

RF EXPOSURE CALCULATIONS FOR NOKIA'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.

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

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,

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

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

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

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

The table below identifies the distances where the $1\text{mW}/\text{cm}^2$ exposure limits may be exceeded during continuous transmission using the proposed fixed antennas

| Antenna type | Antenna gain (dBi) | Numeric gain | Channel | Power (mW) | Minimum RF Exposure Separation Distance (cm) |
|---------------------|---------------------------|---------------------|----------------|-------------------|---|
| Omni internal | 2.15 | 1.64 | 6 | 18.03 | 1.53 |
| Yagi | 9 | 7.94 | 6 | 18.03 | 3.38 |
| Dipole | 4 | 2.51 | 6 | 18.03 | 1.9 |

Notice in Installation Manual:

In-order to comply with FCC RF exposure requirements for mobile transmitter, a minimum separation distance of 20 cm must be maintained between the antenna and all persons during transmission

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