



# SPORTON International Inc.

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## FCC RADIO TEST REPORT

|                        |   |
|------------------------|---|
| Applicant's company    | NETGEAR, Inc.   |
| Applicant Address      | 350 East Plumeria Drive, San Jose, California 95134, USA                |
| FCC ID                 | PY312200200   |
| Manufacturer's company | Ambit Microsystems (Shanghai) Ltd.                                      |
| Manufacturer Address   | No. 1925, Nanle Road, Songjiang Export Processing Zone, Shanghai, China |

|                   |   |
|-------------------|---|
| Product Name      | WiFi USB Adapter                          |
| Brand Name        | NETGEAR                                   |
| Model Name        | A6200                                     |
| Test Rule Part(s) | 47 CFR FCC Part 15 Subpart E § 15.407     |
| Test Freq. Range  | 5150 ~ 5250MHz                            |
| Received Date     | Jun. 22, 2012                             |
| Final Test Date   | Mar. 11, 2013                             |
| Submission Type   | Class II Change                           |
| Operating Mode    | Client (without radar detection function) |

### Statement

**Test result included is for the IEEE 802.11ac (5150 ~ 5250MHz) of the product.**

The test result in this report refers exclusively to the presented test model / sample.

Without written approval of SPORTON International Inc., the test report shall not be reproduced except in full.

The measurements and test results shown in this test report were made in accordance with the procedures and found in compliance with the limit given in **ANSI C63.10-2009** and **47 CFR FCC Part 15 Subpart E, KDB 789033 D01 v01r02** and **KDB 662911 D01 v01r02**.

The test equipment used to perform the test is calibrated and traceable to NML/ROC.





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## 1. CERTIFICATE OF COMPLIANCE

Product Name : WIFI USB Adapter  
Brand Name : NETGEAR  
Model Name : A6200  
Applicant : NETGEAR, Inc.  
Test Rule Part(s) : 47 CFR FCC Part 15 Subpart E § 15.407

Sporton International as requested by the applicant to evaluate the EMC performance of the product sample received on Jun. 22, 2012 would like to declare that the tested sample has been evaluated and found to be in compliance with the tested rule parts. The data recorded as well as the test configuration specified is true and accurate for showing the sample's EMC nature.

A handwritten signature in blue ink that reads 'Sam Chen' is written over a horizontal line.

Sam Chen

SPORTON INTERNATIONAL INC.

## 2. SUMMARY OF THE TEST RESULT

| Applied Standard: 47 CFR FCC Part 15 Subpart E |              |                                |          |             |
|--|--------------|--------------------------------|----------|-------------|
| Part   | Rule Section | Description of Test            | Result   | Under Limit |
| 4.1  | 15.407(a)    | 26dB Spectrum Bandwidth        | Complies | -           |
| 4.2  | 15.407(a)    | Maximum Conducted Output Power | Complies | 1.48 dB     |
| 4.3  | 15.407(a)    | Power Spectral Density         | Complies | 4.24 dB     |
| 4.4  | 15.407(a)    | Peak Excursion                 | Complies | 3.29 dB     |
| 4.5  | 15.407(b)    | Radiated Emissions             | Complies | 14.91 dB    |
| 4.6  | 15.407(b)    | Band Edge Emissions            | Complies | 2.47 dB     |
| 4.7  | 15.203       | Antenna Requirements           | Complies | -           |

Note: The product has beam-forming function for 802.11ac VHT80 in 5150-5250MHz and 5725-5850MHz.

| Test Items                                    | Uncertainty           | Remark                   |
|---|-----------------------|--------------------------|
| AC Power Line Conducted Emissions             | ±2.3dB                | Confidence levels of 95% |
| Maximum Conducted Output Power                | ±0.5dB                | Confidence levels of 95% |
| Power Spectral Density                        | ±0.5dB                | Confidence levels of 95% |
| Peak Excursion                                | ±0.5dB                | Confidence levels of 95% |
| 26dB Spectrum Bandwidth / Frequency Stability | ±8.5×10 <sup>-8</sup> | Confidence levels of 95% |
| Radiated Emissions (9kHz~30MHz)               | ±0.8dB                | Confidence levels of 95% |
| Radiated Emissions (30MHz~1000MHz)            | ±1.9dB                | Confidence levels of 95% |
| Radiated / Band Edge Emissions (1GHz~18GHz)   | ±1.9dB                | Confidence levels of 95% |
| Radiated Emissions (18GHz~40GHz)              | ±1.9dB                | Confidence levels of 95% |
| Temperature                                   | ±0.7°C                | Confidence levels of 95% |
| Humidity                                      | ±3.2%                 | Confidence levels of 95% |
| DC / AC Power Source                          | ±1.4%                 | Confidence levels of 95% |

### 3. GENERAL INFORMATION

#### 3.1. Product Details

##### IEEE 802.11ac

| Items                    | Description  |
|--------------------------|--|
| Product Type             | WLAN (2TX, 2RX)  |
| Radio Type               | Intentional Transceiver                                  |
| Power Type               | From Host System   |
| Modulation               | see the below table for IEEE 802.11ac                    |
| Data Modulation          | OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM) For 802.11ac |
| Data Rate (Mbps)         | see the below table for IEEE 802.11ac                    |
| Frequency Range          | 5150 ~ 5250MHz   |
| Channel Number           | 1 for 80MHz bandwidth                                    |
| Channel Band Width (99%) | 11ac MCS0 VHT80: 77.04 MHz                               |
| Conducted Output Power   | 11ac MCS0 VHT80: 13.76 dBm                               |
| Carrier Frequencies      | Please refer to section 3.4                              |
| Antenna                  | Please refer to section 3.3                              |

##### Antenna & Band width

| Antenna       | Two (TX) |        |       |
|---------------|----------|--------|-------|
|               | 20 MHz   | 40 MHz | 80MHz |
| IEEE 802.11ac | X        | X      | V     |

Note : The beam-forming function only support 802.11ac VHT80

**IEEE 802.11ac Spec.**

| <b>Worst Modulation Used for Conformance Testing</b>  |   |                        |                              |                              |
|---|---|------------------------|------------------------------|------------------------------|
| <b>IEEE 802.11 Protocol</b>   | <b>Number of Transmit Chains (N<sub>TX</sub>)</b> | <b>Data Rate / MCS</b> | <b>Worst Data Rate / MCS</b> | <b>Worst Modulation Mode</b> |
| ac (VHT80)  | 2   | MCS 0-9                | MCS 0-Nss1                   | 11AC5.2G-80M                 |
| Note 1: IEEE 802.11ac modulation consists of VHT20, VHT40, VHT80 and VHT160. Then EUT support VHT80. (VHT: Very High Throughput). |   |                        |                              |                              |
| Note 2: Modulation modes consist of 11AC5.2G-80M.   |   |                        |                              |                              |
| Note 3: 11A: 11AC: IEEE 802.11ac. 5.2G: 5.15-5.25 GHz band.   |   |                        |                              |                              |
| Note 4: 80M: Channel Bandwidth 80MHz  |   |                        |                              |                              |

**3.2. Accessories**

| <b>Other</b>                  |
|-------------------------------|
| USB Cable * 1, No-Shield 0.8m |

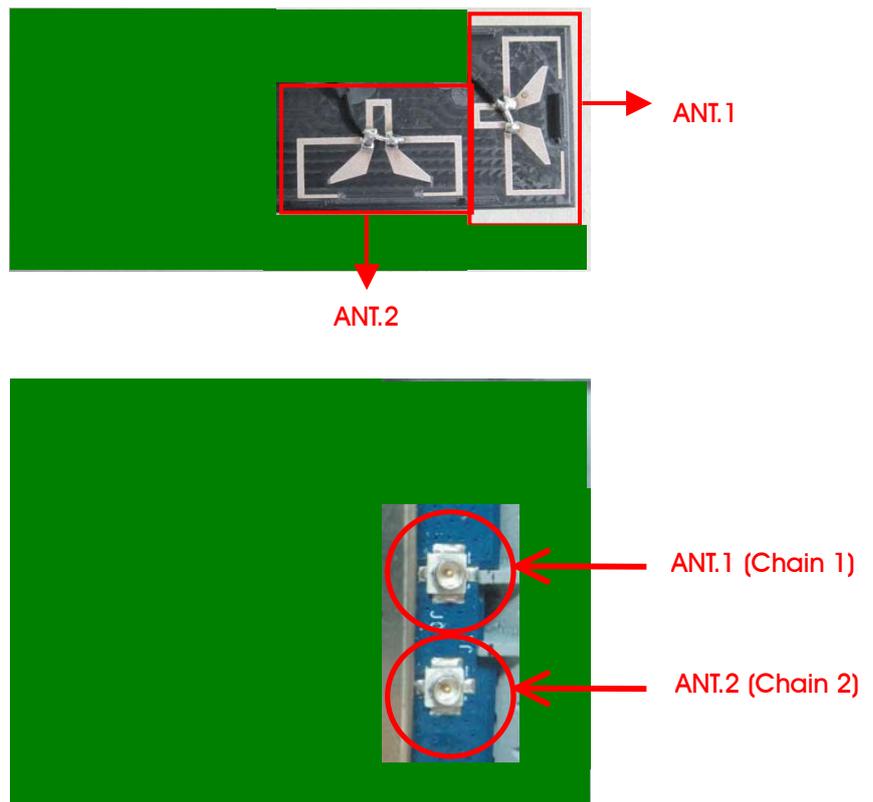
### 3.3. Table for Filed Antenna

| Ant. | Brand | Model Name | Antenna Type | Connector | Gain (dBi)  |      |
|------|-------|------------|--------------|-----------|-------------|------|
| 1    | WNC   | -          | LCD Antenna  | I-PEX     | 5GHz Band 1 | 4.75 |
| 2    | WNC   | -          | LCD Antenna  | I-PEX     | 5GHz Band 1 | 4.75 |

Note: The EUT has two antennas

For IEEE 802.11a/ac mode (2TX/2RX):

Ant. 1 and Ant. 2 could transmit/receive simultaneously.



### 3.4. Table for Carrier Frequencies

For 80MHz bandwidth systems, use Channel 42.

| Frequency Band | Channel No. | Frequency |
|----------------|-------------|-----------|
| 5150~5250 MHz  | 42          | 5210 MHz  |

### 3.5. Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. 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.

| Test Items  | Mode       | Data Rate  | Channel | Antenna |
|---|------------|------------|---------|---------|
| Max. Conducted Output Power   | 11ac 80VHT | MCS 0-Nss1 | 42      | 1+2     |
| Power Spectral Density  | 11ac 80VHT | MCS 0-Nss1 | 42      | 1+2     |
| 26dB Spectrum Bandwidth<br>99% Occupied Bandwidth Measurement<br>Peak Excursion | 11ac 80VHT | MCS 0-Nss1 | 42      | 1+2     |
| Radiated Emission Above 1GHz  | 11ac 80VHT | MCS 0-Nss1 | 42      | 1+2     |
| Band Edge Emission  | 11ac 80VHT | MCS 0-Nss1 | 42      | 1+2     |

The following test modes were performed for all tests:

Mode 1: EUT - X axis + antenna 0°

Mode 2: EUT - X axis + antenna 90°

Mode 3: EUT - X axis + antenna 180°

Mode 3 has been evaluated to be the worst case, thus measurement will follow this same test mode.

Mode 4: EUT - Y axis + antenna 180°

Mode 5: EUT - Z axis + antenna 180°

#### For Radiated Emission test:

<For Radiated Emissions Test above 1GHz:> Radiated Emissions (1GHz~10<sup>th</sup> Harmonic)

Due to Mode 4 generated the worst test result, it was recorded in this report.

<For Radiated Emissions Test above 1GHz:> Band Edge Emissions

Due to Mode 2 generated the worst test result, it was recorded in this report.

### 3.6. Table for Testing Locations

| Test Site No. | Site Category | Location | FCC Reg. No. | IC File No. |
|---------------|---------------|----------|--------------|-------------|
| 03CH01-CB     | SAC           | Hsin Chu | 262045       | IC 4086D    |
| TH01-CB       | OVEN Room     | Hsin Chu | -            | -           |

Open Area Test Site (OATS); Semi Anechoic Chamber (SAC); Fully Anechoic Chamber (FAC).

Please refer section 6 for Test Site Address.

### 3.7. Table for Class II Change

This product is an extension of original one reported under Sporton project number: FR262930AA

Below is the table for the change of the product with respect to the original one.

| Modifications   | Performance Checking  |
|---|---|
| It adds beam-forming function for 802.11ac VHT80 mode in 5150-5250MHz and 5725-5850MHz. | <ol style="list-style-type: none"> <li>1. 26dB Spectrum Bandwidth</li> <li>2. Maximum Conducted Output Power</li> <li>3. Power Spectral Density</li> <li>4. Peak Excursion</li> <li>5. Radiated Emissions (1GHz~10th Harmonic)</li> <li>6. Band Edge Emissions</li> </ol> |

### 3.8. EUT Operation during Test

For Conducted Mode:

The EUT was programmed to be in continuously transmitting mode.

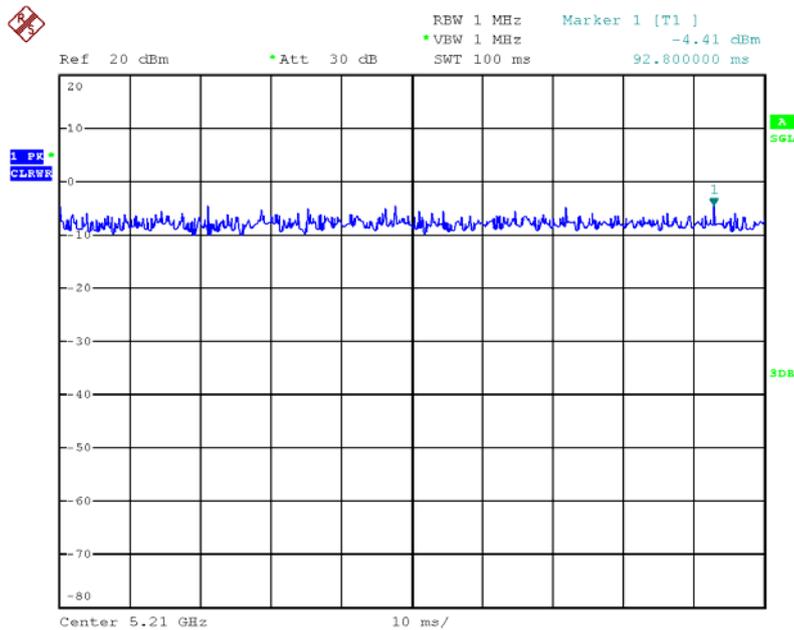
For Radiated Mode:

During the test, the following programs under WIN XP were executed.

The program was executed as follows:

1. During the test, the EUT operation to normal function.
2. Executed command fixed test channel under DOS.
3. Executed "Latest.exe " to link with the remote workstation to receive and transmit packet by Wireless AP and transmit duty cycle no less 98%

### 3.9. Duty Cycle



Date: 11.MAR.2013 10:38:13

### 3.10. Table for Supporting Units

| Support Unit | Brand   | Model | FCC ID      |
|--------------|---------|-------|-------------|
| Wireless AP  | NETGEAR | R6300 | PY312100188 |
| Notebook*2   | DELL    | 1340  | E2K4965AGNM |

### 3.11. Table for Parameters of Test Software Setting

During testing, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

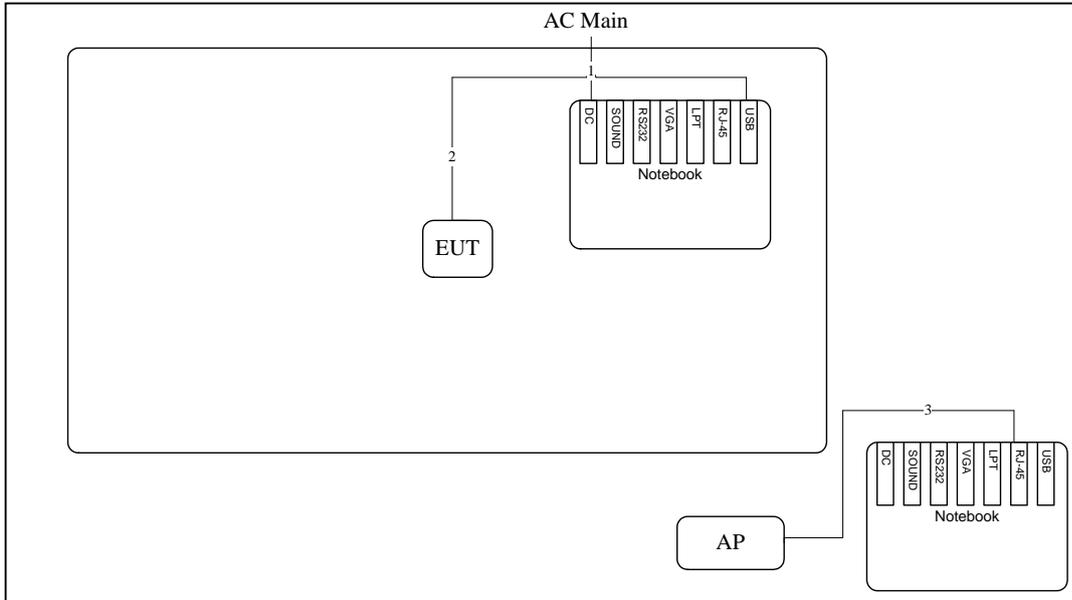
#### Power Parameters of IEEE 802.11ac MCS0 VHT80

| Test Software Version | DOS      |
|-----------------------|----------|
| Frequency             | 5210 MHz |
| MCS0 VHT80            | 34.00    |

### 3.12. Test Configurations

#### 3.12.1. Radiation Emissions Test Configuration

For Radiated Emission test above 1GHz :



| Item | Connection  | Shield | Length |
|------|-------------|--------|--------|
| 1    | Power Cable | No     | 2.6m   |
| 2    | USB Cable   | Yes    | 1.8m   |
| 3    | RJ-45       | No     | 1.5m   |

## 4. TEST RESULT

### 4.1. 26dB Bandwidth Measurement

#### 4.1.1. Limit

No restriction limits.

#### 4.1.2. Measuring Instruments and Setting

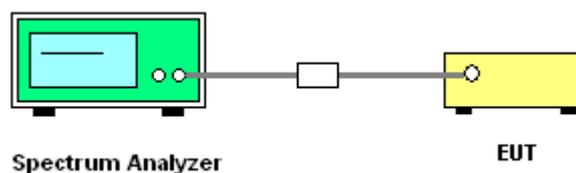
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

| Spectrum Parameters | Setting                                    |
|---------------------|--|
| Attenuation         | Auto                                       |
| Span Frequency      | > 26dB Bandwidth                           |
| RB                  | Approximately 1% of the emission bandwidth |
| VB                  | VBW > RBW                                  |
| Detector            | Peak                                       |
| Trace               | Max Hold                                   |
| Sweep Time          | Auto                                       |

#### 4.1.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

#### 4.1.4. Test Setup Layout



#### 4.1.5. Test Deviation

There is no deviation with the original standard.

#### 4.1.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

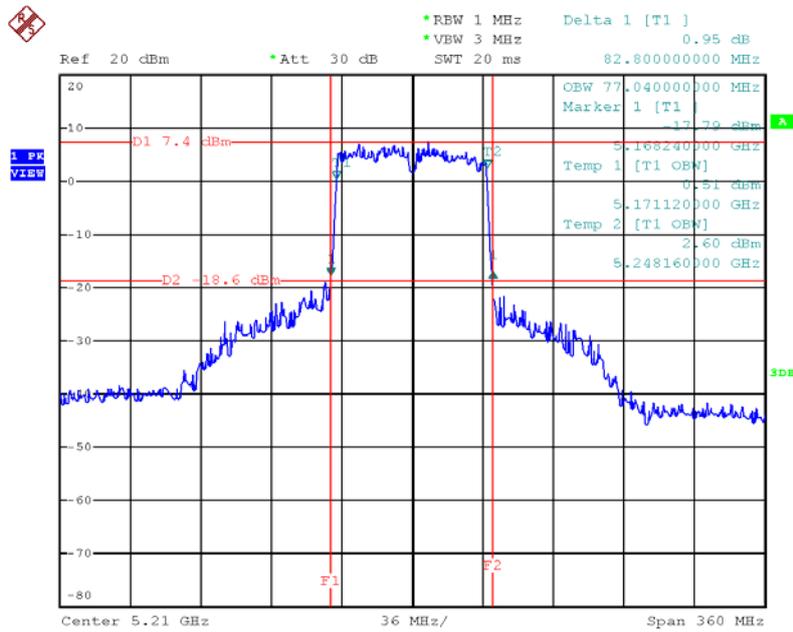
4.1.7. Test Result of 26dB Bandwidth

|               |              |                |                |
|---------------|--------------|----------------|----------------|
| Temperature   | 26°C         | Humidity       | 63%            |
| Test Engineer | Satoshi Yang | Configurations | IEEE 802.11 ac |

Configuration IEEE 802.11ac MCS0 VHT80 / Ant. 1 + Ant. 2

| Channel | Frequency | 26dB Bandwidth (MHz) | 99% Occupied Bandwidth (MHz) |
|---------|-----------|----------------------|------------------------------|
| 42      | 5210 MHz  | 82.80                | 77.04                        |

26 dB Bandwidth Plot on Configuration IEEE 802.11ac MCS0 VHT80 / Ant. 1 + Ant. 2 / 5210 MHz



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## 4.2. Maximum Conducted Output Power Measurement

### 4.2.1. Limit

For the band 5.15~5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW (17dBm) or  $4 \text{ dBm} + 10\log B$ , where B is the 26 dB emissions bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 4.2.2. Measuring Instruments and Setting

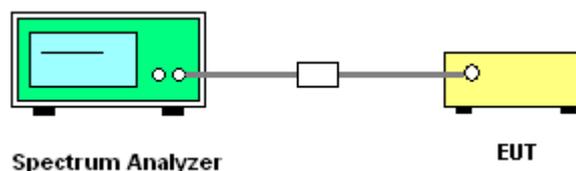
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

| Spectrum Parameter | Setting  |
|--------------------|--|
| Attenuation        | Auto   |
| Span Frequency     | Encompass the entire emissions bandwidth (EBW) of the signal |
| RB                 | 1000 kHz   |
| VB                 | 3000 kHz   |
| Detector           | RMS  |
| Trace              | Average Sweep count 100                                      |
| Sweep Time         | Auto   |

### 4.2.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. Test was performed in accordance with KDB 789033 D01 UNII General Test Procedures v01r02 section C option d) Method SA-2. Multiple antenna systems was performed in accordance with KDB 662911 Emissions Testing of Transmitters with Multiple Outputs in the Same Band.
3. When measuring maximum conducted output power with multiple antenna systems, add every result of the values by mathematic formula.

### 4.2.4. Test Setup Layout



### 4.2.5. Test Deviation

There is no deviation with the original standard.

### 4.2.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

#### 4.2.7. Test Result of Maximum Conducted Output Power

|               |              |                |                |
|---------------|--------------|----------------|----------------|
| Temperature   | 26°C         | Humidity       | 63%            |
| Test Engineer | Satoshi Yang | Configurations | IEEE 802.11 ac |

##### Configuration IEEE 802.11ac MCS0 VHT80 / Ant. 1 + Ant. 2

| Channel | Frequency | Conducted Power (dBm) |       | Total Conducted Output Power (dBm) | Max. Limit (dBm) | Result          |
|---------|-----------|-----------------------|-------|------------------------------------|------------------|-----------------|
|         |           | Ant.1                 | Ant.2 |                                    |                  |                 |
| 42      | 5210 MHz  | 11.23                 | 10.20 | 13.76                              | 15.24            | <b>Complies</b> |

Note:

Directional gain =  $G_{ANT} + 10 \log(N_{ANT}/N_{ss}) = 7.76 \text{ dBi} > 6 \text{ dBi}$ , so the power limit =  $17 - (7.76 - 6) = 15.24 \text{ dBm}$



### 4.3. Power Spectral Density Measurement

#### 4.3.1. Limit

The power spectral density is defined as the highest level of power in dBm per MHz generated by the transmitter within the power envelope. The following table is power spectral density limits and decrease power density limit rule refer to section 4.3.1.

| Frequency Range | Power Spectral Density limit (dBm/MHz) |
|-----------------|--|
| 5.15~5.25 GHz   | 4                                      |

#### 4.3.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

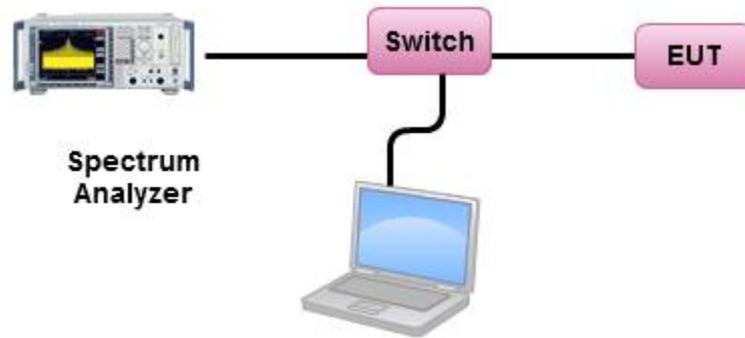
| Spectrum Parameter | Setting  |
|--------------------|--|
| Attenuation        | Auto   |
| Span Frequency     | Encompass the entire emissions bandwidth (EBW) of the signal |
| RB                 | 1000 kHz   |
| VB                 | 3000 kHz   |
| Detector           | RMS  |
| Trace              | AVERAGE  |
| Sweep Time         | Auto   |
| Trace Average      | 100 times  |

#### 4.3.3. Test Procedures

1. Trace A, Set RBW = 1MHz, VBW = 3MHz, Span >26dB bandwidth, Max. hold.
2. Delta Mark trace A Maximum frequency and trace B same frequency.
3. Repeat the above procedure until measurements for all frequencies were complete.
4. Procedures refer KDB 662911: Measure and sum the spectra across the outputs.

The first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the Nth output to obtain the value for the first frequency bin of the summed spectrum. The summed spectrum value for each of the other frequency bins is computed in the same way. This will likely require transferring the measured spectra to a computer, where the bin-by-bin summing can be performed.

#### 4.3.4. Test Setup Layout



#### 4.3.5. Test Deviation

There is no deviation with the original standard.

#### 4.3.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.3.7. Test Result of Power Spectral Density

|               |               |                |               |
|---------------|---------------|----------------|---------------|
| Temperature   | 26°C          | Humidity       | 63%           |
| Test Engineer | Satoshi Yang  | Configurations | IEEE 802.11ac |
| Test Date     | Feb. 19, 2013 |                |               |

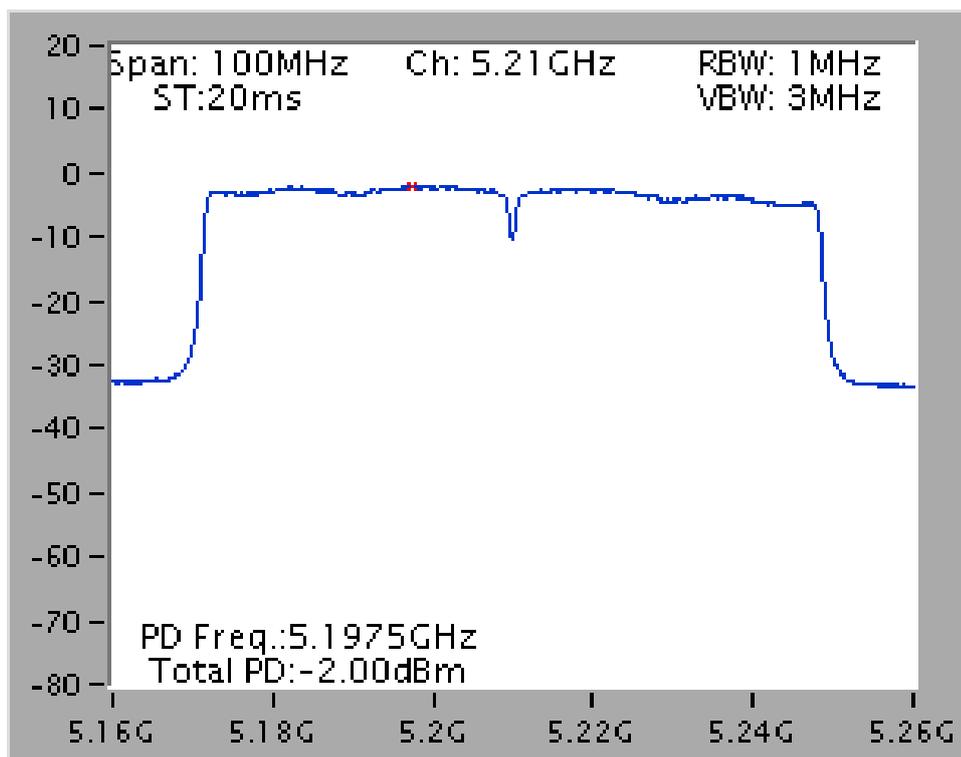
Configuration IEEE 802.11ac MCS0 VHT80

| Channel | Frequency | Total Power Density (dBm/MHz) | Max. Limit (dBm/MHz) | Result   |
|---------|-----------|-------------------------------|----------------------|----------|
| 42      | 5210 MHz  | -2.00                         | 2.24                 | Complies |

Note:

Directional gain =  $G_{ANT} + 10 \log(N_{ANT}/N_{SS}) = 7.76 \text{ dBi} > 6 \text{ dBi}$ , so the power limit =  $4 - (7.76 - 6) = 2.24 \text{ dBm}$

Power Density Plot on Configuration IEEE 802.11ac MCS0 VHT80 / Ant. 1 + Ant. 2 / 5210 MHz



## 4.4. Peak Excursion Measurement

### 4.4.1. Limit

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emissions bandwidth whichever is less.

### 4.4.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

| Spectrum Parameter | Setting   |
|--------------------|---|
| Attenuation        | Auto  |
| Span Frequency     | Encompass the entire emissions bandwidth (EBW) of the signal  |
| RB                 | 1MHz (Peak Trace) / 1MHz (Average Trace)                      |
| VB                 | 3MHz (Peak Trace) / 3MHz (Average Trace)                      |
| Detector           | Peak (Peak Trace) / RMS (Average Trace)                       |
| Trace              | Peak : Trace :Max hold/Average: Trace Average Sweep Count 100 |
| Sweep Time         | AUTO  |

### 4.4.3. Test Procedures

1. The test procedure is the same as section 4.5.3.
2. Trace A, Set RBW = 1MHz, VBW = 3MHz, Span >26dB bandwidth, Max. hold.
3. Delta Mark trace A Maximum frequency and trace B same frequency.
4. Repeat the above procedure until measurements for all frequencies were complete.

### 4.4.4. Test Setup Layout

This test setup layout is the same as that shown in section 4.5.4.

### 4.4.5. Test Deviation

There is no deviation with the original standard.

### 4.4.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

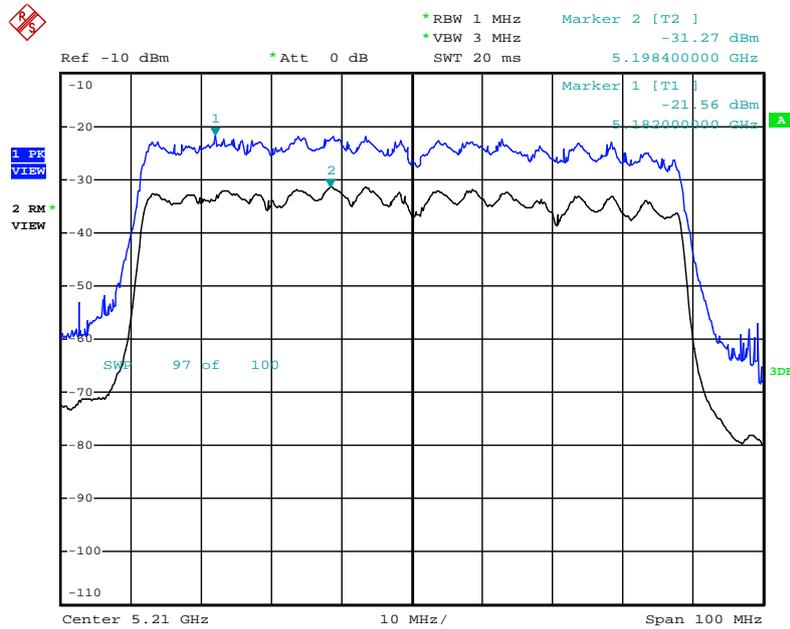
4.4.7. Test Result of Peak Excursion

|               |              |                |                |
|---------------|--------------|----------------|----------------|
| Temperature   | 26°C         | Humidity       | 63%            |
| Test Engineer | Satoshi Yang | Configurations | IEEE 802.11 ac |

Configuration IEEE 802.11ac MCS0 VHT80 / Ant. 1 + Ant. 2

| Channel | Frequency | Peak Excursion (dB) | Max. Limit (dB) | Result   |
|---------|-----------|---------------------|-----------------|----------|
| 42      | 5210 MHz  | 9.71                | 13              | Complies |

Peak Excursion Plot on Configuration IEEE 802.11ac MCS0 VHT80 / Ant. 1 + Ant. 2 / 5210



Date: 6.MAR.2013 00:12:30

## 4.5. Radiated Emissions Measurement

### 4.5.1. Limit

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.25 GHz band shall not exceed an -27dBm peak limit or average and peak limits of 15.209. For transmitters operating in the In addition, In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

| Frequencies (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|-------------------|-----------------------------------|-------------------------------|
| 0.009~0.490       | 2400/F(KHz)                       | 300                           |
| 0.490~1.705       | 24000/F(KHz)                      | 30                            |
| 1.705~30.0        | 30                                | 30                            |
| 30~88             | 100                               | 3                             |
| 88~216            | 150                               | 3                             |
| 216~960           | 200                               | 3                             |
| Above 960         | 500                               | 3                             |

### 4.5.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer and receiver.

| Spectrum Parameter                        | Setting   |
|---|---|
| Attenuation                               | Auto  |
| Start Frequency                           | 1000 MHz  |
| Stop Frequency                            | 40 GHz  |
| RB / VB (Emission in restricted band)     | 1 MHz / 3MHz for Peak, 1 MHz / 10Hz for Average |
| RB / VB (Emission in non-restricted band) | 1 MHz / 3MHz for peak                           |

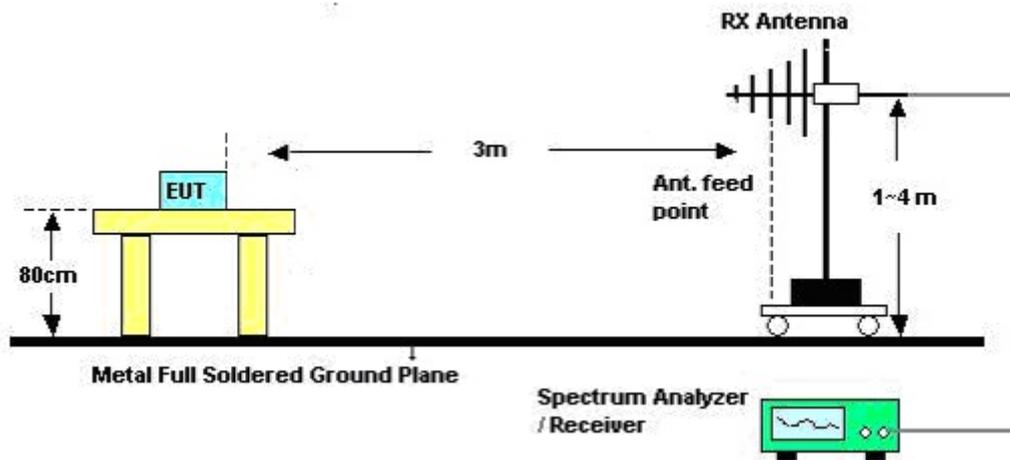
| Receiver Parameter     | Setting                          |
|------------------------|----------------------------------|
| Attenuation            | Auto                             |
| Start ~ Stop Frequency | 9kHz~150kHz / RB 200Hz for QP    |
| Start ~ Stop Frequency | 150kHz~30MHz / RB 9kHz for QP    |
| Start ~ Stop Frequency | 30MHz~1000MHz / RB 120kHz for QP |

#### 4.5.3. Test Procedures

1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average 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 for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions 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.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High – Low scan is not required in this case.

#### 4.5.4. Test Setup Layout

For radiated emissions above 1GHz



#### 4.5.5. Test Deviation

There is no deviation with the original standard.

#### 4.5.6. EUT Operation during Test

The EUT was programmed to be in beam-forming transmitting mode.

## 4.5.7. Results for Radiated Emissions (1GHz~40GHz)

|                      |               |                       |   |
|----------------------|---------------|-----------------------|---|
| <b>Temperature</b>   | 26°C          | <b>Humidity</b>       | 60%   |
| <b>Test Engineer</b> | Satoshi Yang  | <b>Configurations</b> | IEEE 802.11ac MCS0 VHT80 Ch 42<br>Ant. 1 + Ant. 2 |
| <b>Test Date</b>     | Feb. 05, 2013 | <b>Test Mode</b>      | Mode 4  |

**Horizontal**

|   | Freq     | Level  | Limit<br>Line | Over<br>Limit | Read<br>Level | CableAntenna<br>Loss | Antenna<br>Factor | Preamp<br>Factor | Remark  | A/Pos | T/Pos | Pol/Phase  |
|---|----------|--------|---------------|---------------|---------------|----------------------|-------------------|------------------|---------|-------|-------|------------|
|   | MHz      | dBuV/m | dBuV/m        | dB            | dBuV          | dB                   | dB/m              | dB               |         | cm    | deg   |            |
| 1 | 15630.16 | 39.05  | 54.00         | -14.95        | 30.70         | 6.14                 | 37.56             | 35.35            | Average | 100   | 193   | HORIZONTAL |
| 2 | 15630.16 | 49.20  | 74.00         | -24.80        | 40.85         | 6.14                 | 37.56             | 35.35            | Peak    | 100   | 193   | HORIZONTAL |

**Vertical**

|   | Freq     | Level  | Limit<br>Line | Over<br>Limit | Read<br>Level | CableAntenna<br>Loss | Antenna<br>Factor | Preamp<br>Factor | Remark  | A/Pos | T/Pos | Pol/Phase |
|---|----------|--------|---------------|---------------|---------------|----------------------|-------------------|------------------|---------|-------|-------|-----------|
|   | MHz      | dBuV/m | dBuV/m        | dB            | dBuV          | dB                   | dB/m              | dB               |         | cm    | deg   |           |
| 1 | 15630.32 | 39.09  | 54.00         | -14.91        | 30.74         | 6.14                 | 37.56             | 35.35            | Average | 100   | 264   | VERTICAL  |
| 2 | 15630.32 | 49.13  | 74.00         | -24.87        | 40.78         | 6.14                 | 37.56             | 35.35            | Peak    | 100   | 264   | VERTICAL  |

## 4.6. Band Edge Emissions Measurement

### 4.6.1. Limit

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.25 GHz band shall not exceed an -27dBm peak limit or average and peak limits of 15.209, In addition, In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

| Frequencies (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|-------------------|-----------------------------------|-------------------------------|
| 0.009~0.490       | 2400/F(KHz)                       | 300                           |
| 0.490~1.705       | 24000/F(KHz)                      | 30                            |
| 1.705~30.0        | 30                                | 30                            |
| 30~88             | 100                               | 3                             |
| 88~216            | 150                               | 3                             |
| 216~960           | 200                               | 3                             |
| Above 960         | 500                               | 3                             |

### 4.6.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

| Spectrum Parameter                        | Setting   |
|---|---|
| Attenuation                               | Auto  |
| Span Frequency                            | 100 MHz   |
| RB / VB (Emission in restricted band)     | 1 MHz / 3MHz for Peak, 1 MHz / 10Hz for Average |
| RB / VB (Emission in non-restricted band) | 1 MHz / 3MHz for Peak                           |

### 4.6.3. Test Procedures

- The test procedure is the same as section 4.5.3, only the frequency range investigated is limited to 100MHz around bandedges.

### 4.6.4. Test Setup Layout

This test setup layout is the same as that shown in section 4.5.4.

### 4.6.5. Test Deviation

There is no deviation with the original standard.

### 4.6.6. EUT Operation during Test

The EUT was programmed to be in beam-forming transmitting mode.

#### 4.6.7. Test Result of Band Edge and Fundamental Emissions

|                      |               |                       |   |
|----------------------|---------------|-----------------------|---|
| <b>Temperature</b>   | 25.6°C        | <b>Humidity</b>       | 56%   |
| <b>Test Engineer</b> | Satoshi Yang  | <b>Configurations</b> | IEEE 802.11ac MCS0 VHT80 Ch 42<br>/ Ant. 1 + Ant. 2 |
| <b>Test Date</b>     | Feb. 05, 2013 | <b>Test Mode</b>      | Mode 2  |

##### Channel 42

|   | Freq    | Level  | Limit<br>Line | Over<br>Limit | Read<br>Level | Cable<br>Loss | Antenna<br>Factor | Preamp<br>Factor | Remark  | A/Pos | T/Pos | Pol/Phase  |
|---|---------|--------|---------------|---------------|---------------|---------------|-------------------|------------------|---------|-------|-------|------------|
|   | MHz     | dBuV/m | dBuV/m        | dB            | dBuV          | dB            | dB/m              | dB               |         | cm    | deg   |            |
| 1 | 5143.60 | 51.53  | 54.00         | -2.47         | 14.43         | 3.43          | 33.67             | 0.00             | Average | 122   | 276   | HORIZONTAL |
| 2 | 5147.60 | 66.18  | 74.00         | -7.82         | 29.08         | 3.43          | 33.67             | 0.00             | Peak    | 122   | 276   | HORIZONTAL |
| 3 | 5174.00 | 85.28  | 54.00         |               |               | 3.44          | 33.70             | 0.00             | Average | 122   | 276   | HORIZONTAL |
| 4 | 5205.20 | 98.40  | 74.00         |               |               | 3.45          | 33.76             | 0.00             | Peak    | 122   | 276   | HORIZONTAL |

Item 3, 4 are the fundamental frequency at 5210 MHz.

Note:

Emission level (dBuV/m) = 20 log Emission level (uV/m)

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

## 4.7. Antenna Requirements

### 4.7.1. Limit

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

### 4.7.2. Antenna Connector Construction

Please refer to section 3.3 in this test report; antenna connector complied with the requirements.

## 5. LIST OF MEASURING EQUIPMENTS

| Instrument        | Manufacturer | Model No.     | Serial No.     | Characteristics  | Calibration Date | Remark                   |
|-------------------|--------------|---------------|----------------|------------------|------------------|--------------------------|
| BILOG ANTENNA     | Schaffner    | CBL6112D      | 22021          | 20MHz ~ 2GHz     | Jan. 11, 2013    | Radiation<br>(03CH01-CB) |
| forHorn Antenna   | EMCO         | 3115          | 00075790       | 750MHz~18GHz     | Nov. 27, 2012    | Radiation<br>(03CH01-CB) |
| Horn Antenna      | SCHWARZBEAK  | BBHA 9170     | BBHA9170252    | 15GHz ~ 40GHz    | Nov. 23, 2012    | Radiation<br>(03CH01-CB) |
| Pre-Amplifier     | Agilent      | 8447D         | 2944A10991     | 0.1MHz ~ 1.3GHz  | Nov. 27, 2012    | Radiation<br>(03CH01-CB) |
| Pre-Amplifier     | Agilent      | 8449B         | 3008A02310     | 1GHz ~ 26.5GHz   | Nov. 23, 2012    | Radiation<br>(03CH01-CB) |
| Pre-Amplifier     | WM           | TF-130N-R1    | 923365         | 26.5GHz ~ 40GHz  | Jul. 31, 2012    | Radiation<br>(03CH01-CB) |
| Spectrum analyzer | R&S          | FSP40         | 100056         | 9KHz~40GHz       | Nov. 16, 2012    | Radiation<br>(03CH01-CB) |
| EMI Test Receiver | R&S          | ESCS 30       | 100355         | 9KHz ~ 2.75GHz   | Mar. 20, 2012    | Radiation<br>(03CH01-CB) |
| Turn Table        | INN CO       | CO 2000       | N/A            | 0 ~ 360 degree   | N.C.R            | Radiation<br>(03CH01-CB) |
| Antenna Mast      | INN CO       | CO2000        | N/A            | 1 m - 4 m        | N.C.R            | Radiation<br>(03CH01-CB) |
| RF Cable-low      | Woken        | Low Cable-1   | N/A            | 30 MHz - 1 GHz   | Nov. 18, 2012    | Radiation<br>(03CH01-CB) |
| RF Cable-high     | Woken        | High Cable-1  | N/A            | 1 GHz – 26.5 GHz | Nov. 18, 2012    | Radiation<br>(03CH01-CB) |
| RF Cable-high     | Woken        | High Cable-2  | N/A            | 1 GHz – 26.5 GHz | Nov. 18, 2012    | Radiation<br>(03CH01-CB) |
| RF Cable-high     | Woken        | High Cable-3  | N/A            | 1 GHz - 40 GHz   | Nov. 18, 2012    | Radiation<br>(03CH01-CB) |
| RF Cable-high     | Woken        | High Cable-4  | N/A            | 1 GHz - 40 GHz   | Nov. 18, 2012    | Radiation<br>(03CH01-CB) |
| Signal analyzer   | R&S          | FSV40         | 100979         | 9KHz~40GHz       | Oct. 08, 2012    | Conducted<br>(TH01-CB)   |
| RF Power Divider  | Woken        | 2 Way         | 0120A02056002D | 2GHz ~ 18GHz     | Nov. 18, 2012    | Conducted<br>(TH01-CB)   |
| RF Cable-high     | Woken        | High Cable-7  | -              | 1 GHz – 26.5 GHz | Nov. 19, 2012    | Conducted<br>(TH01-CB)   |
| RF Cable-high     | Woken        | High Cable-8  | -              | 1 GHz – 26.5 GHz | Nov. 19, 2012    | Conducted<br>(TH01-CB)   |
| RF Cable-high     | Woken        | High Cable-9  | -              | 1 GHz – 26.5 GHz | Nov. 19, 2012    | Conducted<br>(TH01-CB)   |
| RF Cable-high     | Woken        | High Cable-10 | -              | 1 GHz – 26.5 GHz | Nov. 19, 2012    | Conducted<br>(TH01-CB)   |
| RF Cable-high     | Woken        | High Cable-11 | -              | 1 GHz – 26.5 GHz | Nov. 19, 2012    | Conducted<br>(TH01-CB)   |
| Power Sensor      | Anritsu      | MA2411B       | 0917223        | 300MHz~40GHz     | Nov. 28, 2012    | Conducted<br>(TH01-CB)   |
| Power Meter       | Anritsu      | ML2495A       | 1035008        | 300MHz~40GHz     | Nov. 27, 2012    | Conducted<br>(TH01-CB)   |

Note: Calibration Interval of instruments listed above is one year.

NCR means Non-Calibration required.

## 6. TEST LOCATION

|        |  |
|--------|--|
| SHIJR  | ADD : 6Fl., No. 106, Sec. 1, Shintai 5th Rd., Shijr City, Taipei, Taiwan 221, R.O.C.<br>TEL : 886-2-2696-2468<br>FAX : 886-2-2696-2255 |
| HWA YA | ADD : No. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.<br>TEL : 886-3-327-3456<br>FAX : 886-3-318-0055         |
| LINKOU | ADD : No. 30-2, Dingfu Tsuen, Linkou Shiang, Taipei, Taiwan 244, R.O.C<br>TEL : 886-2-2601-1640<br>FAX : 886-2-2601-1695               |
| DUNGHU | ADD : No. 3, Lane 238, Kangle St., Neihu Chiu, Taipei, Taiwan 114, R.O.C.<br>TEL : 886-2-2631-4739<br>FAX : 886-2-2631-9740            |
| JUNGHE | ADD : 7Fl., No. 758, Jungjeng Rd., Junghe City, Taipei, Taiwan 235, R.O.C.<br>TEL : 886-2-8227-2020<br>FAX : 886-2-8227-2626           |
| NEIHU  | ADD : 4Fl., No. 339, Hsin Hu 2 <sup>nd</sup> Rd., Taipei 114, Taiwan, R.O.C.<br>TEL : 886-2-2794-8886<br>FAX : 886-2-2794-9777         |
| JHUBEI | ADD : No.8, Lane 724, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C.<br>TEL : 886-3-656-9065<br>FAX : 886-3-656-9085       |