FREQUENCY COORDINATION AND INTERFERENCE ANALYSIS REPORT

Prepared for

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
GUAM, GU

Satellite Earth Station

Prepared By:
COMSEARCH
19700 Janelia Farm Boulevard
Ashburn, Virginia 20147
August 22, 2012

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1. CONCLUSIONS

An interference study considering all existing, proposed and prior coordinated microwave facilities within the coordination contours of the proposed earth station demonstrates that this site will operate satisfactorily with the common carrier microwave environment. Further, there will be no restrictions of its operation due to interference considerations.

2. SUMMARY OF RESULTS

A number of great circle interference cases were identified during the interference study of the proposed earth station. Each of the cases, which exceeded the interference objective on a line-of-sight basis, was profiled and the propagation losses estimated using NBS TN101 (Revised) techniques. The losses were found to be sufficient to reduce the signal levels to acceptable magnitudes in every case.

The following companies reported potential great circle interference conflicts that did not meet the objectives on a line-of-sight basis. When over-the-horizon losses are considered on the interfering paths, sufficient blockage exists to negate harmful interference from occurring with the proposed transmit-receive earth station.

Company

None

No carriers reported potential interference cases.

3. SUPPLEMENTAL SHOWING

Pursuant to Part 25.203(c) of the FCC Rules and Regulations, the satellite earth station proposed in this application was coordinated by Comsearch using computer techniques and in accordance with Part 25 of the FCC Rules and Regulations.

Coordination data for this earth station was sent to the below listed carriers with a letter dated August 20, 2012.

Company

Comsearch
Federal Communications Commission

4. EARTH STATION COORDINATION DATA

This section presents the data pertinent to frequency coordination of the proposed earth station that was circulated to all carriers within its coordination contours.

COMSEARCH

Earth Station Data Sheet

19700 Janelia Farm Boulevard, Ashburn, VA 20147
(703)726-5500 http://www.comsearch.com

Date:	08/22/2012
Job Number:	120820COMSJC01

Administrative Information

Status	TEMPORARY (Operation from 09/08/2012 to 09/25/2012)
Call Sign	TEMP09
Licensee Code	ZSCAPI
Licensee Name	SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Site Information — GUAM, GU

Venue Name	ANDERSON AFB
Latitude (NAD 83)	13° 35' 16.2" N
Longitude (NAD 83)	144° 55' 9.0" E
Climate Zone	A
Rain Zone	4
Ground Elevation (AMSL)	153.01 m / 502.0 ft

Link Information

Satellite Type	Geostationary
Mode	TR - Transmit-Receive
Modulation	Digital
Satellite Arc	194° W to 194° West Longitude
Azimuth Range	121.4° to 121.4°
Corresponding Elevation Angles	60.9° / 60.9°
Antenna Centerline (AGL)	3.05 m / 10.0 ft

Antenna Information		Receive - FCC32		Transmit - FCC32	
Manufacturer		Vertex/RSI		Vertex/RSI	
Model		1.8 Meter		1.8 Meter	
Gain / Diameter		35.7 dBi / 1.8 m		38.5 dBi / 1.8 m	
3-dB / 15-dB Beamwidth		2.78° / 5.85°		2.00° / 4.24°	
Max Available RF Power	(dBW/4 kHz)			-10.9	
	(dBW/MHz)			13.1	
Maximum EIRP	(dBW/4 kHz)			27.6	
	(dBW/MHz)			51.6	
Interference Objectives:	Long Term	-156.0 dBW/MHz	20%	-154.0 dBW/4 kHz	20%
	Short Term	-146.0 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)	3M40G7W / 3700.0 - 4200.0	3M40G7W / 5925.0 - 6425.0
Max Great Circle Coordination Distance	285.3 km / 177.2 mi	140.4 km / 87.2 mi
Precipitation Scatter Contour Radius	100.0 km / 62.1 mi	100.0 km / 62.1 mi

COMSEARCH

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Coordination Values	**GUAM, GU**			
Licensee Name	SCIENCE APPLICATIONS INTERNATIONAL CORPORATION			
Latitude (NAD 83)	13° 35' 16.2" N			
Longitude (NAD 83)	144° 55' 9.0" E			
Ground Elevation (AMSL)	153.01 m / 502.0 ft			
Antenna Centerline (AGL)	3.05 m / 10.0 ft			
Antenna Model	Vertex/RSI 1.8 Meter			
Antenna Mode	Receive 4.0 GHz		Transmit 6.1 GHz	
Interference Objectives: Long Term	-156.0 dBW/MHz	20%	-154.0 dBW/4 kHz	20%
Short Term	-146.0 dBW/MHz	0.01%	-131.0 dBW/4 kHz	0.0025%
Max Available RF Power			-10.9 (dBW/4 kHz)	

			Receive 4.0 GHz		Transmit 6.1 GHz	
Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
0	1.13	105.21	-10.00	216.15	-10.00	100.00
5	1.15	102.94	-10.00	215.75	-10.00	100.00
10	1.14	100.58	-10.00	216.04	-10.00	100.00
15	1.15	98.16	-10.00	215.63	-10.00	100.00
20	1.22	95.71	-10.00	213.68	-10.00	100.00
25	1.18	93.20	-10.00	214.70	-10.00	100.00
30	1.18	90.68	-10.00	214.62	-10.00	100.00
35	1.18	88.16	-10.00	214.63	-10.00	100.00
40	1.16	85.65	-10.00	215.48	-10.00	100.00
45	1.29	83.14	-10.00	211.55	-10.00	100.00
50	1.29	80.68	-10.00	211.50	-10.00	100.00
55	0.83	78.44	-10.00	229.64	-10.00	101.92
60	0.74	76.18	-10.00	234.99	-10.00	106.06
65	0.91	73.89	-10.00	225.07	-10.00	100.00
70	0.76	71.86	-10.00	233.81	-10.00	105.16
75	0.71	69.91	-10.00	236.92	-10.00	107.53
80	0.70	68.07	-10.00	237.47	-10.00	107.96
85	0.69	66.39	-10.00	238.04	-10.00	108.39
90	0.73	64.83	-10.00	235.43	-10.00	106.40
95	0.71	63.51	-10.00	236.49	-10.00	107.21
100	0.72	62.38	-10.00	236.13	-10.00	106.94
105	0.70	61.49	-10.00	237.43	-10.00	107.93
110	0.68	60.83	-10.00	238.60	-10.00	108.80
115	0.68	60.39	-10.00	238.70	-10.00	108.88
120	0.63	60.24	-10.00	241.48	-10.00	110.97
125	0.65	60.28	-10.00	240.56	-10.00	110.28
130	0.66	60.57	-10.00	239.65	-10.00	109.60
135	0.67	61.11	-10.00	239.08	-10.00	109.17
140	0.68	61.89	-10.00	238.14	-10.00	108.46
145	0.69	62.89	-10.00	237.90	-10.00	108.28
150	0.71	64.10	-10.00	236.44	-10.00	107.17
155	0.70	65.53	-10.00	237.04	-10.00	107.63
160	0.71	67.13	-10.00	236.91	-10.00	107.53
165	0.71	68.89	-10.00	236.92	-10.00	107.54
170	0.68	70.82	-10.00	238.52	-10.00	108.75
175	0.69	72.85	-10.00	237.94	-10.00	108.31
180	0.83	74.94	-10.00	229.84	-10.00	102.07

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Coordination Values	**GUAM, GU**			
Licensee Name	SCIENCE APPLICATIONS INTERNATIONAL CORPORATION			
Latitude (NAD 83)	13° 35' 16.2" N			
Longitude (NAD 83)	144° 55' 9.0" E			
Ground Elevation (AMSL)	153.01 m / 502.0 ft			
Antenna Centerline (AGL)	3.05 m / 10.0 ft			
Antenna Model	Vertex/RSI 1.8 Meter			
Antenna Mode	Receive 4.0 GHz		Transmit 6.1 GHz	
Interference Objectives: Long Term	-156.0 dBW/MHz	20%	-154.0 dBW/4 kHz	20%
Short Term	-146.0 dBW/MHz	0.01%	-131.0 dBW/4 kHz	0.0025%
Max Available RF Power			-10.9 (dBW/4 kHz)	

			Receive 4.0 GHz		Transmit 6.1 GHz	
Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Horizon Gain (dBi)	Coordination Distance (km)	Horizon Gain (dBi)	Coordination Distance (km)
185	0.95	77.14	-10.00	223.03	-10.00	100.00
190	0.62	79.59	-10.00	241.88	-10.00	111.26
195	0.54	81.98	-10.00	246.85	-10.00	114.92
200	0.60	84.40	-10.00	243.46	-10.00	112.43
205	0.46	86.87	-10.00	254.33	-10.00	120.21
210	0.55	89.33	-10.00	246.20	-10.00	114.45
215	0.60	91.81	-10.00	243.05	-10.00	112.13
220	0.59	94.28	-10.00	243.73	-10.00	112.63
225	0.59	96.72	-10.00	244.03	-10.00	112.85
230	0.56	99.11	-10.00	245.90	-10.00	114.22
235	0.60	101.47	-10.00	243.51	-10.00	112.47
240	0.57	103.74	-10.00	245.39	-10.00	113.85
245	0.58	105.94	-10.00	244.76	-10.00	113.39
250	0.53	108.00	-10.00	247.91	-10.00	115.69
255	0.46	109.93	-10.00	253.75	-10.00	119.80
260	0.32	111.67	-10.00	269.90	-10.00	131.02
265	0.00	113.09	-10.00	285.28	-10.00	140.36
270	0.00	114.57	-10.00	285.28	-10.00	140.36
275	0.00	115.87	-10.00	285.28	-10.00	140.36
280	0.00	116.97	-10.00	285.28	-10.00	140.36
285	0.00	117.85	-10.00	285.28	-10.00	140.36
290	0.00	118.51	-10.00	285.28	-10.00	140.36
295	0.00	118.94	-10.00	285.28	-10.00	140.36
300	0.00	119.13	-10.00	285.28	-10.00	140.36
305	0.32	119.39	-10.00	270.15	-10.00	131.19
310	0.70	119.47	-10.00	237.13	-10.00	107.70
315	0.97	119.17	-10.00	222.14	-10.00	100.00
320	1.02	118.42	-10.00	219.81	-10.00	100.00
325	0.78	117.19	-10.00	232.56	-10.00	104.19
330	0.90	116.06	-10.00	225.62	-10.00	100.00
335	1.23	114.89	-10.00	213.35	-10.00	100.00
340	1.04	113.12	-10.00	218.99	-10.00	100.00
345	1.08	111.36	-10.00	217.80	-10.00	100.00
350	1.11	109.44	-10.00	217.03	-10.00	100.00
355	1.13	107.38	-10.00	216.40	-10.00	100.00

5. CERTIFICATION

I HEREBY CERTIFY THAT I AM THE TECHNICALLY QUALIFIED PERSON RESPONSIBLE FOR THE PREPARATION OF THE FREQUENCY COORDINATION DATA CONTAINED IN THIS APPLICATION, THAT I AM FAMILIAR WITH PARTS 101 AND 25 OF THE FCC RULES AND REGULATIONS, THAT I HAVE EITHER PREPARED OR REVIEWED THE FREQUENCY COORDINATION DATA SUBMITTED WITH THIS APPLICATION, AND THAT IT IS COMPLETE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

Jeffrey E. Cowles

Jeffrey E. Cowles
Engineer III, Telecommunications
COMSEARCH
19700 Janelia Farm Boulevard
Ashburn, Va. 20147

DATED: August 22, 2012

EXHIBIT B

RADIATION HAZARD STUDY

Analysis of Non-Ionizing Radiation for a 1.8-Meter Earth Station System

This report analyzes the non-ionizing radiation levels for a 1.8-meter earth station system. The analysis and calculations performed in this report comply with the methods described in the FCC Office of Engineering and Technology Bulletin, No. 65 first published in 1985 and revised in 1997 in Edition 97-01. The radiation safety limits used in the analysis are in conformance with the FCC R&O 96-326. Bulletin No. 65 and the FCC R&O specifies that there are two separate tiers of exposure limits that are dependant on the situation in which the exposure takes place and/or the status of the individuals who are subject to the exposure. The Maximum Permissible Exposure (MPE) limits for persons in a General Population/Uncontrolled environment are shown in Table 1. The General Population/Uncontrolled MPE is a function of transmit frequency and is for an exposure period of thirty minutes or less. The MPE limits for persons in an Occupational/Controlled environment are shown in Table 2. The Occupational MPE is a function of transmit frequency and is for an exposure period of six minutes or less. The purpose of the analysis described in this report is to determine the power flux density levels of the earth station in the far-field, near-field, transition region, between the subreflector or feed and main reflector surface, at the main reflector surface, and between the antenna edge and the ground and to compare these levels to the specified MPEs.

Table 1. Limits for General Population/Uncontrolled Exposure (MPE)

Frequency Range (MHz)	Power Density (mW/cm^2)
30-300	0.2
300-1500	Frequency (MHz)*(0.8/1200)
1500-100,000	1.0

Table 2. Limits for Occupational/Controlled Exposure (MPE)

Frequency Range (MHz)	Power Density (mW/cm^2)
30-300	1.0
300-1500	Frequency (MHz)*(4.0/1200)
1500-100,000	5.0

Table 3. Formulas and Parameters Used for Determining Power Flux Densities

Parameter	Symbol	Formula	Value	Units
Antenna Diameter	D	Input	1.8	m
Antenna Surface Area	$A_{surface}$	$\pi D^2 / 4$	2.54	m^2
Feed Flange Diameter	D_{fa}	Input	7.6	cm
Area of Feed Flange	A_{fa}	$\pi D_{fa}^2/4$	45.36	cm^2
Frequency	F	Input	6175	MHz
Wavelength	λ	300 / F	0.048583	m
Transmit Power	P	Input	69.00	W
Antenna Gain (dBi)	G_{es}	Input	38.5	dBi
Antenna Gain (factor)	G	$10^{Ges/10}$	7079.5	n/a
Pi	π	Constant	3.1415927	n/a
Antenna Efficiency	η	$G\lambda^2/(\pi^2D^2)$	0.52	n/a

1. Far Field Distance Calculation

The distance to the beginning of the far field can be determined from the following equation:

Distance to the Far Field Region

$$R_{ff} = 0.60\ D^2 / \lambda \quad (1)$$
$$= 40.0\ m$$

The maximum main beam power density in the far field can be determined from the following equation:

On-Axis Power Density in the Far Field

$$S_{ff} = G\ P / (4\ \pi\ R_{ff}^2) \quad (2)$$
$$= 24.278\ W/m^2$$
$$= 2.428\ mW/cm^2$$

2. Near Field Calculation

Power flux density is considered to be at a maximum value throughout the entire length of the defined Near Field region. The region is contained within a cylindrical volume having the same diameter as the antenna. Past the boundary of the Near Field region, the power density from the antenna decreases linearly with respect to increasing distance.

The distance to the end of the Near Field can be determined from the following equation:

Extent of the Near Field

$$R_{nf} = D^2 / (4\ \lambda) \quad (3)$$
$$= 16.7\ m$$

The maximum power density in the Near Field can be determined from the following equation:

Near Field Power Density

$$S_{nf} = 16.0\ \eta\ P / (\pi\ D^2) \quad (4)$$
$$= 56.676\ W/m^2$$
$$= 5.668\ mW/cm^2$$

3. Transition Region Calculation

The Transition region is located between the Near and Far Field regions. The power density begins to decrease linearly with increasing distance in the Transition region. While the power density decreases inversely with distance in the Transition region, the power density decreases inversely with the square of the distance in the Far Field region. The maximum power density in the Transition region will not exceed that calculated for the Near Field region. The power density calculated in Section 1 is the highest power density the antenna can produce in any of the regions away from the antenna. The power density at a distance R_t can be determined from the following equation:

Transition Region Power Density

$$S_t = S_{nf}\ R_{nf} / R_t \quad (5)$$
$$= 5.668\ mW/cm^2$$

4. Region between the Feed Assembly and the Antenna Reflector

Transmissions from the feed assembly are directed toward the antenna reflector surface, and are confined within a conical shape defined by the type of feed assembly. The most common feed assemblies are waveguide flanges, horns or subreflectors. The energy between the feed assembly and reflector surface can be calculated by determining the power density at the feed assembly surface. This can be determined from the following equation:

Power Density at the Feed Flange

$$S_{fa} = 4000\ P / A_{fa} \quad (6)$$
$$= 6084.039\ mW/cm^2$$

5. Main Reflector Region

The power density in the main reflector is determined in the same manner as the power density at the feed assembly. The area is now the area of the reflector aperture and can be determined from the following equation:

Power Density at the Reflector Surface

$$S_{surface} = 4\ P / A_{surface} \quad (7)$$
$$= 108.461\ W/m^2$$
$$= 10.846\ mW/cm^2$$

6. Region between the Reflector and the Ground

Assuming uniform illumination of the reflector surface, the power density between the antenna and the ground can be determined from the following equation:

Power Density between Reflector and Ground

$$S_g = P / A_{surface} \quad (8)$$
$$= 27.115\ W/m^2$$
$$= 2.712\ mW/cm^2$$

7. Summary of Calculations

Table 4. Summary of Expected Radiation levels for Uncontrolled Environment

Region		Calculated Maximum Radiation Power Density Level (mW/cm^2)	Hazard Assessment
1. Far Field (R_{ff} = 40.0 m)	S_{ff}	2.428	Potential Hazard
2. Near Field (R_{nf} = 16.7 m)	S_{nf}	5.668	Potential Hazard
3. Transition Region ($R_{nf} < R_t < R_{ff}$)	S_t	5.668	Potential Hazard
4. Between Feed Assembly and Antenna Reflector	S_{fa}	6084.039	Potential Hazard
5. Main Reflector	$S_{surface}$	10.846	Potential Hazard
6. Between Reflector and Ground	S_g	2.712	Potential Hazard

Table 5. Summary of Expected Radiation levels for Controlled Environment

Region		Calculated Maximum Radiation Power Density Level (mW/cm^2)	Hazard Assessment
1. Far Field (R_{ff} = 40.0 m)	S_{ff}	2.428	Satisfies FCC MPE
2. Near Field (R_{nf} = 16.7 m)	S_{nf}	5.668	Potential Hazard
3. Transition Region ($R_{nf} < R_t < R_{ff}$)	S_t	5.668	Potential Hazard
4. Between Feed Assembly and Antenna Reflector	S_{fa}	6084.039	Potential Hazard
5. Main Reflector	$S_{surface}$	10.846	Potential Hazard
6. Between Reflector and Ground	S_g	2.712	Satisfies FCC MPE

It is the applicant's responsibility to ensure that the public and operational personnel are not exposed to harmful levels of radiation.

8. Conclusions

Based upon the above analysis, it is concluded that harmful levels of radiation may exist in those regions noted for the Uncontrolled (Table 4) and Controlled (Table 5) environments.

The area around the antenna, equal to one diameter removed from the main beam will be roped off, and public access will be denied. This restricted area will be at least 12 feet around the antenna, and radiation hazard signs will be posted during the operation of this earth station.

The applicant will ensure that the main beam of the antenna will be pointed at least one diameter away from any buildings, or other obstacles in those areas that exceed the MPE levels. Since one diameter removed from the center of the main beam the levels are down at least 20 dB, or by a factor of 100, public safety will be ensured.

The earth station will marked with the standard radiation hazard warnings, as well as the area in the vicinity of the earth station, to inform those in the general population, who may be working, or otherwise present on the roof, deck, and in or near, the main beam of the antenna.

Finally, occupational exposure will be limited, and the transmitter will be turned off during periods of maintenance, so that the MPE standard of 5.0 mw/cm**2 will be complied with for those regions in close proximity to the main reflector, and subreflector, which could be occupied by operating personnel.

The applicant agrees to abide by the conditions specified in Condition 5208 provided below:

> *Condition 5208 - The licensee shall take all necessary measures to ensure that the antenna does not create potential exposure of humans to radiofrequency radiation in excess of the FCC exposure limits defined in 47 CFR 1.1307(b) and 1.1310 wherever such exposures might occur. Measures must be taken to ensure compliance with limits for both occupational/controlled exposure and for general population/uncontrolled exposure, as defined in these rule sections. Compliance can be accomplished in most cases by appropriate restrictions such as fencing. Requirements for restrictions can be determined by predictions based on calculations, modeling or by field measurements. The FCC's OET Bulletin 65 (available on-line at www.fcc.gov/oet/rfsafety) provides information on predicting exposure levels and on methods for ensuring compliance, including the use of warning and alerting signs and protective equipment for worker.*