# EXHIBIT A

## Approach

Row 44's present implementation involves a single EIRP and skew-limit. Row 44 proposes to augment its operation by establishing four EIRP–skew limit combinations and 3 emission bandwidth combinations.

Table 1 depicts the present Row 44 authorization:

**Table 1 - Present Authorization**

| EIRP Limit (in a 1.024 MHz emission bandwidth) | Skew Limit |
|---|---|
| 38.8 dBW (14.7 dBW/ 4 kHz, 40.0 dBm TX power) | 35 degrees |

Table 2 depicts the proposed authorizations involving skew angle, EIRP density / TX power, and emission bandwidth:

**Table 2 - Proposed Authorization**

| EIRP Density and TX Power (1.024 MHz emission bandwidth) | EIRP Density and TX Power (2.048 MHz emission bandwidth) | EIRP Density and TX Power (4.096 MHz emission bandwidth) | Skew Limit |
|---|---|---|---|
| 16.2 dBW/ 4 kHz (41.5 dBm TX power) | 16.2 dBW/ 4 kHz (44.5 dBm TX power) | 13.7 dBW/ 4 kHz (45.0 dBm TX power) | 25 degrees |
| 14.7 dBW/ 4 kHz (40.0 dBm TX power) | 14.7 dBW/ 4 kHz (43.0 dBm TX power) | 13.7 dBW/ 4 kHz (45.0 dBm TX power) | 35 degrees |
| 13.7 dBW/ 4 kHz (39.0 dBm TX power) | 13.7 dBW/ 4 kHz (42.0 dBm TX power) | 13.7 dBW/ 4 kHz (45.0 dBm TX power) | 45 degrees |
| 11.9 dBW/ 4 kHz (37.2 dBm TX power) | 11.9 dBW/ 4 kHz (40.2 dBm TX power) | 11.9 dBW/ 4 kHz (43.2 dBm TX power) | 55 degrees |

Introducing the revised limits and emission bandwidths in Table 2 will allow:

(1) Row 44 to transmit at higher EIRP densities within geographic areas limiting skew to 25 degrees, facilitating higher inroute data rates for users / aircraft within those areas

(2) Row 44 to continue to transmit at existing EIRP densities (and facilitating existing data rates), within geographic areas where skew is limited to 35 degrees

(3) Row 44 to transmit at lower EIRP densities within geographic areas limiting skew to 45 and 55 degrees, thereby facilitating services for users / aircraft where data communications were previously unavailable

(4) Row 44 to transmit at a variety of combinations of EIRP and emission bandwidths, thereby optimizing bandwidth usage, and providing users higher data rates than those of the present.

In all cases of skew limits of 25, 35, 45, or 55 degrees, Row 44 shall comply with the EIRP density limits established in Section 25.227.

Table 3 depicts the proposed applicability of the Table 2 categories between satellites and skew angles:

**Table 3 – Applicability of Table 2 Skew-EIRP Limits**

| Satellite | 25 degrees | 35 degrees | 45 degrees | 55 degrees |
|---|---|---|---|---|
| SES-1 | yes | yes | yes | N/A |
| AMC-9 | yes | yes | yes | N/A |
| AMC-2 | yes | yes | yes | N/A |
| SES-6 | yes | yes | yes | yes |

This Exhibit also includes sample link budgets pertaining to each of the combinations of EIRP, emission bandwidth, skew limit, and satellite. These are located at the end of this Exhibit. Note that in all cases, the link budgets for 1.024 MHz emission bandwidths apply to those for 2.048 MHz as well, as the EIRP densities are the identical, and link performance subsequently the same.

# EIRP Density Plots

Horizontal Polarization; 1.024 and 2.048 MHz Bandwidths

The EIRP spectral densities shown in Figures C-1 to C-2, C-3 to C-4, and C-5 to C-6 for 14.05 GHz, 14.25 GHz, and 14.47 GHz respectively, all with horizontal polarization, indicate FCC co-polarization emission compliance according to FCC 25.227. Collectively, each plot addresses configurations of:

$25^0$ Skew:

41.5 dBm transmit power in a 1.024 MHz bandwidth, 44.5 dBm transmit power in a 2.048 MHz bandwidth

$35^0$ Skew:

40.0 dBm transmit power in a 1.024 MHz bandwidth, 43.0 dBm transmit power in a 2.048 MHz bandwidth

$45^0$ Skew:

39.0 dBm transmit power in a 1.024 MHz bandwidth, 42.0 dBm transmit power in a 2.048 MHz bandwidth

$55^0$ Skew:

37.2 dBm transmit power in a 1.024 MHz bandwidth, 40.2 dBm transmit power in a 2.048 MHz bandwidth

Figures C-1, C-3, and C-5 depict the EIRP spectral density in dBW/4kHz for a $\pm$10 degree azimuth axis along with the associated Section 25.227 compliance mask. Figures C-2, C-4, and C-6 depict the EIRP spectral density in dBW/4kHz for a $\pm$180 degree expanded azimuth axis along with the associated Section 25.227 compliance mask.

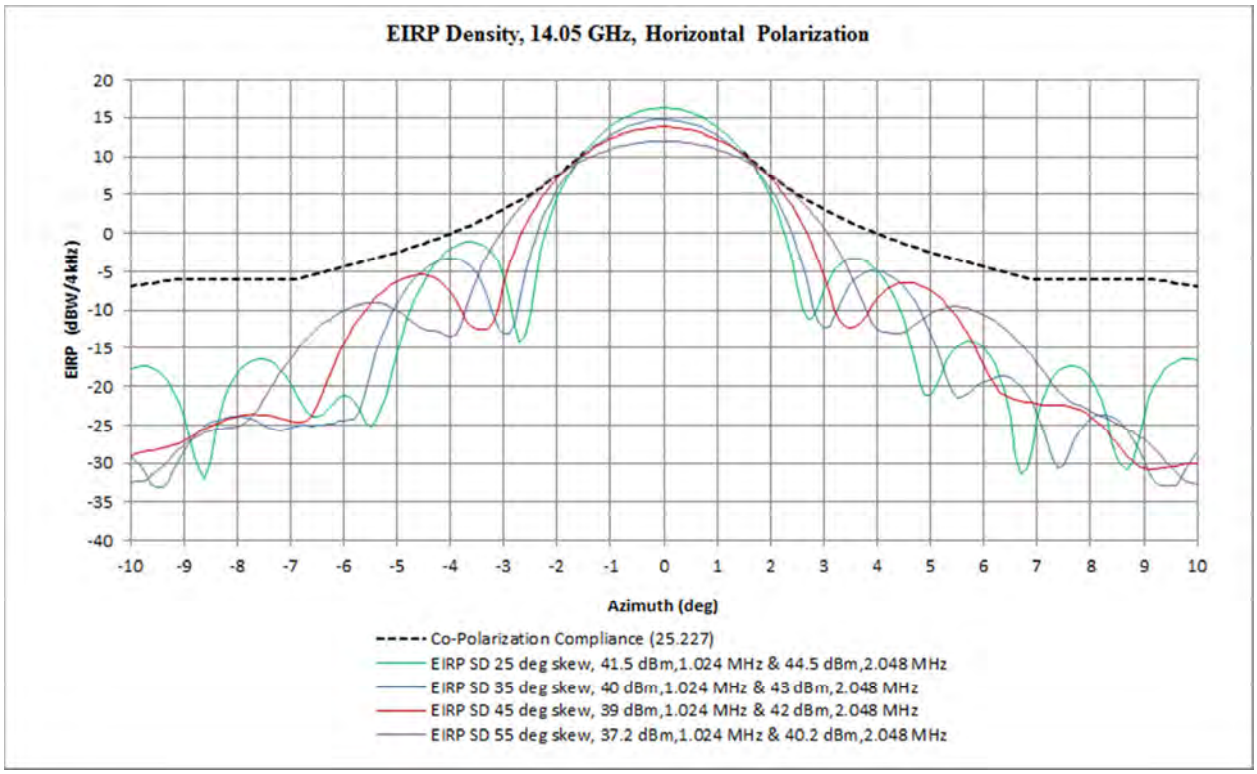


Figure C- 1 EIRP Spectral Density in dBW/4 kHz for 14.05 GHz (Horizontal Polarization) (25.227 Sidelobe Compliance)

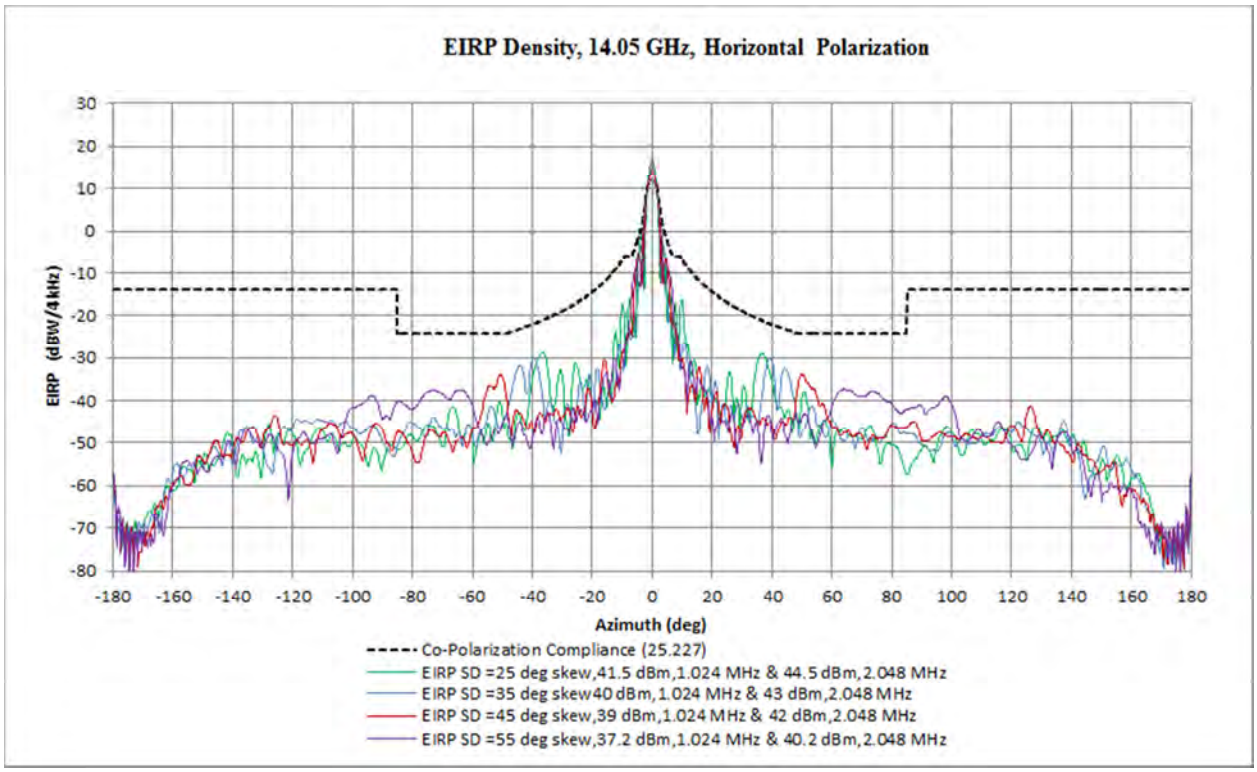


Figure C-2 EIRP Spectral Density in dBW/4 kHz for 14.05 GHz (Horizontal Polarization) (25.227 Expanded Azimuth)

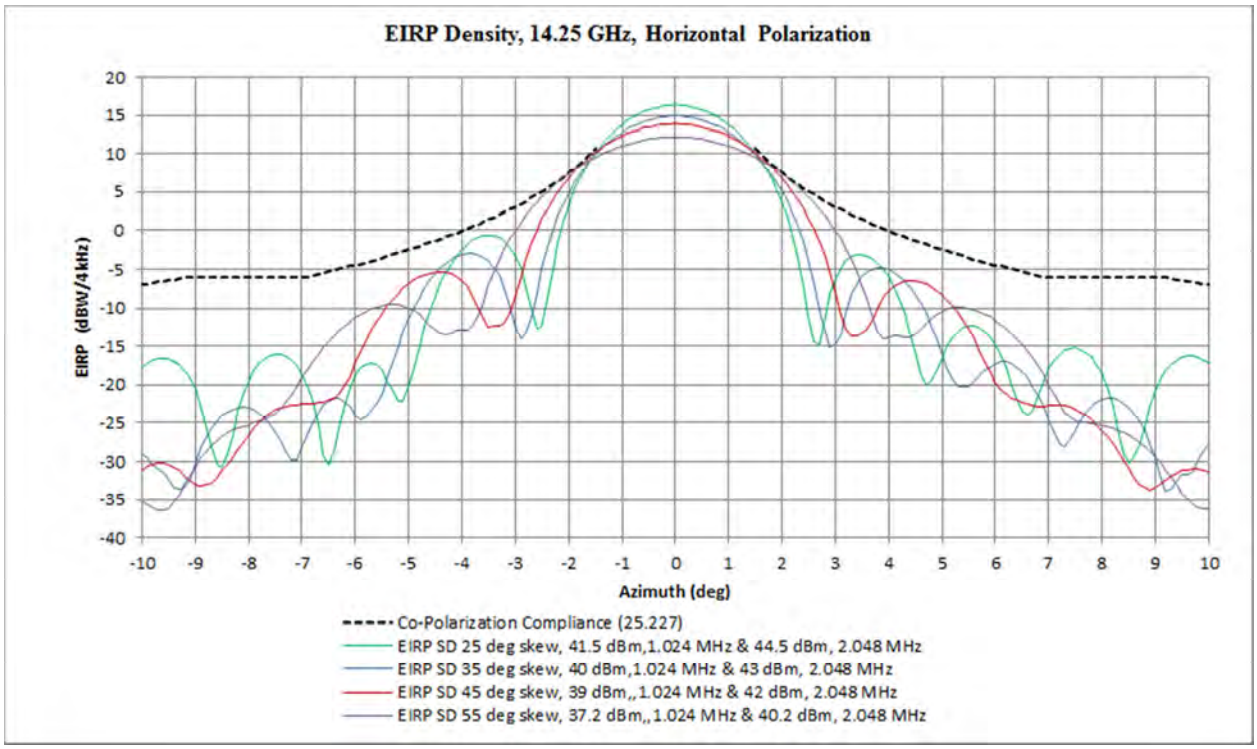


Figure C-3 EIRP Spectral Density in dBW/4 kHz for 14.25 GHz (Horizontal Polarization) (25.227 Sidelobe Compliance)

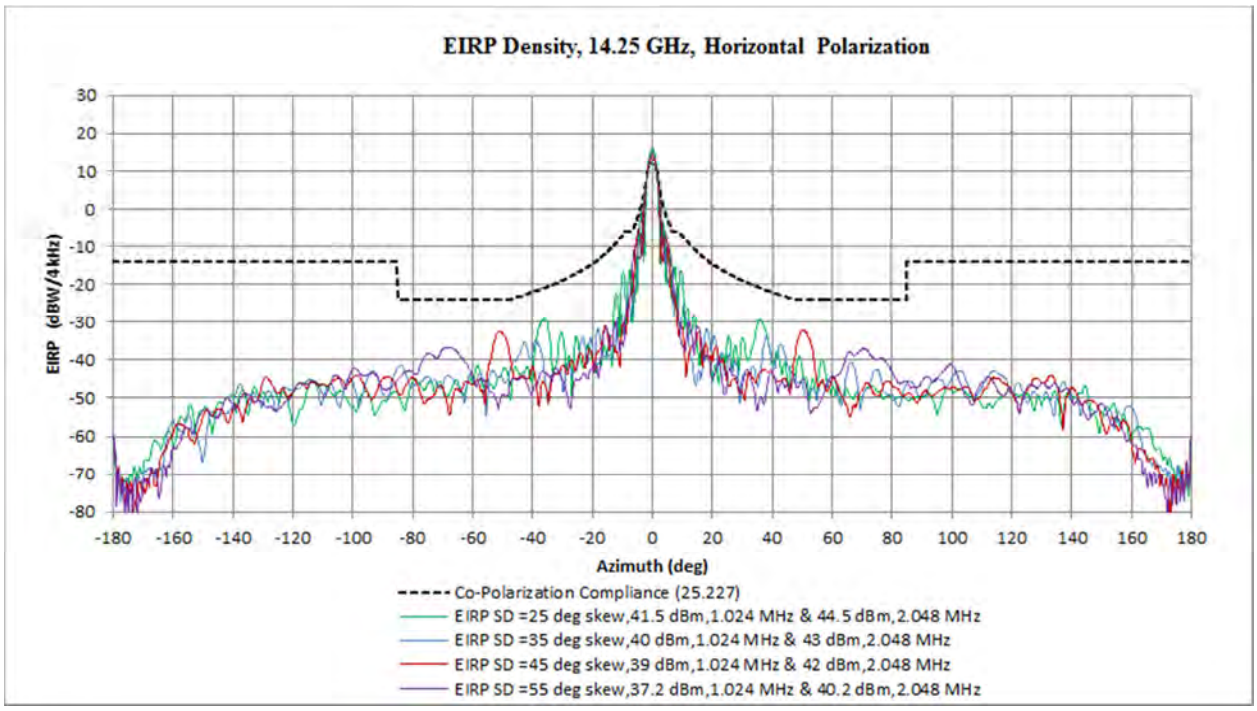


Figure C-4 EIRP Spectral Density in dBW/4 kHz for 14.25 GHz (Horizontal Polarization) (25.227 Expanded Azimuth)

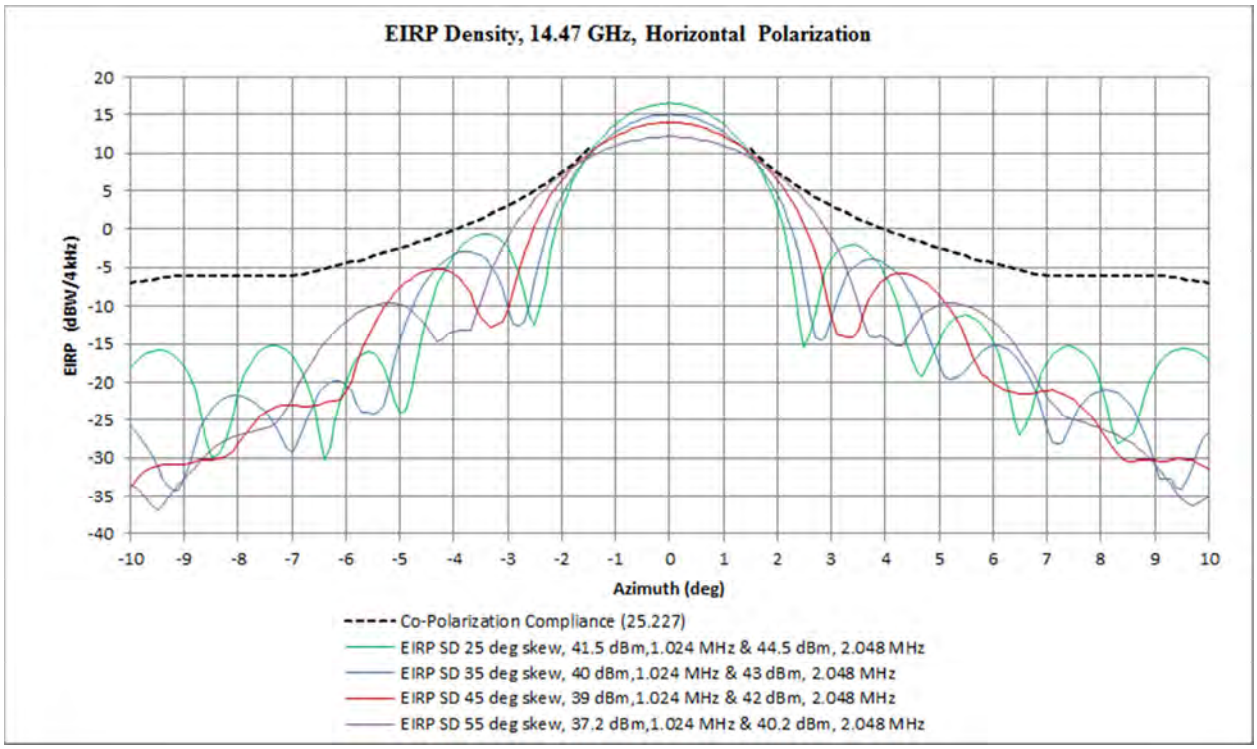


Figure C-5 EIRP Spectral Density in dBW/4 kHz for 14.47 GHz (Horizontal Polarization) (25.227 Sidelobe Compliance)

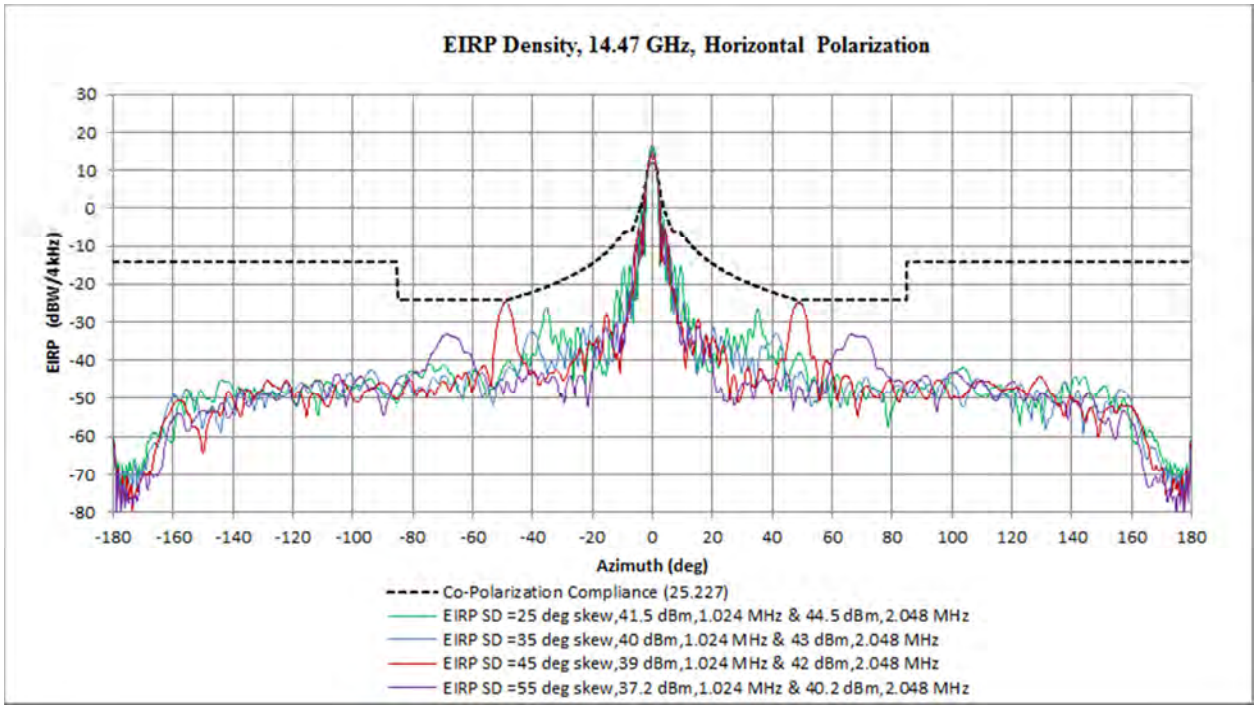


Figure C-6 EIRP Spectral Density in dBW/4 kHz for 14.47 GHz (Horizontal Polarization) (25.227 Expanded Azimuth)

Vertical Polarization; 1.024 and 2.048 MHz Bandwidths

The EIRP spectral densities shown in Figures C-7 to C-8, C-9 to C-10, and C-11 to C-12 for 14.05 GHz, 14.25 GHz, and 14.47 GHz respectively, all with vertical polarization, indicate FCC co-polarization emission compliance according to FCC 25.227. Collectively, each plot addresses configurations of:

$25^0$ Skew:

41.5 dBm transmit power in a 1.024 MHz bandwidth, 44.5 dBm transmit power in a 2.048 MHz bandwidth

$35^0$ Skew:

40.0 dBm transmit power in a 1.024 MHz bandwidth, 43.0 dBm transmit power in a 2.048 MHz bandwidth

$45^0$ Skew:

39.0 dBm transmit power in a 1.024 MHz bandwidth, 42.0 dBm transmit power in a 2.048 MHz bandwidth

$55^0$ Skew:

37.2 dBm transmit power in a 1.024 MHz bandwidth, 40.2 dBm transmit power in a 2.048 MHz bandwidth

Figures C-7, C-9, and C-11 depict the EIRP spectral density in dBW/4kHz for a $\pm$10 degree azimuth axis along with the associated Section 25.227 compliance mask. Figures C-8, C-10, and C-12 depict the EIRP spectral density in dBW/4kHz for a $\pm$180 degree expanded azimuth axis along with the associated Section 25.227 compliance mask.

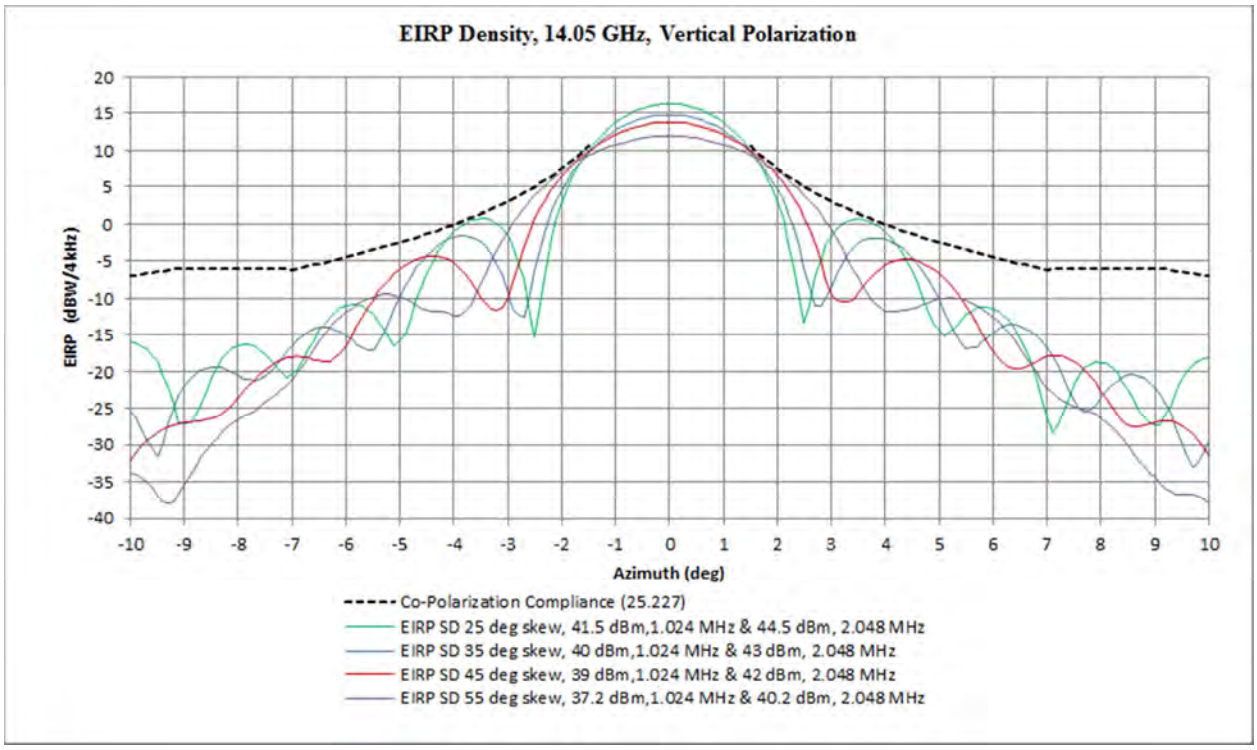


Figure C-7 EIRP Spectral Density in dBW/4 kHz for 14.05 GHz (Vertical Polarization) (25.227 Sidelobe Compliance)

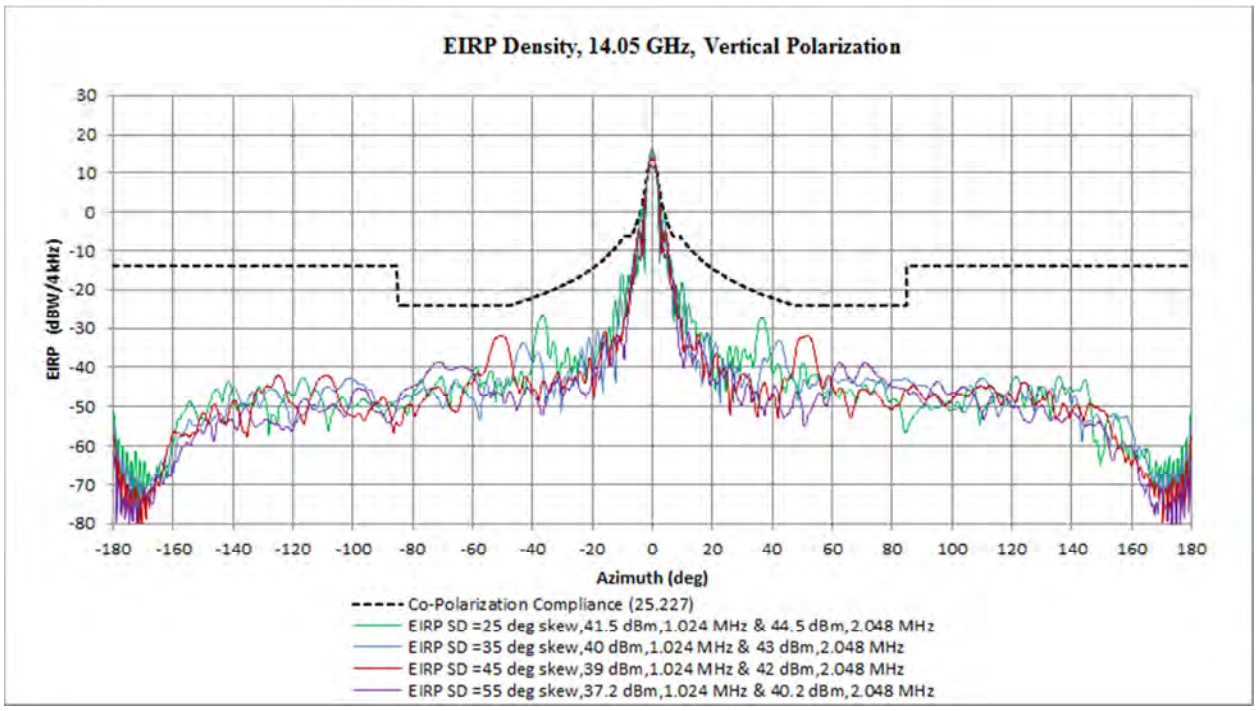


Figure C-8 EIRP Spectral Density in dBW/4 kHz for 14.05 GHz (Vertical Polarization) (25.227 Expanded Azimuth)

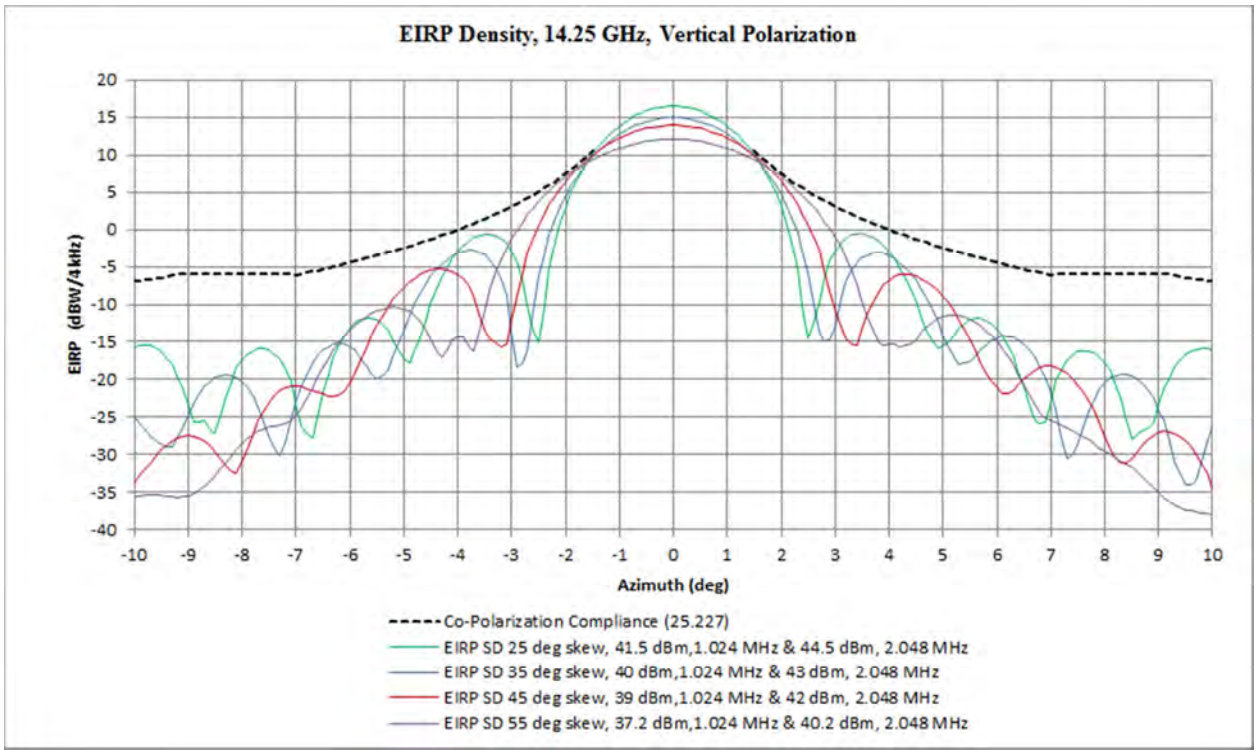


Figure C-9 EIRP Spectral Density in dBW/4 kHz for 14.25 GHz (Vertical Polarization) (25.227 Sidelobe Compliance)

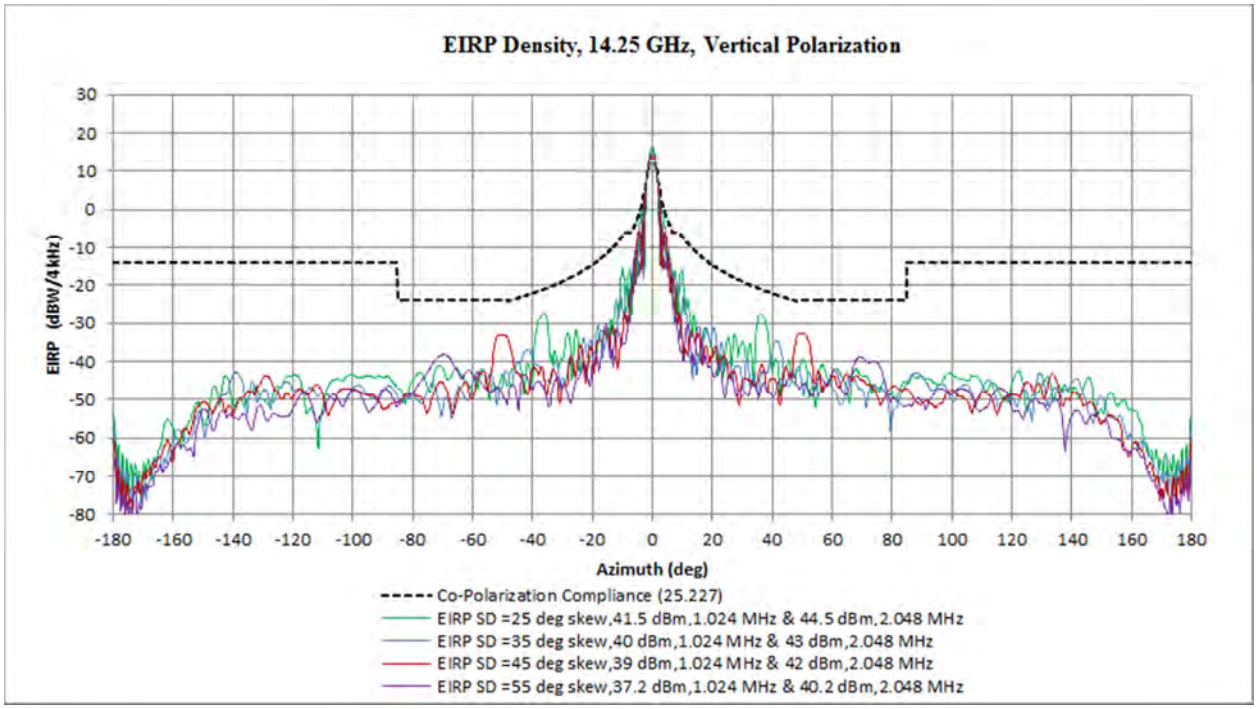


Figure C-10 EIRP Spectral Density in dBW/4 kHz for 14.25 GHz (Vertical Polarization) (25.227 Expanded Azimuth)

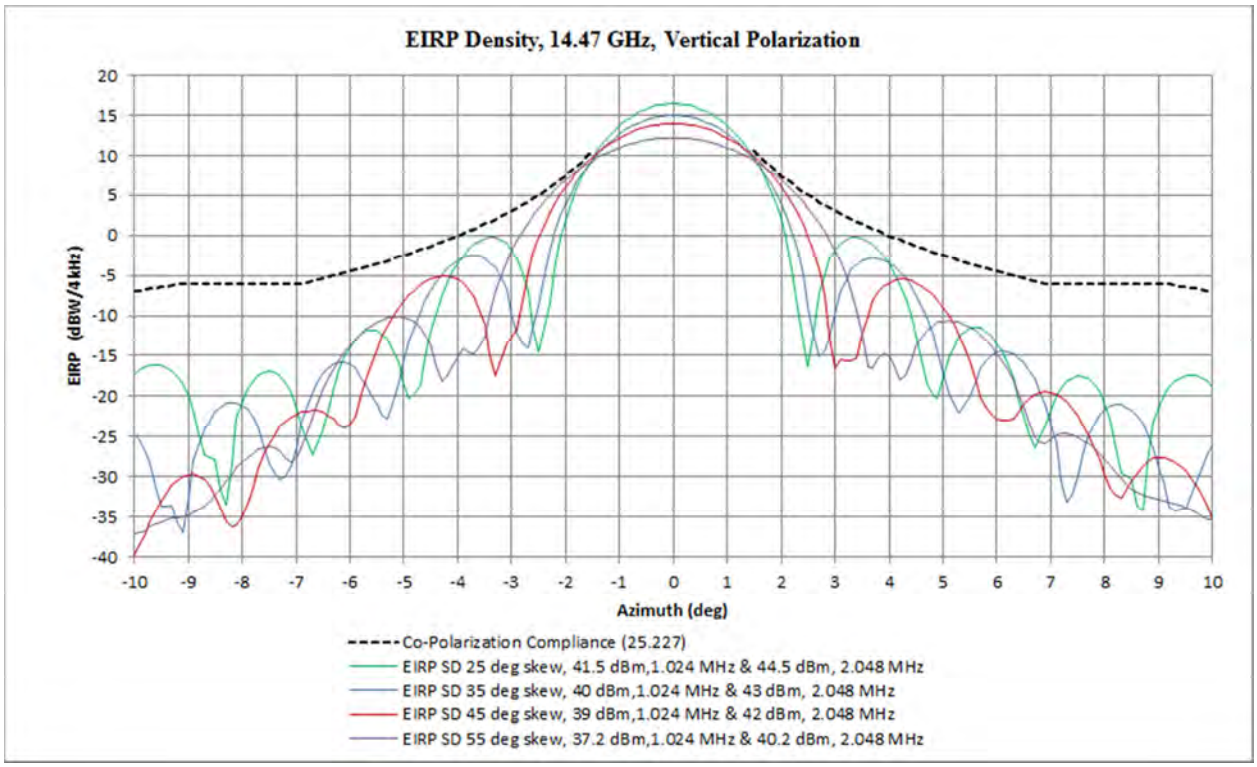


Figure C-11 EIRP Spectral Density in dBW/4 kHz for 14.47 GHz (Vertical Polarization) (25.227 Sidelobe Compliance)

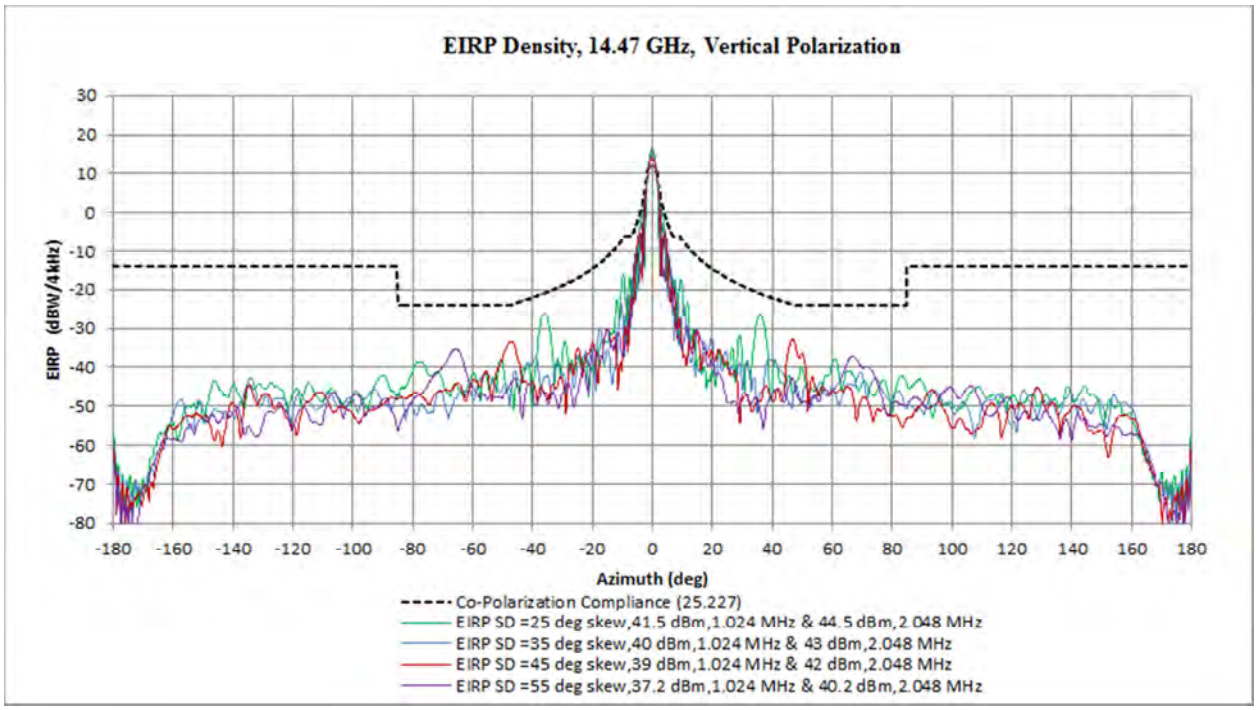


Figure C-12 EIRP Spectral Density in dBW/4 kHz for 14.47 GHz (Vertical Polarization) (25.227 Expanded Azimuth)

Horizontal Polarization; 4.096 MHz Bandwidth

The EIRP spectral densities shown in Figures C-13 to C-14, C-15 to C-16, and C-17 to C-18 for 14.05 GHz, 14.25 GHz, and 14.47 GHz respectively, all with horizontal polarization, indicate FCC co-polarization emission compliance according to FCC 25.227. The plots correspond to the following:

$25^0$ Skew:

45.0 dBm transmit power in a 4.096 MHz bandwidth

$35^0$ Skew:

45.0 dBm transmit power in a 4.096 MHz bandwidth

$45^0$ Skew:

45.0 dBm transmit power in a 4.096 MHz bandwidth

$55^0$ Skew:

43.2 dBm transmit power in a 4.096 MHz bandwidth

Figures C-13, C-15, and C-17 depict the EIRP spectral density in dBW/4kHz for a $\pm$10 degree azimuth axis along with the associated Section 25.227 compliance mask. Figures C-14, C-16, and C-18 depict the EIRP spectral density in dBW/4kHz for a $\pm$180 degree expanded azimuth axis along with the associated Section 25.227 compliance mask.

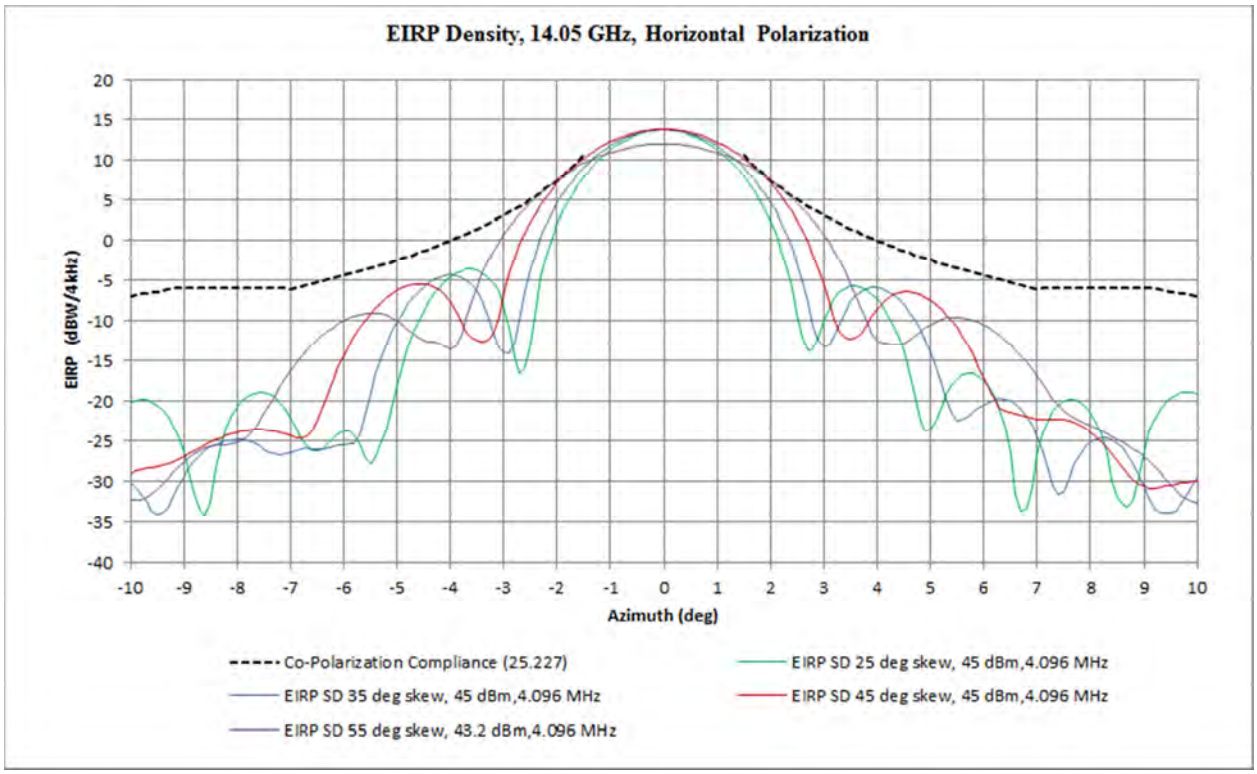


Figure C-13 EIRP Spectral Density in dBW/4 kHz for 14.05 GHz with 4.096 MHz (Horizontal Polarization) (25.227 Sidelobe Compliance)

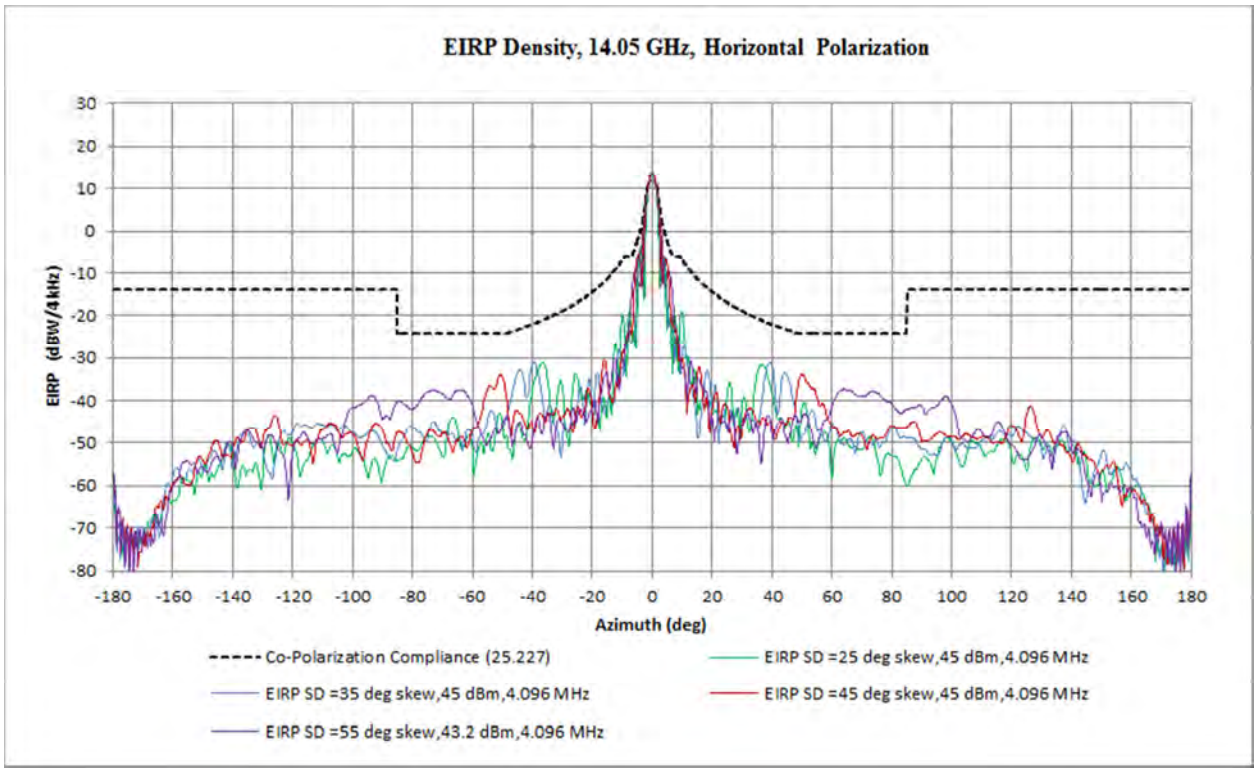


Figure C-14 EIRP Spectral Density in dBW/4 kHz for 14.05 GHz with 4.096 MHz (Horizontal Polarization) (25.227 Expanded Azimuth)

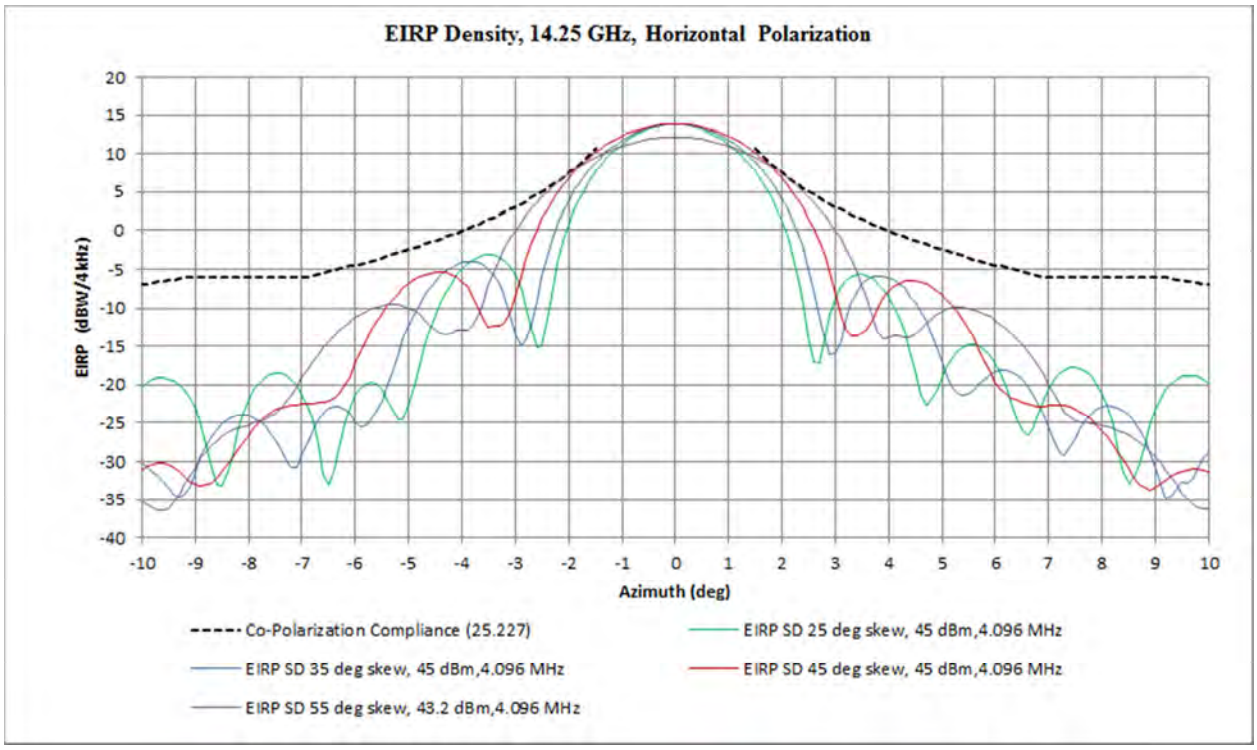


Figure C-15 EIRP Spectral Density in dBW/4 kHz for 14.25 GHz with 4.096 MHz (Horizontal Polarization) (25.227 Sidelobe Compliance)

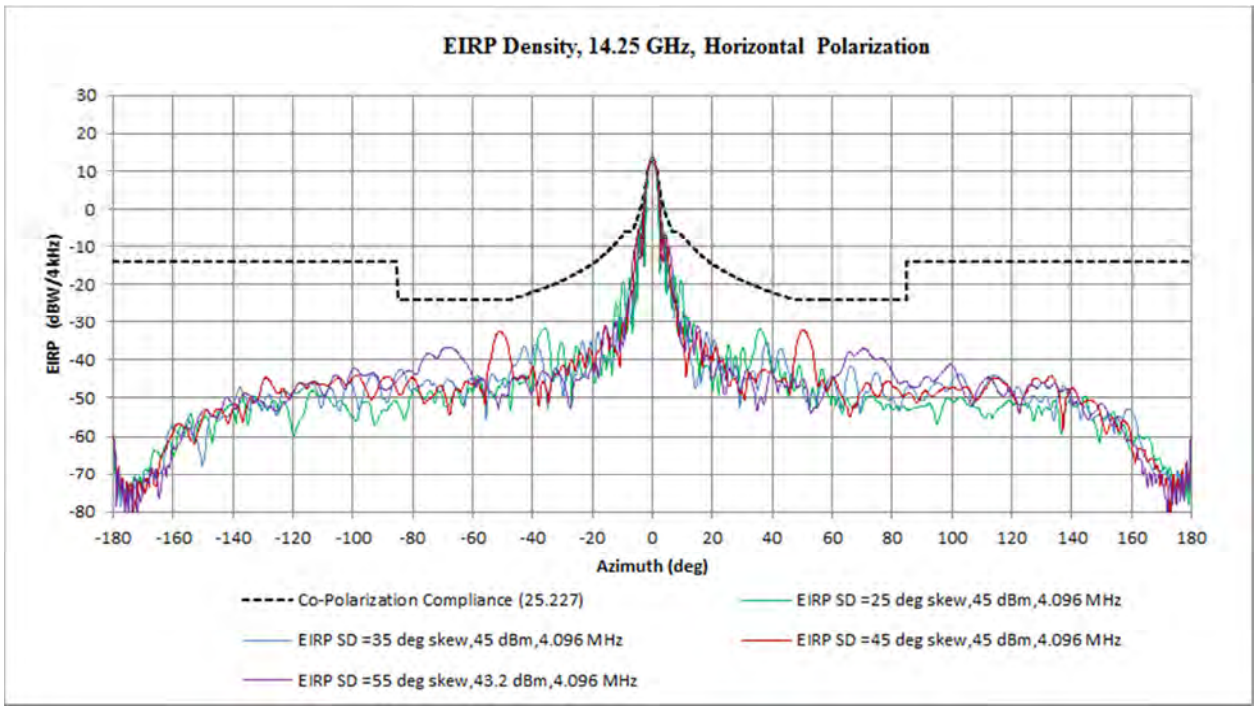


Figure C-16 EIRP Spectral Density in dBW/4 kHz for 14.25 GHz with 4.096 MHz (Horizontal Polarization) (25.227 Expanded Azimuth)

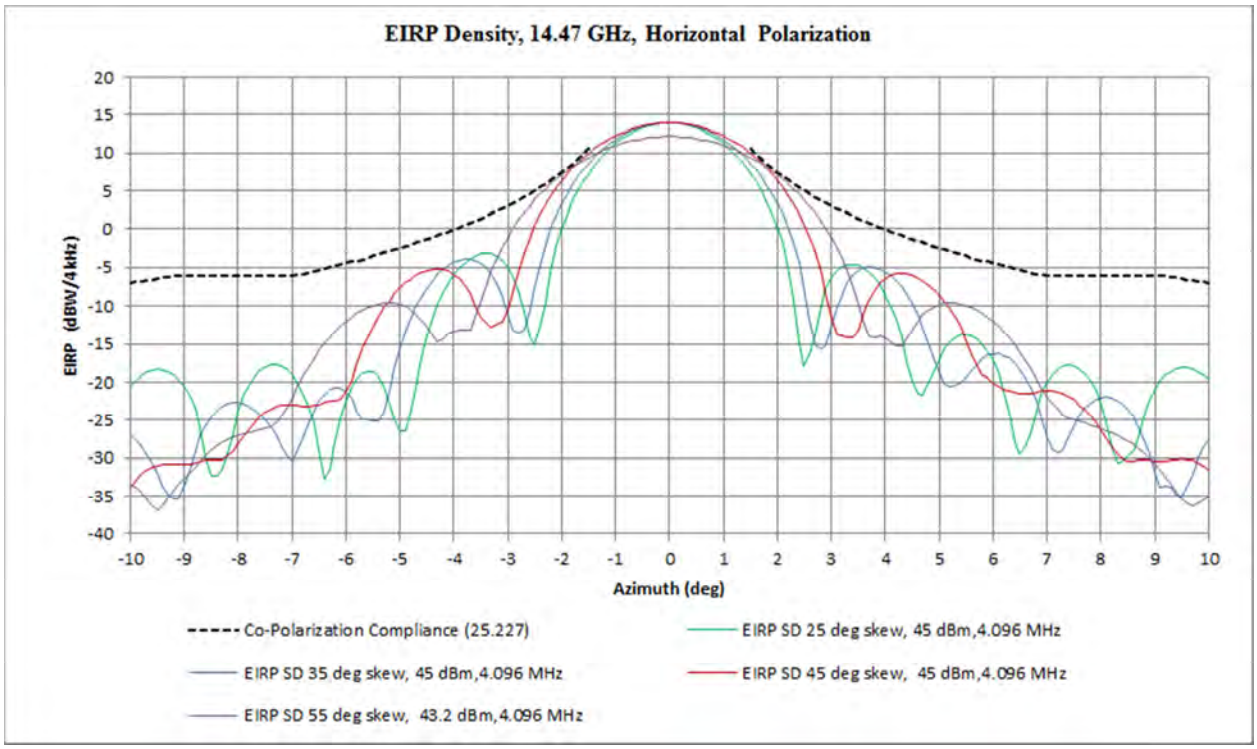


Figure C-17 EIRP Spectral Density in dBW/4 kHz for 14.47 GHz with 4.096 MHz (Horizontal Polarization) (25.227 Sidelobe Compliance)

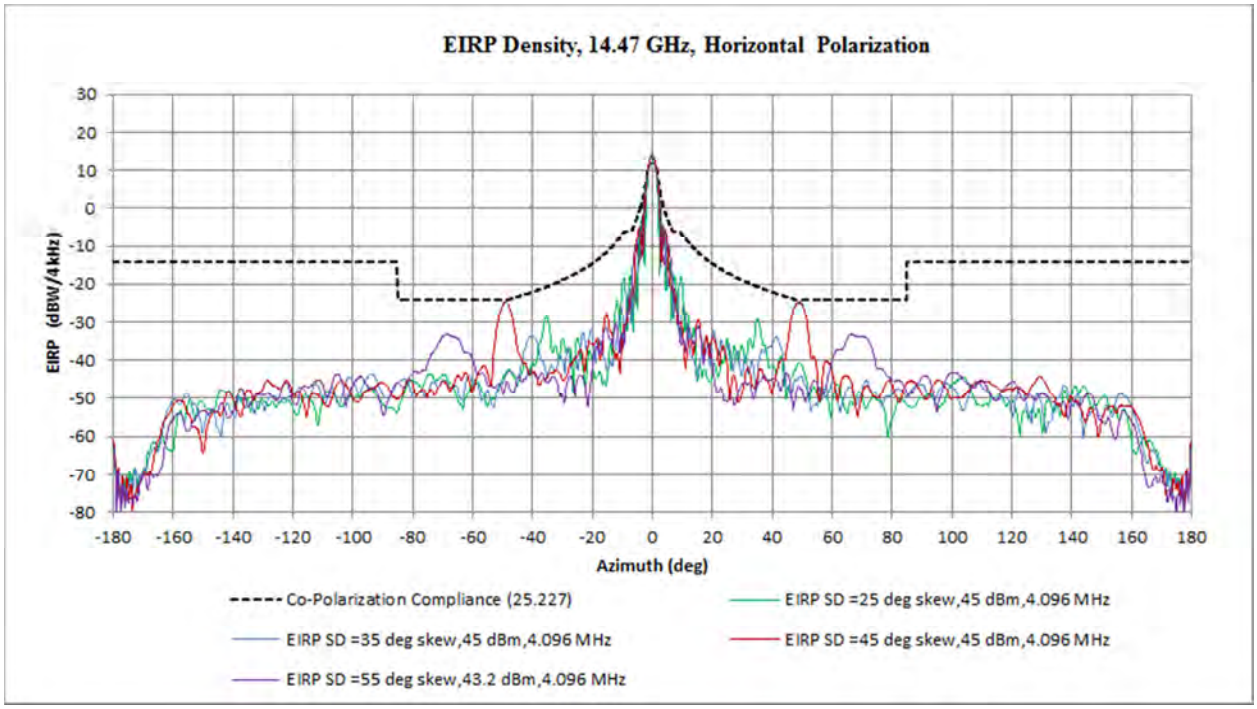


Figure C-18 EIRP Spectral Density in dBW/4 kHz for 14.47 GHz with 4.096 MHz (Horizontal Polarization) (25.227 Expanded Azimuth)

Vertical Polarization; 4.096 MHz Bandwidth

The EIRP spectral densities shown in Figures C-19 to C-20, C-21 to C-22, and C-23 to C-24 for 14.05 GHz, 14.25 GHz, and 14.47 GHz respectively, all with vertical polarization, indicate FCC co-polarization emission compliance according to FCC 25.227. The plots correspond to the following:

$25^0$ Skew:

45.0 dBm transmit power in a 4.096 MHz bandwidth

$35^0$ Skew:

45.0 dBm transmit power in a 4.096 MHz bandwidth

$45^0$ Skew:

45.0 dBm transmit power in a 4.096 MHz bandwidth

$55^0$ Skew:

43.2 dBm transmit power in a 4.096 MHz bandwidth

Figures C-19, C-21, and C-23 depict the EIRP spectral density in dBW/4kHz for a $\pm$10 degree azimuth axis along with the associated Section 25.227 compliance mask. Figures C-20, C-22, and C-24 depict the EIRP spectral density in dBW/4kHz for a $\pm$180 degree expanded azimuth axis along with the associated Section 25.227 compliance mask.

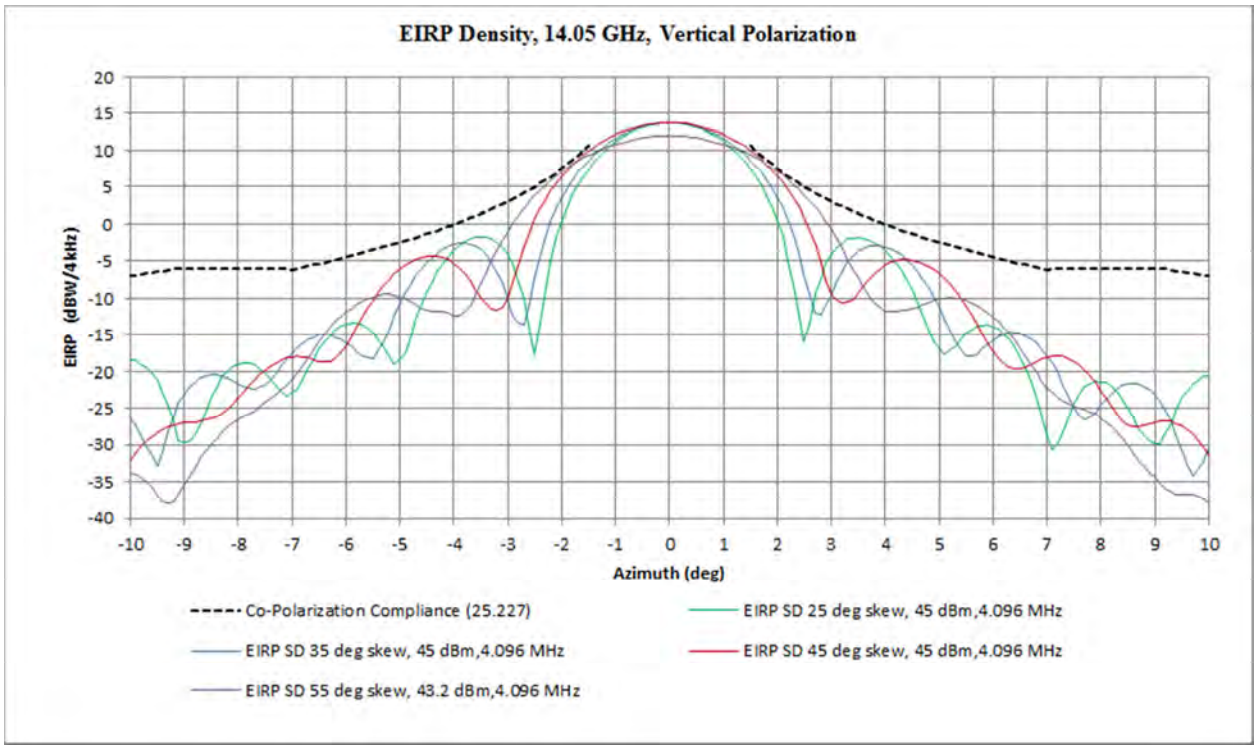


Figure C-19 EIRP Spectral Density in dBW/4 kHz for 14.05 GHz with 4.096 MHz (Vertical Polarization) (25.227 Sidelobe Compliance)

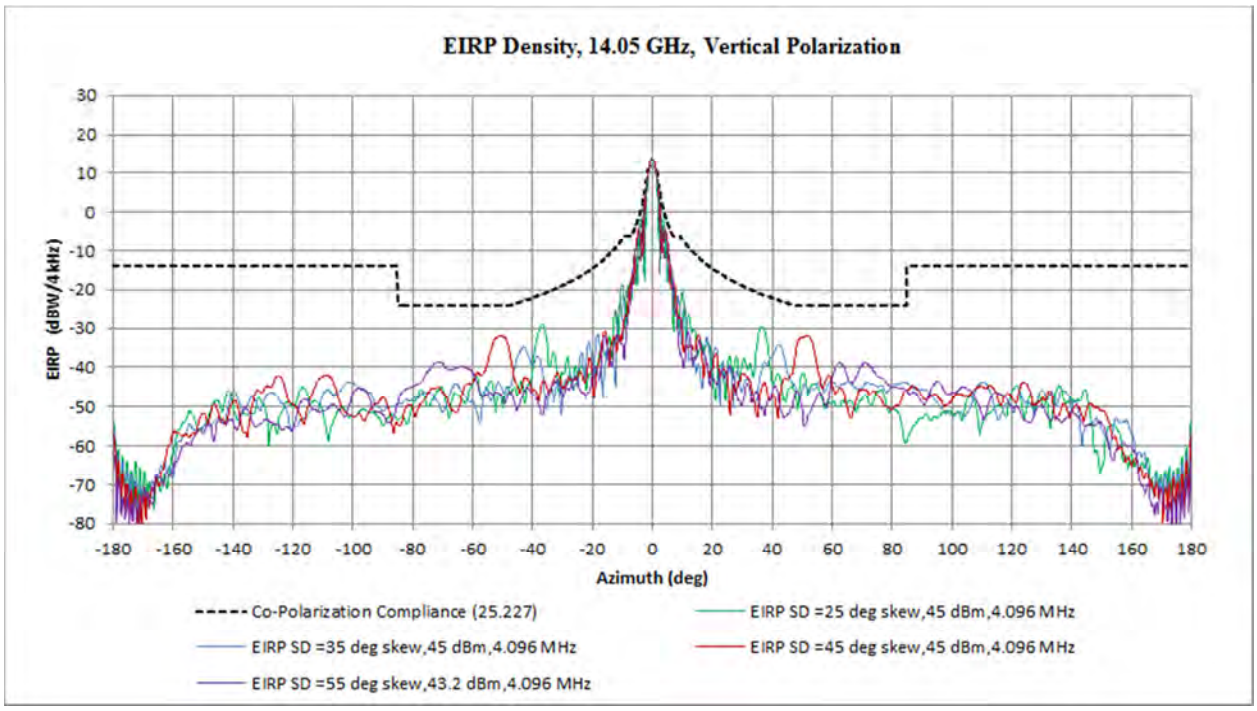


Figure C-20 EIRP Spectral Density in dBW/4 kHz for 14.05 GHz with 4.096 MHz (Vertical Polarization) (25.227 Expanded Azimuth)

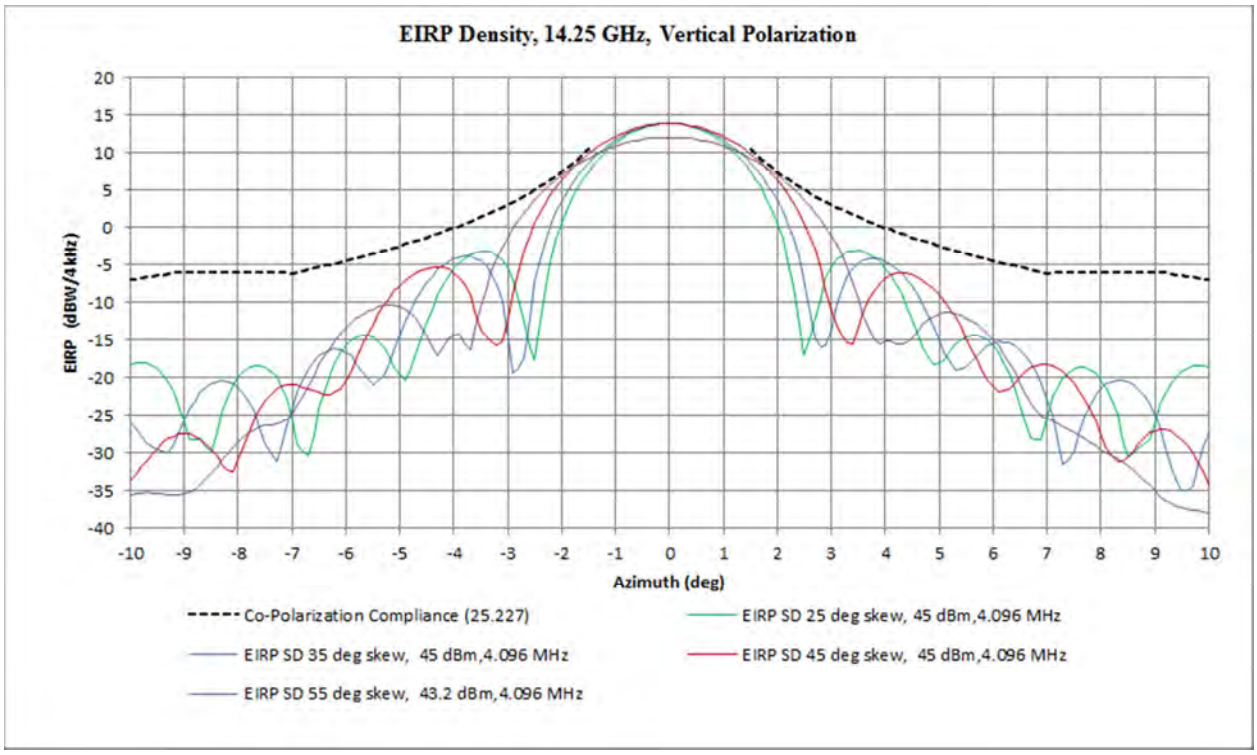


Figure C-21 EIRP Spectral Density in dBW/4 kHz for 14.25 GHz with 4.096 MHz (Vertical Polarization) (25.227 Sidelobe Compliance)

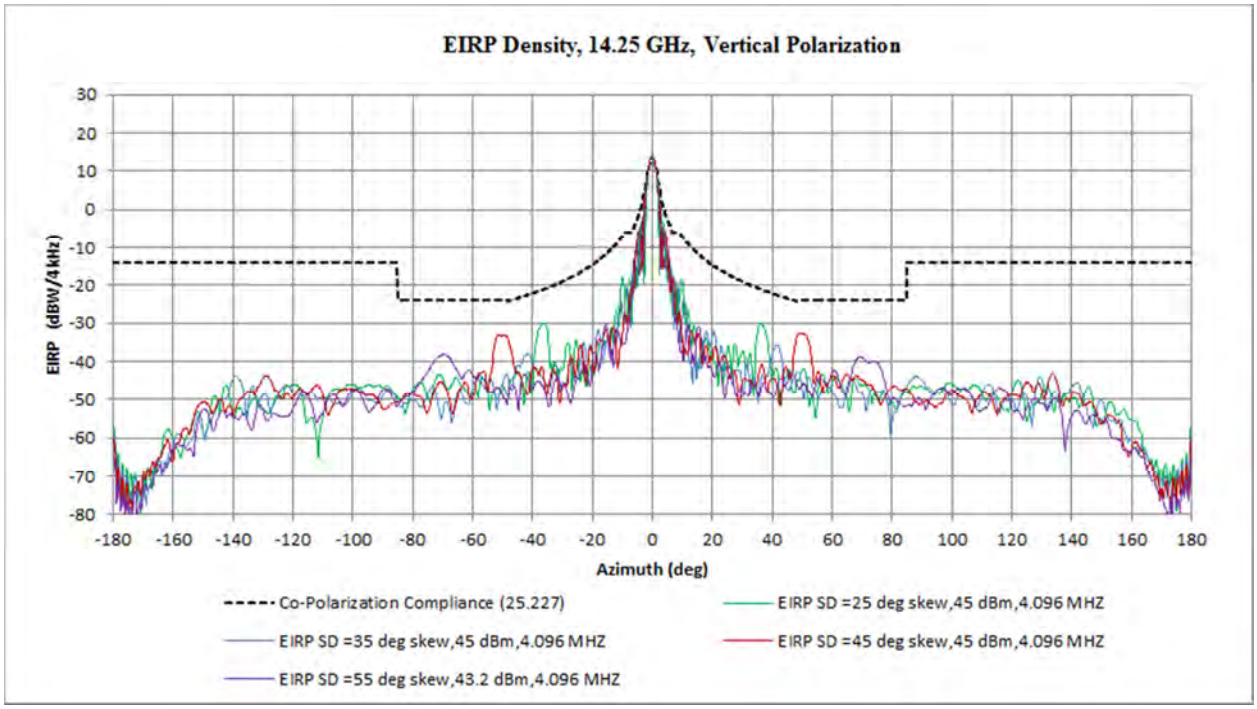


Figure C-22 EIRP Spectral Density in dBW/4 kHz for 14.25 GHz with 4.096 MHz (Vertical Polarization) (25.227 Expanded Azimuth)

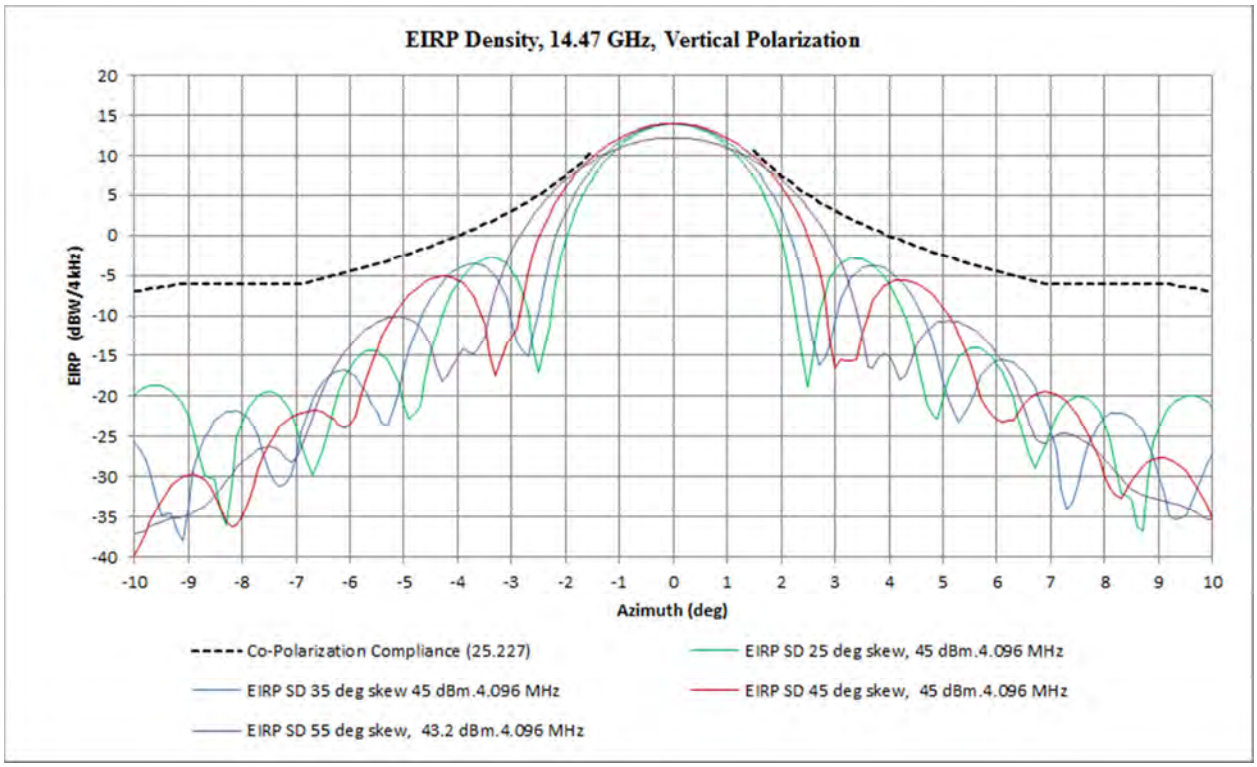


Figure C-23 EIRP Spectral Density in dBW/4 kHz for 14.47 GHz with 4.096 MHz (Vertical Polarization) (25.227 Sidelobe Compliance)

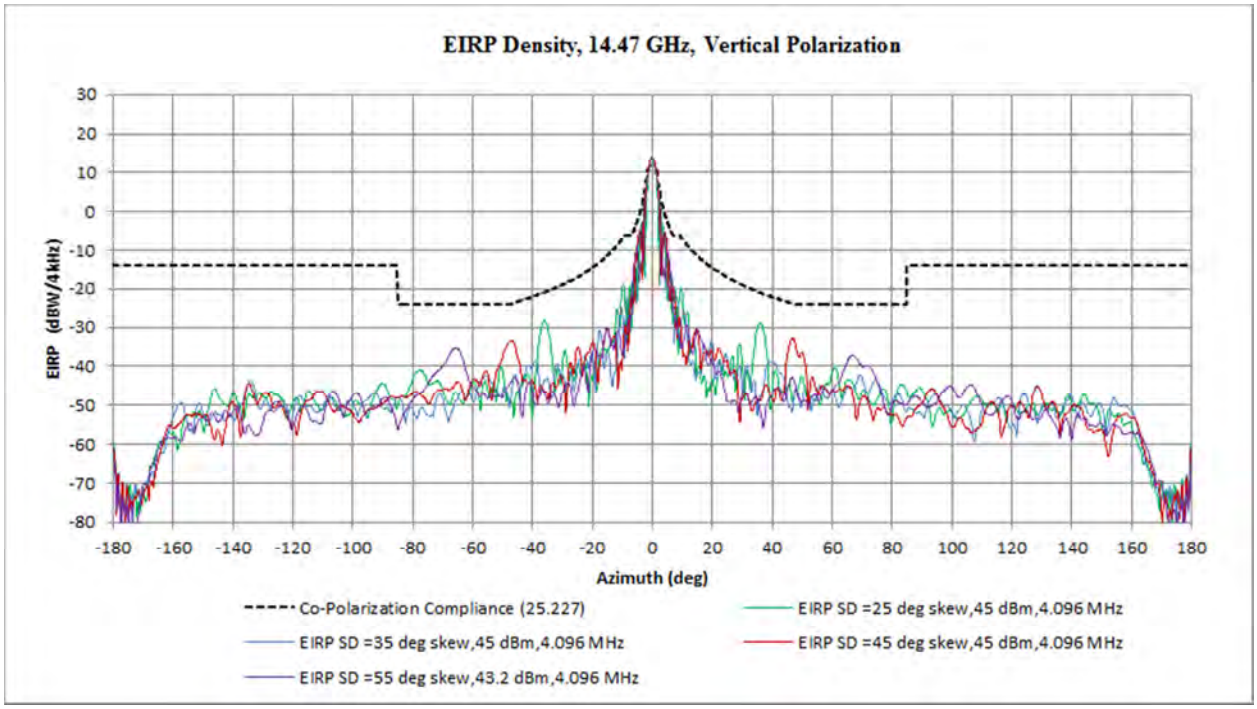


Figure C-24 EIRP Spectral Density in dBW/4 kHz for 14.47 GHz with 4.096 MHz (Vertical Polarization) (25.227 Expanded Azimuth)

## Geographic Representation

Figures C-25, C-26, C-27, and C-28 illustrate the proposed geographic relationships between skew and EIRP density for SES-1, AMC-9, AMC-2, and SES-6, respectively. The boundaries apply, such that for any location between them, the skew is less than or equal to that at each of the boundaries. The authorized EIRP for the given skew value is applicable to any geographic location within those boundaries.

Note that since authorization for operation out to 55 degrees skew is sought only for SES-6, only its figure includes the 55 degree skew boundary.


Figure C-25 Geographic skew boundaries and EIRP density levels for SES-1 at 101 West. EIRP density limits are applicable anywhere between the associated left and right skew boundary contours. (Red: 25 degree boundaries; Green: 35 degree boundaries; Orange: 45 degree boundaries. Labels are located in the vicinity of areas of satellite coverage.)

Note that where two EIRP density values are specified, the 'lesser' value corresponds to the HPT's output being limited from providing the necessary output (for a 4.096 MHz bandwidth emission) that would result in an EIRP density equal to the 'higher' value.


Figure C-26 Geographic skew boundaries and EIRP density levels for AMC-9 at 83 West. EIRP density limits are applicable anywhere between the associated left and right skew boundary contours. (Red: 25 degree boundaries; Green: 35 degree boundaries; Orange: 45 degree boundaries. Labels are located in the vicinity of areas of satellite coverage.)

Note that where two EIRP density values are specified, the 'lesser' value corresponds to the HPT's output being limited from providing the necessary output (for a 4.096 MHz bandwidth emission) that would result in an EIRP density equal to the 'higher' value.


Figure C-27 Geographic skew boundaries and EIRP density levels for AMC-2 at 80.9 West. EIRP density limits are applicable anywhere between the associated left and right skew boundary contours. (Red: 25 degree boundaries; Green: 35 degree boundaries; Orange: 45 degree boundaries. Labels are located in the vicinity of areas of satellite coverage.)

Note that where two EIRP density values are specified, the 'lesser' value corresponds to the HPT's output being limited from providing the necessary output (for a 4.096 MHz bandwidth emission) that would result in an EIRP density equal to the 'higher' value.

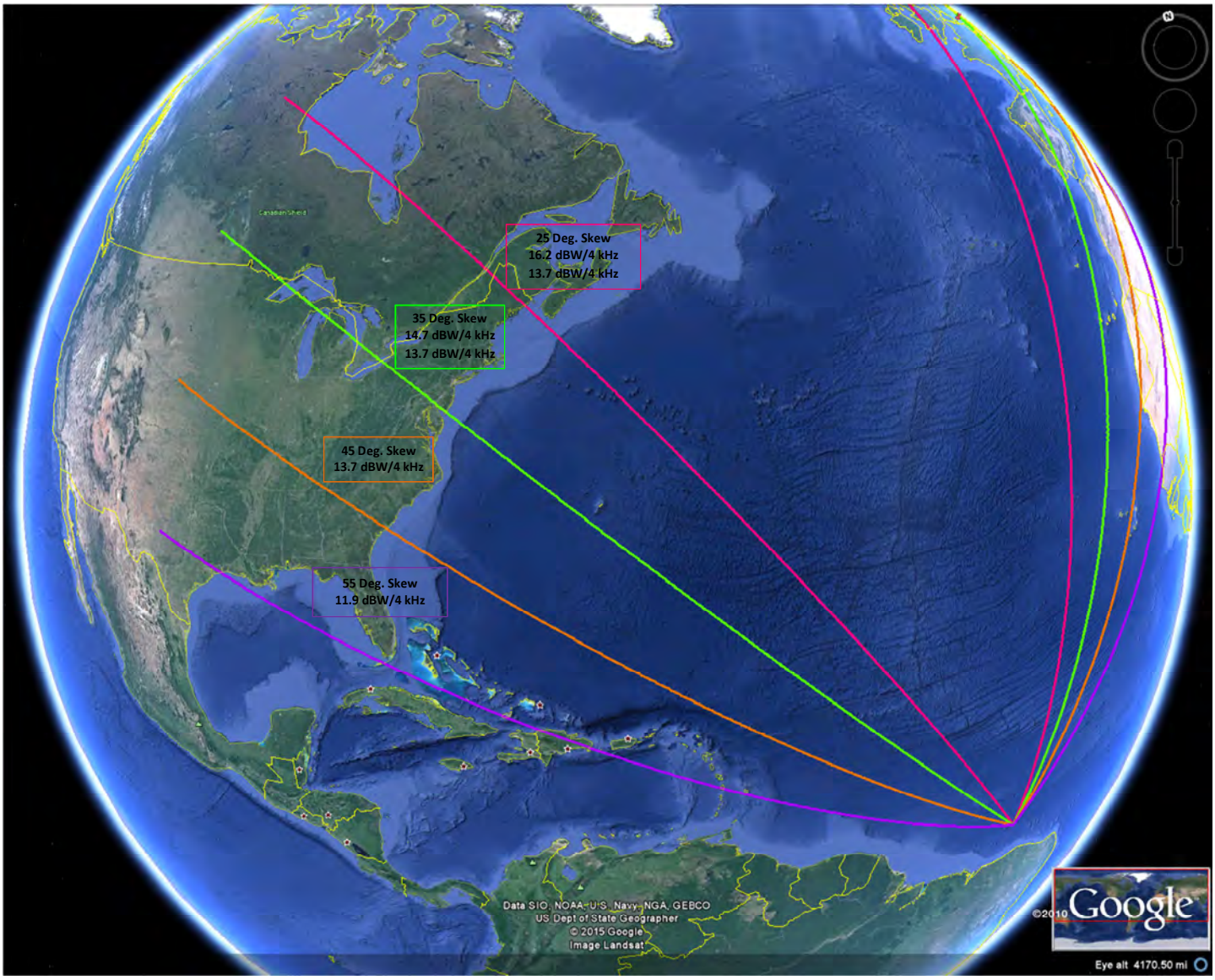


Figure C-28 Geographic skew boundaries and EIRP density levels for SES-6 at 40.5 West. EIRP density limits are applicable anywhere between the associated left and right skew boundary contours. (Red: 25 degree boundaries; Green: 35 degree boundaries; Orange: 45 degree boundaries; Purple: 55 degree boundaries. Labels are located in the vicinity of areas of satellite coverage.)

Note that where two EIRP density values are specified, the ‘lesser’ value corresponds to the HPT’s output being limited from providing the necessary output (for a 4.096 MHz bandwidth emission) that would result in an EIRP density equal to the ‘higher’ value.

# SES-1 Link Budgets

Applicable to transmissions up to skew angles of 25, 35, and 45 degrees, and respective EIRP densities of 16.2, 14.7, and 13.7 dBW/4 kHz

Applicable transmit powers and emission bandwidths:

41.5, 40.0, and 39.0 dBm in 1.024 MHz, respectively

44.5, 43.0, and 42.0 dBm in 2.048 MHz, respectively

| | |
|---|---|
| **Inroute Signal:** | QPSK 2/3 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 1.024 |
| Spread BW (MHz): | 1.024 |
| Required C/N (dB): | 4.2 |
| **Outroute Signal:** | QPSK 5/6 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 5.4 |
| **Satellite:** | SES-1 |
| Longitude (deg East): | -101 |
| G/T towards Remote (dB/K): | 5.80 |
| G/T towards NOC (dB/K): | 2.40 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 48.8 |
| Saturated EIRP towards remote (dBW): | 50.2 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **50.20** |
| Downlink EIRP Inroute (dBW): | **20.86** |
| **Remote:** | Chicago |
| Latitude (deg North): | 41.8 |
| Longitude (deg East): | -87.7 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 41.5 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-13.58** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite SES-1 at -101.0 degrees

**Skew operational limit: 25 degrees**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 2/3** | rate | **1.024** | **Msps** | in bandwidth | **1.024** | **MHz** |
| **Outroute signal:** | **QPSK 5/6** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | Chicago | 41.8 | -87.7 |
| **NOC:** | Las Vegas | 36.24 | -115.12 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 39.30 | 38.30 | 38.30 |
| Uplink Path Loss (dB) | 207.09 | 207.09 | 207.09 |
| Spreading Loss (dB) | -162.54 | -162.54 | -162.54 |
| Flux Density at Satellite (dBW/m^2) | -123.24 | -124.24 | -124.24 |
| Uplink C/T (dB) | -161.99 | -162.99 | -162.99 |
| C/No (dB) | 66.61 | 65.61 | 65.61 |
| Noise BW (dB-Hz) | 60.10 | 60.10 | 60.10 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **6.51** | **5.51** | **4.92** |
| Satellite downlink EIRP (dBW) | 21.86 | 20.86 | 20.86 |
| Downlink Path Loss (dB) | 205.51 | 205.51 | 205.51 |
| Downlink C/T (dB) | -148.32 | -151.32 | -151.32 |
| C/No (dB) | 80.28 | 77.28 | 77.28 |
| Noise BW (dB-Hz) | 60.10 | 60.10 | 60.10 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **20.18** | **17.18** | **14.65** |
| Cumulative C/N (dB) | 6.32 | 5.22 | 4.48 |
| Necessary C/N (dB) | 4.20 | 4.20 | 4.20 |
| **Cumulative Inroute Link Margin (dB)** | **2.12** | **1.02** | **0.28** |

## Link Budget for satellite SES-1 at -101.0 degrees

**Skew operational limit: 25 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

**NOC:**

| | |
|---|---|
| | Las Vegas |
| Latitude (deg North): | 36.24 |
| Longitude (deg East): | -115.12 |
| Antennna diameter (m): | 7.6 m |
| RX Antenna Gain (dBi): | 56.5 |
| Antenna Noise Temp (K): | 61 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 131 |
| Antenna G/T (dB/K): | 35.33 |
| TX Antenna Gain (dBi): | 58.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 78.10 | 76.10 | 76.10 |
| Uplink Path Loss (dB) | 206.99 | 206.99 | 206.99 |
| Spreading Loss (dB) | -162.44 | -162.44 | -162.44 |
| Flux Density at Satellite (dBW/m^2) | -84.34 | -86.34 | -86.34 |
| Uplink C/T (dB) | -126.49 | -128.49 | -128.49 |
| C/No (dB) | 102.11 | 100.11 | 100.11 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **27.34** | **25.34** | **17.98** |
| Satellite downlink EIRP (dBW) | 50.20 | 50.20 | 50.20 |
| Downlink Path Loss (dB) | 205.60 | 205.60 | 205.60 |
| Downlink C/T (dB) | -143.70 | -144.70 | -144.70 |
| C/No (dB) | 10.13 | 9.13 | 9.13 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **10.13** | **9.13** | **6.14** |
| Cumulative C/N (dB) | 10.05 | 9.03 | 5.87 |
| Necessary C/N (dB) | 5.4 | 5.4 | 5.4 |
| **Cumulative Outroute Link Margin (dB)** | **4.65** | **3.63** | **0.47** |

| | |
|---|---|
| **Inroute Signal:** | QPSK 1/2 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 1.024 |
| Spread BW (MHz): | 1.024 |
| Required C/N (dB): | 2.1 |
| **Outroute Signal:** | QPSK 3/4 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 4.2 |
| **Satellite:** | SES-1 |
| Longitude (deg East): | -101 |
| G/T towards Remote (dB/K): | 5.40 |
| G/T towards NOC (dB/K): | 2.40 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 48.8 |
| Saturated EIRP towards remote (dBW): | 48.3 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **48.30** |
| Downlink EIRP Inroute (dBW): | **18.93** |
| **Remote:** | Baltimore |
| Latitude (deg North): | 39.29 |
| Longitude (deg East): | -76.62 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 40 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-15.08** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite SES-1 at -101.0 degrees

**Skew operational limit: 35 degrees**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 1/2** | rate | **1.024** | **Msps** | in bandwidth | **1.024** | **MHz** |
| **Outroute signal:** | **QPSK 3/4** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | Baltimore | 39.29 | -76.62 |
| **NOC:** | Las Vegas | 36.24 | -115.12 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 37.80 | 36.80 | 36.80 |
| Uplink Path Loss (dB) | 207.13 | 207.13 | 207.13 |
| Spreading Loss (dB) | -162.57 | -162.57 | -162.57 |
| Flux Density at Satellite (dBW/m^2) | -124.77 | -125.77 | -125.77 |
| Uplink C/T (dB) | -163.93 | -164.93 | -164.93 |
| C/No (dB) | 64.68 | 63.68 | 63.68 |
| Noise BW (dB-Hz) | 60.10 | 60.10 | 60.10 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **4.57** | **3.57** | **3.19** |
| Satellite downlink EIRP (dBW) | 19.93 | 18.93 | 18.93 |
| Downlink Path Loss (dB) | 205.51 | 205.51 | 205.51 |
| Downlink C/T (dB) | -150.25 | -153.25 | -153.25 |
| C/No (dB) | 78.35 | 75.35 | 75.35 |
| Noise BW (dB-Hz) | 60.10 | 60.10 | 60.10 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **18.25** | **15.25** | **13.46** |
| Cumulative C/N (dB) | 4.39 | 3.29 | 2.80 |
| Necessary C/N (dB) | 2.10 | 2.10 | 2.10 |
| **Cumulative Inroute Link Margin (dB)** | **2.29** | **1.19** | **0.70** |

## Link Budget for satellite SES-1 at -101.0 degrees

**Skew operational limit: 35 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

**NOC:**

| | |
|---|---|
| | Las Vegas |
| Latitude (deg North): | 36.24 |
| Longitude (deg East): | -115.12 |
| Antennna diameter (m): | 7.6 m |
| RX Antenna Gain (dBi): | 56.5 |
| Antenna Noise Temp (K): | 61 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 131 |
| Antenna G/T (dB/K): | 35.33 |
| TX Antenna Gain (dBi): | 58.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 78.10 | 76.10 | 76.10 |
| Uplink Path Loss (dB) | 207.08 | 207.08 | 207.08 |
| Spreading Loss (dB) | -162.53 | -162.53 | -162.53 |
| Flux Density at Satellite (dBW/m^2) | -84.43 | -86.43 | -86.43 |
| Uplink C/T (dB) | -126.58 | -128.58 | -128.58 |
| C/No (dB) | 102.02 | 100.02 | 100.02 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **27.25** | **25.25** | **17.96** |
| Satellite downlink EIRP (dBW) | 48.30 | 48.30 | 48.30 |
| Downlink Path Loss (dB) | 205.63 | 205.63 | 205.63 |
| Downlink C/T (dB) | -145.63 | -146.63 | -146.63 |
| C/No (dB) | 8.20 | 7.20 | 7.20 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **8.20** | **7.20** | **5.06** |
| Cumulative C/N (dB) | 8.14 | 7.13 | 4.85 |
| Necessary C/N (dB) | 4.2 | 4.2 | 4.2 |
| **Cumulative Outroute Link Margin (dB)** | **3.94** | **2.93** | **0.65** |

| | |
|---|---|
| **Inroute Signal:** | QPSK 1/2 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 0.512 |
| Spread BW (MHz): | 1.024 |
| Required C/N (dB): | 2.1 |
| **Outroute Signal:** | QPSK 2/3 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 3.3 |
| **Satellite:** | SES-1 |
| Longitude (deg East): | -101 |
| G/T towards Remote (dB/K): | 3.10 |
| G/T towards NOC (dB/K): | 2.40 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 48.8 |
| Saturated EIRP towards remote (dBW): | 46.9 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **46.90** |
| Downlink EIRP Inroute (dBW): | **15.85** |
| **Remote:** | Miami |
| Latitude (deg North): | 25.79 |
| Longitude (deg East): | -80.21 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 39 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-16.08** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite SES-1 at -101.0 degrees

**Skew operational limit: 45 degrees**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 1/2** | rate | **0.512** | **Msps** | in bandwidth | **1.024** | **MHz** |
| **Outroute signal:** | **QPSK 2/3** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | Miami | 25.79 | -80.21 |
| **NOC:** | Las Vegas | 36.24 | -115.12 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 36.80 | 35.80 | 35.80 |
| Uplink Path Loss (dB) | 206.90 | 206.90 | 206.90 |
| Spreading Loss (dB) | -162.35 | -162.35 | -162.35 |
| Flux Density at Satellite (dBW/m^2) | -125.55 | -126.55 | -126.55 |
| Uplink C/T (dB) | -167.00 | -168.00 | -168.00 |
| C/No (dB) | 61.60 | 60.60 | 60.60 |
| Noise BW (dB-Hz) | 57.09 | 57.09 | 57.09 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **4.51** | **3.51** | **3.13** |
| Satellite downlink EIRP (dBW) | 16.85 | 15.85 | 15.85 |
| Downlink Path Loss (dB) | 205.51 | 205.51 | 205.51 |
| Downlink C/T (dB) | -153.32 | -156.32 | -156.32 |
| C/No (dB) | 75.28 | 72.28 | 72.28 |
| Noise BW (dB-Hz) | 57.09 | 57.09 | 57.09 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **18.18** | **15.18** | **13.42** |
| Cumulative C/N (dB) | 4.33 | 3.23 | 2.74 |
| Necessary C/N (dB) | 2.10 | 2.10 | 2.10 |
| **Cumulative Inroute Link Margin (dB)** | **2.23** | **1.13** | **0.64** |

# Link Budget for satellite SES-1 at -101.0 degrees

**Skew operational limit: 45 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

**NOC:**

| | |
|---|---|
| | Las Vegas |
| Latitude (deg North): | 36.24 |
| Longitude (deg East): | -115.12 |
| Antennna diameter (m): | 7.6 m |
| RX Antenna Gain (dBi): | 56.5 |
| Antenna Noise Temp (K): | 61 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 131 |
| Antenna G/T (dB/K): | 35.33 |
| TX Antenna Gain (dBi): | 58.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 78.10 | 76.10 | 76.10 |
| Uplink Path Loss (dB) | 207.04 | 207.04 | 207.04 |
| Spreading Loss (dB) | -162.49 | -162.49 | -162.49 |
| Flux Density at Satellite (dBW/m^2) | -84.39 | -86.39 | -86.39 |
| Uplink C/T (dB) | -126.54 | -128.54 | -128.54 |
| C/No (dB) | 102.06 | 100.06 | 100.06 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **27.29** | **25.29** | **17.97** |
| Satellite downlink EIRP (dBW) | 46.90 | 46.90 | 46.90 |
| Downlink Path Loss (dB) | 205.40 | 205.40 | 205.40 |
| Downlink C/T (dB) | -146.80 | -147.80 | -147.80 |
| C/No (dB) | 7.03 | 6.03 | 6.03 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **7.03** | **6.03** | **4.31** |
| Cumulative C/N (dB) | 6.98 | 5.97 | 4.13 |
| Necessary C/N (dB) | 3.3 | 3.3 | 3.3 |
| **Cumulative Outroute Link Margin (dB)** | **3.68** | **2.67** | **0.83** |

# SES-1 Link Budgets

Applicable to transmissions up to skew angles of 25, 35, and 45 degrees, and EIRP densities of each:

13.7 dBW/4 kHz

Applicable transmit power and emission bandwidth:

45 dBm, 4.096 MHz

| | |
|---|---|
| **Inroute Signal:** | QPSK 2/3 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 2.048 |
| Spread BW (MHz): | 4.096 |
| Required C/N (dB): | 4.2 |
| **Outroute Signal:** | QPSK 5/6 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 5.4 |
| **Satellite:** | SES-1 |
| Longitude (deg East): | -101 |
| G/T towards Remote (dB/K): | 5.80 |
| G/T towards NOC (dB/K): | 2.40 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 48.8 |
| Saturated EIRP towards remote (dBW): | 50.2 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **50.20** |
| Downlink EIRP Inroute (dBW): | **24.36** |
| **Remote:** | Chicago |
| Latitude (deg North): | 41.8 |
| Longitude (deg East): | -87.7 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 45 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-16.10** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite SES-1 at -101.0 degrees

**Skew operational limit: 25 degrees**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 2/3** | rate | **2.048** | **Msps** | in bandwidth | **4.096** | **MHz** |
| **Outroute signal:** | **QPSK 5/6** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | Chicago | 41.8 | -87.7 |
| **NOC:** | Las Vegas | 36.24 | -115.12 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 42.80 | 41.80 | 41.80 |
| Uplink Path Loss (dB) | 207.09 | 207.09 | 207.09 |
| Spreading Loss (dB) | -162.54 | -162.54 | -162.54 |
| Flux Density at Satellite (dBW/m^2) | -119.74 | -120.74 | -120.74 |
| Uplink C/T (dB) | -158.49 | -159.49 | -159.49 |
| C/No (dB) | 70.11 | 69.11 | 69.11 |
| Noise BW (dB-Hz) | 63.11 | 63.11 | 63.11 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **7.00** | **6.00** | **5.34** |
| Satellite downlink EIRP (dBW) | 25.36 | 24.36 | 24.36 |
| Downlink Path Loss (dB) | 205.51 | 205.51 | 205.51 |
| Downlink C/T (dB) | -142.92 | -145.92 | -145.92 |
| C/No (dB) | 85.68 | 82.68 | 82.68 |
| Noise BW (dB-Hz) | 63.11 | 63.11 | 63.11 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **22.57** | **19.57** | **15.82** |
| Cumulative C/N (dB) | 6.88 | 5.81 | 4.97 |
| Necessary C/N (dB) | 4.20 | 4.20 | 4.20 |
| **Cumulative Inroute Link Margin (dB)** | **2.68** | **1.61** | **0.77** |

# Link Budget for satellite SES-1 at -101.0 degrees

**Skew operational limit: 25 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

**NOC:**

| | |
|---|---|
| | Las Vegas |
| Latitude (deg North): | 36.24 |
| Longitude (deg East): | -115.12 |
| Antennna diameter (m): | 9 m |
| RX Antenna Gain (dBi): | 58.5 |
| Antenna Noise Temp (K): | 64 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 134 |
| Antenna G/T (dB/K): | 37.23 |
| TX Antenna Gain (dBi): | 60.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 80.10 | 78.10 | 78.10 |
| Uplink Path Loss (dB) | 207.00 | 207.00 | 207.00 |
| Spreading Loss (dB) | -162.45 | -162.45 | -162.45 |
| Flux Density at Satellite (dBW/m^2) | -82.35 | -84.35 | -84.35 |
| Uplink C/T (dB) | -124.50 | -126.50 | -126.50 |
| C/No (dB) | 104.10 | 102.10 | 102.10 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **29.33** | **27.33** | **18.28** |
| Satellite downlink EIRP (dBW) | 50.20 | 50.20 | 50.20 |
| Downlink Path Loss (dB) | 205.60 | 205.60 | 205.60 |
| Downlink C/T (dB) | -143.70 | -144.70 | -144.70 |
| C/No (dB) | 10.13 | 9.13 | 9.13 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **10.13** | **9.13** | **6.14** |
| Cumulative C/N (dB) | 10.08 | 9.07 | 5.88 |
| Necessary C/N (dB) | 5.4 | 5.4 | 5.4 |
| **Cumulative Outroute Link Margin (dB)** | **4.68** | **3.67** | **0.48** |

| | |
|---|---|
| **Inroute Signal:** | QPSK 2/3 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 2.048 |
| Spread BW (MHz): | 4.096 |
| Required C/N (dB): | 4.2 |
| **Outroute Signal:** | QPSK 3/4 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 4.2 |
| **Satellite:** | SES-1 |
| Longitude (deg East): | -101 |
| G/T towards Remote (dB/K): | 5.40 |
| G/T towards NOC (dB/K): | 2.40 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 48.8 |
| Saturated EIRP towards remote (dBW): | 48.3 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **48.30** |
| Downlink EIRP Inroute (dBW): | **23.93** |
| **Remote:** | Baltimore |
| Latitude (deg North): | 39.29 |
| Longitude (deg East): | -76.62 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 45 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-16.10** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite SES-1 at -101.0 degrees

**Skew operational limit: 35 degrees**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 2/3** | rate | **2.048** | **Msps** | in bandwidth | **4.096** | **MHz** |
| **Outroute signal:** | **QPSK 3/4** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | Baltimore | 39.29 | -76.62 |
| **NOC:** | Las Vegas | 36.24 | -115.12 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 42.80 | 41.80 | 41.80 |
| Uplink Path Loss (dB) | 207.13 | 207.13 | 207.13 |
| Spreading Loss (dB) | -162.57 | -162.57 | -162.57 |
| Flux Density at Satellite (dBW/m^2) | -119.77 | -120.77 | -120.77 |
| Uplink C/T (dB) | -158.93 | -159.93 | -159.93 |
| C/No (dB) | 69.68 | 68.68 | 68.68 |
| Noise BW (dB-Hz) | 63.11 | 63.11 | 63.11 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **6.56** | **5.56** | **4.97** |
| Satellite downlink EIRP (dBW) | 24.93 | 23.93 | 23.93 |
| Downlink Path Loss (dB) | 205.51 | 205.51 | 205.51 |
| Downlink C/T (dB) | -143.35 | -146.35 | -146.35 |
| C/No (dB) | 85.25 | 82.25 | 82.25 |
| Noise BW (dB-Hz) | 63.11 | 63.11 | 63.11 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **22.14** | **19.14** | **15.63** |
| Cumulative C/N (dB) | 6.44 | 5.38 | 4.61 |
| Necessary C/N (dB) | 4.20 | 4.20 | 4.20 |
| **Cumulative Inroute Link Margin (dB)** | **2.24** | **1.18** | **0.41** |

## Link Budget for satellite SES-1 at -101.0 degrees

**Skew operational limit: 35 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

**NOC:**

| | |
|---|---|
| | Las Vegas |
| Latitude (deg North): | 36.24 |
| Longitude (deg East): | -115.12 |
| Antennna diameter (m): | 9 m |
| RX Antenna Gain (dBi): | 58.5 |
| Antenna Noise Temp (K): | 64 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 134 |
| Antenna G/T (dB/K): | 37.23 |
| TX Antenna Gain (dBi): | 60.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 80.10 | 78.10 | 78.10 |
| Uplink Path Loss (dB) | 207.00 | 207.00 | 207.00 |
| Spreading Loss (dB) | -162.45 | -162.45 | -162.45 |
| Flux Density at Satellite (dBW/m^2) | -82.35 | -84.35 | -84.35 |
| Uplink C/T (dB) | -124.50 | -126.50 | -126.50 |
| C/No (dB) | 104.10 | 102.10 | 102.10 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **29.33** | **27.33** | **18.28** |
| Satellite downlink EIRP (dBW) | 48.30 | 48.30 | 48.30 |
| Downlink Path Loss (dB) | 205.63 | 205.63 | 205.63 |
| Downlink C/T (dB) | -145.63 | -146.63 | -146.63 |
| C/No (dB) | 8.20 | 7.20 | 7.20 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **8.20** | **7.20** | **5.06** |
| Cumulative C/N (dB) | 8.16 | 7.16 | 4.86 |
| Necessary C/N (dB) | 4.2 | 4.2 | 4.2 |
| **Cumulative Outroute Link Margin (dB)** | **3.96** | **2.96** | **0.66** |

| | |
|---|---|
| **Inroute Signal:** | QPSK 1/2 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 2.048 |
| Spread BW (MHz): | 4.096 |
| Required C/N (dB): | 2.1 |
| **Outroute Signal:** | QPSK 2/3 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 3.3 |
| **Satellite:** | SES-1 |
| Longitude (deg East): | -101 |
| G/T towards Remote (dB/K): | 3.10 |
| G/T towards NOC (dB/K): | 2.40 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 48.8 |
| Saturated EIRP towards remote (dBW): | 46.9 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **46.90** |
| Downlink EIRP Inroute (dBW): | **21.85** |
| **Remote:** | Miami |
| Latitude (deg North): | 25.79 |
| Longitude (deg East): | -80.21 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 45 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-16.10** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite SES-1 at -101.0 degrees

**Skew operational limit: 45 degrees**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 1/2** | rate | **2.048** | **Msps** | in bandwidth | **4.096** | **MHz** |
| **Outroute signal:** | **QPSK 2/3** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | Miami | 25.79 | -80.21 |
| **NOC:** | Las Vegas | 36.24 | -115.12 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 42.80 | 41.80 | 41.80 |
| Uplink Path Loss (dB) | 206.90 | 206.90 | 206.90 |
| Spreading Loss (dB) | -162.35 | -162.35 | -162.35 |
| Flux Density at Satellite (dBW/m^2) | -119.55 | -120.55 | -120.55 |
| Uplink C/T (dB) | -161.00 | -162.00 | -162.00 |
| C/No (dB) | 67.60 | 66.60 | 66.60 |
| Noise BW (dB-Hz) | 63.11 | 63.11 | 63.11 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **4.49** | **3.49** | **3.11** |
| Satellite downlink EIRP (dBW) | 22.85 | 21.85 | 21.85 |
| Downlink Path Loss (dB) | 205.51 | 205.51 | 205.51 |
| Downlink C/T (dB) | -145.42 | -148.42 | -148.42 |
| C/No (dB) | 83.18 | 80.18 | 80.18 |
| Noise BW (dB-Hz) | 63.11 | 63.11 | 63.11 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **20.07** | **17.07** | **14.58** |
| Cumulative C/N (dB) | 4.37 | 3.30 | 2.81 |
| Necessary C/N (dB) | 2.10 | 2.10 | 2.10 |
| **Cumulative Inroute Link Margin (dB)** | **2.27** | **1.20** | **0.71** |

# Link Budget for satellite SES-1 at -101.0 degrees

**Skew operational limit: 45 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

**NOC:**

| | |
|---|---|
| | Las Vegas |
| Latitude (deg North): | 36.24 |
| Longitude (deg East): | -115.12 |
| Antennna diameter (m): | 9 m |
| RX Antenna Gain (dBi): | 58.5 |
| Antenna Noise Temp (K): | 64 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 134 |
| Antenna G/T (dB/K): | 37.23 |
| TX Antenna Gain (dBi): | 60.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 80.10 | 78.10 | 78.10 |
| Uplink Path Loss (dB) | 207.00 | 207.00 | 207.00 |
| Spreading Loss (dB) | -162.45 | -162.45 | -162.45 |
| Flux Density at Satellite (dBW/m^2) | -82.35 | -84.35 | -84.35 |
| Uplink C/T (dB) | -124.50 | -126.50 | -126.50 |
| C/No (dB) | 104.10 | 102.10 | 102.10 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **29.33** | **27.33** | **18.28** |
| Satellite downlink EIRP (dBW) | 46.90 | 46.90 | 46.90 |
| Downlink Path Loss (dB) | 205.40 | 205.40 | 205.40 |
| Downlink C/T (dB) | -146.80 | -147.80 | -147.80 |
| C/No (dB) | 7.03 | 6.03 | 6.03 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **7.03** | **6.03** | **4.31** |
| Cumulative C/N (dB) | 7.00 | 5.99 | 4.14 |
| Necessary C/N (dB) | 3.3 | 3.3 | 3.3 |
| **Cumulative Outroute Link Margin (dB)** | **3.70** | **2.69** | **0.84** |

# AMC-9 Link Budgets

Applicable to transmissions up to skew angles of 25, 35, and 45 degrees, and respective EIRP densities of 16.2, 14.7, and 13.7 dBW/4 kHz

Applicable transmit powers and emission bandwidths:

41.5, 40.0, and 39.0 dBm in 1.024 MHz, respectively

44.5, 43.0, and 42.0 dBm in 2.048 MHz, respectively

| | |
|---|---|
| **Inroute Signal:** | QPSK 1/2 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 1.024 |
| Spread BW (MHz): | 1.024 |
| Required C/N (dB): | 2.1 |
| **Outroute Signal:** | QPSK 5/6 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 5.4 |
| **Satellite:** | AMC-9 |
| Longitude (deg East): | -83 |
| G/T towards Remote (dB/K): | 5.00 |
| G/T towards NOC (dB/K): | 3.50 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 49.5 |
| Saturated EIRP towards remote (dBW): | 50.5 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **50.50** |
| Downlink EIRP Inroute (dBW): | **20.80** |
| **Remote:** | New York City |
| Latitude (deg North): | 40.73 |
| Longitude (deg East): | -74.02 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 41.5 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-13.58** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite AMC-9 at -83.0 degrees

**Skew operational limit: 25 degrees**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 1/2** | rate | **1.024** | **Msps** | in bandwidth | **1.024** | **MHz** |
| **Outroute signal:** | **QPSK 5/6** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | New York City | 40.73 | -74.02 |
| **NOC:** | Las Vegas | 36.24 | -115.12 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 39.30 | 38.30 | 38.30 |
| Uplink Path Loss (dB) | 207.05 | 207.05 | 207.05 |
| Spreading Loss (dB) | -162.50 | -162.50 | -162.50 |
| Flux Density at Satellite (dBW/m^2) | -123.20 | -124.20 | -124.20 |
| Uplink C/T (dB) | -162.75 | -163.75 | -163.75 |
| C/No (dB) | 65.85 | 64.85 | 64.85 |
| Noise BW (dB-Hz) | 60.10 | 60.10 | 60.10 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **5.74** | **4.74** | **4.24** |
| Satellite downlink EIRP (dBW) | 21.80 | 20.80 | 20.80 |
| Downlink Path Loss (dB) | 205.67 | 205.67 | 205.67 |
| Downlink C/T (dB) | -148.54 | -151.54 | -151.54 |
| C/No (dB) | 80.06 | 77.06 | 77.06 |
| Noise BW (dB-Hz) | 60.10 | 60.10 | 60.10 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **19.96** | **16.96** | **14.52** |
| Cumulative C/N (dB) | 5.58 | 4.49 | 3.85 |
| Necessary C/N (dB) | 2.10 | 2.10 | 2.10 |
| **Cumulative Inroute Link Margin (dB)** | **3.48** | **2.39** | **1.75** |

## Link Budget for satellite AMC-9 at -83.0 degrees

**Skew operational limit: 25 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

| **NOC:** | Las Vegas |
|---|---|
| Latitude (deg North): | 36.24 |
| Longitude (deg East): | -115.12 |
| Antennna diameter (m): | 7.6 m |
| RX Antenna Gain (dBi): | 56.5 |
| Antenna Noise Temp (K): | 61 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 131 |
| Antenna G/T (dB/K): | 35.33 |
| TX Antenna Gain (dBi): | 58.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 78.10 | 76.10 | 76.10 |
| Uplink Path Loss (dB) | 206.97 | 206.97 | 206.97 |
| Spreading Loss (dB) | -162.42 | -162.42 | -162.42 |
| Flux Density at Satellite (dBW/m^2) | -84.32 | -86.32 | -86.32 |
| Uplink C/T (dB) | -125.37 | -127.37 | -127.37 |
| C/No (dB) | 103.23 | 101.23 | 101.23 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **28.46** | **26.46** | **18.16** |
| Satellite downlink EIRP (dBW) | 50.50 | 50.50 | 50.50 |
| Downlink Path Loss (dB) | 205.56 | 205.56 | 205.56 |
| Downlink C/T (dB) | -143.36 | -144.36 | -144.36 |
| C/No (dB) | 10.47 | 9.47 | 9.47 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **10.47** | **9.47** | **6.31** |
| Cumulative C/N (dB) | 10.40 | 9.38 | 6.03 |
| Necessary C/N (dB) | 5.4 | 5.4 | 5.4 |
| **Cumulative Outroute Link Margin (dB)** | **5.00** | **3.98** | **0.63** |

| | |
|---|---|
| **Inroute Signal:** | QPSK 1/2 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 0.512 |
| Spread BW (MHz): | 1.024 |
| Required C/N (dB): | 2.1 |
| **Outroute Signal:** | QPSK 5/6 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 5.4 |
| **Satellite:** | AMC-9 |
| Longitude (deg East): | -83 |
| G/T towards Remote (dB/K): | 2.50 |
| G/T towards NOC (dB/K): | 3.50 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 49.5 |
| Saturated EIRP towards remote (dBW): | 50 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **50.00** |
| Downlink EIRP Inroute (dBW): | **16.80** |
| **Remote:** | Albuquerque |
| Latitude (deg North): | 35.11 |
| Longitude (deg East): | -106.62 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 40 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-15.08** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite AMC-9 at -83.0 degrees

**Skew operational limit: 35 degrees**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 1/2** | rate | **0.512** | **Msps** | in bandwidth | **1.024** | **MHz** |
| **Outroute signal:** | **QPSK 5/6** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | Albuquerque | 35.11 | -106.62 |
| **NOC:** | Las Vegas | 36.24 | -115.12 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 37.80 | 36.80 | 36.80 |
| Uplink Path Loss (dB) | 207.05 | 207.05 | 207.05 |
| Spreading Loss (dB) | -162.50 | -162.50 | -162.50 |
| Flux Density at Satellite (dBW/m^2) | -124.70 | -125.70 | -125.70 |
| Uplink C/T (dB) | -166.75 | -167.75 | -167.75 |
| C/No (dB) | 61.85 | 60.85 | 60.85 |
| Noise BW (dB-Hz) | 57.09 | 57.09 | 57.09 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **4.76** | **3.76** | **3.35** |
| Satellite downlink EIRP (dBW) | 17.80 | 16.80 | 16.80 |
| Downlink Path Loss (dB) | 205.67 | 205.67 | 205.67 |
| Downlink C/T (dB) | -152.54 | -155.54 | -155.54 |
| C/No (dB) | 76.06 | 73.06 | 73.06 |
| Noise BW (dB-Hz) | 57.09 | 57.09 | 57.09 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **18.97** | **15.97** | **13.93** |
| Cumulative C/N (dB) | 4.59 | 3.50 | 2.99 |
| Necessary C/N (dB) | 2.10 | 2.10 | 2.10 |
| **Cumulative Inroute Link Margin (dB)** | **2.49** | **1.40** | **0.89** |

# Link Budget for satellite AMC-9 at -83.0 degrees

**Skew operational limit: 35 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

| | |
|---|---|
| **NOC:** | Las Vegas |
| Latitude (deg North): | 36.24 |
| Longitude (deg East): | -115.12 |
| Antennna diameter (m): | 7.6 m |
| RX Antenna Gain (dBi): | 56.5 |
| Antenna Noise Temp (K): | 61 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 131 |
| Antenna G/T (dB/K): | 35.33 |
| TX Antenna Gain (dBi): | 58.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 78.10 | 76.10 | 76.10 |
| Uplink Path Loss (dB) | 207.07 | 207.07 | 207.07 |
| Spreading Loss (dB) | -162.52 | -162.52 | -162.52 |
| Flux Density at Satellite (dBW/m^2) | -84.42 | -86.42 | -86.42 |
| Uplink C/T (dB) | -125.47 | -127.47 | -127.47 |
| C/No (dB) | 103.13 | 101.13 | 101.13 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **28.36** | **26.36** | **18.15** |
| Satellite downlink EIRP (dBW) | 50.00 | 50.00 | 50.00 |
| Downlink Path Loss (dB) | 205.56 | 205.56 | 205.56 |
| Downlink C/T (dB) | -143.86 | -144.86 | -144.86 |
| C/No (dB) | 9.97 | 8.97 | 8.97 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **9.97** | **8.97** | **6.06** |
| Cumulative C/N (dB) | 9.91 | 8.89 | 5.80 |
| Necessary C/N (dB) | 5.4 | 5.4 | 5.4 |
| **Cumulative Outroute Link Margin (dB)** | **4.51** | **3.49** | **0.40** |

| | |
|---|---|
| **Inroute Signal:** | QPSK 1/2 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 0.512 |
| Spread BW (MHz): | 1.024 |
| Required C/N (dB): | 2.1 |
| **Outroute Signal:** | QPSK 5/6 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 5.4 |
| **Satellite:** | AMC-9 |
| Longitude (deg East): | -83 |
| G/T towards Remote (dB/K): | 3.50 |
| G/T towards NOC (dB/K): | 3.50 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 49.5 |
| Saturated EIRP towards remote (dBW): | 49.4 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **49.40** |
| Downlink EIRP Inroute (dBW): | **16.76** |
| **Remote:** | Phoenix |
| Latitude (deg North): | 33.48 |
| Longitude (deg East): | -112.12 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 39 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-16.08** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite AMC-9 at -83.0 degrees

**Skew operational limit: 45 degrees**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 1/2** | rate | **0.512** | **Msps** | in bandwidth | **1.024** | **MHz** |
| **Outroute signal:** | **QPSK 5/6** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | Phoenix | 33.48 | -112.12 |
| **NOC:** | Las Vegas | 36.24 | -115.12 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 36.80 | 35.80 | 35.80 |
| Uplink Path Loss (dB) | 207.09 | 207.09 | 207.09 |
| Spreading Loss (dB) | -162.54 | -162.54 | -162.54 |
| Flux Density at Satellite (dBW/m^2) | -125.74 | -126.74 | -126.74 |
| Uplink C/T (dB) | -166.79 | -167.79 | -167.79 |
| C/No (dB) | 61.81 | 60.81 | 60.81 |
| Noise BW (dB-Hz) | 57.09 | 57.09 | 57.09 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **4.72** | **3.72** | **3.32** |
| Satellite downlink EIRP (dBW) | 17.76 | 16.76 | 16.76 |
| Downlink Path Loss (dB) | 205.67 | 205.67 | 205.67 |
| Downlink C/T (dB) | -152.58 | -155.58 | -155.58 |
| C/No (dB) | 76.03 | 73.03 | 73.03 |
| Noise BW (dB-Hz) | 57.09 | 57.09 | 57.09 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **18.93** | **15.93** | **13.91** |
| Cumulative C/N (dB) | 4.56 | 3.47 | 2.96 |
| Necessary C/N (dB) | 2.10 | 2.10 | 2.10 |
| **Cumulative Inroute Link Margin (dB)** | **2.46** | **1.37** | **0.86** |

# Link Budget for satellite AMC-9 at -83.0 degrees

**Skew operational limit: 45 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

**NOC:**

| | |
|---|---|
| | Las Vegas |
| Latitude (deg North): | 36.24 |
| Longitude (deg East): | -115.12 |
| Antennna diameter (m): | 7.6 m |
| RX Antenna Gain (dBi): | 56.5 |
| Antenna Noise Temp (K): | 61 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 131 |
| Antenna G/T (dB/K): | 35.33 |
| TX Antenna Gain (dBi): | 58.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 78.10 | 76.10 | 76.10 |
| Uplink Path Loss (dB) | 207.13 | 207.13 | 207.13 |
| Spreading Loss (dB) | -162.57 | -162.57 | -162.57 |
| Flux Density at Satellite (dBW/m^2) | -84.47 | -86.47 | -86.47 |
| Uplink C/T (dB) | -125.53 | -127.53 | -127.53 |
| C/No (dB) | 103.08 | 101.08 | 101.08 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **28.30** | **26.30** | **18.14** |
| Satellite downlink EIRP (dBW) | 49.40 | 49.40 | 49.40 |
| Downlink Path Loss (dB) | 205.59 | 205.59 | 205.59 |
| Downlink C/T (dB) | -144.49 | -145.49 | -145.49 |
| C/No (dB) | 9.34 | 8.34 | 8.34 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **9.34** | **8.34** | **5.72** |
| Cumulative C/N (dB) | 9.28 | 8.27 | 5.48 |
| Necessary C/N (dB) | 5.4 | 5.4 | 5.4 |
| **Cumulative Outroute Link Margin (dB)** | **3.88** | **2.87** | **0.08** |

# AMC-9 Link Budgets

Applicable to transmissions up to skew angles of 25, 35, and 45 degrees, and EIRP densities of each:

13.7 dBW/4 kHz

Applicable transmit power and emission bandwidth:

45 dBm, 4.096 MHz

| | |
|---|---|
| **Inroute Signal:** | QPSK 2/3 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 2.048 |
| Spread BW (MHz): | 4.096 |
| Required C/N (dB): | 4.2 |
| **Outroute Signal:** | QPSK 5/6 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 5.4 |
| **Satellite:** | AMC-9 |
| Longitude (deg East): | -83 |
| G/T towards Remote (dB/K): | 5.00 |
| G/T towards NOC (dB/K): | 3.50 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 49.5 |
| Saturated EIRP towards remote (dBW): | 50.5 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **50.50** |
| Downlink EIRP Inroute (dBW): | **24.30** |
| **Remote:** | New York City |
| Latitude (deg North): | 40.73 |
| Longitude (deg East): | -74.02 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 45 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-16.10** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite AMC-9 at -83.0 degrees

**Skew operational limit: 25 degrees**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 2/3** | rate | **2.048** | **Msps** | in bandwidth | **4.096** | **MHz** |
| **Outroute signal:** | **QPSK 5/6** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** |

| | | **Lat** | **Long** |
|---|---|---|---|
| **Remote:** | New York City | 40.73 | -74.02 |
| **NOC:** | Las Vegas | 36.24 | -115.12 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 42.80 | 41.80 | 41.80 |
| Uplink Path Loss (dB) | 207.05 | 207.05 | 207.05 |
| Spreading Loss (dB) | -162.50 | -162.50 | -162.50 |
| Flux Density at Satellite (dBW/m^2) | -119.70 | -120.70 | -120.70 |
| Uplink C/T (dB) | -159.25 | -160.25 | -160.25 |
| C/No (dB) | 69.35 | 68.35 | 68.35 |
| Noise BW (dB-Hz) | 63.11 | 63.11 | 63.11 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **6.23** | **5.23** | **4.68** |
| Satellite downlink EIRP (dBW) | 25.30 | 24.30 | 24.30 |
| Downlink Path Loss (dB) | 205.67 | 205.67 | 205.67 |
| Downlink C/T (dB) | -143.14 | -146.14 | -146.14 |
| C/No (dB) | 85.46 | 82.46 | 82.46 |
| Noise BW (dB-Hz) | 63.11 | 63.11 | 63.11 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **22.35** | **19.35** | **15.72** |
| Cumulative C/N (dB) | 6.13 | 5.07 | 4.35 |
| Necessary C/N (dB) | 4.20 | 4.20 | 4.20 |
| **Cumulative Inroute Link Margin (dB)** | **1.93** | **0.87** | **0.15** |

# Link Budget for satellite AMC-9 at -83.0 degrees

**Skew operational limit: 25 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

**NOC:**

| | |
|---|---|
| | Las Vegas |
| Latitude (deg North): | 36.24 |
| Longitude (deg East): | -115.12 |
| Antennna diameter (m): | 9 m |
| RX Antenna Gain (dBi): | 58.5 |
| Antenna Noise Temp (K): | 64 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 134 |
| Antenna G/T (dB/K): | 37.23 |
| TX Antenna Gain (dBi): | 60.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 80.10 | 78.10 | 78.10 |
| Uplink Path Loss (dB) | 207.16 | 207.16 | 207.16 |
| Spreading Loss (dB) | -162.61 | -162.61 | -162.61 |
| Flux Density at Satellite (dBW/m^2) | -82.51 | -84.51 | -84.51 |
| Uplink C/T (dB) | -123.56 | -125.56 | -125.56 |
| C/No (dB) | 105.04 | 103.04 | 103.04 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **30.27** | **28.27** | **18.39** |
| Satellite downlink EIRP (dBW) | 50.50 | 50.50 | 50.50 |
| Downlink Path Loss (dB) | 205.56 | 205.56 | 205.56 |
| Downlink C/T (dB) | -143.36 | -144.36 | -144.36 |
| C/No (dB) | 10.47 | 9.47 | 9.47 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **10.47** | **9.47** | **6.31** |
| Cumulative C/N (dB) | 10.42 | 9.41 | 6.05 |
| Necessary C/N (dB) | 5.4 | 5.4 | 5.4 |
| **Cumulative Outroute Link Margin (dB)** | **5.02** | **4.01** | **0.65** |

| | |
|---|---|
| **Inroute Signal:** | QPSK 1/2 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 2.048 |
| Spread BW (MHz): | 4.096 |
| Required C/N (dB): | 2.1 |
| **Outroute Signal:** | QPSK 5/6 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 5.4 |
| **Satellite:** | AMC-9 |
| Longitude (deg East): | -83 |
| G/T towards Remote (dB/K): | 2.50 |
| G/T towards NOC (dB/K): | 3.50 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 49.5 |
| Saturated EIRP towards remote (dBW): | 50 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **50.00** |
| Downlink EIRP Inroute (dBW): | **21.80** |
| **Remote:** | Albuquerque |
| Latitude (deg North): | 35.11 |
| Longitude (deg East): | -106.62 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 45 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-16.10** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite AMC-9 at -83.0 degrees

**Skew operational limit: 35 degrees**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 1/2** | rate | **2.048** | **Msps** | in bandwidth | **4.096** | **MHz** |
| **Outroute signal:** | **QPSK 5/6** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** |

| | | **Lat** | **Long** |
|---|---|---|---|
| **Remote:** | Albuquerque | 35.11 | -106.62 |
| **NOC:** | Las Vegas | 36.24 | -115.12 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 42.80 | 41.80 | 41.80 |
| Uplink Path Loss (dB) | 207.05 | 207.05 | 207.05 |
| Spreading Loss (dB) | -162.50 | -162.50 | -162.50 |
| Flux Density at Satellite (dBW/m^2) | -119.70 | -120.70 | -120.70 |
| Uplink C/T (dB) | -161.75 | -162.75 | -162.75 |
| C/No (dB) | 66.85 | 65.85 | 65.85 |
| Noise BW (dB-Hz) | 63.11 | 63.11 | 63.11 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **3.74** | **2.74** | **2.41** |
| Satellite downlink EIRP (dBW) | 22.80 | 21.80 | 21.80 |
| Downlink Path Loss (dB) | 205.67 | 205.67 | 205.67 |
| Downlink C/T (dB) | -145.64 | -148.64 | -148.64 |
| C/No (dB) | 82.96 | 79.96 | 79.96 |
| Noise BW (dB-Hz) | 63.11 | 63.11 | 63.11 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **19.85** | **16.85** | **14.46** |
| Cumulative C/N (dB) | 3.63 | 2.57 | 2.15 |
| Necessary C/N (dB) | 2.10 | 2.10 | 2.10 |
| **Cumulative Inroute Link Margin (dB)** | **1.53** | **0.47** | **0.05** |

# Link Budget for satellite AMC-9 at -83.0 degrees

**Skew operational limit: 35 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

| **NOC:** | Las Vegas |
|---|---|
| Latitude (deg North): | 36.24 |
| Longitude (deg East): | -115.12 |
| Antennna diameter (m): | 9 m |
| RX Antenna Gain (dBi): | 58.5 |
| Antenna Noise Temp (K): | 64 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 134 |
| Antenna G/T (dB/K): | 37.23 |
| TX Antenna Gain (dBi): | 60.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 80.10 | 78.10 | 78.10 |
| Uplink Path Loss (dB) | 207.16 | 207.16 | 207.16 |
| Spreading Loss (dB) | -162.61 | -162.61 | -162.61 |
| Flux Density at Satellite (dBW/m^2) | -82.51 | -84.51 | -84.51 |
| Uplink C/T (dB) | -123.56 | -125.56 | -125.56 |
| C/No (dB) | 105.04 | 103.04 | 103.04 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **30.27** | **28.27** | **18.39** |
| Satellite downlink EIRP (dBW) | 50.00 | 50.00 | 50.00 |
| Downlink Path Loss (dB) | 205.56 | 205.56 | 205.56 |
| Downlink C/T (dB) | -143.86 | -144.86 | -144.86 |
| C/No (dB) | 9.97 | 8.97 | 8.97 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **9.97** | **8.97** | **6.06** |
| Cumulative C/N (dB) | 9.93 | 8.92 | 5.81 |
| Necessary C/N (dB) | 5.4 | 5.4 | 5.4 |
| **Cumulative Outroute Link Margin (dB)** | **4.53** | **3.52** | **0.41** |

| | |
|---|---|
| **Inroute Signal:** | QPSK 1/2 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 2.048 |
| Spread BW (MHz): | 4.096 |
| Required C/N (dB): | 2.1 |
| **Outroute Signal:** | QPSK 5/6 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 5.4 |
| **Satellite:** | AMC-9 |
| Longitude (deg East): | -83 |
| G/T towards Remote (dB/K): | 3.50 |
| G/T towards NOC (dB/K): | 3.50 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 49.5 |
| Saturated EIRP towards remote (dBW): | 49.4 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **49.40** |
| Downlink EIRP Inroute (dBW): | **22.76** |
| **Remote:** | Phoenix |
| Latitude (deg North): | 33.48 |
| Longitude (deg East): | -112.12 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 45 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-16.10** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite AMC-9 at -83.0 degrees

**Skew operational limit: 45 degrees**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 1/2** | rate | **2.048** | **Msps** | in bandwidth | **4.096** | **MHz** |
| **Outroute signal:** | **QPSK 5/6** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | Phoenix | 33.48 | -112.12 |
| **NOC:** | Las Vegas | 36.24 | -115.12 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 42.80 | 41.80 | 41.80 |
| Uplink Path Loss (dB) | 207.09 | 207.09 | 207.09 |
| Spreading Loss (dB) | -162.54 | -162.54 | -162.54 |
| Flux Density at Satellite (dBW/m^2) | -119.74 | -120.74 | -120.74 |
| Uplink C/T (dB) | -160.79 | -161.79 | -161.79 |
| C/No (dB) | 67.81 | 66.81 | 66.81 |
| Noise BW (dB-Hz) | 63.11 | 63.11 | 63.11 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **4.70** | **3.70** | **3.30** |
| Satellite downlink EIRP (dBW) | 23.76 | 22.76 | 22.76 |
| Downlink Path Loss (dB) | 205.67 | 205.67 | 205.67 |
| Downlink C/T (dB) | -144.67 | -147.67 | -147.67 |
| C/No (dB) | 83.93 | 80.93 | 80.93 |
| Noise BW (dB-Hz) | 63.11 | 63.11 | 63.11 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **20.81** | **17.81** | **14.99** |
| Cumulative C/N (dB) | 4.60 | 3.54 | 3.02 |
| Necessary C/N (dB) | 2.10 | 2.10 | 2.10 |
| **Cumulative Inroute Link Margin (dB)** | **2.50** | **1.44** | **0.92** |

# Link Budget for satellite AMC-9 at -83.0 degrees

**Skew operational limit: 45 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

**NOC:**

| | |
|---|---|
| | Las Vegas |
| Latitude (deg North): | 36.24 |
| Longitude (deg East): | -115.12 |
| Antennna diameter (m): | 9 m |
| RX Antenna Gain (dBi): | 58.5 |
| Antenna Noise Temp (K): | 64 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 134 |
| Antenna G/T (dB/K): | 37.23 |
| TX Antenna Gain (dBi): | 60.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 80.10 | 78.10 | 78.10 |
| Uplink Path Loss (dB) | 207.16 | 207.16 | 207.16 |
| Spreading Loss (dB) | -162.61 | -162.61 | -162.61 |
| Flux Density at Satellite (dBW/m^2) | -82.51 | -84.51 | -84.51 |
| Uplink C/T (dB) | -123.56 | -125.56 | -125.56 |
| C/No (dB) | 105.04 | 103.04 | 103.04 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **30.27** | **28.27** | **18.39** |
| Satellite downlink EIRP (dBW) | 49.40 | 49.40 | 49.40 |
| Downlink Path Loss (dB) | 205.59 | 205.59 | 205.59 |
| Downlink C/T (dB) | -144.49 | -145.49 | -145.49 |
| C/No (dB) | 9.34 | 8.34 | 8.34 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **9.34** | **8.34** | **5.72** |
| Cumulative C/N (dB) | 9.30 | 8.29 | 5.49 |
| Necessary C/N (dB) | 5.4 | 5.4 | 5.4 |
| **Cumulative Outroute Link Margin (dB)** | **3.90** | **2.89** | **0.09** |

# AMC-2 Link Budgets

Applicable to transmissions up to skew angles of 25, 35, and 45 degrees, and respective EIRP densities of 16.2, 14.7, and 13.7 dBW/4 kHz

Applicable transmit powers and emission bandwidths:

41.5, 40.0, and 39.0 dBm in 1.024 MHz, respectively

44.5, 43.0, and 42.0 dBm in 2.048 MHz, respectively

| | |
|---|---|
| **Inroute Signal:** | QPSK 1/2 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 1.024 |
| Spread BW (MHz): | 1.024 |
| Required C/N (dB): | 2.1 |
| **Outroute Signal:** | QPSK 3/4 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 4.2 |
| **Satellite:** | AMC-2 |
| Longitude (deg East): | -80.9 |
| G/T towards Remote (dB/K): | 4.90 |
| G/T towards NOC (dB/K): | 5.90 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 49.5 |
| Saturated EIRP towards remote (dBW): | 47.1 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **47.10** |
| Downlink EIRP Inroute (dBW): | **20.84** |
| **Remote:** | Atlanta |
| Latitude (deg North): | 33.64 |
| Longitude (deg East): | -84.43 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 41.5 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-13.58** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite AMC-2 at -80.9 degrees

**Skew operational limit: 25 degrees**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 1/2** | rate | **1.024** | **Msps** | in bandwidth | **1.024** | **MHz** |
| **Outroute signal:** | **QPSK 3/4** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | Atlanta | 33.64 | -84.43 |
| **NOC:** | Woodbine MD | 38.376 | -77.081 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 39.30 | 38.30 | 38.30 |
| Uplink Path Loss (dB) | 206.92 | 206.92 | 206.92 |
| Spreading Loss (dB) | -162.36 | -162.36 | -162.36 |
| Flux Density at Satellite (dBW/m^2) | -123.06 | -124.06 | -124.06 |
| Uplink C/T (dB) | -162.72 | -163.72 | -163.72 |
| C/No (dB) | 65.89 | 64.89 | 64.89 |
| Noise BW (dB-Hz) | 60.10 | 60.10 | 60.10 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **5.78** | **4.78** | **4.28** |
| Satellite downlink EIRP (dBW) | 21.84 | 20.84 | 20.84 |
| Downlink Path Loss (dB) | 205.51 | 205.51 | 205.51 |
| Downlink C/T (dB) | -146.44 | -149.44 | -149.44 |
| C/No (dB) | 82.16 | 79.16 | 79.16 |
| Noise BW (dB-Hz) | 60.10 | 60.10 | 60.10 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **22.06** | **19.06** | **15.59** |
| Cumulative C/N (dB) | 5.68 | 4.62 | 3.97 |
| Necessary C/N (dB) | 2.10 | 2.10 | 2.10 |
| **Cumulative Inroute Link Margin (dB)** | **3.58** | **2.52** | **1.87** |

# Link Budget for satellite AMC-2 at -80.9 degrees

**Skew operational limit: 25 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

| | |
|---|---|
| **NOC:** | Woodbine MD |
| Latitude (deg North): | 38.376 |
| Longitude (deg East): | -77.081 |
| Antennna diameter (m): | 9 m |
| RX Antenna Gain (dBi): | 58.5 |
| Antenna Noise Temp (K): | 64 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 134 |
| Antenna G/T (dB/K): | 37.23 |
| TX Antenna Gain (dBi): | 60.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 80.10 | 78.10 | 78.10 |
| Uplink Path Loss (dB) | 207.00 | 207.00 | 207.00 |
| Spreading Loss (dB) | -162.45 | -162.45 | -162.45 |
| Flux Density at Satellite (dBW/m^2) | -82.35 | -84.35 | -84.35 |
| Uplink C/T (dB) | -121.00 | -123.00 | -123.00 |
| C/No (dB) | 107.60 | 105.60 | 105.60 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **32.83** | **30.83** | **18.59** |
| Satellite downlink EIRP (dBW) | 47.10 | 47.10 | 47.10 |
| Downlink Path Loss (dB) | 205.42 | 205.42 | 205.42 |
| Downlink C/T (dB) | -146.62 | -147.62 | -147.62 |
| C/No (dB) | 7.21 | 6.21 | 6.21 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **7.21** | **6.21** | **4.43** |
| Cumulative C/N (dB) | 7.20 | 6.19 | 4.27 |
| Necessary C/N (dB) | 4.2 | 4.2 | 4.2 |
| **Cumulative Outroute Link Margin (dB)** | **3.00** | **1.99** | **0.07** |

**Link Budget for satellite AMC-2 at -80.9 degrees**

**Skew operational limit: 35 degrees**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 1/2** | rate | **1.024** | **Msps** | in bandwidth | **1.024** | **MHz** |
| **Outroute signal:** | **QPSK 3/5** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | San Antonio | 29.53 | -98.47 |
| **NOC:** | Woodbine MD | 38.376 | -77.081 |

| | |
|---|---|
| **Inroute Signal:** | QPSK 1/2 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 1.024 |
| Spread BW (MHz): | 1.024 |
| Required C/N (dB): | 2.1 |
| **Outroute Signal:** | QPSK 3/5 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 2.4 |
| **Satellite:** | AMC-2 |
| Longitude (deg East): | -80.9 |
| G/T towards Remote (dB/K): | 4.80 |
| G/T towards NOC (dB/K): | 5.90 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 49.5 |
| Saturated EIRP towards remote (dBW): | 45.3 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **45.30** |
| Downlink EIRP Inroute (dBW): | **19.23** |
| **Remote:** | San Antonio |
| Latitude (deg North): | 29.53 |
| Longitude (deg East): | -98.47 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 40 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-15.08** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 37.80 | 36.80 | 36.80 |
| Uplink Path Loss (dB) | 206.92 | 206.92 | 206.92 |
| Spreading Loss (dB) | -162.37 | -162.37 | -162.37 |
| Flux Density at Satellite (dBW/m^2) | -124.57 | -125.57 | -125.57 |
| Uplink C/T (dB) | -164.32 | -165.32 | -165.32 |
| C/No (dB) | 64.28 | 63.28 | 63.28 |
| Noise BW (dB-Hz) | 60.10 | 60.10 | 60.10 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **4.18** | **3.18** | **2.83** |
| Satellite downlink EIRP (dBW) | 20.23 | 19.23 | 19.23 |
| Downlink Path Loss (dB) | 205.51 | 205.51 | 205.51 |
| Downlink C/T (dB) | -148.04 | -151.04 | -151.04 |
| C/No (dB) | 80.56 | 77.56 | 77.56 |
| Noise BW (dB-Hz) | 60.10 | 60.10 | 60.10 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **20.45** | **17.45** | **14.80** |
| Cumulative C/N (dB) | 4.08 | 3.02 | 2.56 |
| Necessary C/N (dB) | 2.10 | 2.10 | 2.10 |
| **Cumulative Inroute Link Margin (dB)** | **1.98** | **0.92** | **0.46** |

# Link Budget for satellite AMC-2 at -80.9 degrees

**Skew operational limit: 35 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

**NOC:**

| | |
|---|---|
| | Woodbine MD |
| Latitude (deg North): | 38.376 |
| Longitude (deg East): | -77.081 |
| Antennna diameter (m): | 9 m |
| RX Antenna Gain (dBi): | 58.5 |
| Antenna Noise Temp (K): | 64 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 134 |
| Antenna G/T (dB/K): | 37.23 |
| TX Antenna Gain (dBi): | 60.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 80.10 | 78.10 | 78.10 |
| Uplink Path Loss (dB) | 207.00 | 207.00 | 207.00 |
| Spreading Loss (dB) | -162.45 | -162.45 | -162.45 |
| Flux Density at Satellite (dBW/m^2) | -82.35 | -84.35 | -84.35 |
| Uplink C/T (dB) | -121.00 | -123.00 | -123.00 |
| C/No (dB) | 107.60 | 105.60 | 105.60 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **32.83** | **30.83** | **18.59** |
| Satellite downlink EIRP (dBW) | 45.30 | 45.30 | 45.30 |
| Downlink Path Loss (dB) | 205.43 | 205.43 | 205.43 |
| Downlink C/T (dB) | -148.43 | -149.43 | -149.43 |
| C/No (dB) | 5.40 | 4.40 | 4.40 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **5.40** | **4.40** | **3.15** |
| Cumulative C/N (dB) | 5.40 | 4.39 | 3.03 |
| Necessary C/N (dB) | 2.4 | 2.4 | 2.4 |
| **Cumulative Outroute Link Margin (dB)** | **3.00** | **1.99** | **0.63** |

| | |
|---|---|
| **Inroute Signal:** | QPSK 2/3 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 0.512 |
| Spread BW (MHz): | 1.024 |
| Required C/N (dB): | 4.2 |
| **Outroute Signal:** | QPSK 2/3 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 3.3 |
| **Satellite:** | AMC-2 |
| Longitude (deg East): | -80.9 |
| G/T towards Remote (dB/K): | 5.10 |
| G/T towards NOC (dB/K): | 5.90 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 49.5 |
| Saturated EIRP towards remote (dBW): | 47 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **47.00** |
| Downlink EIRP Inroute (dBW): | **18.28** |
| **Remote:** | San Diego |
| Latitude (deg North): | 32.73 |
| Longitude (deg East): | -117.19 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 39 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-16.08** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite AMC-2 at -80.9 degrees

**Skew operational limit: 45 degrees**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 2/3** | rate | **0.512** | **Msps** | in bandwidth | **1.024** | **MHz** |
| **Outroute signal:** | **QPSK 2/3** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | San Diego | 32.73 | -117.19 |
| **NOC:** | Woodbine MD | 38.376 | -77.081 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 36.80 | 35.80 | 35.80 |
| Uplink Path Loss (dB) | 207.17 | 207.17 | 207.17 |
| Spreading Loss (dB) | -162.62 | -162.62 | -162.62 |
| Flux Density at Satellite (dBW/m^2) | -125.82 | -126.82 | -126.82 |
| Uplink C/T (dB) | -165.27 | -166.27 | -166.27 |
| C/No (dB) | 63.33 | 62.33 | 62.33 |
| Noise BW (dB-Hz) | 57.09 | 57.09 | 57.09 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **6.24** | **5.24** | **4.68** |
| Satellite downlink EIRP (dBW) | 19.28 | 18.28 | 18.28 |
| Downlink Path Loss (dB) | 205.51 | 205.51 | 205.51 |
| Downlink C/T (dB) | -148.99 | -151.99 | -151.99 |
| C/No (dB) | 79.61 | 76.61 | 76.61 |
| Noise BW (dB-Hz) | 57.09 | 57.09 | 57.09 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **22.51** | **19.51** | **15.79** |
| Cumulative C/N (dB) | 6.14 | 5.08 | 4.36 |
| Necessary C/N (dB) | 4.20 | 4.20 | 4.20 |
| **Cumulative Inroute Link Margin (dB)** | **1.94** | **0.88** | **0.16** |

# Link Budget for satellite AMC-2 at -80.9 degrees

**Skew operational limit: 45 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

**NOC:**

| | |
|---|---|
| | Woodbine MD |
| Latitude (deg North): | 38.376 |
| Longitude (deg East): | -77.081 |
| Antennna diameter (m): | 9 m |
| RX Antenna Gain (dBi): | 58.5 |
| Antenna Noise Temp (K): | 64 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 134 |
| Antenna G/T (dB/K): | 37.23 |
| TX Antenna Gain (dBi): | 60.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 80.10 | 78.10 | 78.10 |
| Uplink Path Loss (dB) | 207.00 | 207.00 | 207.00 |
| Spreading Loss (dB) | -162.45 | -162.45 | -162.45 |
| Flux Density at Satellite (dBW/m^2) | -82.35 | -84.35 | -84.35 |
| Uplink C/T (dB) | -121.00 | -123.00 | -123.00 |
| C/No (dB) | 107.60 | 105.60 | 105.60 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **32.83** | **30.83** | **18.59** |
| Satellite downlink EIRP (dBW) | 47.00 | 47.00 | 47.00 |
| Downlink Path Loss (dB) | 205.68 | 205.68 | 205.68 |
| Downlink C/T (dB) | -146.98 | -147.98 | -147.98 |
| C/No (dB) | 6.85 | 5.85 | 5.85 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **6.85** | **5.85** | **4.19** |
| Cumulative C/N (dB) | 6.84 | 5.84 | 4.04 |
| Necessary C/N (dB) | 3.3 | 3.3 | 3.3 |
| **Cumulative Outroute Link Margin (dB)** | **3.54** | **2.54** | **0.74** |

# AMC-2 Link Budgets

Applicable to transmissions up to skew angles of 25, 35, and 45 degrees, and EIRP densities of each:

13.7 dBW/4 kHz

Applicable transmit power and emission bandwidth:

45 dBm, 4.096 MHz

| | |
|---|---|
| **Inroute Signal:** | QPSK 2/3 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 2.048 |
| Spread BW (MHz): | 4.096 |
| Required C/N (dB): | 4.2 |
| **Outroute Signal:** | QPSK 2/3 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 3.3 |
| **Satellite:** | AMC-2 |
| Longitude (deg East): | -80.9 |
| G/T towards Remote (dB/K): | 4.90 |
| G/T towards NOC (dB/K): | 5.90 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 49.5 |
| Saturated EIRP towards remote (dBW): | 47.1 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **47.10** |
| Downlink EIRP Inroute (dBW): | **24.34** |
| **Remote:** | Atlanta |
| Latitude (deg North): | 33.64 |
| Longitude (deg East): | -84.43 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 45 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-16.10** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite AMC-2 at -80.9 degrees

**Skew operational limit: 25 degrees**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 2/3** | rate | **2.048** | **Msps** | in bandwidth | **4.096** | **MHz** |
| **Outroute signal:** | **QPSK 2/3** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | Atlanta | 33.64 | -84.43 |
| **NOC:** | Woodbine MD | 38.376 | -77.081 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 42.80 | 41.80 | 41.80 |
| Uplink Path Loss (dB) | 206.92 | 206.92 | 206.92 |
| Spreading Loss (dB) | -162.36 | -162.36 | -162.36 |
| Flux Density at Satellite (dBW/m^2) | -119.56 | -120.56 | -120.56 |
| Uplink C/T (dB) | -159.22 | -160.22 | -160.22 |
| C/No (dB) | 69.39 | 68.39 | 68.39 |
| Noise BW (dB-Hz) | 63.11 | 63.11 | 63.11 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **6.27** | **5.27** | **4.71** |
| Satellite downlink EIRP (dBW) | 25.34 | 24.34 | 24.34 |
| Downlink Path Loss (dB) | 205.51 | 205.51 | 205.51 |
| Downlink C/T (dB) | -142.94 | -145.94 | -145.94 |
| C/No (dB) | 85.66 | 82.66 | 82.66 |
| Noise BW (dB-Hz) | 63.11 | 63.11 | 63.11 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **22.55** | **19.55** | **15.81** |
| Cumulative C/N (dB) | 6.17 | 5.11 | 4.39 |
| Necessary C/N (dB) | 4.20 | 4.20 | 4.20 |
| **Cumulative Inroute Link Margin (dB)** | **1.97** | **0.91** | **0.19** |

## Link Budget for satellite AMC-2 at -80.9 degrees

**Skew operational limit: 25 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

**NOC:**

| | |
|---|---|
| | Woodbine MD |
| Latitude (deg North): | 38.376 |
| Longitude (deg East): | -77.081 |
| Antennna diameter (m): | 9 m |
| RX Antenna Gain (dBi): | 58.5 |
| Antenna Noise Temp (K): | 64 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 134 |
| Antenna G/T (dB/K): | 37.23 |
| TX Antenna Gain (dBi): | 60.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 80.10 | 78.10 | 78.10 |
| Uplink Path Loss (dB) | 207.00 | 207.00 | 207.00 |
| Spreading Loss (dB) | -162.45 | -162.45 | -162.45 |
| Flux Density at Satellite (dBW/m^2) | -82.35 | -84.35 | -84.35 |
| Uplink C/T (dB) | -121.00 | -123.00 | -123.00 |
| C/No (dB) | 107.60 | 105.60 | 105.60 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **32.83** | **30.83** | **18.59** |
| Satellite downlink EIRP (dBW) | 47.10 | 47.10 | 47.10 |
| Downlink Path Loss (dB) | 205.42 | 205.42 | 205.42 |
| Downlink C/T (dB) | -146.62 | -147.62 | -147.62 |
| C/No (dB) | 7.21 | 6.21 | 6.21 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **7.21** | **6.21** | **4.43** |
| Cumulative C/N (dB) | 7.20 | 6.19 | 4.27 |
| Necessary C/N (dB) | 3.3 | 3.3 | 3.3 |
| **Cumulative Outroute Link Margin (dB)** | **3.90** | **2.89** | **0.97** |

| | |
|---|---|
| **Inroute Signal:** | QPSK 2/3 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 2.048 |
| Spread BW (MHz): | 4.096 |
| Required C/N (dB): | 4.2 |
| **Outroute Signal:** | QPSK 3/5 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 2.4 |
| **Satellite:** | AMC-2 |
| Longitude (deg East): | -80.9 |
| G/T towards Remote (dB/K): | 4.80 |
| G/T towards NOC (dB/K): | 5.90 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 49.5 |
| Saturated EIRP towards remote (dBW): | 45.3 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **45.30** |
| Downlink EIRP Inroute (dBW): | **24.23** |
| **Remote:** | San Antonio |
| Latitude (deg North): | 29.53 |
| Longitude (deg East): | -98.47 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 45 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-16.10** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite AMC-2 at -80.9 degrees

**Skew operational limit: 35 degrees**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 2/3** | rate | **2.048** | **Msps** | in bandwidth | **4.096** | **MHz** |
| **Outroute signal:** | **QPSK 3/5** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | San Antonio | 29.53 | -98.47 |
| **NOC:** | Woodbine MD | 38.376 | -77.081 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 42.80 | 41.80 | 41.80 |
| Uplink Path Loss (dB) | 206.92 | 206.92 | 206.92 |
| Spreading Loss (dB) | -162.37 | -162.37 | -162.37 |
| Flux Density at Satellite (dBW/m^2) | -119.57 | -120.57 | -120.57 |
| Uplink C/T (dB) | -159.32 | -160.32 | -160.32 |
| C/No (dB) | 69.28 | 68.28 | 68.28 |
| Noise BW (dB-Hz) | 63.11 | 63.11 | 63.11 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **6.17** | **5.17** | **4.62** |
| Satellite downlink EIRP (dBW) | 25.23 | 24.23 | 24.23 |
| Downlink Path Loss (dB) | 205.51 | 205.51 | 205.51 |
| Downlink C/T (dB) | -143.04 | -146.04 | -146.04 |
| C/No (dB) | 85.56 | 82.56 | 82.56 |
| Noise BW (dB-Hz) | 63.11 | 63.11 | 63.11 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **22.44** | **19.44** | **15.76** |
| Cumulative C/N (dB) | 6.07 | 5.01 | 4.30 |
| Necessary C/N (dB) | 4.20 | 4.20 | 4.20 |
| **Cumulative Inroute Link Margin (dB)** | **1.87** | **0.81** | **0.10** |

# Link Budget for satellite AMC-2 at -80.9 degrees

**Skew operational limit: 35 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

**NOC:**

| | |
|---|---|
| | Woodbine MD |
| Latitude (deg North): | 38.376 |
| Longitude (deg East): | -77.081 |
| Antennna diameter (m): | 9 m |
| RX Antenna Gain (dBi): | 58.5 |
| Antenna Noise Temp (K): | 64 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 134 |
| Antenna G/T (dB/K): | 37.23 |
| TX Antenna Gain (dBi): | 60.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 80.10 | 78.10 | 78.10 |
| Uplink Path Loss (dB) | 207.00 | 207.00 | 207.00 |
| Spreading Loss (dB) | -162.45 | -162.45 | -162.45 |
| Flux Density at Satellite (dBW/m^2) | -82.35 | -84.35 | -84.35 |
| Uplink C/T (dB) | -121.00 | -123.00 | -123.00 |
| C/No (dB) | 107.60 | 105.60 | 105.60 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **32.83** | **30.83** | **18.59** |
| Satellite downlink EIRP (dBW) | 45.30 | 45.30 | 45.30 |
| Downlink Path Loss (dB) | 205.43 | 205.43 | 205.43 |
| Downlink C/T (dB) | -148.43 | -149.43 | -149.43 |
| C/No (dB) | 5.40 | 4.40 | 4.40 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **5.40** | **4.40** | **3.15** |
| Cumulative C/N (dB) | 5.40 | 4.39 | 3.03 |
| Necessary C/N (dB) | 2.4 | 2.4 | 2.4 |
| **Cumulative Outroute Link Margin (dB)** | **3.00** | **1.99** | **0.63** |

| | |
|---|---|
| **Inroute Signal:** | QPSK 2/3 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 2.048 |
| Spread BW (MHz): | 4.096 |
| Required C/N (dB): | 4.2 |
| **Outroute Signal:** | QPSK 2/3 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 3.3 |
| **Satellite:** | AMC-2 |
| Longitude (deg East): | -80.9 |
| G/T towards Remote (dB/K): | 5.10 |
| G/T towards NOC (dB/K): | 5.90 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 49.5 |
| Saturated EIRP towards remote (dBW): | 47 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **47.00** |
| Downlink EIRP Inroute (dBW): | **24.28** |
| **Remote:** | San Diego |
| Latitude (deg North): | 32.73 |
| Longitude (deg East): | -117.19 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 45 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-16.10** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite AMC-2 at -80.9 degrees

**Skew operational limit: 45 degrees**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 2/3** | rate | **2.048** | **Msps** | in bandwidth | **4.096** | **MHz** |
| **Outroute signal:** | **QPSK 2/3** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | San Diego | 32.73 | -117.19 |
| **NOC:** | Woodbine MD | 38.376 | -77.081 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 42.80 | 41.80 | 41.80 |
| Uplink Path Loss (dB) | 207.17 | 207.17 | 207.17 |
| Spreading Loss (dB) | -162.62 | -162.62 | -162.62 |
| Flux Density at Satellite (dBW/m^2) | -119.82 | -120.82 | -120.82 |
| Uplink C/T (dB) | -159.27 | -160.27 | -160.27 |
| C/No (dB) | 69.33 | 68.33 | 68.33 |
| Noise BW (dB-Hz) | 63.11 | 63.11 | 63.11 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **6.22** | **5.22** | **4.66** |
| Satellite downlink EIRP (dBW) | 25.28 | 24.28 | 24.28 |
| Downlink Path Loss (dB) | 205.51 | 205.51 | 205.51 |
| Downlink C/T (dB) | -142.99 | -145.99 | -145.99 |
| C/No (dB) | 85.61 | 82.61 | 82.61 |
| Noise BW (dB-Hz) | 63.11 | 63.11 | 63.11 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **22.49** | **19.49** | **15.78** |
| Cumulative C/N (dB) | 6.12 | 5.06 | 4.34 |
| Necessary C/N (dB) | 4.20 | 4.20 | 4.20 |
| **Cumulative Inroute Link Margin (dB)** | **1.92** | **0.86** | **0.14** |

# Link Budget for satellite AMC-2 at -80.9 degrees

**Skew operational limit: 45 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

**NOC:**

| | |
|---|---|
| | Woodbine MD |
| Latitude (deg North): | 38.376 |
| Longitude (deg East): | -77.081 |
| Antennna diameter (m): | 9 m |
| RX Antenna Gain (dBi): | 58.5 |
| Antenna Noise Temp (K): | 64 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 134 |
| Antenna G/T (dB/K): | 37.23 |
| TX Antenna Gain (dBi): | 60.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 80.10 | 78.10 | 78.10 |
| Uplink Path Loss (dB) | 207.00 | 207.00 | 207.00 |
| Spreading Loss (dB) | -162.45 | -162.45 | -162.45 |
| Flux Density at Satellite (dBW/m^2) | -82.35 | -84.35 | -84.35 |
| Uplink C/T (dB) | -121.00 | -123.00 | -123.00 |
| C/No (dB) | 107.60 | 105.60 | 105.60 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **32.83** | **30.83** | **18.59** |
| Satellite downlink EIRP (dBW) | 47.00 | 47.00 | 47.00 |
| Downlink Path Loss (dB) | 205.68 | 205.68 | 205.68 |
| Downlink C/T (dB) | -146.98 | -147.98 | -147.98 |
| C/No (dB) | 6.85 | 5.85 | 5.85 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **6.85** | **5.85** | **4.19** |
| Cumulative C/N (dB) | 6.84 | 5.84 | 4.04 |
| Necessary C/N (dB) | 3.3 | 3.3 | 3.3 |
| **Cumulative Outroute Link Margin (dB)** | **3.54** | **2.54** | **0.74** |

# SES-6 Link Budgets

Applicable to transmissions up to skew angles of 25, 35, 45, and 55 degrees, and respective EIRP densities of 16.2, 14.7, 13.7, and 11.9 dBW/4 kHz

Applicable transmit powers and emission bandwidths:

41.5, 40.0, 39.0, and 37.2 dBm in 1.024 MHz, respectively

44.5, 43.0, 42.0, and 40.2 dBm in 2.048 MHz, respectively

| | |
|---|---|
| **Inroute Signal:** | QPSK 1/2 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 0.512 |
| Spread BW (MHz): | 1.024 |
| Required C/N (dB): | 2.1 |
| **Outroute Signal:** | QPSK 2/3 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 10 |
| Required C/N (dB): | 3.3 |
| **Satellite:** | SES-6 |
| Longitude (deg East): | -40.5 |
| G/T towards Remote (dB/K): | 0.40 |
| G/T towards NOC (dB/K): | 1.25 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 49 |
| Saturated EIRP towards remote (dBW): | 47.7 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **42.93** |
| Downlink EIRP Inroute (dBW): | **15.47** |
| **Remote:** | Limestone Maine |
| Latitude (deg North): | 46.95 |
| Longitude (deg East): | -67.89 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 41.5 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-13.58** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite SES-6 at -40.5 degrees

**Skew operational limit: 25 degrees**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 1/2** | rate | **0.512** | **Msps** | in bandwidth | **1.024** | **MHz** |
| **Outroute signal:** | **QPSK 2/3** | rate | **10** | **Msps** | in bandwidth | **10** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | Limestone Maine | 46.95 | -67.89 |
| **NOC:** | Betzdorf | 49.69 | 6.33 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 39.30 | 38.30 | 38.30 |
| Uplink Path Loss (dB) | 207.28 | 207.28 | 207.28 |
| Spreading Loss (dB) | -162.73 | -162.73 | -162.73 |
| Flux Density at Satellite (dBW/m^2) | -123.43 | -124.43 | -124.43 |
| Uplink C/T (dB) | -167.58 | -168.58 | -168.58 |
| C/No (dB) | 61.02 | 60.02 | 60.02 |
| Noise BW (dB-Hz) | 57.09 | 57.09 | 57.09 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **3.93** | **2.93** | **2.59** |
| Satellite downlink EIRP (dBW) | 16.47 | 15.47 | 15.47 |
| Downlink Path Loss (dB) | 206.04 | 206.04 | 206.04 |
| Downlink C/T (dB) | -152.34 | -155.34 | -155.34 |
| C/No (dB) | 76.26 | 73.26 | 73.26 |
| Noise BW (dB-Hz) | 57.09 | 57.09 | 57.09 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **19.17** | **16.17** | **14.05** |
| Cumulative C/N (dB) | 3.80 | 2.72 | 2.29 |
| Necessary C/N (dB) | 2.10 | 2.10 | 2.10 |
| **Cumulative Inroute Link Margin (dB)** | **1.70** | **0.62** | **0.19** |

# Link Budget for satellite SES-6 at -40.5 degrees

**Skew operational limit: 25 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

**NOC:**

| | |
|---|---|
| | Betzdorf |
| Latitude (deg North): | 49.69 |
| Longitude (deg East): | 6.33 |
| Antennna diameter (m): | 9 m |
| RX Antenna Gain (dBi): | 58.5 |
| Antenna Noise Temp (K): | 64 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 134 |
| Antenna G/T (dB/K): | 37.23 |
| TX Antenna Gain (dBi): | 60.1 |
| TX power (dBm): | 45 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.98** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 75.10 | 73.10 | 73.10 |
| Uplink Path Loss (dB) | 207.53 | 207.53 | 207.53 |
| Spreading Loss (dB) | -162.98 | -162.98 | -162.98 |
| Flux Density at Satellite (dBW/m^2) | -87.88 | -89.88 | -89.88 |
| Uplink C/T (dB) | -131.18 | -133.18 | -133.18 |
| C/No (dB) | 97.42 | 95.42 | 95.42 |
| Noise BW (dB-Hz) | 70.00 | 70.00 | 70.00 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **27.42** | **25.42** | **17.99** |
| Satellite downlink EIRP (dBW) | 42.93 | 42.93 | 42.93 |
| Downlink Path Loss (dB) | 205.79 | 205.79 | 205.79 |
| Downlink C/T (dB) | -151.16 | -152.16 | -152.16 |
| C/No (dB) | 7.44 | 6.44 | 6.44 |
| Noise BW (dB-Hz) | 70.00 | 70.00 | 70.00 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **7.44** | **6.44** | **4.58** |
| Cumulative C/N (dB) | 7.40 | 6.39 | 4.39 |
| Necessary C/N (dB) | 3.3 | 3.3 | 3.3 |
| **Cumulative Outroute Link Margin (dB)** | **4.10** | **3.09** | **1.09** |

| | |
|---|---|
| **Inroute Signal:** | QPSK 1/2 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 0.256 |
| Spread BW (MHz): | 1.024 |
| Required C/N (dB): | 2.1 |
| **Outroute Signal:** | QPSK 2/3 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 10 |
| Required C/N (dB): | 3.3 |
| **Satellite:** | SES-6 |
| Longitude (deg East): | -40.5 |
| G/T towards Remote (dB/K): | 1.20 |
| G/T towards NOC (dB/K): | 1.25 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 49 |
| Saturated EIRP towards remote (dBW): | 48.2 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **43.43** |
| Downlink EIRP Inroute (dBW): | **14.82** |
| **Remote:** | Providence |
| Latitude (deg North): | 41.72 |
| Longitude (deg East): | -71.43 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 40 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-15.08** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite SES-6 at -40.5 degrees

**Skew operational limit: 35 degrees**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 1/2** | rate | **0.256** | **Msps** | in bandwidth | **1.024** | **MHz** |
| **Outroute signal:** | **QPSK 2/3** | rate | **10** | **Msps** | in bandwidth | **10** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | Providence | 41.72 | -71.43 |
| **NOC:** | Betzdorf | 49.69 | 6.33 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 37.80 | 36.80 | 36.80 |
| Uplink Path Loss (dB) | 207.23 | 207.23 | 207.23 |
| Spreading Loss (dB) | -162.68 | -162.68 | -162.68 |
| Flux Density at Satellite (dBW/m^2) | -124.88 | -125.88 | -125.88 |
| Uplink C/T (dB) | -168.23 | -169.23 | -169.23 |
| C/No (dB) | 60.37 | 59.37 | 59.37 |
| Noise BW (dB-Hz) | 54.08 | 54.08 | 54.08 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **6.29** | **5.29** | **4.73** |
| Satellite downlink EIRP (dBW) | 15.82 | 14.82 | 14.82 |
| Downlink Path Loss (dB) | 206.04 | 206.04 | 206.04 |
| Downlink C/T (dB) | -152.99 | -155.99 | -155.99 |
| C/No (dB) | 75.61 | 72.61 | 72.61 |
| Noise BW (dB-Hz) | 54.08 | 54.08 | 54.08 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **21.53** | **18.53** | **15.35** |
| Cumulative C/N (dB) | 6.16 | 5.09 | 4.37 |
| Necessary C/N (dB) | 2.10 | 2.10 | 2.10 |
| **Cumulative Inroute Link Margin (dB)** | **4.06** | **2.99** | **2.27** |

# Link Budget for satellite SES-6 at -40.5 degrees

**Skew operational limit: 35 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

**NOC:**

| | |
|---|---|
| | Betzdorf |
| Latitude (deg North): | 49.69 |
| Longitude (deg East): | 6.33 |
| Antennna diameter (m): | 9 m |
| RX Antenna Gain (dBi): | 58.5 |
| Antenna Noise Temp (K): | 64 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 134 |
| Antenna G/T (dB/K): | 37.23 |
| TX Antenna Gain (dBi): | 60.1 |
| TX power (dBm): | 45 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.98** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 75.10 | 73.10 | 73.10 |
| Uplink Path Loss (dB) | 207.53 | 207.53 | 207.53 |
| Spreading Loss (dB) | -162.98 | -162.98 | -162.98 |
| Flux Density at Satellite (dBW/m^2) | -87.88 | -89.88 | -89.88 |
| Uplink C/T (dB) | -131.18 | -133.18 | -133.18 |
| C/No (dB) | 97.42 | 95.42 | 95.42 |
| Noise BW (dB-Hz) | 70.00 | 70.00 | 70.00 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **27.42** | **25.42** | **17.99** |
| Satellite downlink EIRP (dBW) | 43.43 | 43.43 | 43.43 |
| Downlink Path Loss (dB) | 205.74 | 205.74 | 205.74 |
| Downlink C/T (dB) | -150.61 | -151.61 | -151.61 |
| C/No (dB) | 7.99 | 6.99 | 6.99 |
| Noise BW (dB-Hz) | 70.00 | 70.00 | 70.00 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **7.99** | **6.99** | **4.94** |
| Cumulative C/N (dB) | 7.94 | 6.93 | 4.73 |
| Necessary C/N (dB) | 3.3 | 3.3 | 3.3 |
| **Cumulative Outroute Link Margin (dB)** | **4.64** | **3.63** | **1.43** |

| | |
|---|---|
| **Inroute Signal:** | QPSK 1/2 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 0.256 |
| Spread BW (MHz): | 1.024 |
| Required C/N (dB): | 2.1 |
| **Outroute Signal:** | QPSK 2/3 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 10 |
| Required C/N (dB): | 3.3 |
| **Satellite:** | SES-6 |
| Longitude (deg East): | -40.5 |
| G/T towards Remote (dB/K): | 0.50 |
| G/T towards NOC (dB/K): | 1.25 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 49 |
| Saturated EIRP towards remote (dBW): | 48.2 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **43.43** |
| Downlink EIRP Inroute (dBW): | **13.10** |
| **Remote:** | Washington DC |
| Latitude (deg North): | 38.85 |
| Longitude (deg East): | -77.04 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 39 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-16.08** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite SES-6 at -40.5 degrees

**Skew operational limit: 45 degrees**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 1/2** | rate | **0.256** | **Msps** | in bandwidth | **1.024** | **MHz** |
| **Outroute signal:** | **QPSK 2/3** | rate | **10** | **Msps** | in bandwidth | **10** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | Washington DC | 38.85 | -77.04 |
| **NOC:** | Betzdorf | 49.69 | 6.33 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 36.80 | 35.80 | 35.80 |
| Uplink Path Loss (dB) | 207.25 | 207.25 | 207.25 |
| Spreading Loss (dB) | -162.70 | -162.70 | -162.70 |
| Flux Density at Satellite (dBW/m^2) | -125.90 | -126.90 | -126.90 |
| Uplink C/T (dB) | -169.95 | -170.95 | -170.95 |
| C/No (dB) | 58.65 | 57.65 | 57.65 |
| Noise BW (dB-Hz) | 54.08 | 54.08 | 54.08 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **4.57** | **3.57** | **3.18** |
| Satellite downlink EIRP (dBW) | 14.10 | 13.10 | 13.10 |
| Downlink Path Loss (dB) | 206.04 | 206.04 | 206.04 |
| Downlink C/T (dB) | -154.71 | -157.71 | -157.71 |
| C/No (dB) | 73.89 | 70.89 | 70.89 |
| Noise BW (dB-Hz) | 54.08 | 54.08 | 54.08 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **19.81** | **16.81** | **14.44** |
| Cumulative C/N (dB) | 4.44 | 3.37 | 2.87 |
| Necessary C/N (dB) | 2.10 | 2.10 | 2.10 |
| **Cumulative Inroute Link Margin (dB)** | **2.34** | **1.27** | **0.77** |

# Link Budget for satellite SES-6 at -40.5 degrees

**Skew operational limit: 45 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

| **NOC:** | Betzdorf |
|---|---|
| Latitude (deg North): | 49.69 |
| Longitude (deg East): | 6.33 |
| Antennna diameter (m): | 9 m |
| RX Antenna Gain (dBi): | 58.5 |
| Antenna Noise Temp (K): | 64 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 134 |
| Antenna G/T (dB/K): | 37.23 |
| TX Antenna Gain (dBi): | 60.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-13.98** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 80.10 | 78.10 | 78.10 |
| Uplink Path Loss (dB) | 207.53 | 207.53 | 207.53 |
| Spreading Loss (dB) | -162.98 | -162.98 | -162.98 |
| Flux Density at Satellite (dBW/m^2) | -82.88 | -84.88 | -84.88 |
| Uplink C/T (dB) | -126.18 | -128.18 | -128.18 |
| C/No (dB) | 102.42 | 100.42 | 100.42 |
| Noise BW (dB-Hz) | 70.00 | 70.00 | 70.00 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **32.42** | **30.42** | **18.57** |
| Satellite downlink EIRP (dBW) | 43.43 | 43.43 | 43.43 |
| Downlink Path Loss (dB) | 205.76 | 205.76 | 205.76 |
| Downlink C/T (dB) | -150.63 | -151.63 | -151.63 |
| C/No (dB) | 7.97 | 6.97 | 6.97 |
| Noise BW (dB-Hz) | 70.00 | 70.00 | 70.00 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **7.97** | **6.97** | **4.92** |
| Cumulative C/N (dB) | 7.96 | 6.95 | 4.74 |
| Necessary C/N (dB) | 3.3 | 3.3 | 3.3 |
| **Cumulative Outroute Link Margin (dB)** | **4.66** | **3.65** | **1.44** |

| | |
|---|---|
| **Inroute Signal:** | QPSK 1/2 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 0.256 |
| Spread BW (MHz): | 2.048 |
| Required C/N (dB): | 2.1 |
| **Outroute Signal:** | QPSK 2/3 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 10 |
| Required C/N (dB): | 3.3 |
| **Satellite:** | SES-6 |
| Longitude (deg East): | -40.5 |
| G/T towards Remote (dB/K): | 0.00 |
| G/T towards NOC (dB/K): | 1.25 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 49 |
| Saturated EIRP towards remote (dBW): | 47.7 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **42.93** |
| Downlink EIRP Inroute (dBW): | **14.18** |
| **Remote:** | San Juan |
| Latitude (deg North): | 18.44 |
| Longitude (deg East): | -66 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 40.2 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-17.89** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite SES-6 at -40.5 degrees

**Skew operational limit: 55 degrees**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 1/2** | rate | **0.256** | **Msps** | in bandwidth | **2.048** | **MHz** |
| **Outroute signal:** | **QPSK 2/3** | rate | **10** | **Msps** | in bandwidth | **10** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | San Juan | 18.44 | -66 |
| **NOC:** | Betzdorf | 49.69 | 6.33 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 38.00 | 37.00 | 37.00 |
| Uplink Path Loss (dB) | 206.87 | 206.87 | 206.87 |
| Spreading Loss (dB) | -162.32 | -162.32 | -162.32 |
| Flux Density at Satellite (dBW/m^2) | -124.32 | -125.32 | -125.32 |
| Uplink C/T (dB) | -168.87 | -169.87 | -169.87 |
| C/No (dB) | 59.73 | 58.73 | 58.73 |
| Noise BW (dB-Hz) | 54.08 | 54.08 | 54.08 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **5.65** | **4.65** | **4.16** |
| Satellite downlink EIRP (dBW) | 15.18 | 14.18 | 14.18 |
| Downlink Path Loss (dB) | 206.04 | 206.04 | 206.04 |
| Downlink C/T (dB) | -153.63 | -156.63 | -156.63 |
| C/No (dB) | 74.97 | 71.97 | 71.97 |
| Noise BW (dB-Hz) | 54.08 | 54.08 | 54.08 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **20.89** | **17.89** | **15.03** |
| Cumulative C/N (dB) | 5.52 | 4.45 | 3.82 |
| Necessary C/N (dB) | 2.10 | 2.10 | 2.10 |
| **Cumulative Inroute Link Margin (dB)** | **3.42** | **2.35** | **1.72** |

# Link Budget for satellite SES-6 at -40.5 degrees

**Skew operational limit: 55 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

| **NOC:** | Betzdorf |
|---|---|
| Latitude (deg North): | 49.69 |
| Longitude (deg East): | 6.33 |
| Antennna diameter (m): | 9 m |
| RX Antenna Gain (dBi): | 58.5 |
| Antenna Noise Temp (K): | 64 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 134 |
| Antenna G/T (dB/K): | 37.23 |
| TX Antenna Gain (dBi): | 60.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-13.98** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 80.10 | 78.10 | 78.10 |
| Uplink Path Loss (dB) | 207.53 | 207.53 | 207.53 |
| Spreading Loss (dB) | -162.98 | -162.98 | -162.98 |
| Flux Density at Satellite (dBW/m^2) | -82.88 | -84.88 | -84.88 |
| Uplink C/T (dB) | -126.18 | -128.18 | -128.18 |
| C/No (dB) | 102.42 | 100.42 | 100.42 |
| Noise BW (dB-Hz) | 70.00 | 70.00 | 70.00 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **32.42** | **30.42** | **18.57** |
| Satellite downlink EIRP (dBW) | 42.93 | 42.93 | 42.93 |
| Downlink Path Loss (dB) | 205.38 | 205.38 | 205.38 |
| Downlink C/T (dB) | -150.75 | -151.75 | -151.75 |
| C/No (dB) | 7.85 | 6.85 | 6.85 |
| Noise BW (dB-Hz) | 70.00 | 70.00 | 70.00 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **7.85** | **6.85** | **4.85** |
| Cumulative C/N (dB) | 7.84 | 6.83 | 4.67 |
| Necessary C/N (dB) | 3.3 | 3.3 | 3.3 |
| **Cumulative Outroute Link Margin (dB)** | **4.54** | **3.53** | **1.37** |

# SES-6 Link Budgets

Applicable to transmissions up to skew angles of 25, 35, 45, and 55 degrees, and EIRP densities of:

13.7 dBW/4 kHz: 25, 35, and 45 degrees slew

11.9 dBW/4 kHz: 55 degrees skew

Applicable transmit power and emission bandwidth:

45 dBm, 4.096 MHz: 25, 35, and 45 degrees slew

43.2 dBm, 4.096 MHz: 55 degrees slew

| | |
|---|---|
| **Inroute Signal:** | QPSK 1/2 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 1.024 |
| Spread BW (MHz): | 4.096 |
| Required C/N (dB): | 2.1 |
| **Outroute Signal:** | QPSK 2/3 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 3.3 |
| **Satellite:** | SES-6 |
| Longitude (deg East): | -40.5 |
| G/T towards Remote (dB/K): | 0.40 |
| G/T towards NOC (dB/K): | 1.25 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 49 |
| Saturated EIRP towards remote (dBW): | 47.7 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **47.70** |
| Downlink EIRP Inroute (dBW): | **18.97** |
| **Remote:** | estone Maine (Loring) |
| Latitude (deg North): | 46.95 |
| Longitude (deg East): | -67.89 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 45 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-16.10** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite SES-6 at -40.5 degrees

**Skew operational limit: 25 degrees**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 1/2** | rate | **1.024** | **Msps** | in bandwidth | **4.096** | **MHz** | |
| **Outroute signal:** | **QPSK 2/3** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** | |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | Limestone Maine (Lorin | 46.95 | -67.89 |
| **NOC:** | Betzdorf | 49.69 | 6.33 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 42.80 | 41.80 | 41.80 |
| Uplink Path Loss (dB) | 207.28 | 207.28 | 207.28 |
| Spreading Loss (dB) | -162.73 | -162.73 | -162.73 |
| Flux Density at Satellite (dBW/m^2) | -119.93 | -120.93 | -120.93 |
| Uplink C/T (dB) | -164.08 | -165.08 | -165.08 |
| C/No (dB) | 64.52 | 63.52 | 63.52 |
| Noise BW (dB-Hz) | 60.10 | 60.10 | 60.10 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **4.42** | **3.42** | **3.04** |
| Satellite downlink EIRP (dBW) | 19.97 | 18.97 | 18.97 |
| Downlink Path Loss (dB) | 206.04 | 206.04 | 206.04 |
| Downlink C/T (dB) | -148.84 | -151.84 | -151.84 |
| C/No (dB) | 79.76 | 76.76 | 76.76 |
| Noise BW (dB-Hz) | 60.10 | 60.10 | 60.10 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **19.66** | **16.66** | **14.35** |
| Cumulative C/N (dB) | 4.29 | 3.21 | 2.73 |
| Necessary C/N (dB) | 2.10 | 2.10 | 2.10 |
| **Cumulative Inroute Link Margin (dB)** | **2.19** | **1.11** | **0.63** |

## Link Budget for satellite SES-6 at -40.5 degrees

Skew operational limit: 25 degrees

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

**NOC:**

| | |
|---|---|
| | Betzdorf |
| Latitude (deg North): | 49.69 |
| Longitude (deg East): | 6.33 |
| Antennna diameter (m): | 9 m |
| RX Antenna Gain (dBi): | 58.5 |
| Antenna Noise Temp (K): | 64 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 134 |
| Antenna G/T (dB/K): | 37.23 |
| TX Antenna Gain (dBi): | 60.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 80.10 | 78.10 | 78.10 |
| Uplink Path Loss (dB) | 207.53 | 207.53 | 207.53 |
| Spreading Loss (dB) | -162.98 | -162.98 | -162.98 |
| Flux Density at Satellite (dBW/m^2) | -82.88 | -84.88 | -84.88 |
| Uplink C/T (dB) | -126.18 | -128.18 | -128.18 |
| C/No (dB) | 102.42 | 100.42 | 100.42 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **27.65** | **25.65** | **18.03** |
| Satellite downlink EIRP (dBW) | 47.70 | 47.70 | 47.70 |
| Downlink Path Loss (dB) | 205.79 | 205.79 | 205.79 |
| Downlink C/T (dB) | -146.39 | -147.39 | -147.39 |
| C/No (dB) | 7.44 | 6.44 | 6.44 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **7.44** | **6.44** | **4.58** |
| Cumulative C/N (dB) | 7.40 | 6.39 | 4.39 |
| Necessary C/N (dB) | 3.3 | 3.3 | 3.3 |
| **Cumulative Outroute Link Margin (dB)** | **4.10** | **3.09** | **1.09** |

| | |
|---|---|
| **Inroute Signal:** | QPSK 1/2 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 1.024 |
| Spread BW (MHz): | 4.096 |
| Required C/N (dB): | 2.1 |
| **Outroute Signal:** | QPSK 3/4 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 4.2 |
| **Satellite:** | SES-6 |
| Longitude (deg East): | -40.5 |
| G/T towards Remote (dB/K): | 1.20 |
| G/T towards NOC (dB/K): | 1.25 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 49 |
| Saturated EIRP towards remote (dBW): | 48.2 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **48.20** |
| Downlink EIRP Inroute (dBW): | **19.82** |
| **Remote:** | Providence |
| Latitude (deg North): | 41.72 |
| Longitude (deg East): | -71.43 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 45 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-16.10** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite SES-6 at -40.5 degrees

**Skew operational limit: 35 degrees**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 1/2** | rate | **1.024** | **Msps** | in bandwidth | **4.096** | **MHz** |
| **Outroute signal:** | **QPSK 3/4** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | Providence | 41.72 | -71.43 |
| **NOC:** | Betzdorf | 49.69 | 6.33 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 42.80 | 41.80 | 41.80 |
| Uplink Path Loss (dB) | 207.23 | 207.23 | 207.23 |
| Spreading Loss (dB) | -162.68 | -162.68 | -162.68 |
| Flux Density at Satellite (dBW/m^2) | -119.88 | -120.88 | -120.88 |
| Uplink C/T (dB) | -163.23 | -164.23 | -164.23 |
| C/No (dB) | 65.37 | 64.37 | 64.37 |
| Noise BW (dB-Hz) | 60.10 | 60.10 | 60.10 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **5.27** | **4.27** | **3.82** |
| Satellite downlink EIRP (dBW) | 20.82 | 19.82 | 19.82 |
| Downlink Path Loss (dB) | 206.04 | 206.04 | 206.04 |
| Downlink C/T (dB) | -147.99 | -150.99 | -150.99 |
| C/No (dB) | 80.61 | 77.61 | 77.61 |
| Noise BW (dB-Hz) | 60.10 | 60.10 | 60.10 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **20.51** | **17.51** | **14.83** |
| Cumulative C/N (dB) | 5.14 | 4.07 | 3.49 |
| Necessary C/N (dB) | 2.10 | 2.10 | 2.10 |
| **Cumulative Inroute Link Margin (dB)** | **3.04** | **1.97** | **1.39** |

# Link Budget for satellite SES-6 at -40.5 degrees

**Skew operational limit: 35 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

**NOC:**

| | |
|---|---|
| | Betzdorf |
| Latitude (deg North): | 49.69 |
| Longitude (deg East): | 6.33 |
| Antennna diameter (m): | 9 m |
| RX Antenna Gain (dBi): | 58.5 |
| Antenna Noise Temp (K): | 64 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 134 |
| Antenna G/T (dB/K): | 37.23 |
| TX Antenna Gain (dBi): | 60.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 80.10 | 78.10 | 78.10 |
| Uplink Path Loss (dB) | 207.53 | 207.53 | 207.53 |
| Spreading Loss (dB) | -162.98 | -162.98 | -162.98 |
| Flux Density at Satellite (dBW/m^2) | -82.88 | -84.88 | -84.88 |
| Uplink C/T (dB) | -126.18 | -128.18 | -128.18 |
| C/No (dB) | 102.42 | 100.42 | 100.42 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **27.65** | **25.65** | **18.03** |
| Satellite downlink EIRP (dBW) | 48.20 | 48.20 | 48.20 |
| Downlink Path Loss (dB) | 205.74 | 205.74 | 205.74 |
| Downlink C/T (dB) | -145.84 | -146.84 | -146.84 |
| C/No (dB) | 7.99 | 6.99 | 6.99 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **7.99** | **6.99** | **4.94** |
| Cumulative C/N (dB) | 7.95 | 6.94 | 4.73 |
| Necessary C/N (dB) | 4.2 | 4.2 | 4.2 |
| **Cumulative Outroute Link Margin (dB)** | **3.75** | **2.74** | **0.53** |

| | |
|---|---|
| **Inroute Signal:** | QPSK 1/2 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 1.024 |
| Spread BW (MHz): | 4.096 |
| Required C/N (dB): | 2.1 |
| **Outroute Signal:** | QPSK 3/4 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 4.2 |
| **Satellite:** | SES-6 |
| Longitude (deg East): | -40.5 |
| G/T towards Remote (dB/K): | 0.50 |
| G/T towards NOC (dB/K): | 1.25 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 49 |
| Saturated EIRP towards remote (dBW): | 48.2 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **48.20** |
| Downlink EIRP Inroute (dBW): | **19.10** |
| **Remote:** | Washington DC |
| Latitude (deg North): | 38.85 |
| Longitude (deg East): | -77.04 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 45 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-16.10** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite SES-6 at -40.5 degrees

**Skew operational limit: 45 degrees**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 1/2** | rate | **1.024** | **Msps** | in bandwidth | **4.096** | **MHz** |
| **Outroute signal:** | **QPSK 3/4** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** |

| | | Lat | Long |
|---|---|---|---|
| **Remote:** | Washington DC | 38.85 | -77.04 |
| **NOC:** | Betzdorf | 49.69 | 6.33 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 42.80 | 41.80 | 41.80 |
| Uplink Path Loss (dB) | 207.25 | 207.25 | 207.25 |
| Spreading Loss (dB) | -162.70 | -162.70 | -162.70 |
| Flux Density at Satellite (dBW/m^2) | -119.90 | -120.90 | -120.90 |
| Uplink C/T (dB) | -163.95 | -164.95 | -164.95 |
| C/No (dB) | 64.65 | 63.65 | 63.65 |
| Noise BW (dB-Hz) | 60.10 | 60.10 | 60.10 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **4.55** | **3.55** | **3.16** |
| Satellite downlink EIRP (dBW) | 20.10 | 19.10 | 19.10 |
| Downlink Path Loss (dB) | 206.04 | 206.04 | 206.04 |
| Downlink C/T (dB) | -148.71 | -151.71 | -151.71 |
| C/No (dB) | 79.89 | 76.89 | 76.89 |
| Noise BW (dB-Hz) | 60.10 | 60.10 | 60.10 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **19.79** | **16.79** | **14.42** |
| Cumulative C/N (dB) | 4.42 | 3.35 | 2.85 |
| Necessary C/N (dB) | 2.10 | 2.10 | 2.10 |
| **Cumulative Inroute Link Margin (dB)** | **2.32** | **1.25** | **0.75** |

## Link Budget for satellite SES-6 at -40.5 degrees

**Skew operational limit: 45 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

**NOC:**

| | |
|---|---|
| | Betzdorf |
| Latitude (deg North): | 49.69 |
| Longitude (deg East): | 6.33 |
| Antennna diameter (m): | 9 m |
| RX Antenna Gain (dBi): | 58.5 |
| Antenna Noise Temp (K): | 64 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 134 |
| Antenna G/T (dB/K): | 37.23 |
| TX Antenna Gain (dBi): | 60.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 80.10 | 78.10 | 78.10 |
| Uplink Path Loss (dB) | 207.53 | 207.53 | 207.53 |
| Spreading Loss (dB) | -162.98 | -162.98 | -162.98 |
| Flux Density at Satellite (dBW/m^2) | -82.88 | -84.88 | -84.88 |
| Uplink C/T (dB) | -126.18 | -128.18 | -128.18 |
| C/No (dB) | 102.42 | 100.42 | 100.42 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **27.65** | **25.65** | **18.03** |
| Satellite downlink EIRP (dBW) | 48.20 | 48.20 | 48.20 |
| Downlink Path Loss (dB) | 205.76 | 205.76 | 205.76 |
| Downlink C/T (dB) | -145.86 | -146.86 | -146.86 |
| C/No (dB) | 7.97 | 6.97 | 6.97 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **7.97** | **6.97** | **4.92** |
| Cumulative C/N (dB) | 7.92 | 6.91 | 4.72 |
| Necessary C/N (dB) | 4.2 | 4.2 | 4.2 |
| **Cumulative Outroute Link Margin (dB)** | **3.72** | **2.71** | **0.52** |

| | |
|---|---|
| **Inroute Signal:** | QPSK 1/2 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Baseband BW (MHz): | 0.512 |
| Spread BW (MHz): | 4.096 |
| Required C/N (dB): | 2.1 |
| **Outroute Signal:** | QPSK 3/4 |
| Uplink Frequency (MHz): | 14250 |
| Downlink Frequency (MHz): | 12000 |
| Bandwidth (MHz): | 30 |
| Required C/N (dB): | 4.2 |
| **Satellite:** | SES-6 |
| Longitude (deg East): | -40.5 |
| G/T towards Remote (dB/K): | 0.00 |
| G/T towards NOC (dB/K): | 1.25 |
| G/T Degradation (dB): | 0 |
| Saturation Flux Density (dBW/m^2): | -90.5 |
| Saturated EIRP towards NOC (dBW): | 49 |
| Saturated EIRP towards remote (dBW): | 47.7 |
| Attenuation Setting (dB): | 0 |
| Downlink EIRP Outroute (dBW): | **47.70** |
| Downlink EIRP Inroute (dBW): | **17.18** |
| **Remote:** | San Juan |
| Latitude (deg North): | 18.44 |
| Longitude (deg East): | -66 |
| TX Antenna Gain (dBi): | 28.80 |
| TX Power (dBm): | 43.2 |
| TX Backoff (dB): | 1 |
| Power into flange (dBW/4 kHz): | **-17.90** |
| RX G/T (dB/K): | 11.70 |
| Antenna Mispoint (dB): | 0.5 |
| Rain Attenuation (dB): | 0 |
| Atmospheric Attenuation (dB): | 0.5 |
| **Inroute Uplink Interference** | |
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -17.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -20.0 |
| Cumulative Interf. Uplink (dB): | **-13.88** |

## Link Budget for satellite SES-6 at -40.5 degrees

**Skew operational limit: 55 degrees**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Inroute signal:** | **QPSK 1/2** | rate | **0.512** | **Msps** | in bandwidth | **4.096** | **MHz** |
| **Outroute signal:** | **QPSK 3/4** | rate | **30** | **Msps** | in bandwidth | **30** | **MHz** |

| | | **Lat** | **Long** |
|---|---|---|---|
| **Remote:** | San Juan | 18.44 | -66 |
| **NOC:** | Betzdorf | 49.69 | 6.33 |

| **Inroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 41.00 | 40.00 | 40.00 |
| Uplink Path Loss (dB) | 206.87 | 206.87 | 206.87 |
| Spreading Loss (dB) | -162.32 | -162.32 | -162.32 |
| Flux Density at Satellite (dBW/m^2) | -121.32 | -122.32 | -122.32 |
| Uplink C/T (dB) | -165.87 | -166.87 | -166.87 |
| C/No (dB) | 62.73 | 61.73 | 61.73 |
| Noise BW (dB-Hz) | 57.09 | 57.09 | 57.09 |
| Interference (dB) | N/A | N/A | -13.88 |
| **Uplink C/N (dB)** | **5.64** | **4.64** | **4.15** |
| Satellite downlink EIRP (dBW) | 18.18 | 17.18 | 17.18 |
| Downlink Path Loss (dB) | 206.04 | 206.04 | 206.04 |
| Downlink C/T (dB) | -150.63 | -153.63 | -153.63 |
| C/No (dB) | 77.97 | 74.97 | 74.97 |
| Noise BW (dB-Hz) | 57.09 | 57.09 | 57.09 |
| Interference (dB) | N/A | N/A | -18.19 |
| **Downlink C/N (dB)** | **20.88** | **17.88** | **15.02** |
| Cumulative C/N (dB) | 5.51 | 4.43 | 3.81 |
| Necessary C/N (dB) | 2.10 | 2.10 | 2.10 |
| **Cumulative Inroute Link Margin (dB)** | **3.41** | **2.33** | **1.71** |

## Link Budget for satellite SES-6 at -40.5 degrees

**Skew operational limit: 55 degrees**

**Outroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -10.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -20.0 |
| Cumulative Interf. Downlink (dB): | **-9.17** |

**NOC:**

| | |
|---|---|
| | Betzdorf |
| Latitude (deg North): | 49.69 |
| Longitude (deg East): | 6.33 |
| Antennna diameter (m): | 9 m |
| RX Antenna Gain (dBi): | 58.5 |
| Antenna Noise Temp (K): | 64 |
| Antenna LNA Temp (K): | 70 |
| Total Noise Temp (K): | 134 |
| Antenna G/T (dB/K): | 37.23 |
| TX Antenna Gain (dBi): | 60.1 |
| TX power (dBm): | 50 |
| TX backoff (dB): | 0 |
| Power into flange (dBW/ 4 kHz): | **-18.75** |
| Antenna mis-point (dB): | 0.5 |
| Rain Attenuation (dB): | 1 |
| Atmospheric Attenuation (dB): | 0.5 |

**Inroute Downlink Interference**

| | |
|---|---|
| Adjacent Channel Downlink (dB): | -30.0 |
| Adjacent Satellite Downlink (dB): | -25.0 |
| Cross-Pol Downlink (dB): | -20.0 |
| Intermod Downlink (dB): | -30.0 |
| Cumulative Interf. Downlink (dB): | **-18.19** |

**Outroute Uplink Interference**

| | |
|---|---|
| Adjacent Channel Uplink (dB): | -30.0 |
| Adjacent Satellite Uplink (dB): | -30.0 |
| Cross-Pol Uplink (dB): | -20.0 |
| Intermod Uplink (dB): | -30.0 |
| Cumulative Interf. Uplink (dB): | **-18.86** |

| **Outroute Path:** | **Ideal Link** | **Mispoint/ Rain/ Atmospheric Losses** | **Intermod/ Satellite/ Cross-pol Interference** |
|---|---|---|---|
| EIRP towards satellite (dBW) | 80.10 | 78.10 | 78.10 |
| Uplink Path Loss (dB) | 207.53 | 207.53 | 207.53 |
| Spreading Loss (dB) | -162.98 | -162.98 | -162.98 |
| Flux Density at Satellite (dBW/m^2) | -82.88 | -84.88 | -84.88 |
| Uplink C/T (dB) | -126.18 | -128.18 | -128.18 |
| C/No (dB) | 102.42 | 100.42 | 100.42 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -18.86 |
| **Uplink C/N (dB)** | **27.65** | **25.65** | **18.03** |
| Satellite downlink EIRP (dBW) | 47.70 | 47.70 | 47.70 |
| Downlink Path Loss (dB) | 205.38 | 205.38 | 205.38 |
| Downlink C/T (dB) | -145.98 | -146.98 | -146.98 |
| C/No (dB) | 7.85 | 6.85 | 6.85 |
| Noise BW (dB-Hz) | 74.77 | 74.77 | 74.77 |
| Interference (dB) | N/A | N/A | -9.17 |
| **Downlink C/N (dB)** | **7.85** | **6.85** | **4.85** |
| Cumulative C/N (dB) | 7.81 | 6.79 | 4.64 |
| Necessary C/N (dB) | 4.2 | 4.2 | 4.2 |
| **Cumulative Outroute Link Margin (dB)** | **3.61** | **2.59** | **0.44** |