

RADIATION HAZARD STUDY

SITE: KPHO-TV

KPHO has evaluated the radio frequency environment in and around the proposed earth station and found it to be safe for continuous exposure of operating personnel and the general public.

Only the internal antenna structure, specifically the area between the feedhorn and the dish, shows a radio frequency environment that is considered excessive for continuous exposure of personnel. This area is sufficiently high above ground level that it cannot accidentally be entered without the aid of mechanical equipment.

The supporting calculations that are submitted as part of this study show that the proposed earth station is environmentally safe, not only based on the criteria published in the Occupational Safety and Health Act (OSHA), but also in the light of recent recommendations for stricter control of radio frequency radiation.

1.0 Station Parameters

Antenna Diameter (D) = 2.4 M
Operating Wavelength (λ) = .021 M
Antenna Gain (G) = 48.9 dBi
Transmitter RF Power (P) = 100.0 W (max)

2.0 Summary of Results

RF Power Density - Centerline of Near Field = 4.55 mw/cm²

RF Power Density - Far Field = 1.93 mw/cm²

*RF Power Density - Edge of Near Field = 0.05 mw/cm²

*RF Power Density - Behind Antenna = 0.017 mw/cm²

* The density levels denoted by an asterisk are representative of the maximum radiation environment in or around the proposed earth station to which the general public may be exposed.

3.0 Near Field Evaluation

The earth station antenna that will be employed for this service is designed to focus nearly all of the radiated radio frequency energy into a cylindrical beam with a diameter only slightly larger than that of the antenna dish. Any intrusion into this beam would impair the performance of this earth station. This broadcaster has, therefore, selected a site location for the antenna that will insure that the beam of principle radio frequency radiation is clear of any obstructions, buildings, etc. and cannot accidentally be entered by the general public.

- 3.1 The near field cylindrical projection extends to a distance (d) that is defined by the following relationship:

$$d(\text{nf}) = D^2 / 4\lambda$$

$$d(\text{ff}) = .6D^2 / \lambda$$

For the proposed antenna, the near field extends, therefore, to a distance of:

$$68.40 \text{ meters}$$

And the far field extends, therefore, to a distance of:

$$164.16 \text{ meters}$$

- 3.2 The maximum radio frequency power density within this near field cylinder is a function of the antenna diameter and transmitter power as follows:

$$W(\text{nf}) = 9.6P / \pi D^2$$

For the proposed earth station, the maximum power density in the near field was computed not to exceed:

$$4.55 \text{ mw/cm}^2$$

- 3.3 At the edge of the near field cylindrical beam, 0.7 antenna diameter removed from its center, the power density is attenuated at least 20 dB to 1/100th of the maximum near field power. The power along the outside edge of the beam will, therefore, not exceed:

$$0.046 \text{ mw/cm}^2$$

4.0 Far Field Evaluation

Beyond the near field region, the cylindrical beam begins to spread gradually into a slightly tapered cone in accordance with the published radiation pattern for the proposed antenna. The specified antenna gain is realized and the radiated power density decreases proportionally to the inverse square of distance from the antenna.

- 4.1 For the purpose of determining the maximum power density within the far field, this broadcaster has conservatively assumed that the full antenna gain is already realized at the limit of the near field cylindrical region. The radio frequency power density in the far field region is given by:

$$W(\text{ff}) = PG/4\pi d^2$$

For the proposed earth station, the maximum radiated power at the point of transition between the near field and far field regions was computed not to exceed:

$$1.93 \text{ mw/cm}^2$$

5.0 Off-Axis Evaluation

The proposed antenna meets or exceeds the performance specifications under part #25 of the FCC rules. The off-axis gain of this antenna is, therefore, - 10dBi or less in any direction more than 48° removed from the centerline of the main beam.

- 5.1 The off-axis power density may be conservatively evaluated using the far field method of computation:

$$W(\text{OA}) = 0.1P/4\pi d^2$$

Assuming a distance of 2 meters from the antenna, the density was calculated to be:

$$0.017 \text{ mw/cm}^2$$

6.0 Summary

- 6.1 The computed values for near field projection distance, RF power density at the centerline, RF power density in the far field, RF power density at the edge of the near field, and RF power density behind the antenna are furnished by the Engineering Department.
- 6.2 Radiation calculations verify that the actual levels, which are accessible to the general given the system design, do not exceed the OSHA maximum of $5\text{mw}/\text{cm}^2$ with-in the off-axis access areas of the system.

SPECIFICATIONS

Type 243 2.4 m Ku-band RxTx Class III Antenna System

Type Approval Information

Antenna Model	62 - 2435611
Intelsat Standard	Standard G & K-3 (IESS 601)
Approval Code	IA057B00

(See Our Website for a Complete List of Type Approvals)

RF Performance

Effective Aperture	2.4 m (96 in)
Operating Frequency	Tx 13.75 - 14.50 GHz Rx 10.70 - 12.75 GHz
Polarization	Linear, Orthogonal
Gain (± 2 dBi)	Tx 48.9 dBi @ 14.3 GHz Rx 47.4 dBi @ 12.0 GHz
3 dB Beamwidth	Tx 0.59° @ 14.3 GHz Rx 0.71° @ 12.0 GHz
Sidelobe Envelope (Tx, Co-Pol dBi)	1° < θ < 20° 29 - 25 Log θ 20° < θ < 26.3° -3.5 26.3° < θ < 48° 32 - 25 Log θ 48° < θ < 180° -10
Antenna Cross-Polarization	30 dB on Axis 26 dB in .5 dB Contour
Antenna Noise Temperature	10° El 55° K 20° El 46° K 30° El 45° K
VSWR	Tx 1.3:1 Rx 1.5:1
Isolation (Port to Port)	Tx 80 dB Rx 35 dB
Feed Interface	Tx WR75 Flat Flange Rx WR75 Flat Flange

(All specifications typical)

Mechanical Performance

Reflector Material	Glass Fiber Reinforced Polyester
Antenna Optics	Two-Piece Offset Feed Prime Focus
Mount Type	Elevation over Azimuth
Elevation Adjustment Range	10° - 90° Continuous Fine Adjustment
Azimuth Adjustment Range	360° Continuous $\pm 12^\circ$ Fine Adjustment
Feed Support	Rectangular Section with Alignment Legs
Mast Pipe Interface	168 mm (6.63 in) Diameter
Wind Loading	Operational 80 km/h (50 mph) Survival 200 km/h (125 mph)
Temperature	-50°C to 80°C
Humidity	0 to 100% (Condensing)
Atmosphere	Standard Hardware Meets 500 Hour Salt Spray Test Requirements (ASTM B-117)
Solar Radiation	360 BTU/h/ft ²
Shock and Vibration	As Encountered During Shipping and Handling

