RADIATION HAZARD ANALYSIS
1.2 meter EARTH STATION

This analysis calculates the non-ionizing radiation levels due to transmission from the earth station. The Office of Engineering and Technology (OET) Bulletin, No. 65 Edition, specifies that the Maximum Permissible Exposure (MPE) limit for persons in a General Population/Uncontrolled environment to non-ionizing radiation averaged over a thirty minute period, is a power density equal to 1 milli-watt per centimeter squared.

The analysis estimates the maximum power density levels in the vicinity of the antenna for six regions: near field; far field; transition zone; near the reflector surface; between the reflector and the ground; and between the feed mouth and the reflector.

A brief discussion for each region is given below. The attached table shows the assumptions, formulae and calculations for all cases.

1. NEAR FIELD REGION

The near field (or Fresnel region) is essentially an elliptical volume with its axis co-incident with the antenna boresight. The base of this volume is the same as the aperture of the antenna. According to OET Bulletin No. 65, its length is equal to the square of the diameter divided by four times the wavelength. The larger dimension of the antenna (the width) is used in place of the diameter of a circular aperture as a worst case approximation. The maximum value of the on-axis power density is calculated using the equation given in the Bulletin by simply replacing the area of the circular aperture term with the area of the elliptical aperture antenna.

2. FAR FIELD REGION

The far field (or Fraunhofer region) extends outwards from a distance equal to 0.6 times the square of the reflector diameter divided by the wavelength, according to OET Bulletin No. 65. The larger dimension of the antenna (the width) is used in place of the diameter of a circular aperture. Power density varies inversely as the square of the distance. The maximum value of the power density is calculated using the equation given in the Bulletin.

3. TRANSITION REGION

The transition region between the near field and the far field regions will have a power density that essentially decreases inversely with increasing distance. In any case, the maximum power density will not exceed the maximum value calculated for the near field region, for the purpose of evaluating potential exposure.

4. REGION NEAR REFLECTOR SURFACE

The power density in the region near the reflector surface can be estimated as equal to four times the power divided by the area of the reflector surface, assuming that the illumination is uniform and that it would be possible to intercept equal amounts of energy radiated towards and reflected from the reflector surface.

5. REGION BETWEEN REFLECTOR AND GROUND

The power density in the region between the reflector and the ground can be estimated as equal to the power divided by the area of the reflector surface, assuming uniform illumination over the surface of the reflector.

6. REGION BETWEEN THE FEED MOUTH AND REFLECTOR

The radiation from the feed is essentially confined to a conical region whose vertex is located at the feed mouth and extends to the reflector. Power density is maximum at the feed mouth, and can be estimated as four times the output power divided by the area of the feed mouth.

7. RESULTS OF ANALYSIS

The radiation analyses in the following Table was performed using the definitions from the previous sections and assuming nominal operating conditions. As can be seen from this analysis, the terminal exceeds the OET-Bulletin 65 MPE levels in all regions. As such, when the terminal is operating an area sufficiently large surrounding the terminal will be cordoned off and properly marked to ensure that no one enters an area where the maximum MPE would be exceeded.

RADIATION HAZARD ANALYSIS

Nomenclature	Formula	Value	Unit
INPUT PARAMETERS			
D = Antenna Diameter		1.2	meters
d = Diameter of Feed Mouth		0.127	meters
P = Max Power into Antenna		69.2	Watts
η = Apperture Efficiency		61.6	%
Frequency		14	GHz
λ = Wavelength @ 14 GHz		0.021	meters
CALCULATED VALUES			
A = Area of Reflector	pi*D^2/4	1.13	meters^2
l = Length of Near Field	D^2/4λ	16.80	meters
L = Beginning of Far Field	0.6D^2/λ	40.32	meters
G = Antenna Gain @ 14.5 GHz (n=100% max value)	η(pi*D/λ)^2	19055.14	linear
Antenna Gain in dB	10*log(G)	42.80	dBi
a = Area of Feed Mouth	pi*d^2/4	0.01	meters^2

POWER DENSITY CALCULATIONS

Region	Max Power Density In Region		Hazard Assessment
	Formula	Value (W/m^2)	(FCC MPE Limit=50 W/m^2)
1. Near Field	4*η*P/A	150.68	>FCC MPE Limit (See Text)
2. Far Field	G*P/(4*pi*L^2)	64.55	>FCC MPE Limit (See text)
3. Transition	<= Nr Fld Region	150.68	>FCC MPE Limit (See Text)
4. Near Reflector Surface	4*P/A	244.74	>FCC MPE Limit (See Text)
5. Between Reflector and Ground	P/A	61.19	>FCC MPE Limit (See text)
6. Between feed mouth and reflector	4*P/a	21850.87	> FCC Limit (See Text)