

Interference Analysis Report

An Assessment of the Impact of Radiolocation Systems Operating in 3.1-3.7 GHz Band on Fixed Satellite Services Earth Station Receiver

Prepared for

Towerstream Corp.

TRANSMIT-RECEIVE EARTH STATION (2.4 METER)

FCC CALL SIGN: KA412

Site Name: Miami, Florida

Prepared By



COMSEARCH

November 17, 2014

1.0 Introduction

Interference calculations were performed to determine the potential for in-band and out-of-band interference from Radiolocation Systems operating in the 3.1 to 3.7 GHz band¹. The geographical positions and operating parameters of these systems were derived from NTIA Document TR-99-361².

2.0 Radiolocation Systems in the 3.1 – 3.7 GHz Band

High powered mobile and fixed radar systems operated by the Federal Government operate in the 3.1 – 3.7 GHz band. These radars are used to search for, and track, near-surface and high-altitude airborne projectiles, sea surveillance and airborne objects. The NTIA report referenced above has identified the locations for two types of systems: land-based and shipboard based. Also included in the report are the operating characteristics of these radars. There are two prevalent types of shipboard radars, denoted as type A and Type B, and one type of ground-based radar. An Airborne System radar is also specified. This analysis will concern itself with interference from the ground based and shipboard based radars based upon the relative operating positions and parameters specified in the NTIA report.

A summary of the operating parameters for the shipboard and ground based radar systems is shown below:

Table 1 – Technical Characteristics of 3.1-3.7 GHz Radiolocation Systems

Characteristic	Shipboard System A	Shipboard System B	Ground Based System
Modulation	P0N	Q7N	P0N
Tuning Range (GHz)	3.5-3.7	3.1-3.5	3.1-3.4
Peak transmit Power (MW)	1	4	0.12
Pulse Width (µsec.)	1.0	3.5-51.2	10.75
Pulse Repetition Rate (kHz)	1.125	0.152-6.0	2793.3-5050.51
Duty Cycle (%)	0.001	0.8-2.0	0.041
Transmit 3-dB Bandwidth (MHz)	4,16.6	4	1,10
Antenna Type	Reflector	Phased Array	Phase Scan Array
Antenna Mainbeam Gain (dBi)	32	42	36
Antenna Centerline (m)	46	20	46

¹ This report is being provided as required under Footnote US 245.

² National Telecommunications and Information Administration, U.S. DEPARTMENT OF COMMERCE, NTIA Report TR 99-361, *TECHNICAL CHARACTERISTICS OF RADIOLOCATION SYSTEMS OPERATING IN THE 3.1-3.7 GHz BAND AND PROCEDURES FOR ASSESSING EMC WITH FIXED EARTH STATION RECEIVERS*, (December 1999).

3.0 Earth Station System Parameters

The Fixed Satellite Service Earth Station's operational parameters are shown in the Tables 2 and 3 below:

TABLE 2 - SATELLITE EARTH STATION PARAMETERS AND COORDINATION DATA

Administrative Information

Status	ENGINEER PROPOSAL
Call Sign	KA412
Licensee Code	TOWSTR
Licensee Name	Towerstream Corp

Site Information

MIAMI, FL

Venue Name	
Latitude (NAD 83)	25° 48' 35.0" N
Longitude (NAD 83)	80° 21' 11.0" W
Climate Zone	B
Rain Zone	1
Ground Elevation (AMSL)	1.83 m / 6.0 ft

Link Information

Satellite Type	Geostationary
Mode	TR - Transmit-Receive
Modulation	Analog
Satellite Arc	6° W to 60° West Longitude
Azimuth Range	97.0° to 139.6°
Corresponding Elevation Angles	5.4° / 52.3°
Antenna Centerline (AGL)	11.89 m / 39.0 ft

Antenna Information

Receive - FCC32

Transmit - FCC32

Manufacturer	Prodelin	Prodelin	
Model	1244	1244	
Gain / Diameter	38.0 dBi / 2.4 m	42.0 dBi / 2.4 m	
3-dB / 15-dB Beamwidth	0.01° / 0.02°	0.02° / 0.03°	
Max Available RF Power	(dBW/4 kHz) (dBW/MHz)	-13.6 10.4	
Maximum EIRP	(dBW/4 kHz) (dBW/MHz)	28.4 52.4	
Interference Objectives:	Long Term	-158.0 dBW/MHz 20%	-154.0 dBW/4 kHz 20%
	Short Term	-148.0 dBW/MHz 0.01%	-131.0 dBW/4 kHz 0.0025%

Frequency Information

Receive 4.0 GHz

Transmit 6.1 GHz

Emission / Frequency Range (MHz)	3M17G7D / 3625.0 - 4200.0	3M17G7D / 5850.0 - 6018.0 3M17G7D / 6109.0 - 6126.0 3M17G7D / 6178.0 - 6240.0 3M17G7D / 6272.0 - 6425.0
Max Great Circle Coordination Distance	863.3 km / 536.4 mi	278.5 km / 173.0 mi
Precipitation Scatter Contour Radius	720.3 km / 447.5 mi	100.0 km / 62.1 mi

TABLE 3 - TABLE OF EARTH STATION COORDINATION VALUES (continued)

Coordination Values		MIAMI, FL				
Licensee Name	Towerstream Corp					
Latitude (NAD 83)	25° 48' 35.0" N					
Longitude (NAD 83)	80° 21' 11.0" W					
Ground Elevation (AMSL)	1.83 m / 6.0 ft					
Antenna Centerline (AGL)	11.89 m / 39.0 ft					
Antenna Model	Prodelin 2.4 Meter					
Antenna Mode	Receive 4.0 GHz		Transmit 6.1 GHz			
Interference Objectives: Long Term	-158.0 dBW/MHz	20%	-154.0 dBW/4 kHz 20%			
Short Term	-148.0 dBW/MHz	0.01%	-131.0 dBW/4 kHz 0.0025%			
Max Available RF Power	-13.6 (dBW/4 kHz)					
Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Receive 4.0 GHz		Transmit 6.1 GHz	
			Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
0	0.00	96.92	-10.00	437.80	-10.00	147.64
5	0.00	91.95	-10.00	437.80	-10.00	147.64
10	0.00	86.97	-10.00	437.80	-10.00	147.64
15	0.00	81.99	-10.00	437.80	-10.00	147.64
20	0.00	77.01	-10.00	437.80	-10.00	147.64
25	0.00	72.04	-10.00	437.80	-10.00	147.64
30	0.00	67.06	-10.00	437.80	-10.00	147.64
35	0.00	62.09	-10.00	437.80	-10.00	147.64
40	0.00	57.12	-10.00	437.80	-10.00	147.64
45	0.00	52.15	-10.00	437.80	-10.00	147.64
50	0.00	47.19	-9.85	439.83	-9.85	148.13
55	0.00	42.24	-8.64	456.09	-8.64	153.07
60	0.00	37.29	-7.29	474.43	-7.29	158.89
65	0.00	32.36	-5.75	497.02	-5.75	165.88
70	0.00	27.45	-3.96	524.56	-3.96	174.46
75	0.00	22.58	-1.84	559.14	-1.84	185.32
80	0.00	17.77	0.76	604.27	0.76	199.97
85	0.00	13.10	4.07	665.61	4.07	219.49
90	0.00	8.79	8.40	754.84	8.40	247.17
95	0.00	5.73	13.04	863.29	13.04	278.47
100	0.00	6.19	12.21	843.62	12.21	272.20
105	0.00	9.68	7.36	732.56	7.36	240.30
110	0.00	14.05	3.31	650.92	3.31	214.89
115	0.00	18.45	0.35	596.91	0.35	197.64
120	0.00	22.82	-1.96	557.19	-1.96	184.70
125	0.00	27.13	-3.84	526.58	-3.84	175.09
130	0.00	31.37	-5.41	502.11	-5.41	167.46
135	0.00	35.52	-6.76	482.06	-6.76	161.24
140	0.00	39.55	-7.93	465.38	-7.93	156.11
145	0.00	43.42	-8.94	451.97	-8.94	151.81
150	0.00	47.09	-9.82	440.12	-9.82	148.22
155	0.00	50.50	-10.00	437.80	-10.00	147.64
160	0.00	53.55	-10.00	437.80	-10.00	147.64
165	0.00	56.14	-10.00	437.80	-10.00	147.64
170	0.00	58.14	-10.00	437.80	-10.00	147.64
175	0.00	60.08	-10.00	437.80	-10.00	147.64
180	0.00	62.23	-10.00	437.80	-10.00	147.64

TABLE 3 - TABLE OF EARTH STATION COORDINATION VALUES (continued)

Coordination Values		MIAMI, FL				
Licensee Name	Towerstream Corp					
Latitude (NAD 83)	25° 48' 35.0" N					
Longitude (NAD 83)	80° 21' 11.0" W					
Ground Elevation (AMSL)	1.83 m / 6.0 ft					
Antenna Centerline (AGL)	11.89 m / 39.0 ft					
Antenna Model	Prodelin 2.4 Meter					
Antenna Mode	Receive 4.0 GHz		Transmit 6.1 GHz			
Interference Objectives:	Long Term	-158.0 dBW/MHz	20%	-154.0 dBW/4 kHz	20%	
	Short Term	-148.0 dBW/MHz	0.01%	-131.0 dBW/4 kHz	0.0025%	
Max Available RF Power	-13.6 (dBW/4 kHz)					
Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Receive 4.0 GHz		Transmit 6.1 GHz	
			Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
185	0.00	64.56	-10.00	437.80	-10.00	147.64
190	0.00	67.05	-10.00	437.80	-10.00	147.64
195	0.00	69.68	-10.00	437.80	-10.00	147.64
200	0.00	72.42	-10.00	437.80	-10.00	147.64
205	0.00	75.26	-10.00	437.80	-10.00	147.64
210	0.00	78.17	-10.00	437.80	-10.00	147.64
215	0.00	81.14	-10.00	437.80	-10.00	147.64
220	0.00	84.16	-10.00	437.80	-10.00	147.64
225	0.00	87.20	-10.00	437.80	-10.00	147.64
230	0.00	90.26	-10.00	437.80	-10.00	147.64
235	0.00	93.32	-10.00	437.80	-10.00	147.64
240	0.00	96.36	-10.00	437.80	-10.00	147.64
245	0.00	99.37	-10.00	437.80	-10.00	147.64
250	0.00	102.34	-10.00	437.80	-10.00	147.64
255	0.00	105.24	-10.00	437.80	-10.00	147.64
260	0.00	108.06	-10.00	437.80	-10.00	147.64
265	0.00	110.78	-10.00	437.80	-10.00	147.64
270	0.00	113.39	-10.00	437.80	-10.00	147.64
275	0.00	115.85	-10.00	437.80	-10.00	147.64
280	0.00	118.15	-10.00	437.80	-10.00	147.64
285	0.00	120.27	-10.00	437.80	-10.00	147.64
290	0.00	122.17	-10.00	437.80	-10.00	147.64
295	0.00	123.83	-10.00	437.80	-10.00	147.64
300	0.00	125.22	-10.00	437.80	-10.00	147.64
305	0.00	126.33	-10.00	437.80	-10.00	147.64
310	0.00	127.13	-10.00	437.80	-10.00	147.64
315	0.00	127.60	-10.00	437.80	-10.00	147.64
320	0.00	127.74	-10.00	437.80	-10.00	147.64
325	0.00	127.54	-10.00	437.80	-10.00	147.64
330	0.00	126.76	-10.00	437.80	-10.00	147.64
335	0.00	121.80	-10.00	437.80	-10.00	147.64
340	0.00	116.83	-10.00	437.80	-10.00	147.64
345	0.00	111.85	-10.00	437.80	-10.00	147.64
350	0.00	106.88	-10.00	437.80	-10.00	147.64
355	0.00	101.90	-10.00	437.80	-10.00	147.64

4.0 Interference Calculations

The interference was calculated into the earth station receive system for both in-band and out-of-band interference. The interference power level was calculated using the formula below:

$$P_r = P_t + G_t - \text{FSL} - \text{OHLOSS} + G_{es} - \text{LL}_t - \text{LL}_{es}$$

Where:

- P_r : Interference power level received at victim earth station, in dBW
- P_t : Transmitter power of Radiolocation system, in dBW
- G_t : Gain of Radiolocation transmit system, in dBi
- FSL: Free Space Loss between radiolocation system and earth station, in dB
- OHLOSS: Over-the-Horizon losses between radiolocation system and earth station, in dB
- G_{es} : Horizon gain of the earth station toward radiolocation transmitter, in dBi
- LL_t : Line losses of the radiolocation system, in dB (assume 2dB per NTIA report)
- LL_{es} : Line losses of the earth station system, in dB (assume 0 dB unless known)

This interference power level was then compared to in-band and out-of-band interference criteria. The in-band criteria was developed using ITU and FCC recommendations³. The out-of-band interference criteria was developed using the following:

The earth station's low noise amplifier front-end overload criteria of was determined using the following calculations:

$$T = C - G$$

Where:

- T = input threshold at which front-end overload occurs, dBW
- C = output 1 dB gain compression point of the LNA, typical -20 dBW
- G = Gain of the LNA, dB

For the purposes of this report it was assumed that the low-noise amplifier would not provide any out-of-band frequency rejection, thus no Frequency Dependent Rejection values based upon any RF selectivity, such as pre-LNA filtering or inherent LNA filtering, have been assumed. The maximum level of interference includes the input saturation threshold value minus a 10 dB output backoff value to consider in operation levels

The maximum interference power receive, P_r , allowable then becomes:

$$\text{Max } P_r \geq T - \text{IPBO}$$

For a 65 dB gain LNA this value is -95 dBW. In the absence of manufacturer LNA/LNB specifications the following typical values have been used:

- T = -95 dBW
- C = -20 dBW
- G = 65 dB

The propagation model to determine the over-the-horizon loss is the NSMA OH-Loss model⁴. When the propagation link is very lengthy, over 250 miles, an estimated OH-loss using a rounded earth modeling value has been used.

³ FCC Rules 47CFR25.251 by reference ITU Radio Regulations Appendix S7.

⁴ National Spectrum Managers Association has developed an industry accepted version which incorporates NBS Tech Note 101.

5.0 Summary of Results

The summary calculations are shown for all shipboard based and land based systems in Tables 4 through 8 below. Whenever Radar A and B are possibly in use, the interference calculations have assumed the higher powered systems (Radar B). The antenna elevation for the Ground Based systems was assumed to be 46 m even though it was not specified in the NTIA report.

Table 4 Shipboard Radar A Land-Based Test and Training Sites

Radar Location	Lat (N)	Lon (w)	Bearing (deg.)	Distance (mi)	Profile (Is path under 250 miles?)	FSL (dB)	Estimated OH-Loss (dB)	Profiled OH-Loss (dB)	Total Path Loss (dB)	Interfering Power Level (dBW/MHz)	In-Band Interference?	Out-of Band Overload?
Pensacola, FL	302128	0871626	308.2	526.1	NO	-162.2	-72.4	N/A	-234.7	-184.7	NO	NO
Pascagoula, MS	302200	0882900	304.2	587.4	NO	-163.2	-74.3	N/A	-237.5	-187.5	NO	NO
St.Inigoes, MD	381000	0762300	14.3	882.7	NO	-166.7	-58.0	-58	-224.7	-174.7	NO	NO

Table 5 Shipboard Radar B Land-Based Test and Training Sites

Radar Location	Lat (N)	Lon (w)	Bearing (deg.)	Distance (mi)	Profile (Is path under 250 miles?)	FSL (dB)	Estimated OH-Loss (dB)	Profiled OH-Loss (dB)	Total Path Loss (dB)	Interfering Power Level (dBW/MHz)	In-Band Interference?	Out-of Band Overload?
Moorestown, NJ	395849	0745630	16.4	1025.9	NO	-168.0	-65.0	-65	-233.0	-167.0	NO	NO
Wallops Island, VA	375600	0752800	17.7	883.3	NO	-166.7	-62.0	-62	-228.7	-162.7	NO	NO

Table 6 Shipboard Radars A and B Home Ports

Radar Location	Lat (N)	Lon (w)	Bearing (deg.)	Distance (mi)	Profile (Is path under 250 miles?)	FSL (dB)	Estimated OH-Loss (dB)	Profiled OH-Loss (dB)	Total Path Loss (dB)	Interfering Power Level (dBW/MHz)	In-Band Interference?	Out-of Band Overload?
Bath, ME	435425	0694848	22.6	1383.8	NO	-170.6	-89.2	N/A	-259.9	-193.8	NO	NO
Bremerton, WA	473324	1223811	315.2	2786.3	NO	-176.7	-101.4	N/A	-278.1	-212.1	NO	NO
Everett, WA	475858	1221354	316.0	2778.1	NO	-176.7	-101.3	N/A	-278.0	-212.0	NO	NO
Mayport, FL	302334	0812427	348.7	322.1	NO	-158.0	-63.9	N/A	-221.9	-155.9	YES	NO
Norfolk, VA	365200	0762100	16.2	797.7	NO	-165.9	-64.6	-64.6	-230.5	-164.4	NO	NO
Pascagoula, MS	302253	0882933	304.3	588.3	NO	-163.2	-74.4	N/A	-237.6	-171.6	NO	NO
Pearl Harbor, HI	212000	1580000	281.9	4935.1	NO	-181.7	-111.3	N/A	-293.0	-227.0	NO	NO
Portland, ME	434100	0701800	22.0	1358.3	NO	-170.5	-88.9	N/A	-259.4	-193.4	NO	NO
San Diego CA	324105	1170800	291.0	2271.5	NO	-174.9	-97.8	-73.3	-272.8	-206.8	NO	NO

Table 7 Naval At-Sea Operational Areas

Operational Area	Lat (N)	Lon (w)	Bearing (deg.)	Distance (mi)	Profile (Is path under 250 miles?)	FSL (dB)	Estimated OH-Loss (dB)	Profiled OH-Loss (dB)	Total Path Loss (dB)	Interfering Power Level (dBW/MHz)	In-Band Interference ?	Out-of Band Overload ?
AFWTF (North Range)												
AFWTF (NR)1	183000	0670000	117.9	992.7	NO	-167.8	-83.5	N/A	-251.2	-177.2	NO	NO
AFWTF (NR)2	200000	0670000	112.6	940.5	NO	-167.3	-82.5	N/A	-249.8	-170.5	NO	NO
AFWTF (NR)3	221000	0654800	102.3	953.8	NO	-167.4	-82.8	N/A	-250.2	-161.9	NO	NO
AFWTF (NR)4	221000	0652000	101.7	982.3	NO	-167.7	-83.3	N/A	-250.9	-162.7	NO	NO
AFWTF (NR)5	185000	0620000	108.7	1269.2	NO	-169.9	-87.7	N/A	-257.6	-178.3	NO	NO
AFWTF (NR)6	185000	0620000	108.7	1269.2	NO	-169.9	-87.7	N/A	-257.6	-178.3	NO	NO
AFWTF (NR)7	182500	0643000	113.6	1136.6	NO	-168.9	-85.8	N/A	-254.7	-175.4	NO	NO
AFWTF (NR)8	183000	0644500	113.8	1119.4	NO	-168.8	-85.5	N/A	-254.3	-175.0	NO	NO
AFWTF (NR)9	183000	0663800	117.2	1013.0	NO	-167.9	-83.8	N/A	-251.7	-177.7	NO	NO
AFWTF (South Range)												
AFWTF (SR)1	180500	0675500	121.3	959.1	NO	-167.5	-82.9	N/A	-250.3	-176.3	NO	NO
AFWTF (SR)2	180500	0652700	116.3	1094.4	NO	-168.6	-85.2	N/A	-253.8	-179.7	NO	NO
AFWTF (SR)3	181500	0651000	115.2	1104.4	NO	-168.7	-85.3	N/A	-254.0	-179.9	NO	NO
AFWTF (SR)4	181500	0641000	113.6	1161.4	NO	-169.1	-86.2	N/A	-255.3	-176.0	NO	NO
AFWTF (SR)5	170000	0641000	117.2	1206.2	NO	-169.4	-86.8	N/A	-256.3	-182.2	NO	NO
AFWTF (SR)6	165800	0642800	117.8	1190.8	NO	-169.3	-86.6	N/A	-256.0	-181.9	NO	NO
AFWTF (SR)7	153300	0660600	124.9	1161.7	NO	-169.1	-86.2	N/A	-255.3	-181.2	NO	NO
AFWTF (SR)8	153900	0662300	125.2	1142.8	NO	-169.0	-85.9	N/A	-254.9	-184.3	NO	NO
AFWTF (SR)9	163000	0662300	122.9	1105.9	NO	-168.7	-85.3	N/A	-254.0	-180.0	NO	NO
AFWTF (SR)10	163000	0675500	126.3	1026.8	NO	-168.0	-84.0	N/A	-252.1	-181.5	NO	NO

Table 7 Naval At-Sea Operational Areas (continued)

Operational Area	Lat (N)	Lon (w)	Bearing (deg.)	Distance (mi)	Profile (Is path under 250 miles?)	FSL (dB)	Estimated OH-Loss (dB)	Profiled OH-Loss (dB)	Total Path Loss (dB)	Interfering Power Level (dBW/MHz)	In-Band Interference ?	Out-of Band Overload?
AUTEC												
AUTEC1	252000	0780500	102.5	145.5	YES	-151.1	-52.0	-52	-203.1	-114.8	YES	NO
AUTEC2	252000	0774500	100.8	165.8	YES	-152.2	-54.3	-54.3	-206.5	-118.3	YES	NO
AUTEC3	232500	0762000	122.2	301.8	NO	-157.4	-62.8	N/A	-220.2	-146.2	YES	NO
AUTEC4	232500	0771500	129.5	255.4	NO	-156.0	-59.9	N/A	-215.8	-145.2	YES	NO
FORACS, Hawaii												
FORACS, Hawaii1	212530	1581100	282.1	4944.6	NO	-181.7	-111.3	N/A	-293.1	-227.0	NO	NO
FORACS, Hawaii2	212100	1581500	282.0	4950.5	NO	-181.7	-111.4	N/A	-293.1	-227.1	NO	NO
FORACS, Hawaii3	211500	1580800	281.9	4945.4	NO	-181.7	-111.4	N/A	-293.1	-227.0	NO	NO
FORACS, Hawaii4	211500	1580700	281.9	4944.4	NO	-181.7	-111.3	N/A	-293.0	-227.0	NO	NO
Gulf of Mexico OPAREA												
GoM1	293601	0800130	4.3	261.8	NO	-156.2	-60.3	N/A	-216.5	-150.5	YES	NO
GoM2	292521	0864800	303.7	467.2	NO	-161.2	-70.4	N/A	-231.6	-165.5	NO	NO
GoM3	284101	0864800	298.0	443.3	NO	-160.8	-69.5	N/A	-230.2	-164.2	NO	NO
GoM4	285231	0874400	296.6	500.5	NO	-161.8	-71.6	N/A	-233.4	-167.3	NO	NO
Pacific Missile Range Facility (PMRF)												
PMRF1	220000	1594500	283.1	5030.5	NO	-181.9	-111.6	N/A	-293.5	-227.5	NO	NO
PMRF2	220800	1620000	283.8	5169.6	NO	-182.1	-112.1	N/A	-294.2	-228.2	NO	NO
PMRF3	224500	1614000	284.4	5134.3	NO	-182.0	-112.0	N/A	-294.0	-228.0	NO	NO
PMRF4	260000	1581500	287.2	4850.0	NO	-181.5	-111.0	N/A	-292.5	-226.5	NO	NO
Pearl Harbor South OPAREA												
PHS1	190800	1591500	279.9	5066.4	NO	-181.9	-111.8	N/A	-293.7	-227.7	NO	NO
PHS2	210000	1580800	281.6	4951.2	NO	-181.7	-111.4	N/A	-293.1	-227.1	NO	NO
PHS3	210000	1573600	281.5	4917.4	NO	-181.7	-111.3	N/A	-292.9	-226.9	NO	NO
PHS4	191800	1562000	279.3	4876.7	NO	-181.6	-111.1	N/A	-292.7	-226.7	NO	NO
PHS5	184900	1574500	279.1	4978.5	NO	-181.8	-111.5	N/A	-293.2	-227.2	NO	NO

Table 7 Naval At-Sea Operational Areas (continued)

Operational Area	Lat (N)	Lon (w)	Bearing (deg.)	Distance (mi)	Profile (Is path under 250 miles?)	FSL (dB)	Estimated OH-Loss (dB)	Profiled OH-Loss (dB)	Total Path Loss (dB)	Interfering Power Level (dBW/MHz)	In-Band Interference?	Out-of Band Overload?
Southern California (SOCAL)												
SOCAL1	385200	1255200	300.8	2810.4	NO	-176.8	-101.5	N/A	-278.3	-212.3	NO	NO
SOCAL2	390000	1240000	301.3	2708.5	NO	-176.5	-100.9	N/A	-277.4	-211.3	NO	NO
SOCAL3	311500	1163000	288.3	2230.1	NO	-174.8	-97.5	-72.8	-272.3	-206.3	NO	NO
SOCAL4	300000	1203000	286.1	2472.8	NO	-175.7	-99.3	N/A	-275.0	-209.0	NO	NO
Virginia Capes OPAREA												
VC1	384500	0750000	17.9	945.1	NO	-167.3	-61.0	-66	-228.3	-162.3	NO	NO
VC2	384500	0743000	19.5	955.2	NO	-167.4	-66.0	-59.6	-233.4	-167.4	NO	NO
VC3	374500	0724000	26.8	938.8	NO	-167.3	-83.0	-83	-250.3	-184.2	NO	NO
VC4	350600	0724000	33.7	787.4	NO	-165.7	-87.3	N/A	-253.0	-187.0	NO	NO
VC5	320000	0771200	23.4	467.2	NO	-161.2	-70.4	N/A	-231.6	-165.6	NO	NO
VC6	342400	0773000	15.4	615.9	NO	-163.6	-75.6	N/A	-239.2	-173.2	NO	NO
VC7	354000	0752500	22.1	739.8	NO	-165.2	-74.0	-74	-239.2	-173.2	NO	NO
VC8	370000	0755000	17.9	815.9	NO	-166.1	-65.1	-65.1	-231.2	-165.1	NO	NO

Table 8 Land-Based Radar Test and Training Sites

Radar Location	Lat (N)	Lon (w)	Bearing (deg.)	Distance (mi)	Profile (Is path under 250 miles?)	FSL (dB)	Estimated OH-Loss (dB)	Profiled OH-Loss (dB)	Total Path Loss (dB)	Interfering Power Level (dBW/MHz)	In-Band Interference?	Out-of Band Overload?	
Fort Lewis	WA	470525	1223510	314.5	2772.7	NO	-176.7	-101.3	N/A	-278.0	-212.0	NO	NO
Yakima Firing	WA	464018	1202135	314.6	2657.5	NO	-176.3	-100.6	N/A	-276.9	-210.9	NO	NO
Fort Carson	CO	383810	1044750	308.2	1682.6	NO	-172.3	-92.6	N/A	-265.0	-198.9	NO	NO
Fort Riley	KS	385813	0965139	317.6	1324.3	NO	-170.3	-88.5	N/A	-258.7	-192.7	NO	NO
Fort Shafter	HI	211800	1574900	281.9	4924.2	NO	-181.7	-111.3	N/A	-292.9	-226.9	NO	NO
Hunter AAF	GA	320100	0810800	353.9	430.1	NO	-160.5	-68.9	N/A	-229.4	-163.4	NO	NO
Fort Gillem	GA	333600	0841900	337.0	587.1	NO	-163.2	-74.3	N/A	-237.5	-171.5	NO	NO
Fort Benning	GA	322130	0845815	329.3	530.5	NO	-162.3	-72.6	N/A	-234.9	-168.9	NO	NO
Fort Stewart	GA	315145	0813655	349.9	423.8	NO	-160.4	-68.7	N/A	-229.0	-163.0	NO	NO
Fort Rucker	AL	311947	0854255	320.7	500.8	NO	-161.8	-71.6	N/A	-233.4	-167.4	NO	NO
Yuma Proving	AZ	330114	1141855	292.0	2107.4	NO	-174.3	-96.5	-72.8	-270.8	-204.8	NO	NO
Fort Hood	TX	310830	0974550	293.3	1121.3	NO	-168.8	-85.6	N/A	-254.4	-188.4	NO	NO
Fort Knox	KY	375350	0855655	339.9	895.5	NO	-166.9	-102.6	-102.6	-269.5	-203.4	NO	NO
Fort Bragg	NC	350805	0790035	6.8	647.3	NO	-164.0	-83.3	N/A	-247.3	-181.3	NO	NO
Fort Campbell	KY	363950	0872820	332.4	858.3	NO	-166.5	-98.2	N/A	-264.7	-198.7	NO	NO
Fort Polk	LA	310343	0931226	297.9	862.0	NO	-166.5	-81.0	N/A	-247.5	-181.5	NO	NO
Fort Leonard	MO	374430	0920737	323.0	1075.2	NO	-168.4	-84.8	N/A	-253.3	-187.3	NO	NO
Fort Irwin	CA	351536	1164102	296.0	2262.1	NO	-174.9	-97.8	-68.1	-272.7	-206.7	NO	NO
Fort Sill	OK	344024	0982352	304.0	1240.0	NO	-169.7	-87.3	N/A	-257.0	-191.0	NO	NO
Fort Bliss	TX	314850	1062533	290.9	1634.6	NO	-172.1	-92.1	N/A	-264.2	-213.2	NO	NO
Fort Leavenworth	KS	392115	0945500	321.6	1262.1	NO	-169.8	-87.6	N/A	-257.5	-191.4	NO	NO
Fort Drum	NY	440115	0754844	10.3	1281.5	NO	-170.0	-65.6	N/A	-235.6	-169.6	NO	NO
Fort Gordon	GA	332510	0820910	348.8	535.2	NO	-162.4	-72.7	N/A	-235.1	-169.1	NO	NO
Fort McCoy	WI	440636	0904127	338.0	1391.2	NO	-170.7	-89.3	N/A	-260.0	-194.0	NO	NO
Fort Dix	NJ	400025	0743713	17.3	1033.5	NO	-168.1	-61.4	-61.4	-229.5	-163.5	NO	NO
Parks Reserve	CA	374254	1214218	299.5	2568.8	NO	-176.0	-100.0	N/A	-276.0	-210.0	NO	NO
Aberdeen Proving	MD	392825	0760655	13.6	973.4	NO	-167.6	-57.0	-57	-224.6	-158.6	NO	NO
Fort Huachuca	AZ	313500	1102000	289.5	1863.4	NO	-173.2	-94.4	N/A	-267.6	-216.6	NO	NO
Fort Monmouth	NJ	401900	0740215	18.4	1064.8	NO	-168.4	-73.2	-73.2	-241.6	-175.5	NO	NO
Picatinny Arsenal	NJ	405600	0743400	16.2	1094.6	NO	-168.6	-70.5	-70.5	-239.1	-173.1	NO	NO

Table 8 Land-Based Radar Test and Training Sites (continued)

Radar Location	Lat (N)	Lon (w)	Bearing (deg.)	Distance (mi)	Profile (Is path under 250 miles?)	FSL (dB)	Estimated OH-Loss (dB)	Profiled OH-Loss (dB)	Total Path Loss (dB)	Interfering Power Level (dBW/MHz)	In-Band Interference?	Out-of Band Overload?
Redstone Arsenal AL	343630	0863610	329.9	712.1	NO	-164.9	-77.7	N/A	-242.6	-176.5	NO	NO
White Sands NM	322246	1062813	292.3	1643.4	NO	-172.1	-92.2	N/A	-264.3	-213.3	NO	NO
Army Research MD	390000	0765800	11.4	930.2	NO	-167.2	-63.9	-63.9	-231.1	-165.1	NO	NO
Fort Hunter CA	355756	1211404	296.6	2527.7	NO	-175.9	-99.7	N/A	-275.6	-224.5	NO	NO
Kelly Support PA	402357	0800925	0.6	1005.4	NO	-167.9	-65.9	-65.9	-233.8	-167.7	NO	NO

Table Headings

- Radar Location : The site name of the radar system
- Lat (N) : Radar latitude
- Lon (w) : Radar Longitude
- Bearing (deg.) : Azimuth from earth station toward radar.
- Distance (mi) : Distance from earth station to radar
- Profile (Is path under 250 miles?) : If path is over 250 miles no OH-loss profile is generated
- FSL (dB) : Free Space Loss
- Estimated OH-Loss (dB) : Using a rounded-earth model an estimated OH-loss is calculated for long paths
- Profiled OH-Loss (dB) : Using the NSMA Tropo Loss actual OH-loss calculations are performed for shorter paths
- Total Path Loss (dB) : Total of Free Space Loss plus Over-the-Horizon loss
- Interfering Power Level (dBW/MHz) : Level of RF interference at the earth station's LNA input
- In-Band Interference? : If the Radar is operating in-band is the max. permissible interference criteria being met?
- Out-of Band Overload? : If the Radar is operating in out-of-band spectrum is the LNA overload threshold being met?

6.0 Conclusions

Calculations were performed to assess the electromagnetic compatibility (EMC) between the radars listed below and adjacent-band FSS earth station receiver at Miami, Florida. Interference assessment for Earth Stations Operating at 3625 - 3700 MHz at Miami, Florida site identified 6 cases of In-band potential interference. The applicant is aware of this potential for interference and will work with the Government Users to mitigate the problem.

Results

Total Number of Paths <u>2 sites</u>		Lat (N)	Lon (W)	Out-of-Band <u>Overload?</u>	In-Band <u>Interference?</u>
Mayport	FL	203324	812427	No	Yes
AUTEC1		252000	780500	No	Yes
AUTEC2		252000	774500	No	Yes
AUTEC3		232500	762000	No	Yes
AUTEC4		232500	771500	No	Yes
GoM1		293601	800130	No	Yes