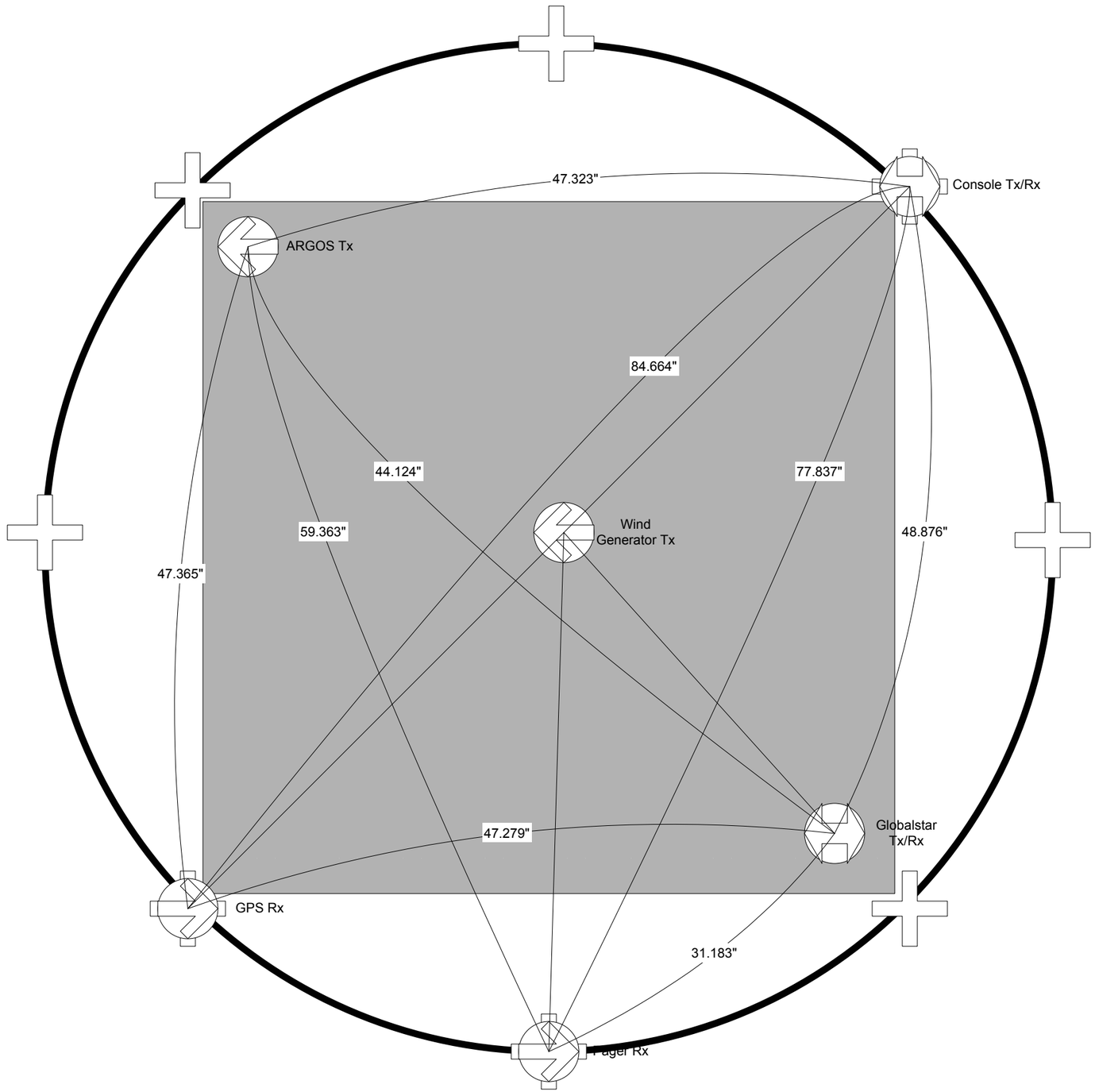
MOOS Buoy Emmiter-Receiver Matrix

	TX	Sat	Console	Wind Gen.	Freewave	ARGOS
RX	freq	1610.73-1625.49MHz	2400-2497	?	902-928MHz	401.65MHz
Sat	2484.39-2499.15MHz	no	*			
Console	2400-2497MHz				1H-3H*	
Pager	929MHz		1H-3H*		*	*
Freewave	902-928MHz					*
GPS (L1)	1575.42MHz	yes - mitigated			3H-5H*	

* likely problematic (may be harmonic in nature)

	SatCom		Wireless Console		GPS		ARGOS	Pager	Freewave		Wind Generator
	TX	RX	Tx	Rx	L1 (Data)	L2 (Delay)	Uplink	RX	TX	RX	EMI??
	1610.73-1625.49MHz	2484.39-2499.15MHz	2400-2497MHz	2400-2497MHz	1575.42MHz	1227.60MHz	401.65MHz	929MHz	902-928MHz	902-928MHz	
Antenna Gain	>1.5dBiC	>1.5dBiC	0dBd	0dBd					0.0dB	0.0dB	
Antenna Pol.	LHCP	LHCP	Vertical	Vertical					Vertical	Vertical	
In-line Gain	-	+27dB	-	-					0.0dB	0.0dB	
Cable Loss	-0.6dB	-3.0dB							-5dB	-5dB	
Power/Sens	+26dBm		0dBm	-70dBm	-195dBm	??	+30dBm		+30dBm	-108dBm	
OOB Blocking	n/a		n/a	-10dBm							
Notes:	Antenna must be installed > 30" from GPS antennaes				circular 20,200km orbits	L2 for military use only			+20.7dB Antenna gain at tower	+20.7dB Antenna gain at tower	
					50W tranmitter power						
	Must keep 9" between antenna and personnel				24 operational sattelites						

Harmonic										
9	14562.99MHz	22425.93MHz	22036.50MHz	22036.50MHz	14178.78MHz	11048.40MHz	3614.85MHz	8361.00MHz	8235.00MHz	8235.00MHz
7	11326.77MHz	17442.39MHz	17139.50MHz	17139.50MHz	11027.94MHz	8593.20MHz	2811.55MHz	6503.00MHz	6405.00MHz	6405.00MHz
5	8090.55MHz	12458.85MHz	12242.50MHz	12242.50MHz	7877.10MHz	6138.00MHz	2008.25MHz	4645.00MHz	4575.00MHz	4575.00MHz
3	4854.33MHz	7475.31MHz	7345.50MHz	7345.50MHz	4726.26MHz	3682.80MHz	1204.95MHz	2787.00MHz	2745.00MHz	2745.00MHz
1/1	1618.11MHz	2491.77MHz	2448.50MHz	2448.50MHz	1575.42MHz	1227.60MHz	401.65MHz	929.00MHz	915.00MHz	915.00MHz
1/3	539.37MHz	830.59MHz	816.17MHz	816.17MHz	525.14MHz	409.20MHz	133.88MHz	309.67MHz	305.00MHz	305.00MHz
1/5	323.62MHz	498.35MHz	489.70MHz	489.70MHz	315.08MHz	245.52MHz	80.33MHz	185.80MHz	183.00MHz	183.00MHz
1/7	231.16MHz	355.97MHz	349.79MHz	349.79MHz	225.06MHz	175.37MHz	57.38MHz	132.71MHz	130.71MHz	130.71MHz
1/9	179.79MHz	276.86MHz	272.06MHz	272.06MHz	175.05MHz	136.40MHz	44.63MHz	103.22MHz	101.67MHz	101.67MHz



Monterey Bay Aquarium Research Institute
7700 Sandholdt Rd. Moss Landing, CA 95039-9644

MOOS Preliminary EMC Analysis

Drawn By: Lance McBride | DOC #: XXXXXXX | REV. 1.0

Date: 06/11/02 | Sheet: 1 of 1

Line	(GPS) Transmitter (Space)	Raw Data	Intentional	Culprit EMI (SatCom)
1	Transmitter Power Output		46.99dBm	26.00dBm
2	Gain of Transmitter Antenna		0.00dB	0.00dB
3	Off-Axis Antenna Gain Reduction			0.00dB
4	Coax & Misc. Losses			-0.60dB
5	Effective Radiated Power: Line 1+2+3-4		46.99dBm	25.40dBm
6	**Propagation Loss**			
7	Conversion of Terms		-32.45dB	-32.45dB
8	Frequency Adjustment: -20log(freq_MHz)	1575MHz	-63.95dB	-64.18dB
9	Distance Adjustment: -20log(dist_km)	12552miles	-86.11dB	58.41dB
10	Polarization Mismatch			
11	Blocking of Line-of_site (LOS)	0	0.00dB	0.00dB
12	Building Attenuation	0	0.00dB	0.00dB
13	Atmospheric Attenuation			
14	Total Propagation Loss: (Sum lines 7 to 13)		-182.50dB	-38.22dB
15	**Receiver (Buoy)**			
16	Receiver Antenna Gain in direction of TX	1		
17	Receiver Rejection of Culprit EMI Frequency			
18	Coax & Misc. Losses	0.6	-7.00dB	-7.00dB
19	Receiver Input Power: Line 5+14+16+17-18		-142.52dBm	-19.82dBm
20	Conversion of Terms (dBm/Hz)		-198.60dBm/Hz	
21	Receiver Noise Figure	0K		
22	Receiver Bandwidth = 10log(BW_Hz)	9.70E+07Hz		
23	Receiver Sensitivity: Line 20+21+22		-195.00dBm	
24	**System Performance**			
25	S/N (Intentional) or S/I (Culprit) (Link Margin): Line 19-23		52.48dB	175.18dB
26	Minimum Acceptable S/N (Link Margin) (design objective)	40.0dB	40.00dB	
27	Performance over Objective: Line 25-26		12.48dB	135.18dB

Line	(GlobalStar) Transmitter (Space)	Raw Data	Intentional	Culprit EMI (BT)	Culprit EMI (ARGOS)
1	Transmitter Power Output			0.00dBm	30.00dBm
2	Gain of Transmitter Antenna		0.00dB	0.00dB	0.00dB
3	Off-Axis Antenna Gain Reduction			0.00dB	
4	Coax & Misc. Losses			0.00dB	0.00dB
5	Effective Radiated Power: Line 1+2+3-4		0.00dBm	0.00dBm	30.00dBm
6	**Propagation Loss**				
7	Conversion of Terms		-32.45dB	-32.45dB	-32.45dB
8	Frequency Adjustment: -20log(freq_MHz)	2492MHz	-67.93dB	-67.93dB	-52.08dB
9	Distance Adjustment: -20log(dist_km)	876miles	-62.98dB	58.12dB	59.01dB
10	Polarization Mismatch	LHCP			
11	Blocking of Line-of_site (LOS)	0	0.00dB	0.00dB	
12	Building Attenuation	0	0.00dB	0.00dB	0.00dB
13	Atmospheric Attenuation				
14	Total Propagation Loss: (Sum lines 7 to 13)		-163.36dB	-42.26dB	-25.52dB
15	**Receiver (Buoy)**				
16	Receiver Antenna Gain in direction of TX	1		0.00dB	
17	Receiver Rejection of Culprit EMI Frequency			0.00dB	0.00dB
18	Coax & Misc. Losses	0.6	-0.60dB	-0.60dB	0.00dB
19	Receiver Input Power: Line 5+14+16+17-18		-163.96dBm	-42.86dBm	4.48dBm
20	Conversion of Terms (dBm/Hz)		-198.60dBm/Hz		
21	Receiver Noise Figure	124K	2.10dB		
22	Receiver Bandwidth = 10log(BW_Hz)	9.70E+07Hz	79.87dBHz		
23	Receiver Sensitivity: Line 20+21+22		-116.63dBm		
24	**System Performance**				
25	S/N (Intentional) or S/I (Culprit) (Link Margin): Line 19-23		-47.33dB	73.77dB	4.48dB
26	Minimum Acceptable S/N (Link Margin) (design objective)	40.0dB	40.00dB		
27	Performance over Objective: Line 25-26		-87.33dB	33.77dB	4.48dB

Line	(BT) Transmitter (Ship)	Raw Data	Intentional	Culprit EMI (SatCom)	
1	Transmitter Power Output	0	0.00dBm	26.00dBm	
2	Gain of Transmitter Antenna		0.00dB	0.00dB	
3	Off-Axis Antenna Gain Reduction		0.00dB	0.00dB	
4	Coax & Misc. Losses			-0.60dB	
5	Effective Radiated Power: Line 1+2+3-4		0.00dBm	25.40dBm	
6	**Propagation Loss**				
7	Conversion of Terms		-32.45dB	-32.45dB	
8	Frequency Adjustment: -20log(freq_MHz)	2492MHz	-67.93dB	-67.93dB	
9	Distance Adjustment: -20log(dist_km)	10m	40.00dB	58.12dB	
10	Polarization Mismatch	vertical	0.00dB		LHCP
11	Blocking of Line-of_site (LOS)	0	0.00dB	0.00dB	
12	Building Attenuation	0	0.00dB	0.00dB	
13	Atmospheric Attenuation				
14	Total Propagation Loss: (Sum lines 7 to 13)		-60.38dB	-42.26dB	
15	**Receiver (Buoy)**				
16	Receiver Antenna Gain in direction of TX	1	0.00dB	0.00dB	
17	Receiver Rejection of Culprit EMI Frequency			0.00dB	
18	Coax & Misc. Losses	0.6		0.00dB	
19	Receiver Input Power: Line 5+14+16+17-18		-60.38dBm	-16.86dBm	
20	Conversion of Terms (dBm/Hz)		-198.60dBm/Hz		
21	Receiver Noise Figure	0K			
22	Receiver Bandwidth = 10log(BW_Hz)	9.70E+07Hz			
23	Receiver Sensitivity: Line 20+21+22		-70.00dBm		
24	**System Performance**				
25	S/N (Intentional) or S/I (Culprit) (Link Margin): Line 19-23		9.62dB	53.14dB	
26	Minimum Acceptable S/N (Link Margin) (design objective)	20.0dB	20.00dB		
27	Performance over Objective: Line 25-26		-10.38dB	33.14dB	

Line	(Freewave) Transmitter (Mt. Toro)	Raw Data	Intentional	Culprit EMI
1	Transmitter Power Output	1mW to 1W	29.80dBm	
2	Gain of Transmitter Antenna	117.489755	20.70dB	
3	Off-Axis Antenna Gain Reduction			
4	Coax & Misc. Losses	-5.00dB	-5.00dB	
5	Effective Radiated Power: Line 1+2+3-4		45.50dBm	
6	**Propagation Loss**			
7	Conversion of Terms		-32.45dB	
8	Frequency Adjustment: -20log(freq_MHz)	900MHz	-59.08dB	
9	Distance Adjustment: -20log(dist_km)	60miles	-39.70dB	
10	Polarization Mismatch			
11	Blocking of Line-of_site (LOS)	n/a	0.00dB	0.00dB
12	Building Attenuation	n/a	0.00dB	0.00dB
13	Atmospheric Attenuation	-0.4	-0.40dB	
14	Total Propagation Loss: (Sum lines 7 to 13)		-131.63dB	
15	**Receiver (Buoy)**			
16	Receiver Antenna Gain in direction of TX	0	0.00dB	
17	Receiver Rejection of Culprit EMI Frequency			
18	Coax & Misc. Losses	-5	-5.00dB	
19	Receiver Input Power: Line 5+14+16+17-18		-91.13dBm	
23	Receiver Sensitivity: Line 20+21+22		-108.00dBm	
24	**System Performance**			
25	S/N (Intentional) or S/I (Culprit) (Link Margin): Line 19-23		16.87dB	
26	Minimum Acceptable S/N (Link Margin) (design objective)	20.0dB	20.00dB	
27	Performance over Objective: Line 25-26		-3.13dB	

Earth's Curvature vs. Line of Sight from Mt. Toro