

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 ²) | 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.

Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$ = 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);

Calculated Data:

| Mode | Frequency Range (MHz) | Antenna Gain | | Tune-up Output Power | | Evaluation Distance (cm) | Power Density (mW/cm ²) | MPE Limit (mW/cm ²) |
|---------------|-----------------------|--------------|-----------|----------------------|-------|--------------------------|-------------------------------------|---------------------------------|
| | | (dBi) | (numeric) | (dBm) | (mW) | | | |
| BLE(1Mbps) | 2402~2480 | -1.0 | 0.79 | 12.0 | 15.85 | 20 | 0.0025 | 1.0 |
| BLE(2Mbps) | | -1.0 | 0.79 | 11.5 | 14.13 | 20 | 0.0022 | 1.0 |
| BLE (125kbps) | | -1.0 | 0.79 | 12.0 | 15.85 | 20 | 0.0025 | 1.0 |
| BLE (500kbps) | | -1.0 | 0.79 | 12.0 | 15.85 | 20 | 0.0025 | 1.0 |
| Zigbee | 2405~2480 | -1.0 | 0.79 | 11.5 | 14.13 | 20 | 0.0022 | 1.0 |

Note:

1. The tune-up output power was declared by the manufacturer.
2. BLE can’t transmit simultaneously with ZigBee.

Result: The device meets MPE at distance 20cm.