

### 3.11 RF EXPOSURE CALCULATIONS FOR SAMSUNG'S HIGH GAIN ANTENNAS

From FCC 1.1310 table 1A, the maximum permissible RF exposure for an uncontrolled environment is  $1\text{mW}/\text{cm}^2$ . The Electric field generated for a  $1\text{mW}/\text{cm}^2$  exposure (S) is calculated as follows:

$$S = E^2/Z$$

where:

S = Power density

E = Electric field

Z = Impedance.

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$$1\text{mW}/\text{cm}^2 = 10\text{ W}/\text{m}^2$$

The impedance of free space is 377 ohms, where E and H fields are perpendicular.

Thus:

$$E = \sqrt{10 \times 377} = 61.4\text{ V}/\text{m} \text{ which is equivalent to } 1\text{mW}/\text{cm}^2$$

Using the relationship between Electric field E, Power in watts P, and distance in meters d, the corresponding Antenna numeric gain G and the transmitter output power and solving for d,

$$d = \sqrt{\frac{P_{\text{eak}} \times 30 \times G}{E}}$$

#### Example using the Stub Omni-directional antenna

1. The Numeric gain G of antenna with a gain specified in dB is determined by:

$$G = \text{Log}^{-1}(\text{dB gain}/10)$$

$$G = \text{Log}^{-1} 2.15 = 1.64$$

2. Stub antenna-gain with a gain of 2.15dB, the  $1\text{mW}/\text{cm}^2$ : distance is:

$$P = 8.13\text{mW} \text{ worst case channel 1 power output}$$

$$d = 1.03\text{ cm}$$

**Notice in Installation Manual:**

**While installing and operating this transmitter and antenna combination the radio frequency exposure limit of  $1\text{mW}/\text{cm}^2$  may be exceeded at distances close to the antennas installed. Therefore, the user must maintain a minimum distance of 20 cm from the antenna.**

The table below identifies the distances where the  $1\text{mW}/\text{cm}^2$  exposure limits may be exceeded during continuous transmission using the external stub or internal antenna

<b>Antenna Type</b>	<b>Gain (dBi)</b>	<b>Gain Numeric</b>	<b>Peak output Power (mW)</b>	<b>Minimum RF Exposure Separation Distance (cm)</b>
<b>Stub</b>	2.15	1.64	8.13	1.03
<b>Patch</b>	2.15	1.64	8.13	1.03