

RF Exposure evaluation

FCC ID: 2AVNZ-HAROUTE0026

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

HAROUTE0026 can 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: |
|-------------|-----------------------|------------------|----------------------------|------------------|
| BLE1 | / | Internal | 2.00dBi for 2400-2500MHz; | |
| BLE2 | / | Internal | 9.98dBi for 2400-2500MHz; | |

5. Conducted power

[2.4GHz BLE1]

| Mode | Channel | Frequency | Peak Conducted Output Power (dBm) |
|------|---------|-----------|-----------------------------------|
| GFSK | 0 | 2402 | 0.821 |
| | 19 | 2440 | 1.632 |
| | 39 | 2480 | 2.215 |

[2.4GHz BLE2]

| Mode | Channel | Frequency | Peak Conducted Output Power (dBm) |
|------|---------|-----------|-----------------------------------|
| GFSK | 0 | 2402 | 0.752 |
| | 19 | 2440 | 0.369 |
| | 39 | 2480 | 0.435 |

6. Manufacturing Tolerance

2.4GHz BLE1

| Frequency (MHz) | BLE (Peak) | | |
|--------------------|------------|------|------|
| | 2402 | 2440 | 2480 |
| Target (dBm) | 1.50 | 1.50 | 1.50 |
| Tolerance ± (dB) | 1.0 | 1.0 | 1.0 |

2.4GHz BLE2

| Frequency (MHz) | BLE (Peak) | | |
|--------------------|------------|------|------|
| | 2402 | 2440 | 2480 |
| Target (dBm) | 1.00 | 1.00 | 1.00 |
| Tolerance ± (dB) | 1.0 | 1.0 | 1.0 |

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

| Modulation Type | Output power | | Antenna Gain (dBi) | Antenna Gain (linear) | Duty Cycle | MPE (mW/cm ²) | MPE Limits (mW/cm ²) |
|-----------------|--------------|----------|--------------------------|-----------------------------|---------------|------------------------------|--|
| | dBm | mW | | | | | |
| BLE1 | 2.50 | 1.778279 | 2.00 | 1.584893 | 100% | 0.000561 | 1.0000 |
| BLE2 | 2.00 | 1.584893 | 9.98 | 9.954054 | 100% | 0.003140 | 1.0000 |

Remark:

1. Output power (Peak) 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.

8. Summary simultaneous transmission results

The sample supports 2 antennas for two BT Chip respectively. The BT antennas can transmit simultaneous.

According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;

\sum of MPE ratios ≤ 1.0

BLE and WIFI for simultaneous transmission

| MPE _{BLE1} (mW/cm ²) | MPE _{BLE2} (mW/cm ²) | Σ MPE ratios | Limit | Results |
|--|--|------------------------|-------|---------|
| 0.000561 | 0.003140 | 0.003701 | 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.

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