

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

COMSAT CORPORATION

Site Name: SANTA PAULA 11, CA

FCC CALL SIGN: KB34

Prepared By



April 6, 2001

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 was 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

Company	COMSAT CORPORATION		
Earth Station Name, State	SANTA PAULA 11, CA		
Call Sign	KB34		
Latitude (DMS) (NAD83)	34 24	5.0 N	
Longitude (DMS) (NAD83)	119 4	29.4 W	
Ground Elevation AMSL (Ft/m)	750.0 /	228.60	
Antenna Centerline AGL (Ft/m)	30.0 /	9.14	
Receive Antenna Type:	PHILCO FORD		
	12.8 METER		
4.0 GHz Gain (dBi) / Diameter (m)	52.8 /	12.8	
3 dB / 15 dB Half Beamwidth	0.20 /	0.50	
Transmit Antenna Type:	PHILCO FORD		
	12.8 METER		
6.0 GHz Gain (dBi) / Diameter (m)	56.0 /	12.8	
3 dB / 15 dB Half Beamwidth	0.10 /	0.30	
Operating Mode	TRANSMIT AND RECEIVE		
Modulation	ANALOG & DIGITAL		
Emission / Receive Band (MHz)	24K0F3E /	3600.0000 -	3655.0000
	24K0F3E /	3700.0000 -	4200.0000
Emission / Transmit Band (MHz)	34M0FXN /	5925.0000 -	6425.0000
	600KFXN /	6425.0000 -	6454.0000
	600KFXN /	6454.4000 -	6456.6000
Max. Available RF Power (dBW)/4 kHz	14.00		
(dBW)/MHz	38.00		
Max. EIRP (dBW)/4 kHz	70.00		
(dBW)/MHz	94.00		
Max permissible Interference Power			
4.0 GHz, 20% (dBW/1 MHz)	-168.0		
4.0 GHz, 0.0100% (dBW/1 MHz)	-156.0		
6.0 GHz, 20% (dBW/4 kHz)	-154.0		
6.0 GHz, 0.0025% (dBW/4 kHz)	-131.0		

TABLE 2 - SATELLITE EARTH STATION PARAMETERS AND COORDINATION DATA (continued)

Range of Satellite Arc (Geostationary)			
Degrees Longitude		48.0 W /	190.0 W
Azimuth Range (Min/Max)		101.0 /	258.9
Corresponding Elevation Angles		6.9 /	7.0
Radio Climate		A	
Rain Zone		4	
Max Great Circle Coordination Distance (Mi/Km)			
4.0 GHz		462.6 /	744.5
6.0 GHz		312.8 /	503.5
Precipitation Scatter Contour Radius (Mi/Km)			
4.0 GHz		250.1 /	402.5
6.0 GHz		198.1 /	318.9

TABLE 3 - TABLE OF EARTH STATION COORDINATION VALUES

Earth Station Name SANTA PAULA 11 CA
 Owner COMSAT CORPORATION
 Latitude (DMS) (NAD83) 34 24 5.0 N
 Longitude (DMS) (NAD83) 119 4 29.4 W
 Ground Elevation (Ft/m) 750.0 / 228.60 AMSL
 Antenna Centerline (Ft/m) 30.0 / 9.14 AGL
 Antenna Model PHILCO FORD 12.8 METER
 Objectives: Receive -168.0 (dBW /1 MHz)
 Transmit -154.0 (dBW /4 kHz) TX Power 14.0 (dBW/4 kHz)

Azimuth (Deg)	Horizon Elevation Angle (Deg)	Antenna Disc. Angle (Deg)	4.0 GHz		6.0 GHz	
			Antenna Gain (dBi)	Coordination Distance (Km)	Antenna Gain (dBi)	Coordination Distance (Km)
0	7.50	100.96	-10.00	151.2	-10.00	100.0
5	8.50	95.96	-10.00	140.4	-10.00	100.0
10	8.90	90.97	-10.00	136.7	-10.00	100.0
15	9.80	85.97	-10.00	130.2	-10.00	100.0
20	10.60	80.98	-10.00	124.4	-10.00	100.0
25	11.40	76.01	-10.00	118.9	-10.00	100.0
30	11.90	71.04	-10.00	115.5	-10.00	100.0
35	12.50	66.09	-10.00	111.5	-10.00	100.0
40	13.10	61.15	-10.00	107.6	-10.00	100.0
45	12.10	56.13	-10.00	114.2	-10.00	100.0
50	11.40	51.11	-10.00	118.9	-10.00	100.0
55	9.30	46.01	-9.57	135.2	-9.57	100.0
60	8.10	40.98	-8.31	153.3	-8.31	100.0
65	8.40	35.99	-6.91	158.3	-6.91	100.0
70	7.70	30.98	-5.28	178.8	-5.28	100.0
75	7.80	25.98	-3.37	189.4	-3.37	100.0
80	7.50	20.97	-1.04	204.8	-1.04	109.7
85	6.90	15.97	1.92	231.0	1.92	128.0
90	6.30	10.98	5.98	271.9	5.98	152.1
95	5.60	6.10	9.36	314.9	9.36	182.1
100	5.00	2.12	20.85	744.5	20.85	503.4
105	4.30	4.79	11.99	374.5	11.99	220.5
110	3.50	9.26	7.83	348.5	7.83	205.5
115	2.70	13.70	3.58	333.4	3.58	202.4
120	2.00	18.02	0.60	329.3	0.60	203.4
125	2.00	21.84	-1.48	310.8	-1.48	193.5
130	2.20	25.43	-3.13	290.5	-3.13	180.8
135	2.40	28.88	-4.51	273.4	-4.51	168.9
140	2.50	32.22	-5.70	261.5	-5.70	158.9
145	2.50	35.42	-6.73	254.0	-6.73	153.9
150	2.50	38.37	-7.60	247.7	-7.60	150.0
155	2.50	41.01	-8.32	242.8	-8.32	146.8
160	2.00	43.70	-9.01	252.0	-9.01	155.0
165	1.50	46.00	-9.57	265.8	-9.57	169.1
170	1.00	47.86	-10.00	281.8	-10.00	182.8
175	0.50	49.22	-10.00	317.7	-10.00	207.1
180	1.20	48.82	-10.00	274.0	-10.00	176.5

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

Earth Station Name SANTA PAULA 11 CA
 Owner COMSAT CORPORATION
 Latitude (DMS) (NAD83) 34 24 5.0 N
 Longitude (DMS) (NAD83) 119 4 29.4 W
 Ground Elevation (Ft/m) 750.0 / 228.60 AMSL
 Antenna Centerline (Ft/m) 30.0 / 9.14 AGL
 Antenna Model PHILCO FORD 12.8 METER
 Objectives: Receive -168.0 (dBW /1 MHz)
 Transmit -154.0 (dBW /4 kHz) TX Power 14.0 (dBW/4 kHz)

Azimuth (Deg)	Horizon Elevation Angle (Deg)	Antenna Disc. Angle (Deg)	4.0 GHz		6.0 GHz	
			Antenna Gain (dBi)	Coordination Distance (Km)	Antenna Gain (dBi)	Coordination Distance (Km)
185	2.00	47.75	-9.97	245.4	-9.97	150.7
190	2.70	46.25	-9.63	229.3	-9.63	137.3
195	3.50	44.20	-9.13	213.8	-9.13	125.8
200	4.20	41.82	-8.53	206.1	-8.53	116.6
205	5.00	38.98	-7.77	198.1	-7.77	108.8
210	5.70	35.90	-6.88	195.1	-6.88	105.5
215	6.50	32.47	-5.79	191.5	-5.79	101.3
220	6.20	29.61	-4.79	201.1	-4.79	108.6
225	6.00	26.43	-3.55	208.4	-3.55	115.9
230	6.30	22.73	-1.92	214.5	-1.92	119.2
235	6.00	19.29	-0.13	230.4	-0.13	129.5
240	5.50	15.85	2.00	252.5	2.00	142.1
245	5.50	11.98	5.03	276.8	5.03	157.1
250	5.50	8.05	8.00	303.2	8.00	175.4
255	5.50	4.07	13.77	359.5	13.77	208.8
260	5.40	1.93	21.89	735.7	21.89	496.2
265	5.20	6.32	8.98	318.2	8.98	184.8
270	5.10	11.22	5.75	289.3	5.75	167.6
275	5.00	16.18	1.78	258.1	1.78	146.5
280	4.70	21.18	-1.15	242.3	-1.15	137.9
285	4.50	26.17	-3.44	229.5	-3.44	132.6
290	4.20	31.17	-5.34	222.3	-5.34	129.0
295	4.00	36.17	-6.96	215.8	-6.96	125.4
300	4.00	41.15	-8.36	207.8	-8.36	120.0
305	4.00	46.13	-9.60	203.6	-9.60	115.3
310	4.00	51.12	-10.00	201.5	-10.00	113.8
315	4.00	56.11	-10.00	201.5	-10.00	113.8
320	5.50	61.07	-10.00	179.5	-10.00	100.0
325	6.20	66.06	-10.00	170.6	-10.00	100.0
330	7.00	71.06	-10.00	157.7	-10.00	100.0
335	7.70	76.06	-10.00	148.8	-10.00	100.0
340	8.50	81.06	-10.00	140.4	-10.00	100.0
345	8.20	86.06	-10.00	143.2	-10.00	100.0
350	8.00	91.06	-10.00	145.2	-10.00	100.0
355	7.50	96.06	-10.00	151.2	-10.00	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:

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

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 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 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:

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

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:

$$\begin{aligned} T &= -95 \text{ dBW} \\ C &= -20 \text{ dBW} \\ G &= 65 \text{ dB} \end{aligned}$$

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	90.0	1880.3	NO	-173.3	-95.3	N/A	-268.6	-218.6	NO	NO
Pascagoula, MS	302200	0882900	90.6	1810.2	NO	-173.0	-94.6	N/A	-267.6	-217.6	NO	NO
St.Inigoes, MD	381000	0762300	71.2	2397.3	NO	-175.4	-99.5	N/A	-274.9	-224.9	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	67.7	2465.1	NO	-175.7	-100.0	N/A	-275.6	-209.6	NO	NO
Wallops Island, VA	375600	0752800	71.4	2450.2	NO	-175.6	-99.9	N/A	-275.5	-209.5	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	60.5	2725.9	NO	-176.5	-101.7	N/A	-278.3	-212.2	NO	NO
Bremerton, WA	473324	1223811	349.6	926.7	NO	-167.2	-83.0	N/A	-250.2	-184.1	NO	NO
Everett, WA	475858	1221354	351.1	951.5	NO	-167.4	-83.5	N/A	-250.8	-184.8	NO	NO
Mayport, FL	302334	0812427	87.1	2219.4	NO	-174.7	-98.2	N/A	-272.9	-206.9	NO	NO
Norfolk, VA	365200	0762100	73.5	2410.7	NO	-175.5	-99.6	N/A	-275.1	-209.0	NO	NO
Pascagoula, MS	302253	0882933	90.6	1809.3	NO	-173.0	-94.6	N/A	-267.6	-201.6	NO	NO
Pearl Harbor, HI	212000	1580000	258.4	2546.3	NO	-175.9	-100.6	N/A	-276.5	-210.5	NO	NO
Portland, ME	434100	0701800	60.9	2700.9	NO	-176.4	-101.6	N/A	-278.0	-212.0	NO	NO
San Diego CA	324105	1170800	136.0	162.9	YES	-152.1	-69.7	-69.7	-221.8	-155.7	YES	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)	183000	0670000	97.1	3407.8	NO	-178.5	-105.6	N/A	-284.1	-218.1	NO	NO
	200000	0670000	95.3	3355.8	NO	-178.3	-105.4	N/A	-283.7	-217.7	NO	NO
	221000	0654800	91.9	3355.1	NO	-178.3	-105.3	N/A	-283.7	-217.7	NO	NO
	221000	0652000	91.7	3382.6	NO	-178.4	-105.5	N/A	-283.9	-217.9	NO	NO
	185000	0620000	94.1	3691.0	NO	-179.2	-107.0	N/A	-286.2	-220.1	NO	NO
	185000	0620000	94.1	3691.0	NO	-179.2	-107.0	N/A	-286.2	-220.1	NO	NO
	182500	0643000	95.9	3557.8	NO	-178.8	-106.4	N/A	-285.2	-219.2	NO	NO
	183000	0644500	95.9	3540.1	NO	-178.8	-106.3	N/A	-285.1	-219.1	NO	NO
183000	0663800	96.9	3429.3	NO	-178.5	-105.7	N/A	-284.3	-218.2	NO	NO	
AFWTF												
(South Range)	180500	0675500	98.2	3368.9	NO	-178.4	-105.4	N/A	-283.8	-217.8	NO	NO
	180500	0652700	96.8	3513.6	NO	-178.7	-106.2	N/A	-284.9	-218.9	NO	NO
	181500	0651000	96.4	3524.4	NO	-178.8	-106.2	N/A	-285.0	-218.9	NO	NO
	181500	0641000	95.9	3583.3	NO	-178.9	-106.5	N/A	-285.4	-219.4	NO	NO
	170000	0641000	97.4	3628.0	NO	-179.0	-106.7	N/A	-285.7	-219.7	NO	NO
	165800	0642800	97.6	3611.5	NO	-179.0	-106.6	N/A	-285.6	-219.6	NO	NO
	153300	0660600	100.1	3568.0	NO	-178.9	-106.4	N/A	-285.3	-219.3	NO	NO
	153900	0662300	100.2	3547.7	NO	-178.8	-106.3	N/A	-285.1	-219.1	NO	NO
	163000	0662300	99.2	3516.1	NO	-178.7	-106.2	N/A	-284.9	-218.9	NO	NO
	163000	0675500	100.1	3426.5	NO	-178.5	-105.7	N/A	-284.2	-218.2	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?
AUTEC												
	252000	0780500	94.0	2538.9	NO	-175.9	-100.5	N/A	-276.4	-210.4	NO	NO
	252000	0774500	93.8	2558.3	NO	-176.0	-100.6	N/A	-276.6	-210.6	NO	NO
	232500	0762000	96.0	2698.3	NO	-176.4	-101.6	N/A	-278.0	-212.0	NO	NO
	232500	0771500	96.5	2645.1	NO	-176.3	-101.2	N/A	-277.5	-211.5	NO	NO
FORACS, Hawaii												
	212530	1581100	258.7	2553.7	NO	-176.0	-100.6	N/A	-276.6	-210.5	NO	NO
	212100	1581500	258.6	2560.1	NO	-176.0	-100.7	N/A	-276.6	-210.6	NO	NO
	211500	1580800	258.4	2556.8	NO	-176.0	-100.6	N/A	-276.6	-210.6	NO	NO
	211500	1580700	258.4	2555.9	NO	-176.0	-100.6	N/A	-276.6	-210.6	NO	NO
Gulf of Mexico OPAREA												
	293601	0800130	87.9	2316.6	NO	-175.1	-98.9	N/A	-274.0	-208.0	NO	NO
	292521	0864800	91.7	1927.6	NO	-173.5	-95.7	N/A	-269.2	-203.2	NO	NO
	284101	0864800	93.2	1944.7	NO	-173.6	-95.9	N/A	-269.5	-203.5	NO	NO
	285231	0874400	93.4	1886.3	NO	-173.3	-95.3	N/A	-268.7	-202.7	NO	NO
Pacific Missile Range Facility (PMRF)												
	220000	1594500	260.6	2624.3	NO	-176.2	-101.1	N/A	-277.3	-211.3	NO	NO
	220800	1620000	262.3	2750.1	NO	-176.6	-101.9	N/A	-278.5	-212.5	NO	NO
	224500	1614000	263.0	2710.7	NO	-176.5	-101.6	N/A	-278.1	-212.1	NO	NO
	260000	1581500	266.0	2414.4	NO	-175.5	-99.6	N/A	-275.1	-209.1	NO	NO
Pearl Harbor South OPAREA												
	190800	1591500	256.1	2696.2	NO	-176.4	-101.6	N/A	-278.0	-212.0	NO	NO
	210000	1580800	258.0	2565.5	NO	-176.0	-100.7	N/A	-276.7	-210.7	NO	NO
	210000	1573600	257.6	2535.0	NO	-175.9	-100.5	N/A	-276.4	-210.4	NO	NO
	191800	1562000	254.1	2524.9	NO	-175.9	-100.4	N/A	-276.3	-210.3	NO	NO

	184900	1574500	254.5	2623.0	NO	-176.2	-101.1	N/A	-277.3	-211.2	NO	NO
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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)												
	385200	1255200	311.2	487.1	NO	-161.6	-71.8	-126.3	-233.4	-167.4	YES	NO
	390000	1240000	320.7	418.7	NO	-160.3	-69.2	-86.6	-229.5	-163.4	YES	NO
	311500	1163000	144.7	263.8	NO	-156.2	-61.2	-101.5	-217.4	-151.4	YES	NO
	300000	1203000	195.8	314.5	NO	-157.8	-64.2	-117.3	-222.0	-156.0	YES	NO
Virginia Capes OPAREA												
	384500	0750000	69.9	2469.6	NO	-175.7	-100.0	N/A	-275.7	-209.7	NO	NO
	384500	0743000	69.8	2497.2	NO	-175.8	-100.2	N/A	-276.0	-210.0	NO	NO
	374500	0724000	71.3	2607.8	NO	-176.1	-101.0	N/A	-277.1	-211.1	NO	NO
	350600	0724000	75.7	2640.9	NO	-176.3	-101.2	N/A	-277.4	-211.4	NO	NO
	320000	0771200	82.4	2431.8	NO	-175.5	-99.8	N/A	-275.3	-209.3	NO	NO
	342400	0773000	78.3	2375.4	NO	-175.3	-99.3	N/A	-274.7	-208.7	NO	NO
	354000	0752500	75.5	2477.0	NO	-175.7	-100.1	N/A	-275.8	-209.8	NO	NO
	370000	0755000	73.2	2438.4	NO	-175.6	-99.8	N/A	-275.4	-209.3	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	349.3	894.7	NO	-166.9	-82.4	N/A	-249.2	-183.2	NO	NO
Yakima Firing WA	464018	1202135	355.8	849.3	NO	-166.4	-81.5	N/A	-247.9	-182.1	NO	NO
Fort Carson CO	383810	1044750	65.6	846.6	NO	-166.4	-81.4	N/A	-247.8	-181.8	NO	NO
Fort Riley KS	385813	0965139	69.0	1273.3	NO	-169.9	-88.5	N/A	-258.4	-192.4	NO	NO
Fort Shafter HI	211800	1574900	258.2	2537.0	NO	-175.9	-100.5	N/A	-276.4	-210.4	NO	NO
Hunter AAF GA	320100	0810800	83.9	2204.2	NO	-174.7	-98.1	N/A	-272.7	-206.7	NO	NO

Fort Gillem	GA	333600	0841900	81.9	1996.1	NO	-173.8	-96.3	N/A	-270.2	-204.1	NO	NO
Fort Benning	GA	322130	0845815	84.7	1976.9	NO	-173.7	-96.2	N/A	-269.9	-203.9	NO	NO
Fort Stewart	GA	315145	0813655	84.4	2179.1	NO	-174.6	-97.9	N/A	-272.4	-206.4	NO	NO
Fort Rucker	AL	311947	0854255	87.2	1951.6	NO	-173.6	-95.9	N/A	-269.6	-203.5	NO	NO
Yuma Proving	AZ	330114	1141855	107.8	290.2	NO	-157.1	-62.8	-216.5	-219.9	-153.9	YES	NO
Fort Hood	TX	310830	0974550	94.5	1260.9	NO	-169.8	-88.3	N/A	-258.2	-192.2	NO	NO
Fort Knox	KY	375350	0855655	72.8	1868.1	NO	-173.2	-95.2	N/A	-268.4	-202.4	NO	NO
Fort Bragg	NC	350805	0790035	77.3	2279.6	NO	-175.0	-98.6	N/A	-273.6	-207.6	NO	NO
Fort Campbell	KY	363950	0872820	75.8	1787.8	NO	-172.9	-94.4	N/A	-267.3	-201.3	NO	NO
Fort Polk	LA	310343	0931226	91.7	1524.1	NO	-171.5	-91.6	N/A	-263.1	-197.1	NO	NO
Fort Leonard	MO	374430	0920737	73.4	1525.9	NO	-171.5	-91.7	N/A	-263.2	-197.1	NO	NO
Fort Irwin	CA	351536	1164102	65.8	148.2	YES	-151.2	-941.9	-941.9	-1093.1	-1027.1	NO	NO
Fort Sill	OK	344024	0982352	83.2	1179.6	NO	-169.3	-87.2	N/A	-256.4	-190.4	NO	NO
Fort Bliss	TX	314850	1062533	100.2	755.0	NO	-165.4	-79.4	N/A	-244.8	-178.8	NO	NO
Fort Leavenworth	KS	392115	0945500	68.4	1381.2	NO	-170.6	-89.9	N/A	-260.6	-194.5	NO	NO
Fort Drum	NY	440115	0754844	60.4	2414.8	NO	-175.5	-99.6	N/A	-275.1	-209.1	NO	NO
Fort Gordon	GA	332510	0820910	81.5	2122.9	NO	-174.4	-97.4	N/A	-271.8	-205.7	NO	NO
Fort McCoy	WI	440636	0904127	57.3	1663.2	NO	-172.2	-93.2	N/A	-265.4	-199.4	NO	NO
Fort Dix	NJ	400025	0743713	67.6	2482.5	NO	-175.7	-100.1	N/A	-275.8	-209.8	NO	NO
Parks Reserve	CA	374254	1214218	328.0	271.8	NO	-156.5	-61.7	-313.2	-218.2	-152.2	YES	NO
Aberdeen Proving	MD	392825	0760655	68.7	2403.6	NO	-175.4	-99.6	N/A	-275.0	-209.0	NO	NO
Fort Huachuca	AZ	313500	1102000	108.6	543.5	NO	-162.5	-73.7	N/A	-236.3	-170.2	NO	NO
Fort Monmouth	NJ	401900	0740215	67.0	2512.6	NO	-175.8	-100.3	N/A	-276.1	-210.1	NO	NO
Picatinny Arsenal	NJ	405600	0743400	65.9	2481.3	NO	-175.7	-100.1	N/A	-275.8	-209.8	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	80.4	1853.1	NO	-173.2	-95.0	N/A	-268.2	-202.2	NO	NO
White Sands	NM	322246	1062813	97.4	741.9	NO	-165.2	-79.1	N/A	-244.4	-178.3	NO	NO
Army Research	MD	390000	0765800	69.7	2359.5	NO	-175.3	-99.2	N/A	-274.5	-208.5	NO	NO
Fort Hunter	CA	355756	1211404	312.0	163.0	YES	-152.1	-165.8	-165.8	-317.9	-251.8	NO	NO
Kelly Support	PA	402357	0800925	67.2	2180.8	NO	-174.6	-97.9	N/A	-272.5	-206.4	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

Interference assessment for Earth Stations Operating at 3100 - 3700 MHz at the Santa Paula, CA site identified 7 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. Please see Table 4-8 and below for results of In-band interference cases.

Total Number of Paths 15 sites		Lat (N)	Lon (W)	Out-of-Band Interference?	In-Band Interference?
San Diego	CA	324105	1170800	No	Yes
Southern CA	CA	385200	1255200	No	Yes
Southern CA	CA	390000	1240000	No	Yes
Southern CA	CA	311500	1163000	No	Yes
Southern CA	CA	300000	1203000	No	Yes
Yuma Proving	AZ	330114	1141855	No	Yes
Fort Irvin	CA	351536	1164102	No	No
Parks Reserve	CA	374254	1214218	No	Yes
Fort Hunter	CA	355756	1211404	No	No