RADIATION HAZARD STUDY

This radiation hazard study describes the R.F. radiation environment of a temporary fixed Ku-band uplink. This transportable earth station uplink will be utilized thru out the US.

This study is done to comply with the requirements of Section 1.1307(b) of the rules of the Federal Communications Commission. All calculations conform to the proceedures presented in OET Bulletin No. 65 for aperature antennas.

Transmit antenna: Advent/Mantis 1.9 meter KU-band

Antenna Diameter $D := 1.9 \cdot m$

Antenna Efficency $\eta := 67 \cdot \%$

Transmitter: 400 watt output flange SSPA, operated at 100% power

Transmit Power $P := 400 \cdot watt \cdot 100 \cdot \%$

$P = 400 \cdot watt$

$mw := \frac{watt}{1000}$

	at 14.0 GHz	at 14.5 GHz
Antenna Gain	$G_1 := 47.10$	$G_2 := 47.30$
Wavelength	$\lambda_1 := 2.14285 \cdot cm$	$\lambda_2 := 2.06896 \cdot cm$

Calculations for the Near Field (Fresnel Region)

Extent of the Near Field

$$R_{n1} := \frac{D^2}{4 \cdot \lambda_1} \qquad R_{n2} := \frac{D^2}{4 \cdot \lambda_2}$$

$$R_{n1} = 42.117 \cdot m \qquad R_{n2} = 43.621 \cdot m$$

Maximum Near Field Power Density

$$S_n := \frac{16 \cdot \eta \cdot P}{\pi \cdot D^2}$$

$$S_n = 37.809 \cdot \frac{mw}{cm^2}$$

Calculations for the Far Field (Fraunhofer Region)

	at 14.0 GHz	at 14.5 GHz
Distance to Far Field	$R_{f1} := \frac{0.6 \cdot D^2}{\lambda_1}$	$R_{f2} := \frac{0.6 \cdot D^2}{\lambda_2}$
	$R_{f1} = 101.08 \cdot m$	$R_{f2} = 104.69 \cdot m$
Absolute Gain of Antenna	$G_{a1} := 10^{\frac{G_1}{10}}$	$G_{a2} := 10^{\frac{G_2}{10}}$
Maximum Far Field Power Density	$S_{f1} := \frac{P \cdot G_{a1}}{4 \cdot \pi \cdot R_{f1}^2}$	$S_{f2} := \frac{P \cdot G_{a2}}{4 \cdot \pi \cdot R_{f2}^2}$
	$S_{f1} = 15.978 \cdot \frac{mw}{cm^2}$	$S_{f2} = 15.597 \cdot \frac{mw}{cm^2}$

Calculations for the Transition Zone

The farthest point in the near field is the beginning of the transition zone -

$$R_{t1} := R_{n2}$$

$$R_{t1} = 43.621 \cdot m$$

The end of the Transition Zone is the beginning of the Far Field -

$$R_{t2} := R_{f2}$$

$$R_{t2} = 104.69 \cdot m$$

	Beginning	End
Transition Zone Power Density	$S_{t1} := \frac{S_n \cdot R_{n2}}{R_{t1}}$	$S_{t2} := \frac{S_n \cdot R_{n2}}{R_{t2}}$
	$S_{t1} = 37.809 \cdot \frac{mw}{cm^2}$	$S_{t2} = 15.754 \cdot \frac{mw}{cm^2}$

Calculations at the Reflector Surface:

Area of Reflector $A := \pi \cdot \left(\frac{D}{2}\right)^2$

$A = 2.835 \cdot m^2$

Power Density at the Reflector Surface $S_{ref} := \left(4 \cdot \frac{P}{\quad}\right)$.

$S_{ref} = 56.432 \ \frac{mw}{cm_2}$

Calculations between the Antenna and the Ground:

Power Density between Antenna and Ground $S_{ga} := \frac{P}{A}$

$S_{ga} = 14.108 \cdot \frac{mw}{cm^2}$

Conclusions

Based upon the above analysis, it is concluded that harmful levels of radiation may exist in those regions noted for both the Controlled and Uncontrolled environment.

The earth station will be surrounded by a barrier, which will restrict any public access. The earth station will be marked with standard radiation hazard warnings, as well as the area in the vicinity of the earth station to inform those in the general population, who might be working or otherwise present in or near the direct path of the main beam.

The applicant will ensure the main beam of the antenna will be pointed at least one diameter away from any building, or other obstacles in those areas that exceed the MPE levels. Since one diameter removed from the center of the main beam will lower levels by at least 20 dB, or by a factor of 100, these potential hazards do not exist for either the public,or for the earth station personnel.

Finally, the earth station's operating personnel will not have access to areas that exceed the MPE levels, while the earth station is in operation. The transmitter will be turned off during periods of maintenance, so that the MPE standard of 5.0 mW/cm² will be complied with for those regions in close proximity to the main reflector, which could be occupied by operating personnel.