

RF Exposure evaluation

FCC ID: 2BD5N-S1N1PRO

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

The device 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
WIFI /BT	WIFI /BT	PCB antenna	2.4GHz – 2.5 GHz	3.37 dBi

5. Conducted power and Manufacturing Tolerance

[2.4GHz BT]

Mode	TX Type	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)	Tune-Up limit (dBm)
BLE 1M	SISO	2402	-12.49	-10.5
		2440	-11.22	-10.5
		2480	-10.63	-10.5

[2.4GHz WLAN]

Mode	TX Type	Frequency (MHz)	Maximum Average Conducted Output Power (dBm)	Tune-Up limit (dBm)
802.11b	SISO	2412	11.88	12.5
		2437	11.15	12.5
		2462	12.22	12.5
802.11g	SISO	2412	11.21	12.0
		2437	10.84	12.0
		2462	11.69	12.0
802.11n (HT20)	SISO	2412	10.20	11.0
		2437	9.80	11.0
		2462	10.75	11.0
802.11n (HT40)	SISO	2422	9.79	11.0
		2437	10.03	11.0
		2452	10.28	11.0

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 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	-10.5	0.0891	3.37	2.1727	100%	0.00004	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	12.5	17.7828	3.37	2.1727	100%	0.0077	1.0000
IEEE 802.11g	12.0	15.8489	3.37	2.1727	100%	0.0069	1.0000
IEEE 802.11n HT20	11.0	12.5893	3.37	2.1727	100%	0.0054	1.0000
IEEE 802.11n HT40	11.0	12.5893	3.37	2.1727	100%	0.0054	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 only support WLAN and BT function and they share the same antenna and cannot transmitting at the same time.

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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