Radio Frequency Radiation Hazard Study

Statement of Compliance

Antenna Operational Data:

- Frequency Band = KU (Transmit / Receive)
- Antenna Diameter = 2.4 meters
- Maximum Antenna Gain = 49.0 dBi
- Power fed to antenna = 500 watt maximum (via two 250 watt HPAs)
- Antenna Aperture efficiency = 0.597

The calculations that appear on pages 2-8 are based on a maximum power output of 500 watts (both HPAs active) using OET Bulletin 65 Section 2 formulas.

Because this transmission system will be operated in the state of Alaska, Far-Field Signal Densities were calculated using antenna elevation angles of 1, 5, and 10 degrees. In reference to RFR Study pages 2-8, you will see that if the elevation angle is 1 degree a minimum distance of 79.3 meters will be maintained by the general public by the use of markers and barricades to insure that human exposure to the RF field is within the 1 mW/cm^2 “general population/uncontrolled” limit. To maintain the “occupational/controlled” field-density of 5 mW/cm^2 the use of the above mentioned markers will be implemented. To further insure that the occupants of the mobile facility will not be exposed to field densities greater that 5 mW/cm^2, the truck/antenna will be positioned such that the near-field will be orientated away from human exposure, such as is practical and safe for the public, and truck personnel.

For elevation angles of 10 degrees and greater, the minimum distance becomes 1.995 meters. The antenna is mounted on the roof of the vehicle at a height of 3.96 meters above ground level. This insures that human exposure to the far-field will always be within, or exceed, the 1 mW/cm^2 guideline. (Reference RFR Study page 8.)

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For : KTUU-TV
New Mobile Satellite Earth Station

Enter Power fed to antenna:	$P := 500\cdot watt$
Enter Diameter of the antenna:	$D := 2.4m$
Enter Frequency:	$f := 14.50GHz$
Enter antenna Gain (dBi) :	$G := 49.0$

$r := \frac{1}{2}\cdot D$ $A := \pi\cdot r^2$ (Area of antenna)

$G' := 10^{\frac{G}{10}}$ *(Convert Gain in dBi to real number)*

$\lambda := \frac{C}{f}$

$$\eta := \frac{\frac{G'\cdot\lambda^2}{4\cdot\pi}}{\frac{\pi\cdot D^2}{4}}$$

$\eta = 0.597$ Calculated aperture efficiency.

$S_{surface} := \frac{4\cdot P}{A}$	$S_{surface} = 44.21\frac{mW}{cm^2}$	Maximum power density at the antenna surface.
$R_{nf} := \frac{D^2}{4\cdot\lambda}$	$R_{nf} = 69.648m$	Extent of Near-Field.
$S_{nf} := \frac{16\cdot\eta\cdot P}{\pi\cdot D^2}$	$S_{nf} = 26.406\frac{mW}{cm^2}$	Maximum Near-Field power density.
$R_{ff} := \frac{0.6D^2}{\lambda}$	$R_{ff} = 167.156m$	Distance to beginning of the Far-Field.
$T_r := R_{ff} - R_{nf}$	$T_r = 97.507m$	**Transition Region**

Define special variables

$mW \equiv \frac{watt}{10^3}$ $C \equiv 299792458\frac{m}{sec}$

Radio Frequency Radiation Hazard Study

Statement of Compliance

Set R= Point of Interest in the Transition Region: $R := 79.3m$

Enter Dish Elevation Angle: $\theta := 1.00 \text{ deg}$

$$G'' := (32 - 25 \cdot \log(\theta))$$

$$G_\theta := 10^{\frac{G''}{10}}$$ *(Convert Gain in dBi to Real Number)*

$$S_t := \frac{S_{nf} \cdot R_{nf}}{R}$$ $$S_t = 23.192 \frac{mW}{cm^2}$$ Power density in the Transition region.

$$S_{ff} := \frac{P \cdot G_\theta}{4 \cdot \pi \cdot R^2}$$ $$S_{ff} = 1.003 \frac{mW}{cm^2}$$ Power density On-Axis.

Set R= Point of Interest in the Transition Region: $R := 10.57m$

Enter Dish Elevation Angle: $\theta := 5.00\,deg$

$G'' := (32 - 25 \cdot \log(\theta))$

$G_\theta := 10^{\frac{G''}{10}}$ *(Convert Gain in dBi to Real Number)*

$S_t := \frac{S_{nf} \cdot R_{nf}}{R}$ $S_t = 173.995 \frac{mW}{cm^2}$ Power density in the Transition region.

$S_{ff} := \frac{P \cdot G_\theta}{4 \cdot \pi \cdot R^2}$ $S_{ff} = 1.01 \cdot \frac{mW}{cm^2}$ Power density On-Axis.

Radio Frequency Radiation Hazard Study
Statement of Compliance

Set R= Point of Interest in the Transition Region: $R := 4.45 m$

Enter Dish Elevation Angle: $\theta := 10.00 \, deg$

$$G'' := (32 - 25 \cdot \log(\theta))$$

$$G_\theta := 10^{\frac{G''}{10}}$$ *(Convert Gain in dBi to Real Number)*

$$S_t := \frac{S_{nf} \cdot R_{nf}}{R}$$

$$S_t = 413.286 \frac{mW}{cm^2}$$ Power density in the Transition region.

$$S_{ff} := \frac{P \cdot G_\theta}{4 \cdot \pi \cdot R^2}$$

$$S_{ff} = 1.007 \frac{mW}{cm^2}$$ Power density On-Axis.

Radio Frequency Radiation Hazard Study

Statement of Compliance

Set R= Point of Interest in the Transition Region: $R := 35.5m$

Enter Dish Elevation Angle: $\theta := 1.00\ \text{deg}$

$$G'' := (32 - 25 \cdot \log(\theta))$$

$$G_\theta := 10^{\frac{G''}{10}}$$ *(Convert Gain in dBi to Real Number)*

$$S_t := \frac{S_{nf} \cdot R_{nf}}{R}$$

$$S_t = 51.806 \frac{mW}{cm^2}$$ Power density in the Transition region.

$$S_{ff} := \frac{P \cdot G_\theta}{4 \cdot \pi \cdot R^2}$$

$$S_{ff} = 5.004 \frac{mW}{cm^2}$$ Power density On-Axis.

Set R= Point of Interest in the Transition Region: $R := 4.75m$

Enter Dish Elevation Angle: $\theta := 5.00\ deg$

$$G'' := (32 - 25 \cdot \log(\theta))$$

$$G_\theta := 10^{\frac{G''}{10}}$$ *(Convert Gain in dBi to Real Number)*

$$S_t := \frac{S_{nf} \cdot R_{nf}}{R}$$ $$S_t = 387.184 \frac{mW}{cm^2}$$ Power density in the Transition region.

$$S_{ff} := \frac{P \cdot G_\theta}{4 \cdot \pi \cdot R^2}$$ $$S_{ff} = 5 \cdot \frac{mW}{cm^2}$$ Power density On-Axis.

Set R= Point of Interest in the Transition Region: $R := 1.995m$

Enter Dish Elevation Angle: $\theta := 10.00\,deg$

$$G'' := (32 - 25 \cdot \log(\theta))$$

$$G_\theta := 10^{\frac{G''}{10}}$$ *(Convert Gain in dBi to Real Number)*

$$S_t := \frac{S_{nf} \cdot R_{nf}}{R}$$ $$S_t = 921.866 \frac{mW}{cm^2}$$ Power density in the Transition region.

$$S_{ff} := \frac{P \cdot G_\theta}{4 \cdot \pi \cdot R^2}$$ $$S_{ff} = 5.01 \cdot \frac{mW}{cm^2}$$ Power density On-Axis.