Radiation Hazard Analysis

INTRODUCTION

The following radiation hazard analysis for the proposed antenna is based on the guidelines set forth in OET Bulletin 65, edition 97-01. From Bulletin 65, the maximum permissible exposure (MPE) limit for occupational/controlled exposure MPE has a power density limit of 5 mW/cm^2 for the proposed transmit band of 1610 – 1618.725 MHz and when averaged over a 6 minute period.

The proposed 1.2 meter antenna will be operated in a controlled area not open to the public. The proposed antenna is located on the Globalstar Gateway site near Clifton, TX. The entire site is enclosed by an 8 foot high chain link security fence with 24 hour per day controlled access. The proposed antenna is located well inside the secure area over 200 feet from the security fence surrounding the site perimeter.

NEAR-FIELD

The extent of the Fresnel region or near-field, is defined by the equation $R_{nf} = D^2/(4*\lambda)$, where D is the diameter of 1.2 meters and λ is the transmit frequency wavelength of 0.185 meters. Therefore,

$$R_{nf} = (1.2m)^2/(4*0.185m) = 1.95 \text{ meters.}$$

The maximum power density in the near field is defined by the equation $S_{nf} = 16*\eta*P/(\pi*D^2)$, where η is the antenna aperture efficiency of 40%, P is the power at the antenna input flange of 2 watts, and D is the antenna diameter of 1.2 meters.

$$S_{nf} = 16*0.4*2000mW/(\pi*(120cm)^2) = 0.283 \text{ mW/cm}^2,$$

which is below the maximum allowable exposure level of 5 mW/cm^2.

FAR-FIELD

The distance to the point where the far-field begins is defined by the equation $R_{ff} = 0.6*D^2/\lambda$, where D is the diameter of 1.2 meters and λ is the transmit frequency wavelength of 0.185 meters. Therefore,

$$R_{ff} = 0.6*(1.2m)^2/0.185m = 4.67 \text{ meters.}$$

The far-field on axis power density is defined by the equation $S_{ff} = P*G/(4*\pi*R_{ff}^2)$, where P is the power at the antenna input flange of 2 watts, and G is the antenna transmit gain of 21 dBi, and R_{ff} is the distance to the beginning of the far-field of 4.67 meters. Therefore,

$$S_{ff} = 2000mW*10^{2.1}/(4*\pi*(467cm)^2) = 0.0918\ mW/cm^2,$$

which is below the maximum allowable exposure level of 5 mW/cm^2.

TRANSITION ZONE

The maximum power density in the transition zone is defined by the equation $S_t = S_{nf}*R_{nf}/R_d$, where S_{nf} is the maximum near-field power density, R_{nf} is the near field extent of 1.95 meters. And R_d is the distance to a point in the transition zone. Using a mean distance of 3.31 meters for R_d,

$$S_t = 0.283mW/cm^2*1.95m/3.31m = 0.167\ mW/cm^2,$$

which is below the maximum allowable exposure level of 5 mW/cm^2.

ANTENNA SURFACE

The maximum power density in front of the antenna reflector (e.g., at the antenna surface) can be approximated by the equation $S_{surface} = 4P/A$, where P is the power at the antenna input flange of 2 watts, A is the main reflector area or $\pi*(D/2)^2$, and D is the antenna diameter of 1.2 meters.

$$S_{surface} = 4*4*P/ (\pi*D^2) = 16*2000mW/(\pi*(120cm)^2) = 0.705\ mW/cm^2,$$

which is below the maximum allowable exposure level of 5 mW/cm^2.

CONCLUSION

The preceding analysis follows OET Bulletin 65 and demonstrates that harmful levels of radiation do not exist above the maximum permissible exposure level of 5 mW/cm^2 for a controlled access area that may be occupied by operation and maintenance personnel.