

Maximum Permissible Exposure Limitation

NOTE: The limits are taken from the reference levels detailed in either Annex II or Annex III of Council Recommendation 1999/519/EC of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (1999/519/EC).

Frequency Range	E-field Strength (V/m)
400- 2000MHz	$1.375 * f^{.5}$
2-300GHz.	61

Calculations

Given

$$E = \frac{\sqrt{30 * P * G}}{D} \quad S = E^2 \frac{2}{3770}$$

where

E = Field Strength in Volts/meter
P = Power in Watts
G = Numeric Antenna Gain
D = Distance in meters
S = Power Density in mW/cm²

Changing to units of power in mW and distance in cm, using:

$$P(W) = P(mW) / 1000 \quad d(cm) = 100 * D(m)$$

yields

$$E = 100 \frac{\sqrt{30 * \frac{P(mW)}{1000} * G}}{d(cm)}$$

or

$$E = 17.32 \frac{\sqrt{P(mW) * G}}{d(cm)}$$

Substituting the logarithmic form of Power and Antenna Gain using:

$$P(mW) = 10^{\frac{P(dBm)}{10}} \quad \text{and} \quad G(numeric) = 10^{\frac{G(dBi)}{10}}$$

yields

$$E = 17.32 * \frac{10^{\frac{P(dBm) + G(dBi)}{20}}}{d} \quad \text{Equation (1)}$$

where

d = distance in cm
P = Power in dBm
G = Antenna Gain in dBi
E = MPE field strength in V/m

Canada Limits 100-6000 MHz

$$PD = 0.02619 f^{0.6834}$$

Where

PD = Power Density in W/m²

WIFI MPE FCC+ISED

Modulation Type	Frequency (MHz)	MPE Distance (cm)	Peak Transmit Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Power Density (W/m ²)	% of Standard
nonHT	2400	20	16.41	2.7	0.02	0.5	0.2	3.24%
HT20	2400	20	16.32	2.7	0.02	0.5	0.2	3.17%
HT40	2400	20	9	2.7	0.00	0.5	0.0	0.59%
VHT20	2400	20	18.94	2.7	0.03	0.5	0.3	5.80%
VHT40	2400	20	12.69	2.7	0.01	0.5	0.1	1.38%
HT20	5000	20	22.59	4.5	0.14	0.9	1.0	15.39%
HT40	5000	20	23.93	4.5	0.37	0.9	1.4	40.76%
VHT20	5000	20	28.16	4.5	0.30	0.9	3.7	32.82%
VHT40	5000	20	27.22	4.5	0.30	0.9	3.0	32.82%
VHT80	5000	20	20.36	4.5	0.06	0.9	0.6	6.76%
VHT80 BF	5000	20	23.8	4.5	0.13	0.9	1.3	14.93%

Note: Limits are based on the RSS 102 limits at the lowest frequency in each band and used to represent the requirements of the FCC

WIFI MPE % of 20cm limit

Modulation Type	Frequency (MHz)	Power Density (mW/cm ²)	Peak Transmit Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)	Limit (cm)	Margin (cm)	% of Standard
nonHT unii-1	5000	0.9	21.87	4.5	6.19	20	13.81	30.95%
HT40 unii-1	5000	0.9	21.82	4.5	6.15	20	13.85	30.77%
VHT20 unii-1	5000	0.9	21.366	4.5	5.84	20	14.16	29.20%
vht40 unii-1	5000	0.9	21.73	4.5	6.09	20	13.91	30.45%
VHT80 unii-1	5000	0.9	20.95	4.5	5.57	20	14.43	27.84%
VHT80 BF unii-1	5000	0.9	21.57	4.5	5.98	20	14.02	29.89%
nonHT unii-3	5000	0.9	22.59	4.5	6.72	20	13.28	33.62%
HT40 unii-3	5000	0.9	23.93	4.5	7.85	20	12.15	39.23%
VHT20 unii-3	5000	0.9	28.16	4.5	12.77	20	7.23	63.84%

VHT40 unii-3	5000	0.9	27.22	4.5	11.46	20	8.54	57.29%
VHT80 unii-3	5000	0.9	20.36	4.5	5.20	20	14.80	26.01%
VHT80 BF unii-3	5000	0.9	23.8	4.5	7.73	20	12.27	38.65%
2.4G								
nonHT	2400	0.9	16.41	2.7	7.73	20	12.27	38.65%
HT20	2400	0.9	16.32	2.7	2.66	20	17.34	13.28%
HT40	2400	0.9	9	2.7	2.68	20	17.32	13.42%
VHT20	2400	0.9	18.94	2.7	2.66	20	17.34	13.28%
VHT40	2400	0.9	12.69	2.7	1.14	20	18.86	5.72%

Note: Limits are based on the RSS 102 limits at the lowest frequency in each band and used to represent the requirements of the FCC

BLE MPE FCC+ISED

	Frequency (MHz)	MPE Distance (cm)	Peak Transmit Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Margin (mW/cm ²)
	2402	20	11.97	2.7	0.01	0.5	0.49
	2440	20	13.82	2.7	0.01	0.5	0.49
	2480	20	14.68	2.7	0.01	0.5	0.49

Note: Limits are based on the RSS 102 limits at the lowest frequency in each band and used to represent the requirements of the FCC

Co-located transmitters

Mode	Co- Located	Radio 1 %	Radio 2 %	Radio 3 %	Total %	Minimum Distance, cm
2.4G						
nonHT	BLE + WIFI	0.03	0.02	0	0.05	1.05
HT20	BLE + WIFI	0.03	0.02	0	0.05	1.03
HT40	BLE + WIFI	0.01	0.02	0	0.03	0.52
VHT20	BLE + WIFI	0.06	0.02	0	0.08	1.56
VHT40	BLE + WIFI	0.01	0.02	0	0.03	0.68
5G						
HT20	BLE + WIFI	0.15	0.02	0	0.17	3.48
HT40	BLE + WIFI	0.41	0.02	0	0.43	8.55
VHT20	BLE + WIFI	0.33	0.02	0	0.35	6.96
VHT40	BLE + WIFI	0.33	0.02	0	0.35	6.96
VHT80	BLE + WIFI	0.07	0.02	0	0.09	1.75
VHT80 BF	BLE + WIFI	0.15	0.02	0	0.17	3.39