

## FCC §15.247 (i) & §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/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.

### 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/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);

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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 (MHz) | Antenna Gain |           | Conducted output power including Tune-up Tolerance |        | Evaluation Distance (cm) | Power Density (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) |
|----------|-----------------|--------------|-----------|--|--------|--------------------------|-------------------------------------|---------------------------------|
|          |                 | (dBi)        | (numeric) | (dBm)  | (mW)   |                          |                                     |                                 |
| WLAN     | 2412-2462       | 2.86         | 1.93      | 20   | 100.00 | 20.00                    | 0.04                                | 1.0                             |
| WLAN     | 5150-5250       | 5.96         | 3.94      | 20   | 100.00 | 20.00                    | 0.08                                | 1.0                             |
| WLAN     | 5725-5850       | 5.96         | 3.94      | 20   | 100.00 | 20.00                    | 0.08                                | 1.0                             |
| BLE      | 2402-2480       | 0            | 1.00      | 1  | 1.26   | 20.00                    | 0.0003                              | 1.0                             |
| WCDMA B2 | 1850-1910       | -1.7         | 0.68      | 24   | 251.19 | 20.00                    | 0.03                                | 1.0                             |
| WCDMA B4 | 1710-1755       | -1.9         | 0.65      | 24   | 251.19 | 20.00                    | 0.03                                | 1.0                             |
| WCDMA B5 | 824-849         | -1.6         | 0.69      | 24   | 251.19 | 20.00                    | 0.03                                | 0.55                            |
| LTE B2   | 1850-1910       | -1.7         | 0.68      | 24   | 251.19 | 20.00                    | 0.03                                | 1.0                             |
| LTE B4   | 1710-1755       | -1.9         | 0.65      | 24   | 251.19 | 20.00                    | 0.03                                | 1.0                             |
| LTE B5   | 824-849         | -1.6         | 0.69      | 24   | 251.19 | 20.00                    | 0.03                                | 0.55                            |
| LTE B7   | 2500-2570       | 2            | 1.58      | 24   | 251.19 | 20.00                    | 0.08                                | 1.0                             |
| LTE B12  | 699-716         | 0.5          | 1.12      | 24   | 251.19 | 20.00                    | <b>0.06</b>                         | <b>0.47</b>                     |
| LTE B13  | 777-787         | 0.7          | 1.17      | 24   | 251.19 | 20.00                    | 0.06                                | 0.52                            |
| LTE B25  | 1850-1915       | -1.7         | 0.68      | 24   | 251.19 | 20.00                    | 0.03                                | 1.0                             |
| LTE B26  | 814-849         | -1.6         | 0.69      | 24   | 251.19 | 20.00                    | 0.04                                | 0.54                            |
| LTE B30  | 2305-2315       | 2.3          | 1.70      | 24   | 251.19 | 20.00                    | 0.08                                | 1.0                             |
| LTE B66  | 1710-1780       | -1.9         | 0.65      | 24   | 251.19 | 20.00                    | 0.03                                | 1.0                             |

*Note: The device build in a certified WWAN Module, FCC ID: XMR201807EP06A, the WLAN 2.4G, WLAN 5G, BLE and WWAN can transmit simultaneously:*

$$\sum_i \frac{S_i}{S_{\text{Limit},i}}$$

$$= S_{2.4}/S_{\text{limit-2.4}} + S_5/S_{\text{limit-5}} + S_{\text{BLE}}/S_{\text{limit-BLE}} + S_{\text{WWAN}}/S_{\text{limit-WWAN}}$$

$$= 0.04/1 + 0.08/1 + 0.0003/1 + 0.06/0.47$$

$$= 0.25$$

$$< 1.0$$

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