

SES LINK BUDGET ANALYSIS



PREPARED BY
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DATE
30-Jun-22
BUSINESS PARTNER

PROJECT
FTISAT Current Eb/No Readings
REVISION
Current Eb/No Readings

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Satellite	SES-2
Orbital location	E -87.00
Transponder information	
Transponder ID	21C
Center frequency and polarisation (U/D)	MHz 6345 VLP / 4120 HLP
Bandwidth	MHz 36.00
Transponder Dlk Saturation EIRP Towards Beam-Peak	dBW 43.47
Transponder Beam-Peak G/T	dB/K 3.64
Saturation flux density, Beam-peak	dBW/m ² -90.85
Operational mode	Multiple Carrier, [IBO: -5.5 dB OBO: -4 dB]
Inclined (Yes,No)	No

AGGREGATE RESOURCE REQUIREMENTS

Capacity Balanced / BW / PWR Limited	
Number of carriers in transponder	2
Required bandwidth	MHz 0.2
Allocated bandwidth	MHz 0.19
PEB of carriers	MHz 0.10

ANALYSIS HIGHLIGHTS ACROSS ALL SITES IN ANALYSIS

Link margin review [over sites]	
Site with highest clear sky link margin	USA-33454 at I64-BUEC >USA-WBN-009 14250.0/11950.0 Woodbine K1 (CSM SES-1) : 0.0 dF
Site with lowest clear sky link margin	USA-WBN-004 6175.0/3950.0 Woodbine C5 (CSM, SES-2)>USA-33454 at I64-BUEC : 0.0 dF
Link availability review [over sites]	
Site with highest link availability	-
Site with lowest link availability	-

Calculation type	Clear sky only	Clear sky only
Carrier Name	ADS GW I64-BUEC	ADS RM I64-BUEC
Carrier PEB	MHz 0.07	0.03
Carrier Predicted Total C/(N+I)	dB 9.16	9.16
Link total Eb/No	dB 7.40	7.40
Required Eb/No (including implementation and additional margin)	dB 7.40	7.40
Link closes? [2 out of 2, 100 %]	Yes	Yes
Link margin in clear sky (For ACM carriers, residual margin in CS)	dB 0.00	0.00
Target Link Availability	% yr clear weather only	clear weather only
Achieved Link Availability	% yr clear weather only	clear weather only
Availability Requirement Satisfied? [0 out of 2, 0 %]	clear weather only	clear weather only
ALC: Is the overdrive limit exceeded ?	Not computed	Not computed
Balanced/Power/Bandwidth limited	BW Lim	BW Lim
Carrier PEB to allocated bandwidth ratio	0.76	0.33
Compliance to SES Coordination constraints	No CoCos	No CoCos
Summary of carrier emission levels		
Carrier power density at transmit antenna flange	dBW/Hz -65.54	-55.00
Carrier Uplink EIRP density	dBW/Hz -9.55	-12.71
Carrier power flux spectral density	dBW/m ² /Hz -172.11	-175.80
Carrier Downlink EIRP density at beam peak	dBW/Hz -36.31	-40.00

EARTH STATIONS

Tx earth station ID	USA-WBN-004 6175.0/3950.0 Woodbine C5 (CSM, SES-2)	USA-33454 at I64-BUEC
Latitude	°N 39.38	41.27
Longitude	°E -77.08	-82.47
Antenna diameter	m 11.10	2.40
Skew angle at transmit location	deg. 11.79	5.12
Effective (Refracted) Elevation	deg. 43.49	42.31
Uplink aspect correction	dB 0.02	0.53
Receive earth station ID	USA-33454 at I64-BUEC	USA-WBN-009 14250.0/11950.0 Woodbine K1 (CSM SES-1)
Latitude	°N 41.27	39.38
Longitude	°E -82.47	-77.08
Antenna diameter	m 2.40	9.20
Skew angle at receive location	deg. 5.12	11.79
Effective (Refracted) Elevation	deg. 42.31	43.49
Effective G/T at the carrier frequency (Clear-Sky)	dB/K 18.65	23.82
Downlink aspect correction	dB 1.09	1.60

CARRIER INFORMATION

Carrier uplink centre frequency	MHz 6345.00	6345.00
Carrier downlink centre frequency	MHz 4120.00	4120.00
Number of carriers	1.00	1.00
Modem		
Modulation setting name (clear sky)	QPSK 0.750	QPSK 0.750
Information rate (clear sky)	Mbps 0.12	0.12
Symbol rate	Msps 0.08	0.08
Aggregate code rate (clear sky)	0.75	0.75
Noise Bandwidth	MHz 0.08	0.08
Spreading Factor	1.00	1.00
Allocated bandwidth	MHz 0.10	0.10
Power Equivalent Bandwidth	MHz 0.07	0.03

SES LINK BUDGET ANALYSIS

ACM analysis (constant SR)			
Spectral efficiency in clear sky	b/sym	1.50	1.50
Clear sky throughput	Mbps	0.12	0.12
Clear sky achievable modulation setting		QPSK 0.750	QPSK 0.750
Is the minimum recommended TPD OBO exceeded ?			
Under fade: Spectral efficiency at required availability	b/sym	N/A	N/A
Under fade: Throughput when meeting the required availability	Mbps	N/A	N/A
Under fade : Mod Cod meeting the required availability		N/A	N/A
LINK BUDGET			
Uplink Calculations			
Carrier Input Backoff in clear sky	dB	-32.43	-36.12
Carrier FD from Uplink E/S	dBW/m ²	-123.24	-126.42
C/N _{UP,Thermal} : Uplink Thermal Noise ratio (clear sky)	dB	22.62	18.94
C/(N+I) _{UP, NO ASI} : Uplink Thermal Noise and interference ratio prior to ASI (clear sky)	dB	20.72	18.02
C/(N+I) _{UP} Uplink Thermal Noise and interference ratio (clear sky)	dB	15.81	12.42
Total propagation loss considering uplink rain fade	dB		
C/(N+I) _{UP} Uplink Thermal Noise and Interference ratio (UL under fade)	dB		
Resulting uplink path availability	% yr	clear weather only	clear weather only
Downlink Calculations			
Carrier Downlink EIRP towards Receive E/S	dBW	11.44	7.26
Carrier Downlink EIRP at beam peak	dBW	12.54	8.85
Carrier Output Backoff (clear sky)	dB	-30.93	-34.62
C/(N+I) _{DN, NO ASI} : Downlink Thermal Noise and interference ratio prior to ASI (clear sky)	dB	12.52	12.49
C/N _{DN,Thermal} : Downlink Thermal Noise ratio (clear sky)	dB	13.53	14.54
C/(N+I) _{DN} Downlink Thermal Noise and interference ratio (clear sky)	dB	10.22	11.94
Total propagation loss considering downlink rain fade	dB		
C/(N+I) _{DN} Downlink Thermal Noise and Interference ratio (DL under fade)	dB		
Resulting downlink path availability	% yr	clear weather only	clear weather only
NOISE CONTRIBUTION ANALYSIS			
Limiting factor		Downlink Thermal Noise	Uplink Adjacent Satellite Interference
Total C/(N+I) clear sky	dB	9.16	9.16
Total Eb/No clear sky	dB	7.40	7.40
Total C/(N+I) (UL fade, DL clear)	dB		
Total C/(N+I) (DL fade, UL clear)	dB		
Total C/(N+I), excluding ASI, clear sky	dB	11.91	11.42
Required C/N (including implementation and additional margin)	dB	9.16	9.16
Required Eb/No (including implementation and additional margin)	dB	7.40	7.40
Link margin in clear sky (For ACM carriers, residual margin in CS)	dB	0.00	0.00
POWER DENSITY REVIEW			
Carrier power density at antenna flange (clear sky)	dBW/Hz	-65.54	-55.00
Uplink EIRP density	dBW/Hz	-9.55	-12.71
Skew angle at transmit location	deg	11.79	5.12
Uplink off-axis EIRP density at 2 deg	dBW/Hz	-44.06	-33.52
Downlink EIRP density at beam peak	dBW/Hz	-36.31	-40.00
HPA Sizing			
Total number of carriers		1.00	1.00
Total EIRP required from E/S	dBW	39.31	36.15
UPC Range	dB	0.00	0.00
HPA type/mode		Not Defined Multi Carrier	Not Defined Multi Carrier
Required backoff	dB	-4.00	-4.00
Required HPA capability	W	0.10	0.70
Recommended HPA size (for a single carrier)	W	HPA type not supplied	HPA type not supplied
Recommended HPA size (to support all carriers)	W	HPA type not supplied	HPA type not supplied

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Antenna Alignment

Produced using Satmaster Pro

Thursday

30 June 2022

Site name I64-BUEC

Satellite name SES-2

Input Parameters	Value	Units
Site latitude	41.268085N	degrees
Site longitude	82.467937W	degrees
Satellite longitude	87.00W	degrees
Inclination	0	degrees
Spot beam polarization cant	0	degrees
Antenna offset focus angle	0	degrees

Satellite Look Angles	Value	Units
Elevation	42.09	degrees
True azimuth	186.85	degrees
Azimuth compass bearing	194.93	degrees
Polarization offset	5.18	degrees
Path distance to satellite	37621.00	km

Modified Polar Mount Settings	Value	Units
Polar axis	41.96	degrees
Polar elevation	48.04	degrees
Declination offset	5.74	degrees
Apex declination	47.69	degrees
Apex elevation	42.31	degrees