# FCC 47 CFR MPE REPORT

WOW Technologies (Singapore) Pte Ltd

Shockwafe Wireless 11.2.6

Model Number: Shockwafe Wireless

FCC ID: 2AGB6-SWWIRELESS

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| Applicant: | WOW Technologies (Singapore) Pte Ltd |
| Address: | 33 Ubi Avenue 3, #03-48 Vertex Singapore 408868 |
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| Prepared By: | EST Technology Co., Ltd. |
| | Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China |
| Tel: 86-769-83081888-808 | |

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# Maximum Permissible Exposure

## 1. Applicable Standards

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 limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2m normally can be maintained between the user and the device.

### 1.1. Limits for Maximum Permissible Exposure (MPE)

**(a) Limits for Occupational/Controlled Exposure**

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) ($mW/cm^2$) | Averaging Times $\|E\|^2$, $\|H\|^2$ or S (minutes) |
|---|---|---|---|---|
| 0.3-3.0 | 614 | 1.63 | (100)* | 6 |
| 3.0-30 | 1842/f | 4.89/f | (900/f)* | 6 |
| 30-300 | 61.4 | 0.163 | 1.0 | 6 |
| 300-1500 | | | F/300 | 6 |
| 1500-10000 | | | 5 | 6 |

**(b) Limits for General Population / Uncontrolled Exposure**

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) ($mW/cm^2$) | Averaging Times $\|E\|^2$, $\|H\|^2$ or S (minutes) |
|---|---|---|---|---|
| 0.3-1.34 | 614 | 1.63 | (100)* | 30 |
| 1.34-30 | 824/f | 2.19/f | (180/f)* | 30 |
| 30-300 | 27.5 | 0.073 | 0.2 | 30 |
| 300-1500 | | | F/1500 | 30 |
| 1500-10000 | | | 1.o | 30 |

Note: f=frequency in MHz; *Plane-wave equivalent power density

## 1.2. MPE Calculation Method

E (V/m) = $\frac{\sqrt{30 \times P \times G}}{d}$ Power Density: Pd (W/m$^2$) = $\frac{E^2}{377}$

E = Electric Field (V/m)

P = Peak RF output Power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

Pd = $\frac{30 \times P \times G}{377 \times d^2}$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained

## 2. Conducted Power Result

| Mode | Frequency (MHz) | Peak output power (dBm) | Peak output power (mW) |
|---|---|---|---|
| GFSK | 2402 | 2.35 | 1.718 |
| | 2441 | 1.88 | 1.542 |
| | 2480 | 1.95 | 1.567 |
| π/4-DQPSK | 2402 | 4.64 | 2.911 |
| | 2441 | 4.34 | 2.716 |
| | 2480 | 4.45 | 2.786 |
| 8-DPSK | 2402 | 5.60 | 3.631 |
| | 2441 | 4.93 | 3.112 |
| | 2480 | 5.00 | 3.162 |
| BLE 1M | 2402 | 2.15 | 1.641 |
| | 2440 | 1.75 | 1.496 |
| | 2480 | 1.72 | 1.486 |
| BLE 2M | 2402 | 2.34 | 1.714 |
| | 2440 | 1.76 | 1.500 |
| | 2480 | 1.76 | 1.500 |
| IEEE 802.11b | 2412 | 19.50 | 89.125 |
| | 2437 | 18.40 | 69.183 |
| | 2462 | 18.24 | 66.681 |
| IEEE 802.11g | 2412 | 22.33 | 171.002 |
| | 2437 | 21.25 | 133.352 |
| | 2462 | 21.35 | 136.458 |
| IEEE 802.11n HT20 | 2412 | 23.18 | 207.970 |
| | 2437 | 22.36 | 172.187 |
| | 2462 | 22.46 | 176.198 |
| IEEE 802.11n HT40 | 2422 | 22.92 | 195.884 |
| | 2437 | 22.24 | 167.494 |
| | 2452 | 22.34 | 171.396 |
| IEEE 802.11a | 5180 | 12.27 | 16.866 |
| | 5200 | 12.13 | 16.331 |
| | 5240 | 11.75 | 14.962 |
| | 5745 | 15.41 | 34.754 |
| | 5785 | 14.92 | 31.046 |
| | 5825 | 14.12 | 25.823 |

| | | | |
|---|---|---|---|
| IEEE 802.11n HT20 | 5180 | 12.42 | 17.458 |
| | 5200 | 12.23 | 16.711 |
| | 5240 | 11.82 | 15.205 |
| | 5745 | 15.60 | 36.308 |
| | 5785 | 15.22 | 33.266 |
| | 5825 | 14.63 | 29.040 |
| IEEE 802.11n HT40 | 5190 | 13.20 | 20.893 |
| | 5230 | 13.11 | 20.464 |
| | 5755 | 14.77 | 29.992 |
| | 5795 | 15.85 | 38.459 |

# 3. Calculated Result and Limit

| Mode | Peak output power (dBm) | Target power (dBm) | MAX Target power (dBm) | Antenna gain | | Power Density (S) (mW /cm$^2$) | Limited of Power Density (S) (mW /cm$^2$) | Test Result |
|---|---|---|---|---|---|---|---|---|
| | | | | (dBi) | (Linear) | | | |
| 2.4G Band | | | | | | | | |
| GFSK | 2.35 | 2±1 | 3 | 3.66 | 2.323 | 0.00092 | 1 | Complies |
| π/4-DQPSK | 4.64 | 4±1 | 5 | 3.66 | 2.323 | 0.00146 | 1 | Complies |
| 8-DPSK | 5.60 | 5±1 | 6 | 3.66 | 2.323 | 0.00184 | 1 | Complies |
| BLE 1M | 2.15 | 2±1 | 3 | 3.66 | 2.323 | 0.00092 | 1 | Complies |
| BLE 2M | 2.34 | 2±1 | 3 | 3.66 | 2.323 | 0.00092 | 1 | Complies |
| IEEE 802.11b | 19.50 | 19±1 | 20 | 4.58 | 2.871 | 0.05711 | 1 | Complies |
| IEEE 802.11g | 22.33 | 22±1 | 23 | 4.58 | 2.871 | 0.11395 | 1 | Complies |
| IEEE 802.11n HT20 | 23.18 | 23±1 | 24 | 4.58 | 2.871 | 0.14346 | 1 | Complies |
| IEEE 802.11n HT40 | 22.92 | 22±1 | 23 | 4.58 | 2.871 | 0.11395 | 1 | Complies |
| 5G Band | | | | | | | | |
| IEEE 802.11a | 15.41 | 15±1 | 16 | 5.70 | 3.715 | 0.02943 | 1 | Complies |
| IEEE 802.11n HT20 | 15.60 | 15±1 | 16 | 5.70 | 3.715 | 0.02943 | 1 | Complies |
| IEEE 802.11n HT40 | 15.85 | 15±1 | 16 | 5.70 | 3.715 | 0.02943 | 1 | Complies |

Simultaneous Transmission Mode (BT+WIFI+Contain Module)

| Mode | Result | Limit | Simultaneous Transmissions Result | Simultaneous Transmissions Limit | Total Result |
|---|---|---|---|---|---|
| BT | 0.00184 | 1 | 0.16820 | 1 | Complies |
| WIFI | 0.14346 | 1 | | | |
| Contain Module 1 | 0.01145 | 1 | | | |
| Contain Module 2 | 0.01145 | 1 | | | |
| Note: WIFI 2.4G and WIFI 5GHz bands are share an antenna, cann't both the 2.4G and 5 GHz bands operate simultaneously. | | | | | |

**End of Test Report**