

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

Applicable Standard

According to subpart 15.247 (i) and subpart 1.1310, 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				
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

Calculated Formulary:

Predication of MPE limit at a given distance

S = PG/4πR² = 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		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
		(dBi)	(numeric)	(dBm)	(mW)			
BLE	2402~2480	2.5	1.78	2.50	1.78	20	0.0060	1.0
GSM850	824-849	3.7	2.34	25.97	395.37	20	0.1844	0.55
GSM1900	1850-1910	1.53	1.42	22.97	198.15	20	0.0561	1.0
WCDMA II	1850-1910	1.53	1.42	25.00	316.23	20	0.0895	1.0
WCDMA V	824-849	3.7	2.34	25.00	316.23	20	0.1475	0.55
LTE Band 2	1850-1910	1.53	1.42	25.00	316.23	20	0.0895	1.0
LTE Band 4	1710-1755	2.03	1.60	25.00	316.23	20	0.1004	1.0
LTE Band 5	824-849	3.7	2.34	25.70	371.54	20	0.1733	0.55
LTE Band 7	2500-2570	2.24	1.67	25.00	316.23	20	0.1054	1.0

Note:

(1) The LTE module FCC ID: XMR201805EC21AU, Date of Grant: 05/22/2018.

(2) BLE & GSM/WCDMA/LTE can transmit simultaneously; the worst condition as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0060/1.00 + 0.1844/0.55 = 0.341 < 1.0$$

Conclusion: The device meets MPE at distance 20cm