# RF Exposure Evaluation Report

| | | |
|---|---|---|
| APPLICANT | : | Quanta Computer Inc. |
| EQUIPMENT | : | Clover Mini 3G |
| BRAND NAME | : | Clover |
| MODEL NAME | : | C301 |
| FCC ID | : | HFS-C301 |
| STANDARD | : | 47 CFR Part 2.1091 |

**We, SPORTON INTERNATIONAL INC., would like to declare that the device has been evaluated in accordance with 47 CFR Part 2.1091, and pass the limit. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.**

Reviewed by: Eric Huang / Deputy Manager

Approved by: Jones Tsai / Manager

Testing Laboratory
1190

***SPORTON INTERNATIONAL INC.***
***No.52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Taoyuan City, Taiwan (R.O.C.)***

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## Revision History

| REPORT NO. | VERSION | DESCRIPTION | ISSUED DATE |
|---|---|---|---|
| FA511632 | Rev. 01 | Initial issue of report | Apr. 15, 2015 |
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# 1. Administration Data

## 1.1. Testing Laboratory

| Testing Laboratory | |
|---|---|
| Test Site | SPORTON INTERNATIONAL INC. |
| Test Site Location | No.52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Taoyuan City, Taiwan (R.O.C.)<br>TEL: +886-3-327-3456<br>FAX: +886-3-328-4978 |

| Applicant | |
|---|---|
| Company Name | Quanta Computer Inc. |
| Address | No.188, Wenhua 2nd Rd., Guishan Dist., Taoyuan City 33377, Taiwan |

| Manufacturer | |
|---|---|
| Company Name | Quanta Computer Inc. |
| Address | No.188, Wenhua 2nd Rd., Guishan Dist., Taoyuan City 33377, Taiwan |

# 2. Description of Equipment Under Test (EUT)

| Product Feature & Specification | |
|---|---|
| EUT Type | Clover Mini 3G |
| Brand Name | Clover |
| Model Name | C301 |
| FCC ID | HFS-C301 |
| Integrated WWAN Module | Brand Name: HUAWEI<br>Model Name: MU736 |
| Integrated WLAN Module | Brand Name: AzureWave<br>Model Name: AW-AH691A |
| Wireless Technology and Frequency Range | GSM850: 824.2 MHz ~ 848.8 MHz<br>GSM1900: 1850.2 MHz ~ 1909.8 MHz<br>WCDMA Band V: 826.4 MHz ~ 846.6 MHz<br>WCDMA Band IV: 1712.4 MHz ~ 1752.6 MHz<br>WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz<br>WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz<br>WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz<br>WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz<br>WLAN 5.5GHz Band: 5500 MHz ~ 5700 MHz<br>WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz<br>Bluetooth: 2402 MHz ~ 2480 MHz<br>NFC: 13.56 MHz |
| Mode | • GPRS/EGPRS<br>• RMC 12.2Kbps<br>• HSDPA<br>• HSUPA<br>• 802.11a/b/g/n HT20/HT40<br>• Bluetooth v2.1+EDR，Bluetooth v4.0-LE<br>• NFC:ASK |
| EUT Stage | Identical Prototype |

## 3. Maximum RF average output power among production units

| Mode | Burst Average Power | |
|---|---|---|
| | GSM 850 | GSM 1900 |
| GPRS/EDGE (GMSK, 1 Tx slot) | 31.0 | 27.5 |
| GPRS/EDGE (GMSK, 2 Tx slots) | 31.0 | 25.0 |
| EDGE (8PSK, 1 Tx slot) | 25.0 | 23.5 |
| EDGE (8PSK, 2 Tx slots) | 25.0 | 23.5 |
| EDGE (8PSK, 3 Tx slots) | 25.0 | 23.5 |
| EDGE (8PSK, 4 Tx slots) | 25.0 | 23.5 |

| Mode | Average Power | | |
|---|---|---|---|
| | WCDMA Band V | WCDMA Band II | WCDMA Band IV |
| RMC 12.2Kbps | 22.0 | 22.0 | 22.0 |
| HSDPA Subtest-1 | 22.0 | 22.0 | 22.0 |
| HSUPA Subtest-5 | 22.0 | 22.0 | 22.0 |

| Mode / Band | Average Power (dBm) | | | |
|---|---|---|---|---|
| | v2.1+EDR | | | v4.0-LE |
| Bluetooth | 1Mbps | 2Mbps | 3Mbps | |
| | 9.0 | 9.0 | 9.0 | 8.0 |

| Band / Frequency (MHz) | | IEEE 802.11 Average Power (dBm) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Ant 0 | | | Ant 1 | | | Ant 0+1 |
| | | 11b | 11g | HT20 | 11b | 11g | HT20 | HT20 |
| 2.4GHz Band | 2412 | 16.0 | 14.5 | 13.5 | 16.0 | 14.0 | 13.5 | 15.0 |
| | 2437 | 16.0 | 14.5 | 13.5 | 16.0 | 15.0 | 13.5 | 18.0 |
| | 2462 | 16.0 | 14.5 | 13.5 | 16.0 | 14.0 | 13.5 | 13.0 |

| Band / Frequency (MHz) | | IEEE 802.11 Average Power (dBm) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Ant 0 | | | Ant 1 | | | Ant 0+1 | |
| | | 11a | HT20 | HT40 | 11a | HT20 | HT40 | HT20 | HT40 |
| 5.2GHz Band | 5180 | 15.0 | 13.5 | 13.0 | 15.0 | 13.0 | 14.0 | 16.0 | |
| | 5190 | | | | | | | | 15.0 |
| | 5200 | | | | | | | 19.0 | |
| | 5220 | | | | | | | 19.0 | |
| | 5230 | | | | | | | | 19.0 |
| | 5240 | | | | | | | 19.0 | |
| 5.3GHz Band | 5260 | 15.0 | 13.0 | 13.0 | 15.0 | 13.0 | | 19.0 | |
| | 5270 | | | | | | 14.0 | | 19.0 |
| | 5280 | | | | | | | 19.0 | |
| | 5300 | | | | | | | 19.0 | |
| | 5310 | | | | | | 13.0 | | 15.0 |
| | 5320 | | | | | | | 16.0 | |
| 5.5GHz Band | 5500 | 15.0 | 13.0 | | 16.0 | 14.0 | | 17.0 | |
| | 5510 | | | 13.0 | | | 14.0 | | 15.0 |
| | 5520 | | | | 16.0 | 14.0 | | 19.0 | |
| | 5540 | | | | 16.0 | 14.0 | | 19.0 | |
| | 5550 | | | 13.0 | | | 14.0 | | 19.0 |
| | 5560 | | | | 16.0 | 14.0 | | 19.0 | |
| | 5580 | | | | 16.0 | 14.0 | | 19.0 | |
| | 5600 | | | | 16.0 | 14.0 | | 19.0 | |
| | 5620 | | | | 16.0 | 14.0 | | 19.0 | |
| | 5630 | | | 13.0 | | | 14.0 | | 19.0 |
| | 5640 | | | | 16.0 | 14.0 | | 19.0 | |
| | 5660 | | | | 16.0 | 14.0 | | 19.0 | |
| | 5670 | | | 13.0 | | | 14.0 | | 15.0 |
| | 5680 | | | | 16.0 | 14.0 | | 19.0 | |
| | 5700 | | | | 13.0 | 13.0 | | 14.0 | |
| 5.8GHz Band | 5745 | | | | 11.0 | 11.0 | | 14.0 | |
| | 5755 | | | 11.0 | | | 10.0 | | 11.0 |
| | 5765 | | | | 16.0 | 14.0 | | 19.0 | |
| | 5785 | | | | 16.0 | 14.0 | | 19.0 | |
| | 5795 | | | 13.0 | | | 13.0 | | 15.0 |
| | 5805 | | | | 16.0 | 14.0 | | 19.0 | |
| | 5825 | | | | 13.0 | 14.0 | | 16.0 | |

# 4. RF Exposure Limit Introduction

According to ANSI/IEEE C95.1-1992, the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310.

| Frequency range (MHz) | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density ($mW/cm^2$) | Averaging time (minutes) |
|---|---|---|---|---|
| (A) Limits for Occupational/Controlled Exposures | | | | |
| 0.3-3.0 | 614 | 1.63 | *(100) | 6 |
| 3.0-30 | 1842/f | 4.89/f | *(900/f2) | 6 |
| 30-300 | 61.4 | 0.163 | 1.0 | 6 |
| 300-1500 | | | f/300 | 6 |
| 1500-100,000 | | | 5 | 6 |
| (B) Limits for General Population/Uncontrolled Exposure | | | | |
| 0.3-1.34 | 614 | 1.63 | *(100) | 30 |
| 1.34-30 | 824/f | 2.19/f | *(180/f2) | 30 |
| 30-300 | 27.5 | 0.073 | 0.2 | 30 |
| 300-1500 | | | f/1500 | 30 |
| 1500-100,000 | | | 1.0 | 30 |

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$S = \frac{PG}{4\pi R^2}$$

Where:
S = Power Density
P = Output Power at Antenna Terminals
G = Gain of Transmit Antenna (linear gain)
R = Distance from Transmitting Antenna

# 5. Radio Frequency Radiation Exposure Evaluation

## 5.1. Standalone Power Density Calculation

| Band | Frequency (MHz) | Antenna Gain (dBi) | Maximum Power (dBm) | Maximum EIRP (dBm) | Maximum EIRP (W) | Average EIRP (mW) | Power Density at 20cm (mW/cm^2) | Limit (mW/cm^2) | Power Density / Limit |
|---|---|---|---|---|---|---|---|---|---|
| GPRS 850 (1 Tx slot) | 824.2 | 0.04 | 31.0 | 31.040 | 1.271 | 159.956 | 0.032 | 0.549 | 0.058 |
| GPRS 850 (2 Tx slots) | 824.2 | 0.04 | 31.0 | 31.040 | 1.271 | 319.154 | 0.064 | 0.549 | **0.116** |
| EGPRS 850 (1 Tx slot) | 824.2 | 0.04 | 25.0 | 25.040 | 0.319 | 40.179 | 0.008 | 0.549 | 0.015 |
| EGPRS 850 (2 Tx slots) | 824.2 | 0.04 | 25.0 | 25.040 | 0.319 | 80.168 | 0.016 | 0.549 | 0.029 |
| EGPRS 850 (3 Tx slots) | 824.2 | 0.04 | 25.0 | 25.040 | 0.319 | 119.674 | 0.024 | 0.549 | 0.043 |
| EGPRS 850 (4 Tx slots) | 824.2 | 0.04 | 25.0 | 25.040 | 0.319 | 159.956 | 0.032 | 0.549 | 0.058 |
| GPRS 1900 (1 Tx slot) | 1850.2 | 1.02 | 27.5 | 28.520 | 0.711 | 89.536 | 0.018 | 1.000 | 0.018 |
| GPRS 1900 (2 Tx slots) | 1850.2 | 1.02 | 27.5 | 28.520 | 0.711 | 178.649 | 0.036 | 1.000 | 0.036 |
| EGPRS 1900 (1 Tx slot) | 1850.2 | 1.02 | 23.5 | 24.520 | 0.283 | 35.645 | 0.007 | 1.000 | 0.007 |
| EGPRS 1900 (2 Tx slots) | 1850.2 | 1.02 | 23.5 | 24.520 | 0.283 | 71.121 | 0.014 | 1.000 | 0.014 |
| EGPRS 1900 (3 Tx slots) | 1850.2 | 1.02 | 23.5 | 24.520 | 0.283 | 106.170 | 0.021 | 1.000 | 0.021 |
| EGPRS 1900 (4 Tx slots) | 1850.2 | 1.02 | 23.5 | 24.520 | 0.283 | 141.906 | 0.028 | 1.000 | 0.028 |
| WCDMA Band 5 | 826.4 | 0.04 | 22.0 | 22.040 | 0.160 | 159.956 | 0.032 | 0.551 | 0.058 |
| WCDMA Band 4 | 1712.4 | 1.08 | 22.0 | 23.080 | 0.203 | 203.236 | 0.040 | 1.000 | 0.040 |
| WCDMA Band 2 | 1852.4 | 1.02 | 22.0 | 23.020 | 0.200 | 200.447 | 0.040 | 1.000 | 0.040 |
| 2.4GHz WLAN | 2412.0 | 1.70 | 18.0 | 19.700 | 0.093 | 93.325 | 0.019 | 1.000 | 0.019 |
| 5GHz WLAN | 5180.0 | 5.80 | 19.0 | 24.800 | 0.302 | 301.995 | 0.060 | 1.000 | **0.060** |
| Bluetooth | 2402.0 | 1.70 | 9.0 | 10.700 | 0.012 | 11.749 | 0.002 | 1.000 | **0.002** |

**Note:** For conservativeness, the lowest uplink frequency of each band is used to determine the MPE limit of that band

## 5.2. Collocated Power Density Calculation

| WLAN Power Density / Limit | Bluetooth Power Density / Limit | WWAN Power Density / Limit | Σ(Power Density / Limit) of WWAN+WLAN+Bluetooth |
|---|---|---|---|
| 0.060 | 0.002 | 0.116 | 0.196 |

**Note:**

1. For colocation analysis, GSM850 is chosen for summation due to the highest (power density/limit) among all WWAN wireless modes.
2. Σ(Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for WWAN + WLAN + Bluetooth.
3. Considering the WWAN module collocation with the WLAN and Bluetooth transmitter of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1, and MPE of 3 collocated transmitters is compliant

## Conclusion:

According to 47 CFR §2.1091, the RF exposure analysis concludes that the RF Exposure is FCC compliant.