RF Exposure evaluation

FCC ID: 2AVTZ-MP1

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

Antenna	Antenna type	Operate frequency band	Maximum antenna gain
2.4G/5G Wifi Bluetooth	FPC antenna	2.4GHz – 2.5 GHz 5.1GHz – 5.8 GHz	2.50 dBi 3.3 dBi

5. Manufacturing Tolerance

Bluetooth

*GFSK (*Peak*)*			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	0.0	0.0	0.0
Tolerance ±(dB)	1.0	1.0	1.0
*π/4DQPSK (*Peak*)*			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	1.0	1.0	1.0
Tolerance ±(dB)	1.0	1.0	1.0
*8-DPSK (*Peak*)*			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	1.0	1.0	1.0
Tolerance ±(dB)	1.0	1.0	1.0
BLE GFSK			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	-1.0	-1.0	-1.0
Tolerance ±(dB)	1.0	1.0	1.0

2.4GHz WLAN

IEEE 802.11b (Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	25.0	25.0	25.0
Tolerance ± (dB)	1.0	1.0	1.0
IEEE 802.11g (Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	24.0	24.0	24.0
Tolerance ± (dB)	1.0	1.0	1.0
IEEE 802.11n(HT20) (Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	24.0	24.0	24.0
Tolerance ± (dB)	1.0	1.0	1.0
IEEE 802.11n(HT40) (Peak)			
Channel	Channel 03	Channel 06	Channel 09
Target (dBm)	23.0	23.0	23.0
Tolerance ± (dB)	1.0	1.0	1.0

5GHz WLAN

5GHz WLAN Band 1				*5GHz WLAN Band 4*		
IEEE 802.11a (Average)						
Frequency (MHz)	5180	5200	5240	5745	5785	5825
Target (dBm)	14.0	14.0	14.0	15.0	15.0	15.0
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)				*IEEE 802.11n HT20 (Average)*		
Frequency (MHz)	5180	5200	5240	5745	5785	5825
Target (dBm)	13.0	13.0	13.0	15.0	15.0	15.0
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11ac VHT20 (Average)				*IEEE 802.11ac VHT20 (Average)*		
Frequency (MHz)	5180	5200	5240	5745	5785	5825
Target (dBm)	13.0	13.0	13.0	15.0	15.0	15.0
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11n HT40 (Average)				*IEEE 802.11n HT40 (Average)*		
Frequency	5190		5230	5755		5795

(MHz)				
Target (dBm)	12.0	12.0	14.0	14.0
Tolerance ± (dB)	1.0	1.0	1.0	1.0
IEEE 802.11ac VHT40 (Average)			*IEEE 802.11ac VHT40 (Average)*	
Frequency (MHz)	5190	5230	5755	5795
Target (dBm)	12.0	12.0	14.0	14.0
Tolerance ± (dB)	1.0	1.0	1.0	1.0
IEEE 802.11ac VHT80 (Average)			*IEEE 802.11ac VHT80 (Average)*	
Frequency (MHz)	5210		5775	
Target (dBm)	12.0		14.0	
Tolerance ± (dB)	1.0		1.0	

6. 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, the RF power density can be obtained.

Bluetooth

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW					
GFSK	1.00	1.2589	2.50	1.7783	100%	0.00045	1.0000
π/4DQPSK	2.00	1.5849	2.50	1.7783	100%	0.00056	1.0000
8-DPSK	2.00	1.5849	2.50	1.7783	100%	0.00056	1.0000
BLE GFSK	0.00	1.0000	2.50	1.7783	100%	0.00035	1.0000

2.4GHz WLAN

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW					
IEEE 802.11b	26.00	398.1072	2.50	1.7783	100%	0.14084	1.0000
IEEE 802.11g	25.00	316.2278	2.50	1.7783	100%	0.11187	1.0000
IEEE 802.11n HT20	25.00	316.2278	2.50	1.7783	100%	0.11187	1.0000
IEEE 802.11n HT40	24.00	251.1886	2.50	1.7783	100%	0.08886	1.0000

5GHz WLAN Band 1

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW					
IEEE 802.11a	15.00	31.6228	3.30	2.1380	100%	0.01345	1.0000
IEEE 802.11n HT20	14.00	25.1189	3.30	2.1380	100%	0.01068	1.0000
IEEE 802.11ac VHT20	14.00	25.1189	3.30	2.1380	100%	0.01068	1.0000
IEEE 802.11n HT40	13.00	19.9526	3.30	2.1380	100%	0.00849	1.0000
IEEE 802.11ac VHT40	13.00	19.9526	3.30	2.1380	100%	0.00849	1.0000
IEEE 802.11ac VHT80	13.00	19.9526	3.30	2.1380	100%	0.00849	1.0000

5GHz WLAN Band 3

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW					
IEEE 802.11a	16.00	39.8107	3.30	2.1380	100%	0.01693	1.0000
IEEE 802.11n HT20	16.00	39.8107	3.30	2.1380	100%	0.01693	1.0000
IEEE 802.11ac VHT20	16.00	39.8107	3.30	2.1380	100%	0.01693	1.0000
IEEE 802.11n HT40	15.00	31.6228	3.30	2.1380	100%	0.01345	1.0000
IEEE 802.11ac VHT40	15.00	31.6228	3.30	2.1380	100%	0.01345	1.0000
IEEE 802.11ac VHT80	15.00	31.6228	3.30	2.1380	100%	0.01345	1.0000

Remark:

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

2. Output power was adjust to duty cycle at 100% if measured duty cycle less than 98%;

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

7. Summary simultaneous transmission information

As the WIFI and BT share the same antenna and cannot working at the same time, so simultaneous transmission need consideration.

8. 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----------