

RF Exposure evaluation

FCC ID: 2BO56-ZA001

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.

KDB 447498 D01v06: 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

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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

ZA001 can only use antennas certificated as follows provided by manufacturer;

Module 1

Antenna No.	Model No. of antenna:	Type of antenna:	Gain of the antenna (Max.)	Frequency range:
BT	/	Ceramic antenna	3.12dBi for 2400-2500MHz	
BLE	/	Ceramic antenna	3.12dBi for 2400-2500MHz	
2.4GWIFI	/	Ceramic antenna	3.12dBi for 2400-2500MHz	
5GWIFI	/	PCB antenna	5.93dBi for 5180-5240MHz 2.57dBi for 5745-5825MHz	

Module 2

Antenna No.	Model No. of antenna:	Type of antenna:	Gain of the antenna (Max.)	Frequency range:
BT	/	PCB antenna	-3.85dBi for 2400-2500MHz	
BLE	/	PCB antenna	-3.85dBi for 2400-2500MHz	
2.4GWIFI	/	PCB antenna	-5.35dBi for 2400-2500MHz	
5GWIFI	/	PCB antenna	2.55dBi for 5180-5240MHz 0.63dBi for 5745-5825MHz	

5. Manufacturing Tolerance

Module1:

Mode	Max. Peak Conducted Output Power (dBm)	Max. tune-up
BT	0.43	1.0 ± 1
BLE	-2.99	-2.0 ± 1
2.4GWIFI	14.34	14.0 ± 1
Mode	Max. Average Conducted Output Power (dBm)	Max. tune-up
5.2GWIFI	13.41	14.0 ± 1
5.8GWIFI	11.52	12.0 ± 1

Module2:

Mode	Max. Peak Conducted Output Power (dBm)	Max. tune-up
BT	-0.05	0.0 ± 1
BLE	-3.49	-3.0 ± 1
2.4GWIFI	14.57	14.0 ± 1
Mode	Max. Average Conducted Output Power (dBm)	Max. tune-up
5.2GWIFI	13.78	14.0 ± 1
5.8GWIFI	11.19	12.0 ± 1

6. Standalone MPE Result

As declared by the Applicant, 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, $r = 20\text{cm}$, as well as the gain of the used antenna is refer to section 4, the RF power density can be obtained.

Module1:

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
BT	2.0	1.5849	3.12	2.0512	0.0006	1.0000
BLE	-1.0	0.7943	3.12	2.0512	0.0003	1.0000
2.4GWIFI	15.0	31.6228	3.12	2.0512	0.0129	1.0000
5.2GWIFI	15.0	31.6228	5.93	3.9174	0.0247	1.0000
5.8GWIFI	13.0	19.9526	2.57	1.8072	0.0072	1.0000

Module2:

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
BT	1.0	1.2589	-3.85	0.4121	0.0001	1.0000
BLE	-2.0	0.6310	-3.85	0.4121	0.0001	1.0000
2.4GWIFI	15.0	31.6228	-5.35	0.2917	0.0018	1.0000
5.2GWIFI	15.0	31.6228	2.55	1.7989	0.0113	1.0000
5.8GWIFI	13.0	19.9526	0.63	1.1561	0.0046	1.0000

Remark:

1. Output power including turn-up tolerance;
2. MPE evaluate distance is 20cm from user manual provide by manufacturer.
3. The sample support two modulars, they supports difference antenna and the modulars BT/WIFI also support difference antennas, support simultaneous transmission;

7. simultaneous MPE Result

Module 1 BT MPE (Ratio)	0.0006
Module 1 2.4GWIFI MPE (Ratio)	0.0129
Module 1 5.2GWIFI MPE (Ratio)	0.0247
Module 2 BT MPE (Ratio)	0.0001
Module 2 5.2GWIFI MPE (Ratio)	0.0113
simultaneous MPE (Ratio)	0.0496
MPE Limits (Ratio)	1.0000

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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