# Appendix A. 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.

(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/ cm²) | 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/ 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

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \qquad\qquad \text{Power Density:} \quad Pd \text{ (W/m²)} = \frac{E^2}{377}$$

**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

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

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

**Antenna Type : PCB Antenna (TFF-A015MPAX-361)**

**For Single Chain:**

**Max Conducted Power for IEEE 802.11a : 16.59dBm**

| Antenna Gain (dBi) | Antenna Gain (numeric) | Peak Output Power (dBm) | Peak Output Power (mW) | Power Density (S) (mW/cm²) | Limit of Power Density (S) (mW/cm²) | Test Result |
|---|---|---|---|---|---|---|
| 3.00 | 1.9953 | 16.5900 | 45.6037 | 0.018111 | 1 | **Complies** |

**Max Conducted Power for IEEE 802.11n (40MHz) : 17.48dBm**

| Antenna Gain (dBi) | Antenna Gain (numeric) | Peak Output Power (dBm) | Peak Output Power (mW) | Power Density (S) (mW/cm²) | Limit of Power Density (S) (mW/cm²) | Test Result |
|---|---|---|---|---|---|---|
| 3.00 | 1.9953 | 17.4800 | 55.9758 | 0.022231 | 1 | **Complies** |

**For Two Chain:**

**Max Conducted Power for IEEE 802.11n Ant. A & B (40MHz) : 19.26dBm**

| Antenna Gain (dBi) | Antenna Gain (numeric) | Peak Output Power (dBm) | Peak Output Power (mW) | Power Density (S) (mW/cm²) | Limit of Power Density (S) (mW/cm²) | Test Result |
|---|---|---|---|---|---|---|
| 3.00 | 1.9953 | 19.2600 | 84.3335 | 0.033493 | 1 | **Complies** |