# RF Exposure evaluation

## FCC ID: 2APQM-T21

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

Only use antennas certificated as follows provided by manufacturer;

| Antenna No. | Model No. of antenna: | Type of antenna: | Gain of the antenna (Max.) | Frequency range: |
|---|---|---|---|---|
| 2.4GWIFI | / | PCB Antenna | 1dBi for 2412-2462MHz; | |
| 2.4GBLE | / | PCB Antenna | 1dBi for 2402-2480MHz; | |

# 5. Manufacturing Tolerance

WIFI(Peak)

| *IEEE 802.11b (PEAK)* | | | | | | |
|---|---|---|---|---|---|---|
| Frequency (MHz) | Antenna 1 | | | | | |
| | 2412 | 2437 | 2462 | | | |
| Target (dBm) | 14 | 14 | 14 | | | |
| Tolerance ± (dB) | 1.0 | 1.0 | 1.0 | | | |
| *IEEE 802.11g (PEAK)* | | | | | | |
| Frequency (MHz) | Antenna 1 | | | | | |
| | 2412 | 2437 | 2462 | | | |
| Target (dBm) | 14 | 14 | 14 | | | |
| Tolerance ± (dB) | 1.0 | 1.0 | 1.0 | | | |
| *IEEE 802.11n HT20 (PEAK)* | | | | | | |
| Frequency (MHz) | Antenna 1 | | | | | |
| | 2412 | 2437 | 2462 | | | |
| Target (dBm) | 14 | 14 | 14 | | | |
| Tolerance ± (dB) | 1.0 | 1.0 | 1.0 | | | |
| *IEEE 802.11n HT40 (PEAK)* | | | | | | |
| Frequency (MHz) | Antenna 1 | | | | | |
| | 2422 | 2437 | 2452 | | | |
| Target (dBm) | 14 | 14 | 14 | | | |
| Tolerance ± (dB) | 1.0 | 1.0 | 1.0 | | | |

BLE

| GFSK 1Mbps(Peak) | | | |
|---|---|---|---|
| Channel | Channel 0 | Channel 19 | Channel 39 |
| Target (dBm) | 2 | 2 | 2 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |

# 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 is 2.54dBi, the RF power density can be obtained.

| Modulation Type | Output power | | Antenna Gain (dBi) | Antenna Gain (linear) | MPE ($mW/cm^2$) | MPE Limits ($mW/cm^2$) |
|---|---|---|---|---|---|---|
| | dBm | mW | | | | |
| 2.4GWIFI | 15 | 31.623 | 1 | 1.259 | 0.00792 | 1.0000 |
| 2.4GBLE | 3 | 1.995 | 1 | 1.259 | 0.00050 | 1.0000 |

*Remark:*

*1. Output power (Peak) including turn-up tolerance;*

*2. 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.

----------THE END OF REPORT----------