

## **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 <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

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

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

**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 802.11a

| Operating Frequency (GHz) | Min. User Distance (cm) | Gain (dBi) | Numeric Gain | Output Power (dBm) | Conducted Power (mW) | Power Density (mW/cm2) |
|---------------------------|-------------------------|------------|--------------|--------------------|----------------------|------------------------|
| 5.180                     | 20                      | 3          | 1.995262     | 15.32              | 34.0408              | 0.0135                 |

For Two Chains:  
Configuration of IEEE 802.11n (20MHz) Port 1+Port 2

| Operating Frequency (GHz) | Min. User Distance (cm) | Gain (dBi) | Numeric Gain | Output Power (dBm) | Conducted Power (mW) | Power Density (mW/cm2) |
|---------------------------|-------------------------|------------|--------------|--------------------|----------------------|------------------------|
| 5.200                     | 20                      | 3          | 1.995262     | 14.85              | 30.5492              | 0.0121                 |

Configuration of IEEE 802.11n (40MHz) Port 1+Port 2

| Operating Frequency (GHz) | Min. User Distance (cm) | Gain (dBi) | Numeric Gain | Output Power (dBm) | Conducted Power (mW) | Power Density (mW/cm2) |
|---------------------------|-------------------------|------------|--------------|--------------------|----------------------|------------------------|
| 5.230                     | 20                      | 3          | 1.995262     | 16.68              | 46.5586              | 0.0185                 |

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