

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(i) Maximum Permissible Exposure

RF Exposure Requirements: **§1.1307(b)(1) and §1.1307(b)(2):** Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

RF Radiation Exposure Limit: **§1.1310:** As specified in this section, the Maximum Permissible Exposure (MPE) Limit shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 2.1093 of this chapter.

Note:

Co-located transmitters are:

8.2MHz RFID, 2.4GHz BT and 2.4GHz WiFi

OR

8..2MHz RFID, 2.4GHz BT and 1800MHz Cellular

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	*900/f ²	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	*180/f ²	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

Equation from page 18 of OET 65, Edition 97-01

$$S = PG / 4\pi R^2 \quad \text{or} \quad R = \sqrt{(PG / 4\pi S)}$$

where, S = Power Density (mW/cm²)

P = Power Input to antenna (mW)

G = Antenna Gain (numeric value)

R = Distance (cm)

$$G(\text{dBi}) = 10 \log G (\text{linear})$$

Test Results:

Results are based on KDB 447498 [Section 7.2]. Transmitters used in mobile device exposure conditions for simultaneous transmission operations.

MPE Result for Intentional Radiators of Frequency Range: 300 MHz – 1500 MHz

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (mW)	Ant Gain (dBi)	Ant Gain (dBi)	Power Density (mW/cm ²)	Limit at 20 cm (mW/cm ²) f/1500	Percentage of Limit (%)
836 (Cellular)	31.58	1438.79	1.8	1.513	0.393	0.557	70.55

Note: Tune Up Tolerance is [+/-] 1dB for 836 MHz radios.

The safe distance where Power Density is less than the MPE Limit listed above was found to be 21 cm.

Note: Cellular radio is pre-certified with FCC-ID: QISMS2372H-517

MPE Result for Intentional Radiators of Frequency Range: 1500 MHz – 100,000 MHz

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (mW)	Ant Gain (dBi)	Ant Gain (dBi)	Power Density (mW/cm ²)	Limit at 20 cm (mW/cm ²)	Percentage of Limit (%)
2402 (BLE)	0.05	1.011	-4.1	0.389	0.00007	1	0.007
2437 (WiFi)	10.86	12.18	2	1.584	0.00384	1	0.384

Note: Tune Up Tolerance is [+/-] 1dB for 2402 MHz and 2437 MHz radios.

The safe distance where Power Density is less than the MPE Limit listed above was found to be 21 cm.

Note: BLE radio is pre-certified with FCC-ID: PANBT400 and WiFi radio is pre-certified with FCC-ID: W6RRNWD-N1502UBE

MPE Result for Intentional Radiators of Frequency Range: 1.34 MHz – 30 MHz

$$S = E / 4\pi R^2$$

where, S = Power Density (mW/cm²)

E = EIRP (mW)

R = Distance (cm)

Frequency (MHz)	EIRP (dBuV/m)	EIRP (dBm)	EIRP (mW)	Power Density (mW/cm ²)	Limit at 20 cm (mW/cm ²) 180/f ²	Percentage of Limit (%)
8.2	54.7	-40.5	0.0001	0.000000019	2.67	0.00000007

Note: Tune Up Tolerance is [+/-] 1dB for 8.2 MHz radio.

The safe distance where Power Density is less than the MPE Limit listed above was found to be 21 cm.