RF Radiation Hazard Analysis

PSSI CK32 4.5

Antenna Diameter (D) = 4.5 meters, 450 cm
Antenna Surface Area (SA) = 159043.0 sq. cm
Sub-reflector Diameter (DS) = 0 cm
Sub-reflector Surface Area (AS) = 0 sq. cm
C-Band Wavelength at 6.175 GHz Center Band, LAMBDA = .049 meters, 4.90 cm
Power at output at HPA = 500 watts
Path Loss to OMT (IL) = 3.15 dB
Power at OMT Flange (P) = 241.55 watts
Antenna Gain at 6.1750 GHz (G) = 46.9 dBi
Antenna Gain given in Power Ratio (GES) = 4.8977E+4
Antenna Aperture Efficiency (N) = .627 or 62.7%

Region	*Radiation Level*	*Hazard Assessment*
Far Field (RF) = 24796 cm, 247.96 meters	1.5312 mW/cm^2	Potential Hazard
Near Field (RN) = 10331 cm, 103.31 meters	3.809 mW/cm^2	Potential Hazard
Transition Region (RT) ≤	3.809 mW/cm^2	Potential Hazard
Sub-Reflector Region (WS)	0 mW/cm^2	Satisfies ANSI
Main Reflector Region (WM)	3.037 mW/cm^2	Potential Hazard
Power Density between Reflector and Ground	1.5187 mW/cm^2	Potential Hazard
Power Density between Reflector Edge and Ground	0.3375 mW/cm^2	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/cm^2 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 is 8 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, operation or public will be able to have access to the area around the sub-reflector region. 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 CK30 4.6 – Supporting Calculations

Antenna Diameter, (D) = ………………	D = 4.5 m D = 450 cm
Antenna Surface Area, (Sa) =…………	$Sa = \pi \cdot (D \cdot D/4)$ Sa = 15.9043 sq. m Sa = 159043.0 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 = 6.175 GHz
Wavelength at (Cf), (λ) =……….	λ = .049 meters λ = 4.9 cm
Transmit Power at HPA Flange, (P1) =...	P1 = 500 Watts $P2 = \log(P1) \cdot 10$ P2 = 26.98 dBw
Path Loss from HPA to OMT, (Loss) =...	Loss = .65 dB
HPA Back off from Saturation, (Loss2) =.	Loss 2 = 2.5 dB
Power at OMT, (P) =……	P3 = P2-Loss-Loss2 P3 = 23.83 dBw (OMT power in dBw) $P = 10^{P3/10}$ P = 241.55 Watts (OMT in Watts)
Antenna Gain at (Cf), (Gain) =…………	Gain = 46.9 dBi
Antenna Gain/ Power Ratio, (Ges) =…...	$Ges = 10^{Gain/10}$ Ges = 4.8977-10^4 Ratio
Antenna Aperture Efficiency, (n) =…….	n = .627 or n = 62.7%

Far Field (Rf) = $Rf = (0.6 \cdot (D \cdot D))/\lambda$ Rf = 247.96 meters   Rf = 24796 cm

Far Field Pwr Density (Wf) = $Wf = (Ges \cdot P)/(4 \cdot \pi) \cdot (Rf \cdot Rf)$ Wf = 0.0015312 W/cm²   Wf = 1.5312 mW/cm²

Near Field (Rn) = $Rn = (D \cdot D)/4 \cdot \lambda$ Rn = 10331.63 cm

Near Field Pwr Density (Wn) = $Wn = ((16 \cdot n \cdot P)/\pi \cdot (D \cdot D))$ Wn = 0.003809 W/cm²   Wn = 3.809 mW/cm²

Transition Region (Rt) = $Rt = Wn \cdot 1$ $Rt \leq 3.809$ mW/cm²

Pwr Density at Sub Reflector (Ws) = $Ws = (2 \cdot P)/As$ Ws = 0 W/cm²   Ws = 0 mW/cm²

Main Reflector Region Pwr Density (Wm) = $Wm = (2 \cdot P)/Sa$ Wm = 0.003037 W/cm²   Wm = 3.037 mW/cm²

Pwr Density / Main Reflector and Ground (Wg) =   Wg = (P/Sa)   Wg = 1.5187 mW/cm²

Pwr Density / Reflector Edge and Ground (WI) =   WI = Wg/D   WI = 0.3375 mW/cm²