

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 337 ohms, where E and H fields are perpendicular.

Thus:

$$E = \sqrt{10 \times 337} = 61.4\text{ V/m which is equivalent to } 1\text{mW}/\text{cm}^2$$

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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