RF Exposure evaluation

FCC ID: 2AVBN-RD3019PRO

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

HC500 can only use antennas certificated as follows provided by manufacturer;

Antenna No.	Model No. of antenna:	Antenna type and antenna number	Operate frequency band	Maximum antenna gain
BT ANT	/	PCB Antenna	2.4GHz – 2.5 GHz	0 dBi
2.4GWIFI ANT	/	PIFA Antenna	2.4GHz – 2.5 GHz	2.0 dBi

5. Conducted power

[2.4GHz WIFI]

Mode	Channel	Frequency	Peak Conducted Output Power (dBm)
IEEE 802.11b	1	2412	18.27
	6	2437	18.32
	11	2462	18.48
IEEE 802.11g	1	2412	20.01
	6	2437	20.11
	11	2462	19.78
IEEE 802.11n HT20	1	2412	19.91
	6	2437	19.85
	11	2462	18.32

[2.4GHz BLE]

Mode	Channel	Frequency	Peak Conducted Output Power (dBm)
BLE	00	2402	1.013
	19	2440	1.067
	39	2480	1.232

6. Manufacturing Tolerance

2.4GHz WLAN

Frequency (MHz)	*IEEE 802.11b (Peak)*		
	2412	2437	2462
Target (dBm)	18.0	18.0	18.0
Tolerance ± (dB)	1.0	1.0	1.0
Frequency (MHz)	*IEEE 802.11g (Peak)*		
	2412	2437	2462
Target (dBm)	20.0	20.0	20.0
Tolerance ± (dB)	1.0	1.0	1.0
Frequency (MHz)	*IEEE 802.11n HT20 (Peak)*		
	2412	2437	2462
Target (dBm)	19.0	19.0	19.0
Tolerance ± (dB)	1.0	1.0	1.0

2.4GHz BLE

Frequency (MHz)	*GFSK (Peak)*		
	2402	2440	2480
Target (dBm)	1.0	1.0	1.0
Tolerance ± (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 =20cm, as well as the gain of WIFI antenna is 2.0dBi, the gain of BT antenna is 0dBi. the RF power density can be obtained.

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
WIFI	21.00	125.8925	2.00	1.584893	0.0397	1.0000
BLE	2.00	1.584893	0.00	1.00000	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 BT antenna and WLAN antenna can transmit simultaneous.

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

∑ of MPE ratios ≤ 1.0

BLE and WIFI for simultaneous transmission

MPE_{BLE} (mW/cm^2)	MPE wifi (mW/cm^2)	∑MPE ratios	Limit	Results
0.0003	0.0397	0.04	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.

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