

FCC §15.247 (i) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247 (i) and subpart 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

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

Result

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = 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:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

Mode	Frequency (MHz)	Antenna Gain		Max Tune Up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
		(dBi)	(numeric)	(dBm)	(mW)			
Wi-Fi	2412-2472	2.0	1.58	18.0	63.1	20	0.020	1.0
LTE Data Module								
WCDMA Band 2	1850-1910	2.0	1.58	24.0	251.2	20	0.079	1.0
WCDMA Band 4	1710-1755	2.0	1.58	23.0	199.5	20	0.063	1.0
WCDMA Band 5	824-849	2.0	1.58	24.0	251.2	20	0.079	0.55
LTE Band 2	1850-1910	2.0	1.58	24.0	251.2	20	0.079	1.0
LTE Band 4	1710-1755	2.0	1.58	23.0	199.5	20	0.063	1.0
LTE Band 5	824-849	2.0	1.58	23.0	199.5	20	0.063	0.55
LTE Band 12	699-716	2.0	1.58	23.0	199.5	20	0.063	0.466
LTE Band 13	777-787	2.0	1.58	23.0	199.5	20	0.063	0.518
LTE Voice Module (FCC ID: XMR201808EC25AF)								
WCDMA Band 2	1850-1910	2.0	1.58	25.0	316.23	20	0.099	1.0
WCDMA Band 4	1710-1755	2.0	1.58	25.0	316.23	20	0.099	1.0
WCDMA Band 5	824-849	2.0	1.58	25.0	316.23	20	0.099	0.55
LTE Band 2	1850-1910	2.0	1.58	25.0	316.23	20	0.099	1.0
LTE Band 4	1710-1755	2.0	1.58	25.0	316.23	20	0.099	1.0
LTE Band 5	824-849	2.0	1.58	25.0	316.23	20	0.099	0.55
LTE Band 12	699-716	2.0	1.58	25.0	316.23	20	0.099	0.466
LTE Band 13	777-787	2.0	1.58	25.0	316.23	20	0.099	0.518
LTE Band 14	788-798	2.0	1.58	25.0	316.23	20	0.099	0.525
LTE Band 66	1710-1780	2.0	1.58	25.0	316.23	20	0.099	1.0
LTE Band 71	663-698	2.0	1.58	25.0	316.23	20	0.099	0.442

- Note: 1. the tune up conducted power was declared by the applicant
 2. the Wi-Fi, LTE Voice module and LTE Data module can transmit at the same time.
 3. Please refer to the MPE report of the FCC ID: XMR201808EC25AF for the LTE voice module output power.

So the worst simultaneous transmitting consideration:

$$\begin{aligned} \text{The ratio} &= \text{MPE}_{\text{Wi-Fi}}/\text{limit} + \text{MPE}_{\text{LTE Voice Module}}/\text{limit} + \text{MPE}_{\text{LTE Data Module}}/\text{limit} \\ &= 0.02/1.0 + 0.079/0.55 + 0.099/0.442 \\ &= 0.39 < 1.0 \end{aligned}$$

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliance