

## 4 FCC§15.247(i), §1.1310, § 2.1091 - Maximum Permissible Exposure (MPE)

### 4.1 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 <sup>2</sup> )	Averaging Time (minutes)
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.

**Calculated Formulary:** Predication of MPE limit at a given distance

$S = PG/4\pi R^2$  = 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:

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

## 4.2 RF Exposure Evaluation Result

### MPE Evaluation:

Mode	Frequency Range (MHz)	Antenna Gain		Target Power		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
		(dBi)	(numeric)	(dBm)	(mW)			
Wi-Fi 2.4G	2412-2462	3.00	1.995	25.00	316.2278	20	0.1256	1.0
BLE	2402-2480	3.00	1.995	4.00	2.5119	20	0.0010	1.0
BR+EDR	2402-2480	3.00	1.995	9.00	7.9433	20	0.0032	1.0
Wi-Fi 5G UNII-1	5150-5250	3.00	1.995	20.00	100.0000	20	0.0397	1.0
Wi-Fi 5G UNII-3	5745-5850	3.00	1.995	21.00	125.8925	20	0.0500	1.0

### LTE module FCC ID: 2AJYU-SIM7000A

Mode	Frequency Range (MHz)	Antenna Gain		Target Power		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
		(dBi)	(numeric)	(dBm)	(mW)			
LTE B2	1850-1910	0.48	1.117	25.70	371.54	20	0.0826	1.0
LTE B4	1710-1755	-0.73	0.845	25.70	371.54	20	0.0625	1.0
LTE B12	699-716	2.11	1.626	25.70	371.54	20	0.1202	0.466
LTE B13	777-787	2.11	1.626	25.70	371.54	20	0.1202	0.518

### LTE module FCC ID: RI7LE910NAV2

Mode	Frequency Range (MHz)	Antenna Gain		Target Power		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
		(dBi)	(numeric)	(dBm)	(mW)			
LTE B2	1850-1910	0.48	1.117	24.00	251.189	20	0.0558	1.0
LTE B4	1710-1755	-0.73	0.845	24.00	251.189	20	0.0422	1.0
LTE B5	824-849	2.65	1.841	24.00	251.189	20	0.0920	0.550
LTE B12	699-716	2.11	0.845	24.00	251.189	20	0.0812	0.466
LTE B13	777-787	2.11	1.626	24.00	251.189	20	0.0812	0.518
LTE B17	704-716	2.11	0.845	24.00	251.189	20	0.0812	0.469

### MPE evaluation for simultaneous transmission:

#### Note:

1. Wi-Fi (2.4G) or Wi-Fi 5G and BT can't transmit simultaneously.

2. Wi-Fi (2.4G) and Wi-Fi 5G can't transmit simultaneously

Wi-Fi or BT & WWAN can transmit simultaneously , MPE evaluation is as below formula:

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

**The worst case is as below:**

Max MPE of Wi-Fi + Max MPE of LTE  
=  $0.1256/1.0 + 0.1202/0.466 = 0.3835 < 1.0$

**Result:** MPE evaluation of single and simultaneous transmission meet the requirement of standard.