

# **FCC TEST REPORT**

**REPORT NO. : FC3D2546**  
**MODEL NO. : BCM943162ZP**  
**RECEIVED DATE : Dec. 25, 2013**  
**FINAL TESTED DATE : Jan. 08, 2014**  
**ISSUED DATE : Jan. 31, 2014**

**TEST STANDARD : 47 CFR FCC Rules and Regulations Part 15  
Subpart B, Class B Digital Device**

**Filing Type : Certification**

**FCC ID : QDS-BRCM1075**

**APPLICANT : Broadcom Corporation**  
**ADDRESS : 190 Mathilda Place Sunnyvale CA 94086 U.S.A.**

**Manufacturer : Broadcom Corporation**  
**ADDRESS : 190 Mathilda Place Sunnyvale CA 94086 U.S.A.**

**ISSUED BY : SPORTON International Inc.**  
**LAB ADDRESS : No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park,  
Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.**

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- This test report is only applicable to U.S.A..



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## History of This Test Report

| REPORT NO. | VERSION | ISSUED DATE   | Description             |
|------------|---------|---------------|-------------------------|
| FC3D2546   | Rev. 01 | Jan. 31, 2014 | Initial issue of report |
|            |         |               |                         |
|            |         |               |                         |
|            |         |               |                         |
|            |         |               |                         |
|            |         |               |                         |
|            |         |               |                         |
|            |         |               |                         |
|            |         |               |                         |
|            |         |               |                         |

## CERTIFICATE OF COMPLIANCE

**EQUIPMENT NAME : Broadcom 802.11a/b/g/n/ac WLAN + Bluetooth 4.0  
NGFF2230 Mini Card**

**BRAND NAME : Broadcom**

**MODEL NO. : BCM943162ZP**

**APPLICANT : Broadcom Corporation**

**ADDRESS : 190 Mathilda Place Sunnyvale CA 94086 U.S.A.**

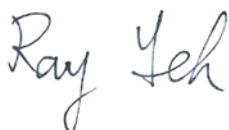
**FINAL TESTED DATE : Jan. 08, 2014**

**TEST STANDARD : 47 CFR FCC Rules and Regulations Part 15  
Subpart B, Class B Digital Device**

### I **HEREBY** CERTIFY THAT:

The measurements shown in this test report were made in accordance with the procedures given in **ANSI C63.4 – 2009**.

The above equipment has been tested by **SPORTON International Inc.** LAB., 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 EMI characteristics under the conditions specified in this report.



**Ray Yeh**

**SPORTON INTERNATIONAL INC.**

## 1. Summary of Test Results

After estimating all the combination of every test mode, the result shown as below is the worst case.

The EUT has been tested according to the following specifications.

| EMISSION   |   |        |  |
|--|---|--------|--|
| Test Standard  | Test Type   | Result | Remarks  |
| 47 CFR FCC Rules and Regulations Part 15 Subpart B, Class B Digital Device | AC Power Port Conducted emission test 150 kHz – 30 MHz  | PASS   | Meet minimum passing margin is -14.30dB at 0.15403MHz. |
|  | Radiated emission test<br>30 MHz – 1,000 MHz @ 3 m<br>1,000 MHz – 18,000 MHz @ 3 m<br>18,000 MHz – 30,000 MHz @ 1 m | PASS   | Meet minimum passing margin is -3.47dB at 198.78MHz.   |

## 2. General Description of Equipment under Test

| Product Detail |   |
|----------------|---|
| Equipment Name | Broadcom 802.11a/b/g/n/ac WLAN + Bluetooth 4.0 NGFF2230 Mini Card |
| Model No.      | BCM943162ZP   |
| Brand Name     | Broadcom  |
| Power Supply   | From host system  |
| Accessories    | N/A   |

### 2.1. Feature of Equipment under Test

For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

### 2.2. Modification of EUT

Please refer to the Photographs of EUT.

### 3. Test Configuration of Equipment under Test

#### 3.1. Test Mode

Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

| Conducted Emissions  |   |
|--|---|
| Test Mode  | Normal Link                               |
| 1  | 2.4GHz WLAN function + Bluetooth function |
| 2  | 5GHz WLAN function + Bluetooth function   |
| Mode 1 generated the worst test result, so it was recorded in this report. |   |

| Radiated Emissions   |   |
|--|---|
| Test Mode  | Normal Link                               |
| 1  | 2.4GHz WLAN function + Bluetooth function |
| 2  | 5GHz WLAN function + Bluetooth function   |
| For Radiated Emission test below 1GHz:<br>Mode 1 generated the worst test result, so it was recorded in this report.<br>For Radiated Emission test above 1GHz:<br>Mode 1 generated the worst test result for Radiated emission below 1GHz test, thus the measurement for Radiated emission above 1GHz test will follow this same test configuration. |   |

### 3.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| Support Unit   | Brand      | Model         | FCC ID       |
|--|------------|---------------|--------------|
| Wireless AP  | Planex     | GW-AP54SGX    | N/A          |
| NB   | DELL       | E6430         | DoC          |
| NB   | DELL       | E6220         | DoC          |
| Mouse  | Logitech   | M-U0026       | DoC          |
| Earphone   | SHYARO CHI | MIC-04        | N/A          |
| Broadcom 802.11a/b/g/n/ac WLAN +<br>Bluetooth 4.0 NGFF2230 Mini Card<br>(Device) | Broadcom   | BCM943162ZP   | QDS-BRCM1075 |
| Test fixture   | Broadcom   | BCM9NGFF2EC_1 | N/A          |

### 3.3. EUT Operation Condition

An executive program, EMCTEST.EXE under WIN 7, which generates a complete line of continuously repeating " H " pattern was used as the test software.

The program was executed as follows :

- Turn on the power of all equipment.
- The NB sends " H " messages to the panel, and the panel displays " H " patterns on the screen.
- Repeat the step b.

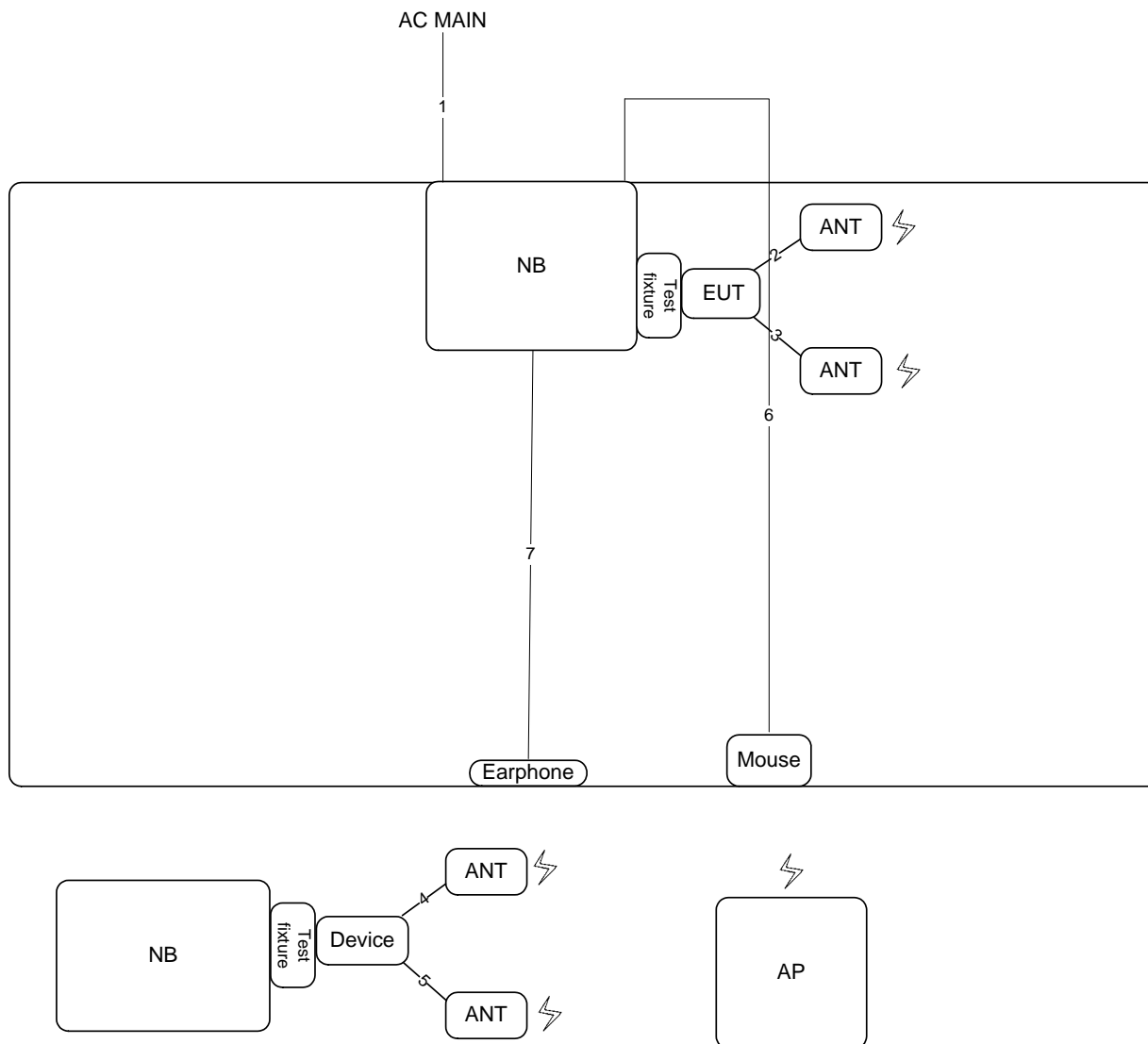
At the same time, the following programs under WIN 7 were executed:

The remote notebook executed "ping.exe" to link with the EUT to maintain the connection by WLAN.

The remote notebook executed "Bluetool" to link with the EUT to receive and transmit signal by Bluetooth.



## 3.4. Connection Diagram of Test System



| Item | Connection  | Shield | Length |
|------|-------------|--------|--------|
| 1    | Power cable | No     | 2.6m   |
| 2    | ANT cable   | Yes    | 0.2m   |
| 3    | ANT cable   | Yes    | 0.2m   |
| 4    | ANT cable   | Yes    | 0.2m   |
| 5    | ANT cable   | Yes    | 0.2m   |
| 6    | USB cable   | Yes    | 1.8m   |
| 7    | Audio cable | No     | 1.1m   |

## 4. General Information of Test

### 4.1. Test Facility

Test Site Location : No.8, Lane 724, Bo-ai St., Jhubei City,  
Hsinchu County 302, Taiwan, R.O.C.  
TEL : 886-3-656-9065  
FAX : 886-3-656-9085  
Test Site No. : Conduction: CO01-CB  
Radiation: 03CH01-CB

### 4.2. Test Voltage

| Power Type      | Test Voltage  |
|-----------------|---------------|
| AC Power Supply | 120 V / 60 Hz |

### 4.3. Standard for Methods of Measurement

ANSI C63.4-2009

### 4.4. Frequency Range Investigated

| Test Items              | Frequency Range      |
|-------------------------|----------------------|
| Conducted emission test | 150 kHz to 30 MHz    |
| Radiated emission test  | 30 MHz to 30,000 MHz |

### 4.5. Test Distance

| Test Items  | Test Distance |
|---|---------------|
| Radiated emission test below 1 GHz (30 MHz to 1,000 MHz)      | 3 m           |
| Radiated emission test above 1 GHz (1,000 MHz to 18,000 MHz)  | 3 m           |
| Radiated emission test above 1 GHz (18,000 MHz to 30,000 MHz) | 1 m           |

## 5. Test of Conducted Emission

### 5.1. Limit

| Frequency (MHz) | QP Limit (dBuV) | AV Limit (dBuV) |
|-----------------|-----------------|-----------------|
| 0.15~0.5        | 66~56           | 56~46           |
| 0.5~5           | 56              | 46              |
| 5~30            | 60              | 50              |

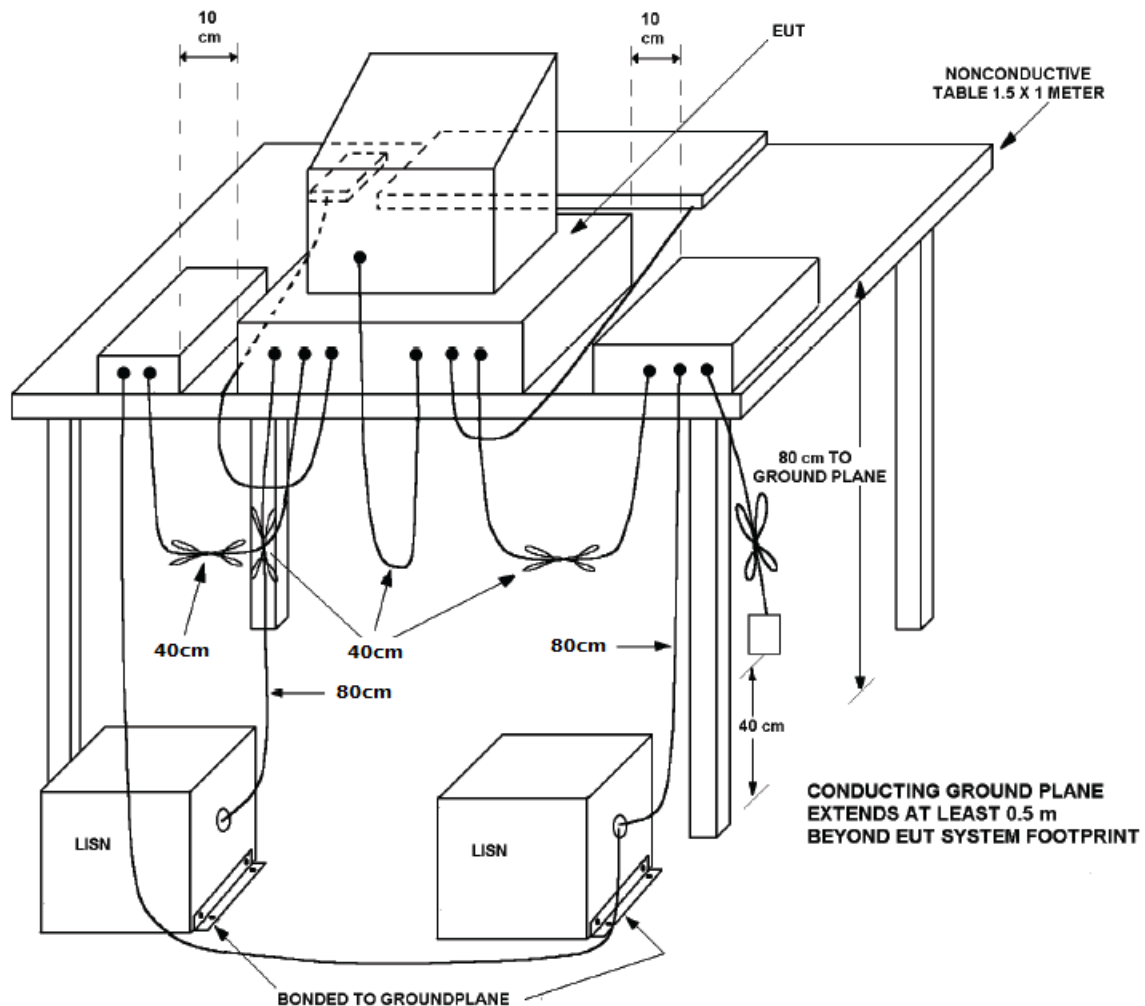
### 5.2. Description of Major Test Instruments

| Test Receiver   | R&S ESCS 30 |
|-----------------|-------------|
| Start Frequency | 0.15 MHz    |
| Stop Frequency  | 30 MHz      |
| IF Bandwidth    | 9 kHz       |

### 5.3. Test Procedures

- The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- Connect EUT to the power mains through a line impedance stabilization network (LISN).
- All the support units are connect to the other LISN.
- The LISN provides 50  $\Omega$  coupling impedance for the measuring instrument.
- The FCC states that a 50  $\Omega$ , 50  $\mu$ H LISN should be used.
- Both sides of AC line were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched.
- Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

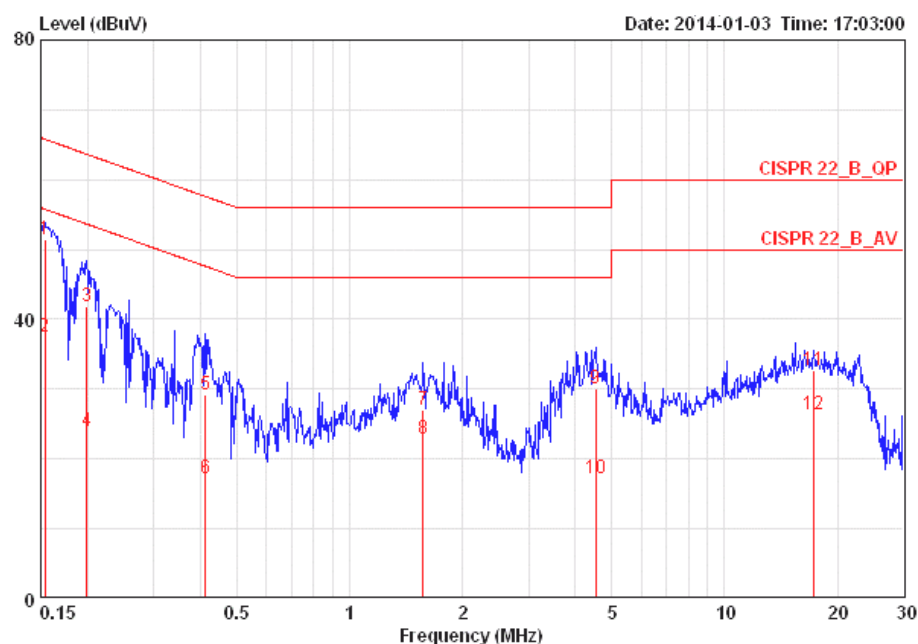
#### 5.4. Typical Test Setup Layout of Conducted Emission



## 5.5. Test Result of AC Power Ports

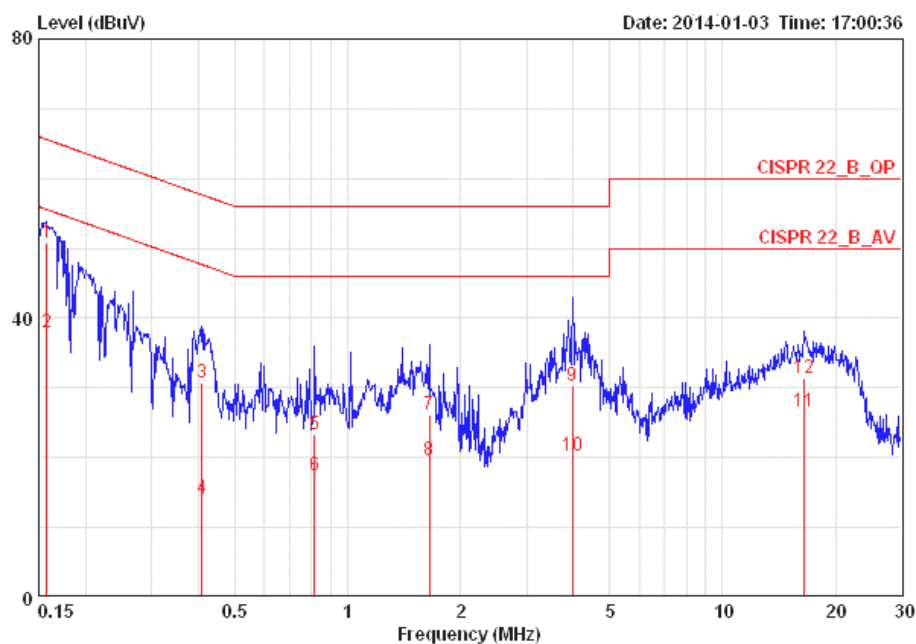
|  |             |                 |                    |
|--|-------------|-----------------|--------------------|
| Temperature  | 25°C        | Humidity        | 52%                |
| Test Engineer  | Justin Chiu | Frequency Range | 0.15 MHz to 30 MHz |
| Test Mode  | Mode 1      |                 |                    |
| <ul style="list-style-type: none"><li>▪ Corrected Reading (dBuV) = LISN Factor + Cable Loss + Read Level = Level</li><li>▪ All emissions not reported here are more than 10 dB below the prescribed limit.</li><li>▪ The test was passed at the minimum margin that marked by a frame in the following table</li></ul> |             |                 |                    |

## Line



|    | Freq    | Level | Over   | Limit | Read  | LISN | Cable |         |           |
|----|---------|-------|--------|-------|-------|------|-------|---------|-----------|
|    | MHz     | dBuV  | dB     | dBuV  | dBuV  | dB   | dB    | Remark  | Pol/Phase |
| 1  | 0.15403 | 51.48 | -14.30 | 65.78 | 51.17 | 0.15 | 0.16  | QP      | LINE      |
| 2  | 0.15403 | 37.53 | -18.25 | 55.78 | 37.22 | 0.15 | 0.16  | AVERAGE | LINE      |
| 3  | 0.19863 | 41.83 | -21.83 | 63.67 | 41.52 | 0.15 | 0.16  | QP      | LINE      |
| 4  | 0.19863 | 24.04 | -29.62 | 53.67 | 23.73 | 0.15 | 0.16  | AVERAGE | LINE      |
| 5  | 0.41266 | 29.25 | -28.34 | 57.59 | 28.92 | 0.15 | 0.18  | QP      | LINE      |
| 6  | 0.41266 | 17.23 | -30.36 | 47.59 | 16.90 | 0.15 | 0.18  | AVERAGE | LINE      |
| 7  | 1.568   | 27.12 | -28.88 | 56.00 | 26.71 | 0.18 | 0.23  | QP      | LINE      |
| 8  | 1.568   | 22.83 | -23.17 | 46.00 | 22.42 | 0.18 | 0.23  | AVERAGE | LINE      |
| 9  | 4.525   | 30.12 | -25.88 | 56.00 | 29.52 | 0.29 | 0.31  | QP      | LINE      |
| 10 | 4.525   | 17.19 | -28.81 | 46.00 | 16.59 | 0.29 | 0.31  | AVERAGE | LINE      |
| 11 | 17.291  | 32.62 | -27.38 | 60.00 | 31.60 | 0.54 | 0.48  | QP      | LINE      |
| 12 | 17.291  | 26.45 | -23.55 | 50.00 | 25.43 | 0.54 | 0.48  | AVERAGE | LINE      |

## Neutral



|    | Freq    | Level | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Remark  | Pol/Phase |
|----|---------|-------|------------|------------|------------|-------------|------------|---------|-----------|
|    | MHz     | dBuV  | dB         | dBuV       | dBuV       | dB          | dB         |         |           |
| 1  | 0.15733 | 50.75 | -14.85     | 65.60      | 50.52      | 0.07        | 0.16       | QP      | NEUTRAL   |
| 2  | 0.15733 | 37.89 | -17.71     | 55.60      | 37.66      | 0.07        | 0.16       | AVERAGE | NEUTRAL   |
| 3  | 0.40831 | 30.65 | -27.03     | 57.68      | 30.40      | 0.07        | 0.18       | QP      | NEUTRAL   |
| 4  | 0.40831 | 14.26 | -33.42     | 47.68      | 14.01      | 0.07        | 0.18       | AVERAGE | NEUTRAL   |
| 5  | 0.81737 | 23.29 | -32.71     | 56.00      | 23.02      | 0.08        | 0.20       | QP      | NEUTRAL   |
| 6  | 0.81737 | 17.42 | -28.58     | 46.00      | 17.15      | 0.08        | 0.20       | AVERAGE | NEUTRAL   |
| 7  | 1.654   | 26.16 | -29.84     | 56.00      | 25.82      | 0.10        | 0.24       | QP      | NEUTRAL   |
| 8  | 1.654   | 19.56 | -26.44     | 46.00      | 19.22      | 0.10        | 0.24       | AVERAGE | NEUTRAL   |
| 9  | 3.985   | 30.40 | -25.60     | 56.00      | 29.97      | 0.13        | 0.30       | QP      | NEUTRAL   |
| 10 | 3.985   | 20.33 | -25.67     | 46.00      | 19.90      | 0.13        | 0.30       | AVERAGE | NEUTRAL   |
| 11 | 16.486  | 26.51 | -23.49     | 50.00      | 25.66      | 0.39        | 0.47       | AVERAGE | NEUTRAL   |
| 12 | 16.486  | 31.45 | -28.55     | 60.00      | 30.60      | 0.39        | 0.47       | QP      | NEUTRAL   |

## 6. Test of Radiated Emission

### 6.1. Limit

Radiated Emission below 1 GHz test at 3 m:

| Frequency (MHz) | QP (dBuV/m) |
|-----------------|-------------|
| 30~88           | 40          |
| 88~216          | 43.5        |
| 216~960         | 46          |
| Above 960       | 54          |

Radiated Emission 1~18 GHz test at 3 m:

| Frequency (MHz) | PK (dBuV/m) | AV (dBuV/m) |
|-----------------|-------------|-------------|
| 1,000 to 18,000 | 74          | 54          |

Radiated Emission 18~30 GHz test at 1 m:

| Frequency (MHz)  | PK (dBuV/m) | AV (dBuV/m) |
|------------------|-------------|-------------|
| 18,000 to 30,000 | 83.54       | 63.54       |

### 6.2. Description of Major Test Instruments

#### 6.2.1. 30 MHz ~ 1,000 MHz

| Receiver Parameter     | Setting                           |
|------------------------|-----------------------------------|
| Start ~ Stop Frequency | 30MHz~1000MHz / RBW 120kHz for QP |

#### 6.2.2. Above 1 GHz

| Spectrum Parameter | Setting  |
|--------------------|--|
| Start Frequency    | 1000 MHz   |
| Stop Frequency     | 5th harmonic of highest frequency                |
| RBW / VBW          | 1 MHz / 3MHz for Peak ; 1 MHz / 10Hz for Average |

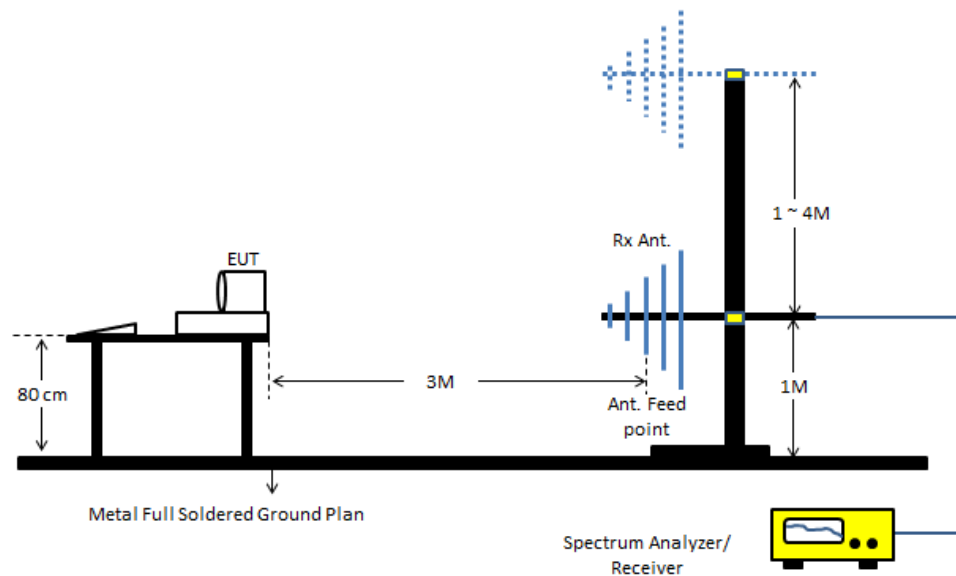
**6.3. Test Procedures**

- a. The EUT was placed on a rotatable table top 0.8 meter above ground.
- b. The EUT was set 3m meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
- c. The table was rotated 360 degrees to determine the position of the highest radiation.
- d. The antenna is a half wave dipole and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
- e. For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
- f. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.
- h. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.



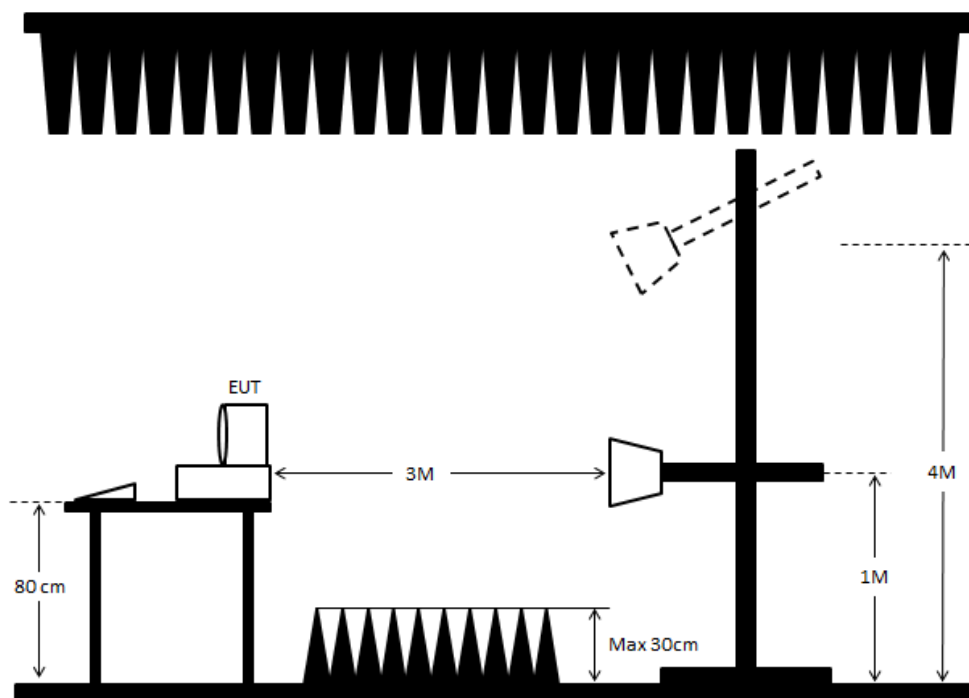
#### 6.4. Typical Test Setup Layout of Radiated Emission

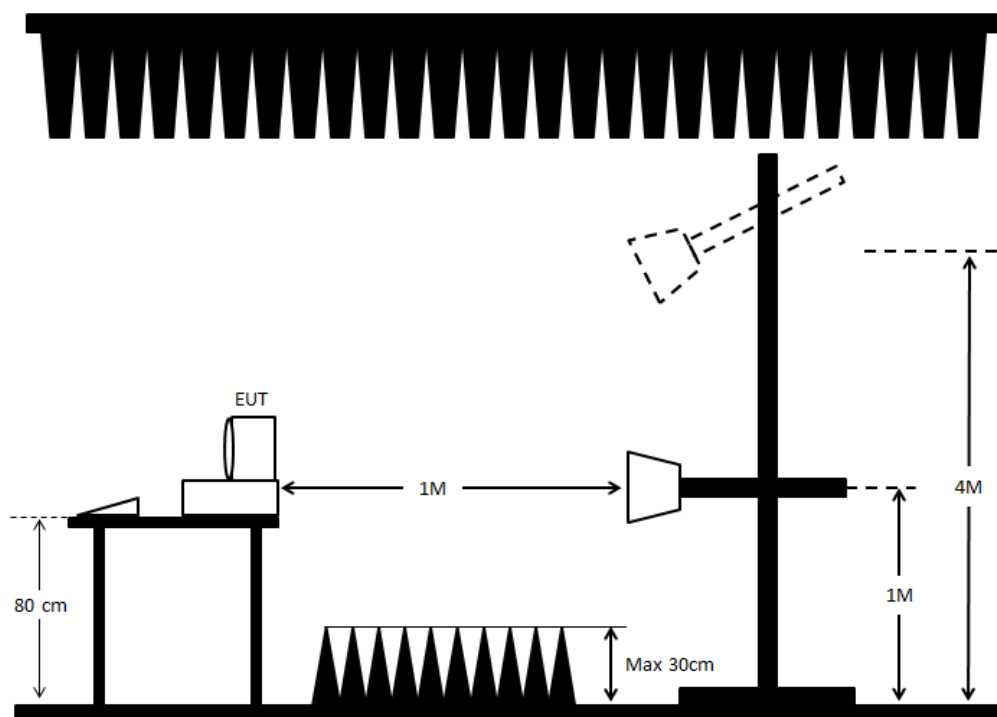
<Below 1 GHz>:



<Above 1 GHz>:

1,000~18,000 MHz

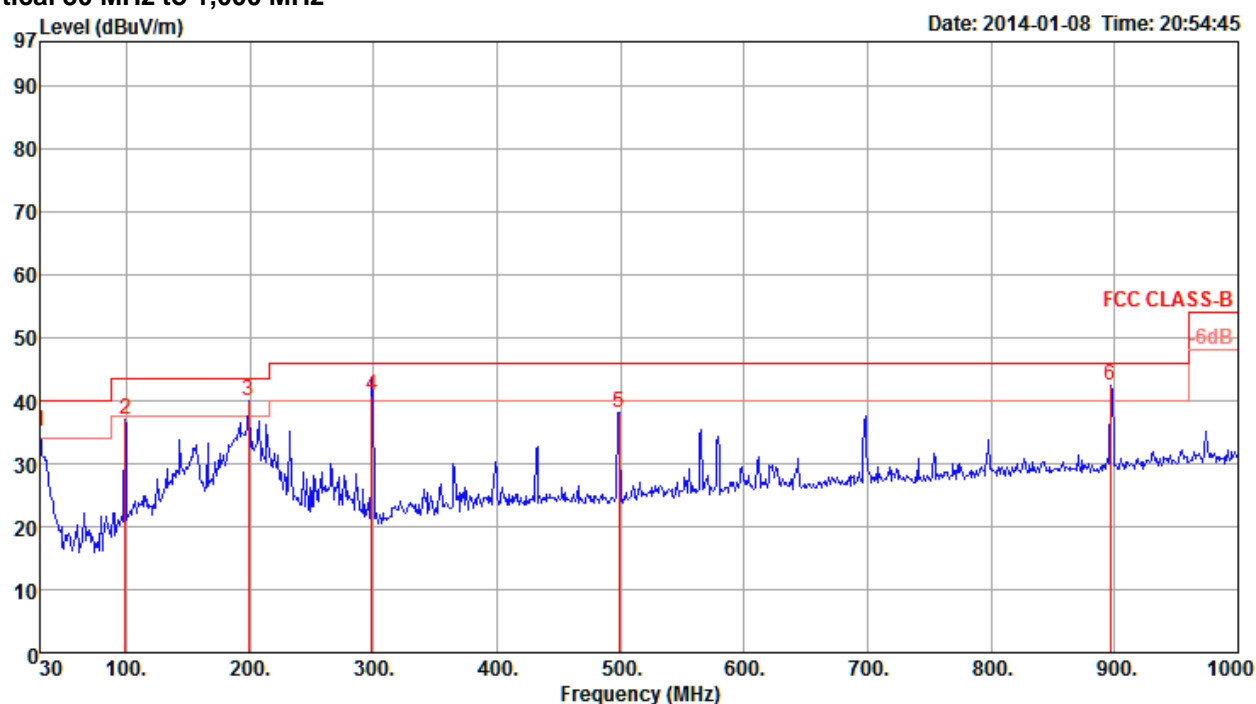


**18,000~30,000 MHz**

## 6.5. Test Result of Radiated Emission below 1 GHz

|   |             |                 |                     |
|---|-------------|-----------------|---------------------|
| Temperature   | 20°C        | Humidity        | 55%                 |
| Test Engineer   | David Tseng | Frequency Range | 30 MHz to 1,000 MHz |
| Test Mode   | Mode 1      |                 |                     |
| <div><div>▪ Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level</div><div>▪ The test was passed at the minimum margin that marked by the frame in the following test record</div></div> |             |                 |                     |

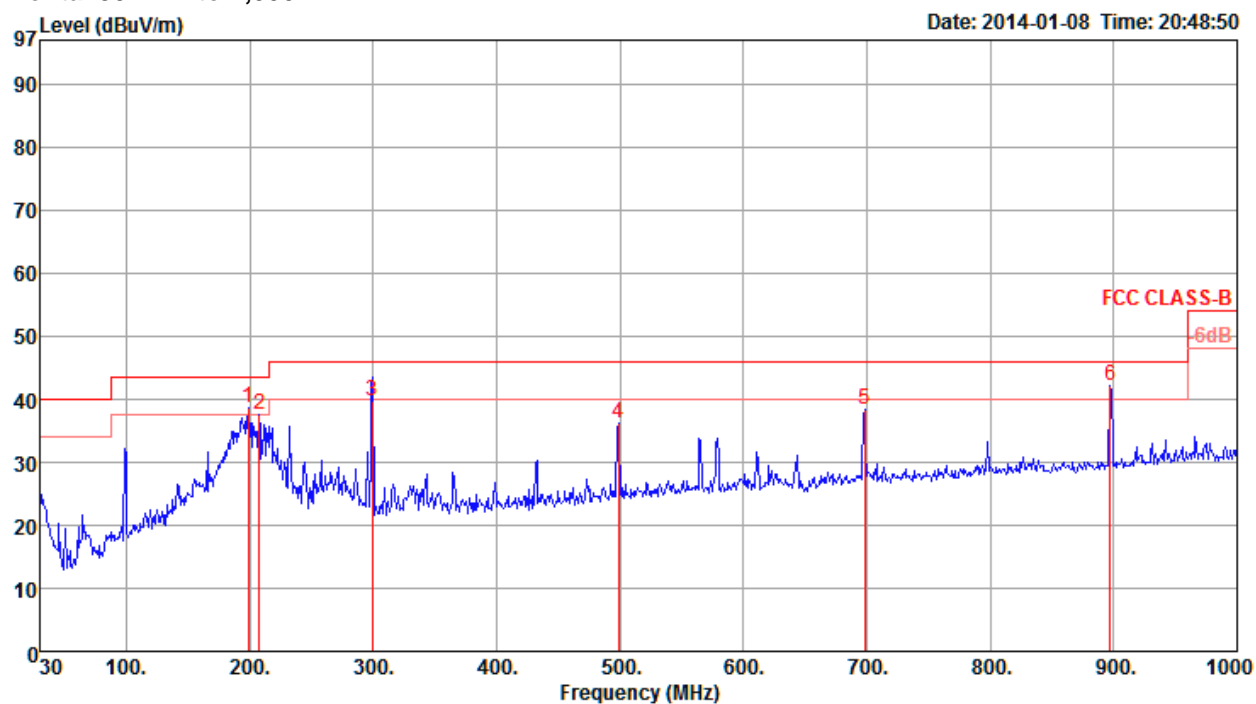
## Vertical 30 MHz to 1,000 MHz



|   | Freq   | Level  | Limit | Over  | Read  | Cable | Preamp |        |        | T/Pos | A/Pos |           |
|---|--------|--------|-------|-------|-------|-------|--------|--------|--------|-------|-------|-----------|
|   | MHz    | dBuV/m | Line  | Limit | Level | Loss  | Factor | Factor | Remark | deg   | cm    | Pol/Phase |
| 1 | 30.00  | 35.16  | 40.00 | -4.84 | 42.40 | 0.83  | 27.97  | -7.24  | Peak   | 0     | 100   | VERTICAL  |
| 2 | 98.87  | 36.98  | 43.50 | -6.52 | 52.12 | 1.49  | 27.82  | -15.14 | Peak   | 0     | 100   | VERTICAL  |
| 3 | 198.78 | 40.03  | 43.50 | -3.47 | 54.86 | 2.09  | 27.26  | -14.83 | Peak   | 0     | 100   | VERTICAL  |
| 4 | 298.69 | 40.78  | 46.00 | -5.22 | 51.30 | 2.51  | 26.83  | -10.52 | QP     | 166   | 100   | VERTICAL  |
| 5 | 498.51 | 38.14  | 46.00 | -7.86 | 44.92 | 3.38  | 27.93  | -6.78  | Peak   | 0     | 100   | VERTICAL  |
| 6 | 896.21 | 42.29  | 46.00 | -3.71 | 43.07 | 4.58  | 26.84  | -0.78  | Peak   | 0     | 100   | VERTICAL  |

## Horizontal 30 MHz to 1,000 MHz

Date: 2014-01-08 Time: 20:48:50

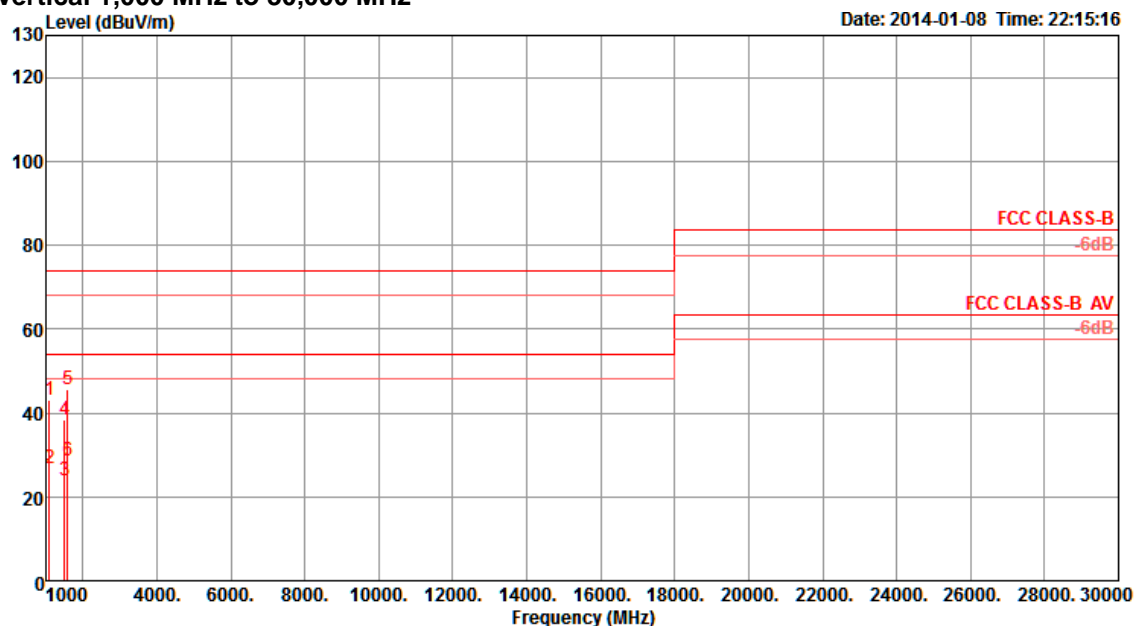


|   | Freq   | Level  | Limit  | Over  | Read  | Cable | Preamp |        |        | T/Pos | A/Pos | Pol/Phase  |
|---|--------|--------|--------|-------|-------|-------|--------|--------|--------|-------|-------|------------|
|   | MHz    | dBuV/m | dBuV/m | Limit | Level | Loss  | Factor | Factor | Remark | deg   | cm    |            |
| 1 | 198.78 | 38.73  | 43.50  | -4.77 | 53.56 | 2.09  | 27.26  | -14.83 | Peak   | 0     | 400   | HORIZONTAL |
| 2 | 207.51 | 37.62  | 43.50  | -5.88 | 52.11 | 2.15  | 27.19  | -14.49 | Peak   | 0     | 400   | HORIZONTAL |
| 3 | 299.66 | 39.82  | 46.00  | -6.18 | 50.34 | 2.51  | 26.83  | -10.52 | QP     | 349   | 106   | HORIZONTAL |
| 4 | 498.51 | 36.29  | 46.00  | -9.71 | 43.07 | 3.38  | 27.93  | -6.78  | Peak   | 0     | 400   | HORIZONTAL |
| 5 | 698.33 | 38.35  | 46.00  | -7.65 | 41.32 | 4.15  | 27.10  | -2.97  | Peak   | 0     | 400   | HORIZONTAL |
| 6 | 897.18 | 42.27  | 46.00  | -3.73 | 43.04 | 4.58  | 26.83  | -0.77  | Peak   | 0     | 400   | HORIZONTAL |

## 6.6. Test Result of Radiated Emission above 1 GHz

|   |             |                 |                         |
|---|-------------|-----------------|-------------------------|
| Temperature   | 20°C        | Humidity        | 55%                     |
| Test Engineer   | David Tseng | Frequency Range | 1,000 MHz to 30,000 MHz |
| Test Mode   | Mode 1      |                 |                         |
| <div><div>▪ Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level</div><div>▪ The test was passed at the minimum margin that marked by the frame in the following test record</div></div> |             |                 |                         |

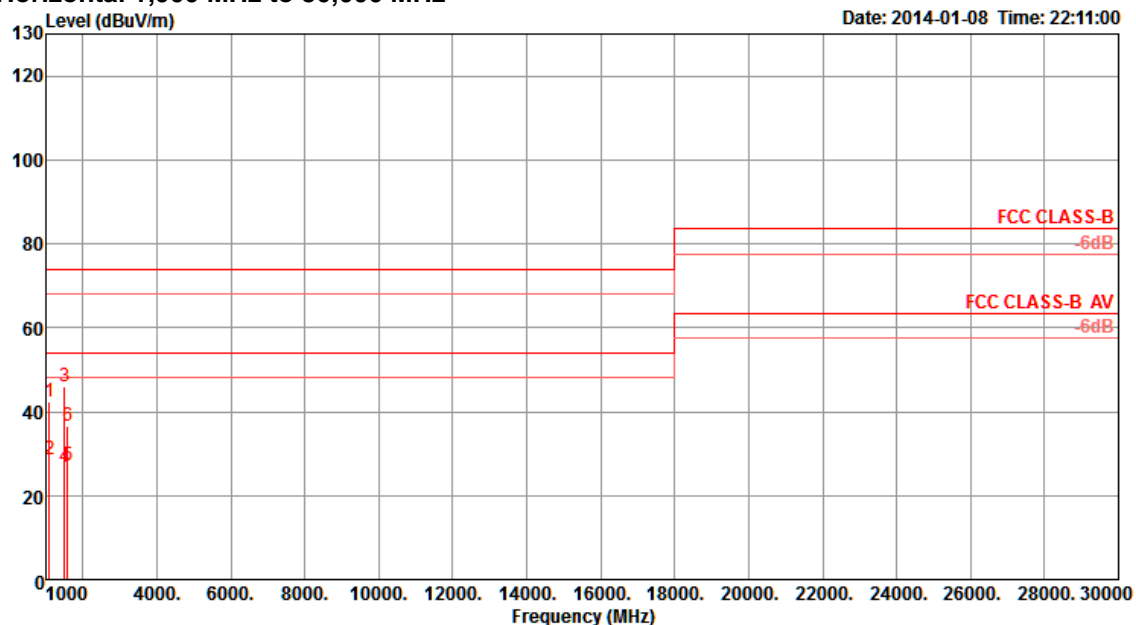
## Vertical 1,000 MHz to 30,000 MHz



|   | Freq    | Level  | Limit  | Over   | Read  | Cable | Preamp |       |         | T/Pos | A/Pos |           |
|---|---------|--------|--------|--------|-------|-------|--------|-------|---------|-------|-------|-----------|
|   | MHz     | dBuV/m | dBuV/m | dB     | dBuV  | dB    | dB     | dB/m  | Remark  | deg   | cm    | Pol/Phase |
| 1 | 1096.01 | 43.04  | 74.00  | -30.96 | 52.83 | 1.92  | 35.76  | -9.79 | Peak    | 313   | 107   | VERTICAL  |
| 2 | 1096.44 | 26.78  | 54.00  | -27.22 | 36.57 | 1.92  | 35.76  | -9.79 | Average | 312   | 107   | VERTICAL  |
| 3 | 1495.58 | 23.96  | 54.00  | -30.04 | 31.40 | 2.25  | 35.09  | -7.44 | Average | 59    | 100   | VERTICAL  |
| 4 | 1495.76 | 38.34  | 74.00  | -35.66 | 45.78 | 2.25  | 35.09  | -7.44 | Peak    | 59    | 100   | VERTICAL  |
| 5 | 1594.15 | 45.78  | 74.00  | -28.22 | 52.44 | 2.33  | 35.01  | -6.66 | Peak    | 329   | 129   | VERTICAL  |
| 6 | 1595.37 | 28.69  | 54.00  | -25.31 | 35.35 | 2.33  | 35.01  | -6.66 | Average | 329   | 129   | VERTICAL  |

## Horizontal 1,000 MHz to 30,000 MHz

Date: 2014-01-08 Time: 22:11:00



|   | Freq    | Level  | Limit  | Over   | Read  | Cable | Preamp |       |         | T/Pos | A/Pos | Pol/Phase  |
|---|---------|--------|--------|--------|-------|-------|--------|-------|---------|-------|-------|------------|
|   | MHz     | dBuV/m | dBuV/m | dB     | dBuV  | dB    | dB     | dB/m  | Remark  | deg   | cm    |            |
| 1 | 1095.08 | 42.44  | 74.00  | -31.56 | 52.23 | 1.92  | 35.76  | -9.79 | Peak    | 70    | 100   | HORIZONTAL |
| 2 | 1096.16 | 28.43  | 54.00  | -25.57 | 38.22 | 1.92  | 35.76  | -9.79 | Average | 70    | 100   | HORIZONTAL |
| 3 | 1494.92 | 46.07  | 74.00  | -27.93 | 53.51 | 2.25  | 35.09  | -7.44 | Peak    | 162   | 100   | HORIZONTAL |
| 4 | 1496.12 | 26.72  | 54.00  | -27.28 | 34.16 | 2.25  | 35.09  | -7.44 | Average | 162   | 100   | HORIZONTAL |
| 5 | 1594.62 | 26.99  | 54.00  | -27.01 | 33.65 | 2.33  | 35.01  | -6.66 | Average | 106   | 100   | HORIZONTAL |
| 6 | 1596.45 | 36.58  | 74.00  | -37.42 | 43.24 | 2.33  | 35.01  | -6.66 | Peak    | 106   | 100   | HORIZONTAL |

## 7. List of Measuring Equipment Used

| Instrument               | Manufacturer | Model No.        | Serial No.  | Characteristics   | Calibration Date | Remark                |
|--------------------------|--------------|------------------|-------------|-------------------|------------------|-----------------------|
| EMI Test Receiver        | R&S          | ESCS 30          | 100355      | 9 kHz ~ 2.75 GHz  | Apr. 12, 2013    | Conduction (CO01-CB)  |
| LISN                     | F.C.C.       | FCC-LISN-50-16-2 | 04083       | 150 kHz ~ 100 MHz | Nov. 23, 2013    | Conduction (CO01-CB)  |
| Artificial Mains Network | Schwarzbeck  | NSLK 8127        | 8127647     | 9kHz ~ 30MHz      | Nov. 23, 2013    | Conduction (CO01-CB)  |
| COND Cable               | Woken        | Cable            | 01          | 150 kHz ~ 30 MHz  | Dec. 04, 2013    | Conduction (CO01-CB)  |
| Software                 | Audix        | E3               | 5.410e      | -                 | -                | Conduction (CO01-CB)  |
| BILOG ANTENNA            | Schaffner    | CBL6112D         | 22021       | 20MHz ~ 2GHz      | Apr. 16, 2013    | Radiation (03CH01-CB) |
| Horn Antenna             | SCHWARZBEAK  | BBHA 9170        | BBHA9170252 | 15GHz ~ 40GHz     | Dec. 17, 2013    | Radiation (03CH01-CB) |
| Pre-Amplifier            | Agilent      | 8447D            | 2944A10991  | 0.1MHz ~ 1.3GHz   | Nov. 12, 2013    | Radiation (03CH01-CB) |
| Pre-Amplifier            | Agilent      | 8449B            | 3008A02310  | 1GHz ~ 26.5GHz    | Dec. 16, 2013    | Radiation (03CH01-CB) |
| Pre-Amplifier            | WM           | TF-130N-R1       | 923365      | 26GHz ~ 40GHz     | Oct. 23, 2013    | Radiation (03CH01-CB) |
| Spectrum analyzer        | R&S          | FSP40            | 100019      | 9kHz~40GHz        | Dec. 02, 2013    | Radiation (03CH01-CB) |
| EMI Test Receiver        | Agilent      | N9038A           | MY52260123  | 9kHz ~ 8GHz       | Dec. 12, 2013    | Radiation (03CH01-CB) |
| Turn Table               | INN CO       | CO 2000          | N/A         | 0 ~ 360 degree    | N.C.R            | Radiation (03CH01-CB) |
| Antenna Mast             | INN CO       | CO2000           | N/A         | 1 m - 4 m         | N.C.R            | Radiation (03CH01-CB) |
| RF Cable-low             | Woken        | Low Cable-1      | N/A         | 30 MHz - 1 GHz    | Nov. 17, 2013    | Radiation (03CH01-CB) |
| RF Cable-high            | Woken        | High Cable-3     | N/A         | 1 GHz - 40 GHz    | Nov. 17, 2013    | Radiation (03CH01-CB) |
| RF Cable-high            | Woken        | High Cable-4     | N/A         | 1 GHz - 40 GHz    | Nov. 17, 2013    | Radiation (03CH01-CB) |

※ Calibration Interval of instruments listed above is one year.

N.C.R. means Non-Calibration required.

## 8. Uncertainty of Test Site

### Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz)

| Contribution  | Uncertainty of $x_i$ |      |                               | $u(x_i)$ |
|---|----------------------|------|-------------------------------|----------|
|   | Value                | Unit | Probability Distribution<br>k |          |
| Receiver reading  | 0.026                | dB   | normal(k=2)                   | 0.013    |
| Cable loss  | 0.002                | dB   | normal(k=2)                   | 0.001    |
| AMN/LISN specification  | 1.200                | dB   | normal(k=2)                   | 0.600    |
| Mismatch<br>Receiver VSWR 1=<br>AMN/LISN VSWR 2=                | -0.080               | dB   | U-shaped                      | 0.060    |
| Combined standard uncertainty Uc(y)                             |                      |      |                               | 1.2      |
| Measuring uncertainty for a level of confidence of 95% U=2Uc(y) |                      |      |                               | 2.4      |

### Uncertainty of Radiated Emission Measurement (30MHz ~ 1,000MHz)

| Contribution  | Uncertainty of $x_i$ |      |                               | $u(x_i)$ |
|---|----------------------|------|-------------------------------|----------|
|   | Value                | Unit | Probability Distribution<br>k |          |
| Receiver reading  | ±0.173               | dB   | K=1                           | 0.086    |
| Cable loss  | ±0.174               | dB   | K=2                           | 0.087    |
| Antenna gain  | ±0.169               | dB   | K=2                           | 0.084    |
| Site imperfection   | ±0.433               | dB   | Triangular                    | 0.214    |
| Pre-amplifier gain  | ±0.366               | dB   | K=2                           | 0.183    |
| Transmitter antenna   | ±1.200               | dB   | Rectangular                   | 0.600    |
| Signal generator  | ±0.461               | dB   | Rectangular                   | 0.231    |
| Mismatch  | ±0.080               | dB   | U-shape                       | 0.040    |
| Spectrum analyzer   | ±0.500               | dB   | Rectangular                   | 0.250    |
| Combined standard uncertainty Uc(y)                             |                      |      |                               | 1.778    |
| Measuring uncertainty for a level of confidence of 95% U=2Uc(y) |                      |      |                               | 3.555    |



**Uncertainty of Radiated Emission Measurement (1GHz ~ 18GHz)**

| Contribution  | Uncertainty of $x_i$ |      |                            | $u(x_i)$ |
|---|----------------------|------|----------------------------|----------|
|   | Value                | Unit | Probability Distribution k |          |
| Receiver reading  | $\pm 0.191$          | dB   | K=1                        | 0.095    |
| Cable loss  | $\pm 0.169$          | dB   | K=2                        | 0.084    |
| Antenna gain  | $\pm 0.191$          | dB   | K=2                        | 0.096    |
| Site imperfection   | $\pm 0.582$          | dB   | Triangular                 | 0.291    |
| Pre-amplifier gain  | $\pm 0.304$          | dB   | K=2                        | 0.152    |
| Transmitter antenna   | $\pm 1.200$          | dB   | Rectangular                | 0.600    |
| Signal generator  | $\pm 0.461$          | dB   | Rectangular                | 0.231    |
| Mismatch  | $\pm 0.080$          | dB   | U-shape                    | 0.040    |
| Spectrum analyzer   | $\pm 0.500$          | dB   | Rectangular                | 0.250    |
| Combined standard uncertainty Uc(y)                               |                      |      |                            | 1.839    |
| Measuring uncertainty for a level of confidence of 95% $U=2Uc(y)$ |                      |      |                            | 3.678    |

**Uncertainty of Radiated Emission Measurement (18GHz ~ 40GHz)**

| Contribution  | Uncertainty of $x_i$ |      |                            | $u(x_i)$ |
|---|----------------------|------|----------------------------|----------|
|   | Value                | Unit | Probability Distribution k |          |
| Receiver reading  | $\pm 0.186$          | dB   | K=1                        | 0.093    |
| Cable loss  | $\pm 0.167$          | dB   | K=2                        | 0.083    |
| Antenna gain  | $\pm 0.190$          | dB   | K=2                        | 0.095    |
| Site imperfection   | $\pm 0.488$          | dB   | Triangular                 | 0.244    |
| Pre-amplifier gain  | $\pm 0.269$          | dB   | K=2                        | 0.134    |
| Transmitter antenna   | $\pm 1.200$          | dB   | Rectangular                | 0.600    |
| Signal generator  | $\pm 0.461$          | dB   | Rectangular                | 0.231    |
| Mismatch  | $\pm 0.080$          | dB   | U-shape                    | 0.040    |
| Spectrum analyzer   | $\pm 0.500$          | dB   | Rectangular                | 0.250    |
| Combined standard uncertainty Uc(y)                               |                      |      |                            | 1.771    |
| Measuring uncertainty for a level of confidence of 95% $U=2Uc(y)$ |                      |      |                            | 3.541    |