Radiation Hazard Analysis

Lake Pointe Church

Rockwall, Texas

This analysis predicts the radiation levels around a proposed earth station complex, comprised of one (reflector) type antennas. This report is developed in accordance with the prediction methods contained in OET Bulletin No. 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields, Edition 97-01, pp 26-30. The maximum level of non-ionizing radiation to which employees may be exposed is limited to a power density level of 5 milliwatts per square centimeter (5 mW/cm^2) averaged over any 6 minute period in a controlled environment and the maximum level of non-ionizing radiation to which the general public is exposed is limited to a power density level of 1 milliwatt per square centimeter (1 mW/cm^2) averaged over any 30 minute period in a uncontrolled environment. Note that the worse-case radiation hazards exist along the beam axis. Under normal circumstances, it is highly unlikely that the antenna axis will be aligned with any occupied area since that would represent a blockage to the desired signals, thus rendering the link unusable.

Earth Station Technical Parameter Table

Antenna Actual Diameter	2.4 meters Antenna Surface
Area	4.5 sq. meters Antenna
Isotropic Gain	49.4 dBi Number of Identical
Adjacent Antennas	1
Nominal Antenna Efficiency (ε)	67.50%
Nominal Frequency	14.25 GHz
Nominal Wavelength (λ)	0.0211 meters
Maximum Transmit Power / Carrier	13.7 Watts
Number of Carriers	1
Total Transmit Power	13.7 Watts
W/G Loss from Transmitter to Feed	1.0 dB
Total Feed Input Power	10.90 Watts
Near Field Limit	$R_{nf} = D^2/4\lambda$ =68.40 meters
Far Field Limit	$R_{ff} = 0.6\ D^2/\lambda$ = 164.16 meters
Transition Region	R_{nf} to R_{ff}

In the following sections, the power density in the above regions, as well as other critically important areas will be calculated and evaluated. The calculations are done in the order discussed in OET Bulletin 65.

1.0 At the Antenna Surface

The power density at the reflector surface can be calculated from the expression:

$PD_{refl} = 4P/A =$ **0.964** mW/cm^2 (1)
Where: P = total power at feed, milliwatts
A = Total area of reflector, sq. cm

In the normal range of transmit powers for satellite antennas, the power densities at or around the reflector surface is expected to exceed safe levels. This area will not be accessible to the general public. Operators and technicians should receive training specifying this area as a high exposure area. Procedures must be established that will assure that all transmitters are rerouted or turned off before access by maintenance personnel to this area is possible.

2.0 On-Axis Near Field Region

The geometrical limits of the radiated power in the near field approximate a cylindrical volume with a diameter equal to that of the antenna. In the near field, the power density is neither uniform nor does its value vary uniformly with distance from the antenna. For the purpose of considering radiation hazard it is assumed that the on-axis flux density is at its maximum value throughout the length of this region. The length of this region, i.e., the distance from the antenna to the end of the near field, is computed as Rnf above.

The maximum power density in the near field is given by:

$PD_{nf} = (16\varepsilon P)/(\pi D^2)$ = **0.651** mW/cm² (2)
from 0 to 68.40 meters

Evaluation
Uncontrolled Environment: **Meets Uncontrolled Limits**
Controlled Environment: **Meets Controlled Limits**

3.0 On-Axis Transition Region

The transition region is located between the near and far field regions. As stated in Bulletin 65, the power density begins to vary inversely with distance in the transition region. The maximum power density in the transition region will not exceed that calculated for the near field region, and the transition region begins at that value. The maximum value for a given distance within the transition region may be computed for the point of interest according to:

$PD_t = (PD_{nf})(R_{nf})/R$ = dependent on R (3)
where: PD_{nf} = near field power density
R_{nf} = near field distance
R = distance to point of interest
For: $68.40 < R < 164.2$ meters

We use Eq (3) to determine the safe on-axis distances required for the two occupancy conditions:

Evaluation

Uncontrolled Environment Safe Operating Distance,(meters),
R_{safeu}: 44.5 Controlled Environment
Safe Operating Distance,(meters), R

The on- axis power density in the far field region (PD_{ff}) varies inversely with the square of the distance as follows:

$PD_{ff} = PG/(4\pi R^2)$ = dependent on R (4)
where: P = total power at feed
G = Numeric Antenna gain in the direction of interest relative to isotropic radiator