RF Exposure evaluation

FCC ID: 2A7ZS-U2-AIR

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

The EUT can only use antennas certificated as follows provided by manufacturer.

Internal Identification	Antenna type and antenna number	Operate frequency band	Maximum antenna gain
WIFI/BT ANT	FPC antenna	2.4GHz – 2.5 GHz 5.1GHz 5.8 GHz	1dBi 1dBi 1dBi

5. Conducted power and Tune Up

[BT Mode]

Mode	Channel	Frequency	Peak Conducted Output Power (dBm)	Tune_Up
GFSK	00	2402	3.51	4±1
	39	2441	3.70	4±1
	78	2480	3.58	4±1
π/4DQPSK	00	2402	3.53	4±1
	39	2441	3.68	4±1
	78	2480	3.61	4±1
8DPSK	00	2402	4.02	4±1
	39	2441	4.19	4±1
	78	2480	4.10	4±1

[2.4GHz WLAN SISO Mode]

Mode	Channel	Frequency	Peak Conducted Output Power (dBm)	Tune_Up
802.11b	1	2412	18.98	18±1
	7	2437	18.75	18±1
	13	2462	18.37	18±1
802.11g	1	2412	18.45	18±1
	7	2437	18.56	18±1
	13	2462	18.11	18±1

802.11n HT20	1	2412	18.73	18±1
	7	2437	18.46	18±1
	13	2462	18.18	18±1
802.11n HT40	3	2422	18.78	18±1
	7	2437	18.74	18±1
	11	2452	18.56	18±1

[5GHz WLAN Band 1 SISO Mode]

Mode	Channel	Frequency	Average Conducted Output Power (dBm)	Tune_Up
802.11a	36	5180	13.28	13±1
	40	5200	13.18	13±1
	48	5240	12.79	13±1
802.11n HT20	36	5180	13.26	13±1
	40	5200	13.28	13±1
	48	5240	12.74	13±1
802.11n HT40	38	5190	13.60	13±1
	46	5230	13.25	13±1
802.11ac VHT20	36	5180	13.06	13±1
	40	5200	13.23	13±1
	48	5240	12.70	13±1
802.11ac VHT40	38	5190	13.56	13±1
	46	5230	13.41	13±1
802.11ac VHT80	42	5210	13.74	13±1

[5GHz WLAN Band 3 SISO Mode]

Mode	Channel	Frequency	Average Conducted Output Power (dBm)	Tune_Up
802.11a	149	5745	13.66	13±1
	157	5785	13.07	13±1
	165	5825	12.40	13±1
802.11n HT20	149	5745	13.55	13±1
	157	5785	13.02	13±1
	165	5825	12.42	13±1
802.11n HT40	151	5755	13.90	13±1
	159	5795	13.27	13±1
802.11ac VHT20	149	5745	13.60	13±1
	157	5785	13.06	13±1
	165	5825	12.44	13±1
802.11ac VHT40	151	5755	13.91	13±1
	159	5795	13.40	13±1
802.11ac VHT80	155	5775	14.30	14±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, the RF power density can be obtained.

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Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
GFSK	5.00	3.1623	1.0	1.2589	0.0008	1.0000
π/4DQPSK	5.00	3.1623	1.0	1.2589	0.0008	1.0000
8DPSK	5.00	3.1623	1.0	1.2589	0.0008	1.0000

2.4GHz WLAN

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
IEEE 802.11b	19.00	79.4328	1.0	1.2589	0.0199	1.0000
IEEE 802.11g	19.00	79.4328	1.0	1.2589	0.0199	1.0000
IEEE 802.11n HT20	19.00	79.4328	1.0	1.2589	0.0199	1.0000
IEEE 802.11n HT40	19.00	79.4328	1.0	1.2589	0.0199	1.0000

5GHz WLAN Band 1

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
IEEE 802.11a	14.00	25.1189	1.0	1.2589	0.0063	1.0000
IEEE 802.11n HT20	14.00	25.1189	1.0	1.2589	0.0063	1.0000
IEEE 802.11n HT40	14.00	25.1189	1.0	1.2589	0.0063	1.0000
IEEE 802.11ac VHT20	14.00	25.1189	1.0	1.2589	0.0063	1.0000
IEEE 802.11ac VHT40	14.00	25.1189	1.0	1.2589	0.0063	1.0000
IEEE 802.11ac VHT80	14.00	25.1189	1.0	1.2589	0.0063	1.0000

5GHz WLAN Band 3

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
IEEE 802.11a	14.00	25.1189	1.0	1.2589	0.0063	1.0000
IEEE 802.11n HT20	14.00	25.1189	1.0	1.2589	0.0063	1.0000
IEEE 802.11n HT40	14.00	25.1189	1.0	1.2589	0.0063	1.0000
IEEE 802.11ac VHT20	14.00	25.1189	1.0	1.2589	0.0063	1.0000
IEEE 802.11ac VHT40	14.00	25.1189	1.0	1.2589	0.0063	1.0000
IEEE 802.11ac VHT80	15.00	31.6228	1.0	1.2589	0.0079	1.0000

Remark:

1. Output power 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. 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----------