RF Exposure evaluation

FCC ID: 2AW5W-PROC4G

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

PROC4G 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:
2.4GWIFI	/	PIFA Antenna	0.75dBi for 2400-2500MHz;	
WCDMA/LTE	/	PIFA Antenna	FDD Band II/ IV/ V: 1.0dBi E-UTRA Band 2, 4, 5, 12, 17, 26,41,66:1.0dBi	

5. Manufacturing Tolerance

WIFI(Peak)

Frequency (MHz)	11b		
	2412	2437	2462
Target (dBm)	15.0	15.0	15.0
Tolerance ± (dB)	1.0	1.0	1.0
Frequency (MHz)	11g		
	2412	2437	2462
Target (dBm)	13.0	13.0	13.0
Tolerance ± (dB)	1.0	1.0	1.0
Frequency (MHz)	11n(HT20)		
	2412	2437	2462
Target (dBm)	13.0	13.0	13.0
Tolerance ± (dB)	1.0	1.0	1.0

WCMDA	Modulation	Conducted power (dBm)	Target (dBm)	Tolerance ±(dB)
Band 2	QPSK	23.59	23.0	1.0
Band 4	QPSK	23.46	23.0	1.0
Band 5	QPSK	23.91	23.0	1.0

LTE	Conducted power (dBm)	Target (dBm)	Tolerance ±(dB)
Band2	23.94	23.0	1.0
Band4	23.91	23.0	1.0
Band5	23.94	23.0	1.0
Band12	23.98	23.0	1.0
Band17	23.9	23.0	1.0
Band26	23.9	23.0	1.0
Band41	23.96	23.0	1.0
Band66	23.9	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 =20cm, 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				
2.4GWIFI	16.0	39.8107	0.75	1.1885	0.0094	1.00
WCDMA 2	24.0	251.1886	1.000	1.2589	0.0629	1.00
WCDMA 4	24.0	251.1886	1.000	1.2589	0.0629	1.00
WCDMA 5	24.0	251.1886	1.000	1.2589	0.0629	0.55
Band2	24.0	281.8383	1.000	1.2589	0.0629	1.00
Band4	24.0	251.1886	1.000	1.2589	0.0629	1.00
Band5	24.0	281.8383	1.000	1.2589	0.0629	0.55
Band12	24.0	251.1886	1.000	1.2589	0.0629	0.47
Band17	24.0	251.1886	1.000	1.2589	0.0629	0.47
Band26	24.0	251.1886	1.000	1.2589	0.0629	0.54
Band41	24.0	281.8383	1.000	1.2589	0.0629	1.00
Band66	24.0	281.8383	1.000	1.2589	0.0629	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)	LTE MPE (Ratio)	simultaneous MPE (Ratio)	MPE Limits (Ratio)
0.0094	0.1338	0.1432	1.0000

The sample WCDMA&LTE /2.4GWiFi supports difference antenna, support simultaneous transmission.

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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