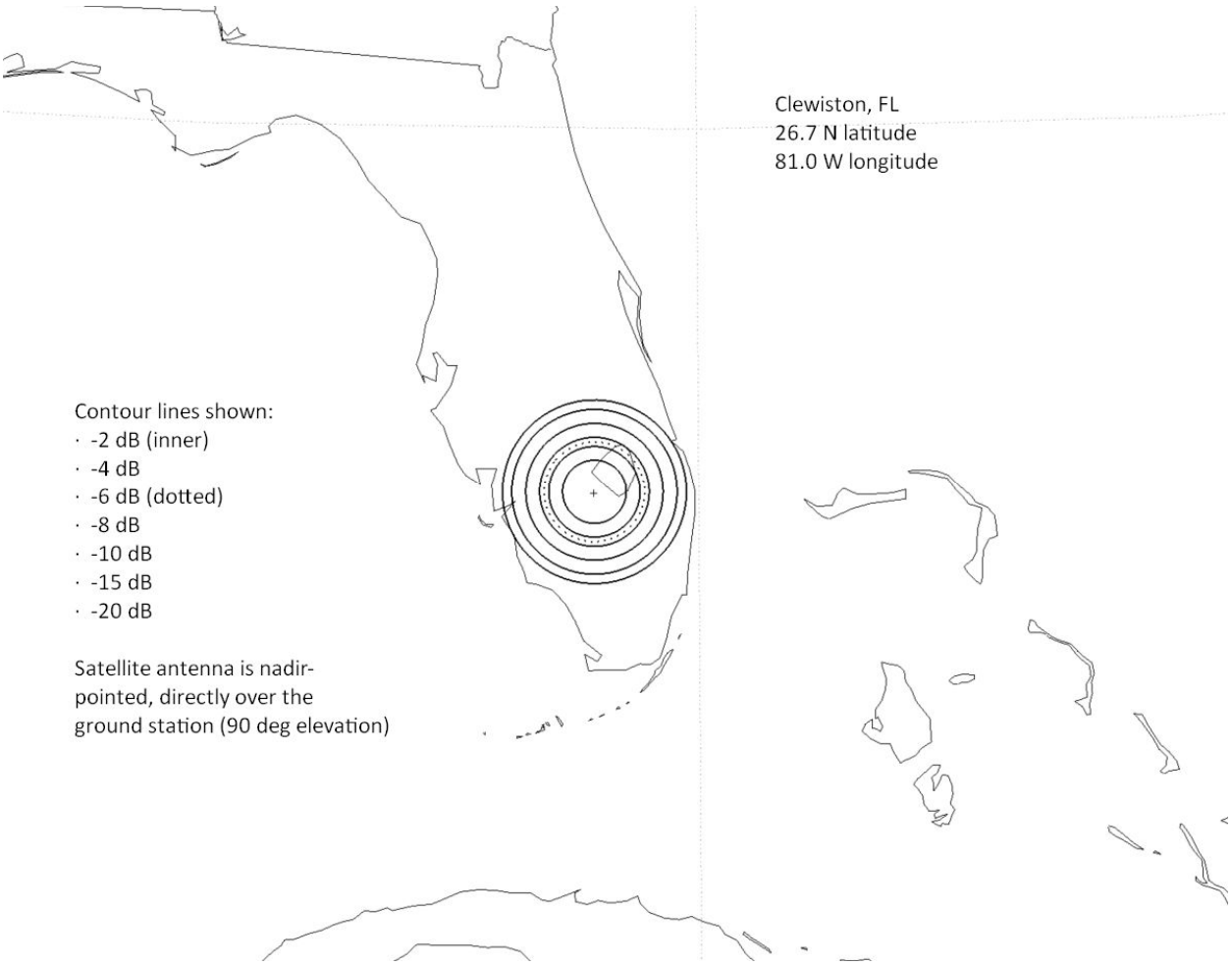
0

Wideband Downlink Contours: 870 km Altitude (10 of 12)



Green River, WY

Wideband Downlink Contours: 518 km Altitude (11 of 12)



Clewiston, FL

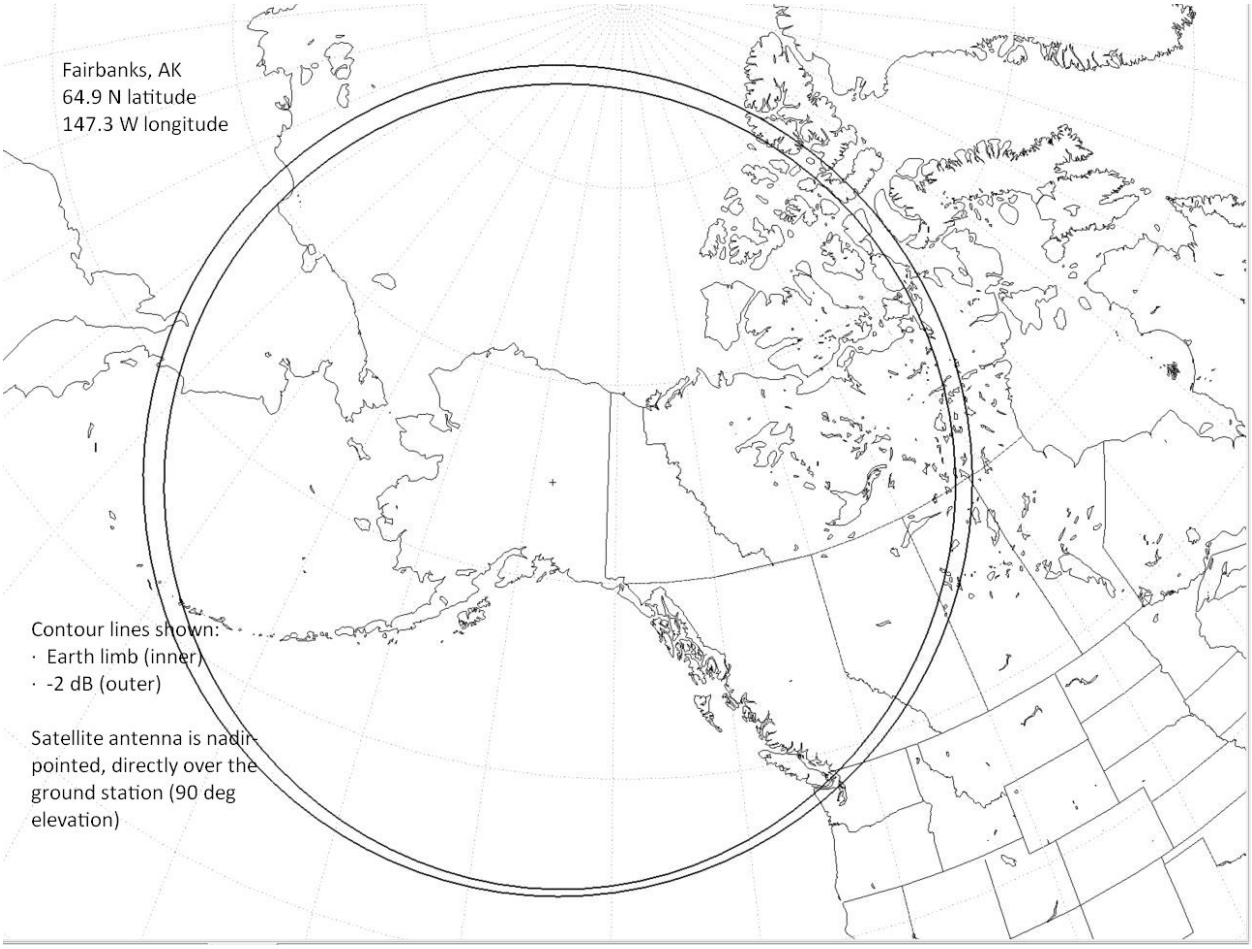
Wideband Downlink Contours: 518 km Altitude (12 of 12)

Green River, WY

Attachment B

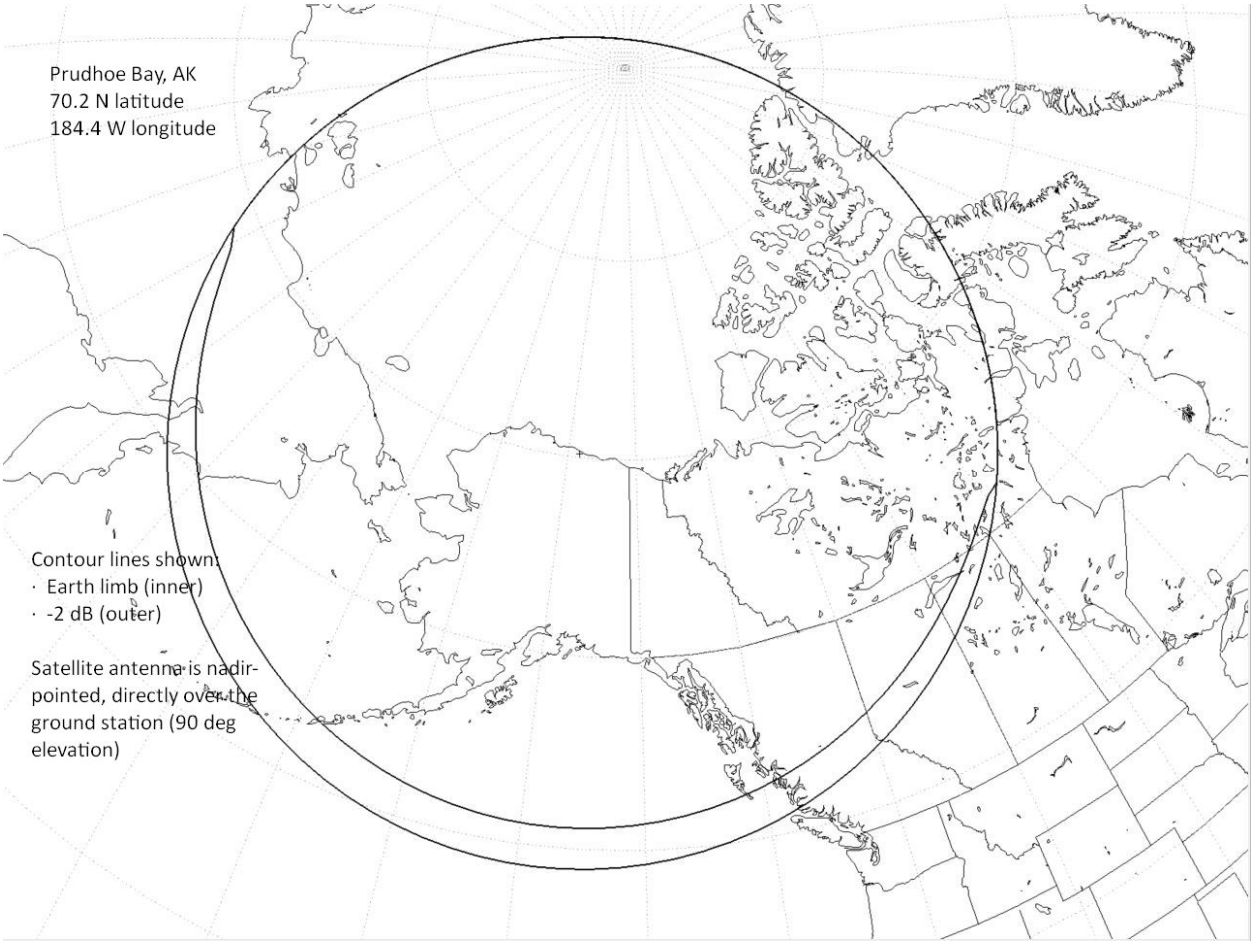
Antenna Beam Patterns for Sun-Synchronous Orbits

Narrowband Downlink Contours: 470 km Altitude (1 of 21)



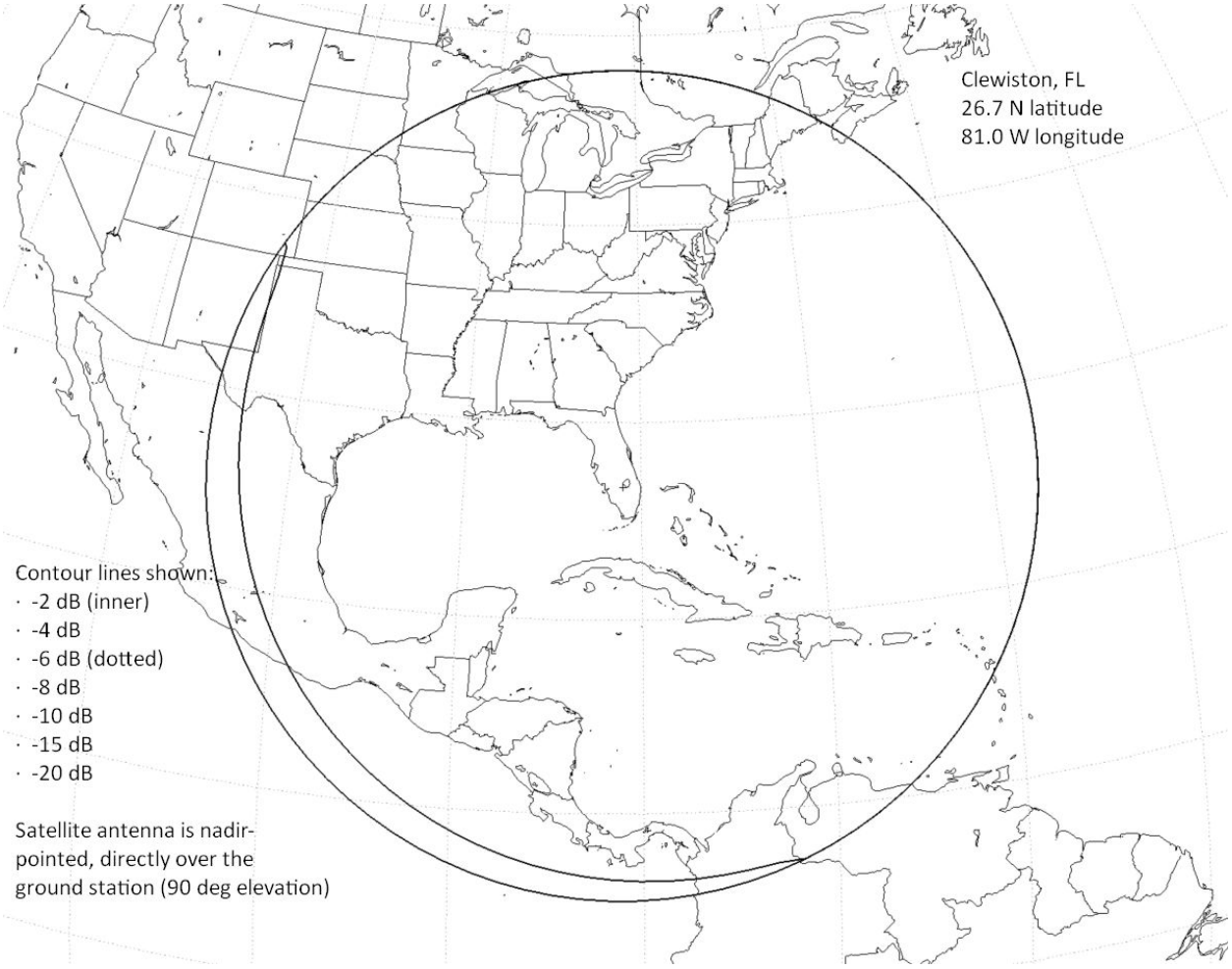
Fairbanks, AK

Narrowband Downlink Contours: 470 km Altitude (2 of 21)



Prudhoe Bay, AK

Narrowband Downlink Contours: 470 km Altitude (3 of 21)



Clewiston, FL

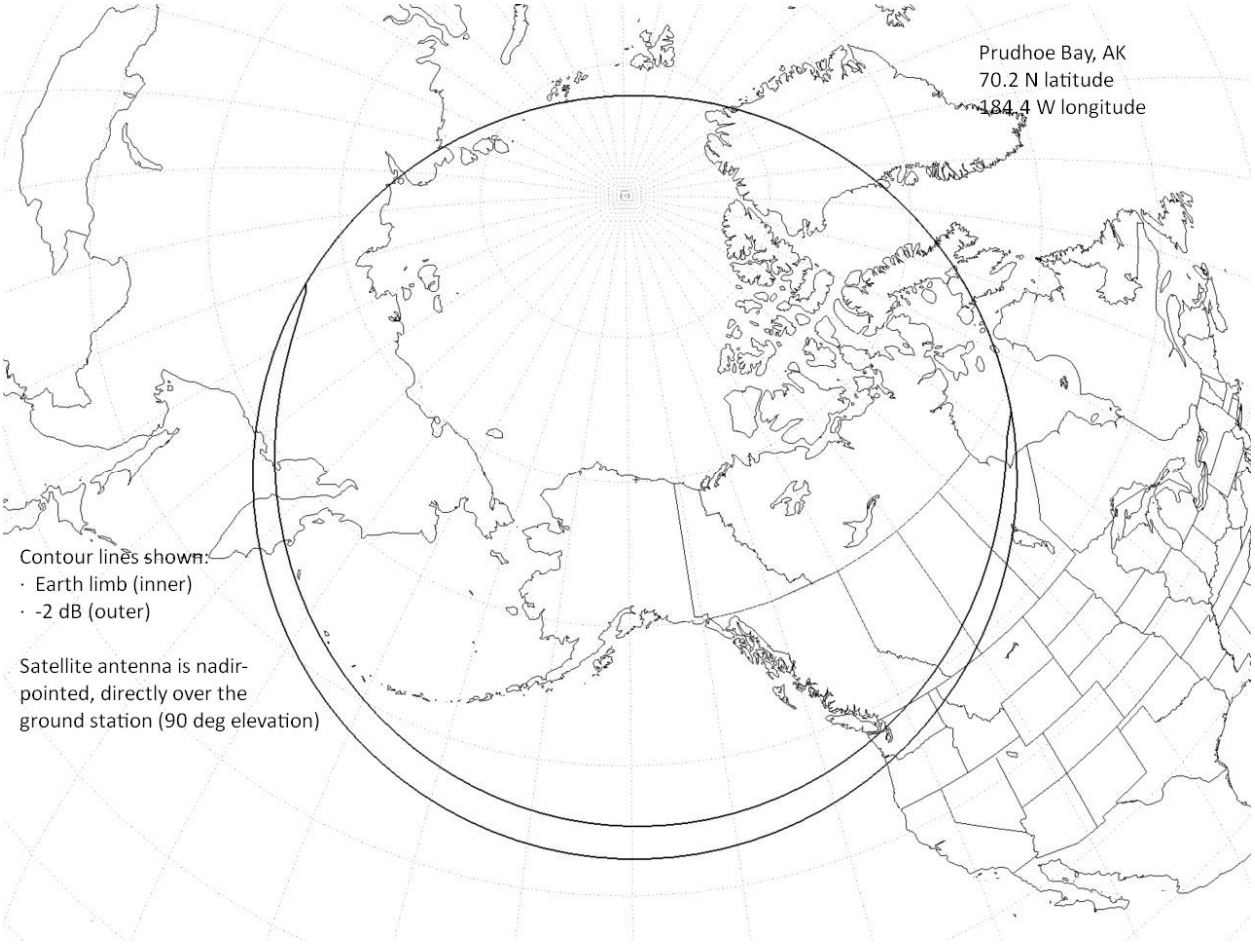
Narrowbandownlink Contours: 470 km Altitude (4 of 21)

Green River, WY

Narrowband Downlink Contours: 800 km Altitude (5 of 21)

Fairbanks, AK

Narrowband Downlink Contours: 800 km Altitude (6 of 21)



Prudhoe Bay, AK

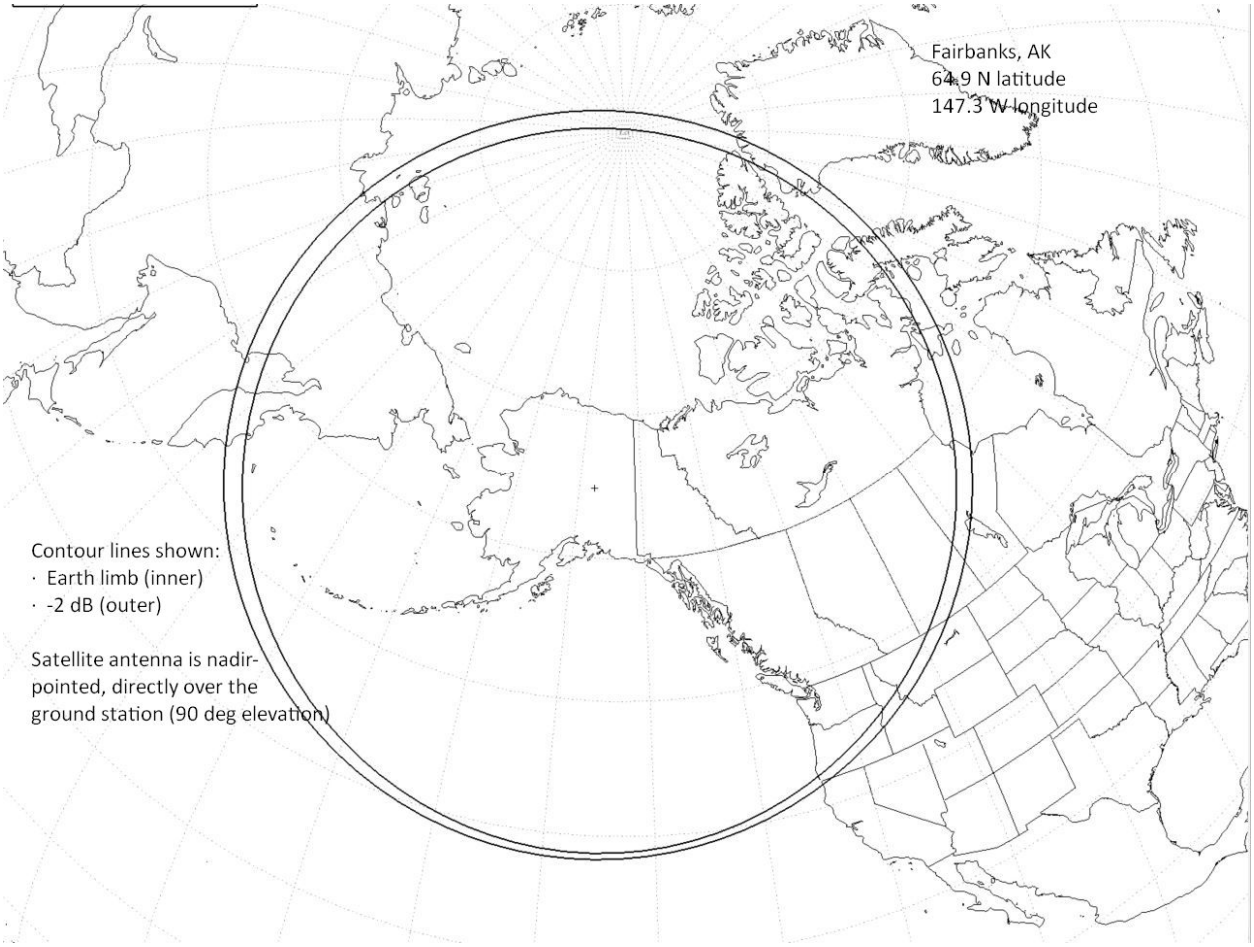
Narrowband Downlink Contours: 800 km Altitude (7 of 21)

Clewiston, FL

Narrowband Downlink Contours: 800 km Altitude (8 of 21)

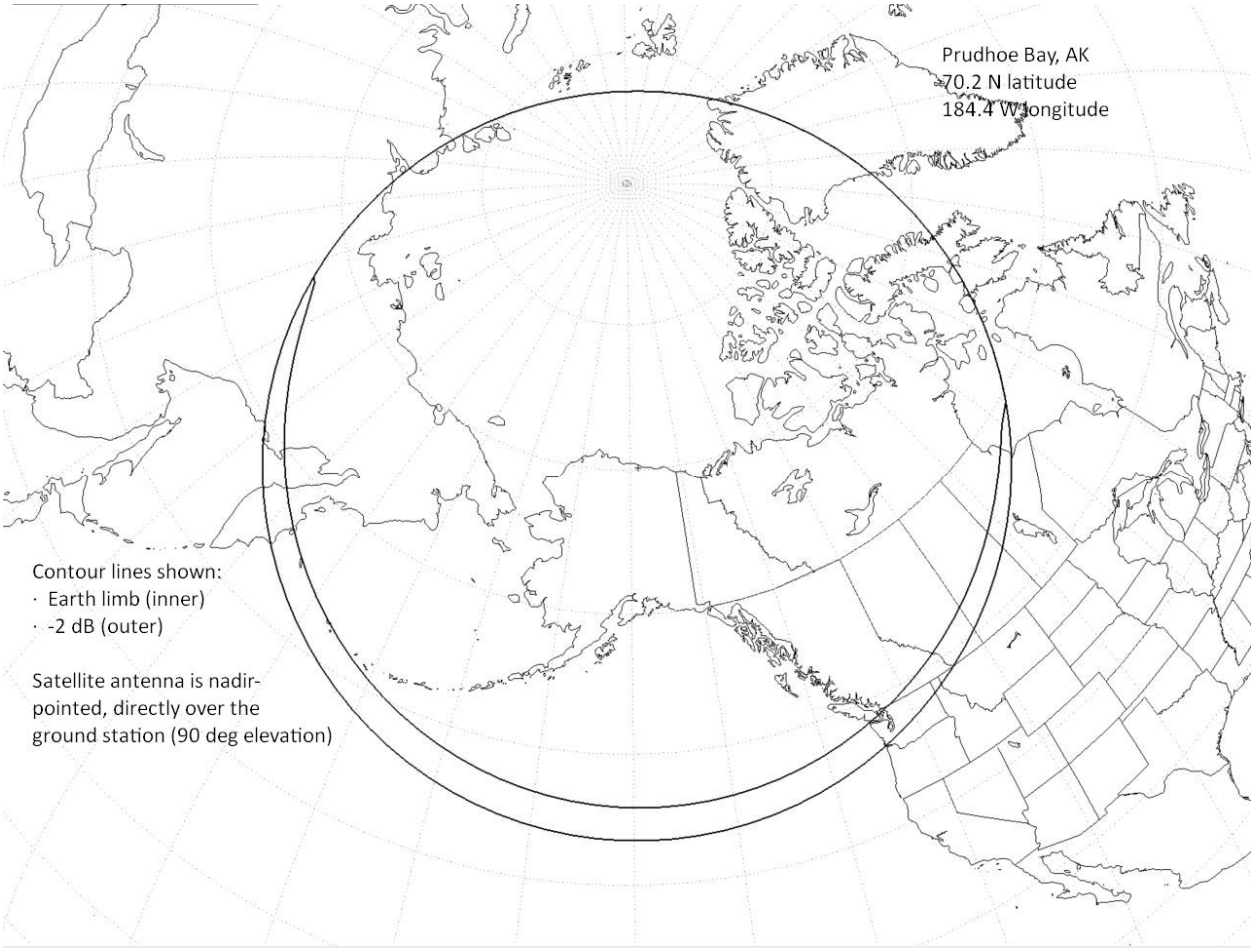
Green River, WY

Narrowband Downlink Contours: 763 km Altitude (9 of 21)



Fairbanks, AK

Narrowband Downlink Contours: 763 km Altitude (10 of 21)



Prudhoe Bay, AK

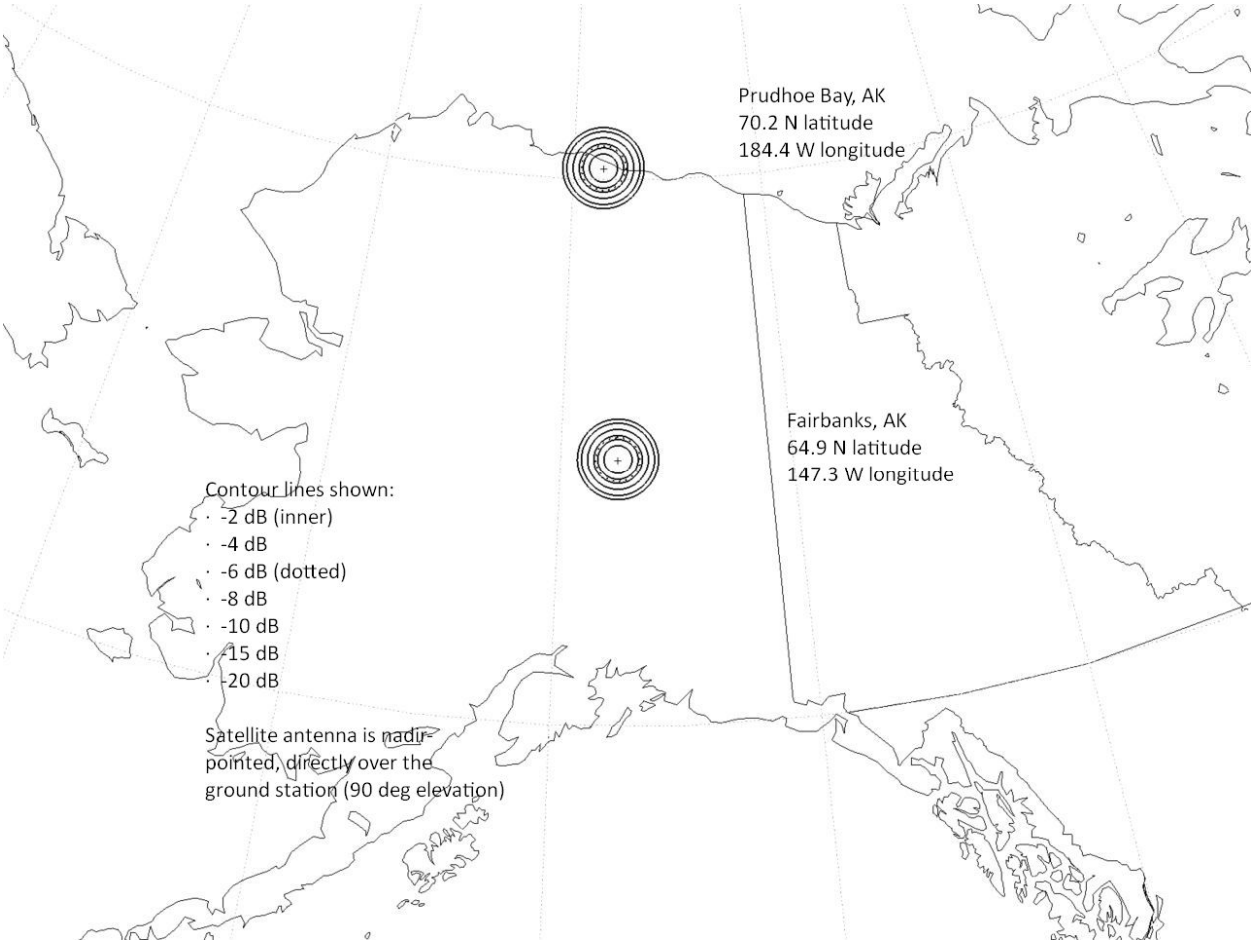
Narrowband Downlink Contours: 763 km Altitude (11 of 21)

Clewiston, FL

Narrowband Downlink Contours: 763 km Altitude (12 of 21)

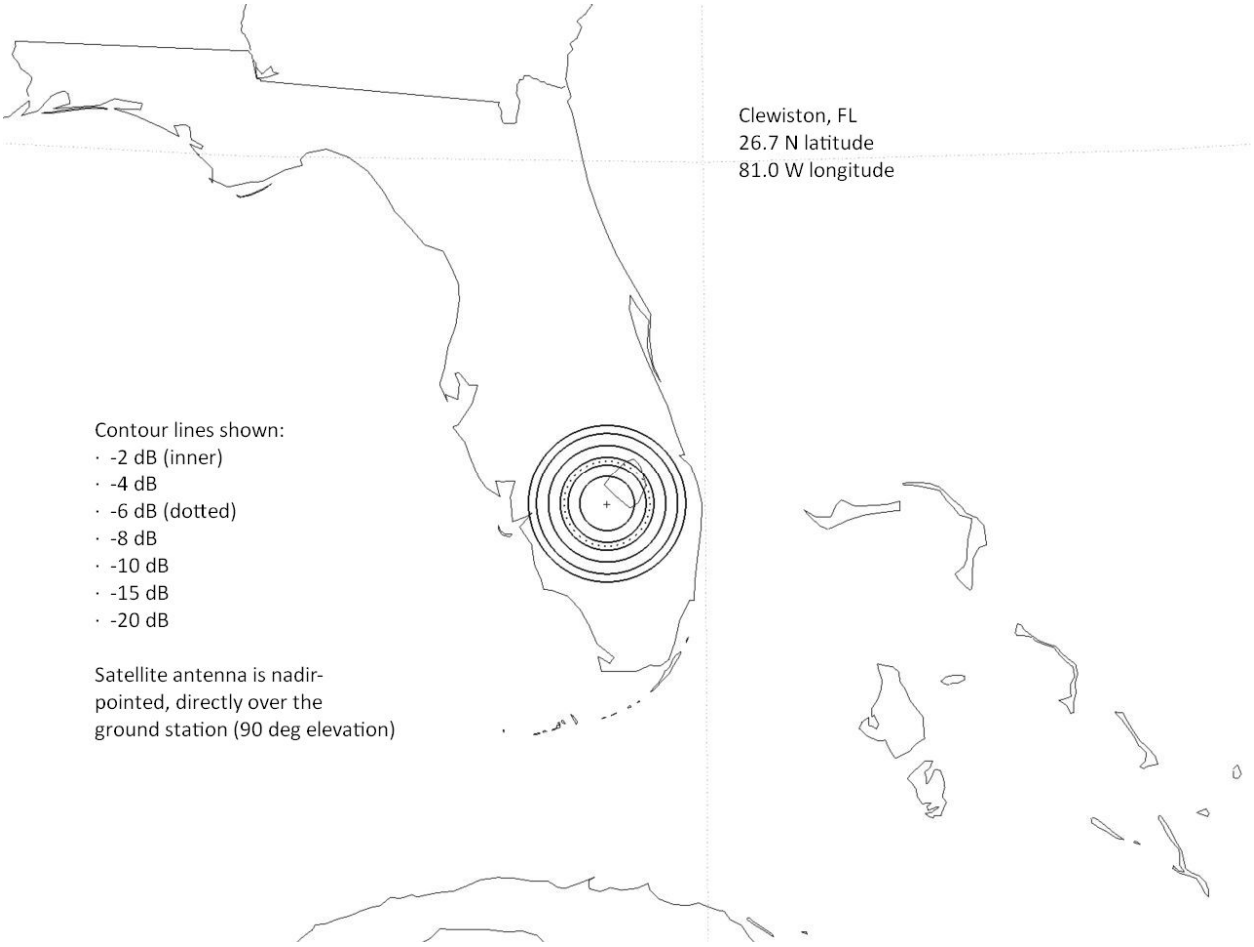
Green River, WY

Wideband Downlink Contours: 470 km Altitude (13 of 21)



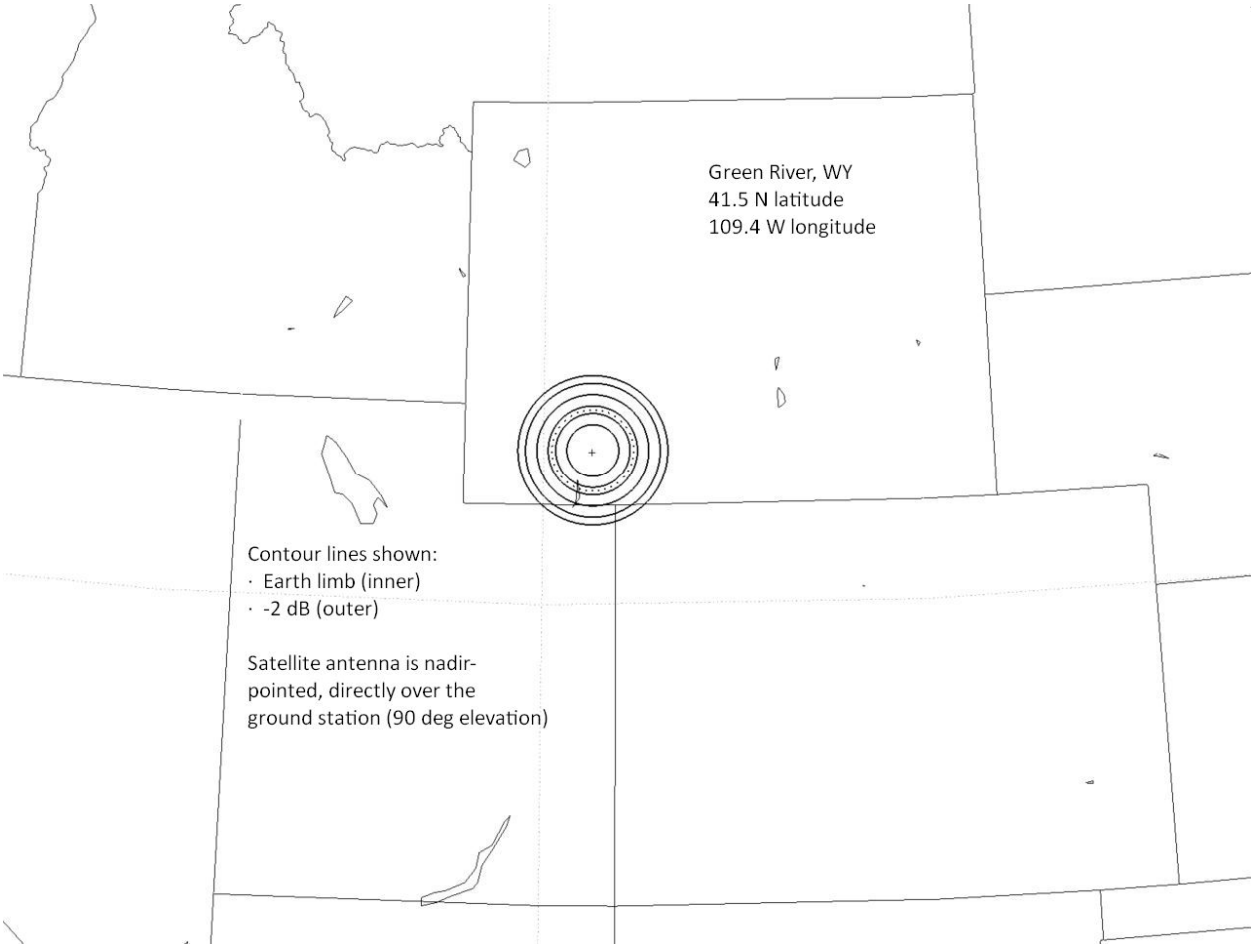
Prudhoe Bay, AK, and Fairbanks, AK

Wideband Downlink Contours: 470 km Altitude (14 of 21)



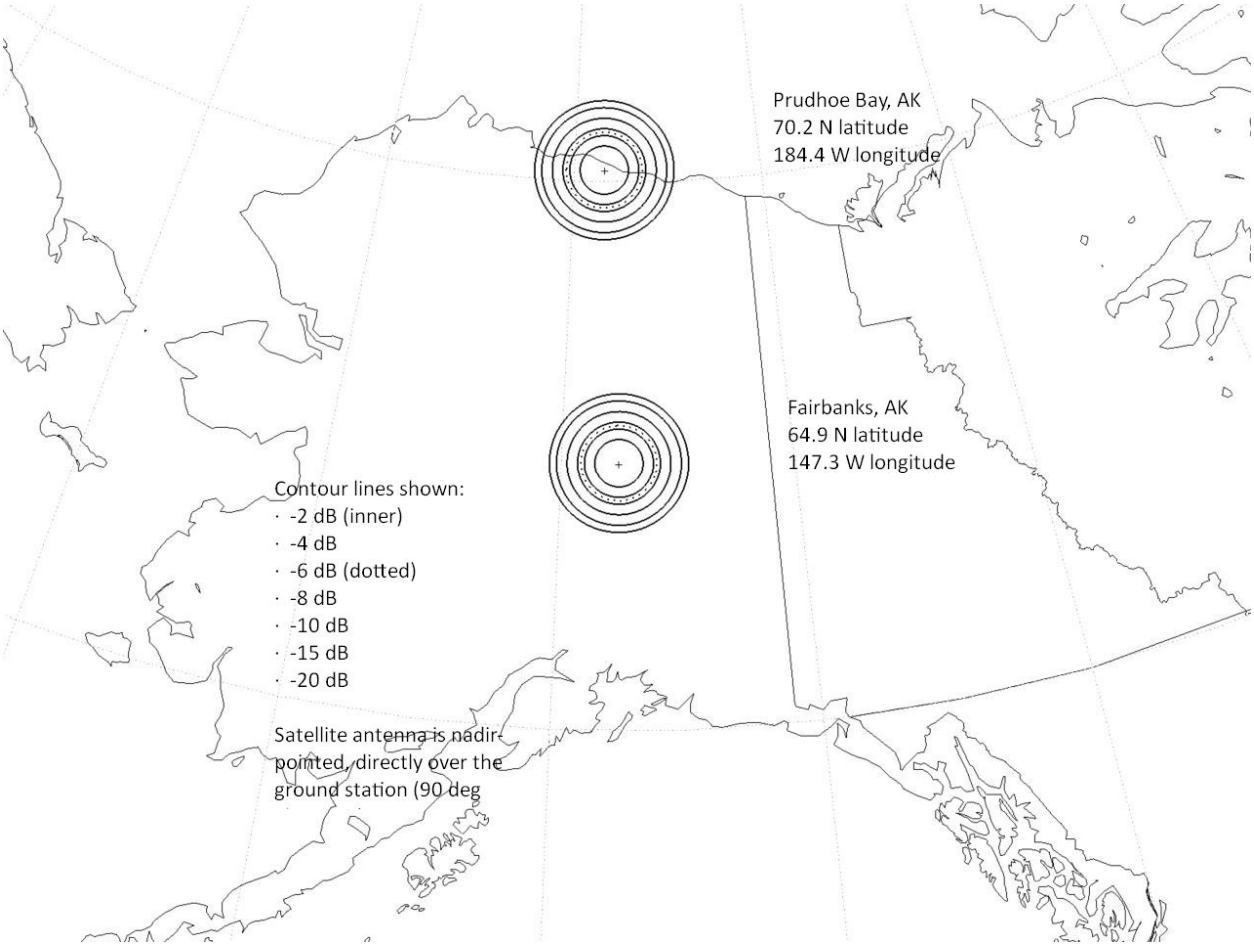
Clewiston, FL

Wideband Downlink Contours: 470 km Altitude (15 of 21)



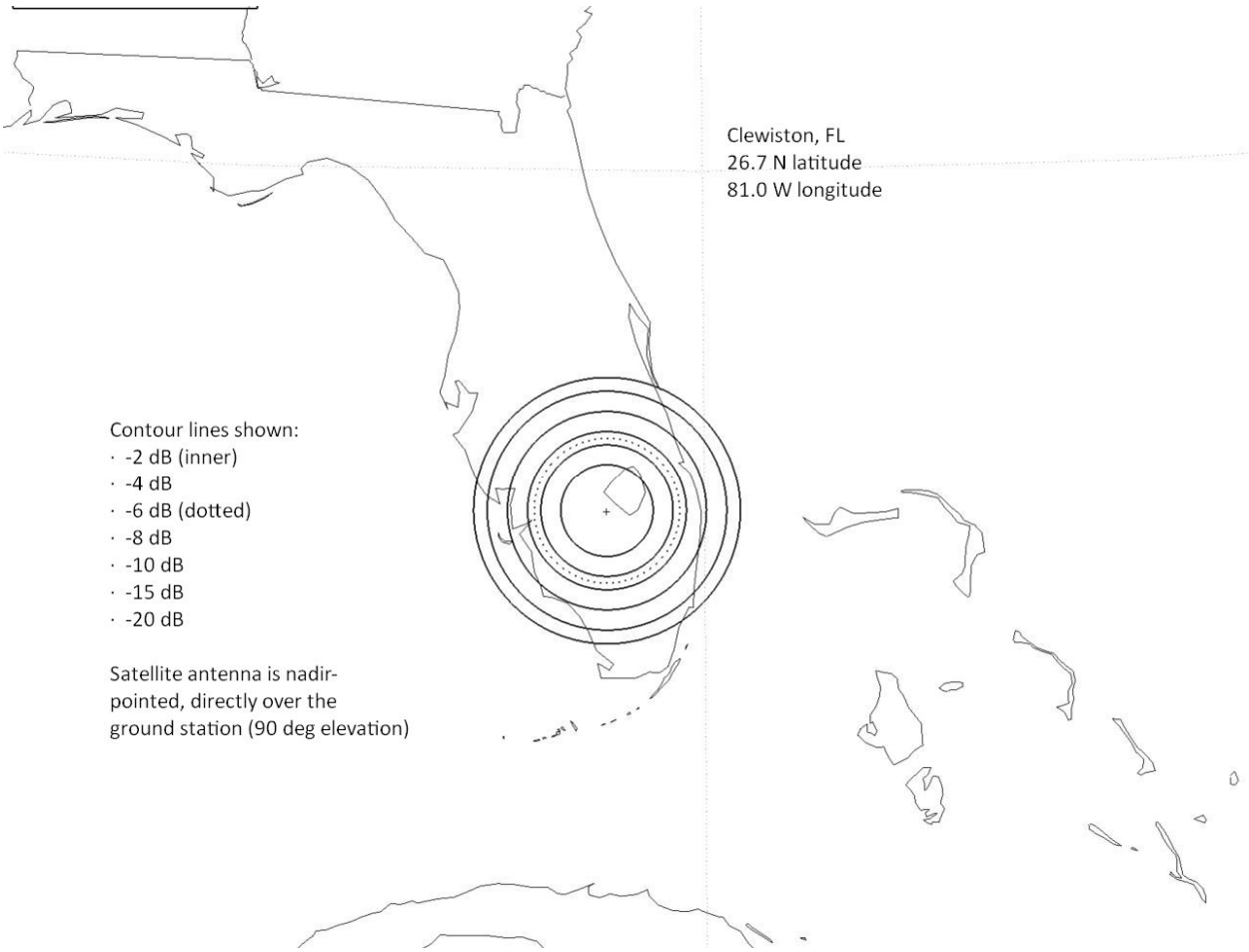
Green River, WY

Wideband Downlink Contours: 800 km Altitude (16 of 21)



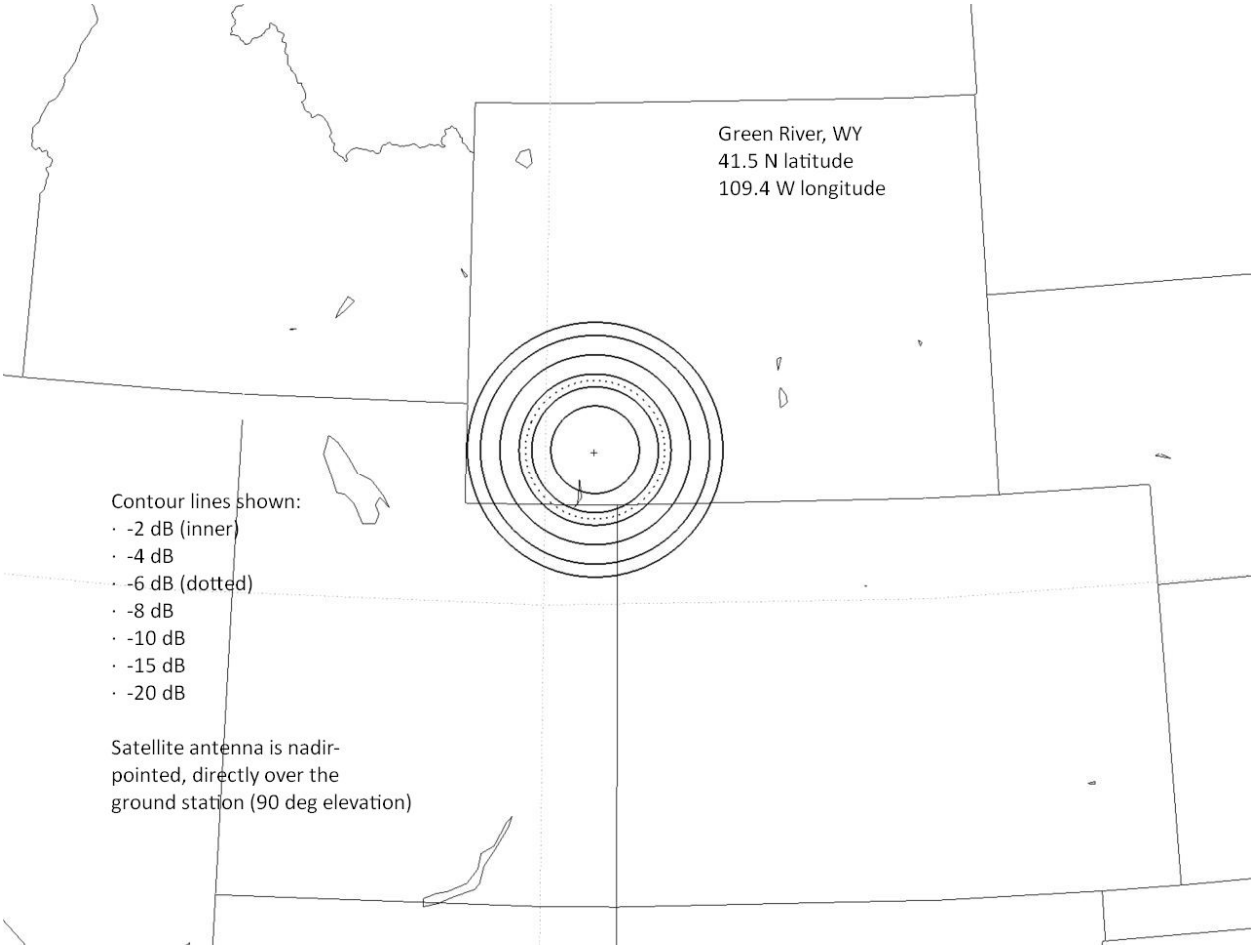
Prudhoe Bay, AK, and Fairbanks, AK

Wideband Downlink Contours: 800 km Altitude (17 of 21)



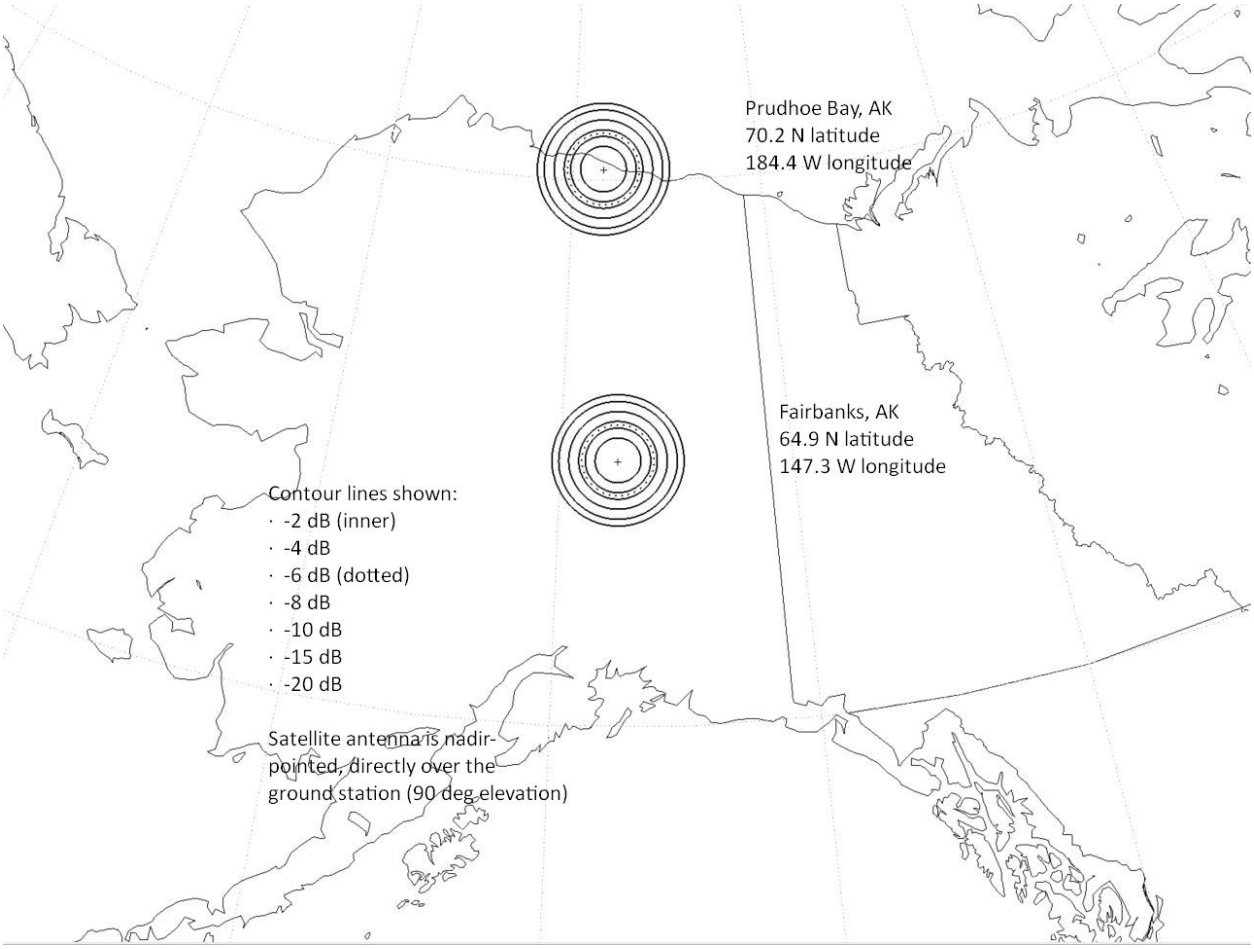
Clewiston, FL

Wideband Downlink Contours: 800 km Altitude (18 of 21)



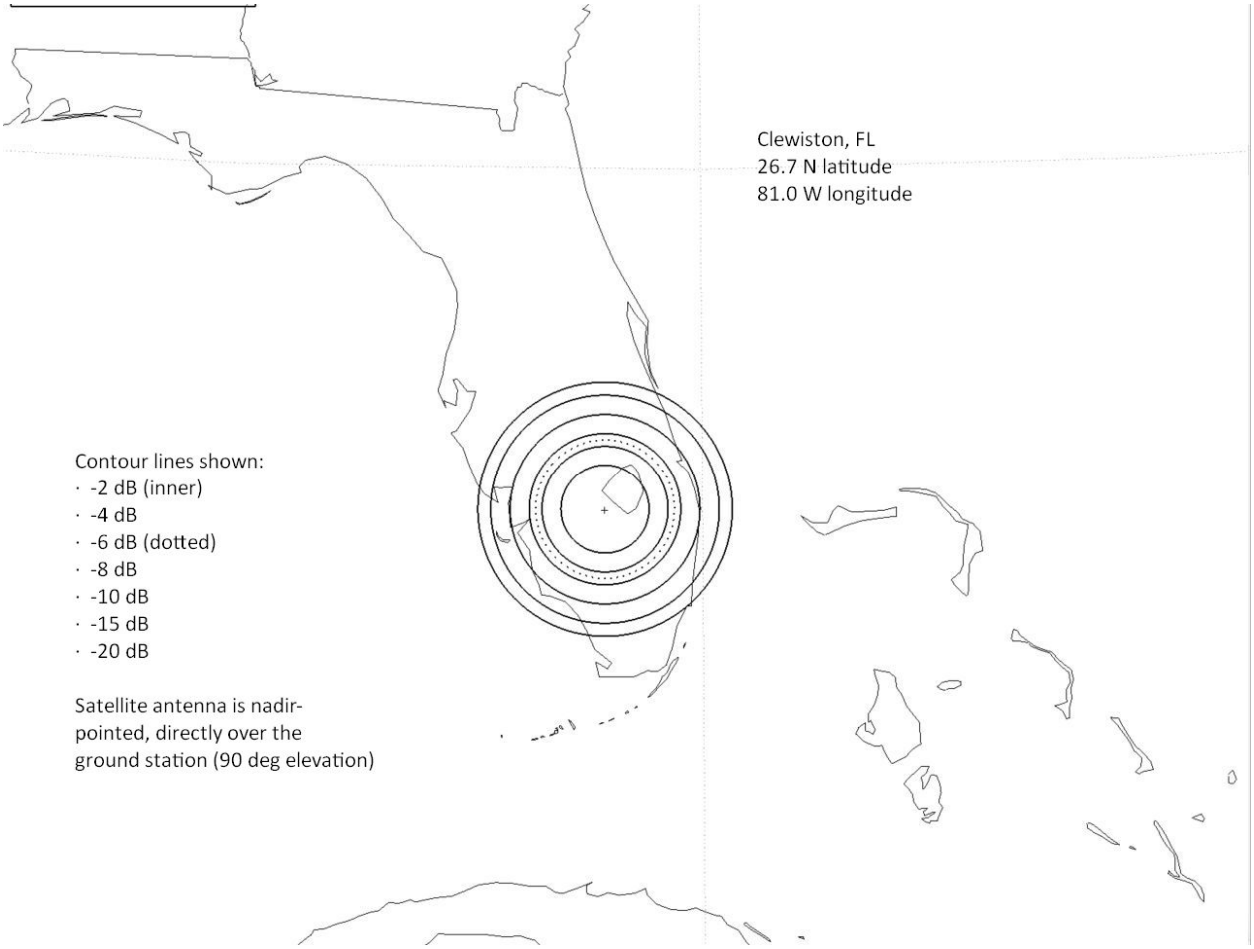
Green River, WY

Wideband Downlink Contours: 763 km Altitude (19 of 21)



Prudhoe Bay, AK, and Fairbanks, AK

Wideband Downlink Contours: 763 km Altitude (20 of 21)



Clewiston, FL

Wideband Downlink Contours: 763 km Altitude (21 of 21)

Green River, WY

ATTACHMENT C

LINK BUDGETS FOR SUN SYNCHRONOUS ORBITS

WV-L

TELEMETRY DOWNLINK FAIRBANKS, AK

FREQUENCY	8.380 GHz	WAVELENGTH	0.036 METERS
POWER	3.0 WATTS	5 DEG SLANT RANGE	2783.9 KM
ALTITUDE	800 KM		
DATA	OQPSK	DATA RATE	544 KBPS
		MARGIN	10.6 dB

ANTENNA: NADIR

PARAMETER	UNITS	VALUE
TOTAL TRANSMIT POWER	dBm	34.8
PASSIVE LOSS	dB	-5.5
S/C ANTENNA GAIN	dBi	-2.0
FREE SPACE DISPERSION LOSS	dB	-179.8
ATMOSPHERIC LOSS	dB	-1.7
GROUND STATION G/T	dB/K	31.6
TOTAL RECEIVED POWER/T	dBm/K	-122.6
BOLTZMANN CONSTANT	dBm/(Hz·K)	-198.6
TOTAL RECEIVED POWER/KT	dBm/Hz	76.0
DATA CHANNEL		
DATA POWER/KT	dB·Hz	76.0
INFORMATION RATE 544 KBPS	dB·Hz	57.4
AVAILABLE Eb/No	dB	18.6
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	5.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	10.6

WV-L

TELEMETRY DOWNLINK FAIRBANKS, AK

FREQUENCY	8.380 GHz	WAVELENGTH	0.036 METERS
POWER	3.0 WATTS	5 DEG SLANT RANGE	1998.6 KM
ALTITUDE	470 KM		
DATA	OQPSK	DATA RATE	544 KBPS
		MARGIN	13.5 dB

ANTENNA: NADIR

PARAMETER	UNITS	VALUE
TOTAL TRANSMIT POWER	dBm	34.8
PASSIVE LOSS	dB	-5.5
S/C ANTENNA GAIN	dBi	-2.0
FREE SPACE DISPERSION LOSS	dB	-176.9
ATMOSPHERIC LOSS	dB	-1.7
GROUND STATION G/T	dB/K	31.6
TOTAL RECEIVED POWER/T	dBm/K	-119.7
BOLTZMANN CONSTANT	dBm/(Hz·K)	-198.6
TOTAL RECEIVED POWER/KT	dBm/Hz	78.9
DATA CHANNEL		
DATA POWER/KT	dB·Hz	78.9
INFORMATION RATE 544 KBPS	dB·Hz	57.4
AVAILABLE Eb/No	dB	21.5
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	5.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	13.5

WV-L

TELEMETRY DOWNLINK FAIRBANKS, AK

FREQUENCY	8.380 GHz	WAVELENGTH	0.036 METERS
POWER	3.0 WATTS	5 DEG SLANT RANGE	2703.6 KM
ALTITUDE	763 KM		
DATA	OQPSK	DATA RATE	544 KBPS
		MARGIN	10.8 dB

ANTENNA: NADIR

PARAMETER	UNITS	VALUE
TOTAL TRANSMIT POWER	dBm	34.8
PASSIVE LOSS	dB	-5.5
S/C ANTENNA GAIN	dBi	-2.0
FREE SPACE DISPERSION LOSS	dB	-179.6
ATMOSPHERIC LOSS	dB	-1.7
GROUND STATION G/T	dB/K	31.6
TOTAL RECEIVED POWER/T	dBm/K	-122.4
BOLTZMANN CONSTANT	dBm/(Hz·K)	-198.6
TOTAL RECEIVED POWER/KT	dBm/Hz	76.2
DATA CHANNEL		
DATA POWER/KT	dB·Hz	76.2
INFORMATION RATE 544 KBPS	dB·Hz	57.4
AVAILABLE Eb/No	dB	18.9
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	5.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	10.8

WV-L

TELEMETRY DOWNLINK PRUDHOE BAY, AK

FREQUENCY	8.380 GHz	WAVELENGTH	0.036 METERS
POWER	3.0 WATTS	5 DEG SLANT RANGE	2783.9 KM
ALTITUDE	800 KM		
DATA	OQPSK	DATA RATE	544 KBPS
		MARGIN	8.3 dB

ANTENNA: NADIR

PARAMETER	UNITS	VALUE
TOTAL TRANSMIT POWER	dBm	34.8
PASSIVE LOSS	dB	-5.5
S/C ANTENNA GAIN	dBi	-2.0
FREE SPACE DISPERSION LOSS	dB	-179.8
ATMOSPHERIC LOSS	dB	-1.7
GROUND STATION G/T	dB/K	29.3
TOTAL RECEIVED POWER/T	dBm/K	-124.9
BOLTZMANN CONSTANT	dBm/(Hz·K)	-198.6
TOTAL RECEIVED POWER/KT	dBm/Hz	73.7
DATA CHANNEL		
DATA POWER/KT	dB·Hz	73.7
INFORMATION RATE 544 KBPS	dB·Hz	57.4
AVAILABLE Eb/No	dB	16.3
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	5.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	8.3

WV-L

TELEMETRY DOWNLINK PRUDHOE BAY, AK

FREQUENCY	8.380 GHz	WAVELENGTH	0.036 METERS
POWER	3.0 WATTS	5 DEG SLANT RANGE	1998.6 KM
ALTITUDE	470 KM		
DATA	OQPSK	DATA RATE	544 KBPS
		MARGIN	11.1 dB

ANTENNA: NADIR

PARAMETER	UNITS	VALUE
TOTAL TRANSMIT POWER	dBm	34.8
PASSIVE LOSS	dB	-5.5
S/C ANTENNA GAIN	dBi	-2.0
FREE SPACE DISPERSION LOSS	dB	-176.9
ATMOSPHERIC LOSS	dB	-1.7
GROUND STATION G/T	dB/K	29.3
TOTAL RECEIVED POWER/T	dBm/K	-122.1
BOLTZMANN CONSTANT	dBm/(Hz·K)	-198.6
TOTAL RECEIVED POWER/KT	dBm/Hz	76.5
DATA CHANNEL		
DATA POWER/KT	dB·Hz	76.5
INFORMATION RATE 544 KBPS	dB·Hz	57.4
AVAILABLE Eb/No	dB	19.2
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	5.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	11.1

WV-L

TELEMETRY DOWNLINK PRUDHOE BAY, AK

FREQUENCY	8.380 GHz	WAVELENGTH	0.036 METERS
POWER	3.0 WATTS	5 DEG SLANT RANGE	2703.6 KM
ALTITUDE	763 KM		
DATA	OQPSK	DATA RATE	544 KBPS
		MARGIN	8.5 dB

ANTENNA: NADIR

PARAMETER	UNITS	VALUE
TOTAL TRANSMIT POWER	dBm	34.8
PASSIVE LOSS	dB	-5.5
S/C ANTENNA GAIN	dBi	-2.0
FREE SPACE DISPERSION LOSS	dB	-179.6
ATMOSPHERIC LOSS	dB	-1.7
GROUND STATION G/T	dB/K	29.3
TOTAL RECEIVED POWER/T	dBm/K	-124.7
BOLTZMANN CONSTANT	dBm/(Hz·K)	-198.6
TOTAL RECEIVED POWER/KT	dBm/Hz	73.9
DATA CHANNEL		
DATA POWER/KT	dB·Hz	73.9
INFORMATION RATE 544 KBPS	dB·Hz	57.4
AVAILABLE Eb/No	dB	16.6
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	5.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	8.5

WV-L

TELEMETRY DOWNLINK CLEWISTON,FL

FREQUENCY	8.380 GHz	WAVELENGTH	0.036 METERS
POWER	3.0 WATTS	5 DEG SLANT RANGE	2783.9 KM
ALTITUDE	800 KM		
DATA	OQPSK	DATA RATE	544 KBPS
		MARGIN	5.6 dB

ANTENNA: NADIR

PARAMETER	UNITS	VALUE
TOTAL TRANSMIT POWER	dBm	34.8
PASSIVE LOSS	dB	-5.5
S/C ANTENNA GAIN	dBi	-2.0
FREE SPACE DISPERSION LOSS	dB	-179.6
ATMOSPHERIC LOSS	dB	-4.8
GROUND STATION G/T	dB/K	29.5
TOTAL RECEIVED POWER/T	dBm/K	-127.6
BOLTZMANN CONSTANT	dBm/(Hz·K)	-198.6
TOTAL RECEIVED POWER/KT	dBm/Hz	71.0
DATA CHANNEL		
DATA POWER/KT	dB·Hz	71.0
INFORMATION RATE 544 KBPS	dB·Hz	57.4
AVAILABLE Eb/No	dB	13.6
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	5.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	5.6

WV-L

TELEMETRY DOWNLINK CLEWISTON,FL

FREQUENCY	8.380 GHz	WAVELENGTH	0.036 METERS
POWER	3.0 WATTS	5 DEG SLANT RANGE	1998.6 KM
ALTITUDE	470 KM		
DATA	OQPSK	DATA RATE	544 KBPS
		MARGIN	5.6 dB

ANTENNA: NADIR

PARAMETER	UNITS	VALUE
TOTAL TRANSMIT POWER	dBm	34.8
PASSIVE LOSS	dB	-5.5
S/C ANTENNA GAIN	dBi	-2.0
FREE SPACE DISPERSION LOSS	dB	-179.6
ATMOSPHERIC LOSS	dB	-4.8
GROUND STATION G/T	dB/K	29.5
TOTAL RECEIVED POWER/T	dBm/K	-127.6
BOLTZMANN CONSTANT	dBm/(Hz·K)	-198.6
TOTAL RECEIVED POWER/KT	dBm/Hz	71.0
DATA CHANNEL		
DATA POWER/KT	dB·Hz	71.0
INFORMATION RATE 544 KBPS	dB·Hz	57.4
AVAILABLE Eb/No	dB	13.6
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	5.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	5.6

WV-L

TELEMETRY DOWNLINK CLEWISTON,FL

FREQUENCY	8.380 GHz	WAVELENGTH	0.036 METERS
POWER	3.0 WATTS	5 DEG SLANT RANGE	2703.6 KM
ALTITUDE	763 KM		
DATA	OQPSK	DATA RATE	544 KBPS
		MARGIN	5.6 dB

ANTENNA: NADIR

PARAMETER	UNITS	VALUE
TOTAL TRANSMIT POWER	dBm	34.8
PASSIVE LOSS	dB	-5.5
S/C ANTENNA GAIN	dBi	-2.0
FREE SPACE DISPERSION LOSS	dB	-179.6
ATMOSPHERIC LOSS	dB	-4.8
GROUND STATION G/T	dB/K	29.5
TOTAL RECEIVED POWER/T	dBm/K	-127.6
BOLTZMANN CONSTANT	dBm/(Hz·K)	-198.6
TOTAL RECEIVED POWER/KT	dBm/Hz	71.0
DATA CHANNEL		
DATA POWER/KT	dB·Hz	71.0
INFORMATION RATE 544 KBPS	dB·Hz	57.4
AVAILABLE Eb/No	dB	13.6
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	5.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	5.6

WV-L

TELEMETRY DOWNLINK GREEN RIVER, WY

FREQUENCY	8.380 GHz	WAVELENGTH	0.036 METERS
POWER	3.0 WATTS	5 DEG SLANT RANGE	2783.9 KM
ALTITUDE	800 KM		
DATA	OQPSK	DATA RATE	544 KBPS
		MARGIN	11.1 dB

ANTENNA: NADIR

PARAMETER	UNITS	VALUE
TOTAL TRANSMIT POWER	dBm	34.8
PASSIVE LOSS	dB	-5.5
S/C ANTENNA GAIN	dBi	-2.0
FREE SPACE DISPERSION LOSS	dB	-179.8
ATMOSPHERIC LOSS	dB	-1.6
GROUND STATION G/T	dB/K	32.0
TOTAL RECEIVED POWER/T	dBm/K	-122.1
BOLTZMANN CONSTANT	dBm/(Hz·K)	-198.6
TOTAL RECEIVED POWER/KT	dBm/Hz	76.5
DATA CHANNEL		
DATA POWER/KT	dB·Hz	76.5
INFORMATION RATE 544 KBPS	dB·Hz	57.4
AVAILABLE Eb/No	dB	19.1
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	5.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	11.1

WV-L

TELEMETRY DOWNLINK GREEN RIVER, WY

FREQUENCY	8.380 GHz	WAVELENGTH	0.036 METERS
POWER	3.0 WATTS	5 DEG SLANT RANGE	1998.6 KM
ALTITUDE	470 KM		
DATA	OQPSK	DATA RATE	544 KBPS
		MARGIN	14.0 dB

ANTENNA: NADIR

PARAMETER	UNITS	VALUE
TOTAL TRANSMIT POWER	dBm	34.8
PASSIVE LOSS	dB	-5.5
S/C ANTENNA GAIN	dBi	-2.0
FREE SPACE DISPERSION LOSS	dB	-176.9
ATMOSPHERIC LOSS	dB	-1.6
GROUND STATION G/T	dB/K	32.0
TOTAL RECEIVED POWER/T	dBm/K	-119.2
BOLTZMANN CONSTANT	dBm/(Hz·K)	-198.6
TOTAL RECEIVED POWER/KT	dBm/Hz	79.4
DATA CHANNEL		
DATA POWER/KT	dB·Hz	79.4
INFORMATION RATE 544 KBPS	dB·Hz	57.4
AVAILABLE Eb/No	dB	22.0
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	5.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	14.0

WV-L

TELEMETRY DOWNLINK GREEN RIVER, WY

FREQUENCY	8.380 GHz	WAVELENGTH	0.036 METERS
POWER	3.0 WATTS	5 DEG SLANT RANGE	2703.6 KM
ALTITUDE	763 KM		
DATA	OQPSK	DATA RATE	544 KBPS
		MARGIN	11.3 dB

ANTENNA: NADIR

PARAMETER	UNITS	VALUE
TOTAL TRANSMIT POWER	dBm	34.8
PASSIVE LOSS	dB	-5.5
S/C ANTENNA GAIN	dBi	-2.0
FREE SPACE DISPERSION LOSS	dB	-179.6
ATMOSPHERIC LOSS	dB	-1.6
GROUND STATION G/T	dB/K	32.0
TOTAL RECEIVED POWER/T	dBm/K	-121.9
BOLTZMANN CONSTANT	dBm/(Hz·K)	-198.6
TOTAL RECEIVED POWER/KT	dBm/Hz	76.7
DATA CHANNEL		
DATA POWER/KT	dB·Hz	76.7
INFORMATION RATE 544 KBPS	dB·Hz	57.4
AVAILABLE Eb/No	dB	19.4
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	5.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	11.3

WV-L			FAIRBANKS, AK		
COMMAND UPLINK			OMNI ANTENNA NOMINAL		
DigitalGlobe					
FREQUENCY	2085.6875 GHz				
UPLINK	53.0 dBW EIRP		WAVELENGTH	0.144	METERS
ALTITUDE	800 KM		5 DEG SLANT RANGE	2783.9	KM
			DATA RATE	64	KBPS
CMD MOD INDEX	1.57		MARGIN	14.6	dB

ANTENNA: OMNI NOMINAL +/- 90 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	53.0
FREE SPACE DISPERSION LOSS	dB	-167.7
ATMOSPHERIC LOSS	dB	-0.9
S/C ANTENNA GAIN < +/- 90 DEG	dBi	-3.5
POLARIZATION LOSS	dB	-0.6
S/C LINE LOSS	dB	-5.1
TOTAL S/C RECEIVED POWER	dBm	-94.8
DATA CHANNEL		
DATA POWER/KT	dB-Hz	75.7
INFORMATION RATE	dB-Hz	48.1
AVAILABLE Eb/No	dB	27.6
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	0.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	14.6

WV-L			FAIRBANKS, AK		
COMMAND UPLINK			OMNI ANTENNA NOMINAL		
DigitalGlobe					
FREQUENCY	2085.6875 GHz				
UPLINK	53.0 dBW EIRP		WAVELENGTH	0.144	METERS
ALTITUDE	470 KM		5 DEG SLANT RANGE	1998.6	KM
			DATA RATE	64	KBPS
CMD MOD INDEX	1.57		MARGIN	17.5	dB

ANTENNA: OMNI NOMINAL +/- 90 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	53.0
FREE SPACE DISPERSION LOSS	dB	-164.8
ATMOSPHERIC LOSS	dB	-0.9
S/C ANTENNA GAIN < +/- 90 DEG	dBi	-3.5
POLARIZATION LOSS	dB	-0.6
S/C LINE LOSS	dB	-5.1
TOTAL S/C RECEIVED POWER	dBm	-91.9
DATA CHANNEL		
DATA POWER/KT	dB-Hz	78.5
INFORMATION RATE	dB-Hz	48.1
AVAILABLE Eb/No	dB	30.5
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	0.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	17.5

WV-L			FAIRBANKS, AK		
COMMAND UPLINK			OMNI ANTENNA NOMINAL		
DigitalGlobe					
FREQUENCY	2085.6875 GHz				
UPLINK	53.0 dBW EIRP		WAVELENGTH	0.144	METERS
ALTITUDE	800 KM		5 DEG SLANT RANGE	2783.9	KM
			DATA RATE	64	KBPS
CMD MOD INDEX	1.57		MARGIN	14.6	dB

ANTENNA: OMNI NOMINAL +/- 90 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	53.0
FREE SPACE DISPERSION LOSS	dB	-167.7
ATMOSPHERIC LOSS	dB	-0.9
S/C ANTENNA GAIN < +/- 90 DEG	dBi	-3.5
POLARIZATION LOSS	dB	-0.6
S/C LINE LOSS	dB	-5.1
TOTAL S/C RECEIVED POWER	dBm	-94.8
DATA CHANNEL		
DATA POWER/KT	dB-Hz	75.7
INFORMATION RATE	dB-Hz	48.1
AVAILABLE Eb/No	dB	27.6
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	0.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	14.6

WV-L			FAIRBANKS, AK		
COMMAND UPLINK			OMNI ANTENNA NOMINAL		
DigitalGlobe					
FREQUENCY	2085.6875 GHz				
UPLINK	53.0 dBW EIRP		WAVELENGTH	0.144	METERS
ALTITUDE	470 KM		5 DEG SLANT RANGE	1998.6	KM
			DATA RATE	64	KBPS
CMD MOD INDEX	1.57		MARGIN	17.5	dB

ANTENNA: OMNI NOMINAL +/- 90 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	53.0
FREE SPACE DISPERSION LOSS	dB	-164.8
ATMOSPHERIC LOSS	dB	-0.9
S/C ANTENNA GAIN < +/- 90 DEG	dBi	-3.5
POLARIZATION LOSS	dB	-0.6
S/C LINE LOSS	dB	-5.1
TOTAL S/C RECEIVED POWER	dBm	-91.9
DATA CHANNEL		
DATA POWER/KT	dB-Hz	78.5
INFORMATION RATE	dB-Hz	48.1
AVAILABLE Eb/No	dB	30.5
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	0.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	17.5

WV-L			FAIRBANKS, AK		
COMMAND UPLINK			OMNI ANTENNA NOMINAL		
DigitalGlobe					
FREQUENCY	2085.6875 GHz				
UPLINK	53.0 dBW EIRP		WAVELENGTH	0.144	METERS
ALTITUDE	763 KM		5 DEG SLANT RANGE	2703.6	KM
			DATA RATE	64	KBPS
CMD MOD INDEX	1.57		MARGIN	14.9	dB

ANTENNA: OMNI NOMINAL +/- 90 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	53.0
FREE SPACE DISPERSION LOSS	dB	-167.5
ATMOSPHERIC LOSS	dB	-0.9
S/C ANTENNA GAIN < +/- 90 DEG	dBi	-3.5
POLARIZATION LOSS	dB	-0.6
S/C LINE LOSS	dB	-5.1
TOTAL S/C RECEIVED POWER	dBm	-94.6
DATA CHANNEL		
DATA POWER/KT	dB-Hz	75.9
INFORMATION RATE	dB-Hz	48.1
AVAILABLE Eb/No	dB	27.9
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	0.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	14.9

WV-L			PRUDHOE BAY, AK		
COMMAND UPLINK			OMNI ANTENNA NOMINAL		
DigitalGlobe					
FREQUENCY	2085.6875 GHz				
UPLINK	53.0 dBW EIRP		WAVELENGTH	0.144	METERS
ALTITUDE	800 KM		5 DEG SLANT RANGE	2783.9	KM
			DATA RATE	64	KBPS
CMD MOD INDEX	1.57		MARGIN	14.6	dB

ANTENNA: OMNI NOMINAL +/- 90 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	53.0
FREE SPACE DISPERSION LOSS	dB	-167.7
ATMOSPHERIC LOSS	dB	-0.9
S/C ANTENNA GAIN < +/- 90 DEG	dBi	-3.5
POLARIZATION LOSS	dB	-0.6
S/C LINE LOSS	dB	-5.1
TOTAL S/C RECEIVED POWER	dBm	-94.8
DATA CHANNEL		
DATA POWER/KT	dB-Hz	75.6
INFORMATION RATE	dB-Hz	48.1
AVAILABLE Eb/No	dB	27.6
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	0.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	14.6

WV-L			PRUDHOE BAY, AK		
COMMAND UPLINK			OMNI ANTENNA NOMINAL		
DigitalGlobe					
FREQUENCY	2085.6875 GHz				
UPLINK	53.0 dBW EIRP		WAVELENGTH	0.144	METERS
ALTITUDE	470 KM		5 DEG SLANT RANGE	1998.6	KM
			DATA RATE	64	KBPS
CMD MOD INDEX	1.57		MARGIN	17.5	dB

ANTENNA: OMNI NOMINAL +/- 90 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	53.0
FREE SPACE DISPERSION LOSS	dB	-164.8
ATMOSPHERIC LOSS	dB	-0.9
S/C ANTENNA GAIN < +/- 90 DEG	dBi	-3.5
POLARIZATION LOSS	dB	-0.6
S/C LINE LOSS	dB	-5.1
TOTAL S/C RECEIVED POWER	dBm	-91.9
DATA CHANNEL		
DATA POWER/KT	dB-Hz	78.5
INFORMATION RATE	dB-Hz	48.1
AVAILABLE Eb/No	dB	30.5
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	0.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	17.5

WV-L			PRUDHOE BAY, AK		
COMMAND UPLINK			OMNI ANTENNA NOMINAL		
DigitalGlobe					
FREQUENCY	2085.6875 GHz				
UPLINK	53.0 dBW EIRP		WAVELENGTH	0.144	METERS
ALTITUDE	763 KM		5 DEG SLANT RANGE	2703.6	KM
			DATA RATE	64	KBPS
CMD MOD INDEX	1.57		MARGIN	14.8	dB

ANTENNA: OMNI NOMINAL +/- 90 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	53.0
FREE SPACE DISPERSION LOSS	dB	-167.5
ATMOSPHERIC LOSS	dB	-0.9
S/C ANTENNA GAIN < +/- 90 DEG	dBi	-3.5
POLARIZATION LOSS	dB	-0.6
S/C LINE LOSS	dB	-5.1
TOTAL S/C RECEIVED POWER	dBm	-94.6
DATA CHANNEL		
DATA POWER/KT	dB-Hz	75.9
INFORMATION RATE	dB-Hz	48.1
AVAILABLE Eb/No	dB	27.8
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	0.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	14.8

WV-L			CLEWISTON, FL		
COMMAND UPLINK			OMNI ANTENNA NOMINAL		
DigitalGlobe					
FREQUENCY	2085.6875 GHz				
UPLINK	53.0 dBW EIRP		WAVELENGTH	0.144	METERS
ALTITUDE	800 KM		5 DEG SLANT RANGE	2783.9	KM
			DATA RATE	64	KBPS
CMD MOD INDEX	1.57		MARGIN	14.1	dB

ANTENNA: OMNI NOMINAL +/- 90 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	53.0
FREE SPACE DISPERSION LOSS	dB	-167.7
ATMOSPHERIC LOSS	dB	-1.5
S/C ANTENNA GAIN < +/- 90 DEG	dBi	-3.5
POLARIZATION LOSS	dB	-0.6
S/C LINE LOSS	dB	-5.1
TOTAL S/C RECEIVED POWER	dBm	-95.4
DATA CHANNEL		
DATA POWER/KT	dB-Hz	75.1
INFORMATION RATE	dB-Hz	48.1
AVAILABLE Eb/No	dB	27.1
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	0.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	14.1

WV-L			CLEWISTON, FL		
COMMAND UPLINK			OMNI ANTENNA NOMINAL		
DigitalGlobe					
FREQUENCY	2085.6875 GHz				
UPLINK	53.0 dBW EIRP		WAVELENGTH	0.144	METERS
ALTITUDE	470 KM		5 DEG SLANT RANGE	1998.6	KM
			DATA RATE	64	KBPS
CMD MOD INDEX	1.57		MARGIN	16.9	dB

ANTENNA: OMNI NOMINAL +/- 90 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	53.0
FREE SPACE DISPERSION LOSS	dB	-164.8
ATMOSPHERIC LOSS	dB	-1.5
S/C ANTENNA GAIN < +/- 90 DEG	dBi	-3.5
POLARIZATION LOSS	dB	-0.6
S/C LINE LOSS	dB	-5.1
TOTAL S/C RECEIVED POWER	dBm	-92.5
DATA CHANNEL		
DATA POWER/KT	dB-Hz	78.0
INFORMATION RATE	dB-Hz	48.1
AVAILABLE Eb/No	dB	29.9
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	0.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	16.9

WV-L			CLEWISTON, FL		
COMMAND UPLINK			OMNI ANTENNA NOMINAL		
DigitalGlobe					
FREQUENCY	2085.6875 GHz				
UPLINK	53.0 dBW EIRP		WAVELENGTH	0.144	METERS
ALTITUDE	763 KM		5 DEG SLANT RANGE	2703.6	KM
			DATA RATE	64	KBPS
CMD MOD INDEX	1.57		MARGIN	14.3	dB

ANTENNA: OMNI NOMINAL +/- 90 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	53.0
FREE SPACE DISPERSION LOSS	dB	-167.5
ATMOSPHERIC LOSS	dB	-1.5
S/C ANTENNA GAIN < +/- 90 DEG	dBi	-3.5
POLARIZATION LOSS	dB	-0.6
S/C LINE LOSS	dB	-5.1
TOTAL S/C RECEIVED POWER	dBm	-95.1
DATA CHANNEL		
DATA POWER/KT	dB-Hz	75.4
INFORMATION RATE	dB-Hz	48.1
AVAILABLE Eb/No	dB	27.3
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	0.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	14.3

WV-L			GREEN RIVER, WY		
COMMAND UPLINK			OMNI ANTENNA NOMINAL		
DigitalGlobe					
FREQUENCY	2085.6875 GHz				
UPLINK	53.0 dBW EIRP		WAVELENGTH	0.144	METERS
ALTITUDE	800 KM		5 DEG SLANT RANGE	2783.9	KM
			DATA RATE	64	KBPS
CMD MOD INDEX	1.57		MARGIN	14.6	dB

ANTENNA: OMNI NOMINAL +/- 90 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	53.0
FREE SPACE DISPERSION LOSS	dB	-167.7
ATMOSPHERIC LOSS	dB	-0.9
S/C ANTENNA GAIN < +/- 90 DEG	dBi	-3.5
POLARIZATION LOSS	dB	-0.6
S/C LINE LOSS	dB	-5.1
TOTAL S/C RECEIVED POWER	dBm	-94.8
DATA CHANNEL		
DATA POWER/KT	dB-Hz	75.7
INFORMATION RATE	dB-Hz	48.1
AVAILABLE Eb/No	dB	27.6
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	0.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	14.6

WV-L			GREEN RIVER, WY		
COMMAND UPLINK			OMNI ANTENNA NOMINAL		
DigitalGlobe					
FREQUENCY	2085.6875 GHz				
UPLINK	53.0 dBW EIRP		WAVELENGTH	0.144	METERS
ALTITUDE	470 KM		5 DEG SLANT RANGE	1998.6	KM
			DATA RATE	64	KBPS
CMD MOD INDEX	1.57		MARGIN	17.5	dB

ANTENNA: OMNI NOMINAL +/- 90 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	53.0
FREE SPACE DISPERSION LOSS	dB	-164.8
ATMOSPHERIC LOSS	dB	-0.9
S/C ANTENNA GAIN < +/- 90 DEG	dBi	-3.5
POLARIZATION LOSS	dB	-0.6
S/C LINE LOSS	dB	-5.1
TOTAL S/C RECEIVED POWER	dBm	-91.9
DATA CHANNEL		
DATA POWER/KT	dB-Hz	78.6
INFORMATION RATE	dB-Hz	48.1
AVAILABLE Eb/No	dB	30.5
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	0.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	17.5

WV-L			GREEN RIVER, WY		
COMMAND UPLINK			OMNI ANTENNA NOMINAL		
DigitalGlobe					
FREQUENCY	2085.6875 GHz				
UPLINK	53.0 dBW EIRP		WAVELENGTH	0.144	METERS
ALTITUDE	763 KM		5 DEG SLANT RANGE	2703.6	KM
			DATA RATE	64	KBPS
CMD MOD INDEX	1.57		MARGIN	14.9	dB

ANTENNA: OMNI NOMINAL +/- 90 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	53.0
FREE SPACE DISPERSION LOSS	dB	-167.5
ATMOSPHERIC LOSS	dB	-0.9
S/C ANTENNA GAIN < +/- 90 DEG	dBi	-3.5
POLARIZATION LOSS	dB	-0.6
S/C LINE LOSS	dB	-5.1
TOTAL S/C RECEIVED POWER	dBm	-94.5
DATA CHANNEL		
DATA POWER/KT	dB-Hz	75.9
INFORMATION RATE	dB-Hz	48.1
AVAILABLE Eb/No	dB	27.9
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	0.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	14.9

WV-L

600 Mbps DATA RATE DOWNLINK ANALYSIS **FAIRBANKS, AK**

Fo = 8.185 GHz **8PSK Modulation**

DOWNLINK PARAMETERS

Frequency	8.185	GHz
Orbit height in km	800	km
Local elevation above horizon	5	degrees
Data rate	600	Mbps
Bandwidth (baseband)	145.5	MHz
Spacecraft ant. EIRP at beam edge	60.5	dBm
Slant range	2783.9	km
Ground ant. G/T	28.6	dB/K
BER	3.00E-05	
Required Eb/No (without coding)	12.4	dB
Hardware imp. BER loss	2.5	dB

LINK CALCULATION:

TOTAL POWER TO GROUND:

Satellite EIRP	60.5	dBm
Path loss	-179.6	dB
Environment loss (rain, polarization, etc.)	-1.87	dB
Symbol rate to noise bandwidth ratio	1.38	dB

RECEIVER SENSITIVITY:

Required Eb/No	12.4	dB
Available Eb/No	18.4	dB
DOWNLINK MARGIN	3.5	dB

ANTENNA SIZES:

Spacecraft Antenna

Spacecraft antenna diameter	9.4	inches
Approx. HPBW	8.3	degrees
Gain of spacecraft antenna	24.0	dBic
Loss between HPA out and ant. Output	3.5	dB
Transmitter power output	10	watts
EIRP of satellite system	60.5	dBm

Ground Antenna

Ground ant. diameter	5.4	meters
Gain of ground antenna	50.4	dBic
System noise temperature	151.9	K (referenced at ant. output)
Ground Antenna G/T	28.6	dB/K
Approx. HPBW	0.49	degrees

WV-L

600 Mbps DATA RATE DOWNLINK ANALYSIS **FAIRBANKS, AK**

Fo = 8.185 GHz **8PSK Modulation**

DOWNLINK PARAMETERS

Frequency	8.185	GHz
Orbit height in km	470	km
Local elevation above horizon	5	degrees
Data rate	600	Mbps
Bandwidth (baseband)	145.5	MHz
Spacecraft ant. EIRP at beam edge	60.5	dBm
Slant range	1998.6	km
Ground ant. G/T	28.6	dB/K
BER	3.00E-05	
Required Eb/No (without coding)	12.4	dB
Hardware imp. BER loss	2.5	dB

LINK CALCULATION:

TOTAL POWER TO GROUND:

Satellite EIRP	60.5	dBm
Path loss	-176.7	dB
Environment loss (rain, polarization, etc.)	-1.87	dB
Symbol rate to noise bandwidth ratio	1.38	dB

RECEIVER SENSITIVITY:

Required Eb/No	12.4	dB
Available Eb/No	21.3	dB
DOWNLINK MARGIN	6.4	dB

ANTENNA SIZES:

Spacecraft Antenna

Spacecraft antenna diameter	9.4	inches
Approx. HPBW	8.3	degrees
Gain of spacecraft antenna	24.0	dBic
Loss between HPA out and ant. Output	3.5	dB
Transmitter power output	10	watts
EIRP of satellite system	60.5	dBm

Ground Antenna

Ground ant. diameter	5.4	meters
Gain of ground antenna	50.4	dBic
System noise temperature	151.9	K (referenced at ant. output)
Ground Antenna G/T	28.6	dB/K
Approx. HPBW	0.49	degrees

WV-L

600 Mbps DATA RATE DOWNLINK ANALYSIS **FAIRBANKS, AK**

Fo = 8.185 GHz **8PSK Modulation**

DOWNLINK PARAMETERS

Frequency	8.185	GHz
Orbit height in km	763	km
Local elevation above horizon	5	degrees
Data rate	600	Mbps
Bandwidth (baseband)	145.5	MHz
Spacecraft ant. EIRP at beam edge	60.5	dBm
Slant range	2703.6	km
Ground ant. G/T	28.6	dB/K
BER	3.00E-05	
Required Eb/No (without coding)	12.4	dB
Hardware imp. BER loss	2.5	dB

LINK CALCULATION:

TOTAL POWER TO GROUND:

Satellite EIRP	60.5	dBm
Path loss	-179.3	dB
Environment loss (rain, polarization, etc.)	-1.87	dB
Symbol rate to noise bandwidth ratio	1.38	dB

RECEIVER SENSITIVITY:

Required Eb/No	12.4	dB
Available Eb/No	18.7	dB
DOWNLINK MARGIN	3.8	dB

ANTENNA SIZES:

Spacecraft Antenna

Spacecraft antenna diameter	9.4	inches
Approx. HPBW	8.3	degrees
Gain of spacecraft antenna	24.0	dBic
Loss between HPA out and ant. Output	3.5	dB
Transmitter power output	10	watts
EIRP of satellite system	60.5	dBm

Ground Antenna

Ground ant. diameter	5.4	meters
Gain of ground antenna	50.4	dBic
System noise temperature	151.9	K (referenced at ant. output)
Ground Antenna G/T	28.6	dB/K
Approx. HPBW	0.49	degrees

WV-L

600 Mbps DATA RATE DOWNLINK ANALYSIS **FAIRBANKS, AK**

Fo = 8.185 GHz **8PSK Modulation**

DOWNLINK PARAMETERS

Frequency	8.185	GHz
Orbit height in km	763	km
Local elevation above horizon	5	degrees
Data rate	600	Mbps
Bandwidth (baseband)	145.5	MHz
Spacecraft ant. EIRP at beam edge	60.5	dBm
Slant range	2703.6	km
Ground ant. G/T	28.6	dB/K
BER	3.00E-05	
Required Eb/No (without coding)	12.4	dB
Hardware imp. BER loss	2.5	dB

LINK CALCULATION:

TOTAL POWER TO GROUND:

Satellite EIRP	60.5	dBm
Path loss	-179.3	dB
Environment loss (rain, polarization, etc.)	-1.87	dB
Symbol rate to noise bandwidth ratio	1.38	dB

RECEIVER SENSITIVITY:

Required Eb/No	12.4	dB
Available Eb/No	18.7	dB
DOWNLINK MARGIN	3.8	dB

ANTENNA SIZES:

Spacecraft Antenna

Spacecraft antenna diameter	9.4	inches
Approx. HPBW	8.3	degrees
Gain of spacecraft antenna	24.0	dBic
Loss between HPA out and ant. Output	3.5	dB
Transmitter power output	10	watts
EIRP of satellite system	60.5	dBm

Ground Antenna

Ground ant. diameter	5.4	meters
Gain of ground antenna	50.4	dBic
System noise temperature	151.9	K (referenced at ant. output)
Ground Antenna G/T	28.6	dB/K
Approx. HPBW	0.49	degrees

WV-L

600 Mbps DATA RATE DOWNLINK ANALYSIS **PRUDHOE BAY, AK**

Fo = 8.185 GHz **8PSK Modulation**

DOWNLINK PARAMETERS

Frequency	8.185	GHz
Orbit height in km	470	km
Local elevation above horizon	5	degrees
Data rate	600	Mbps
Bandwidth (baseband)	145.5	MHz
Spacecraft ant. EIRP at beam edge	60.5	dBm
Slant range	1998.6	km
Ground ant. G/T	28.7	dB/K
BER	3.00E-05	
Required Eb/No (without coding)	12.4	dB
Hardware imp. BER loss	2.5	dB

LINK CALCULATION:

TOTAL POWER TO GROUND:

Satellite EIRP	60.5	dBm
Path loss	-179.6	dB
Environment loss (rain, polarization, etc.)	-1.85	dB
Symbol rate to noise bandwidth ratio	1.38	dB

RECEIVER SENSITIVITY:

Required Eb/No	12.4	dB
Available Eb/No	18.6	dB
DOWNLINK MARGIN	3.7	dB

ANTENNA SIZES:

Spacecraft Antenna

Spacecraft antenna diameter	9.4	inches
Approx. HPBW	8.3	degrees
Gain of spacecraft antenna	24.0	dBic
Loss between HPA out and ant. Output	3.5	dB
Transmitter power output	10	watts
EIRP of satellite system	60.5	dBm

Ground Antenna

Ground ant. diameter	5.4	meters
Gain of ground antenna	50.4	dBic
System noise temperature	145.7	K (referenced at ant. output)
Ground Antenna G/T	28.7	dB/K
Approx. HPBW	0.49	degrees

WV-L

600 Mbps DATA RATE DOWNLINK ANALYSIS **PRUDHOE BAY, AK**

Fo = 8.185 GHz **8PSK Modulation**

DOWNLINK PARAMETERS

Frequency	8.185	GHz
Orbit height in km	763	km
Local elevation above horizon	5	degrees
Data rate	600	Mbps
Bandwidth (baseband)	145.5	MHz
Spacecraft ant. EIRP at beam edge	60.5	dBm
Slant range	2703.6	km
Ground ant. G/T	28.7	dB/K
BER	3.00E-05	
Required Eb/No (without coding)	12.4	dB
Hardware imp. BER loss	2.5	dB

LINK CALCULATION:

TOTAL POWER TO GROUND:

Satellite EIRP	60.5	dBm
Path loss	-179.6	dB
Environment loss (rain, polarization, etc.)	-1.85	dB
Symbol rate to noise bandwidth ratio	1.38	dB

RECEIVER SENSITIVITY:

Required Eb/No	12.4	dB
Available Eb/No	18.6	dB
DOWNLINK MARGIN	3.7	dB

ANTENNA SIZES:

Spacecraft Antenna

Spacecraft antenna diameter	9.4	inches
Approx. HPBW	8.3	degrees
Gain of spacecraft antenna	24.0	dBic
Loss between HPA out and ant. Output	3.5	dB
Transmitter power output	10	watts
EIRP of satellite system	60.5	dBm

Ground Antenna

Ground ant. diameter	5.4	meters
Gain of ground antenna	50.4	dBic
System noise temperature	145.7	K (referenced at ant. output)
Ground Antenna G/T	28.7	dB/K
Approx. HPBW	0.49	degrees

WV-L

600 Mbps DATA RATE DOWNLINK ANALYSIS **CLEWISTON, FL**

Fo = 8.185 GHz **8PSK Modulation**

DOWNLINK PARAMETERS

Frequency	8.185	GHz
Orbit height in km	800	km
Local elevation above horizon	5	degrees
Data rate	600	Mbps
Bandwidth (baseband)	145.5	MHz
Spacecraft ant. EIRP at beam edge	60.5	dBm
Slant range	2783.9	km
Ground ant. G/T	31.1	dB/K
BER	3.00E-05	
Required Eb/No (without coding)	12.4	dB
Hardware imp. BER loss	2.5	dB

LINK CALCULATION:

TOTAL POWER TO GROUND:

Satellite EIRP	60.5	dBm
Path loss	-179.6	dB
Environment loss (rain, polarization, etc.)	-4.78	dB
Symbol rate to noise bandwidth ratio	1.38	dB

RECEIVER SENSITIVITY:

Required Eb/No	12.4	dB
Available Eb/No	18.1	dB
DOWNLINK MARGIN	3.2	dB

ANTENNA SIZES:

Spacecraft Antenna

Spacecraft antenna diameter	9.4	inches
Approx. HPBW	8.3	degrees
Gain of spacecraft antenna	24.0	dBic
Loss between HPA out and ant. Output	3.5	dB
Transmitter power output	10	watts
EIRP of satellite system	60.5	dBm

Ground Antenna

Ground ant. diameter	9.1	meters
Gain of ground antenna	54.9	dBic
System noise temperature	239.5	K (referenced at ant. output)
Ground Antenna G/T	31.1	dB/K
Approx. HPBW	0.29	degrees

WV-L

600 Mbps DATA RATE DOWNLINK ANALYSIS **CLEWISTON, FL**

Fo = 8.185 GHz **8PSK Modulation**

DOWNLINK PARAMETERS

Frequency	8.185	GHz
Orbit height in km	470	km
Local elevation above horizon	5	degrees
Data rate	600	Mbps
Bandwidth (baseband)	145.5	MHz
Spacecraft ant. EIRP at beam edge	60.5	dBm
Slant range	1998.6	km
Ground ant. G/T	31.1	dB/K
BER	3.00E-05	
Required Eb/No (without coding)	12.4	dB
Hardware imp. BER loss	2.5	dB

LINK CALCULATION:

TOTAL POWER TO GROUND:

Satellite EIRP	60.5	dBm
Path loss	-176.7	dB
Environment loss (rain, polarization, etc.)	-4.78	dB
Symbol rate to noise bandwidth ratio	1.38	dB

RECEIVER SENSITIVITY:

Required Eb/No	12.4	dB
Available Eb/No	20.9	dB
DOWNLINK MARGIN	6.0	dB

ANTENNA SIZES:

Spacecraft Antenna

Spacecraft antenna diameter	9.4	inches
Approx. HPBW	8.3	degrees
Gain of spacecraft antenna	24.0	dBic
Loss between HPA out and ant. Output	3.5	dB
Transmitter power output	10	watts
EIRP of satellite system	60.5	dBm

Ground Antenna

Ground ant. diameter	9.1	meters
Gain of ground antenna	54.9	dBic
System noise temperature	239.5	K (referenced at ant. output)
Ground Antenna G/T	31.1	dB/K
Approx. HPBW	0.29	degrees

WV-L

600 Mbps DATA RATE DOWNLINK ANALYSIS **CLEWISTON, FL**

Fo = 8.185 GHz **8PSK Modulation**

DOWNLINK PARAMETERS

Frequency	8.185	GHz
Orbit height in km	763	km
Local elevation above horizon	5	degrees
Data rate	600	Mbps
Bandwidth (baseband)	145.5	MHz
Spacecraft ant. EIRP at beam edge	60.5	dBm
Slant range	2703.6	km
Ground ant. G/T	31.1	dB/K
BER	3.00E-05	
Required Eb/No (without coding)	12.4	dB
Hardware imp. BER loss	2.5	dB

LINK CALCULATION:

TOTAL POWER TO GROUND:

Satellite EIRP	60.5	dBm
Path loss	-179.3	dB
Environment loss (rain, polarization, etc.)	-4.78	dB
Symbol rate to noise bandwidth ratio	1.38	dB

RECEIVER SENSITIVITY:

Required Eb/No	12.4	dB
Available Eb/No	18.3	dB
DOWNLINK MARGIN	3.4	dB

ANTENNA SIZES:

Spacecraft Antenna

Spacecraft antenna diameter	9.4	inches
Approx. HPBW	8.3	degrees
Gain of spacecraft antenna	24.0	dBic
Loss between HPA out and ant. Output	3.5	dB
Transmitter power output	10	watts
EIRP of satellite system	60.5	dBm

Ground Antenna

Ground ant. diameter	9.1	meters
Gain of ground antenna	54.9	dBic
System noise temperature	239.5	K (referenced at ant. output)
Ground Antenna G/T	31.1	dB/K
Approx. HPBW	0.29	degrees

WV-L

600 Mbps DATA RATE DOWNLINK ANALYSIS **GREEN RIVER, WY**

Fo = 8.185 GHz **8PSK Modulation**

DOWNLINK PARAMETERS

Frequency	8.185	GHz
Orbit height in km	800	km
Local elevation above horizon	5	degrees
Data rate	600	Mbps
Bandwidth (baseband)	145.5	MHz
Spacecraft ant. EIRP at beam edge	60.5	dBm
Slant range	2783.9	km
Ground ant. G/T	31.3	dB/K
BER	3.00E-05	
Required Eb/No (without coding)	12.4	dB
Hardware imp. BER loss	2.5	dB

LINK CALCULATION:

TOTAL POWER TO GROUND:

Satellite EIRP	60.5	dBm
Path loss	-179.6	dB
Environment loss (rain, polarization, etc.)	-1.71	dB
Symbol rate to noise bandwidth ratio	1.38	dB

RECEIVER SENSITIVITY:

Required Eb/No	12.4	dB
Available Eb/No	21.4	dB
DOWNLINK MARGIN	6.5	dB

ANTENNA SIZES:

Spacecraft Antenna

Spacecraft antenna diameter	9.4	inches
Approx. HPBW	8.3	degrees
Gain of spacecraft antenna	24.0	dBic
Loss between HPA out and ant. Output	3.5	dB
Transmitter power output	10	watts
EIRP of satellite system	60.5	dBm

Ground Antenna

Ground ant. diameter	7.3	meters
Gain of ground antenna	53.0	dBic
System noise temperature	146.4	K (referenced at ant. output)
Ground Antenna G/T	31.3	dB/K
Approx. HPBW	0.36	degrees

WV-L

600 Mbps DATA RATE DOWNLINK ANALYSIS **GREEN RIVER, WY**

Fo = 8.185 GHz **8PSK Modulation**

DOWNLINK PARAMETERS

Frequency	8.185	GHz
Orbit height in km	470	km
Local elevation above horizon	5	degrees
Data rate	600	Mbps
Bandwidth (baseband)	145.5	MHz
Spacecraft ant. EIRP at beam edge	60.5	dBm
Slant range	1998.6	km
Ground ant. G/T	31.3	dB/K
BER	3.00E-05	
Required Eb/No (without coding)	12.4	dB
Hardware imp. BER loss	2.5	dB

LINK CALCULATION:

TOTAL POWER TO GROUND:

Satellite EIRP	60.5	dBm
Path loss	-176.7	dB
Environment loss (rain, polarization, etc.)	-1.71	dB
Symbol rate to noise bandwidth ratio	1.38	dB

RECEIVER SENSITIVITY:

Required Eb/No	12.4	dB
Available Eb/No	24.2	dB
DOWNLINK MARGIN	9.3	dB

ANTENNA SIZES:

Spacecraft Antenna

Spacecraft antenna diameter	9.4	inches
Approx. HPBW	8.3	degrees
Gain of spacecraft antenna	24.0	dBic
Loss between HPA out and ant. Output	3.5	dB
Transmitter power output	10	watts
EIRP of satellite system	60.5	dBm

Ground Antenna

Ground ant. diameter	7.3	meters
Gain of ground antenna	53.0	dBic
System noise temperature	146.4	K (referenced at ant. output)
Ground Antenna G/T	31.3	dB/K
Approx. HPBW	0.36	degrees

WV-L

600 Mbps DATA RATE DOWNLINK ANALYSIS **GREEN RIVER, WY**

Fo = 8.185 GHz **8PSK Modulation**

DOWNLINK PARAMETERS

Frequency	8.185	GHz
Orbit height in km	763	km
Local elevation above horizon	5	degrees
Data rate	600	Mbps
Bandwidth (baseband)	145.5	MHz
Spacecraft ant. EIRP at beam edge	60.5	dBm
Slant range	2703.6	km
Ground ant. G/T	31.3	dB/K
BER	3.00E-05	
Required Eb/No (without coding)	12.4	dB
Hardware imp. BER loss	2.5	dB

LINK CALCULATION:

TOTAL POWER TO GROUND:

Satellite EIRP	60.5	dBm
Path loss	-179.3	dB
Environment loss (rain, polarization, etc.)	-1.71	dB
Symbol rate to noise bandwidth ratio	1.38	dB

RECEIVER SENSITIVITY:

Required Eb/No	12.4	dB
Available Eb/No	21.6	dB
DOWNLINK MARGIN	6.7	dB

ANTENNA SIZES:

Spacecraft Antenna

Spacecraft antenna diameter	9.4	inches
Approx. HPBW	8.3	degrees
Gain of spacecraft antenna	24.0	dBic
Loss between HPA out and ant. Output	3.5	dB
Transmitter power output	10	watts
EIRP of satellite system	60.5	dBm

Ground Antenna

Ground ant. diameter	7.3	meters
Gain of ground antenna	53.0	dBic
System noise temperature	146.4	K (referenced at ant. output)
Ground Antenna G/T	31.3	dB/K
Approx. HPBW	0.36	degrees

ATTACHMENT D

LINK BUDGETS FOR INCLINED ORBITS

WV-L

TELEMETRY DOWNLINK CLEWISTON,FL

FREQUENCY	8.380 GHz	WAVELENGTH	0.036 METERS
POWER	3.0 WATTS	5 DEG SLANT RANGE	2931.8 KM
ALTITUDE	870 KM		
DATA	OQPSK	DATA RATE	544 KBPS
		MARGIN	5.6 dB

ANTENNA: NADIR

PARAMETER	UNITS	VALUE
TOTAL TRANSMIT POWER	dBm	34.8
PASSIVE LOSS	dB	-5.5
S/C ANTENNA GAIN	dBi	-2.0
FREE SPACE DISPERSION LOSS	dB	-179.6
ATMOSPHERIC LOSS	dB	-4.8
GROUND STATION G/T	dB/K	29.5
TOTAL RECEIVED POWER/T	dBm/K	-127.6
BOLTZMANN CONSTANT	dBm/(Hz·K)	-198.6
TOTAL RECEIVED POWER/KT	dBm/Hz	71.0
DATA CHANNEL		
DATA POWER/KT	dB·Hz	71.0
INFORMATION RATE 544 KBPS	dB·Hz	57.4
AVAILABLE Eb/No	dB	13.6
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	5.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	5.6

WV-L

TELEMETRY DOWNLINK CLEWISTON,FL

FREQUENCY	8.380 GHz	WAVELENGTH	0.036 METERS
POWER	3.0 WATTS	5 DEG SLANT RANGE	1944.5 KM
ALTITUDE	450 KM		
DATA	OQPSK	DATA RATE	544 KBPS
		MARGIN	5.6 dB

ANTENNA: NADIR

PARAMETER	UNITS	VALUE
TOTAL TRANSMIT POWER	dBm	34.8
PASSIVE LOSS	dB	-5.5
S/C ANTENNA GAIN	dBi	-2.0
FREE SPACE DISPERSION LOSS	dB	-179.6
ATMOSPHERIC LOSS	dB	-4.8
GROUND STATION G/T	dB/K	29.5
TOTAL RECEIVED POWER/T	dBm/K	-127.6
BOLTZMANN CONSTANT	dBm/(Hz·K)	-198.6
TOTAL RECEIVED POWER/KT	dBm/Hz	71.0
DATA CHANNEL		
DATA POWER/KT	dB·Hz	71.0
INFORMATION RATE 544 KBPS	dB·Hz	57.4
AVAILABLE Eb/No	dB	13.6
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	5.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	5.6

WV-L

TELEMETRY DOWNLINK CLEWISTON,FL

FREQUENCY	8.380 GHz	WAVELENGTH	0.036 METERS
POWER	3.0 WATTS	5 DEG SLANT RANGE	2124.6 KM
ALTITUDE	518 KM		
DATA	OQPSK	DATA RATE	544 KBPS
		MARGIN	5.6 dB

ANTENNA: NADIR

PARAMETER	UNITS	VALUE
TOTAL TRANSMIT POWER	dBm	34.8
PASSIVE LOSS	dB	-5.5
S/C ANTENNA GAIN	dBi	-2.0
FREE SPACE DISPERSION LOSS	dB	-179.6
ATMOSPHERIC LOSS	dB	-4.8
GROUND STATION G/T	dB/K	29.5
TOTAL RECEIVED POWER/T	dBm/K	-127.6
BOLTZMANN CONSTANT	dBm/(Hz·K)	-198.6
TOTAL RECEIVED POWER/KT	dBm/Hz	71.0
DATA CHANNEL		
DATA POWER/KT	dB·Hz	71.0
INFORMATION RATE 544 KBPS	dB·Hz	57.4
AVAILABLE Eb/No	dB	13.6
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	5.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	5.6

WV-L

TELEMETRY DOWNLINK GREEN RIVER, WY

FREQUENCY	8.380 GHz	WAVELENGTH	0.036 METERS
POWER	3.0 WATTS	5 DEG SLANT RANGE	2931.8 KM
ALTITUDE	870 KM		
DATA	OQPSK	DATA RATE	544 KBPS
		MARGIN	10.6 dB

ANTENNA: NADIR

PARAMETER	UNITS	VALUE
TOTAL TRANSMIT POWER	dBm	34.8
PASSIVE LOSS	dB	-5.5
S/C ANTENNA GAIN	dBi	-2.0
FREE SPACE DISPERSION LOSS	dB	-180.3
ATMOSPHERIC LOSS	dB	-1.6
GROUND STATION G/T	dB/K	32.0
TOTAL RECEIVED POWER/T	dBm/K	-122.6
BOLTZMANN CONSTANT	dBm/(Hz·K)	-198.6
TOTAL RECEIVED POWER/KT	dBm/Hz	76.0
DATA CHANNEL		
DATA POWER/KT	dB·Hz	76.0
INFORMATION RATE 544 KBPS	dB·Hz	57.4
AVAILABLE Eb/No	dB	18.7
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	5.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	10.6

WV-L

TELEMETRY DOWNLINK GREEN RIVER, WY

FREQUENCY	8.380 GHz	WAVELENGTH	0.036 METERS
POWER	3.0 WATTS	5 DEG SLANT RANGE	1944.5 KM
ALTITUDE	450 KM		
DATA	OQPSK	DATA RATE	544 KBPS
		MARGIN	14.2 dB

ANTENNA: NADIR

PARAMETER	UNITS	VALUE
TOTAL TRANSMIT POWER	dBm	34.8
PASSIVE LOSS	dB	-5.5
S/C ANTENNA GAIN	dBi	-2.0
FREE SPACE DISPERSION LOSS	dB	-176.7
ATMOSPHERIC LOSS	dB	-1.6
GROUND STATION G/T	dB/K	32.0
TOTAL RECEIVED POWER/T	dBm/K	-119.0
BOLTZMANN CONSTANT	dBm/(Hz·K)	-198.6
TOTAL RECEIVED POWER/KT	dBm/Hz	79.6
DATA CHANNEL		
DATA POWER/KT	dB·Hz	79.6
INFORMATION RATE 544 KBPS	dB·Hz	57.4
AVAILABLE Eb/No	dB	22.2
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	5.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	14.2

WV-L

TELEMETRY DOWNLINK GREEN RIVER, WY

FREQUENCY	8.380 GHz	WAVELENGTH	0.036 METERS
POWER	3.0 WATTS	5 DEG SLANT RANGE	2124.6 KM
ALTITUDE	518 KM		
DATA	OQPSK	DATA RATE	544 KBPS
		MARGIN	13.4 dB

ANTENNA: NADIR

PARAMETER	UNITS	VALUE
TOTAL TRANSMIT POWER	dBm	34.8
PASSIVE LOSS	dB	-5.5
S/C ANTENNA GAIN	dBi	-2.0
FREE SPACE DISPERSION LOSS	dB	-177.5
ATMOSPHERIC LOSS	dB	-1.6
GROUND STATION G/T	dB/K	32.0
TOTAL RECEIVED POWER/T	dBm/K	-119.8
BOLTZMANN CONSTANT	dBm/(Hz·K)	-198.6
TOTAL RECEIVED POWER/KT	dBm/Hz	78.8
DATA CHANNEL		
DATA POWER/KT	dB·Hz	78.8
INFORMATION RATE 544 KBPS	dB·Hz	57.4
AVAILABLE Eb/No	dB	21.5
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	5.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	13.4

WV-L			CLEWISTON, FL		
COMMAND UPLINK			OMNI ANTENNA NOMINAL		
DigitalGlobe					
FREQUENCY	2085.6875 GHz				
UPLINK	53.0 dBW EIRP		WAVELENGTH	0.144	METERS
ALTITUDE	870 KM		5 DEG SLANT RANGE	2931.8	KM
			DATA RATE	64	KBPS
CMD MOD INDEX	1.57		MARGIN	13.6	dB

ANTENNA: OMNI NOMINAL +/- 90 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	53.0
FREE SPACE DISPERSION LOSS	dB	-168.2
ATMOSPHERIC LOSS	dB	-1.5
S/C ANTENNA GAIN < +/- 90 DEG	dBi	-3.5
POLARIZATION LOSS	dB	-0.6
S/C LINE LOSS	dB	-5.1
TOTAL S/C RECEIVED POWER	dBm	-95.8
DATA CHANNEL		
DATA POWER/KT	dB-Hz	74.7
INFORMATION RATE	dB-Hz	48.1
AVAILABLE Eb/No	dB	26.6
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	0.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	13.6

WV-L			CLEWISTON, FL		
COMMAND UPLINK			OMNI ANTENNA NOMINAL		
DigitalGlobe					
FREQUENCY	2085.6875 GHz				
UPLINK	53.0 dBW EIRP		WAVELENGTH	0.144	METERS
ALTITUDE	450 KM		5 DEG SLANT RANGE	1944.5	KM
			DATA RATE	64	KBPS
CMD MOD INDEX	1.57		MARGIN	17.2	dB

ANTENNA: OMNI NOMINAL +/- 90 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	53.0
FREE SPACE DISPERSION LOSS	dB	-164.6
ATMOSPHERIC LOSS	dB	-1.5
S/C ANTENNA GAIN < +/- 90 DEG	dBi	-3.5
POLARIZATION LOSS	dB	-0.6
S/C LINE LOSS	dB	-5.1
TOTAL S/C RECEIVED POWER	dBm	-92.2
DATA CHANNEL		
DATA POWER/KT	dB-Hz	78.2
INFORMATION RATE	dB-Hz	48.1
AVAILABLE Eb/No	dB	30.2
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	0.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	17.2

WV-L			CLEWISTON, FL		
COMMAND UPLINK			OMNI ANTENNA NOMINAL		
DigitalGlobe					
FREQUENCY	2085.6875 GHz				
UPLINK	53.0 dBW EIRP		WAVELENGTH	0.144	METERS
ALTITUDE	518 KM		5 DEG SLANT RANGE	2124.6	KM
			DATA RATE	64	KBPS
CMD MOD INDEX	1.57		MARGIN	16.4	dB

ANTENNA: OMNI NOMINAL +/- 90 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	53.0
FREE SPACE DISPERSION LOSS	dB	-165.4
ATMOSPHERIC LOSS	dB	-1.5
S/C ANTENNA GAIN < +/- 90 DEG	dBi	-3.5
POLARIZATION LOSS	dB	-0.6
S/C LINE LOSS	dB	-5.1
TOTAL S/C RECEIVED POWER	dBm	-93.0
DATA CHANNEL		
DATA POWER/KT	dB-Hz	77.5
INFORMATION RATE	dB-Hz	48.1
AVAILABLE Eb/No	dB	29.4
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	0.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	16.4

WV-L			GREEN RIVER, WY		
COMMAND UPLINK			OMNI ANTENNA NOMINAL		
DigitalGlobe					
FREQUENCY	2085.6875 GHz				
UPLINK	53.0 dBW EIRP		WAVELENGTH	0.144	METERS
ALTITUDE	870 KM		5 DEG SLANT RANGE	2931.8	KM
			DATA RATE	64	KBPS
CMD MOD INDEX	1.57		MARGIN	14.2	dB

ANTENNA: OMNI NOMINAL +/- 90 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	53.0
FREE SPACE DISPERSION LOSS	dB	-168.2
ATMOSPHERIC LOSS	dB	-0.9
S/C ANTENNA GAIN < +/- 90 DEG	dBi	-3.5
POLARIZATION LOSS	dB	-0.6
S/C LINE LOSS	dB	-5.1
TOTAL S/C RECEIVED POWER	dBm	-95.2
DATA CHANNEL		
DATA POWER/KT	dB-Hz	75.2
INFORMATION RATE	dB-Hz	48.1
AVAILABLE Eb/No	dB	27.2
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	0.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	14.2

WV-L			GREEN RIVER, WY		
COMMAND UPLINK			OMNI ANTENNA NOMINAL		
DigitalGlobe					
FREQUENCY	2085.6875 GHz				
UPLINK	53.0 dBW EIRP		WAVELENGTH	0.144	METERS
ALTITUDE	450 KM		5 DEG SLANT RANGE	1944.5	KM
			DATA RATE	64	KBPS
CMD MOD INDEX	1.57		MARGIN	17.7	dB

ANTENNA: OMNI NOMINAL +/- 90 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	53.0
FREE SPACE DISPERSION LOSS	dB	-164.6
ATMOSPHERIC LOSS	dB	-0.9
S/C ANTENNA GAIN < +/- 90 DEG	dBi	-3.5
POLARIZATION LOSS	dB	-0.6
S/C LINE LOSS	dB	-5.1
TOTAL S/C RECEIVED POWER	dBm	-91.7
DATA CHANNEL		
DATA POWER/KT	dB-Hz	78.8
INFORMATION RATE	dB-Hz	48.1
AVAILABLE Eb/No	dB	30.7
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	0.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	17.7

WV-L			GREEN RIVER, WY		
COMMAND UPLINK			OMNI ANTENNA NOMINAL		
DigitalGlobe					
FREQUENCY	2085.6875 GHz				
UPLINK	53.0 dBW EIRP		WAVELENGTH	0.144	METERS
ALTITUDE	518 KM		5 DEG SLANT RANGE	2124.6	KM
			DATA RATE	64	KBPS
CMD MOD INDEX	1.57		MARGIN	17.0	dB

ANTENNA: OMNI NOMINAL +/- 90 DEG

PARAMETER	UNIT	VALUE
UPLINK EIRP	dBW	53.0
FREE SPACE DISPERSION LOSS	dB	-165.4
ATMOSPHERIC LOSS	dB	-0.9
S/C ANTENNA GAIN < +/- 90 DEG	dBi	-3.5
POLARIZATION LOSS	dB	-0.6
S/C LINE LOSS	dB	-5.1
TOTAL S/C RECEIVED POWER	dBm	-92.4
DATA CHANNEL		
DATA POWER/KT	dB-Hz	78.0
INFORMATION RATE	dB-Hz	48.1
AVAILABLE Eb/No	dB	30.0
REQUIRED Eb/No 1.00E-6 BER	dB	10.5
CODING GAIN	dB	0.0
IMPLEMENTATION LOSS	dB	-2.5
AVAILABLE SIGNAL MARGIN	dB	17.0

WV-L

600 Mbps DATA RATE DOWNLINK ANALYSIS **CLEWISTON, FL**

Fo = 8.185 GHz **8PSK Modulation**

DOWNLINK PARAMETERS

Frequency	8.185	GHz
Orbit height in km	870	km
Local elevation above horizon	5	degrees
Data rate	600	Mbps
Bandwidth (baseband)	145.5	MHz
Spacecraft ant. EIRP at beam edge	60.5	dBm
Slant range	2931.8	km
Ground ant. G/T	31.1	dB/K
BER	3.00E-05	
Required Eb/No (without coding)	12.4	dB
Hardware imp. BER loss	2.5	dB

LINK CALCULATION:

TOTAL POWER TO GROUND:

Satellite EIRP	60.5	dBm
Path loss	-180.1	dB
Environment loss (rain, polarization, etc.)	-4.78	dB
Symbol rate to noise bandwidth ratio	1.38	dB

RECEIVER SENSITIVITY:

Required Eb/No	12.4	dB
Available Eb/No	17.6	dB
DOWNLINK MARGIN	2.7	dB

ANTENNA SIZES:

Spacecraft Antenna

Spacecraft antenna diameter	9.4	inches
Approx. HPBW	8.3	degrees
Gain of spacecraft antenna	24.0	dBic
Loss between HPA out and ant. Output	3.5	dB
Transmitter power output	10	watts
EIRP of satellite system	60.5	dBm

Ground Antenna

Ground ant. diameter	9.1	meters
Gain of ground antenna	54.9	dBic
System noise temperature	239.5	K (referenced at ant. output)
Ground Antenna G/T	31.1	dB/K
Approx. HPBW	0.29	degrees

WV-L

600 Mbps DATA RATE DOWNLINK ANALYSIS **CLEWISTON, FL**

Fo = 8.185 GHz **8PSK Modulation**

DOWNLINK PARAMETERS

Frequency	8.185	GHz
Orbit height in km	450	km
Local elevation above horizon	5	degrees
Data rate	600	Mbps
Bandwidth (baseband)	145.5	MHz
Spacecraft ant. EIRP at beam edge	60.5	dBm
Slant range	1944.5	km
Ground ant. G/T	31.1	dB/K
BER	3.00E-05	
Required Eb/No (without coding)	12.4	dB
Hardware imp. BER loss	2.5	dB

LINK CALCULATION:

TOTAL POWER TO GROUND:

Satellite EIRP	60.5	dBm
Path loss	-176.5	dB
Environment loss (rain, polarization, etc.)	-4.78	dB
Symbol rate to noise bandwidth ratio	1.38	dB

RECEIVER SENSITIVITY:

Required Eb/No	12.4	dB
Available Eb/No	21.2	dB
DOWNLINK MARGIN	6.3	dB

ANTENNA SIZES:

Spacecraft Antenna

Spacecraft antenna diameter	9.4	inches
Approx. HPBW	8.3	degrees
Gain of spacecraft antenna	24.0	dBic
Loss between HPA out and ant. Output	3.5	dB
Transmitter power output	10	watts
EIRP of satellite system	60.5	dBm

Ground Antenna

Ground ant. diameter	9.1	meters
Gain of ground antenna	54.9	dBic
System noise temperature	239.5	K (referenced at ant. output)
Ground Antenna G/T	31.1	dB/K
Approx. HPBW	0.29	degrees

WV-L

600 Mbps DATA RATE DOWNLINK ANALYSIS **CLEWISTON, FL**

Fo = 8.185 GHz **8PSK Modulation**

DOWNLINK PARAMETERS

Frequency	8.185	GHz
Orbit height in km	518	km
Local elevation above horizon	5	degrees
Data rate	600	Mbps
Bandwidth (baseband)	145.5	MHz
Spacecraft ant. EIRP at beam edge	60.5	dBm
Slant range	2124.6	km
Ground ant. G/T	31.1	dB/K
BER	3.00E-05	
Required Eb/No (without coding)	12.4	dB
Hardware imp. BER loss	2.5	dB

LINK CALCULATION:

TOTAL POWER TO GROUND:

Satellite EIRP	60.5	dBm
Path loss	-177.3	dB
Environment loss (rain, polarization, etc.)	-4.78	dB
Symbol rate to noise bandwidth ratio	1.38	dB

RECEIVER SENSITIVITY:

Required Eb/No	12.4	dB
Available Eb/No	20.4	dB
DOWNLINK MARGIN	5.5	dB

ANTENNA SIZES:

Spacecraft Antenna

Spacecraft antenna diameter	9.4	inches
Approx. HPBW	8.3	degrees
Gain of spacecraft antenna	24.0	dBic
Loss between HPA out and ant. Output	3.5	dB
Transmitter power output	10	watts
EIRP of satellite system	60.5	dBm

Ground Antenna

Ground ant. diameter	9.1	meters
Gain of ground antenna	54.9	dBic
System noise temperature	239.5	K (referenced at ant. output)
Ground Antenna G/T	31.1	dB/K
Approx. HPBW	0.29	degrees

WV-L

600 Mbps DATA RATE DOWNLINK ANALYSIS **GREEN RIVER, WY**

Fo = 8.185 GHz **8PSK Modulation**

DOWNLINK PARAMETERS

Frequency	8.185	GHz
Orbit height in km	870	km
Local elevation above horizon	5	degrees
Data rate	600	Mbps
Bandwidth (baseband)	145.5	MHz
Spacecraft ant. EIRP at beam edge	60.5	dBm
Slant range	2931.8	km
Ground ant. G/T	31.3	dB/K
BER	3.00E-05	
Required Eb/No (without coding)	12.4	dB
Hardware imp. BER loss	2.5	dB

LINK CALCULATION:

TOTAL POWER TO GROUND:

Satellite EIRP	60.5	dBm
Path loss	-180.1	dB
Environment loss (rain, polarization, etc.)	-1.71	dB
Symbol rate to noise bandwidth ratio	1.38	dB

RECEIVER SENSITIVITY:

Required Eb/No	12.4	dB
Available Eb/No	20.9	dB
DOWNLINK MARGIN	6.0	dB

ANTENNA SIZES:

Spacecraft Antenna

Spacecraft antenna diameter	9.4	inches
Approx. HPBW	8.3	degrees
Gain of spacecraft antenna	24.0	dBic
Loss between HPA out and ant. Output	3.5	dB
Transmitter power output	10	watts
EIRP of satellite system	60.5	dBm

Ground Antenna

Ground ant. diameter	7.3	meters
Gain of ground antenna	53.0	dBic
System noise temperature	146.4	K (referenced at ant. output)
Ground Antenna G/T	31.3	dB/K
Approx. HPBW	0.36	degrees

WV-L

600 Mbps DATA RATE DOWNLINK ANALYSIS **GREEN RIVER, WY**

Fo = 8.185 GHz **8PSK Modulation**

DOWNLINK PARAMETERS

Frequency	8.185	GHz
Orbit height in km	450	km
Local elevation above horizon	5	degrees
Data rate	600	Mbps
Bandwidth (baseband)	145.5	MHz
Spacecraft ant. EIRP at beam edge	60.5	dBm
Slant range	1944.5	km
Ground ant. G/T	31.3	dB/K
BER	3.00E-05	
Required Eb/No (without coding)	12.4	dB
Hardware imp. BER loss	2.5	dB

LINK CALCULATION:

TOTAL POWER TO GROUND:

Satellite EIRP	60.5	dBm
Path loss	-176.5	dB
Environment loss (rain, polarization, etc.)	-1.71	dB
Symbol rate to noise bandwidth ratio	1.38	dB

RECEIVER SENSITIVITY:

Required Eb/No	12.4	dB
Available Eb/No	24.5	dB
DOWNLINK MARGIN	9.6	dB

ANTENNA SIZES:

Spacecraft Antenna

Spacecraft antenna diameter	9.4	inches
Approx. HPBW	8.3	degrees
Gain of spacecraft antenna	24.0	dBic
Loss between HPA out and ant. Output	3.5	dB
Transmitter power output	10	watts
EIRP of satellite system	60.5	dBm

Ground Antenna

Ground ant. diameter	7.3	meters
Gain of ground antenna	53.0	dBic
System noise temperature	146.4	K (referenced at ant. output)
Ground Antenna G/T	31.3	dB/K
Approx. HPBW	0.36	degrees

WV-L

600 Mbps DATA RATE DOWNLINK ANALYSIS **GREEN RIVER, WY**

Fo = 8.185 GHz **8PSK Modulation**

DOWNLINK PARAMETERS

Frequency	8.185	GHz
Orbit height in km	518	km
Local elevation above horizon	5	degrees
Data rate	600	Mbps
Bandwidth (baseband)	145.5	MHz
Spacecraft ant. EIRP at beam edge	60.5	dBm
Slant range	2124.6	km
Ground ant. G/T	31.3	dB/K
BER	3.00E-05	
Required Eb/No (without coding)	12.4	dB
Hardware imp. BER loss	2.5	dB

LINK CALCULATION:

TOTAL POWER TO GROUND:

Satellite EIRP	60.5	dBm
Path loss	-177.3	dB
Environment loss (rain, polarization, etc.)	-1.71	dB
Symbol rate to noise bandwidth ratio	1.38	dB

RECEIVER SENSITIVITY:

Required Eb/No	12.4	dB
Available Eb/No	23.7	dB
DOWNLINK MARGIN	8.8	dB

ANTENNA SIZES:

Spacecraft Antenna

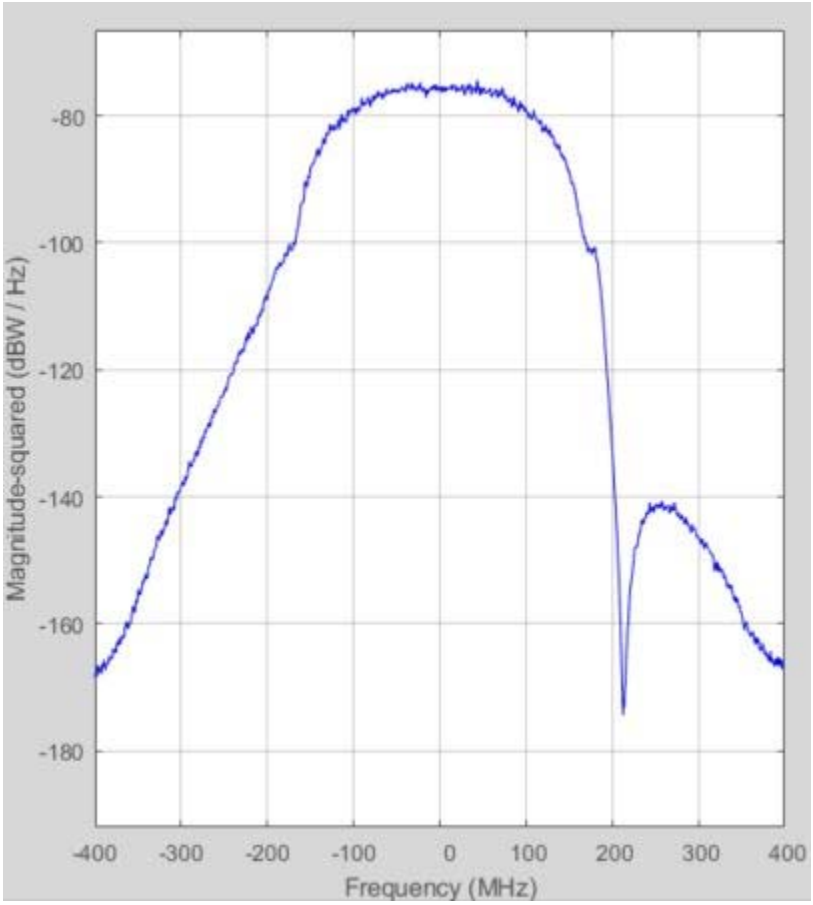
Spacecraft antenna diameter	9.4	inches
Approx. HPBW	8.3	degrees
Gain of spacecraft antenna	24.0	dBic
Loss between HPA out and ant. Output	3.5	dB
Transmitter power output	10	watts
EIRP of satellite system	60.5	dBm

Ground Antenna

Ground ant. diameter	7.3	meters
Gain of ground antenna	53.0	dBic
System noise temperature	146.4	K (referenced at ant. output)
Ground Antenna G/T	31.3	dB/K
Approx. HPBW	0.36	degrees

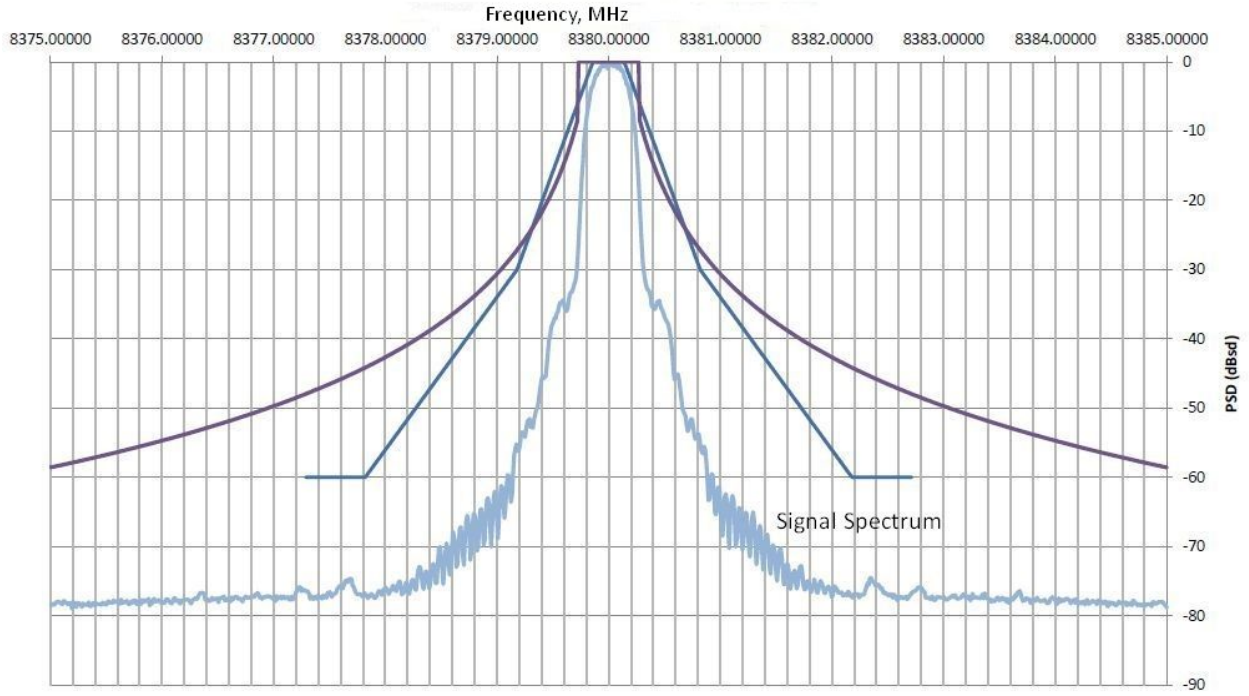
ATTACHMENT E

Wideband Downlink Spectrum*

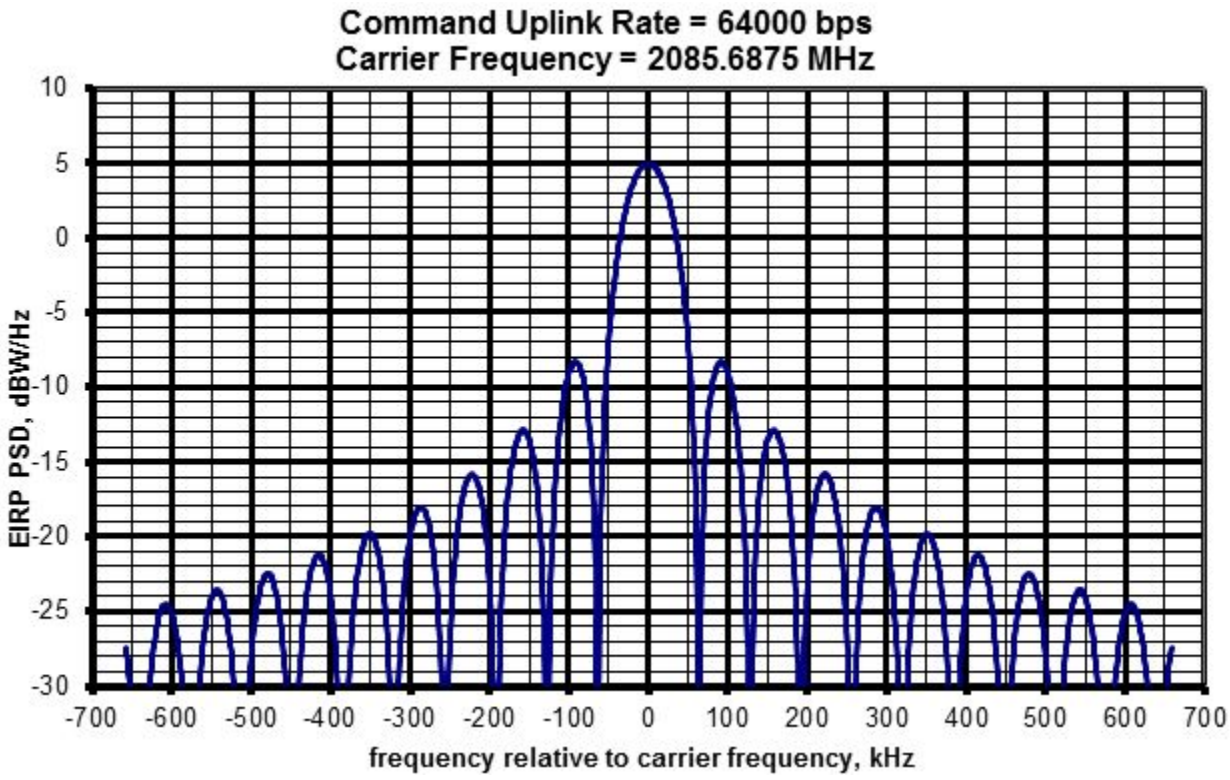


*Center frequency of signal is 8185 MHz.

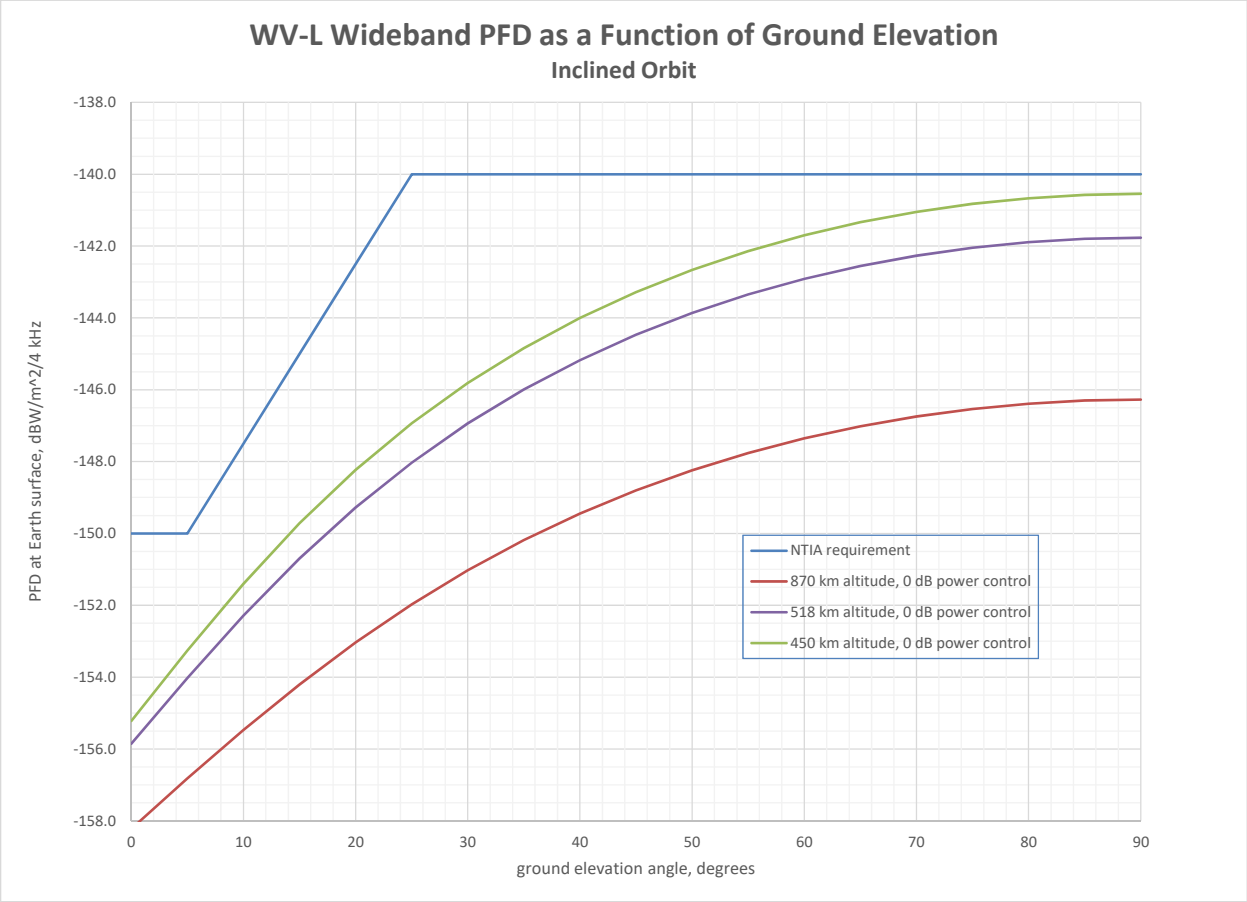
Narrowband Telemetry Downlink Spectrum

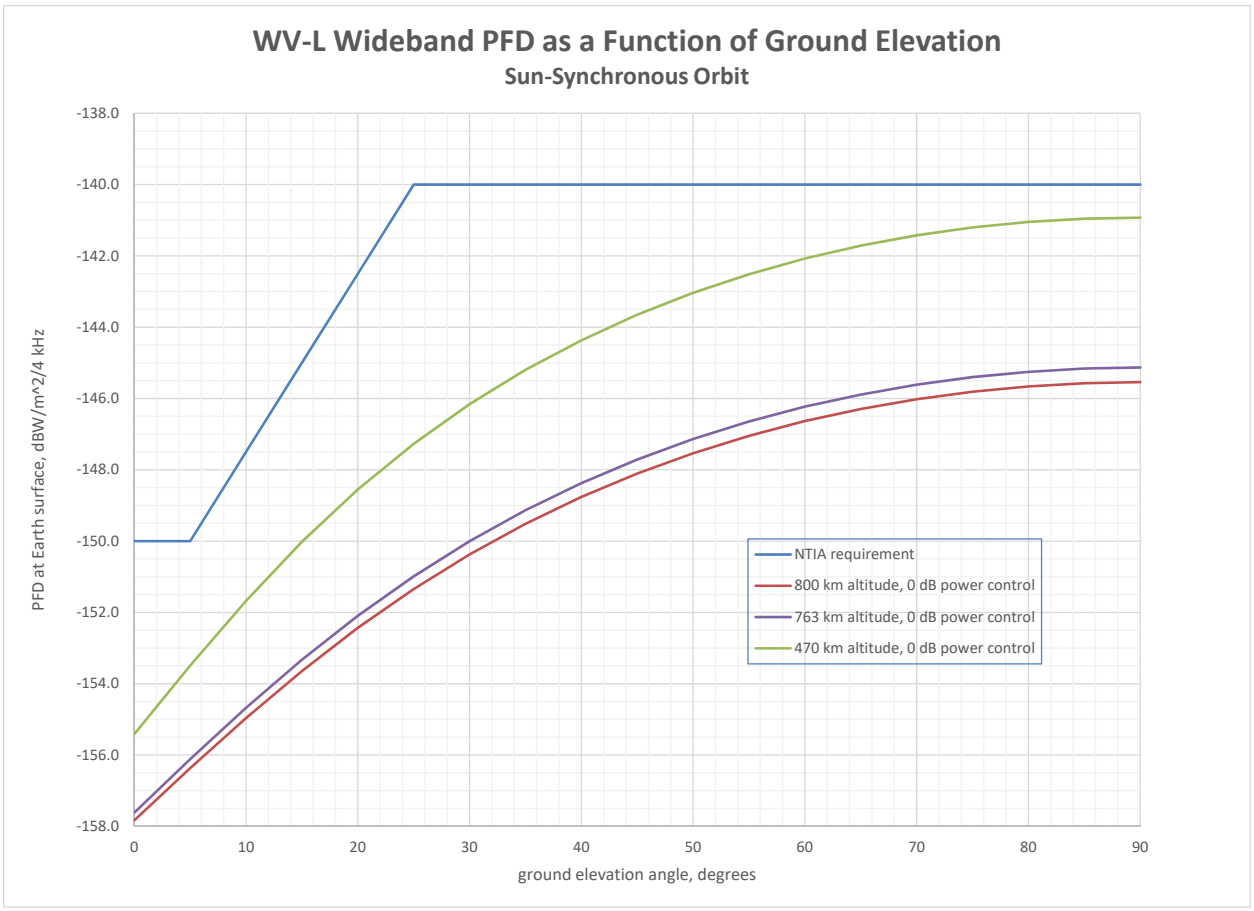


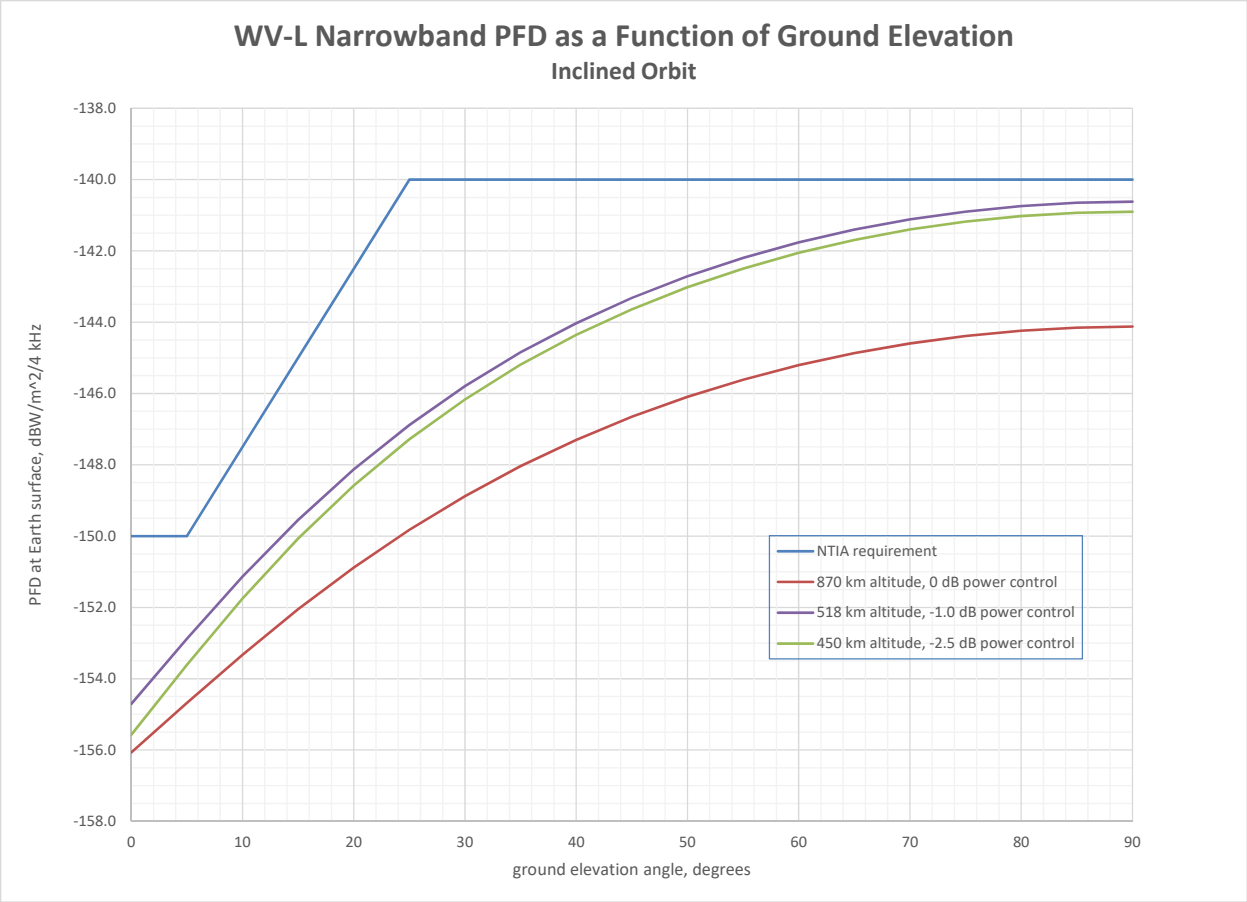
Command Uplink Spectrum

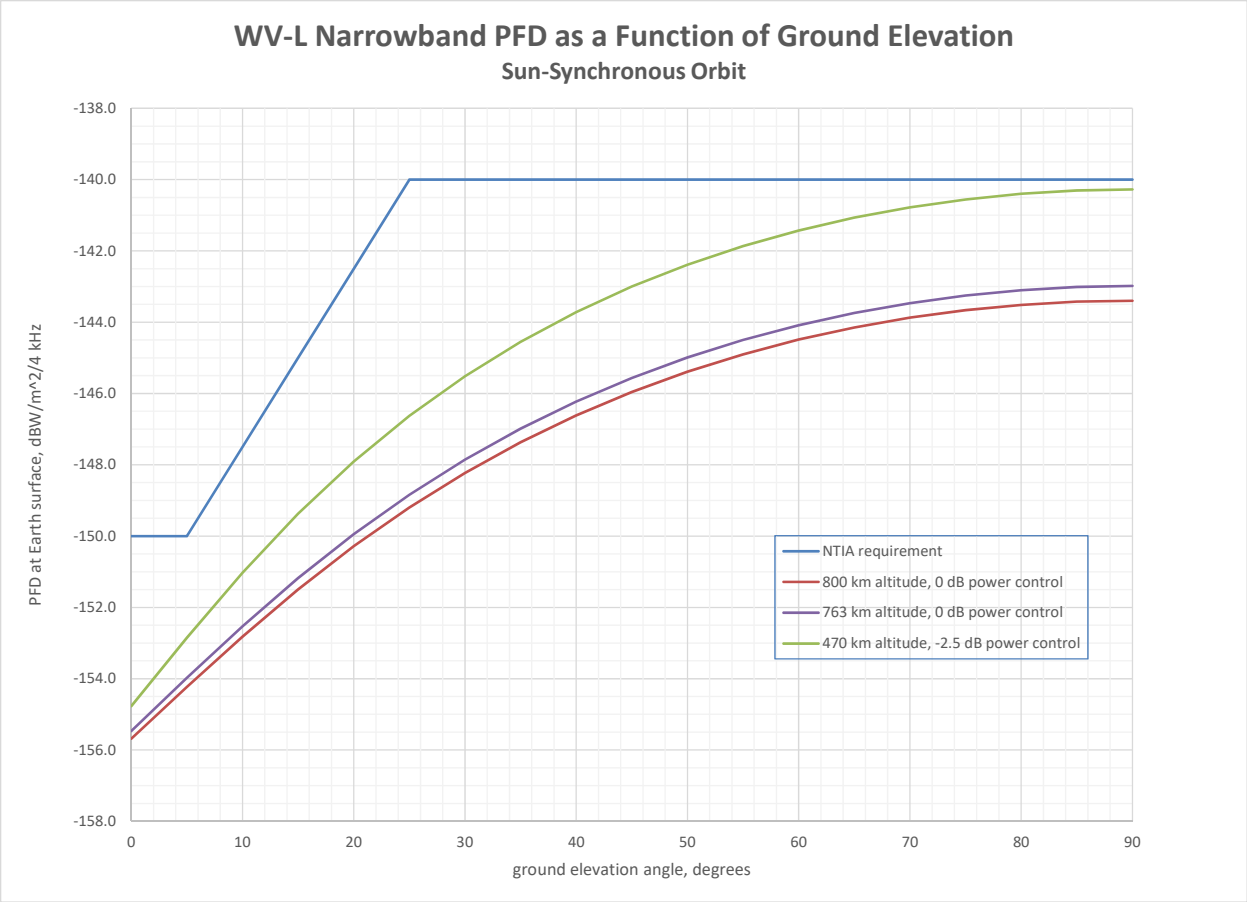


ATTACHMENT F




WV-L Wideband PFD as a Function of Ground Elevation
Sun-Synchronous Orbit
PFD at Earth surface, dBW/m^2/4 kHz
-138.0
-140.0
-142.0
-144.0
-146.0
-148.0
-150.0
-152.0
-154.0
-156.0
-158.0
0
10
20
30
40
50
60
70
80
90
ground elevation angle, degrees
NTIA requirement
800 km altitude, 0 dB power control
763 km altitude, 0 dB power control
470 km altitude, 0 dB power control


WV-L Narrowband PFD as a Function of Ground Elevation
Inclined Orbit
PFD at Earth surface, dBW/m^2/4 kHz
-138.0
-140.0
-142.0
-144.0
-146.0
-148.0
-150.0
-152.0
-154.0
-156.0
-158.0
0
10
20
30
40
50
60
70
80
90
ground elevation angle, degrees
NTIA requirement
870 km altitude, 0 dB power control
518 km altitude, -1.0 dB power control
450 km altitude, -2.5 dB power control


WV-L Narrowband PFD as a Function of Ground Elevation
Sun-Synchronous Orbit
PFD at Earth surface, dBW/m^2/4 kHz
-138.0
-140.0
-142.0
-144.0
-146.0
-148.0
-150.0
-152.0
-154.0
-156.0
-158.0
0
10
20
30
40
50
60
70
80
90
ground elevation angle, degrees
NTIA requirement
800 km altitude, 0 dB power control
763 km altitude, 0 dB power control
470 km altitude, -2.5 dB power control