

FCC RF Exposure Requirements

General information:

FCC ID: RAYEVR100US

Device category: Mobile per Part 2.1091

Environment: Uncontrolled Exposure

Mobile devices that operate under Part 80 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 doesn't specify an antenna to be used with this device.

This device has provisions for operation in a vehicle, or a fixed location.

Configuration	Antenna p/n	Type	Max. Gain (dBi)
Boat	Any	omni	5

Operating configuration and exposure conditions:

The conducted output power is 7 Watts. Typical use qualifies for a maximum duty cycle factor of 50%. In the case of these calculations this duty factor is expressed as an exposure time. The result given as a time compensated power output.

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

- Vehicle Operation: The maximum antenna gain that can be used is 5 dBi. A coaxial cable of the type RG 58 has a loss of 1dB for a length of 15 feet.

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 general uncontrolled exposure environment below 300 MHz is 0.2 mW/cm².

Channel frequency: 156.025-157.425 MHz

The conducted power output is 7 watt.

The coax loss was taken as 1 dB.

Antenna gain was taken as 5 dBi

50% talk time in 30 minutes (time compensated).

Power in Watts

$$W := 7$$

Duty Factor in decimal % (1=100%)

$$D := 1$$

for an FM device D=1

Exposure time in minutes

$$U := 30 \quad (\text{use 6 for controlled and 30 for uncontrolled})$$

$$E := 15$$

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

$$PC := \frac{E}{U} \quad \text{percent on time}$$

$$PC = 0.5$$

Time compensated power output

$$W_{\text{exp}} = 3.5 \quad \text{Watts}$$

$$W_{1\text{exp}} := W_{\text{exp}} \cdot 1000$$

$$W_{1\text{exp}} = 3.5 \times 10^3 \quad \text{mWatts}$$

Antenna gain

$$\text{dBd} := 2.85$$

Coax Loss

$$CL := 1 \quad \text{dB}$$

For all VHF frequencies
300 > f > 30 MHz

$$f := 300$$

$$G := \text{dBd} + 2.15 - CL$$

$$G = 4 \quad \text{Net gain in dBi}$$

$$S := \frac{f}{1500} \quad \frac{\text{mW}}{\text{cm}^2} \quad \text{from OET 65}$$

$$G_n := 10^{\frac{G}{10}}$$

$$G_n = 2.512 \quad \text{Gain Numeric}$$

$$S = 0.2$$

$$R := \sqrt{\frac{(W_{1\text{exp}} \cdot G_n)}{(4 \cdot \pi \cdot S)}}$$

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

$$R = 59.144 \quad \text{distance in centimeters} \\ \text{required for compliance}$$

$$R_{\text{inches}} = 23.285$$

Conclusion:

The device complies with the MPE requirements by providing a safe separation distance of 59 cm between the antenna (5 dBi max), including any radiating structure, and any persons when normally operated .

Proposed RF exposure safety information to include in User's Manual:**“FCC RF Exposure Requirements:****CAUTION:**

The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This device is approved with emissions having a source-based time-averaging duty factor not exceeding 50%. The safe operating distance between the general population and the antenna when transmitting is 24 inches (2 feet). This value is based on an antenna with 5 dBi gain and what would be considered a normal installation. Lower gain similar antennas may be used.

Failure to observe these restrictions will result in exceeding the FCC RF exposure limits.