

## 5 FCC §15.247(i), §1.1310, §2.1091 – Maximum Permissible Exposure (MPE)

### 5.1 Applicable Standard

According to subpart 15.247(i) and subpart §1.1310, 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 level in excess of the Commission's guidelines.

**Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)**

| <b>(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;

According to §1.1310 and §2.1091 RF exposure is calculated.

#### Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$  = 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:

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

**5.2 RF Exposure Evaluation Result**

| Mode                  | Frequency Range (MHz) | Antenna Gain |           | Target Power |        | Evaluation Distance (cm) | Power Density (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) |
|-----------------------|-----------------------|--------------|-----------|--------------|--------|--------------------------|-------------------------------------|---------------------------------|
|                       |                       | (dBi)        | (numeric) | (dBm)        | (mW)   |                          |                                     |                                 |
| BLE                   | 2402-2480             | 6            | 3.98      | 1            | 1.26   | 30                       | 0.0004                              | 1                               |
| WIFI 2.4GHz XOR       | 2412-2462             | 12           | 15.85     | 20.5         | 112.20 | 30                       | 0.16                                | 1                               |
| WIFI 5GHz XOR         | 5150-5850             | 12.02        | 15.92     | 22.5         | 177.83 | 30                       | 0.25                                | 1                               |
| WIFI 5GHz Regular     | 5150-5850             | 12.02        | 15.92     | 21.5         | 141.25 | 30                       | 0.20                                | 1                               |
| WIFI 5GHz Regular 8TX | 5150-5850             | 13.78        | 23.88     | 25.5         | 354.81 | 30                       | 0.75                                | 1                               |
| WIFI 2.4GHz AUX       | 2412-2462             | 6            | 3.98      | 20           | 100.00 | 30                       | 0.04                                | 1                               |
| WIFI 5GHz AUX         | 5150-5850             | 6            | 3.98      | 20           | 100.00 | 30                       | 0.04                                | 1                               |

**Transmit simultaneously:**

Worst case is Mode 6:

$$0.0004/1+0.75/1+0.04/1 = 0.7904 < 1$$

**Result:** The EUT meets exemption requirement- RF exposure evaluation greater than **30cm** distance.