RF Radiation Hazard Analysis

PSSI K46 2.4m

Antenna Diameter (D) = 2.4 meters, 240 cm
Antenna Surface Area (SA) = 4.524 m², 45240.00 cm²
Sub-reflector Diameter (DS) = N/A
Sub-reflector Surface Area (AS) = N/A
C-Band Wavelength at 14.250 GHz Center Band, LAMBDA = .021 meters, 2.1 cm
Power at output at HPA = 400 watts
Path Loss to OMT (IL) = 1.25 dB
Power at OMT Flange (P) = 300 watts
Antenna Gain at 6.1750 GHz (G) = 48.0 dBi
Antenna Gain given in Power Ratio (GES) = $6.3095\text{-}10^{4}$
Antenna Aperture Efficiency (N) = .627 or 62.7%

Region	*Radiation Level*	*Hazard Assessment*
Far Field (RF) = 16,457 cm, 164.57 meters	5.5616 mW/cm²	Potential Hazard
Near Field (RN) = 6857cm, 68.57meters	16.6 mW/cm²	Potential Hazard
Transition Region (RT) ≤	16.6 mW/cm²	Potential Hazard
Sub-Reflector Region (WS)	0 mW/cm²	Potential Hazard
Main Reflector Region (WM)	26.5 mW/cm²	Potential Hazard
Power Density between Reflector and Ground	6.63 mW/cm²	Potential Hazard
Power Density between Reflector Edge and Ground	0.0276 mW/cm²	Satisfies ANSI

Conclusion:

Based on the above analysis, harmful areas of radiation do exist in areas around the antenna and in the path of the antenna toward the satellite that it is pointed. The area occupied by the general public, "uncontrolled environment", will not exceed the ANSI limit of 1mW/cm² because precautions will be taken to warn, educate and limit the access of personnel around the areas of the antenna and its path that may pose a radiation hazard. The bottom edge of the antenna, which is mounted on top of a truck, is 12 feet high when deployed which moves the hazard away from the public. Normal look angles for domestic operation move the potential hazard even further away from the general public. As well during operation no maintenance personnel or public will be able to have access to the main reflector area. This area has the greatest concentration of radiation, but fortunately is not accessible during operation due to the operational angle of the antenna and the height above ground level. In addition the antenna will be marked with the standard radiation hazard signs. The warning signs will warn personnel to avoid the area around and in front of the reflector when the transmitter is operational. To ensure compliance with safety limits, the Earth Station transmitters will be turned off and marked to remain off whenever maintenance and repair personnel are required to work in the areas of potential hazard as defined in the above study. Additionally, all Earth Station personnel will be trained to insure that the antenna path is clear at all times while the transmitter is in operation.

Note: See the following sheet for how the above calculations were made.

Analysis of Non-Ionizing Radiation

PSSI K46 2.4m – Supporting Calculations

Antenna Diameter, (D) = ………………	D = 2.4 m D = 240 cm
Antenna Surface Area, (Sa) =…………	$Sa = \pi \cdot (D \cdot D/4)$ Sa = 4.524 sq m Sa = 45240.00 cm²
Sub Reflector Diameter, (Ds) =………..	Ds = 0 m Ds = 0 cm
Sub Reflector Area, (As) =…………….	$As = \pi \cdot (Ds \cdot Ds/4)$ As = 0 m² As = 0 cm²
Center Frequency, (Cf) =………………	Cf = 14.250 GHz
Wavelength at (Cf), (λ) =……….	λ = .021 meters λ = 2.1 cm
Transmit Power at HPA Flange, (P1) =...	P1 = 400 Watts $P2 = \log(P1) \cdot 10$ P2 = 26.02 dBw
Path Loss from HPA to OMT, (Loss) =...	Loss = .25 dB
HPA Back off from Saturation, (Loss2) =.	Loss 2 = 1.0 dB
Power at OMT, (P) =……	P3 = P2-Loss-Loss2 P3 = 24.77 dBw (OMT power in dBw) $P = 10^{P3/10}$ P = 300.00 Watts (OMT in Watts)
Antenna Gain at (Cf), (Gain) =…………	Gain = 48.00 dBi
Antenna Gain/ Power Ratio, (Ges) =…...	$Ges = 10^{Gain/10}$ $Ges = 6.3095\text{-}10^{4}$ Ratio
Antenna Aperture Efficiency, (n) =…….	n = .627 or n = 62.7%

Far Field (Rf) = $Rf = (0.6 \cdot (D \cdot D))/\lambda$ Rf = 164.57 meters   Rf = 16,457 cm

Far Field Pwr Density (Wf) = $Wf = (Ges \cdot P)/4 \cdot \pi \cdot (Rf \cdot Rf)$ Wf = 0.0055616 W/cm²   Wf = 5.5616 mW/cm²

Near Field (Rn) = $Rn = (D \cdot D)/4 \cdot \lambda$ Rn = 6857 cm

Near Field Pwr Density (Wn) = $Wn = ((16 \cdot n \cdot P)/\pi \cdot (D \cdot D))$ Wn = 0.0166 W/cm²   Wn = 16.6 mW/cm²

Transition Region (Rt) = $Rt = Wn \cdot 1$ $Rt \leq 16.6$ mW/cm²

Pwr Density at Sub Reflector (Ws) = $Ws = (4 \cdot P)/As$ Ws = 0 W/cm²   Ws = 0 mW/cm²

Main Reflector Region Pwr Density (Wm) = $Wm = (4 \cdot P)/Sa$ Wm = 0.0265 W/cm²   Wm = 26.5 mW/cm²

Pwr Density / Main Reflector and Ground (Wg) = $Wg = (P/Sa)$ Wg = 6.63 mW/cm²

Pwr Density / Reflector Edge and Ground (WI) = $WI = Wg/D$ WI = 0.0276 mW/cm²