

# EchoStar-16 DBS Spot Beam Link Budgets

(QPSK)

Link Parameters		Bangor	Raleigh	Tampa Bay	Detroit	Nashville	Houston	Las Vegas	Puerto Rico	Mexico	Bermuda
<b>Link Geometry:</b>											
Tx E/S Range to Satellite	(km)	39,130	37,644	38,159	38,159	37,644	37,989	40,187	39,023	39,130	40,187
Rx E/S Range to Satellite	(km)	37,683	37,428	37,073	38,054	37,754	37,823	39,483	36,178	37,639	36,934
<b>Uplink (per carrier):</b>											
Carrier Frequency	(MHz)	17,500	17,500	17,500	17,500	17,500	17,500	17,500	17,500	17,500	17,500
Tx E/S Antenna Diameter	(m)	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
Tx E/S Power to Antenna	(dBW)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Tx E/S Antenna Gain	(dB)	65.8	65.8	65.8	65.8	65.8	65.8	65.8	65.8	65.8	65.8
Tx E/S EIRP per Carrier	(dBW)	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8
Atmospheric and Other Losses	(dB)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Free Space Loss	(dB)	209.2	208.8	208.9	208.9	208.8	208.9	209.4	209.1	209.2	209.4
<b>Satellite:</b>											
G/T towards Tx E/S	(dB/K)	12.7	12.3	12.7	12.7	12.3	14.0	13.6	11.7	12.7	13.6
Peak EIRP	(dBW)	55.1	59.4	59.5	58.1	60.4	61.1	58.0	57.8	56.7	54.9
EIRP towards Rx E/S	(dBW)	54.9	58.8	58.8	56.1	60.2	61.0	57.2	57.6	55.9	54.7
<b>Downlink (per carrier):</b>											
Carrier Frequency	(MHz)	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500
Atmospheric Losses	(dB)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Free Space Loss	(dB)	205.9	205.8	205.8	206.0	205.9	205.9	206.3	205.5	205.9	205.7
Rain Attenuation	(dB)	4.7	7.9	8.2	5.5	7.8	9.2	2.2	8.3	4.2	6.0
Rx E/S Antenna Diameter	(m)	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
Antenna Mis-pointing Error	(dB)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Rx E/S Antenna Gain	(dB)	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0
Rx E/S G/T	(dB/K)	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
Noise Temperature - Clear Sky	(K)	120	120	120	120	120	120	120	120	120	120
Noise Temperature - Rain	(K)	309	357	359	324	355	368	236	361	297	332
<b>Total Link:</b>											
Noise Bandwidth	(dB-Hz)	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8	73.8
(C/N) - Thermal Uplink	(dB)	31.8	31.8	32.1	32.1	31.8	33.4	32.5	30.9	31.8	32.5
(C/N) - Thermal Downlink - Clear Sky	(dB)	16.6	20.5	20.6	17.7	21.9	22.6	18.5	19.6	17.6	16.6
(C/N) - Thermal Downlink - Rain Down	(dB)	7.8	7.9	7.7	7.8	9.4	8.6	13.3	6.5	9.5	6.2
(C/I) - Adjacent Satellite Interference	(dB)	25.4	29.3	29.4	26.5	30.7	31.4	27.3	28.4	26.4	25.3
(C/I) - Other Link Degradations	(dB)	18.4	12.0	11.7	12.7	11.0	11.3	15.9	17.6	17.9	18.4
(C/N) - Clear Sky	(dB)	14.0	11.3	11.1	11.3	10.6	10.9	13.7	15.2	14.4	14.0
(C/N) - Rain Down	(dB)	7.3	6.4	6.2	6.6	7.1	6.7	11.3	6.2	8.8	5.9
(C/N) - Total Required	(dB)	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Downlink Margin - Clear Sky	(dB)	8.2	5.5	5.3	5.5	4.8	5.1	7.9	9.4	8.6	8.2
Downlink Margin - Rain Down	(dB)	1.5	0.6	0.4	0.8	1.3	0.9	5.5	0.4	3.0	0.1
Downlink Availability	(%)	99.98	99.98	99.97	99.98	99.98	99.98	99.99	99.96	99.99	99.96