

Appendix A. RF Exposure Evaluation

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.

(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 ²) | 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 |

(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 ²) | 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

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d}$$

$$\text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric field (V/m)

P = Peak 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 peak 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

Mobile
For Single Chain:
IEEE 802.11b

| Operating Frequency (GHz) | Min. User Distance (cm) | Gain (dBi) | Numeric Gain | Output Power (dBm) | Conducted Power (mW) | Power Density (mW/cm ²) |
|---------------------------|-------------------------|------------|--------------|--------------------|----------------------|-------------------------------------|
| 2.412 | 20 | 5 | 3.162278 | 16.36 | 43.2514 | 0.0272 |

IEEE 802.11g

| Operating Frequency (GHz) | Min. User Distance (cm) | Gain (dBi) | Numeric Gain | Output Power (dBm) | Conducted Power (mW) | Power Density (mW/cm ²) |
|---------------------------|-------------------------|------------|--------------|--------------------|----------------------|-------------------------------------|
| 2.437 | 20 | 5 | 3.162278 | 22.14 | 163.6817 | 0.1030 |

For Two Chains:
Configuration of IEEE 802.11n (20MHz)

| Operating Frequency (GHz) | Min. User Distance (cm) | Gain (dBi) | Numeric Gain | Output Power (dBm) | Conducted Power (mW) | Power Density (mW/cm ²) |
|---------------------------|-------------------------|------------|--------------|--------------------|----------------------|-------------------------------------|
| 2.412 | 20 | 5 | 3.162278 | 21.68 | 147.2313 | 0.0927 |

Configuration of IEEE 802.11n (40MHz)

| Operating Frequency (GHz) | Min. User Distance (cm) | Gain (dBi) | Numeric Gain | Output Power (dBm) | Conducted Power (mW) | Power Density (mW/cm ²) |
|---------------------------|-------------------------|------------|--------------|--------------------|----------------------|-------------------------------------|
| 2.422 | 20 | 5 | 3.162278 | 20.31 | 107.3989 | 0.0676 |

**The antenna gain refer to report section 2.2 table.