RF Exposure evaluation

FCC ID: 2A7DX-MP200DK1

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	Antenna 1:3.743dBi;Antenna 2:3.768dBi For 2.4G Antenna 1:5.343dBi,Antenna 2:7.070dBi for 5150~5250MHz; Antenna 1:6.429dBi,Antenna 2:5.233dBi for 5.725GHz-5.875GHz;	

5. Manufacturing Tolerance

BR_EDR (Conducted)

Frequency (MHz)	BR_EDR_GFSK		
	2402	2441	2480
Target (dBm)	6.0	6.0	7.0
Tolerance ± (dB)	1.0	1.0	1.0
Frequency (MHz)	BR_EDR_ π /4-DQPSK		
	2402	2441	2480
Target (dBm)	5.0	6.0	6.0
Tolerance ± (dB)	1.0	1.0	1.0
Frequency (MHz)	BR_EDR_8-DPSK		
	2402	2441	2480
Target (dBm)	5.0	6.0	6.0
Tolerance ± (dB)	1.0	1.0	1.0

BLE (Conducted)

Frequency (MHz)	GFSK 1Mbps		
	2402	2440	2480
Target (dBm)	5.0	6.0	6.0
Tolerance ± (dB)	1.0	1.0	1.0
Frequency (MHz)	GFSK 2Mbps		
	2402	2440	2480
Target (dBm)	5.0	6.0	6.0
Tolerance ± (dB)	1.0	1.0	1.0

WIFI (Conducted)

Frequency (MHz)	ANT1_11b(Peak)			ANT2_11b(Peak)		
	2412	2437	2462	2412	2437	2462
Target (dBm)	13	13	13	13	13	12
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (MHz)	ANT1_11g(Peak)			ANT2_11g(Peak)		
	2412	2437	2462	2412	2437	2462
Target (dBm)	13	13	13	13	13	13
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (MHz)	ANT1_11n(HT20) (Peak)			ANT2_11n(HT20)(Peak)		
	2412	2437	2462	2412	2437	2462
Target (dBm)	10	10	10	10	10	10
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (MHz)	ANT1_11n(HT40) (Peak)			ANT2_11n(HT40)(Peak)		
	2422	2437	2452	2422	2437	2452
Target (dBm)	9	9	9	9	9	9
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (MHz)	ANT1_11ax(HT20) (Peak)			ANT2_11ax(HT20)(Peak)		
	2412	2437	2412	2437	2412	2437
Target (dBm)	10	10	10	10	10	10
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (MHz)	ANT1_11ax(HT40) (Peak)			ANT2_11ax(HT40)(Peak)		
	2422	2437	2452	2422	2437	2452
Target (dBm)	9	9	9	9	9	9
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0

5.2G WIFI (Conducted)

Frequency (MHz)	ANT 1_IEEE 802.11a(AV)			ANT 2_IEEE 802.11a(AV)		
	5180	5200	5240	5180	5200	5240
Target (dBm)	13	13	12	12	12	12
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (MHz)	ANT 1_IEEE 802.11n20(AV)			ANT 2_IEEE 802.11n20(AV)		
	5180	5200	5240	5180	5200	5240
Target (dBm)	9	9	9	9	9	9
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (MHz)	ANT 1_IEEE 802.11n40(AV)			ANT 2_IEEE 802.11n40(AV)		
	5190		5230	5190		5230
Target (dBm)	9		8	9		8
Tolerance ± (dB)	1.0		1.0	1.0		1.0
Frequency (MHz)	ANT 1_IEEE 802.11ac20(AV)			ANT 2_IEEE 802.11ac20(AV)		
	5180	5200	5240	5180	5200	5240
Target (dBm)	9	9	9	9	9	9
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (MHz)	ANT 1_IEEE 802.11ac40(AV)			ANT 2_IEEE 802.11ac40(AV)		
	5190		5230	5190		5230
Target (dBm)	9		8	9		8
Tolerance ± (dB)	1.0		1.0	1.0		1.0
Frequency (MHz)	ANT 1_IEEE 802.11ac80(AV)			ANT 2_IEEE 802.11ac80(AV)		
	5210			5210		
Target (dBm)	9			8		
Tolerance ± (dB)	1.0			1.0		
Frequency (MHz)	ANT 1_IEEE 802.11ax20(AV)			ANT 2_IEEE 802.11ax20(AV)		
	5180	5200	5240	5180	5200	5240
Target (dBm)	9	9	9	9	9	9
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (MHz)	ANT 1_IEEE 802.11ax40(AV)			ANT 2_IEEE 802.11ax40(AV)		
	5190		5230	5190		5230
Target (dBm)	9		9	8		8
Tolerance ± (dB)	1.0		1.0	1.0		1.0
Frequency (MHz)	ANT 1_IEEE 802.11ax80(AV)			ANT 2_IEEE 802.11ax80(AV)		
	5210			5210		
Target (dBm)	9			8		
Tolerance ± (dB)	1.0			1.0		

5.8G WIFI (Conducted)

Frequency (MHz)	ANT 1_IEEE 802.11a(AV)			ANT 2_IEEE 802.11a(AV)		
	5745	5785	5825	5745	5785	5825
Target (dBm)	11	11	11	11	11	11
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (MHz)	ANT 1_IEEE 802.11n20(AV)			ANT 2_IEEE 802.11n20(AV)		
	5745	5785	5825	5745	5785	5825
Target (dBm)	8	8	8	8	8	8
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (MHz)	ANT 1_IEEE 802.11n40(AV)			ANT 2_IEEE 802.11n40(AV)		
	5755		5795	5755		5795
Target (dBm)	8		8	8		8
Tolerance ± (dB)	1.0		1.0	1.0		1.0
Frequency (MHz)	ANT 1_IEEE 802.11ac20(AV)			ANT 2_IEEE 802.11ac20(AV)		
	5745	5785	5825	5745	5785	5825
Target (dBm)	8	8	8	8	8	8
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (MHz)	ANT 1_IEEE 802.11ac40(AV)			ANT 2_IEEE 802.11ac40(AV)		
	5755		5795	5755		5795
Target (dBm)	8		8	8		8
Tolerance ± (dB)	1.0		1.0	1.0		1.0
Frequency (MHz)	ANT 1_IEEE 802.11ac80(AV)			ANT 2_IEEE 802.11ac80(AV)		
	5775			5775		
Target (dBm)	8			8		
Tolerance ± (dB)	1.0			1.0		
Frequency (MHz)	ANT 1_IEEE 802.11ax20(AV)			ANT 2_IEEE 802.11ax20(AV)		
	5745	5785	5825	5745	5785	5825
Target (dBm)	8	8	8	8	8	8
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (MHz)	ANT 1_IEEE 802.11ax40(AV)			ANT 2_IEEE 802.11ax40(AV)		
	5755		5795	5755		5795
Target (dBm)	8		8	7		7
Tolerance ± (dB)	1.0		1.0	1.0		1.0
Frequency (MHz)	ANT 1_IEEE 802.11ax80(AV)			ANT 2_IEEE 802.11ax80(AV)		
	5775			5775		
Target (dBm)	8			7		
Tolerance ± (dB)	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.

ANT 1

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
BR_EDR	8.0	6.310	3.743	2.368	0.00297	1.0000
BLE	7.0	5.012	3.743	2.368	0.00236	1.0000
2.4G WIFI	14.0	25.119	3.743	2.368	0.01183	1.0000
5.2G WIFI	14.0	25.119	5.343	3.422	0.01710	1.0000
5.8G WIFI	12.0	15.849	6.429	4.394	0.01386	1.0000

ANT 2

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
2.4G WIFI	14.0	25.119	3.768	2.381	0.01190	1.0000
5.2G WIFI	13.0	19.953	7.070	5.093	0.00508	1.0000
5.8G WIFI	12.0	15.849	5.233	3.337	0.01052	1.0000

Remark:

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

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

3.WIFI and BT do not support simultaneous transmission .

Max. Simultaneous MPE Result

ANT1 MPE (Ratio)	ANT2 MPE (Ratio)	simultaneous MPE (Ratio)	MPE Limits (Ratio)
0.0171	0.01190	0.029	1.0000

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----------