

## 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) Limits for General Population/Uncontrolled Exposure |                               |                               |                                     |                          |
|---------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| Frequency Range (MHz)                                   | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm <sup>2</sup> ) | Averaging Time (minutes) |
| 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);

### Calculated Data:

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

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

For worst case:

| 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> ) |
|-----------------|-----------------------|--------------|-----------|----------------------|-------|--------------------------|-------------------------------------|---------------------------------|
|                 |                       | (dBi)        | (numeric) | (dBm)                | (mW)  |                          |                                     |                                 |
| BT              | 2402-2480             | 1.89         | 1.55      | 7.00                 | 5.01  | 20                       | 0.0015                              | 1.0                             |
| 2.4G Wi-Fi      | 2412-2462             | 2.68         | 1.85      | 19.50                | 89.13 | 20                       | 0.0329                              | 1.0                             |
| 5G Wi-Fi Band 1 | 5150-5250             | 3.47         | 2.22      | 17.00                | 50.12 | 20                       | 0.0222                              | 1.0                             |
| 5G Wi-Fi Band 4 | 5725-5850             | 4.31         | 2.70      | 17.00                | 50.12 | 20                       | 0.0269                              | 1.0                             |

Note: 1. The BT function can transmit at the same time with the Wi-Fi function.

2. The 2.4G Wi-Fi function can transmit at the same time with the 5G Wi-Fi function.

Simultaneous transmitting consideration:

The ratio=  $MPE_{BT}/limit + MPE_{2.4G\ Wi-Fi}/limit + MPE_{5G\ Wi-Fi}/limit = 0.0015/1 + 0.0329/1 + 0.0269/1 = 0.0613 < 1.0$

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

Result: Compliant.