

ECHOSTAR-6 Link Budgets			
Link Parameters	High Power Mode		
	1	2	3
	13 meter Feeder Link E/S Nominal Feeder Link Site	13 meter Feeder Link E/S Nominal Feeder Link Site	13 meter Feeder Link E/S Nominal Feeder Link Site
	to 45 cm Receive-Only	to 45 cm Receive-Only	to 45 cm Receive-Only
Modulation Parameters:			
Information Bit Rate per Carrier (kbps)	27,647	27,647	27,647
FEC Rate	3/4	3/4	3/4
Reed-Solomon Ratio (188/204, None)	188/204	188/204	188/204
Overall Coding Overhead (%)	44.7%	44.7%	44.7%
Modulation Type (BPSK/QPSK/8PSK/16QAM)	QPSK	QPSK	QPSK
Filter Roll-off Factor ("alpha") (%)	20	20	20
Link Geometry:			
Tx E/S City Location (name)	Cheyenne	Cheyenne	Cheyenne
Tx E/S Longitude ("East)	-104.7	-104.7	-104.7
Tx E/S Latitude ("North)	41.1	41.1	41.1
Tx E/S Range to Satellite (Km)	39,021	39,021	39,021
Tx E/S Elevation to Satellite (°)	25.5	25.5	25.5
Tx E/S Altitude (m)	1876.0	1876.0	1876.0
Rx E/S City Location (name)	Miami	New York	Chicago
Rx E/S Longitude ("East)	-80.3	-74.0	-87.8
Rx E/S Latitude ("North)	25.9	40.8	41.8
Rx E/S Range to Satellite (km)	36,876	37,689	38,192
Rx E/S Elevation to Satellite (°)	53.3	41.2	34.9
Rx E/S Altitude (m)	1.0	15.0	182.0
Uplink (per carrier):			
Carrier Frequency (MHz)	17,550	17,550	17,550
HPA Power Level (to give required PFD at satellite) (W)	67.1	67.1	67.1
HPA Power in dBW (dBW)	18.3	18.3	18.3
Post-HPA Losses (dB)	2.0	2.0	2.0
Tx E/S Power to Antenna in dBW (dBW)	16.3	16.3	16.3
Tx E/S Antenna Diameter (m)	13.0	13.0	13.0
Antenna Efficiency (%)	65	65	65
Tx E/S Antenna Gain (dB)	65.7	65.7	65.7
Tx E/S EIRP (dBW)	82.0	82.0	82.0
E/S Pointing Loss (dB)	0.1	0.1	0.1
Atmospheric Loss (dB)	0.44	0.44	0.44
Availability up (%)	99.9	99.9	99.9
Rain attenuation (dB)	3.9	3.9	3.9
Free Space Loss (dB)	209.2	209.2	209.2
Satellite:			
Resulting PFD at Satellite (dBW/m ²)	-85.3	-85.3	-85.3
Transponder Gain Setting (dB)	10	10	10
G/T towards Tx E/S (dB/K)	3.5	3.5	3.5
EIRP towards Rx E/S (dBW)	52.2	53.5	51.4
Downlink:			
Carrier Frequency (MHz)	12,450	12,450	12,450
Atmospheric Loss (dB)	0.09	0.11	0.13
Availability down (%)	99.8	99.9	99.9
Rain attenuation (dB)	3.50	2.60	2.80
E/S Pointing Loss (dB)	0.5	0.5	0.5
Free Space Loss (dB)	205.7	205.9	206.0
Rx E/S Antenna Diameter (m)	0.45	0.45	0.45
Rx E/S Antenna Gain (dB)	34.0	34.0	34.0
Rx E/S G/T (dB/K)	13.2	13.2	13.2
System (LNA+Sky) Noise Temp. (K)	120	120	120
Increase in Noise Temp due to rain (K)	150	120	127
Total Link:			
Carrier Noise Bandwidth (kHz)	24,000	24,000	24,000
(C/N) - Thermal Uplink (dB)	30.6	30.6	30.6
(C/N) - Thermal Downlink - CLEAR SKY (dB)	13.9	15.0	12.8
(C/N) - Thermal Downlink - RAIN DOWN (dB)	6.9	9.4	6.9
(C/I) - Other Link Degradations (dB)	20.0	20.0	20.0
(C/N) - Total Actual - CLEAR SKY (dB)	12.9	13.7	12.0
(C/N) - Total Actual - RAIN DOWN (dB)	6.7	9.0	6.6
(C/N) - Total Required (dB)	5.7	5.7	5.7
Excess Margin - CLEAR SKY (dB)	7.2	8.0	6.3
Excess Margin - RAIN DOWN (dB)	1.0	3.3	0.9