

## 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 0.3 m normally can be maintained between the user and the device.

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm <sup>2</sup> )	Averaging Time  E  <sup>2</sup> ,  H  <sup>2</sup> 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

(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/ cm <sup>2</sup> )	Averaging Time  E  <sup>2</sup> ,  H  <sup>2</sup> 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

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

**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=0.3m, as well as the gain of the used antenna, the RF power density can be obtained.

### 1.3. Calculated Result and Limit

For 5GHz UNII Band:

Antenna Type : Dipole Antenna

Test Mode : Mode 1

Max Conducted Power for IEEE 802.11n 40MHz MCS16 B3 (3TX) : 21.93dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm <sup>2</sup> )	Limit of Power Density (S) (mW/cm <sup>2</sup> )	Test Result
8.00	6.3096	21.9330	156.0640	0.087111	1	Complies

Antenna Type : Patch Antenna

Test Mode : Mode 2

Max Conducted Power for IEEE 802.11n 40MHz MCS0 B3 (3TX) : 22.72dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm <sup>2</sup> )	Limit of Power Density (S) (mW/cm <sup>2</sup> )	Test Result
7.07	5.0947	22.7162	186.9061	0.084239	1	Complies

Antenna Type : Panel Antenna

Test Mode : Mode 3

Max Conducted Power for IEEE 802.11n 20MHz MCS0 B3 (1TX) : 19.42dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm <sup>2</sup> )	Limit of Power Density (S) (mW/cm <sup>2</sup> )	Test Result
10.50	11.2202	19.4200	87.4984	0.086850	1	Complies

Antenna Type : Yagi Antenna

Test Mode : Mode 4

Max Conducted Power for IEEE 802.11n 20MHz MCS0 B3 (3TX) : 17.17dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm <sup>2</sup> )	Limit of Power Density (S) (mW/cm <sup>2</sup> )	Test Result
12.77	18.9287	17.1655	52.0650	0.087184	1	Complies

Antenna Type Facade Antenna

Test Mode : Mode 5

Max Conducted Power for IEEE 802.11n 20MHz MCS0 B2 (3TX) : 22.62dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm <sup>2</sup> )	Limit of Power Density (S) (mW/cm <sup>2</sup> )	Test Result
7.27	5.3348	22.6247	183.0097	0.086370	1	Complies

**Test Mode : USB Dongle (2.4G)**

**Max Conducted Power : 25.02 dBm**

Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm <sup>2</sup> )	Limit of Power Density (S) (mW/cm <sup>2</sup> )	Test Result
8.25	6.6834	25.02	317.6874	0.187831	1	Complies

**Test Mode : USB Dongle (5G)**

**Max Conducted Power : 25.41 dBm**

Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power (dBm)	Average Output Power (mW)	Power Density (S) (mW/cm <sup>2</sup> )	Limit of Power Density (S) (mW/cm <sup>2</sup> )	Test Result
8.69	7.3961	25.41	347.5362	0.227388	1	Complies

Radio 1 (5G) + Ant. 8 + USB Dongle right (5G)

Therefore, the worst-case situation is  $0.087184 / 1 + 0.227388 / 1 = 0.314572$ , which is less than "1". This confirmed that the device complies with FCC 1.1310 MPE limit.

Radio 1 (5G) + Ant. 8 + USB Dongle right (2.4G)

Therefore, the worst-case situation is  $0.087184 / 1 + 0.187831 / 1 = 0.275015$ , which is less than "1". This confirmed that the device complies with FCC 1.1310 MPE limit.

Radio 1 (5G) + Ant. 6 + Radio 1 (5G) + Ant. 8

Therefore, the worst-case situation is  $0.087184 / 1 + 0.087184 / 1 = 0.174368$ , which is less than "1". This confirmed that the device complies with FCC 1.1310 MPE limit.