RF Exposure evaluation

FCC ID: 2A5U2-M1003-7

Exposure category: General population/uncontrolled environment

EUT Type: Production Unit

Device Type: Portable 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

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

Antenna	Model No. of antenna:	Type of antenna:	Gain of the antenna (Max.)	Frequency range:
WIFI-BT	/	FPC antenna	3.35dBi For 2.4G 0.96dBi for 5150~5250MHz;	
FM	/	Spring Antenna	Antenna :0dBi for 88.1-107.9MHz;	

5. Manufacturing Tolerance

BR_EDR (Conducted)

Frequency (MHz)	BR_EDR_GFSK		
	2402	2441	2480
Target (dBm)	-1.0	-1.0	-1.0
Tolerance ± (dB)	1.0	1.0	1.0
Frequency (MHz)	BR_EDR_π/4-DQPSK		
	2402	2441	2480
Target (dBm)	0	0	0
Tolerance ± (dB)	1.0	1.0	1.0
Frequency (MHz)	BR_EDR_8-DPSK		
	2402	2441	2480
Target (dBm)	0	0	0
Tolerance ± (dB)	1.0	1.0	1.0

2.4GWIFI (Conducted)

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

5.2G WIFI (Conducted)

Frequency (MHz)	IEEE 802.11a(AV)		
	5180	5200	5240
Target (dBm)	14.0	14.0	14.0
Tolerance ± (dB)	1.0	1.0	1.0
Frequency (MHz)	IEEE 802.11n20(AV)		
	5180	5200	5240
Target (dBm)	14.0	14.0	14.0
Tolerance ± (dB)	1.0	1.0	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				
BR_EDR	1.0	1.259	3.35	2.163	0.00054	1.0000
2.4G WIFI	15.0	31.623	3.35	2.163	0.01361	1.0000
5.2G WIFI	15.0	31.623	0.96	1.247	0.00785	1.0000
FM	-31.0	0.002	0.00	1.000	0.00000	0.2

According to the follow transmitter output power（P_t）formula：
P_t=（E x d）^{2}/（30 x g_t）
P_t=transmitter output power in watts
g_t=numeric gain of the transmitting antenna (unitess)
E=electric field strength in V/m
d=measurement distance in meters (m)

According to the formula described above:

Emax= **63.60** dBuv/m=**0.0015**V/m, d=3m, g_t=1.0

P_t=（E x d）^{2}/（30 x g_t）=(**0.0015**x3)^2 / (30x1.0)=**0.0006**mW=**-31.62**dBm

Remark:

1. Output power (Peak) including turn-up tolerance;

2. MPE evaluate distance is 20cm from user manual provide by manufacturer.

3. Simultaneous transmission = 0.00054 + 0.01361 + 0.00000 = 0.01415 mW/cm^2 < *1.0000* mW/cm^2

7. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

----------THE END OF REPORT----------