

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

Applicable Standard

According to subpart 15.247 (i) and subpart 1.1310, 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

| 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

Calculated Formulary:

Predication of MPE limit at a given distance

S = PG/4πR² = 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 (worst case):

| Mode | Frequency (MHz) | Maximum Antenna Gain | | Tune-up Conducted Power | | Evaluation Distance (cm) | Power Density (mW/cm ²) | MPE Limit (mW/cm ²) |
|------------------|-----------------|----------------------|-----------|-------------------------|--------|--------------------------|-------------------------------------|---------------------------------|
| | | (dBi) | (numeric) | (dBm) | (mW) | | | |
| Wi-Fi | 2412 | -0.36 | 0.92 | 17.00 | 50.12 | 20 | 0.0092 | 1.00 |
| BLE 1Mbps | 2402 | 2.94 | 1.97 | 4.50 | 2.82 | 20 | 0.0010 | 1.00 |
| BLE 2Mbps | 2402 | 2.94 | 1.97 | 4.50 | 2.82 | 20 | 0.0010 | 1.00 |
| GSM850 | 824.2 | -0.66 | 0.86 | 26.00 | 398.11 | 20 | 0.0681 | 0.55 |
| GSM1900 | 1850.2 | 1.74 | 1.49 | 23.00 | 199.53 | 20 | 0.0592 | 1.23 |
| WCDMA B2 | 1852.4 | 1.74 | 1.49 | 25.00 | 316.23 | 20 | 0.0939 | 1.23 |
| WCDMA B4 | 1712.4 | 1.74 | 1.49 | 25.00 | 316.23 | 20 | 0.0939 | 1.14 |
| WCDMA B5 | 826.4 | -0.66 | 0.86 | 25.00 | 316.23 | 20 | 0.0540 | 0.55 |
| LTE B2 | 1850.7 | 1.74 | 1.49 | 25.00 | 316.23 | 20 | 0.0939 | 1.23 |
| LTE B4 | 1710.7 | 1.74 | 1.49 | 25.00 | 316.23 | 20 | 0.0939 | 1.14 |
| LTE B5 | 824.7 | -0.66 | 0.86 | 25.00 | 316.23 | 20 | 0.0540 | 0.55 |
| LTE B7 | 2502.5 | 2.32 | 1.71 | 25.00 | 316.23 | 20 | 0.1073 | 1.00 |
| LTE B12 | 699.7 | -0.66 | 0.86 | 25.00 | 316.23 | 20 | 0.0540 | 0.47 |
| LTE B13 | 779.5 | -0.51 | 0.89 | 25.00 | 316.23 | 20 | 0.0559 | 0.52 |
| LTE B25 | 1850.7 | 2.32 | 1.71 | 25.00 | 316.23 | 20 | 0.1073 | 1.00 |
| LTE B26(814-824) | 814.7 | -0.66 | 0.86 | 25.00 | 316.23 | 20 | 0.0540 | 0.54 |
| LTE B26(824-849) | 824.7 | -0.66 | 0.86 | 25.00 | 316.23 | 20 | 0.0540 | 0.55 |
| LTE B38 | 2572.5 | 2.28 | 1.69 | 25.00 | 316.23 | 20 | 0.1063 | 1.00 |
| LTE B41 | 2498.5 | 2.28 | 1.69 | 25.00 | 316.23 | 20 | 0.1063 | 1.00 |

Note:

- (1) The tune-up output powers are all declared by the Manufacturer.
- (2) The LTE module FCC ID: XMR201903EG25G.
- (3) Wi-Fi & BLE & GSM/WCDMA/LTE can transmit simultaneously; the worst condition is Wi-Fi & BLE & GSM850 as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0092/1.00 + 0.0010/1.00 + 0.0681/0.55 = 0.1340 < 1.0$$

Conclusion: The device meets MPE at distance 20cm.