

RF Exposure evaluation

FCC ID: 2AAUI-MONDODUO

Exposure category: General population/uncontrolled environment

EUT Type: Production Unit

Device Type: Mobile Device

1. Reference

According to §1.1307(b)(1), 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.

According to §1.1310 and §2.1091 RF exposure is calculated.

KDB447498 D01 V06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies

2. Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
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 – 1500	/	/	f/300	6
1500 – 100,000	/	/	5	6

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	30
3.0 – 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

3. MPE Calculation Method

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

Where: S=power density

P=power input to antenna

G=power gain of the antenna in the direction of interest relative to an isotropic radiator

R=distance to the center of radiation of the antenna

4. Antenna Information

Internal Identification	Antenna Identification in Internal photos	Antenna type and antenna number	Operate frequency band	Maximum antenna gain
Antenna 1	2.4G/5G Wifi	FPC antenna	2.4GHz – 2.5 GHz	1.3 dBi
			5.1GHz – 5.8 GHz	2.3 dBi
Antenna 2	2.4G/5G Wifi	FPC antenna	2.4GHz – 2.5 GHz	1.6 dBi
			5.1GHz – 5.8 GHz	2.8 dBi
Antenna 1	BT	FPC antenna	2.4GHz – 2.5 GHz	1.6 dBi
Antenna 2	BT	FPC antenna	2.4GHz – 2.5 GHz	1.3 dBi

5. Standalone MPE Result

The EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance, $r = 20\text{cm}$, the RF power density can be obtained.

Bluetooth

Antenna ID	Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
		dBm	mW				
1	GFSK	4.49	2.8119	1.6	1.4454	0.0008	1.0000
	$\pi/4$ DQPSK	4.89	3.0832	1.6	1.4454	0.0009	1.0000
	8-DPSK	5.20	3.3113	1.6	1.4454	0.0010	1.0000
	BLE 1M	5.06	3.2063	1.6	1.4454	0.0009	1.0000
	BLE 2M	5.04	3.1915	1.6	1.4454	0.0009	1.0000
2	GFSK	4.40	2.7542	1.3	1.3490	0.0007	1.0000
	$\pi/4$ DQPSK	4.81	3.0269	1.3	1.3490	0.0008	1.0000
	8-DPSK	5.14	3.2659	1.3	1.3490	0.0009	1.0000
	BLE 1M	4.94	3.1189	1.3	1.3490	0.0008	1.0000
	BLE 2M	4.96	3.1333	1.3	1.3490	0.0008	1.0000

2.4GHz WIFI

Antenna ID	Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
		dBm	mW				
1	IEEE 802.11b	15.83	38.2825	1.3	1.3490	0.0103	1.0000
	IEEE 802.11g	19.35	86.0994	1.3	1.3490	0.0231	1.0000
	IEEE 802.11n HT20	19.59	90.9913	1.3	1.3490	0.0244	1.0000
	IEEE 802.11n HT40	19.61	91.4113	1.3	1.3490	0.0245	1.0000
2	IEEE 802.11b	17.69	58.7489	1.6	1.4454	0.0169	1.0000
	IEEE 802.11g	21.12	129.4196	1.6	1.4454	0.0372	1.0000
	IEEE 802.11n HT20	21.35	136.4583	1.6	1.4454	0.0392	1.0000
	IEEE 802.11n HT40	21.28	134.2765	1.6	1.4454	0.0386	1.0000

5GHz WIFI

Antenna ID	Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
		dBm	mW				
1	IEEE 802.11a	13.67	23.2809	2.3	1.6982	0.0079	1.0000
	IEEE 802.11n HT20	13.83	24.1546	2.3	1.6982	0.0082	1.0000
	IEEE 802.11ac VHT20	13.39	21.8273	2.3	1.6982	0.0074	1.0000
	IEEE 802.11n HT40	13.39	21.8273	2.3	1.6982	0.0074	1.0000
	IEEE 802.11ac VHT40	13.23	21.0378	2.3	1.6982	0.0071	1.0000
	IEEE 802.11ac VHT80	13.90	24.5471	2.3	1.6982	0.0083	1.0000
2	IEEE 802.11a	13.85	24.2661	2.8	1.9055	0.0092	1.0000
	IEEE 802.11n HT20	13.25	21.1349	2.8	1.9055	0.0080	1.0000
	IEEE 802.11ac	13.26	21.1836	2.8	1.9055	0.0080	1.0000

	VHT20						
	IEEE 802.11n HT40	13.17	20.7491	2.8	1.9055	0.0079	1.0000
	IEEE 802.11ac VHT40	13.30	21.3796	2.8	1.9055	0.0081	1.0000
	IEEE 802.11ac VHT80	13.08	20.3236	2.8	1.9055	0.0077	1.0000

Remark:

1. MPE evaluate distance is 20cm from user manual provide by manufacturer.

6. Summary simultaneous transmission information

Synchronization transmit between WIFI, BT and WPT

Modulation Type	Modulation Type	Modulation Type	Synchronization transmit
WPT	WIFI antenna 1	BT antenna 1	Yes
WPT	WIFI antenna 2	BT antenna 2	Yes

7. Summary simultaneous transmission results

Synchronization transmit between WIFI antenna 2, BT antenna 2 and WPT.

$MPE_{(WPT)}$ ratios	$MPE_{(WIFI)}$ ratios	$MPE_{(BT)}$ ratios	$\sum MPE_{(WPT+WIFI+BT)}$ ratios	Limit ratios	Results
0.4405	0.0392	0.0009	0.4806	1.0	PASS

8. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of Mobile Device.

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