1. INTRODUCTION

This report is an analysis of the non ionising radiation for a 1.2m Mantis antenna system. This antenna is designed for ground mounting and being deployed only when stationary. The maximum amplifier size that Advent Communications would recommend for use with this antenna is 400W. Smaller amplifiers can of course be fitted.

The Maximum Permissible Exposure (MPE) limits used in this report are from FCC Office of Engineering document OET Bulletin 65 edition 97-01. These specify separate limits for an Occupational Controlled Exposure and a general Population Uncontrolled Exposure as shown in the table below.

Power Density mW/cm^2

Frequency	30-300MHz	.3 to 1.5GHz	1.5-100GHz
Controlled Exposure (6 Min Average)	1	f/300	5
Uncontrolled Exposure (30 Min Average)	.2	f/1500	1

The following table lists the Parameters used in these calculations.

Antenna Diameter		1.2m
Antenna Gain @14.25GHz		43.1dBi
Antenna 1st sidelobe Gain	1.8deg	25.6dBi
Antenna feedline losses		1dB
Antenna Effiiciency		65%
Amplifier Flange Power		350W
Frequency		14.25GHz
Wavelength		.021m

2. ANALYSIS

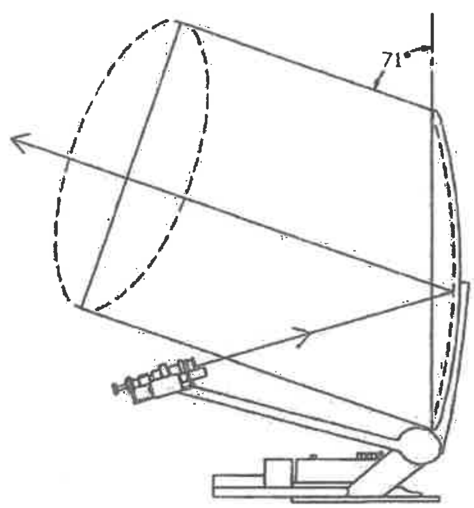
Assumptions

For the purpose of analysis it will be assumed that the worst case exposure would occur in the main beam, and in off axis directions in the 1st sidelobe as this is the highest off axis emission. The 1st sidelobe for this antenna occurs at +/-1.8 degrees from boresight (measured) and from the FCC off axis radiation limits lie below 32-25log1.8deg limit as given in the table in the previous table.

The antenna is designed for ground mounting. A minimum operational deployment angle of 10 degrees will be assumed, with a minimum distance of .6m between the lower edge of the reflector and the ground level. Below this angle the antenna will not deploy properly and transmission should be inhibited.

The calculations are for the final transmit frequency. Other frequencies generated in the uplink system will be below 10mW and be in screened units and cables so should contribute significantly to radiation.

In the area close to the antenna most power will be in the main beam as illustrated below.



For convenience radiation will be calculated in three regions;

1) Near field

This is the field immediately adjacent to the antenna and is usually taken to extend to a distance given by D^2/ (4.λ).

So the extent of the near field is 17.14m

In this region the power density remains fairly constant at different distances from the antenna, although there are localised energy fluctuations.

The on axis near field power density is given by
16ηP/(πD^2)

=79.21mW/cm^2.

2) Transition Region

This is the region between the end of the near field and the start of the far field (below). Power density decreases inversely with distance from the antenna between the near field value and the maximum value in the far field.

3) Far Field

In the far field region of the antenna the power density decreases inversely as the square of the distance from the antenna. The region is assumed to start at a distance 0.6D^2/λ

So the far field starts at 41.14m.

The on axis power density in the far field is given by
PG/(4πr^2)

= 26.69mW/cm^2

The energy density in the 1st sidelobe is

=0.47mW/cm^2

Minimum Uncontrolled Safe Access Limit

Given that this is a ground mounted antenna, uncontrolled access to the boresight field is likely at low elevation angles. From the nearfield calculations above it can be seen that the power density within the main beam exceeds maximum exposure limits. Therefore access to an area in front of the reflector should be prohibited until the main beam is above the level of personnel.

The lower edge of the reflector is .6m above ground level. So the minimum distance in front of the reflector before the beam is greater 2m above ground level is given by

(2m-antenna height)/tan (min elevation) m

= 7.94m

Far Field

From the FCC off axis radiation limit at the maximum antenna gain at an angle of 10 degrees the radiation in the direction of the horizon is calculated..

Gain to the horizon = 32-25log10dBi
= 7dBi

By re-arranging the above equation the minimum safe far field distance for uncontrolled access (an exposure of 1mW/cm^2) is given by
√(PG/(4πS)) (S= Power Density)

= 3.33m from the antenna.

3. CONCLUSIONS

It can be seen that the limiting factor is the power in the nearfield for as long as it is less than 2m above ground level, where accidental exposure would be possible. Therefore it would be necessary to restrict access in front of the antenna for a distance of 8m when operating at minimum elevation angle.

The calculation in the direction of the horizon is difficult because this is based on a far field pattern and the calculation places the limit within the near field zone. However for operation at higher elevation angles, it would be reasonable to restrict uncontrolled access closer than 4m, in the direction directly below the main beam.

If the antenna system is operated in accordance with Advent Communications instructions there should be no risk to either operators or the public if the above guidelines are followed.