

RF Exposure evaluation

FCC ID: 2AX2E-HIIBOTBLUEFI

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: 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

HiiBot BlueFi can only use antennas certificated as follows provided by manufacturer;

Internal Identification	Antenna Identification in Internal photos	Antenna type and antenna number	Operate frequency band	Maximum antenna gain
Antenna	2.4G	Patch Antenna	2.4GHz – 2.5 GHz	2.0 dBi
Antenna	2.4G	Patch Antenna	2.4GHz – 2.5 GHz	2.0 dBi

5. Conducted power

[2.4GHz WLAN]

Mode	Channel	Frequency	Peak Conducted Output Power (dBm)
<i>IEEE 802.11b</i>	1	2412	6.22
	6	2437	6.97
	11	2462	6.21
<i>IEEE 802.11g</i>	1	2412	8.83
	6	2437	9.23
	11	2462	8.99
<i>IEEE 802.11n HT20</i>	1	2412	8.30
	6	2437	8.58
	11	2462	8.33

BLE

Mode	Channel	Frequency	Peak Conducted Output Power (dBm)
<i>BLE</i>	00	2402	-2.437
	19	2440	-2.572
	39	2480	-2.595

6. Manufacturing Tolerance

2.4GHz WLAN

Frequency (MHz)	<i>IEEE 802.11b (Peak)</i>		
	2412	2437	2462
Target (dBm)	6.0	6.0	6.0
Tolerance \pm (dB)	1.0	1.0	1.0
Frequency (MHz)	<i>IEEE 802.11g (Peak)</i>		
	2412	2437	2462
Target (dBm)	8.50	8.50	8.50
Tolerance \pm (dB)	1.0	1.0	1.0
Frequency (MHz)	<i>IEEE 802.11n HT20 (Peak)</i>		
	2412	2437	2462
Target (dBm)	8.50	8.50	8.50
Tolerance \pm (dB)	1.0	1.0	1.0

Frequency (MHz)	<i>BLE (Peak)</i>		
	2402	2440	2480
Target (dBm)	-2.0	-2.0	-2.0
Tolerance \pm (Db)	1.0	1.0	1.0

7. 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 2dBi, the RF power density can be obtained.

2.4GHz WLAN&BT

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (Mw/cm ²)	MPE Limits (Mw/cm ²)
	dBm	Mw					
IEEE 802.11b	7.00	5.011872	2.00	1.5849	100%	0.0016	1.0000
IEEE 802.11g	9.50	8.912509	2.00	1.5849	100%	0.0028	1.0000
IEEE 802.11n HT20	9.50	8.912509	2.00	1.5849	100%	0.0028	1.0000
BLE	-1.00	0.794328	2.00	1.5849	100%	0.0003	1.0000

Remark:

1. Output power (Peak) including turn-up tolerance;
2. Output power was adjust to duty cycle at 100% if measured duty cycle less than 98%;
3. MPE evaluate distance is 20cm from user manual provide by manufacturer.

8. Summary simultaneous transmission results

The sample supports 2 antennas for 2.4G WLAN and BT. The antenna WIFI and antenna BT can transmit simultaneous.

According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;

Σ of MPE ratios ≤ 1.0

simultaneous transmission	MPE _{antWIFI} (mW/cm ²)	MPE _{antBT} (mW/cm ²)	Σ MPE ratios	Limit	Results
WIFI & BT	0.0028	0.0003	0.0031	1.0	PASS

9. Conclusion

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

-----THE END OF REPORT-----