RADIATION HAZARD ANALYSIS
EARTH STATION ANTENNA

In accordance with "Evaluation compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields," F.C.C. Office of Engineering and Technology OET Bulletin 65, edition 97-01, released August, 1997, the operation of the earth station will be in compliance with government standards prescribed to protect employees and the public from exposure to excessive levels of non-ionizing radiations as required by 47 C.F.R. Ch. I, Section 1.1307(b). Supporting calculations demonstrate that the earth station will not expose workers nor the public with radio frequency radiation in excess of MPE found in OET Bulletin 56, 4th edition, released August, 1999.

Radiation Hazard and Power Density Calculations as follows:

This analysis calculates the non-ionizing radiation levels due to transmission from the earth station. The maximum level of non-ionizing radiation to which a person may be exposed corresponds to a power density of 50 Watts/meter^2 (or 5mW/cm.^{2}) averaged over any six minute period for confined areas and a power density of 10 Watts/meter^2 (or 1 mW/cm.^{2}) averaged over any thirty minute period for non-confined areas, as derived from OET Bulletin 65, edition 97-01. These are based on MPE limits found in Section 4.1 of , "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," ANSI/IEEE C95.1-1992, Copyright 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017, and approved for use as an American National Standard by the American National Standards Institute (ANSI).
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The analysis estimates the maximum power density levels in the vicinity of the antenna for six regions: near field; transition zone; near the reflector surface; between the reflector and the ground; and between the feed mouth and reflector.

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

1. Near Field Region

The near field (for Fresnel region) is essentially a cylindrical region with its axis co-incident with the antenna boresight. The diameter of this cylinder is equal to that 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 maximum value of the on-axis power density is calculated using the equation given in the bulletin.

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. 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. Transmission Region

The transmission region between the near field and the far field regions will have a power density that essentially decreases inversely as 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 twice 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 even illumination over 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 twice the output power divided by the area of the feed mouth.

The analysis shows that the power density levels will never exceed the ANSI limit even during periods of maximum output, except in the region between the feed and the reflector. To ensure compliance with the ANSI limit, the earth station transmitter will be turned off whenever maintenance and repair personnel are required to work near this potentially hazardous area.

RADIATION HAZARD CALCULATIONS FOR FIXED 3.7 METER EARTH STATION

Nomenclature		**Value Unit**
INPUT PARAMETERS		
D = Antenna Diameter		3.7 Meters
d = Feed Mouth Diameter		0.127 Meters
P = Max power into Antenna		350.0 Watts
n = Apperture Efficiency		0.8 (80% worse case)
k = Wavelength @ 14.5 GHz.		0.0211 Meters
CALCULATED VALUES	**FORMULA**	
A = Area of reflector	$[(pi)D^2]/4$	10.752 Meters^2
l = Length of near field	$[D^2]/4k$	162.204 Meters
L = Start of far field	$[0.6D^2]/k$	389.29 Meters
G = Gain of Antenna @ 14.5 GHz n=.8 for worst case	$n[(pi)(D)/k]^2$	242,789 (@52.8 dBi)
a = Area of feed mouth	$[(pi)(d)^2]/4$	0.0127 Meters^2

RADIATION HAZARD CALCULATIONS FOR FIXED 3.7 METER EARTH STATION

POWER DENSITY CALCULATIONS for 350 watts into antenna WORSE CASE ASSESSMENT

Region	Formula	Value W/m^2	Hazard Assessment ANSI Limit=50 W/m^2
1 Surface	4P/A	130.2 @ ant surface	Potential Hazard
2 Transition	Surf to Nr Fld	130.2 to 416.7	Potential Hazard
3 Near Field	16nP/A	416.7 @ 162.2meters	Potential Hazard
4 Transition	Nr Fld to Far	416.7 to 44.6	Potential Hazard
5 Far Field	$GP/[4(pi)L^2]$	44.6 @ 389.3meters	Potential Hazard
6 Between Subref-feed	2P/a	55,118.1	Potential Hazard

The length of the cone (cylinder) of danger (Clear Zone Length to reduce energy by 20 dB) will be:

X = H/tan(El)

where X = Clear Zone length all directions

H = Height of Human Life Form (2 meters) plus 3.7 meters (ant diameter)

El= Antenna elevation (10 degrees absolute minimum)

X = (5.7)/tan(10) = **33 meters worst case.**

Declaration: Public protection from antenna.
This Temporary-Fixed antenna will be protected from human access as it is to be installed at a limited access location within a confined parking area available only to personnel associated with business commerce. The exact location places the antenna next to a chain-link fence and associated building wall where there is no human traffic. The front and other sides of the antenna is beyond the reach of human personnel and guarded by a construction fence. Antenna access is restricted, locked and available only to authorized personnel. Thus, the antenna location will conform to defined standards. (OET Bulletin 65, Ed. 97-01, August 1997 and OET Bulletin 56, 4th ed. August 1999).