# 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 amanner that ensures that the public is not exposed to radio frequency energy level in excess of theCommission's guidelines.
According to §1.1310 and §2.1091 RF exposure requirement
KDB447498 v06: Mobile and Portable Devices RF Exposure Procedures and Equipment AuthorizationPolicies.

## 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<br>3.0 – 30<br>30 – 300<br>300 – 1500<br>1500 – 100,000 | 614<br>1842/f<br>61.4<br>/<br>/ | 1.63<br>4.89/f<br>0.163<br>/<br>/ | (100) *<br>($900/f^2$)*<br>1.0<br>f/300<br>5 | 6<br>6<br>6<br>6<br>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<br>3.0 – 30<br>30 – 300<br>300 – 1500<br>1500 – 100,000 | 614<br>824/f<br>27.5<br>/<br>/ | 1.63<br>2.19/f<br>0.073<br>/<br>/ | (100) *<br>($180/f^2$)*<br>0.2<br>f/1500<br>1.0 | 30<br>30<br>30<br>30<br>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

As declared by the Applicant, the EUT transmits with the maximum soure-baed 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 =20cm, 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<br>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 =20cm, 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 toleranc e(dBm) | Max Output power to antenna (mW) | Antenna Gain | Antenna Gain (linear) | Power Density at R=20cm (mW/cm2) | Limit (mW/cm2) | 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 toleranc e(dBm) | Max Output power to antenna (mW) | Antenna Gain | Antenna Gain (linear) | Power Density at R=20cm (mW/cm2) | Limit (mW/cm2) | Result |
|---|---|---|---|---|---|---|---|---|
| 802.11a | 12±1.0 | 13 | 19.953 | 2.90 | 1.950 | 0.00774 | 1.0 | Pass |
| 802.11ac 20 | 11±1.0 | 12 | 15.849 | 2.90 | 1.950 | 0.00615 | 1.0 | Pass |
| 802.11ac 40 | 10±1.0 | 11 | 12.589 | 2.90 | 1.950 | 0.00488 | 1.0 | Pass |
| 802.11n2 0 | 13±1.0 | 14 | 25.119 | 2.90 | 1.950 | 0.00974 | 1.0 | Pass |
| 802.11n4 0 | 12±1.0 | 13 | 19.953 | 2.90 | 1.950 | 0.00774 | 1.0 | Pass |
| 802.11ax 20 | 10±1.0 | 11 | 12.589 | 2.90 | 1.950 | 0.00488 | 1.0 | Pass |
| 802.11ax 40 | 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 | ∑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 | ∑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.