

Radiation Hazard Report

Advent Mantis 240 C-Band Antenna System

The purpose of this report is to examine the potential human exposure to radio frequencies (RF) emitted in the form of electro magnetic (EM) radiation from an Advent Mantis 2.4m C-Band satellite antenna. The mathematical analysis performed below complies with the methods described in the Federal Communications Commission Office of Engineering and Technology Bulletin No. 65 (1985 rev. 1997) R&O 96-326.

Maximum Permissible Exposure

There are two separate levels of exposure limits. The first applies to persons in the general population who are in an uncontrolled environment. The second applies to trained personnel in a controlled environment.

According to 47 C.F.R. § 1.1310, the Maximum Permissible Exposure (MPE) limits for frequencies above 1.5GHz are as follows:

- General Population / Uncontrolled Exposure 1.0 mW/cm²
- Occupational / Controlled Exposure 5.0 mW/cm²

The purpose of this study is to determine the power flux density levels for the earth station under study as compared with the MPE limits. This comparison is done in each of the following regions:

1. Far-field region
2. Near-field region
3. Transition region
4. The region between the feed and the antenna surface
5. The main reflector region
6. The region between the antenna edge and the ground

Input Parameters

The values below are used in the calculations detailed in this report

Parameter	Value	Unit	Symbol
Antenna Diameter	2.4	m	<i>D</i>
Antenna Transmit Gain	42.1	dBi	<i>G</i>
Transmit Frequency	6200	MHz	<i>f</i>
Feed Flange Diameter	9.8	cm	<i>d</i>
Power Input to Antenna	260	W	<i>P</i>

Calculated Parameters

The following values are calculated from the input parameters from there corresponding formulas.

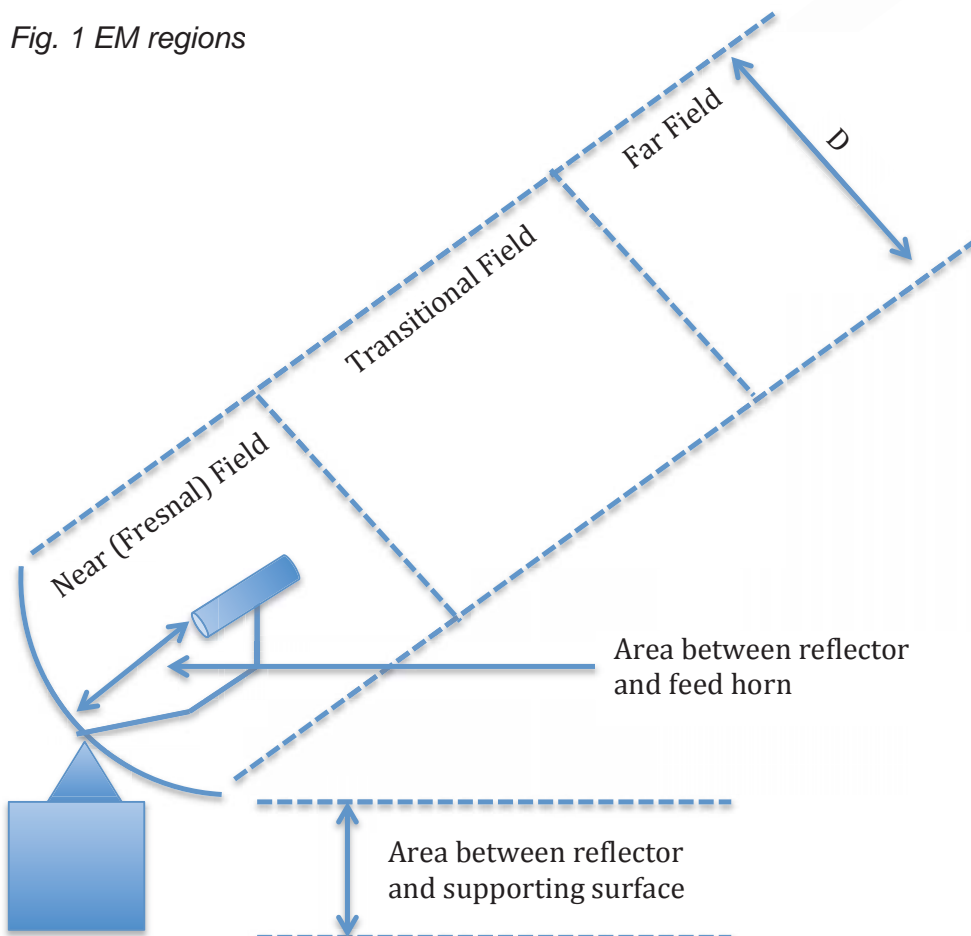
(All values rounded to two decimal places)

Parameter	Value	Unit	Symbol	Formula
Antenna Surface Area	4.52	m ²	A	$\pi D^2/4$
Feed Flange Surface Area	75.43	cm ²	a	$\pi a^2/4$
Antenna Efficiency	0.67		η	$G\lambda^2/(\pi^2 D^2)$
Gain Factor	16218.10		g	$10^{G/10}$
Wavelength	0.048	m	λ	$300/f$

Regions of EM fields, Characteristics and there Behavior

EM radiation emitting from a parabolic antenna has different behavioral and characteristics depending on the distance from the reflector surface. This distance from the reflector can be catagorised in three regions, Near (Fresnal) Field Region, Transitional Region and Far Field Region. Additional areas of interest are also the area between the feed horn and the reflector, the area between the supporting surface and the reflector, and the main reflector area.

Fig. 1 EM regions



Parabolic antennas with circular reflectors, such as the dish under analysis in this report, have the Near, Transitional and Far Field distances calculated with the formulas below

Parameter	Value	Unit	Formula
Near Field Distance	30	m	$R_{nf}=D^2/(4\lambda)$
Distance to Transitional Field	30	m	$R_t=R_{nf}$
Distance to Far Field	72	m	$R_{ff}=0.60D^2/\lambda$

The distance within the transition region is between the near and far fields. This allows for the following rule, $R_{nf} \leq R_t \leq R_{ff}$. However, the power density in the transition region cannot exceed the power density in the near field.

Power Flux Density Calculations

Power flux density is the rate of transfer the EM moves through space. Flux density is at it strongest through the entire length of the near field and is concentrated through a cylinder proportional to the surface diameter of the reflector (D). Within the transitional and far field, the power density decreases at an opposite rate. Power density with in the three regions is calculated below.

Parameter	Value	Unit	Symbol	Formula
Power Density in the Near Field	1.54	mW/cm ²	S_{nf}	$16\eta P/(\pi D^2)$
Power Density in the Trans. Field	1.54	mW/cm ²	S_t	$GP/(4\pi R_{ff}^2)$
Power Density in the Far Field	0.79	mW/cm ²	S_{ff}	$S_{nf}R_{nf}/(R_t)$

The area between the feed horn and the reflector surface is confined within a conical shape, this is due to the aperture of the feed assembly. The Power density is defined below.

Parameter	Value	Unit	Symbol	Formula
Power Density at Feed Flange	1378.76	mW/cm ²	S_{fa}	$4P/a$

The above formula also applies when working out the power density at the reflector surface.

Parameter	Value	Unit	Symbol	Formula
Power Density at the Reflector	2.30	mW/cm ²	$S_{surface}$	$4P/A$

Assuming there is uniform spread across the reflector, the power density between the surface and reflector is shown below.

Parameter	Value	Unit	Symbol	Formula
Power Density Between the Surface and the Reflector	1.22	mW/cm ²	S_g	P/A

The table below shows the results of this report and if they meet the FCC limitations for EM exposure. It can be seen that only the area between the feed horn and the reflector exceeds the limitations set out by the FCC. This area is only accessed by experienced engineers who are trained to cease the transmission before accessing this area.

Area of exposure	mW/cm²	FCC Limitation (<5 mW/cm²)
Power Density in the Near Field	1.54	Within FCC Limitation
Power Density in the Trans. Field	1.54	Within FCC Limitation
Power Density in the Far Field	0.79	Within FCC Limitation
Power Density at Feed Flange	1378.76	Exceeds FCC Limitation
Power Density at the Reflector	2.30	Within FCC Limitation
Power Density Between the Surface and the Reflector	1.22	Within FCC Limitation

In conclusion to this report it can be seen that the antenna, with appropriate controls, and operation by a trained engineer, meet the guidelines set out in 47 C.F.R. § 1.1310.

Additional Information

Fig. 2 Advent Mantis 2.4m C-Band Antenna



Fig. 3. Advent Mantis 2.4m C-Band Antenna off axis gain meets requirements for the following standards

ITU-R S.580-6

ITU-R S.465-5

INTELSAT IESS-601

EUTELSAT ESS-502

MIL STD 188-164A

STANAG 4484

19700 Janelia Farm Boulevard

Ashburn, VA 20147

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<http://www.comsearch.com>

November 1, 2012

*** CLIENT COPY ***

*** PLEASE MAIL ***

*** TO CUSTOMER ***

Re: Overon America
Washington, DC
Temporary Transmit-Only Earth Station
Operation Dates: 11/04/2012 - 11/10/2012
Job Number: 121101COMSJC01

Dear Frequency Coordinator:

On behalf of Overon America, we are forwarding the attached coordination data for a temporary transmit-only earth station to be located at the site referenced above.

This earth station will transmit only on the satellite(s) and frequency or frequencies as described in the attached data. Please do not report cases involving 4 GHz facilities or problems involving non-active paths or frequencies outside the specified range.

If there are any questions concerning this coordination notice, please contact Comsearch.

Sincerely,

COMSEARCH

Jeffrey E. Cowles
Engineer III, Telecommunications
jcowles@comsearch.com

Enclosure(s)

COMSEARCH**Earth Station Data Sheet**

19700 Janelia Farm Boulevard, Ashburn, VA 20147
(703)726-5660 <http://www.comsearch.com>

Date: 11/01/2012
Job Number: 121101COMSJC01

Administrative Information

Status TEMPORARY (Operation from 11/04/2012 to 11/10/2012)
Call Sign TEMP11
Licensee Code OVEAME
Licensee Name Overon America

Site Information**WASHINGTON, DC**

Venue Name
Latitude (NAD 83) 38° 54' 1.5" N
Longitude (NAD 83) 77° 2' 12.6" W
Climate Zone A
Rain Zone 2
Ground Elevation (AMSL) 20.12 m / 66.0 ft

Link Information

Satellite Type Geostationary
Mode TO - Transmit-Only
Modulation Digital
Satellite Arc 55.5° W to 55.5° West Longitude
Azimuth Range 147.9° to 147.9°
Corresponding Elevation Angles 39.7° / 39.7°
Antenna Centerline (AGL) 28.96 m / 95.0 ft

Antenna Information**Transmit - FCC32**

Manufacturer Advent
Model Mantis 2.4 Meter
Gain / Diameter 42.1 dBi / 2.4 m
3-dB / 15-dB Beamwidth 1.34° / 2.50°

Max Available RF Power (dBW/4 kHz) -11.5
(dBW/MHz) 12.5

Maximum EIRP (dBW/4 kHz) 30.6
(dBW/MHz) 54.6
(dBW) 67.1

Interference Objectives: Long Term -154.0 dBW/4 kHz 20%
Short Term -131.0 dBW/4 kHz 0.0025%

Frequency Information**Transmit 6.1 GHz**

Emission / Frequency Range (MHz) 18M0G7W / 6157.0

Max Great Circle Coordination Distance 144.7 km / 89.9 mi
Precipitation Scatter Contour Radius 100.0 km / 62.1 mi

COMSEARCH Earth Station Data Sheet

19700 Janelia Farm Boulevard, Ashburn, VA 20147
(703)726-5660 <http://www.comsearch.com>

Coordination Values	WASHINGTON, DC
Licensee Name	Overon America
Latitude (NAD 83)	38° 54' 1.5" N
Longitude (NAD 83)	77° 2' 12.6" W
Ground Elevation (AMSL)	20.12 m / 66.0 ft
Antenna Centerline (AGL)	28.96 m / 95.0 ft
Antenna Model	Advent Mantis 2.4 Meter
Antenna Mode	Transmit 6.1 GHz
Interference Objectives: Long Term	-154.0 dBW/4 kHz 20%
Short Term	-131.0 dBW/4 kHz 0.0025%
Max Available RF Power	-11.5 (dBW/4 kHz)

Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Transmit 6.1 GHz	
			Horizon Gain (dBi)	Coordination Distance (km)
0	0.29	130.86	-10.00	131.80
5	0.32	128.04	-10.00	129.43
10	0.26	124.93	-10.00	133.64
15	0.28	121.70	-10.00	133.34
20	0.48	118.39	-10.00	116.65
25	0.57	114.89	-10.00	112.34
30	0.50	111.23	-10.00	115.72
35	0.31	107.47	-10.00	130.56
40	0.00	103.65	-10.00	138.58
45	0.00	99.86	-10.00	138.58
50	0.00	96.04	-10.00	138.58
55	0.00	92.20	-10.00	138.58
60	0.00	88.35	-10.00	138.58
65	0.00	84.51	-10.00	138.58
70	0.00	80.68	-10.00	138.58
75	0.00	76.89	-10.00	138.58
80	0.00	73.14	-10.00	138.58
85	0.00	69.45	-10.00	138.58
90	0.00	65.83	-10.00	138.58
95	0.00	62.31	-10.00	138.58
100	0.00	58.92	-10.00	138.58
105	0.00	55.66	-10.00	138.58
110	0.00	52.59	-10.00	138.58
115	0.00	49.73	-10.00	138.58
120	0.23	46.96	-9.79	136.53
125	0.27	44.62	-9.24	134.83
130	0.27	42.68	-8.75	136.33
135	0.25	41.16	-8.36	139.05
140	0.00	40.34	-8.14	144.24
145	0.00	39.78	-7.99	144.72
150	0.00	39.74	-7.98	144.75
155	0.00	40.23	-8.11	144.33
160	0.00	41.22	-8.38	143.50
165	0.00	42.67	-8.75	142.33
170	0.00	44.55	-9.22	140.90
175	0.00	46.79	-9.75	139.30
180	0.00	49.35	-10.00	138.58
185	0.00	52.17	-10.00	138.58

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Antenna Mode		Transmit 6.1 GHz
Interference Objectives:	Long Term	-154.0 dBW/4 kHz 20%
	Short Term	-131.0 dBW/4 kHz 0.0025%
Max Available RF Power		-11.5 (dBW/4 kHz)

Azimuth (°)	Horizon Elevation (°)	Antenna Discrimination (°)	Transmit 6.1 GHz	
			Horizon Gain (dBi)	Coordination Distance (km)
190	0.00	55.21	-10.00	138.58
195	0.00	58.44	-10.00	138.58
200	0.00	61.82	-10.00	138.58
205	0.00	65.33	-10.00	138.58
210	0.00	68.93	-10.00	138.58
215	0.00	72.61	-10.00	138.58
220	0.00	76.35	-10.00	138.58
225	0.00	80.14	-10.00	138.58
230	0.00	83.96	-10.00	138.58
235	0.22	87.80	-10.00	137.07
240	0.29	91.66	-10.00	132.48
245	0.32	95.52	-10.00	130.10
250	0.33	99.36	-10.00	128.91
255	0.33	103.17	-10.00	129.09
260	0.40	106.96	-10.00	123.55
265	0.52	110.71	-10.00	114.43
270	0.57	114.38	-10.00	111.92
275	0.44	117.88	-10.00	119.82
280	0.36	121.26	-10.00	126.57
285	0.25	124.48	-10.00	134.36
290	0.33	127.62	-10.00	128.86
295	0.43	130.57	-10.00	121.10
300	0.58	133.31	-10.00	111.62
305	0.64	135.69	-10.00	108.73
310	0.73	137.74	-10.00	104.89
315	0.82	139.38	-10.00	100.62
320	0.81	140.45	-10.00	101.37
325	0.78	140.99	-10.00	102.66
330	0.61	140.86	-10.00	110.31
335	0.43	140.19	-10.00	121.20
340	0.46	139.22	-10.00	118.43
345	0.37	137.66	-10.00	125.53
350	0.44	135.82	-10.00	120.33
355	0.25	133.41	-10.00	133.82