

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

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

Mode	Frequency Range (MHz)	Antenna Gain		Target Output Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
		(dBi)	(numeric)	(dBm)	(mW)			
Wi-Fi 802.11b	2412~2462	5.00	3.16	23.00	199.53	20	0.1254	1.0
Wi-Fi 802.11g		5.00	3.16	24.00	251.19	20	0.1579	1.0
Wi-Fi 802.11n-HT20		5.00	3.16	24.00	251.19	20	0.1579	1.0
Wi-Fi 802.11n-HT40	2422~2452	5.00	3.16	23.00	199.53	20	0.1254	1.0
WCDMA Band II	1852.4~1907.6	5.00	3.16	24.50	281.84	20	0.1772	1.0
WCDMA Band	1712.4~1752.6	5.00	3.16	24.50	281.84	20	0.1772	1.0
WCDMA Band	826.4~846.6	4.50	2.82	24.50	281.84	20	0.1580	0.5509
LTE Band 2	1850.7~1909.3	5.00	3.16	24.00	251.19	20	0.1579	1.0
LTE Band 4	1710.7~1754.3	5.00	3.16	24.00	251.19	20	0.1579	1.0
LTE Band 5	824.7~848.3	4.50	2.82	24.00	251.19	20	0.1408	0.5498
LTE Band 12	699.7~715.3	7.00	5.01	24.00	251.19	20	0.2504	0.4665
LTE Band 17	706.5~713.5	7.00	5.01	24.00	251.19	20	0.2504	0.4710
LTE Band 13	779.5~784.5	7.00	5.01	24.00	251.19	20	0.2504	0.5197
LTE Band 66	1710.7~1779.3	5.00	5.01	24.00	251.19	20	0.1579	1.0
LTE Band 71	665.5~695.5	7.00	5.01	24.00	251.19	20	0.2504	0.4437

Note:

- (1) The target output powers are all declared by the Manufacturer.
 (2) The LTE module FCC ID: ZMONL668AM00.
 (3) Wi-Fi and LTE can transmit simultaneously; the worst condition is 802.11g of Wi-Fi and LTE Band 71 as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.1579/1.0 + 0.2504/0.4437 = 0.1579 + 0.5643 = 0.7222$$

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