

RF Exposure calculations

From §FCC 1.1310 table 1A, the maximum permissible RF exposure for an uncontrolled environment is $1\text{mW}/(\text{cm}^2)$, where, $(\text{cm}^2) = \text{square cm}$. 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

so, $1\text{mW}/(\text{cm}^2) = 10\text{ W}/(\text{m}^2)$

Z is 377 ohm of the impedance of free space, where E and H field are perpendicular.

Thus the Electric field to produce a $1\text{mW}/(\text{cm}^2)$ exposure is:

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

Maximum conducted peak output power is 14.47 dBm and maximum antenna gain is 1 dBi. The maximum radiated output power resulted in 35.24 mW.

Using the relationship between electric field E, effective radiated power in watts P, and distance in meters D, the corresponding distance D to produce a $1\text{mW}/(\text{cm}^2)$ is calculated in the following expression:

$$D = (P \times 30)^{1/2} / E = (35.24 \times 10 \times 30)^{1/2} / 61.4 = 1.67\text{ m}$$

where, P: maximum effective radiated power measured, 15.47 dBm (35.24 mW)

E: electric field equivalent to $1\text{mW}/(\text{cm}^2)$, 61.4 V/m

Notice in Installation Manual:

While installing and operating this transmitter, the radio frequency exposure limit of $1\text{mW}/(\text{cm}^2)$ may be exceeded at distances close to the transmitter. therefore, the user must maintain a minimum distance of 20 cm from the device at all time.

The table below identifies the distance where the $1\text{mW}/(\text{cm}^2)$ exposure limits may be exceeded during continuous transmission using this device.

Peak output power		calculated RF Exposure Separation Distance(cm)	Minimum RF Exposure Separation Distance(cm)
dBm	mW	1.67	20
15.47	35.24		