

ANALYSIS OF NON-IONIZING RADIATION  
for WESTGATE COMMUNICATIONS LLC  
Site: STEHEKIN 2 State: WA  
Latitude: 48 19 34.0 Longitude: 120 41 4.0 (NAD83)  
09-02-2005

The Office of Science and Technology Bulletin, No. 65, October 1985, 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). 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) = 4.8000 m
Antenna Surface Area      (Sa) = pi(D**2)/4      = 18.0956 m**2
Sub Reflector Diameter    (Ds) = 35.5600 cm
Area of the Sub Reflector (As) = pi(Ds**2)/4      = 0.0993 m**2
Wavelength at 6.1750 GHz (lambda) = 0.0485 m
Transmit Power at Flange  (P) = 25.5000 Watts
Antenna Gain at Earth Site (GES) = 48.1000 dBi      = 64565.4229
                                Power Ratio:
                                AntiLog
(GES/10)
pi                            = 3.1415927
Antenna Aperture Efficiency (n) = 0.6500

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### 1. FAR ZONE CALCULATIONS

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$$\text{Distance to the Far Zone} \quad (Df) = \frac{(n)(D^{**2})}{\text{lambda}} = 308.7835 \text{ m}$$

$$\begin{aligned} \text{Far Zone Power Density} \quad (Rf) &= \frac{(GES)(P)}{4*\text{pi}*(Df^{**2})} = 1.3741 \text{ W/m}^{**2} \\ &= 0.1374 \text{ mW/cm}^{**2} \end{aligned}$$

### 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.

$$\text{Distance to the Near Zone} \quad (Dn) = \frac{D^{**2}}{4*\text{lambda}} = 118.7629 \text{ m}$$

$$\begin{aligned} \text{Near Zone Power Density} \quad (Rn) &= \frac{16.0(n)P}{\text{pi}(D^{**2})} = 3.6639 \text{ W/m}^{**2} \\ &= 0.3664 \text{ mW/cm}^{**2} \end{aligned}$$

### 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.

#### 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:

$$\begin{aligned} \text{Sub Reflector Power Density} &= \frac{2(P)}{A_s} = 513.5193 \text{ W/m}^2 \\ &= 51.3519 \text{ mW/cm}^2 \end{aligned}$$

#### 5. MAIN REFLECTOR ZONE

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$$\begin{aligned} \text{Main Reflector Power Density} &= \frac{2(P)}{S_a} = 2.8184 \text{ W/m}^2 \\ &= 0.2818 \text{ mW/cm}^2 \end{aligned}$$

#### 6. ZONE BETWEEN THE MAIN REFLECTOR AND THE GROUND

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Applying uniform illumination of the Main Reflector Surface:

$$\begin{aligned} \text{Main to Ground Power Density} &= \frac{P}{S_a} = 1.4092 \text{ W/m}^2 \\ &= 0.1409 \text{ mW/cm}^2 \end{aligned}$$

CALCULATED SAFETY MARGINS SUMMARY  
AND EVALUATION

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Safety Margin = 5.0 - Calculated Zone Value (mW/cm\*\*2)  
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Zones	Safety Margins (mW/cm**2)	Conclusions
1. Far Zone	4.8626	Complies with ANSI
2. Near Zone	4.6336	Complies with ANSI
3. Transition Zone	Rf < Rt < Rn	Complies with ANSI
4. Sub to Main Reflector	-46.3519	POTENTIALLY HAZARDOUS
5. Main Reflector Surface	4.7182	Complies with ANSI
6. Main Reflector to Ground	4.8591	Complies with ANSI

7. EVALUATION  
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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.