

**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>(B) Limits for General Population/Uncontrolled Exposure</b>				
<b>Frequency Range (MHz)</b>	<b>Electric Field Strength (V/m)</b>	<b>Magnetic Field Strength (A/m)</b>	<b>Power Density (mW/cm<sup>2</sup>)</b>	<b>Averaging Time (minutes)</b>
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/4πR<sup>2</sup> = 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);

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	1.58	17	50.12	20.00	0.02	1.0
Lora-DSS	902.3-914.9	4	2.51	21	125.89	20.00	0.06	0.60
Lora-DTS	903-927.5	4	2.51	11	12.59	20.00	0.01	0.60
WCDMA B2	1850-1910	2	1.58	25	316.23	20.00	0.10	1.0
WCDMA B4	1710-1755	2	1.58	25	316.23	20.00	0.10	1.0
WCDMA B5	824-849	2	1.58	25	316.23	20.00	0.10	0.55
LTE B2	1850-1910	2	1.58	25	316.23	20.00	0.10	1.0
LTE B4	1710-1755	2	1.58	25	316.23	20.00	0.10	1.0
LTE B5	824-849	2	1.58	25	316.23	20.00	0.10	0.55
LTE B12	699-716	2	1.58	25	316.23	20.00	0.10	0.47
LTE B13	777-787	2	1.58	25	316.23	20.00	0.10	0.52
LTE B14	788-798	2	1.58	25	316.23	20.00	0.10	0.53
LTE B66	1710-1780	2	1.58	25	316.23	20.00	0.10	1.0
LTE B71	663-698	2	1.58	25	316.23	20.00	0.10	0.44

The WLAN 2.4G,Lora and WWAN can transmit simultaneously:

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

=S<sub>WLAN</sub>/S<sub>limit-WLAN</sub>+ S<sub>WWAN</sub>/S<sub>limit-WWAN</sub>+ S<sub>Lora</sub>/S<sub>limit-Lora</sub>

=0.02/1+0.10/0.44+0.06/0.60

=0.35

< 1.0

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