

## Digital Ku-band link budgets

S13.c.	K1	K2	K3	K4	K5	K6	K7
Parameter	Digital TV MCPC 40 Mbps QPSK ¾ RS	Digital TV MCPC 32 Mbps QPSK ¾ RS	Digital TV SCPC QPSK ¾ RS	Digital TV SCPC QPSK ¾ RS	56 Kbps QPSK ¾ RS	1.544 Mbps QPSK ¾ RS	Digital TV MCPC 50 Mbps 8PSK ¾ RS
Carrier designation	36M0G7W	27M0G7W	6M95G1W	5M00G1W	100KG1W	1M60G1W	36M0G7W
Noise bandwidth (MHz)	36	27	7	5	0.100	1.600	36
<b>Uplinks:</b>							
Transmit Power (dBW)	20	20	8.9	8.9	-2	8	20
Transmit Loss (dB)	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5
TX earth station antenna diameter (m)	6	6	6	6	6	6	6
TX earth station antenna gain (dBi)	57.2	57.2	57.2	57.2	57.2	57.2	57.2
TX earth station antenna EIRP (dBW)	74.7	74.7	63.6	63.6	52.7	62.7	74.7
Uplink Rain Loss (dB)	-2	-2	-2	-2	-2	-2	-2
Free Space Loss (dB)	-207	-207	-207	-207	-207	-207	-207
Satellite G/T (dB/K)	3	3	3	3	3	3	3
Boltzmann's Constant (dBW/K-Hz)	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6
C/N uplink (dB)	21.7	23.0	17.7	19.2	25.3	23.2	21.7
C/I uplink (dB)	27.6	28.9	23.6	25.1	31.2	29.1	27.6
C/N+I uplink (dB)	20.7	22.0	16.7	18.2	24.3	22.2	20.7
<b>Downlinks:</b>							
Satellite Carrier EIRP (dBW)	49.5	48.3	38.4	36.9	19.9	32.0	45.5
Interference bandwidth (MHz)	36.0	27.0	7.0	5.0	0.1	1.6	36.0
Satellite EIRP density (dBW/4KHz)	9.96	9.96	5.96	5.96	5.96	5.96	5.96
Downlink Rain Loss (dB)	-3	-3	-3	-3	-3	-3	-3
Free Space Loss (dB)	-205.4	-205.4	-205.4	-205.4	-205.4	-205.4	-205.4
RX earth station antenna diameter (m)	1.2	1.2	1.2	1.8	1.8	1.8	1.2
RX earth station antenna G/T (dB/K)	21.7	21.7	21.7	25.2	25.2	25.2	21.7
C/N downlink (dB)	15.8	15.8	11.8	15.4	15.4	15.4	11.8
C/I downlink (dB)	17.6	17.6	13.6	17.2	17.2	17.2	13.6
C/N+I downlink (dB)	13.6	13.6	9.6	13.2	13.2	13.2	9.6
C/N system (dB)	14.8	15.1	10.8	13.9	14.9	14.7	11.4
C/I system (dB)	17.2	17.3	13.2	16.5	17.0	16.9	13.5
C/N+I system (dB)	12.9	13.0	8.9	12.0	12.8	12.7	9.3

## Digital C-band link budgets

S13.c.	C1	C2	C3	C4	C5	C6	C7
	Digital TV MCPC 40 Mbps QPSK ¾ RS	Digital TV MCPC 32 Mbps QPSK ¾ RS	Digital TV SCPC QPSK ¾ RS	Digital TV SCPC QPSK ¾ RS	56 Kbps QPSK ¾ RS	1.544 Mbps QPSK ¾ RS	Digital TV MCPC 50 Mbps 8PSK ½ RS
Carrier designation	36M0G7W	27M0G7W	6M95G1W	5M00G1W	100KG1W	1M60G1W	36M0G7W
Noise bandwidth (MHz)	36	27	7	5	0.100	1.600	36
<b>Uplinks:</b>							
Transmit Power (dBW)	25.1	20	9.6	12	-3.4	11.8	25.1
Transmit Loss (dB)	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5
TX earth station antenna diameter (m)	9	9	9	9	4.5	4.5	9
TX earth station antenna gain (dBi)	53.2	53.2	53.2	53.2	47.2	47.2	53.2
TX earth station antenna EIRP (dBW)	75.8	70.7	60.3	62.7	41.3	56.5	75.8
Uplink Rain Loss (dB)	0	0	0	0	0	0	0
Free Space Loss (dB)	-199.7	-199.7	-199.7	-199.7	-199.7	-199.7	-199.7
Satellite G/T (dB/K)	3	3	3	3	3	3	3
Boltzmann's Constant (dBW/K-Hz)	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6
C/N uplink (dB)	32.1	28.3	23.7	27.6	23.2	26.3	32.1
C/I uplink (dB)	20.7	16.9	12.3	16.2	11.8	14.9	20.7
C/N+I uplink (dB)	20.4	16.6	12.0	15.9	11.5	14.6	20.4
<b>Downlinks:</b>							
Satellite Carrier EIRP (dBW)	39	37.8	31.9	30.4	13.4	25.5	39.0
Interference bandwidth (MHz)	36	27	7	5	0.100	1.600	36
Satellite EIRP density (dBW/4KHz)	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54	-0.54
Downlink Rain Loss (dB)	0	0	0	0	0	0	0
Free Space Loss (dB)	-195.8	-195.8	-195.8	-195.8	-195.8	-195.8	-195.8
RX earth station antenna diameter (m)	3.8	3.8	3.8	3.8	3.8	3.8	3.8
RX earth station antenna G/T (dB/K)	22.2	22.2	22.2	22.2	22.2	22.2	22.2
C/N downlink (dB)	18.4	18.4	18.4	18.4	18.4	18.4	18.4
C/I downlink (dB)	18.2	18.2	18.2	18.2	18.2	18.2	18.2
C/N+I downlink (dB)	15.3	15.3	15.3	15.3	15.3	15.3	15.3
C/N system (dB)	18.2	18.0	17.3	17.9	17.2	17.8	18.2
C/I system (dB)	16.2	14.5	11.3	14.1	10.9	13.2	16.2
C/N+I system (dB)	14.1	12.9	10.3	12.6	10.0	11.9	14.1

TV-FM C and Ku link budget

S13.d. Parameter	K8	C8
	Ku-band Typical TV/FM link	C-band Typical TV/FM link
Carrier designation	36M0F3F	36M0F3F
<b>Uplinks:</b>		
Transmit Power (dBW)	22	25
Transmit Loss (dB)	-1	-0.5
TX earth station antenna diameter (m)	6.1	9
TX earth station antenna gain (dBi)	57.3	53.5
TX earth station antenna EIRP (dBW)	78.3	78.0
Uplink Rain Loss (dB)	-2	-1
Free Space Loss (dB)	-207	-199.7
Satellite G/T (dB/K)	3	1.3
Bandwidth (dB-Hz)	75.6	75.6
Boltzmann's Constant (dBW/K-Hz)	-228.6	-228.6
C/N, uplink (dB)	25.4	31.7
<b>Downlinks:</b>		
Satellite Carrier EIRP (dBW)	48.2	42
Downlink Rain Loss (dB)	-3	-0.5
Free Space Loss (dB)	-205.4	-195.8
RX earth station antenna diameter (m)	1.2	3.8
RX earth station antenna G/T (dB/K)	21.7	22.1
C/N downlink (dB)	14.5	20.8
C/I ASI (dB)	17.3	17.6
C/N Total (dB)	12.7	15.9
Required (dB)	11	11
Margin (dB)	1.7	4.9

## Ka-band link budget

<b>S13.c.</b>	<b>KA1</b>	<b>KA2</b>
Carrier designation	1M20G1W	5M50G1W
Required bandwidth (MHz)	1.2	5.5
C/N required (dB)	4.7	1.3
Faded system margin (dB)	0.5	0.5
<b>Uplink</b>		
Transmit Power (dBW)	4	10.5
TX earth station antenna diameter (m)	9	9
TX earth station antenna gain (dBi)	65.6	65.6
TX earth station input power density (dBW/MHz)	3.2	3.1
TX earth station antenna EIRP (dBW)	69.6	76.1
Uplink Rain Loss (dB)	0	0
Uplink Path Loss (dB)	-212.2	-212.2
Boltzmann's Constant (dBW/K-Hz)	-228.6	-228.6
Satellite G/T (dB/K)	-8	-8
C/N uplink (dB)	17.2	17.1
C/I X-pol uplink (dB)	30	30
<b>Downlink</b>		
Satellite Carrier EIRP (dBW)	29.6	31.6
RX earth station antenna diameter (m)	0.95	1.5
RX earth station antenna G/T (dB/K)	22.9	26.9
Downlink path loss (dB)	-209.1	-209.1
C/N downlink clear-sky (dB)	11.3	10.6
Min C/N down (dB)	6.2	2.6
C/I ASI (dB)	12.2	9.5
C/I Total (dB)	12.0	9.5
Rain margin to min C/N down (dB)	5.0	8.0

## Command link budget

CMD S13.d	KTC	CTC
	<b>Ku-band</b>	<b>C-band</b>
TX earth station antenna diameter (m)	8.4	13
TX earth station antenna gain (dBi)	60.2	57.0
TX earth station input power (dBW)	10	10
TX earth station EIRP (dBW)	70.2	67.0
Link loss (dB)	207.5	200.1
Satellite G/T (dB/K)	6	2
Command carrier bandwidth (MHz)	1	1
TX earth station input power density (dBW/Hz)	-50	-50
C/N (dB)	37.3	37.5
C/N Required (dB)	10	10
Margin	27.3	27.5

## Telemetry link budget

TLM S13.d	KTM	CTM
	<b>Ku-band</b>	<b>C-band</b>
EIRP (dBW)	19	16
Carrier bandwidth (MHz)	0.5	0.5
EIRP density (dBW/4 kHz)	-1.97	-4.97
RX earth station antenna diameter (m)	5.7	4.5
RX earth station antenna gain (dBi)	55.0	43.0
RX earth station antenna G/T (dB/K)	34.6	22.5
Rain fade (dB)	8	1
C/N (dB)	10.21	9.16
C/N Required (dB)	9	9
Margin	1.2	0.2