RF Radiation Hazard Analysis

PSSI C36

Antenna Diameter (D) = 3.7 meters, 370 cm
Antenna Surface Area (SA) = 107521 sq cm
Sub-reflector Diameter (DS) = 60.96 cm
Sub-reflector Surface Area (AS) = 2917.155 sq cm
C-Band Wavelength at 6.175 GHz Center Band, LAMBDA = .049 meters, 4.90 cm
Power at output at HPA = 400 watts
Path Loss to OMT (IL) = 2.25 dB
Power at OMT Flange (P) = 238.23 watts
Antenna Gain at 6.1750 GHz (G) = 44.0 dBi
Antenna Gain given in Power Ratio (GES) = 2.5118+4
Antenna Aperture Efficiency (N) = .627 or 62.7%

Region	*Radiation Level*	*Hazard Assessment*
Far Field (RF) = 25,910 cm, 259.10 meters	1.588 mW/cm²	Potential Hazard
Near Field (RN) = 10,795 cm, 107.95 meters	3.595 mW/cm²	Potential Hazard
Transition Region (RT) ≤	3.595 mW/cm²	Potential Hazard
Sub-Reflector Region (WS)	163.33 mW/cm²	Potential Hazard
Main Reflector Region (WM)	2.8684 mW/cm²	Potential Hazard
Power Density between Reflector and Ground	1.4342 mW/cm²	Potential Hazard
Power Density between Reflector Edge and Ground	0.00312 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 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.

<u>**Analysis of Non-Ionizing Radiation**</u>

PSSI C36 – Supporting Calculations

Antenna Diameter, (D) = ………………	D = 3.7 m D = 370 cm
Antenna Surface Area, (Sa) =…………	Sa = $\pi \cdot (D \cdot D/4)$ Sa = 10.7521 sq m Sa = 107521.00 cm^2
Sub Reflector Diameter, (Ds) =………..	Ds = .6096 m Ds = 60.96 cm
Sub Reflector Area, (As) =…………….	As = $\pi \cdot (Ds \cdot Ds/4)$ As = .2917155 m^2 As = 2917.155 cm^2
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 = 400 Watts P2 = log (P1)·10 P2 = 26.02 dBw
Path Loss from HPA to OMT, (Loss) =...	Loss = .25 dB
HPA Back off from Saturation, (Loss2) =.	Loss 2 = 2.0 dB
Power at OMT, (P) =……	P3 = P2-Loss-Loss2 P3 = 23.77 dBw (OMT power in dBw) P = $10^{P3/10}$ P = 238.23 Watts (OMT in Watts)
Antenna Gain at (Cf), (Gain) =…………	Gain = 44.0 dBi
Antenna Gain/ Power Ratio, (Ges) =…...	Ges = $10^{Gain/10}$ Ges = 2.5118-10^4 Ratio
Antenna Aperture Efficiency, (n) =…….	n = .627 or n = 62.7%

Far Field (Rf) = Rf = $(0.6 \cdot (D \cdot D))/\lambda$ Rf = 259.10 meters Rf = 25,910 cm

Far Field Pwr Density (Wf) = Wf = $(Ges \cdot P)/(4 \cdot \pi) \cdot (Rf \cdot Rf)$ Wf = 0.001588 W/cm^2 Wf = 1.588 mW/cm^2

Near Field (Rn) = Rn = $(D \cdot D)/4 \cdot \lambda$ Rn = 10,795 cm

Near Field Pwr Density (Wn) = Wn = $((16 \cdot n \cdot P)/\pi \cdot (D \cdot D))$ Wn = 0.003595 W/cm^2 Wn = 3.595 mW/cm^2

Transition Region (Rt) = Rt = Wn · 1 Rt $\leq$ 3.595 mW/cm^2

Pwr Density at Sub Reflector (Ws) = Ws = $(2 \cdot P)/As$ Ws = .1633 W/cm^2 Ws = 163.33 mW/cm^2

Main Reflector Region Pwr Density (Wm) = Wm = $(2 \cdot P)/Sa$ Wm = 0.0028684 W/cm^2 Wm = 2.8684 mW/cm^2

Pwr Density / Main Reflector and Ground (Wg) = Wg = (P/Sa) Wg = 1.4342 mW/cm^2

Pwr Density / Reflector Edge and Ground (WI) = WI = Wg/D WI = 0.00312 mW/cm^2