U.S. General Services Administration
Federal Acquisition Service (FAS)
Office of Information Technology Category (ITC)

ATTACHMENT J-17 Sample Task Order Link Budget Template

Template Instructions	
Please use one tab per link when submitting your Link Budgets. For each additional link past the first, new tabs should be created and completed. For example, a full duplex, 512 kbps link would require two tabs in the link budget template. One tab would be the link showing site A to site B while the second tab would demonstrate the link from site B to site A. One workbook with multiple tabs may be used for all links; it is not necessary to submit separate workbook files for each link. Please use a separate workbook file for each STO. Definitions for each parameter in the link budget are below.	
Top of Document (header information)	
LINK NAME	Descriptive name for the link contained on that tab.
Sample Task Order #:	Indicate the STO to which the Contractor is responding.
DATE	Date link budget prepared
Block 1, Satellite Characteristics	
1a. Satellite Name	Name of satellite being proposed
1b. Satellite Longitude (West/East) [deg]	Orbital location of satellite
1c. Uplink/Downlink Beam	Uplink/Downlink Beam name on which proposed transponder is located (ie. MEK, NA, Regional, etc.)
1d. Transponder Id	Name of transponder (ie. 23k, NEAVA4, etc.)
1e. Type of Band (C,Ku,C/Ku,Ku/C,X)	Band of beam provided
1f. Xpdr Total Bandwidth [MHz]	Total BW on proposed transponder
1g. UL Beam Polarization (V,H,L,R)	Uplink polarization
1h. DL Beam Polarization (V,H,L,R)	Downlink polarization
1i. Xpdr SFD (@ 0 dbi/K G/T) [dBW/m2]	Current or proposed SFD setting of transponder
Block 2, Carrier Parameters	
2a. Data Rate (including "Overhead") [kbps]	Total Data rate of proposed carrier
2b. Modulation Scheme (1-BPSK,2-QPSK,3-8PSK … others)	Modulation used for proposed carrier
2c. Coding Type (Conv., Conv+RS, TPC, LDPC)	Type of encoding utilized
2d. Inner Code Rate (FEC Rate/Code Rate)	Inner code rate used for carrier
2e. Outer Code Rate (e.g. Reed/Solomon)	Outer code rate used for carrier
2f. Rolloff Factor/Spacing Factor	Rolloff factor of carrier
2g. Required Eb/No Threshold [dB]	Eb/No threshold required to maintain link closure
2h. Bit Error Rate (BER)	Target BER
Block 3, Transmitting Terminal	
3a. Location Name	Geographic location of terminal (ie. Qatar; Erbil, Iraq; Kabal, Afghanistan, etc)
3b. Terminal Id (Name/Number)	Terminal name or identifier (ie. WA-TFT, Swan, DKET, etc)
3c. Uplink Frequency [GHz]	Tx uplink frequency of carrier
3d. Latitude (plus for North) [deg]	Latitude of terminal
3e. Longitude (plus for East) [deg]	Longitude of terminal
3f. Elevation Angle [deg]	Look angle of terminal
3g. Tx Dish Size [m]	Antenna size of terminal in meters
3h. Uplink Tx EIRP@ Tx [dBW]	Uplink EIRP value of terminal
3i. Satellite Footprint G/T @ Tx [dB/K]	Satellite G/T value for terminal location
Block 4, Receiving Terminal	
4a. Location Name	Geographic location of terminal (ie. Qatar; Erbil, Iraq; Kabal, Afghanistan, etc)
4b. Terminal Id (Name/Number)	Terminal name or identifier (ie. WA-TFT, Swan, DKET, etc)
4c. Downlink Frequency [GHz]	Rx downlink frequency of carrier
4d. Latitude (plus for North) [deg]	Latitude of terminal
4e. Longitude (plus for East) [deg]	Longitude of terminal
4f. Elevation Angle [deg]	Look angle of terminal
4g. Rx Dish Size [m]	Antenna size of terminal in meters
4h. G/T of Rx [dB/K]	Downlink G/T value of terminal
4i. Satellite Footprint EIRP @ Rx [dBW]	Satellite EIRP value for terminal location
Block 5, Uplink and Intermod	
5a. Carrier Output Backoff at Tx Earth Station [dB]	Difference between EIRP maximum and transmit power
5b. Up Link Free Space Loss [dB]	Loss in signal strength of the uplink signal path through free space
5c. C/No Uplink Total [dBHz]	Sum of all uplink losses, gains, and Boltzmann's constant
5d. C/IMo Intermod [dBHz]	Ratio of average received modulated carrier power and combination of all interferences
Block 6, Downlink	
6a. Carrier Output Backoff at Transmitting Transponder [dB]	Difference between satellite EIRP and the individual carrier power
6b. Down Link Free Space Loss [dB]	Loss in signal strength of the downlink signal path through free space
6c. C/No Downlink Total [dBHz]	Sum of all downlink losses, gains, and Boltzmann's constant
6d. C/Io Interference [dBHz]	Ratio of average received modulated carrier power and combination of all interferences

Block 7, Total (Uplink + Downlink + Intermod + Other Interference)	
7a. C/No Overall [dBHz]	Overall (uplink and downlink) ratio of carrier power over noise and all interferences.
7b. System Link Margin (including Rain Model) [dB]	Difference between Required Eb/No and target Eb/No including margins to overcome rain fade and interference
7c.Total Link Availability (end-to-end) [%]	Calculated availability based on ITU Rain Fade Models and interference
7d. Required Thresh. Eb/No + Sys. Link Margin [dB]	Target Eb/No including margins to overcome rain fade and interference
Block 8	
8a. Required Bandwidth [%]	Required percentage of transponder bandwidth to support proposed carrier
8b. Required Bandwidth [MHz]	Required bandwidth in Mhz to support proposed carrier
Block 9, Transponder Power Bandwidth Utilization	
9a. Required Power Equivalent BW (PEB) [%]	Required percentage of transponder PEB to support proposed carrier power
9b. Required Power Equivalent BW (PEB) [MHz]	Required PEB in Mhz to support proposed carrier power

LINK NAME		Sample Task Order #	DATE
Satellite & Carrier Characteristics			
1. Satellite Characteristics		**2. Carrier Parameters**	
1a. Satellite Name		2a. Data Rate (including "Overhead") [kbps]	
1b. Satellite Longitude (West/East) [deg]		2b. Modulation Scheme (BPSK, QPSK, 8PSK … others)	
1c. Uplink/Downlink Beam		2c. Coding Type (Conv., Conv+RS, TPC, LDPC)	
1d. Transponder Id		2d. Inner Code Rate (FEC Rate/Code Rate)	
1e. Type of Band (C,Ku,C/Ku,Ku/C,X)		2e. Outer Code Rate (e.g. Reed/Solomon)	
1f. Xpdr Total Bandwidth [MHz]		2f. Rolloff Factor/Spacing Factor	
1g. UL Beam Polarization (V,H,L,R)		2g. Required Eb/No Threshold [dB]	
1h. DL Beam Polarization (V,H,L,R)		2h. Bit Error Rate (BER)	
1i. Xpdr SFD (@ 0 dbi/K G/T) [dBW/m2]			
Terminal Characteristics			
3. Transmitting Terminal Tx		**4. Receiving Terminal Rx**	
3a. Location Name		4a. Location Name	
3b. Terminal Id (Name/Number)		4b. Terminal Id (Name/Number)	
3c. Uplink Frequency [GHz]		4c. Downlink Frequency [GHz]	
3d. Latitude (plus for North) [deg]		4d. Latitude (plus for North) [deg]	
3e. Longitude (West/East) [deg]		4e. Longitude (West/East) [deg]	
3f. Elevation Angle [deg]		4f. Elevation Angle [deg]	
3g. Tx Dish Size [m]		4g. Rx Dish Size [m]	
3h. Uplink Tx EIRP@ Tx [dBW]		4h. G/T of Rx [dB/K]	
3i. Satellite Footprint G/T @ Tx [dB/K]		4i. Satellite Footprint EIRP @ Rx [dBW]	
Link Budgets (including Rain statistics)			
5. Uplink & Intermod		**6. Downlink & Intermod**	
5.a. Carrier Output Backoff at Tx Earth Station [db]		6a. Carrier Output Backoff at Transmitting Transponder [dB]	
5b. Up Link Free Space Loss [dB]		6b. Down Link Free Space Loss [dB]	
5c. C/No Uplink Total [dBHz]		6c. C/No Downlink Total [dBHz]	
5d. C/(IMo Intermod + Io + X-Po) Uplink [dBHz]		6d. C/(IMo Intermod + Io + X-Po) Downlink [dBHz]	
7. Total (Uplink + Downlink + Intermod + Other Interference)			
7a. C/No Overall [dBHz]		7c.Total Link Availability (end-to-end) [%]	
7b. System Link Margin (including Rain Model) [dB]		7d. Required Thresh. Eb/No + Sys. Link Margin [dB]	
8. Transponder Bandwidth Utilization		**9. Transponder Power Bandwidth Utilization**	
8a. Required Bandwidth [%]		9a. Required Power Equivalent BW (PEB) [%]	
8b. Required Bandwidth [MHz]		9b. Required Power Equivalent BW (PEB) [MHz]	

Site A to Site B		STO # 1	29-Oct-15
Satellite & Carrier Characteristics			
1. Satellite Characteristics		**2. Carrier Parameters**	
1a. Satellite Name	E 70A	2a. Data Rate (including "Overhead") [kbps]	8192
1b. Satellite Longitude (West/East) [deg]	116 E	2b. Modulation Scheme (BPSK, QPSK, 8PSK … others)	QPSK
1c. Uplink/Downlink Beam	Fixed	2c. Coding Type (Conv., Conv+RS, TPC, LDPC)	Conv+RS
1d. Transponder Id	D1	2d. Inner Code Rate (FEC Rate/Code Rate)	0.875
1e. Type of Band (C,Ku,C/Ku,Ku/C,X)	Ku	2e. Outer Code Rate (e.g. Reed/Solomon)	(219/201)
1f. Xpdr Total Bandwidth [MHz]	72.00	2f. Rolloff Factor/Spacing Factor	1.35
1i. UL Beam Polarization (V,H,L,R)	Y	2g. Required Eb/No Threshold [dB]	6.9
1j. DL Beam Polarization (V,H,L,R)	X	2h. Bit Error Rate (BER)	1.0E-07
1k. Xpdr SFD (@ 0 dBi/K G/T) [dBW/m2]	-78.00		
Terminal Characteristics			
3. Transmitting Terminal Tx		**4. Receiving Terminal Rx**	
3a. Location Name	Site A	4a. Location Name	Site B
3b. Terminal Id (Name/Number)	OKET 13	4b. Terminal Id (Name/Number)	OKET 48
3c. Uplink Frequency [GHz]	13.79167	4c. Downlink Frequency [GHz]	11.49167
3d. Latitude (plus for North) [deg]	Numbers	4d. Latitude (plus for North) [deg]	Numbers
3e. Longitude (West/East) [deg]	Numbers	4e. Longitude (West/East) [deg]	Numbers
3f. Elevation Angle [deg]	53.63	4f. Elevation Angle [deg]	62.54
3g. Tx Dish Size [m]	4.80	4g. Rx Dish Size [m]	3.80
3h. Uplink Tx EIRP @ Tx [dBW]	62.34	4h. G/T of Rx [dB/K]	30.60
3i. Satellite Footprint G/T @ Tx [dB/K]	3.50	4i. Satellite Footprint EIRP @ Rx [dBW]	40.50
Link Budget with Included Rain Model			
5. Uplink		**6. Downlink**	
5.a. Carrier Output Backoff at Tx Earth Station [db]	18.58	6a. Carrier Output Backoff at Transmitting Transponder [dB]	13.88
5b. Up Link Free Space Loss [dB]	206.56	6b. Down Link Free Space Loss [dB]	204.87
5c. C/No Uplink Total [dBHz]	87.77	6c. C/No Downlink Total [dBHz]	80.94
5d. C/(IMo+Io) Intermod + Interference [dBHz]	93.77	6d. C/(IMo+Io) Intermod + Interference [dBHz]	86.94
7. Total (Uplink + Downlink + Intermod + Other Interference)			
7a. C/(No+IMo+Io) Overall [dBHz]	79.15	7c.Total Link Availability (end-to-end) [%]	99.929%
7b. System Link Margin (including Rain Model)[dB]	3.12	7d. Required Threshold Eb/No + System Link Margin [dB]	10.02
8. Transponder Bandwidth Utilization		**9. Transponder Power Bandwidth Utilization**	
8a. Required Bandwidth [%]	9.58%	9a. Required Power Equivalent BW (PEB) [%]	9.58%
8b. Required Bandwidth [MHz]	6.900	9b. Required Power Equivalent BW (PEB) [MHz]	6.900

Example

Site B to Site A		STO # 1	29-Oct-15
Satellite & Carrier Characteristics			
1. Satellite Characteristics		**2. Carrier Parameters**	
1a. Satellite Name	E 70A	2a. Data Rate (including "Overhead") [kbps]	8192
1b. Satellite Longitude (West/East) [deg]	116 E	2b. Modulation Scheme (BPSK, QPSK, 8PSK … others)	QPSK
1c. Uplink/Downlink Beam	Fixed	2c. Coding Type (Conv., Conv+RS, TPC, LDPC)	Conv+RS
1d. Transponder Id	D1	2d. Inner Code Rate (FEC Rate/Code Rate)	0.875
1e. Type of Band (C,Ku,C/Ku,Ku/C,X)	Ku	2e. Outer Code Rate (e.g. Reed/Solomon)	(219/201)
1f. Xpdr Total Bandwidth [MHz]	72.00	2f. Rolloff Factor/Spacing Factor	1.35
1i. UL Beam Polarization (V,H,L,R)	Y	2g. Required Eb/No Threshold [dB]	6.9
1j. DL Beam Polarization (V,H,L,R)	X	2h. Bit Error Rate (BER)	1.0E-07
1k. Xpdr SFD (@ 0 dBi/K G/T) [dBW/m2]	-78.00		
Terminal Characteristics			
3. Transmitting Terminal Tx		**4. Receiving Terminal Rx**	
3a. Location Name	Site B	4a. Location Name	Site A
3b. Terminal Id (Name/Number)	OKET 48	4b. Terminal Id (Name/Number)	OKET 13
3c. Uplink Frequency [GHz]	13.79167	4c. Downlink Frequency [GHz]	11.49167
3d. Latitude (plus for North) [deg]	Numbers	4d. Latitude (plus for North) [deg]	Numbers
3e. Longitude (West/East) [deg]	Numbers	4e. Longitude (West/East) [deg]	Numbers
3f. Elevation Angle [deg]	62.54	4f. Elevation Angle [deg]	53.63
3g. Tx Dish Size [m]	3.80	4g. Rx Dish Size [m]	4.80
3h. Uplink Tx EIRP @ Tx [dBW]	63.00	4h. G/T of Rx [dB/K]	31.80
3i. Satellite Footprint G/T @ Tx [dB/K]	-4.00	4i. Satellite Footprint EIRP @ Rx [dBW]	47.60
Link Budget with Included Rain Model			
5. Uplink		**6. Downlink**	
5.a. Carrier Output Backoff at Tx Earth Station [db]	25.31	6a. Carrier Output Backoff at Transmitting Transponder [dB]	20.61
5b. Up Link Free Space Loss [dB]	206.46	6b. Down Link Free Space Loss [dB]	204.98
5c. C/No Uplink Total [dBHz]	81.04	6c. C/No Downlink Total [dBHz]	82.41
5d. C/(IMo+Io) Intermod + Interference [dBHz]	87.04	6d. C/(IMo+Io) Intermod + Interference [dBHz]	88.41
7. Total (Uplink + Downlink + Intermod + Other Interference)			
7a. C/(No+IMo+Io) Overall [dBHz]	77.69	7c.Total Link Availability (end-to-end) [%]	99.879%
7b. System Link Margin (including Rain Model)[dB]	1.65	7d. Required Threshold Eb/No + System Link Margin [dB]	8.55
8. Transponder Bandwidth Utilization		**9. Transponder Power Bandwidth Utilization**	
8a. Required Bandwidth [%]	9.58%	9a. Required Power Equivalent BW (PEB) [%]	2.03%
8b. Required Bandwidth [MHz]	6.900	9b. Required Power Equivalent BW (PEB) [MHz]	1.465

Example

TDMA to worst case scenario		STO # 2	29-Oct-15
Satellite & Carrier Characteristics			
1. Satellite Characteristics		**2. Carrier Parameters**	
1a. Satellite Name	E 70A	2a. Data Rate (including "Overhead") [kbps]	2000
1b. Satellite Longitude (West/East) [deg]	116 E	2b. Modulation Scheme (BPSK, QPSK, 8PSK ... others)	QPSK
1c. Uplink/Downlink Beam	Fixed	2c. Coding Type (Conv., Conv+RS, TPC, LDPC)	LDPC
1d. Transponder Id	D1	2d. Inner Code Rate (FEC Rate/Code Rate)	0.500
1e. Type of Band (C,Ku,C/Ku,Ku/C,X)	Ku	2e. Outer Code Rate (e.g. Reed/Solomon)	1.00
1f. Xpdr Total Bandwidth [MHz]	72.00	2f. Rolloff Factor/Spacing Factor	1.35
1i. UL Beam Polarization (V,H,L,R)	Y	2g. Required Eb/No Threshold [dB]	1.7
1j. DL Beam Polarization (V,H,L,R)	X	2h. Bit Error Rate (BER)	1.0E-07
1k. Xpdr SFD (@ 0 dBi/K G/T) [dBW/m^2]	-78.00		
Terminal Characteristics			
3. Transmitting Terminal Tx		**4. Receiving Terminal Rx**	
3a. Location Name	HUB	4a. Location Name	Spoke
3b. Terminal Id (Name/Number)	OKET 88	4b. Terminal Id (Name/Number)	OKET 99
3c. Uplink Frequency [GHz]	13.79167	4c. Downlink Frequency [GHz]	11.49167
3d. Latitude (plus for North) [deg]	Numbers	4d. Latitude (plus for North) [deg]	Numbers
3e. Longitude (West/East) [deg]	Numbers	4e. Longitude (West/East) [deg]	Numbers
3f. Elevation Angle [deg]	53.64	4f. Elevation Angle [deg]	53.64
3g. Tx Dish Size [m]	4.90	4g. Rx Dish Size [m]	1.50
3h. Uplink Tx EIRP @ Tx [dBW]	58.26	4h. G/T of Rx [dB/K]	23.00
3i. Satellite Footprint G/T @ Tx [dB/K]	3.50	4i. Satellite Footprint EIRP @ Rx [dBW]	47.60
Link Budget with Included Rain Model			
5. Uplink		**6. Downlink**	
5.a. Carrier Output Backoff at Tx Earth Station [db]	22.66	6a. Carrier Output Backoff at Transmitting Transponder [dB]	17.96
5b. Up Link Free Space Loss [dB]	206.56	6b. Down Link Free Space Loss [dB]	204.98
5c. C/N_o Uplink Total [dBHz]	83.70	6c. C/N_o Downlink Total [dBHz]	76.26
5d. C/(IM_o+I_o) Intermod + Interference [dBHz]	89.70	6d. C/(IM_o+I_o) Intermod + Interference [dBHz]	82.26
7. Total (Uplink + Downlink + Intermod + Other Interference)			
7a. C/(N_o+IM_o+I_o) Overall [dBHz]	74.57	7c.Total Link Availability (end-to-end) [%]	99.990%
7b. System Link Margin (including Rain Model)[dB]	9.86	7d. Required Threshold E_b/N_o + System Link Margin [dB]	11.56
8. Transponder Bandwidth Utilization		**9. Transponder Power Bandwidth Utilization**	
8a. Required Bandwidth [%]	3.75%	9a. Required Power Equivalent BW (PEB) [%]	3.75%
8b. Required Bandwidth [MHz]	2.700	9b. Required Power Equivalent BW (PEB) [MHz]	2.700

Example