

RF EXPOSURE EVALUATION

MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to 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/cm²) | Averaging Time (minutes) |
| 0.3–1.34 | 614 | 1.63 | *(100) | 30 |
| 1.34–30 | 824/f | 2.19/f | *(180/f ²) | 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.

Result

Calculation formula:

Prediction of power density at the distance of the applicable MPE limit

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm²);

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:

For worst case:

| Mode | Frequency (MHz) | Antenna Gain [#] | | Max Tune-up Power [#] | | Evaluation Distance (cm) | Power Density (mW/cm ²) | MPE Limit (mW/cm ²) |
|------------|-----------------|---------------------------|-----------|--------------------------------|--------|--------------------------|-------------------------------------|---------------------------------|
| | | (dBi) | (numeric) | (dBm) | (mW) | | | |
| BT | 2402-2480 | 2.64 | 1.84 | 9.0 | 7.94 | 20 | 0.0029 | 1.0 |
| BLE | 2402-2480 | 2.64 | 1.84 | 2.5 | 1.78 | 20 | 0.0007 | 1.0 |
| 2.4G Wi-Fi | 2412-2462 | 5.83 | 3.83 | 25.5 | 354.81 | 20 | 0.2703 | 1.0 |
| 5G Wi-Fi | 5150-5250 | 5.67 | 3.69 | 18.0 | 63.10 | 20 | 0.0463 | 1.0 |
| | 5725-5850 | 5.18 | 3.30 | 19.0 | 79.43 | 20 | 0.0521 | 1.0 |

Note:

- 1) The tune up conducted power and antenna gain was declared by the applicant.
- 2) For the Wi-Fi mode, the antenna gain should be the directional gain.
- 3) The BT and Wi-Fi can transmit at same time, the 2.4G and 5G Wi-Fi cannot transmit at same time.

Simultaneous transmitting consideration (worst case):

The ratio=MPE_{BT}/limit+ MPE_{2.4G Wi-Fi}/limit = 0.0029/1.0+0.2703/1.0 =0.273<1.0

So simultaneous exposure is compliant.

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

Result: Compliant.