

- *Directive 2004/40/EC of the European Parliament and of the Council of 29 April 2004 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (18th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC).*
- *US FCC limits for the general population. See the FCC web site at <http://www.fcc.gov>, and the policies, guidelines, and requirements in Part 1 of Title 47 of the Code of Federal Regulations, as well as the guidelines and suggestions for evaluating compliance in FCC OET Bulletin 65.*
- *Health Canada limits for the general population. See the Health Canada web site at http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/99ehd-dhm237/limits-limités_e.html and Safety Code 6.*
- *EN 50383:2002 to 2010 Basic standard for the calculation and measurement of electromagnetic field strength and SAR related to human exposure from radio base stations and fixed terminal stations for wireless telecommunication systems (110 MHz - 40 GHz).*
- *BS EN 50385:2002 Product standard to demonstrate the compliances of radio base stations and fixed terminal stations for wireless telecommunication systems with the basic restrictions or the reference levels related to human exposure to radio frequency electromagnetic fields (110 MHz – 40 GHz) – general public.*
- *ICNIRP (International Commission on Non-Ionizing Radiation Protection) guidelines for the general public. See the ICNIRP web site at <http://www.icnirp.de/> and Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields.*

Power density exposure limit

Install the radios for the PMP/PTP 450(i) family of wireless solutions so as to provide and maintain the minimum separation distances from all persons.

*The applicable power density exposure limit for RF energy in the 4.9, 5.4 and 5.8 GHz frequency bands is **10 W/m²**. The applicable power density exposure limit for RF energy in the 900 MHz frequency band is **6 W/m²**. For more information, see [Human exposure to radio frequency energy](#) on page 4-22.*

Calculation of power density

The following calculation is based on the ANSI IEEE C95.1-1991 method, as that provides a worst case analysis. Details of the assessment to EN50383:2002 can be provided, if required.

Peak power density in the far field of a radio frequency point source is calculated as follows:

$$S = \frac{P \cdot G}{4\pi d^2}$$

Where:

Is:

<i>S</i>	power density in W/m ²
<i>P</i>	maximum average transmit power capability of the radio, in W
<i>G</i>	total Tx gain as a factor, converted from dB
<i>d</i>	distance from point source, in m

Rearranging terms to solve for distance yields:

$$d = \sqrt{\frac{P \cdot G}{4\pi \cdot S}}$$

Calculated distances and power compliance margins

[Table 59](#) and [Table 60](#) shows calculated minimum separation distances, recommended distances and resulting margins for each frequency band and antenna combination for the USA and Canada. These are conservative distances that include compliance margins. At these and greater separation distances, the power density from the RF field is below generally accepted limits for the general population.

PMP 450(i) equipment adheres to all applicable EIRP limits for transmit power when operating in MIMO mode. Separation distances and compliance margins include compensation for both transmitters.

Explanation of terms used in [Table 59](#) and [Table 60](#):

P burst – maximum average transmit power during transmit burst (Watt)

P – maximum average transmit power of the radio (Watt)

G – total transmit gain as a factor, converted from dB

S – power density (Watt/m²)

d – minimum safe separation distance from point source (meters)

Table 58 FCC minimum safe distances – 900 MHz

Band	Antenna	P burst (W)	P (W)	G (dBi)	S (W/ m²)	d (m)
900 MHz	Sector antenna		0.19	22.75 (13 dBi)	6	0.27
	Yagi antenna (AP)		0.24	23.82 (12 dBi)	6	0.28
	Yagi antenna (SM)		0.24	23.89 (12 dBi)	6	0.28

Table 59 FCC minimum safe distances – 4.9 GHz and 5.8 GHz

Band	Antenna	P burst (W)	P (W)	G (dBi)	S (W/ m²)	d (m)
4.9 GHz	Omni-directional	0.25	0.21	20.0 (13 dBi)	10.0	0.17
	90° sector antenna	0.25	0.21	50.0 (17 dBi)	10.0	0.26
	2ft directional flat plate	0.25	0.21	631.0 (28 dBi)	10.0	0.93
	4ft directional parabolic	0.10	0.85	2344.0 (34.9 dBi)	10.0	1.14
	6ft directional parabolic	0.04	0.03	5248.0 (37.2 dBi)	10.0	1.07
5.1 GHz	Omni-directional	0.1700	0.2000	20.0 (10 dBi)	10.0	0.15
	90° sector	0.0339	0.0398	50.0 (17 dBi)	10.0	0.10
	2ft directional flat plate	0.0017	0.0020	708.0 (28.5 dBi)	10.0	0.09
	4ft directional parabolic	0.1070	0.0126	3388.0 (35.3 dBi)	10.0	0.44
5.8 GHz	Omni-directional	0.28	0.24	20.0 (13 dBi)	10.0	0.18
	90° sector	0.12	0.10	50.0 (17 dBi)	10.0	0.18
	2ft directional flat plate	0.63	0.54	708.0 (28.5 dBi)	10.0	1.57
	4ft directional parabolic	0.63	0.54	3388.0 (35.3 dBi)	10.0	3.43
	6ft directional parabolic	0.63	0.54	6457.0 (38.1 dBi)	10.0	4.74

Table 60 IC minimum safe distances – 4.9 GHz and 5.8 GHz

Band	Antenna	P burst (W)	P (W)	G (dBi)	S (W/ m²)	d (m)
4.9	Omni-directional	0.25	0.17	20.0 (13 dBi)	10.0	0.17