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: 2ABC5-W0718

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 §2.1093 RF exposure requirement
KDB447498 v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

2. Requirement

According to KDB447498 D01 General RF Exposure Guidance v06 Section 4.3.1 Standalone SAR test exclusion considerations: "Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition, listed below, is satisfied. These test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions.22 The minimum test separation distance is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander (see 5) of section 4.1). To qualify for SAR test exclusion, the test separation distances applied must be fully explained and justified by the operating configurations and exposure conditions of the transmitter and applicable host platform requirements, typically in the SAR measurement or SAR analysis report, according to the required published RF exposure KDB procedures. When no other RF exposure testing or reporting is required, a statement of justification and compliance must be included in the equipment approval, in lieu of the SAR report, to qualify for the SAR test exclusion. When required, the device specific conditions described in the other published RF exposure KDB procedures must be satisfied before applying these SAR test exclusion provisions; for example, handheld PTT two-way radios, handsets, laptops & tablets etc.23 "

$$[(\text{max. power of channel, including tune-up tolerance, mW})/ (\text{min. test separation distance, mm})] \cdot [\sqrt{f\,(\text{GHz})}]$$

≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where:

• f (GHz) is the RF channel transmit frequency in GHz

• Power and distance are rounded to the nearest mW and mm before calculation

• The result is rounded to one decimal place for comparison

• 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

3. 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/cm²)	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/f²)*	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/cm²)	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/f²)*	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

4. 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 1.06dBi for WLAN, and the power drift from Turn-up Procedure provide by manufacturer as following states, the RF power density can be obtained.

5. Antenna Information

use anten**nas 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	2.4G Wifi Chain	Internal Antenna	2.4GHz – 2.4835 GHz	2.12 dBi

6. Evaluation Results for Standalone

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.

Modulation Type	Target power W/ tolerance (dBm)	Max tune up power tolerance(dBm)	Max Output power to antenna (mW)	Antenna Gain (Numeric)	Power Density at R=20cm (mW/cm2)	Limit (mW/cm2)	Result
802.11b	13±1.0	14	25.119	2.12	0.00814	1.0	Pass
802.11g	12±1.0	13	19.953	2.12	0.00647	1.0	Pass
802.11n (HT20)	12±1.0	13	19.953	2.12	0.00647	1.0	Pass
802.11n (HT40)	12±1.0	13	19.953	2.12	0.00647	1.0	Pass

7. Conclusion

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