

## FCC Test Report

**Report No.:** RF131203E01B-1

**FCC ID:** TX2-RTL8821AU

**Test Model:** RTL8821AU

**Received Date:** Dec. 21, 2015

**Test Date:** Dec. 25 to 29, 2015 and Jan. 06, 2016

**Issued Date:** Feb. 03, 2016

**Applicant:** Realtek Semiconductor Corp.

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**Issued By:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch  
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### Release Control Record

| Issue No.      | Description       | Date Issued   |
|----------------|-------------------|---------------|
| RF131203E01B-1 | Original release. | Feb. 03, 2016 |

## 1 Certificate of Conformity

**Product:** 802.11a/b/g/n/ac RTL8821AU Combo module

**Brand:** Realtek

**Test Model:** RTL8821AU

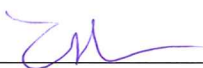
**Sample Status:** ENGINEERING SAMPLE

**Applicant:** Realtek Semiconductor Corp.

**Test Date:** Dec. 25 to 29, 2015 and Jan. 06, 2016

**Standard:** 47 CFR FCC Part 15, Subpart E (Section 15.407)  
ANSI C63.10: 2013

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

**Prepared by :** , **Date:** Feb. 03, 2016  
Elsie Hsu / Specialist

**Approved by :** , **Date:** Feb. 03, 2016  
May Chen / Manager

## 2 Summary of Test Results

| 47 CFR FCC Part 15, Subpart E (SECTION 15.407) |                                            |        |                                                                                   |
|------------------------------------------------|--------------------------------------------|--------|-----------------------------------------------------------------------------------|
| FCC Clause                                     | Test Item                                  | Result | Remarks                                                                           |
| 15.407(b)<br>(1/2/3/4/6)                       | Radiated Emissions & Band Edge Measurement | PASS   | Meet the requirement of limit.<br>Minimum passing margin is -1.6dB at 5715.00MHz. |
| 15.407(a)(1/2 /3)                              | Max Average Transmit Power                 | PASS   | Meet the requirement of limit.                                                    |
| 15.407(a)(1/2 /3)                              | Peak Power Spectral Density                | PASS   | Meet the requirement of limit.                                                    |
| 15.407(e)                                      | 6dB bandwidth                              | PASS   | Meet the requirement of limit.<br>(U-NII-3 Band only)                             |
| 15.407(g)                                      | Frequency Stability                        | PASS   | Meet the requirement of limit.                                                    |
| 15.203                                         | Antenna Requirement                        | PASS   | Antenna connector is IPEX not a standard connector.                               |

**NOTE:** 1. Upgraded the standard to section 15.407 under new rule.

### 2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

| Measurement                    | Frequency     | Expended Uncertainty (k=2) (±) |
|--------------------------------|---------------|--------------------------------|
| Radiated Emissions up to 1 GHz | 30MHz ~ 1GHz  | 5.19 dB                        |
| Radiated Emissions above 1 GHz | 1GHz ~6GHz    | 3.43 dB                        |
|                                | 6GHz ~ 18GHz  | 3.49 dB                        |
|                                | 18GHz ~ 40GHz | 4.11 dB                        |

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT (WLAN)

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product               | 802.11a/b/g/n/ac RTL8821AU Combo module                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Brand                 | Realtek                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Test Model            | RTL8821AU                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Status of EUT         | ENGINEERING SAMPLE                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Power Supply Rating   | DC 3.3V from host equipment                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Modulation Type       | CCK, DQPSK, DBPSK for DSSS<br>64QAM, 16QAM, QPSK, BPSK for OFDM<br>256QAM for OFDM in 11ac mode only                                                                                                                                                                                                                                                                                                                                                         |
| Modulation Technology | DSSS, OFDM, DTS                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Transfer Rate         | 802.11b: up to 11Mbps<br>802.11a / g: up to 54Mbps<br>802.11n: up to 150Mbps<br>802.11ac: up to 433.4Mbps                                                                                                                                                                                                                                                                                                                                                    |
| Operating Frequency   | <b>For 15.407</b><br>5.18 ~ 5.24GHz, 5.26 ~ 5.32GHz, 5.50 ~ 5.58GHz,<br>5.66GHz ~ 5.70GHz & 5.745 ~ 5.825GHz<br><b>For 15.247</b><br>2.412 ~ 2.462GHz                                                                                                                                                                                                                                                                                                        |
| Number of Channel     | <b>For 15.407</b><br>21 for 802.11a, 802.11n (HT20), 802.11ac (VHT20)<br>9 for 802.11n (HT40), 802.11ac (VHT40)<br>4 for 802.11ac (VHT80)<br><b>For 15.247</b><br>11 for 802.11b, 802.11g, 802.11n (HT20)<br>7 for 802.11n (HT40)                                                                                                                                                                                                                            |
| Output Power          | <b>For 15.407(U-NII-3 band)</b><br>802.11a: 67.764mW<br>802.11ac (VHT20): 68.077mW<br>802.11ac (VHT40): 65.464mW<br>802.11ac (VHT80): 13.49mW<br><b>For 15.407 (U-NII-1, U-NII-2A and U-NII-2C Bands)</b><br>802.11a: 69.823mW<br>802.11ac (VHT20): 69.343mW<br>802.11ac (VHT40): 71.285mW<br>802.11ac (VHT80): 20.701mW<br><b>For 15.247 (2.4GHz)</b><br>802.11b: 123.310mW<br>802.11g: 293.765mW<br>802.11n (HT20): 264.850mW<br>802.11n (HT40): 213.304mW |
| Antenna Type          | Refer to Note                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Antenna Connector     | Refer to Note                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Accessory Device      | Adapter x 1                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Data Cable Supplied   | NA                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

**Note:**

1. This report is prepared for FCC class II permissive change. The difference compared with the Report No.: RF131203E01-1 design is as the following:
  - ◆ Upgraded the standard to section 15.407 under new rule.
  - ◆ Changed product name.
2. For U-NII-1, U-NII-2A and 2C Bands: There is no increase in authorized power level, so RF test refer original test report (Report No.: RF131203E01-1).
3. According to above conditions, therefor only U-NII-3 band and DFS need to be performed (except for Conducted Emission test item). And all data was verified to meet the requirements.
4. There are Bluetooth technology and WLAN technology used for the EUT.
5. For WLAN: 2.4GHz and 5GHz technology cannot transmit at same time.
6. The antennas provided to the EUT, please refer to the following table:

| No. | Brand   | Model                                                                    | Antenna Type | Peak gain with cable loss (dBi) (2.4GHz) | Peak gain with cable loss(dBi) (5GHz) | Cable Loss (dB) (2.4GHz) | Cable Loss (dB) (5GHz) | Connector Type |
|-----|---------|--------------------------------------------------------------------------|--------------|------------------------------------------|---------------------------------------|--------------------------|------------------------|----------------|
| 1   | LYNwave | ALA110-222050-300010 (Main)<br>ALA110-222050-300010 (Aux)                | PIFA         | 3.5<br>3.5                               | 5<br>5                                | NA                       | NA                     | IPEX           |
| 2   | WGT     | SKA91WMPB02+A (Tx1)<br>SKA91WMPB01+A (Tx2)                               | PIFA         | 0.82<br>-2.23                            | 0.94<br>2.18                          | -1.32<br>-0.75           | -2.04<br>-1.17         | IPEX           |
| 3   | JEM     | 1510-0122-0027 (Tx1)<br>1510-0122-0027 (Tx2)                             | PIFA         | 3.23<br>2.31                             | 4.89<br>1.89                          | NA                       | NA                     | RF             |
| 4   | FVC     | K05007014501(6-23-7W25H-010) (Tx1)<br>K05007014501(6-23-7W25H-010) (Tx2) | PIFA         | 2.85<br>1.59                             | 2.46<br>2.91                          | NA                       | NA                     | IPEX           |
| 5   | JEM     | 1510-0122-0022(IA-120073) (Tx1)<br>1510-0122-0022(IA-120073) (Tx2)       | PIFA         | 2.23<br>2.21                             | 1.69<br>1.84                          | NA                       | NA                     | RF             |
| 6   | WGT     | SK81WMPB01+A (Tx1)<br>SK81WMPB02+A (Tx2)                                 | PIFA         | 1.79<br>0.66                             | 1.49<br>-0.40                         | -1.88<br>-2.95           | -3.17<br>-4.96         | IPEX           |
| 7   | WGT     | SKW2UWMPB01+A (Tx1)<br>SKW2UWMPB01+A (Tx2)                               | PIFA         | 1.36<br>2.88                             | 1.92<br>3.16                          | NA                       | NA                     | IPEX           |
| 8   | WGT     | SKW25WMPB01+A (Tx1)<br>SKW25WMPB01+A (Tx2)                               | PIFA         | 0.72<br>0.49                             | -0.72<br>-0.71                        | -1.41<br>-1.39           | -2.18<br>-2.15         | IPEX           |
| 9   | WGT     | SK549WMPB01+A (Tx1)<br>SK549WMPB02+A (Tx2)                               | PIFA         | -0.17<br>-2.24                           | -0.13<br>0.03                         | -1.04<br>-0.88           | -1.94<br>-1.64         | IPEX           |
| 10  | WGT     | SK110WMPB01+A (Tx1)<br>SK110WMPB02+A (Tx2)                               | PIFA         | 1.05<br>-0.41                            | 1.08<br>2.32                          | -0.98<br>-0.99           | -1.52<br>-1.54         | IPEX           |
| 11  | WGT     | SKW31WMPB01+A (Tx1)<br>SKW31WMPB01+A (Tx2)                               | PIFA         | 1.85<br>3.14                             | 1.74<br>2.10                          | NA                       | NA                     | IPEX           |
| 12  | FVC     | 6-23-7B51M-031 (Tx1)<br>6-23-7B51M-031 (Tx2)                             | PIFA         | 1.58<br>1.75                             | 2.54<br>2.24                          | NA                       | NA                     | IPEX           |
| 13  | FVC     | 6-23-7E51Q-011 (Tx1)<br>6-23-7E51Q-011 (Tx2)                             | PIFA         | 2.70<br>2.19                             | 1.57<br>2.94                          | NA                       | NA                     | IPEX           |
| 14  | FVC     | 6-23-7B710-022 (WM1)<br>6-23-7B710-022 (WM2)                             | PIFA         | 1.51<br>2.04                             | 2.99<br>3.02                          | NA                       | NA                     | IPEX           |
| 15  | WGT     | SKM11WMPB03+A (Tx1)<br>SKM11WMPB02+D (Tx2)                               | PIFA         | -1.84<br>-2.93                           | 0.44<br>1.35                          | 1.17<br>0.89             | 2.02<br>1.54           | IPEX           |
| 16  | WGT     | SKW23WMPB01+A (Tx1)<br>SKW23WMPB02+A (Tx2)                               | PIFA         | -1.61<br>-2.84                           | -0.14<br>-0.96                        | -2.10<br>-2.07           | -3.25<br>-3.20         | IPEX           |

| No. | Brand | Model                                                                        | Antenna Type | Peak gain with cable loss (dBi) (2.4GHz) | Peak gain with cable loss(dBi) (5GHz) | Cable Loss (dB) (2.4GHz) | Cable Loss (dB) (5GHz) | Connector Type |
|-----|-------|------------------------------------------------------------------------------|--------------|------------------------------------------|---------------------------------------|--------------------------|------------------------|----------------|
| 17  | WGT   | SKW24WMPB01+B (WM1)<br>SKW24WMPB01+B (WM2)                                   | PIFA         | 1.25<br>3.17                             | 1.95<br>2.42                          | NA                       | NA                     | IPEX           |
| 18  | FVC   | K05007015501(6-23-7W244-020-1) (Tx1)<br>K05007015501(6-23-7W244-020-1) (Tx2) | PIFA         | 2.53<br>2.28                             | 2.86<br>2.97                          | NA                       | NA                     | IPEX           |
| 19  | FVC   | K05007014201(6-23-7W25P-020) (Tx1)<br>K05007014201(6-23-7W25P-020) (Tx2)     | PIFA         | 3.00<br>1.52                             | 2.82<br>2.21                          | NA                       | NA                     | IPEX           |
| 20  | WGT   | SKW10WMPB01+A (Tx1)<br>SKW10WMPB02+A (Tx2)                                   | PIFA         | 0.85<br>0.44                             | 0.75<br>1.24                          | -1.56<br>-1.53           | -2.42<br>-2.36         | IPEX           |
| 21  | WGT   | SKCZTWMPB01+A (Tx1)<br>SKCZTWMPB02+A (Tx2)                                   | PIFA         | 0.46<br>-0.79                            | 2.80<br>1.03                          | -1.56<br>-1.53           | -2.42<br>-2.36         | IPEX           |
| 22  | JEM   | IA-120266 (Tx1)<br>IA-120267 (Tx2)                                           | PIFA         | 2.60<br>0.53                             | 2.61<br>2.60                          | 2.12<br>1.76             | 3.48<br>2.87           | IPEX           |
| 23  | WGT   | SK547WMPB01+A (Tx1)<br>SK549WMPB02+A (Tx2)                                   | PIFA         | -0.66<br>0.78                            | -0.19<br>2.06                         | -1.42<br>-1.43           | -2.20<br>-2.21         | IPEX           |
| 24  | WGT   | SK555WMPB01+B (Tx1)<br>SK555WMPB02+B (Tx2)                                   | PIFA         | 0.76<br>0.09                             | 1.97<br>0.56                          | -1.83<br>-1.80           | -2.83<br>-2.78         | IPEX           |
| 25  | WGT   | SK65EWMPB01+A (Tx1)<br>SK650WMPB02+A (Tx2)                                   | PIFA         | 0.42<br>-0.13                            | 0.11<br>1.27                          | -1.56<br>-0.61           | -2.41<br>-0.94         | IPEX           |
| 26  | WGT   | SK670WMPB01+A (Tx1)<br>SK670WMPB02+A (Tx2)                                   | PIFA         | 1.48<br>1.15                             | -0.44<br>0.42                         | -2.47<br>-1.93           | -3.82<br>-2.99         | IPEX           |
| 27  | WGT   | SK740WMPB01+A (Tx1)<br>SK740WMPB02+A (Tx2)                                   | PIFA         | -0.93<br>0.20                            | 0.96<br>0.86                          | -1.39<br>-1.26           | -2.16<br>-1.95         | IPEX           |
| 28  | WGT   | SK840WMPB01+B_SN (Tx1)<br>SK840WMPB01+B_SN (Tx2)                             | PIFA         | 3.03<br>0.55                             | 4.16<br>0.90                          | -1.12<br>-1.20           | -1.74<br>-1.86         | IPEX           |
| 29  | WGT   | SK94SWMPB01+B (TX1)<br>SK94SWMPB01+B (TX2)                                   | PIFA         | 0.76<br>0.46                             | 1.12<br>1.44                          | -0.32<br>-0.44           | -0.50<br>-0.68         | IPEX           |
| 30  | WGT   | SK94TWMPB01+B (TX1)<br>SK94TWMPB01+B (TX2)                                   | PIFA         | 1.32<br>1.86                             | 2.59<br>1.57                          | -0.59<br>-0.71           | -0.91<br>-1.10         | IPEX           |
| 31  | WGT   | SK50SWMPB01+A (TX1)<br>SK50SWMPB02+A (TX2)                                   | PIFA         | -0.03<br>-0.13                           | 1.25<br>2.13                          | -0.86<br>-0.72           | -1.32<br>-1.12         | IPEX           |
| 32  | WGT   | SK94TWMPB01+D (TX1)<br>SK94TWMPB01+D (TX2)                                   | PIFA         | 1.32<br>1.86                             | 2.59<br>1.57                          | -0.59<br>-0.71           | -0.91<br>-1.10         | IPEX           |
| 33  | WGT   | SKC45WMPB03+B (WM1)<br>SKC45WMPB03+B (WM2)                                   | PIFA         | 2.46<br>2.91                             | 2.90<br>2.67                          | NA                       | NA                     | IPEX           |
| 34  | FVC   | K05007015801 (WM1)<br>K05007015901 (WM2)                                     | PIFA         | 3.12<br>1.01                             | 3.51<br>1.93                          | NA                       | NA                     | RF             |
| 35  | WGT   | SK345WMPB01+A (WM1)<br>SK345WMPB02+A (WM2)                                   | PIFA         | 0.86<br>2.51                             | 2.94<br>3.25                          | NA                       | NA                     | IPEX           |

| No. | Brand          | Model                                         | Antenna Type | Peak gain with cable loss (dBi) (2.4GHz) | Peak gain with cable loss(dBi) (5GHz) | Cable Loss (dB) (2.4GHz) | Cable Loss (dB) (5GHz) | Connector Type |
|-----|----------------|-----------------------------------------------|--------------|------------------------------------------|---------------------------------------|--------------------------|------------------------|----------------|
| 36  | FVC            | K05007014901 (WM1)<br>K05007015001 (WM2)      | PIFA         | 1.85<br>1.94                             | 1.35<br>1.99                          | NA                       | NA                     | IPEX           |
| 37  | WGT            | SKX51WMPB01+C (WM1)<br>SKX51WMPB02+C (WM2)    | PIFA         | 3.2<br>2.76                              | 2.28<br>2.51                          | NA                       | NA                     | IPEX           |
| 38  | INPAQ          | WA-P-LB-02-122 (Main)<br>WA-P-LB-01-072 (Aux) | PIFA         | -1.41<br>-0.33                           | -2.44<br>-3.87                        | 1.23<br>1.86             | 2.06<br>3.12           | IPEX           |
| 39  | Smart Approach | SE-ECZ50-001 (Tx1)<br>SE-ECZ50-002 (Tx2)      | PIFA         | -1.37<br>-2.17                           | 1.83<br>1.86                          | 0.96<br>1.45             | 1.73<br>2.62           | IPEX           |
| 40  | INPAQ          | WA-P-LB-02-121 (Main)<br>WA-P-LB-01-071 (Aux) | PIFA         | -2.26<br>-4.63                           | -2.87<br>-2.49                        | 1.32<br>1.95             | 2.22<br>3.28           | IPEX           |
| 41  | Smart Approach | SE-ECZ70-001 (Tx1)<br>SE-ECZ70-002 (Tx2)      | PIFA         | -0.65<br>-2.39                           | 1.52<br>0.58                          | 1.03<br>1.52             | 1.87<br>2.76           | IPEX           |

**Note:** The **Antenna 1** was chosen for final test. The worst case was found in Aux. Therefore only the test data of the mode was recorded in this report.

7. The EUT incorporates a SISO function.

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

The modulation and bandwidth are similar for 802.11n mode for 20MHz (40MHz) and 802.11ac mode for 20MHz (40MHz), therefore investigated worst case to representative mode in test report. (Final test mode refer section 3.2.1)

8. The above EUT information was declared by the manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

### 3.2 Description of Test Modes

#### FOR 5745 ~ 5825MHz:

5 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

| Channel | Frequency | Channel | Frequency |
|---------|-----------|---------|-----------|
| 149     | 5745MHz   | 161     | 5805MHz   |
| 153     | 5765MHz   | 165     | 5825MHz   |
| 157     | 5785MHz   |         |           |

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

| Channel | Frequency | Channel | Frequency |
|---------|-----------|---------|-----------|
| 151     | 5755MHz   | 159     | 5795MHz   |

1 channel is provided for 802.11ac (VHT80):

| Channel | Frequency |
|---------|-----------|
| 155     | 5775MHz   |

### 3.2.1 Test Mode Applicability and Tested Channel Detail

| EUT CONFIGURE MODE | APPLICABLE TO |       |     |      | DESCRIPTION |
|--------------------|---------------|-------|-----|------|-------------|
|                    | RE≥1G         | RE<1G | PLC | APCM |             |
| -                  | √             | √     | -   | √    | -           |

Where **RE≥1G**: Radiated Emission above 1GHz

**RE<1G**: Radiated Emission below 1GHz

**PLC**: Power Line Conducted Emission

**APCM**: Antenna Port Conducted Measurement

#### NOTE:

1. "-" means no effect..

#### **Radiated Emission Test (Above 1GHz):**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

| MODE             | FREQ. BAND (MHz) | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | DATA RATE (Mbps) |
|------------------|------------------|-------------------|----------------|-----------------------|-----------------|------------------|
| 802.11a          | 5745-5825        | 149 to 165        | 149, 157, 165  | OFDM                  | BPSK            | 6                |
| 802.11ac (VHT20) |                  | 149 to 165        | 149, 157, 165  | OFDM                  | BPSK            | 6.5              |
| 802.11ac (VHT40) |                  | 151 to 159        | 151, 159       | OFDM                  | BPSK            | 13.5             |
| 802.11ac (VHT80) |                  | 155               | 155            | OFDM                  | BPSK            | 29.3             |

#### **Radiated Emission Test (Below 1GHz):**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

| MODE             | FREQ. BAND (MHz) | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | DATA RATE (Mbps) |
|------------------|------------------|-------------------|----------------|-----------------------|-----------------|------------------|
| 802.11ac (VHT20) | 5745-5825        | 149 to 165        | 165            | OFDM                  | BPSK            | 6                |

#### **Antenna Port Conducted Measurement:**

- ☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

| MODE             | FREQ. BAND (MHz) | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | DATA RATE (Mbps) |
|------------------|------------------|-------------------|----------------|-----------------------|-----------------|------------------|
| 802.11a          | 5745-5825        | 149 to 165        | 149, 157, 165  | OFDM                  | BPSK            | 6                |
| 802.11ac (VHT20) |                  | 149 to 165        | 149, 157, 165  | OFDM                  | BPSK            | 6.5              |
| 802.11ac (VHT40) |                  | 151 to 159        | 151, 159       | OFDM                  | BPSK            | 13.5             |
| 802.11ac (VHT80) |                  | 155               | 155            | OFDM                  | BPSK            | 29.3             |

**Test Condition:**

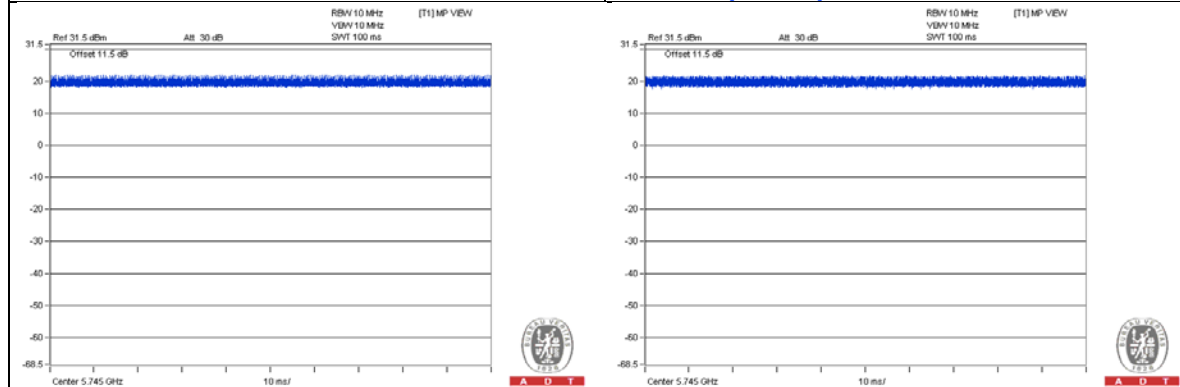
| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | INPUT POWER  | TESTED BY    |
|---------------|--------------------------|--------------|--------------|
| RE $\geq$ 1G  | 23deg. C, 63%RH          | 120Vac, 60Hz | Jyunchun Lin |
| RE<1G         | 25deg. C, 62%RH          | 120Vac, 60Hz | Jyunchun Lin |
| APCM          | 25deg. C, 60%RH          | 120Vac, 60Hz | Gary Cheng   |

### 3.3 Duty Cycle of Test Signal

Duty cycle of test signal is 100 %, duty factor is not required.

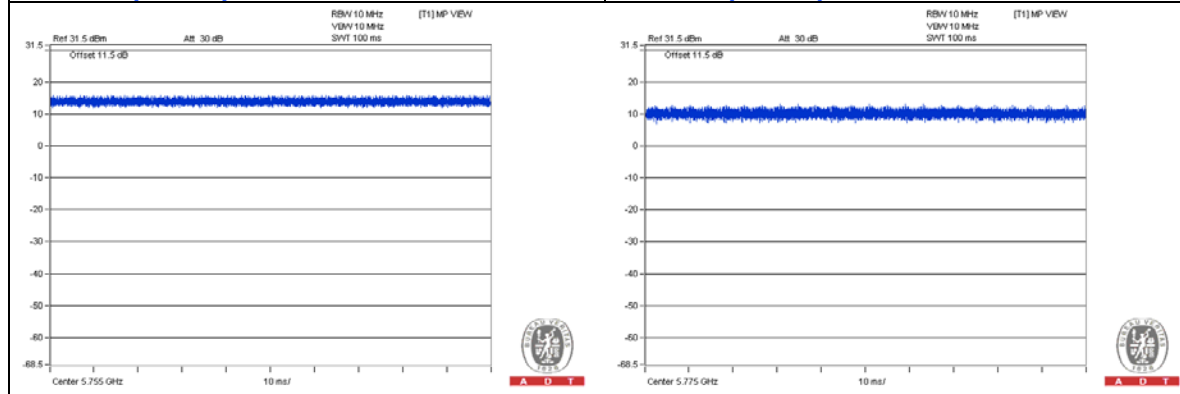
802.11a

802.11ac (VHT20)



802.11ac (VHT40)

802.11ac (VHT80)



### 3.4 Description of Support Units

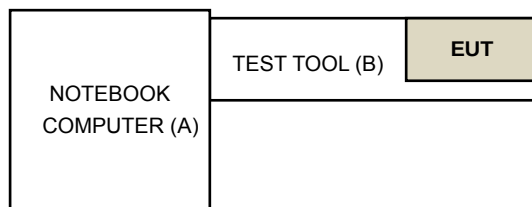
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| ID | Product           | Brand | Model No. | Serial No. | FCC ID  | Remarks            |
|----|-------------------|-------|-----------|------------|---------|--------------------|
| A. | Notebook Computer | DELL  | E5430     | HYV4VY1    | FCC DoC | Provided by Lab    |
| B. | Test Tool         | NA    | NA        | NA         | NA      | Supplied by Client |

Note:

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

#### 3.4.1 Configuration of System under Test



### 3.5 General Description of Applied Standard

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC Part 15, Subpart E (15.407)**

**KDB 789033 D02 General UNII Test Procedure New Rules v01**

**ANSI C63.10-2013**

All test items have been performed and recorded as per the above standards.

## 4 Test Types and Results

### 4.1 Radiated Emission and Bandedge Measurement

#### 4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table.

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

#### NOTE:

- The lower limit shall apply at the transition frequencies.
- Emission level (dBuV/m) = 20 log Emission level (uV/m).
- For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

#### LIMITS OF UNWANTED EMISSION OUT OF THE RESTRICTED BANDS

| APPLICABLE TO                                        | LIMIT                                                            |                                                                  |
|------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------------|
| 789033 D02 General UNII Test Procedure New Rules v01 | FIELD STRENGTH AT 3m                                             |                                                                  |
|                                                      | PK:74 (dBuV/m)                                                   | AV:54 (dBuV/m)                                                   |
| APPLICABLE TO                                        | EIRP LIMIT                                                       | EQUIVALENT FIELD STRENGTH AT 3m                                  |
| 15.407(b)(1)                                         | PK:-27 (dBm/MHz)                                                 | PK:68.2(dBuV/m)                                                  |
| 15.407(b)(2)                                         |                                                                  |                                                                  |
| 15.407(b)(3)                                         |                                                                  |                                                                  |
| 15.407(b)(4)                                         | PK:-27 (dBm/MHz) <sup>*1</sup><br>PK:-17 (dBm/MHz) <sup>*2</sup> | PK: 68.2(dBuV/m) <sup>*1</sup><br>PK:78.2 (dBuV/m) <sup>*2</sup> |

**NOTE:** <sup>\*1</sup> beyond 10MHz of the band edge <sup>\*2</sup> within 10 MHz of band edge

The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000\sqrt{30P}}{3} \mu\text{V/m, where P is the eirp (Watts).}$$

## 4.1.2 Test Instruments

| DESCRIPTION & MANUFACTURER                      | MODEL NO.                                                               | SERIAL NO.                    | CALIBRATED DATE | CALIBRATED UNTIL |
|-------------------------------------------------|-------------------------------------------------------------------------|-------------------------------|-----------------|------------------|
| Test Receiver<br>Agilent                        | N9038A                                                                  | MY54450088                    | July 24, 2015   | July 23, 2016    |
| Pre-Amplifier <sup>(*)</sup><br>EMCI            | EMC001340                                                               | 980142                        | Jan. 13, 2014   | Jan. 12, 2016    |
| Loop Antenna <sup>(*)</sup><br>Electro-Metrics  | EM-6879                                                                 | 264                           | Dec. 16, 2014   | Dec. 15, 2016    |
| RF Cable                                        | NA                                                                      | LOOPCAB-001<br>LOOPCAB-002    | Jan. 18, 2015   | Jan. 17, 2016    |
| Pre-Amplifier<br>Mini-Circuits                  | ZFL-1000VH2<br>B                                                        | AMP-ZFL-06                    | Nov. 11, 2015   | Nov. 10, 2016    |
| Trilog Broadband Antenna<br>SCHWARZBECK         | VULB 9168                                                               | 9168-406                      | Feb. 03, 2015   | Feb. 02, 2016    |
| RF Cable                                        | 8D                                                                      | 966-4-1<br>966-4-2<br>966-4-3 | Apr. 03, 2015   | Apr. 02, 2016    |
| Horn_Antenna<br>SCHWARZBECK                     | BBHA 9120D                                                              | 9120D-783                     | Feb. 06, 2015   | Feb. 05, 2016    |
| Pre-Amplifier<br>Agilent                        | 8449B                                                                   | 3008A01922                    | Sep. 19, 2015   | Sep. 18, 2016    |
| RF Cable                                        | EMC104-SM-<br>SM-2000<br>EMC104-SM-<br>SM-5000<br>EMC104-SM-<br>SM-5000 | 150318<br>150323<br>150324    | Mar. 31, 2015   | Mar. 30, 2016    |
| Pre-Amplifier<br>EMCI                           | EMC184045                                                               | 980143                        | Jan. 16, 2015   | Jan. 15, 2016    |
| Horn_Antenna<br>SCHWARZBECK                     | BBHA 9170                                                               | BBHA9170608                   | Feb. 05, 2015   | Feb. 04, 2016    |
| RF Cable                                        | SUCOFLEX<br>102                                                         | 36432/2<br>36441/2            | Jan. 17, 2015   | Jan. 16, 2016    |
| Software                                        | ADT_Radiated<br>_V8.7.07                                                | NA                            | NA              | NA               |
| Antenna Tower & Turn Table<br>CT                | NA                                                                      | NA                            | NA              | NA               |
| Power Meter<br>Anritsu                          | ML2495A                                                                 | 1014008                       | Apr. 28, 2015   | Apr. 27, 2016    |
| Power Sensor<br>Anritsu                         | MA2411B                                                                 | 0917122                       | Apr. 28, 2015   | Apr. 27, 2016    |
| Spectrum Analyzer<br>R&S                        | FSP40                                                                   | 100060                        | May 08, 2015    | May 07, 2016     |
| Temperature & Humidity<br>Chamber<br>GIANTFORCE | GTH-150-40-S<br>P-AR                                                    | MAA0812-008                   | Jan. 12, 2015   | Jan. 11, 2016    |

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
  2. \*The calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
  3. Loop antenna was used for all emissions below 30 MHz.
  4. The test was performed in 966 Chamber No. 4.
  5. The FCC Site Registration No. is 292998
  6. The CANADA Site Registration No. is 20331-2
- Tested Date: Dec. 25 to 29, 2015 and Jan. 06, 2016

#### 4.1.3 Test Procedure

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

**Note:**

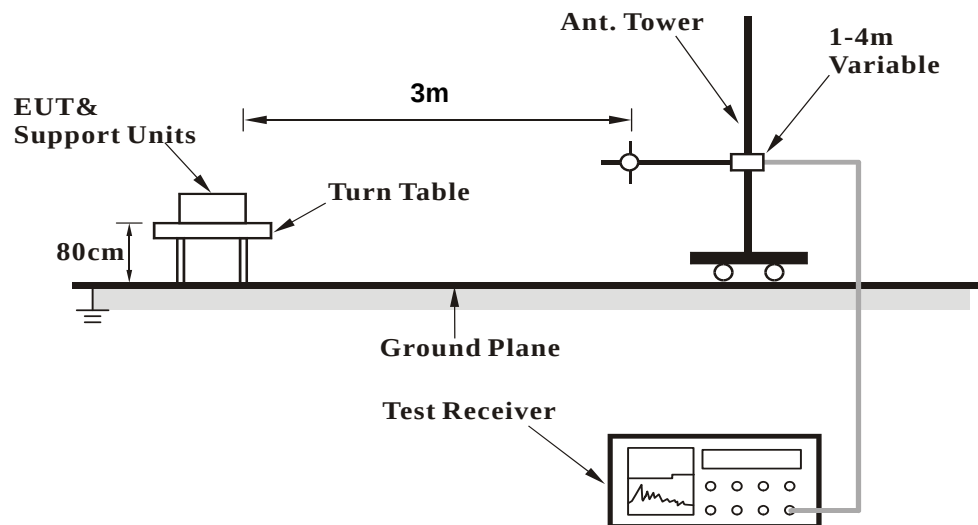
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average (Duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor ( $10 \log(1/\text{duty cycle})$ ).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle  $\geq 98\%$ ) for Average detection (AV) at frequency above 1GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

#### 4.1.4 Deviation from Test Standard

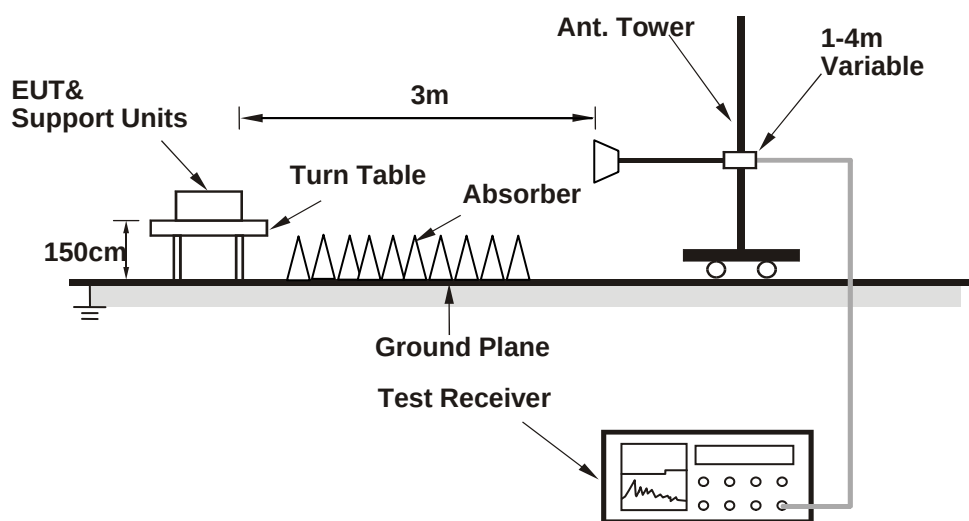
No deviation.

#### 4.1.5 Test Setup

##### <Frequency Range below 1GHz>



##### <Frequency Range above 1GHz>



For the actual test configuration, please refer to the attached file (Test Setup Photo).

#### 4.1.6 EUT Operating Condition

1. Connect the EUT with the support unit 1 (Notebook Computer) which is placed on a testing table.
2. The communication partner run test program "MP Kit RTL11ac 8821AU" to enable EUT under transmission/receiving condition continuously at specific channel frequency.

#### 4.1.7 Test Results

##### Above 1GHz Data:

##### 802.11a

|                        |                |                              |              |
|------------------------|----------------|------------------------------|--------------|
| <b>CHANNEL</b>         | TX Channel 149 | <b>DETECTOR<br/>FUNCTION</b> | Peak (PK)    |
| <b>FREQUENCY RANGE</b> | 1GHz ~ 40GHz   |                              | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M |                |                               |                   |                |                          |                            |                        |                                |
|-----------------------------------------------------|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | #5715.00       | 57.5 PK                       | 74.0              | -16.5          | 2.18 H                   | 97                         | 50.12                  | 7.38                           |
| 2                                                   | #5715.00       | 42.1 AV                       | 54.0              | -11.9          | 2.18 H                   | 97                         | 34.72                  | 7.38                           |
| 3                                                   | #5725.00       | 76.6 PK                       | 78.2              | -1.6           | 2.18 H                   | 97                         | 69.22                  | 7.38                           |
| 4                                                   | *5745.00       | 106.4 PK                      |                   |                | 2.18 H                   | 97                         | 99.02                  | 7.38                           |
| 5                                                   | *5745.00       | 97.3 AV                       |                   |                | 2.18 H                   | 97                         | 89.92                  | 7.38                           |
| 6                                                   | 11490.00       | 54.5 PK                       | 74.0              | -19.5          | 1.91 H                   | 207                        | 39.98                  | 14.52                          |
| 7                                                   | 11490.00       | 42.5 AV                       | 54.0              | -11.5          | 1.91 H                   | 207                        | 27.98                  | 14.52                          |
| 8                                                   | #17235.00      | 56.7 PK                       | 74.0              | -17.3          | 2.02 H                   | 213                        | 32.94                  | 23.76                          |
| 9                                                   | #17235.00      | 45.3 AV                       | 54.0              | -8.7           | 2.02 H                   | 213                        | 21.54                  | 23.76                          |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M   |                |                               |                   |                |                          |                            |                        |                                |
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | #5715.00       | 52.9 PK                       | 74.0              | -21.1          | 3.23 V                   | 142                        | 45.52                  | 7.38                           |
| 2                                                   | #5715.00       | 39.9 AV                       | 54.0              | -14.1          | 3.23 V                   | 142                        | 32.52                  | 7.38                           |
| 3                                                   | #5725.00       | 66.9 PK                       | 78.2              | -11.3          | 3.23 V                   | 142                        | 59.52                  | 7.38                           |
| 4                                                   | *5745.00       | 100.6 PK                      |                   |                | 3.23 V                   | 142                        | 93.22                  | 7.38                           |
| 5                                                   | *5745.00       | 91.5 AV                       |                   |                | 3.23 V                   | 142                        | 84.12                  | 7.38                           |
| 6                                                   | 11490.00       | 53.9 PK                       | 74.0              | -20.1          | 1.42 V                   | 192                        | 39.38                  | 14.52                          |
| 7                                                   | 11490.00       | 42.4 AV                       | 54.0              | -11.6          | 1.42 V                   | 192                        | 27.88                  | 14.52                          |
| 8                                                   | #17235.00      | 56.9 PK                       | 74.0              | -17.1          | 1.57 V                   | 183                        | 33.14                  | 23.76                          |
| 9                                                   | #17235.00      | 44.5 AV                       | 54.0              | -9.5           | 1.57 V                   | 183                        | 20.74                  | 23.76                          |

##### REMARKS:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
- The other emission levels were very low against the limit.
- Margin value = Emission Level – Limit value
- " \* ": Fundamental frequency.
- " # ": The radiated frequency is out of the restricted band.

|                        |                |                              |              |
|------------------------|----------------|------------------------------|--------------|
| <b>CHANNEL</b>         | TX Channel 157 | <b>DETECTOR<br/>FUNCTION</b> | Peak (PK)    |
| <b>FREQUENCY RANGE</b> | 1GHz ~ 40GHz   |                              | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M |                |                               |                   |                |                          |                            |                        |                                |
|-----------------------------------------------------|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | *5785.00       | 108.3 PK                      |                   |                | 2.15 H                   | 101                        | 100.92                 | 7.38                           |
| 2                                                   | *5785.00       | 98.4 AV                       |                   |                | 2.15 H                   | 101                        | 91.02                  | 7.38                           |
| 3                                                   | 11570.00       | 54.1 PK                       | 74.0              | -19.9          | 1.90 H                   | 222                        | 39.53                  | 14.57                          |
| 4                                                   | 11570.00       | 42.3 AV                       | 54.0              | -11.7          | 1.90 H                   | 222                        | 27.73                  | 14.57                          |
| 5                                                   | #17355.00      | 56.9 PK                       | 74.0              | -17.1          | 1.96 H                   | 208                        | 32.84                  | 24.06                          |
| 6                                                   | #17355.00      | 45.2 AV                       | 54.0              | -8.8           | 1.96 H                   | 208                        | 21.14                  | 24.06                          |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M   |                |                               |                   |                |                          |                            |                        |                                |
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | *5785.00       | 102.5 PK                      |                   |                | 3.25 V                   | 148                        | 95.12                  | 7.38                           |
| 2                                                   | *5785.00       | 92.6 AV                       |                   |                | 3.25 V                   | 148                        | 85.22                  | 7.38                           |
| 3                                                   | 11570.00       | 53.6 PK                       | 74.0              | -20.4          | 1.41 V                   | 177                        | 39.03                  | 14.57                          |
| 4                                                   | 11570.00       | 42.0 AV                       | 54.0              | -12.0          | 1.41 V                   | 177                        | 27.43                  | 14.57                          |
| 5                                                   | #17355.00      | 57.2 PK                       | 74.0              | -16.8          | 1.55 V                   | 192                        | 33.14                  | 24.06                          |
| 6                                                   | #17355.00      | 45.0 AV                       | 54.0              | -9.0           | 1.55 V                   | 192                        | 20.94                  | 24.06                          |

**REMARKS:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

|                        |                |                              |              |
|------------------------|----------------|------------------------------|--------------|
| <b>CHANNEL</b>         | TX Channel 165 | <b>DETECTOR<br/>FUNCTION</b> | Peak (PK)    |
| <b>FREQUENCY RANGE</b> | 1GHz ~ 40GHz   |                              | Average (AV) |

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

| NO. | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
|-----|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| 1   | *5825.00       | 108.4 PK                      |                   |                | 2.17 H                   | 99                         | 101.09                 | 7.31                           |
| 2   | *5825.00       | 98.6 AV                       |                   |                | 2.17 H                   | 99                         | 91.29                  | 7.31                           |
| 3   | #5850.00       | 60.9 PK                       | 78.2              | -17.3          | 2.17 H                   | 99                         | 53.65                  | 7.25                           |
| 4   | #5860.00       | 55.7 PK                       | 74.0              | -18.3          | 2.17 H                   | 99                         | 48.48                  | 7.22                           |
| 5   | #5860.00       | 42.4 AV                       | 54.0              | -11.6          | 2.17 H                   | 99                         | 35.18                  | 7.22                           |
| 6   | 11650.00       | 54.4 PK                       | 74.0              | -19.6          | 1.88 H                   | 234                        | 39.73                  | 14.67                          |
| 7   | 11650.00       | 42.7 AV                       | 54.0              | -11.3          | 1.88 H                   | 234                        | 28.03                  | 14.67                          |
| 8   | #17475.00      | 56.7 PK                       | 74.0              | -17.3          | 1.93 H                   | 198                        | 32.68                  | 24.02                          |
| 9   | #17475.00      | 44.9 AV                       | 54.0              | -9.1           | 1.93 H                   | 198                        | 20.88                  | 24.02                          |

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

| NO. | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
|-----|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| 1   | *5825.00       | 102.6 PK                      |                   |                | 3.26 V                   | 157                        | 95.29                  | 7.31                           |
| 2   | *5825.00       | 92.8 AV                       |                   |                | 3.26 V                   | 157                        | 85.49                  | 7.31                           |
| 3   | #5850.00       | 53.4 PK                       | 78.2              | -24.8          | 3.26 V                   | 157                        | 46.15                  | 7.25                           |
| 4   | #5860.00       | 53.1 PK                       | 74.0              | -20.9          | 3.26 V                   | 157                        | 45.88                  | 7.22                           |
| 5   | #5860.00       | 40.2 AV                       | 54.0              | -13.8          | 3.26 V                   | 157                        | 32.98                  | 7.22                           |
| 6   | 11650.00       | 54.1 PK                       | 74.0              | -19.9          | 1.41 V                   | 162                        | 39.43                  | 14.67                          |
| 7   | 11650.00       | 42.4 AV                       | 54.0              | -11.6          | 1.41 V                   | 162                        | 27.73                  | 14.67                          |
| 8   | #17475.00      | 57.3 PK                       | 74.0              | -16.7          | 1.51 V                   | 187                        | 33.28                  | 24.02                          |
| 9   | #17475.00      | 45.3 AV                       | 54.0              | -8.7           | 1.51 V                   | 187                        | 21.28                  | 24.02                          |

**REMARKS:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

## 802.11ac (VHT20)

|                 |                |                      |              |
|-----------------|----------------|----------------------|--------------|
| CHANNEL         | TX Channel 149 | DETECTOR<br>FUNCTION | Peak (PK)    |
| FREQUENCY RANGE | 1GHz ~ 40GHz   |                      | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M |                |                               |                   |                |                          |                            |                        |                                |
|-----------------------------------------------------|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | #5715.00       | 57.5 PK                       | 74.0              | -16.5          | 2.17 H                   | 111                        | 50.12                  | 7.38                           |
| 2                                                   | #5715.00       | 42.5 AV                       | 54.0              | -11.5          | 2.17 H                   | 111                        | 35.12                  | 7.38                           |
| 3                                                   | #5725.00       | 76.0 PK                       | 78.2              | -2.2           | 2.17 H                   | 111                        | 68.62                  | 7.38                           |
| 4                                                   | *5745.00       | 105.4 PK                      |                   |                | 2.17 H                   | 111                        | 98.02                  | 7.38                           |
| 5                                                   | *5745.00       | 96.6 AV                       |                   |                | 2.17 H                   | 111                        | 89.22                  | 7.38                           |
| 6                                                   | 11490.00       | 54.5 PK                       | 74.0              | -19.5          | 1.94 H                   | 235                        | 39.98                  | 14.52                          |
| 7                                                   | 11490.00       | 42.5 AV                       | 54.0              | -11.5          | 1.94 H                   | 235                        | 27.98                  | 14.52                          |
| 8                                                   | #17235.00      | 57.2 PK                       | 74.0              | -16.8          | 1.91 H                   | 200                        | 33.44                  | 23.76                          |
| 9                                                   | #17235.00      | 45.5 AV                       | 54.0              | -8.5           | 1.91 H                   | 200                        | 21.74                  | 23.76                          |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M   |                |                               |                   |                |                          |                            |                        |                                |
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | #5715.00       | 53.3 PK                       | 74.0              | -20.7          | 3.18 V                   | 135                        | 45.92                  | 7.38                           |
| 2                                                   | #5715.00       | 39.4 AV                       | 54.0              | -14.6          | 3.18 V                   | 135                        | 32.02                  | 7.38                           |
| 3                                                   | #5725.00       | 66.3 PK                       | 78.2              | -11.9          | 3.18 V                   | 135                        | 58.92                  | 7.38                           |
| 4                                                   | *5745.00       | 99.6 PK                       |                   |                | 3.18 V                   | 135                        | 92.22                  | 7.38                           |
| 5                                                   | *5745.00       | 90.8 AV                       |                   |                | 3.18 V                   | 135                        | 83.42                  | 7.38                           |
| 6                                                   | 11490.00       | 53.2 PK                       | 74.0              | -20.8          | 1.42 V                   | 167                        | 38.68                  | 14.52                          |
| 7                                                   | 11490.00       | 41.7 AV                       | 54.0              | -12.3          | 1.42 V                   | 167                        | 27.18                  | 14.52                          |
| 8                                                   | #17235.00      | 57.1 PK                       | 74.0              | -16.9          | 1.51 V                   | 191                        | 33.34                  | 23.76                          |
| 9                                                   | #17235.00      | 45.0 AV                       | 54.0              | -9.0           | 1.51 V                   | 191                        | 21.24                  | 23.76                          |

## REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

|                        |                |                              |              |
|------------------------|----------------|------------------------------|--------------|
| <b>CHANNEL</b>         | TX Channel 157 | <b>DETECTOR<br/>FUNCTION</b> | Peak (PK)    |
| <b>FREQUENCY RANGE</b> | 1GHz ~ 40GHz   |                              | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M |                |                               |                   |                |                          |                            |                        |                                |
|-----------------------------------------------------|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | *5785.00       | 108.1 PK                      |                   |                | 2.17 H                   | 102                        | 100.72                 | 7.38                           |
| 2                                                   | *5785.00       | 98.1 AV                       |                   |                | 2.17 H                   | 102                        | 90.72                  | 7.38                           |
| 3                                                   | 11570.00       | 54.6 PK                       | 74.0              | -19.4          | 1.85 H                   | 216                        | 40.03                  | 14.57                          |
| 4                                                   | 11570.00       | 42.5 AV                       | 54.0              | -11.5          | 1.85 H                   | 216                        | 27.93                  | 14.57                          |
| 5                                                   | #17355.00      | 56.7 PK                       | 74.0              | -17.3          | 2.01 H                   | 209                        | 32.64                  | 24.06                          |
| 6                                                   | #17355.00      | 45.3 AV                       | 54.0              | -8.7           | 2.01 H                   | 209                        | 21.24                  | 24.06                          |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M   |                |                               |                   |                |                          |                            |                        |                                |
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | *5785.00       | 102.3 PK                      |                   |                | 3.24 V                   | 152                        | 94.92                  | 7.38                           |
| 2                                                   | *5785.00       | 92.2 AV                       |                   |                | 3.24 V                   | 152                        | 84.82                  | 7.38                           |
| 3                                                   | 11570.00       | 54.3 PK                       | 74.0              | -19.7          | 1.45 V                   | 164                        | 39.73                  | 14.57                          |
| 4                                                   | 11570.00       | 42.4 AV                       | 54.0              | -11.6          | 1.45 V                   | 164                        | 27.83                  | 14.57                          |
| 5                                                   | #17355.00      | 57.8 PK                       | 74.0              | -16.2          | 1.52 V                   | 186                        | 33.74                  | 24.06                          |
| 6                                                   | #17355.00      | 45.4 AV                       | 54.0              | -8.6           | 1.52 V                   | 186                        | 21.34                  | 24.06                          |

#### REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

|                        |                |                              |              |
|------------------------|----------------|------------------------------|--------------|
| <b>CHANNEL</b>         | TX Channel 165 | <b>DETECTOR<br/>FUNCTION</b> | Peak (PK)    |
| <b>FREQUENCY RANGE</b> | 1GHz ~ 40GHz   |                              | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M |                |                               |                   |                |                          |                            |                        |                                |
|-----------------------------------------------------|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | *5825.00       | 107.5 PK                      |                   |                | 2.15 H                   | 106                        | 100.19                 | 7.31                           |
| 2                                                   | *5825.00       | 98.3 AV                       |                   |                | 2.15 H                   | 106                        | 90.99                  | 7.31                           |
| 3                                                   | #5850.00       | 69.1 PK                       | 78.2              | -9.1           | 2.15 H                   | 106                        | 61.85                  | 7.25                           |
| 4                                                   | #5860.00       | 58.9 PK                       | 74.0              | -15.1          | 2.15 H                   | 106                        | 51.68                  | 7.22                           |
| 5                                                   | #5860.00       | 44.8 AV                       | 54.0              | -9.2           | 2.15 H                   | 106                        | 37.58                  | 7.22                           |
| 6                                                   | 11650.00       | 54.1 PK                       | 74.0              | -19.9          | 1.92 H                   | 211                        | 39.43                  | 14.67                          |
| 7                                                   | 11650.00       | 42.6 AV                       | 54.0              | -11.4          | 1.92 H                   | 211                        | 27.93                  | 14.67                          |
| 8                                                   | #17475.00      | 56.6 PK                       | 74.0              | -17.4          | 1.92 H                   | 213                        | 32.58                  | 24.02                          |
| 9                                                   | #17475.00      | 45.1 AV                       | 54.0              | -8.9           | 1.92 H                   | 213                        | 21.08                  | 24.02                          |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M   |                |                               |                   |                |                          |                            |                        |                                |
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | *5825.00       | 101.7 PK                      |                   |                | 3.18 V                   | 153                        | 94.39                  | 7.31                           |
| 2                                                   | *5825.00       | 92.5 AV                       |                   |                | 3.18 V                   | 153                        | 85.19                  | 7.31                           |
| 3                                                   | #5850.00       | 53.5 PK                       | 78.2              | -24.7          | 3.18 V                   | 153                        | 46.25                  | 7.25                           |
| 4                                                   | #5860.00       | 55.1 PK                       | 74.0              | -18.9          | 3.18 V                   | 153                        | 47.88                  | 7.22                           |
| 5                                                   | #5860.00       | 40.1 AV                       | 54.0              | -13.9          | 3.18 V                   | 153                        | 32.88                  | 7.22                           |
| 6                                                   | 11650.00       | 52.9 PK                       | 74.0              | -21.1          | 1.41 V                   | 162                        | 38.23                  | 14.67                          |
| 7                                                   | 11650.00       | 41.5 AV                       | 54.0              | -12.5          | 1.41 V                   | 162                        | 26.83                  | 14.67                          |
| 8                                                   | #17475.00      | 57.2 PK                       | 74.0              | -16.8          | 1.58 V                   | 189                        | 33.18                  | 24.02                          |
| 9                                                   | #17475.00      | 44.9 AV                       | 54.0              | -9.1           | 1.58 V                   | 189                        | 20.88                  | 24.02                          |

#### REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

## 802.11ac (VHT40)

|                 |                |                      |              |
|-----------------|----------------|----------------------|--------------|
| CHANNEL         | TX Channel 151 | DETECTOR<br>FUNCTION | Peak (PK)    |
| FREQUENCY RANGE | 1GHz ~ 40GHz   |                      | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M |                |                               |                   |                |                          |                            |                        |                                |
|-----------------------------------------------------|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | #5715.00       | 67.5 PK                       | 74.0              | -6.5           | 2.17 H                   | 265                        | 60.12                  | 7.38                           |
| 2                                                   | #5715.00       | 52.4 AV                       | 54.0              | -1.6           | 2.17 H                   | 265                        | 45.02                  | 7.38                           |
| 3                                                   | #5725.00       | 69.1 PK                       | 78.2              | -9.1           | 2.17 H                   | 265                        | 61.72                  | 7.38                           |
| 4                                                   | *5755.00       | 100.3 PK                      |                   |                | 2.17 H                   | 265                        | 92.92                  | 7.38                           |
| 5                                                   | *5755.00       | 90.7 AV                       |                   |                | 2.17 H                   | 265                        | 83.32                  | 7.38                           |
| 6                                                   | 11510.00       | 54.5 PK                       | 74.0              | -19.5          | 1.85 H                   | 230                        | 40.00                  | 14.50                          |
| 7                                                   | 11510.00       | 42.5 AV                       | 54.0              | -11.5          | 1.85 H                   | 230                        | 28.00                  | 14.50                          |
| 8                                                   | #17265.00      | 57.6 PK                       | 74.0              | -16.4          | 2.00 H                   | 205                        | 34.08                  | 23.52                          |
| 9                                                   | #17265.00      | 45.7 AV                       | 54.0              | -8.3           | 2.00 H                   | 205                        | 22.18                  | 23.52                          |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M   |                |                               |                   |                |                          |                            |                        |                                |
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | #5715.00       | 62.4 PK                       | 74.0              | -11.6          | 3.18 V                   | 164                        | 55.02                  | 7.38                           |
| 2                                                   | #5715.00       | 47.3 AV                       | 54.0              | -6.7           | 3.18 V                   | 164                        | 39.92                  | 7.38                           |
| 3                                                   | #5725.00       | 60.2 PK                       | 78.2              | -18.0          | 3.18 V                   | 164                        | 52.82                  | 7.38                           |
| 4                                                   | *5755.00       | 94.5 PK                       |                   |                | 3.18 V                   | 164                        | 87.12                  | 7.38                           |
| 5                                                   | *5755.00       | 85.1 AV                       |                   |                | 3.18 V                   | 164                        | 77.72                  | 7.38                           |
| 6                                                   | 11510.00       | 54.7 PK                       | 74.0              | -19.3          | 1.51 V                   | 159                        | 40.20                  | 14.50                          |
| 7                                                   | 11510.00       | 42.9 AV                       | 54.0              | -11.1          | 1.51 V                   | 159                        | 28.40                  | 14.50                          |
| 8                                                   | #17265.00      | 57.7 PK                       | 74.0              | -16.3          | 1.48 V                   | 186                        | 34.18                  | 23.52                          |
| 9                                                   | #17265.00      | 45.6 AV                       | 54.0              | -8.4           | 1.48 V                   | 186                        | 22.08                  | 23.52                          |

## REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

|                        |                |                              |              |
|------------------------|----------------|------------------------------|--------------|
| <b>CHANNEL</b>         | TX Channel 159 | <b>DETECTOR<br/>FUNCTION</b> | Peak (PK)    |
| <b>FREQUENCY RANGE</b> | 1GHz ~ 40GHz   |                              | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M |                |                               |                   |                |                          |                            |                        |                                |
|-----------------------------------------------------|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | *5795.00       | 105.9 PK                      |                   |                | 2.17 H                   | 101                        | 98.52                  | 7.38                           |
| 2                                                   | *5795.00       | 95.8 AV                       |                   |                | 2.17 H                   | 101                        | 88.42                  | 7.38                           |
| 3                                                   | #5850.00       | 62.3 PK                       | 78.2              | -15.9          | 2.17 H                   | 101                        | 55.05                  | 7.25                           |
| 4                                                   | #5860.00       | 59.8 PK                       | 74.0              | -14.2          | 2.17 H                   | 101                        | 52.58                  | 7.22                           |
| 5                                                   | #5860.00       | 44.2 AV                       | 54.0              | -9.8           | 2.17 H                   | 101                        | 36.98                  | 7.22                           |
| 6                                                   | 11590.00       | 54.3 PK                       | 74.0              | -19.7          | 1.88 H                   | 214                        | 39.69                  | 14.61                          |
| 7                                                   | 11590.00       | 42.4 AV                       | 54.0              | -11.6          | 1.88 H                   | 214                        | 27.79                  | 14.61                          |
| 8                                                   | #17385.00      | 57.6 PK                       | 74.0              | -16.4          | 1.95 H                   | 207                        | 33.11                  | 24.49                          |
| 9                                                   | #17385.00      | 45.6 AV                       | 54.0              | -8.4           | 1.95 H                   | 207                        | 21.11                  | 24.49                          |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M   |                |                               |                   |                |                          |                            |                        |                                |
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | *5795.00       | 100.1 PK                      |                   |                | 3.20 V                   | 168                        | 92.72                  | 7.38                           |
| 2                                                   | *5795.00       | 90.3 AV                       |                   |                | 3.20 V                   | 168                        | 82.92                  | 7.38                           |
| 3                                                   | #5850.00       | 53.3 PK                       | 78.2              | -24.9          | 3.20 V                   | 168                        | 46.05                  | 7.25                           |
| 4                                                   | #5860.00       | 55.6 PK                       | 74.0              | -18.4          | 3.20 V                   | 168                        | 48.38                  | 7.22                           |
| 5                                                   | #5860.00       | 40.2 AV                       | 54.0              | -13.8          | 3.20 V                   | 168                        | 32.98                  | 7.22                           |
| 6                                                   | 11590.00       | 54.6 PK                       | 74.0              | -19.4          | 1.48 V                   | 178                        | 39.99                  | 14.61                          |
| 7                                                   | 11590.00       | 42.6 AV                       | 54.0              | -11.4          | 1.48 V                   | 178                        | 27.99                  | 14.61                          |
| 8                                                   | #17385.00      | 58.1 PK                       | 74.0              | -15.9          | 1.57 V                   | 201                        | 33.61                  | 24.49                          |
| 9                                                   | #17385.00      | 45.6 AV                       | 54.0              | -8.4           | 1.57 V                   | 201                        | 21.11                  | 24.49                          |

#### REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

## 802.11ac (VHT80)

|                 |                |                      |              |
|-----------------|----------------|----------------------|--------------|
| CHANNEL         | TX Channel 155 | DETECTOR<br>FUNCTION | Peak (PK)    |
| FREQUENCY RANGE | 1GHz ~ 40GHz   |                      | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M |                |                               |                   |                |                          |                            |                        |                                |
|-----------------------------------------------------|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | #5715.00       | 66.8 PK                       | 74.0              | -7.2           | 2.17 H                   | 296                        | 59.42                  | 7.38                           |
| 2                                                   | #5715.00       | 52.4 AV                       | 54.0              | -1.6           | 2.17 H                   | 296                        | 45.02                  | 7.38                           |
| 3                                                   | #5725.00       | 68.9 PK                       | 78.2              | -9.3           | 2.17 H                   | 296                        | 61.52                  | 7.38                           |
| 4                                                   | *5775.00       | 96.8 PK                       |                   |                | 2.17 H                   | 296                        | 89.42                  | 7.38                           |
| 5                                                   | *5775.00       | 87.3 AV                       |                   |                | 2.17 H                   | 296                        | 79.92                  | 7.38                           |
| 6                                                   | #5850.00       | 63.5 PK                       | 78.2              | -14.7          | 2.17 H                   | 296                        | 56.25                  | 7.25                           |
| 7                                                   | #5860.00       | 61.9 PK                       | 74.0              | -12.1          | 2.17 H                   | 296                        | 54.68                  | 7.22                           |
| 8                                                   | #5860.00       | 47.5 AV                       | 54.0              | -6.5           | 2.17 H                   | 296                        | 40.28                  | 7.22                           |
| 9                                                   | 11550.00       | 54.5 PK                       | 74.0              | -19.5          | 1.85 H                   | 220                        | 39.95                  | 14.55                          |
| 10                                                  | 11550.00       | 42.6 AV                       | 54.0              | -11.4          | 1.85 H                   | 220                        | 28.05                  | 14.55                          |
| 11                                                  | #17325.00      | 57.0 PK                       | 74.0              | -17.0          | 2.01 H                   | 221                        | 33.38                  | 23.62                          |
| 12                                                  | #17325.00      | 45.2 AV                       | 54.0              | -8.8           | 2.01 H                   | 221                        | 21.58                  | 23.62                          |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M   |                |                               |                   |                |                          |                            |                        |                                |
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | #5715.00       | 61.7 PK                       | 74.0              | -12.3          | 3.24 V                   | 149                        | 54.32                  | 7.38                           |
| 2                                                   | #5715.00       | 47.6 AV                       | 54.0              | -6.4           | 3.24 V                   | 149                        | 40.22                  | 7.38                           |
| 3                                                   | #5725.00       | 64.1 PK                       | 78.2              | -14.1          | 3.24 V                   | 149                        | 56.72                  | 7.38                           |
| 4                                                   | *5775.00       | 91.0 PK                       |                   |                | 3.24 V                   | 149                        | 83.62                  | 7.38                           |
| 5                                                   | *5775.00       | 81.8 AV                       |                   |                | 3.24 V                   | 149                        | 74.42                  | 7.38                           |
| 6                                                   | #5850.00       | 58.3 PK                       | 78.2              | -19.9          | 3.24 V                   | 149                        | 51.05                  | 7.25                           |
| 7                                                   | #5860.00       | 56.9 PK                       | 74.0              | -17.1          | 3.24 V                   | 149                        | 49.68                  | 7.22                           |
| 8                                                   | #5860.00       | 42.6 AV                       | 54.0              | -11.4          | 3.24 V                   | 149                        | 35.38                  | 7.22                           |
| 9                                                   | 11550.00       | 54.3 PK                       | 74.0              | -19.7          | 1.45 V                   | 159                        | 39.75                  | 14.55                          |
| 10                                                  | 11550.00       | 42.1 AV                       | 54.0              | -11.9          | 1.45 V                   | 159                        | 27.55                  | 14.55                          |
| 11                                                  | #17325.00      | 57.5 PK                       | 74.0              | -16.5          | 1.55 V                   | 179                        | 33.88                  | 23.62                          |
| 12                                                  | #17325.00      | 45.4 AV                       | 54.0              | -8.6           | 1.55 V                   | 179                        | 21.78                  | 23.62                          |

## REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

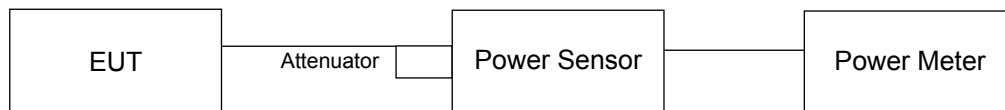
## 4.2 Transmit Power Measurement

### 4.2.1 Limits of Transmit Power Measurement

| Operation Band | EUT Category |                                   | LIMIT                                                                                                                       |
|----------------|--------------|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| U-NII-1        |              | Outdoor Access Point              | 1 Watt (30 dBm)<br>(Max. e.i.r.p $\leq$ 125mW(21 dBm) at any elevation angle above 30 degrees as measured from the horizon) |
|                |              | Fixed point-to-point Access Point | 1 Watt (30 dBm)                                                                                                             |
|                |              | Indoor Access Point               | 1 Watt (30 dBm)                                                                                                             |
|                |              | Mobile and Portable client device | 250mW (24 dBm)                                                                                                              |
| U-NII-2A       |              |                                   | 250mW (24 dBm) or 11 dBm+10 log B*                                                                                          |
| U-NII-2C       |              |                                   | 250mW (24 dBm) or 11 dBm+10 log B*                                                                                          |
| U-NII-3        | √            |                                   | 1 Watt (30 dBm)                                                                                                             |

\*B is the 26 dB emission bandwidth in megahertz

### 4.2.2 Test Setup



### 4.2.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.2.4 Test Procedure

Method PM is used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

### 4.2.5 Deviation from Test Standard

No deviation.

### 4.2.6 EUT Operating Condition

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

#### 4.2.7 Test Result

##### POWER OUTPUT:

##### 802.11a

| Chan. | Chan. Freq.<br>(MHz) | Average<br>Power<br>(mW) | Average<br>Power<br>(dBm) | Limit (dBm) | Pass / Fail |
|-------|----------------------|--------------------------|---------------------------|-------------|-------------|
| 149   | 5745                 | 66.374                   | 18.22                     | 30          | Pass        |
| 157   | 5785                 | 67.764                   | 18.31                     | 30          | Pass        |
| 165   | 5825                 | 65.615                   | 18.17                     | 30          | Pass        |

##### 802.11ac (VHT20)

| Chan. | Chan. Freq.<br>(MHz) | Average<br>Power<br>(mW) | Average<br>Power<br>(dBm) | Limit (dBm) | Pass / Fail |
|-------|----------------------|--------------------------|---------------------------|-------------|-------------|
| 149   | 5745                 | 35.645                   | 15.52                     | 30          | Pass        |
| 157   | 5785                 | 67.92                    | 18.32                     | 30          | Pass        |
| 165   | 5825                 | 68.077                   | 18.33                     | 30          | Pass        |

##### 802.11ac (VHT40)

| Chan. | Chan. Freq.<br>(MHz) | Average<br>Power<br>(mW) | Average<br>Power<br>(dBm) | Limit (dBm) | Pass / Fail |
|-------|----------------------|--------------------------|---------------------------|-------------|-------------|
| 151   | 5755                 | 17.906                   | 12.53                     | 30          | Pass        |
| 159   | 5795                 | 65.464                   | 18.16                     | 30          | Pass        |

##### 802.11ac (VHT80)

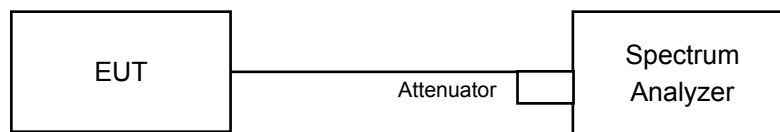
| Chan. | Chan. Freq.<br>(MHz) | Average<br>Power<br>(mW) | Average<br>Power<br>(dBm) | Limit (dBm) | Pass / Fail |
|-------|----------------------|--------------------------|---------------------------|-------------|-------------|
| 155   | 5775                 | 13.49                    | 11.30                     | 30          | Pass        |

### 4.3 Peak Power Spectral Density Measurement

#### 4.3.1 Limits of Peak Power Spectral Density Measurement

| Operation Band | EUT Category |                                   | LIMIT         |
|----------------|--------------|-----------------------------------|---------------|
| U-NII-1        |              | Outdoor Access Point              | 17dBm/ MHz    |
|                |              | Fixed point-to-point Access Point |               |
|                |              | Indoor Access Point               |               |
|                |              | Mobile and Portable client device | 11dBm/ MHz    |
| U-NII-2A       |              |                                   | 11dBm/ MHz    |
| U-NII-2C       |              |                                   | 11dBm/ MHz    |
| U-NII-3        | √            |                                   | 30dBm/ 500kHz |

#### 4.3.2 Test Setup



#### 4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

#### 4.3.4 Test Procedure

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 300 kHz, Set VBW ≥ 1 MHz, Detector = RMS
3. Use the peak marker function to determine the maximum power level in any 300 kHz band segment within the fundamental EBW.
4. Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where  $BWCF = 10\log(500 \text{ kHz}/300\text{kHz})$
5. Sweep time = auto, trigger set to "free run".
6. Trace average at least 100 traces in power averaging mode.
7. Record the max value

#### 4.3.5 Deviation from Test Standard

No deviation.

#### 4.3.6 EUT Operating Condition

Same as Item 4.3.6.

#### 4.3.7 Test Results

##### For U-NII-1 Band

##### 802.11a

| Chan. | Chan. Freq.<br>(MHz) | PSD<br>(dBm/300kHz) | PSD<br>(dBm/500kHz) | Limit<br>(dBm/500kHz) | Pass<br>/Fail |
|-------|----------------------|---------------------|---------------------|-----------------------|---------------|
| 149   | 5745                 | -4.31               | -2.09               | 30                    | Pass          |
| 157   | 5785                 | -3.13               | -0.91               | 30                    | Pass          |
| 165   | 5825                 | -3.56               | -1.34               | 30                    | Pass          |

##### 802.11ac (VHT20)

| Chan. | Chan. Freq.<br>(MHz) | PSD<br>(dBm/300kHz) | PSD<br>(dBm/500kHz) | Limit<br>(dBm/500kHz) | Pass<br>/Fail |
|-------|----------------------|---------------------|---------------------|-----------------------|---------------|
| 149   | 5745                 | -5.97               | -3.75               | 30                    | Pass          |
| 157   | 5785                 | -3.57               | -1.35               | 30                    | Pass          |
| 165   | 5825                 | -3.29               | -1.07               | 30                    | Pass          |

##### 802.11ac (VHT40)

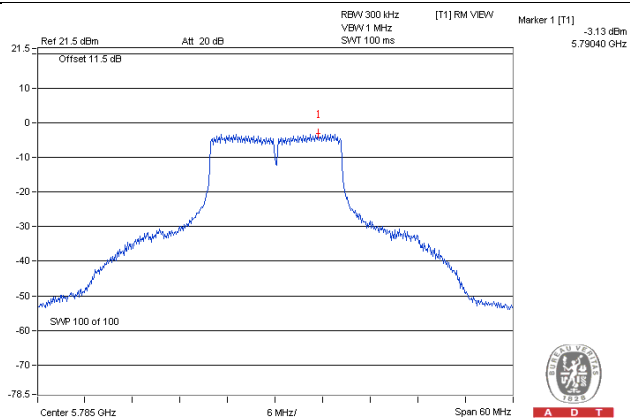
| Chan. | Chan. Freq.<br>(MHz) | PSD<br>(dBm/300kHz) | PSD<br>(dBm/500kHz) | Limit<br>(dBm/500kHz) | Pass<br>/Fail |
|-------|----------------------|---------------------|---------------------|-----------------------|---------------|
| 151   | 5755                 | -11.89              | -9.67               | 30                    | Pass          |
| 159   | 5795                 | -6.93               | -4.71               | 30                    | Pass          |

##### 802.11ac (VHT80)

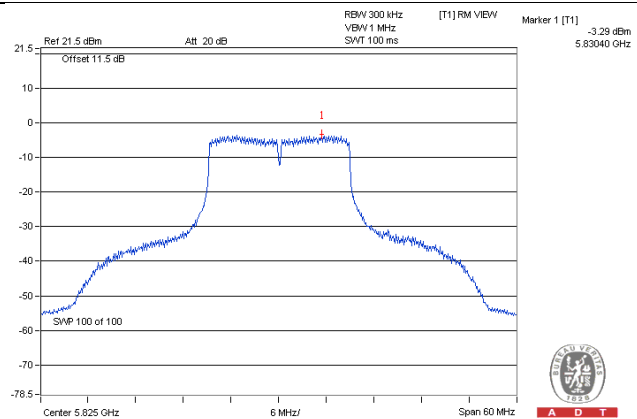
| Chan. | Chan. Freq.<br>(MHz) | PSD<br>(dBm/300kHz) | PSD<br>(dBm/500kHz) | Limit<br>(dBm/500kHz) | Pass<br>/Fail |
|-------|----------------------|---------------------|---------------------|-----------------------|---------------|
| 155   | 5775                 | -15.37              | -13.15              | 30                    | Pass          |

# Spectrum Plot of Worst Value

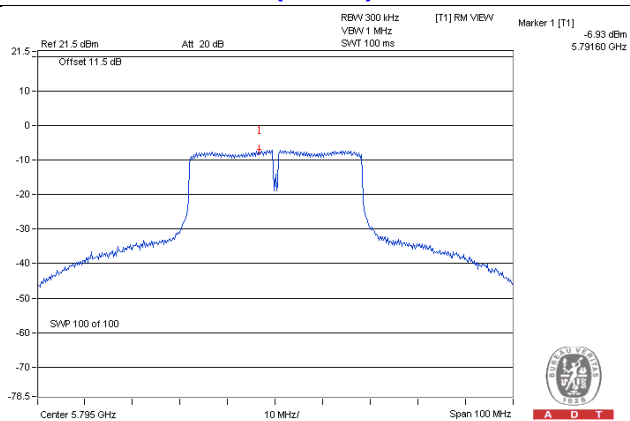
## 802.11a: CH157



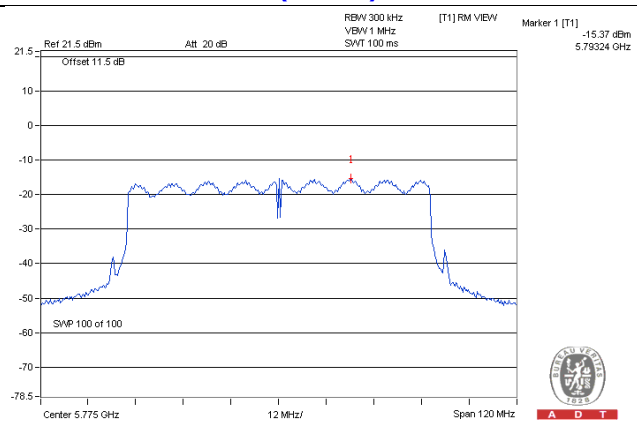
## 802.11ac (VHT20): CH165



## 802.11ac (VHT40): CH159



## 802.11ac (VHT80): CH155

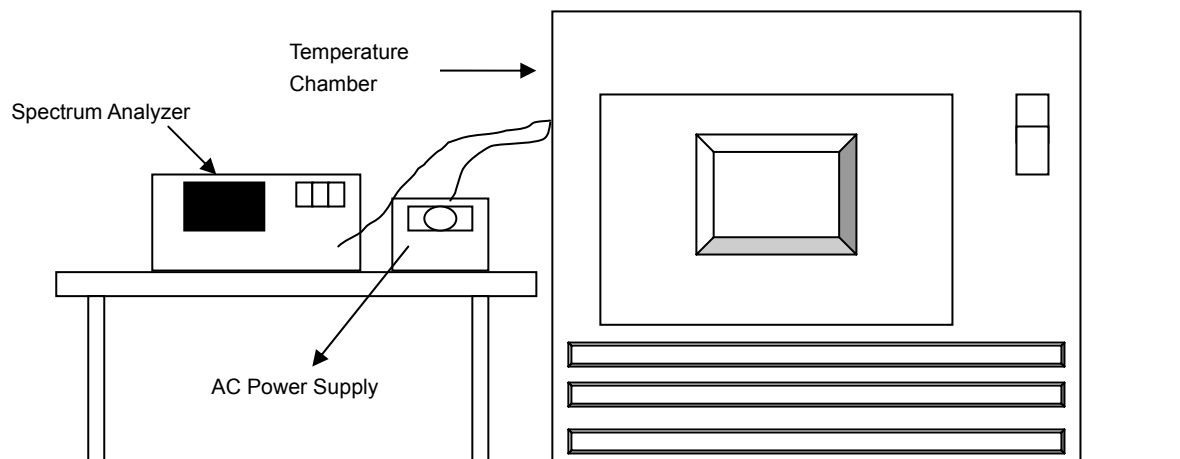


## 4.4 Frequency Stability Measurement

### 4.4.1 Limits of Frequency Stability Measurement

The frequency of the carrier signal shall be maintained within band of operation

### 4.4.2 Test Setup



### 4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.4.4 Test Procedure

- The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
- Turn the EUT on and couple its output to a spectrum analyzer.
- Turn the EUT off and set the chamber to the highest temperature specified.
- 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.
- Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
- The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

### 4.4.5 Deviation from Test Standard

No deviation.

### 4.4.6 EUT Operating Condition

Set the EUT transmit at un-modulation mode to test frequency stability.

#### 4.4.7 Test Results

| FREQUENCY STABILITY VERSUS TEMP. |                          |                                |                           |                                |                           |                                |                           |                                |                           |
|----------------------------------|--------------------------|--------------------------------|---------------------------|--------------------------------|---------------------------|--------------------------------|---------------------------|--------------------------------|---------------------------|
| OPERATING FREQUENCY: 5745MHz     |                          |                                |                           |                                |                           |                                |                           |                                |                           |
| TEMP.<br>(°C)                    | POWER<br>SUPPLY<br>(Vac) | 0 MINUTE                       |                           | 2 MINUTE                       |                           | 5 MINUTE                       |                           | 10 MINUTE                      |                           |
|                                  |                          | Measured<br>Frequency<br>(MHz) | Frequency<br>Drift<br>(%) | Measured<br>Frequency<br>(MHz) | Frequency<br>Drift<br>(%) | Measured<br>Frequency<br>(MHz) | Frequency<br>Drift<br>(%) | Measured<br>Frequency<br>(MHz) | Frequency<br>Drift<br>(%) |
| 50                               | 120                      | 5745.0213                      | 0.00037                   | 5745.0178                      | 0.00031                   | 5745.019                       | 0.00033                   | 5745.019                       | 0.00033                   |
| 40                               | 120                      | 5744.9905                      | -0.00017                  | 5744.9887                      | -0.00020                  | 5744.993                       | -0.00012                  | 5744.989                       | -0.00019                  |
| 30                               | 120                      | 5745.0175                      | 0.00030                   | 5745.0159                      | 0.00028                   | 5745.0135                      | 0.00023                   | 5745.0142                      | 0.00025                   |
| 20                               | 120                      | 5745.0175                      | 0.00030                   | 5745.0201                      | 0.00035                   | 5745.0176                      | 0.00031                   | 5745.017                       | 0.00030                   |
| 10                               | 120                      | 5745.0044                      | 0.00008                   | 5745.0044                      | 0.00008                   | 5745.004                       | 0.00007                   | 5745.005                       | 0.00009                   |
| 0                                | 120                      | 5745.0109                      | 0.00019                   | 5745.0094                      | 0.00016                   | 5745.0093                      | 0.00016                   | 5745.0116                      | 0.00020                   |
| -10                              | 120                      | 5745.0053                      | 0.00009                   | 5745.0058                      | 0.00010                   | 5745.0052                      | 0.00009                   | 5745.0106                      | 0.00018                   |
| -20                              | 120                      | 5745.0116                      | 0.00020                   | 5745.0131                      | 0.00023                   | 5745.012                       | 0.00021                   | 5745.0129                      | 0.00022                   |
| -30                              | 120                      | 5744.9758                      | -0.00042                  | 5744.9736                      | -0.00046                  | 5744.9737                      | -0.00046                  | 5744.9739                      | -0.00045                  |

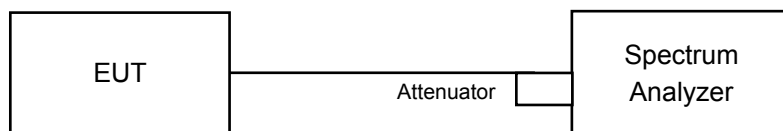
| FREQUENCY STABILITY VERSUS VOLTAGE |                          |                                |                           |                                |                           |                                |                           |                                |                           |
|------------------------------------|--------------------------|--------------------------------|---------------------------|--------------------------------|---------------------------|--------------------------------|---------------------------|--------------------------------|---------------------------|
| OPERATING FREQUENCY: 5745MHz       |                          |                                |                           |                                |                           |                                |                           |                                |                           |
| TEMP.<br>(°C)                      | POWER<br>SUPPLY<br>(Vac) | 0 MINUTE                       |                           | 2 MINUTE                       |                           | 5 MINUTE                       |                           | 10 MINUTE                      |                           |
|                                    |                          | Measured<br>Frequency<br>(MHz) | Frequency<br>Drift<br>(%) | Measured<br>Frequency<br>(MHz) | Frequency<br>Drift<br>(%) | Measured<br>Frequency<br>(MHz) | Frequency<br>Drift<br>(%) | Measured<br>Frequency<br>(MHz) | Frequency<br>Drift<br>(%) |
| 20                                 | 138                      | 5745.0165                      | 0.00029                   | 5745.0209                      | 0.00036                   | 5745.0181                      | 0.00032                   | 5745.0178                      | 0.00031                   |
|                                    | 120                      | 5745.0175                      | 0.00030                   | 5745.0201                      | 0.00035                   | 5745.0176                      | 0.00031                   | 5745.017                       | 0.00030                   |
|                                    | 102                      | 5745.017                       | 0.00030                   | 5745.0196                      | 0.00034                   | 5745.0173                      | 0.00030                   | 5745.0159                      | 0.00028                   |

## 4.5 6dB Bandwidth Measurement

### 4.5.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5MHz.

### 4.5.2 Test Setup



### 4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.5.4 Test Procedure

#### MEASUREMENT PROCEDURE REF

- Set resolution bandwidth (RBW) = 100kHz
- Set the video bandwidth (VBW)  $\geq 3 \times$  RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

### 4.5.5 Deviation from Test Standard

No deviation.

### 4.5.6 EUT Operating Condition

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

#### 4.5.7 Test Results

##### 802.11a

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | Minimum Limit (MHz) | Pass / Fail |
|---------|-----------------|---------------------|---------------------|-------------|
| 149     | 5745            | 16.58               | 0.5                 | Pass        |
| 157     | 5785            | 16.58               | 0.5                 | Pass        |
| 165     | 5825            | 16.58               | 0.5                 | Pass        |

##### 802.11ac (VHT20)

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | Minimum Limit (MHz) | Pass / Fail |
|---------|-----------------|---------------------|---------------------|-------------|
| 149     | 5745            | 17.81               | 0.5                 | Pass        |
| 157     | 5785            | 17.81               | 0.5                 | Pass        |
| 165     | 5825            | 17.86               | 0.5                 | Pass        |

##### 802.11ac (VHT40)

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | Minimum Limit (MHz) | Pass / Fail |
|---------|-----------------|---------------------|---------------------|-------------|
| 151     | 5755            | 36.61               | 0.5                 | Pass        |
| 159     | 5795            | 36.64               | 0.5                 | Pass        |

##### 802.11ac (VHT80)

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | Minimum Limit (MHz) | Pass / Fail |
|---------|-----------------|---------------------|---------------------|-------------|
| 155     | 5775            | 76.68               | 0.5                 | Pass        |

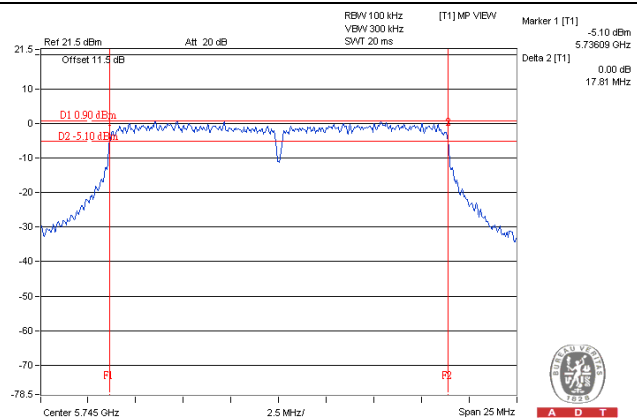
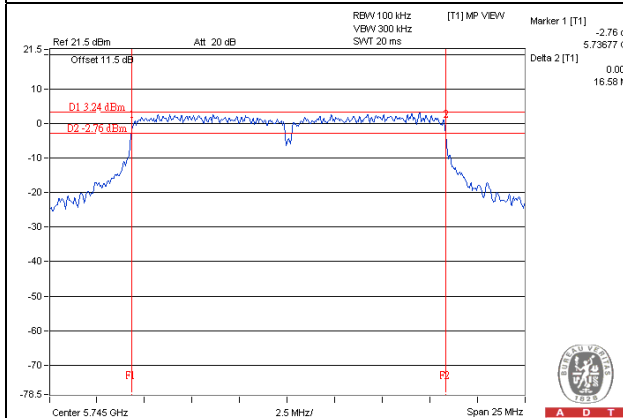


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## Spectrum Plot of Worst Value

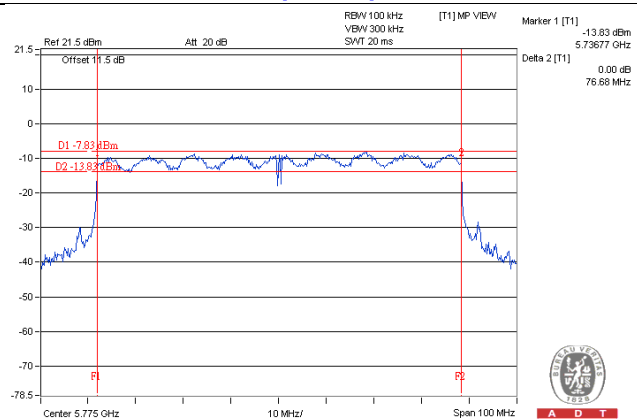
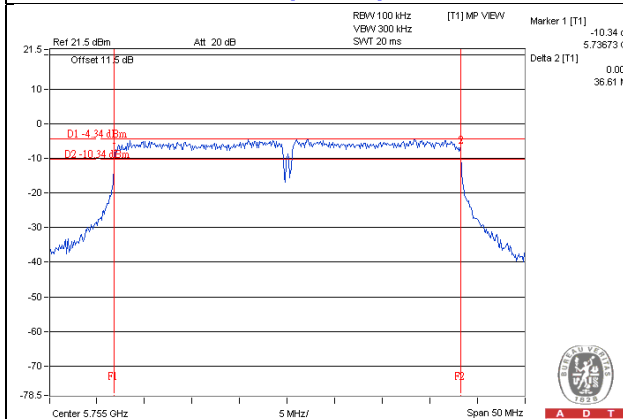
802.11a: CH149

802.11ac (VHT20): CH149



802.11ac (VHT40): CH151

802.11ac (VHT80): CH155



## 5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

## Appendix – Information on the Testing Laboratories

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

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

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**Hsin Chu EMC/RF Lab/Telecom Lab**

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**Web Site:** [www.bureauveritas-adt.com](http://www.bureauveritas-adt.com)

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

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