

## FCC Test Report (WLAN)

**Report No.:** RF170816E07S-1

**FCC ID:** PPD-QCNFA344AH

**Test Model:** QCNFA344A

**Received Date:** Sep. 18, 2019

**Test Date:** Sep. 26 to 28, 2019

**Issued Date:** Oct. 15, 2019

**Applicant:** Qualcomm Atheros, Inc.

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

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

**Lab Address:** E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,  
Taiwan

**Test Location:** E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,  
Taiwan

**FCC Registration /  
Designation Number:** 723255 / TW2022



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### Release Control Record

| Issue No.      | Description       | Date Issued   |
|----------------|-------------------|---------------|
| RF170816E07S-1 | Original release. | Oct. 15, 2019 |

## 1 Certificate of Conformity

**Product:** 802.11a/b/g/n/ac + BT 4.1 M.2 2230 Type Card

**Brand:** Qualcomm Atheros

**Test Model:** QCNFA344A

**Sample Status:** R&D SAMPLE

**Applicant:** Qualcomm Atheros, Inc.

**Test Date:** Sep. 26 to 28, 2019

**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:**

Oct. 15, 2019

Claire Kuan / Specialist

**Approved by :**



**Date:**

Oct. 15, 2019

Clark Lin / Technical 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(i/ii)/6)                 | Radiated Emissions & Band Edge Measurement* | Pass   | Meet the requirement of limit.<br>Minimum passing margin is -14.7dB at 11490.00MHz |
| 15.407(a)<br>(1/2/3)                           | Max Average Transmit Power                  | Pass   | Meet the requirement of limit.                                                     |
| ---                                            | Occupied Bandwidth Measurement              | -      | Reference only.                                                                    |
| 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)                              |
| 15.203                                         | Antenna Requirement                         | Pass   | Antenna connector is IPEX not a standard connector.                                |

\*For U-NII-3 band compliance with rule part 15.407(b)(4)(i), the OOB test plots were recorded in Annex A.  
Note:

1. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
2. This report is prepared for FCC Class II change.

### 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     | Expanded Uncertainty<br>(k=2) (±) |
|--------------------------------|---------------|-----------------------------------|
| Radiated Emissions above 1 GHz | 1GHz ~ 6GHz   | 5.0 dB                            |
|                                | 6GHz ~ 18GHz  | 5.0 dB                            |
|                                | 18GHz ~ 40GHz | 5.3 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 + BT 4.1 M.2 2230 Type Card                                                                                                                                                                |
| Brand                 | Qualcomm Atheros                                                                                                                                                                                            |
| Test Model            | QCNFA344A                                                                                                                                                                                                   |
| Status of EUT         | R&D SAMPLE                                                                                                                                                                                                  |
| Power Supply Rating   | 3.3Vdc form host equipment                                                                                                                                                                                  |
| Modulation Type       | CCK, DQPSK, DBPSK for DSSS<br>64QAM, 16QAM, QPSK, BPSK for OFDM<br>256QAM for OFDM in 11ac mode and VHT (20/40) mode in 2.4GHz                                                                              |
| Modulation Technology | DSSS, OFDM                                                                                                                                                                                                  |
| Transfer Rate         | 802.11b: up to 11Mbps<br>802.11a/g: up to 54Mbps<br>802.11n : up to 300Mbps<br>802.11ac: up to 866.7Mbps                                                                                                    |
| Operating Frequency   | <b>2.4GHz:</b> 2.412 ~ 2.472GHz<br><b>5GHz:</b> 5.18~ 5.24GHz, 5.26 ~ 5.32GHz, 5.5 ~ 5.72GHz, 5.745 ~ 5.825GHz                                                                                              |
| Number of Channel     | <b>2.4GHz:</b><br>13 for 802.11b/g, 802.11n (HT20), VHT20<br>9 for 802.11n (HT40), VHT40<br><b>5GHz:</b><br>25 for 802.11a, 802.11n (HT20), VHT20<br>12 for 802.11n (HT40), VHT40<br>6 for 802.11ac (VHT80) |
| Output Power          | <b>5.745 ~ 5.825GHz:</b> 72.033mW                                                                                                                                                                           |
| Antenna Type          | See item 3.2                                                                                                                                                                                                |
| Antenna Connector     | See item 3.2                                                                                                                                                                                                |
| Accessory Device      | NA                                                                                                                                                                                                          |
| Data Cable Supplied   | NA                                                                                                                                                                                                          |

Note:

1. This report is prepared for FCC class II change. The difference compared with the Report No.: RF150107E06B-1 design is as the following information:
  - ◆ Update UNII-3 band test data in comply with FCC ORDER ON RECONSIDERATION FCC16-24.
2. According to above conditions, only U-NII-3 band: Radiated Emissions above 1GHz & Band Edge Measurement, Max Average Transmit Power, Occupied Bandwidth Measurement, Peak Power Spectral Density and 6dB bandwidth need to be performed. And all data was verified to meet the requirements.
3. There are Bluetooth technology and WLAN technology used for the EUT.

4. The EUT incorporates a 2T2R function.

| 2.4GHz Band      |                 |                       |     |
|------------------|-----------------|-----------------------|-----|
| MODULATION MODE  | DATA RATE (MCS) | TX & RX CONFIGURATION |     |
| 802.11b          | 1 ~ 11Mbps      | 2TX                   | 2RX |
| 802.11g          | 6 ~ 54Mbps      | 2TX                   | 2RX |
| 802.11n (HT20)   | MCS 0~7         | 2TX                   | 2RX |
|                  | MCS 8~15        | 2TX                   | 2RX |
| 802.11n (HT40)   | MCS 0~7         | 2TX                   | 2RX |
|                  | MCS 8~15        | 2TX                   | 2RX |
| VHT20            | MCS 0~8, Nss=1  | 2TX                   | 2RX |
|                  | MCS 0~8, Nss=2  | 2TX                   | 2RX |
| VHT40            | MCS 0~9, Nss=1  | 2TX                   | 2RX |
|                  | MCS 0~9, Nss=2  | 2TX                   | 2RX |
| 5GHz Band        |                 |                       |     |
| MODULATION MODE  | DATA RATE (MCS) | TX & RX CONFIGURATION |     |
| 802.11a          | 6 ~ 54Mbps      | 2TX                   | 2RX |
| 802.11n (HT20)   | MCS 0~7         | 2TX                   | 2RX |
|                  | MCS 8~15        | 2TX                   | 2RX |
| 802.11n (HT40)   | MCS 0~7         | 2TX                   | 2RX |
|                  | MCS 8~15        | 2TX                   | 2RX |
| 802.11ac (VHT20) | MCS 0~8, Nss=1  | 2TX                   | 2RX |
|                  | MCS 0~8, Nss=2  | 2TX                   | 2RX |
| 802.11ac (VHT40) | MCS 0~9, Nss=1  | 2TX                   | 2RX |
|                  | MCS 0~9, Nss=2  | 2TX                   | 2RX |
| 802.11ac (VHT80) | MCS 0~9, Nss=1  | 2TX                   | 2RX |
|                  | MCS 0~9, Nss=2  | 2TX                   | 2RX |

Note: 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 3.3.1)

5. The EUT was pre-tested under the following modes:

| Test Mode | Data rate |
|-----------|-----------|
| Mode A    | 400ns GI  |
| Mode B    | 800ns GI  |

From the above modes, the worst case was found in **Mode B**. Therefore only the test data of the mode was recorded in this report.

6. WLAN/BT coexistence mode:

◆ 2x2 WLAN + BT:

- 5GHz 802.11a/an (or 11ac) transmit concurrent with BT.
- 2.4GHz: timely shared coexistence.

7. Simultaneously transmission condition.

| Condition | Technology |           |
|-----------|------------|-----------|
| 1         | WLAN 5GHz  | Bluetooth |

Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.

8. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

### 3.2 Description of Antenna

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

| Transmitter Circuit | Brand | Model        | Ant. Type | 2.4GHz Gain with cable loss (dBi) | 5GHz Gain with cable loss (dBi) | 2.4GHz Cable Loss (dBi) | 5G Cable Loss (dBi) | Connector Type | Cable Length (mm) |
|---------------------|-------|--------------|-----------|-----------------------------------|---------------------------------|-------------------------|---------------------|----------------|-------------------|
| Chain (0)           | WNC   | 81-EBJ15.005 | PIFA      | 3.00                              | Band 1&2: 2.56                  | 1.15                    | Band 1&2: 1.70      | IPEX           | 300               |
|                     |       |              |           |                                   | Band 3: 4.76                    |                         | Band 3: 1.74        |                |                   |
|                     |       |              |           |                                   | Band 4: 4.76                    |                         | Band 4: 1.79        |                |                   |
| Chain (1)           | WNC   | 81-EBJ15.005 | PIFA      | 3.62                              | Band 1&2: 3.08                  | 1.15                    | Band 1&2: 1.70      | IPEX           | 300               |
|                     |       |              |           |                                   | Band 3: 3.31                    |                         | Band 3: 1.74        |                |                   |
|                     |       |              |           |                                   | Band 4: 2.42                    |                         | Band 4: 1.79        |                |                   |

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

### 3.3 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     | 5745 MHz  | 161     | 5805 MHz  |
| 153     | 5765 MHz  | 165     | 5825 MHz  |
| 157     | 5785 MHz  |         |           |

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

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

1 channel is provided for 802.11ac (VHT80):

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

### 3.3.1 Test Mode Applicability and Tested Channel Detail

| EUT Configure Mode | Applicable To |      | Description |
|--------------------|---------------|------|-------------|
|                    | RE≥1G         | APCM |             |
| -                  | √             | √    | -           |

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

**APCM**: Antenna Port Conducted Measurement

**Note:** In the original test report, the EUT's antenna had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on Z-plane.

#### **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 | DATA RATE (Mbps) |
|------------------|------------------|-------------------|----------------|-----------------------|------------------|
| 802.11a          | 5745-5825        | 149 to 165        | 149, 157, 165  | OFDM                  | 6                |
| 802.11ac (VHT20) |                  | 149 to 165        | 149, 157, 165  | OFDM                  | 6.5              |
| 802.11ac (VHT40) |                  | 151 to 159        | 151, 159       | OFDM                  | 13.5             |
| 802.11ac (VHT80) |                  | 155               | 155            | OFDM                  | 29.3             |

#### **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 | DATA RATE (Mbps) |
|------------------|------------------|-------------------|----------------|-----------------------|------------------|
| 802.11a          | 5745-5825        | 149 to 165        | 149, 157, 165  | OFDM                  | 6                |
| 802.11ac (VHT20) |                  | 149 to 165        | 149, 157, 165  | OFDM                  | 6.5              |
| 802.11ac (VHT40) |                  | 151 to 159        | 151, 159       | OFDM                  | 13.5             |
| 802.11ac (VHT80) |                  | 155               | 155            | OFDM                  | 29.3             |

#### **Test Condition:**

| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | INPUT POWER (SYSTEM) | TESTED BY     |
|---------------|--------------------------|----------------------|---------------|
| <b>RE≥1G</b>  | 22deg. C, 72%RH          | 120Vac, 60Hz         | Jeff Lee      |
| <b>APCM</b>   | 25deg. C, 60%RH          | 120Vac, 60Hz         | Anderson Chen |

### 3.4 Duty Cycle of Test Signal

If duty cycle of test signal is  $\geq 98\%$ , duty factor is not required.

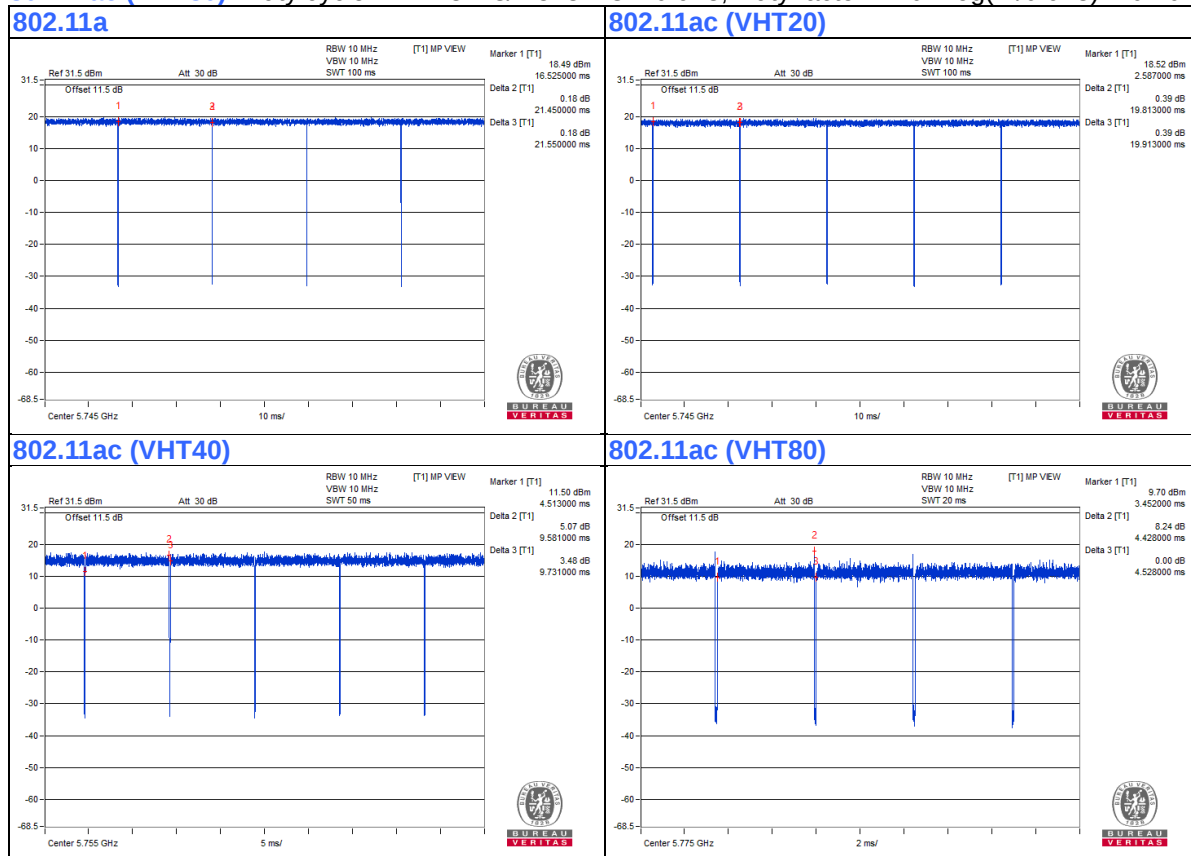
If duty cycle of test signal is  $< 98\%$ , duty factor shall be considered.

**802.11a:** Duty cycle = 21.45 ms/21.55 ms = 0.995

**802.11ac (VHT20):** Duty cycle = 19.813 ms/19.913 ms = 0.995

**802.11ac (VHT40):** Duty cycle = 9.581 ms/9.731 ms = 0.985

**802.11ac (VHT80):** Duty cycle = 4.428 ms/4.528 ms = 0.978, Duty factor =  $10 \cdot \log(1/0.978) = 0.10$



### 3.5 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.

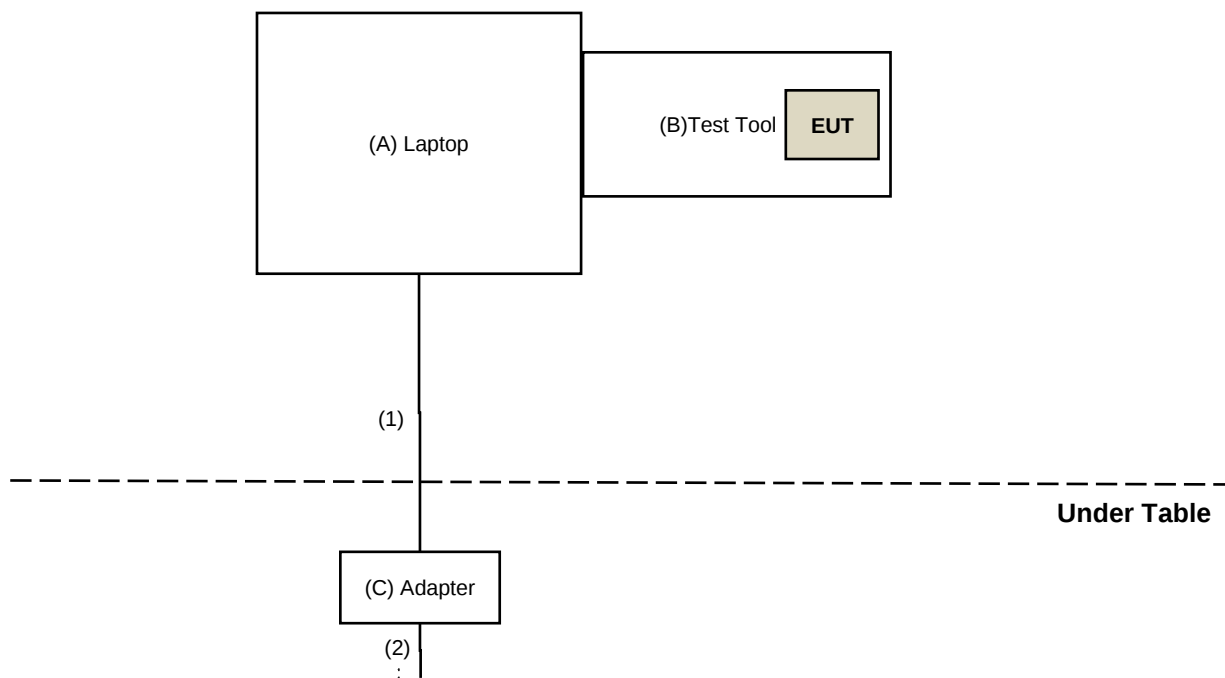
| ID | Product   | Brand                  | Model No.  | Serial No.     | FCC ID | Remarks            |
|----|-----------|------------------------|------------|----------------|--------|--------------------|
| A. | Laptop    | DELL                   | E6400      | D814C A00 APCC | NA     | Provided by Lab    |
| B. | Test Tool | Qualcomm Atheros, Inc. | NA         | NA             | NA     | Supplied by client |
| C. | Adapter   | DELL                   | LA65NS2-01 | NA             | NA     | Provided by Lab    |

Note:

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

| ID | Descriptions | Qty. | Length (m) | Shielding (Yes/No) | Cores (Qty.) | Remarks         |
|----|--------------|------|------------|--------------------|--------------|-----------------|
| 1. | DC Cable     | 1    | 1.8        | No                 | 0            | Provided by Lab |
| 2. | AC Cable     | 1    | 1          | No                 | 0            | Provided by Lab |

### 3.5.1 Configuration of System under Test



### 3.6 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 v02r01**

**KDB 662911 D01 Multiple Transmitter Output v02r01**

**ANSI C63.10-2013**

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

#### 4 Test Types and Results (Radiated Versus Conducted)

##### 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:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. 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<br>New Rules v02r01                                       |                                                     | Field Strength at 3m                                                                                                                |                                                                                                                                         |
|                                                                                                  |                                                     | PK:74 (dBuV/m)                                                                                                                      | AV:54 (dBuV/m)                                                                                                                          |
| Frequency Band                                                                                   | Applicable To                                       | EIRP Limit                                                                                                                          | Equivalent Field Strength at 3m                                                                                                         |
| 5150~5250 MHz                                                                                    | 15.407(b)(1)                                        | PK:-27 (dBm/MHz)                                                                                                                    | PK:68.2(dBuV/m)                                                                                                                         |
| 5250~5350 MHz                                                                                    | 15.407(b)(2)                                        |                                                                                                                                     |                                                                                                                                         |
| 5470~5725 MHz                                                                                    | 15.407(b)(3)                                        |                                                                                                                                     |                                                                                                                                         |
| 5725~5850 MHz                                                                                    | <input checked="" type="checkbox"/> 15.407(b)(4)(i) | PK:-27 (dBm/MHz) <sup>*1</sup><br>PK:10 (dBm/MHz) <sup>*2</sup><br>PK:15.6 (dBm/MHz) <sup>*3</sup><br>PK:27 (dBm/MHz) <sup>*4</sup> | PK: 68.2(dBuV/m) <sup>*1</sup><br>PK:105.2 (dBuV/m) <sup>*2</sup><br>PK: 110.8(dBuV/m) <sup>*3</sup><br>PK:122.2 (dBuV/m) <sup>*4</sup> |
|                                                                                                  | <input type="checkbox"/> 15.407(b)(4)(ii)           | Emission limits in section 15.247(d)                                                                                                |                                                                                                                                         |
| <sup>*1</sup> beyond 75 MHz or more above of the band edge.                                      |                                                     | <sup>*2</sup> below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above.                                                |                                                                                                                                         |
| <sup>*3</sup> below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above. |                                                     | <sup>*4</sup> from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.                |                                                                                                                                         |

###### Note:

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>ESR7 R&S                           | ESR7                 | 102026      | Apr. 24, 2019   | Apr. 23, 2020    |
| Spectrum Analyzer<br>Keysight                       | N9030B               | MY57141948  | May 25, 2019    | May 24, 2020     |
| Horn_Antenna<br>SCHWARZBECK                         | BBHA 9120D           | 9120D-1819  | Nov. 25, 2018   | Nov. 24, 2019    |
| Pre-Amplifier<br>EMCI                               | EMC12630SE           | 980509      | May 03, 2019    | May 02, 2020     |
| RF Cable<br>EMCI                                    | EMC104-SM-SM-1500    | 180503      | May 03, 2019    | May 02, 2020     |
| RF Cable<br>EMCI                                    | EMC104-SM-SM-2000    | 180501      | May 03, 2019    | May 02, 2020     |
| RF Cable<br>EMCI                                    | EMC104-SM-SM-6000    | 180505      | May 03, 2019    | May 02, 2020     |
| Pre-Amplifier<br>EMCI                               | EMC184045SE          | 980387      | Jan. 28, 2019   | Jan. 27, 2020    |
| Horn_Antenna<br>SCHWARZBECK                         | BBHA 9170            | BBHA9170519 | Nov. 25, 2018   | Nov. 24, 2019    |
| RF Cable                                            | EMC102-KM-KM-1200    | 160924      | Jan. 28, 2019   | Jan. 27, 2020    |
| RF Cable                                            | EMC102-KM-KM-1200    | 160925      | Jan. 28, 2019   | Jan. 27, 2020    |
| Software                                            | ADT_Radiated_V8.7.08 | NA          | NA              | NA               |
| Boresight Antenna Tower &<br>Turn Table<br>Max-Full | MF-7802BS            | MF780208530 | NA              | NA               |
| Spectrum Analyzer<br>R&S                            | FSV40                | 100964      | June 04, 2019   | June 03, 2020    |
| Power meter<br>Anritsu                              | ML2495A              | 1014008     | May 13, 2019    | May 12, 2020     |
| Power sensor<br>Anritsu                             | MA2411B              | 0917122     | May 13, 2019    | May 12, 2020     |

#### Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in 966 Chamber No. 5.
3. Tested Date: Sep. 26 to 28, 2019

#### 4.1.3 Test Procedure

Following FCC KDB 789033 D02 General UNII Test Procedures:

Radiated versus Conducted Measurements.

The unwanted emission limits in both the restricted and non-restricted bands are based on antenna-port conducted measurements in conjunction with cabinet emissions tests are permitted to demonstrate compliance.

The following steps was performed:

- a. Cabinet emissions measurements. Radiated measurement was performed to ensure that cabinet emissions are below the emission limits. For the cabinet-emission measurements the antenna was replaced by a termination matching the nominal impedance of the antenna.
- b. Conducted tests was performed using equipment that matches the nominal impedance of the antenna assembly used with the EUT
- c. EIRP calculation. A value representative of an upper bound on out-of-band antenna gain (in dBi) shall be added to the measured antenna-port conducted emission power to compute EIRP within the specified measurement bandwidth. (For emissions in the restricted bands, additional calculations are required to convert EIRP to field strength at the specified distance.) The upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands or 2 dBi, whichever is greater
- d. EIRP adjustments for multiple outputs. (Follow the procedures specified in FCC KDB Publication 662911)
- e. For all of Radiation emission test
  - e-1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meters chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
  - e-2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
  - e-3. 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.
  - e-4. 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-5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
  - e-6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

**NOTE:**

1. 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.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle < 98%) or 10Hz (Duty cycle  $\geq 98\%$ ) for Average detection (AV) at frequency above 1GHz.
3. All modes of operation were investigated and the worst-case emissions are reported.

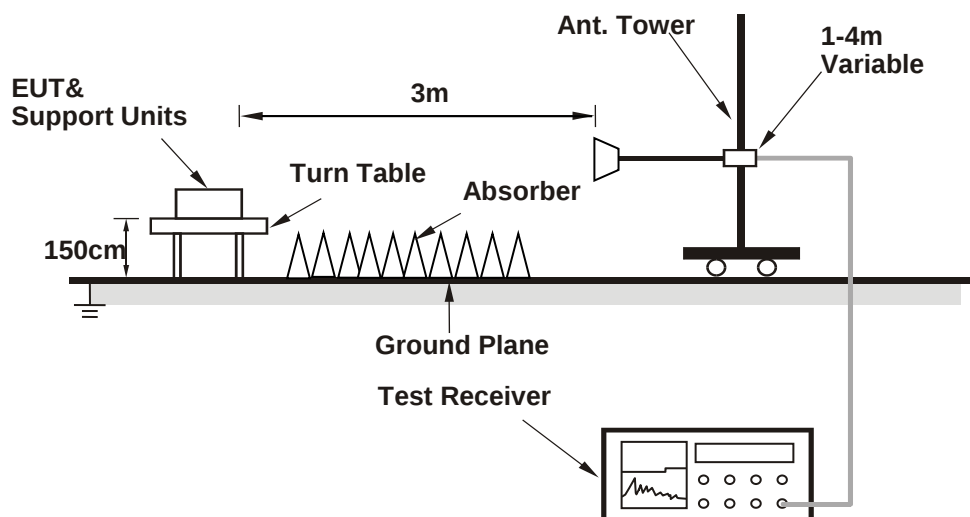
#### 4.1.4 Deviation from Test Standard

No deviation.

#### 4.1.5 Test Setup

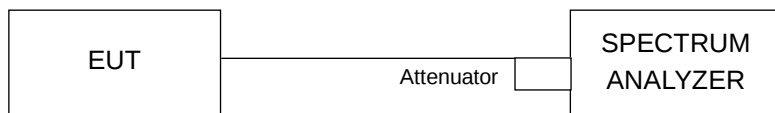
**For radiated configuration:**

**For Radiated emission above 1GHz**



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

**For conducted configuration:**



#### 4.1.6 EUT Operating Condition

- Connected the EUT with the Laptop which is placed.
- Controlling software (QRCT-CON30033\_0919) has been activated to set the EUT under transmission/receiving condition continuously.

#### 4.1.7 Test Results (Radiated Measurement)

| Radiated versus Conducted Measurement                                                                                                                                                                                                                                                                                                                                                             |                                                          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| <input type="checkbox"/> Conducted measurement                                                                                                                                                                                                                                                                                                                                                    | <input checked="" type="checkbox"/> Radiated measurement |
| <p><u>For Radiated measurement:</u><br/>The level of unwanted emissions was measured when radiated by the cabinet or structure of the equipment with the antenna connector(s) terminated by a specified load (cabinet radiation)</p> <p><u>For Conducted measurement:</u><br/>The level of unwanted emissions was measured as their power in a specified load (conducted spurious emissions).</p> |                                                          |

Radiated test was done with 50ohm terminator on antenna port

#### ABOVE 1GHz DATA

#### 802.11a

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

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M |             |                         |                |             |                    |                      |                  |                          |
|-----------------------------------------------------|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| NO.                                                 | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1                                                   | 11490.00    | 52.9 PK                 | 74.0           | -21.1       | 1.05 H             | 187                  | 38.8             | 14.1                     |
| 2                                                   | 11490.00    | 39.3 AV                 | 54.0           | -14.7       | 1.05 H             | 187                  | 25.2             | 14.1                     |
| 3                                                   | #17235.00   | 45.6 PK                 | 68.2           | -22.6       | 2.14 H             | 129                  | 27.9             | 17.7                     |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M   |             |                         |                |             |                    |                      |                  |                          |
| NO.                                                 | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1                                                   | 11490.00    | 48.1 PK                 | 74.0           | -25.9       | 1.96 V             | 120                  | 34.0             | 14.1                     |
| 2                                                   | 11490.00    | 37.1 AV                 | 54.0           | -16.9       | 1.96 V             | 120                  | 23.0             | 14.1                     |
| 3                                                   | #17235.00   | 43.8 PK                 | 68.2           | -24.4       | 1.36 V             | 152                  | 26.1             | 17.7                     |

#### 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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " # ": 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                                                   | 11570.00       | 52.5 PK                       | 74.0              | -21.5          | 1.10 H                   | 192                        | 38.4                   | 14.1                           |
| 2                                                   | 11570.00       | 38.9 AV                       | 54.0              | -15.1          | 1.10 H                   | 192                        | 24.8                   | 14.1                           |
| 3                                                   | #17355.00      | 45.1 PK                       | 68.2              | -23.1          | 2.20 H                   | 141                        | 26.8                   | 18.3                           |

| 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                                                 | 11570.00       | 48.1 PK                       | 74.0              | -25.9          | 1.94 V                   | 105                        | 34.0                   | 14.1                           |
| 2                                                 | 11570.00       | 36.9 AV                       | 54.0              | -17.1          | 1.94 V                   | 105                        | 22.8                   | 14.1                           |
| 3                                                 | #17355.00      | 43.4 PK                       | 68.2              | -24.8          | 1.34 V                   | 151                        | 25.1                   | 18.3                           |

**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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " # ": 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                                                   | 11650.00       | 53.0 PK                       | 74.0              | -21.0          | 1.00 H                   | 186                        | 39.1                   | 13.9                           |
| 2                                                   | 11650.00       | 39.2 AV                       | 54.0              | -14.8          | 1.00 H                   | 186                        | 25.3                   | 13.9                           |
| 3                                                   | #17475.00      | 45.4 PK                       | 68.2              | -22.8          | 2.18 H                   | 132                        | 25.9                   | 19.5                           |

| 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                                                 | 11650.00       | 48.1 PK                       | 74.0              | -25.9          | 1.94 V                   | 105                        | 34.2                   | 13.9                           |
| 2                                                 | 11650.00       | 37.0 AV                       | 54.0              | -17.0          | 1.94 V                   | 105                        | 23.1                   | 13.9                           |
| 3                                                 | #17475.00      | 44.2 PK                       | 68.2              | -24.0          | 1.40 V                   | 159                        | 24.7                   | 19.5                           |

**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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " # ": The radiated frequency is out of the restricted band.

# 802.11ac (VHT20)

|                        |                |                              |              |
|------------------------|----------------|------------------------------|--------------|
| <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                                                   | 11490.00       | 50.5 PK                       | 74.0              | -23.5          | 1.00 H                   | 193                        | 36.4                   | 14.1                           |
| 2                                                   | 11490.00       | 37.4 AV                       | 54.0              | -16.6          | 1.00 H                   | 193                        | 23.3                   | 14.1                           |
| 3                                                   | #17235.00      | 45.3 PK                       | 68.2              | -22.9          | 2.16 H                   | 118                        | 27.6                   | 17.7                           |
| 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                                                   | 11490.00       | 48.4 PK                       | 74.0              | -25.6          | 1.92 V                   | 108                        | 34.3                   | 14.1                           |
| 2                                                   | 11490.00       | 37.1 AV                       | 54.0              | -16.9          | 1.92 V                   | 108                        | 23.0                   | 14.1                           |
| 3                                                   | #17235.00      | 43.5 PK                       | 68.2              | -24.7          | 1.41 V                   | 174                        | 25.8                   | 17.7                           |

## 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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " # ": 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                                                   | 11570.00       | 50.6 PK                       | 74.0              | -23.4          | 1.00 H                   | 202                        | 36.5                   | 14.1                           |
| 2                                                   | 11570.00       | 37.3 AV                       | 54.0              | -16.7          | 1.00 H                   | 202                        | 23.2                   | 14.1                           |
| 3                                                   | #17355.00      | 45.5 PK                       | 68.2              | -22.7          | 2.21 H                   | 111                        | 27.2                   | 18.3                           |

| 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                                                 | 11570.00       | 48.0 PK                       | 74.0              | -26.0          | 1.95 V                   | 113                        | 33.9                   | 14.1                           |
| 2                                                 | 11570.00       | 36.8 AV                       | 54.0              | -17.2          | 1.95 V                   | 113                        | 22.7                   | 14.1                           |
| 3                                                 | #17355.00      | 43.3 PK                       | 68.2              | -24.9          | 1.38 V                   | 161                        | 25.0                   | 18.3                           |

**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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " # ": 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                                                   | 11650.00       | 50.5 PK                       | 74.0              | -23.5          | 1.00 H                   | 196                        | 36.6                   | 13.9                           |
| 2                                                   | 11650.00       | 37.7 AV                       | 54.0              | -16.3          | 1.00 H                   | 196                        | 23.8                   | 13.9                           |
| 3                                                   | #17475.00      | 45.4 PK                       | 68.2              | -22.8          | 2.11 H                   | 128                        | 25.9                   | 19.5                           |

| 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                                                 | 11650.00       | 48.5 PK                       | 74.0              | -25.5          | 1.96 V                   | 120                        | 34.6                   | 13.9                           |
| 2                                                 | 11650.00       | 36.9 AV                       | 54.0              | -17.1          | 1.96 V                   | 120                        | 23.0                   | 13.9                           |
| 3                                                 | #17475.00      | 43.5 PK                       | 68.2              | -24.7          | 1.38 V                   | 186                        | 24.0                   | 19.5                           |

**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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " # ": 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                                                   | 11510.00       | 50.0 PK                       | 74.0              | -24.0          | 1.00 H                   | 195                        | 35.9                   | 14.1                           |
| 2                                                   | 11510.00       | 37.4 AV                       | 54.0              | -16.6          | 1.00 H                   | 195                        | 23.3                   | 14.1                           |
| 3                                                   | #17265.00      | 44.3 PK                       | 68.2              | -23.9          | 2.12 H                   | 128                        | 26.5                   | 17.8                           |
| 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                                                   | 11510.00       | 47.4 PK                       | 74.0              | -26.6          | 1.96 V                   | 104                        | 33.3                   | 14.1                           |
| 2                                                   | 11510.00       | 36.2 AV                       | 54.0              | -17.8          | 1.96 V                   | 104                        | 22.1                   | 14.1                           |
| 3                                                   | #17265.00      | 42.6 PK                       | 68.2              | -25.6          | 1.39 V                   | 183                        | 24.8                   | 17.8                           |

## 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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " # ": 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                                                   | 11590.00       | 51.2 PK                       | 74.0              | -22.8          | 1.00 H                   | 204                        | 37.1                   | 14.1                           |
| 2                                                   | 11590.00       | 38.1 AV                       | 54.0              | -15.9          | 1.00 H                   | 204                        | 24.0                   | 14.1                           |
| 3                                                   | #17385.00      | 45.2 PK                       | 68.2              | -23.0          | 2.09 H                   | 131                        | 26.7                   | 18.5                           |
| 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                                                   | 11590.00       | 48.2 PK                       | 74.0              | -25.8          | 1.98 V                   | 93                         | 34.1                   | 14.1                           |
| 2                                                   | 11590.00       | 36.8 AV                       | 54.0              | -17.2          | 1.98 V                   | 93                         | 22.7                   | 14.1                           |
| 3                                                   | #17385.00      | 42.7 PK                       | 68.2              | -25.5          | 1.34 V                   | 188                        | 24.2                   | 18.5                           |

**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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " # ": The radiated frequency is out of the restricted band.

# 802.11ac (VHT80)

|                        |                |                              |              |
|------------------------|----------------|------------------------------|--------------|
| <b>CHANNEL</b>         | TX Channel 155 | <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                                                   | 11550.00       | 49.8 PK                       | 74.0              | -24.2          | 1.00 H                   | 202                        | 35.6                   | 14.2                           |
| 2                                                   | 11550.00       | 37.9 AV                       | 54.0              | -16.1          | 1.00 H                   | 202                        | 23.7                   | 14.2                           |
| 3                                                   | #17325.00      | 43.1 PK                       | 68.2              | -25.1          | 2.08 H                   | 143                        | 25.0                   | 18.1                           |
| 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                                                   | 11550.00       | 45.8 PK                       | 74.0              | -28.2          | 2.00 V                   | 118                        | 31.6                   | 14.2                           |
| 2                                                   | 11550.00       | 37.2 AV                       | 54.0              | -16.8          | 2.00 V                   | 118                        | 23.0                   | 14.2                           |
| 3                                                   | #17325.00      | 41.2 PK                       | 68.2              | -27.0          | 1.40 V                   | 180                        | 23.1                   | 18.1                           |

## 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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " # ": The radiated frequency is out of the restricted band.

#### 4.1.8 Test Results (Conducted Measurement)

| Radiated versus Conducted Measurement                                                                                                                                                                                                                                                                                                                                                                   |                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| <input checked="" type="checkbox"/> Conducted measurement                                                                                                                                                                                                                                                                                                                                               | <input type="checkbox"/> Radiated measurement |
| <p><u>For Radiated measurement:</u></p> <p>The level of unwanted emissions was measured when radiated by the cabinet or structure of the equipment with the antenna connector(s) terminated by a specified load (cabinet radiation)</p> <p><u>For Conducted measurement:</u></p> <p>The level of unwanted emissions was measured as their power in a specified load (conducted spurious emissions).</p> |                                               |

| Conducted Measurement Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>a. The composite gain will be used when signal support the correlated signal.<br/>Composite gain = <math>4.76\text{dBi} + 10\log(2) = 7.77\text{dBi}</math></p> <p>b. For the out of band spurious the gain for the specific band may have been used rather than the highest gain across all bands.</p> <p>c. For the band edge the gain for the specific band may have been used.</p> <p>Note: The conducted emission test was considered some factor to compute test result.</p> |

**Above 1GHz Data**  
**802.11a - Channel 149**

**Conducted spurious emission table**

| No. | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Raw Value (dBm) |        | Correction Factor (dB) | EIRP Level (dBm) |
|-----|-----------------|-------------------------|----------------|-------------|-----------------|--------|------------------------|------------------|
|     |                 |                         |                |             | Chain0          | Chain1 |                        |                  |
| 1   | 3814.06 PK      | 56.44                   | 74             | -17.56      | -49.5           | -49.7  | 7.77                   | -38.82           |
| 2   | 3812.5 AV       | 35.47                   | 54             | -18.53      | -70.53          | -70.61 | 7.77                   | -59.79           |
| 3   | 7668.75 PK      | 57.41                   | 74             | -16.59      | -47.12          | -50.98 | 7.77                   | -37.85           |
| 4   | 7659.37 AV      | 36.38                   | 54             | -17.62      | -69.21          | -70.16 | 7.77                   | -58.88           |
| 5   | 11490.62 PK     | 57.19                   | 74             | -16.81      | -49.3           | -48.45 | 7.77                   | -38.07           |
| 6   | 11490.62 AV     | 42.27                   | 54             | -11.73      | -68.38          | -61.58 | 7.77                   | -52.99           |
| 7   | 17221.68 PK     | 54.93                   | 68.2           | -13.27      | -51.21          | -51.01 | 7.77                   | -40.33           |

Note :

Emission Level (dBuV/m) = EIRP Level (dBm) – 20log(d) + 104.8  
d = measurement distance in 3 meters.

## Chain 0

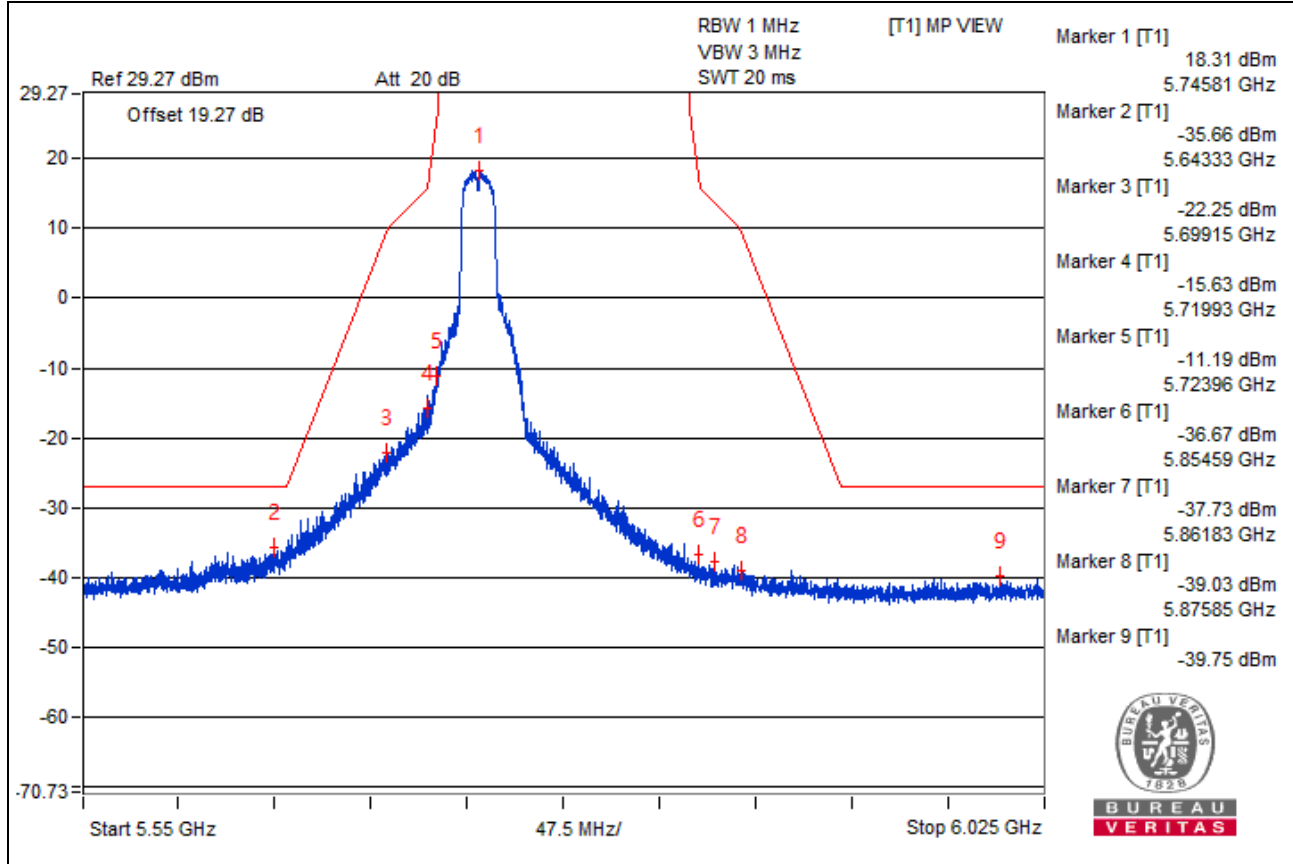


## Chain 1



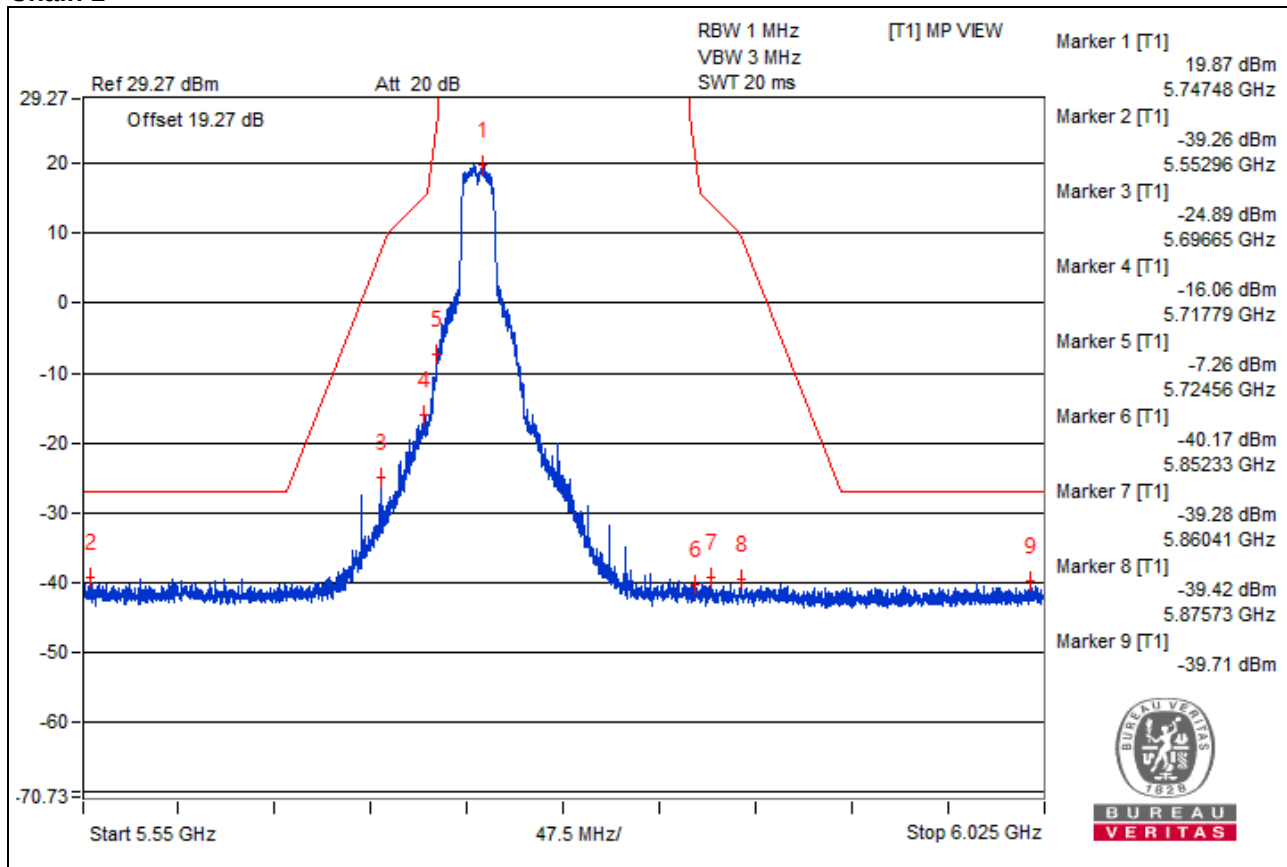
## Bandedge Measurement

### Chain 0



## Bandedge Measurement

### Chain 1



## 802.11a - Channel 157

### Conducted spurious emission table

| No. | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Raw Value (dBm) |        | Correction Factor (dB) | EIRP Level (dBm) |
|-----|-----------------|-------------------------|----------------|-------------|-----------------|--------|------------------------|------------------|
|     |                 |                         |                |             | Chain0          | Chain1 |                        |                  |
| 1   | 3842.18 PK      | 56.09                   | 74             | -17.91      | -50.67          | -49.33 | 7.77                   | -39.17           |
| 2   | 3856.25 AV      | 35.33                   | 54             | -18.67      | -71.1           | -70.36 | 7.77                   | -59.93           |
| 3   | 7726.56 PK      | 57.68                   | 74             | -16.32      | -48.22          | -48.51 | 7.77                   | -37.58           |
| 4   | 7714.06 AV      | 36.52                   | 54             | -17.48      | -69.02          | -70.09 | 7.77                   | -58.74           |
| 5   | 11564.06 PK     | 56.43                   | 74             | -17.57      | -50.55          | -48.84 | 7.77                   | -38.83           |
| 6   | 11570.31 AV     | 42                      | 54             | -12         | -69.29          | -61.73 | 7.77                   | -53.26           |
| 7   | 17365.43 PK     | 55.84                   | 68.2           | -12.36      | -50.71          | -49.75 | 7.77                   | -39.42           |

Note :

Emission Level (dBuV/m) = EIRP Level (dBm) – 20log(d) + 104.8

d = measurement distance in 3 meters.

## Chain 0

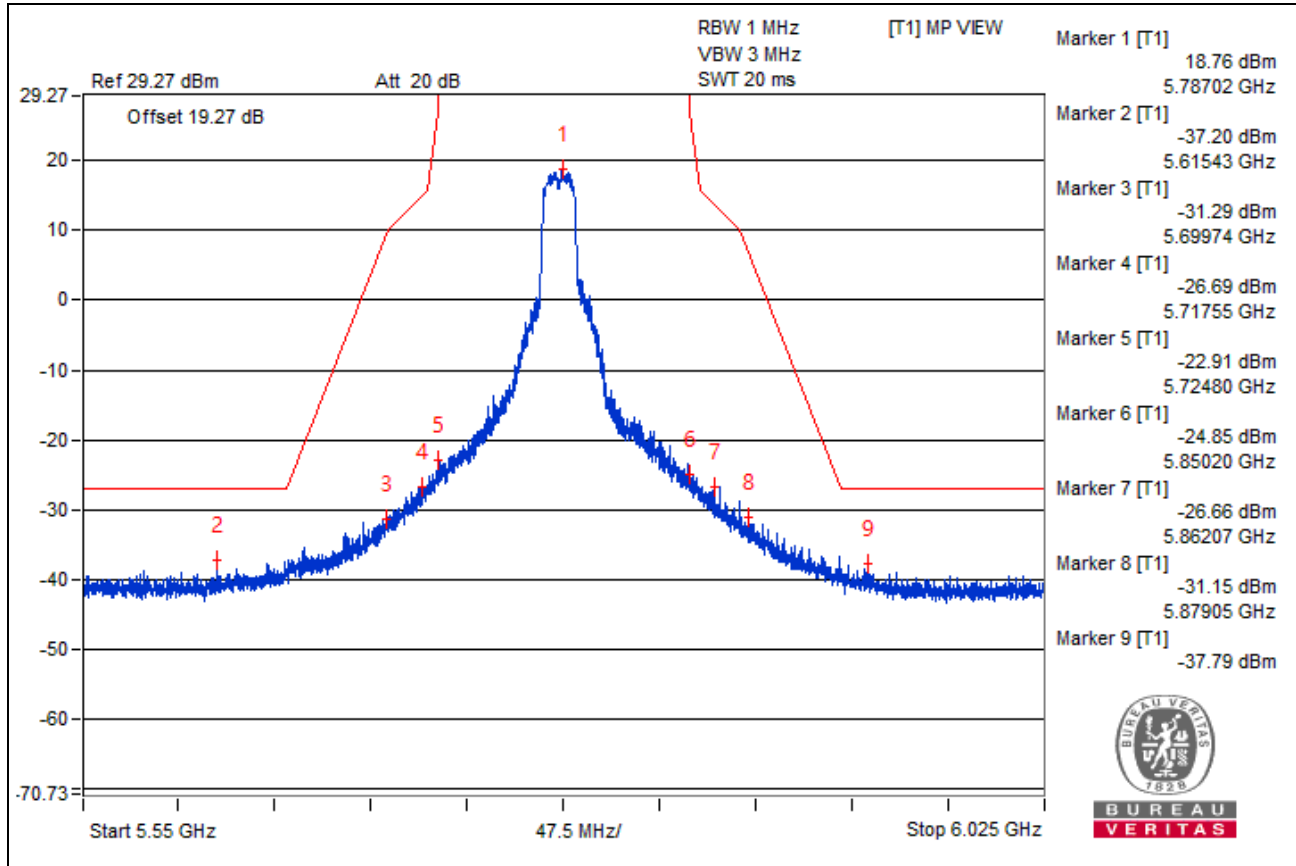


## Chain 1



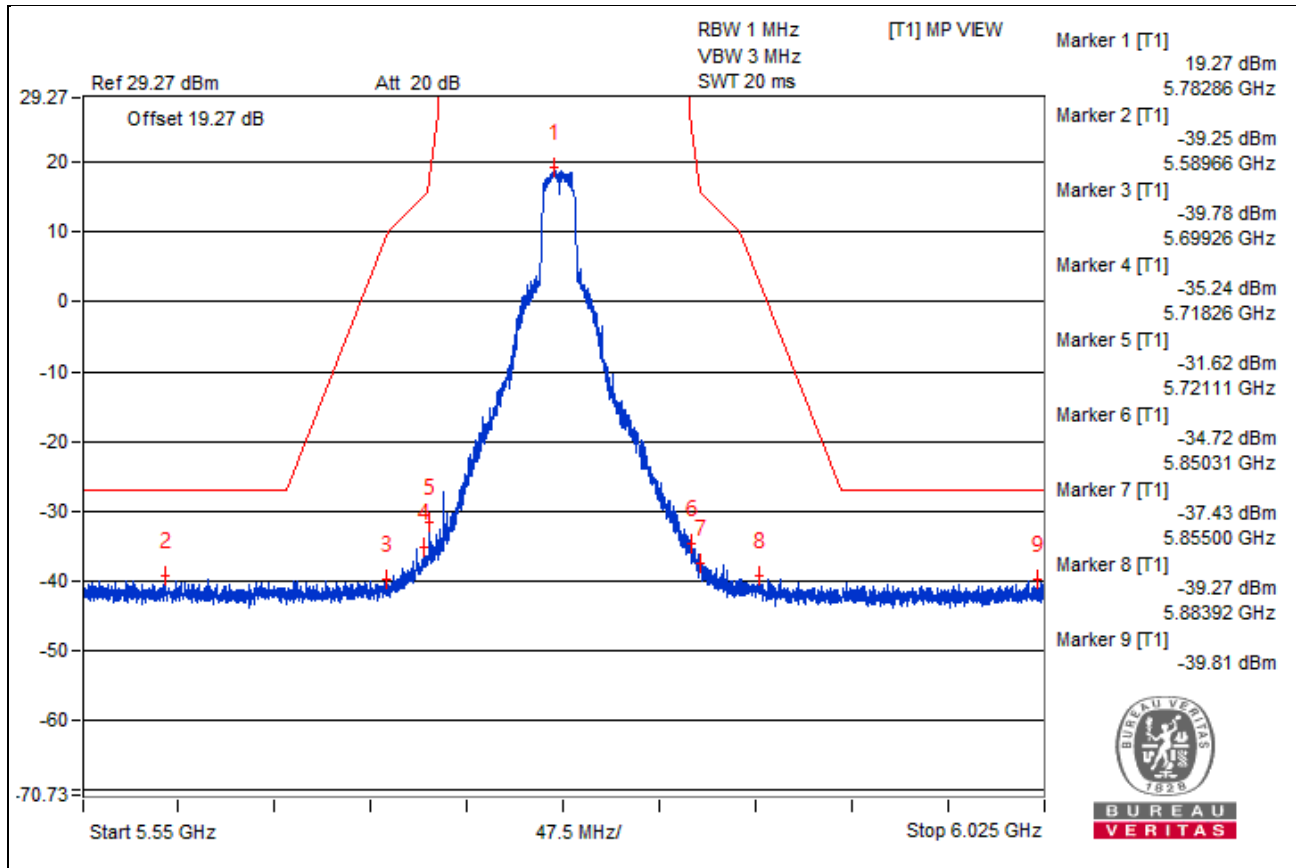
## Bandedge Measurement

### Chain 0



## Bandedge Measurement

### Chain 1



## 802.11a - Channel 165

### Conducted spurious emission table

| No. | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Raw Value (dBm) |        | Correction Factor (dB) | EIRP Level (dBm) |
|-----|-----------------|-------------------------|----------------|-------------|-----------------|--------|------------------------|------------------|
|     |                 |                         |                |             | Chain0          | Chain1 |                        |                  |
| 1   | 3898.43 PK      | 56.47                   | 74             | -17.53      | -50.79          | -48.62 | 7.77                   | -38.79           |
| 2   | 3882.81 AV      | 36.05                   | 54             | -17.95      | -70.99          | -69.18 | 7.77                   | -59.21           |
| 3   | 7753.12 PK      | 57.33                   | 68.2           | -10.87      | -49.98          | -47.73 | 7.77                   | -37.93           |
| 4   | 11646.87 PK     | 57.69                   | 74             | -16.31      | -50.8           | -46.79 | 7.77                   | -37.57           |
| 5   | 11651.56 AV     | 41.91                   | 54             | -12.09      | -69.23          | -61.85 | 7.77                   | -53.35           |
| 6   | 17481.87 PK     | 57.19                   | 68.2           | -11.01      | -49.73          | -48.12 | 7.77                   | -38.07           |

Note :

Emission Level (dBuV/m) = EIRP Level (dBm) – 20log(d) + 104.8

d = measurement distance in 3 meters.

## Chain 0

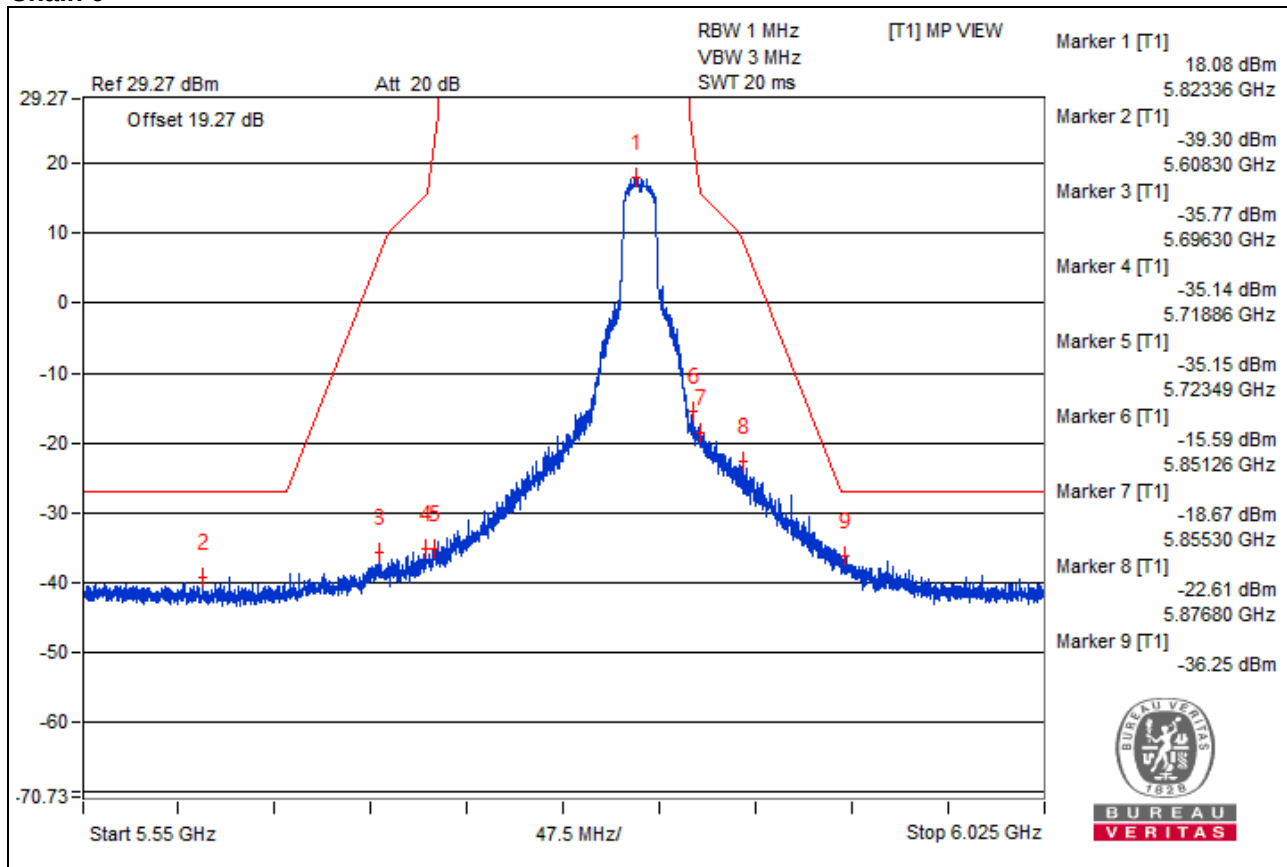


## Chain 1



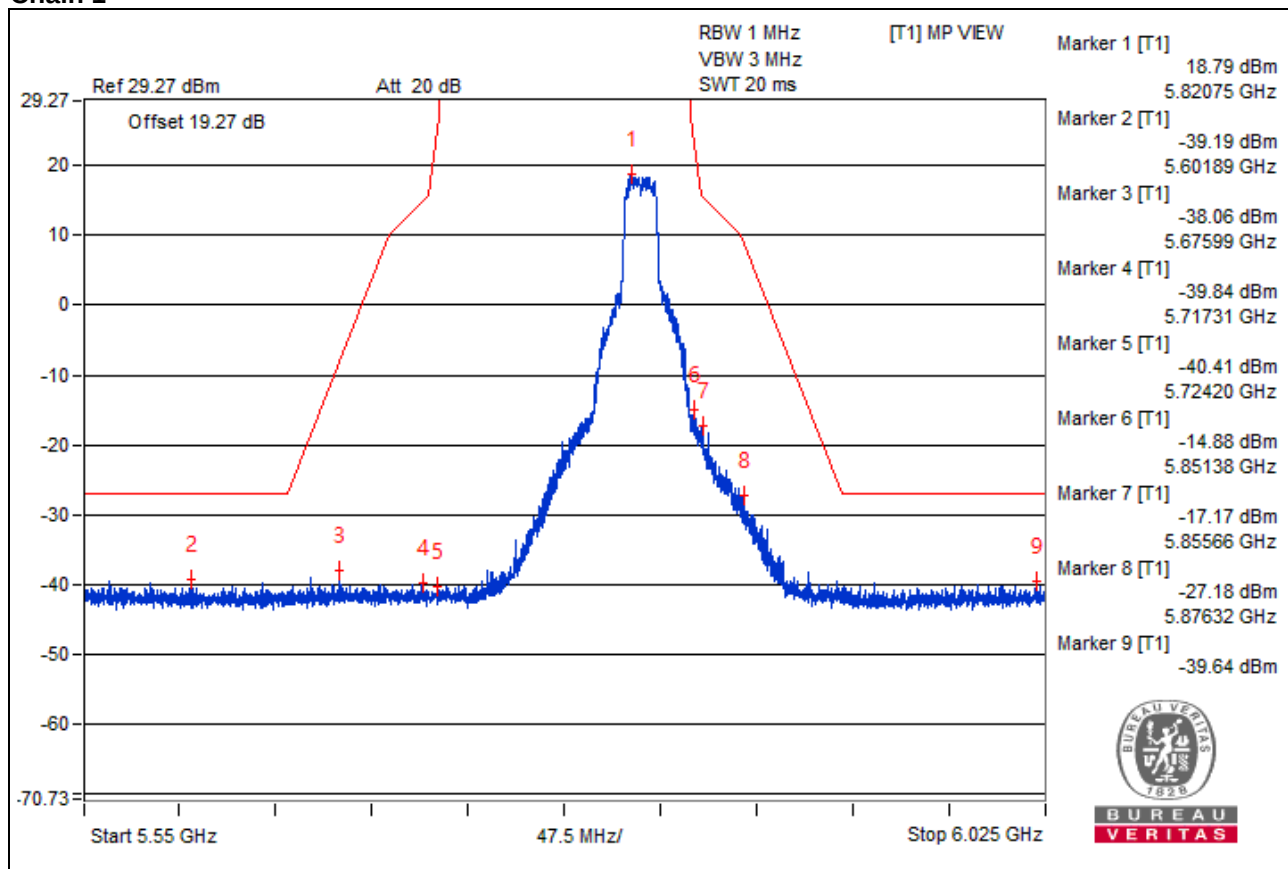
## Bandedge Measurement

### Chain 0



## Bandedge Measurement

### Chain 1



## 802.11ac (VHT20) - Channel 149

### Conducted spurious emission table

| No. | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Raw Value (dBm) |        | Correction Factor (dB) | EIRP Level (dBm) |
|-----|-----------------|-------------------------|----------------|-------------|-----------------|--------|------------------------|------------------|
|     |                 |                         |                |             | Chain0          | Chain1 |                        |                  |
| 1   | 3815.62 PK      | 57.25                   | 74             | -16.75      | -48.8           | -48.79 | 7.77                   | -38.01           |
| 2   | 3814.06 AV      | 35.46                   | 54             | -18.54      | -70.53          | -70.64 | 7.77                   | -59.8            |
| 3   | 7656.25 PK      | 57.27                   | 74             | -16.73      | -49.1           | -48.46 | 7.77                   | -37.99           |
| 4   | 7660.93 AV      | 36.41                   | 54             | -17.59      | -69.22          | -70.09 | 7.77                   | -58.85           |
| 5   | 11495.31 PK     | 57.46                   | 74             | -16.54      | -50.61          | -47.2  | 7.77                   | -37.8            |
| 6   | 11490.62 AV     | 42.25                   | 54             | -11.75      | -68.8           | -61.52 | 7.77                   | -53.01           |
| 7   | 17223.12 PK     | 54.8                    | 68.2           | -13.4       | -52.43          | -50.3  | 7.77                   | -40.46           |

Note :

Emission Level (dBuV/m) = EIRP Level (dBm) – 20log(d) + 104.8

d = measurement distance in 3 meters.

## Chain 0

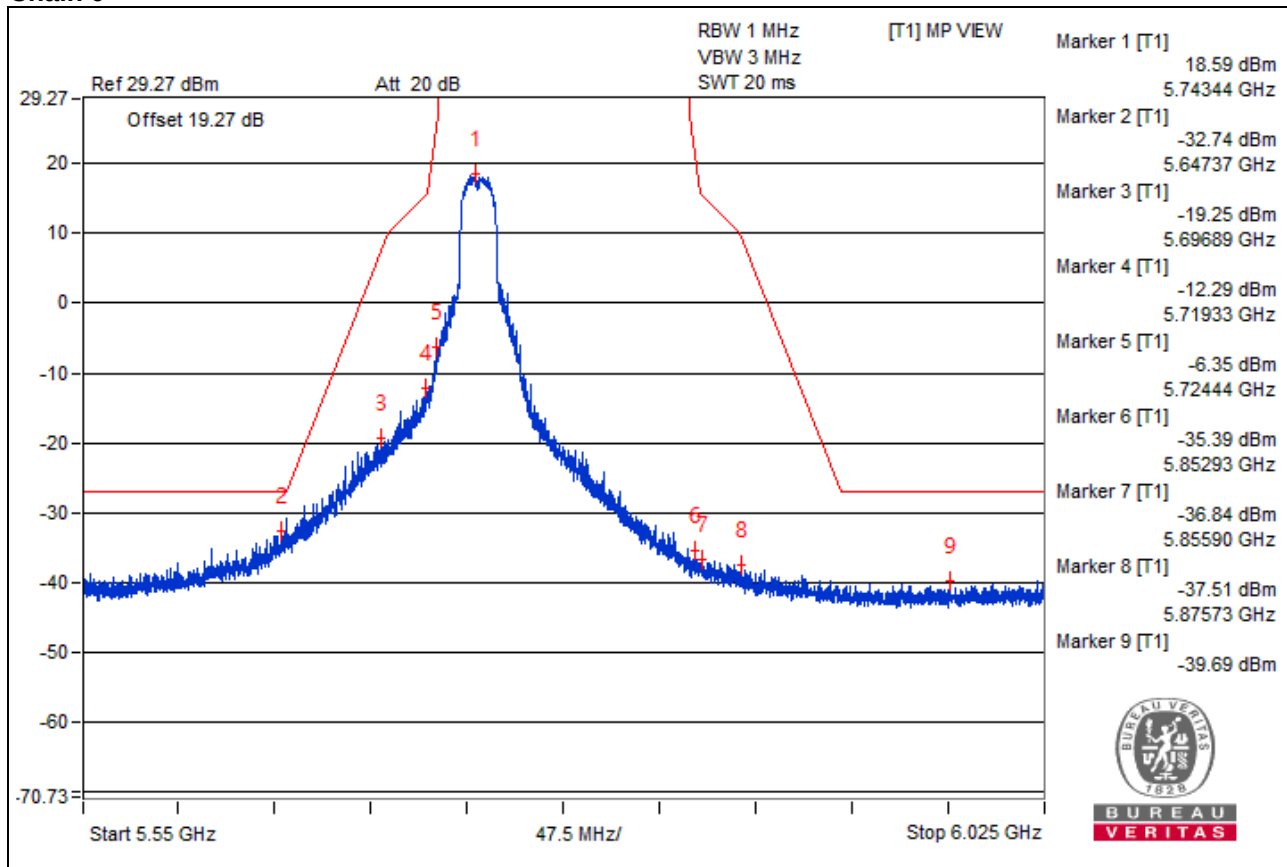


## Chain 1



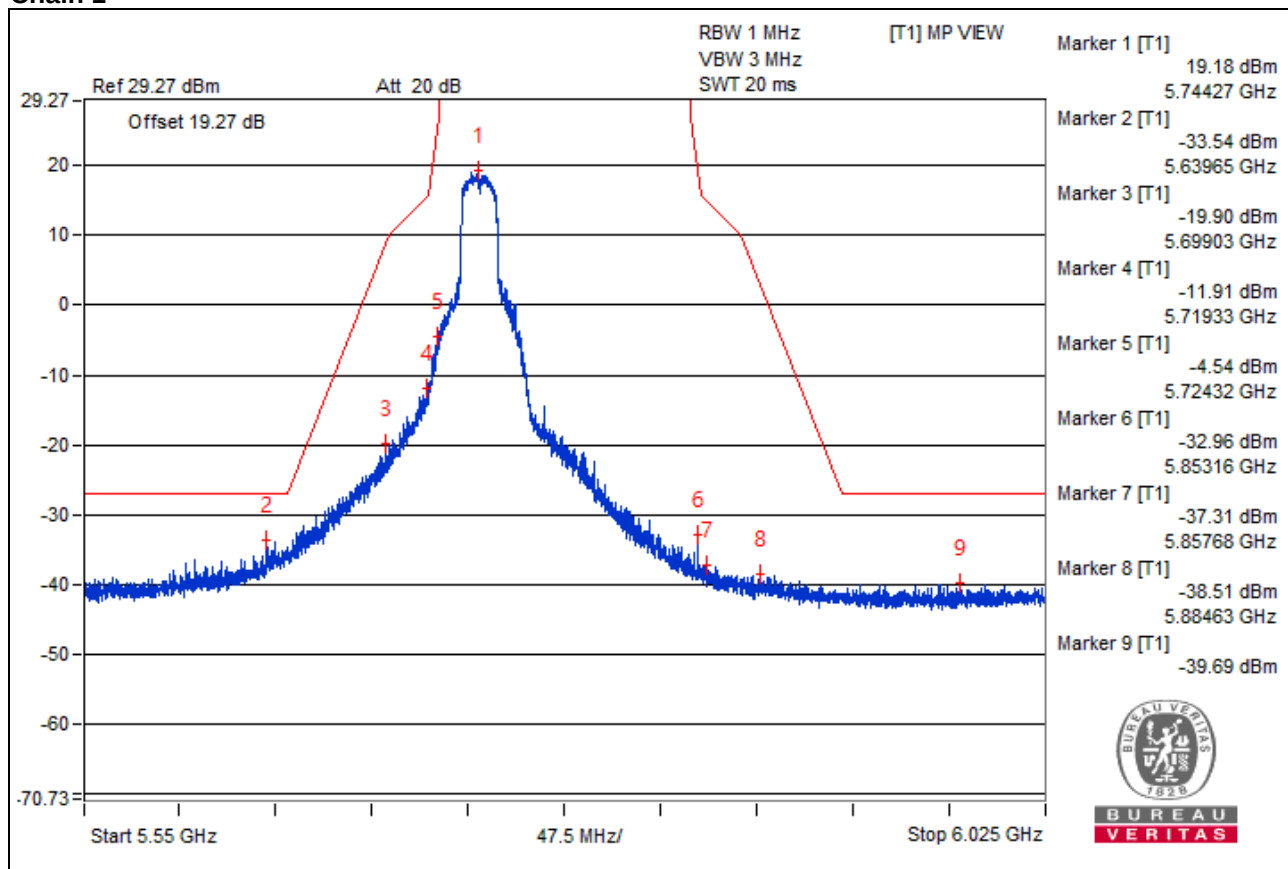
## Bandedge Measurement

### Chain 0



## Bandedge Measurement

### Chain 1



## 802.11ac (VHT20) - Channel 157

### Conducted spurious emission table

| No. | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Raw Value (dBm) |        | Correction Factor (dB) | EIRP Level (dBm) |
|-----|-----------------|-------------------------|----------------|-------------|-----------------|--------|------------------------|------------------|
|     |                 |                         |                |             | Chain0          | Chain1 |                        |                  |
| 1   | 3843.75 PK      | 56.65                   | 74             | -17.35      | -48.84          | -50.03 | 7.77                   | -38.61           |
| 2   | 3856.25 AV      | 35.24                   | 54             | -18.76      | -71.09          | -70.52 | 7.77                   | -60.02           |
| 3   | 7707.81 PK      | 58.07                   | 74             | -15.93      | -47.54          | -48.45 | 7.77                   | -37.19           |
| 4   | 7714.06 AV      | 36.67                   | 54             | -17.33      | -68.88          | -69.92 | 7.77                   | -58.59           |
| 5   | 11576.56 PK     | 56.86                   | 74             | -17.14      | -49.9           | -48.56 | 7.77                   | -38.4            |
| 6   | 11570.31 AV     | 41.5                    | 54             | -12.5       | -69.91          | -62.21 | 7.77                   | -53.76           |
| 7   | 17365.43 PK     | 55.01                   | 68.2           | -13.19      | -51.64          | -50.49 | 7.77                   | -40.25           |

Note :

Emission Level (dBuV/m) = EIRP Level (dBm) – 20log(d) + 104.8

d = measurement distance in 3 meters.

## Chain 0

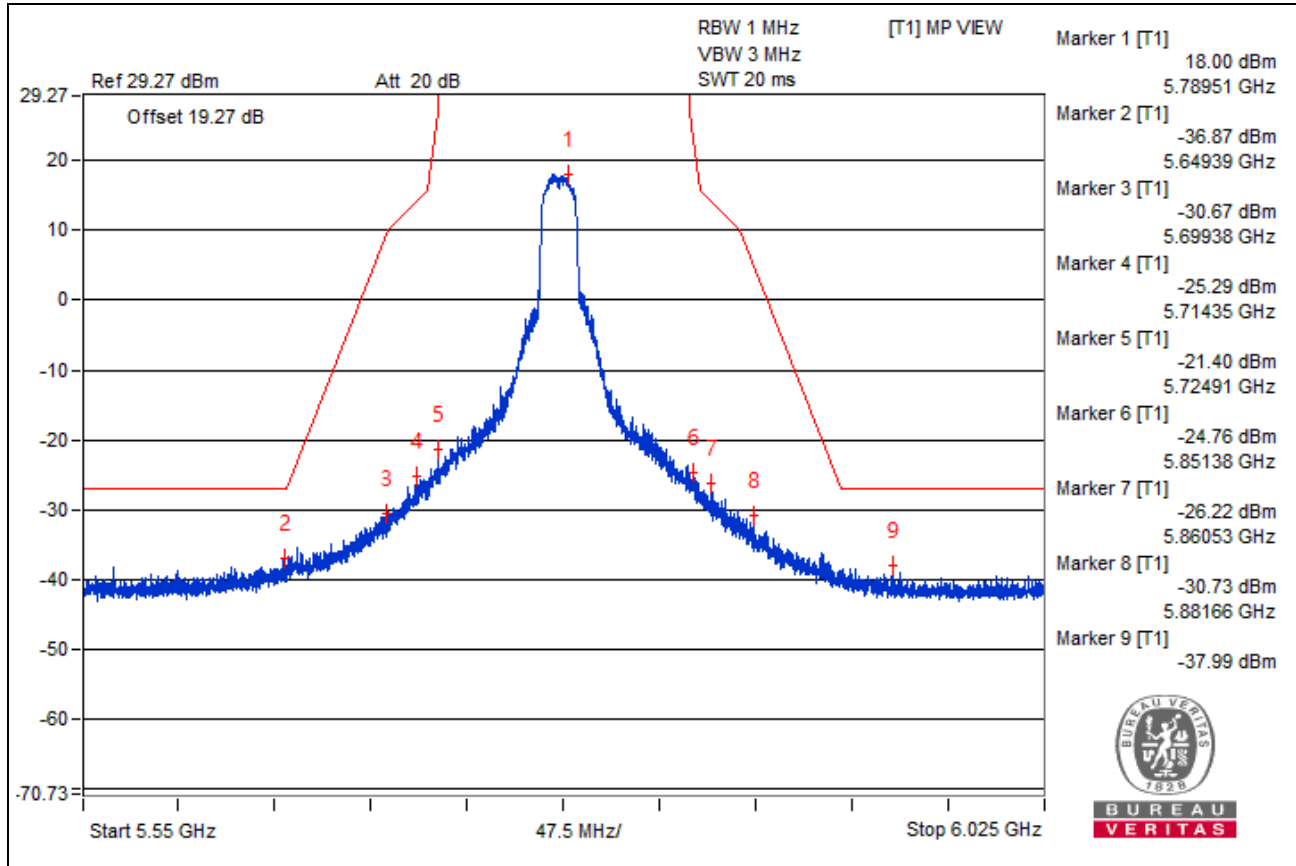


## Chain 1



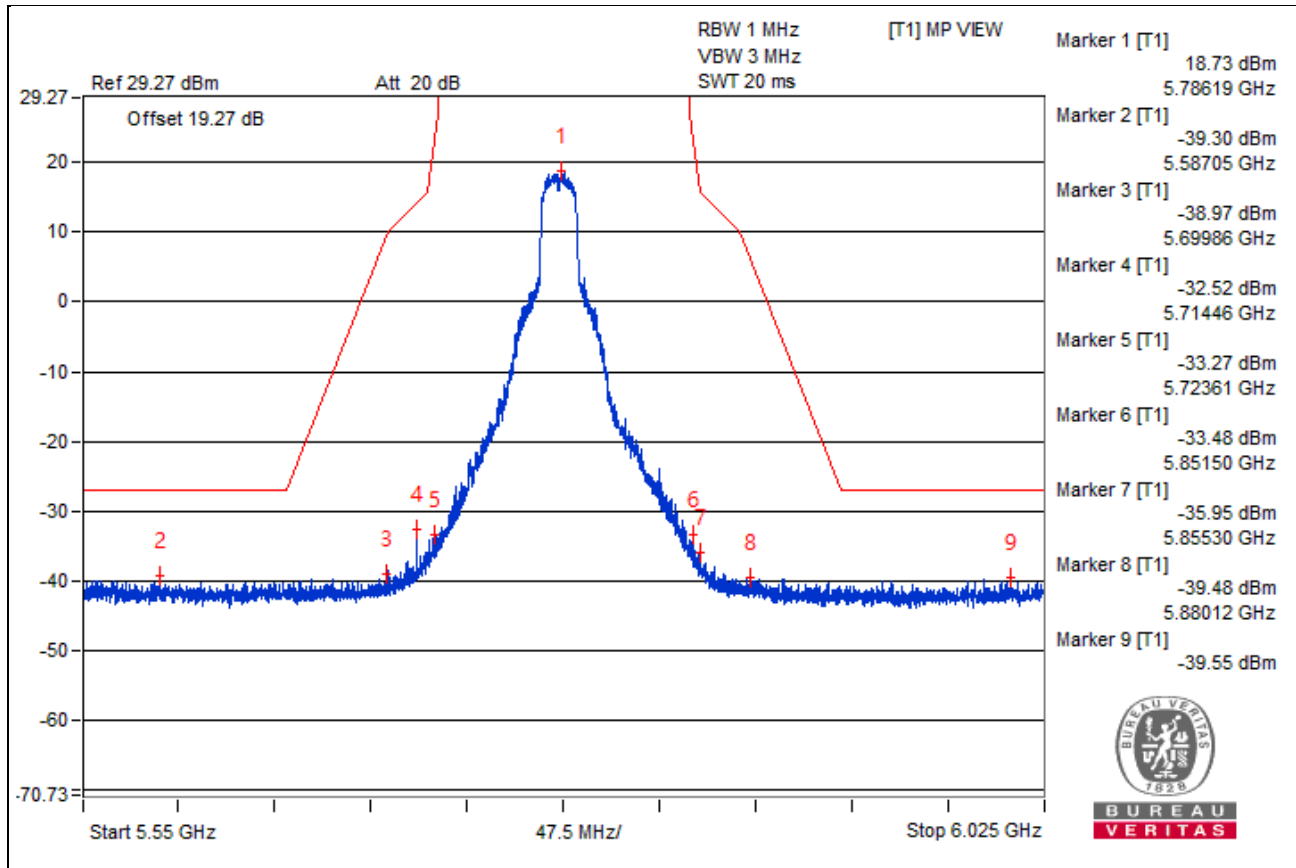
## Bandedge Measurement

### Chain 0



## Bandedge Measurement

### Chain 1



## 802.11ac (VHT20) - Channel 165

### Conducted spurious emission table

| No. | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Raw Value (dBm) |        | Correction Factor (dB) | EIRP Level (dBm) |
|-----|-----------------|-------------------------|----------------|-------------|-----------------|--------|------------------------|------------------|
|     |                 |                         |                |             | Chain0          | Chain1 |                        |                  |
| 1   | 3895.31 PK      | 56.82                   | 74             | -17.18      | -50.89          | -48.02 | 7.77                   | -38.44           |
| 2   | 3882.81 AV      | 36.52                   | 54             | -17.48      | -70.83          | -68.51 | 7.77                   | -58.74           |
| 3   | 7782.81 PK      | 57.17                   | 68.2           | -11.03      | -47.76          | -50.37 | 7.77                   | -38.09           |
| 4   | 11650 PK        | 57.63                   | 74             | -16.37      | -49.26          | -47.7  | 7.77                   | -37.63           |
| 5   | 11651.56 AV     | 41.81                   | 54             | -12.19      | -69.15          | -61.98 | 7.77                   | -53.45           |
| 6   | 17471.81 PK     | 56.96                   | 68.2           | -11.24      | -50.08          | -48.26 | 7.77                   | -38.3            |

Note :

Emission Level (dBuV/m) = EIRP Level (dBm) – 20log(d) + 104.8

d = measurement distance in 3 meters.

## Chain 0

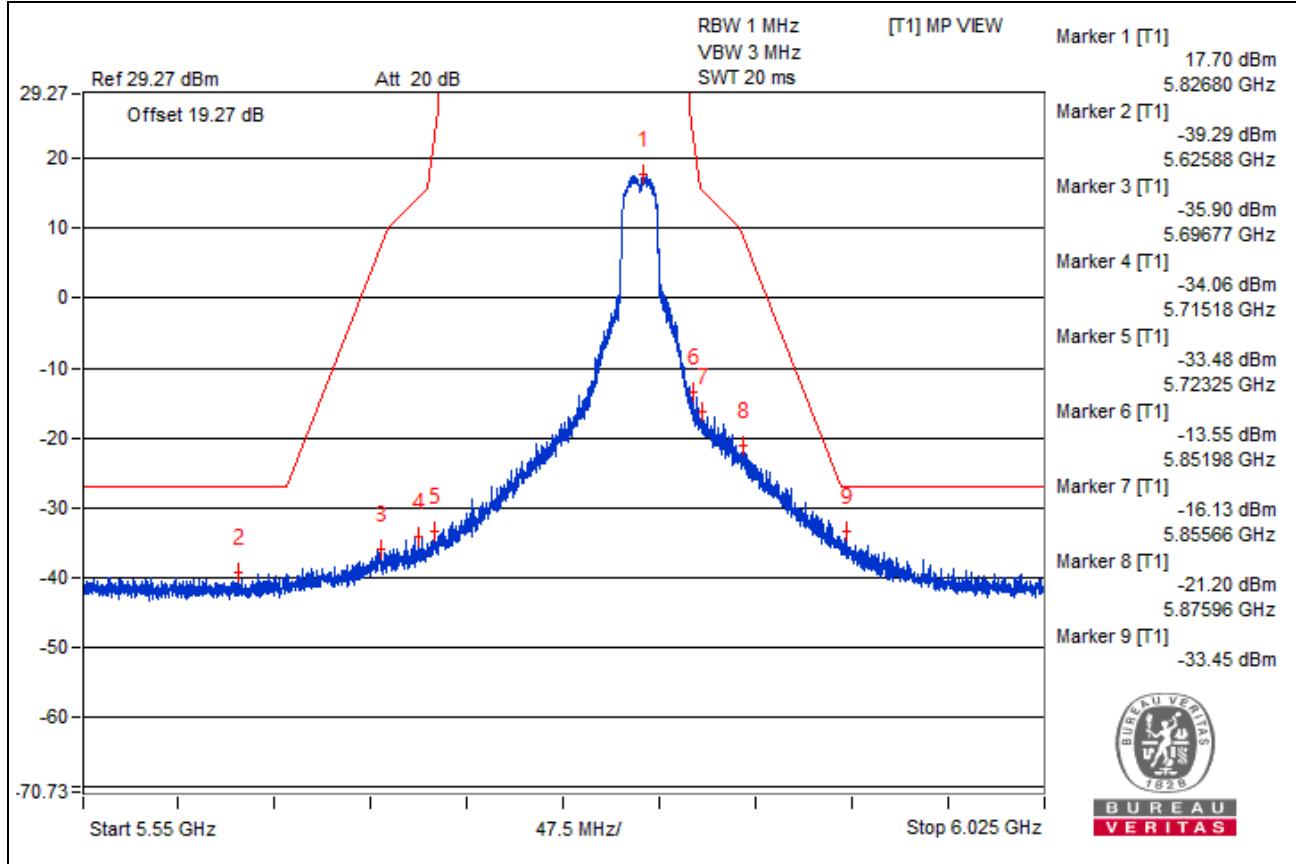


## Chain 1



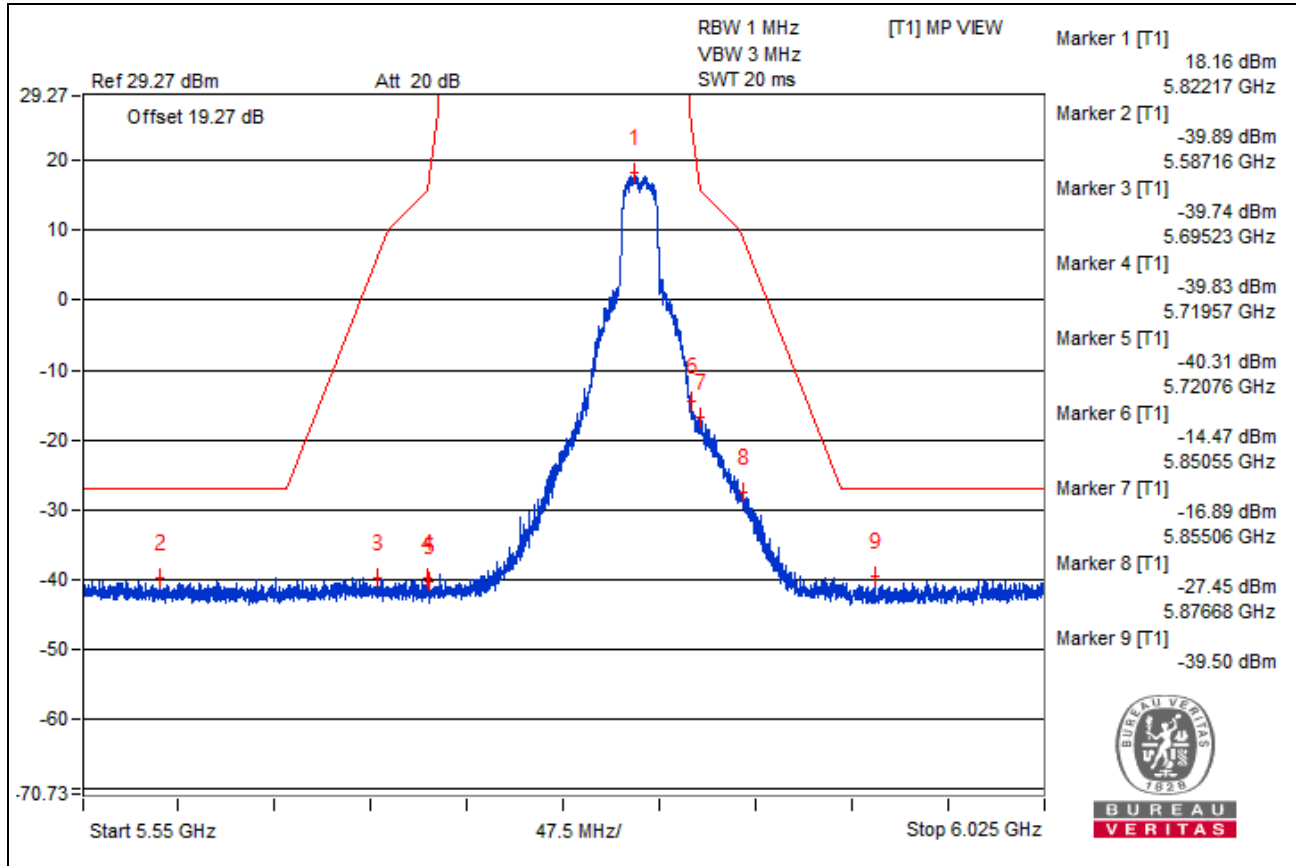
## Bandedge Measurement

### Chain 0



## Bandedge Measurement

### Chain 1



## 802.11ac (VHT40) - Channel 151

### Conducted spurious emission table

| No. | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Raw Value (dBm) |        | Correction Factor (dB) | EIRP Level (dBm) |
|-----|-----------------|-------------------------|----------------|-------------|-----------------|--------|------------------------|------------------|
|     |                 |                         |                |             | Chain0          | Chain1 |                        |                  |
| 1   | 3821.87 PK      | 56.9                    | 74             | -17.1       | -48.28          | -50.22 | 7.77                   | -38.36           |
| 2   | 3821.87 AV      | 35.47                   | 54             | -18.53      | -70.3           | -70.86 | 7.77                   | -59.79           |
| 3   | 7675 PK         | 56.94                   | 74             | -17.06      | -48.72          | -49.52 | 7.77                   | -38.32           |
| 4   | 7673.43 AV      | 36.53                   | 54             | -17.47      | -69             | -70.08 | 7.77                   | -58.73           |
| 5   | 11507.81 PK     | 57.56                   | 74             | -16.44      | -51.99          | -46.57 | 7.77                   | -37.7            |
| 6   | 11510.93 AV     | 41.05                   | 54             | -12.95      | -69             | -62.94 | 7.77                   | -54.21           |
| 7   | 17279.18 PK     | 55.12                   | 68.2           | -13.08      | -50.93          | -50.91 | 7.77                   | -40.14           |

Note :

Emission Level (dBuV/m) = EIRP Level (dBm) – 20log(d) + 104.8

d = measurement distance in 3 meters.

## Chain 0

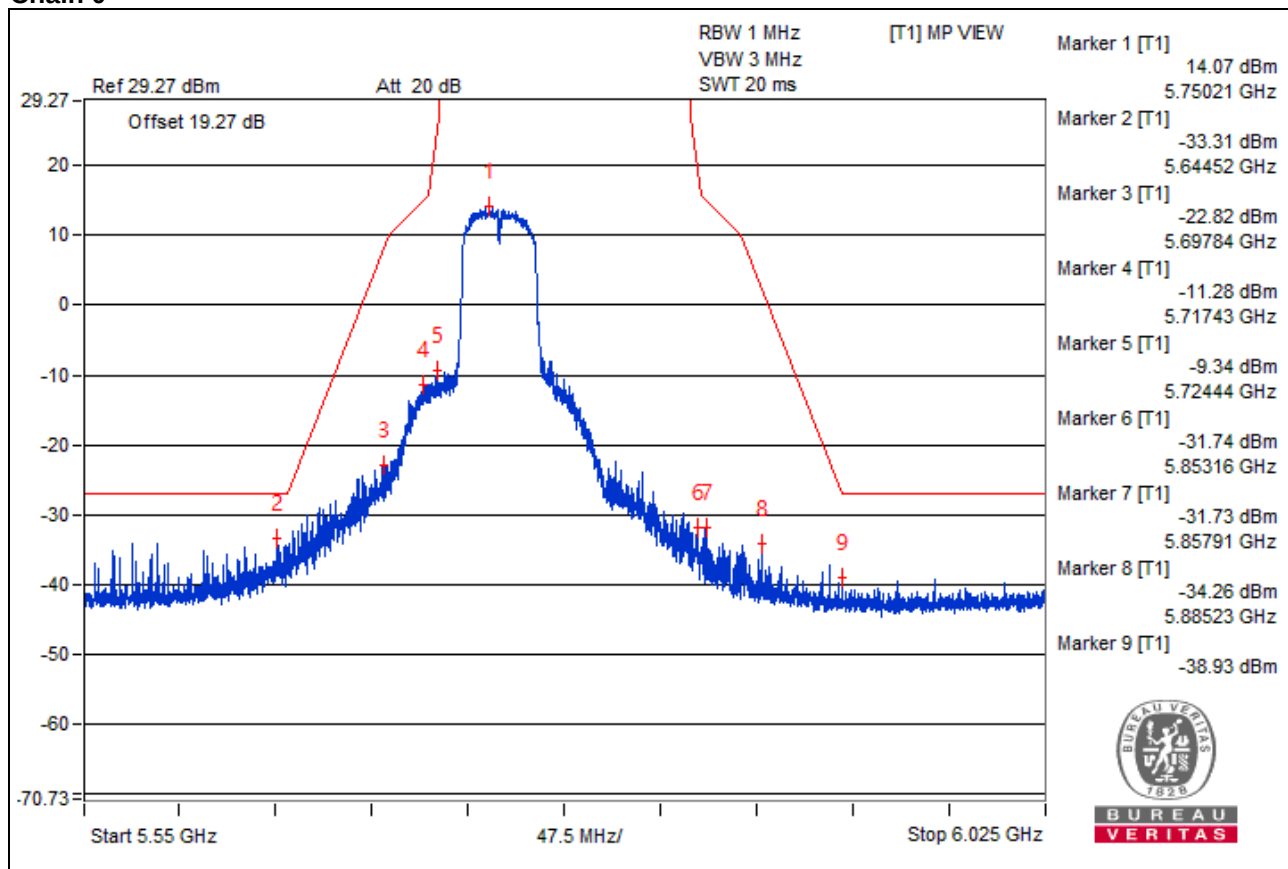


## Chain 1



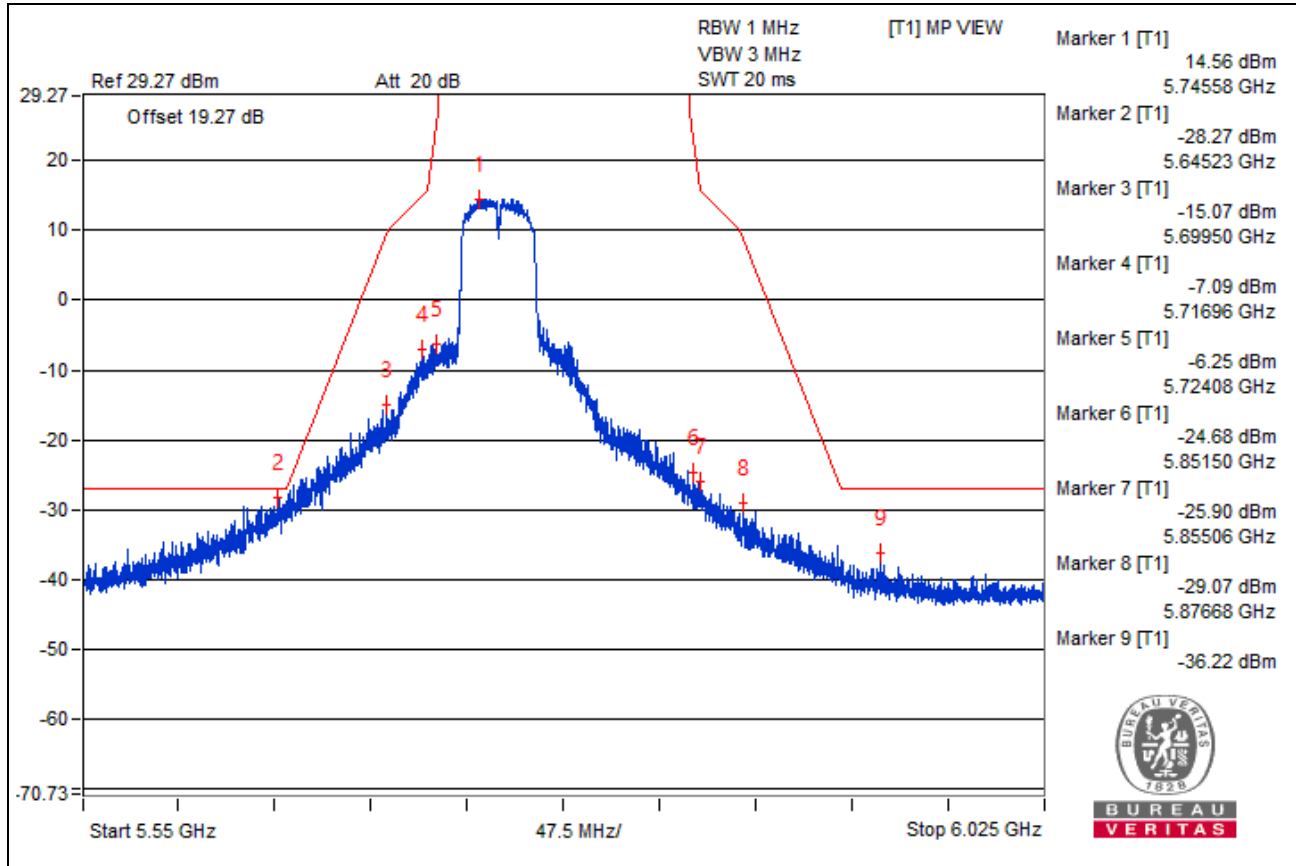
## Bandedge Measurement

### Chain 0



## Bandedge Measurement

### Chain 1



## 802.11ac (VHT40) - Channel 159

### Conducted spurious emission table

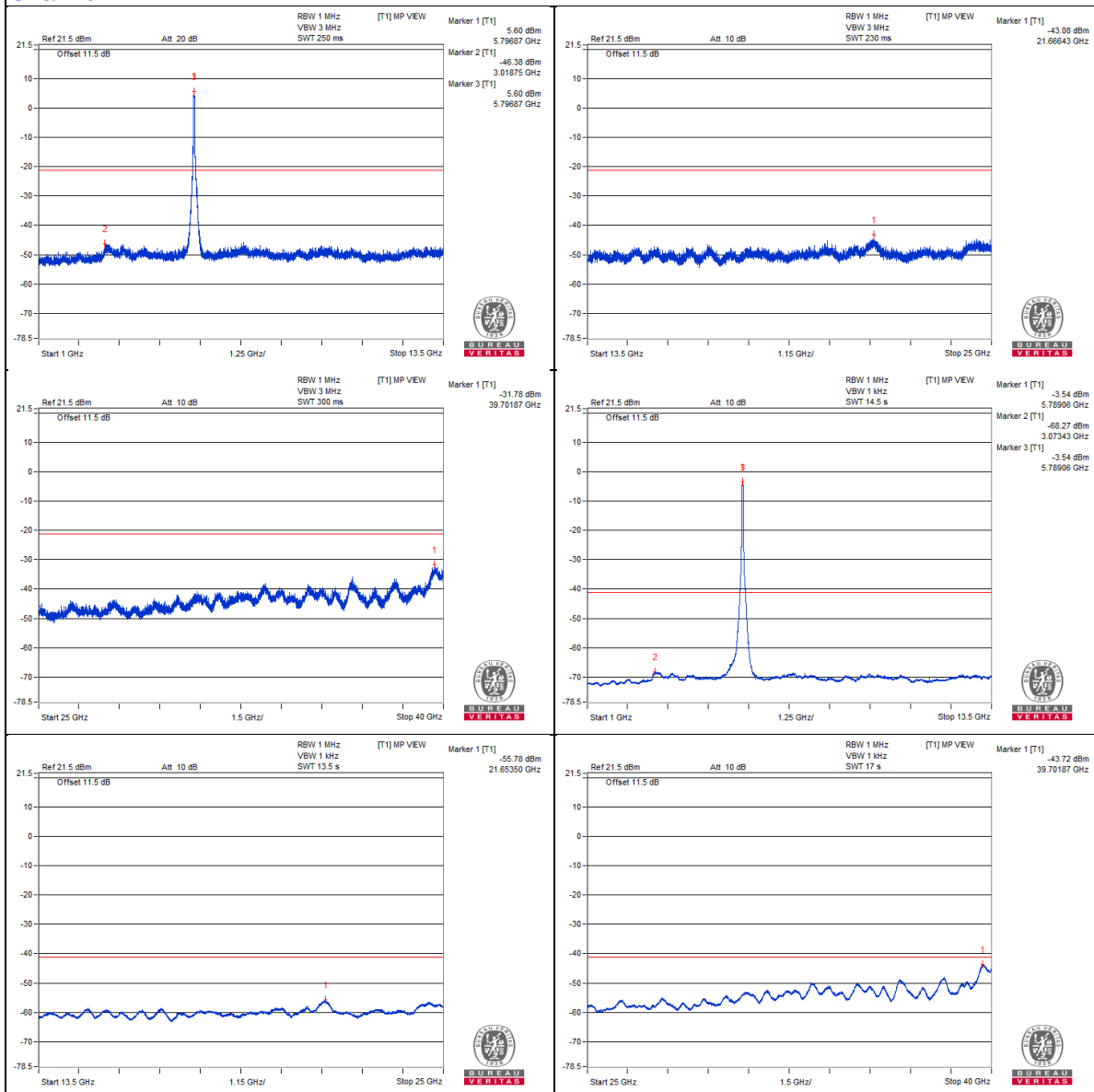
| No. | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Raw Value (dBm) |        | Correction Factor (dB) | EIRP Level (dBm) |
|-----|-----------------|-------------------------|----------------|-------------|-----------------|--------|------------------------|------------------|
|     |                 |                         |                |             | Chain0          | Chain1 |                        |                  |
| 1   | 3876.56 PK      | 56.84                   | 74             | -17.16      | -48.65          | -49.82 | 7.77                   | -38.42           |
| 2   | 3862.5 AV       | 35.61                   | 54             | -18.39      | -71.14          | -69.82 | 7.77                   | -59.65           |
| 3   | 7717.18 PK      | 57.96                   | 74             | -16.04      | -47.85          | -48.32 | 7.77                   | -37.3            |
| 4   | 7726.56 AV      | 36.86                   | 54             | -17.14      | -68.7           | -69.73 | 7.77                   | -58.4            |
| 5   | 11579.68 PK     | 57.05                   | 74             | -16.95      | -50.4           | -47.93 | 7.77                   | -38.21           |
| 6   | 11590.62 AV     | 40.49                   | 54             | -13.51      | -70.36          | -63.32 | 7.77                   | -54.77           |
| 7   | 17402.81 PK     | 55.85                   | 68.2           | -12.35      | -50.15          | -50.23 | 7.77                   | -39.41           |

Note :

Emission Level (dBuV/m) = EIRP Level (dBm) – 20log(d) + 104.8

d = measurement distance in 3 meters.

## Chain 0

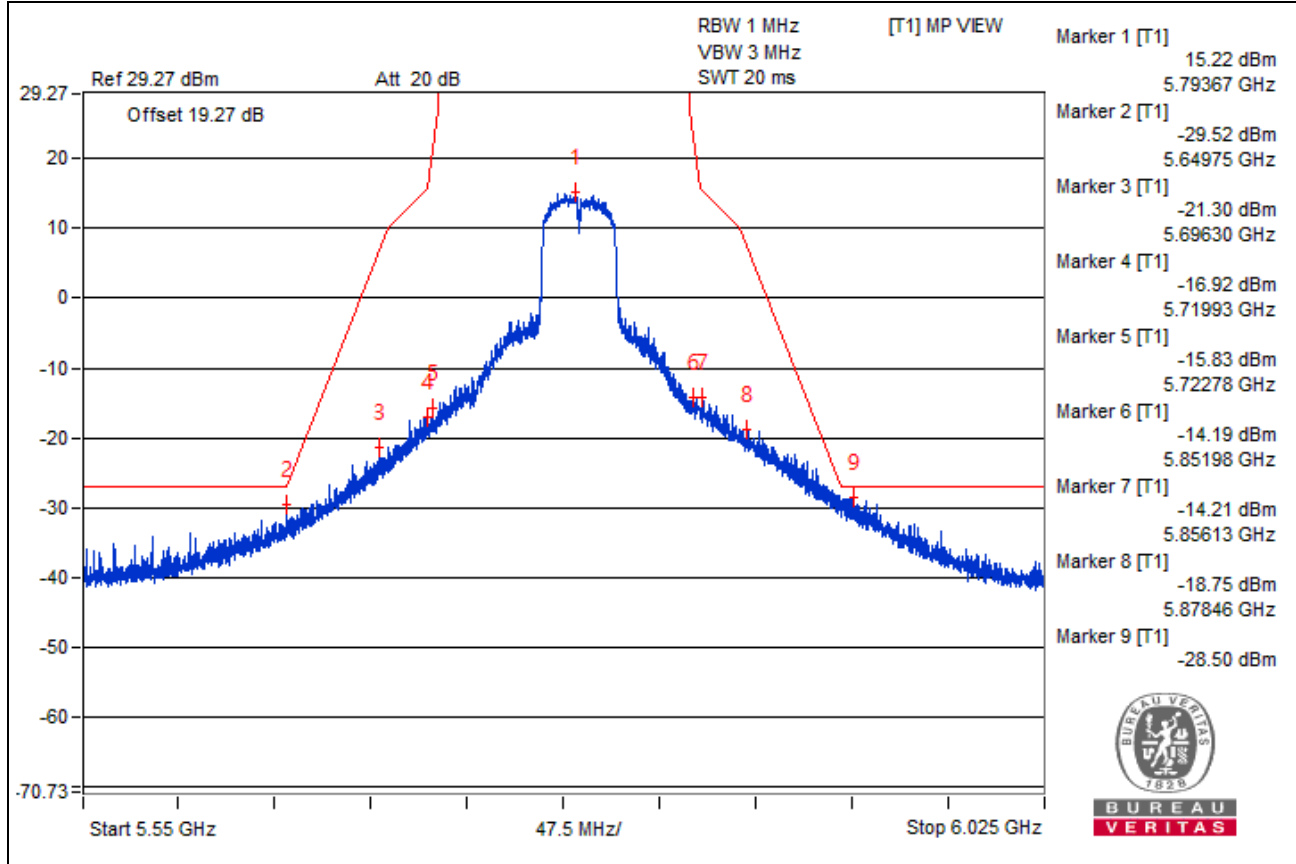


## Chain 1



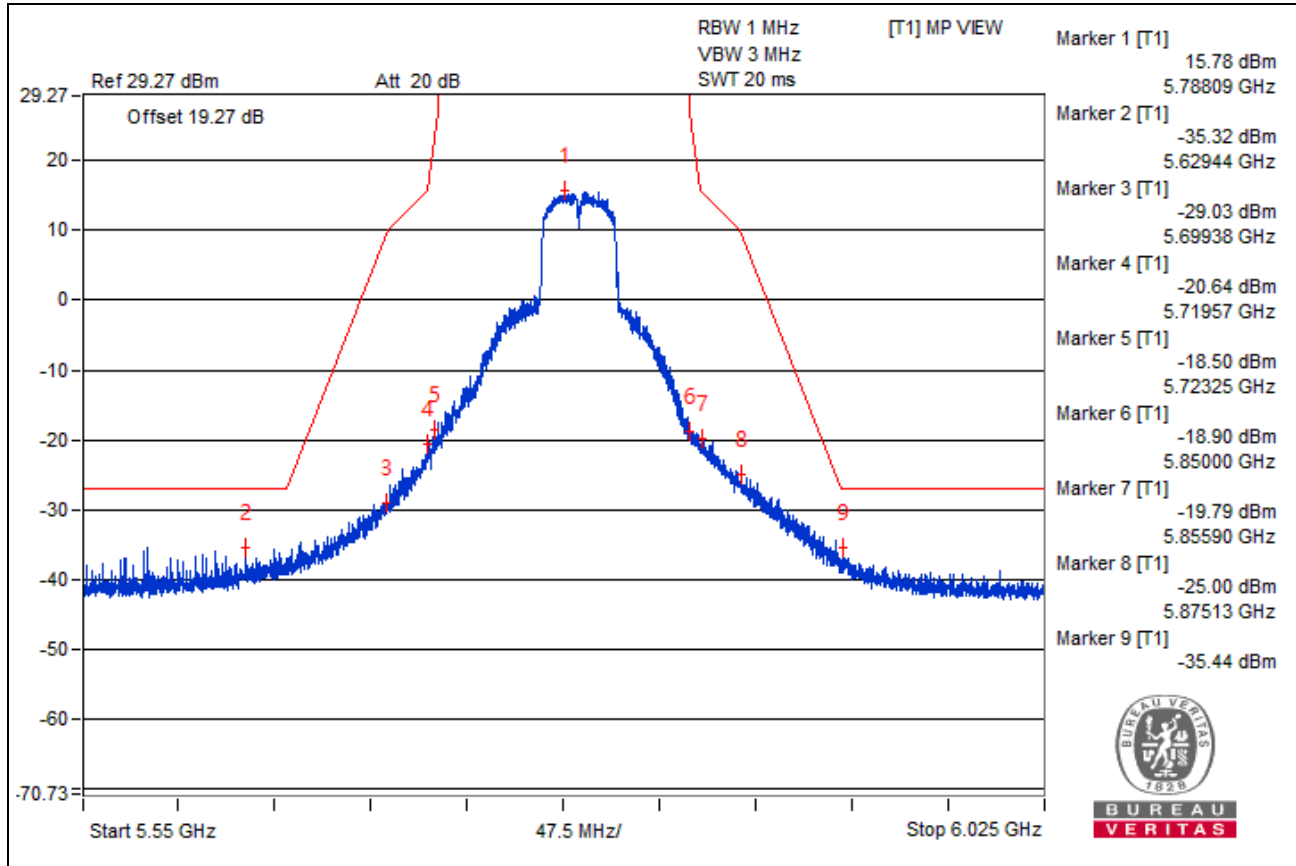
## Bandedge Measurement

### Chain 0



## Bandedge Measurement

### Chain 1



## 802.11ac (VHT80) - Channel 155

### Conducted spurious emission table

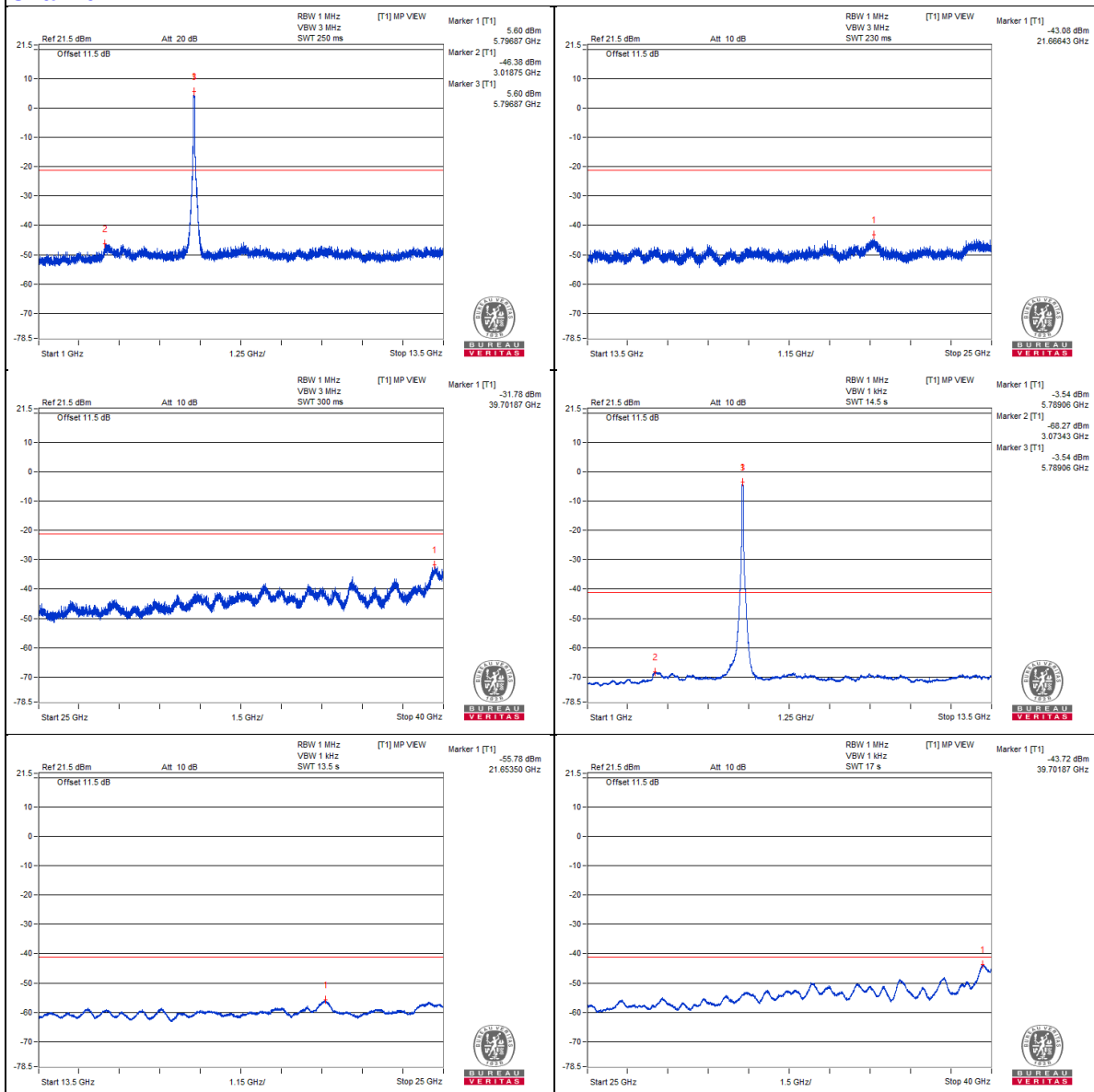
| No. | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Raw Value (dBm) |        | Correction Factor (dB) | EIRP Level (dBm) |
|-----|-----------------|-------------------------|----------------|-------------|-----------------|--------|------------------------|------------------|
|     |                 |                         |                |             | Chain0          | Chain1 |                        |                  |
| 1   | 3834.37 PK      | 56.02                   | 74             | -17.98      | -49.12          | -51.16 | 7.77                   | -39.24           |
| 2   | 3850 AV         | 35.48                   | 54             | -18.52      | -71             | -70.16 | 7.77                   | -59.78           |
| 3   | 7709.37 PK      | 57.71                   | 74             | -16.29      | -49.68          | -47.3  | 7.77                   | -37.55           |
| 4   | 7700 AV         | 36.55                   | 54             | -17.45      | -69.32          | -69.66 | 7.77                   | -58.71           |
| 5   | 11535.93 PK     | 56.26                   | 74             | -17.74      | -50.74          | -48.99 | 7.77                   | -39              |
| 6   | 11551.56 AV     | 39.26                   | 54             | -14.74      | -70.52          | -64.8  | 7.77                   | -56              |
| 7   | 17326.62 PK     | 54.58                   | 68.2           | -13.62      | -51.19          | -51.74 | 7.77                   | -40.68           |

Note :

Emission Level (dBuV/m) = EIRP Level (dBm) – 20log(d) + 104.8

d = measurement distance in 3 meters.

## Chain 0

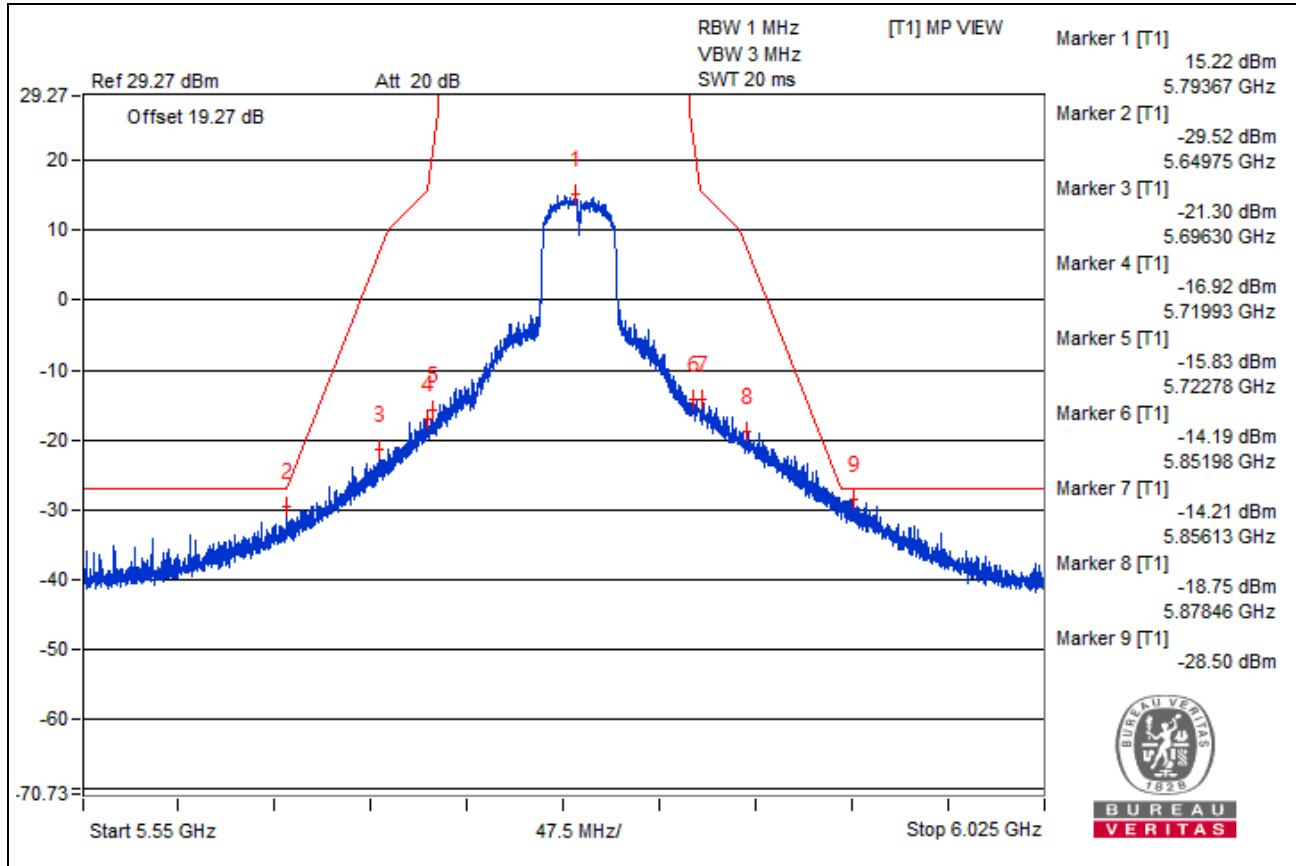


## Chain 1



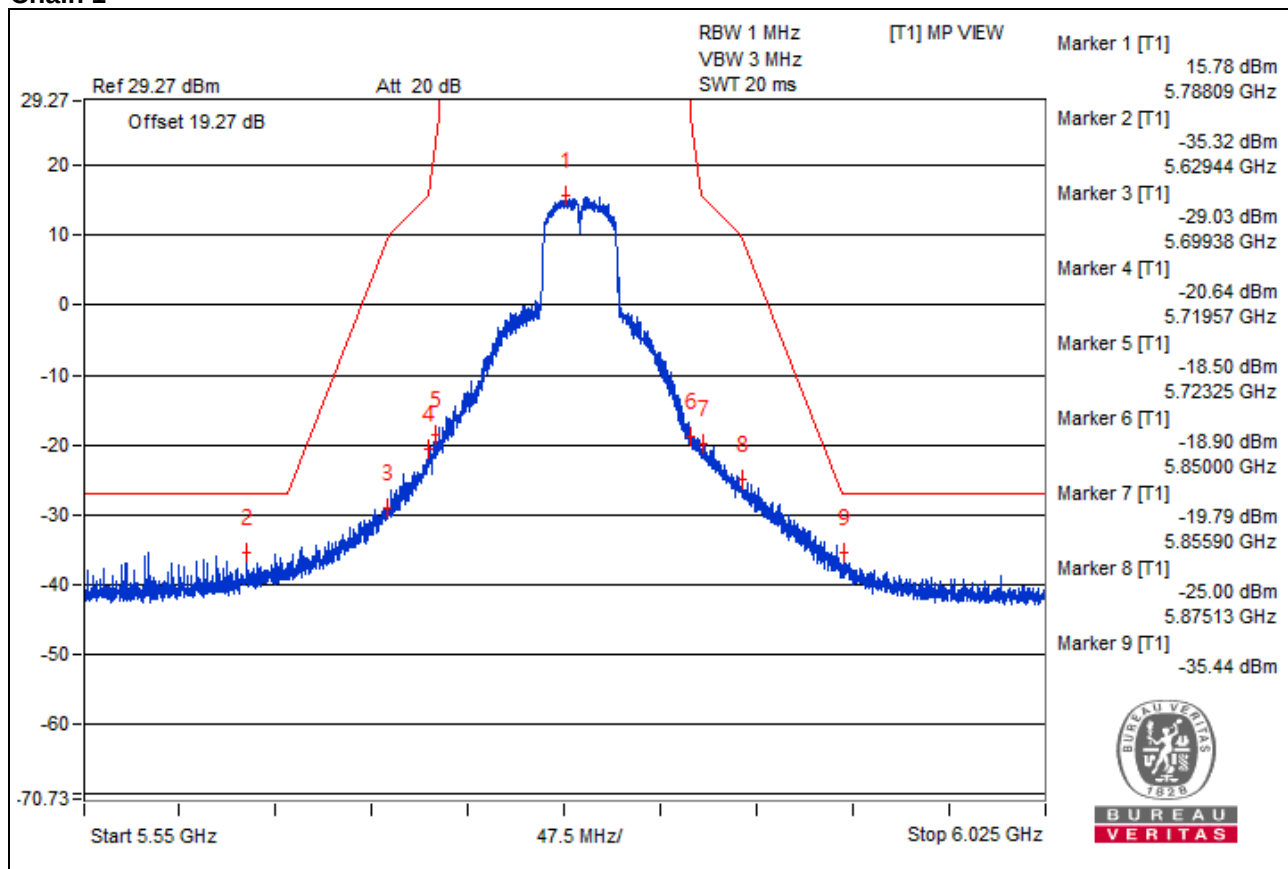
## Bandedge Measurement

### Chain 0



## Bandedge Measurement

### Chain 1



## 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)                                                                                                             |
|                |              | 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

Per KDB 662911 Method of conducted output power measurement on IEEE 802.11 devices,

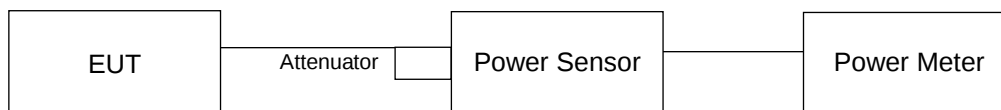
Array Gain = 0 dB (i.e., no array gain) for  $N_{ANT} \leq 4$ ;

Array Gain = 0 dB (i.e., no array gain) for channel widths  $\geq 40$  MHz for any  $N_{ANT}$ ;

Array Gain =  $5 \log(N_{ANT}/N_{SS})$  dB or 3 dB, whichever is less for 20-MHz channel widths with  $N_{ANT} \geq 5$ .

For power measurements on all other devices: Array Gain =  $10 \log(N_{ANT}/N_{SS})$  dB.

### 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 Results

##### 802.11a

| Chan. | Chan. Freq. (MHz) | Maximum Conducted Power (dBm) |         | Total Power (mW) | Total Power (dBm) | Limit (dBm) | Pass / Fail |
|-------|-------------------|-------------------------------|---------|------------------|-------------------|-------------|-------------|
|       |                   | Chain 0                       | Chain 1 |                  |                   |             |             |
| 149   | 5745              | 15.20                         | 15.67   | 70.011           | 18.45             | 28.23       | Pass        |
| 157   | 5785              | 15.26                         | 15.85   | 72.033           | 18.58             | 28.23       | Pass        |
| 165   | 5825              | 15.01                         | 15.26   | 65.27            | 18.15             | 28.23       | Pass        |

Note: 1. Directional gain =  $4.76\text{dBi} + 10\log(2) = 7.77\text{dBi} > 6\text{dBi}$ , therefore the limit needs to reduce, so the power limit shall be reduced to  $30 - (7.77 - 6) = 28.23\text{dBm}$ .

##### 802.11ac (VHT20)

| Chan. | Chan. Freq. (MHz) | Maximum Conducted Power (dBm) |         | Total Power (mW) | Total Power (dBm) | Limit (dBm) | Pass / Fail |
|-------|-------------------|-------------------------------|---------|------------------|-------------------|-------------|-------------|
|       |                   | Chain 0                       | Chain 1 |                  |                   |             |             |
| 149   | 5745              | 15.29                         | 15.74   | 71.303           | 18.53             | 28.23       | Pass        |
| 157   | 5785              | 15.04                         | 15.56   | 67.89            | 18.32             | 28.23       | Pass        |
| 165   | 5825              | 15.01                         | 15.45   | 66.771           | 18.25             | 28.23       | Pass        |

Note: 1. Directional gain =  $4.76\text{dBi} + 10\log(2) = 7.77\text{dBi} > 6\text{dBi}$ , therefore the limit needs to reduce, so the power limit shall be reduced to  $30 - (7.77 - 6) = 28.23\text{dBm}$ .

##### 802.11ac (VHT40)

| Chan. | Chan. Freq. (MHz) | Maximum Conducted Power (dBm) |         | Total Power (mW) | Total Power (dBm) | Limit (dBm) | Pass / Fail |
|-------|-------------------|-------------------------------|---------|------------------|-------------------|-------------|-------------|
|       |                   | Chain 0                       | Chain 1 |                  |                   |             |             |
| 151   | 5755              | 14.58                         | 14.89   | 59.54            | 17.75             | 28.23       | Pass        |
| 159   | 5795              | 15.12                         | 15.34   | 66.707           | 18.24             | 28.23       | Pass        |

Note: 1. Directional gain =  $4.76\text{dBi} + 10\log(2) = 7.77\text{dBi} > 6\text{dBi}$ , therefore the limit needs to reduce, so the power limit shall be reduced to  $30 - (7.77 - 6) = 28.23\text{dBm}$ .

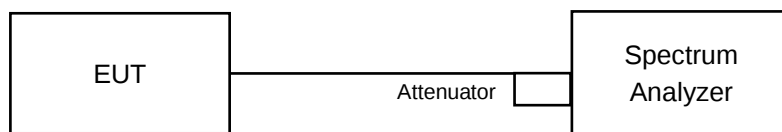
##### 802.11ac (VHT80)

| Chan. | Chan. Freq. (MHz) | Maximum Conducted Power (dBm) |         | Total Power (mW) | Total Power (dBm) | Limit (dBm) | Pass / Fail |
|-------|-------------------|-------------------------------|---------|------------------|-------------------|-------------|-------------|
|       |                   | Chain 0                       | Chain 1 |                  |                   |             |             |
| 155   | 5775              | 13.47                         | 14.22   | 48.657           | 16.87             | 28.23       | Pass        |

Note: 1. Directional gain =  $4.76\text{dBi} + 10\log(2) = 7.77\text{dBi} > 6\text{dBi}$ , therefore the limit needs to reduce, so the power limit shall be reduced to  $30 - (7.77 - 6) = 28.23\text{dBm}$ .

### 4.3 Occupied Bandwidth Measurement

#### 4.3.1 Test Setup



#### 4.3.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

#### 4.3.3 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to SAMPLE. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean power of a given emission.

#### 4.3.4 Test Results

##### 802.11a

| Channel | Channel Frequency (MHz) | Occupied Bandwidth (MHz) |         |
|---------|-------------------------|--------------------------|---------|
|         |                         | Chain 0                  | Chain 1 |
| 149     | 5745                    | 16.80                    | 25.56   |
| 157     | 5785                    | 22.08                    | 28.80   |
| 165     | 5825                    | 20.16                    | 24.48   |

##### 802.11ac (VHT20)

| Channel | Channel Frequency (MHz) | Occupied Bandwidth (MHz) |         |
|---------|-------------------------|--------------------------|---------|
|         |                         | Chain 0                  | Chain 1 |
| 149     | 5745                    | 18.96                    | 24.60   |
| 157     | 5785                    | 20.52                    | 23.76   |
| 165     | 5825                    | 21.12                    | 29.28   |

##### 802.11ac (VHT40)

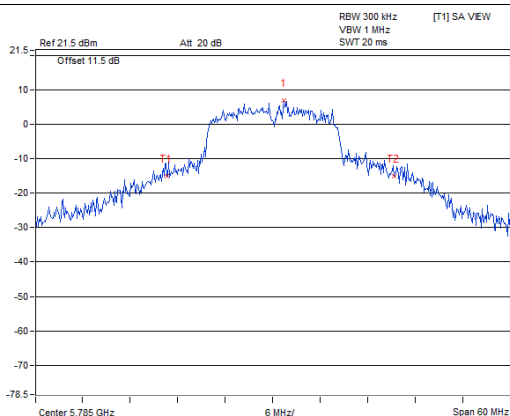
| Channel | Channel Frequency (MHz) | Occupied Bandwidth (MHz) |         |
|---------|-------------------------|--------------------------|---------|
|         |                         | Chain 0                  | Chain 1 |
| 151     | 5755                    | 40.80                    | 54.72   |
| 159     | 5795                    | 37.92                    | 55.20   |

##### 802.11ac (VHT80)

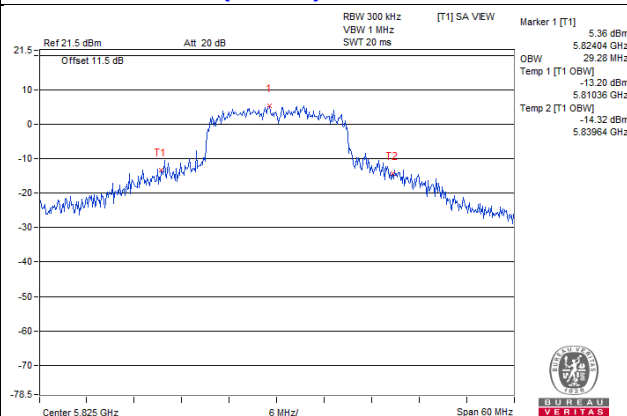
| Channel | Channel Frequency (MHz) | Occupied Bandwidth (MHz) |         |
|---------|-------------------------|--------------------------|---------|
|         |                         | Chain 0                  | Chain 1 |
| 155     | 5775                    | 96.96                    | 85.92   |

# Spectrum Plot of Max. Value

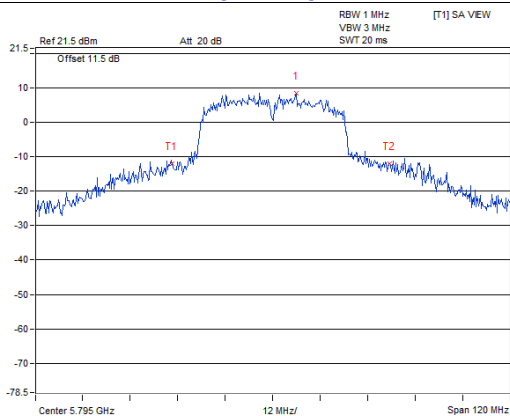
## 802.11a\_Chain 1 / CH157



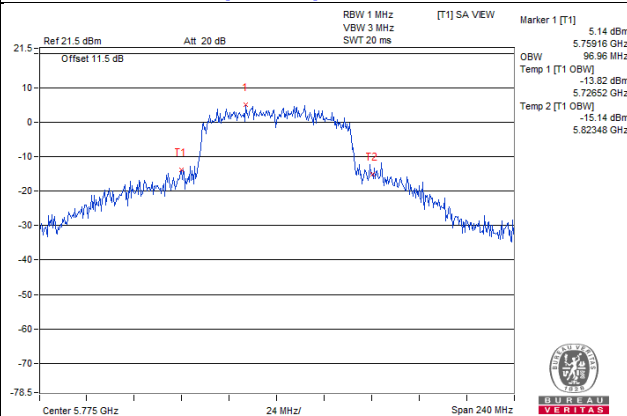
## 802.11ac (VHT20)\_Chain 1 / CH165



## 802.11ac (VHT40)\_Chain 1 / CH159

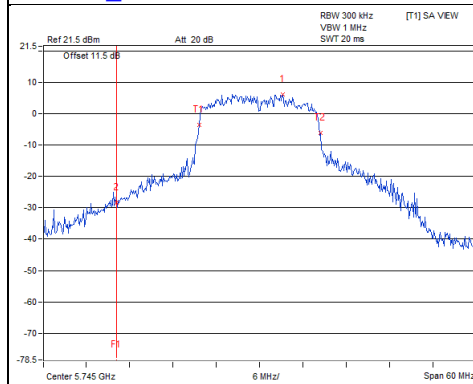


## 802.11ac (VHT80)\_Chain 0 / CH155

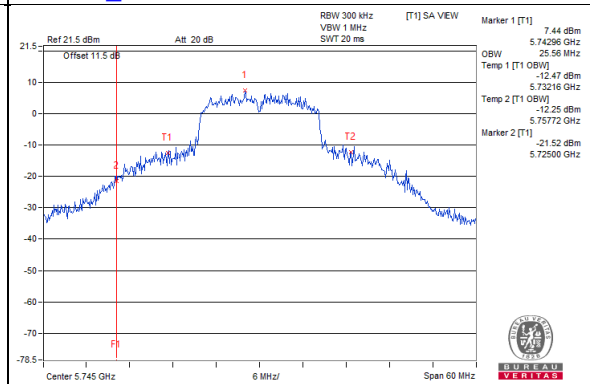


**Spectrum Plot for near by DFS band**  
(DFS is required, if 99% OCP straddle into U-NII-2C band)

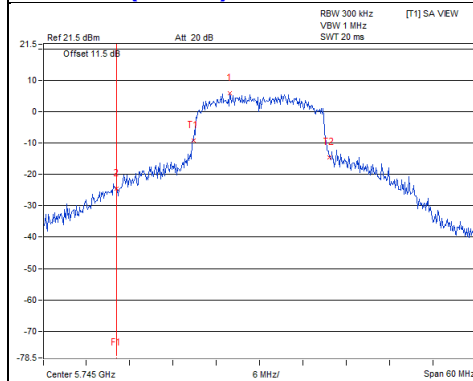
**802.11a\_Chain 0 / CH149**



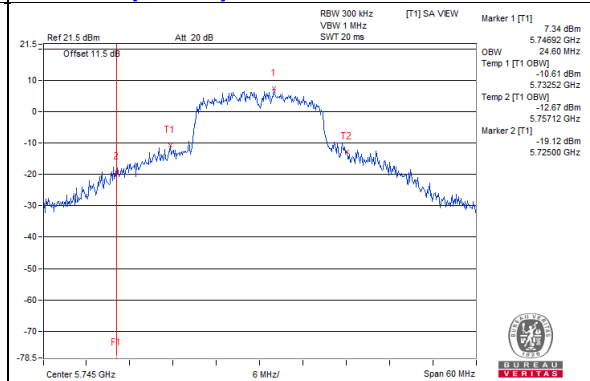
**802.11a\_Chain 1 / CH149**



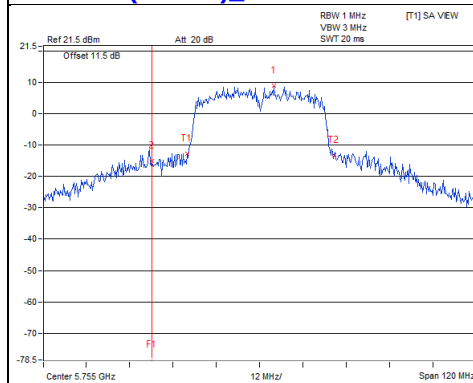
**802.11ac (VHT20)\_Chain 0 / CH149**



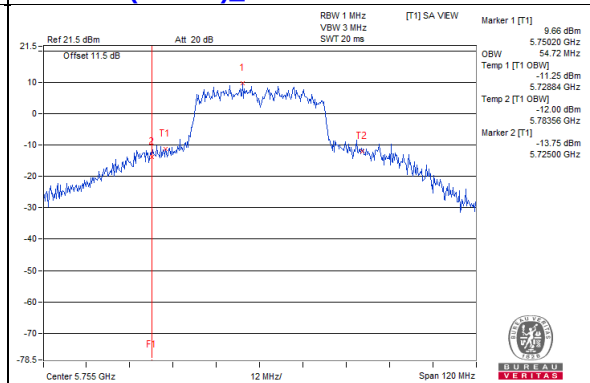
**802.11ac (VHT20)\_Chain 1 / CH149**



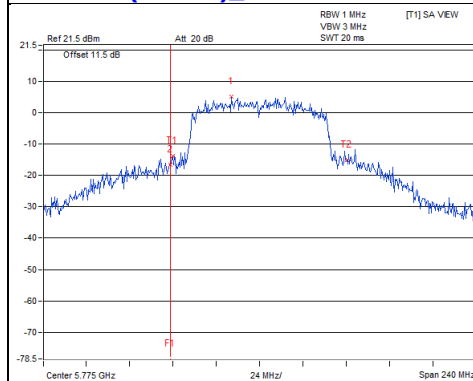
**802.11ac (VHT40)\_Chain 0 / CH151**



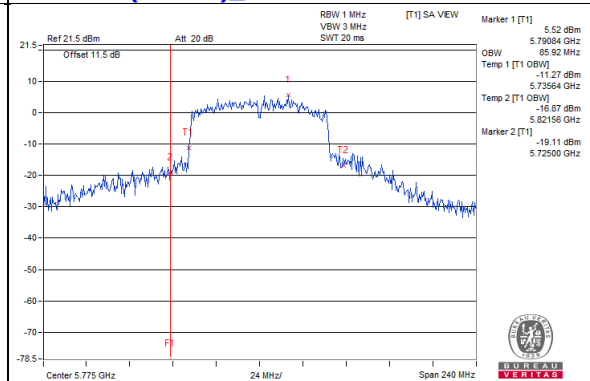
**802.11ac (VHT40)\_Chain 1 / CH151**



**802.11ac (VHT80)\_Chain 0 / CH155**



**802.11ac (VHT80)\_Chain 1 / CH155**

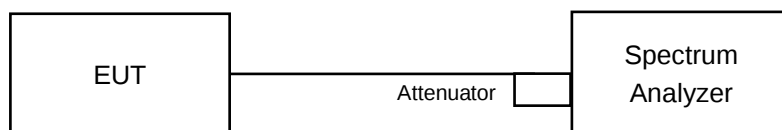


## 4.4 Peak Power Spectral Density Measurement

### 4.4.1 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               |               |
|                |              | Client device                     | 11dBm/ MHz    |
| U-NII-2A       |              |                                   | 11dBm/ MHz    |
| U-NII-2C       |              |                                   | 11dBm/ MHz    |
| U-NII-3        | √            |                                   | 30dBm/ 500kHz |

### 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

##### For U-NII-3:

##### For 802.11ac (VHT80):

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 300 kHz, Set VBW  $\geq$  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 and add 10 log (1/duty cycle)

##### For other Modulation test:

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 300 kHz, Set VBW  $\geq$  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

#### 4.4.5 Deviation from Test Standard

No deviation.

#### 4.4.6 EUT Operating Condition

Same as Item 4.2.6.

#### 4.4.7 Test Results

##### For U-NII-3:

##### 802.11a

| Chan. | Freq.<br>(MHz) | PSD (dBm/300kHz) |         | Total PSD     |                | Total PSD<br>(dBm/500kHz) | Limit<br>(dBm/<br>500kHz) | Pass<br>/Fail |
|-------|----------------|------------------|---------|---------------|----------------|---------------------------|---------------------------|---------------|
|       |                | Chain 0          | Chain 1 | mW/<br>300kHz | dBm/<br>300kHz |                           |                           |               |
| 149   | 5745           | -5.35            | -5.51   | 0.5729        | -2.42          | -0.20                     | 28.23                     | Pass          |
| 157   | 5785           | -5.98            | -6.12   | 0.4967        | -3.04          | -0.82                     | 28.23                     | Pass          |
| 165   | 5825           | -5.98            | -6.53   | 0.4747        | -3.24          | -1.02                     | 28.23                     | Pass          |

- Note: 1. Method b) Measure and sum spectral maxima across the outputs of KDB 662911 is using for calculating total power density.  
2. Directional gain =  $4.76\text{dBi} + 10\log(2) = 7.77\text{dBi} > 6\text{dBi}$ , therefore the limit needs to reduce, so the power density limit shall be reduced to  $30-(7.77-6) = 28.23\text{dBm}$ .

##### 802.11ac (VHT20)

| Chan. | Freq.<br>(MHz) | PSD (dBm/300kHz) |         | Total PSD     |                | Total PSD<br>(dBm/500kHz) | Limit<br>(dBm/<br>500kHz) | Pass<br>/Fail |
|-------|----------------|------------------|---------|---------------|----------------|---------------------------|---------------------------|---------------|
|       |                | Chain 0          | Chain 1 | mW/<br>300kHz | dBm/<br>300kHz |                           |                           |               |
| 149   | 5745           | -5.81            | -5.66   | 0.5341        | -2.72          | -0.50                     | 28.23                     | Pass          |
| 157   | 5785           | -5.98            | -6.10   | 0.4978        | -3.03          | -0.81                     | 28.23                     | Pass          |
| 165   | 5825           | -6.29            | -6.90   | 0.4391        | -3.57          | -1.35                     | 28.23                     | Pass          |

- Note: 1. Method b) Measure and sum spectral maxima across the outputs of KDB 662911 is using for calculating total power density.  
2. Directional gain =  $4.76\text{dBi} + 10\log(2) = 7.77\text{dBi} > 6\text{dBi}$ , therefore the limit needs to reduce, so the power density limit shall be reduced to  $30-(7.77-6) = 28.23\text{dBm}$ .

##### 802.11ac (VHT40)

| Chan. | Freq.<br>(MHz) | PSD (dBm/300kHz) |         | Total PSD     |                | Total PSD<br>(dBm/500kHz) | Limit<br>(dBm/<br>500kHz) | Pass<br>/Fail |
|-------|----------------|------------------|---------|---------------|----------------|---------------------------|---------------------------|---------------|
|       |                | Chain 0          | Chain 1 | mW/<br>300kHz | dBm/<br>300kHz |                           |                           |               |
| 151   | 5755           | -9.85            | -9.59   | 0.2134        | -6.71          | -4.49                     | 28.23                     | Pass          |
| 159   | 5795           | -9.39            | -9.88   | 0.2179        | -6.62          | -4.40                     | 28.23                     | Pass          |

- Note: 1. Method b) Measure and sum spectral maxima across the outputs of KDB 662911 is using for calculating total power density.  
2. Directional gain =  $4.76\text{dBi} + 10\log(2) = 7.77\text{dBi} > 6\text{dBi}$ , therefore the limit needs to reduce, so the power density limit shall be reduced to  $30-(7.77-6) = 28.23\text{dBm}$ .

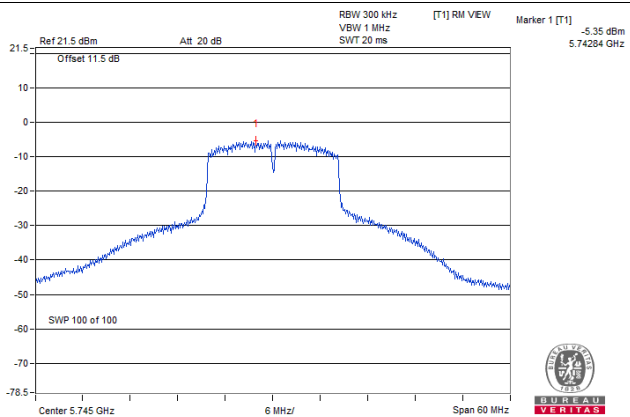
### 802.11ac (VHT80)

| Chan. | Freq.<br>(MHz) | PSD W/O Duty Factor<br>(dBm/300kHz) |         | Duty<br>Factor<br>(dB) | Total PSD<br>With Duty Factor |                | Total PSD<br>With Duty<br>Factor<br>(dBm/500kHz) | Limit<br>(dBm/<br>500kHz) | Pass<br>/Fail |
|-------|----------------|-------------------------------------|---------|------------------------|-------------------------------|----------------|--------------------------------------------------|---------------------------|---------------|
|       |                | Chain 0                             | Chain 1 |                        | mW/<br>300kHz                 | dBm/<br>300kHz |                                                  |                           |               |
| 155   | 5775           | -13.34                              | -13.32  | 0.10                   | 0.095                         | -10.22         | -8.00                                            | 28.23                     | Pass          |

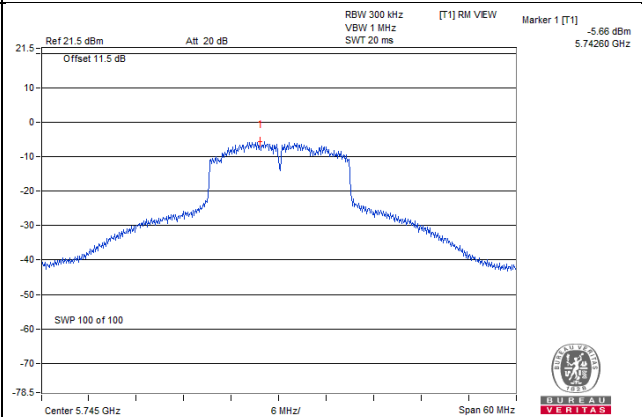
- Note: 1. Method b) Measure and sum spectral maxima across the outputs of KDB 662911 is using for calculating total power density.
2. Directional gain =  $4.76\text{dBi} + 10\log(2) = 7.77\text{dBi} > 6\text{dBi}$ , therefore the limit needs to reduce, so the power density limit shall be reduced to  $30 - (7.77 - 6) = 28.23\text{dBm}$ .
3. Refer to section 3.3 for duty cycle spectrum plot.

# Spectrum Plot of Worst Value

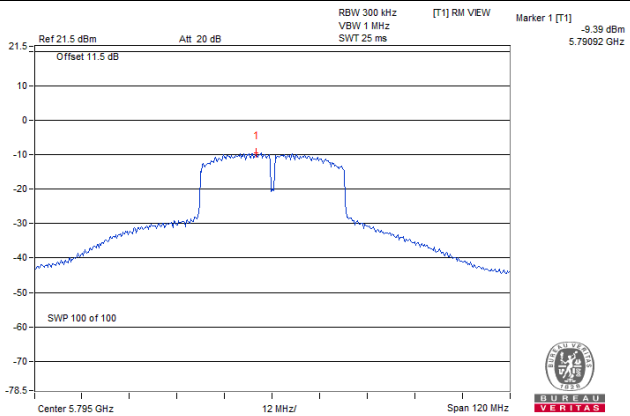
## 802.11a\_Chain 0 / CH149



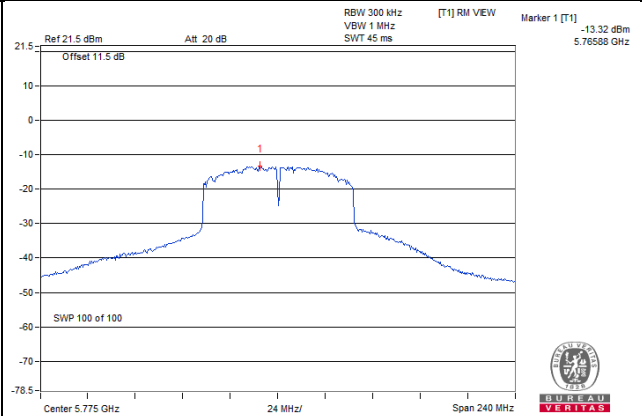
## 802.11ac (VHT20)\_Chain 1 / CH149



## 802.11ac (VHT40)\_Chain 0 / CH159



## 802.11ac (VHT80)\_Chain 1 / CH155

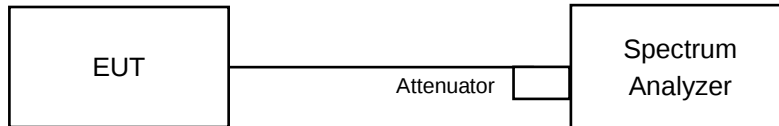


## 4.5 6dB Bandwidth Measurement

### 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 |
|---------|-----------------|---------------------|---------|---------------------|-------------|
|         |                 | Chain 0             | Chain 1 |                     |             |
| 149     | 5745            | 15.09               | 16.08   | 0.5                 | Pass        |
| 157     | 5785            | 15.27               | 16.07   | 0.5                 | Pass        |
| 165     | 5825            | 15.34               | 16.30   | 0.5                 | Pass        |

##### 802.11ac (VHT20)

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) |         | Minimum Limit (MHz) | Pass / Fail |
|---------|-----------------|---------------------|---------|---------------------|-------------|
|         |                 | Chain 0             | Chain 1 |                     |             |
| 149     | 5745            | 14.74               | 15.09   | 0.5                 | Pass        |
| 157     | 5785            | 14.15               | 15.71   | 0.5                 | Pass        |
| 165     | 5825            | 15.96               | 16.31   | 0.5                 | Pass        |

##### 802.11ac (VHT40)

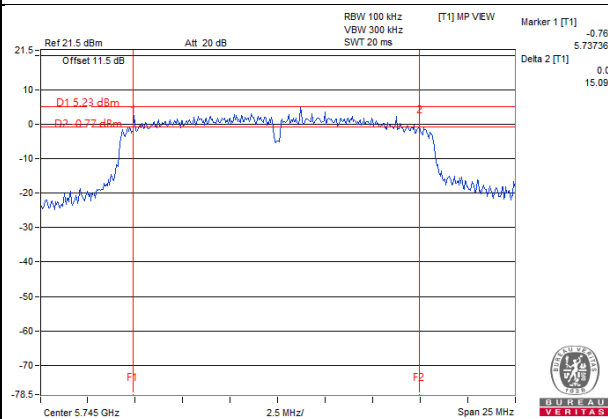
| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) |         | Minimum Limit (MHz) | Pass / Fail |
|---------|-----------------|---------------------|---------|---------------------|-------------|
|         |                 | Chain 0             | Chain 1 |                     |             |
| 151     | 5755            | 34.24               | 36.34   | 0.5                 | Pass        |
| 159     | 5795            | 33.83               | 31.67   | 0.5                 | Pass        |

##### 802.11ac (VHT80)

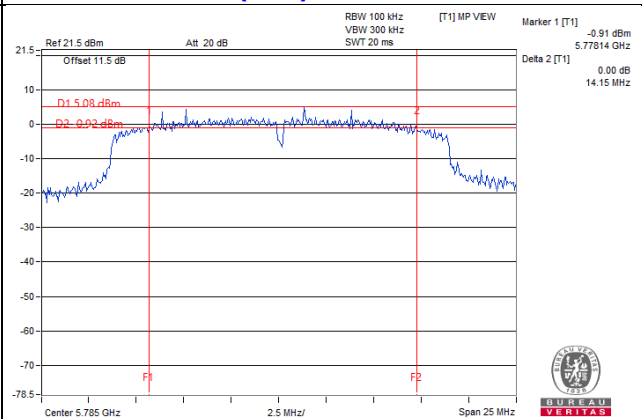
| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) |         | Minimum Limit (MHz) | Pass / Fail |
|---------|-----------------|---------------------|---------|---------------------|-------------|
|         |                 | Chain 0             | Chain 1 |                     |             |
| 155     | 5775            | 62.97               | 56.81   | 0.5                 | Pass        |

# Spectrum Plot of Worst Value

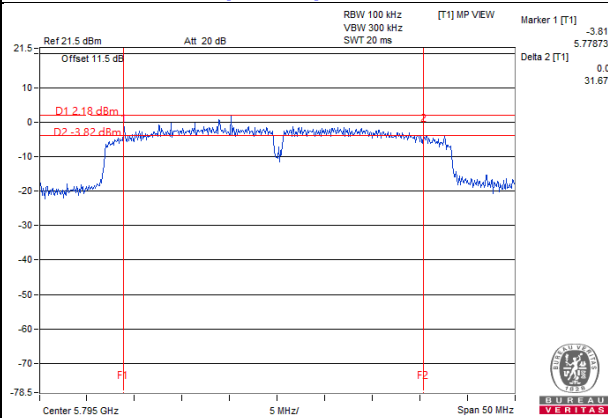
## 802.11a\_Chain 0 / CH149



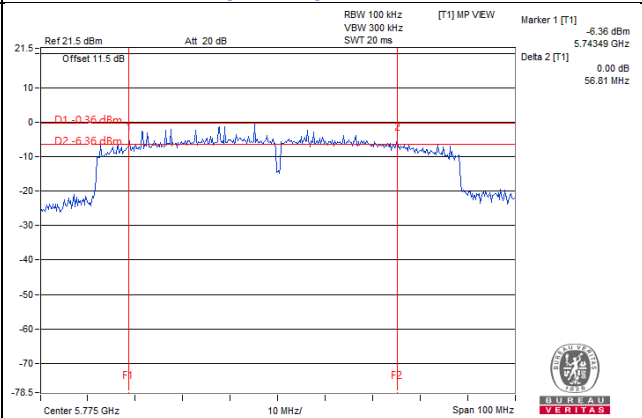
## 802.11ac (VHT)\_Chain 0 / CH157



## 802.11ac (VHT40)\_Chain 1 / CH159



## 802.11ac (VHT80)\_Chain 1 / CH155



## 5 Pictures of Test Arrangements

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

## Appendix – Information of 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 FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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

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Tel: 886-2-26052180

Fax: 886-2-26051924

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

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