

## **FCC §1.1310 & §2.1091 - MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

### **Applicable Standard**

According to subpart §2.1091 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:

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

**Calculated Data:**

| Mode     | Frequency Range (MHz) | Antenna Gain |           | ★Tune-up Output Power |        | Evaluation Distance (cm) | Power Density (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) | MPE ratio |
|----------|-----------------------|--------------|-----------|-----------------------|--------|--------------------------|-------------------------------------|---------------------------------|-----------|
|          |                       | (dBi)        | (numeric) | (dBm)                 | (mW)   |                          |                                     |                                 |           |
| 2.4G SRD | 2411-2466             | 3.34         | 2.16      | 25                    | 316.23 | 20                       | 0.1357                              | 1.0                             | 0.1357    |
| 5G SRD   | 5180-5240             | 3.27         | 2.12      | 17.7                  | 58.88  | 20                       | 0.0249                              | 1.0                             | 0.0249    |
|          | 5735-5805             | 2.90         | 1.95      | 26.5                  | 446.68 | 20                       | 0.1733                              | 1.0                             | 0.1733    |
| 5G Wi-Fi | 5150-5250             | 3.04         | 2.01      | 13.5                  | 22.39  | 20                       | 0.0090                              | 1.0                             | 0.0090    |
|          | 5725-5850             | 4.64         | 2.91      | 10.5                  | 11.22  | 20                       | 0.0065                              | 1.0                             | 0.0065    |

**Note:**

1. For the above tune up power were declared by the manufacturer.
2. SRD and Wi-Fi can transmit simultaneously, but 2.4G SRD and 5G SRD cannot transmit simultaneously.

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

$$= S_{5G\ Wi-Fi}/S_{limit- 5G\ Wi-Fi} + S_{5G\ SRD}/S_{limit- 5G\ SRD}$$

$$= 0.0090 + 0.1733$$

$$= 0.1823$$

$$< 1.0$$

**Result:** The device meet FCC MPE at 20 cm distance.