RF Exposure evaluation

FCC ID: 2AF62-AESRZBV2LSKG

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 device evaluated with antennas certificated as follows provided by manufacturer.

Antenna model	Antenna type and antenna number	Operate frequency band	Maximum antenna gain
146187	PCB antenna	2.4GHz – 2.5 GHz 5.15GHz – 5.85 GHz	3.20 dBi 4.25 dBi

5. Conducted power and Manufacturing Tolerance

2.4GHz WLAN

Mode	Channel	Output Power[dBm]	Tune up [dBm]
11B	2412	8.22	9±1
	2437	8.48	9±1
	2462	8.36	9±1
11G	2412	8.13	9±1
	2437	8.49	9±1
	2462	8.49	9±1
11N20SISO	2412	8.28	9±1
	2437	9.27	9±1
	2462	8.58	9±1
11N40SISO	2422	8.30	9±1
	2437	8.56	9±1
	2452	8.71	9±1

5GHz WLAN Band 1

Mode	Channel	Output Power[dBm]	Tune-Up[dBm]
11A	5180	9.81	9±1
	5200	10.33	10±1
	5240	11.07	11±1
11N20SISO	5180	9.83	9±1
	5200	10.34	10±1

	5240	11.14	11±1
11N40SISO	5190	10.75	11±1
	5230	11.72	11±1
11AC20SISO	5180	9.57	9±1
	5200	10.08	10±1
	5240	10.84	11±1
11AC40SISO	5190	10.69	11±1
	5230	11.93	11±1
11AC80SISO	5210	12.18	12±1

5GHz WLAN Band 2A

Mode	Channel	Output Power[dBm]	Tune-Up[dBm]
11A	5260	11.08	11±1
	5300	10.78	11±1
	5320	11.12	11±1
11N20SISO	5260	10.83	11±1
	5300	10.92	11±1
	5320	10.66	11±1
11N40SISO	5270	11.39	11±1
	5310	11.35	11±1
11AC20SISO	5260	11.24	11±1
	5300	11.36	11±1
	5320	11.19	11±1
11AC40SISO	5270	11.49	11±1
	5310	11.40	11±1
11AC80SISO	5290	12.09	12±1

5GHz WLAN Band 2C

Mode	Channel	Output Power[dBm]	Tune-Up[dBm]
11A	5500	11.28	12±1
	5580	13.41	13±1
	5700	13.39	13±1
11N20SISO	5500	11.13	12±1
	5580	12.87	13±1
	5700	12.85	13±1
11N40SISO	5510	11.97	10±1
	5550	12.95	12±1
	5670	13.50	13±1
11AC20SISO	5500	11.02	12±1
	5580	12.48	13±1
	5700	12.43	13±1
11AC40SISO	5510	10.96	10±1
	5550	12.15	12±1

	5670	13.12	13±1
11AC80SISO	5530	12.15	13±1
	5610	13.54	13±1

5GHz WLAN Band 3

Mode	Channel	Output Power[dBm]	Tune-Up[dBm]
11A	5745	11.41	11±1
	5785	11.09	11±1
	5825	11.00	11±1
11N20SISO	5745	11.19	11±1
	5785	10.88	11±1
	5825	10.81	11±1
11N40SISO	5755	8.93	9±1
	5795	8.64	9±1
11AC20SISO	5745	11.16	11±1
	5785	10.86	11±1
	5825	10.77	11±1
11AC40SISO	5755	9.35	9±1
	5795	8.86	9±1
11AC80SISO	5775	12.11	12±1

Bluetooth

Mode	Channel	Output Power[dBm]	Tune-Up[dBm]
DH5	2402	5.92	6±1
	2441	6.30	6±1
	2480	6.07	6±1
2DH5	2402	5.17	5±1
	2441	5.59	5±1
	2480	5.29	5±1
3DH5	2402	4.90	5±1
	2441	5.33	5±1
	2480	5.03	5±1
BLE	2402	1.82	2±1
	2440	2.17	2±1
	2480	1.89	2±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.

2.4GHz WLAN

Type	Max. Output power With Tune-Up		Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW			
IEEE 802.11b	10.00	10.0000	2.0893	0.0042	1.0000
IEEE 802.11g	10.00	10.0000	2.0893	0.0042	1.0000
IEEE 802.11n HT20	10.00	10.0000	2.0893	0.0042	1.0000
IEEE 802.11n HT40	10.00	10.0000	2.0893	0.0042	1.0000

5GHz WLAN Band 1

Type	Max. Output power With Tune-Up		Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW			
IEEE 802.11a	12.00	15.8489	2.6607	0.0084	1.0000
IEEE 802.11n HT20	12.00	15.8489	2.6607	0.0084	1.0000
IEEE 802.11n HT40	12.00	15.8489	2.6607	0.0084	1.0000
IEEE 802.11ac VHT20	12.00	15.8489	2.6607	0.0084	1.0000
IEEE 802.11ac VHT40	12.00	15.8489	2.6607	0.0084	1.0000
IEEE 802.11ac VHT80	13.00	19.9526	2.6607	0.0106	1.0000

5GHz WLAN Band 2A

Type	Max. Output power With Tune-Up		Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW			
IEEE 802.11a	12.00	15.8489	2.6607	0.0084	1.0000
IEEE 802.11n HT20	12.00	15.8489	2.6607	0.0084	1.0000
IEEE 802.11n HT40	12.00	15.8489	2.6607	0.0084	1.0000
IEEE 802.11ac VHT20	12.00	15.8489	2.6607	0.0084	1.0000
IEEE 802.11ac VHT40	12.00	15.8489	2.6607	0.0084	1.0000
IEEE 802.11ac VHT80	13.00	19.9526	2.6607	0.0106	1.0000

5GHz WLAN Band 2C

Type	Max. Output power With Tune-Up		Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW			
IEEE 802.11a	14.00	25.1189	2.6607	0.0133	1.0000
IEEE 802.11n HT20	14.00	25.1189	2.6607	0.0133	1.0000
IEEE 802.11n HT40	14.00	25.1189	2.6607	0.0133	1.0000
IEEE 802.11ac VHT20	14.00	25.1189	2.6607	0.0133	1.0000
IEEE 802.11ac VHT40	14.00	25.1189	2.6607	0.0133	1.0000
IEEE 802.11ac VHT80	14.00	25.1189	2.6607	0.0133	1.0000

5GHz WLAN Band 3

Type	Output power		Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW			
IEEE 802.11a	12.00	15.8489	2.6607	0.0084	1.0000
IEEE 802.11n HT20	12.00	15.8489	2.6607	0.0084	1.0000
IEEE 802.11n HT40	10.00	10.0000	2.6607	0.0053	1.0000
IEEE 802.11ac VHT20	12.00	15.8489	2.6607	0.0084	1.0000
IEEE 802.11ac VHT40	10.00	10.0000	2.6607	0.0053	1.0000
IEEE 802.11ac VHT80	13.00	19.9526	2.6607	0.0106	1.0000

Bluetooth

Type	Output power		Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW			
BT	7.00	5.0119	2.0893	0.0021	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. Conclusion

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

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