

ANALYSIS OF NON-IONIZING RADIATION
for World Religious Relief Inc. dba The Word Network
Site: Southfield State: MI
Latitude: 42 28 17.0 Longitude: 83 14 48.0 (NAD83)
08-04-2020

The Office of Science and Technology Bulletin, No. 65, October 1985 and revised August 1997, specifies that the maximum level of non-ionizing radiation that a person may be exposed to over a six minute period is an average power density equal to 5 mW/cm**2 (five milliwatts per centimeter squared) for a controlled environment. For an uncontrolled environment, the maximum level of non-ionizing radiation that a person may be exposed to over a thirty minute period is an average power density equal to 1 mW/cm**2 (one milliwatt per centimeter squared). It is the purpose of this report to determine the maximum power flux densities of the earth station in the far zone, near zone, transition zone, at the main reflector surface, and between the antenna edge and the ground.

Parameters which were used in the calculations:

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Antenna Diameter, (D) = 9.3000 m

Antenna Surface Area (Sa) = $\pi(D^{**2})/4$ = 67.9291 m**2

Sub Reflector Diameter (Ds) = 122.0000 cm

Area of the Sub Reflector (As) = $\pi(Ds^{**2})/4$ = 1.1690 m**2

Wavelength at 6.1750 GHz (lambda) = 0.0485 m

Transmit Power at Flange (P) = 100.0000 Watts

Antenna Gain at Earth Site (GES) = 53.9000 dBi = 245470.8916
Power Ratio:
AntiLog(GES/10)

pi = 3.1415927

Antenna Aperture Efficiency (n) = 0.6800

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1. FAR ZONE CALCULATIONS

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Distance to the Far Zone (Df) = (n)(D**2) = 1212.6433 m

$$\frac{\lambda}{4\pi(Df)^2}$$

Far Zone Power Density (Rf) = $\frac{(GES)(P)}{4\pi(Df)^2}$ = 1.3284 W/m²
= 0.1328 mW/cm²

2. NEAR ZONE CALCULATIONS

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Power Flux Density is considered to be at a maximum value throughout the entire length of this Zone. The Zone is contained within a cylindrical volume which has the same diameter as the antenna. Beyond the Near Zone, the Power Flux Density will decrease with distance from the Antenna.

Distance to the Near Zone (Dn) = $\frac{D^2}{4\lambda}$ = 445.8247 m

Near Zone Power Density (Rn) = $\frac{16.0(n)P}{\pi(D^2)}$ = 4.0042 W/m²
= 0.4004 mW/cm²

3. TRANSITION ZONE CALCULATIONS

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The Power Density begins to decrease with distance in the Transition Zone. While the Power Density decreases inversely with distance in the Transition Zone, the Power Density decreases inversely with the square of the distance in the Far Zone. Since the maximum Power Density in the Transition Zone will not exceed the Near Zone values, it is not calculated.

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4. ZONE BETWEEN THE SUB AND MAIN REFLECTORS

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Transmissions from the feed horn are directed toward the Sub Reflector surface and are reflected back toward the Main Reflector. The energy between the Sub Reflector and Main Reflector surfaces can be calculated by determining the Power Density at the Sub Reflector surface as follows:

$$\begin{aligned} \text{Sub Reflector Power Density} &= \frac{2(P)}{A_s} = 171.0884 \text{ W/m}^2 \\ &= 17.1088 \text{ mW/cm}^2 \end{aligned}$$

5. MAIN REFLECTOR ZONE
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$$\begin{aligned} \text{Main Reflector Power Density} &= \frac{2(P)}{S_a} = 2.9442 \text{ W/m}^2 \\ &= 0.2944 \text{ mW/cm}^2 \end{aligned}$$

6. ZONE BETWEEN THE MAIN REFLECTOR AND THE GROUND
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Applying uniform illumination of the Main Reflector Surface:

$$\begin{aligned} \text{Main to Ground Power Density} &= \frac{P}{S_a} = 1.4721 \text{ W/m}^2 \\ &= 0.1472 \text{ mW/cm}^2 \end{aligned}$$



CALCULATED SAFETY MARGINS SUMMARY
AND EVALUATION

Controlled Safety Margin = 5.0 - Calculated Zone Value (mW/cm**2)

Zones	Safety Margins (mW/cm**2)	Conclusions
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1. Far Zone	4.8672	Complies with ANSI
2. Near Zone	4.5996	Complies with ANSI
3. Transition Zone	Rf < Rt < Rn	Complies with ANSI
4. Sub to Main Reflector	-12.1088	POTENTIALLY HAZARDOUS
5. Main Reflector Surface	4.7056	Complies with ANSI
6. Main Reflector to Ground	4.8528	Complies with ANSI

Uncontrolled Safety Margin = $1.0 - \text{Calculated Zone Value (mW/cm}^2\text{)}$

Zones	Safety Margins (mW/cm ²)	Conclusions
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7. EVALUATION

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A. Controlled Environment

The SUB to MAIN Reflector ZONE does not comply with the ANSI standards! WARNING SIGNS will be posted for the affected Zone indicating danger while the system is in use. Additionally, the system will be shut down for servicing.

B. Uncontrolled Environment

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