RF Exposure Calculation

FCC ID: PEJ-93821283-XETA1

It is the responsibility of the licensee or user to guarantee compliance with the appropriate MPE regulations when operating this device in a way other than described herein. The installer of this equipment must ensure the antenna is located or oriented such that it does not emit an RF field in excess guidelines as posted in the Canadian RSS-102/Safety Code 6 of Health Canada, Office of Engineering and Technology Bulletin 65/47CFR § 1.1310 of the Federal Communications Commission, or the Council of European Union as appropriate. People should not be near the antenna when the radio link is operating as general practice and maintain a safe distance as calculated below.

Note

Industry Canada and the US FCC use the same RF power density level for their limits, but express them in different units. The US FCC/OSHA/ANSI use milliwatts per square centimeter (mW/cm^2) and Industry Canada uses Watts per square meter (W/m^2).

$$W/m^2 = 10(mW/cm^2) \quad \text{eq. 1}$$

The following calculations are based off of the Maximum Permissible Exposure requirements as outlined by the FCC and IC. The MPE (Maximum Permissible Exposure) distance is calculated based on the limits for the General Population/Uncontrolled Exposure in the 400 to 512 MHz frequency band. The MPE limit was calculated in Table 1 for each frequency. For convenience, Table1 provides safe distance for several power levels and antennas besides the worst case this band.

To calculate safe distance:

$$MPED = \sqrt{\frac{(ConductedPower(mW))(DutyCycle)(AntennaGain)}{(4\pi)(ExposureLimt(mW/cm^2)}} \quad \text{eq.2}$$

Where:

MPED is Maximum Permissible Exposure Distance or safe distance.

All quantities are calculated in linear or numeric quantities.

The exposure limit, MPED, and conducted power units must be consistent, mW and cm for this case.

Duty cycle is set using packet sizes for master and slave. The highest duty cycle, 91%, that can be set is 1024 transmit and 64 receive using a modulation of 305 kbps 4FSK. Packet settings are set in the radio Network Configuration Menu. If the radio is a master then master packet size is set to 1024 and slave packet size is set to 64. All radios in the link must have the same master and slave settings. At Power up and with no data transmitting, the radios will transmit or beacon with a duty cycle of 6 to 10% depending upon modulation setting.

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The limits for Industry Canada are in Watts per square meter and easily calculated from equations 2 and then 1 above. Industry Canada and the FCC have different maximum ERP requirements.

An antenna gain of 10 dBd or 12.15 dBi is assumed to be the antenna industry maximum from 150 to 174 MHz and used below for the worst case MPE safe distance calculations.

The United States/FCC allows 500W ERP. IC allows 125 W ERP for fixed operation and 30 w for mobile.

Table 1. MPE Safe Distance

MPE Safe Distance vs. Antenna Gain and Xeta4 Power Output Settings									
Freq (MHz)	Power Setting (mW)	Duty cycle (linear)	Antenna Gain (dBi)	Antenna Gain (linear)	EIRP (W)	ERP (W)	MPE Limit (mW/cm^2)	MPE Limit (W/m^2)	Safe Distance (cm)
150	1500	0.91	12.15	16.41	25	27	0.2	2.00	42.21
174	1500	0.91	12.15	16.41	25	27	0.2	2.00	42.21

Notes
1. The worst case for the United States 42.2 cm.