EXHIBIT 12: GALAXY KA LINK BUDGETS

Satellite Information	Clear Sky	Up Fade	Dn Fade
Satellite Longitude (degrees)	-89.1	-89.1	-89.1
G/T (EOC, dB/K)	2.5	2.5	2.5
Attenuation setting (dB)	17.0	17.0	17.0
SFD (EOC, dBW/m2)	-77.2	-77.2	-77.2
Downlink EIRP (Beam Peak, dBW)	61.2	61.2	61.2
Carrier Information			
Emission Designation	110MG7W	110MG7W	110MG7W
Bits/Symbol	2	2	2
Info Rate + Overhead (Mbit/s)	86.27	86.27	86.27
Codec:	0.50	0.50	0.50
RS:	0.92	0.92	0.92
Noise Bandwidth (MHz)	93.616	93.616	93.616
C/N required (dB)	3.1	3.1	3.1
Transmit Earth Station			
Antenna Diameter (m)	6.0	6.0	6.0
Rain Rate (mm/hr)	95.0	95.0	95.0
Peak Antenna Gain (dBi)	63.6	63.6	63.6
S/C Relative Gain from Peak towards E/S (dB)	-4.0	-4.0	-4.0
Receive Earth Station			
Antenna Diameter (m)	0.73	0.73	0.73
Rain Rate (mm/hr)	95.0	95.0	95.0
Peak Antenna Gain (dBi)	41.8	41.8	41.8
D/Lamda	48.6	48.6	48.6
S/C Relative Gain from Peak towards E/S (dB)	-4.0	-4.0	-4.0
System (LNA_Sky) Noise Temp	150.0	150.0	150.0
Temperature due to rain fade and gases	37.4	37.4	223.6
G/T of ES (dB/K)	19.1	19.1	16.1
C/N Uplink Per Carrier			
Uplink EIRP per carrier (EOC, dBW)	85.1	95.1	85.1
Pathloss at uplink frequency (dB)	213.2	213.2	213.2
Uplink gazeous attenuation (dB)	0.5	0.5	0.5
Uplink rain attenuation (dB)	0.0	12.8	0.0
Uplink control correction (dB)	0.0	10.0	0.0
Gain of 1 m2 antenna (dB)	50.9	50.9	50.9
Per carrier input back-off (dB)	0.0	0.0	0.0
C/N uplink, thermal (EOC, dB)	22.7	20.0	22.7
C/N Downlink Per Carrier			
Transponder BP saturation EIRP (dBW)	61.2	61.2	61.2
Per carrier output back-off (dB)	0.0	0.0	0.0
Per carrier EIRP (EOC, dBW)	57.2	57.2	57.2
Pointing Error (dB)	-0.5	-0.5	-0.5
Pathloss at downlink frequency (dB)	209.7	209.7	209.7
Downlink gazeous attenuation (dB)	0.6	0.6	0.6
Downlink rain attenuation (dB)	0.0	0.0	5.8
ES G/T (dB/K)	19.1	19.1	16.1
C/N downlink, thermal (EOC, dB)	14.4	14.4	5.6
C/I Other links (re-use, IM)	30.0	30.0	30.0
INTERFERING SATELLITE #1			
Orbital Separation (degrees)	1.80	1.80	1.80
G (AP-7) (dBi)	22.7	22.7	22.7
Interfering Uplink power density (dBW/Hz)	-56.5	-56.5	-56.5
Interfering D/L eirp density (dBW/Hz)	-15.9	-15.9	-15.9
C/I ASI uplink (dB)	40.4	50.4	40.4
C/I ASI downlink (dB)	12.5	12.5	12.5
INTERFERING SATELLITE #2			
Orbital Separation (degrees)	1.91	1.91	1.91
G (AP-7) (dBi)	21.2	21.2	21.2
Interfering Uplink power density (dBW/Hz)	-56.5	-56.5	-56.5
Interfering D/L eirp density (dBW/Hz)	-15.9	-15.9	-15.9
C/I ASI uplink (dB)	40.4	50.4	40.4
C/I ASI downlink (dB)	14.0	14.0	14.0
Total C/N			
C/N available per carrier (dB)	8.6	8.4	4.2
Margin for other losses (dB)	1.1	1.1	1.1
C/N total (clear-sky, dB)	7.5	7.3	3.1
PSD (EOC, dBW/Hz)	-58.2	-48.2	-58.2
ESD at beam peak (dBW/Hz)	-18.5	-18.5	-18.5
# of carriers	1	1	1

Notes:

1) Carrier modulation is QPSK
2) Link calculations apply to all combinations of the Conus and South America uplink and downlink beams.
3) The orbital location listed for each adjacent satellite corresponds to the topocentric location corresponding to a 2 degree geocentric separation with respect to Galaxy Ka and incorporating 0.05 degrees of stationkeeping accuracy as well as 0.05 degrees of receive antenna mispointing towards one of the adjacent satellites (and 0.05 degree of mispointing away from the other adjacent satellite).

EXHIBIT 12: GALAXY KA LINK BUDGETS (continued)

Satellite Information	Clear Sky	Up Fade	Dn Fade
Satellite Longitude (degrees)	-89.1	-89.1	-89.1
G/T (EOC, dB/K)	2.5	2.5	2.5
Attenuation setting (dB)	15.0	15.0	15.0
SFD (EOC, dBW/m2)	-79.2	-79.2	-79.2
Downlink EIRP (Beam Peak, dBW)	61.2	61.2	61.2
Carrier Information			
Emission Designation	10M3G7W	10M3G7W	10M3G7W
Bits/Symbol	2	2	2
Info Rate ÷ Overhead (Mbit/s)	6.24	6.24	6.24
Codec:	0.50	0.50	0.50
RS:	0.92	0.92	0.92
Noise Bandwidth (MHz)	6.771	6.771	6.771
C/N required (dB)	3.9	3.6	3.6
Transmit Earth Station			
Antenna Diameter (m)	6.0	6.0	6.0
Rain Rate (mm/hr)	95.0	95.0	95.0
Peak Antenna Gain (dBi)	63.6	63.6	63.6
S/C Relative Gain from Peak towards E/S (dB)	-4.0	-4.0	-4.0
Receive Earth Station			
Antenna Diameter (m)	0.67	0.67	0.67
Rain Rate (mm/hr)	95.0	95.0	95.0
Peak Antenna Gain (dBi)	41.0	41.0	41.0
D/Lamda	44.4	44.4	44.4
S/C Relative Gain from Peak towards E/S (dB)	-4.0	-4.0	-4.0
System (LNA_Sky) Noise Temp	150.0	150.0	150.0
Temperature due to rain fade and gases	37.4	37.4	223.6
G/T of ES (dB/K)	18.3	18.3	15.3
C/N Uplink Per Carrier			
Uplink EIRP per carrier (EOC, dBW)	69.2	79.2	69.2
Pathloss at uplink frequency (dB)	213.2	213.2	213.2
Uplink gazeous atttenuation (dB)	0.5	0.5	0.5
Uplink rain attenuation (dB)	0.0	12.8	0.0
Uplink control correction (dB)	0.0	10.0	0.0
Gain of 1 m2 antenna (dB)	50.9	50.9	50.9
Per carrier input back-off (dB)	-13.9	-13.9	-13.9
C/N uplink, thermal (EOC, dB)	18.3	15.5	18.3
C/N Downlink Per Carrier			
Transponder BP saturation EIRP (dBW)	61.2	61.2	61.2
Per carrier output back-off (dB)	-8.8	-8.8	-8.8
Per carrier EIRP (EOC, dBW)	48.4	48.4	48.4
Pointing Error (dB)	-0.5	-0.5	-0.5
Pathloss at downlink frequency (dB)	209.7	209.7	209.7
Downlink gazeous attenuation (dB)	0.6	0.6	0.6
Downlink rain attenuation (dB)	0.0	0.0	5.8
ES G/T (dB/K)	18.3	18.3	15.3
C/N downlink, thermal (EOC, dB)	16.2	16.2	7.4
C/I Other links (re-use, IM)	16.0	16.0	16.0
INTERFERING SATELLITE #1			
Orbital Separation (degrees)	1.77	1.77	1.77
G (AP-7) (dBi)	25.5	25.5	25.5
Interfering Uplink power density (dBW/Hz)	-56.5	-56.5	-56.5
Interfering D/L eirp density (dBW/Hz)	-15.9	-15.9	-15.9
C/I ASI uplink (dB)	35.9	45.9	35.9
C/I ASI downlink (dB)	11.5	11.5	11.5
INTERFERING SATELLITE #2			
Orbital Separation (degrees)	1.88	1.88	1.88
G (AP-7) (dBi)	23.6	23.6	23.6
Interfering Uplink power density (dBW/Hz)	-56.5	-56.5	-56.5
Interfering D/L eirp density (dBW/Hz)	-15.9	-15.9	-15.9
C/I ASI uplink (dB)	35.9	45.9	35.9
C/I ASI downlink (dB)	13.5	13.5	13.5
Total C/N			
C/N available per carrier (dB)	7.4	7.1	4.7
Margin for other losses (dB)	1.1	1.1	1.1
C/N total (clear-sky, dB)	6.3	6.0	3.6
PSD (EOC, dBW/Hz)	-62.7	-62.7	-62.7
ESD at beam peak (dBW/Hz)	-15.9	-15.9	-15.9
# of carriers	7	7	7

Notes:

1) Carrier modulation is QPSK
2) Link calculations apply to all combinations of the Conus and South America uplink and downlink beams.
3) The orbital location listed for each adjacent satellite corresponds to the topocentric location corresponding to a 2 degree geocentric separation with respect to Galaxy Ka and incorporating 0.05 degrees of stationkeeping accuracy as well as 0.05 degrees of receive antenna mispointing towards one of the adjacent satellites (and 0.05 degree of mispointing away from the other adjacent satellite).

EXHIBIT 12: GALAXY KA LINK BUDGETS (continued)

Satellite Information	Clear Sky	Up Fade	Dn Fade
Satellite Longitude (degrees)	-89.1	-89.1	-89.1
G/T (EOC, dB/K)	2.5	2.5	2.5
Attenuation setting (dB)	15.0	15.0	15.0
SFD (EOC, dBW/m2)	-79.2	-79.2	-79.2
Downlink EIRP (Beam Peak, dBW)	61.2	61.2	61.2
Carrier Information			
Emission Designation	100KG7W	100KG7W	100KG7W
Bits/Symbol	2	2	2
Info Rate + Overhead (Mbit/s)	0.07	0.07	0.07
Codec:	0.50	0.50	0.50
RS:	0.93	0.93	0.93
Noise Bandwidth (MHz)	0.075	0.075	0.075
C/N required (dB)	3.0	2.8	2.8
Transmit Earth Station			
Antenna Diameter (m)	6.0	6.0	6.0
Rain Rate (mm/hr)	95.0	95.0	95.0
Peak Antenna Gain (dBi)	63.6	63.6	63.6
S/C Relative Gain from Peak towards E/S (dB)	-4.0	-4.0	-4.0
Receive Earth Station			
Antenna Diameter (m)	0.64	0.64	0.64
Rain Rate (mm/hr)	95.0	95.0	95.0
Peak Antenna Gain (dBi)	40.6	40.6	40.6
D/Lamda	42.5	42.5	42.5
S/C Relative Gain from Peak towards E/S (dB)	-4.0	-4.0	-4.0
System (LNA_Sky) Noise Temp	150.0	150.0	150.0
Temperature due to rain fade and gases	37.4	37.4	223.6
G/T of ES (dB/K)	17.9	17.9	14.9
C/N Uplink Per Carrier			
Uplink EIRP per carrier (EOC, dBW)	49.6	59.6	49.6
Pathloss at uplink frequency (dB)	213.2	213.2	213.2
Uplink gazeous attenuation (dB)	0.5	0.5	0.5
Uplink rain attenuation (dB)	0.0	12.8	0.0
Uplink control correction (dB)	0.0	10.0	0.0
Gain of 1 m2 antenna (dB)	50.9	50.9	50.9
Per carrier input back-off (dB)	-33.4	-33.4	-33.4
C/N uplink, thermal (EOC, dB)	18.3	15.5	18.3
C/N Downlink Per Carrier			
Transponder BP saturation EIRP (dBW)	61.2	61.2	61.2
Per carrier output back-off (dB)	-28.3	-28.3	-28.3
Per carrier EIRP (EOC, dBW)	28.9	28.9	28.9
Pointing Error (dB)	-0.5	-0.5	-0.5
Pathloss at downlink frequency (dB)	209.7	209.7	209.7
Downlink gazeous attenuation (dB)	0.6	0.6	0.6
Downlink rain attenuation (dB)	0.0	0.0	5.8
ES G/T (dB/K)	17.9	17.9	14.9
C/N downlink, thermal (EOC, dB)	15.8	15.8	7.0
C/I Other links (re-use, IM)	16.0	16.0	16.0
INTERFERING SATELLITE #1			
Orbital Separation (degrees)	1.76	1.76	1.76
G (AP-7) (dBi)	26.7	26.7	26.7
Interfering Uplink power density (dBW/Hz)	-56.5	-56.5	-56.5
Interfering D/L eirp density (dBW/Hz)	-15.9	-15.9	-15.9
C/I ASI uplink (dB)	35.9	45.9	35.9
C/I ASI downlink (dB)	10.0	10.0	10.0
INTERFERING SATELLITE #2			
Orbital Separation (degrees)	1.87	1.87	1.87
G (AP-7) (dBi)	24.9	24.9	24.9
Interfering Uplink power density (dBW/Hz)	-56.5	-56.5	-56.5
Interfering D/L eirp density (dBW/Hz)	-15.9	-15.9	-15.9
C/I ASI uplink (dB)	35.9	45.9	35.9
C/I ASI downlink (dB)	11.8	11.8	11.8
Total C/N			
C/N available per carrier (dB)	6.3	6.1	3.9
Margin for other losses (dB)	1.1	1.1	1.1
C/N total (clear-sky, dB)	5.2	5.0	2.8
PSD (EOC, dBW/Hz)	-62.7	-52.7	-62.7
ESD at beam peak (dBW/Hz)	-15.9	-15.9	-15.9
# of carriers	680	680	680

Notes:

1) Carrier modulation is QPSK
2) Link calculations apply to all combinations of the Conus and South America uplink and downlink beams.
3) The orbital location listed for each adjacent satellite corresponds to the topocentric location corresponding to a 2 degree geocentric separation with respect to Galaxy Ka and incorporating 0.05 degrees of stationkeeping accuracy as well as 0.05 degrees of receive antenna mispointing towards one of the adjacent satellites (and 0.05 degree of mispointing away from the other adjacent satellite).

EXHIBIT 12: GALAXY KA LINK BUDGETS (continued)

Satellite Information	Clear Sky	Up Fade	Dn Fade
Satellite Longitude (degrees)	-89.1	-89.1	-89.1
G/T (EOC, dB/K)	2.5	2.5	2.5
Attenuation setting (dB)	15.0	15.0	15.0
SFD (EOC, dBW/m2)	-79.2	-79.2	-79.2
Downlink EIRP (Beam Peak, dBW)	61.2	61.2	61.2
Carrier Information			
Emission Designation	1M45G7W	1M45G7W	1M45G7W
Bits/Symbol	1	1	1
Info Rate + Overhead (Mbit/s)	0.61	0.61	0.61
Codec:	0.50	0.50	0.50
RS:	1.00	1.00	1.00
Noise Bandwidth (MHz)	1.229	1.229	1.229
C/N required (dB)	3.4	2.7	2.7
Transmit Earth Station			
Antenna Diameter (m)	6.0	6.0	6.0
Rain Rate (mm/hr)	95.0	95.0	95.0
Peak Antenna Gain (dBi)	63.6	63.6	63.6
S/C Relative Gain from Peak towards E/S (dB)	-4.0	-4.0	-4.0
Receive Earth Station			
Antenna Diameter (m)	0.80	0.80	0.80
Rain Rate (mm/hr)	95.0	95.0	95.0
Peak Antenna Gain (dBi)	42.6	42.6	42.6
D/Lamda	53.2	53.2	53.2
S/C Relative Gain from Peak towards E/S (dB)	-4.0	-4.0	-4.0
System (LNA_Sky) Noise Temp	150.0	150.0	150.0
Temperature due to rain fade and gases	37.4	37.4	223.6
G/T of ES (dB/K)	19.9	19.9	16.9
C/N Uplink Per Carrier			
Uplink EIRP per carrier (EOC, dBW)	58.5	68.5	58.5
Pathloss at uplink frequency (dB)	213.2	213.2	213.2
Uplink gazeous attenuation (dB)	0.5	0.5	0.5
Uplink rain attenuation (dB)	0.0	12.8	0.0
Uplink control correction (dB)	0.0	10.0	0.0
Gain of 1 m2 antenna (dB)	50.9	50.9	50.9
Per carrier input back-off (dB)	-24.5	-24.5	-24.5
C/N uplink, thermal (EOC, dB)	15.0	12.3	15.0
C/N Downlink Per Carrier			
Transponder BP saturation EIRP (dBW)	61.2	61.2	61.2
Per carrier output back-off (dB)	-19.4	-19.4	-19.4
Per carrier EIRP (EOC, dBW)	37.8	37.8	37.8
Pointing Error (dB)	-0.5	-0.5	-0.5
Pathloss at downlink frequency (dB)	209.7	209.7	209.7
Downlink gazeous attenuation (dB)	0.6	0.6	0.6
Downlink rain attenuation (dB)	0.0	0.0	5.8
ES G/T (dB/K)	19.9	19.9	16.9
C/N downlink, thermal (EOC, dB)	14.5	14.5	5.7
C/I Other links (re-use, IM)	16.0	16.0	16.0
INTERFERING SATELLITE #1			
Orbital Separation (degrees)	1.82	1.82	1.82
G (AP-7) (dBi)	22.1	22.1	22.1
Interfering Uplink power density (dBW/Hz)	-56.5	-56.5	-56.5
Interfering D/L eirp density (dBW/Hz)	-15.9	-15.9	-15.9
C/I ASI uplink (dB)	32.7	42.7	32.7
C/I ASI downlink (dB)	13.2	13.2	13.2
INTERFERING SATELLITE #2			
Orbital Separation (degrees)	1.93	1.93	1.93
G (AP-7) (dBi)	21.8	21.8	21.8
Interfering Uplink power density (dBW/Hz)	-56.5	-56.5	-56.5
Interfering D/L eirp density (dBW/Hz)	-15.9	-15.9	-15.9
C/I ASI uplink (dB)	32.7	42.7	32.7
C/I ASI downlink (dB)	13.5	13.5	13.5
Total C/N			
C/N available per carrier (dB)	7.3	6.7	3.8
Margin for other losses (dB)	1.1	1.1	1.1
C/N total (clear-sky, dB)	6.2	5.6	2.7
PSD (EOC, dBW/Hz)	-65.9	-55.9	-65.9
ESD at beam peak (dBW/Hz)	-19.1	-19.1	-19.1
# of carriers	75	75	75

Notes:

1) Carrier modulation is BPSK
2) Link calculations apply to all combinations of the Conus and South America uplink and downlink beams.
3) The orbital location listed for each adjacent satellite corresponds to the topocentric location corresponding to a 2 degree geocentric separation with respect to Galaxy Ka and incorporating 0.05 degrees of stationkeeping accuracy as well as 0.05 degrees of receive antenna mispointing towards one of the adjacent satellites (and 0.05 degree of mispointing away from the other adjacent satellite).

EXHIBIT 12: GALAXY KA LINK BUDGETS (continued)

Satellite Information	Clear Sky	Up Fade	Dn Fade
Satellite Longitude (degrees)	-89.1	-89.1	-89.1
G/T (EOC, dB/K)	2.5	2.5	2.5
Attenuation setting (dB)	15.0	15.0	15.0
SFD (EOC, dBW/m2)	-79.2	-79.2	-79.2
Downlink EIRP (Beam Peak, dBW)	61.2	61.2	61.2
Carrier Information			
Emission Designation	400KG7W	400KG7W	400KG7W
Bits/Symbol	1	1	1
Info Rate + Overhead (Mbit/s)	0.15	0.15	0.15
Codec:	0.50	0.50	0.50
RS:	1.00	1.00	1.00
Noise Bandwidth (MHz)	0.307	0.307	0.307
C/N required (dB)	3.4	2.7	2.7
Transmit Earth Station			
Antenna Diameter (m)	0.8	0.8	0.8
Rain Rate (mm/hr)	95.0	95.0	95.0
Peak Antenna Gain (dBi)	46.1	46.1	46.1
S/C Relative Gain from Peak towards E/S (dB)	-4.0	-4.0	-4.0
Receive Earth Station			
Antenna Diameter (m)	6.00	6.00	6.00
Rain Rate (mm/hr)	95.0	95.0	95.0
Peak Antenna Gain (dBi)	60.1	60.1	60.1
D/Lamda	399.0	399.0	399.0
S/C Relative Gain from Peak towards E/S (dB)	-4.0	-4.0	-4.0
System (LNA_Sky) Noise Temp	150.0	150.0	150.0
Temperature due to rain fade and gases	37.4	37.4	223.6
G/T of ES (dB/K)	37.4	37.4	34.4
C/N Uplink Per Carrier			
Uplink EIRP per carrier (EOC, dBW)	44.4	54.4	44.4
Pathloss at uplink frequency (dB)	213.2	213.2	213.2
Uplink gazeous attenuation (dB)	0.5	0.5	0.5
Uplink rain attenuation (dB)	0.0	12.8	0.0
Uplink control correction (dB)	0.0	10.0	0.0
Gain of 1 m2 antenna (dB)	50.9	50.9	50.9
Per carrier input back-off (dB)	-38.6	-38.6	-38.6
C/N uplink, thermal (EOC, dB)	7.0	4.2	7.0
C/N Downlink Per Carrier			
Transponder BP saturation EIRP (dBW)	61.2	61.2	61.2
Per carrier output back-off (dB)	-33.5	-33.5	-33.5
Per carrier EIRP (EOC, dBW)	23.7	23.7	23.7
Pointing Error (dB)	-0.5	-0.5	-0.5
Pathloss at downlink frequency (dB)	209.7	209.7	209.7
Downlink gazeous attenuation (dB)	0.6	0.6	0.6
Downlink rain attenuation (dB)	0.0	0.0	5.8
ES G/T (dB/K)	37.4	37.4	34.4
C/N downlink, thermal (EOC, dB)	24.0	24.0	15.2
C/I Other links (re-use, IM)	16.0	16.0	16.0
INTERFERING SATELLITE #1			
Orbital Separation (degrees)	2.05	2.05	2.05
G (AP-7) (dBi)	21.2	21.2	21.2
Interfering Uplink power density (dBW/Hz)	-56.5	-56.5	-56.5
Interfering D/L eirp density (dBW/Hz)	-15.9	-15.9	-15.9
C/I ASI uplink (dB)	24.6	34.6	24.6
C/I ASI downlink (dB)	23.6	23.6	23.6
INTERFERING SATELLITE #2			
Orbital Separation (degrees)	2.16	2.16	2.16
G (AP-7) (dBi)	20.6	20.6	20.6
Interfering Uplink power density (dBW/Hz)	-56.5	-56.5	-56.5
Interfering D/L eirp density (dBW/Hz)	-15.9	-15.9	-15.9
C/I ASI uplink (dB)	24.6	34.6	24.6
C/I ASI downlink (dB)	24.2	24.2	24.2
Total C/N			
C/N available per carrier (dB)	6.1	3.8	5.6
Margin for other losses (dB)	1.1	1.1	1.1
C/N total (clear-sky, dB)	5.0	2.7	4.5
PSD (EOC, dBW/Hz)	-56.5	-46.5	-56.5
ESD at beam peak (dBW/Hz)	-27.2	-27.2	-27.2
# of carriers	275	275	275

Notes:

1) Carrier modulation is BPSK
2) Link calculations apply to all combinations of the Conus and South America uplink and downlink beams.
3) The orbital location listed for each adjacent satellite corresponds to the topocentric location corresponding to a 2 degree geocentric separation with respect to Galaxy Ka and incorporating 0.05 degrees of stationkeeping accuracy as well as 0.05 degrees of receive antenna mispointing towards one of the adjacent satellites (and 0.05 degree of mispointing away from the other adjacent satellite).

EXHIBIT 12: GALAXY KA LINK BUDGETS (continued)

Satellite Information	Clear Sky	Up Fade	Dn Fade
Satellite Longitude (degrees)	-89.1	-89.1	-89.1
G/T (EOC, dB/K)	2.5	2.5	2.5
Attenuation setting (dB)	17.0	17.0	17.0
SFD (EOC, dBW/m2)	-77.2	-77.2	-77.2
Downlink EIRP (Beam Peak, dBW)	61.2	61.2	61.2
Carrier Information			
Emission Designation	110MG7W	110MG7W	110MG7W
Bits/Symbol	2	2	2
Info Rate + Overhead (Mbit/s)	86.27	86.27	86.27
Codec:	0.50	0.50	0.50
RS:	0.92	0.92	0.92
Noise Bandwidth (MHz)	93.616	93.616	93.616
C/N required (dB)	3.1	3.1	3.1
Transmit Earth Station			
Antenna Diameter (m)	6.0	6.0	6.0
Rain Rate (mm/hr)	41.9	41.9	41.9
Peak Antenna Gain (dBi)	63.6	63.6	63.6
S/C Relative Gain from Peak towards E/S (dB)	-4.0	-4.0	-4.0
Receive Earth Station			
Antenna Diameter (m)	0.66	0.66	0.66
Rain Rate (mm/hr)	41.9	41.9	41.9
Peak Antenna Gain (dBi)	40.9	40.9	40.9
D/Lamda	43.9	43.9	43.9
S/C Relative Gain from Peak towards E/S (dB)	-4.0	-4.0	-4.0
System (LNA_Sky) Noise Temp	150.0	150.0	150.0
Temperature due to rain fade and gases	20.7	20.7	151.6
G/T of ES (dB/K)	18.6	18.6	16.1
C/N Uplink Per Carrier			
Uplink EIRP per carrier (EOC, dBW)	85.3	91.5	85.3
Pathloss at uplink frequency (dB)	213.4	213.4	213.4
Uplink gazeous attenuation (dB)	0.3	0.3	0.3
Uplink rain attenuation (dB)	0.0	6.3	0.0
Uplink control correction (dB)	0.0	6.2	0.0
Gain of 1 m2 antenna (dB)	50.9	50.9	50.9
Per carrier input back-off (dB)	0.0	0.0	0.0
C/N uplink, thermal (EOC, dB)	22.9	22.9	22.9
C/N Downlink Per Carrier			
Transponder BP saturation EIRP (dBW)	61.2	61.2	61.2
Per carrier output back-off (dB)	0.0	0.0	0.0
Per carrier EIRP (EOC, dBW)	57.2	57.2	57.2
Pointing Error (dB)	-0.5	-0.5	-0.5
Pathloss at downlink frequency (dB)	210.0	210.0	210.0
Downlink gazeous attenuation (dB)	0.3	0.3	0.3
Downlink rain attenuation (dB)	0.0	0.0	2.9
ES G/T (dB/K)	18.6	18.6	16.1
C/N downlink, thermal (EOC, dB)	13.9	13.9	8.5
C/I Other links (re-use, IM)	30.0	30.0	30.0
INTERFERING SATELLITE #1			
Orbital Separation (degrees)	1.77	1.77	1.77
G (AP-7) (dBi)	25.9	25.9	25.9
Interfering Uplink power density (dBW/Hz)	-56.5	-56.5	-56.5
Interfering D/L eirp density (dBW/Hz)	-15.9	-15.9	-15.9
C/I ASI uplink (dB)	40.6	46.8	40.6
C/I ASI downlink (dB)	8.5	8.5	8.5
INTERFERING SATELLITE #2			
Orbital Separation (degrees)	1.88	1.88	1.88
G (AP-7) (dBi)	23.9	23.9	23.9
Interfering Uplink power density (dBW/Hz)	-56.5	-56.5	-56.5
Interfering D/L eirp density (dBW/Hz)	-15.9	-15.9	-15.9
C/I ASI uplink (dB)	40.6	46.8	40.6
C/I ASI downlink (dB)	10.4	10.4	10.4
Total C/N			
C/N available per carrier (dB)	5.5	5.5	4.2
Margin for other losses (dB)	1.1	1.1	1.1
C/N total (clear-sky, dB)	4.4	4.4	3.1
PSD (EOC, dBW/Hz)	-58.0	-51.8	-58.0
ESD at beam peak (dBW/Hz)	-18.5	-18.5	-18.5
# of carriers	1	1	1

Notes:

1) Carrier modulation is QPSK
2) Link calculations apply to all combinations of the Conus and South America uplink and downlink beams.
3) The orbital location listed for each adjacent satellite corresponds to the topocentric location corresponding to a 2 degree geocentric separation with respect to Galaxy Ka and incorporating 0.05 degrees of stationkeeping accuracy as well as 0.05 degrees of receive antenna mispointing towards one of the adjacent satellites (and 0.05 degree of mispointing away from the other adjacent satellite).

EXHIBIT 12: GALAXY KA LINK BUDGETS (continued)

Satellite Information	Clear Sky	Up Fade	Dn Fade
Satellite Longitude (degrees)	-89.1	-89.1	-89.1
G/T (EOC, dB/K)	2.5	2.5	2.5
Attenuation setting (dB)	15.0	15.0	15.0
SFD (EOC, dBW/m2)	-79.2	-79.2	-79.2
Downlink EIRP (Beam Peak, dBW)	61.2	61.2	61.2
Carrier Information			
Emission Designation	10M3G7W	10M3G7W	10M3G7W
Bits/Symbol	2	2	2
Info Rate + Overhead (Mbit/s)	6.24	6.24	6.24
Codec:	0.50	0.50	0.50
RS:	0.92	0.92	0.92
Noise Bandwidth (MHz)	6.771	6.771	6.771
C/N required (dB)	3.9	3.6	3.6
Transmit Earth Station			
Antenna Diameter (m)	6.0	6.0	6.0
Rain Rate (mm/hr)	41.9	41.9	41.9
Peak Antenna Gain (dBi)	63.6	63.6	63.6
S/C Relative Gain from Peak towards E/S (dB)	-4.0	-4.0	-4.0
Receive Earth Station			
Antenna Diameter (m)	0.62	0.62	0.62
Rain Rate (mm/hr)	41.9	41.9	41.9
Peak Antenna Gain (dBi)	40.4	40.4	40.4
D/Lamda	41.2	41.2	41.2
S/C Relative Gain from Peak towards E/S (dB)	-4.0	-4.0	-4.0
System (LNA_Sky) Noise Temp	150.0	150.0	150.0
Temperature due to rain fade and gases	20.7	20.7	151.6
G/T of ES (dB/K)	18.1	18.1	15.6
C/N Uplink Per Carrier			
Uplink EIRP per carrier (EOC, dBW)	69.4	75.6	69.4
Pathloss at uplink frequency (dB)	213.4	213.4	213.4
Uplink gazeous atttenuation (dB)	0.3	0.3	0.3
Uplink rain attenuation (dB)	0.0	6.3	0.0
Uplink control correction (dB)	0.0	6.2	0.0
Gain of 1 m2 antenna (dB)	50.9	50.9	50.9
Per carrier input back-off (dB)	-13.9	-13.9	-13.9
C/N uplink, thermal (EOC, dB)	18.4	18.4	18.4
C/N Downlink Per Carrier			
Transponder BP saturation EIRP (dBW)	61.2	61.2	61.2
Per carrier output back-off (dB)	-8.8	-8.8	-8.8
Per carrier EIRP (EOC, dBW)	48.4	48.4	48.4
Pointing Error (dB)	-0.5	-0.5	-0.5
Pathloss at downlink frequency (dB)	210.0	210.0	210.0
Downlink gazeous attenuation (dB)	0.3	0.3	0.3
Downlink rain attenuation (dB)	0.0	0.0	2.9
ES G/T (dB/K)	18.1	18.1	15.6
C/N downlink, thermal (EOC, dB)	16.0	16.0	10.6
C/I Other Ilnks (re-use, IM)	16.0	16.0	16.0
INTERFERING SATELLITE #1			
Orbital Separation (degrees)	1.75	1.75	1.75
G (AP-7) (dBi)	27.4	27.4	27.4
Interfering Uplink power density (dBW/Hz)	-56.5	-56.5	-56.5
Interfering D/L eirp density (dBW/Hz)	-15.9	-15.9	-15.9
C/I ASI uplink (dB)	36.1	42.3	36.1
C/I ASI downlink (dB)	9.0	9.0	9.0
INTERFERING SATELLITE #2			
Orbital Separation (degrees)	1.86	1.86	1.86
G (AP-7) (dBi)	25.7	25.7	25.7
Interfering Uplink power density (dBW/Hz)	-56.5	-56.5	-56.5
Interfering D/L eirp density (dBW/Hz)	-15.9	-15.9	-15.9
C/I ASI uplink (dB)	36.1	42.3	36.1
C/I ASI downlink (dB)	10.7	10.7	10.7
Total C/N			
C/N available per carrier (dB)	5.6	5.6	4.7
Margin for other losses (dB)	1.1	1.1	1.1
C/N total (clear-sky, dB)	4.5	4.5	3.6
PSD (EOC, dBW/Hz)	-62.5	-56.3	-62.5
ESD at beam peak (dBW/Hz)	-15.9	-15.9	-15.9
# of carriers	7	7	7

Notes:

1) Carrier modulation is QPSK
2) Link calculations apply to all combinations of the Conus and South America uplink and downlink beams.
3) The orbital location listed for each adjacent satellite corresponds to the topocentric location corresponding to a 2 degree geocentric separation with respect to Galaxy Ka and incorporating 0.05 degrees of stationkeeping accuracy as well as 0.05 degrees of receive antenna mispointing towards one of the adjacent satellites (and 0.05 degree of mispointing away from the other adjacent satellite).

EXHIBIT 12: GALAXY KA LINK BUDGETS (continued)

Satellite Information	Clear Sky	Up Fade	Dn Fade
Satellite Longitude (degrees)	-89.1	-89.1	-89.1
G/T (EOC, dB/K)	2.5	2.5	2.5
Attenuation setting (dB)	15.0	15.0	15.0
SFD (EOC, dBW/m2)	-79.2	-79.2	-79.2
Downlink EIRP (Beam Peak, dBW)	61.2	61.2	61.2
Carrier Information			
Emission Designation	100KG7W	100KG7W	100KG7W
Bits/Symbol	2	2	2
Info Rate + Overhead (Mbit/s)	0.07	0.07	0.07
Codec:	0.50	0.50	0.50
RS:	0.93	0.93	0.93
Noise Bandwidth (MHz)	0.075	0.075	0.075
C/N required (dB)	3.0	2.8	2.8
Transmit Earth Station			
Antenna Diameter (m)	6.0	6.0	6.0
Rain Rate (mm/hr)	41.9	41.9	41.9
Peak Antenna Gain (dBi)	63.6	63.6	63.6
S/C Relative Gain from Peak towards E/S (dB)	-4.0	-4.0	-4.0
Receive Earth Station			
Antenna Diameter (m)	0.60	0.60	0.60
Rain Rate (mm/hr)	41.9	41.9	41.9
Peak Antenna Gain (dBi)	40.1	40.1	40.1
D/Lamda	39.9	39.9	39.9
S/C Relative Gain from Peak towards E/S (dB)	-4.0	-4.0	-4.0
System (LNA_Sky) Noise Temp	150.0	150.0	150.0
Temperature due to rain fade and gases	20.7	20.7	151.6
G/T of ES (dB/K)	17.8	17.8	15.3
C/N Uplink Per Carrier			
Uplink EIRP per carrier (EOC, dBW)	49.6	56.0	49.6
Pathloss at uplink frequency (dB)	213.4	213.4	213.4
Uplink gazeous attenuation (dB)	0.3	0.3	0.3
Uplink rain attenuation (dB)	0.0	6.3	0.0
Uplink control correction (dB)	0.0	6.2	0.0
Gain of 1 m2 antenna (dB)	50.9	50.9	50.9
Per carrier input back-off (dB)	-33.5	-33.5	-33.5
C/N uplink, thermal (EOC, dB)	18.4	18.3	18.4
C/N Downlink Per Carrier			
Transponder BP saturation EIRP (dBW)	61.2	61.2	61.2
Per carrier output back-off (dB)	-28.4	-28.4	-28.4
Per carrier EIRP (EOC, dBW)	28.8	28.8	28.8
Pointing Error (dB)	-0.5	-0.5	-0.5
Pathloss at downlink frequency (dB)	210.0	210.0	210.0
Downlink gazeous attenuation (dB)	0.3	0.3	0.3
Downlink rain attenuation (dB)	0.0	0.0	2.9
ES G/T (dB/K)	17.8	17.8	15.3
C/N downlink, thermal (EOC, dB)	15.6	15.6	10.3
C/I Other links (re-use, IM)	16.0	16.0	16.0
INTERFERING SATELLITE #1			
Orbital Separation (degrees)	1.74	1.74	1.74
G (AP-7) (dBi)	28.1	28.1	28.1
Interfering Uplink power density (dBW/Hz)	-56.5	-56.5	-56.5
Interfering D/L eirp density (dBW/Hz)	-15.9	-15.9	-15.9
C/I ASI uplink (dB)	36.1	42.3	36.1
C/I ASI downlink (dB)	7.9	7.9	7.9
INTERFERING SATELLITE #2			
Orbital Separation (degrees)	1.85	1.85	1.85
G (AP-7) (dBi)	26.5	26.5	26.5
Interfering Uplink power density (dBW/Hz)	-56.5	-56.5	-56.5
Interfering D/L eirp density (dBW/Hz)	-15.9	-15.9	-15.9
C/I ASI uplink (dB)	36.1	42.3	36.1
C/I ASI downlink (dB)	9.5	9.5	9.5
Total C/N			
C/N available per carrier (dB)	4.7	4.7	3.9
Margin for other losses (dB)	1.1	1.1	1.1
C/N total (clear-sky, dB)	3.6	3.6	2.8
PSD (EOC, dBW/Hz)	-62.5	-56.3	-62.5
ESD at beam peak (dBW/Hz)	-16.0	-16.0	-16.0
# of carriers	689	689	689

Notes:

1) Carrier modulation is QPSK
2) Link calculations apply to all combinations of the Conus and South America uplink and downlink beams.
3) The orbital location listed for each adjacent satellite corresponds to the topocentric location corresponding to a 2 degree geocentric separation with respect to Galaxy Ka and incorporating 0.05 degrees of stationkeeping accuracy as well as 0.05 degrees of receive antenna mispointing towards one of the adjacent satellites (and 0.05 degree of mispointing away from the other adjacent satellite).

EXHIBIT 12: GALAXY KA LINK BUDGETS (continued)

Satellite Information	Clear Sky	Up Fade	Dn Fade
Satellite Longitude (degrees)	-89.1	-89.1	-89.1
G/T (EOC, dB/K)	2.5	2.5	2.5
Attenuation setting (dB)	15.0	15.0	15.0
SFD (EOC, dBW/m2)	-79.2	-79.2	-79.2
Downlink EIRP (Beam Peak, dBW)	61.2	61.2	61.2
Carrier Information			
Emission Designation	1M45G7W	1M45G7W	1M45G7W
Bits/Symbol	1	1	1
Info Rate + Overhead (Mbit/s)	0.61	0.61	0.61
Codec:	0.50	0.50	0.50
RS:	1.00	1.00	1.00
Noise Bandwidth (MHz)	1.229	1.229	1.229
C/N required (dB)	3.4	2.7	2.7
Transmit Earth Station			
Antenna Diameter (m)	6.0	6.0	6.0
Rain Rate (mm/hr)	41.9	41.9	41.9
Peak Antenna Gain (dBi)	63.6	63.6	63.6
S/C Relative Gain from Peak towards E/S (dB)	-4.0	-4.0	-4.0
Receive Earth Station			
Antenna Diameter (m)	0.66	0.66	0.66
Rain Rate (mm/hr)	41.9	41.9	41.9
Peak Antenna Gain (dBi)	40.9	40.9	40.9
D/Lamda	43.9	43.9	43.9
S/C Relative Gain from Peak towards E/S (dB)	-4.0	-4.0	-4.0
System (LNA_Sky) Noise Temp	150.0	150.0	150.0
Temperature due to rain fade and gases	20.7	20.7	151.6
G/T of ES (dB/K)	18.6	18.6	16.1
C/N Uplink Per Carrier			
Uplink EIRP per carrier (EOC, dBW)	59.5	65.7	59.5
Pathloss at uplink frequency (dB)	213.4	213.4	213.4
Uplink gazeous attenuation (dB)	0.3	0.3	0.3
Uplink rain attenuation (dB)	0.0	6.3	0.0
Uplink control correction (dB)	0.0	6.2	0.0
Gain of 1 m2 antenna (dB)	50.9	50.9	50.9
Per carrier input back-off (dB)	-23.8	-23.8	-23.8
C/N uplink, thermal (EOC, dB)	15.9	15.9	15.9
C/N Downlink Per Carrier			
Transponder BP saturation EIRP (dBW)	61.2	61.2	61.2
Per carrier output back-off (dB)	-18.7	-18.7	-18.7
Per carrier EIRP (EOC, dBW)	38.5	38.5	38.5
Pointing Error (dB)	-0.5	-0.5	-0.5
Pathloss at downlink frequency (dB)	210.0	210.0	210.0
Downlink gazeous attenuation (dB)	0.3	0.3	0.3
Downlink rain attenuation (dB)	0.0	0.0	2.9
ES G/T (dB/K)	18.6	18.6	16.1
C/N downlink, thermal (EOC, dB)	14.0	14.0	8.7
C/I Other links (re-use, IM)	16.0	16.0	16.0
INTERFERING SATELLITE #1			
Orbital Separation (degrees)	1.77	1.77	1.77
G (AP-7) (dBi)	25.9	25.9	25.9
Interfering Uplink power density (dBW/Hz)	-56.5	-56.5	-56.5
Interfering D/L eirp density (dBW/Hz)	-15.9	-15.9	-15.9
C/I ASI uplink (dB)	33.6	39.8	33.6
C/I ASI downlink (dB)	8.6	8.6	8.6
INTERFERING SATELLITE #2			
Orbital Separation (degrees)	1.88	1.88	1.88
G (AP-7) (dBi)	23.9	23.9	23.9
Interfering Uplink power density (dBW/Hz)	-56.5	-56.5	-56.5
Interfering D/L eirp density (dBW/Hz)	-15.9	-15.9	-15.9
C/I ASI uplink (dB)	33.6	39.8	33.6
C/I ASI downlink (dB)	10.5	10.5	10.5
Total C/N			
C/N available per carrier (dB)	4.9	4.9	3.8
Margin for other losses (dB)	1.1	1.1	1.1
C/N total (clear-sky, dB)	3.8	3.8	2.7
PSD (EOC, dBW/Hz)	-65.0	-58.8	-65.0
ESD at beam peak (dBW/Hz)	-18.4	-18.4	-18.4
# of carriers	74	74	74

Notes:

1) Carrier modulation is BPSK
2) Link calculations apply to all combinations of the Conus and South America uplink and downlink beams.
3) The orbital location listed for each adjacent satellite corresponds to the topocentric location corresponding to a 2 degree geocentric separation with respect to Galaxy Ka and incorporating 0.05 degrees of stationkeeping accuracy as well as 0.05 degrees of receive antenna mispointing towards one of the adjacent satellites (and 0.05 degree of mispointing away from the other adjacent satellite).

EXHIBIT 12: GALAXY KA LINK BUDGETS (continued)

Satellite Information	Clear Sky	Up Fade	Dn Fade
Satellite Longitude (degrees)	-89.1	-89.1	-89.1
G/T (EOC, dB/K)	2.5	2.5	2.5
Attenuation setting (dB)	15.0	15.0	15.0
SFD (EOC, dBW/m2)	-79.2	-79.2	-79.2
Downlink EIRP (Beam Peak, dBW)	61.2	61.2	61.2
Carrier Information			
Emission Designation	400KG7W	400KG7W	400KG7W
Bits/Symbol	1	1	1
Info Rate + Overhead (Mbit/s)	0.15	0.15	0.15
Codec:	0.50	0.50	0.50
RS:	1.00	1.00	1.00
Noise Bandwidth (MHz)	0.307	0.307	0.307
C/N required (dB)	3.4	2.7	2.7
Transmit Earth Station			
Antenna Diameter (m)	0.7	0.7	0.7
Rain Rate (mm/hr)	41.9	41.9	41.9
Peak Antenna Gain (dBi)	44.4	44.4	44.4
S/C Relative Gain from Peak towards E/S (dB)	-4.0	-4.0	-4.0
Receive Earth Station			
Antenna Diameter (m)	6.00	6.00	6.00
Rain Rate (mm/hr)	41.9	41.9	41.9
Peak Antenna Gain (dBi)	60.1	60.1	60.1
D/Lamda	399.0	399.0	399.0
S/C Relative Gain from Peak towards E/S (dB)	-4.0	-4.0	-4.0
System (LNA_Sky) Noise Temp	150.0	150.0	150.0
Temperature due to rain fade and gases	20.7	20.7	151.6
G/T of ES (dB/K)	37.8	37.8	35.3
C/N Uplink Per Carrier			
Uplink EIRP per carrier (EOC, dBW)	42.6	49.0	42.6
Pathloss at uplink frequency (dB)	213.4	213.4	213.4
Uplink gazeous attenuation (dB)	0.3	0.3	0.3
Uplink rain attenuation (dB)	0.0	6.3	0.0
Uplink control correction (dB)	0.0	6.2	0.0
Gain of 1 m2 antenna (dB)	50.9	50.9	50.9
Per carrier input back-off (dB)	-40.6	-40.6	-40.6
C/N uplink, thermal (EOC, dB)	5.2	5.1	5.2
C/N Downlink Per Carrier			
Transponder BP saturation EIRP (dBW)	61.2	61.2	61.2
Per carrier output back-off (dB)	-35.5	-35.5	-35.5
Per carrier EIRP (EOC, dBW)	21.7	21.7	21.7
Pointing Error (dB)	-0.5	-0.5	-0.5
Pathloss at downlink frequency (dB)	210.0	210.0	210.0
Downlink gazeous attenuation (dB)	0.3	0.3	0.3
Downlink rain attenuation (dB)	0.0	0.0	2.9
ES G/T (dB/K)	37.8	37.8	35.3
C/N downlink, thermal (EOC, dB)	22.5	22.5	17.1
C/I Other Ilinks (re-use, IM)	16.0	16.0	16.0
INTERFERING SATELLITE #1			
Orbital Separation (degrees)	2.05	2.05	2.05
G (AP-7) (dBi)	21.2	21.2	21.2
Interfering Uplink power density (dBW/Hz)	-56.5	-56.5	-56.5
Interfering D/L eirp density (dBW/Hz)	-15.9	-15.9	-15.9
C/I ASI uplink (dB)	22.9	29.1	22.9
C/I ASI downlink (dB)	21.7	21.7	21.7
INTERFERING SATELLITE #2			
Orbital Separation (degrees)	2.16	2.16	2.16
G (AP-7) (dBi)	20.6	20.6	20.6
Interfering Uplink power density (dBW/Hz)	-56.5	-56.5	-56.5
Interfering D/L eirp density (dBW/Hz)	-15.9	-15.9	-15.9
C/I ASI uplink (dB)	22.9	29.1	22.9
C/I ASI downlink (dB)	22.3	22.3	22.3
Total C/N			
C/N available per carrier (dB)	4.5	4.5	4.3
Margin for other losses (dB)	1.1	1.1	1.1
C/N total (clear-sky, dB)	3.4	3.4	3.2
PSD (EOC, dBW/Hz)	-56.5	-50.3	-56.5
ESD at beam peak (dBW/Hz)	-29.1	-29.1	-29.1
# of carriers	275	275	275

Notes:

1) Carrier modulation is BPSK
2) Link calculations apply to all combinations of the Conus and South America uplink and downlink beams.
3) The orbital location listed for each adjacent satellite corresponds to the topocentric location corresponding to a 2 degree geocentric separation with respect to Galaxy Ka and incorporating 0.05 degrees of stationkeeping accuracy as well as 0.05 degrees of receive antenna mispointing towards one of the adjacent satellites (and 0.05 degree of mispointing away from the other adjacent satellite).