RF Exposure evaluation

FCC ID: 2AGN7-ZD24S

Exposure category: General population/uncontrolled environment

EUT Type: Production Unit

Device Type: Mobile Devices

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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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-Bluetooth	/	stick antenna	Bluetooth: 2.88dBi 2.4G WIFI: Ant1: 2.88dBi, Ant2: 2.88dBi 5.2G WIFI: Ant1: 3.00dBi, Ant2: 3.00dBi 5.8G WIFI: Ant1: 2.84dBi, Ant2: 2.84dBi	

5. Manufacturing Tolerance

BR_EDR (Conducted)

Frequency	BR_EDR_GFSK		
(MHz)	2402	2441	2480
Target (dBm)	4	5	4
Tolerance ± (dB)	1	1	1
Frequency	BR_EDR_π/4-DQPSK		
(MHz)	2402	2441	2480
Target (dBm)	4	5	4
Tolerance ± (dB)	1	1	1
Frequency	BR_EDR_8DQPSK		
(MHz)	2402	2441	2480
Target (dBm)	4	5	5
Tolerance ± (dB)	1	1	1

BLE (Conducted)

Frequency	GFSK 1Mbps		
(MHz)	2402	2440	2480
Target (dBm)	0	0	0
Tolerance ± (dB)	1	1	1

2.4G WIFI (Conducted)

Frequency (MHz)	802.11b(Peak) ANT1			802.11b(Peak) ANT2		
	2412	2437	2462	2412	2437	2462
Target (dBm)	18	22	21	16	19	19
Tolerance ± (dB)	1	1	1	1	1	1
Frequency (MHz)	802.11g(Peak) ANT1			802.11g(Peak) ANT2		
	2412	2437	2462	2412	2437	2462
Target (dBm)	23	26	25	21	24	24
Tolerance ± (dB)	1	1	1	1	1	1
Frequency (MHz)	802.11n(HT20) (Peak) MIMO					
	2412	2437	2462			
Target (dBm)	24	27	27			
Tolerance ± (dB)	1	1	1			
Frequency (MHz)	802.11n(HT40) (Peak) MIMO					
	2422	2437	2452			
Target (dBm)	25	26	25			
Tolerance ± (dB)	1	1	1			
Frequency (MHz)	802.11ax(HE20) (Peak) MIMO					
	2412	2437	2462			
Target (dBm)	24	27	26			
Tolerance ± (dB)	1	1	1			
Frequency (MHz)	802.11ax(HE40) (Peak) MIMO					
	2422	2437	2452			
Target (dBm)	25	27	26			
Tolerance ± (dB)	1	1	1			

5G WLAN U-NII-1(5150MHz-5250MHz)

Frequency	802.11a(Peak) ANT1			802.11a(Peak) ANT2		
(MHz)	5180	5200	5240	5180	5200	5240
Target (dBm)	12	12	12	10	10	10
Tolerance ± (dB)	1	1	1	1	1	1
Frequency	802.11n(HT20) (Peak) MIMO					
(MHz)	5180	5200	5240			
Target (dBm)	15	15	15			
Tolerance ± (dB)	1	1	1			
Frequency	802.11n(HT40) (Peak) MIMO					
(MHz)	5190	5230				
Target (dBm)	16	15				
Tolerance ± (dB)	1	1				
Frequency	802.11ac(VHT20) (Peak) MIMO					
(MHz)	5180	5200	5240			
Target (dBm)	14	13	13			
Tolerance ± (dB)	1	1	1			
Frequency	802.11ac(VHT40) (Peak) MIMO					
(MHz)	5190	5230				
Target (dBm)	14	14				
Tolerance ± (dB)	1	1				
Frequency	802.11ac(VHT80) (Peak) MIMO					
(MHz)	5210					
Target (dBm)	14					
Tolerance ± (dB)	1					
Frequency	802.11ax(HE20) (Peak) MIMO					
(MHz)	5180	5200	5240			
Target (dBm)	14	14	14			
Tolerance ± (dB)	1	1	1			
Frequency	802.11ax(HE40) (Peak) MIMO					
(MHz)	5190	5230				
Target (dBm)	15	14				
Tolerance ± (dB)	1	1				
Frequency	802.11ax(HE80) (Peak) MIMO					
(MHz)	5210					
Target (dBm)	15					
Tolerance ± (dB)	1					

5G WLAN U-NII-3(5725MHz-5850MHz)

Frequency	802.11a(Peak) ANT1			802.11a(Peak) ANT2		
(MHz)	5745	5785	5825	5745	5785	5825
Target (dBm)	12	12	11	12	12	11
Tolerance ±(dB)	1	1	1	1	1	1
Frequency	802.11n(HT20) (Peak) MIMO					
(MHz)	5745	5785	5825			
Target (dBm)	16	16	14			
Tolerance ±(dB)	1	1	1			
Frequency	802.11n(HT40) (Peak) MIMO					
(MHz)	5755	5795				
Target (dBm)	16	16				
Tolerance ±(dB)	1	1				
Frequency	802.11ac(VHT20) (Peak) MIMO					
(MHz)	5745	5785	5825			
Target (dBm)	14	14	13			
Tolerance ±(dB)	1	1	1			
Frequency	802.11ac(VHT40) (Peak) MIMO					
(MHz)	5755	5795				
Target (dBm)	15	15				
Tolerance ±(dB)	1	1				
Frequency	802.11ac(VHT80) (Peak) MIMO					
(MHz)	5775					
Target (dBm)	15					
Tolerance ±(dB)	1					
Frequency	802.11ax(HE20) (Peak) MIMO					
(MHz)	5745	5785	5825			
Target (dBm)	15	15	13			
Tolerance ±(dB)	1	1	1			
Frequency	802.11ax(HE40) (Peak) MIMO					
(MHz)	5755	5795				
Target (dBm)	16	15				
Tolerance ±(dB)	1	1				
Frequency	802.11ax(HE80) (Peak) MIMO					
(MHz)	5775					
Target (dBm)	15					
Tolerance ±(dB)	1					

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/cm2)	MPE Limits (mW/cm2)
	dBm	mW				
BR_EDR	6	3.98	2.88	1.941	0.00154	1
BLE	1	1.26	2.88	1.941	0.00049	1
2.4G WLAN	28	630.96	2.88	1.941	0.24364	1
5G WLAN (5150~5250 MHz)	17	50.12	3	1.995	0.01989	1
5G WLAN (5725~5850 MHz)	17	50.12	2.84	1.923	0.01918	1

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 .

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----------