RADIATION HAZARD CALCULATIONS FOR 4.6 meter EARTH STATION

Nomenclature	Formula	Value	Unit
INPUT PARAMETERS			
D = Antenna Diameter		4.6	meters
d = Diameter of Feed Mouth		0.165	meters
P = Max Power into Antenna		300	Watts
n = Apperture Effeciency		65%	
k = Wavelength @ 14.25 GHz		0.0211	meters
CALCULATED VALUES			
A = Area of Reflector	PI*D^2/4	16.619	meters^2
l = Length of Near Field	D^2/4k	251	meters
L = Beginning of Far Field	0.6D^2/k	603	meters
G = Antenna Gain @ 14.25 GHz	n(PI*D/k)^2	306,319	54.9 dBi
a = Area of Feed Mouth	PI*d^2/4	0.0214	meters^2

POWER DENSITY CALCULATIONS

Region	Maximum Power Density in Region		Hazard Assessment (FCC MPE Limit = 5 mW/cm^2)
	Formula	Value (mW/cm^2)	
1 Near Field	4nP/A	4.7	< FCC MPE Limit
2 Far Field	GP/(4(PI)L^2)	2.0	< FCC MPE Limit
3 Transition	<= Nr Fld Region	4.7	< FCC MPE Limit
4 Near Reflector Surface	4P/A	7.2	> FCC MPE Limit (See Text)
5 Between Reflector & Ground	P/A	1.8	< FCC MPE Limit
6 Between Subreflector and Feed	4P/a	5612.1	> FCC MPE Limit (See Text)

RADIATION HAZARD ANALYSIS
4.6 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 specifies that the Maximum Permissible Exposure (MPE) limit for the persons in an Occupational/Controlled environment to non-ionizing radiation averaged over six minutes, is a power density of 5 milli-Watts per meter 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 subreflector.

A brief discusion 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 a cylindrical region with its axis co-incident with the antena 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. TRANSITION REGION

The transition region between the near field and the far field regions will have a power density that maximum essentially decreases inversely as distance. In any case, the maximum power density will not exceed the 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 even illumination over the reflector.

6. REGION BETEEN THE FEED MOUTH AND SUBREFLECTOR

The radiation from the feed is essentially confined to a conical region whose vertex is located at the feed mouth and extends to the subreflector. 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.

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