

RF Exposure evaluation

FCC ID: 2BF4O-CC4PRO

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

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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

CC4PRO can only use antennas certificated as follows provided by manufacturer;

Antenna No.	Model No. of antenna:	Type of antenna:	Gain of the antenna (Max.)	Frequency range:
BT/ BLE	/	External antenna	1.01dBi for 2400-2500MHz;	
2.4GWIFI	/	External antenna	1.01dBi for 2400-2500MHz for Antenna 1&2	
5.2GWIFI	/	External antenna	1.25dBi for 5180-5240MHz for Antenna 1&2	
5.8GWIFI	/	External antenna	0.98dBi for 5745-5825MHz for Antenna 1&2	
LTE	/	External antenna	E-UTRA Band 2/4/5/7/12/13/14/17/25/26/38/40/41/66/71:1.0dBi	

5. Manufacturing Tolerance

BT

Mode	Max. Peak Conducted Output Power (dBm)	Max. tune-up
BT	1.36	1.0 ± 1
BLE	-4.13	-4.0 ± 1

2.4GWIFI

Mode	Max. Peak Conducted Output Power (dBm)		Max. tune-up	
	Antenna0	Antenna1	Antenna0	Antenna1
2.4GWIFI	15.31	14.9	15 ± 1	15 ± 1

5.2&5.8GWIFI

Mode	Max. Average Conducted Output Power (dBm)		Max. tune-up	
	Antenna0	Antenna1	Antenna0	Antenna1
5.2GWIFI	10.3	10.11	11 ± 1	11 ± 1
5.8GWIFI	9.79	9.43	10 ± 1	10 ± 1

LTE	Target (dBm)	Tolerance $\pm$ (dB)
Band2	23.98	1.0
Band4	23.89	1.0
Band5	23.95	1.0
Band7	23.98	1.0
Band12	23.95	1.0
Band13	23.92	1.0
Band14	23.91	1.0
Band17	23.91	1.0
Band25	23.96	1.0
Band26	23.98	1.0
Band38	23.87	1.0
Band40	23.9	1.0
Band41	23.99	1.0
Band66	23.97	1.0
Band71	23.94	1.0

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 is refer to section 4, 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				
BT	2.0	1.5849	1.01	1.2618	0.0004	1.00
BLE	-3.0	1.5849	1.01	1.2618	0.0001	1.00
2.4GWIFI Ant1	16.0	39.8107	1.01	1.2618	0.0100	1.00
2.4GWIFI Ant2	16.0	39.8107	1.01	1.2618	0.0100	1.00
5.2GWIFI Ant1	12.0	15.8489	1.25	1.3335	0.0042	1.00
5.2GWIFI Ant2	12.0	15.8489	1.25	1.3335	0.0042	1.00
5.8GWIFI Ant1	11.0	15.8489	0.98	1.2531	0.0031	1.00
5.8GWIFI Ant2	11.0	15.8489	0.98	1.2531	0.0031	1.00
LTE Band 2	24.5	281.8383	1.000	1.2589	0.0706	1.00
LTE Band 4	24.5	281.8383	1.000	1.2589	0.0706	1.00
LTE Band 5	24.5	281.8383	1.000	1.2589	0.0706	0.55
LTE Band 7	24.5	281.8383	1.000	1.2589	0.0706	1.00
LTE Band 12	24.5	281.8383	1.000	1.2589	0.0706	0.47
LTE Band 13	24.5	281.8383	1.000	1.2589	0.0706	0.52

LTE Band 14	24.5	281.8383	1.000	1.2589	0.0706	0.53
LTE Band 17	24.5	281.8383	1.000	1.2589	0.0706	0.47
LTE Band 25	24.5	281.8383	1.000	1.2589	0.0706	1.00
LTE Band 26	24.5	281.8383	1.000	1.2589	0.0706	0.54
LTE Band 38	24.5	281.8383	1.000	1.2589	0.0706	1.00
LTE Band 40	24.5	281.8383	1.000	1.2589	0.0706	1.00
LTE Band 41	24.5	281.8383	1.000	1.2589	0.0706	1.00
LTE Band 66	24.5	281.8383	1.000	1.2589	0.0706	0.44
LTE Band 71	24.5	281.8383	1.000	1.2589	0.0706	1.00

Remark:

1. Output power (Peak) including turn-up tolerance;
2. MPE evaluate distance is 20cm from user manual provide by manufacturer.

7. simultaneous MPE Result

2.4GWIFI MPE (Ratio)Ant 1	2.4GWIFI MPE (Ratio)Ant 2	LTE MPE (Ratio)	simultaneous MPE (Ratio)	MPE Limits (Ratio)
0.01	0.01	0.0706	0.0906	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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