

## **FCC §1.1307(b) & 2.1091 - MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

### **Applicable Standard**

According to subpart 15.247 (i) and subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

#### **Limits for General Population/Uncontrolled Exposure**

| <b>Limits for General Population/Uncontrolled Exposure</b> |                                      |                                      |                                          |                                 |
|------------------------------------------------------------|--------------------------------------|--------------------------------------|------------------------------------------|---------------------------------|
| <b>Frequency Range (MHz)</b>                               | <b>Electric Field Strength (V/m)</b> | <b>Magnetic Field Strength (A/m)</b> | <b>Power Density (mW/cm<sup>2</sup>)</b> | <b>Averaging Time (Minutes)</b> |
| 0.3-1.34                                                   | 614                                  | 1.63                                 | *(100)                                   | 30                              |
| 1.34-30                                                    | 824/f                                | 2.19/f                               | *(180/f <sup>2</sup> )                   | 30                              |
| 30-300                                                     | 27.5                                 | 0.073                                | 0.2                                      | 30                              |
| 300-1500                                                   | /                                    | /                                    | f/1500                                   | 30                              |
| 1500-100,000                                               | /                                    | /                                    | 1.0                                      | 30                              |

f = frequency in MHz

\* = Plane-wave equivalent power density

### **Result**

#### **Calculated Formulary:**

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm<sup>2</sup>)

P = power input to the antenna (in appropriate units, e.g., mW).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

**Result****For worst case:**

| Mode     | Frequency<br>(MHz) | Antenna Gain <sup>#</sup> |           | Tune up conducted power <sup>#</sup> |        | Evaluation Distance<br>(cm) | Power Density<br>(mW/cm <sup>2</sup> ) | MPE Limit<br>(mW/cm <sup>2</sup> ) |
|----------|--------------------|---------------------------|-----------|--------------------------------------|--------|-----------------------------|----------------------------------------|------------------------------------|
|          |                    | (dBi)                     | (numeric) | (dBm)                                | (mW)   |                             |                                        |                                    |
| Wi-Fi    | 2412-2462          | 2.84                      | 1.92      | 26                                   | 398.11 | 20                          | 0.1521                                 | 1                                  |
| WCDMA B2 | 1850-1910          | 2.56                      | 1.8       | 23                                   | 199.53 | 20                          | 0.0715                                 | 1                                  |
| WCDMA B5 | 824-849            | -2.31                     | 0.59      | 25                                   | 316.23 | 20                          | 0.0371                                 | 0.549                              |
| LTE B2   | 1850-1910          | 2.56                      | 1.8       | 23                                   | 199.53 | 20                          | 0.0715                                 | 1                                  |
| LTE B4   | 1710-1755          | 1.62                      | 1.45      | 22                                   | 158.49 | 20                          | 0.0457                                 | 1                                  |
| LTE B12  | 699-716            | -1.56                     | 0.7       | 23                                   | 199.53 | 20                          | 0.0278                                 | 0.466                              |
| LTE B17  | 704-716            | -1.56                     | 0.7       | 24                                   | 251.19 | 20                          | 0.0350                                 | 0.469                              |

Note: The tune-up power and antenna gain was declared by the applicant.

Simultaneous transmitting consideration (worst case):

The ratio= $MPE_{Wi-Fi}/limit_{Wi-Fi} + MPE_{LTE\ Band\ 17}/limit_{LTE\ Band\ 17} = 0.1521/1 + 0.0350/0.469 = 0.227 < 1.0$

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

**Result: Compliant.**