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

INTELSAT

TRANSMIT-RECEIVE EARTH STATION

Site Name: Clarksburg, MD
Earth Station Call Signs: KA261, KA262, KA263, and KA264

Prepared By

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1.0 Introduction

The Intelsat Clarksburg facility includes a number of large diameter earth stations that will operate in the extended C-band receive spectrum. This analysis considers the worst case operating parameters for any of the extended C-band stations, specifically earth station will call signs KA261, KA262, KA263, and KA264. 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 band[1]. The geographical positions and operating parameters of these systems was derived from NTIA Document TR-99-361[2]. Due to proximity of the Intelsat earth stations to each other and the use of the worst case antenna height and interference criterion this analysis has been provided as a comprehensive interference analysis for all earth stations operating in the extended C-band at this site.

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 (ìsec.)	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

Company	INTELSAT CLARKSBURG TELEPORT	
Owner code		P2540I
Earth Station Name, State		CLARKSBURG, MD
Call Sign		KA261
Latitude (DMS) (NAD83)		39 13 2.6 N
Longitude (DMS) (NAD83)		77 16 10.9 W
Ground Elevation AMSL (Ft/m)		462.03 / 140.82
Antenna Centerline AGL (Ft/m)		29.00 / 8.84
Receive Antenna Type:	V41521	VERTEX COMMUNICATI
		15.2 KPC
4.0 GHz Gain (dBi) / Diameter (m)		55.0 / 15.2
3 dB / 15 dB Half Beamwidth		0.17 / 0.35
Transmit Antenna Type:	V61521	VERTEX COMMUNICATI
		15.2 KPC
6.0 GHz Gain (dBi) / Diameter (m)		58.4 / 15.2
3 dB / 15 dB Half Beamwidth		0.11 / 0.22
Operating Mode		TRANSMIT AND RECEIVE
Modulation		ANALOG
Emission / Receive Band (MHz)		36M0F8W / 3700.0000 - 4200.0000
Emission / Transmit Band (MHz)		36M0F8W / 5925.0000 - 6425.0000
Max. Available RF Power (dBW)/4 kHz)		-14.20
(dBW)/MHz)		9.80
Max. EIRP (dBW)/4 kHz)		44.20
(dBW)/MHz)		68.20
(dBW)		0.00
Max permissible Interference Power		
4.0 GHz, 20% (dBW/1 MHz)		-164.0
4.0 GHz, 0.0100% (dBW/1 MHz)		-144.0
6.0 GHz, 20% (dBW/4 kHz)		-154.0
6.0 GHz, 0.0025% (dBW/4 kHz)		-131.0
Range of Satellite Arc (Geostationary)		
Degrees Longitude		18.5 W / 65.0 W
Azimuth Range (Min/Max)		111.0 / 161.0
Corresponding Elevation Angles		15.3 / 42.8
Radio Climate		A
Rain Zone		2
Max Great Circle Coordination Distance (Mi/Km)		
4.0 GHz		194.9 / 313.7
6.0 GHz		88.7 / 142.8
Precipitation Scatter Contour Radius (Mi/Km)		
4.0 GHz		320.2 / 515.4
6.0 GHz		62.1 / 100.0

Table of Earth Station Coordination Values

Earth Station Name CLARKSBURG MD
Owner INTELSAT CLARKSBURG TELEPORT
Latitude (DMS) (NAD83) 39 13 2.6 N
Longitude (DMS) (NAD83) 77 16 10.9 W
Ground Elevation (Ft/m) 462.03 / 140.82 AMSL
Antenna Centerline (Ft/m) 29.00 / 8.84 AGL
Antenna Model VERTEX COMMUNICATI 15.2 KPC
Objectives: Receive -164.0 (dBW /1 MHz)
Transmit -154.0 (dBW /4 kHz) TX Power -14.2 (dBW/4 kHz)

Azimuth (Deg)	Horizon Elevation Angle (Deg)	Antenna Disc. Angle (Deg)	4.0 GHz Antenna Gain (dBi)	4.0 GHz Coordination Distance (Km)	6.0 GHz Antenna Gain (dBi)	6.0 GHz Coordination Distance (Km)
0	0.80	110.28	-10.00	220.9	-9.60	100.0
5	1.00	105.47	-10.00	210.5	-9.60	100.0
10	0.70	100.62	-10.00	226.5	-9.60	100.1
15	0.90	95.79	-10.00	215.6	-9.60	100.0
20	0.90	90.95	-10.00	215.6	-9.60	100.0
25	0.80	86.11	-10.00	220.9	-9.60	100.0
30	0.80	81.27	-10.00	220.9	-9.60	100.0
35	0.90	76.43	-10.00	215.6	-9.60	100.0
40	0.80	71.61	-10.00	220.9	-9.60	100.0
45	0.80	66.79	-10.00	220.9	-9.60	100.0
50	0.70	62.00	-10.00	226.5	-9.60	100.1
55	0.80	57.20	-10.00	220.9	-9.60	100.0
60	0.70	52.46	-10.00	226.5	-9.60	100.1
65	0.70	47.74	-9.55	228.9	-9.15	101.3
70	0.80	43.04	-8.61	228.1	-8.21	100.0
75	0.70	38.45	-7.69	238.9	-7.29	106.2
80	0.70	33.93	-6.57	245.3	-6.17	109.1
85	0.70	29.55	-4.82	255.9	-4.42	113.9
90	0.60	25.42	-3.17	273.1	-2.77	123.2
95	0.60	21.58	-1.63	283.4	-1.23	127.6
100	0.70	18.19	0.45	291.0	0.85	129.1
105	0.80	15.66	2.48	299.0	2.88	130.6
110	0.70	14.63	3.37	313.6	3.40	135.5
115	0.70	15.13	2.90	309.3	3.30	135.2
120	0.70	17.11	1.31	297.3	1.71	131.7
125	0.70	20.13	-1.05	280.5	-0.65	124.7
130	0.60	23.63	-2.45	277.8	-2.05	125.2
135	0.40	27.07	-3.83	287.6	-3.43	133.9
140	0.40	30.20	-5.08	279.3	-4.68	130.4
145	0.20	33.29	-6.32	296.2	-5.92	142.7
150	0.30	35.90	-7.18	277.9	-6.78	132.7
155	0.70	37.97	-7.59	239.4	-7.19	106.4
160	0.10	40.55	-8.11	284.5	-7.71	137.3
165	0.10	42.23	-8.45	282.4	-8.05	136.4
170	0.20	43.38	-8.68	281.0	-8.28	135.7
175	0.00	44.70	-8.94	279.3	-8.54	135.0
180	0.00	46.22	-9.24	277.4	-8.84	134.1

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Objectives: Receive -164.0 (dBW /1 MHz)
Transmit -154.0 (dBW /4 kHz) TX Power -14.2 (dBW/4 kHz)

Azimuth (Deg)	Horizon Elevation Angle (Deg)	Antenna Disc. Angle (Deg)	4.0 GHz Antenna Gain (dBi)	4.0 GHz Coordination Distance (Km)	6.0 GHz Antenna Gain (dBi)	6.0 GHz Coordination Distance (Km)
185	0.00	48.12	-9.62	275.1	-9.22	133.1
190	0.00	50.34	-10.00	272.8	-9.60	133.3
195	0.00	52.83	-10.00	272.8	-9.60	133.3
200	0.00	55.57	-10.00	272.8	-9.60	133.3
205	0.00	58.52	-10.00	272.8	-9.60	133.3
210	0.20	61.53	-10.00	272.8	-9.60	133.3
215	0.20	64.79	-10.00	272.8	-9.60	133.3
220	0.20	68.17	-10.00	272.8	-9.60	133.3
225	0.50	71.55	-10.00	238.4	-9.60	109.2
230	0.50	75.12	-10.00	238.4	-9.60	109.2
235	0.50	78.74	-10.00	238.4	-9.60	109.2
240	0.90	82.35	-10.00	215.6	-9.60	100.0
245	1.00	86.06	-10.00	210.5	-9.60	100.0
250	0.60	89.79	-10.00	232.3	-9.60	104.6
255	0.60	93.50	-10.00	232.3	-9.60	104.6
260	0.80	97.22	-10.00	220.9	-9.60	100.0
265	0.70	100.88	-10.00	226.5	-9.60	100.1
270	1.30	104.66	-10.00	204.5	-9.60	100.0
275	1.20	108.25	-10.00	204.8	-9.60	100.0
280	1.50	111.90	-10.00	198.9	-9.60	100.0
285	1.50	115.38	-10.00	198.9	-9.60	100.0
290	1.50	118.74	-10.00	198.9	-9.60	100.0
295	2.00	122.24	-10.00	184.9	-9.60	100.0
300	2.00	125.34	-10.00	184.9	-9.60	100.0
305	2.50	128.57	-10.00	173.0	-9.60	100.0
310	1.90	130.82	-10.00	187.7	-9.60	100.0
315	1.60	132.95	-10.00	196.1	-9.60	100.0
320	1.30	134.72	-10.00	204.5	-9.60	100.0
325	1.30	136.35	-10.00	204.5	-9.60	100.0
330	1.20	137.47	-10.00	204.8	-9.60	100.0
335	1.00	134.17	-10.00	210.5	-9.60	100.0
340	1.10	129.47	-10.00	207.6	-9.60	100.0
345	1.20	124.73	-10.00	204.8	-9.60	100.0
350	1.10	119.93	-10.00	207.6	-9.60	100.0
355	1.00	115.12	-10.00	210.5	-9.60	100.0

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:

$$P_r = P_t + G_t - FSL - OHLOSS + G_{es} - LL_t - LL_{es}$$

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 recommendations[3]. 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 is the 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:

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

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 model[4]. 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 above ground level 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	225.8	834.7	NO	-166.2	-81.3	N/A	-247.5	-194.6	NO	NO
Pascagoula,	MS	302200	0882900	229.5	882.5	NO	-166.7	-82.2	N/A	-249.0	-196.0	NO	NO
St.Inigoes,	MD	381000	0762300	146.3	86.9	YES	-146.6	-56.0	-56	-202.6	-151.7	YES	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	66.3	134.9	YES	-150.4	-62.5	-62.5	-212.9	-151.0	YES	NO
Wallops Island,	VA	375600	0752800	131.7	131.8	YES	-150.2	-60.0	-60	-210.2	-147.7	YES	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	47.6	504.1	NO	-161.9	-72.5	N/A	-234.4	-172.5	NO	NO
Bremerton,	WA	473324	1223811	299.7	2355.6	NO	-175.3	-99.3	N/A	-274.6	-212.5	NO	NO
Everett,	WA	475858	1221354	300.5	2335.6	NO	-175.2	-99.1	N/A	-274.3	-212.3	NO	NO
Mayport,	FL	302334	0812427	202.3	652.2	NO	-164.1	-77.0	N/A	-241.1	-179.2	NO	NO
Norfolk,	VA	365200	0762100	162.5	169.7	YES	-152.4	-62.7	-62.7	-215.1	-152.9	YES	NO
Pascagoula,	MS	302253	0882933	229.5	882.2	NO	-166.7	-82.2	N/A	-249.0	-180.0	NO	NO
Pearl Harbor,	HI	212000	1580000	276.0	4981.5	NO	-181.8	-112.3	N/A	-294.1	-226.4	NO	NO
Portland,	ME	434100	0701800	47.3	475.3	NO	-161.4	-71.5	N/A	-232.8	-170.9	NO	NO
San Diego	CA	324105	1170800	270.3	2279.7	NO	-175.0	-98.7	N/A	-273.7	-204.0	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	153.9	1556.7	NO	-171.7	-92.1	N/A	-263.8	-196.8	NO	NO
AFWTF (NR)2	200000	0670000	152.4	1460.8	NO	-171.1	-91.0	N/A	-262.1	-195.2	NO	NO
AFWTF (NR)3	221000	0654800	146.9	1358.6	NO	-170.5	-89.7	N/A	-260.2	-193.3	NO	NO
AFWTF (NR)4	221000	0652000	145.8	1372.8	NO	-170.6	-89.9	N/A	-260.5	-193.6	NO	NO
AFWTF (NR)5	185000	0620000	142.9	1680.8	NO	-172.3	-93.4	N/A	-265.8	-198.8	NO	NO
AFWTF (NR)6	185000	0620000	142.9	1680.8	NO	-172.3	-93.4	N/A	-265.8	-198.8	NO	NO
AFWTF (NR)7	182500	0643000	148.5	1628.4	NO	-172.1	-92.9	N/A	-264.9	-198.0	NO	NO
AFWTF (NR)8	183000	0644500	149.0	1616.1	NO	-172.0	-92.7	N/A	-264.7	-197.8	NO	NO
AFWTF (NR)9	183000	0663800	153.1	1565.7	NO	-171.7	-92.2	N/A	-263.9	-197.0	NO	NO
AFWTF (South Range)												
AFWTF (SR)1	180500	0675500	156.4	1562.4	NO	-171.7	-92.2	N/A	-263.9	-201.6	NO	NO
AFWTF (SR)2	180500	0652700	150.9	1622.9	NO	-172.0	-92.8	N/A	-264.8	-197.9	NO	NO
AFWTF (SR)3	181500	0651000	150.1	1620.1	NO	-172.0	-92.8	N/A	-264.8	-197.9	NO	NO
AFWTF (SR)4	181500	0641000	148.0	1648.5	NO	-172.2	-93.1	N/A	-265.3	-198.3	NO	NO
AFWTF (SR)5	170000	0641000	149.3	1726.4	NO	-172.6	-93.9	N/A	-266.5	-199.5	NO	NO
AFWTF (SR)6	165800	0642800	150.0	1720.1	NO	-172.5	-93.8	N/A	-266.4	-199.4	NO	NO
AFWTF (SR)7	153300	0660600	154.6	1768.2	NO	-172.8	-94.3	N/A	-267.1	-200.2	NO	NO
AFWTF (SR)8	153900	0662300	155.1	1755.1	NO	-172.7	-94.2	N/A	-266.9	-204.7	NO	NO
AFWTF (SR)9	163000	0662300	154.4	1700.2	NO	-172.4	-93.6	N/A	-266.1	-199.1	NO	NO
AFWTF (SR)10	163000	0675500	157.7	1665.7	NO	-172.3	-93.3	N/A	-265.5	-203.3	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	183.1	957.8	NO	-167.4	-83.7	N/A	-251.1	-189.2	NO	NO
AUTEC2	252000	0774500	181.8	957.1	NO	-167.4	-83.6	N/A	-251.1	-189.2	NO	NO
AUTEC3	232500	0762000	176.8	1090.0	NO	-168.6	-85.9	N/A	-254.5	-192.6	NO	NO
AUTEC4	232500	0771500	179.9	1088.5	NO	-168.6	-85.9	N/A	-254.4	-192.5	NO	NO
FORACS, Hawaii												
FORACS, Hawaii1	212530	1581100	276.2	4988.4	NO	-181.8	-112.3	N/A	-294.1	-226.4	NO	NO
FORACS, Hawaii2	212100	1581500	276.2	4995.3	NO	-181.8	-112.4	N/A	-294.1	-226.4	NO	NO
FORACS, Hawaii3	211500	1580800	276.0	4992.6	NO	-181.8	-112.3	N/A	-294.1	-226.4	NO	NO
FORACS, Hawaii4	211500	1580700	276.0	4991.6	NO	-181.8	-112.3	N/A	-294.1	-226.4	NO	NO
Gulf of Mexico OPAREA												
GoM1	293601	0800130	194.1	681.3	NO	-164.5	-77.7	N/A	-242.2	-180.3	NO	NO
GoM2	292521	0864800	221.6	867.7	NO	-166.6	-81.9	N/A	-248.5	-181.3	NO	NO
GoM3	284101	0864800	219.7	909.3	NO	-167.0	-82.8	N/A	-249.7	-182.5	NO	NO
GoM4	285231	0874400	223.0	931.9	NO	-167.2	-83.2	N/A	-250.4	-183.1	NO	NO
Pacific Missile Range Facility (PMRF)												
PMRF1	220000	1594500	277.4	5055.7	NO	-181.9	-112.6	N/A	-294.5	-226.8	NO	NO
PMRF2	220800	1620000	278.5	5180.7	NO	-182.1	-113.0	N/A	-295.1	-227.4	NO	NO
PMRF3	224500	1614000	279.0	5136.2	NO	-182.0	-112.8	N/A	-294.9	-227.2	NO	NO
PMRF4	260000	1581500	280.9	4810.2	NO	-181.5	-111.7	N/A	-293.2	-225.5	NO	NO
Pearl Harbor South OPAREA												
PHS1	190800	1591500	274.4	5144.7	NO	-182.0	-112.9	N/A	-294.9	-225.2	NO	NO
PHS2	210000	1580800	275.8	5002.8	NO	-181.8	-112.4	N/A	-294.2	-226.5	NO	NO
PHS3	210000	1573600	275.5	4971.9	NO	-181.7	-112.3	N/A	-294.0	-226.3	NO	NO
PHS4	191800	1562000	273.3	4968.2	NO	-181.7	-112.3	N/A	-294.0	-224.3	NO	NO
PHS5	184900	1574500	273.4	5070.6	NO	-181.9	-112.6	N/A	-294.5	-224.9	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	284.8	2614.5	NO	-176.2	-101.1	N/A	-277.3	-209.6	NO	NO
SOCAL2	390000	1240000	284.4	2511.6	NO	-175.8	-100.4	N/A	-276.2	-208.5	NO	NO
SOCAL3	311500	1163000	267.4	2286.0	NO	-175.0	-98.8	N/A	-273.8	-204.1	NO	NO
SOCAL4	300000	1203000	267.8	2544.5	NO	-175.9	-100.6	N/A	-276.6	-206.9	NO	NO
Virginia Capes OPAREA												
VC1	384500	0750000	104.1	126.4	YES	-149.9	-60.7	-60.7	-210.6	-148.6	YES	NO
VC2	384500	0743000	101.3	152.6	YES	-151.5	-63.4	-63.4	-214.9	-153.0	YES	NO
VC3	374500	0724000	110.6	269.3	NO	-156.4	-61.6	N/A	-218.0	-156.1	YES	NO
VC4	350600	0724000	136.8	381.0	NO	-159.4	-67.6	N/A	-227.1	-160.2	YES	NO
VC5	320000	0771200	179.5	497.6	NO	-161.8	-72.3	N/A	-234.0	-172.1	NO	NO
VC6	342400	0773000	182.3	332.4	NO	-158.3	-65.3	N/A	-223.5	-161.6	YES	NO
VC7	354000	0752500	156.8	265.2	NO	-156.3	-61.4	N/A	-217.6	-155.4	YES	NO
VC8	370000	0755000	152.5	171.8	YES	-152.5	-61.2	-61.2	-213.7	-146.8	YES	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	298.8	2354.0	NO	-175.3	-99.3	N/A	-274.5	-212.5	NO	NO
Yakima Firing	WA	464018	1202135	297.9	2245.0	NO	-174.8	-98.5	N/A	-273.3	-211.2	NO	NO
Fort Carson	CO	383810	1044750	277.1	1483.8	NO	-171.2	-91.3	N/A	-262.5	-194.8	NO	NO
Fort Riley	KS	385813	0965139	275.2	1053.3	NO	-168.3	-85.3	N/A	-253.6	-185.9	NO	NO
Fort Shafter	HI	211800	1574900	275.9	4972.2	NO	-181.7	-112.3	N/A	-294.0	-226.3	NO	NO
Hunter AAF	GA	320100	0810800	204.8	542.0	NO	-162.5	-73.8	N/A	-236.3	-174.3	NO	NO
Fort Gillem	GA	333600	0841900	227.5	551.6	NO	-162.7	-74.1	N/A	-236.7	-167.8	NO	NO
Fort Benning	GA	322130	0845815	224.7	640.9	NO	-164.0	-76.7	N/A	-240.6	-173.4	NO	NO
Fort Stewart	GA	315145	0813655	207.0	563.1	NO	-162.8	-74.4	N/A	-237.3	-172.6	NO	NO
Fort Rucker	AL	311947	0854255	223.7	723.6	NO	-165.0	-78.8	N/A	-243.8	-176.5	NO	NO
Yuma Proving	AZ	330114	1141855	269.3	2116.0	NO	-174.3	-97.4	N/A	-271.8	-202.1	NO	NO
Fort Hood	TX	310830	0974550	250.3	1286.7	NO	-170.0	-88.8	N/A	-258.8	-188.1	NO	NO
Fort Knox	KY	375350	0855655	261.7	478.8	NO	-161.4	-71.6	N/A	-233.0	-162.5	YES	NO
Fort Bragg	NC	350805	0790035	199.4	297.5	NO	-157.3	-63.3	N/A	-220.6	-158.7	YES	NO
Fort Campbell	KY	363950	0872820	255.6	584.4	NO	-163.2	-75.1	N/A	-238.2	-167.7	NO	NO
Fort Polk	LA	310343	0931226	242.7	1063.3	NO	-168.4	-85.5	N/A	-253.8	-183.5	NO	NO
Fort Leonard	MO	374430	0920737	267.4	812.0	NO	-166.0	-80.8	N/A	-246.8	-177.1	NO	NO
Fort Irwin	CA	351536	1164102	274.8	2190.3	NO	-174.6	-98.0	N/A	-272.7	-203.0	NO	NO
Fort Sill	OK	344024	0982352	261.4	1210.7	NO	-169.5	-87.7	N/A	-257.2	-186.7	NO	NO
Fort Bliss	TX	314850	1062533	261.2	1720.9	NO	-172.5	-93.8	N/A	-266.4	-195.9	NO	NO
Fort Leavenworth	KS	392115	0945500	276.2	946.1	NO	-167.3	-83.4	N/A	-250.8	-183.1	NO	NO
Fort Drum	NY	440115	0754844	12.3	340.0	NO	-158.4	-65.7	N/A	-224.1	-161.3	YES	NO
Fort Gordon	GA	332510	0820910	215.7	483.8	NO	-161.5	-71.8	N/A	-233.3	-166.1	NO	NO
Fort McCoy	WI	440636	0904127	300.4	772.3	NO	-165.6	-79.9	N/A	-245.5	-183.4	NO	NO
Fort Dix	NJ	400025	0743713	68.1	151.5	YES	-151.4	-66.1	-66.1	-217.5	-155.6	YES	NO
Parks Reserve	CA	374254	1214218	281.4	2412.0	NO	-175.5	-99.7	N/A	-275.2	-207.5	NO	NO
Aberdeen Proving	MD	392825	0760655	73.7	64.3	YES	-144.0	-58.8	-58.8	-202.8	-140.9	YES	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?
Fort Huachuca AZ	313500	1102000	263.8	1939.1	NO	-173.6	-95.9	N/A	-269.5	-199.0	NO	NO
Fort Monmouth NJ	401900	0740215	65.2	188.1	YES	-153.3	-69.3	-69.3	-222.6	-160.7	YES	NO
Picatinny Arsenal NJ	405600	0743400	49.6	185.9	YES	-153.2	-184.3	-184.3	-337.5	-275.6	NO	NO
Redstone Arsenal AL	343630	0863610	241.2	606.7	NO	-163.5	-75.7	N/A	-239.2	-168.9	NO	NO
White Sands NM	322246	1062813	262.5	1706.6	NO	-172.5	-93.7	N/A	-266.2	-195.7	NO	NO
Army Research MD	390000	0765800	132.5	22.1	YES	-134.7	-73.8	-73.8	-208.5	-146.0	YES	NO
Fort Hunter CA	355756	1211404	278.1	2423.1	NO	-175.5	-99.8	N/A	-275.3	-207.6	NO	NO
Kelly Support PA	402357	0800925	298.9	173.9	YES	-152.6	-150.7	-150.7	-303.3	-241.3	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 perform to assess the electromagnetic compatibility (EMC) between the radars listed below and adjacent-band FSS earth station receivers at Clarksburg, MD. This interference assessment for an earth station operating at 3625 - 3700 MHz identified seventeen cases of In-band potential interference, see Table 9 below. No cases of potential LNB overload exist. The applicant is aware of this potential for interference but feels in most instances the site has sufficient close-in shielding to protect the site. Intelsat will work with the Government Users to mitigate any problems as necessary.

Table 9 - Summary of Results

Site Name		Lat (n)	Lon(w)	Interfering Level (dBW/MHz)	In-Band Interference	LNB Overload
St.Inigoes,	MD	381000	0762300	-149.8	YES	NO
Moorestown,	NJ	395849	0745630	-145.5	YES	NO
Wallops Island,	VA	375600	0752800	-136.6	YES	NO
Norfolk,	VA	365200	0762100	-147.2	YES	NO
VC1		384500	0750000	-134.1	YES	NO
VC2		384500	0743000	-138.4	YES	NO
VC3		374500	0724000	-138.7	YES	NO
VC4		350600	0724000	-156.1	YES	NO
VC6		342400	0773000	-156.7	YES	NO
VC7		354000	0752500	-149.7	YES	NO
VC8		370000	0755000	-144.9	YES	NO
Fort Bragg	NC	350805	0790035	-154.6	YES	NO
Fort Drum	NY	440115	0754844	-158.1	YES	NO
Fort Dix	NJ	400025	0743713	-150.1	YES	NO
Aberdeen Proving	MD	392825	0760655	-135.4	YES	NO
Fort Monmouth	NJ	401900	0740215	-155.2	YES	NO
Army Research	MD	390000	0765800	-135.0	YES	NO