

RF Exposure evaluation

FCC ID: 2ARQB-PROBEWIFI

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

$$S = \frac{PG}{4\pi R^2}$$

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

The device can only use antennas certificated as follows provided by manufacturer.

Internal Identification	Antenna type and antenna number	Operate frequency band	Maximum antenna gain
WIFI ANT	PCB antenna	2.4GHz – 2.5 GHz	-3.89dBi
BT ANT	PCB antenna	2.4GHz – 2.5 GHz	-2.03 dBi

5. Conducted power

[2.4GHz BT]

Mode	Channel	Frequency(MHz)	Peak Conducted Output Power (dBm)	Tune_Up limit (dBm)
BLE_1Mbps	00	2402	-8.15	-7
	19	2440	-8.83	-7
	39	2480	-8.85	-7
BLE_2Mbps	00	2402	-8.10	-7
	19	2440	-8.79	-7
	39	2480	-8.84	-7

[2.4GHz WLAN Mode]

Mode	Frequency (MHz)	Maximum Average Conducted Output Power (dBm)	Tune_Up limit (dBm)
802.11b	2412	12.13	13.0
	2437	13.71	13.0
	2462	12.91	13.0
802.11g	2412	11.69	13.0
	2437	13.37	13.0
	2462	12.60	13.0
802.11n (HT20)	2412	10.25	12.0
	2437	11.58	12.0
	2462	10.93	12.0

802.11n (HT40)	2422	11.36	12.0
	2437	11.69	12.0
	2452	11.52	12.0

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, the RF power density can be obtained.

BT

Modulation Type	Max. Output power with Tune_up		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW					
BLE	-7.0	0.1995	-2.03	0.6266	100%	0.000025	1.0000

2.4GHz WLAN SISO MODE

Modulation Type	Max. Output power with Tune_up		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW					
IEEE 802.11b	13.0	19.9526	-3.89	0.4083	100%	0.0016	1.0000
IEEE 802.11g	13.0	19.9526	-3.89	0.4083	100%	0.0016	1.0000
IEEE 802.11n HT20	12.0	15.8489	-3.89	0.4083	100%	0.0013	1.0000
IEEE 802.11n HT40	12.0	15.8489	-3.89	0.4083	100%	0.0013	1.0000

Remark:

1. Output power (Average) 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.

7. Summary simultaneous transmission information

The device BT and WIFI can transmit simultaneously.

WIFI +BT

Modulation Type	Max MPE _{WIFI} (mW/cm ²)	Max MPE _{BT} (mW/cm ²)	ΣMPE ratios	Limit	Results
WIFI+BT	0.0016	0.000025	0.001625	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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