# FCC RF Exposure Requirements

**General information:**

FCCID:
Device category: Fixed per Part 2.1091
Environment: Uncontrolled Exposure

Fixed devices that operate under Part 90 of this chapter are subject to routine environmental evaluation for RF exposure prior to equipment authorization or use if they operate at frequencies of 1.5 GHz or below and their effective radiated power (ERP) is 1.5 watts or more. However, compliance with the power density limits of 1.1310 is not required.

**Antenna:**

The manufacturer does not specify an antenna. A typical fix mounted antenna has a gain of 3 to 7 dBi.

This device has provisions for operation in fixed locations.

| Configuration | Antenna p/n | Type | Max. Gain (dBi) |
|---|---|---|---|
| Fix | Any | omni | 3 – 7 |
| | | | |

**Operating configuration and exposure conditions:**

The conducted output power is 100 Watts. In repeater operation duty cycle can reach near 100 %. The manufacturer also markets this device only for occupation use. But, typical installations do not control exposure.

- Part 2.1091 states that devices are excluded from routine evaluation if the EIRP is less than 2.46Watt (or 1.5WERP).

- A typical fixed installation consists of an antenna system with a coaxial cable of the type RG 213U which has a loss of 1.0 dB for a length of 30 feet at UHF frequencies. A repeater system typically uses outdoor structures for antenna mounting.

**MPE Calculation:**

The minimum separation distance is calculated as follows:

$$E(V/m) = \frac{\sqrt{30 \times P \times G}}{d} \qquad \text{Power density: } P_d(mW/cm^2) = \frac{E^2}{3770}$$

The limit for uncontrolled exposure environment above 300 MHz is f/1500 mW/cm$^2$ .

Frequency: 450-470 MHz
The conducted power output is 100 watt.
The coax loss was taken as 1.5 dB.
Antenna gain was taken as 3 – 7 dBi
100% talk time in 30 minutes
Power Density = S= f/1500 mW/cm$^2$

W := 100 power in Watts

peak - antenna gain

D := 1 Duty Factor in decimal % (1=100%)

1 for FM

E := 30 exposure time in minutes

U := 30 (use 6 for controlled and 30 for uncontrolled)

$Wexp := W \cdot D \cdot \left(\frac{E}{U}\right)$

Wexp = 100 Watts

$PC := \left(\frac{E}{U}\right) \cdot 100$

PC = 100 % on time

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Po := 100000 mWatts

dBd := 4.85 antenna gain in dBd

G1 := dBd + 2.15 gain in dBi

G1 = 7 dBi

CL := 1.5 dB coax loss

G := G1 – CL

$Gn := 10^{\frac{G}{10}}$ gain numeric

Gn = 3.548

$R := \sqrt{\frac{(Po \cdot Gn)}{(4 \cdot \pi \cdot S)}}$

R = 313.839 distance in centimeters required for compliance

f := 430 Frequency in MHz

$S := \frac{f}{1500}$ power density limit for uncontrolled exposure

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S = 0.287 $\frac{mW}{cm^2}$

$inches := \frac{R}{2.54}$

inches = 123.559

**Conclusion:**

The device complies with the MPE requirements by providing a safe separation distance of 3 m 123 inches) between the antenna, including any radiating structure, and any persons when normally operated.

The minimum safe operating distance between the public and the antenna should be at least 3.2 m (10 ft) when used with a 7 dBi antenna.