# FCC Certification Test Report

**Report No.:** FC150401E01

**Test Model:** QCNFA425

**Received Date:** Apr. 01, 2015

**Test Date:** Apr. 08 to 09, 2015

**Issued Date:** Aug. 07, 2015

**Applicant:** Qualcomm Atheros, Inc.

**Address:** 1700 Technology Drive, San Jose, CA 95110

**Issued By:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory

**Lab Address:** No. 81-1, Lu Liao Keng, 9th Ling,Wu Lung Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan R.O.C.

**Test Location (1):** No. 81-1, Lu Liao Keng, 9th Ling,Wu Lung Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan R.O.C.

**Test Location (2):** No. 49, Ln. 206, Wende Rd., Shangshan Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan R.O.C.

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The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any government agencies.

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## Release Control Record

| Issue No. | Description | Date Issued |
|---|---|---|
| FC150401E01 | Original release. | Aug. 07, 2015 |

## 1 Certificate of Conformity

**Product:** Single Stream 802.11a/b/g/n/ac + BT 4.1 M.2 1216 Type Card

**Brand:** Qualcomm Atheros

**Test Model:** QCNFA425

**Sample Status:** ENGINEERING SAMPLE

**Applicant:** Qualcomm Atheros, Inc.

**Test Date:** Apr. 08 to 09, 2015

**Standards:** 47 CFR FCC Part 15, Subpart B, Class B
ICES-003:2012 Issue 5, Class B
ANSI C63.4:2009

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

**Prepared by :** _____ , **Date:** Aug. 07, 2015
Lori Chung / Specialist

**Approved by :** _____ , **Date:** Aug. 07, 2015
Ken Lu / Manager

## 2 Summary of Test Results

47 CFR FCC Part 15, Subpart B / ICES-003:2012 Issue 5, Class B

ANSI C63.4:2009

| FCC Clause | ICES-003 Clause | Test Item | Result/Remarks | Verdict |
|---|---|---|---|---|
| 15.107 | 6.1 | AC Power Line Conducted Emissions | Minimum passing Class B margin is -16.74 dB at 0.16172 MHz | Pass |
| 15.109 | 6.2.1 | Radiated Emissions up to 1 GHz | Minimum passing Class B margin is -5.68 dB at 143.97 MHz | Pass |
| | 6.2.2 | Radiated Emissions above 1 GHz | Minimum passing Class B margin is -20.76 dB at 5278.30 MHz | Pass |

Note: There is no deviation to the applied test methods and requirements covered by the scope of this report.

### 2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT:

The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

| Measurement | Frequency | Expended Uncertainty (k=2) (±) |
|---|---|---|
| Conducted Emissions at mains ports | 150kHz ~ 30MHz | 2.86 dB |
| Radiated Emissions up to 1 GHz | 30MHz ~ 1GHz | 3.99 dB |
| Radiated Emissions above 1 GHz | 1GHz ~ 6GHz | 3.65 dB |
| | 6GHz ~ 18GHz | 3.50 dB |
| | 18GHz ~ 40GHz | 4.11 dB |

### 2.2 Modification Record

There were no modifications required for compliance.

## 3 General Information

### 3.1 Features of EUT

The tests reported herein were performed according to the method specified by Qualcomm Atheros, Inc., for detailed feature description, please refer to the manufacturer's specifications or user's manual.

### 3.2 General Description of EUT

| | |
|---|---|
| Product | Single Stream 802.11a/b/g/n/ac + BT 4.1 M.2 1216 Type Card |
| Brand | Qualcomm Atheros |
| Test Model | QCNFA425 |
| Sample Status | ENGINEERING SAMPLE |
| Operating Software | NA |
| Power Supply Rating | 3.3Vdc from host equipment |
| Accessory Device | NA |
| Data Cable Supplied | NA |

Note:

1. There are Bluetooth technology and WLAN technology used for the EUT.
2. The modular has two variant designs as following table:

| Variant No. | Difference | Description |
|---|---|---|
| SKU #1 | Dual antenna connector version | Support TX diversity for WLAN/BT transmit at J1 or J2 antenna connector. |
| SKU #2 | Single antenna connector version | WLAN/BT transmit at J2 antenna connector. |
| Note: From the above Variants, SKU #1 was selected as representative model for the test and its data was recorded in this report. | | |

3. The EUT incorporates a 1T1R function.

| 2.4GHz Band | | | |
|---|---|---|---|
| **MODULATION MODE** | **DATA RATE (MCS)** | **TX & RX CONFIGURATION** | |
| **802.11b** | 1 ~ 11Mbps | 1TX | 1RX |
| **802.11g** | 6 ~ 54Mbps | 1TX | 1RX |
| **802.11n (HT20)** | MCS 0~7 | 1TX | 1RX |
| **802.11n (HT40)** | MCS 0~7 | 1TX | 1RX |
| **VHT20** | MCS 0~8, Nss=1 | 1TX | 1RX |
| **VHT40** | MCS 0~9, Nss=1 | 1TX | 1RX |
| **5GHz Band** | | | |
| **MODULATION MODE** | **DATA RATE (MCS)** | **TX & RX CONFIGURATION** | |
| **802.11a** | 6 ~ 54Mbps | 1TX | 1RX |
| **802.11n (HT20)** | MCS 0~7 | 1TX | 1RX |
| **802.11n (HT40)** | MCS 0~7 | 1TX | 1RX |
| **802.11ac (VHT20)** | MCS 0~8, Nss=1 | 1TX | 1RX |
| **802.11ac (VHT40)** | MCS 0~9, Nss=1 | 1TX | 1RX |
| **802.11ac (VHT80)** | MCS 0~9, Nss=1 | 1TX | 1RX |

### 3.3 Description of Antenna

The antenna gain was declared by client; please refer to the following table:

| Ant. No. | Transmitter Circuit | Brand | Model | Ant. Type | 2.4GHz Gain with cable loss (dBi) | 5GHz Gain with cable loss (dBi) | 2.4GHz Cable Loss (dB) | 5GHz Cable Loss (dB) | Connector Type | Cable Length (mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Chain (0) | WNC | 81.EBJ15.005 | PIFA | 3.00 | 5.15~5.35GHz: 2.56 | 1.15 | 5.15~5.35GHz: 1.70 | IPEX | 300 |
| | | | | | | 5.47~5.725GHz: 4.76 | | 5.47~5.725GHz: 1.74 | | |
| | | | | | | 5.725~5.85GHz: 4.76 | | 5.725~5.85GHz: 1.79 | | |
| | Chain (1) | WNC | 81.EBJ15.005 | PIFA | 3.62 | 5.15~5.35GHz: 3.08 | 1.15 | 5.15~5.35GHz: 1.70 | IPEX | 300 |
| | | | | | | 5.47~5.725GHz: 3.31 | | 5.47~5.725GHz: 1.74 | | |
| | | | | | | 5.725~5.85GHz: 2.42 | | 5.725~5.85GHz: 1.79 | | |
| 2 | Chain (0) | WNC | 81.ED415.001 | PIFA | 0.22 | 5.15~5.35GHz: 5.56 | 0.96 | 5.15~5.35GHz: 1.29 | IPEX | 300 |
| | | | | | | 5.47~5.725GHz: 5.03 | | 5.47~5.725GHz: 1.36 | | |
| | | | | | | 5.725~5.85GHz: 3.14 | | 5.725~5.85GHz: 1.38 | | |
| | Chain (1) | WNC | 81.ED415.001 | PIFA | 1.48 | 5.15~5.35GHz: 5.17 | 0.96 | 5.15~5.35GHz: 1.29 | IPEX | 300 |
| | | | | | | 5.47~5.725GHz: 5.34 | | 5.47~5.725GHz: 1.36 | | |
| | | | | | | 5.725~5.85GHz: 2.94 | | 5.725~5.85GHz: 1.38 | | |

Note: 1. Above antenna gains of antenna are Total (H+V).

### 3.4 Operating Modes of EUT and Determination of Worst Case Operating Mode

For Radiated emission test, the EUT has been pre-tested under following test modes, and test mode 1 was the worst case for final test.

| Mode | Test Condition |
|---|---|
| | Radiated emission test |
| **1** | **WLAN (5GHz) + BT mode** |
| 2 | WLAN (2.4GHz) + BT mode |

Test modes are presented in the report as below.

| Mode | Test Condition |
|---|---|
| | Description |
| 1 | WLAN (5GHz) + BT mode |

### 3.5 Test Program Used and Operation Descriptions

1. Turn on the power of all equipment.
2. Support unit A (NOTEBOOK COMPUTER) runs test program “Ping.exe” to link with support unit F (WiFi AP) via EUT by Wireless.
3. Support unit A (NOTEBOOK COMPUTER) links to support unit G (NOTEBOOK COMPUTER) via EUT by BT.

### 3.6 Primary Clock Frequencies of Internal Source

The EUT is a WLAN and BT technology device, provided by Qualcomm Atheros, Inc., for detailed internal source, please refer to the manufacturer's specifications.

### 3.7 Miscellaneous

**Labelling Requirements for Part 15 Devices:**

- Verification

The specific labelling requirements for a device subject to the Verification procedure are contained in Section 15.19(a). These labelling requirements are:

If the device is subject only to Verification, include a label bearing a unique identifier (Section 2.954) and one of three compliance statements specified in Section 15.19(a). If the labeling area for the device is so small, and/or it is not practical to place the compliance statement on the device, then the statement can be placed in the user manual or product packaging (Section 15.19(a)(5)). However, the device must still be labelled with the unique identifier (Verification). Generally, devices smaller than the palm of the hand are considered too small for the compliance statement.

- Certification

If the device is subject to Certification: (1) Section 2.925 contains information on identification of the equipment; (2) include a label bearing an FCC Identifier (FCC ID) (Section 2.926) and (3) include the appropriate compliance statement in Section 15.19(a). If the device is considered too small and therefore it is impractical (smaller than the palm of the hand) to display the compliance statement, then the statement may be placed in the user manual or product packaging. However, the device must still be labelled with the FCC ID. If the device is unquestionably too small for the FCC ID to be readable (smaller than 4-6 points), the FCC ID may be placed in the user manual. However, it must be determined that the device itself is too small – the label area allocated to the FCC ID may not be reduced because of over crowded identification of other product and regulatory information.

An electronic display of the FCC ID (see 9. Electronic Labelling below) may be used for Certification of Section 15.212 modular transmitters and software defined radios (Section 2.944).

- Declaration of Conformity (DoC):

The labelling requirements for a device subject to the DoC procedure are specified in Section 15.19(b). The label should include the FCC logo along with the Trade Name and Model Number, which satisfies the unique identifier requirement of Section 2.1074 if it represents the identical equipment tested for DoC compliance. For personal computers assembled from authorized components, the following additional text must also be included: “Assembled from tested components,” “Complete system not tested.” When the device is so small and/or when it is not practical to place the required additional text on the device, the text may be placed in the user manual or pamphlet supplied to the user. However, the FCC logo, Trade Name, and Model Number must still be displayed on the device (Section 15.19(b)(3)).

Part 15 Declaration of Conformity (DoC) Label Examples

Equipment certified as software defined radio may use a means that readily displays the FCC ID on an electronic display screen, instead of labelling the device (Section 2.925 (e)).

Further information may refer to FCC KDB:784748 D01 Labelling Part 15 &18 Guidelines

**Labelling Requirements for ICES-003 Devices:**

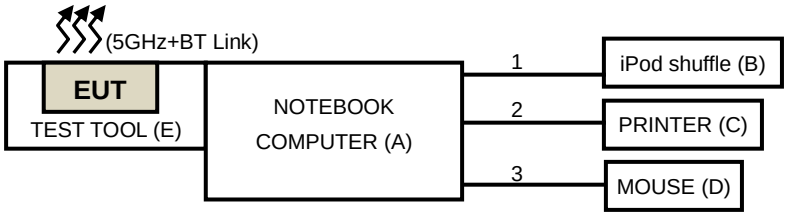
- Industry Canada ICES-003 Compliance Label:

*CAN ICES-3 (*)/NMB-3(*)*

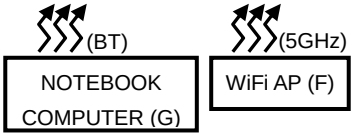
* Insert either “A” or “B” but not both to identify the applicable Class of ITE.

## 4 Configuration and Connections with EUT

### 4.1 Connection Diagram of EUT and Peripheral Devices




**Remote site**




### 4.2 Configuration of Peripheral Devices and Cable Connections

| No. | Product | Brand | Model No. | Serial No. | FCC ID | Remark |
|---|---|---|---|---|---|---|
| A | NOTEBOOK COMPUTER | DELL | E5420 | CHHYLQ1 | FCC DoC | Provided by Lab |
| B | iPod shuffle | Apple | MD778TA/A | CC4JMFL0F4T1 | NA | Provided by Lab |
| C | PRINTER | EPSON | LQ-300+II | G88Y074083 | FCC DoC | Provided by Lab |
| D | MOUSE | DELL | MOC5UO | I1401LVG | FCC DoC | Provided by Lab |
| E | TEST TOOL | Qualcomm Atheros | NA | NA | NA | Supplied by Client |
| F | WiFi AP | Linksys | WRT320N | NA | NA | Provided by Lab |
| G | NOTEBOOK COMPUTER | DELL | E5440 | HSLB32S | FCC DoC | Provided by Lab |

**NOTE:**

1. All power cords of the above support units are non-shielded (1.8 m).

| No. | Cable | Qty. | Length (m) | Shielded (Yes/ No) | Cores (Number) | Remark |
|---|---|---|---|---|---|---|
| 1 | USB | 1 | 0.1 | Yes | 0 | Provided by Lab |
| 2 | USB | 1 | 1.8 | Yes | 0 | Provided by Lab |
| 3 | USB | 1 | 1.8 | Yes | 0 | Provided by Lab |

## 5 Conducted Emissions at Mains Ports

### 5.1 Limits

| Frequency (MHz) | Class A (dBuV) | | Class B (dBuV) | |
|---|---|---|---|---|
| | Quasi-peak | Average | Quasi-peak | Average |
| 0.15 - 0.5 | 79 | 66 | 66 - 56 | 56 - 46 |
| 0.50 - 5.0 | 73 | 60 | 56 | 46 |
| 5.0 - 30.0 | 73 | 60 | 60 | 50 |

Notes: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases linearly with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

### 5.2 Test Instruments

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---|---|---|---|
| Test Receiver ROHDE & SCHWARZ | ESCS 30 | 847124/029 | Oct. 22, 2014 | Oct. 21, 2015 |
| Line-Impedance Stabilization Network (for EUT) SCHWARZBECK | NSLK-8127 | 8127-523 | Sep. 29, 2014 | Sep. 28, 2015 |
| RF Cable (JYEBAO) | 5D-FB | COACAB-002 | Mar. 05, 2015 | Mar. 04, 2016 |
| 50 ohms Terminator | 50 | 3 | Oct. 17, 2014 | Oct. 16, 2015 |
| 50 ohms Terminator | N/A | EMC-04 | Oct. 21, 2014 | Oct. 20, 2015 |
| Software ADT | BV ADT_Cond_V7.3.7.3 | NA | NA | NA |
| Line-Impedance Stabilization Network (for Peripheral) ROHDE & SCHWARZ | ENV216 | 100072 | June 10, 2014 | June 09, 2015 |

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Shielded Room No. A.
3 The VCCI Con A Registration No. is C-817.
4. Tested Date: Apr. 09, 2015

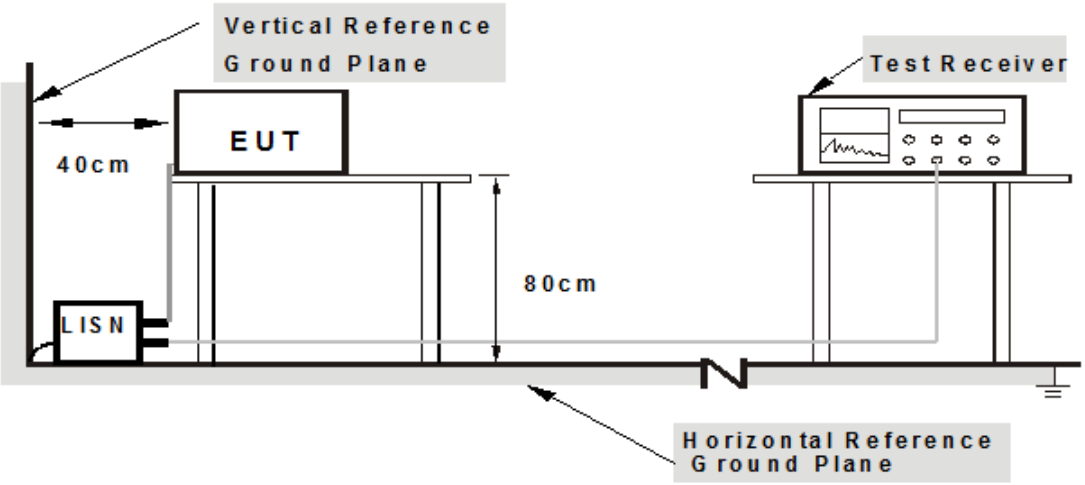
## 5.3 Test Arrangement

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

c. The test results of conducted emissions at mains ports are recorded of six worst margins for quasi-peak (mandatory) [and average (if necessary)] values against the limits at frequencies of interest unless the margin is 20 dB or greater.

Note: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.




Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the related Item – Photographs of the Test Configuration.

## 5.4 Supplementary Information

There is not any deviation from the test standards for the test method.

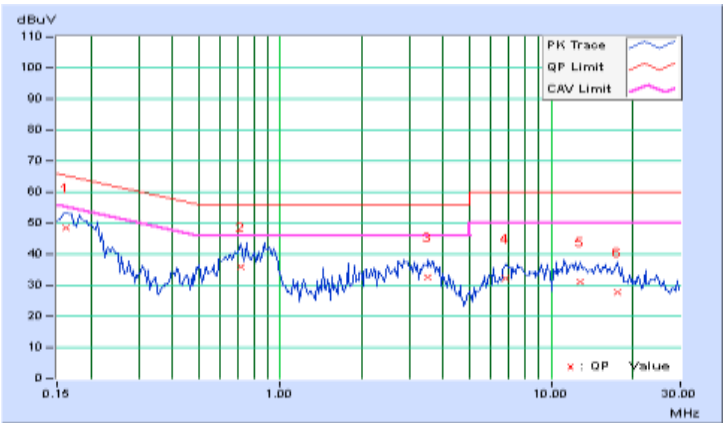
## 5.5 Test Results

| | | | |
|---|---|---|---|
| **Frequency Range** | 150kHz ~ 30MHz | **Detector Function & Resolution Bandwidth** | Quasi-Peak (QP) / Average (AV), 9kHz |
| **Input Power (System)** | 120Vac, 60Hz | **Environmental Conditions** | 25℃, 65%RH |
| **Tested by** | Barry Lee | | |

| **Phase Of Power : Line (L)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **No** | **Frequency (MHz)** | **Correction Factor (dB)** | **Reading Value (dBuV)** | | **Emission Level (dBuV)** | | **Limit (dBuV)** | | **Margin (dB)** | |
| | | | **Q.P.** | **AV.** | **Q.P.** | **AV.** | **Q.P.** | **AV.** | **Q.P.** | **AV.** |
| **1** | **0.16172** | **0.07** | **48.56** | **29.95** | **48.63** | **30.02** | **65.38** | **55.38** | **-16.74** | **-25.35** |
| 2 | 0.72031 | 0.10 | 35.96 | 21.22 | 36.06 | 21.32 | 56.00 | 46.00 | -19.94 | -24.68 |
| 3 | 3.52344 | 0.22 | 32.35 | 25.09 | 32.57 | 25.31 | 56.00 | 46.00 | -23.43 | -20.69 |
| 4 | 6.77344 | 0.33 | 31.81 | 24.47 | 32.14 | 24.80 | 60.00 | 50.00 | -27.86 | -25.20 |
| 5 | 12.73047 | 0.50 | 30.65 | 24.23 | 31.15 | 24.73 | 60.00 | 50.00 | -28.85 | -25.27 |
| 6 | 17.65234 | 0.61 | 27.25 | 20.62 | 27.86 | 21.23 | 60.00 | 50.00 | -32.14 | -28.77 |

**Remarks:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

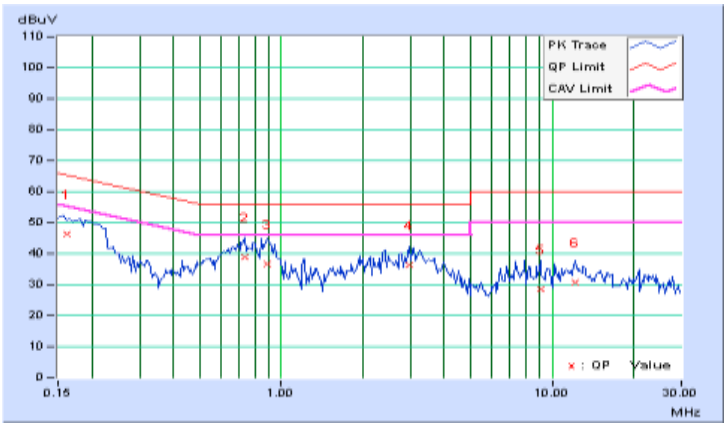


| | | | |
|---|---|---|---|
| **Frequency Range** | 150kHz ~ 30MHz | **Detector Function & Resolution Bandwidth** | Quasi-Peak (QP) / Average (AV), 9kHz |
| **Input Power (System)** | 120Vac, 60Hz | **Environmental Conditions** | 25℃, 65%RH |
| **Tested by** | Barry Lee | | |

| **Phase Of Power : Neutral (N)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **No** | **Frequency (MHz)** | **Correction Factor (dB)** | **Reading Value (dBuV)** | | **Emission Level (dBuV)** | | **Limit (dBuV)** | | **Margin (dB)** | |
| | | | **Q.P.** | **AV.** | **Q.P.** | **AV.** | **Q.P.** | **AV.** | **Q.P.** | **AV.** |
| 1 | 0.16172 | 0.07 | 46.15 | 26.88 | 46.22 | 26.95 | 65.38 | 55.38 | -19.16 | -28.43 |
| 2 | 0.73594 | 0.09 | 38.69 | 22.65 | 38.78 | 22.74 | 56.00 | 46.00 | -17.22 | -23.26 |
| 3 | 0.88438 | 0.09 | 36.40 | 22.96 | 36.49 | 23.05 | 56.00 | 46.00 | -19.51 | -22.95 |
| 4 | 2.96875 | 0.17 | 36.15 | 27.80 | 36.32 | 27.97 | 56.00 | 46.00 | -19.68 | -18.03 |
| 5 | 9.08203 | 0.37 | 28.28 | 21.86 | 28.65 | 22.23 | 60.00 | 50.00 | -31.35 | -27.77 |
| 6 | 12.10938 | 0.45 | 30.35 | 23.54 | 30.80 | 23.99 | 60.00 | 50.00 | -29.20 | -26.01 |

**Remarks:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



## 6 Radiated Emissions up to 1 GHz

### 6.1 Limits

Emissions radiated outside of the specified bands, shall be according to the general radiated limits as following:

| Radiated Emissions Limits at 10 meters (dBμV/m) | | | | |
|---|---|---|---|---|
| Frequencies (MHz) | FCC 15B / ICES-003, Class A | FCC 15B / ICES-003, Class B | CISPR 22, Class A | CISPR 22, Class B |
| 30-88 | 39 | 29.5 | 40 | 30 |
| 88-216 | 43.5 | 33.1 | | |
| 216-230 | 46.4 | 35.6 | | |
| 230-960 | | | 47 | 37 |
| 960-1000 | 49.5 | 43.5 | | |

| Radiated Emissions Limits at 3 meters (dBμV/m) | | | | |
|---|---|---|---|---|
| Frequencies (MHz) | FCC 15B / ICES-003, Class A | FCC 15B / ICES-003, Class B | CISPR 22, Class A | CISPR 22, Class B |
| 30-88 | 49.5 | 40 | 50.5 | 40.5 |
| 88-216 | 54 | 43.5 | | |
| 216-230 | 56.9 | 46 | | |
| 230-960 | | | 57.5 | 47.5 |
| 960-1000 | 60 | 54 | | |

Notes:
1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. QP detector shall be applied if not specified.

## 6.2 Test Instruments

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---|---|---|---|
| Test Receiver Agilent | N9038A | MY50010125 | Apr. 17, 2014 | Apr. 16, 2015 |
| | N9038A | MY50010132 | July 05, 2014 | July 04, 2015 |
| Pre-Amplifier Mini-Circuits | ZFL-1000VH2B | AMP-ZFL-01 | Nov. 12, 2014 | Nov. 11, 2015 |
| | ZFL-1000VH2B | AMP-ZFL-02 | Nov. 12, 2014 | Nov. 11, 2015 |
| Trilog Broadband Antenna SCHWARZBECK | VULB 9168 | 9168-359 | Feb. 05, 2015 | Feb. 04, 2016 |
| | VULB 9168 | 9168-358 | Feb. 04, 2015 | Feb. 03, 2016 |
| RF Cable | 8DFB | CHFCAB-001<br>CHFCAB-002<br>CHFCAB-003 | Oct. 03, 2014 | Oct. 02, 2015 |
| Pre-Amplifier Agilent | 8449B | 3008A01975 | Feb. 28, 2015 | Feb. 27, 2016 |
| Horn Antenna SCHWARZBECK | BBHA 9120D | 9120D-783 | Feb. 06, 2015 | Feb. 05, 2016 |
| RF Cable | NA | RF104-206<br>RF104-209<br>RF104-110 | Dec. 11, 2014 | Dec.10, 2015 |
| Spectrum Analyzer R&S | FSV40 | 100964 | July 05, 2014 | July 04, 2015 |
| Pre-Amplifier EMCI | EMC184045 | 980143 | Jan. 16, 2015 | Jan. 15, 2016 |
| Horn_Antenna SCHWARZBECK | BBHA 9170 | 9170-424 | Feb. 05, 2015 | Feb. 04, 2016 |
| RF Cable | NA | 36442/2<br>36434/2 | Jan. 17, 2015 | Jan. 16, 2016 |
| Software | ADT_Radiated_V8.7.07 | NA | NA | NA |
| Antenna Tower & Turn Table CT | NA | NA | NA | NA |

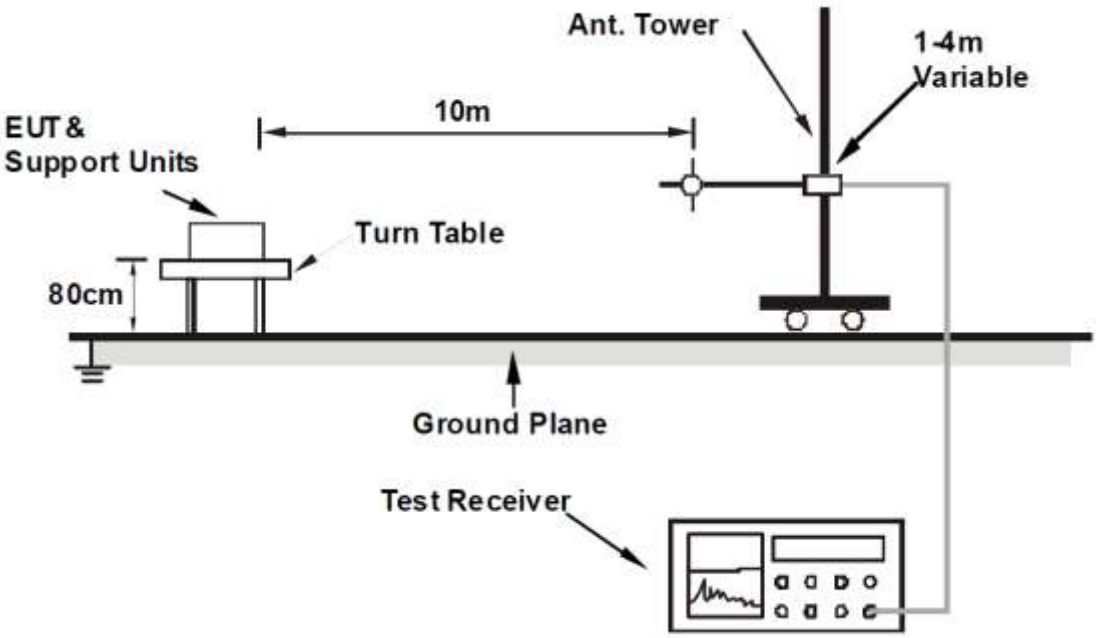
**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in 10m Chamber No. F.
3 The FCC Site Registration No. is 928149.
4. The VCCI Site Registration No. is R-3252 & G-136.
5 The CANADA Site Registration No. is IC 7450H-1.
6 Tested Date: Apr. 08, 2015

## 6.3 Test Arrangement

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at an accredited test facility. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

Note: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for quasi-peak detection (QP) at frequency below 1GHz.




For the actual test configuration, please refer to the related Item – Photographs of the Test Configuration.

## 6.4 Supplementary Information

There is not any deviation from the test standards for the test method.

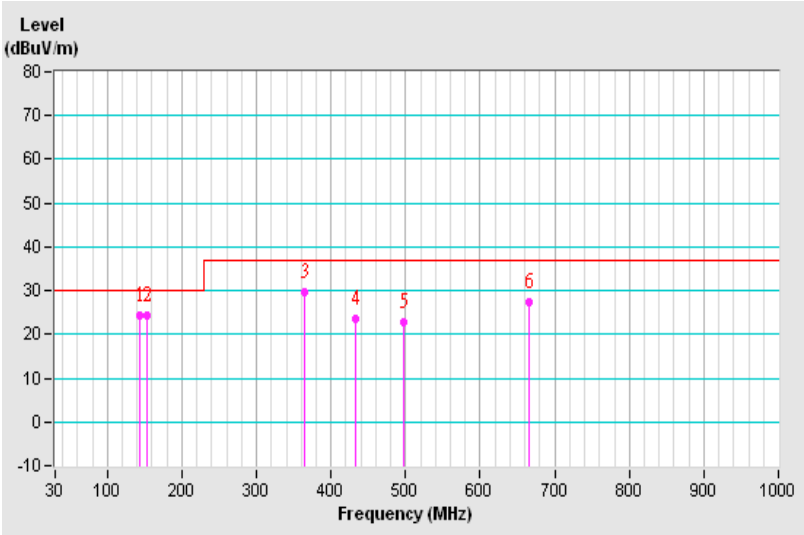
## 6.5 Test Results

| | | | |
|---|---|---|---|
| Frequency Range | 30MHz ~ 1GHz | Detector Function & Bandwidth | Quasi-Peak (QP), 120kHz |
| Input Power | 3.3Vdc from host equipment | Environmental Conditions | 19℃, 57%RH |
| Tested by | Jyunchun Lin | | |

| Antenna Polarity & Test Distance : Horizontal at 10 m | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| No | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| **1** | **143.97** | **24.32 QP** | **30.00** | **-5.68** | **4.00 H** | **208** | **36.69** | **-12.37** |
| 2 | 152.37 | 24.25 QP | 30.00 | -5.75 | 4.00 H | 53 | 36.32 | -12.07 |
| 3 | 365.18 | 29.56 QP | 37.00 | -7.44 | 2.00 H | 239 | 38.87 | -9.31 |
| 4 | 431.97 | 23.57 QP | 37.00 | -13.43 | 2.00 H | 192 | 30.75 | -7.18 |
| 5 | 497.88 | 22.69 QP | 37.00 | -14.31 | 2.00 H | 117 | 28.34 | -5.65 |
| 6 | 666.51 | 27.27 QP | 37.00 | -9.73 | 1.00 H | 261 | 29.09 | -1.82 |

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value

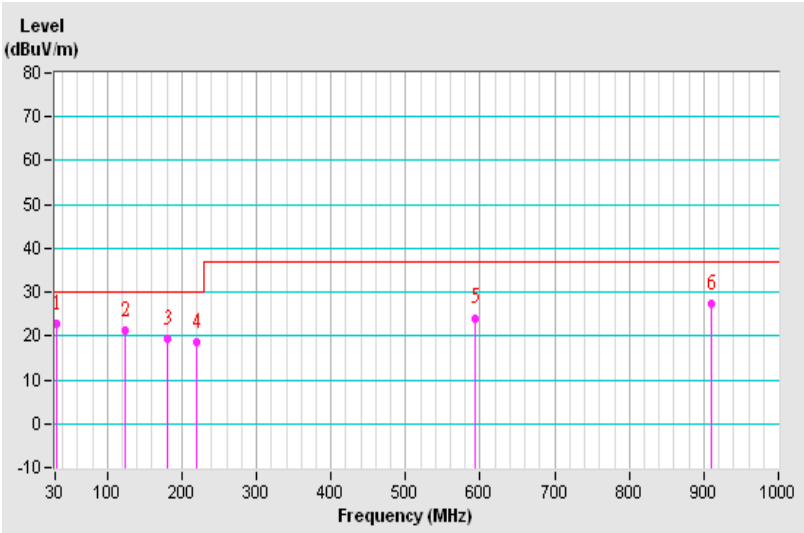


| | | | |
|---|---|---|---|
| Frequency Range | 30MHz ~ 1GHz | Detector Function & Bandwidth | Quasi-Peak (QP), 120kHz |
| Input Power | 3.3Vdc from host equipment | Environmental Conditions | 19℃, 57%RH |
| Tested by | Jyunchun Lin | | |

| Antenna Polarity & Test Distance : Vertical at 10 m | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| No | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1 | 31.55 | 22.89 QP | 30.00 | -7.11 | 1.00 V | 103 | 37.16 | -14.27 |
| 2 | 124.24 | 21.36 QP | 30.00 | -8.64 | 3.00 V | 242 | 35.27 | -13.91 |
| 3 | 181.22 | 19.44 QP | 30.00 | -10.56 | 2.00 V | 0 | 33.22 | -13.78 |
| 4 | 219.00 | 18.43 QP | 30.00 | -11.57 | 2.00 V | 205 | 33.79 | -15.36 |
| 5 | 594.01 | 24.11 QP | 37.00 | -12.89 | 1.00 V | 329 | 27.21 | -3.10 |
| 6 | 910.76 | 27.52 QP | 37.00 | -9.48 | 3.00 V | 351 | 24.66 | 2.86 |

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value



## 7 Radiated Emissions above 1 GHz

### 7.1 Limits

Emissions radiated outside of the specified bands, shall be according to the general radiated limits as following:

| Radiated Emissions Limits at 10 meters (dBμV/m) | | | | |
|---|---|---|---|---|
| Frequencies (MHz) | FCC 15B / ICES-003, Class A | FCC 15B / ICES-003, Class B | CISPR 22, Class A | CISPR 22, Class B |
| 1000-3000 | Avg: 49.5<br>Peak: 69.5 | Avg: 43.5<br>Peak: 63.5 | Not defined | Not defined |
| Above 3000 | | | Not defined | Not defined |

| Radiated Emissions Limits at 3 meters (dBμV/m) | | | | |
|---|---|---|---|---|
| Frequencies (MHz) | FCC 15B / ICES-003, Class A | FCC 15B / ICES-003, Class B | CISPR 22, Class A | CISPR 22, Class B |
| 1000-3000 | Avg: 60<br>Peak: 80 | Avg: 54<br>Peak: 74 | Avg: 56<br>Peak: 76 | Avg: 50<br>Peak: 70 |
| Above 3000 | | | Avg: 60<br>Peak: 80 | Avg: 54<br>Peak: 74 |

Notes:
1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

Frequency Range (For unintentional radiators)

| Highest frequency generated or used in the device or on which the device operates or tunes (MHz) | Upper frequency of measurement range (MHz) |
|---|---|
| Below 1.705 | 30 |
| 1.705-108 | 1000 |
| 108-500 | 2000 |
| 500-1000 | 5000 |
| Above 1000 | 5th harmonic of the highest frequency or 40GHz, whichever is lower |

## 7.2 Test Instruments

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---|---|---|---|
| Test Receiver Agilent | N9038A | MY50010125 | Apr. 17, 2014 | Apr. 16, 2015 |
| | N9038A | MY50010132 | July 05, 2014 | July 04, 2015 |
| Pre-Amplifier Mini-Circuits | ZFL-1000VH2B | AMP-ZFL-01 | Nov. 12, 2014 | Nov. 11, 2015 |
| | ZFL-1000VH2B | AMP-ZFL-02 | Nov. 12, 2014 | Nov. 11, 2015 |
| Trilog Broadband Antenna SCHWARZBECK | VULB 9168 | 9168-359 | Feb. 05, 2015 | Feb. 04, 2016 |
| | VULB 9168 | 9168-358 | Feb. 04, 2015 | Feb. 03, 2016 |
| RF Cable | 8DFB | CHFCAB-001<br>CHFCAB-002<br>CHFCAB-003 | Oct. 03, 2014 | Oct. 02, 2015 |
| Pre-Amplifier Agilent | 8449B | 3008A01975 | Feb. 28, 2015 | Feb. 27, 2016 |
| Horn Antenna SCHWARZBECK | BBHA 9120D | 9120D-783 | Feb. 06, 2015 | Feb. 05, 2016 |
| RF Cable | NA | RF104-206<br>RF104-209<br>RF104-110 | Dec. 11, 2014 | Dec.10, 2015 |
| Spectrum Analyzer R&S | FSV40 | 100964 | July 05, 2014 | July 04, 2015 |
| Pre-Amplifier EMCI | EMC184045 | 980143 | Jan. 16, 2015 | Jan. 15, 2016 |
| Horn_Antenna SCHWARZBECK | BBHA 9170 | 9170-424 | Feb. 05, 2015 | Feb. 04, 2016 |
| RF Cable | NA | 36442/2<br>36434/2 | Jan. 17, 2015 | Jan. 16, 2016 |
| Software | ADT_Radiated_V8.7.07 | NA | NA | NA |
| Antenna Tower & Turn Table CT | NA | NA | NA | NA |

**Note:**

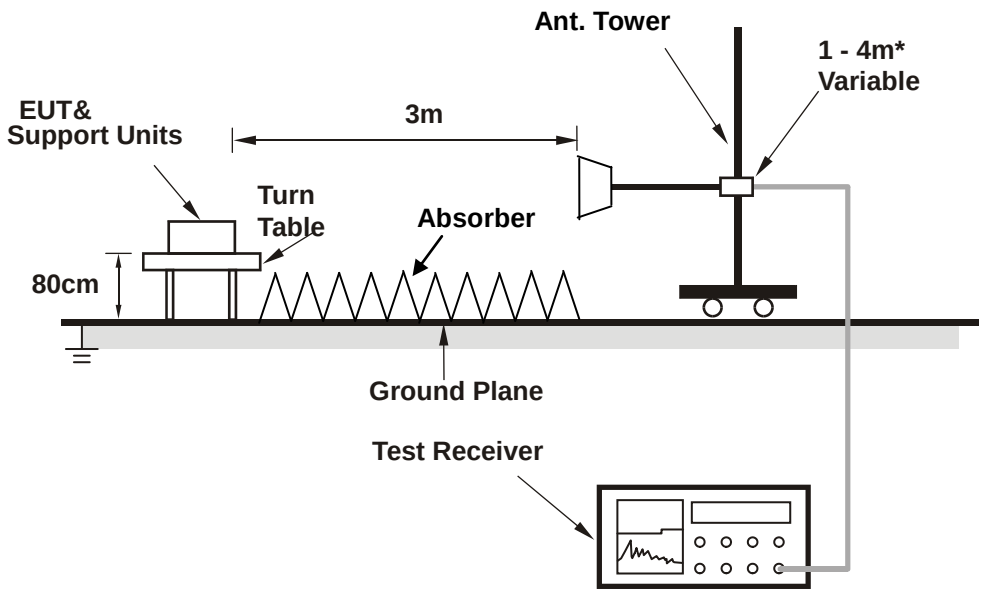
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in 10m Chamber No. F.
3 The FCC Site Registration No. is 928149.
4. The VCCI Site Registration No. is R-3252 & G-136.
5 The CANADA Site Registration No. is IC 7450H-1.
6 Tested Date: Apr. 08, 2015

### 7.3 Test Arrangement

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at an accredited chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The height of antenna can be varied from one meter to four meters, the height of adjustment depends on the EUT height and the antenna 3dB beamwidth both, to detect the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The spectrum analyzer system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.

Note: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection (PK) at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz for Average detection (AV) at frequency above 1GHz.

**<Frequency Range above 1GHz>**




* : depends on the EUT height and the antenna 3dB beamwidth both.
For the actual test configuration, please refer to the related Item – Photographs of the Test Configuration.

### 7.4 Supplementary Information

There is not any deviation from the test standards for the test method.

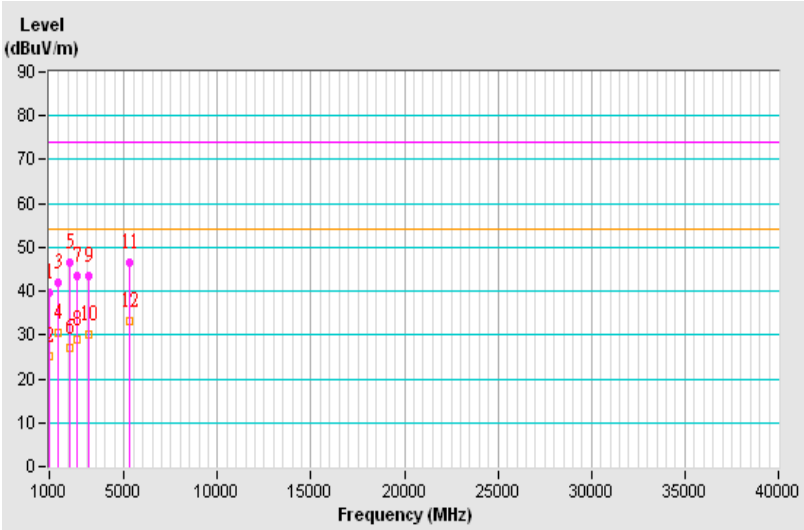
## 7.5 Test Results

| | | | |
|---|---|---|---|
| Frequency Range | 1GHz ~ 29.5GHz | Detector Function & Resolution Bandwidth | Peak (PK) / Average (AV), 1MHz |
| Input Power | 3.3Vdc from host equipment | Environmental Conditions | 19℃, 60%RH |
| Tested by | Jyunchun Lin | | |

| Antenna Polarity & Test Distance : Horizontal at 3 m | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| No | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1 | 1035.10 | 39.52 PK | 74.00 | -34.48 | 1.00 H | 245 | 44.98 | -5.46 |
| 2 | 1035.10 | 25.09 AV | 54.00 | -28.91 | 1.00 H | 245 | 30.55 | -5.46 |
| 3 | 1496.60 | 41.98 PK | 74.00 | -32.02 | 1.00 H | 127 | 43.36 | -1.38 |
| 4 | 1496.60 | 30.53 AV | 54.00 | -23.47 | 1.00 H | 127 | 31.91 | -1.38 |
| 5 | 2115.40 | 46.61 PK | 74.00 | -27.39 | 1.00 H | 360 | 45.61 | 1.00 |
| 6 | 2115.40 | 26.92 AV | 54.00 | -27.08 | 1.00 H | 360 | 25.92 | 1.00 |
| 7 | 2496.30 | 43.38 PK | 74.00 | -30.62 | 1.00 H | 106 | 40.35 | 3.03 |
| 8 | 2496.30 | 29.12 AV | 54.00 | -24.88 | 1.00 H | 106 | 26.09 | 3.03 |
| 9 | 3128.10 | 43.56 PK | 74.00 | -30.44 | 1.00 H | 239 | 38.29 | 5.27 |
| 10 | 3128.10 | 30.03 AV | 54.00 | -23.97 | 1.00 H | 239 | 24.76 | 5.27 |
| 11 | 5278.30 | 46.53 PK | 74.00 | -27.47 | 1.00 H | 12 | 34.97 | 11.56 |
| **12** | **5278.30** | **33.24 AV** | **54.00** | **-20.76** | **1.00 H** | **12** | **21.68** | **11.56** |

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value

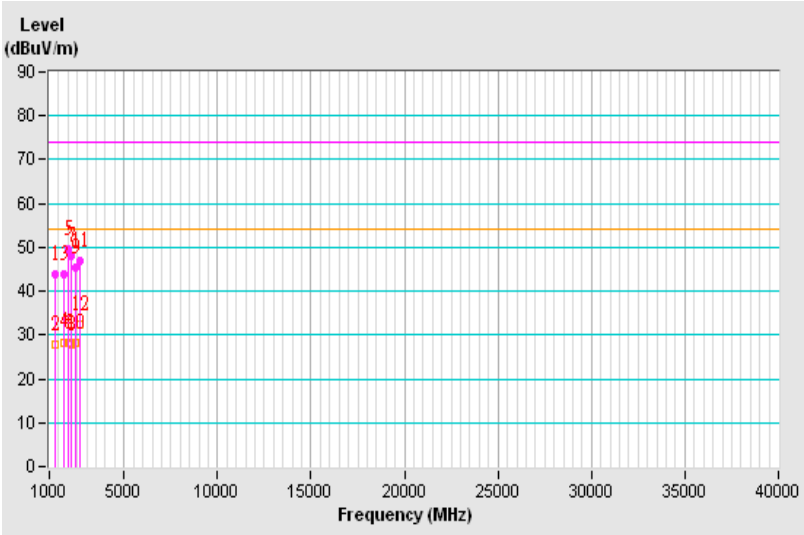


| | | | |
|---|---|---|---|
| Frequency Range | 1GHz ~ 29.5GHz | Detector Function & Resolution Bandwidth | Peak (PK) / Average (AV), 1MHz |
| Input Power | 3.3Vdc from host equipment | Environmental Conditions | 19℃, 60%RH |
| Tested by | Jyunchun Lin | | |

| Antenna Polarity & Test Distance : Vertical at 3 m | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| No | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1 | 1327.25 | 43.94 PK | 74.00 | -30.06 | 1.00 V | 185 | 46.56 | -2.62 |
| 2 | 1327.25 | 27.90 AV | 54.00 | -26.10 | 1.00 V | 185 | 30.52 | -2.62 |
| 3 | 1756.50 | 43.86 PK | 74.00 | -30.14 | 1.00 V | 193 | 44.09 | -0.23 |
| 4 | 1756.50 | 28.37 AV | 54.00 | -25.63 | 1.00 V | 193 | 28.60 | -0.23 |
| 5 | 2007.25 | 49.57 PK | 74.00 | -24.43 | 1.00 V | 129 | 49.57 | 0.00 |
| 6 | 2007.25 | 28.35 AV | 54.00 | -25.65 | 1.00 V | 129 | 28.35 | 0.00 |
| 7 | 2143.25 | 47.96 PK | 74.00 | -26.04 | 1.00 V | 193 | 46.89 | 1.07 |
| 8 | 2143.25 | 27.98 AV | 54.00 | -26.02 | 1.00 V | 193 | 26.91 | 1.07 |
| 9 | 2375.30 | 45.27 PK | 74.00 | -28.73 | 1.00 V | 191 | 42.91 | 2.36 |
| 10 | 2375.30 | 28.29 AV | 54.00 | -25.71 | 1.00 V | 191 | 25.93 | 2.36 |
| 11 | 2666.00 | 46.97 PK | 74.00 | -27.03 | 1.00 V | 346 | 43.16 | 3.81 |
| 12 | 2666.00 | 32.53 AV | 54.00 | -21.47 | 1.00 V | 346 | 28.72 | 3.81 |

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value



## Appendix – Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:


**Linko EMC/RF Lab**
Tel: 886-2-26052180
Fax: 886-2-26051924

**Hsin Chu EMC/RF/Telecom Lab**
Tel: 886-3-5935343
Fax: 886-3-5935342

**Hwa Ya EMC/RF/Safety Lab**
Tel: 886-3-3183232
Fax: 886-3-3270892

**Email:** service.adt@tw.bureauveritas.com
**Web Site:** www.bureauveritas-adt.com


The address and road map of all our labs can be found in our web site also.

**--- END ---**