

# EchoStar 17/24 GHz Link Budget

| Link Parameters                           |           | Clear Sky<br>(New York) | Faded D/L<br>(New York) | Clear Sky<br>(Los Angeles) | Faded D/L<br>(Los Angeles) |
|---|-----------|-------------------------|-------------------------|----------------------------|----------------------------|
| <b>Link Geometry:</b>                     |           |                         |                         |                            |                            |
| Tx E/S Range to Satellite (Cheyenne)      | (km)      | 37,621                  | 37,621                  | 37,621                     | 37,621                     |
| Rx E/S Range to Satellite                 | (km)      | 38,600                  | 38,600                  | 37,096                     | 37,096                     |
| <b>Uplink:</b>                            |           |                         |                         |                            |                            |
| Carrier Frequency                         | (MHz)     | 25,000                  | 25,000                  | 25,000                     | 25,000                     |
| Tx E/S Antenna Diameter                   | (m)       | 12.0                    | 12.0                    | 12.0                       | 12.0                       |
| Max. Tx E/S Power to Antenna              | (W)       | 4.7                     | 4.7                     | 4.7                        | 4.7                        |
| Max. Tx E/S Power Density to Antenna      | (dBW/MHz) | -6.9                    | -6.9                    | -6.9                       | -6.9                       |
| Tx E/S Antenna Gain                       | (dB)      | 68.2                    | 68.2                    | 68.2                       | 68.2                       |
| Tx E/S EIRP per Carrier                   | (dBW)     | 74.9                    | 74.9                    | 74.9                       | 74.9                       |
| Atmospheric and Other Losses              | (dB)      | 0.5                     | 0.5                     | 0.5                        | 0.5                        |
| Free Space Loss                           | (dB)      | 211.9                   | 211.9                   | 211.9                      | 211.9                      |
| <b>Satellite:</b>                         |           |                         |                         |                            |                            |
| G/T towards Tx E/S                        | (dB/K)    | 10.3                    | 10.3                    | 10.3                       | 10.3                       |
| EIRP per Carrier towards Rx E/S           | (dBW)     | 54.9                    | 54.9                    | 53.3                       | 53.3                       |
| <b>Downlink:</b>                          |           |                         |                         |                            |                            |
| Carrier Frequency                         | (MHz)     | 17,500                  | 17,500                  | 17,500                     | 17,500                     |
| Atmospheric and Other Losses              | (dB)      | 0.2                     | 3.0                     | 0.2                        | 2.2                        |
| Free Space Loss                           | (dB)      | 209.0                   | 209.0                   | 208.7                      | 208.7                      |
| Rx E/S Antenna Diameter                   | (m)       | 0.45                    | 0.45                    | 0.45                       | 0.45                       |
| Rx E/S Antenna Gain                       | (dB)      | 36.1                    | 36.1                    | 36.1                       | 36.1                       |
| Pointing Error                            | (dB)      | 0.5                     | 0.5                     | 0.5                        | 0.5                        |
| Rx E/S G/T                                | (dB/K)    | 13.1                    | 10.9                    | 13.1                       | 11.4                       |
| System (LNA+Sky) Noise Temperature        | (K)       | 200                     | 333                     | 200                        | 299                        |
| <b>Total Link:</b>                        |           |                         |                         |                            |                            |
| Bandwidth                                 | (dB-Hz)   | 73.60                   | 73.60                   | 73.60                      | 73.60                      |
| C/N - Thermal Uplink                      | (dB)      | 27.8                    | 27.8                    | 27.8                       | 27.8                       |
| C/N - Thermal Downlink                    | (dB)      | 13.3                    | 8.2                     | 12.0                       | 8.3                        |
| C/I - Aggregate uplink ASI                | (dB)      | 37.5                    | 37.5                    | 37.5                       | 37.5                       |
| C/I - Aggregate downlink ASI              | (dB)      | 18.4                    | 18.4                    | 20.2                       | 20.2                       |
| C/I - Other Link Degradations             | (dB)      | 20.0                    | 20.0                    | 20.0                       | 20.0                       |
| C/(N+I) - Total, Actual                   | (dB)      | 11.3                    | 7.5                     | 10.7                       | 7.7                        |
| C/(N+I) - Total, Required                 | (dB)      | 7.5                     | 7.5                     | 7.5                        | 7.5                        |
| Excess Margin                             | (dB)      | 3.8                     | 0.0                     | 3.2                        | 0.2                        |
| Availability                              | (%)       | N/A                     | 99.60                   | N/A                        | 99.90                      |
| <b>Aggregate Interference Assessment:</b> |           |                         |                         |                            |                            |
| (C/N) - no ASI                            | (dB)      | 12.3                    | 7.9                     | 11.3                       | 7.9                        |
| Degradation due to aggregate ASI          | (dB)      | 1.0                     | 0.4                     | 0.5                        | 0.3                        |