

FCC RF Exposure Requirements

General information:

FCCID:

Device category: Fixed as described in 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.

Antenna:

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

This device has provisions for operation only in fixed locations.

Configuration	Antenna p/n	Type	Max. Gain (dBi)
fixed	Any	omni	3

Operating configuration and exposure conditions:

The conducted output power is 3 Watts. Although in a typical setting the use qualifies for a duty cycle factor of approximately 50%. The RF exposure calculation will be taken using 100% since in repeater operation the true duty factor can possibly exceed 50%. The manufacturer also markets this device only for occupation use. But, typical installations do not allow for controlled exposure.

- A typical fixed installation consists of an antenna system with a coaxial cable of the type RG 213U which has a loss of 1.5 dB for a length of 30 feet at UHF frequencies.

MPE Calculation:

The minimum separation distance is calculated as follows:

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

The limit for an uncontrolled exposure environment above 300 MHz is determined by the formula $S = f/1500$ and at 470 MHz is 0.313 mW/cm².

Frequency: 470-495 MHz

The conducted power output is 3 watts.

The coax loss was taken as 0.5 dB.

Antenna gain was taken as 3 dBi

100% talk time in 30 minutes

Power Density = $S = 0.313 \text{ mW/cm}^2$

$W := 3.0$ power in Watts

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

1 for FM

0.6 for SSB

$E := 30$ exposure time in minutes

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

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

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

$W_{exp} = 3$ Watts

$PC = 100$ % on time

$Po := 3000$ mWatts

$f := 470$ Frequency in MHz

$dBd := 0.85$ antenna gain in dBd

$G1 := dBd + 2.15$ gain in dBi

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

$G1 = 3$ dBi

$CL := 0.5$ dB coax loss

$S = 0.313 \frac{\text{mW}}{\text{cm}^2}$

$G := G1 - CL$

General population

S is 1 between 1500 and 100k MHz

S is $f/1500$ for 300 to 1500 MHz

S is 0.2 between 30 and 300 MHz

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

Occupational

S is 1 between 30 and 300 MHz

S is $f/300$ between 300 and 1500 MHz

S is 5 between 1500 and 100k MHz

(See 47 CFR 1.1310)

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

$R = 36.809$ distance in centimeters required for compliance

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

$$\text{inches} = 14.492$$

$$\text{ft} := \frac{\text{inches}}{12}$$

$$\text{ft} = 1.208$$

Conclusion:

Using the criteria above to comply with the MPE requirements a safe separation distance of 0.37 m or approximately 1.5 ft is required between the antenna, including any radiating structure, and any persons when normally operated.