

APPENDIX A: FCC PART 1.1307, 1.1310, 2.1091, 2.1093 RF EXPOSURE

FCC Rules and Regulations Part 1.1307, 1.1310, 2.1091, 2.1093:

1. General Information: Modulation Type/Mode: DSSS
 Environment: General Population/Uncontrolled Exposure Device category: Mobile per Part 2.1091
2. Antenna Data:

Antenna	Type	Gain (dBi)	Numeric Gain	Frequency Range
Whip	Omni	5.0	3.2	2412-2462

3. MPE Calculation:

The limit for general population/uncontrolled exposure environment above 1500 MHz is $1 \text{ mW} / \text{cm}^2$. The maximum distance, from the antenna at which MPE is met or exceeded, is calculated from the equation relating field strength E in V/m, transmit power P in Watts, transmit antenna numeric gain G, and separation distance in meters. The Electric field generated for a $1\text{mW}/\text{cm}^2$ exposure (S) is calculated as follows:

$$S = \frac{E^2}{Z} \quad \text{where: } S = \text{Power density; } E = \text{Electric field; and } Z = \text{Impedance}$$

or $E(V/m) = \sqrt{S \times Z}$ and $1 \text{ mW}/\text{cm}^2 = 10 \text{ W}/\text{m}^2$ and the impedance of free space is 337 ohms, where E and H fields are perpendicular. Thus: $E(V/m) = \sqrt{10 \times 377} = 61.4 \text{ V/m}$

$$\text{from the formula } P = \frac{E(V/m)^2 \times d^2}{30 \times G} \quad \text{or } d = \frac{\sqrt{30 \times P \times G}}{E(V/m)}$$

Substitution yields: $0.04\text{m} = \frac{\sqrt{30 \times 0.060 \times 3.2}}{61.4}$

Separation Distance	
Power (Watt)	(cm)
0.060	4

$$S = \frac{P \times G}{4 \times \pi \times d^2}$$
 Where: S = power density; P = power (W); G = numeric gain; d = distance to radiation center

Substitution yields:

$$S = \frac{60 \times 3.2}{4 \times \pi \times 20^2} = 0.04 \text{ mW} / \text{cm}^2$$

Power Density Limit	Calculated Power Density at 20 cm Distance
1 mW/cm ²	0.04 mW/ cm ²

CONCLUSION: The device complies with the MPE requirements by providing a safe separation distance between the antenna, including any radiating structure, and any persons.

Proposed RF exposure safety information to include in User's Manual:

CAUTION: Antenna Installation Requirement

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.