9. MAXIMUM PERMISSIBLE EXPOSURE

FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

1.1310 – Table 1(b) LIMITS for GENERAL POPULATION/UNCONTROLLED EXPOSURE

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (mW/cm2)	Averaging Time (minutes)
0.3-1.34	614	1.63	*(100)	
1.34-30	824/f	2.19/f	*(180/f^2)	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000	-	-	1.0	30

INDUSTRY CANADA RULES

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Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m2)	Averaging Time (minutes)
0.003-1	280	2.19	-	6
1-10	280/f	2.19/f	-	6
10-30	28	2.19/f	-	6
30-300	28	0.073	2*	6
300-1500	1.585 $f^{0.5}$	0.0042 $f^{0.5}$	f/150	6
1500-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/f 1.2
150000-300000	0.158 $f^{0.5}$	4.21 x 10^{-4} $f^{0.5}$	6.67 x 10^{-5} f	616000/f 1.2

Power Density Limit for 1616-1626 MHz frequency range is 100mW/cm^2 (10W/m^2).

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EQUATIONS

Power density is given by:

$$S = EIRP / (4 * Pi * D^2)$$

where

S = Power density in W/m^2
EIRP = Equivalent Isotropic Radiated Power in W
D = Separation distance in m

Power density in units of W/m^2 is converted to units of mWc/m^2 by dividing by 10.

Distance is given by:

$$D = SQRT (EIRP / (4 * Pi * S))$$

where

D = Separation distance in m
EIRP = Equivalent Isotropic Radiated Power in W
S = Power density in W/m^2

For multiple colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the Power * Gain product (in linear units) of each transmitter.

$$Total\ EIRP = (P1 * G1) + (P2 * G2) + ... + (Pn * Pn)$$

where

Px = Power of transmitter x
Gx = Numeric gain of antenna x

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm^2

RESULTS – 20 cm spacing

General Public

Operating Frequency	1616	MHz			
Output Power (Max Avg)	1.383	Watts			
Antenna Gain	3.0	dB	or (linear)	1.995262	(unitless)
Separation Distance	0.20	m	-or-	7.874	inches

Peak Power Density	2.760	W/m^2	- or -	0.2760	mW/cm^2
Exposure % (over 6 min timespan for uncontrolled)	100%				
Transmit Duty Cycle (Peak-to-Average Ratio)	9.222%				
Average Power Density	**0.506**	W/m^2	- or -	**0.0506**	mW/cm^2

Limit for **Uncontrolled** Exposure at Operating Frequency	**10.0**	W/m^2	- or -	**1.00**	mW/cm^2