

RF Exposure evaluation

Exposure category: General population/uncontrolled environment

EUT Type: Production Unit

Device Type: Mobile Device

Refer Standard: KDB 447498 D01 General RF Exposure Guidance v06

FCC Part 2 §2.1091

FCC ID: 2A8WL-BWNIP-4L-BS

1. Applicable Standard

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 requirement

KDB447498 v06: 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

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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

$$S = \frac{PG}{4\pi R^2}$$

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

As declared by the Applicant, the EUT transmits with the maximum source-based Duty Cycle of 100%-see the User manual, and the EUT is a wireless device used in a mobile application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum mobile separation distance, $r = 20\text{cm}$, as well as the gain of the used antenna is 2.90dBi for WLAN, and the power drift from Turn-up Procedure provide by manufacturer as following states, the RF power density can be obtained..

4. Antenna Information

use antennas certificated as follows provided by manufacturer;

Internal Identification	Antenna Identification in Internal photos	Antenna type and antenna number	Operate frequency band	Maximum antenna gain
Antenna	5G Wifi	Internal Antenna	5.18GHz – 5.24 GHz 5.745 GHz -5.825 GHz	2.9 dBi

5. Evaluation ResultsforStandalone

6.1 Standalone MPE

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 refer to antenna information, the RF power density can be obtained.

5.18GHz – 5.24 GHz

Modulation Type	Target power W/ tolerance (dBm)	Max tune up power tolerance (dBm)	Max Output power to antenna (mW)	Antenna Gain	Antenna Gain (linear)	Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	Result
802.11a	13±1.0	14	25.119	2.90	1.950	0.00974	1.0	Pass
802.11ac20	11±1.0	12	15.849	2.90	1.950	0.00615	1.0	Pass
802.11ac40	10±1.0	11	12.589	2.90	1.950	0.00488	1.0	Pass
802.11n20	13±1.0	14	25.119	2.90	1.950	0.00974	1.0	Pass
802.11n40	12±1.0	13	19.953	2.90	1.950	0.00774	1.0	Pass
802.11ax20	11±1.0	12	15.849	2.90	1.950	0.00615	1.0	Pass
802.11ax40	10±1.0	11	12.589	2.90	1.950	0.00488	1.0	Pass

5.745 GHz -5.825 GHz

Modulation Type	Target power W/ tolerance (dBm)	Max tune up power tolerance (dBm)	Max Output power to antenna (mW)	Antenna Gain	Antenna Gain (linear)	Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	Result
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802.11ax40	10±1.0	11	12.589	2.90	1.950	0.00488	1.0	Pass

Power Density at R=20cm (mW/cm2) BLE	Power Density at R=20cm (mW/cm2) 2.4G WIFI	Power Density at R=20cm (mW/cm2) 5.18GHz – 5.24 GHz WIFI	Σ MPE ratios	Limit (mW/cm2)	Result
0.00080	0.02528	0.00974	0.03582	1.0	Pass

Power Density at R=20cm (mW/cm2) BLE	Power Density at R=20cm (mW/cm2) 2.4G WIFI	Power Density at R=20cm (mW/cm2) 5.745 GHz -5.825 GHz WIFI	Σ MPE ratios	Limit (mW/cm2)	Result
0.00080	0.02528	0.00974	0.03582	1.0	Pass

6. Conclusion

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