

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 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.

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:

| Mode | Frequency (MHz) | Antenna Gain | | Conducted output power including Tune-up Tolerance | | Evaluation Distance (cm) | Power Density (mW/cm ²) | MPE Limit (mW/cm ²) |
|------|-----------------|--------------|-----------|--|------|--------------------------|-------------------------------------|---------------------------------|
| | | (dBi) | (numeric) | (dBm) | (mW) | | | |
| WLAN | 2412-2462 | 4 | 2.51 | 30 | 1000 | 25.00 | 0.32 | 1.0 |
| WWAN | 668-693 | 2 | 1.58 | 25 | 316 | 25.00 | 0.06 | 0.45 |

Note: The device contains a certified WWAN module, FCC ID: XMR201808EC25AF.

The WWAN antenna gain is 2dBi in all bands that declared by manufacturer, the WWAN conducted output power is 25dBm for all band. Therefore, the lower frequency band is the worst mode.

The WLAN and WWAN can transmit simultaneously:

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

$$= S_{\text{WLAN}}/S_{\text{limit-WLAN}} + S_{\text{WWAN}}/S_{\text{limit-WWAN}}$$

$$= 0.32/1 + 0.06/0.45$$

$$= 0.45$$

$$< 1.0$$

Result: The device meet FCC MPE at 25 cm distance