

Appendix B. Maximum Permissible Exposure



1. Maximum Permissible Exposure

1.1. Applicable Standard

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 limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2 m normally can be maintained between the user and the device.

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	U		Averaging Time E ² , H ² or S (minutes)	
0.3-3.0	614	1.63	(100)*	6	
3.0-30	1842 / f	4.89 / f	(900 / f)*	6	
30-300	61.4	0.163	1.0	6	
300-1500			F/300	6	
1500-100,000			5	6	

(A) Limits for Occupational / Controlled Exposure

(B) Limits for General Population / Uncontrolled Exposure

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

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

1.2. MPE Calculation Method

$$E (V/m) = \frac{\sqrt{30 \times P \times G}}{d}$$
 Power Density: $Pd (W/m^2) = \frac{E^2}{377}$

E = Electric field (V/m)

P = Average RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

From the EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained.





1.3. Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

For IEEE 802.15.4 ZigBee:

Antenna Type : PCB Antenna

Conducted Power for 802.15.4 ZigBee: 1.45 dBm

Distance (m)	Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power		Power Density (S)	Limit of Power	Test Result
			(dBm)	(mW)	(mW/cm ²)	Density (S) (mW/cm²)	
0.2	4.87	3.0690	1.4500	1.3964	0.000853	1	Complies