

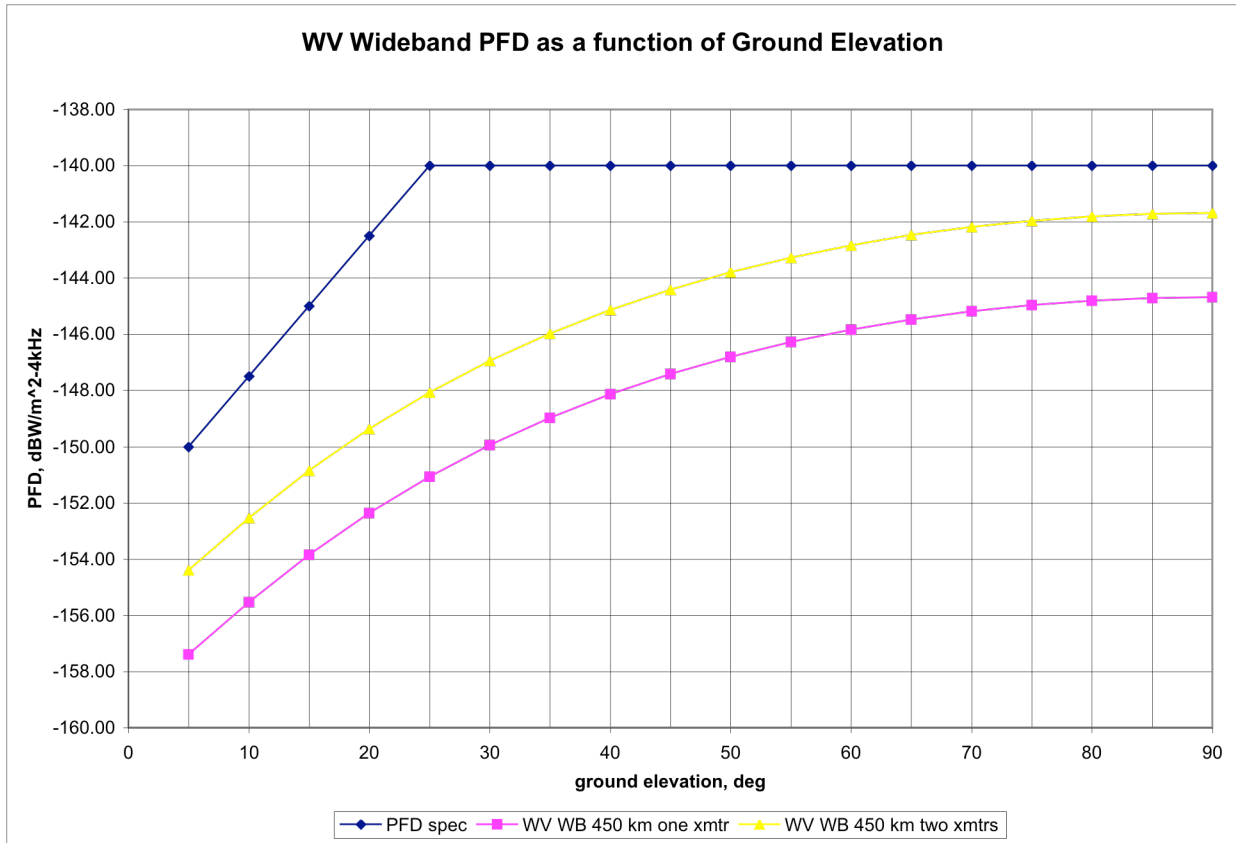
Attachment B

**Summary Information Related to DigitalGlobe
NGSO Remote Sensing Satellite System**

Appendix 1, Mission Data Downlink Analysis

400 MHz DATA RATE DOWNLINK ANALYSIS	
Fo = 8.185 GHz	
<u>DOWNLINK PARAMETERS:</u>	
Frequency	8.185 GHz
Orbit height in km	450 km
Local elevation above hor.	5 degrees
Data rate	400 Mbps
Bandwidth (baseband)	200 MHz
Spacecraft ant. EIRP at max scan	59.4 dBm
Slant range	1944.46 km
Ground ant. G/T	29.4 dB/K
BER	1.00E-06
Required Eb/No (without coding)	10.8 dB
Hardware imp. BER loss	-2.5 dB
<u>LINK CALCULATION:</u>	
<u>TOTAL POWER TO GROUND:</u>	
Satellite EIRP	59.4 dBm
Path loss	-176.5 dB
Total loss (rain, polarization, etc.)	-7.5 dB
<u>RECEIVER SENSITIVITY:</u>	
Required Eb/No	10.8 dB
Available Eb/No	14.9 dB
<u>DOWNLINK MARGIN</u>	4.1 dB
<u>ANTENNA SIZES:</u>	
<u>Spacecraft Antenna Segment</u>	
Spacecraft dish diameter	16 inches
Approx. HPBW	6.4 degrees
Gain of spacecraft antenna	28.0 dBic
Loss between HPA out and ant. input	-7.6 dB
Transmitter Po	8.0 watts
EIRP of satellite system	59.4 dBm
<u>Ground Antenna Segment</u>	
Ground antenna G/T	29.4 dB/K
System noise temperature	147.9 K (referenced at aperture)
Directivity gain ground antenna	51.1 dBic
Ground dish diameter	5.4 meters
Approx. HPBW	0.5 degrees

Appendix 2, Power Flux Density; Wideband Downlink



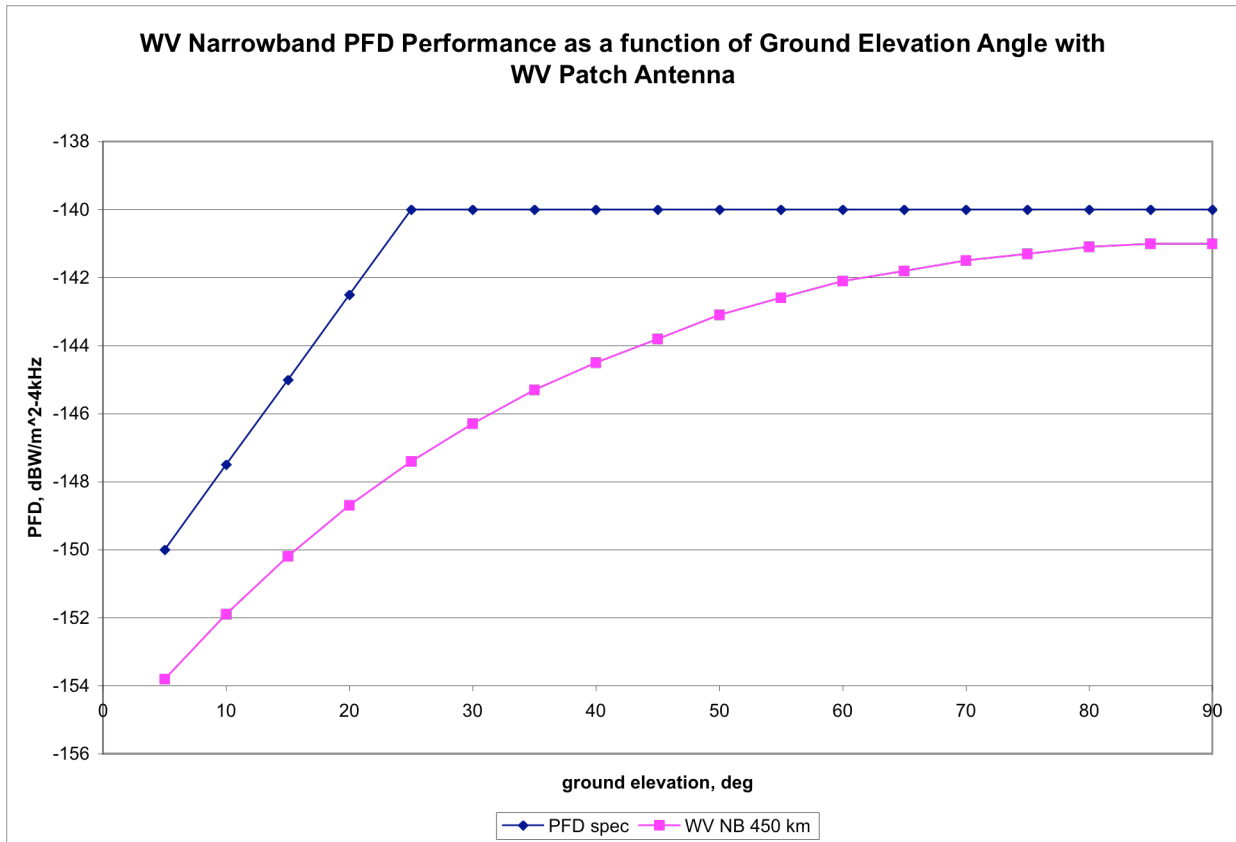
Appendix 3, S-Band Command Uplink Link Analysis

COMMAND UPLINK		OMNI ANTENNA NOMINAL	
EarthWatch			
FREQUENCY	2.0856875 GHz		
UPLINK	45.0 dBW EIRP	WAVELENGTH	0.14 METERS
ALTITUDE	450.0 KM	5 DEG SLANT RANGE	1944.5 KM
COMMAND DATA ON TONES		DATA RATE	KBPS
CMD MOD INDEX	1.0	MARGIN	dB
		CARRIER	8.4
		CMD	3.4
ANTENNA: OMNI NOMINAL +/- 75 DEG			
PARAMETER	UNIT	VALUE	
UPLINK EIRP	dBW	45.0	
FREE SPACE DISPERSION LOSS	dB	-164.6	
POINTING LOSS	dB	-0.5	
ATMOSPHERIC LOSS 42 mm/hr	dB	-0.4	
S/C ANTENNA GAIN < +/- 75 DEG	dBi	-16.0	
POLARIZATION LOSS	dB	-3.0	
S/C LINE LOSS	dB	-1.1	
TOTAL S/C RECEIVED POWER	dBm	-110.6	
CARRIER PERFORMANCE			
NET RECEIVED POWER	dBm	-110.6	
MIN CARRIER ACQUIS POWER	dBm	-119.0	
MARGIN CARRIER ACQUISITION	dB	8.4	
COMMAND CHANNEL PERFORMANCE (MI=1.0)			
NET RECEIVED POWER	dBm	-110.6	
MINIMUMCMD CHANNEL POWER	dBm	-114.0	
COMMAND DESIGN MARGIN	dB	3.4	

Appendix 4, Narrowband Downlink Link Analysis

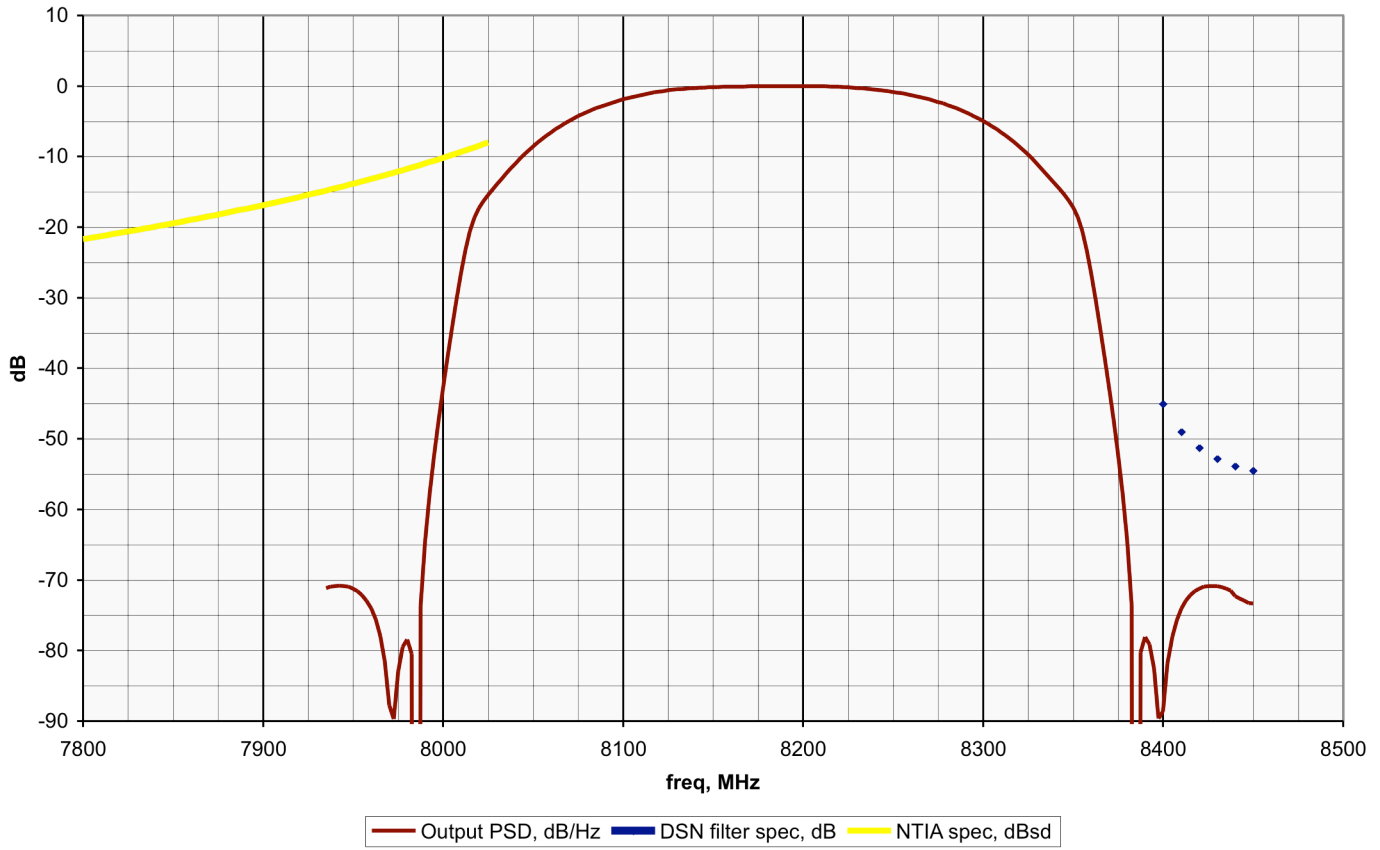
TELEMETRY DOWNLINK		R/T, PBK /NADIR	
FREQUENCY	8.38 GHz	WAVELENGTH	0.04 METERS
POWER	5.0 WATTS	5 DEG SLANT RANGE	1944.5 KM
ALTITUDE	450.0 KM		
REAL TIME DATA UQPSK I CHANNEL		DATA RATE	16.384 KBPS
PLAYBACK DATA UQPSK Q CHANNEL		DATA RATE	524.288 KBPS
		MARGIN	
		R/T	23.1 dB
		PBK	14.0 dB
ANTENNA: NADIR			
PARAMETER	UNITS	VALUE	
TOTAL TRANSMIT POWER	dBm	37.0	
PASSIVE LOSS	dB	-7.0	
S/C ANTENNA GAIN >+/-90 DEG	dBic	0.0	
FREE SPACE DISPERSION LOSS	dB	-176.7	
ATMOSPHERIC LOSS	dB	-1.0	
GROUND STATION G/T	dB/K	29.4	
TOTAL RECEIVED POWER/T	dBm/K	-118.3	
BOLTZMANN CONSTANT	dBm/Hz-K	-198.6	
TOTAL RECEIVED POWER/KT	dB-Hz	80.3	
DATA CHANNEL I (real time)			
DATA/TOTAL POWER	dB	-7.0	
DATA POWER/KT	dB-Hz	73.3	
INFORMATION RATE 16 KBPS	dB-Hz	42.1	
AVAILABLE S/N	dB	31.2	
REQUIRED Eb/No 1.00E-6 BER	dB	13.3	
CODING GAIN	dB	5.2	
AVAILABLE SIGNAL MARGIN	dB	23.1	
DATA CHANNEL Q (playback)			
DATA/TOTAL POWER	dB	-1.0	
DATA POWER/KT	dB-Hz	79.3	
INFORMATION RATE 512 KBPS	dB-Hz	57.2	
AVAILABLE S/N	dB	22.1	
REQUIRED Eb/No 1.00E-6 BER	dB	13.3	
CODING GAIN	dB	5.2	
AVAILABLE SIGNAL MARGIN	dB	14.0	

Appendix 5, Flux Density; Narrowband Downlink

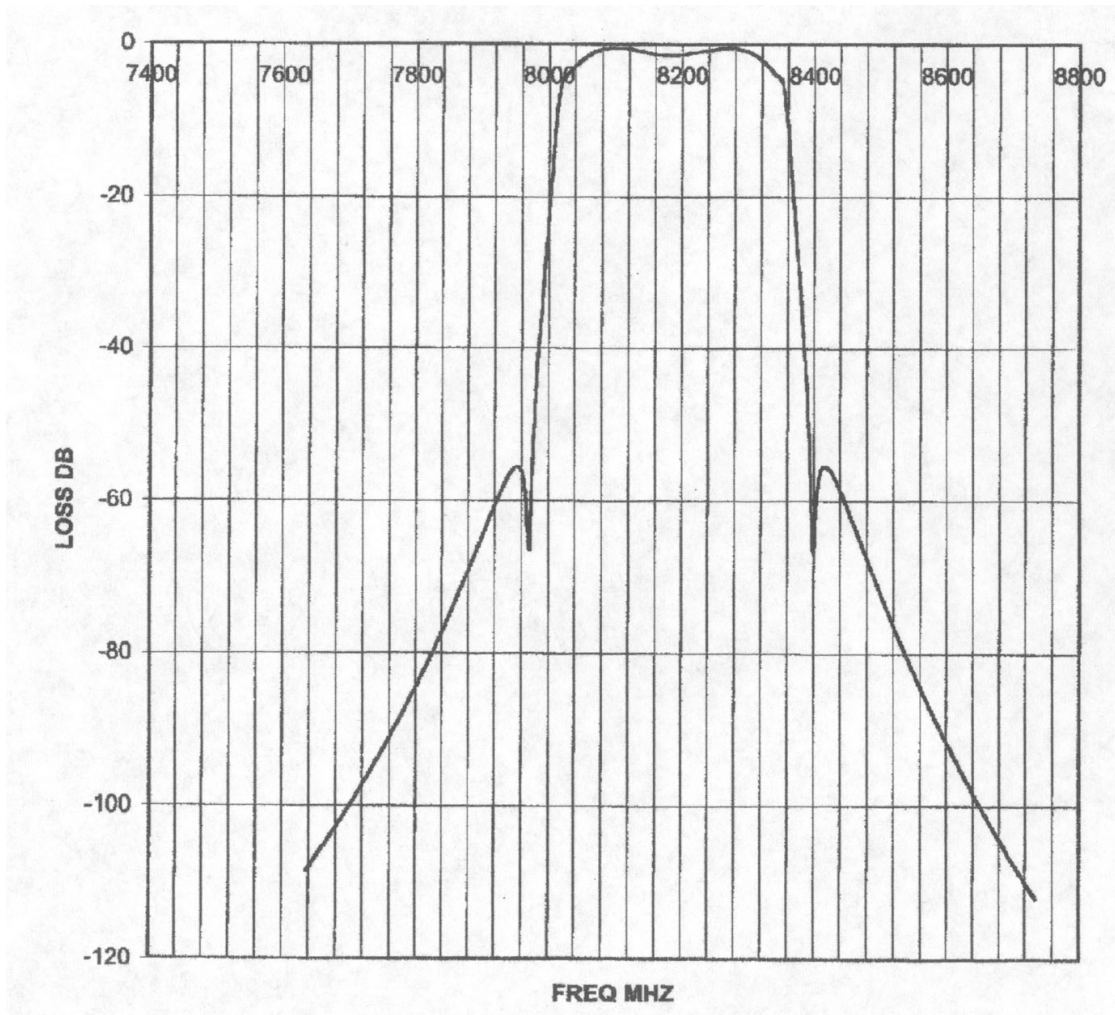


Appendix 6, WideBand vs Out of Band Specs

Filtered WideBand PSD vs Out of Band Spec



Filter Performance



Filter Description

Manufacturer: Aeroflex p/n FA4825

400 MSPS Transmit Filter

Technology is a 10 pole cross-coupled cavity combline filter utilizing all aluminum construction.

Input connector is SMA female. Output is WR112 waveguide

Filter shape (amplitude vs. frequency) is raised cosine with $x/\sin x$ peaking (Shape is optimized for best bit error rate performance)

Attenuation in stopband (deep-space) is 8400 MHz >45 dB increasing to >55 dB at 8450 MHz