

FCC ID: 2BMG5-MR4G-USA

KDB447498 D01 General RF Exposure Guidance v06

RF EXPOSURE EVALUATION

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency(RF) Radiation as specified in §1.1307(b)

Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
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
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
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
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

MPE Calculation Method

$$E \text{ (V/m)} = \frac{\sqrt{30 * P * G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric field (V/m)

P = Average RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 * P * G}{377 * D^2}$$

From the EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained.

Measurement Result

2.4G WIFI

Operation Frequency:

WIFI 802.11b/g/n HT20: 2412-2462MHz,

WIFI 802.11n HT40:2422-2452MHz

Power density limited: 1mW/ cm²

Antenna Type:FPC antenna

Antennagain: Ant:4.66dBi;

R=20cm

$mW=10^{(dBm/10)}$

antennagain Numeric= $10^{(dBi/10)}=10^{(4.66/10)}=2.92$

Antenna	Channel Freq. (MHz)	modulation	conducted power	Tune-up pow er (dBm)	Max		Antenna		Evaluation result	Power density Limits
			(dBm)		tune-up pow er		Gain		(mW/cm2)	(mW/cm2)
					(dBm)	(mW)	(dBi)	Numeric		
Ant 1	2412	802.11b	14.95	15±1	16	39.811	4.66	2.92	0.0232	1
Ant 1	2437		15.43	15±1	16	39.811	4.66	2.92	0.0232	1
Ant 1	2462		15.67	15±1	16	39.811	4.66	2.92	0.0232	1
Ant 1	2412	802.11g	14.74	15±1	16	39.811	4.66	2.92	0.0232	1
Ant 1	2437		14.84	15±1	16	39.811	4.66	2.92	0.0232	1
Ant 1	2462		14.74	15±1	16	39.811	4.66	2.92	0.0232	1
Ant 1	2412	802.11n H20	13.27	14±1	15	31.623	4.66	2.92	0.0184	1
Ant 1	2437		13.46	14±1	15	31.623	4.66	2.92	0.0184	1
Ant 1	2462		13.46	14±1	15	31.623	4.66	2.92	0.0184	1
Ant 1	2422	802.11n H40	13.3	14±1	15	31.623	4.66	2.92	0.0184	1
Ant 1	2437		13.19	14±1	15	31.623	4.66	2.92	0.0184	1
Ant 1	2452		13.1	14±1	15	31.623	4.66	2.92	0.0184	1

For LTE

Antenna Type: FPC antenna

Operating Mode	Maximum measured Conducted Tune-up power	Maximum measured Conducted Tune-up power	Antenna gain	Evaluation result	Power density Limits
	(dBm)	(mW)			
LTE Band II	22	158.49	4.77	0.0946	1.0000
LTE Band IV	22	158.49	2.65	0.0580	1.0000
LTE Band V	23	199.53	2.03	0.0633	0.5498
LTE Band VII	23	199.53	1.54	0.0566	1.0000
LTE Band XXXVIII	22.5	177.83	1.28	0.0475	1.0000
LTE Band XLI	23.5	223.87	1.54	0.0635	1.0000

SIMULTANEOUS TRANSMISSIONS

When a number of sources at different frequencies, and/or broadband sources, contribute to the total exposure, it becomes necessary to weigh each contribution relative to the MPE. To comply with the MPE, the fraction of the MPE in terms of E^2 , H^2 (or power density) incurred within each frequency interval should be determined and the sum of all such fractions should not exceed unity. In order to ensure compliance with the MPE for a controlled environment, the sum of the ratios of the power density to the corresponding MPE should not exceed unity. That is

$$\sum_{i=1}^n \frac{S_i}{MPE_i} \leq 1$$

Max. SIMULTANEOUS TRANSMISSIONS for LTE Module + Wi-Fi Module

Mode	Max Conducted Tune-up power (dBm)	Max Conducted Tune-up power (mW)	Antenna gain dBi	Standalone	Standalone	Simultaneous		Verdict
				Evaluation result	Power density Limits	Evaluation result	Power density Limits	
				(mW/cm ²)	(mW/cm ²)	(mW/cm ²)	(mW/cm ²)	
WIFI	16	39.81	4.66	0.0232	1	0.1177	1	PASS
LTE B2	22	158.49	4.77	0.0946	1			

Signature: 

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