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## FCC RADIO TEST REPORT

|                        |                                                                                                |
|------------------------|------------------------------------------------------------------------------------------------|
| Applicant's company    | ASUSTeK COMPUTER INC.                                                                          |
| Applicant Address      | 4F, No. 150, Li-Te Rd., Peitou, Taipei 112, Taiwan                                             |
| FCC ID                 | MSQ-RTAC87U                                                                                    |
| Manufacturer's company | Compal Networking (KunShan) Co., LTD.                                                          |
| Manufacturer Address   | No. 520, Nabbang Rd., Economic & Technical Development Zone<br>Kunshan, Jiangsu Province China |

|                   |                                       |
|-------------------|---------------------------------------|
| Product Name      | Dual-band Wireless-AC Router          |
| Brand Name        | ASUS                                  |
| Model No.         | RT-AC87U, RT-AC87R                    |
| Test Rule Part(s) | 47 CFR FCC Part 15 Subpart E § 15.407 |
| Test Freq. Range  | 5150 ~ 5250 MHz / 5725 ~ 5850 MHz     |
| Received Date     | May 05, 2014                          |
| Final Test Date   | Mar. 18, 2016                         |
| Submission Type   | Class II Change                       |

### Statement

Test result included is for the IEEE 802.11n and IEEE 802.11a/ac 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 C63.10-2013, 47 CFR FCC Part 15 Subpart E, KDB789033 D02 v01r01, KDB662911 D01 v02r01, KDB644545 D03 v01, ET Docket No. 13-49; FCC 16-24.

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



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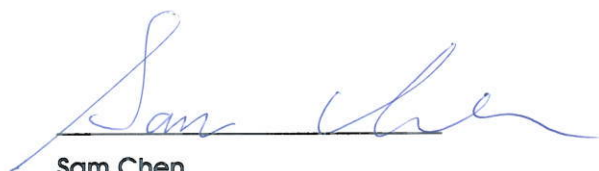
## History of This Test Report

| REPORT NO.    | VERSION | DESCRIPTION             | ISSUED DATE   |
|---------------|---------|-------------------------|---------------|
| FR450542-07AB | Rev. 01 | Initial issue of report | Apr. 29, 2016 |
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## 1. VERIFICATION OF COMPLIANCE

Product Name : Dual-band Wireless-AC Router  
Brand Name : ASUS  
Model No. : RT-AC87U, RT-AC87R  
Applicant : ASUSTeK COMPUTER 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 May 05, 2014 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.



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                                            | 15.207       | AC Power Line Conducted Emissions                  | Complies | 16.96 dB    |
| 4.2                                            | 15.407(a)    | 26dB Spectrum Bandwidth and 99% Occupied Bandwidth | Complies | -           |
| 4.3                                            | 15.407(a)    | Power Spectral Density                             | Complies | 0.96 dB     |
| 4.4                                            | 15.407(b)    | Radiated Emissions                                 | Complies | 4.39 dB     |
| 4.5                                            | 15.407(g)    | Frequency Stability                                | Complies | -           |
| 4.6                                            | 15.203       | Antenna Requirements                               | Complies | -           |

### 3. GENERAL INFORMATION

#### 3.1. Product Details

| Items                    | Description                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product Type             | WLAN (4TX, 4RX)                                                                                                                                                                                                                                                                                                                                                                                                     |
| Radio Type               | Intentional Transceiver                                                                                                                                                                                                                                                                                                                                                                                             |
| Power Type               | From power adapter                                                                                                                                                                                                                                                                                                                                                                                                  |
| Modulation               | IEEE 802.11a: OFDM<br>IEEE 802.11n/ac: see the below table                                                                                                                                                                                                                                                                                                                                                          |
| Data Modulation          | IEEE 802.11a/n: OFDM (BPSK / QPSK / 16QAM / 64QAM)<br>IEEE 802.11ac: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)                                                                                                                                                                                                                                                                                                    |
| Data Rate (Mbps)         | IEEE 802.11a: OFDM (6/9/12/18/24/36/48/54)<br>IEEE 802.11n/ac: see the below table                                                                                                                                                                                                                                                                                                                                  |
| Frequency Range          | 5150 ~ 5250 MHz / 5725 ~ 5850 MHz                                                                                                                                                                                                                                                                                                                                                                                   |
| Channel Number           | 9 for 20MHz bandwidth ; 4 for 40MHz bandwidth<br>2 for 80MHz bandwidth                                                                                                                                                                                                                                                                                                                                              |
| Channel Band Width (99%) | <b>&lt;For Non-Beamforming Mode&gt;</b><br>Band 4:<br>IEEE 802.11a: 16.85 MHz<br>IEEE 802.11ac MCS0/Nss1 (VHT20): 18.15 MHz<br>IEEE 802.11ac MCS0/Nss1 (VHT40): 37.77 MHz<br>IEEE 802.11ac MCS0/Nss1 (VHT80): 76.12 MHz<br><b>&lt;For Beamforming Mode&gt;</b><br>Band 4:<br>IEEE 802.11ac MCS0/Nss1 (VHT20): 17.97 MHz<br>IEEE 802.11ac MCS0/Nss1 (VHT40): 37.19 MHz<br>IEEE 802.11ac MCS0/Nss1 (VHT80): 74.96 MHz |
| Carrier Frequencies      | Please refer to section 3.4                                                                                                                                                                                                                                                                                                                                                                                         |
| Antenna                  | Please refer to section 3.3                                                                                                                                                                                                                                                                                                                                                                                         |

| Items                | Description                                               |                                              |
|----------------------|-----------------------------------------------------------|----------------------------------------------|
| Communication Mode   | <input checked="" type="checkbox"/> IP Based (Load Based) | <input type="checkbox"/> Frame Based         |
| Beamforming Function | <input checked="" type="checkbox"/> With beamforming      | <input type="checkbox"/> Without beamforming |
| Operate Condition    | <input checked="" type="checkbox"/> Indoor                | <input type="checkbox"/> Outdoor             |

Note: The product has beamforming function for 802.11n/ac in 2.4GHz / 5GHz.

### Antenna and Band width

| Antenna         | Four (TX) |        |        |
|-----------------|-----------|--------|--------|
| Band width Mode | 20 MHz    | 40 MHz | 80 MHz |
| IEEE 802.11a    | V         | X      | X      |
| IEEE 802.11n    | V         | V      | X      |
| IEEE 802.11ac   | V         | V      | V      |

### IEEE 11n/ac Spec.

| Protocol         | Number of Transmit Chains (NTX) | Data Rate / MCS |
|------------------|---------------------------------|-----------------|
| 802.11n (HT20)   | 4                               | MCS 0-31        |
| 802.11n (HT40)   | 4                               | MCS 0-31        |
| 802.11ac (VHT20) | 4                               | MCS0-9/Nss1-4   |
| 802.11ac (VHT40) | 4                               | MCS0-9/Nss1-4   |
| 802.11ac (VHT80) | 4                               | MCS0-9/Nss1-4   |

Note 1: IEEE Std. 802.11n modulation consists of HT20 and HT40 (HT: High Throughput).

Then EUT supports HT20 and HT40.

Note 2: IEEE Std. 802.11ac modulation consists of VHT20, VHT40, VHT80 and VHT160 (VHT: Very High Throughput). Then EUT supports VHT20, VHT40 and VHT80.

Note 3: Modulation modes consist of below configuration:

HT20/HT40: IEEE 802.11n, VHT20/VHT40/VHT80: IEEE 802.11ac

## 3.2. Accessories

| Power                       | Brand | Model      | Rating                                             |
|-----------------------------|-------|------------|----------------------------------------------------|
| Adapter 1                   | ASUS  | AD883J20   | Input: 100-240V~50-60Hz 1.0A<br>Output: 19V, 2.37A |
| Adapter 2                   | ASUS  | ADP-45BW B | Input: 100-240V~50-60Hz 1.2A<br>Output: 19V, 2.37A |
| Others                      |       |            |                                                    |
| RJ-45 Cable: Shielded, 1.5m |       |            |                                                    |

### 3.3. Table for Filed Antenna

| Ant. | Brand  | Model Name         | Antenna Type   | Connector    | Gain (dBi) |             |             |
|------|--------|--------------------|----------------|--------------|------------|-------------|-------------|
|      |        |                    |                |              | 2.4GHz     | 5GHz Band 1 | 5GHz Band 4 |
| 1    | M.gear | C660-510310-A      | Dipole Antenna | Reversed-SMA | 3.66       | 3.24        | 3.29        |
|      | PSA    | RFDPA171300SBLB803 | Dipole Antenna | Reversed-SMA | 2.85       | 2.75        | 3.26        |
| 2    | M.gear | C660-510310-A      | Dipole Antenna | Reversed-SMA | 3.66       | 3.24        | 3.29        |
|      | PSA    | RFDPA171300SBLB803 | Dipole Antenna | Reversed-SMA | 2.85       | 2.75        | 3.26        |
| 3    | M.gear | C660-510310-A      | Dipole Antenna | Reversed-SMA | 3.66       | 3.24        | 3.29        |
|      | PSA    | RFDPA171300SBLB803 | Dipole Antenna | Reversed-SMA | 2.85       | 2.75        | 3.26        |
| 4    | M.gear | C660-510310-A      | Dipole Antenna | Reversed-SMA | -          | 3.24        | 3.29        |
|      | PSA    | RFDPA171300SBLB803 | Dipole Antenna | Reversed-SMA | -          | 2.75        | 3.26        |

Note: M.gear antennas and PSA antennas are the same type antennas, only the higher gain antennas "M.gear" Antenna" was tested and recorded in the report.

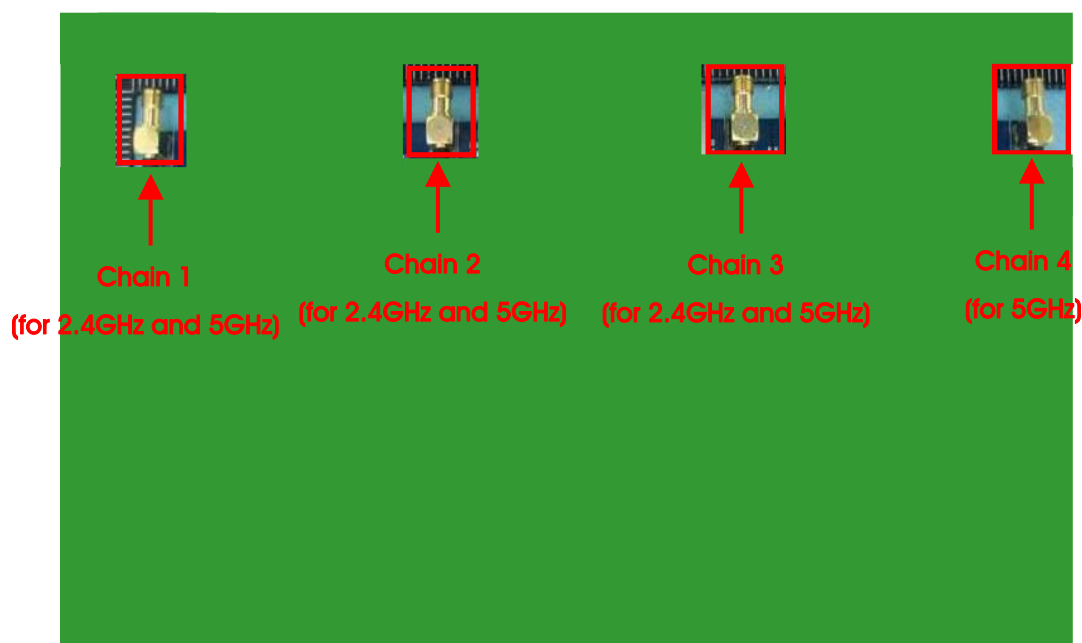
Chain 1: Connect to Ant. 1, Chain 2: Connect to Ant. 2, Chain 3: Connect to Ant. 3 and Chain 4: Connect to Ant. 4.

**For 2.4GHz WLAN function (3TX/3RX):**

Chain 1, Chain 2 and Chain 3 could transmit/receive simultaneously.

**For 5GHz WLAN function (4TX/4RX):**

Chain 1, Chain 2, Chain 3 and Chain 4 could transmit/receive simultaneously.



### 3.4. Table for Carrier Frequencies

There are three bandwidth systems.

For 20MHz bandwidth systems, use Channel 36, 40, 44, 48, 149, 153, 157, 161, 165.

For 40MHz bandwidth systems, use Channel 38, 46, 151, 159.

For 80MHz bandwidth systems, use Channel 42, 155.

| Frequency Band          | Channel No. | Frequency | Channel No. | Frequency |
|-------------------------|-------------|-----------|-------------|-----------|
| 5150~5250 MHz<br>Band 1 | 36          | 5180 MHz  | 44          | 5220 MHz  |
|                         | 38          | 5190 MHz  | 46          | 5230 MHz  |
|                         | 40          | 5200 MHz  | 48          | 5240 MHz  |
|                         | 42          | 5210 MHz  | -           | -         |
| 5725~5850 MHz<br>Band 4 | 149         | 5745 MHz  | 157         | 5785 MHz  |
|                         | 151         | 5755 MHz  | 159         | 5795 MHz  |
|                         | 153         | 5765 MHz  | 161         | 5805 MHz  |
|                         | 155         | 5775 MHz  | 165         | 5825 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     | Chain   |
|--------------------------------------------------------------|----------------------------|--------|-----------|-------------|---------|
| AC Power Conducted Emission                                  | CTX                        |        | -         | -           | -       |
| Power Spectral Density                                       | <For Non-Beamforming Mode> |        |           |             |         |
|                                                              | 11a/BPSK                   | Band 4 | 6Mbps     | 149/157/165 | 1+2+3+4 |
|                                                              | 11ac VHT20                 | Band 4 | MCS0/Nss1 | 149/157/165 | 1+2+3+4 |
|                                                              | 11ac VHT40                 | Band 4 | MCS0/Nss1 | 151/159     | 1+2+3+4 |
|                                                              | 11ac VHT80                 | Band 4 | MCS0/Nss1 | 155         | 1+2+3+4 |
|                                                              | <For Beamforming Mode>     |        |           |             |         |
|                                                              | 11ac VHT20                 | Band 4 | MCS0/Nss1 | 149/157/165 | 1+2+3+4 |
|                                                              | 11ac VHT40                 | Band 4 | MCS0/Nss1 | 151/159     | 1+2+3+4 |
|                                                              | 11ac VHT80                 | Band 4 | MCS0/Nss1 | 155         | 1+2+3+4 |
|                                                              | <For Non-Beamforming Mode> |        |           |             |         |
| 26dB Spectrum Bandwidth & 99% Occupied Bandwidth Measurement | 11a/BPSK                   | Band 4 | 6Mbps     | 149/157/165 | 1+2+3+4 |
|                                                              | 11ac VHT20                 | Band 4 | MCS0/Nss1 | 149/157/165 | 1+2+3+4 |
|                                                              | 11ac VHT40                 | Band 4 | MCS0/Nss1 | 151/159     | 1+2+3+4 |
|                                                              | 11ac VHT80                 | Band 4 | MCS0/Nss1 | 155         | 1+2+3+4 |
|                                                              | <For Beamforming Mode>     |        |           |             |         |
|                                                              | 11ac VHT20                 | Band 4 | MCS0/Nss1 | 149/157/165 | 1+2+3+4 |
|                                                              | 11ac VHT40                 | Band 4 | MCS0/Nss1 | 151/159     | 1+2+3+4 |
|                                                              | 11ac VHT80                 | Band 4 | MCS0/Nss1 | 155         | 1+2+3+4 |
|                                                              | <For Non-Beamforming Mode> |        |           |             |         |
|                                                              | 11a/BPSK                   | Band 4 | 6Mbps     | 149/157/165 | 1+2+3+4 |
| Radiated Emission Below 1GHz                                 | CTX                        |        | -         | -           | -       |
| Frequency Stability                                          | 20 MHz                     | Band 4 | -         | 40/157      | 1       |
|                                                              | 40 MHz                     | Band 4 | -         | 38/151      | 1       |
|                                                              | 80 MHz                     | Band 4 | -         | 42/155      | 1       |

Note 1: VHT20/VHT40 covers HT20/HT40, due to same modulation. The power setting for 802.11n HT20 and HT40 are the same or lower than 802.11ac VHT20 and VHT40.

Note 2: There are two modes of EUT, one is beamforming mode, and the other is non-beamforming mode, Beamforming mode and non-beamforming mode has been test and record in this test report.

The following test modes were performed for all tests:

There are two version of EUT, one is EUT "Rev1.50", the other one is EUT "Rev1.60".

EUT "Rev1.50" has been evaluated to be the worst case after evaluating.

Consequently, measurement for all test will follow this same test mode.

#### For Conducted Emission test:

Mode 1. 2.4GHz CTX - EUT "Rev1.50" + Adapter 2

Mode 2. 5GHz CTX - EUT "Rev1.50" + Adapter 2

Mode 2 has been evaluated to be the worst case among Mode 1~2, thus measurement for Mode 3 will follow this same test mode.

Mode 3. 5GHz CTX - EUT "Rev1.50" + Adapter 1

Mode 3 is the worst case, so it was selected to record in this test report.

#### For Radiated Emissions Below 1GHz test:

Mode 1. 2.4GHz CTX - EUT "Rev1.50" + Adapter 1

Mode 2. 5GHz CTX - EUT "Rev1.50" + Adapter 1

Mode 1 has been evaluated to be the worst case among Mode 1~2, thus measurement for Mode 3 will follow this same test mode.

Mode 3. 2.4GHz CTX - EUT "Rev1.50" + Adapter 2

Mode 1 is the worst case, so it was selected to record in this test report.

#### For other test:

Mode 1. CTX - EUT "Rev1.50"

### 3.6. Table for Testing Locations

| Test Site Location |                                                                            |          |                     |             |              |
|--------------------|----------------------------------------------------------------------------|----------|---------------------|-------------|--------------|
| Address:           | 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.      | Site Category                                                              | Location | FCC Designation No. | IC File No. | VCCI Reg. No |
| 03CH01-CB          | SAC                                                                        | Hsin Chu | TW0006              | IC 4086D    | -            |
| CO01-CB            | Conduction                                                                 | Hsin Chu | TW0006              | IC 4086D    | -            |
| TH01-CB            | OVEN Room                                                                  | Hsin Chu | -                   | -           | -            |

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

### 3.7. Table for Multiple Listing

The EUT has two model names which are identical to each other in all aspects except for the following table:

| Model No. | Description                                                                      |
|-----------|----------------------------------------------------------------------------------|
| RT-AC87U  | All the models are identical, the difference model served as marketing strategy. |
| RT-AC87R  |                                                                                  |

From the above models, model: RT-AC87U was selected as representative model for the test and its data was recorded in this report.

### 3.8. Table for Class II Change

This product is an extension of original one reported under Sporton project number: FR450542

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

#### Modifications:

- A. Adding EUT version Rev1.60. The difference between original EUT "Rev1.50" and new EUT "Rev1.60" as below:

| EUT version            | Description                                                                                                                                                                               |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Original EUT "Rev1.50" | Original                                                                                                                                                                                  |
| New EUT "Rev1.60"      | <ol style="list-style-type: none"> <li>1. Adding a TVS (D1).</li> <li>2. Adding a snubber circuit (C267, R266, R267).</li> <li>3. Adding a snubber circuit (C266, R264, R265).</li> </ol> |

- B. Changing the adapter 1 (model: AD883J20). The difference between original adapter 1 and new adapter 1 as below:

| Original adapter 1 | New adapter 1  |
|--------------------|----------------|
| Type: 010KLF BAH   | Type: 010K-3LF |

- C. Changing the adapter 2 (model: ADP-45BW B). The difference between original adapter 2 and new adapter 2 as below:

| Original adapter 2 |           |                   |                                          |
|--------------------|-----------|-------------------|------------------------------------------|
| Design No          | MFG TITLE | MFG PART          | DESCRIPTION                              |
| Q1                 | AUK       | SMK0760F          | FET 600V 7A 1.2ohm TO-220F-3P            |
| Q1                 | ST        | STP6NK60ZFP       | FET 600V 6A 1.2ohm TO-220FP-3P           |
| Q1                 | TOSHIBA   | TK10A60DR(STA4,X) | FET 600V 10A 750mohm TO-220SIS-3P        |
| D101               | ST        | STPS20S100CT      | DIO SBD 20A 100V TO-220AB-3P C.C.        |
| D101               | ST        | STPS20SM100ST     | DIO SBD 20A 100V TO-220AB-3P             |
| D101               | ST        | STPS30SM100ST     | DIO SBD 30A 100V TO-220AB-3P             |
| IC31               | ON        | DAP022ASN65T1G    | IC ASIC PWM CURRENT MODE TSOP-6P SMD     |
| IC131              | TI        | TL432BIDBZR       | IC VOL REF ADJ 2.495V 100mA 0.5%         |
| IC131              | NXP       | TL431BMFDT        | IC VOL REF ADJ 2.495V 100mA 0.5%         |
| IC131              | DIODES    | AS431ANTR-G1      | IC VOL REF ADJ 2.5V 100mA 0.5% SOT-23-3P |

| IC32          | EVERLIGHT   | EL816M(Y)(D)-VG      | PHOTO TR 50mA 80V DIP-4P 150%-300%       |
|---------------|-------------|----------------------|------------------------------------------|
| IC32          | SHARP       | PC123Y92FZ0F         | PHOTO TR 50mA 70V DIP-4P 160%-300%       |
| IC32          | Renesas     | PS2561DL1-1Y-V-A(G)  | EOL PHOTO TR 40mA 80V DIP-4P 150%-300%   |
| CX1           | EUROPTRONIC | MPX2224K30B15LXD20   | CAP X2 MP PC 305VAC 0.22uF K S15         |
| CX1           | OKAYA       | LE224-MX-30-C3.2     | CAP X2 MP PC 300VAC 0.22uF K S15         |
| CX1           | HUA         | MKP-224K0275AB115S-G | CAP X2 MP PC 275VAC 0.22uF K S15         |
| FL1           | DELTA       | HFV-MP13202          | LINE FILTER T14 14mH MIN                 |
| FL101         | DELTA       | LFV-MP13303          | LINE FILTER T10 17uH MIN                 |
| T1            | DELTA       | MV-MP13167           | TRANSFORMER MAIN RM10 1mH +/-5%          |
| C1            | NICHICON    | UPT2G680MHD3         | CAP AL 400V 68uF M 16*25 P7.5            |
| C1            | NCC         | EKMG401ELL680ML25S   | CAP AL 400V 68uF M 16*25 P7.5            |
| C1            | L-Tec       | TYJ2GM680K25O        | CAP AL 400V 68uF M 16*25 P7.5            |
| CY1           | MURATA      | DE1B3KX221KNHAN99F   | CAP Y1/X1 CD 250VAC 220pF K B TP VI10    |
| CY1           | TDK         | CD70-B2GA221KYVK     | CAP Y1/X1 CD 250VAC 220pF K B TP VI10    |
| CY1           | WALSIN      | YP0AH221K061DASDAB   | CAP Y1/X1 CD 250VAC 220pF K B TP VI10    |
| New adapter 2 |             |                      |                                          |
| Design No     | MFG TITLE   | MFG PART             | DESCRIPTION                              |
| Q1            | TOSHIBA     | TK10A60DR(STA4,X)    | FET 600V 10A 750mohm TO-220SIS-3P        |
| Q1            | FUJI        | FMV11N60ES           | FET 600V 11A 750mohm TO-220F-3P          |
| D101          | ST          | STPS20S100CT         | DIO SBD 20A 100V TO-220AB-3P C.C.        |
| D101          | ST          | STPS20H100CT         | DIO SBD 20A 100V TO-220AB-3P C.C.        |
| D101          | ST          | STPS30H100CT         | DIO SBD 30A 100V TO-220AB-3P C.C.        |
| IC31          | NeoEnergy   | DAPO22AT             | IC ASIC PWM CURRENT MODE SOT-26-6P SMD   |
| IC131         | LITE-ON     | LA431OCRPA           | IC REGU ADJ 2.495V 100mA 0.4% SOT-23R-3P |
| IC131         | TI          | TL432BIDBZR          | IC VOL REF ADJ 2.495V 100mA 0.5%         |
| IC131         | NXP         | TL431BMFDT           | IC VOL REF ADJ 2.495V 100mA 0.5%         |
| IC32          | EVERLIGHT   | EL816M(Y)(D)-VG      | PHOTO TR 50mA 80V DIP-4P 150%-300%       |
| IC32          | SHARP       | PC123Y92FZ0F         | PHOTO TR 50mA 70V DIP-4P 160%-300%       |
| IC32          | TOSHIBA     | TLP785F(D4-GRH,F     | PHOTO TR 60mA 80V DIP-4P 150%-300%       |
| CX1           | HUA         | MKP-334K0275AB115S-G | CAP X2 MP PC 275VAC 0.33uF K S15         |
| CX1           | HUA         | MKP-334K0275AB115S-P | CAP X2 MP PC 275VAC 0.33uF K S15         |
| CX1           | EUROPTRONIC | MPX2334K30B15LXD31   | CAP X2 MP PC 305VAC 0.33uF K S15         |
| FL1           | DELTA       | HFV-MP15027          | LINE FILTER T16 12.7mH MIN               |
| FL101         | DELTA       | LFV-MP13171          | LINE FILTER T6 1.55uH MIN                |
| T1            | DELTA       | MV-MP15037           | TRANSFORMER MAIN RM10 1000uH +/-5%       |
| C1            | NCC         | EKMG401ELL680ML25S   | CAP AL 400V 68uF M 16*25 P7.5            |
| CY1           | MURATA      | DE1B3KX221KNHAN99F   | CAP Y1/X1 CD 250VAC 220pF K B TP VI10    |

|     |        |                    |                                       |
|-----|--------|--------------------|---------------------------------------|
| CY1 | WALSIN | YP0AH221K061DASDAB | CAP Y1/X1 CD 250VAC 220pF K B TP VI10 |
|-----|--------|--------------------|---------------------------------------|

#### Performance Checking for above change:

- AC Power Line Conducted Emissions.
- Radiated Emissions Below 1GHz.

D. Updating test rule of 5GHz band 4 to "15.407 (b)(4)(ii) of New Rules (ET Docket No. 13-49; FCC 16-24)" from "Old Rules".

#### Performance Checking

- AC Conducted Emissions
- Radiated Emissions below 1GHz
- 26dB Bandwidth and 99% Occupied Bandwidth
- Power Spectral Density Measurement
- Frequency Stability

Note: The above test items will be based on original output power to re-test.

### 3.9. Table for Supporting Units

#### For Test Site No: 03CH01-CB

| Support Unit | Brand | Model | FCC ID |
|--------------|-------|-------|--------|
| Notebook     | DELL  | E4300 | DoC    |

#### For Test Site No: CO01-CB

| Support Unit | Brand | Model | FCC ID |
|--------------|-------|-------|--------|
| Notebook     | DELL  | E6430 | DoC    |

#### For Test Site No: TH01-CB

| Support Unit | Brand | Model | FCC ID |
|--------------|-------|-------|--------|
| Notebook     | DELL  | E4300 | DoC    |

### 3.10. EUT Operation during Test

#### For non-beamforming mode:

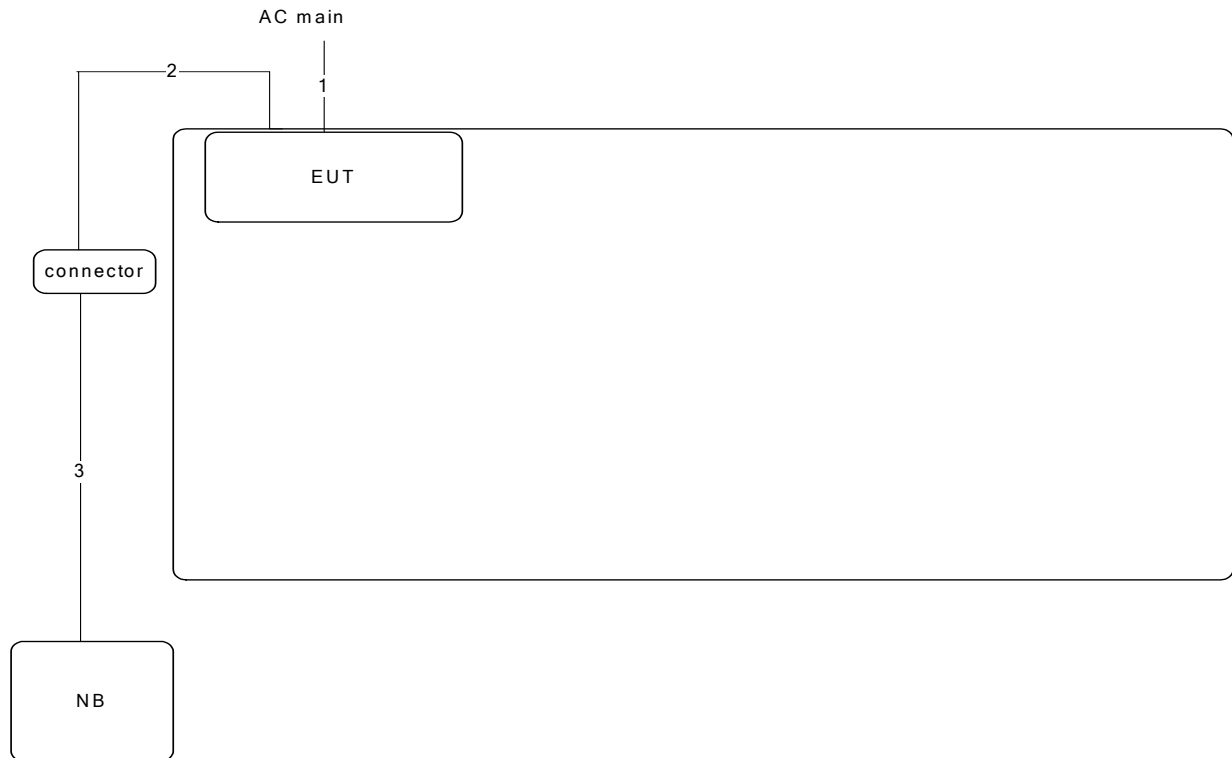
The EUT was programmed to be in continuously transmitting mode.

#### For beamforming mode:

The EUT was programmed to be in continuously transmitting mode.

### 3.11. Test Configurations

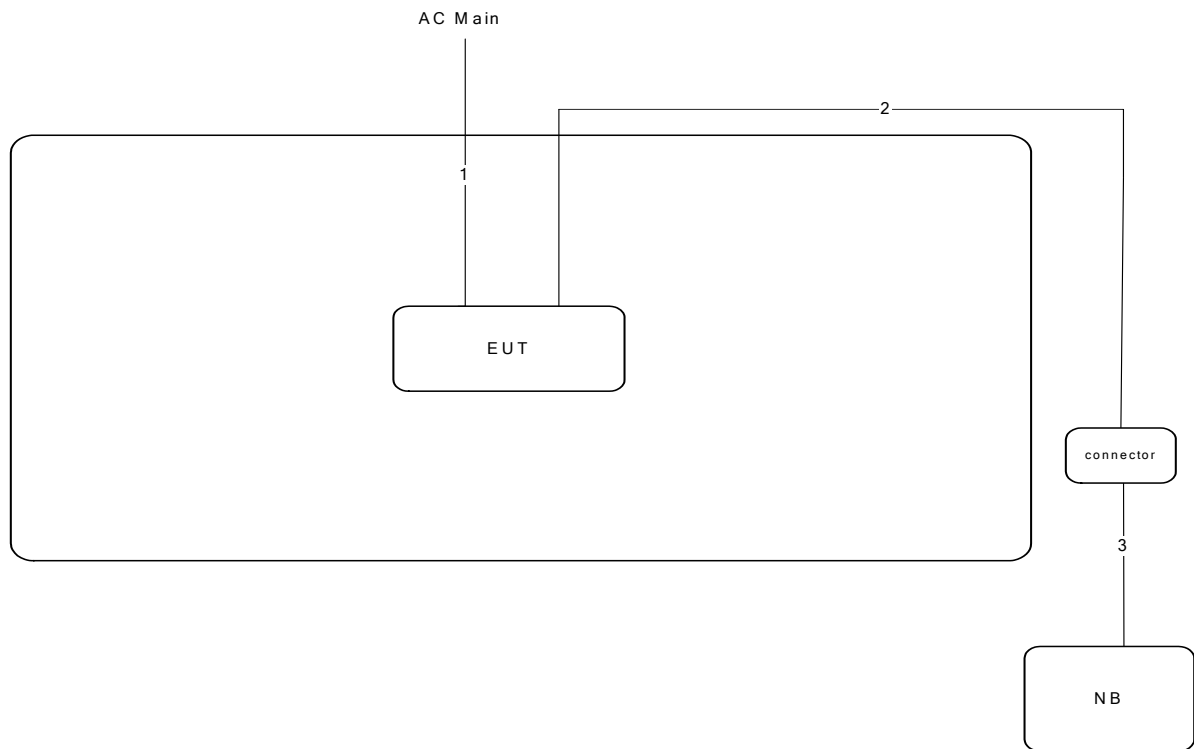
#### 3.11.1. AC Power Line Conduction Emissions Test Configuration



| Item | Connection  | Shielded | Length |
|------|-------------|----------|--------|
| 1    | Power cable | No       | 2.3m   |
| 2    | RJ-45 cable | Yes      | 1.5m   |
| 3    | RJ-45 cable | No       | 10m    |

### 3.11.2. Radiation Emissions Test Configuration

Test Configuration: 30MHz ~1GHz



| Item | Connection  | Shielded | Length |
|------|-------------|----------|--------|
| 1    | Power cable | No       | 2.3m   |
| 2    | RJ-45 cable | No       | 10m    |
| 3    | RJ-45 cable | Yes      | 1.5m   |

## 4. TEST RESULT

### 4.1. AC Power Line Conducted Emissions Measurement

#### 4.1.1. Limit

For this product that is designed to connect to the AC power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed below limits table.

| 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              |

#### 4.1.2. Measuring Instruments and Setting

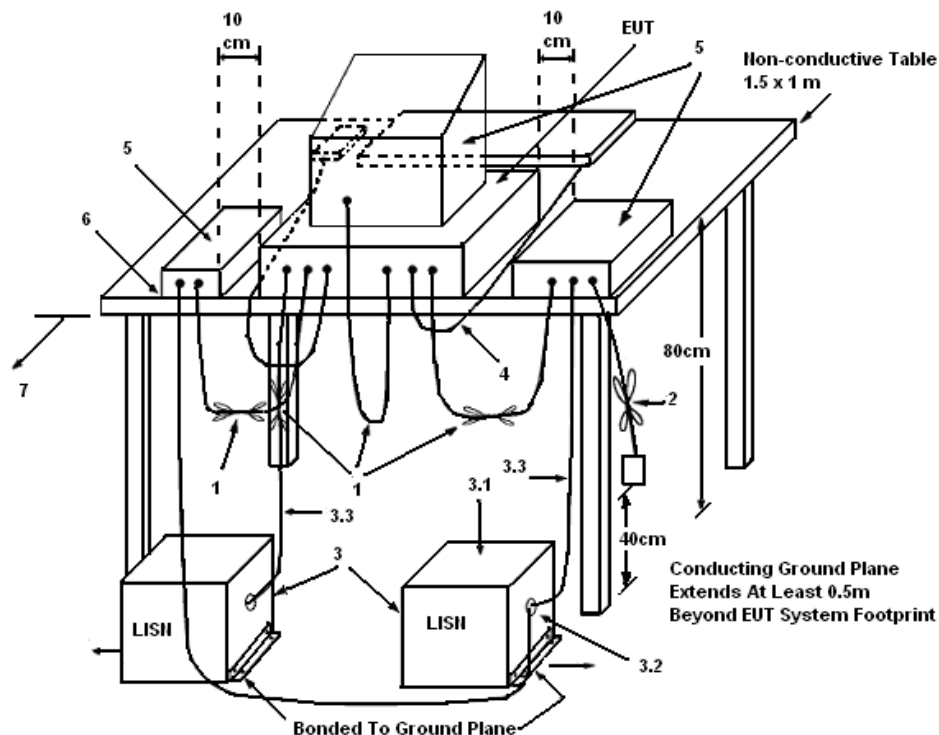
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

| Receiver Parameters | Setting  |
|---------------------|----------|
| Attenuation         | 10 dB    |
| Start Frequency     | 0.15 MHz |
| Stop Frequency      | 30 MHz   |
| IF Bandwidth        | 9 kHz    |

#### 4.1.3. Test Procedures

1. Configure the EUT according to ANSI C63.10. The EUT or host of EUT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT or host of EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connected to the other LISNs. The LISN should provide 50uH/50ohms coupling impedance.
4. The frequency range from 150 kHz to 30 MHz was searched.
5. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. The measurement has to be done between each power line and ground at the power terminal.

#### 4.1.4. Test Setup Layout



##### LEGEND:

- (1) Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- (2) I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- (3) EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50  $\Omega$ . LISN can be placed on top of, or immediately beneath, reference ground plane.
  - (3.1) All other equipment powered from additional LISN(s).
  - (3.2) Multiple outlet strip can be used for multiple power cords of non-EUT equipment.
  - (3.3) LISN at least 80 cm from nearest part of EUT chassis.
- (4) Cables of hand-operated devices, such as keyboards, mice, etc., shall be placed as for normal use.
- (5) Non-EUT components of EUT system being tested.
- (6) Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop.
- (7) Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane.

#### 4.1.5. Test Deviation

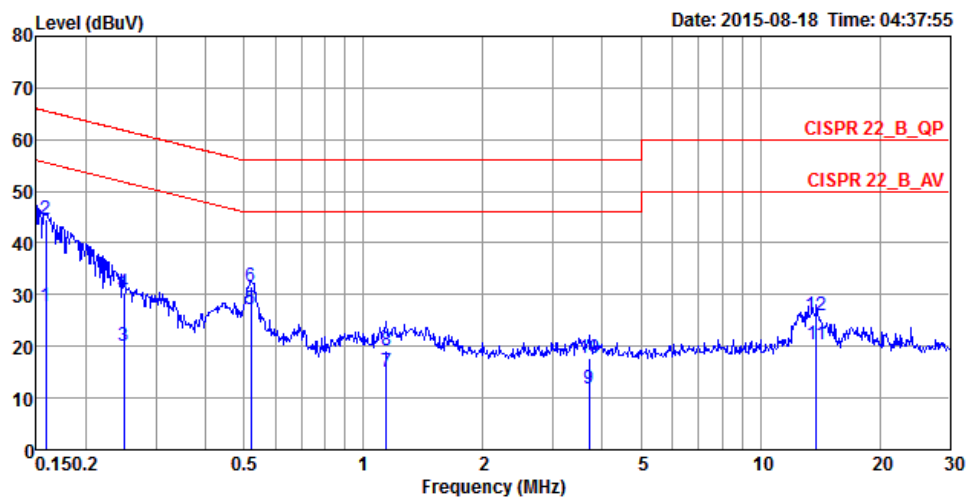
There is no deviation with the original standard.

#### 4.1.6. EUT Operation during Test

The EUT was placed on the test table and programmed in normal function.

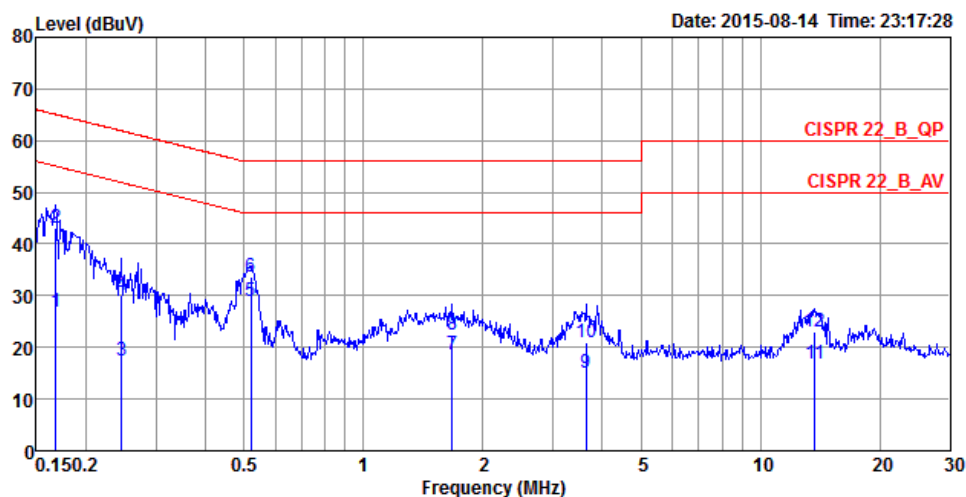
#### 4.1.7. Results of AC Power Line Conducted Emissions Measurement

|               |            |           |        |
|---------------|------------|-----------|--------|
| Temperature   | 25°C       | Humidity  | 56%    |
| Test Engineer | Edison Lin | Phase     | Line   |
| Configuration | CTX        | Test Mode | Mode 3 |



|    | Freq    | Level | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Pol/Phase | Remark  |
|----|---------|-------|------------|------------|------------|-------------|------------|-----------|---------|
|    | MHz     | dBuV  | dB         | dBuV       | dBuV       | dB          | dB         |           |         |
| 1  | 0.1582  | 27.68 | -27.88     | 55.56      | 17.73      | 9.93        | 0.02       | LINE      | Average |
| 2  | 0.1582  | 44.53 | -21.03     | 65.56      | 34.58      | 9.93        | 0.02       | LINE      | QP      |
| 3  | 0.2495  | 20.05 | -31.73     | 51.78      | 10.09      | 9.93        | 0.03       | LINE      | Average |
| 4  | 0.2495  | 30.54 | -31.24     | 61.78      | 20.58      | 9.93        | 0.03       | LINE      | QP      |
| 5  | 0.5210  | 27.03 | -18.97     | 46.00      | 17.05      | 9.94        | 0.04       | LINE      | Average |
| 6  | 0.5210  | 31.62 | -24.38     | 56.00      | 21.64      | 9.94        | 0.04       | LINE      | QP      |
| 7  | 1.1413  | 14.95 | -31.05     | 46.00      | 4.93       | 9.97        | 0.05       | LINE      | Average |
| 8  | 1.1413  | 19.06 | -36.94     | 56.00      | 9.04       | 9.97        | 0.05       | LINE      | QP      |
| 9  | 3.7001  | 11.88 | -34.12     | 46.00      | 1.80       | 10.02       | 0.06       | LINE      | Average |
| 10 | 3.7001  | 17.66 | -38.34     | 56.00      | 7.58       | 10.02       | 0.06       | LINE      | QP      |
| 11 | 13.8411 | 20.32 | -29.68     | 50.00      | 9.77       | 10.30       | 0.25       | LINE      | Average |
| 12 | 13.8411 | 25.90 | -34.10     | 60.00      | 15.35      | 10.30       | 0.25       | LINE      | QP      |

|               |            |           |         |
|---------------|------------|-----------|---------|
| Temperature   | 25°C       | Humidity  | 56%     |
| Test Engineer | Edison Lin | Phase     | Neutral |
| Configuration | CTX        | Test Mode | Mode 3  |



|    | Freq    | Level | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Pol/Phase | Remark  |
|----|---------|-------|------------|------------|------------|-------------|------------|-----------|---------|
|    | MHz     | dBuV  | dB         | dBuV       | dBuV       | dB          | dB         |           |         |
| 1  | 0.1677  | 27.00 | -28.08     | 55.08      | 17.20      | 9.78        | 0.02       | NEUTRAL   | Average |
| 2  | 0.1677  | 43.00 | -22.08     | 65.08      | 33.20      | 9.78        | 0.02       | NEUTRAL   | QP      |
| 3  | 0.2455  | 17.41 | -34.50     | 51.91      | 7.59       | 9.79        | 0.03       | NEUTRAL   | Average |
| 4  | 0.2455  | 30.06 | -31.85     | 61.91      | 20.24      | 9.79        | 0.03       | NEUTRAL   | QP      |
| 5  | 0.5210  | 29.04 | -16.96     | 46.00      | 19.20      | 9.80        | 0.04       | NEUTRAL   | Average |
| 6  | 0.5210  | 33.60 | -22.40     | 56.00      | 23.76      | 9.80        | 0.04       | NEUTRAL   | QP      |
| 7  | 1.6713  | 18.47 | -27.53     | 46.00      | 8.58       | 9.83        | 0.06       | NEUTRAL   | Average |
| 8  | 1.6713  | 22.55 | -33.45     | 56.00      | 12.66      | 9.83        | 0.06       | NEUTRAL   | QP      |
| 9  | 3.6418  | 15.17 | -30.83     | 46.00      | 5.24       | 9.87        | 0.06       | NEUTRAL   | Average |
| 10 | 3.6418  | 21.03 | -34.97     | 56.00      | 11.10      | 9.87        | 0.06       | NEUTRAL   | QP      |
| 11 | 13.6952 | 16.80 | -33.20     | 50.00      | 6.46       | 10.09       | 0.25       | NEUTRAL   | Average |
| 12 | 13.6952 | 23.16 | -36.84     | 60.00      | 12.82      | 10.09       | 0.25       | NEUTRAL   | QP      |

Note:

Level = Read Level + LISN Factor + Cable Loss.

## 4.2. 26dB Bandwidth and 99% Occupied Bandwidth Measurement

### 4.2.1. Limit

No restriction limits.

### 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.

| 26dB Bandwidth         |                                            |
|------------------------|--------------------------------------------|
| Spectrum Parameters    | Setting                                    |
| Attenuation            | Auto                                       |
| Span Frequency         | > 26dB Bandwidth                           |
| RBW                    | Approximately 1% of the emission bandwidth |
| VBW                    | VBW > RBW                                  |
| Detector               | Peak                                       |
| Trace                  | Max Hold                                   |
| Sweep Time             | Auto                                       |
| 99% Occupied Bandwidth |                                            |
| Spectrum Parameters    | Setting                                    |
| Span                   | 1.5 times to 5.0 times the OBW             |
| RBW                    | 1 % to 5 % of the OBW                      |
| VBW                    | $\geq 3 \times \text{RBW}$                 |
| Detector               | Peak                                       |
| Trace                  | Max Hold                                   |

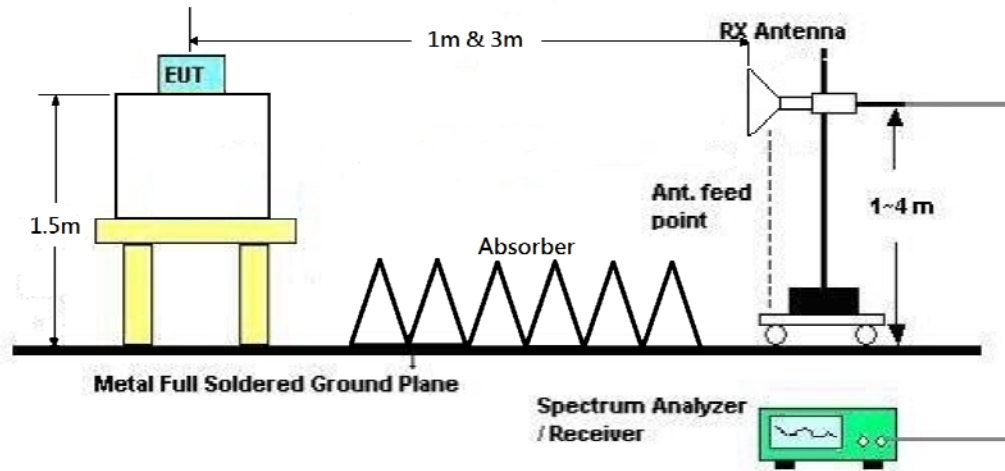
### 4.2.3. Test Procedures

For Radiated 26dB Bandwidth and 99% Occupied Bandwidth Measurement:

1. The transmitter was radiated 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%.

#### 4.2.4. Test Setup Layout

For Radiated 26dB Bandwidth and 99% Occupied Bandwidth Measurement:



#### 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 26dB Bandwidth and 99% Occupied Bandwidth

<For Non-Beamforming Mode>

|               |          |          |     |
|---------------|----------|----------|-----|
| Temperature   | 24°C     | Humidity | 62% |
| Test Engineer | Wen Chao |          |     |

| Mode                        | Frequency | 26dB Bandwidth (MHz) | 99% Occupied Bandwidth (MHz) |
|-----------------------------|-----------|----------------------|------------------------------|
| 802.11a                     | 5745 MHz  | 21.30                | 16.85                        |
|                             | 5785 MHz  | 20.78                | 16.67                        |
|                             | 5825 MHz  | 20.09                | 16.50                        |
| 802.11ac<br>MCS0/Nss1 VHT20 | 5745 MHz  | 22.26                | 18.06                        |
|                             | 5785 MHz  | 23.04                | 18.06                        |
|                             | 5825 MHz  | 23.91                | 18.15                        |
| 802.11ac<br>MCS0/Nss1 VHT40 | 5755 MHz  | 48.99                | 36.76                        |
|                             | 5795 MHz  | 64.49                | 37.77                        |
| 802.11ac<br>MCS0/Nss1 VHT80 | 5775 MHz  | 91.59                | 76.12                        |

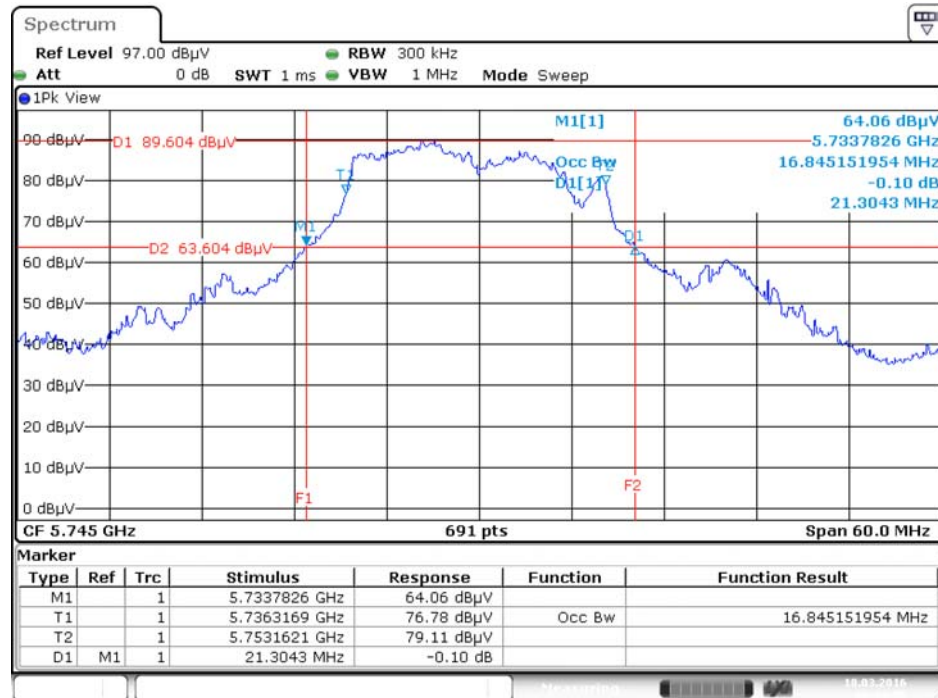
<For Beamforming Mode>

|               |          |          |     |
|---------------|----------|----------|-----|
| Temperature   | 24°C     | Humidity | 62% |
| Test Engineer | Wen Chao |          |     |

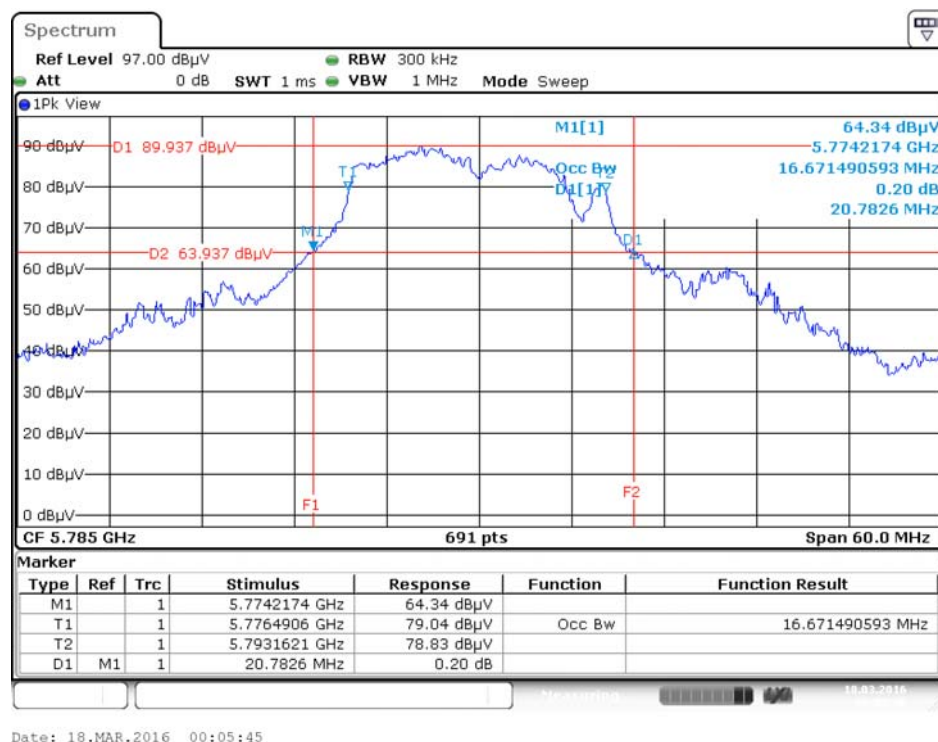
| Mode                        | Frequency | 26dB Bandwidth (MHz) | 99% Occupied Bandwidth (MHz) |
|-----------------------------|-----------|----------------------|------------------------------|
| 802.11ac<br>MCS0/Nss1 VHT20 | 5745 MHz  | 22.96                | 17.97                        |
|                             | 5785 MHz  | 23.13                | 17.97                        |
|                             | 5825 MHz  | 23.83                | 17.97                        |
| 802.11ac<br>MCS0/Nss1 VHT40 | 5755 MHz  | 43.33                | 37.19                        |
|                             | 5795 MHz  | 43.48                | 37.19                        |
| 802.11ac<br>MCS0/Nss1 VHT80 | 5775 MHz  | 78.84                | 74.96                        |

<For Non-Beamforming Mode>

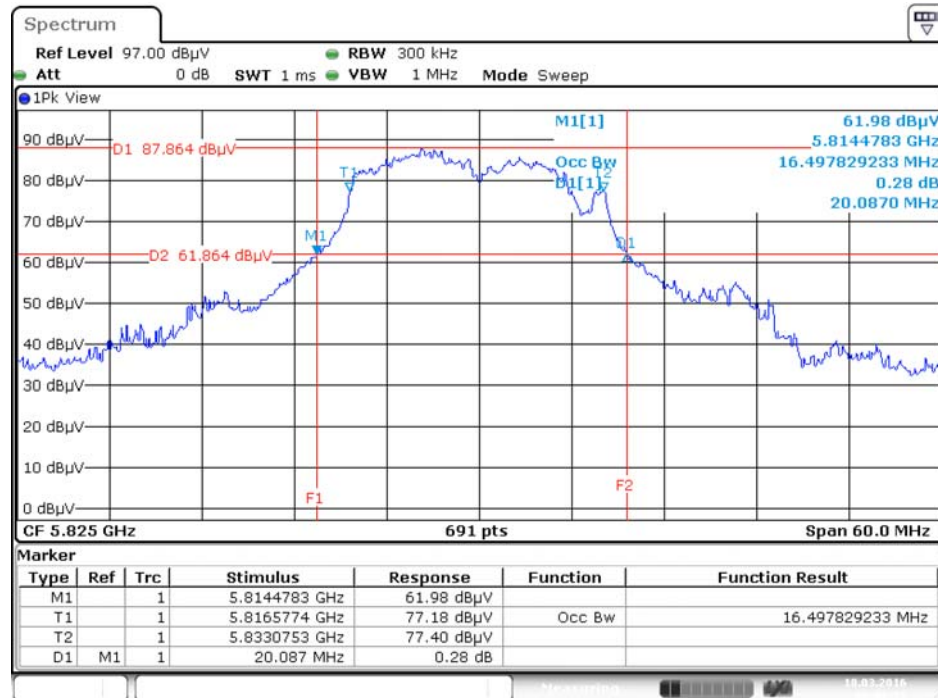
26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2  
+ Chain 3 + Chain 4 / 5745 MHz



26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2  
+ Chain 3 + Chain 4 / 5785 MHz

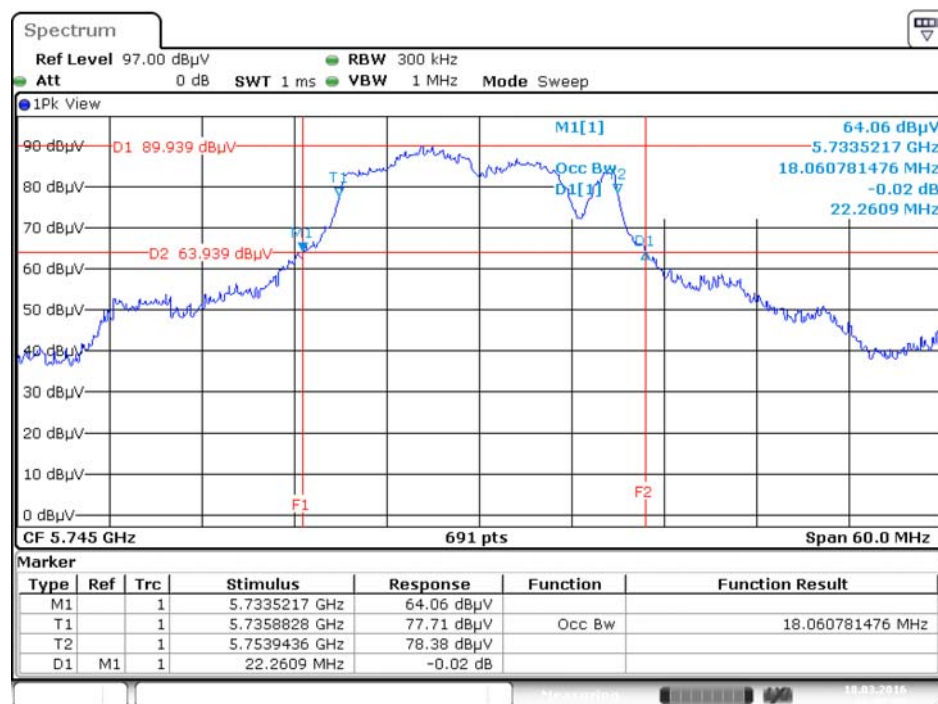


26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2  
+ Chain 3 + Chain 4 / 5825 MHz



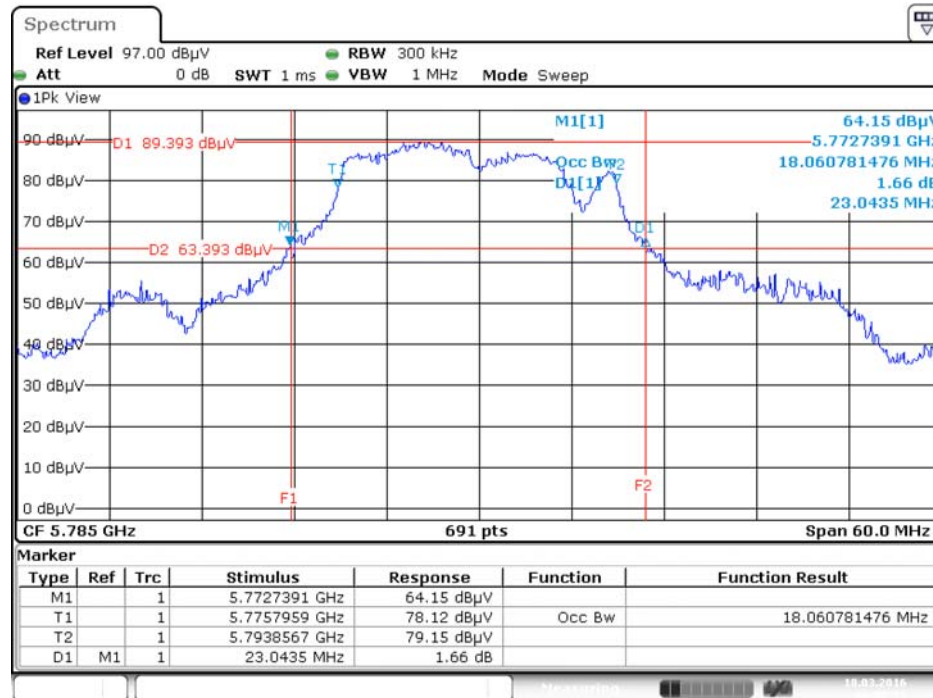
Date: 18.MAR.2016 00:06:11

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 /  
Chain 1 + Chain 2 + Chain 3 + Chain 4 / 5745 MHz

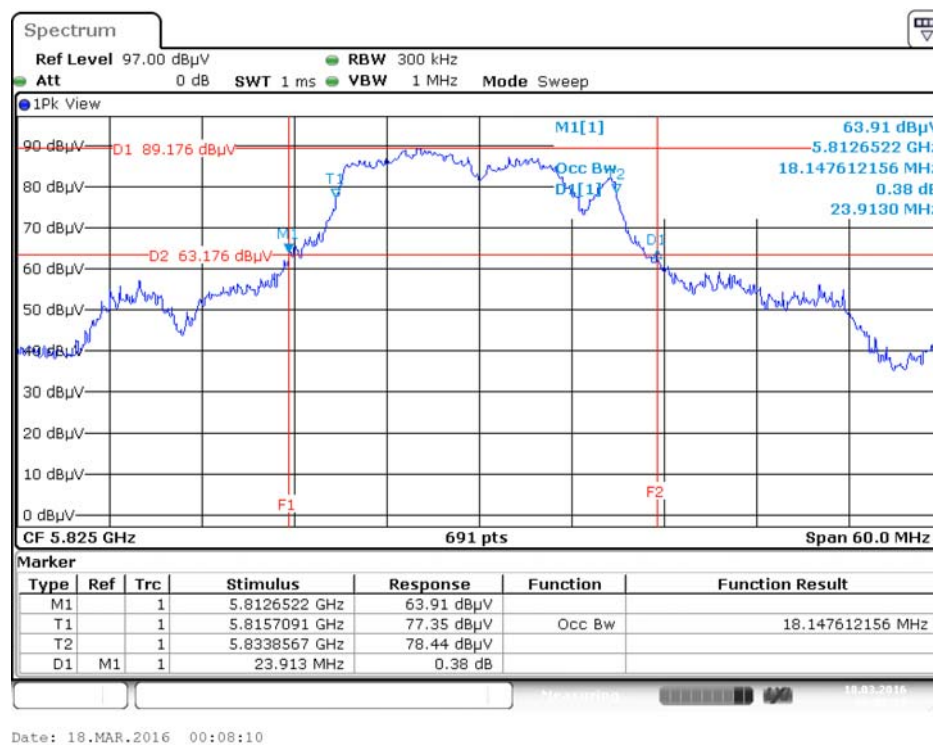


Date: 18.MAR.2016 00:07:28

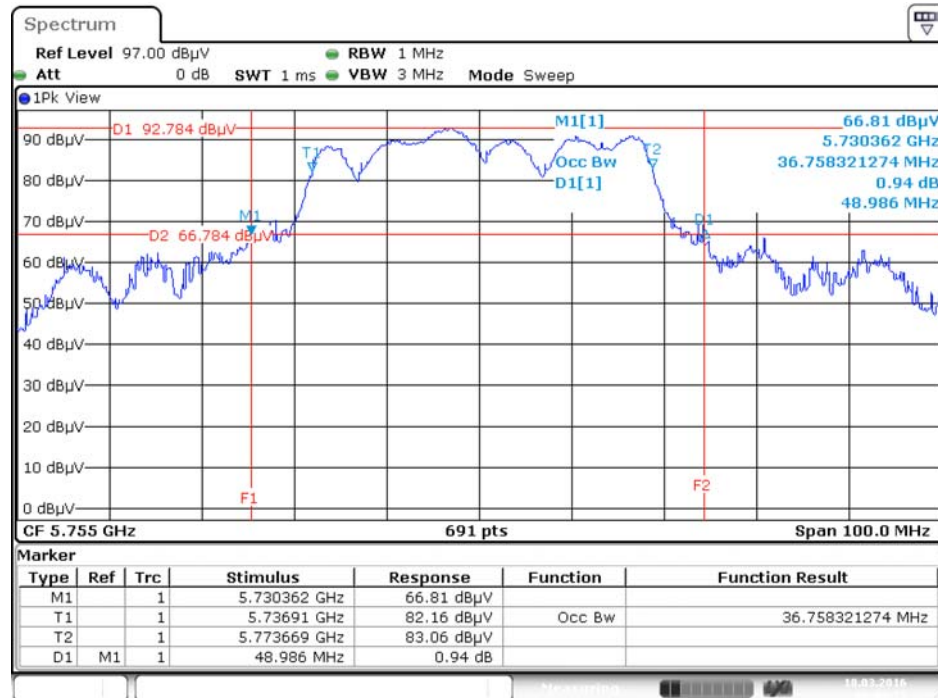
26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 + Chain 4 / 5785 MHz



26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 + Chain 4 / 5825 MHz

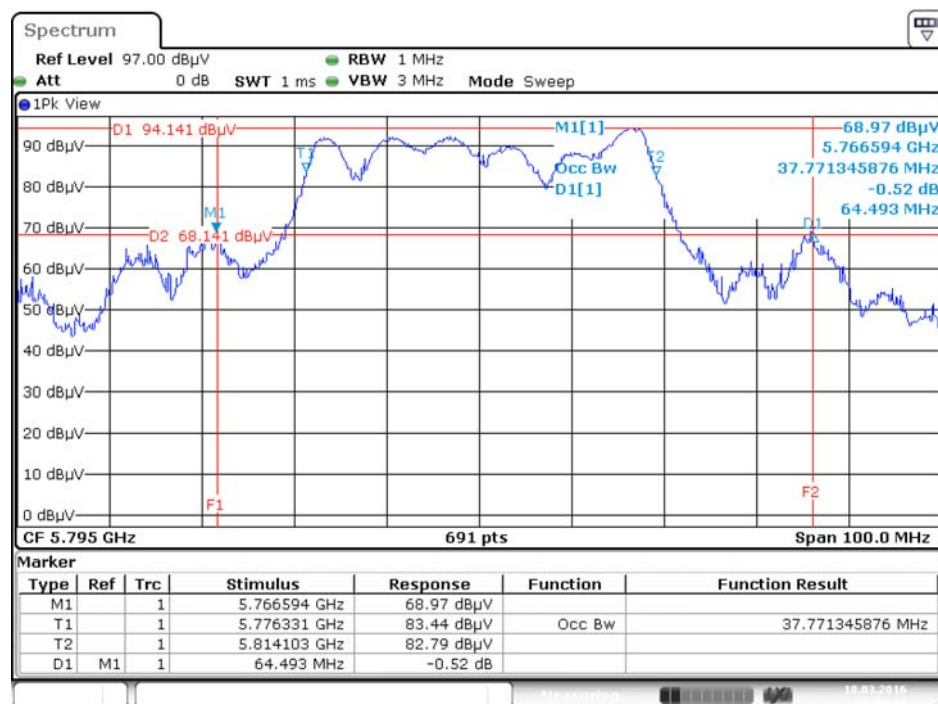


26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3 + Chain 4 / 5755 MHz



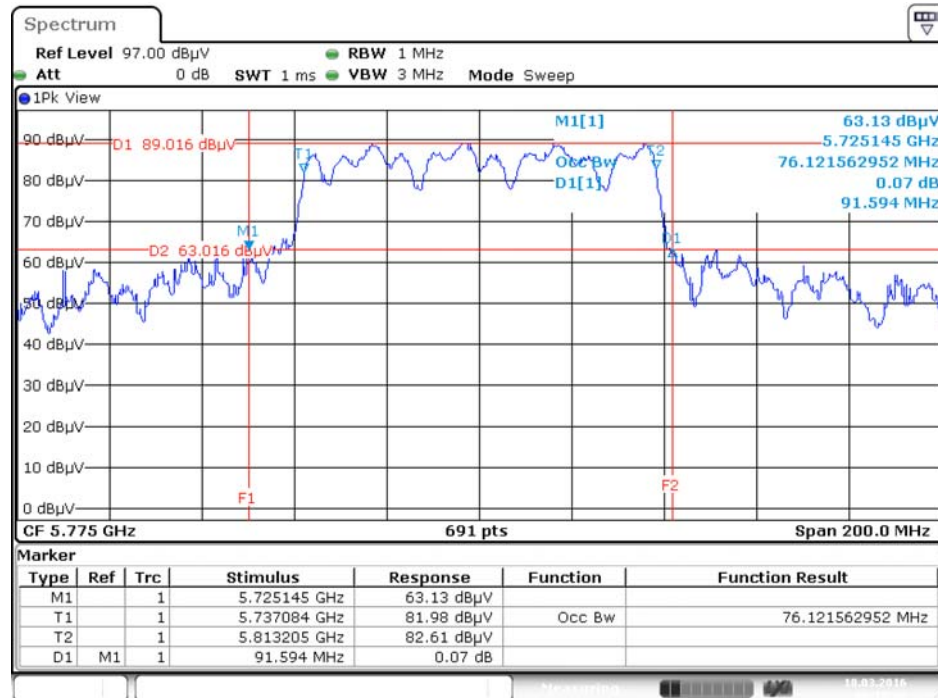
Date: 18.MAR.2016 00:09:21

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3 + Chain 4 / 5795 MHz



Date: 18.MAR.2016 00:09:41

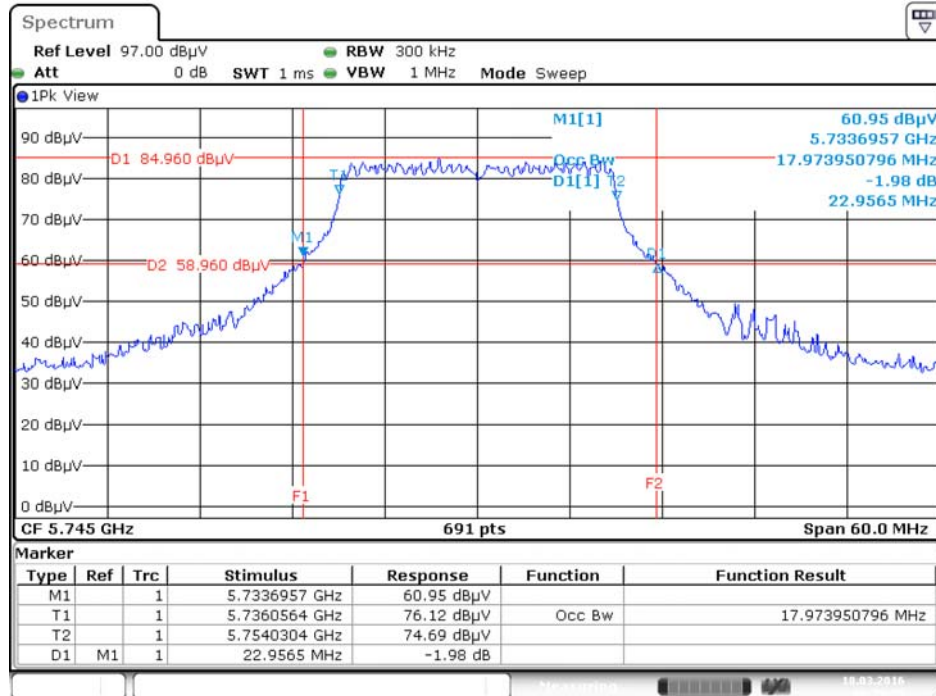
26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 + Chain 3 + Chain 4 / 5775 MHz



Date: 18.MAR.2016 00:10:47

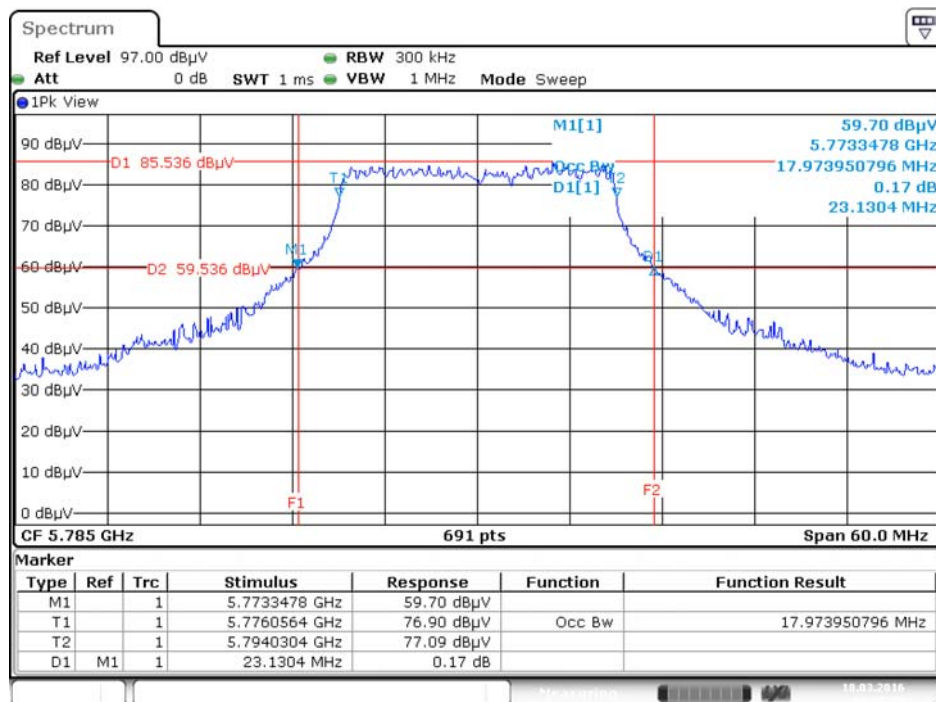
<For Beamforming Mode>

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 + Chain 4 / 5745 MHz



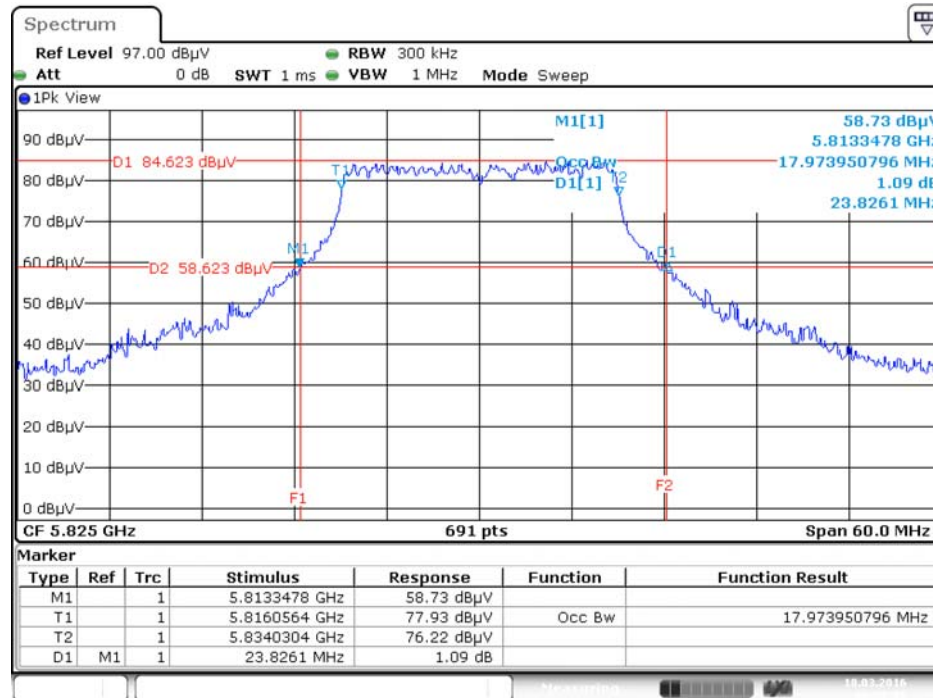
Date: 18.MAR.2016 00:29:25

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 + Chain 4 / 5785 MHz

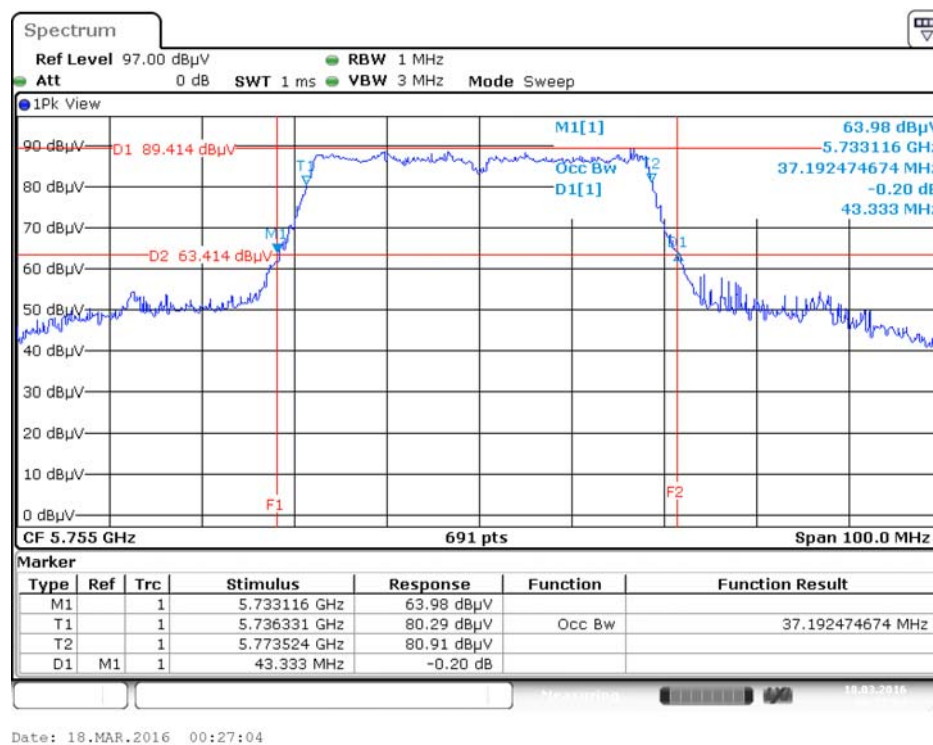


Date: 18.MAR.2016 00:28:53

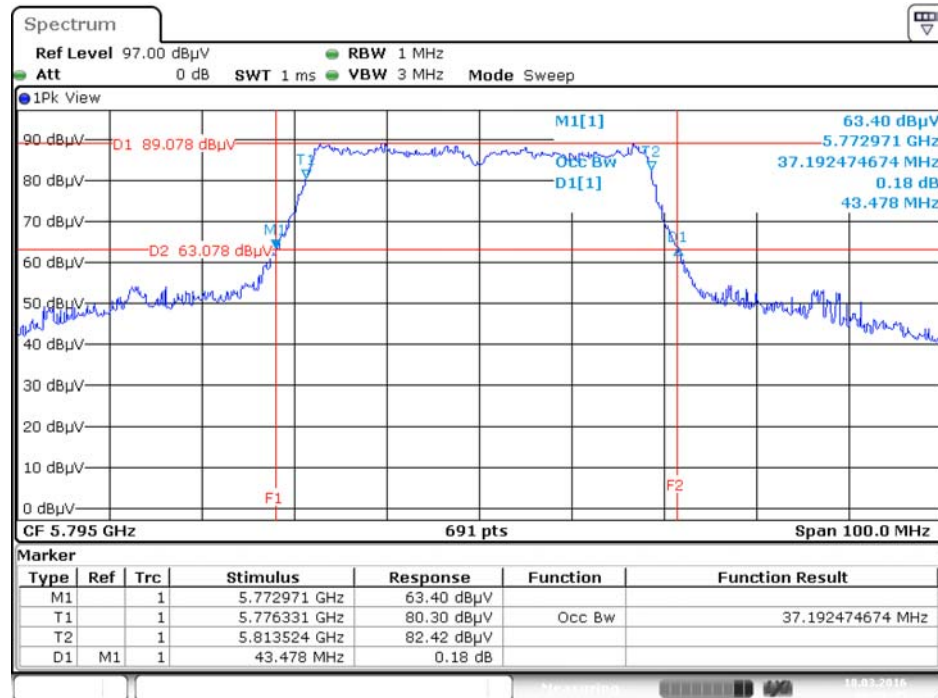
26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 + Chain 4 / 5825 MHz



26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3 + Chain 4 / 5755 MHz

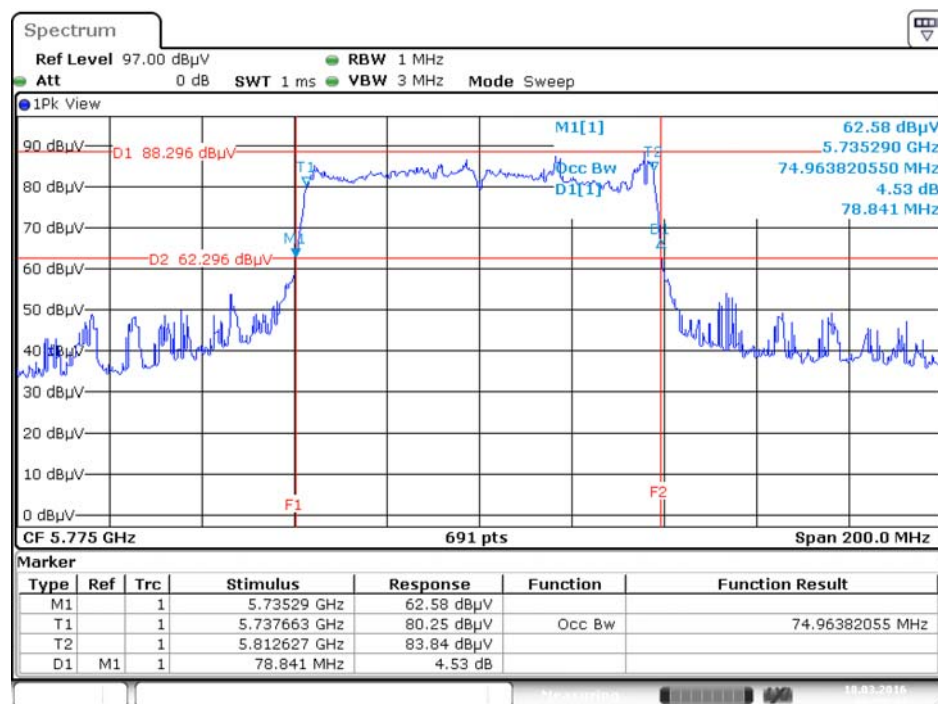


26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3 + Chain 4 / 5795 MHz



Date: 18.MAR.2016 00:26:45

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 + Chain 3 + Chain 4 / 5775 MHz



Date: 18.MAR.2016 00:25:42

### 4.3. Power Spectral Density Measurement

#### 4.3.1. Limit

| Frequency Band                      |                | Limit         |
|-------------------------------------|----------------|---------------|
| <input checked="" type="checkbox"/> | 5.725~5.85 GHz | 30 dBm/500kHz |

#### 4.3.2. Measuring Instruments and Setting

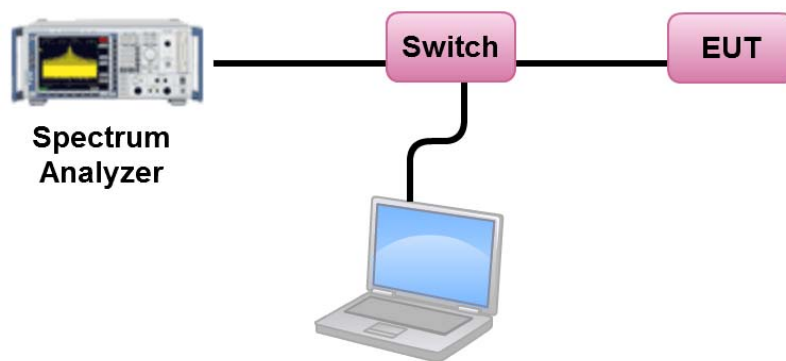
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

| Spectrum Parameter                                                                                                                                                                                                                                 | Setting                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| Attenuation                                                                                                                                                                                                                                        | Auto                                                         |
| Span Frequency                                                                                                                                                                                                                                     | Encompass the entire emissions bandwidth (EBW) of the signal |
| RBW                                                                                                                                                                                                                                                | 1000 kHz                                                     |
| VBW                                                                                                                                                                                                                                                | 3000 kHz                                                     |
| Detector                                                                                                                                                                                                                                           | RMS                                                          |
| Trace                                                                                                                                                                                                                                              | AVERAGE                                                      |
| Sweep Time                                                                                                                                                                                                                                         | Auto                                                         |
| Trace Average                                                                                                                                                                                                                                      | 100 times                                                    |
| Note: If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10\log(500\text{kHz}/\text{RBW})$ to the measured result, whereas RBW (< 500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement. |                                                              |

#### 4.3.3. Test Procedures

1. The transmitter output (antenna port) was connected RF switch to the spectrum analyzer.
2. Test was performed in accordance with KDB789033 D02 v01r01 for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - section (F) Maximum Power Spectral Density (PSD).
3. Multiple antenna systems was performed in accordance KDB662911 D01 v02r01 in-Band Power Spectral Density (PSD) Measurements and sum the spectra across the outputs.
4. For 5.725~5.85 GHz, the measured result of PSD level must add  $10\log(500\text{kHz}/\text{RBW})$  and the final result should  $\leq 30 \text{ dBm}$ .

#### 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

<For Non-Beamforming Mode>

|               |          |          |     |
|---------------|----------|----------|-----|
| Temperature   | 24°C     | Humidity | 62% |
| Test Engineer | Wen Chao |          |     |

| Mode      | Frequency | Power Density (dBm/3kHz) |         |         |         |       | 10log(500k<br>Hz/RBW)<br>Factor (dB) | Total Power<br>Density<br>(dBm/500kHz) | Power Density<br>Limit<br>(dBm/500kHz) | Result   |
|-----------|-----------|--------------------------|---------|---------|---------|-------|--------------------------------------|----------------------------------------|----------------------------------------|----------|
|           |           | Chain 1                  | Chain 2 | Chain 3 | Chain 4 | Total |                                      |                                        |                                        |          |
| 802.11a   | 5745 MHz  | -5.03                    | -2.88   | -6.01   | -3.44   | 1.85  | 22.22                                | 24.07                                  | 26.69                                  | Complies |
|           | 5785 MHz  | -5.39                    | -3.83   | -4.90   | -3.30   | 1.74  | 22.22                                | 23.96                                  | 26.69                                  | Complies |
|           | 5825 MHz  | -6.87                    | -6.99   | -6.69   | -2.64   | 0.66  | 22.22                                | 22.88                                  | 26.69                                  | Complies |
| 802.11ac  | 5745 MHz  | -2.89                    | -2.95   | -3.67   | -0.99   | 3.52  | 22.22                                | 25.73                                  | 26.69                                  | Complies |
| MCS0/Nss1 | 5785 MHz  | -3.70                    | -3.12   | -4.51   | -3.13   | 2.44  | 22.22                                | 24.66                                  | 26.69                                  | Complies |
| VHT20     | 5825 MHz  | -4.15                    | -3.04   | -3.81   | -3.38   | 2.45  | 22.22                                | 24.66                                  | 26.69                                  | Complies |
| 802.11ac  | 5755 MHz  | -6.84                    | -5.60   | -6.17   | -3.81   | 0.57  | 22.22                                | 22.79                                  | 26.69                                  | Complies |
| MCS0/Nss1 | 5795 MHz  | -5.75                    | -5.47   | -5.98   | -3.38   | 1.01  | 22.22                                | 23.23                                  | 26.69                                  | Complies |
| VHT40     |           |                          |         |         |         |       |                                      |                                        |                                        |          |
| 802.11ac  | 5775 MHz  | -9.00                    | -5.45   | -9.54   | -5.01   | -0.77 | 22.22                                | 21.45                                  | 26.69                                  | Complies |
| MCS0/Nss1 |           |                          |         |         |         |       |                                      |                                        |                                        |          |
| VHT80     |           |                          |         |         |         |       |                                      |                                        |                                        |          |

Note:  $DirectionalGain = 10 \cdot \log \left[ \frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right] = 9.31 \text{ dBi} > 6 \text{ dBi}$ , So Limit = 30-(9.31-6)=26.69dBm/500kHz.

## &lt;For Beamforming Mode&gt;

|               |          |          |     |
|---------------|----------|----------|-----|
| Temperature   | 24°C     | Humidity | 62% |
| Test Engineer | Wen Chao |          |     |

| Mode                           | Frequency | Power Density (dBm/3kHz) |         |         |         |       | 10log(500k Hz/RBW) Factor (dB) | Total Power Density (dBm/500kHz) | Power Density Limit (dBm/500kHz) | Result   |
|--------------------------------|-----------|--------------------------|---------|---------|---------|-------|--------------------------------|----------------------------------|----------------------------------|----------|
|                                |           | Chain 1                  | Chain 2 | Chain 3 | Chain 4 | Total |                                |                                  |                                  |          |
| 802.11ac<br>MCS0/Nss1<br>VHT20 | 5745 MHz  | -5.67                    | -6.28   | -5.89   | -6.03   | 0.06  | 22.22                          | 22.28                            | 26.69                            | Complies |
|                                | 5785 MHz  | -5.96                    | -6.54   | -6.13   | -6.35   | -0.22 | 22.22                          | 22.00                            | 26.69                            | Complies |
|                                | 5825 MHz  | -6.49                    | -5.12   | -6.66   | -5.95   | 0.01  | 22.22                          | 22.23                            | 26.69                            | Complies |
| 802.11ac<br>MCS0/Nss1<br>VHT40 | 5755 MHz  | -8.18                    | -9.80   | -8.54   | -9.02   | -2.82 | 22.22                          | 19.40                            | 26.69                            | Complies |
|                                | 5795 MHz  | -9.07                    | -8.18   | -8.11   | -8.96   | -2.54 | 22.22                          | 19.68                            | 26.69                            | Complies |
| 802.11ac<br>MCS0/Nss1<br>VHT80 | 5775 MHz  | -11.41                   | -9.36   | -7.64   | -8.48   | -2.99 | 22.22                          | 19.23                            | 26.69                            | Complies |

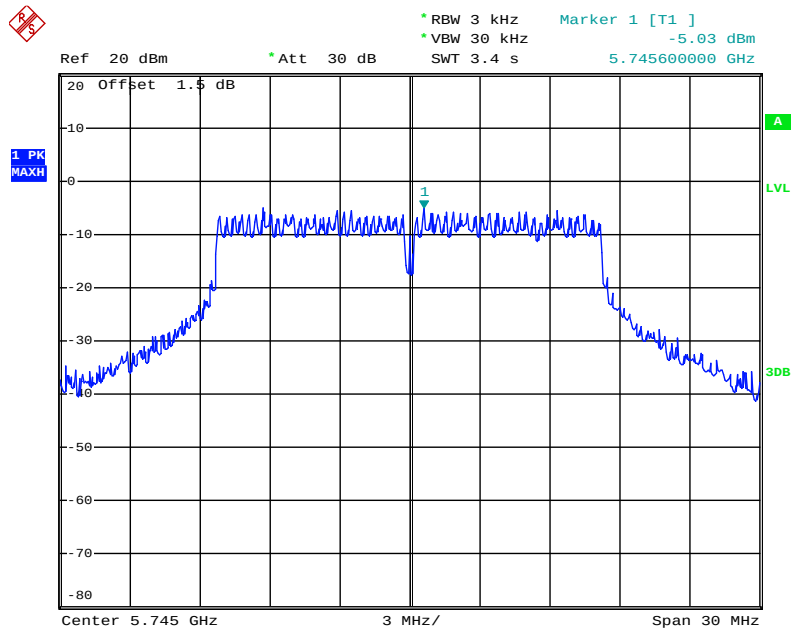
Note:  $DirectionalGain = 10 \cdot \log \left[ \frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right] = 9.31 \text{ dBi} > 6 \text{ dBi}$ , So Limit = 30-(9.31-6)=26.69dBm/500kHz.

Note: All the test values were listed in the report.

For plots, only the channel with worse result was shown.

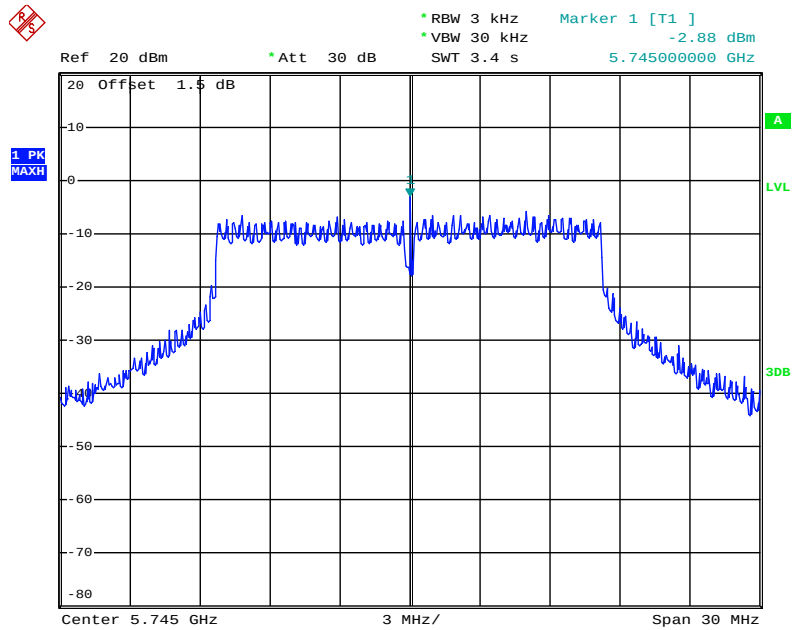
<For Non-Beamforming Mode>

### Power Density Plot on Configuration IEEE 802.11a / Chain 1 / 5745 MHz



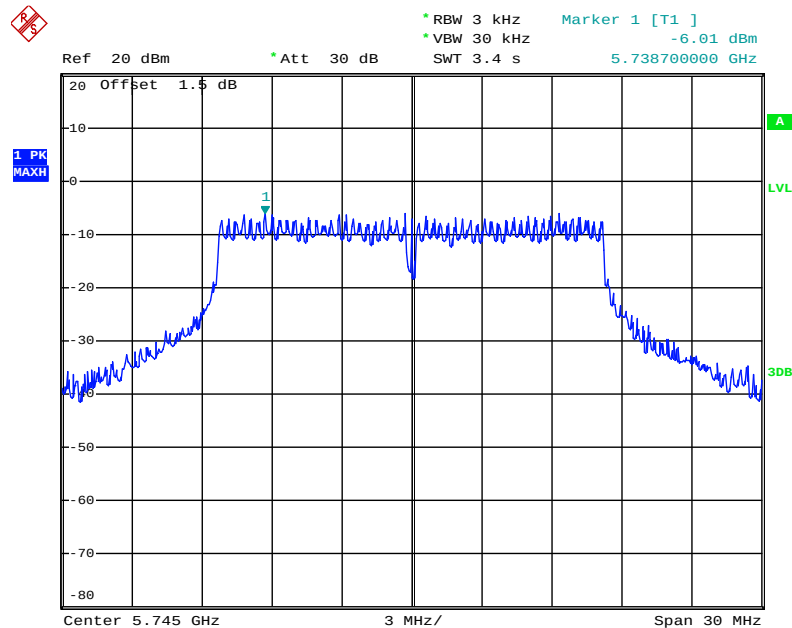
Date: 31.MAY.2014 06:56:30

### Power Density Plot on Configuration IEEE 802.11a / Chain 2 / 5745 MHz



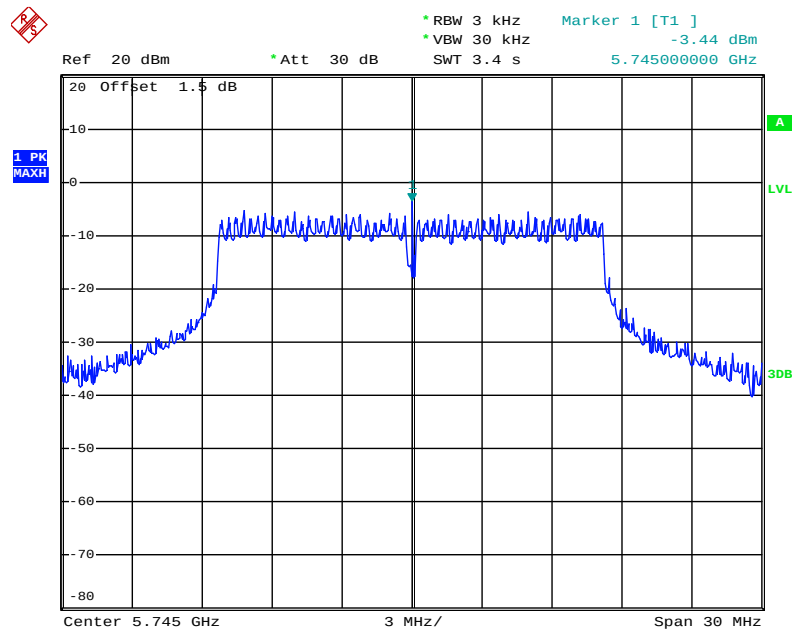
Date: 31.MAY.2014 06:58:19

### Power Density Plot on Configuration IEEE 802.11a / Chain 3 / 5745 MHz



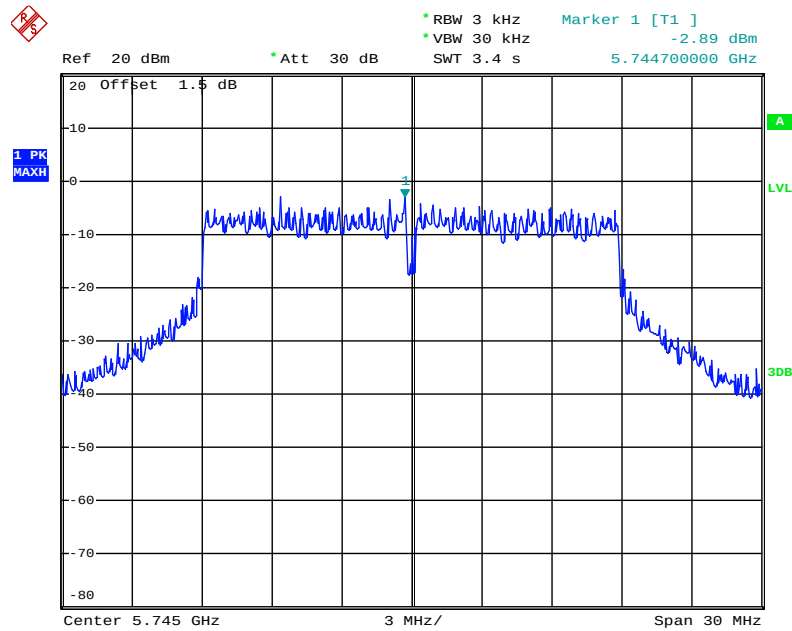
Date: 31.MAY.2014 06:58:59

### Power Density Plot on Configuration IEEE 802.11a / Chain 4 / 5745 MHz



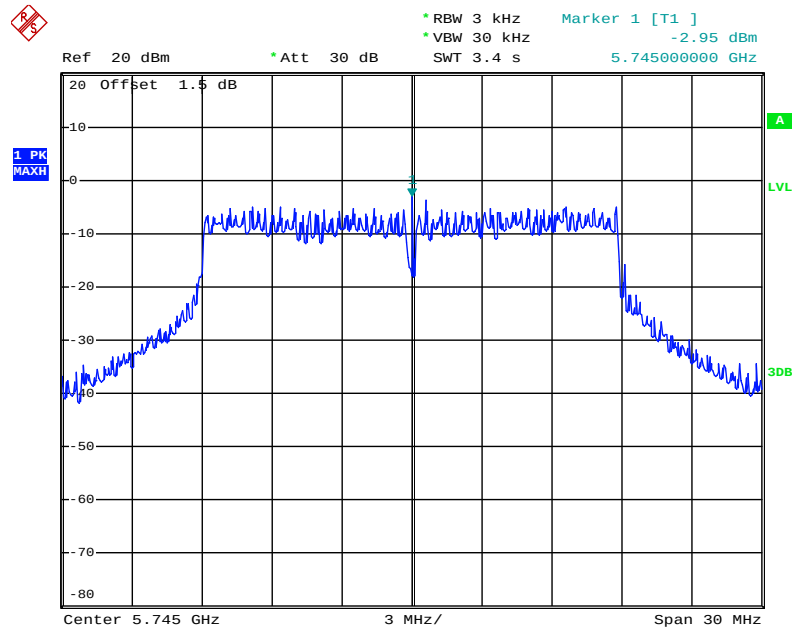
Date: 31.MAY.2014 06:59:37

### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 / 5745 MHz



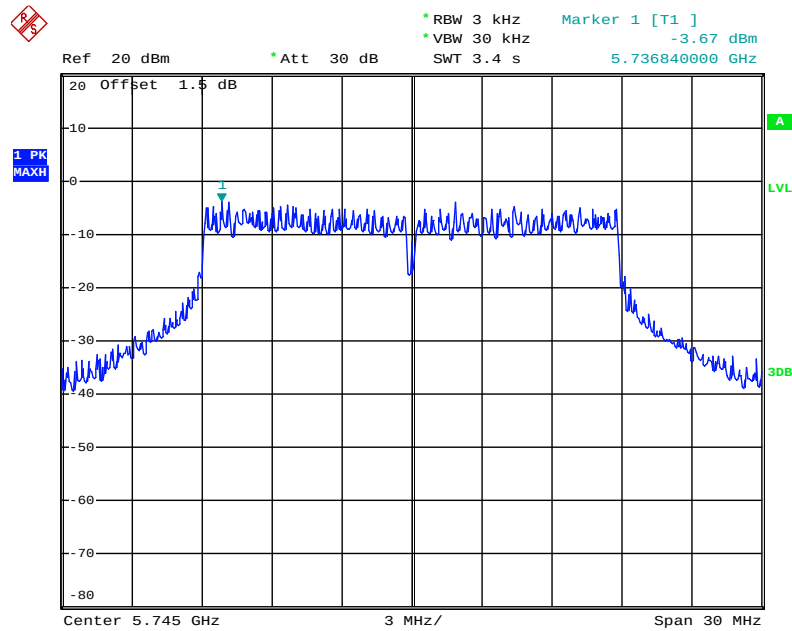
Date: 31.MAY.2014 07:24:13

### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 2 / 5745 MHz



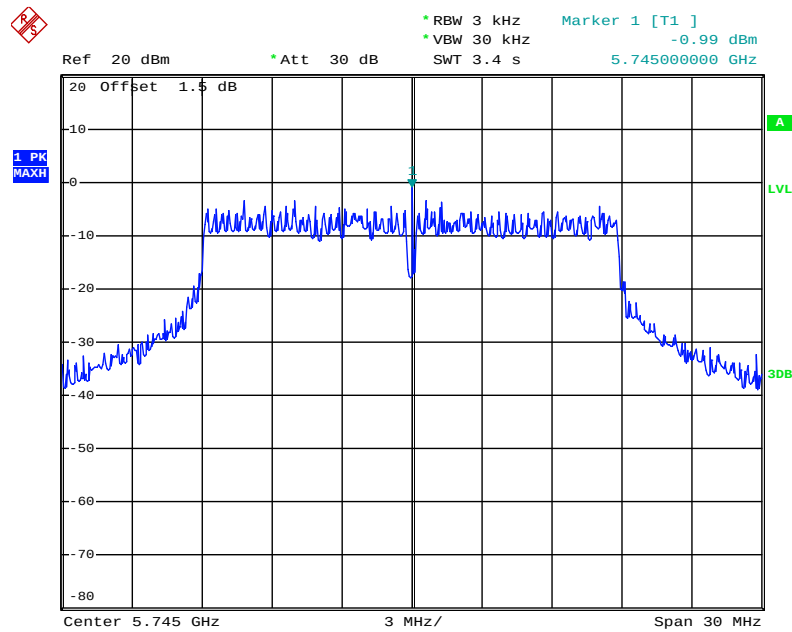
Date: 31.MAY.2014 07:23:31

### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 3 / 5745 MHz



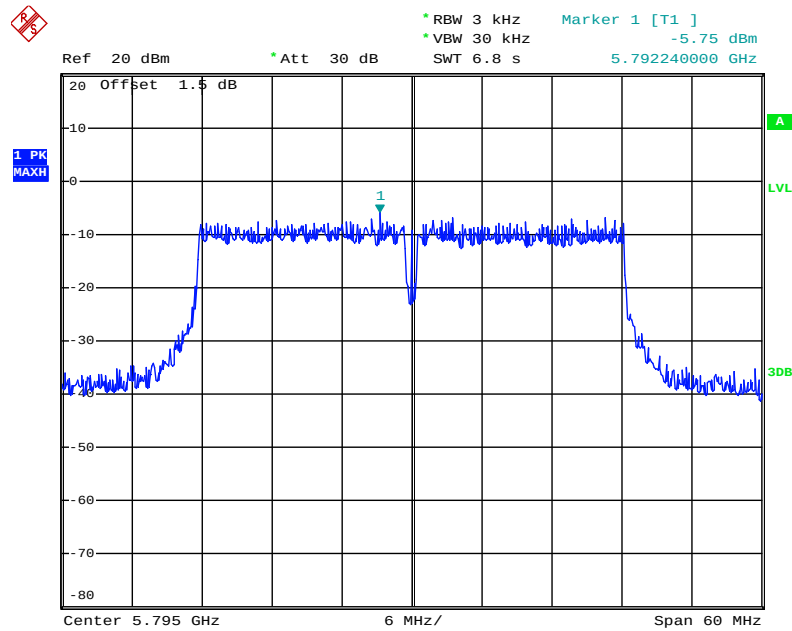
Date: 31.MAY.2014 07:22:39

### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 4 / 5745 MHz



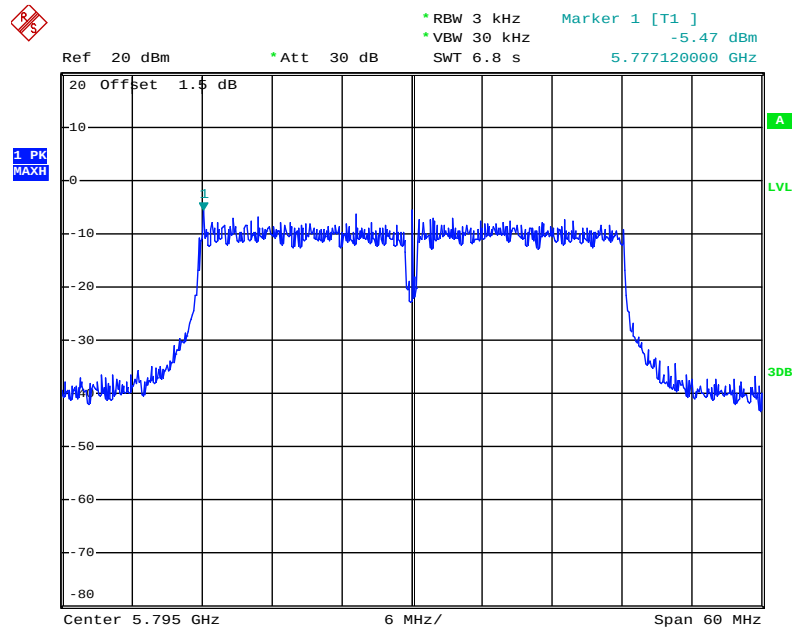
Date: 31.MAY.2014 07:21:47

### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 / 5795 MHz



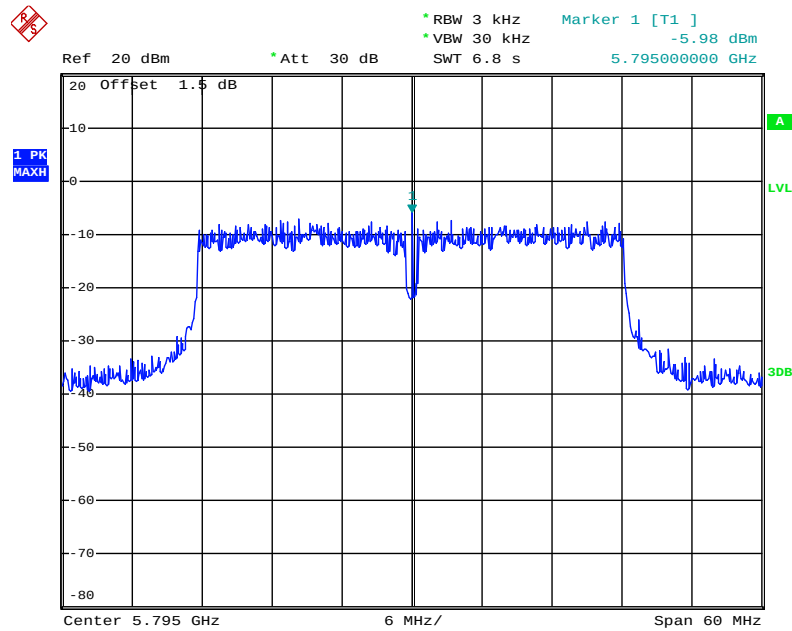
Date: 31.MAY.2014 07:35:12

### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 2 / 5795 MHz



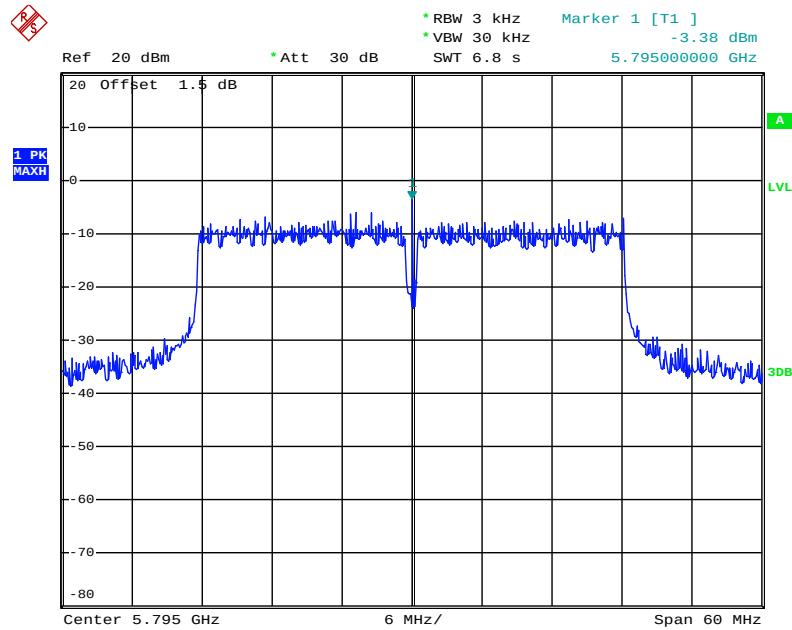
Date: 31.MAY.2014 07:34:30

### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 3 / 5795 MHz



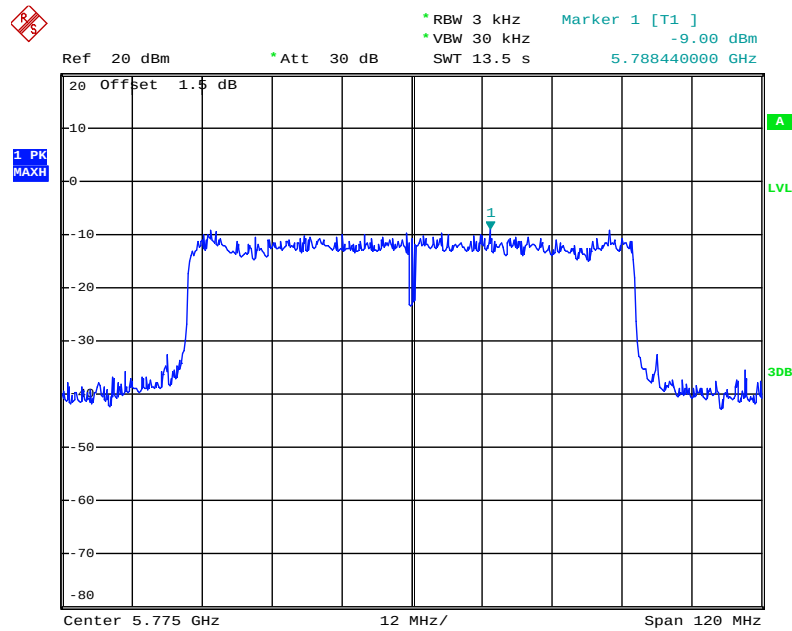
Date: 31.MAY.2014 07:33:44

### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 4 / 5795 MHz



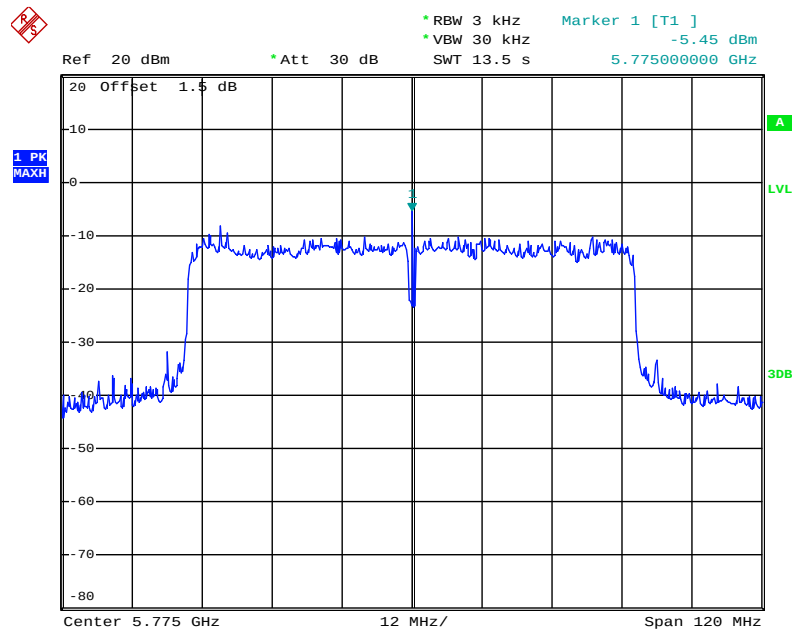
Date: 31.MAY.2014 07:33:09

### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 / 5775 MHz



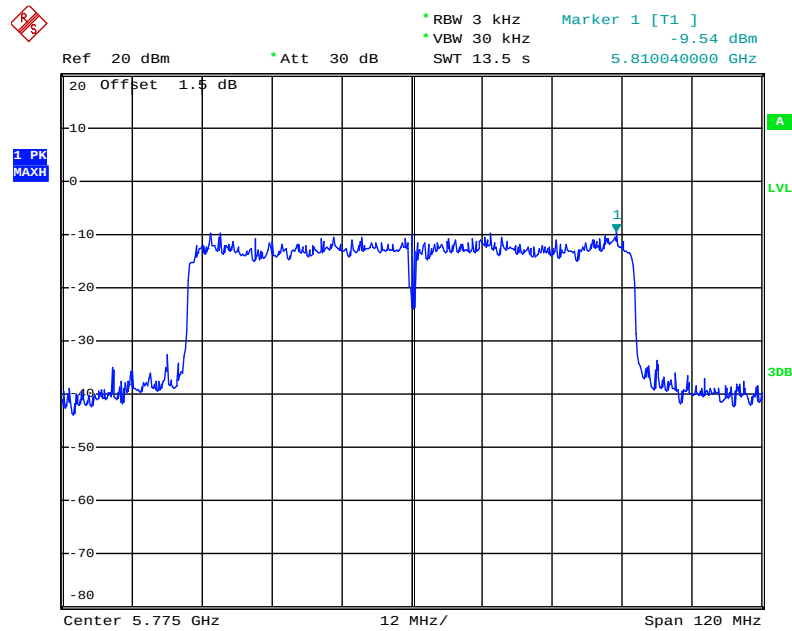
Date: 31.MAY.2014 07:36:13

### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 2 / 5775 MHz



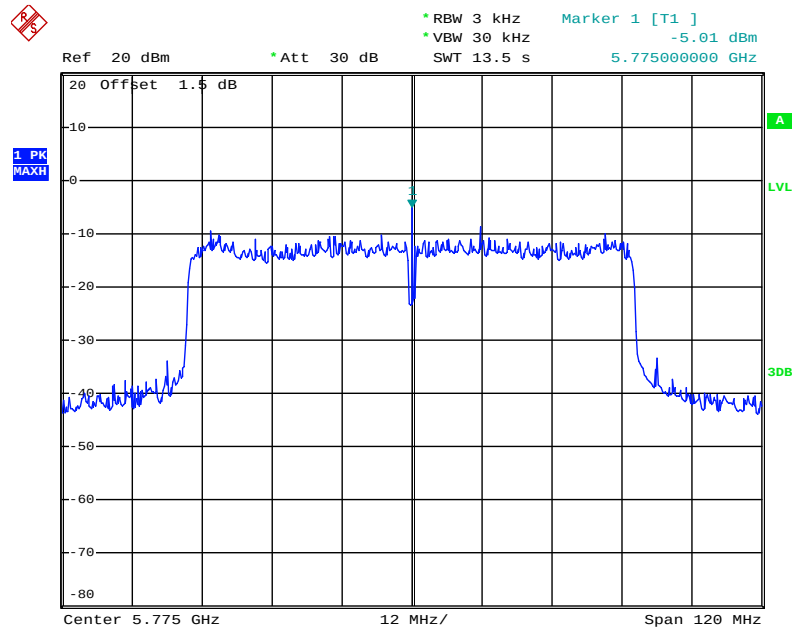
Date: 31.MAY.2014 07:37:08

### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 3 / 5775 MHz



Date: 31.MAY.2014 07:37:58

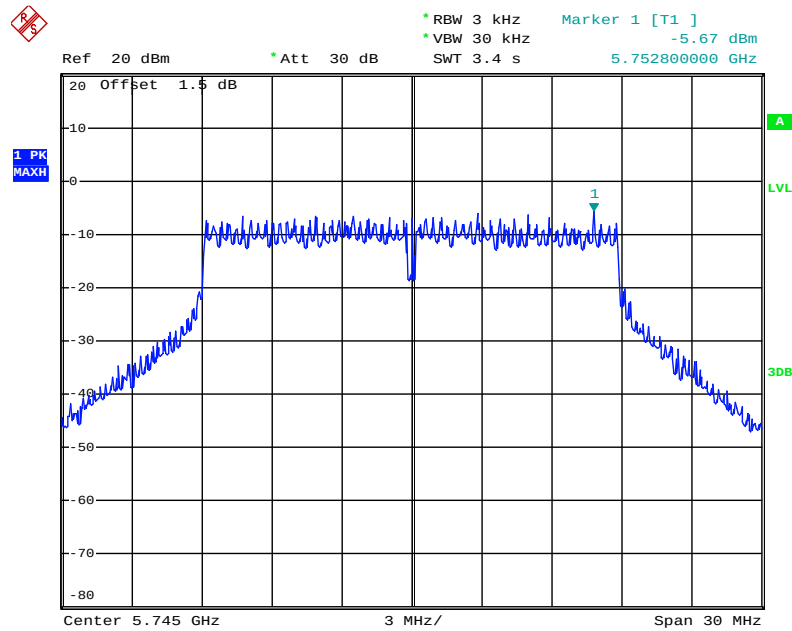
### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 4 / 5775 MHz



Date: 31.MAY.2014 07:38:41

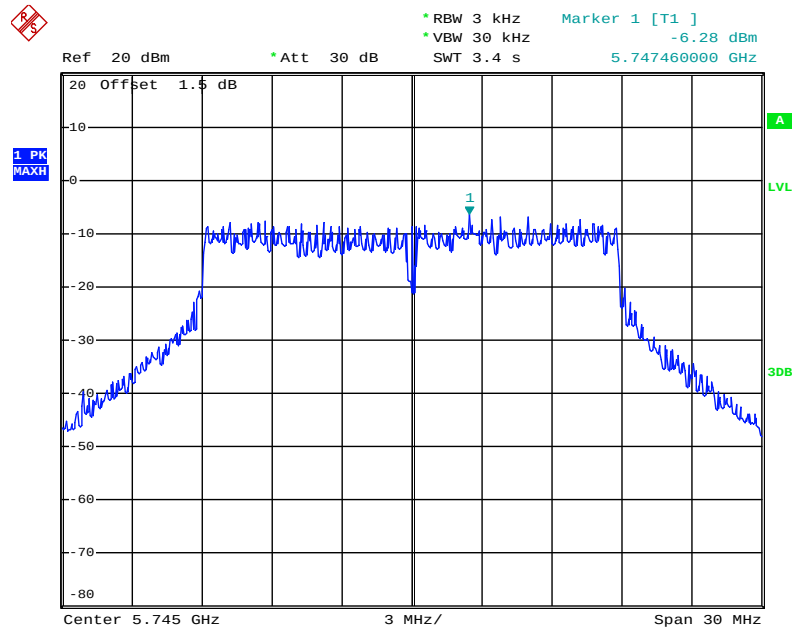
<For Beamforming Mode>

Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 / 5745 MHz



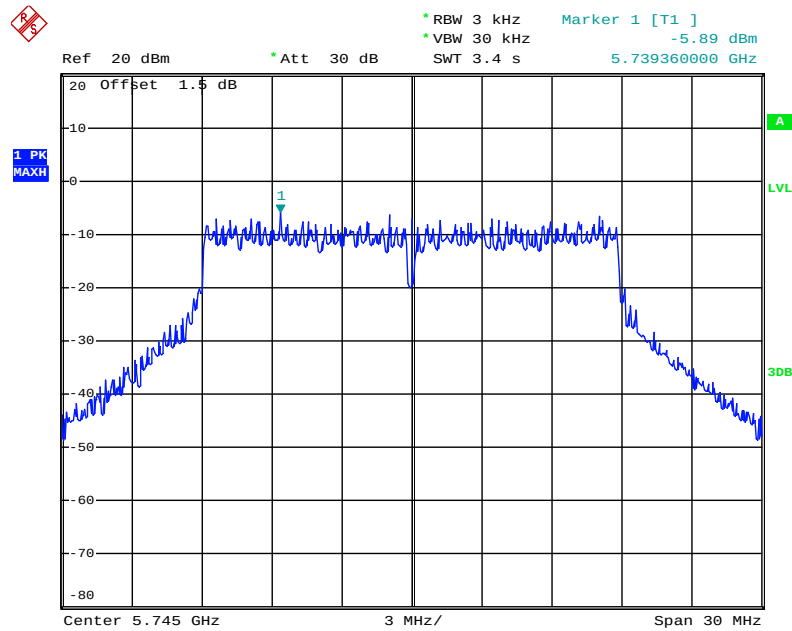
Date: 31.MAY.2014 07:56:12

Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 2 / 5745 MHz



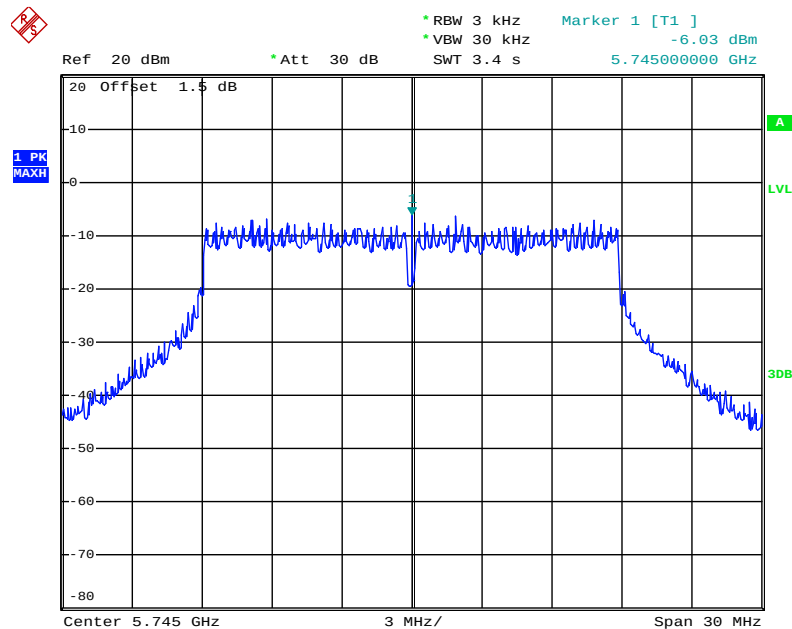
Date: 31.MAY.2014 07:57:54

### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 3 / 5745 MHz



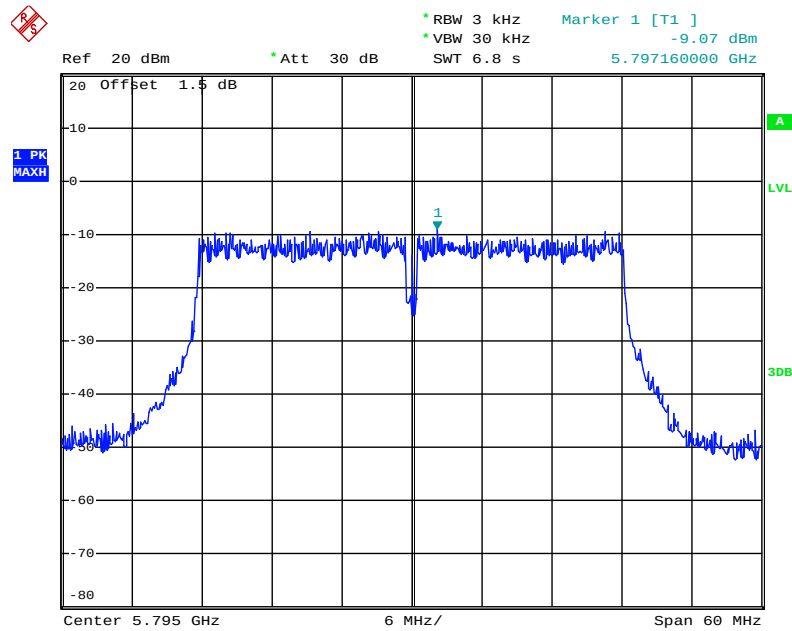
Date: 31.MAY.2014 07:58:37

### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 4 / 5745 MHz



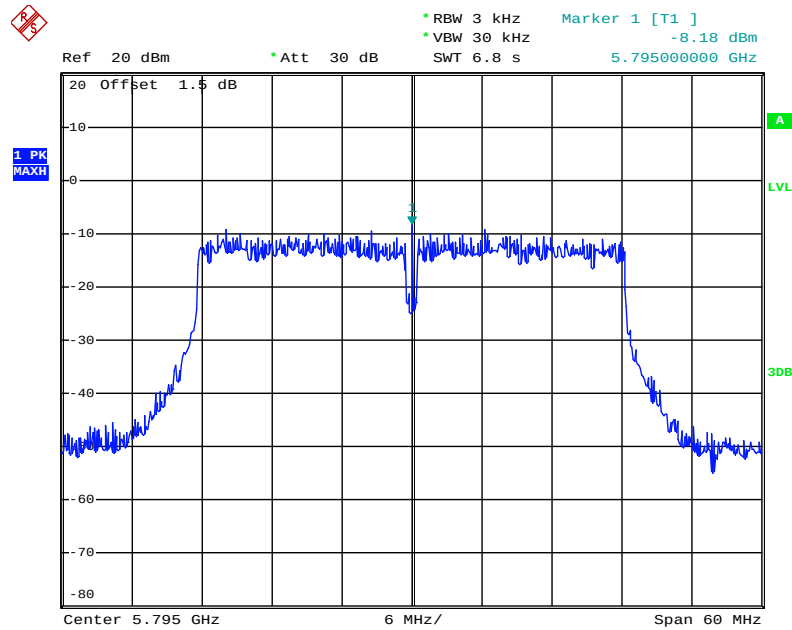
Date: 31.MAY.2014 07:59:17

### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 / 5795 MHz



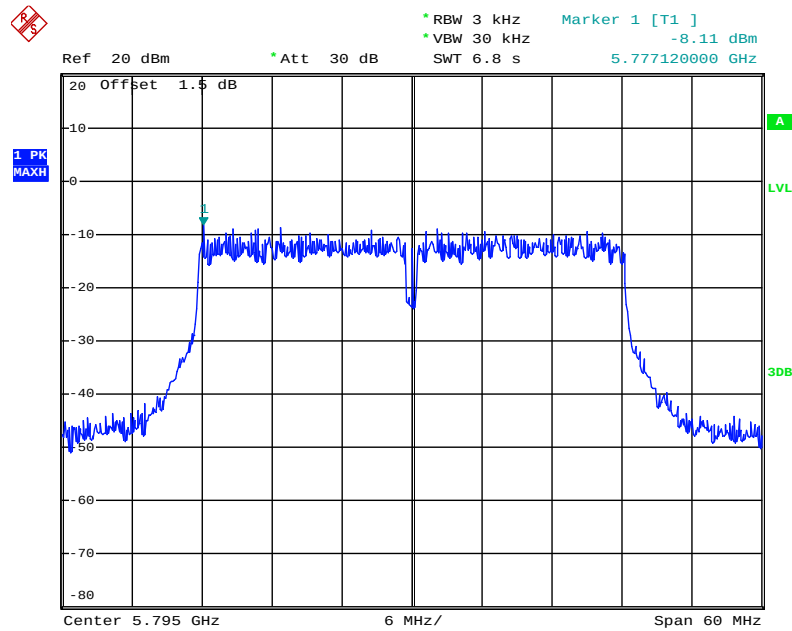
Date: 31.MAY.2014 07:44:43

### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 2 / 5795 MHz



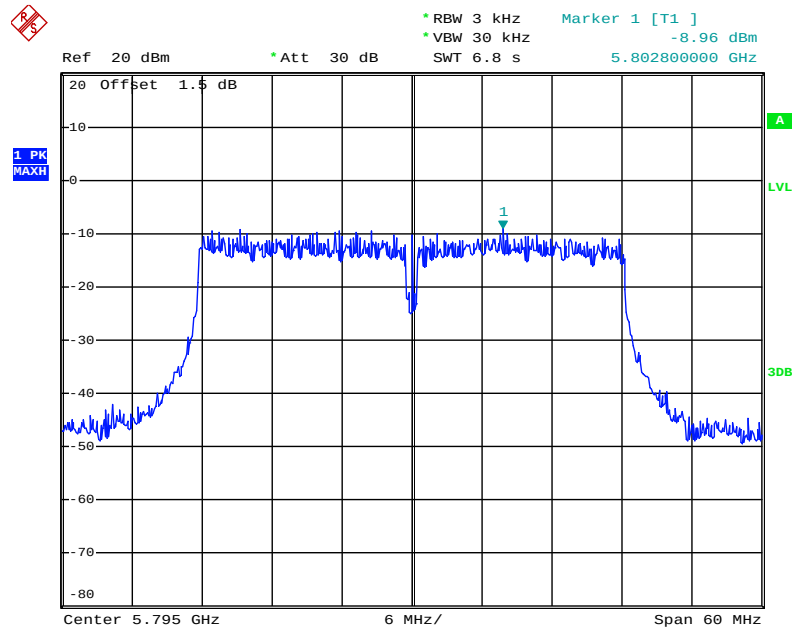
Date: 31.MAY.2014 07:45:13

### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 3 / 5795 MHz



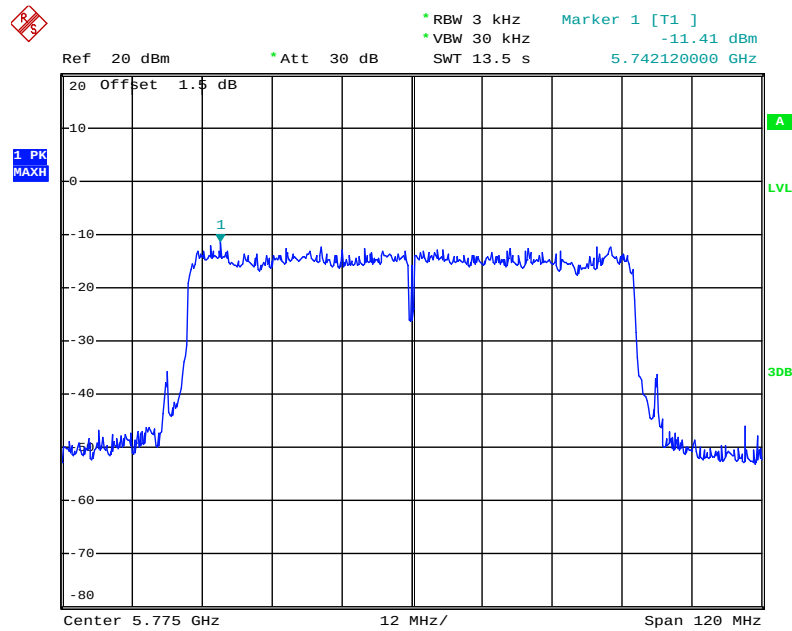
Date: 31.MAY.2014 07:45:58

### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 4 / 5795 MHz



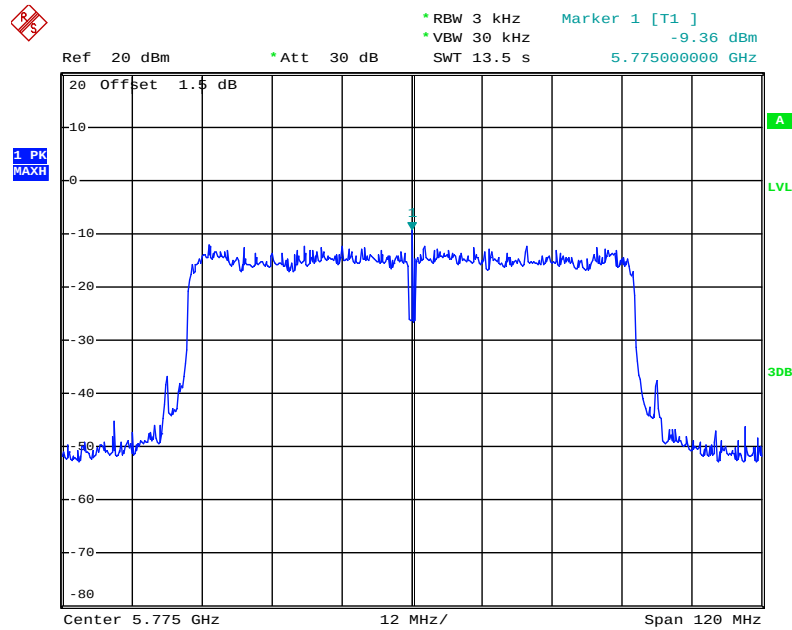
Date: 31.MAY.2014 07:46:43

### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 / 5775 MHz



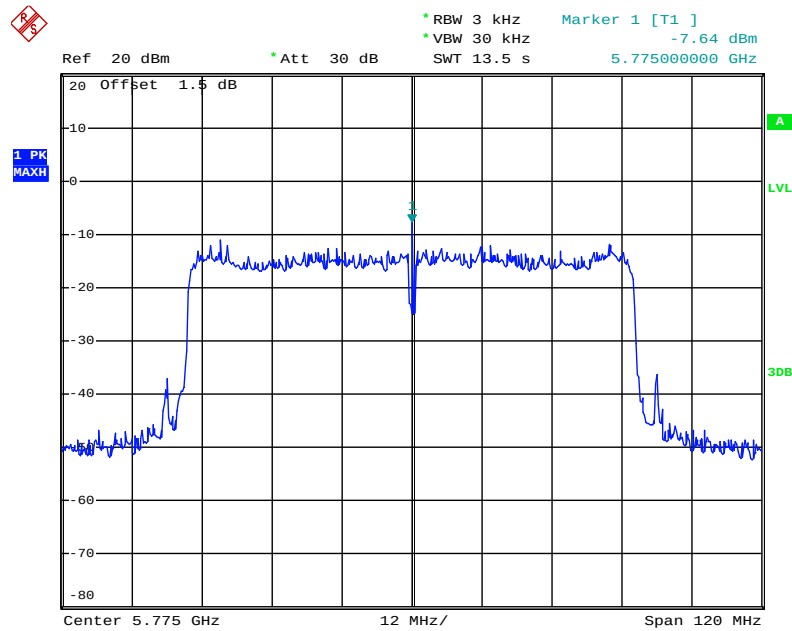
Date: 31.MAY.2014 07:43:55

### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 2 / 5775 MHz



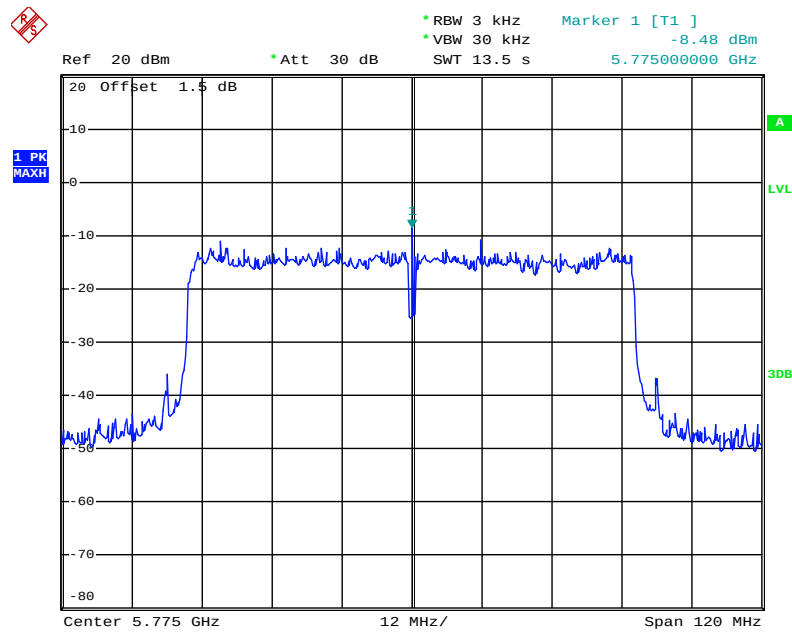
Date: 31.MAY.2014 07:40:31

### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 3 / 5775 MHz



Date: 31.MAY.2014 07:42:09

### Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 4 / 5775 MHz



Date: 31.MAY.2014 07:43:02

## 4.4. Radiated Emissions Measurement

### 4.4.1. Limit

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of  $-27$  dBm/MHz.

For transmitters operating in the 5.725-5.85 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of  $-17$  dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of  $-27$  dBm/MHz.

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<br>(MHz) | Field Strength<br>(micorvolts/meter) | Measurement Distance<br>(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                                |

### 4.4.2. 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                                            |
| RBW / VBW (Emission in restricted band)     | 1 MHz / 3MHz for Peak,<br>1 MHz / 1/T for Average |
| RBW / VBW (Emission in non-restricted band) | 1 MHz / 3MHz for peak                             |

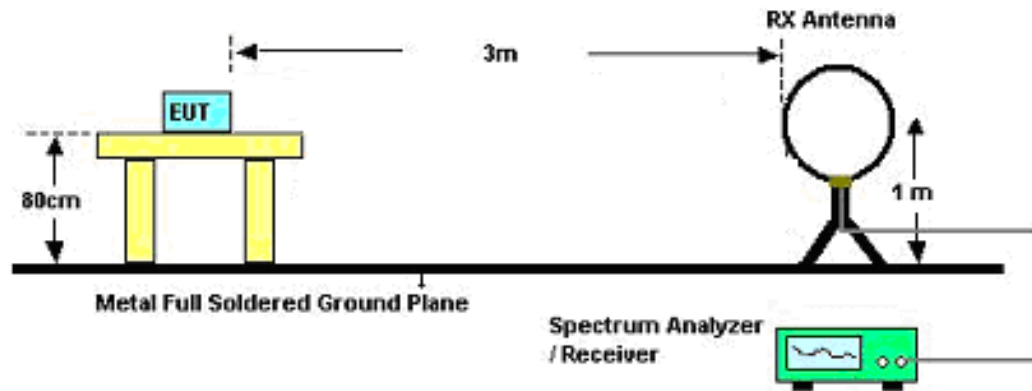
| Receiver Parameter     | Setting                           |
|------------------------|-----------------------------------|
| Attenuation            | Auto                              |
| Start ~ Stop Frequency | 9kHz~150kHz / RBW 200Hz for QP    |
| Start ~ Stop Frequency | 150kHz~30MHz / RBW 9kHz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

#### 4.4.3. Test Procedures

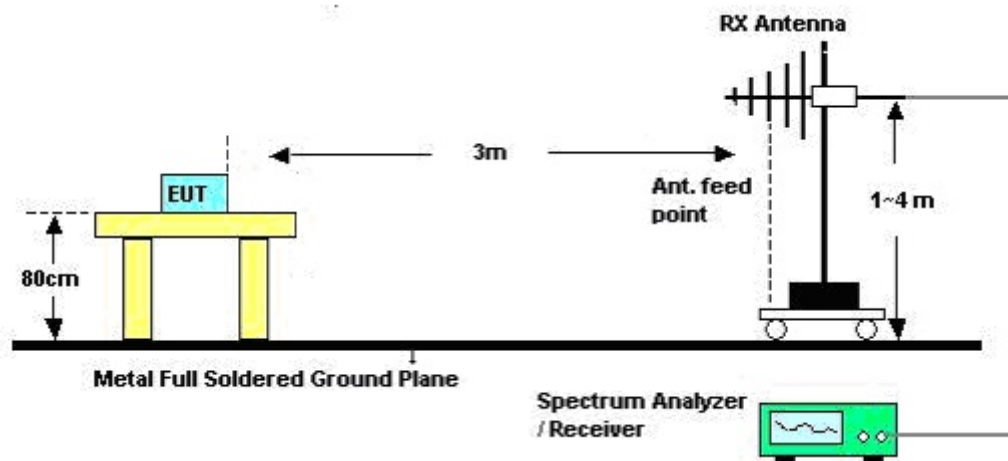
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 1m & 3m far away from the turntable.
2. Power on the EUT and all the supporting 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 3MHz RBW for peak reading. Then 1MHz RBW and 1/T VBW for average reading in spectrum analyzer.
7. 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.
8. 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.
9. 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.

#### 4.4.4. Test Setup Layout

For Radiated Emissions: 9kHz ~30MHz



For Radiated Emissions: 30MHz~1GHz



#### 4.4.5. Test Deviation

There is no deviation with the original standard.

#### 4.4.6. EUT Operation during Test

For Non-beamforming mode:

The EUT was programmed to be in continuously transmitting mode.

For beamforming mode:

The EUT was programmed to be in beamforming transmitting mode.

#### 4.4.7. Results of Radiated Emissions (9kHz~30MHz)

|               |               |                |        |
|---------------|---------------|----------------|--------|
| Temperature   | 24°C          | Humidity       | 55%    |
| Test Engineer | Lucke Hsieh   | Configurations | CTX    |
| Test Date     | Aug. 13, 2015 | Test Mode      | Mode 1 |

| Freq.<br>(MHz) | Level<br>(dBuV) | Over Limit<br>(dB) | Limit Line<br>(dBuV) | Remark   |
|----------------|-----------------|--------------------|----------------------|----------|
| -              | -               | -                  | -                    | See Note |

Note:

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

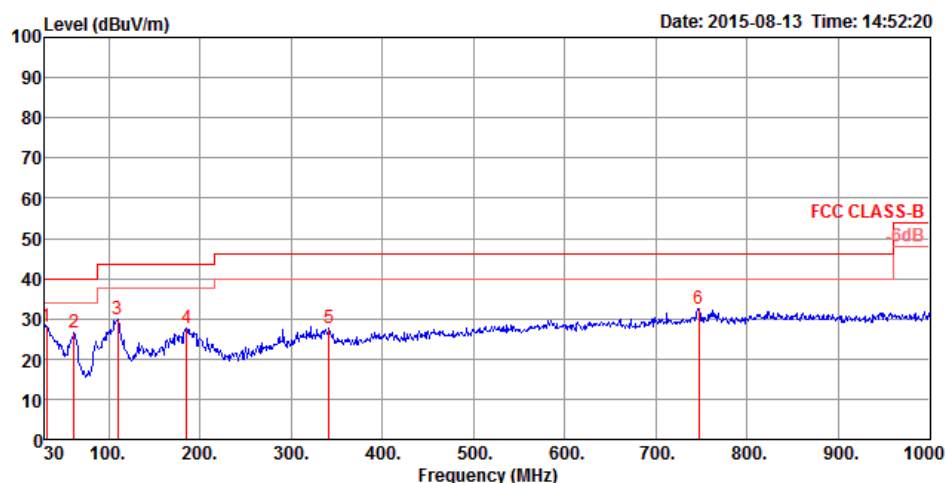
Distance extrapolation factor =  $40 \log (\text{specific distance} / \text{test distance})$  (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

#### 4.4.8. Results of Radiated Emissions (30MHz~1GHz)

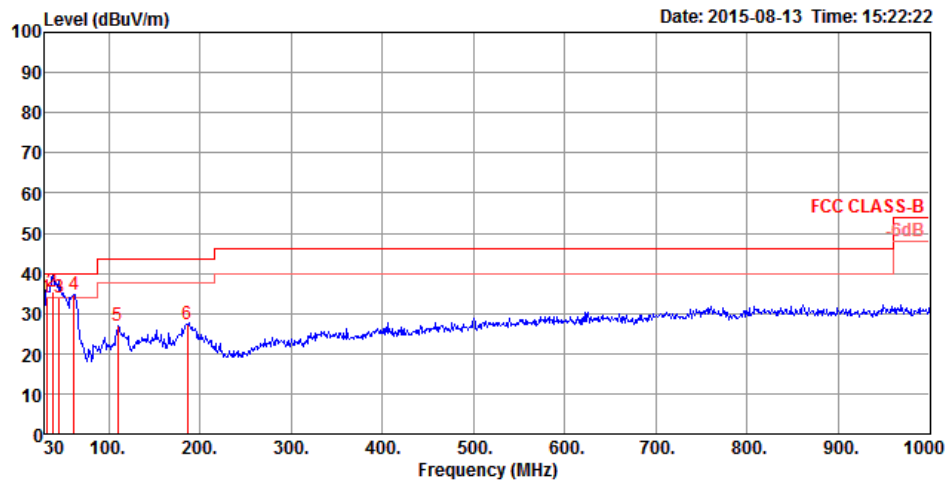
|               |             |                |     |
|---------------|-------------|----------------|-----|
| Temperature   | 24°C        | Humidity       | 55% |
| Test Engineer | Lucke Hsieh | Configurations | CTX |
| Test Mode     | Mode 1      |                |     |

##### Horizontal



|   | Freq   | Level  | Limit  | Over   | Read  | CableAntenna | Preamp | A/Pos | T/Pos | Remark   | Pol/Phase  |
|---|--------|--------|--------|--------|-------|--------------|--------|-------|-------|----------|------------|
|   | MHz    | dBuV/m | dBuV/m | dB     | dBuV  | dB           | dB/m   | dB    | cm    | deg      |            |
| 1 | 31.94  | 27.91  | 40.00  | -12.09 | 40.80 | 0.64         | 18.87  | 32.40 | 200   | 355 Peak | HORIZONTAL |
| 2 | 62.01  | 26.40  | 40.00  | -13.60 | 51.14 | 0.78         | 6.88   | 32.40 | 200   | 270 Peak | HORIZONTAL |
| 3 | 109.54 | 29.95  | 43.50  | -13.55 | 49.14 | 0.98         | 12.21  | 32.38 | 200   | 242 Peak | HORIZONTAL |
| 4 | 185.20 | 27.82  | 43.50  | -15.68 | 49.30 | 1.21         | 9.65   | 32.34 | 200   | 93 Peak  | HORIZONTAL |
| 5 | 341.37 | 27.75  | 46.00  | -18.25 | 43.40 | 1.60         | 15.05  | 32.30 | 100   | 121 Peak | HORIZONTAL |
| 6 | 746.83 | 32.56  | 46.00  | -13.44 | 42.28 | 2.22         | 20.36  | 32.30 | 200   | 276 Peak | HORIZONTAL |

## Vertical



|   | Freq   | Level  | Limit  | Over   | Read  | CableAntenna | Preamp | A/Pos | T/Pos | Remark   | Pol/Phase |
|---|--------|--------|--------|--------|-------|--------------|--------|-------|-------|----------|-----------|
|   | MHz    | dBuV/m | dBuV/m | dB     | dBuV  | dB           | dB/m   | dB    | cm    | deg      |           |
| 1 | 31.94  | 33.82  | 40.00  | -6.18  | 46.71 | 0.64         | 18.87  | 32.40 | 100   | 328 QP   | VERTICAL  |
| 2 | 38.73  | 35.61  | 40.00  | -4.39  | 52.55 | 0.66         | 14.81  | 32.41 | 100   | 64 QP    | VERTICAL  |
| 3 | 45.52  | 34.00  | 40.00  | -6.00  | 54.66 | 0.68         | 11.07  | 32.41 | 100   | 272 QP   | VERTICAL  |
| 4 | 62.01  | 34.82  | 40.00  | -5.18  | 59.56 | 0.78         | 6.88   | 32.40 | 100   | 307 Peak | VERTICAL  |
| 5 | 109.54 | 26.77  | 43.50  | -16.73 | 45.96 | 0.98         | 12.21  | 32.38 | 100   | 151 Peak | VERTICAL  |
| 6 | 186.17 | 27.42  | 43.50  | -16.08 | 48.92 | 1.21         | 9.63   | 32.34 | 100   | 214 Peak | VERTICAL  |

### Note:

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

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

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

## 4.5. Frequency Stability Measurement

### 4.5.1. Limit

In-band emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

The transmitter center frequency tolerance shall be  $\pm 20$  ppm maximum for the 5 GHz band (IEEE 802.11n specification).

### 4.5.2. Measuring Instruments and Setting

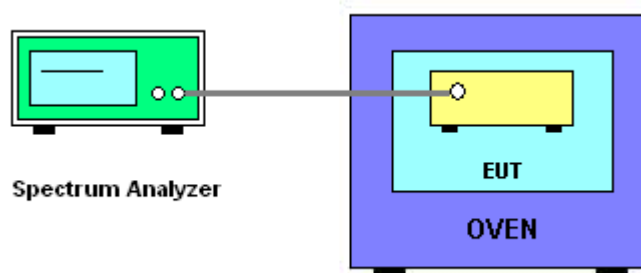
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

| Spectrum Parameter | Setting                                          |
|--------------------|--------------------------------------------------|
| Attenuation        | Auto                                             |
| Span Frequency     | Entire absence of modulation emissions bandwidth |
| RBW                | 10 kHz                                           |
| VBW                | 10 kHz                                           |
| Sweep Time         | Auto                                             |

### 4.5.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. EUT have transmitted absence of modulation signal and fixed channelize.
3. Set the spectrum analyzer span to view the entire absence of modulation emissions bandwidth.
4. Set RBW = 10 kHz, VBW = 10 kHz with peak detector and maxhold settings.
5.  $f_c$  is declaring of channel frequency. Then the frequency error formula is  $(f_c - f)/f_c \times 10^6$  ppm and the limit is less than  $\pm 20$  ppm (IEEE 802.11n specification).
6. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 minutes.
7. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value
8. Extreme temperature is  $-30^\circ\text{C} \sim 50^\circ\text{C}$ .

### 4.5.4. Test Setup Layout



#### 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 continuously un-modulation transmitting mode.

#### 4.5.7. Test Result of Frequency Stability

|               |          |           |               |
|---------------|----------|-----------|---------------|
| Temperature   | 24°C     | Humidity  | 62%           |
| Test Engineer | Wen Chao | Test Date | Mar. 17, 2016 |

Mode: 20 MHz / Chain 1

##### Voltage vs. Frequency Stability

| Voltage              | Measurement Frequency (MHz) |           |           |           |
|----------------------|-----------------------------|-----------|-----------|-----------|
| (V)                  | 5785 MHz                    |           |           |           |
|                      | 0 Minute                    | 2 Minute  | 5 Minute  | 10 Minute |
| 126.50               | 5784.9552                   | 5784.9542 | 5784.9534 | 5784.9530 |
| 110.00               | 5784.9548                   | 5784.9540 | 5784.9537 | 5784.9528 |
| 93.50                | 5784.9542                   | 5784.9541 | 5784.9537 | 5784.9531 |
| Max. Deviation (MHz) | 0.0458                      | 0.0460    | 0.0466    | 0.0472    |
| Max. Deviation (ppm) | 7.92                        | 7.95      | 8.06      | 8.16      |
| Result               | Complies                    |           |           |           |

##### Temperature vs. Frequency Stability

| Temperature          | Measurement Frequency (MHz) |           |           |           |
|----------------------|-----------------------------|-----------|-----------|-----------|
| (°C)                 | 5785 MHz                    |           |           |           |
|                      | 0 Minute                    | 2 Minute  | 5 Minute  | 10 Minute |
| -30                  | 5784.9580                   | 5784.9578 | 5784.9568 | 5784.9562 |
| -20                  | 5784.9564                   | 5784.9554 | 5784.9545 | 5784.9535 |
| -10                  | 5784.9559                   | 5784.9556 | 5784.9553 | 5784.9548 |
| 0                    | 5784.9556                   | 5784.9551 | 5784.9542 | 5784.9536 |
| 10                   | 5784.9551                   | 5784.9541 | 5784.9538 | 5784.9532 |
| 20                   | 5784.9548                   | 5784.9540 | 5784.9537 | 5784.9532 |
| 30                   | 5784.9531                   | 5784.9524 | 5784.9521 | 5784.9515 |
| 40                   | 5784.9516                   | 5784.9512 | 5784.9510 | 5784.9501 |
| 50                   | 5784.9499                   | 5784.9489 | 5784.9488 | 5784.9482 |
| Max. Deviation (MHz) | 0.0501                      | 0.0511    | 0.0512    | 0.0518    |
| Max. Deviation (ppm) | 8.66                        | 8.83      | 8.85      | 8.95      |
| Result               | Complies                    |           |           |           |

Mode: 40 MHz / Chain 1

#### Voltage vs. Frequency Stability

| Voltage              | Measurement Frequency (MHz) |           |           |           |
|----------------------|-----------------------------|-----------|-----------|-----------|
| (V)                  | 5755 MHz                    |           |           |           |
|                      | 0 Minute                    | 2 Minute  | 5 Minute  | 10 Minute |
| 126.50               | 5754.9552                   | 5754.9547 | 5754.9542 | 5754.9532 |
| 110.00               | 5754.9548                   | 5754.9544 | 5754.9534 | 5754.9525 |
| 93.50                | 5754.9538                   | 5754.9534 | 5754.9532 | 5754.9530 |
| Max. Deviation (MHz) | 0.0462                      | 0.0466    | 0.0468    | 0.0475    |
| Max. Deviation (ppm) | 8.03                        | 8.10      | 8.13      | 8.25      |
| Result               | Complies                    |           |           |           |

#### Temperature vs. Frequency Stability

| Temperature          | Measurement Frequency (MHz) |           |           |           |
|----------------------|-----------------------------|-----------|-----------|-----------|
| (°C)                 | 5755 MHz                    |           |           |           |
|                      | 0 Minute                    | 2 Minute  | 5 Minute  | 10 Minute |
| -30                  | 5754.9608                   | 5754.9603 | 5754.9597 | 5754.9591 |
| -20                  | 5754.9605                   | 5754.9596 | 5754.9592 | 5754.9589 |
| -10                  | 5754.9598                   | 5754.9589 | 5754.9583 | 5754.9580 |
| 0                    | 5754.9578                   | 5754.9568 | 5754.9561 | 5754.9553 |
| 10                   | 5754.9561                   | 5754.9551 | 5754.9546 | 5754.9542 |
| 20                   | 5754.9548                   | 5754.9544 | 5754.9535 | 5754.9529 |
| 30                   | 5754.9531                   | 5754.9523 | 5754.9521 | 5754.9517 |
| 40                   | 5754.9524                   | 5754.9523 | 5754.9517 | 5754.9514 |
| 50                   | 5754.9523                   | 5754.9522 | 5754.9513 | 5754.9506 |
| Max. Deviation (MHz) | 0.0477                      | 0.0478    | 0.0487    | 0.0494    |
| Max. Deviation (ppm) | 8.29                        | 8.31      | 8.46      | 8.58      |
| Result               | Complies                    |           |           |           |

Mode: 80 MHz / Chain 1

#### Voltage vs. Frequency Stability

| Voltage              | Measurement Frequency (MHz) |           |           |           |
|----------------------|-----------------------------|-----------|-----------|-----------|
| (V)                  | 5775 MHz                    |           |           |           |
|                      | 0 Minute                    | 2 Minute  | 5 Minute  | 10 Minute |
| 126.50               | 5774.9555                   | 5774.9548 | 5774.9543 | 5774.9536 |
| 110.00               | 5774.9548                   | 5774.9546 | 5774.9538 | 5774.9533 |
| 93.50                | 5774.9547                   | 5774.9541 | 5774.9538 | 5774.9533 |
| Max. Deviation (MHz) | 0.0453                      | 0.0459    | 0.0462    | 0.0467    |
| Max. Deviation (ppm) | 7.84                        | 7.95      | 8.00      | 8.09      |
| Result               | Complies                    |           |           |           |

#### Temperature vs. Frequency Stability

| Temperature          | Measurement Frequency (MHz) |           |           |           |
|----------------------|-----------------------------|-----------|-----------|-----------|
| (°C)                 | 5775 MHz                    |           |           |           |
|                      | 0 Minute                    | 2 Minute  | 5 Minute  | 10 Minute |
| -30                  | 5774.9610                   | 5774.9609 | 5774.9601 | 5774.9595 |
| -20                  | 5774.9590                   | 5774.9581 | 5774.9574 | 5774.9567 |
| -10                  | 5774.9585                   | 5774.9576 | 5774.9573 | 5774.9571 |
| 0                    | 5774.9579                   | 5774.9578 | 5774.9571 | 5774.9570 |
| 10                   | 5774.9559                   | 5774.9558 | 5774.9548 | 5774.9538 |
| 20                   | 5774.9548                   | 5774.9538 | 5774.9535 | 5774.9530 |
| 30                   | 5774.9531                   | 5774.9525 | 5774.9516 | 5774.9513 |
| 40                   | 5774.9528                   | 5774.9527 | 5774.9519 | 5774.9515 |
| 50                   | 5774.9519                   | 5774.9510 | 5774.9503 | 5774.9494 |
| Max. Deviation (MHz) | 0.0481                      | 0.0490    | 0.0497    | 0.0506    |
| Max. Deviation (ppm) | 8.33                        | 8.48      | 8.61      | 8.76      |
| Result               | Complies                    |           |           |           |

## **4.6. Antenna Requirements**

### **4.6.1. 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.

### **4.6.2. 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                |
|----------------------------|--------------|------------------|---------------|------------------|------------------|-----------------------|
| EMI Test Receiver          | R&S          | ESCS 30          | 100355        | 9kHz ~ 2.75GHz   | Apr. 22, 2015    | Conduction (CO01-CB)  |
| LISN                       | F.C.C.       | FCC-LISN-50-16-2 | 04083         | 150kHz ~ 100MHz  | Dec. 02, 2014    | Conduction (CO01-CB)  |
| LISN                       | Schwarzbeck  | NSLK 8127        | 8127647       | 9kHz ~ 30MHz     | Dec. 02, 2014    | Conduction (CO01-CB)  |
| COND Cable                 | Woken        | Cable            | 01            | 150kHz ~ 30MHz   | Dec. 03, 2014    | Conduction (CO01-CB)  |
| Software                   | Audix        | E3               | 5.410e        | -                | N.C.R.           | Conduction (CO01-CB)  |
| BILOG ANTENNA              | Schaffner    | CBL6112D         | 22021         | 20MHz ~ 2GHz     | May 06, 2015     | Radiation (O3CH01-CB) |
| Pre-Amplifier              | Agilent      | 8447D            | 2944A10991    | 0.1MHz ~ 1.3GHz  | Feb. 24, 2015    | Radiation (O3CH01-CB) |
| Spectrum Analyzer          | R&S          | FSP40            | 100056        | 9kHz ~ 40GHz     | Nov. 06, 2014    | Radiation (O3CH01-CB) |
| EMI Receiver               | Agilent      | N9038A           | MY52260123    | 9kHz ~ 8.4GHz    | Jan. 21, 2015    | Radiation (O3CH01-CB) |
| RF Cable-low               | Woken        | Low Cable-1      | N/A           | 30 MHz ~ 1 GHz   | Nov. 15, 2014    | Radiation (O3CH01-CB) |
| Loop Antenna               | Teseq        | HLA 6120         | 24155         | 9kHz - 30 MHz    | Mar. 12, 2015*   | Radiation (O3CH01-CB) |
| Signal analyzer            | R&S          | FSV40            | 100979        | 9kHz~40GHz       | Nov. 29, 2013    | Conducted (TH01-CB)   |
| Spectrum analyzer          | R&S          | FSV40            | 100979        | 9kHz~40GHz       | Dec. 09, 2015    | Conducted (TH01-CB)   |
| Temp. and Humidity Chamber | Ten Billion  | TTH-D3SP         | TBN-931011    | -30~100 degree   | Jun. 02, 2015    | Conducted (TH01-CB)   |
| RF Cable-high              | Woken        | High Cable-7     | -             | 1 GHz – 26.5 GHz | Nov. 17, 2013    | Conducted (TH01-CB)   |
| RF Cable-high              | Woken        | RG402            | High Cable-7  | 1 GHz – 26.5 GHz | Nov. 02, 2015    | Conducted (TH01-CB)   |
| RF Cable-high              | Woken        | High Cable-8     | -             | 1 GHz – 26.5 GHz | Nov. 17, 2013    | Conducted (TH01-CB)   |
| RF Cable-high              | Woken        | RG402            | High Cable-8  | 1 GHz – 26.5 GHz | Nov. 02, 2015    | Conducted (TH01-CB)   |
| RF Cable-high              | Woken        | High Cable-9     | -             | 1 GHz – 26.5 GHz | Nov. 17, 2013    | Conducted (TH01-CB)   |
| RF Cable-high              | Woken        | RG402            | High Cable-9  | 1 GHz – 26.5 GHz | Nov. 02, 2015    | Conducted (TH01-CB)   |
| RF Cable-high              | Woken        | High Cable-10    | -             | 1 GHz – 26.5 GHz | Nov. 17, 2013    | Conducted (TH01-CB)   |
| RF Cable-high              | Woken        | RG402            | High Cable-10 | 1 GHz – 26.5 GHz | Nov. 02, 2015    | Conducted (TH01-CB)   |
| RF Cable-high              | Woken        | High Cable-11    | -             | 1 GHz – 26.5 GHz | Nov. 17, 2013    | Conducted (TH01-CB)   |
| RF Cable-high              | Woken        | RG402            | High Cable-6  | 1 GHz – 26.5 GHz | Nov. 02, 2015    | Conducted (TH01-CB)   |

|              |         |         |            |              |               |                        |
|--------------|---------|---------|------------|--------------|---------------|------------------------|
| Power Sensor | Anritsu | MA2411B | 0917223    | 300MHz~40GHz | Sep. 18, 2013 | Conducted<br>(TH01-CB) |
| Power Sensor | Agilent | U2021XA | MY53410001 | 50MHz~18GHz  | Nov. 02, 2015 | Conducted<br>(TH01-CB) |

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

“\*” Calibration Interval of instruments listed above is two years.

NCR means Non-Calibration required.

## 6. MEASUREMENT UNCERTAINTY

| Test Items                           | Uncertainty | Remark                   |
|--------------------------------------|-------------|--------------------------|
| Conducted Emission (150kHz ~ 30MHz)  | 3.2 dB      | Confidence levels of 95% |
| Radiated Emission (30MHz ~ 1,000MHz) | 3.6 dB      | Confidence levels of 95% |
| Conducted Emission                   | 1.7 dB      | Confidence levels of 95% |

## Appendix A. Test Photos

## 1. Photographs of Conducted Emissions Test Configuration

Test Mode: Mode 3

FRONT VIEW



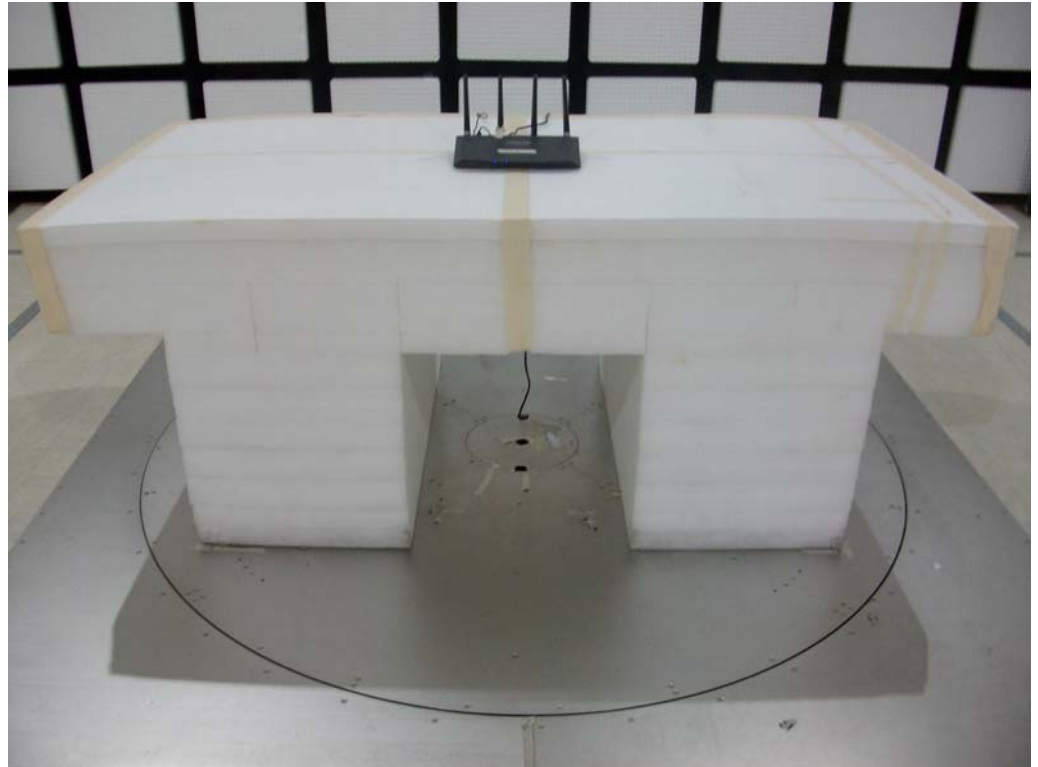
REAR VIEW



## 2. Photographs of Radiated Emissions Test Configuration

Test Configuration: 30MHz~1GHz / Test Mode: Mode 1

FRONT VIEW



REAR VIEW

