# Maximum Permissible Exposure Report

## 1. Product Information

| | |
|---|---|
| FCC ID: | 2AV9UCC |
| Product name | Formuler CC |
| Test Model | CC(US) |
| Power supply | For AC Adapter: Input: 100-240V~, 50/60Hz, 0.4A<br>Output: 12.0V 1.5A |
| Operation frequency | 2412MHz-2462MHz<br>5180MHz-5240MHz<br>5745MHz-5825MHz |
| Antenna Type | Internal Antenna, 2.0dBi(Max.) |
| Antenna Gain | 2dBi(Max) |
| Hardware version | UT100 |
| Software version | 1.4.70-r24481 |
| Channel Number | 11 Channels for 20MHz bandwidth (2412~2462MHz)<br>7 Channels for 40MHz bandwidth (2422~2452MHz)<br>4 channels for 20MHz bandwidth (5180-5240MHz)<br>2 channels for 40MHz bandwidth (5190~5230MHz)<br>1 channels for 80MHz bandwidth (5210MHz)<br>5 channels for 20MHz bandwidth(5745-5825MHz)<br>2 channels for 40MHz bandwidth(5755~5795MHz)<br>1 channels for 80MHz bandwidth(5775MHz) |
| Channel Spacing | 5MHz |
| Exposure category | General population/uncontrolled environment |
| EUT Type | Production Unit |
| Device Type | Mobile Devices |

## 2. Evaluation Method

Systems operating under the provisions of FCC 47 CFR 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.
In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498D01 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modelled or measured field strengths or power density, is ≤ 1.0. The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

## 3. Limit

### 3. 1 Refer Evaluation Method

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: Radiofrequency radiation exposure limits.
FCC CFR 47 part2 2.1091: Radiofrequency radiation exposure evaluation: Mobile Devices

### 3. 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

## 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

## 5. Antenna Information

ES-D4 can only use antennas certificated as follows provided by manufacturer;

| Antenna type and antenna number | Operate frequency band | Maximum antenna gain | Notes |
|---|---|---|---|
| Internal Antenna | 2412MHz-2462MHz<br>5180MHz-5240MHz<br>5745MHz-5825MHz | 2 dBi | WiFi Antenna |

## 6. Conducted Power

[2.4GWIFI Max Conducted Power]

| Mode | Channel | Frequency (MHz) | Max Conducted Power(dBm) |
|---|---|---|---|
| 11B | 1 | 2412 | 22.24 |
| | 6 | 2437 | 22.50 |
| | 11 | 2462 | 22.18 |
| 11G | 1 | 2412 | 21.86 |
| | 6 | 2437 | 22.11 |
| | 11 | 2462 | 21.80 |
| 11N20SISO | 1 | 2412 | 22.11 |
| | 6 | 2437 | 22.41 |
| | 11 | 2462 | 22.26 |
| 11N40SISO | 3 | 2422 | 21.61 |
| | 6 | 2437 | 21.71 |
| | 9 | 2452 | 21.67 |

[5.2GWIFI Max Conducted Power]

| Mode | Channel | Frequency (MHz) | Max Conducted Power(dBm) |
|---|---|---|---|
| 11A | 36 | 5180 | 18.68 |
| | 40 | 5200 | 19.28 |
| | 48 | 5240 | 20.47 |
| 11N20 SISO | 36 | 5180 | 18.69 |
| | 40 | 5200 | 19.10 |
| | 48 | 5240 | 20.13 |
| 11N40 SISO | 38 | 5190 | 18.29 |
| | 46 | 5230 | 19.40 |
| 11AC20 SISO | 36 | 5180 | 21.36 |
| | 40 | 5200 | 22.06 |
| | 48 | 5240 | 21.06 |
| 11AC40 SISO | 38 | 5190 | 21.28 |
| | 46 | 5230 | 20.07 |
| 11AC80 SISO | 42 | 5210 | 19.01 |

[5.8WIFI Max Conducted Power]

| Mode | Channel | Frequency (MHz) | Max Conducted Power(dBm) |
|---|---|---|---|
| 11A | 149 | 5745 | 12.78 |
| | 157 | 5785 | 15.12 |
| | 165 | 5825 | 15.55 |
| 11N20 SISO | 149 | 5745 | 13.94 |
| | 157 | 5785 | 14.62 |
| | 165 | 5825 | 15.56 |
| 11N40 SISO | 151 | 5755 | 12.74 |
| | 159 | 5795 | 13.88 |
| 11AC20 SISO | 149 | 5745 | 14.01 |
| | 157 | 5785 | 14.91 |
| | 165 | 5825 | 14.81 |
| 11AC40 SISO | 151 | 5755 | 13.06 |
| | 159 | 5795 | 14.07 |
| 11AC80 SISO | 155 | 5775 | 12.74 |

## 7. Measurement Results

2.4GWIFI

| 11B (Peak) | | | |
|---|---|---|---|
| Channel | Channel 1 | Channel 6 | Channel 11 |
| Target (dBm) | 22.0 | 22.0 | 22.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| 11G (Peak) | | | |
| Channel | Channel 1 | Channel 6 | Channel 11 |
| Target (dBm) | 22.0 | 22.0 | 22.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| 11N20SISO (Peak) | | | |
| Channel | Channel 1 | Channel 6 | Channel 11 |
| Target (dBm) | 22.0 | 22.0 | 22.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| 11N40SISO (Peak) | | | |
| Channel | Channel 3 | Channel 6 | Channel 9 |
| Target (dBm) | 22.0 | 22.0 | 22.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |

5.2GWIFI

| 11A (Peak) | | | |
|---|---|---|---|
| Channel | Channel 36 | Channel 40 | Channel 48 |
| Target (dBm) | 19.0 | 19.0 | 20.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| 11N20 SISO (Peak) | | | |
| Channel | Channel 36 | Channel 40 | Channel 48 |
| Target (dBm) | 19.0 | 19.0 | 20.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| 11N40 SISO (Peak) | | | |
| Channel | Channel 38 | | Channel 46 |
| Target (dBm) | 19.0 | | 19.0 |
| Tolerance ±(dB) | 1.0 | | 1.0 |
| 11AC20 SISO (Peak) | | | |
| Channel | Channel 36 | Channel 40 | Channel 48 |
| Target (dBm) | 22.0 | 22.0 | 22.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| 11AC40 SISO (Peak) | | | |
| Channel | Channe38 | | Channel 46 |
| Target (dBm) | 21.0 | | 21.0 |
| Tolerance ±(dB) | 1.0 | | 1.0 |
| 11AC80 SISO (Peak) | | | |
| Channel | Channel 42 | | |
| Target (dBm) | 19.0 | | |
| Tolerance ±(dB) | 1.0 | | |

5.8GWIFI

| 11A (Peak) | | | |
|---|---|---|---|
| Channel | Channel 149 | Channel 157 | Channel 165 |
| Target (dBm) | 13.0 | 15.0 | 15.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| 11N20 SISO (Peak) | | | |
| Channel | Channel 149 | Channel 157 | Channel 165 |
| Target (dBm) | 14.0 | 14.0 | 15.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| 11N40 SISO (Peak) | | | |
| Channel | Channel 151 | | Channel 159 |
| Target (dBm) | 13.0 | | 13.0 |
| Tolerance ±(dB) | 1.0 | | 1.0 |
| 11AC20 SISO (Peak) | | | |
| Channel | Channel 149 | Channel 157 | Channel 165 |
| Target (dBm) | 15.0 | 15.0 | 15.0 |
| Tolerance ±(dB) | 1.0 | 1.0 | 1.0 |
| 11AC40 SISO (Peak) | | | |
| Channel | Channe151 | | Channel 159 |
| Target (dBm) | 14.0 | | 14.0 |
| Tolerance ±(dB) | 1.0 | | 1.0 |
| 11AC80 SISO (Peak) | | | |
| Channel | Channel 155 | | |
| Target (dBm) | 12.0 | | |
| Tolerance ±(dB) | 1.0 | | |

## 8. Evaluation Results

### 8.1 Standalone MPE Evaluation

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.

2.4GWIFI

| Band/Mode | f (GHz) | RF output power | | Antenna Gain (dBi) | Antenna Gain (linear) | MPE (mW/cm2) | MPE Limits (mW/cm2) |
|---|---|---|---|---|---|---|---|
| | | dBm | mW | | | | |
| IEEE 802.11b | 2.462 | 23.0 | 199.5262 | 2.0 | 1.5849 | 0.0629 | 1.0000 |
| IEEE 802.11g | 2.462 | 23.0 | 199.5262 | 2.0 | 1.5849 | 0.0629 | 1.0000 |
| IEEE 802.11n HT20 | 2.462 | 23.0 | 199.5262 | 2.0 | 1.5849 | 0.0629 | 1.0000 |
| IEEE 802.11n HT40 | 2.452 | 23.0 | 199.5262 | 2.0 | 1.5849 | 0.0629 | 1.0000 |

5.2GWIFI

| Band/Mode | f (GHz) | RF output power | | Antenna Gain (dBi) | Antenna Gain (linear) | MPE (mW/cm2) | MPE Limits (mW/cm2) |
|---|---|---|---|---|---|---|---|
| | | dBm | mW | | | | |
| 11A | 5.240 | 21.0 | 125.8925 | 2.0 | 1.5849 | 0.0397 | 1.0000 |
| 11N20 SISO | 5.240 | 21.0 | 125.8925 | 2.0 | 1.5849 | 0.0397 | 1.0000 |
| 11N40 SISO | 5.230 | 20.0 | 100.0000 | 2.0 | 1.5849 | 0.0315 | 1.0000 |
| 11AC20 SISO | 5.240 | 23.0 | 199.5262 | 2.0 | 1.5849 | 0.0629 | 1.0000 |
| 11AC40 SISO | 5.230 | 22.0 | 158.4893 | 2.0 | 1.5849 | 0.0500 | 1.0000 |
| 11AC80 SISO | 5.210 | 20.0 | 100.0000 | 2.0 | 1.5849 | 0.0315 | 1.0000 |

5.8GWIFI

| Band/Mode | f (GHz) | RF output power | | Antenna Gain (dBi) | Antenna Gain (linear) | MPE (mW/cm2) | MPE Limits (mW/cm2) |
|---|---|---|---|---|---|---|---|
| | | dBm | mW | | | | |
| 11A | 5.825 | 16.0 | 39.8107 | 2.0 | 1.5849 | 0.0126 | 1.0000 |
| 11N20 SISO | 5.825 | 16.0 | 39.8107 | 2.0 | 1.5849 | 0.0126 | 1.0000 |
| 11N40 SISO | 5.795 | 14.0 | 25.1189 | 2.0 | 1.5849 | 0.0079 | 1.0000 |
| 11AC20 SISO | 5.825 | 16.0 | 39.8107 | 2.0 | 1.5849 | 0.0126 | 1.0000 |
| 11AC40 SISO | 5.795 | 15.0 | 31.6228 | 2.0 | 1.5849 | 0.0100 | 1.0000 |
| 11AC80 SISO | 5.775 | 13.0 | 19.9526 | 2.0 | 1.5849 | 0.0063 | 1.0000 |

*Remark:*
*1. Output power including turn-up tolerance;*
*2. Output power is burst average power;*
*3. MPE evaluate distance is 20cm from user manual provide by manufacturer;*
*4. MPE values = $PG/4\pi R^2$*

## 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----------