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

Applicable Standard

According to subpart §2.1091 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)

Limits for Occupational/Controlled Exposure				
Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time |E|, |H| or S (minutes)
0.3- 3.0	614	1.63	(100)*	6
3.0 - 30	1842/f	4.89/f	($900/f^2$)*	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	f/300	6
1500-100,000	/	/	5	6

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^2);
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);

$$\sum_i \frac{S_i}{S_{Limit\_i}} \leq 1$$

Calculated Data:

2.4G Wi-Fi&BLE&BT: (Based on General Population/Uncontrolled Exposure)

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Output Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
802.11b	2412~2462	1.0	1.26	20.00	100.00	25	0.0160	1.0
802.11g		1.0	1.26	21.50	141.25	25	**0.0226**	**1.0**
802.11n-HT20		1.0	1.26	18.50	70.79	25	0.0113	1.0
802.11n-HT40	2422~2452	1.0	1.26	15.50	35.48	25	0.0057	1.0
BLE	2402-2480	1.0	1.26	10.00	10.00	25	0.0016	1.0
BT	2402-2480	1.0	1.26	12.50	17.78	25	0.0029	1.0

WCDMA/LTE: (Based on General Population/Uncontrolled Exposure)

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Conducted Power		EvaluationDistance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
WCDMA Band II	1850-1910	1.0	1.26	24.50	281.84	25	0.0452	1.00
WCDMA Band V	824-849	1.0	1.26	24.50	281.84	25	0.0452	0.55
LTE Band 2	1850-1910	1.0	1.26	24.00	251.19	25	0.0403	1.00
LTE Band 4	1710-1755	1.0	1.26	24.00	251.19	25	0.0403	1.00
LTE Band 5	824-849	1.0	1.26	24.00	251.19	25	0.0403	0.55
LTE Band 12	699-716	1.0	1.26	24.00	251.19	25	0.0403	0.47
LTE Band 13	777-787	1.0	1.26	24.00	251.19	25	0.0403	0.52
LTE Band 17	704-716	1.0	1.26	24.00	251.19	25	**0.0403**	**0.47**

UHF: (Based on Occupational/controlled Exposure)

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Conducted Power		EvaluationDistance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
UHF	410-470	5.5	3.55	33.50	2238.72	25	**1.0112**	**1.37**

Note:
1.The Tune-up output power was declared by the Manufacturer.
2.The LTE module FCC ID: RI7LE910NAV2(Grant on: 08/19/2015)
3. 2.4G Wi-Fi/BT/BLE, LTE and UHF can transmit simultaneously; the worst condition as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0226/1.0+0.0403/0.47+1.0112/1.37=0.846< 1.0$$

Conclusion: The device meets MPE at distance 25cm.