Digital Link Budget

Produced using Satfinder

Tuesday, June 07, 2005

Service Name	Camp Pendleton Test Satcom-On-The-Move
Coverage	CONUS
Uplink earth station	Camp Pendleton
Downlink earth station	Camp Pendleton
Satellite name	Intelsat 707

Link Input Parameters	Uplink	Downlink	Units
Site latitude	33.14N	33.14N	degrees
Site longitude	117.24W	117.24W	degrees
Magnetic variation	13.4E	13.4E	degrees
Site altitude	0.1	0.1	km
Frequency	14.2	11.9	GHz
Polarization	Horizontal	Vertical	
Rain climatic zone (model)	E (ITU)	E (ITU)	
Availability (average year)	95	95	%
Water vapour density	3	3	gm/m3
Surface temperature	23	23	°C
Antenna aperture	0.6	2.4	metres
Antenna efficiency / gain	+37.3	+47.4	% (+ prefix dBi)
Coupling loss	1.2	0.1	dB
Antenna tracking / mispoint error	0.1	0.1	dB
LNB noise figure / temp		+65	dB (+ prefix K)
Antenna noise		43	K
Adjacent carrier interference	60	60	dB
Adjacent satellite interference	65	65	dB
Cross polarization interference	30	30	dB
Uplink station HPA output back-off	2		dB
Number of carriers / HPA	1		
HPA C/IM (up)	22		dB
Uplink power control	0		dB
Uplink filter truncation loss	0		dB

Satellite Input Parameters	Value	Units
Satellite longitude	53.0W	degrees
Transponder type	TWTA	
Receive G/T	2.6	dB/K
Saturation flux density	-94.8	dBW/m2
Satellite attenuator pad	1	dB
Transmit EIRP at saturation	49.2	dBW
Transponder bandwidth	27	MHz
Input back off total	7.6	dB
Output back off total	AUTO	dB
Intermodulation interference	AUTO	dB

Carrier/Link Input Parameters	Value	Units
Modulation	BPSK	
Required bit error rate performance	10^-6	
Required Eb/No without FEC coding	10.53	dB

Required Eb/No with FEC coding	4.1			dB
Information rate	0.256			Mbps
Overhead	0			%
FEC code rate	0.5			
Spreading gain	0			dB
Roll off factor + 1	1.2			
Carrier spacing factor	1.4			
Bandwidth allocation step size	0.001			MHz
System margin	0			dB

Calculations at Saturation	**Value**			**Units**
Gain 1m^2	44.50			dB/m2
Uplink C/No	92.90			dB.Hz
Downlink C/No	97.92			dB.Hz
Total C/No	91.71			dB.Hz
Uplink EIRP for saturation	69.93			dBW

General Calculations	**Uplink**	**Downlink**		**Units**
Elevation	12.93	12.93		degrees
True azimuth	104.78	104.78		degrees
Compass bearing	91.38	91.38		degrees
Path distance to satellite	40281.59	40281.59		km
Propagation time delay	0.13	0.13		seconds
Antenna efficiency	67.37	61.35		%
Antenna gain	37.30	47.40		dBi
Availability (average year)	95	95		%
Link downtime (average year)	438.300	438.300		hours
Availability (worst month)	88.439	88.439		%
Link downtime (worst month)	84.456	84.456		hours
Spectral power density	-21.03	-1.66		dBW/4kHz

Uplink Calculation	**Clear**	**Rain Up**	**Rain Dn**	**Units**
Uplink transmit EIRP	38.13	38.13	38.13	dBW
Transponder input back-off (total)	7.60	7.60	7.60	dB
Input back-off per carrier	31.80	32.30	31.80	dB
Mispoint loss	0.10	0.10	0.10	dB
Free space loss	207.60	207.60	207.60	dB
Atmospheric absorption	0.26	0.26	0.26	dB
Tropospheric scintillation fading	0.27	0.27	0.27	dB
Atmospheric losses total	0.54	0.54	0.54	dB
Total path loss (excluding rain)	208.23	208.23	208.23	dB
Rain attenuation	0.00	0.50	0.00	dB
UPC (or manual power boost)	0.00	0.00	0.00	dB
Uncompensated Rain Fade	0.00	0.50	0.00	dB
C/No (thermal)	61.10	60.60	61.10	dB.Hz
C/N (thermal)	3.21	2.71	3.21	dB
C/ACI	60.00	59.50	60.00	dB
C/ASI	65.00	64.50	65.00	dB
C/XPI	30.00	29.50	30.00	dB
C/IM	22.00	22.00	22.00	dB
Eb/(No+Io)	6.95	6.45	6.95	dB

Downlink Calculation	**Clear**	**Rain Up**	**Rain Dn**	**Units**

Satellite EIRP total	49.20	49.20	49.20	dBW
Transponder output back-off (total)	4.79	4.79	4.79	dB
Output back-off per carrier	28.99	29.50	28.99	dB
Satellite EIRP per carrier	20.21	19.70	20.21	dBW
Mispoint loss	0.10	0.10	0.10	dB
Free space loss	206.06	206.06	206.06	dB
Atmospheric absorption	0.22	0.22	0.22	dB
Tropospheric scintillation fading	0.24	0.24	0.24	dB
Atmospheric losses total	0.46	0.46	0.46	dB
Total path loss (excluding rain)	206.62	206.62	206.62	dB
Rain attenuation	0.00	0.00	0.38	dB
Noise increase due to precipitation	0.00	0.00	0.81	dB
Downlink degradation (DND)	0.00	0.00	1.19	dB
Total system noise	113.76	113.76	137.05	K
Figure of merit (G/T)	26.74	26.74	25.93	dB/K
C/No (thermal)	68.93	68.42	67.74	dB.Hz
C/N (thermal)	11.04	10.54	9.85	dB
C/ACI	60.00	59.50	60.00	dB
C/ASI	65.00	64.50	65.00	dB
C/XPI	30.00	29.50	30.00	dB
C/IM	6.22	5.21	6.22	dB
Eb/(No+Io)	8.77	7.88	8.45	dB

Totals per Carrier (End-to-End)	**Clear**	**Rain Up**	**Rain Dn**	**Units**
C/No (thermal)	60.44	59.93	60.25	dB.Hz
C/N (thermal)	2.55	2.05	2.36	dB
C/ACI	56.99	56.49	56.99	dB
C/ASI	61.99	61.49	61.99	dB
C/XPI	26.99	26.49	26.99	dB
C/IM	6.11	5.12	6.11	dB
C/(No+Io)	58.84	58.18	58.71	dB.Hz
C/(N+I)	0.95	0.30	0.82	dB
Eb/(No+Io)	4.76	4.10	4.62	dB
System margin	0.00	0.00	0.00	dB
Net Eb/(No+Io)	4.76	4.10	4.62	dB
Required Eb/(No+Io)	4.10	4.10	4.10	dB
Excess margin	0.66	0.00	0.52	dB

Earth Station Power Requirements	**Value**	**Units**
EIRP per carrier	38.13	dBW
HPA power per carrier	0.83	dBW
Uplink power control	0.00	dB
HPA output back off	2.00	dB
Waveguide loss	1.2	dB
Filter truncation loss	0	dB
Number of HPA carriers	1	
Total HPA power required	4.03	dBW
Required HPA power capability	2.53	W
Spectral power density	-21.03	dBW/4kHz

Space Segment Utilization	**Value**	**Units**
Overall link availability	90.25	%
Information rate (inc overhead)	0.2560	Mbps

Transmit rate	0.5120	Mbps
Symbol rate	0.5120	MBaud
Occupied bandwidth	0.6144	MHz
Noise bandwidth	57.88	dB.Hz
Minimum allocated bandwidth required	0.7168	MHz
Allocated transponder bandwidth	0.7170	MHz
Percentage transponder bandwidth used	2.66	%
Used transponder power	20.21	dBW
Percentage transponder power used	0.38	%
Max carriers by transponder bandwidth	37.66	
Max carriers by transponder power	262.93	
Maximum carriers limited by:-	Transponder bandwidth [37.66 carriers]	
Total transponder capacity	9.64	Mbps