



### ATTACHMENT J-17 Sample Task Order Link Budget Template

Template Instructions	
<p>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.</p>	
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/I <sub>Mo</sub> Intermod [dBHz]	Ratio of average received modulated carrier power and combination of all interferences
<b>Block 6, Downlink</b>	
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/I <sub>o</sub> Interference [dBHz]	Ratio of average received modulated carrier power and combination of all interferences
<b>Block 7, Total (Uplink + Downlink + Intermod + Other Interference)</b>	
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
<b>Block 8</b>	
8a. Required Bandwidth [%]	Required percentage of transponder bandwidth to support proposed carrier
8b. Required Bandwidth [MHz]	Required bandwidth in Mhz to support proposed carrier
<b>Block 9, Transponder Power Bandwidth Utilization</b>	
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
<b>Satellite &amp; Carrier Characteristics</b>		
<b>1. Satellite Characteristics</b>	<b>2. Carrier Parameters</b>	
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]		
<b>Terminal Characteristics</b>		
<b>3. Transmitting Terminal Tx</b>	<b>4. Receiving Terminal Rx</b>	
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]	
<b>Link Budgets (including Rain statistics)</b>		
<b>5. Uplink &amp; Intermod</b>	<b>6. Downlink &amp; Intermod</b>	
5a. 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/(I <sub>Mo</sub> Intermod + I <sub>o</sub> + X-Po) Uplink [dBHz]	6d. C/(I <sub>Mo</sub> Intermod + I <sub>o</sub> + X-Po) Downlink [dBHz]	
<b>7. Total (Uplink + Downlink + Intermod + Other Interference)</b>		
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]	
<b>8. Transponder Bandwidth Utilization</b>	<b>9. Transponder Power Bandwidth Utilization</b>	
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
<b>Satellite &amp; Carrier Characteristics</b>			
<b>1. Satellite Characteristics</b>		<b>2. Carrier Parameters</b>	
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		
<b>Terminal Characteristics</b>			
<b>3. Transmitting Terminal Tx</b>		<b>4. Receiving Terminal Rx</b>	
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
<b>Link Budget with Included Rain Model</b>			
<b>5. Uplink</b>		<b>6. Downlink</b>	
5a. 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/(I <sub>Mo</sub> +I <sub>o</sub> ) Intermod + Interference [dBHz]	93.77	6d. C/(I <sub>Mo</sub> +I <sub>o</sub> ) Intermod + Interference [dBHz]	86.94
<b>7. Total (Uplink + Downlink + Intermod + Other Interference)</b>			
7a. C/(No+I <sub>Mo</sub> +I <sub>o</sub> ) 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
<b>8. Transponder Bandwidth Utilization</b>		<b>9. Transponder Power Bandwidth Utilization</b>	
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

Site B to Site A		STO # 1		29-Oct-15	
<b>Satellite &amp; Carrier Characteristics</b>					
<b>1. Satellite Characteristics</b>		<b>2. Carrier Parameters</b>			
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				
<b>Terminal Characteristics</b>					
<b>3. Transmitting Terminal Tx</b>		<b>4. Receiving Terminal Rx</b>			
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		
<b>Link Budget with Included Rain Model</b>					
<b>5. Uplink</b>		<b>6. Downlink</b>			
5a. 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/(I <sub>Mo</sub> +I <sub>o</sub> ) Intermod + Interference [dBHz]	87.04	6d. C/(I <sub>Mo</sub> +I <sub>o</sub> ) Intermod + Interference [dBHz]	88.41		
<b>7. Total (Uplink + Downlink + Intermod + Other Interference)</b>					
7a. C/(No+I <sub>Mo</sub> +I <sub>o</sub> ) 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		
<b>8. Transponder Bandwidth Utilization</b>		<b>9. Transponder Power Bandwidth Utilization</b>			
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		

TDMA to worst case scenario		STO # 2	29-Oct-15
<b>Satellite &amp; Carrier Characteristics</b>			
<b>1. Satellite Characteristics</b>		<b>2. Carrier Parameters</b>	
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 <sup>2</sup> ]	-78.00		
<b>Terminal Characteristics</b>			
<b>3. Transmitting Terminal Tx</b>		<b>4. Receiving Terminal Rx</b>	
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
<b>Link Budget with Included Rain Model</b>			
<b>5. Uplink</b>		<b>6. Downlink</b>	
5a. 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/No Uplink Total [dBHz]	83.70	6c. C/No Downlink Total [dBHz]	76.26
5d. C/((I <sub>0</sub> +I <sub>0</sub> ) Intermod + Interference [dBHz]	89.70	6d. C/((I <sub>0</sub> +I <sub>0</sub> ) Intermod + Interference [dBHz]	82.26
<b>7. Total (Uplink + Downlink + Intermod + Other Interference)</b>			
7a. C/((N <sub>0</sub> +I <sub>0</sub> +I <sub>0</sub> ) 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 Eb/No + System Link Margin [dB]	11.56
<b>8. Transponder Bandwidth Utilization</b>		<b>9. Transponder Power Bandwidth Utilization</b>	
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