

RF Exposure evaluation

| | |
|----------------------|---|
| FCC ID | 2BF5C-MMA4020 |
| Product Name | BLUETOOTH SPEAKER |
| Model/Type reference | MMA4020 |
| Exposure category | General population/uncontrolled environment |
| EUT Type | Production Unit |
| Device Type | Mobile Device |

1. Reference

ANSI C95.1–1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

FCC KDB publication 447498 D01 General 1 RF Exposure Guidance v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

FCC CFR 47 part1 1.1310: Radio frequency radiation exposure limits.

FCC CFR 47 part2 2.1091: Radio frequency radiation exposure evaluation: mobile devices

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

405-ECO-WiFi can only use antennas certificated as follows provided by manufacturer;

| Antenna No. | Type of antenna: | Gain of the antenna (Max.) | Frequency range: |
|-------------|------------------|----------------------------|------------------|
| BT ANT | PCB antenna | -0.58dBi | 2402-2480MHz |

5. Conducted Peak Output Power

BR/EDR

| Modulation | Packet Type | Channel | Peak Output Power (dBm) | Peak Output Power (mW) |
|---------------|-------------|---------|-------------------------|------------------------|
| GFSK | DH5 | 0 | 1.274 | 1.341 |
| | | 39 | 1.930 | 1.560 |
| | | 78 | 1.529 | 1.422 |
| $\pi/4$ DQPSK | 2-DH5 | 0 | 1.767 | 1.502 |
| | | 39 | 1.223 | 1.325 |
| | | 78 | 1.343 | 1.362 |
| 8DPSK | 3-DH5 | 0 | 1.647 | 1.461 |
| | | 39 | 1.697 | 1.478 |
| | | 78 | 1.599 | 1.445 |

BLE

| Mode | Channel | Peak Output Power (dBm) | Peak Output Power (mW) |
|------|---------|-------------------------|------------------------|
| LE | 0 | 1.011 | 1.26 |
| | 19 | 0.370 | 1.09 |
| | 39 | 0.359 | 1.09 |

6. Manufacturing Tolerance

BR/EDR

| DH5 | | | |
|----------------------|-----------|------------|------------|
| Channel | Channel 0 | Channel 19 | Channel 39 |
| Target (dBm) | 2.0 | 2.0 | 2.0 |
| Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |

| 2DH5 | | | |
|----------------------|-----------|------------|------------|
| Channel | Channel 0 | Channel 19 | Channel 39 |
| Target (dBm) | 2.0 | 2.0 | 2.0 |
| Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |

| 3DH5 | | | |
|----------------------|-----------|------------|------------|
| Channel | Channel 0 | Channel 19 | Channel 39 |
| Target (dBm) | 2.0 | 2.0 | 2.0 |
| Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |

BLE

| Channel | Channel 0 | Channel 19 | Channel 39 |
|----------------------|-----------|------------|------------|
| Target (dBm) | 1.0 | 1.0 | 1.0 |
| Tolerance \pm (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.

| Mode | Output power | | Antenna Gain (dBi) | Antenna Gain(linear) | MPE (mW/cm ²) | MPE Limits (mW/cm ²) |
|--------|--------------|------|--------------------|----------------------|---------------------------|----------------------------------|
| | dBm | mW | | | | |
| BR/EDR | 3.0 | 2.00 | -0.58 | 0.87 | 0.0003 | 1.0000 |
| BLE | 2.0 | 1.58 | -0.58 | 0.87 | 0.0003 | 1.0000 |

Remark:

1. Output power (Peak) including turn-up tolerance;
2. MPE evaluate distance is 20cm from user manual provide by manufacturer.

8. Conclusion

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

-----End of the report-----