

Table D4.2

IA-9 Link Budget

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C-band Digital

Wanted System Orbital Location -97 deg W  
 Interfering System Orbital Location -99 deg W and 95W (FCC allocation)  
 Minimum Orbital Separation (Geo-centric) 1.90 deg ; Note: the calculations take topocentric advantage into account

|        |          |       |        |      |       |     |
|--------|----------|-------|--------|------|-------|-----|
| Uplink | I, psd   | -35.7 | dBw/hz | Tx F | 6.000 | GHz |
| Dnlink | I, eirpd | -30   | dBw/hz | Rx F | 4.000 | GHz |

| Carrier Type                                     | 64K, 8PSK, R2/3 RS |         |         |         |         |         | 64K, QPSK, R1/2 RS |         |         |         |         |         |
|--|--------------------|---------|---------|---------|---------|---------|--------------------|---------|---------|---------|---------|---------|
|  | CONUS              | CONUS   | Mexico  | Mexico  | Conus   | Conus   | CONUS              | CONUS   | Mexico  | Mexico  | Conus   | Conus   |
| Transmit ES Location                             | CONUS              | CONUS   | Mexico  | Mexico  | Conus   | Conus   | CONUS              | CONUS   | Mexico  | Mexico  | Conus   | Conus   |
| Receive ES Location                              | CONUS              | CONUS   | Conus   | Conus   | Mexico  | Mexico  | CONUS              | CONUS   | Conus   | Conus   | Mexico  | Mexico  |
| Tx ES Size at SA                                 | 4.5                | 4.5     | 4.5     | 4.5     | 4.5     | 4.5     | 4.5                | 4.5     | 4.5     | 4.5     | 4.5     | 4.5     |
| Transmit ES Peak gain                            | 46.8               | 46.8    | 46.8    | 46.8    | 46.8    | 46.8    | 46.8               | 46.8    | 46.8    | 46.8    | 46.8    | 46.8    |
| RX ES Size                                       | 3.8                | 16.0    | 3.8     | 16.0    | 6.0     | 16.0    | 2.4                | 16.0    | 2.4     | 16.0    | 3.0     | 16.0    |
| Receive ES Gain                                  | 41.8               | 54.3    | 41.8    | 54.3    | 45.8    | 54.3    | 37.8               | 54.3    | 37.8    | 54.3    | 39.8    | 54.3    |
| Receive ES G/T (Temp=83K)                        | 22.6               | 35.1    | 22.6    | 35.1    | 26.6    | 35.1    | 18.6               | 35.1    | 18.6    | 35.1    | 20.6    | 35.1    |
| Carrier Type                                     | 64KR2/3            | 64KR2/3 | 64KR2/3 | 64KR2/3 | 64KR2/3 | 64KR2/3 | 64KR1/2            | 64KR1/2 | 64KR1/2 | 64KR1/2 | 64KR1/2 | 64KR1/2 |
| Occupied bandwidth per carrier (kHz)             | 34.9               | 34.9    | 34.9    | 34.9    | 34.9    | 34.9    | 69.7               | 69.7    | 69.7    | 69.7    | 69.7    | 69.7    |
| Allocated bandwidth per carrier (kHz)            | 47.1               | 47.1    | 47.1    | 47.1    | 47.1    | 47.1    | 94.1               | 94.1    | 94.1    | 94.1    | 94.1    | 94.1    |
| C/N Threshold                                    | 10.54              | 10.54   | 10.54   | 10.54   | 10.54   | 10.54   | 4.5                | 4.5     | 4.5     | 4.5     | 4.5     | 4.5     |
| System Margin                                    | 1.00               | 1.00    | 1.00    | 1.00    | 1.00    | 1.00    | 1.00               | 1.00    | 1.00    | 1.00    | 0.30    | 1.00    |
| C/N, Threshold + margin                          | 11.54              | 11.54   | 11.54   | 11.54   | 11.54   | 11.54   | 5.53               | 5.53    | 5.53    | 5.53    | 4.83    | 5.53    |
| Nominal e/s e.i.r.p. per carrier @ES(dBW)        | 49.7               | 46.7    | 53.0    | 50.2    | 50.5    | 47.2    | 53.2               | 43.1    | 56.5    | 46.6    | 56.5    | 43.2    |
| TX ES PSD @ ES                                   | -42.5              | -45.5   | -39.2   | -42.0   | -41.7   | -45.0   | -42.0              | -52.1   | -38.7   | -48.6   | -38.7   | -52.0   |
| ES eirp @ bp-- minimum (dBW)                     | 48.0               | 45.0    | 47.3    | 44.5    | 48.8    | 45.5    | 51.5               | 41.4    | 50.8    | 40.9    | 54.8    | 41.5    |
| ES Power @ bp dBW, min                           | 1.2                | -1.8    | 0.5     | -2.3    | 2.0     | -1.3    | 4.7                | -5.4    | 4.0     | -5.9    | 8.0     | -5.3    |
| ES Power @ site dBW, max                         | 2.9                | -0.1    | 6.2     | 3.4     | 3.7     | 0.4     | 6.4                | -3.7    | 9.7     | -0.2    | 9.7     | -3.6    |
| Sat G/T at bp                                    | 1.8                | 1.8     | 1.8     | 1.8     | 1.8     | 1.8     | 1.8                | 1.8     | 1.8     | 1.8     | 1.8     | 1.8     |
| Sat G/T at e/s                                   | 0.1                | 0.1     | -3.9    | -3.9    | 0.1     | 0.1     | 0.1                | 0.1     | -3.9    | -3.9    | 0.1     | 0.1     |
| Free space path loss (dB)                        | 199.5              | 199.5   | 199.2   | 199.2   | 199.5   | 199.5   | 199.5              | 199.5   | 199.2   | 199.2   | 199.5   | 199.5   |
| Input back off, dB                               | 5.0                | 5.0     | 5.0     | 5.0     | 5.0     | 5.0     | 5.0                | 5.0     | 5.0     | 5.0     | 5.0     | 5.0     |
| Output back off dB                               | 3.0                | 3.0     | 3.0     | 3.0     | 3.0     | 3.0     | 3.0                | 3.0     | 3.0     | 3.0     | 3.0     | 3.0     |
| C/N uplink (dB)                                  | 33.5               | 30.5    | 33.1    | 30.3    | 34.3    | 31.0    | 34.0               | 23.9    | 33.6    | 23.7    | 37.3    | 24.0    |
| X-pol interf:C/I -uplink (dB)-wanted system      | 30.0               | 30.0    | 30.0    | 30.0    | 30.0    | 30.0    | 30.0               | 30.0    | 30.0    | 30.0    | 30.0    | 30.0    |
| X-pol interf:C/I -uplink (dB)-interfering ES     | 23.4               | 20.4    | 26.7    | 23.9    | 24.2    | 20.9    | 23.9               | 13.8    | 27.2    | 17.3    | 27.2    | 13.9    |
| C/I - copol asi uplink (dB)                      | 17.3               | 14.3    | 16.6    | 13.8    | 18.1    | 14.8    | 17.8               | 7.7     | 17.1    | 7.2     | 21.1    | 7.8     |
| HPA IM at 10 deg el angle(limit: 21.c;10,Ku)     | 21.0               | 21.0    | 21.0    | 21.0    | 21.0    | 21.0    | 21.0               | 21.0    | 21.0    | 21.0    | 21.0    | 21.0    |
| Satellite TWTA IM per carrier @ bp               | -21.0              | -21.0   | -21.0   | -21.0   | -21.0   | -21.0   | -21.0              | -21.0   | -21.0   | -21.0   | -21.0   | -21.0   |
| C/N+I+others, uplink                             | 15.4               | 12.6    | 15.3    | 12.7    | 16.1    | 13.1    | 15.8               | 6.5     | 15.7    | 6.6     | 18.3    | 6.6     |
| Downlink e.i.r.p. -bp (dBW)                      | 42.2               | 42.2    | 42.2    | 42.2    | 42.2    | 42.2    | 42.2               | 42.2    | 42.2    | 42.2    | 42.2    | 42.2    |
| Downlink BP-BE difference                        | 6                  | 6       | 6       | 6       | 6       | 6       | 6                  | 6       | 6       | 6       | 6       | 6       |
| DL ES Pattern Advantage                          | 4.7                | 4.7     | 4.7     | 4.7     | 0       | 0       | 4.7                | 4.7     | 4.7     | 4.7     | 0       | 0       |
| Satellite e.i.r.p.d. per carrier (dBW)-tow es    | -34.3              | -36.4   | -34.3   | -36.4   | -39.0   | -41.1   | -34.3              | -36.4   | -34.3   | -36.4   | -39.0   | -41.1   |
| Satellite e.i.r.p.d. per carrier (dBW)-bp        | -33.0              | -35.1   | -33.0   | -35.1   | -33.0   | -35.1   | -33.0              | -35.1   | -33.0   | -35.1   | -33.0   | -35.1   |
| Satellite e.i.r.p. per carrier (dBW)-at es       | 11.1               | 9.1     | 11.1    | 9.1     | 6.4     | 4.4     | 14.1               | 12.1    | 14.1    | 12.1    | 9.4     | 7.4     |
| Satellite e.i.r.p. per carrier (dBW)-bp          | 12.4               | 10.4    | 12.4    | 10.4    | 12.4    | 10.4    | 15.4               | 13.4    | 15.4    | 13.4    | 15.4    | 13.4    |
| Free space path loss (dB)                        | 196.0              | 196.0   | 195.7   | 195.7   | 196.0   | 196.0   | 196.0              | 196.0   | 195.7   | 195.7   | 196.0   | 196.0   |
| Earth station pointing loss (dB)                 | 0.30               | 0.3     | 0.3     | 0.3     | 0.3     | 0.3     | 0.30               | 0.3     | 0.3     | 0.3     | 0.3     | 0.3     |
| C/N downlink towards BP (dB)                     | 26.6               | 37.1    | 26.9    | 37.4    | 25.9    | 32.4    | 22.6               | 37.1    | 22.9    | 37.4    | 19.9    | 32.4    |
| C/N downlink towards ES (dB)                     | 25.3               | 35.8    | 25.6    | 36.1    | 19.9    | 26.4    | 21.3               | 35.8    | 21.6    | 36.1    | 13.9    | 26.4    |
| C/N-thermal-total                                | 24.7               | 29.4    | 24.9    | 29.3    | 19.7    | 25.1    | 21.1               | 23.6    | 21.3    | 23.5    | 13.8    | 22.0    |
| Interference & Margins:                          |                    |         |         |         |         |         |                    |         |         |         |         |         |
| C/I Co-polar downlink interference d/I(dB)       | 21.6               | 32.4    | 21.6    | 32.4    | 20.7    | 27.7    | 9.2                | 32.4    | 9.2     | 32.4    | 9.9     | 27.7    |
| C/I X-polar external interference d/I (dB)       | 17.8               | 30.8    | 17.8    | 30.8    | 19.3    | 26.1    | 11.8               | 30.8    | 11.8    | 30.8    | 10.0    | 26.1    |
| Downlink C/(Nth +I+others) composite with ASI dn | 15.7               | 27.8    | 15.8    | 27.8    | 15.1    | 21.9    | 7.1                | 27.8    | 7.1     | 27.8    | 6.1     | 21.9    |
| Total C/(Nth +I) composite with ASI tot          | 12.6               | 12.5    | 12.5    | 12.6    | 12.6    | 12.5    | 6.6                | 6.5     | 6.6     | 6.5     | 5.9     | 6.5     |
| Total C/(Nth +others) w/o ASI                    | 20.8               | 20.7    | 20.8    | 20.7    | 18.0    | 19.8    | 18.9               | 19.2    | 19.1    | 19.2    | 13.3    | 18.6    |
| Other losses(terrestrial, OBE, etc.)             | 1.0                | 1.0     | 1.0     | 1.0     | 1.0     | 1.0     | 1.0                | 1.0     | 1.0     | 1.0     | 1.0     | 1.0     |
| Available C/N                                    | 11.6               | 11.5    | 11.5    | 11.6    | 11.6    | 11.5    | 5.6                | 5.5     | 5.6     | 5.5     | 4.9     | 5.5     |
| C/N Margin                                       | 0.0                | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0                | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     |