iNTELLICOM

Radiation Safety Report
for
GD Satcom 3.8 M Ku Band Antenna
Series 1385

February 11, 2014

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Revision History

Revision History:	Date	Document Revision Description
V01	24 Jan 14	Initial draft
V02	4 Feb 14	Added Section 2, which includes FF, NF and other pertinent calculations for 3.8 M antenna. It also includes ***Figure 3***, which is the MPE for the antenna @ 12 Deg E.
V03	4 Feb 14	Minor changes were made in the Main Reflector and Main Reflector to Ground calculations.
V04	5 Feb 14	Modified ***1.0***. Added ***3.4.***

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1.0 INTRODUCTION

This radiation report is based on the Prodelin (GD Satcom) Ku band 3.8 M prime focus offset feed antenna system Series 1385. This antenna incorporates a rib design for the main reflector that provides increased strength during high wind loads and improved surface tolerances to yield a higher gain in both transmit and receive directions. The antenna has been designed to ease installation requirements, aided by factory pre-assembly of critical components. Specifications for this antenna are provided in ***Figure 8 – Appendix A***.

This is a development program where this antenna serves as the hub of a network that will communicate with 1 or more Satellite On The Move (SOTM) systems being conducted by Toyon Research Corporation of Goleta, California (http://www.toyon.com/). Four (4) SOTM antennas will be mounted on a single vehicle in a quadrant. The receiver of each will be phase combined to effectively increase the receive aperture and G/T, and to boast the receive data rate capability. The program will also select one of the 4 transmit antennas, choosing the antenna that has the best look angle to the satellite.

The primary purpose for this report is to determine the minimum distance a person can safely stand in front of the antenna without being exposed to harmful radiation in both a controlled and uncontrolled exposure. With these guidelines, a parameter fence must be erected that surrounds the antenna with appropriate radiation hazard warning labels being placed on the fence so as to be seen by observers in a 360^{o} parameter.

The Power Amplifier (PA) used for this report is assumed to be a 40 W Solid State Power Amplifier (SSPA), or a 40 W Solid State Power Amplifier with Block Up Converter (SSPB). The 40 Watt maximum output assumes that the measurement is at saturation.

1.1 Maximum Permissible Exposure Limits

This report is in response to the original 1985 FCC adoption of the 1982 American National Standards Institute (ANSI) guidelines and the further 1993 adoption of the 1992 ANSI and 1991 Institute of Electrical and Electronics Engineers (IEEE) guidelines[1] for evaluating exposure to RF transmitters licensed and authorized by the FCC. In 1996, the FCC adapted a modified version of its original proposal[2], which also fulfills the requirements of the Telecommunications Act of 1996 RF exposure guidelines[3].

The Maximum Permissible Exposure (MPE) radiation limit specifies two separate tiers as shown in ***Table 1***[4]:

- **(A) Occupational/Controlled Exposure**: The time-averaged exposure period is 6 minutes.
- **(B) General Population/Uncontrolled Exposure**: The time-averaged exposure period is 30 minutes.

1 ANSI/IEEE C95.1-1992 (IEEE Standard for Safety Levels with Respect to Human Exposure to RF Electromagnetic Fields, 3 kHz to 300 GHz)
2 Refer to ET Docket 93-62 References 55 and 56, and FCC Office of Engineering (OET) Bulletin 65 Reference 57 Edition 97-01 for detailed information.
3 See Section 704(b) of the Telecommunications Act of 1996, Pub. L No 104-104, Stat 56.
4 The specifications highlighted in green cover C, X, Ku, and Ka bands and beyond..

Table 1 - Maximum Permissible Exposure Limits.

	(A) Controlled Exposure (6-Minute Average)			***(B) Uncontrolled Exposure (30-Minute Average)***		
Frequency Range (MHz)	***Electric Field Strength (E) (V/m)***	***Magnetic Field Strength (H) (A/m)***	***Power Density (S) (mW/cm^2)***	***Electric Field Strength (E) (V/m)***	***Magnetic Field Strength (H) (A/m)***	***Power Density (S) (mW/cm^2)***
0.3-3.0	614	1.63	(100)*			
3.0-30	1842/f	4.89/f	($900/f^2$)*			
0.3-1.34				614	1.63	(100)*
1.34-30				824/f	2.19/f	($180/f^2$)*
30-300	61.4	0.163	1.0	27.5	0.073	0.2
300-1500	--	--	f/300	--	--	f/1500
1,500-100,000	--	--	**5**	--	--	**1.0**

F = frequency in MHz
* = Plane Wave equivalent Power Density
-- = Not specified.

The purpose of this analysis is to determine the Power Flux Density (S) for the earth station and to compare these levels to the specified MPE's of ***Table 1***. Several formulas and parameters to be used for determining the Power Flux Densities are provided in ***Table 2***.

Table 2 - Formulas and Parameters Used in this Document

Parameter	Symbol	Formula	Value	Units
Transmit Frequency	F	Input	14,500	MHz
Wavelength	λ	C/F	0.0207	m
Antenna Diameter (inches) (equivalent to a parabolic antenna)				
Major (Azimuth)	D_1		149.61	inches
Minor (Elevation)	D_2		149.61	inches
Antenna Diameter (m)				
Major (Azimuth)	D_1		3.80	m
Minor (Elevation)	D_2		3.80	m
Antenna Radius				
Major (Azimuth)	R_1		1.90	m
Minor (Elevation)	R_2		1.90	m
Antenna Reflector				
Antenna Surface Area (plane)	$A_{surface}$	area of a rectangle, D_1 x D_2	11.341	m^2
Equivalent Diameter (as if circular)	De	$2*sqrt(A_{surface}/\pi)$	3.800	m
Power Amplifier				
Transmit Power - saturated	P_{sat}	Measured	46.02059991	dBm
Line Losses between SSPA and feed	L	Flex Waveguide @ 10' Length	1.5	dB
Net Power Into Feed	P		44.52059991	dBm
Net Power Into Feed	P		28.32	Watts
EIRP Spectral Density (dBW/4kHz)				
13.75 GHz	$EIRP_{sat}$	Measured at 12^o Elevation	71.8 V; 71.9 H	dBW
14.25 GHz	$EIRP_{sat}$	Measured at 12^o Elevation	72.1 V; 72.3 H	dBW
14.50 GHz	$EIRP_{sat}$	Measured at 12^o Elevation	72.3 V; 72.5 H	dBW

1.2 Assumptions used for this Analysis

This antenna system is designed to be fixed-mount on the ground, roof of a building, or any other flat surface using one of the suggested mounting methods:

1. ***In-Ground Mast Mount.*** This method requires the use of a 10” Schedule 40 pipe (purchased locally) to be buried a minimum of 10’ in the ground. The top of the post is then welded to the kingpost mount of the antenna.
2. ***Pad or Pier Pedestal Mount.*** This method utilizes a concrete pad or pier-style foundation where 8 anchor bolts are buried in the concrete before the pour. Once the concrete is cured, the kingpost mount of the antenna is then fastened to the anchor bolts.
3. ***Non-Penetrating Roof or Ground Mounts.*** This mount is used where temporary installations are desired, or where building codes prevent the antenna kingpost from being attached permanently to the superstructure of the building, or where the antenna is to be installed on an existing concrete surface, such as a driveway or parking lot. Non-penetrating mounts use ballasts (such as concrete block, sand bags, etc.) to anchor the antenna. A well-known manufacturer of these mounts is Baird (https://www.bairdmounts.com/).

These calculations are based on the Elevation pattern report received from General Dynamics Satcom Division in both the Horizontal and Vertical Planes. (The report also included Azimuth patterns which closely track the Elevation patterns.) Copies of these Elevation patterns in the 13.75, 14.25 and 14.50 GHz frequencies are repeated in ***Figure 1.***

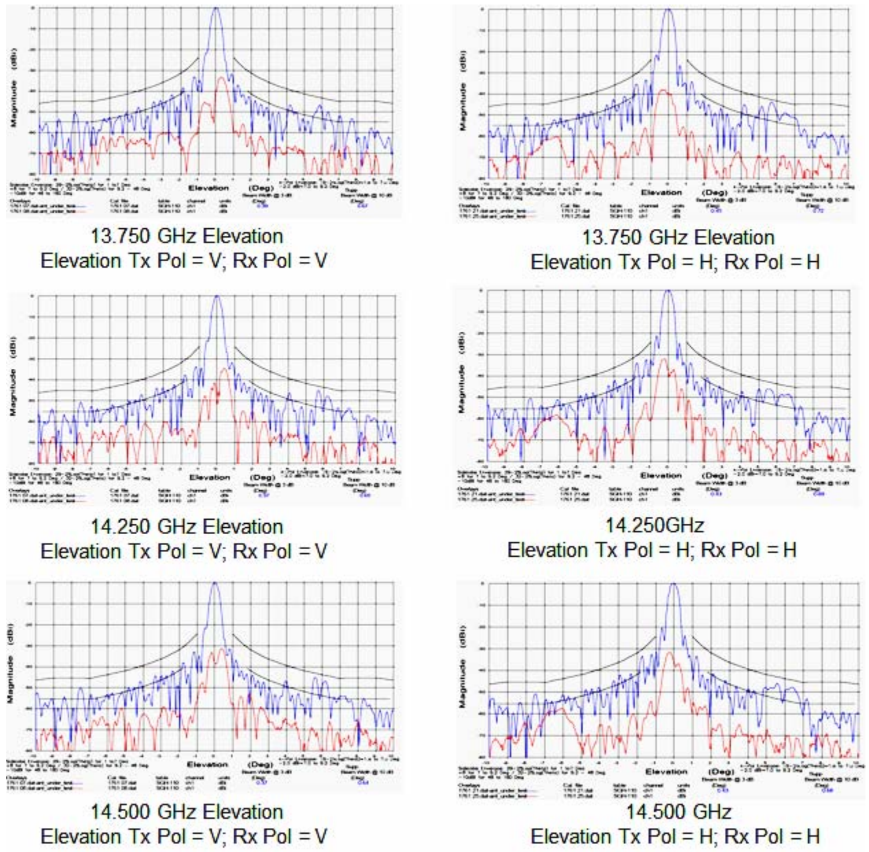


Figure 1. Elevation Antenna Patterns in Vertical and Horizontal Planes.

Using the midband gain factor average of 53.2 dBi, the net power into the feed as provided in ***Table 2*** of 44.52 dBm, and the Safe Far Field Spectral Density of 10 Watts/M^2 from ***Table 1***, a Safe Far Field Spectral Density (Sffsd) chart can be constructed using the following formula:

$$\frac{\sqrt{P * G}}{4Pi} * PD\ in\ Feet$$

Based on this formula, a chart is assembled as shown in ***Figure 2*** that depicts the minimum safe distance from the antenna boresight for Maximum Permissible Exposure (MPE) for general population in an uncontrolled exposure. The minimum safe distance at boresight is 711', with the minimum safe distance at +2' offset from boresight, as shown in the green box. Outside of this green box, the MPE falls quickly to under 2' at antenna boresight.

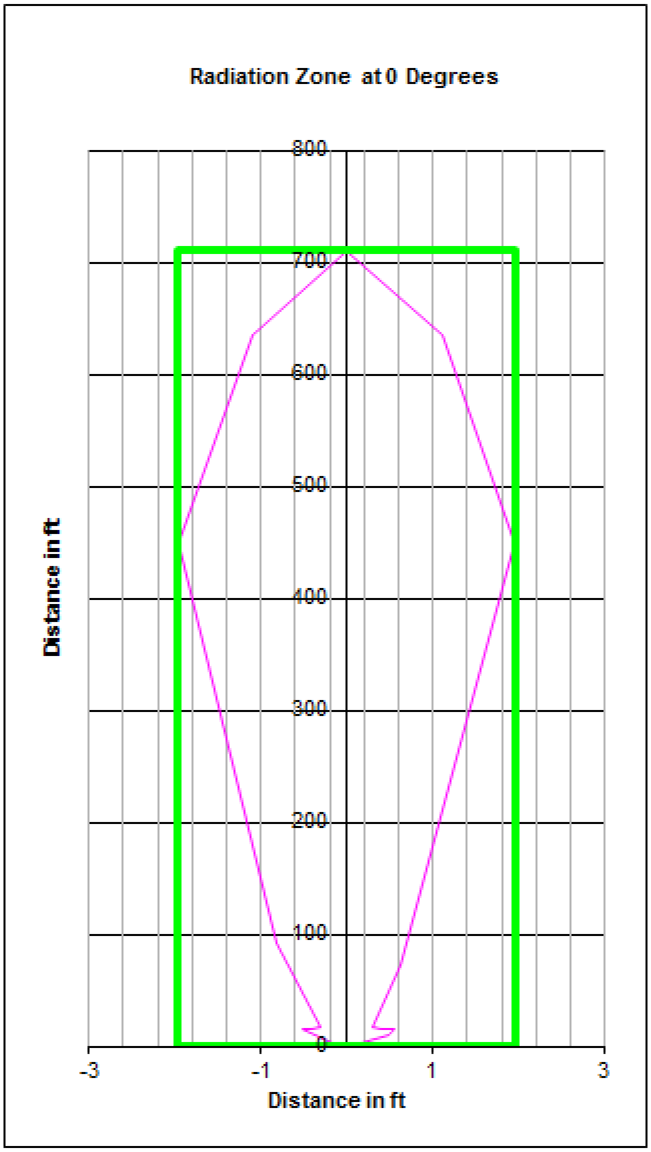


Figure 2. Minimum Safe Distance from Antenna Boresight for MPE in a Uncontrolled Exposure.

Figure 3 is another chart that provides the radiation pattern with the antenna being positioned at its lowest Elevation of 12^{o}.

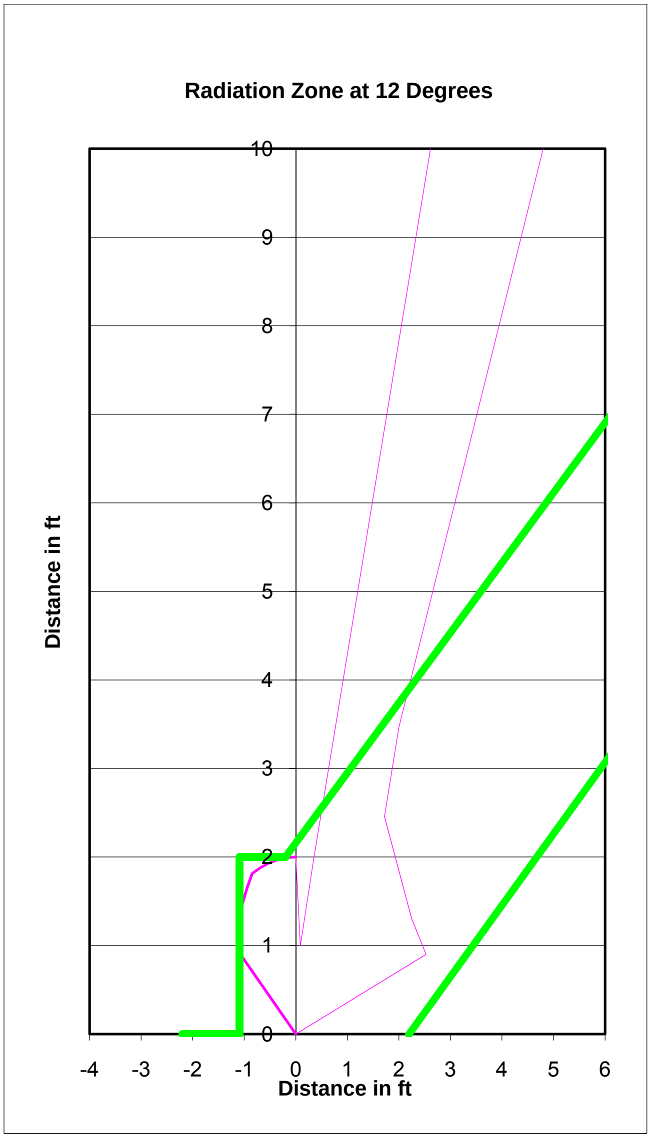


Figure 3. Minimum Safe Distance with the Antenna Positioned at 12^o.

Figure 4 is an artist's rendition[5] of the 3.8 M antenna positioned at its lowest operational elevation of 12^o. The photo is overlaid with an approximate radiation pattern of the main lobe and its significant sidelobes. Notice that the antenna is actually pointed below horizon in order to achieve the minimum beam elevation of 12^o due to the feed being offset by 22.62^o.

Numerical values in feet are illustrated in the drawing; with the most important being the height of the center of the antenna to ground (does not include the height of the pad). This antenna exhibits an excellent main beamwidth characteristic, with the following measured offsets (maximum) at the 3, 10 and 15 dB levels as shown in ***Table 3*** :

[5] Drawing is not to scale. The antenna is a little over 15' but the antenna beam in the safe zone is 711'.

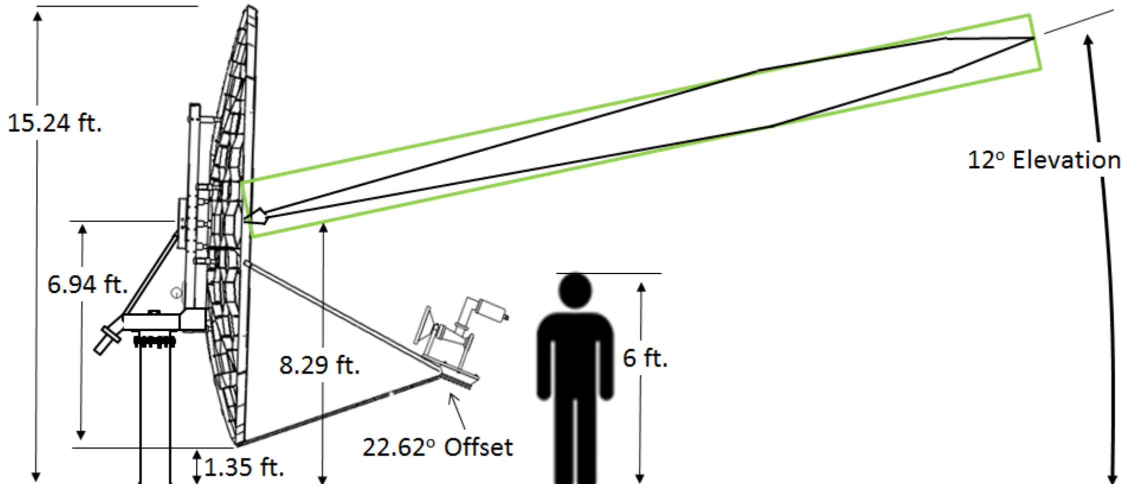


Figure 4. 3.8 M Beam Height with the Antenna Elevation Positioned to 12°.

Table 3. Main Beamwidth (in Degrees) at the 3, 10, and 15 dB Level.

Frequency (GHz)	3 dB Level (in Deg)	10 dB Level (in Deg)	15 dB Level (in Deg)
13.75	0.45	0.72	0.85
14.25	0.43	0.69	0.81
14.50	0.43	0.68	0.79

The first sidelobes also exhibit respectable attenuation patterns from beam peak, as shown in ***Table 4***. Notice that the values are presented in average attenuation in both clockwise and counterclockwise directions referenced to the main beam, in dB. In all cases, the 1st sidelobe occurs well within ±1 Degree from beam center.

Table 4. 1st Sidelobe Performance.

Frequency (GHz)	Average CW (dB)	Average CCW (dB)
13.75	28.3	24.3
14.25	28.8	22.5
14.50	28.5	22.3

This analysis shows that the radiation being emitted from the main beam at the antennas lowest operational elevation (12^o) is far above even the tallest person (8.29' versus 7' person). This value is measured at the antenna main reflector surface. Assuming that a fence is installed that surrounds the antenna a total of 10' from antenna boresight, then the main beam height as measured at the fence surround is calculated as follows:

$$Height\ of\ Main\ Beam\ @\ 10'from\ antenna\ boresight = 12' * Tan\left(12 * \frac{Pi}{180}\right) + 8.29' = \mathbf{10.42'}$$

If the antenna is to be installed where the general public has easy access to, as a safety measure and the limiting of vandalism, it is recommended that the installer of the antenna:

- Install a parameter fence that has a minimum of 20' diameter (10' radius) from the boresight of the antenna with a minimum height of 6'. The fence can consist of many types of materials, including wire mesh (chain link), wood, or plastic.
- Provide four (4) hazardous warning signs as shown in ***Figure 5*** on or near the fence 90^o apart from each other to warn of the potential dangers to nearby personnel.

If the antenna is to be installed in a limited access (protected) environment, then a fence may not be necessary.

2 ANALYSIS

2.1 Far Field Distance Calculation

In the Far Field or Fraunhofer region of the antenna, the power density decreases inversely with the ***square*** of the distance from the main reflector. The distance to the beginning of the far field is shown in ***Table 5*** [6,7]:

Table 5. Distance to the Far Field Region.

Distance to the **Far Field Region**	R_{ff}	$0.6{*}D^2 / \lambda$		
	R_{ff}	$0.6{*}(D_1 D_2) / \lambda$	418.8	m
	R_{ff}		1373	ft

The maximum main beam power density at the beginning of the far field is shown in ***Table 6*** [8].

Table 6. On-Axis Power Density (PD) in the Far Field.

On-Axis Power Density (PD) in the Far Field	S_{ff}	$P\ G / (4\ \pi\ R_{ff}^2)$	3	W/m^2
			0	mW/cm^2

The power density @ -10° from the boresight of the antenna in the Far Field is provided in ***Table 7***.

Table 7. Mainlobe Power Density in the Far Field (10°).

Mainlobe Power Density in the Far Field (10°)	S_{ffsl}	$P\ G / (4\ \pi\ R_{ff}^2)$	0	W/m^2
	S_{ffsl}	$1000\ mW/W\ /\ (10000\ cm^2/m^2)$	0.0	mW/cm^2

2.2 Safe Far Field Distance Calculation

It is important to know the minimum distance from the center of the antenna to where the Uncontrolled Exposure ***Power Density (S)*** in ***(mW/cm²)*** is considered safe. Per FCC OET Bulletin 65, a safe limit for uncontrolled exposure is **1.0 mW/cm²**. For a 0° elevation angle, the minimum distance at which this level is achieved is shown in ***Table 8***:

Table 8. Safe Far Field Distance of Main Beam.

Uncontrolled Exposure ***Power Density (S)*** in ***(mW/cm²)*** is considered safe	Sffsd		1	mW/cm^2
	Sffsd		10	W/m^2
Safe Distance away from Antenna Center	R_{ffsd}	$\sqrt{(P\ G / (4\ \pi\ S_{ffsd}))}$	216.98	m
			711.42	ft

2.3 Near Field Distance Calculation

In the radiating Near Field region, the average power density remains fairly constant at different distances from the antenna, although there are localized energy fluctuations. This area is called the Fresnel Region, or the focusing region of the antenna.

[6] OET Bulletin 65 Edition 97-01 dated August 1997, Formula (16).
[7] D_1 = Width; D_2 = Height
[8] OET Bulletin 65 Edition 97-01 dated August 1997, Formula (18).

The distance to the end of the Near Field is shown in ***Table 9***[9]:

Table 9. Distance to the end of the Near Field.

Extent of the **Near Field**	R_{nf}	$= D^2 / (4\ \lambda)$	
		$= (D_1 D_2) / (4\ \lambda)$	174
			572

The maximum power density in the Near Field is provided in ***Table 10*** [10]:

Table 10. Maximum Power Density in the Near Field.

On-Axis Near Field Power Density	S_{nf}	$= 16\ \eta\ P / (\pi\ D^2)$	6	W/m^2
		1000 mW/W / (10000 cm^2/m^2)	0.6	mW/cm^2

2.4 Transition Region Calculation

The area between the Near and Far Field regions is called the Transition region. Power density in this region decreases inversely with the distance from the antenna. This region extends from R_{nf} to R_{ff}. The power density at a distance R_t in this region can be determined from the following equation (***Table 11***)[11]:

Table 11. Transition Region Power Density.

Transition Region Power Density	S_t	$= S_{nf}\ R_{nf} / R_{t,}$ Rt=Rnf	6	W/m^2
		1000 mW/W / (10000 cm^2/m^2)	0.6	mW/cm^2
		$= S_{nf}\ R_{nf} / R_{t,}$ Rt=Rff	3	W/m^2
		1000 mW/W / (10000 cm^2/m^2)	0.3	mW/cm^2

2.5 Region between Main Reflector and Sub-reflector

This antenna is a prime focus antenna and therefore has no sub-reflector.

2.6 Main Reflector Region

Power Density in the main reflector can be determined from the following equation (***Table 12***)[12]:

Table 12. Power Density at the Main Reflector Surface.

Power Density at Main **Reflector Surface**	S_{mr}	$= 4\ P / A_{surface}$	10	W/m^2
		1000 mW/W / (10000 cm^2/m^2)	1.0	mW/cm^2

2.7 Region between Main Reflector and Ground

Assuming uniform illumination of the main reflector surface, the Power Density between the antenna and the ground can be determined from the following equation (***Table 13***):

[9] OET Bulletin 65 Edition 97-01 dated August 1997, Formula (12).
[10] OET Bulletin 65 Edition 97-01 dated August 1997, Formula (13).
[11] OET Bulletin 65 Edition 97-01 dated August 1997, Formula (17).
[12] OET Bulletin 65 Edition 97-01 dated August 1997, Formula (11).

Table 13. Power Density between Main Reflector and Ground.

Power Density between Reflector and Gnd	S_g	$= 4P / A_{surface}$	10	W/m^2
		1000 mW/W / (10000 cm^2/m^2)	1.0	mW/cm^2

3 CONCLUSIONS

3.1 Conclusions

Table 14 provides a simplified summary of the radiation hazard area. It is recommended that the operator perform radiation flux density measurements around the antenna during typical operation to verify the area of hazard to personnel and ensure that personnel are restricted from entering the hazard area.

Table 14 - Radiation Hazard Area

Radiation Hazard Area	
IF • no elevation limits are used • or if personnel are at or above the level of the antenna	**IF** • elevation limits of **12°** or greater are used • **and** personnel are below the level of the antenna
THEN 1. Keep a distance of **711 ft.** or more 2. This area shall be roped off around the antenna, and radiation hazard signs shall be posted during the operation of this antenna. 3. Operator shall perform measurements to verify hazard area.	**THEN** 1. Keep a distance of **10 ft.** or more 2. Access to this area shall be restricted and radiation hazard signs shall be posted during the operation of this antenna. 3. Operator shall perform measurements to verify hazard area.

3.2 Manufacturer Responsibility

1. The manufacturer shall advise the owner/operator to have or seek sufficient knowledge on the safe operation of radio transmitters.
2. A parameter fence of 20' is recommended to be installed to prevent the general population from getting in close proximity to the antenna to include in front of the antenna feed.
3. The manufacturer shall be responsible for installing permanent RF hazard warning labels on the antenna housing, similar to the one shown in ***Figure 5.***
4. Radiation hazard warnings signs shall be of sufficient size and in clear view of personnel nearby.
5. The manufacturer shall include warnings in the Operation, Installation, and Maintenance Manuals furnished with each antenna system regarding the potential hazard from RF radiation.
6. The manufacturer shall provide safety warnings to the operator regarding reducing or removing elevation restrictions.
7. The manufacturer shall maintain this document particularly if parameters of the transmission system change which could impact safety.
8. If a system is delivered that includes a modem and an antenna system, the manufacturer shall ensure that the system is muted within 3 seconds if it is not locked to a receive signal.
9. The manufacturer shall include warnings that an operational system shall include a modem that mutes its transmitter within 3 seconds if it is not locked to a receive signal.
10. The manufacturer shall provide updated labels and documentation to all customers if the safety information is revised.
11. The manufacturer shall recommend that the operator perform a **radiation safety test** of the areas in which personnel will be located during transmission. If radiation exceeds recommended levels, all transmission shall cease until radiation levels have been corrected.

3.3 Operator Responsibility

1. The operator shall have sufficient knowledge or seek training on the safe operation of radio transmitters.
2. The operator shall adhere to the warnings provided by the manufacturer's labels, manuals, updates, or other documentation.
3. The operator shall keep the labels on the antenna platform in good shape and within clear view of anyone within close proximity.
4. The operator shall ensure that individuals will be prevented from straying within the hazard region (***Table 14***) by means of signs, fencing or caution tape, verbal warnings, and placement of the earth station or other appropriate means so as to minimize the general public from gaining access to the hazardous region.
5. The operator shall perform a visual inspection of the area around the antenna within the hazard area to ensure that all personnel are below the antenna base and removed from the hazard area (***Table 14***) during transmission.

6. The operator shall ensure that the antenna system is configured with elevation restrictions (***Table 14***) that turn off the RF transmission when the antenna elevation falls below the above specified limits.

7. The operator shall ensure that the system mutes its transmitter within 3 seconds if it is not locked to a receive signal.

8. The operator shall perform a **radiation safety test** of the areas in which personnel will be located during transmission. If radiation exceeds recommended levels, all transmission shall cease until radiation levels have been corrected.

NOTE:
If the antenna is mounted in an area that allows the general public to gain access, then a fence is recommended to be installed. However, a fence is not required if the antenna is to be installed in a protected zone such as a rooftop, a gated area, and etc.

Figure 5 - Radiation Hazard Warning Label Sample.

3.4 Actual Implementation of Antenna at Toyon Research

This antenna will actually be installed in a fenced-in area surrounding Toyon Research Corporation's parking lot, as shown in the **X** of ***Figure 6***. Only qualified Toyon personnel are allowed within that fenced area, which is surrounded by an 8' 10" chain link fence having three strings of barbed wire on the top (***Figure 7***). Notice that the dissembled antenna is behind the fence. The antenna will use a non-penetrating ground mount that is also seen on the trailer.

During maintenance, the transmitter to the antenna is muted to prevent trained personnel from being exposed to a potential radiation hazard.

Figure 6. 3.8 Meter Installation Location[13].

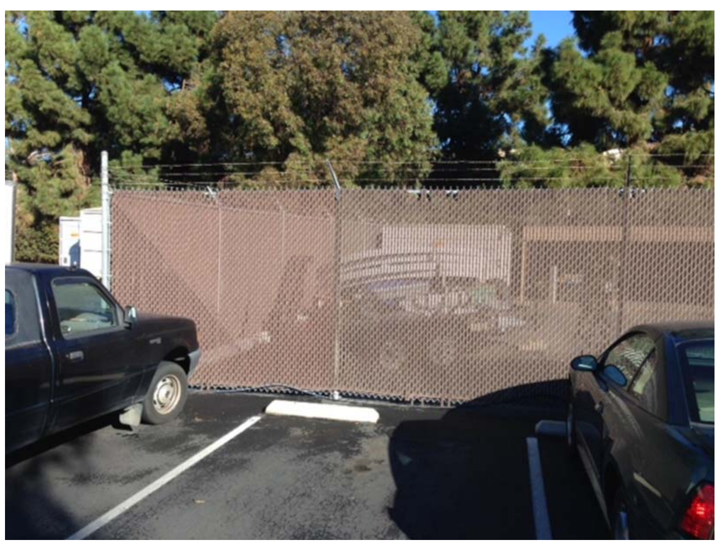


Figure 7. Actual Chain Link Fence Photo.

[13] Courtesy Google Maps.

Figure 8 – Appendix A

PRODELIN

TRANSMIT / RECEIVE ~ NEW SERIES 1385 ~ 3.8m VSAT ANTENNA

Key Features

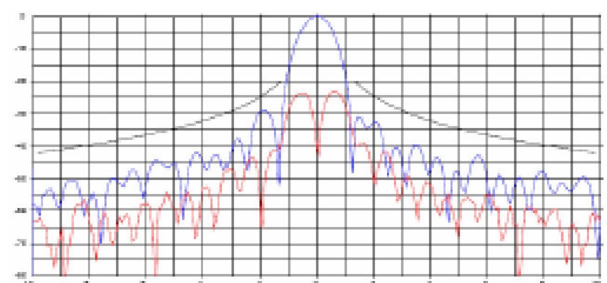
- UPGRADED INTEGRAL RIB DESIGN FOR HIGHER FREQUENCY OPERATION.
- INCREASED STRENGTH FOR HEAVIER RADIO AND ODU EQUIPMENT LOADS.
- HIGHER PRECISION ASSEMBLY AND ALIGNMENT FROM AUTOMATED MANUFACTURING PROCESSES.
- FIELD FRIENDLY INSTALLATION WITHOUT REQUIREMENT FOR SPECIALIZED TOOLS.
- ANTI-ICE CAPABILITY FOR USE IN COLD CLIMATE AND ARCTIC ENVIRONMENTAL CONDITIONS.
- OPTIMIZED, 4-PIECE REFLECTOR DESIGN FOR MAXIMUM SHIPPING EFFICIENCIES.
- UPGRADABLE FOR HIGH XPD PERFORMANCE.

Description

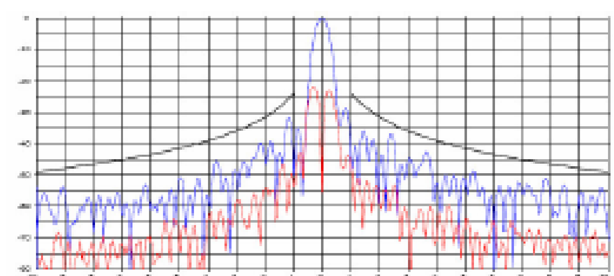
The General Dynamics new series 1385 ~ 3.8m antenna has been designed to provide a reliable, long-life and trouble free antenna solution for demanding applications in the primary VSAT communications bands. Enhancements to this antenna design have improved the structural stability and surface tolerances of the reflector, offering growth potential for reliable communications up to Ka-band.

The antenna has been designed to meet the performance requirements of the major satellite service providers and regulatory agencies.

The mechanical design has been optimized for high efficiency packaging to reduce shipping costs. Material selections for the reflector significantly reduce the risk for shipping damage when compared to metal reflector solutions. Factory pre-assembly of critical components eliminates the requirement for complex assembly procedures in the field.



C-band Azimuth, +/- 10 deg, Coverage (Tx) Band



Ku-band Azimuth, +/- 10 deg, Coverage (Tx) Band

GENERAL DYNAMICS
SATCOM Technologies

CMR Rev 04-2008

PRODELIN®

Series 1385 Transmit / Receive Multi-band 3.8m VSAT Antenna

PARAMETER	C-Band Linear	C-Band Circular	Ku-Band Linear
ELECTRICAL PERFORMANCE			
Antenna Size	3.8M	3.8M	3.8M
Operating Frequency	Rx 3625 - 4200 MHz Tx 5845 - 6425 MHz	3625 - 4200 MHz 5845 - 6425 MHz	10.95-12.75 GHz 13.75-14.50 GHz
Midband Gain (+/-0.2 dB)	Rx 41.8 dB Tx 46.2 dB	42.1 dB 46.0 dB	51.7 dB 53.2 dB
HPBW Nominal mid-band to -3 dB points (degrees)	Rx 1.4 deg Tx 0.9 deg	1.4 deg 0.9 deg	0.5 deg 0.4 deg
Antenna Noise Temperature (at feed flange)			
10°	31K	26K	29K
20°	25K	22K	21K
30°	23K	20K	20K
40°	22K	19K	19K
Sidelobe Envelope Co-pol (Azimuth) (Gain - dBi)			
1° <= θ <= 20°	29 - 25 LOG(θ) (Note)	29 - 25 LOG(θ) (Note)	29 - 25 LOG(θ)
20° < θ <= 26.3°	-3.5 dBi	-3.5 dBi	-3.5 dBi
26.3° < θ <= 48°	32-25 Log (θ)	32-25 Log (θ)	32-25 Log (θ)
48° < θ < 180	<= - 10 dBi averaged	<= - 10 dBi averaged	<= - 10 dBi averaged
Note: In receive portion of C-band only, sidelobe envelope specified from 100λ/D rather than 1°			
Polarization	Linear	Circular	Linear
Feed Interface	Rx CPR 229 Tx CPR 137 or Type N	CPR 229 CPR 137 or Type N	WR 75 or direct radio Connect
Cross Pol Isolation	>30 dB on axis	>17.69 dB on axis	>30 dB on axis
Note: Standard C-band Circular polarizaion in Tx-band provides an axial ratio of of 1.3 (XPD equivalence of 17.69 dB). Optional F-1 station feed available with axial ratio of 1.09 (XPD equivalence >27.2 dB) in Tx band. Call factory when specifying this option.			
VSWR	Tx 1.3:1 Max. (Γ<-17.7dB) Rx 1.5:1 Max. (Γ<-14.0dB)	1.3:1 Max. (Γ<-17.7dB) 1.5:1 Max. (Γ<-14.0dB)	1.3:1 Max. (Γ<-17.7dB) 1.5:1 Max. (Γ<-14.0dB)
MECHANICAL PERFORMANCE			
Reflector Material	Glass Fiber Reinforced SMC. Highly resistant to corrosion, fungus and UV radiation.		
Antenna Optics	Easy-to-assemble, 4-Piece, Offset Fed Prime Focus Design with 0.6 F/D optics.		
Mast Pipe Size	10" SHC 40 Pipe (10.75" OD) 27.3 cm.		
Elevation Adjustment Range	12° to 90° or 0° to 15° for polar latitudes		
Azimuth Adjustment Range	360° Continuous with +/- 35° Fine Adjustment		
Maximum Radio weights	20 lbs on feedboom (unsupported). Call factory for feed stabilizer option when using heavier radios.		
Shipping Specifications	Weight (nominal) 1882 lbs, (855 Kg)		
ENVIRONMENTAL PERFORMANCE			
Wind Loading	Operational Survival	50 mph (80 km/h) 125 mph (201 km/h)	
Temperature	Operational Survival	-40° to 140°F (-40° to 60°C) -50° to 160°F (-46° to 71°C)	
Atmospheric Conditions		Salt, Pollutants and Contaminants as Encountered in Coastal and Industrial Areas	
Solar Radiation		360 BTU/h/ft²	

GENERAL DYNAMICS
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