

RF Exposure evaluation

FCC ID: 2BB7S-GTC129A-H01E

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

WCPAA-3 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	/	External Antenna	2.50dBi for 2400-2500MHz;	
BLE	/	External Antenna	2.50dBi for 2400-2500MHz;	
2.4GWIFI	/	External Antenna	2.50dBi for 2400-2500MHz;	
5.2GWIFI	/	External Antenna	2.50dBi for 5180-5240MHz	
5.8GWIFI	/	External Antenna	2.50dBi for 5745-5825MHz	
WCDMA/LTE	/	External Antenna	FDD Band II: 2.0dBi FDD Band IV: 2.0dBi FDD Band V: 2.0dBi E-UTRA Band 2/4/5/7/12/13/14/17/25/26/41/66/71:2.0dBi	

5. Manufacturing Tolerance

BT GFSK(Peak)			
Channel	Channel 00	Channel 39	Channel 78
Target (dBm)	1.0	1.0	1.0
Tolerance ±(dB)	1.0	1.0	1.0
Π/4DQPSK (Peak)			
Channel	Channel 00	Channel 39	Channel 78
Target (dBm)	1.0	1.0	1.0
Tolerance ±(dB)	1.0	1.0	1.0
8DPSK (Peak)			
Channel	Channel 00	Channel 39	Channel 78
Target (dBm)	1.0	1.0	1.0
Tolerance ±(dB)	1.0	1.0	1.0

BLE GFSK(Peak)			
Channel	Channel 00	Channel 19	Channel 39
Target (dBm)	4.0	4.0	4.0
Tolerance ±(dB)	1.0	1.0	1.0

WIFI(Peak)			
Frequency (MHz)	11b		
	2412	2437	2462
Target (dBm)	14.0	13.0	12.0
Tolerance ± (dB)	1.0	1.0	1.0
Frequency (MHz)	11g		
	2412	2437	2462
Target (dBm)	14.0	13.0	12.0
Tolerance ± (dB)	1.0	1.0	1.0
Frequency (MHz)	11n(HT20)		
	2412	2437	2462
Target (dBm)	14.0	13.0	12.0
Tolerance ± (dB)	1.0	1.0	1.0

[5.2GHz WLAN]			
IEEE 802.11A (Average)			
Frequency (MHz)	5180	5220	5240
Target (dBm)	13.0	13.0	13.0
Tolerance ± (dB)	1.0	1.0	1.0
IEEE 802.11n20 (Average)			
Frequency (MHz)	5180	5220	5240
Target (dBm)	13.0	13.0	14.0
Tolerance ± (dB)	1.0	1.0	1.0
IEEE 802.11ac20 (Average)			
Frequency (MHz)	5180	5220	5240
Target (dBm)	13.0	14.0	13.0
Tolerance ± (dB)	1.0	1.0	1.0
IEEE 802.11n40 (Average)			
Frequency (MHz)	5190	/	5230
Target (dBm)	13.0	/	13.0
Tolerance ± (dB)	1.0	/	1.0
IEEE 802.11ac40 (Average)			
Frequency (MHz)	5190	/	5230
Target (dBm)	13.0	/	13.0
Tolerance ± (dB)	1.0	/	1.0

IEEE 802.11ac80 (Average)			
Frequency (MHz)	/	5210	/
Target (dBm)	/	13.0	/
Tolerance ± (dB)	/	1.0	/

[5.8GHz WLAN]

IEEE 802.11A (Average)			
Frequency (MHz)	5745	5785	5825
Target (dBm)	14.0	14.0	14.0
Tolerance ± (dB)	1.0	1.0	1.0
IEEE 802.11n20 (Average)			
Frequency (MHz)	5745	5785	5825
Target (dBm)	14.0	14.0	14.0
Tolerance ± (dB)	1.0	1.0	1.0
IEEE 802.11ac20 (Average)			
Frequency (MHz)	5745	5785	5825
Target (dBm)	14.0	14.0	14.0
Tolerance ± (dB)	1.0	1.0	1.0
IEEE 802.11n40 (Average)			
Frequency (MHz)	5755	/	5795
Target (dBm)	13.0	/	13.0
Tolerance ± (dB)	1.0	/	1.0
IEEE 802.11ac40 (Average)			
Frequency (MHz)	5755	/	5795
Target (dBm)	13.0	/	13.0
Tolerance ± (dB)	1.0	/	1.0
IEEE 802.11ac80 (Average)			
Frequency (MHz)	/	5775	/
Target (dBm)	/	14.0	/
Tolerance ± (dB)	/	1.0	/

WCMDA	Modulation	Target (dBm)	Tolerance $\pm$ (dB)
Band 2	QPSK	23.0	1.0
Band 4	QPSK	23.0	1.0
Band 5	QPSK	23.0	1.0

LTE	Target (dBm)	Tolerance $\pm$ (dB)
Band2	23.5	1.0
Band4	23.0	1.0
Band5	23.0	1.0
Band7	23.0	1.0
Band12	23.0	1.0
Band13	23.5	1.0
Band14	23.5	1.0
Band17	23.5	1.0
Band25	24.5	1.0
Band26	24.0	1.0
Band41	23.5	1.0
Band66	23.0	1.0
Band71	23.0	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	2.50	1.7783	0.0006	1.00
BLE	5.0	3.1623	2.50	1.7783	0.0011	1.00
2.4GWIFI	15.0	31.6228	2.50	1.7783	0.0112	1.00
5.2GWIFI	15.0	31.6228	2.50	1.7783	0.0112	1.00
5.8GWIFI	15.0	31.6228	2.50	1.7783	0.0112	1.00
WCDMA 2	24.0	251.1886	2.00	1.5849	0.0792	1.00
WCDMA 4	24.0	251.1886	2.00	1.5849	0.0792	1.00
WCDMA 5	24.0	251.1886	2.00	1.5849	0.0792	0.55
LTE Band 2	24.5	281.8383	2.00	1.5849	0.0889	1.00
LTE Band 4	24.0	251.1886	2.00	1.5849	0.0792	1.00
LTE Band 5	24.0	281.8383	2.00	1.5849	0.0792	0.55

LTE Band 7	24.0	251.1886	2.00	1.5849	0.0792	1.00
LTE Band 12	24.0	251.1886	2.00	1.5849	0.0792	0.47
LTE Band 13	24.5	281.8383	2.00	1.5849	0.0889	0.52
LTE Band 14	24.5	281.8383	2.00	1.5849	0.0889	0.55
LTE Band 17	24.5	281.8383	2.00	1.5849	0.0889	0.47
LTE Band 25	25.5	354.8134	2.00	1.5849	0.1119	1.00
LTE Band 26	25.0	316.2278	2.00	1.5849	0.0889	0.55
LTE Band 41	24.5	281.8383	2.00	1.5849	0.0397	1.00
LTE Band 66	24.0	251.1886	2.00	1.5849	0.0792	1.00
LTE Band 71	24.0	251.1886	2.00	1.5849	0.0792	0.44

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)	LTE MPE (Ratio)	simultaneous MPE (Ratio)	MPE Limits (Ratio)
0.0112	0.1119	0.1231	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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