

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

Applicable Standard

According to subpart 15.247(i) 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/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.

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);

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 | | Target Output Power | | Evaluation Distance (cm) | Power Density (mW/cm ²) | MPE Limit (mW/cm ²) |
|-------------|-----------------------|--------------|-----------|---------------------|---------|--------------------------|-------------------------------------|---------------------------------|
| | | (dBi) | (numeric) | (dBm) | (mW) | | | |
| BLE | 2402~2480 | 3.28 | 2.13 | -3.50 | 0.45 | 20 | 0.0002 | 1.00 |
| WCDMA II | 1850~1910 | -4.39 | 0.36 | 24.00 | 251.189 | 20 | 0.0182 | 1.00 |
| WCDMA IV | 1710~1755 | -4.14 | 0.39 | 24.00 | 251.189 | 20 | 0.0193 | 1.00 |
| WCDMA V | 824~849 | -5.55 | 0.28 | 24.00 | 251.189 | 20 | 0.0139 | 0.55 |
| LTE Band 2 | 1850~1910 | -4.39 | 0.36 | 24.50 | 281.838 | 20 | 0.0204 | 1.00 |
| LTE Band 4 | 1710~1755 | -4.14 | 0.39 | 24.50 | 281.838 | 20 | 0.0216 | 1.00 |
| LTE Band 5 | 824~849 | -5.55 | 0.28 | 24.50 | 281.838 | 20 | 0.0156 | 0.55 |
| LTE Band 12 | 699~716 | -6.24 | 0.24 | 24.50 | 281.838 | 20 | 0.0133 | 0.47 |
| LTE Band 13 | 777~787 | -4.17 | 0.38 | 24.50 | 281.838 | 20 | 0.0215 | 0.52 |

Note:

- (1) The target output powers are all declared by the Manufacturer.
- (2) The LTE/WCDMA module FCC ID: XMR201807EG91NA.
- (3) BLE and WCDMA or LTE can transmit simultaneously; the worst condition was as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0002/1.00 + 0.0215/0.52 = 0.0002 + 0.0413 = 0.0415 < 1.0$$

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