

# RF Radiation Hazard Analysis

## PSSI K44 2.4m

Antenna Diameter (D) = 2.4 meters, 240 cm  
Antenna Surface Area (SA) = 4.524 m<sup>2</sup>, 45240.00 cm<sup>2</sup>  
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) = 6.3095-10<sup>4</sup>  
Antenna Aperture Efficiency (N) = .627 or 62.7%

| <u>Region</u>                                   | <u>Radiation Level</u>    | <u>Hazard Assessment</u> |
|---|---------------------------|--------------------------|
| Far Field (RF) = 16,457 cm, 164.57 meters       | 5.5616 mW/cm <sup>2</sup> | Potential Hazard         |
| Near Field (RN) = 6857cm, 68.57meters           | 16.6 mW/cm <sup>2</sup>   | Potential Hazard         |
| Transition Region (RT) ≤                        | 16.6 mW/cm <sup>2</sup>   | Potential Hazard         |
| Sub-Reflector Region (WS)                       | 0 mW/cm <sup>2</sup>      | Potential Hazard         |
| Main Reflector Region (WM)                      | 26.5 mW/cm <sup>2</sup>   | Potential Hazard         |
| Power Density between Reflector and Ground      | 6.63 mW/cm <sup>2</sup>   | Potential Hazard         |
| Power Density between Reflector Edge and Ground | 0.0276 mW/cm <sup>2</sup> | 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<sup>2</sup> 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 K44 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 cm <sup>2</sup>                                      |
| Sub Reflector Diameter, (Ds) =.....            | Ds = 0 m        Ds = 0 cm  |
| Sub Reflector Area, (As) =.....                | As = $\pi \cdot (Ds \cdot Ds/4)$ As = 0 m <sup>2</sup> As = 0 cm <sup>2</sup>  |
| Center Frequency, (Cf) =.....                  | Cf = 14.250 GHz  |
| Wavelength at (Cf), ( $\lambda$ ) =.....       | $\lambda$ = .021 meters $\lambda$ = 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)<br>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 = 6.3095-10 <sup>4</sup> Ratio  |
| Antenna Aperture Efficiency, (n) =.....        | n = .627 or n = 62.7%  |
| <hr/>  |  |
| 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/cm <sup>2</sup> Wf = 5.5616 mW/cm <sup>2</sup> |
| 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/cm <sup>2</sup> Wn = 16.6 mW/cm <sup>2</sup>       |
| Transition Region (Rt) =                       | Rt = Wn · 1    Rt ≤ 16.6 mW/cm <sup>2</sup>  |
| Pwr Density at Sub Reflector (Ws) =            | Ws = $(4 \cdot P)/As$ Ws = 0 W/cm <sup>2</sup> Ws = 0 mW/cm <sup>2</sup>   |
| Main Reflector Region Pwr Density (Wm) =       | Wm = $(4 \cdot P)/Sa$ Wm = 0.0265 W/cm <sup>2</sup> Wm = 26.5 mW/cm <sup>2</sup>                                     |
| Pwr Density / Main Reflector and Ground (Wg) = | Wg = $(P/Sa)$ Wg = 6.63 mW/cm <sup>2</sup>   |
| Pwr Density / Reflector Edge and Ground (WI) = | WI = Wg/D    WI = 0.0276 mW/cm <sup>2</sup>  |