

RF Exposure evaluation

FCC ID: 2AVE7-L007

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

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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
XBY230284-WIFI-V1.0	WIFI antenna	2.4GHz – 2.5 GHz	1.58 dBi
		5.15GHz – 5.85 GHz	3.97 dBi
XBY230284-BT-V1.0	BT antenna	2.4GHz – 2.5 GHz	1.21 dBi

5. Conducted power and Manufacturing Tolerance

2.4GHz WLAN

Mode	Channel	Output Power[dBm]	Tune up [dBm]
11B	2412	14.65	14±1
	2437	12.88	13±1
	2462	14.56	14±1
11G	2412	14.10	14±1
	2437	13.76	14±1
	2462	13.91	14±1
11N20SISO	2412	12.95	13±1
	2437	13.68	13±1
	2462	13.81	13±1
11N40SISO	2422	14.13	14±1
	2437	13.97	13±1
	2452	13.94	13±1

5GHz WLAN Band 1

Mode	Channel	Output Power[dBm]	Tune-Up[dBm]
11A	5180	11.73	12±1
	5200	11.84	12±1
	5240	12.17	12±1
11N20SISO	5180	11.68	12±1
	5200	11.88	12±1

	5240	12.28	12±1
11N40SISO	5190	11.89	12±1
	5230	12.12	12±1
11AC20SISO	5180	11.91	12±1
	5200	11.95	12±1
	5240	12.31	12±1
11AC40SISO	5190	11.92	12±1
	5230	12.14	12±1

5GHz WLAN Band 3

Mode	Channel	Output Power[dBm]	Tune-Up[dBm]
11A	5745	9.90	9±1
	5785	9.07	9±1
	5825	8.36	9±1
11N20SISO	5745	10.01	10±1
	5785	9.06	9±1
	5825	8.37	9±1
11N40SISO	5755	9.76	9±1
	5795	8.79	9±1
11AC20SISO	5745	10.02	10±1
	5785	9.10	10±1
	5825	8.42	9±1
11AC40SISO	5755	9.77	9±1
	5795	8.79	9±1

Bluetooth

Mode	Channel	Output Power[dBm]	Tune-Up[dBm]
DH5	2402	1.62	2±1
	2441	2.05	2±1
	2480	1.78	2±1
2DH5	2402	1.63	2±1
	2441	2.05	2±1
	2480	1.79	2±1
3DH5	2402	1.75	2±1
	2441	2.17	2±1
	2480	1.90	2±1
BLE 1M	2402	1.64	2±1
	2440	2.15	2±1
	2480	1.78	2±1
BLE 2M	2402	1.67	2±1
	2440	2.19	2±1
	2480	1.83	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, $r=20\text{cm}$, 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	15.00	31.6228	1.4388	0.0091	1.0000
IEEE 802.11g	15.00	31.6228	1.4388	0.0091	1.0000
IEEE 802.11n HT20	14.00	25.1189	1.4388	0.0072	1.0000
IEEE 802.11n HT40	15.00	31.6228	1.4388	0.0091	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	13.00	19.9526	2.4946	0.0099	1.0000
IEEE 802.11n HT20	13.00	19.9526	2.4946	0.0099	1.0000
IEEE 802.11n HT40	13.00	19.9526	2.4946	0.0099	1.0000
IEEE 802.11ac VHT20	13.00	19.9526	2.4946	0.0099	1.0000
IEEE 802.11ac VHT40	13.00	19.9526	2.4946	0.0099	1.0000

5GHz WLAN Band 3

Type	Max. Output power With Tune-Up		Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW			
IEEE 802.11a	10.00	10.0000	2.4946	0.0050	1.0000
IEEE 802.11n HT20	11.00	12.5893	2.4946	0.0062	1.0000
IEEE 802.11n HT40	10.00	10.0000	2.4946	0.0050	1.0000
IEEE 802.11ac VHT20	11.00	12.5893	2.4946	0.0062	1.0000
IEEE 802.11ac VHT40	10.00	10.0000	2.4946	0.0050	1.0000

Bluetooth

Type	Output power		Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW			
BT	3.00	1.9953	1.3213	0.0005	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

The device has two antennas, one WIFI antenna and one BT antenna, and WIFI and BT the can transmit simultaneously.

8. Summary simultaneous transmission results

WIFI +BT

Modulation Type	Max MPE WIFI (mW/cm ²)	Max MPE BT (mW/cm ²)	ΣMPE ratios	Limit	Results
WIFI+BT	0.0099	0.0005	0.0104	1.0	PASS

9. 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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