

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/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.

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 Result

Operation 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)			
Wi-Fi	2412	-0.4	0.91	26	398.11	20.00	0.07	1.00
GSM850	824.2	2	1.58	25.81	381.07	20.00	0.12	0.55
PCS1900	1850.2	2	1.58	22.81	190.99	20.00	0.06	1.00
WCDMA B2	1852.4	2	1.58	25	316.23	20.00	0.10	1.00
WCDMA B4	1712.4	2	1.58	25	316.23	20.00	0.10	1.00
WCDMA B5	826.4	2	1.58	25	316.23	20.00	0.10	0.55
LTE B2	1850.7	2	1.58	25	316.23	20.00	0.10	1.00
LTE B4	1710.7	2	1.58	25	316.23	20.00	0.10	1.00
LTE B5	824.7	2	1.58	25	316.23	20.00	0.10	0.55
LTE B7	2502.5	2	1.58	25	316.23	20.00	0.10	1.00
LTE B12	699.7	2	1.58	25	316.23	20.00	0.10	0.47
LTE B13	779.5	2	1.58	25	316.23	20.00	0.10	0.52
LTE B25	1850.7	2	1.58	25	316.23	20.00	0.10	1.00
LTE B26	814.7	2	1.58	25	316.23	20.00	0.10	0.54
LTE B38	2572.5	2	1.58	25	316.23	20.00	0.10	1.00
LTE B41	2498.5	2	1.58	25	316.23	20.00	0.10	1.00

Note: The device contains one LTE module (FCC ID: XMR201903EG25G). The output power of WWAN please refers to MPE report of LTE module.

MPE evaluation for simultaneous transmission:

Note: WLAN, WWAN can transmit simultaneously, MPE evaluation is as below formula:

$$PD1/Limit1 + PD2/Limit2 + \dots < 1, PD \text{ (Power Density)}$$

The worst case is as below:

$$MPE \text{ of WLAN} + MPE \text{ of WWAN} = 0.07/1.00 + 0.12/0.55 = 0.29 < 1.0$$

Conclusion: Compliance. The device meets FCC MPE at 20 cm distance