# FCC Test Report (Straddle Channel)

| | |
|---|---|
| **Report No.:** | RF180521E10F-1 |
| **FCC ID:** | PY318200414 |
| **Test Model:** | RAX80 |
| **Received Date:** | Mar. 14, 2019 |
| **Test Date:** | Mar. 30 to Apr. 02, 2019 |
| **Issued Date:** | Sep. 18, 2020 |
| **Applicant:** | NETGEAR, Inc. |
| **Address:** | 350 East Plumeria Drive San Jose, CA 95134 |
| **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 R.O.C. |
| **Test Location:** | E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C. |
| **FCC Registration / Designation Number:** | 723255 / TW2022 |

Testing Laboratory
2022

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## Release Control Record

| Issue No. | Description | Date Issued |
|---|---|---|
| RF180521E10F-1 | Original release. | |

## 1 Certificate of Conformity

| | |
|---|---|
| **Product:** | Nighthawk AX8 8-Stream AX6000 WiFi Router |
| **Brand:** | NETGEAR |
| **Test Model:** | RAX80 |
| **Sample Status:** | ENGINEERING SAMPLE |
| **Applicant:** | NETGEAR, Inc. |
| **Test Date:** | Mar. 30 to Apr. 02, 2019 |
| **Standard:** | 47 CFR FCC Part 15, Subpart E (Section 15.407)<br>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 :** Phoenix Huang , **Date:** Sep. 18, 2020

Phoenix Huang / Specialist

**Approved by :** , **Date:** Sep. 18, 2020

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)(6) | AC Power Conducted Emissions | Pass | Meet the requirement of limit. Minimum passing margin is -13.42dB at 0.15781MHz. |
| 15.407(b) (1/2/3/4(i/ii)/6) | Radiated Emissions & Band Edge Measurement* | Pass | Meet the requirement of limit. Minimum passing margin is -4.0dB at 792.12MHz. |
| 15.407(a)(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. (U-NII-3 Band only) |
| 15.407(g) | Frequency Stability | Pass | Meet the requirement of limit. |
| 15.203 | Antenna Requirement | Pass | Antenna connector is i-pex(MHF) not a standard connector. |

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

Note:

Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

### 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 (k=2) (±) |
|---|---|---|
| Conducted Emissions at mains ports | 150kHz ~ 30MHz | 1.8 dB |
| Radiated Emissions up to 1 GHz | 30MHz ~ 1GHz | 4.9 dB |
| Radiated Emissions above 1 GHz | 1GHz ~ 6GHz | 5.1 dB |
| | 6GHz ~ 18GHz | 4.9 dB |
| | 18GHz ~ 40GHz | 5.2 dB |

### 2.2 Modification Record

There were no modifications required for compliance.

## 3 General Information

### 3.1 General Description of EUT (5GHz add Straddle Channels)

| | |
|---|---|
| Product | Nighthawk AX8 8-Stream AX6000 WiFi Router |
| Brand | NETGEAR |
| Test Model | RAX80 |
| Status of EUT | ENGINEERING SAMPLE |
| Power Supply Rating | 19Vdc from power adapter |
| Modulation Type | 64QAM, 16QAM, QPSK, BPSK for OFDM<br>256QAM for OFDM in 11ac mode only<br>1024QAM for OFDMA in 11ax HE mode |
| Modulation Technology | OFDM,OFDMA |
| Transfer Rate | 802.11a: up to 54Mbps<br>802.11n: up to 600Mbps<br>802.11ac: up to 1733.3Mbps<br>802.11ax: up to 3466.7Mbps |
| Operating Frequency | 5.5 ~ 5.72GHz |
| Number of Channel | 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20): 12<br>802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40): 6<br>802.11ac (VHT80), 802.11ax (HE80): 3<br>802.11ac (VHT160), 802.11ax (HE160): 1 |
| Output Power | **Non-Beamforming Mode:**<br>**Straddle Channels:** 112.52mW<br>**Beamforming Mode:**<br>**Straddle Channels:** 147.122mW |
| Antenna Type | Refer to Note |
| Antenna Connector | Refer to Note |
| Accessory Device | Adapter x 1 |
| Data Cable Supplied | RJ45 cable x 1 (unshielded, 1.8m) |

Note:

1. This report is prepared for FCC class II change. The difference compared with the Report No.: RF180521E10-1 as the following:
   - ◆ Add straddle channels (CH144, CH142 & CH138).
   - ◆ Change the product name to Nighthawk AX8 8-Stream AX6000 WiFi Router.
   - ◆ Change the model name to RAX80.
2. According to above condition, all of test items need to be performed for straddle channels. And all data were verified to meet the requirements.
3. Simultaneously transmission condition.

| Condition | Technology | |
|---|---|---|
| 1 | WLAN (2.4GHz) | WLAN (5GHz) |
| **Note:** The emission of the simultaneous operation has been evaluated and no non-compliance was found. | | |

4. The EUT must be supplied power adapter and following different models could be chosen as following table:

| No. | Brand | Model No. | P/N | Spec. |
|---|---|---|---|---|
| 1 | NETGEAR | AD2003F10 | 332-10631-01 | Input: 100-120Vac, 1.5A, 50/60Hz<br>Output: 19V, 3.16A<br>DC Output cable: Unshielded, 1.8m |
| 2 | NETGEAR | 2ABS060K 1 NA | 332-10788-01 | Input: 100-120Vac, 1.7A, 50/60Hz<br>Output: 19V, 3.16A<br>DC Output cable: Unshielded, 1.8m |
| Note: In original report, from the above adapters, the worse radiated emissions was found in Adapter 2. Therefore only the test data of the mode was recorded in this report. | | | | |

5. The antennas provided to the EUT, please refer to the following table:

| Frequency Range (GHz) | Directional Antenna Gain (dBi) | Antenna Type | Antenna Connector |
|---|---|---|---|
| 2.4~2.4835 | 4.28 | Dipole | i-pex(MHF) |
| 5.15~5.25 | 5.56 | | |
| 5.25~5.35 | 5.56 | | |
| 5.47~5.725 | 6.22 | | |
| 5.725~5.85 | 6.22 | | |
| Note: More detailed information, please refer to opearating description. | | | |

6. The EUT incorporates a MIMO function:

| **2.4GHz Band** | | |
|---|---|---|
| **MODULATION MODE** | **TX & RX CONFIGURATION** | |
| **802.11b** | 4TX | 4RX |
| **802.11g** | 4TX | 4RX |
| **802.11n (HT20)** | 4TX | 4RX |
| **802.11n (HT40)** | 4TX | 4RX |
| **VHT20** | 4TX | 4RX |
| **VHT40** | 4TX | 4RX |
| **802.11ax (HE20)** | 4TX | 4RX |
| **802.11ax (HE40)** | 4TX | 4RX |
| **5GHz Band** | | |
| **MODULATION MODE** | **TX & RX CONFIGURATION** | |
| **802.11a** | 4TX | 4RX |
| **802.11n (HT20)** | 4TX | 4RX |
| **802.11n (HT40)** | 4TX | 4RX |
| **802.11ac (VHT20)** | 4TX | 4RX |
| **802.11ac (VHT40)** | 4TX | 4RX |
| **802.11ac (VHT80)** | 4TX | 4RX |
| **802.11ac (VHT160)** | 4TX | 4RX |
| **802.11ax (HE20)** | 4TX | 4RX |
| **802.11ax (HE40)** | 4TX | 4RX |
| **802.11ax (HE80)** | 4TX | 4RX |
| **802.11ax (HE160)** | 4TX | 4RX |

Note:
1. All of modulation mode support beamforming function except 802.11a/b/g modulation mode.
2. The EUT support Beamforming and non-beamforming mode, therefore both mode were investigated and the worst case scenario was identified. The worst case data were presented in test report.
3. The modulation and bandwidth are similar for 802.11n mode for 20MHz (40MHz), 802.11ac mode for 20MHz (40MHz, 80MHz) and 802.11ax mode for 20MHz (40MHz, 80MHz), therefore investigated worst case to representative mode in test report. (Final test mode refer section 3.2.1)

7. 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.
8. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

## 3.2 Description of Test Modes

**FOR 5500 ~ 5720MHz**

12 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20):

| Channel | Frequency | Channel | Frequency |
|---|---|---|---|
| 100 | 5500 MHz | 124 | 5620 MHz |
| 104 | 5520 MHz | 128 | 5640 MHz |
| 108 | 5540 MHz | 132 | 5660 MHz |
| 112 | 5560 MHz | 136 | 5680 MHz |
| 116 | 5580 MHz | 140 | 5700 MHz |
| 120 | 5600 MHz | 144* | 5720 MHz |

Note: * This is the straddle channel.

6 channels are provided for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40):

| Channel | Frequency | Channel | Frequency |
|---|---|---|---|
| 102 | 5510 MHz | 126 | 5630 MHz |
| 110 | 5550 MHz | 134 | 5670 MHz |
| 118 | 5590 MHz | 142* | 5710 MHz |

Note: * This is the straddle channel.

3 channels are provided for 802.11ac (VHT80), 802.11ax (VHT80):

| Channel | Frequency | Channel | Frequency |
|---|---|---|---|
| 106 | 5530 MHz | 138* | 5690 MHz |
| 122 | 5610 MHz | | |

Note: * This is the straddle channel.

1 channel is provided for 802.11ac (VHT160), 802.11ax (HE160):

| Channel | Frequency |
|---|---|
| 114 | 5570 MHz |

### 3.2.1 Test Mode Applicability and Tested Channel Detail

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

Where **RE≥1G:** Radiated Emission above 1GHz **RE<1G:** Radiated Emission below 1GHz
**APCM:** Antenna Port Conducted Measurement

**Note:** In the original, the EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-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.

| Non-Beamforming Mode | | | | | | |
|---|---|---|---|---|---|---|
| Mode | FREQ. Band (MHz) | Available Channel | Tested Channel | Modulation Technology | Modulation Type | Data Rate Parameter |
| 802.11a | 5500-5720 | 100 to 144 | 144 | OFDM | BPSK | 6Mb/s |
| **Beamforming Mode** | | | | | | |
| Mode | FREQ. Band (MHz) | Available Channel | Tested Channel | Modulation Technology | Modulation Type | Data Rate Parameter |
| 802.11ax (HE20) | 5500-5720 | 100 to 144 | 144 | OFDMA | BPSK | MCS0 |
| 802.11ax (HE40) | | 102 to 142 | 142 | OFDMA | BPSK | MCS0 |
| 802.11ax (HE80) | | 106 to 138 | 138 | OFDMA | BPSK | MCS0 |

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

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

| Beamforming Mode | | | | | | |
|---|---|---|---|---|---|---|
| Mode | FREQ. Band (MHz) | Available Channel | Tested Channel | Modulation Technology | Modulation Type | Data Rate Parameter |
| 802.11ax (HE80) | 5500-5720 | 106 to 138 | 138 | OFDMA | BPSK | MCS0 |

**Power Line Conducted Emission Test:**

☒ 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.

| Beamforming Mode | | | | | | |
|---|---|---|---|---|---|---|
| Mode | FREQ. Band (MHz) | Available Channel | Tested Channel | Modulation Technology | Modulation Type | Data Rate Parameter |
| 802.11ax (HE80) | 5500-5720 | 106 to 138 | 138 | OFDMA | BPSK | MCS0 |

## 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.

| Non-Beamforming Mode | | | | | | |
|---|---|---|---|---|---|---|
| **Mode** | **FREQ. Band (MHz)** | **Available Channel** | **Tested Channel** | **Modulation Technology** | **Modulation Type** | **Data Rate Parameter** |
| 802.11a | 5500-5720 | 100 to 144 | 144 | OFDM | BPSK | 6Mb/s |
| **Beamforming Mode** | | | | | | |
| **Mode** | **FREQ. Band (MHz)** | **Available Channel** | **Tested Channel** | **Modulation Technology** | **Modulation Type** | **Data Rate Parameter** |
| 802.11ax (HE20) | 5500-5720 | 100 to 144 | 144 | OFDMA | BPSK | MCS0 |
| 802.11ax (HE40) | | 102 to 142 | 142 | OFDMA | BPSK | MCS0 |
| 802.11ax (HE80) | | 106 to 138 | 138 | OFDMA | BPSK | MCS0 |
| **Beamforming Mode (Out power only)** | | | | | | |
| **Mode** | **FREQ. Band (MHz)** | **Available Channel** | **Tested Channel** | **Modulation Technology** | **Modulation Type** | **Data Rate Parameter** |
| 802.11ac (VHT20) | 5500-5720 | 100 to 144 | 144 | OFDM | BPSK | MCS0 |
| 802.11ac (VHT40) | | 102 to 142 | 142 | OFDM | BPSK | MCS0 |
| 802.11ac (VHT80) | | 106 to 138 | 138 | OFDM | BPSK | MCS0 |

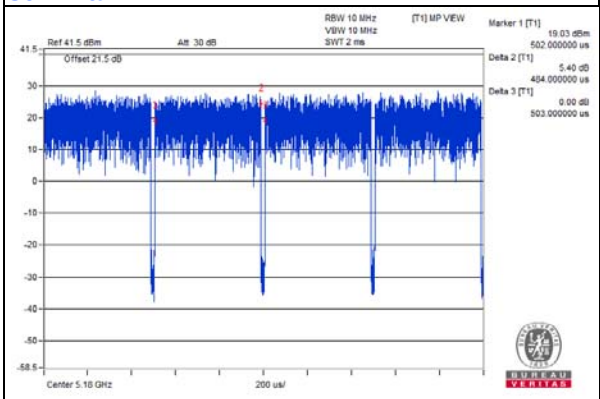
## Test Condition:

| Applicable To | Environmental Conditions | Input Power | Tested By |
|---|---|---|---|
| **RE≥1G** | 22deg. C, 66%RH | 120Vac, 60Hz | Robert Cheng |
| **RE<1G** | 22deg. C, 65%RH | 120Vac, 60Hz | Frank Chuang |
| **PLC** | 25deg. C, 75%RH | 120Vac, 60Hz | Frank Chuang |
| **APCM** | 25deg. C, 60%RH | 120Vac, 60Hz | Jyunchun Lin |

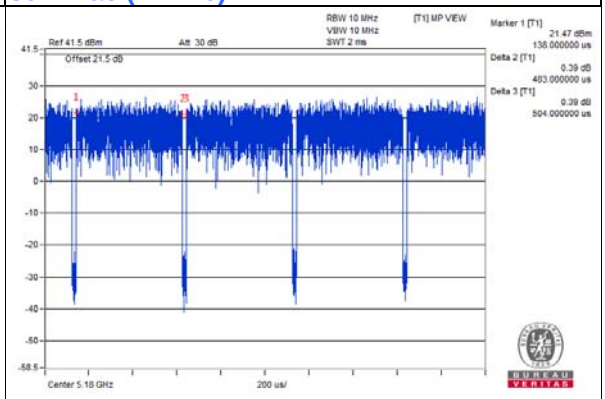
### 3.3 Duty Cycle of Test Signal

If duty cycle of test signal is ≥ 98 %, duty factor is not required.
If duty cycle of test signal is < 98%, duty factor shall be considered.
**802.11a**: Duty cycle = 0.484 ms/0.503 ms = 0.962, Duty factor = 10 * log( 1/Duty cycle) = 0.17
**802.11ac (VHT20)**: Duty cycle = 0.483 ms/0.504 ms = 0.958, Duty factor = 10 * log( 1/Duty cycle) = 0.18
**802.11ac (VHT40):** Duty cycle = 0.255 ms/0.275 ms = 0.927, Duty factor = 10 * log( 1/Duty cycle) = 0.33
**802.11ac (VHT80):** Duty cycle = 0.427 ms/0.491 ms = 0.961, Duty factor = 10 * log( 1/Duty cycle) = 0.17
**802.11ax (HE20)**: Duty cycle = 1.567 ms/1.591 ms = 0.985
**802.11ax (HE40):** Duty cycle = 0.411 ms/0.435 ms = 0.945, Duty factor = 10 * log( 1/Duty cycle) = 0.25
**802.11ax (HE80):** Duty cycle = 0.231 ms/0.252 ms = 0.917, Duty factor = 10 * log( 1/Duty cycle) = 0.38

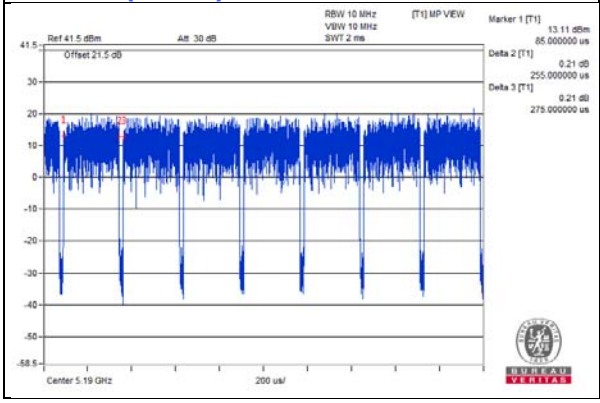
**802.11a**



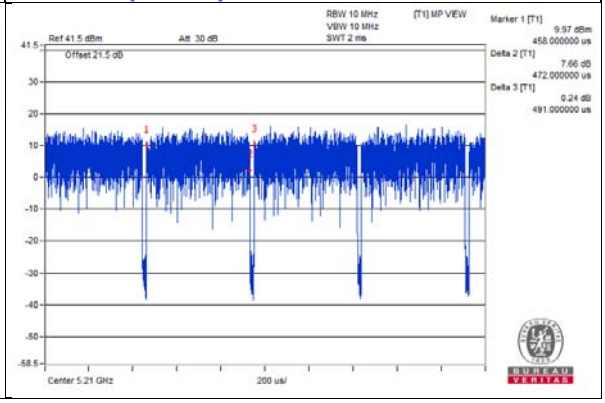

**802.11ac (VHT20)**

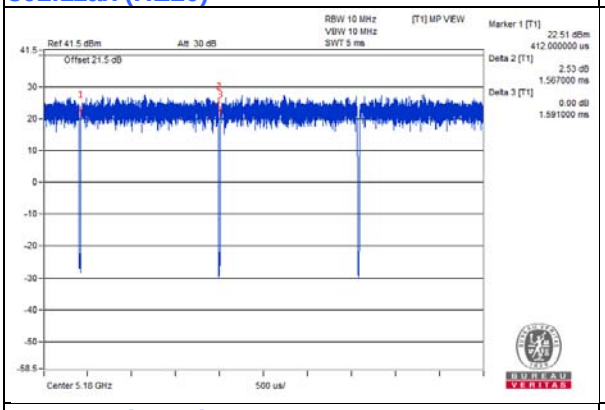
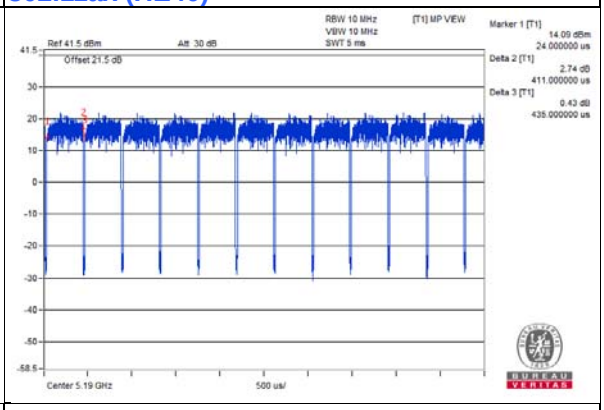
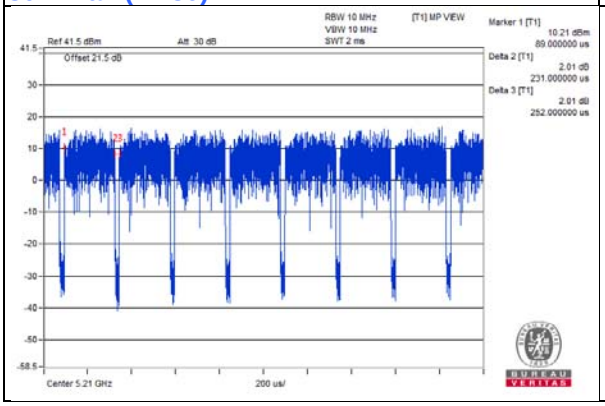



**802.11ac (VHT40)**




**802.11ac (VHT80)**



| 802.11ax (HE20) | 802.11ax (HE40) |
| --- | --- |
|  |  |
| **802.11ax (HE80)** | |
|  | |

### 3.4 Description of Support Units

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

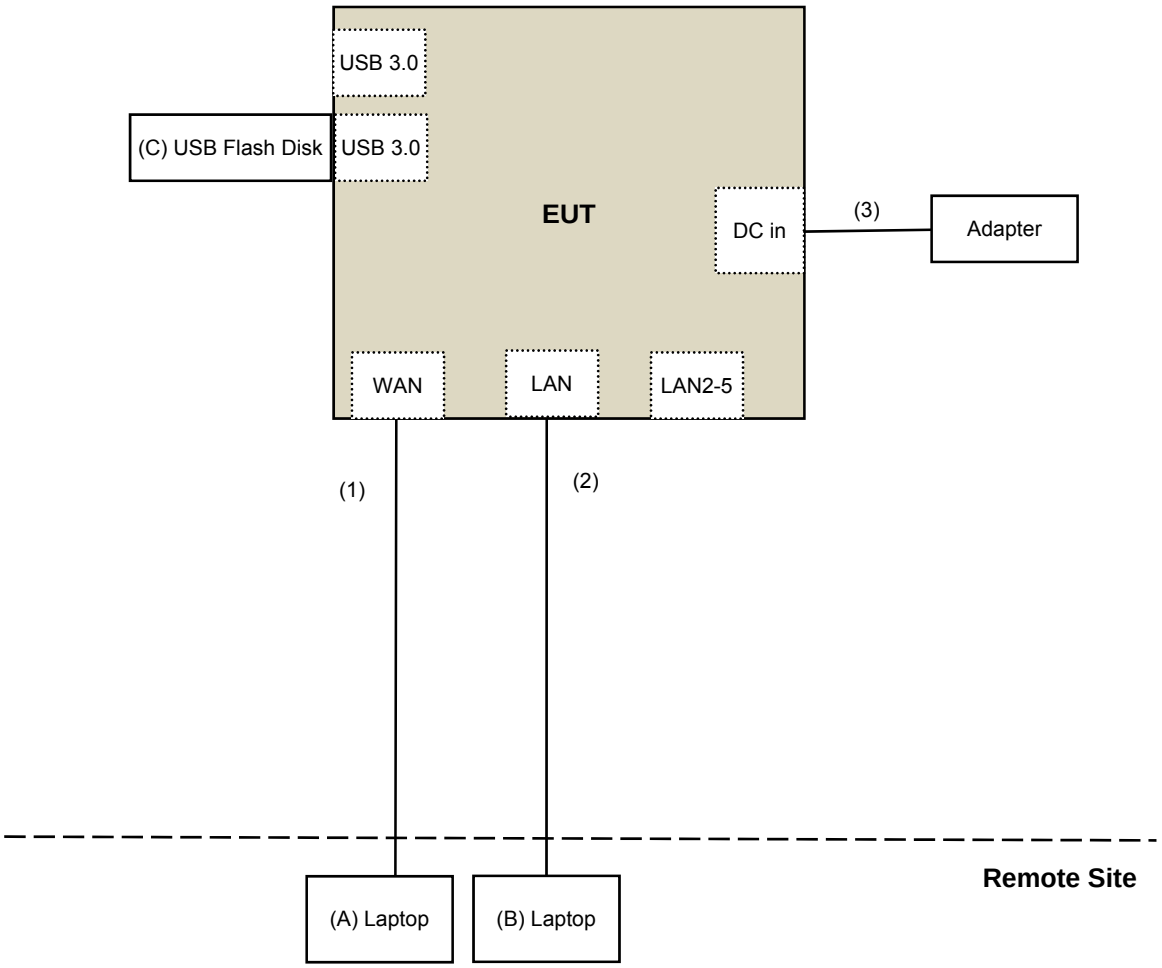
| ID | Product | Brand | Model No. | Serial No. | FCC ID | Remarks |
|---|---|---|---|---|---|---|
| A. | Laptop | DELL | E5430 | HYV4VY1 | FCC DoC | Provided by Lab |
| B. | Laptop | DELL | E6420 | B92T3R1 | FCC DoC | Provided by Lab |
| C. | USB Disk | Transcend | 16GB | NA | NA | Provided by Lab |

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. | RJ-45 Cable | 1 | 10 | No | 0 | Provided by Lab |
| 2. | RJ-45 Cable | 1 | 10 | No | 0 | Provided by Lab |
| 3. | DC Cable | 1 | 1.8 | No | 0 | Supplied by client |

### 3.4.1 Configuration of System under Test



### 3.5 General Description of Applied Standard and References

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

**Test Standard:**

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

**ANSI C63.10-2013**

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

**References Test Guidance:**

**KDB 789033 D02 General UNII Test Procedure New Rules v02r01**

**KDB 662911 D01 Multiple Transmitter Output v02r01**

All test items have been performed as a reference to the above KDB test guidance.

## 4 Test Types and Results

### 4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

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

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

**NOTE**:

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

<table>
<tr><td colspan="3">Applicable To</td><td colspan="2">Limit</td></tr>
<tr><td colspan="3" rowspan="2">789033 D02 General UNII Test Procedure New Rules v02r01</td><td colspan="2">Field Strength at 3m</td></tr>
<tr><td>PK:74 (dBμV/m)</td><td>AV:54 (dBμV/m)</td></tr>
<tr><td>Frequency Band</td><td colspan="2">Applicable To</td><td>EIRP Limit</td><td>Equivalent Field Strength at 3m</td></tr>
<tr><td>5150~5250 MHz</td><td colspan="2">15.407(b)(1)</td><td rowspan="3">PK:-27 (dBm/MHz)</td><td rowspan="3">PK:68.2(dBμV/m)</td></tr>
<tr><td>5250~5350 MHz</td><td colspan="2">15.407(b)(2)</td></tr>
<tr><td>5470~5725 MHz</td><td colspan="2">15.407(b)(3)</td></tr>
<tr><td rowspan="2">5725~5850 MHz</td><td>☒</td><td>15.407(b)(4)(i)</td><td>PK:-27 (dBm/MHz) *1<br>PK:10 (dBm/MHz) *2<br>PK:15.6 (dBm/MHz) *3<br>PK:27 (dBm/MHz) *4</td><td>PK: 68.2(dBμV/m) *1<br>PK:105.2 (dBμV/m) *2<br>PK: 110.8(dBμV/m) *3<br>PK:122.2 (dBμV/m) *4</td></tr>
<tr><td>☐</td><td>15.407(b)(4)(ii)</td><td colspan="2">Emission limits in section 15.247(d)</td></tr>
<tr><td colspan="5">*1 beyond 75 MHz or more above of the band edge.<br>*2 below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above.<br>*3 below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above.<br>*4 from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.</td></tr>
</table>

**Note:**

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

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

4.1.2 Test Instruments

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---|---|---|---|
| Test Receiver Keysight | N9038A | MY54450088 | July 05, 2018 | July 04, 2019 |
| Pre-Amplifier EMCI | EMC001340 | 980142 | Jan. 25, 2019 | Jan. 24, 2020 |
| Loop Antenna Electro-Metrics | EM-6879 | 269 | Sep. 07, 2018 | Sep. 06, 2019 |
| RF Cable | NA | LOOPCAB-001 | Jan. 14, 2019 | Jan. 13, 2020 |
| RF Cable | NA | LOOPCAB-002 | Jan. 14, 2019 | Jan. 13, 2020 |
| Pre-Amplifier Mini-Circuits | ZFL-1000VH2B | AMP-ZFL-01 | Oct. 30, 2018 | Oct. 29, 2019 |
| Trilog Broadband Antenna SCHWARZBECK | VULB 9168 | 9168-406 | Nov. 22, 2018 | Nov. 21, 2019 |
| RF Cable | 8D | 966-4-1 | Mar. 19, 2019 | Mar. 18, 2020 |
| RF Cable | 8D | 966-4-2 | Mar. 19, 2019 | Mar. 18, 2020 |
| RF Cable | 8D | 966-4-3 | Mar. 19, 2019 | Mar. 18, 2020 |
| Fixed attenuator Mini-Circuits | UNAT-5+ | PAD-3m-4-01 | Sep. 27, 2018 | Sep. 26, 2019 |
| Horn_Antenna SCHWARZBECK | BBHA 9120D | 9120D-783 | Nov. 25, 2018 | Nov. 24, 2019 |
| Pre-Amplifier EMCI | EMC12630SE | 980385 | Aug. 16, 2018 | Aug. 15, 2019 |
| RF Cable | EMC104-SM-SM-1200 | 160923 | Jan. 28, 2019 | Jan. 27, 2020 |
| RF Cable | 104 RF cable | 131215 | Jan. 10, 2019 | Jan. 09, 2020 |
| RF Cable | EMC104-SM-SM-6000 | 180418 | May 07, 2018 | May 06, 2019 |
| Pre-Amplifier EMCI | EMC184045SE | 980387 | Jan. 28, 2019 | Jan. 27, 2020 |
| Horn_Antenna 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 & Turn Table Max-Full | MF-7802BS | MF780208530 | NA | NA |
| Spectrum Analyzer R&S | FSV40 | 100964 | June 20, 2018 | June 19, 2019 |
| Power meter Anritsu | ML2495A | 1014008 | May 09, 2018 | May 08, 2019 |
| Power sensor Anritsu | MA2411B | 0917122 | May 09, 2018 | May 08, 2019 |
| Fixed Attenuator Mini-Circuits | MDCS18N-10 | MDCS18N-10-01 | Apr. 16, 2018 | Apr. 15, 2019 |
| AC Power Source Extech Electronics | 6205 | 1440452 | NA | NA |
| Temperature & Humidity Chamber Giant Force | GTH-150-40-SP-AR | MAA0812-008 | Jan. 09, 2019 | Jan. 08, 2020 |
| True RMS Clamp Meter FLUKE | 325 | 31130711WS | May 22, 2018 | May 21, 2019 |

**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. 4.
3. Loop antenna was used for all emissions below 30 MHz.
4. Tested Date: Mar. 30 to Apr. 02, 2019

4.1.3 Test Procedure

**For Radiated emission below 30MHz**

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

**Note:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

**For Radiated emission above 30MHz**

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

**Note:**

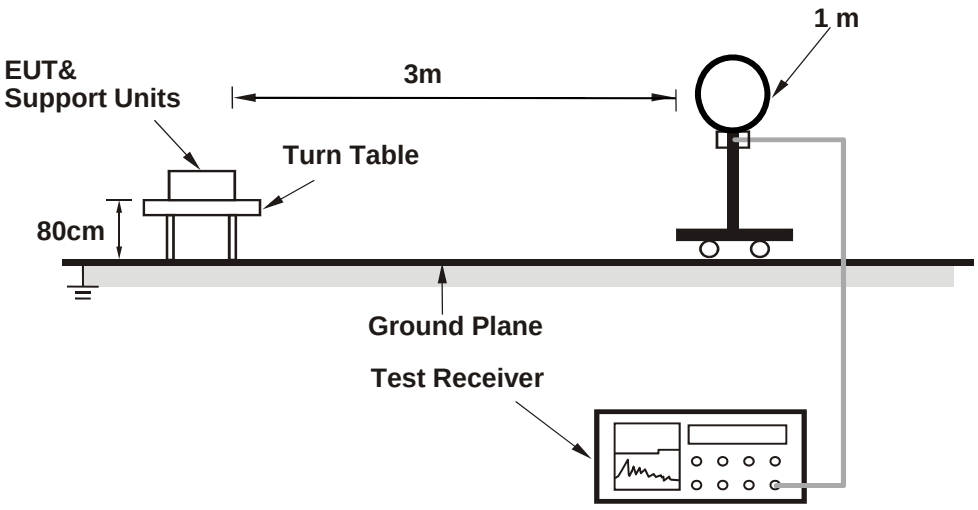
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

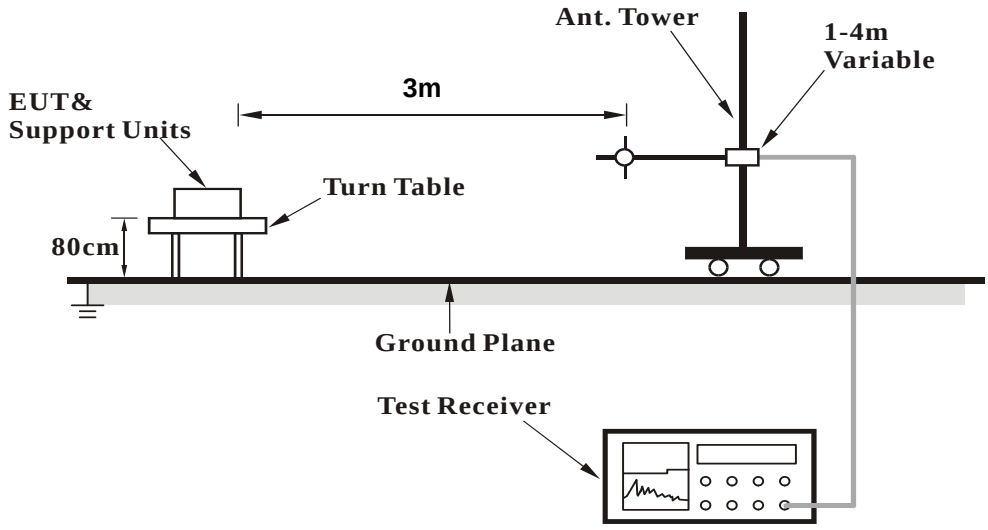
No deviation.

4.1.5 Test Setup

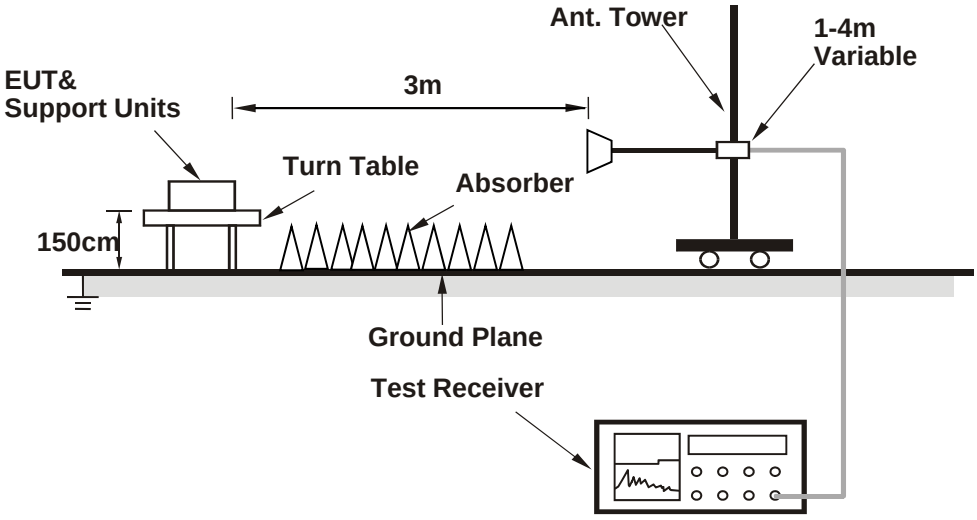
**For Radiated emission below 30MHz**




**For Radiated emission 30MHz to 1GHz**



**For Radiated emission above 1GHz**




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

4.1.6 EUT Operating Condition

a. Connected the EUT with the Laptop which is placed on remote site.
b. Controlling software (MTool3.0.0.8) has been activated to set the EUT on specific status.

4.1.7 Test Results

**Above 1GHz Data:**

**802.11a**

| CHANNEL | TX Channel 144 | DETECTOR FUNCTION | Peak (PK)<br>Average (AV) |
|---|---|---|---|
| FREQUENCY RANGE | 1GHz ~ 40GHz | | |

| 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 | #5470.00 | 50.9 PK | 68.2 | -17.3 | 1.50 H | 148 | 48.0 | 2.9 |
| 2 | *5720.00 | 110.1 PK | | | 1.50 H | 148 | 106.8 | 3.3 |
| 3 | *5720.00 | 99.8 AV | | | 1.50 H | 148 | 96.5 | 3.3 |
| 4 | #5850.00 | 54.6 PK | 68.2 | -13.6 | 1.50 H | 148 | 50.9 | 3.7 |
| 5 | 11440.00 | 40.1 PK | 74.0 | -33.9 | 1.41 H | 129 | 26.7 | 13.4 |
| 6 | 11440.00 | 31.9 AV | 54.0 | -22.1 | 1.41 H | 129 | 18.5 | 13.4 |
| 7 | #17160.00 | 41.1 PK | 68.2 | -27.1 | 1.66 H | 234 | 24.8 | 16.3 |
| 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 | #5470.00 | 51.4 PK | 68.2 | -16.8 | 1.78 V | 182 | 48.5 | 2.9 |
| 2 | *5720.00 | 118.0 PK | | | 1.78 V | 182 | 114.7 | 3.3 |
| 3 | *5720.00 | 108.0 AV | | | 1.78 V | 182 | 104.7 | 3.3 |
| 4 | #5850.00 | 56.8 PK | 68.2 | -11.4 | 1.78 V | 182 | 53.1 | 3.7 |
| 5 | 11440.00 | 42.5 PK | 74.0 | -31.5 | 2.06 V | 108 | 29.1 | 13.4 |
| 6 | 11440.00 | 31.8 AV | 54.0 | -22.2 | 2.06 V | 108 | 18.4 | 13.4 |
| 7 | #17160.00 | 44.3 PK | 68.2 | -23.9 | 1.52 V | 338 | 28.0 | 16.3 |

**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. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

## 802.11ax (HE20)

| CHANNEL | TX Channel 144 | DETECTOR FUNCTION | Peak (PK)<br>Average (AV) |
|---|---|---|---|
| FREQUENCY RANGE | 1GHz ~ 40GHz | | |

| 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 | #5470.00 | 50.5 PK | 68.2 | -17.7 | 1.50 H | 134 | 47.6 | 2.9 |
| 2 | *5720.00 | 110.5 PK | | | 1.50 H | 134 | 107.2 | 3.3 |
| 3 | *5720.00 | 100.0 AV | | | 1.50 H | 134 | 96.7 | 3.3 |
| 4 | #5850.00 | 54.8 PK | 68.2 | -13.4 | 1.50 H | 134 | 51.1 | 3.7 |
| 5 | 11440.00 | 40.0 PK | 74.0 | -34.0 | 1.38 H | 144 | 26.6 | 13.4 |
| 6 | 11440.00 | 31.9 AV | 54.0 | -22.1 | 1.38 H | 144 | 18.5 | 13.4 |
| 7 | #17160.00 | 41.3 PK | 68.2 | -26.9 | 1.61 H | 247 | 25.0 | 16.3 |
| 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 | #5470.00 | 51.4 PK | 68.2 | -16.8 | 1.74 V | 177 | 48.5 | 2.9 |
| 2 | *5720.00 | 117.7 PK | | | 1.74 V | 177 | 114.4 | 3.3 |
| 3 | *5720.00 | 107.9 AV | | | 1.74 V | 177 | 104.6 | 3.3 |
| 4 | #5850.00 | 56.8 PK | 68.2 | -11.4 | 1.74 V | 177 | 53.1 | 3.7 |
| 5 | 11440.00 | 42.4 PK | 74.0 | -31.6 | 2.02 V | 117 | 29.0 | 13.4 |
| 6 | 11440.00 | 31.8 AV | 54.0 | -22.2 | 2.02 V | 117 | 18.4 | 13.4 |
| 7 | #17160.00 | 44.3 PK | 68.2 | -23.9 | 1.50 V | 325 | 28.0 | 16.3 |

**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. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

## 802.11ax (HE40)

| CHANNEL | TX Channel 142 | DETECTOR FUNCTION | Peak (PK)<br>Average (AV) |
|---|---|---|---|
| FREQUENCY RANGE | 1GHz ~ 40GHz | | |

| 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 | #5470.00 | 50.6 PK | 68.2 | -17.6 | 1.52 H | 145 | 47.7 | 2.9 |
| 2 | *5710.00 | 110.2 PK | | | 1.52 H | 145 | 106.9 | 3.3 |
| 3 | *5710.00 | 99.8 AV | | | 1.52 H | 145 | 96.5 | 3.3 |
| 4 | #5850.00 | 54.6 PK | 68.2 | -13.6 | 1.52 H | 145 | 50.9 | 3.7 |
| 5 | 11420.00 | 40.8 PK | 74.0 | -33.2 | 1.40 H | 135 | 27.5 | 13.3 |
| 6 | 11420.00 | 32.4 AV | 54.0 | -21.6 | 1.40 H | 135 | 19.1 | 13.3 |
| 7 | #17130.00 | 40.9 PK | 68.2 | -27.3 | 1.71 H | 247 | 24.6 | 16.3 |
| 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 | #5470.00 | 51.7 PK | 68.2 | -16.5 | 1.74 V | 185 | 48.8 | 2.9 |
| 2 | *5710.00 | 117.9 PK | | | 1.74 V | 185 | 114.6 | 3.3 |
| 3 | *5710.00 | 107.7 AV | | | 1.74 V | 185 | 104.4 | 3.3 |
| 4 | #5850.00 | 56.7 PK | 68.2 | -11.5 | 1.74 V | 185 | 53.0 | 3.7 |
| 5 | 11420.00 | 43.0 PK | 74.0 | -31.0 | 2.08 V | 121 | 29.7 | 13.3 |
| 6 | 11420.00 | 32.2 AV | 54.0 | -21.8 | 2.08 V | 121 | 18.9 | 13.3 |
| 7 | #17130.00 | 44.4 PK | 68.2 | -23.8 | 1.58 V | 350 | 28.1 | 16.3 |

**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. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

## 802.11ax (HE80)

| CHANNEL | TX Channel 138 | DETECTOR FUNCTION | Peak (PK)<br>Average (AV) |
|---|---|---|---|
| FREQUENCY RANGE | 1GHz ~ 40GHz | | |

| 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 | #5470.00 | 50.6 PK | 68.2 | -17.6 | 1.51 H | 147 | 47.7 | 2.9 |
| 2 | *5690.00 | 109.4 PK | | | 1.51 H | 147 | 106.1 | 3.3 |
| 3 | *5690.00 | 99.4 AV | | | 1.51 H | 147 | 96.1 | 3.3 |
| 4 | #5850.00 | 54.2 PK | 68.2 | -14.0 | 1.51 H | 147 | 50.5 | 3.7 |
| 5 | 11380.00 | 39.4 PK | 74.0 | -34.6 | 1.38 H | 135 | 25.9 | 13.5 |
| 6 | 11380.00 | 31.5 AV | 54.0 | -22.5 | 1.38 H | 135 | 18.0 | 13.5 |
| 7 | #17070.00 | 41.3 PK | 68.2 | -26.9 | 1.64 H | 247 | 24.9 | 16.4 |
| 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 | #5470.00 | 54.8 PK | 68.2 | -13.4 | 1.75 V | 187 | 51.9 | 2.9 |
| 2 | *5690.00 | 118.2 PK | | | 1.75 V | 187 | 114.9 | 3.3 |
| 3 | *5690.00 | 108.2 AV | | | 1.75 V | 187 | 104.9 | 3.3 |
| 4 | #5850.00 | 58.6 PK | 68.2 | -9.6 | 1.75 V | 187 | 54.9 | 3.7 |
| 5 | 11380.00 | 42.5 PK | 74.0 | -31.5 | 2.07 V | 113 | 29.0 | 13.5 |
| 6 | 11380.00 | 31.7 AV | 54.0 | -22.3 | 2.07 V | 113 | 18.2 | 13.5 |
| 7 | #17070.00 | 44.2 PK | 68.2 | -24.0 | 1.57 V | 346 | 27.8 | 16.4 |

**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. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

**Below 1GHz Data:**

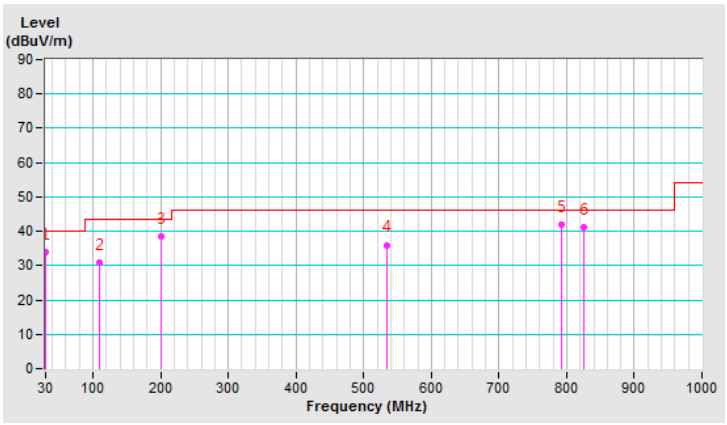
**802.11ax (HE80)**

| | | | |
|---|---|---|---|
| **CHANNEL** | TX Channel 138 | **DETECTOR FUNCTION** | Quasi-Peak (QP) |
| **FREQUENCY RANGE** | 9kHz ~ 1GHz | | |

| 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 | 30.63 | 33.8 QP | 40.0 | -6.2 | 1.50 H | 237 | 43.5 | -9.7 |
| 2 | 110.20 | 30.9 QP | 43.5 | -12.6 | 1.50 H | 256 | 41.6 | -10.7 |
| 3 | 200.01 | 38.5 QP | 43.5 | -5.0 | 1.50 H | 100 | 48.8 | -10.3 |
| 4 | 533.59 | 36.0 QP | 46.0 | -10.0 | 2.50 H | 215 | 37.2 | -1.2 |
| **5** | **792.12** | **42.0 QP** | **46.0** | **-4.0** | **2.00 H** | **4** | **37.8** | **4.2** |
| 6 | 824.99 | 41.3 QP | 46.0 | -4.7 | 1.50 H | 8 | 36.5 | 4.8 |

**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 of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

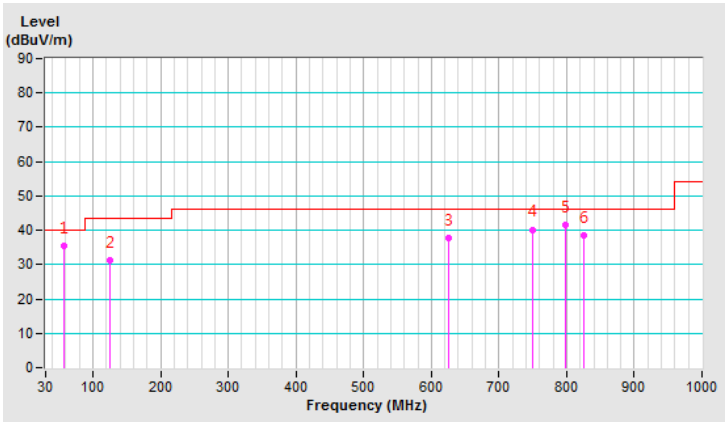


| CHANNEL | TX Channel 138 | DETECTOR FUNCTION | Quasi-Peak (QP) |
|---|---|---|---|
| FREQUENCY RANGE | 9kHz ~ 1GHz | | |

| 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 | 57.93 | 35.4 QP | 40.0 | -4.6 | 1.50 V | 160 | 43.9 | -8.5 |
| 2 | 125.17 | 31.4 QP | 43.5 | -12.1 | 2.00 V | 358 | 40.8 | -9.4 |
| 3 | 625.07 | 37.7 QP | 46.0 | -8.3 | 1.00 V | 61 | 36.6 | 1.1 |
| 4 | 749.98 | 40.2 QP | 46.0 | -5.8 | 1.50 V | 52 | 36.6 | 3.6 |
| 5 | 798.88 | 41.5 QP | 46.0 | -4.5 | 2.00 V | 344 | 37.5 | 4.0 |
| 6 | 824.99 | 38.6 QP | 46.0 | -7.4 | 1.50 V | 270 | 33.8 | 4.8 |

**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 of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



## 4.2 Conducted Emission Measurement

### 4.2.1 Limits of Conducted Emission Measurement

| Frequency (MHz) | Conducted Limit (dBuV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 - 0.5 | 66 - 56 | 56 - 46 |
| 0.50 - 5.0 | 56 | 46 |
| 5.0 - 30.0 | 60 | 50 |

Note: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

### 4.2.2 Test Instruments

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED DATE | CALIBRATED UNTIL |
|---|---|---|---|---|
| Test Receiver R&S | ESCS 30 | 847124/029 | Oct. 24, 2018 | Oct. 23, 2019 |
| Line-Impedance Stabilization Network (for EUT) R&S | ESH3-Z5 | 848773/004 | Oct. 22, 2018 | Oct. 21, 2019 |
| Line-Impedance Stabilization Network (for Peripheral) R&S | ESH3-Z5 | 835239/001 | Mar. 17, 2019 | Mar. 16, 2020 |
| 50 ohms Terminator | N/A | 3 | Oct. 22, 2018 | Oct. 21, 2019 |
| RF Cable | 5D-FB | COCCAB-001 | Sep. 28, 2018 | Sep. 27, 2019 |
| Fixed attenuator EMCI | STI02-2200-10 | 003 | Mar. 14, 2019 | Mar. 13, 2020 |
| Software BVADT | BVADT_Cond_ V7.3.7.4 | NA | NA | NA |

**Note:**
1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Conduction 1.
3 Tested Date: Apr. 02, 2019

4.2.3 Test Procedure

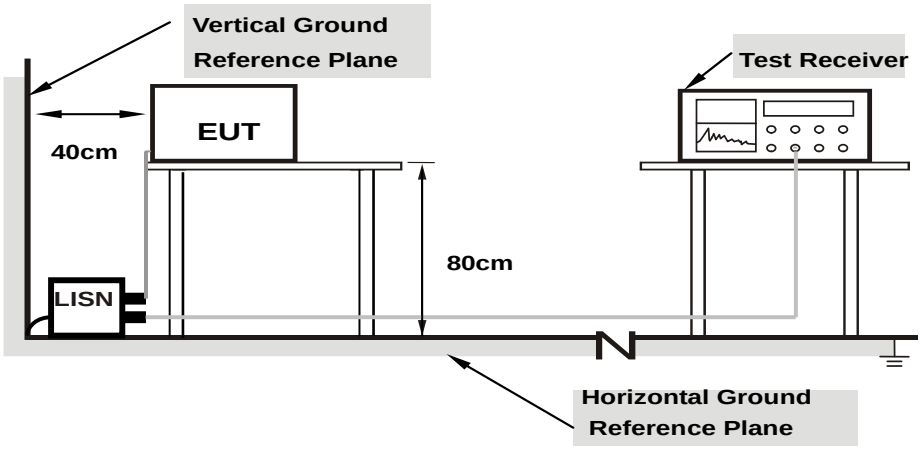
a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

**Note:** All modes of operation were investigated and the worst-case emissions are reported.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup




**Note: 1.Support units were connected to second LISN.**

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

4.2.6 EUT Operating Condition

Same as 4.1.6.

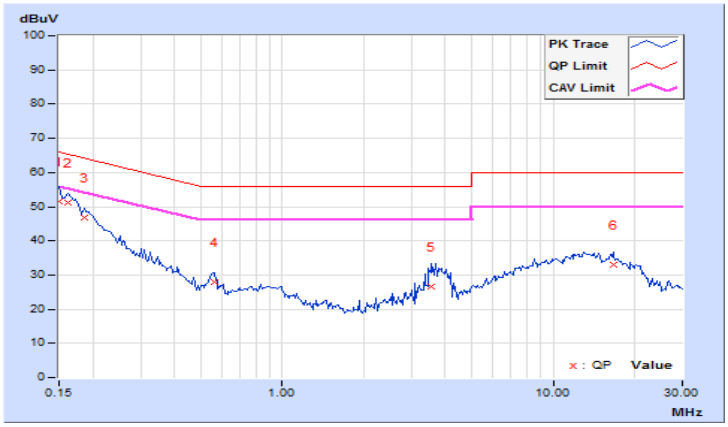
4.2.7 Test Results

| Phase | Line (L) | Detector Function | Quasi-Peak (QP) / Average (AV) |
|---|---|---|---|

| No | Freq. | Corr. Factor | Reading Value [dB (uV)] | | Emission Level [dB (uV)] | | Limit [dB (uV)] | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | [MHz] | (dB) | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.15000 | 10.03 | 41.47 | 25.83 | 51.50 | 35.86 | 66.00 | 56.00 | -14.50 | -20.14 |
| 2 | 0.16172 | 10.03 | 41.22 | 26.25 | 51.25 | 36.28 | 65.38 | 55.38 | -14.13 | -19.10 |
| 3 | 0.18516 | 10.04 | 36.72 | 19.22 | 46.76 | 29.26 | 64.25 | 54.25 | -17.49 | -24.99 |
| 4 | 0.56016 | 10.09 | 17.81 | 7.18 | 27.90 | 17.27 | 56.00 | 46.00 | -28.10 | -28.73 |
| 5 | 3.57031 | 10.29 | 16.27 | 5.08 | 26.56 | 15.37 | 56.00 | 46.00 | -29.44 | -30.63 |
| 6 | 16.66016 | 11.14 | 21.85 | 14.88 | 32.99 | 26.02 | 60.00 | 50.00 | -27.01 | -23.98 |

**Remarks:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

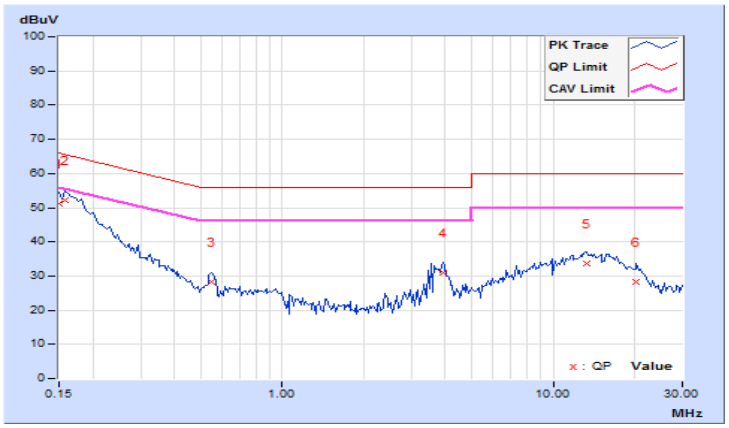


| Phase | Neutral (N) | Detector Function | Quasi-Peak (QP) / Average (AV) |
|---|---|---|---|

| No | Freq. | Corr. Factor | Reading Value [dB (uV)] | | Emission Level [dB (uV)] | | Limit [dB (uV)] | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | [MHz] | (dB) | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.15000 | 9.94 | 41.27 | 25.74 | 51.21 | 35.68 | 66.00 | 56.00 | -14.79 | -20.32 |
| **2** | **0.15781** | **9.94** | **42.22** | **26.88** | **52.16** | **36.82** | **65.58** | **55.58** | **-13.42** | **-18.76** |
| 3 | 0.54844 | 9.98 | 18.36 | 4.64 | 28.34 | 14.62 | 56.00 | 46.00 | -27.66 | -31.38 |
| 4 | 3.92969 | 10.17 | 20.84 | 7.92 | 31.01 | 18.09 | 56.00 | 46.00 | -24.99 | -27.91 |
| 5 | 13.30469 | 10.73 | 22.87 | 17.15 | 33.60 | 27.88 | 60.00 | 50.00 | -26.40 | -22.12 |
| 6 | 20.35547 | 11.15 | 17.29 | 12.52 | 28.44 | 23.67 | 60.00 | 50.00 | -31.56 | -26.33 |

**Remarks:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



## 4.3 Transmit Power Measurement

### 4.3.1 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 ≦ 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,

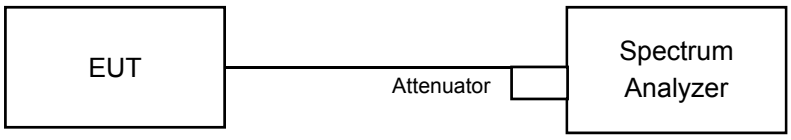
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any $N_{ANT}$;
Array Gain = 5 log($N_{ANT}/N_{SS}$) dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.

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

### 4.3.2 Test Setup

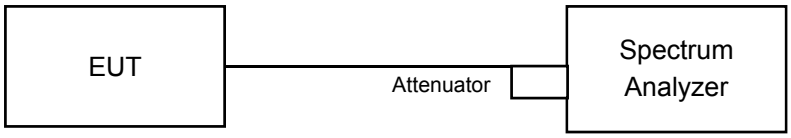
**FOR POWER OUTPUT MEASUREMENT**

**For channel straddling 5725MHz:**




**For other channels:**


**FOR 26dB OCCUPIED BANDWIDTH**



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

**FOR POWER OUTPUT MEASUREMENT**

**For channel straddling 5725MHz:**

**For 802.11ax (HE20):**

Follow FCC KDB 789033 UNII test procedure:

Method SA-1

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW =1MHz.
3. Set the VBW ≥ 3 x RBW.
4. Number of points in sweep ≥ 2 Span / RBW.
5. Sweep time = auto.
6. Set trigger to free run (duty cycle ≥ 98 percent)
7. Detector = RMS.
8. Trace average at least 100 traces in power averaging mode
9. Compute power by integrating the spectrum across the 26 dB EBW of the signal.

**For other modulation mode:**

Follow FCC KDB 789033 UNII test procedure:

Method SA-2

1. Set span to encompass the emission bandwidth (EBW) of the signal.
2. Set RBW =1MHz.
3. Set the VBW ≥ 3 x RBW.
4. Number of points in sweep ≥ 2 Span / RBW.
5. Sweep time = auto.
6. Detector = RMS.
7. Trace average at least 100 traces in power averaging mode
8. Compute power by integrating the spectrum across the 26 dB EBW of the signal.
9. Duty factor need added to measured value (duty cycle < 98 percent).

**For other channels:**

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.

**FOR 26dB OCCUPIED BANDWIDTH**

1. Set RBW = approximately 1% of the emission bandwidth.
2. Set the VBW > RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

### 4.3.5 Deviation from Test Standard

No deviation.

### 4.3.6 EUT Operating Condition

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

4.3.7 Test Results

**CDD Mode**

**802.11a**

**POWER OUTPUT**

| Chan. | Chan. Freq. (MHz) | Maximum Conducted Power (dBm) | | | | Total Power (mW) | Total Power (dBm) | Limit (dBm) | Pass / Fail |
|---|---|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 | | | | |
| *144 (U-NII-2C Band) | 5720 | 14.63 | 14.49 | 13.70 | 14.42 | 112.52 | 20.51 | 22.71 | Pass |
| *144 (U-NII-3 Band) | 5720 | 8.63 | 8.31 | 7.49 | 8.28 | 27.448 | 14.39 | 29.78 | Pass |

Note: * Test was performed in accordance with Measurement follow FCC KDB 789033 UNII test procedure Method SA-2 and use spectrum analyzer test.

The Total Power for the straddle channel:

| Chan. | Chan. Freq. (MHz) | Average Power (mW) | Average Power (dBm) |
|---|---|---|---|
| 144 | 5720 | 139.968 | 21.46 |
| Note: The total power was calculated through formula and record the value for reference only. | | | |

Note: The directional gain is 6.22dBi > 6dBi, therefore the limit needs to reduce, so the power limit shall be reduced to “Determined Conducted Limit-(6.22-6)”.

**26dB OCCUPIED BANDWIDTH**

| Channel | Frequency (MHz) | 26dBc Bandwidth (MHz) | | | |
|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 |
| 144 (U-NII-2C Band) | 5720 | 15.63 | 15.89 | 15.76 | 15.63 |

**Note: For U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.**

| Power Limit = 11dBm + 10logB < U-NII-2C > | | | |
|---|---|---|---|
| Channel Number | Freq.(MHz) | Min. B(MHz) | Determined Conducted Limit (dBm) |
| 144 (U-NII-2C Band) | 5720 | 15.63 | 22.93 < 24 |

## Beamforming Mode

### 802.11ac (VHT20)

### POWER OUTPUT

| Chan. | Chan. Freq. (MHz) | Maximum Conducted Power (dBm) | | | | Total Power (mW) | Total Power (dBm) | Limit (dBm) | Pass / Fail |
|---|---|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 | | | | |
| *144 (U-NII-2C Band) | 5720 | 14.61 | 14.34 | 13.55 | 14.38 | 110.747 | 20.44 | 22.73 | Pass |
| *144 (U-NII-3 Band) | 5720 | 8.98 | 8.67 | 7.97 | 8.66 | 30.136 | 14.79 | 29.78 | Pass |

Note: * Test was performed in accordance with Measurement follow FCC KDB 789033 UNII test procedure Method SA-2 and use spectrum analyzer test.

The Total Power for the straddle channel:

| Chan. | Chan. Freq. (MHz) | Average Power (mW) | Average Power (dBm) |
|---|---|---|---|
| 144 | 5720 | 140.883 | 21.49 |
| Note: The total power was calculated through formula and record the value for reference only. | | | |

Note: The directional gain is 6.22dBi > 6dBi, therefore the limit needs to reduce, so the power limit shall be reduced to “Determined Conducted Limit-(6.22-6)”.

### 26dB OCCUPIED BANDWIDTH

| Channel | Frequency (MHz) | 26dBc Bandwidth (MHz) | | | |
|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 |
| 144 (U-NII-2C Band) | 5720 | 15.91 | 15.67 | 16.02 | 15.88 |

**Note: For U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.**

| Power Limit = 11dBm + 10logB < U-NII-2C > | | | |
|---|---|---|---|
| Channel Number | Freq.(MHz) | Min. B(MHz) | Determined Conducted Limit (dBm) |
| 144 (U-NII-2C Band) | 5720 | 15.67 | 22.95 < 24 |

## 802.11ac (VHT40)

### POWER OUTPUT

| Chan. | Chan. Freq. (MHz) | Maximum Conducted Power (dBm) | | | | Total Power (mW) | Total Power (dBm) | Limit (dBm) | Pass / Fail |
|---|---|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 | | | | |
| *142 (U-NII-2C Band) | 5710 | 14.92 | 14.72 | 14.14 | 14.89 | 126.681 | 21.03 | 23.78 | Pass |
| *142 (U-NII-3 Band) | 5710 | 4.52 | 4.39 | 3.85 | 4.27 | 11.517 | 10.61 | 29.78 | Pass |

Note: * Test was performed in accordance with Measurement follow FCC KDB 789033 UNII test procedure Method SA-2 and use spectrum analyzer test.

The Total Power for the straddle channel:

| Chan. | Chan. Freq. (MHz) | Average Power (mW) | Average Power (dBm) |
|---|---|---|---|
| 142 | 5710 | 138.198 | 21.41 |
| Note: The total power was calculated through formula and record the value for reference only. | | | |

Note: The directional gain is 6.22dBi > 6dBi, therefore the limit needs to reduce, so the power limit shall be reduced to “Determined Conducted Limit-(6.22-6)”.

### 26dB OCCUPIED BANDWIDTH

| Channel | Frequency (MHz) | 26dBc Bandwidth (MHz) | | | |
|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 |
| 142 (U-NII-2C Band) | 5710 | 35.81 | 35.64 | 35.68 | 35.75 |

**Note: For U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.**

| Power Limit = 11dBm + 10logB < U-NII-2C > | | | |
|---|---|---|---|
| Channel Number | Freq.(MHz) | Min. B(MHz) | Determined Conducted Limit (dBm) |
| 142 (U-NII-2C Band) | 5710 | 35.64 | 26.51 > 24 |

## 802.11ac (VHT80)

### POWER OUTPUT

| Chan. | Chan. Freq. (MHz) | Maximum Conducted Power (dBm) | | | | Total Power (mW) | Total Power (dBm) | Limit (dBm) | Pass / Fail |
|---|---|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 | | | | |
| *138 (U-NII-2C Band) | 5690 | 15.91 | 15.66 | 14.69 | 15.27 | 144.493 | 21.60 | 23.78 | Pass |
| *138 (U-NII-3 Band) | 5690 | 1.79 | 1.61 | 0.75 | 0.73 | 5.546 | 7.44 | 29.78 | Pass |

Note: * Test was performed in accordance with Measurement follow FCC KDB 789033 UNII test procedure Method SA-2 and use spectrum analyzer test.

The Total Power for the straddle channel:

| Chan. | Chan. Freq. (MHz) | Average Power (mW) | Average Power (dBm) |
|---|---|---|---|
| 138 | 5690 | 150.039 | 21.76 |
| Note: The total power was calculated through formula and record the value for reference only. | | | |

Note: The directional gain is 6.22dBi > 6dBi, therefore the limit needs to reduce, so the power limit shall be reduced to “Determined Conducted Limit-(6.22-6)”.

### 26dB OCCUPIED BANDWIDTH

| Channel | Frequency (MHz) | 26dBc Bandwidth (MHz) | | | |
|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 |
| 138 (U-NII-2C Band) | 5690 | 76.30 | 76.05 | 75.64 | 75.66 |

**Note: For U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.**

| Power Limit = 11dBm + 10logB < U-NII-2C > | | | |
|---|---|---|---|
| Channel Number | Freq.(MHz) | Min. B(MHz) | Determined Conducted Limit (dBm) |
| 138 (U-NII-2C Band) | 5690 | 75.64 | 29.78 > 24 |

## 802.11ax (HE20)

### POWER OUTPUT

| Chan. | Chan. Freq. (MHz) | Maximum Conducted Power (dBm) | | | | Total Power (mW) | Total Power (dBm) | Limit (dBm) | Pass / Fail |
|---|---|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 | | | | |
| *144 (U-NII-2C Band) | 5720 | 14.92 | 14.19 | 14.08 | 14.02 | 108.109 | 20.34 | 22.71 | Pass |
| *144 (U-NII-3 Band) | 5720 | 9.70 | 8.07 | 8.88 | 8.70 | 30.885 | 14.90 | 29.78 | Pass |

Note: * Test was performed in accordance with Measurement follow FCC KDB 789033 UNII test procedure Method SA-1 and use spectrum analyzer test.

The Total Power for the straddle channel:

| Chan. | Chan. Freq. (MHz) | Average Power (mW) | Average Power (dBm) |
|---|---|---|---|
| 144 | 5720 | 138.994 | 21.43 |
| Note: The total power was calculated through formula and record the value for reference only. | | | |

Note: The directional gain is 6.22dBi > 6dBi, therefore the limit needs to reduce, so the power limit shall be reduced to “Determined Conducted Limit-(6.22-6)”.

### 26dB OCCUPIED BANDWIDTH

| Channel | Frequency (MHz) | 26dBc Bandwidth (MHz) | | | |
|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 |
| 144 (U-NII-2C Band) | 5720 | 16.06 | 15.62 | 15.84 | 15.85 |

**Note: For U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.**

| Power Limit = 11dBm + 10logB < U-NII-2C > | | | |
|---|---|---|---|
| Channel Number | Freq.(MHz) | Min. B(MHz) | Determined Conducted Limit (dBm) |
| 144 (U-NII-2C Band) | 5720 | 15.62 | 22.93 < 24 |

## 802.11ax (HE40)

### POWER OUTPUT

| Chan. | Chan. Freq. (MHz) | Maximum Conducted Power (dBm) | | | | Total Power (mW) | Total Power (dBm) | Limit (dBm) | Pass / Fail |
|---|---|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 | | | | |
| *142 (U-NII-2C Band) | 5710 | 15.19 | 15.57 | 14.77 | 15.22 | 140.082 | 21.46 | 23.78 | Pass |
| *142 (U-NII-3 Band) | 5710 | 5.41 | 5.78 | 5.12 | 5.17 | 14.605 | 11.65 | 29.78 | Pass |

Note: * Test was performed in accordance with Measurement follow FCC KDB 789033 UNII test procedure Method SA-2 and use spectrum analyzer test.

The Total Power for the straddle channel:

| Chan. | Chan. Freq. (MHz) | Average Power (mW) | Average Power (dBm) |
|---|---|---|---|
| 142 | 5710 | 154.687 | 21.89 |
| Note: The total power was calculated through formula and record the value for reference only. | | | |

Note: The directional gain is 6.22dBi > 6dBi, therefore the limit needs to reduce, so the power limit shall be reduced to “Determined Conducted Limit-(6.22-6)”.

### 26dB OCCUPIED BANDWIDTH

| Channel | Frequency (MHz) | 26dBc Bandwidth (MHz) | | | |
|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 |
| 142 (U-NII-2C Band) | 5710 | 35.88 | 35.78 | 35.82 | 35.78 |

**Note: For U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.**

| Power Limit = 11dBm + 10logB < U-NII-2C > | | | |
|---|---|---|---|
| Channel Number | Freq.(MHz) | Min. B(MHz) | Determined Conducted Limit (dBm) |
| 142 (U-NII-2C Band) | 5710 | 35.78 | 26.53 > 24 |

## 802.11ax (HE80)

### POWER OUTPUT

| Chan. | Chan. Freq. (MHz) | Maximum Conducted Power (dBm) | | | | Total Power (mW) | Total Power (dBm) | Limit (dBm) | Pass / Fail |
|---|---|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 | | | | |
| *138 (U-NII-2C Band) | 5690 | 15.36 | 15.55 | 15.25 | 14.93 | 147.122 | 21.68 | 23.78 | Pass |
| *138 (U-NII-3 Band) | 5690 | 1.30 | 2.14 | 1.90 | 1.10 | 6.352 | 8.03 | 29.78 | Pass |

Note: * Test was performed in accordance with Measurement follow FCC KDB 789033 UNII test procedure Method SA-2 and use spectrum analyzer test.

The Total Power for the straddle channel:

| Chan. | Chan. Freq. (MHz) | Average Power (mW) | Average Power (dBm) |
|---|---|---|---|
| 138 | 5690 | 153.474 | 21.86 |
| Note: The total power was calculated through formula and record the value for reference only. | | | |

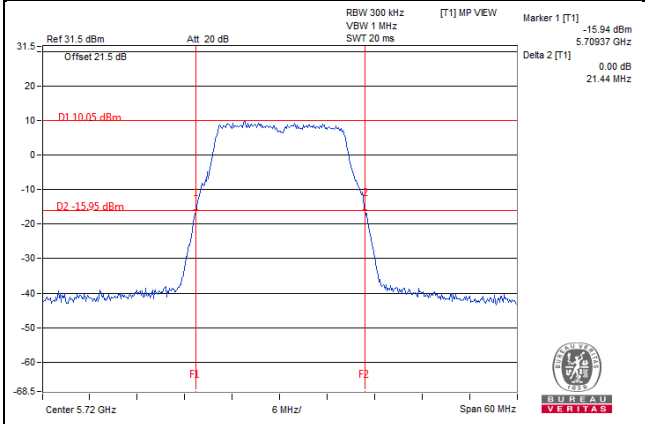
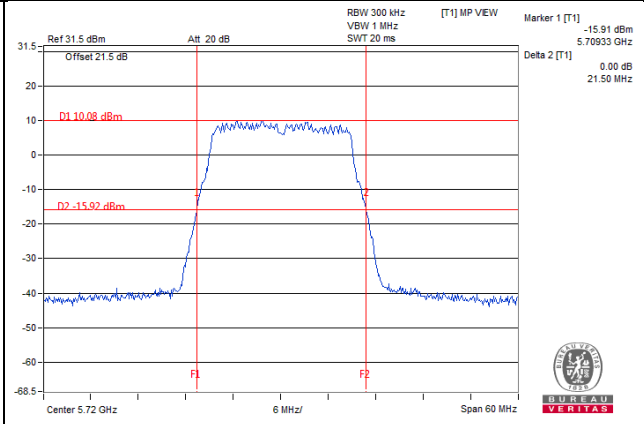
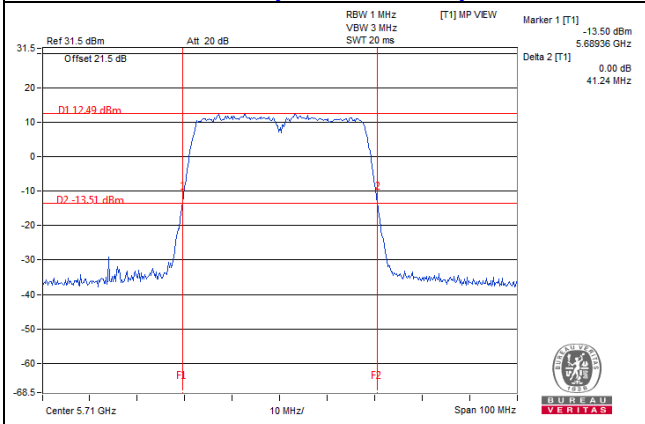
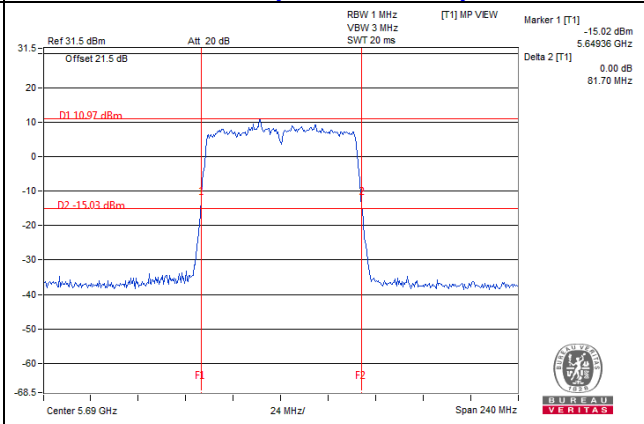
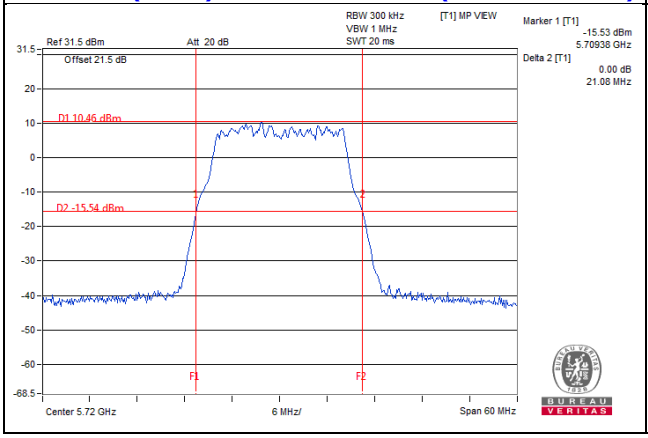
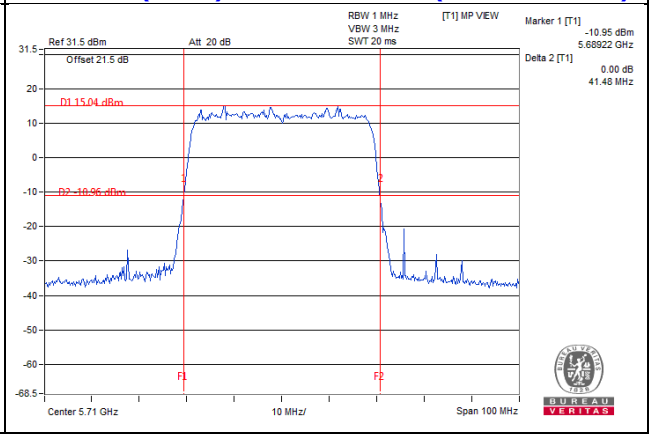
Note: The directional gain is 6.22dBi > 6dBi, therefore the limit needs to reduce, so the power limit shall be reduced to “Determined Conducted Limit-(6.22-6)”.

### 26dB OCCUPIED BANDWIDTH

| Channel | Frequency (MHz) | 26dBc Bandwidth (MHz) | | | |
|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 |
| 138 (U-NII-2C Band) | 5690 | 76.14 | 75.71 | 75.75 | 75.98 |

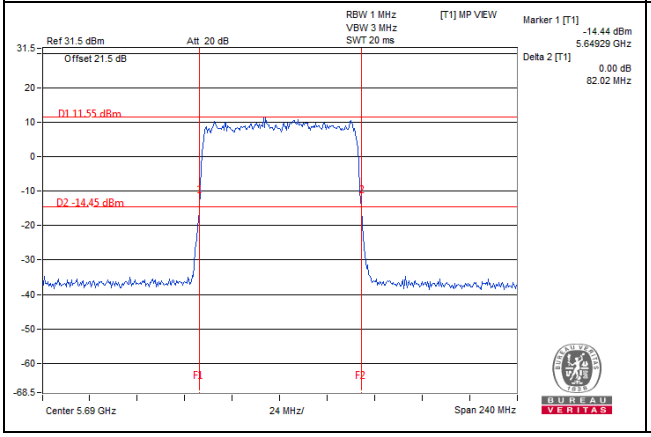
**Note: For U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.**

| Power Limit = 11dBm + 10logB < U-NII-2C > | | | |
|---|---|---|---|
| Channel Number | Freq.(MHz) | Min. B(MHz) | Determined Conducted Limit (dBm) |
| 138 (U-NII-2C Band) | 5690 | 75.71 | 29.79 > 24 |

| Spectrum Plot of Worst Value | |
|---|---|
| **802.11a_Chain 0 / CH144 (U-NII-2C Band)** | **802.11ac (VHT20)_Chain 1 / CH144 (U-NII-2C Band)** |
|  |  |
| **802.11ac (VHT40)_Chain 1 / CH142 (U-NII-2C Band)** | **802.11ac (VHT80)_Chain 2 / CH138 (U-NII-2C Band)** |
|  |  |
| **802.11ax (HE20)_Chain 1 / CH144 (U-NII-2C Band)** | **802.11ax (HE40)_Chain 1 / CH42 (U-NII-2C Band)** |
|  |  |

**Note:**

For CH144 (U-NII-2C) = 5725MHz - Marker 1
For CH142 (U-NII-2C) = 5725MHz - Marker 1
For CH138 (U-NII-2C) = 5725MHz - Marker 1

| Spectrum Plot of Worst Value | |
|---|---|
| **802.11ax (HE80)_Chain 1 / CH138 (U-NII-2C Band)** | |
|  | |

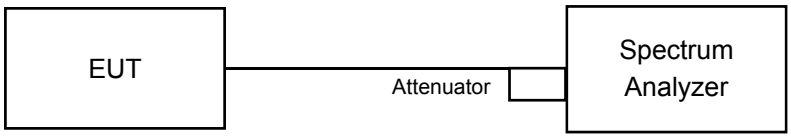


**Note:**

For CH138 (U-NII-2C) = 5725MHz - Marker 1

## 4.4 Occupied Bandwidth Measurement

### 4.4.1 Test Setup




### 4.4.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.4.3 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.

4.4.4 Test Results

**CDD Mode**

**802.11a**

| Channel | Channel Frequency (MHz) | Occupied Bandwidth (MHz) | | | |
|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 |
| 144 (U-NII-2C Band) | 5720 | 13.40 | 13.40 | 13.40 | 13.40 |
| 144 (U-NII-3 Band) | 5720 | 3.40 | 3.40 | 3.52 | 3.52 |

**Beamforming Mode**

**802.11ax (HE20)**

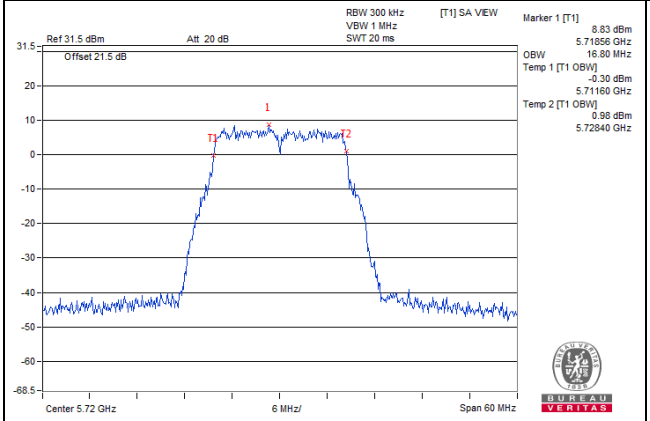
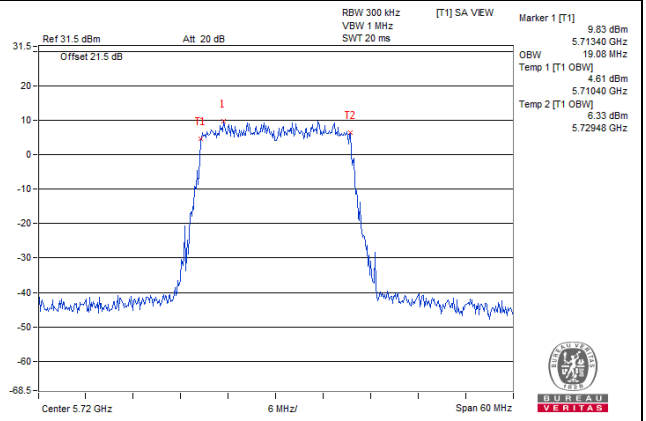
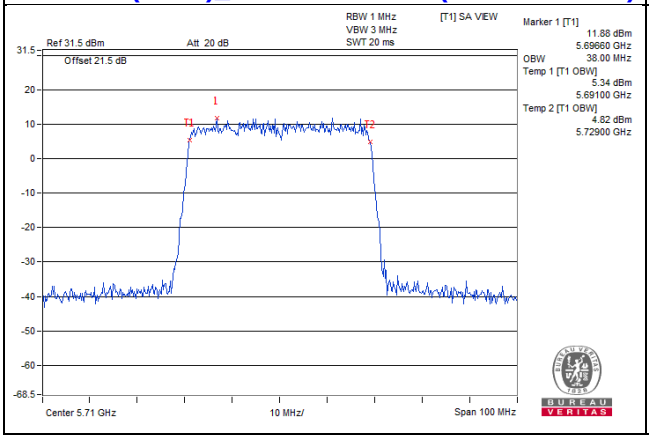
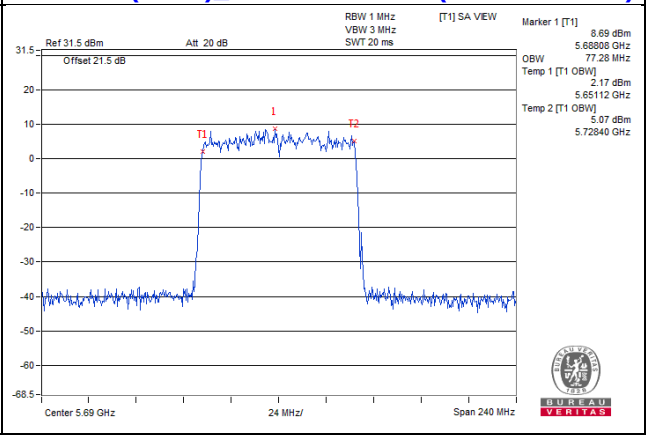
| Channel | Channel Frequency (MHz) | Occupied Bandwidth (MHz) | | | |
|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 |
| 144 (U-NII-2C Band) | 5720 | 14.60 | 13.52 | 14.60 | 14.60 |
| 144 (U-NII-3 Band) | 5720 | 4.48 | 3.40 | 4.48 | 4.60 |

**802.11ax (HE40)**

| Channel | Channel Frequency (MHz) | Occupied Bandwidth (MHz) | | | |
|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 |
| 142 (U-NII-2C Band) | 5710 | 34.00 | 34.00 | 34.00 | 34.00 |
| 142 (U-NII-3 Band) | 5710 | 4.00 | 3.80 | 4.00 | 3.80 |

**802.11ax (HE80)**

| Channel | Channel Frequency (MHz) | Occupied Bandwidth (MHz) | | | |
|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 |
| 138 (U-NII-2C Band) | 5690 | 73.40 | 73.40 | 73.88 | 73.88 |
| 138 (U-NII-3 Band) | 5690 | 2.92 | 3.40 | 3.40 | 3.40 |

| Spectrum Plot of Max. Value | |
|---|---|
| **802.11a_Chain 0 / CH144 (U-NII-2C Band)** | **802.11ax (HE20)_Chain 0 / CH144 (U-NII-2C Band)** |
|  |  |
| **802.11ax (HE40)_Chain 0 / CH142 (U-NII-2C Band)** | **802.11ax (HE80)_Chain 2 / CH138 (U-NII-2C Band)** |
|  |  |

**Note:**

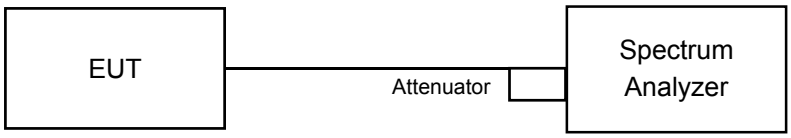
For CH144 (U-NII-2C) = 5725MHz - Temp 1
For CH142 (U-NII-2C) = 5725MHz - Temp 1
For CH138 (U-NII-2C) = 5725MHz - Temp 1

## 4.5 Peak Power Spectral Density Measurement

### 4.5.1 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 |

### 4.5.2 Test Setup




### 4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.5.4 Test Procedure

**For U-NII-2C band:**

**For 802.11ax (HE20):**

Using method SA-1

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 1 MHz, Set VBW ≥ 3 MHz, Detector = RMS
3. Sweep time = auto, trigger set to “free run”.
4. Trace average at least 100 traces in power averaging mode.
5. Record the max value

**For other modulation mode:**

Using method SA-2

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 1 MHz, Set VBW ≥ 3 MHz, Detector = RMS
3. Sweep time = auto, trigger set to “free run”.
4. Trace average at least 100 traces in power averaging mode.
5. Record the max value and add 10 log (1/duty cycle)

**For U-NII-3:**

**For 802.11ax (HE20):**

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 300 kHz, Set VBW ≥ 1 MHz, Detector = RMS
3. Use the peak marker function to determine the maximum power level in any 300 kHz band segment within the fundamental EBW.
4. Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where BWCF = 10log(500kHz/300kHz)
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

**For other modulation mode:**

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 300 kHz, Set VBW ≥ 1 MHz, Detector = RMS
3. Use the peak marker function to determine the maximum power level in any 300 kHz band segment within the fundamental EBW.
4. Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where BWCF = 10log(500kHz/300kHz)
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)

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Condition

Same as Item 4.3.6.

4.5.7 Test Results

**CDD Mode**

**For U-NII-2C:**

**802.11a**

| Chan. | Chan. Freq. (MHz) | PSD W/O Duty Factor (dBm/MHz) | | | | Duty Factor (dB) | Total PSD With Duty Factor (dBm/MHz) | Max. Limit (dBm/MHz) | Pass / Fail |
|---|---|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 | | | | |
| 144 (U-NII-2C Band) | 5720 | 4.39 | 4.11 | 3.27 | 4.22 | 0.17 | 10.21 | 10.78 | Pass |

Note: 1. Method a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. The directional gain = 6.22dBi > 6dBi, so the power density limit shall be reduced to 11-(6.22-6) = 10.78dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

**Beamforming Mode**

**802.11ax (HE20)**

| Chan. | Chan. Freq. (MHz) | PSD (dBm/MHz) | | | | Total Power Density (dBm/MHz) | Max. Limit (dBm/MHz) | Pass / Fail |
|---|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 | | | |
| 144 (U-NII-2C Band) | 5720 | 4.12 | 4.52 | 3.34 | 3.62 | 9.94 | 10.78 | Pass |

Note: 1. Method a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. The directional gain = 6.22dBi > 6dBi, so the power density limit shall be reduced to 11-(6.22-6) = 10.78dBm.

**802.11ax (HE40)**

| Chan. | Chan. Freq. (MHz) | PSD W/O Duty Factor (dBm/MHz) | | | | Duty Factor (dB) | Total PSD With Duty Factor (dBm/MHz) | Max. Limit (dBm/MHz) | Pass / Fail |
|---|---|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 | | | | |
| 142 (U-NII-2C Band) | 5710 | 1.12 | 1.22 | 0.38 | 1.15 | 0.25 | 7.25 | 10.78 | Pass |

Note: 1. Method a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. The directional gain = 6.22dBi > 6dBi, so the power density limit shall be reduced to 11-(6.22-6) = 10.78dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

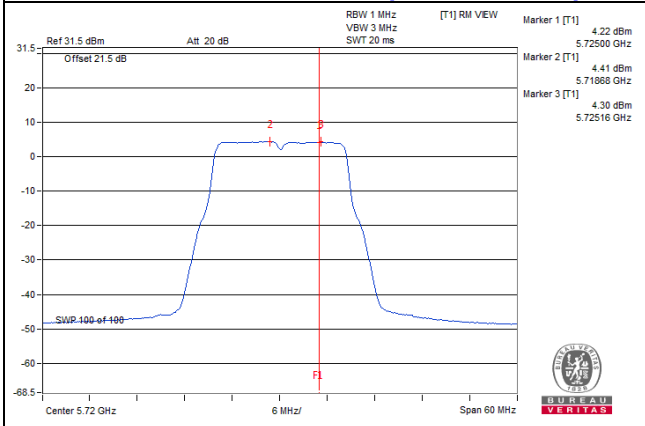
## 802.11ax (HE80)

| Chan. | Chan. Freq. (MHz) | PSD W/O Duty Factor (dBm/MHz) | | | | Duty Factor (dB) | Total PSD With Duty Factor (dBm/MHz) | Max. Limit (dBm/MHz) | Pass / Fail |
|---|---|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 | | | | |
| 138 (U-NII-2C Band) | 5690 | -1.77 | -1.65 | -1.91 | -2.49 | 0.38 | 4.46 | 10.78 | Pass |

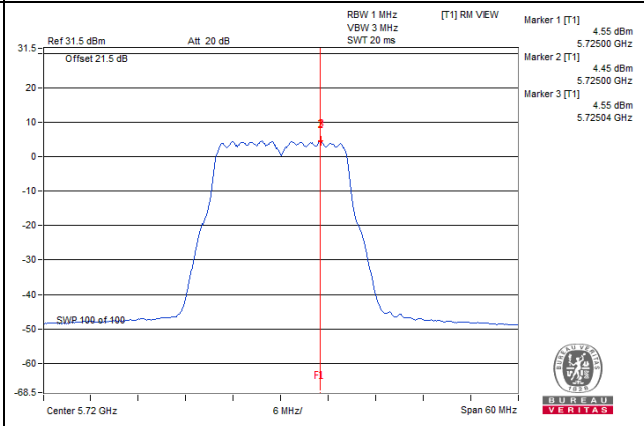
Note: 1. Method a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. The directional gain = 6.22dBi > 6dBi, so the power density limit shall be reduced to 11-(6.22-6) = 10.78dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

Spectrum Plot of Worst Value

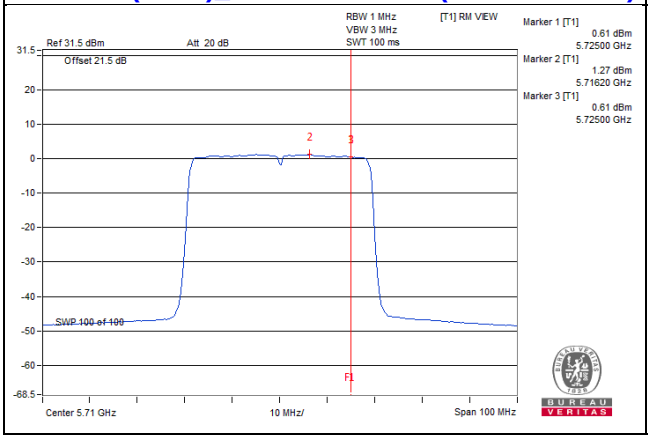
802.11a_Chain 0 / CH144 (U-NII-2C Band)



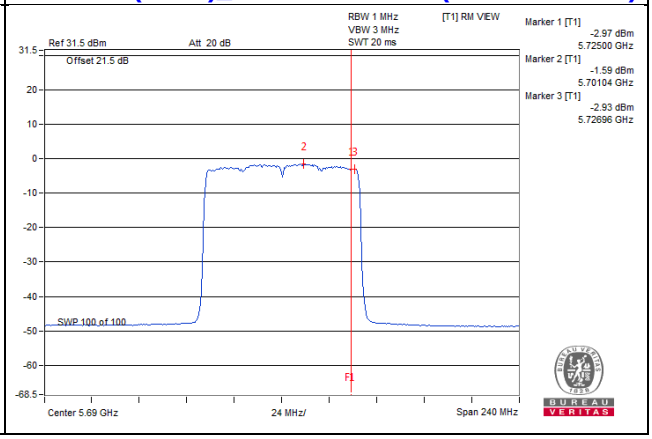

802.11ax (HE20)_Chain 1 / CH144 (U-NII-2C Band)




802.11ax (HE40)_Chain 1 / CH142 (U-NII-2C Band)




802.11ax (HE80)_Chain 1 / CH138 (U-NII-2C Band)



**For U-NII-3:**

**CDD Mode**

**802.11a**

| Chan. | Freq. (MHz) | PSD W/O Duty Factor (dBm/300kHz) | | | | Duty Factor (dB) | Total PSD With Duty Factor | | Limit (dBm/500kHz) | Pass /Fail |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 | | dBm/300kHz | dBm/500kHz | | |
| 144 (U-NII-3 Band) | 5720 | -3.43 | -4.01 | -4.92 | -3.95 | 0.17 | 2.14 | 4.36 | 29.78 | Pass |

Note: 1. Method b) Measure and sum spectral maxima across the outputs of KDB 662911 is using for calculating total power density.

2. The directional gain = 6.22dBi > 6dBi, so the power density limit shall be reduced to 30-(6.22-6) = 29.78dBm.

3. Refer to section 3.3 for duty cycle spectrum plot.

**Beamforming Mode**

**802.11ax (HE20)**

| Chan. | Freq. (MHz) | PSD (dBm/300kHz) | | | | Total PSD | | Limit (dBm/500kHz) | Pass /Fail |
|---|---|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 | dBm/300kHz | dBm/500kHz | | |
| 144 (U-NII-3 Band) | 5720 | -4.35 | -1.18 | -5.45 | -5.55 | 2.29 | 4.51 | 29.78 | Pass |

Note: 1. Method b) Measure and sum spectral maxima across the outputs of KDB 662911 is using for calculating total power density.

2. The directional gain = 6.22dBi > 6dBi, so the power density limit shall be reduced to 30-(6.22-6) = 29.78dBm.

**802.11ax (HE40)**

| Chan. | Freq. (MHz) | PSD W/O Duty Factor (dBm/300kHz) | | | | Duty Factor (dB) | Total PSD With Duty Factor | | Limit (dBm/500kHz) | Pass /Fail |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 | | dBm/300kHz | dBm/500kHz | | |
| 142 (U-NII-3 Band) | 5710 | -7.90 | -8.03 | -8.68 | -8.42 | 0.25 | -1.98 | 0.24 | 29.78 | Pass |

Note: 1. Method b) Measure and sum spectral maxima across the outputs of KDB 662911 is using for calculating total power density.

2. The directional gain = 6.22dBi > 6dBi, so the power density limit shall be reduced to 30-(6.22-6) = 29.78dBm.

3. Refer to section 3.3 for duty cycle spectrum plot.

## 802.11ax (HE80)

| Chan. | Freq. (MHz) | PSD W/O Duty Factor (dBm/300kHz) | | | | Duty Factor (dB) | Total PSD With Duty Factor | | Limit (dBm/500kHz) | Pass /Fail |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 | | dBm/300kHz | dBm/500kHz | | |
| 138 (U-NII-3 Band) | 5690 | -12.00 | -11.53 | -12.08 | -12.92 | 0.38 | -5.71 | -3.49 | 29.78 | Pass |

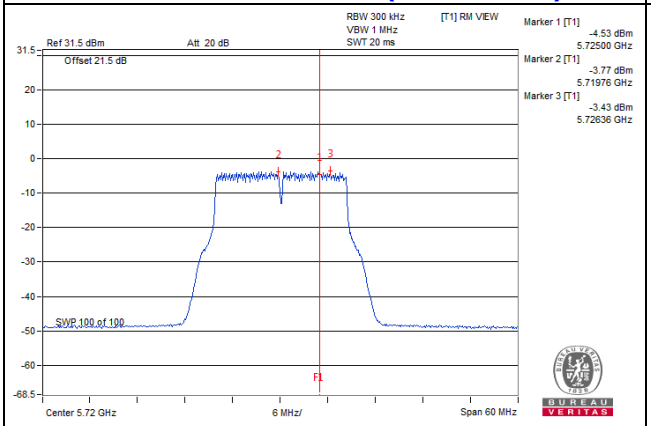
Note: 1. Method b) Measure and sum spectral maxima across the outputs of KDB 662911 is using for calculating total power density.

2. The directional gain = 6.22dBi > 6dBi, so the power density limit shall be reduced to 30-(6.22-6) = 29.78dBm.

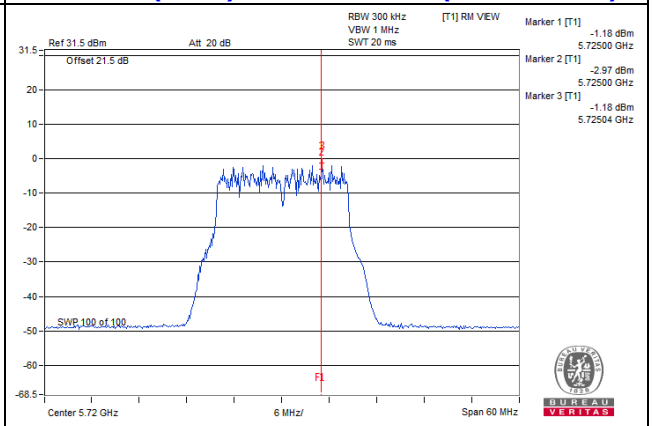
3. Refer to section 3.3 for duty cycle spectrum plot.

Spectrum Plot of Worst Value

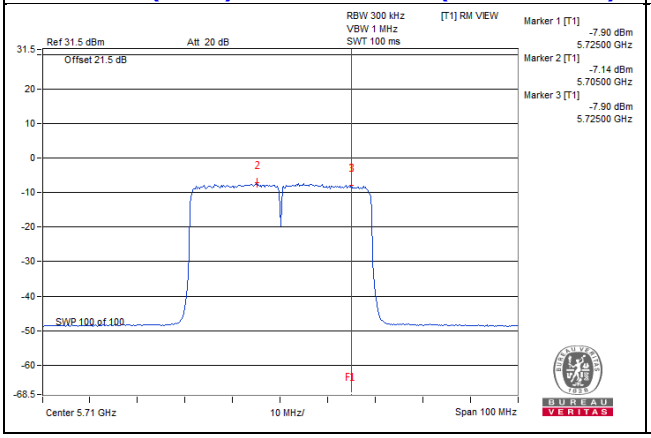
**802.11a_Chain 0 / 144 (U-NII-3 Band)**



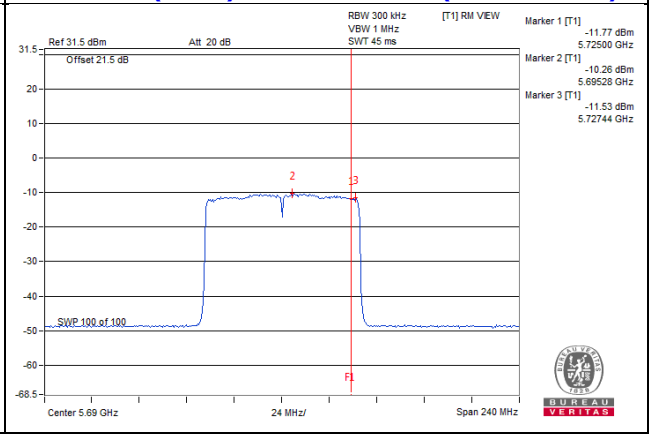

**802.11ax (HE20)_Chain 1 / 144 (U-NII-3 Band)**




**802.11ax (HE40)_Chain 0 / 142 (U-NII-3 Band)**




**802.11ax (HE80)_Chain 1 / 138 (U-NII-3 Band)**

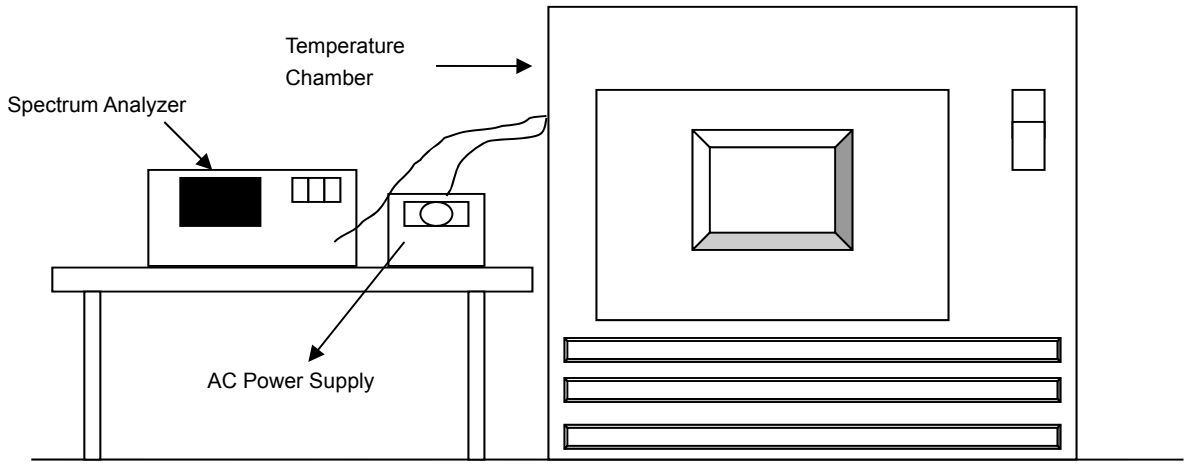


## 4.6 Frequency Stability Measurement

### 4.6.1 Limits of Frequency Stability Measurement

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

### 4.6.2 Test Setup




### 4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.6.4 Test Procedure

a. The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
b. Turn the EUT on and couple its output to a spectrum analyzer.
c. Turn the EUT off and set the chamber to the highest temperature specified.
d. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 Minutes.
e. Repeat step (d) with the temperature chamber set to the next desired temperature until measurements down to the lowest specified temperature have been completed.
f. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 Minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

### 4.6.5 Deviation from Test Standard

No deviation.

### 4.6.6 EUT Operating Condition

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

### 4.6.7 Test Results

| Frequency Stability Versus Temp. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Operating Frequency: 5725 MHz | | | | | | | | | |
| TEMP. (℃) | Power Supply (Vac) | 0 Minute | | 2 Minutes | | 5 Minutes | | 10 Minutes | |
| | | Measured Frequency (MHz) | Pass/Fail | Measured Frequency (MHz) | Pass/Fail | Measured Frequency (MHz) | Pass/Fail | Measured Frequency (MHz) | Pass/Fail |
| 50 | 120 | 5720.0101 | Pass | 5720.0079 | Pass | 5720.0059 | Pass | 5720.0078 | Pass |
| 40 | 120 | 5720.0094 | Pass | 5720.0096 | Pass | 5720.0114 | Pass | 5720.0099 | Pass |
| 30 | 120 | 5719.9737 | Pass | 5719.9726 | Pass | 5719.9754 | Pass | 5719.9755 | Pass |
| 20 | 120 | 5720.0054 | Pass | 5720.0025 | Pass | 5720.003 | Pass | 5720.0056 | Pass |
| 10 | 120 | 5720.0184 | Pass | 5720.0164 | Pass | 5720.0167 | Pass | 5720.0193 | Pass |
| 0 | 120 | 5720 | Pass | 5720.0018 | Pass | 5720.0013 | Pass | 5719.9998 | Pass |
| -10 | 120 | 5720.0142 | Pass | 5720.0167 | Pass | 5720.0167 | Pass | 5720.0124 | Pass |
| -20 | 120 | 5719.9848 | Pass | 5719.9807 | Pass | 5719.983 | Pass | 5719.9803 | Pass |
| -30 | 120 | 5719.9738 | Pass | 5719.9767 | Pass | 5719.9737 | Pass | 5719.9754 | Pass |

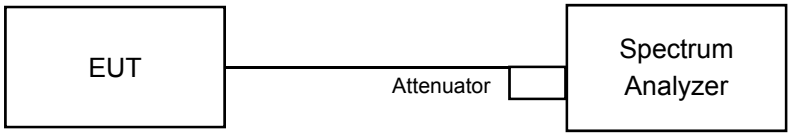
| Frequency Stability Versus Voltage | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Operating Frequency: 5725 MHz | | | | | | | | | |
| TEMP. (℃) | Power Supply (Vac) | 0 Minute | | 2 Minutes | | 5 Minutes | | 10 Minutes | |
| | | Measured Frequency (MHz) | Pass/Fail | Measured Frequency (MHz) | Pass/Fail | Measured Frequency (MHz) | Pass/Fail | Measured Frequency (MHz) | Pass/Fail |
| 20 | 138 | 5720.0056 | Pass | 5720.0014 | Pass | 5720.0028 | Pass | 5720.0054 | Pass |
| | 120 | 5720.0054 | Pass | 5720.0025 | Pass | 5720.003 | Pass | 5720.0056 | Pass |
| | 102 | 5720.0055 | Pass | 5720.0019 | Pass | 5720.0032 | Pass | 5720.005 | Pass |

## 4.7 6dB Bandwidth Measurement

### 4.7.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5MHz.

### 4.7.2 Test Setup




### 4.7.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.7.4 Test Procedure

**MEASUREMENT PROCEDURE REF**

a. Set resolution bandwidth (RBW) = 100kHz
b. Set the video bandwidth (VBW) ≥ 3 x RBW, Detector = Peak.
c. Trace mode = max hold.
d. Sweep = auto couple.
e. 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

### 4.7.5 Deviation from Test Standard

No deviation.

### 4.7.6 EUT Operating Condition

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

4.7.7 Test Results

## CDD Mode

### 802.11a

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | | | | Minimum Limit (MHz) | Pass / Fail |
|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 | | |
| 144 (U-NII-3 Band) | 5720 | 3.27 | 3.27 | 3.26 | 3.26 | 0.5 | Pass |

## Beamforming Mode

### 802.11ax (HE20)

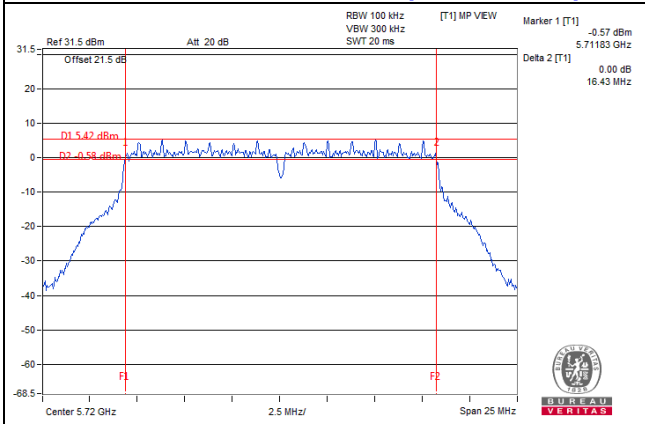
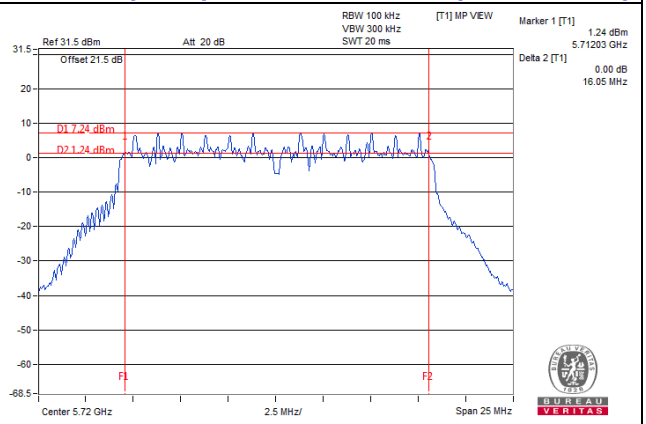
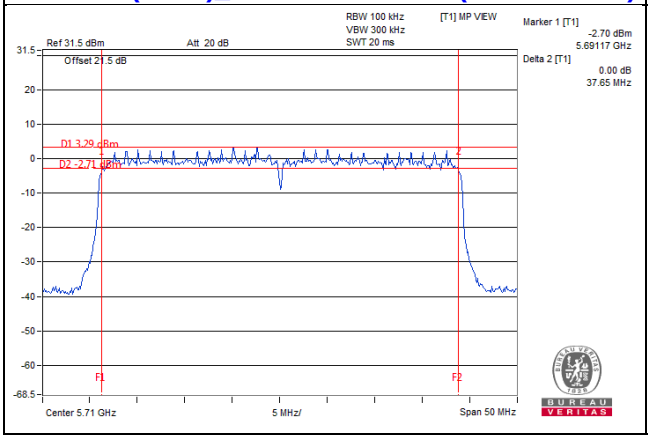
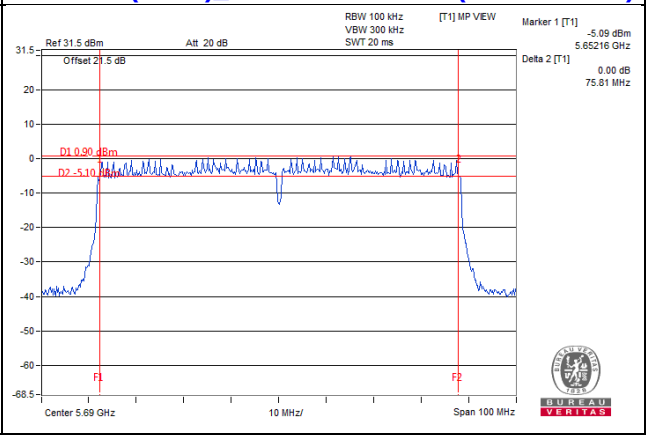
| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | | | | Minimum Limit (MHz) | Pass / Fail |
|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 | | |
| 144 (U-NII-3 Band) | 5720 | 4.55 | 3.08 | 4.55 | 4.53 | 0.5 | Pass |

### 802.11ax (HE40)

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | | | | Minimum Limit (MHz) | Pass / Fail |
|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 | | |
| 142 (U-NII-3 Band) | 5710 | 3.91 | 3.91 | 3.91 | 3.82 | 0.5 | Pass |

### 802.11ax (HE80)

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | | | | Minimum Limit (MHz) | Pass / Fail |
|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Chain 3 | | |
| 138 (U-NII-3 Band) | 5690 | 2.97 | 3.52 | 3.83 | 3.47 | 0.5 | Pass |

| Spectrum Plot of Worst Value | |
|---|---|
| **802.11a_Chain 2 / CH144 (U-NII-3 Band)** | **802.11ax (HE20)_Chain 1 / CH144 (U-NII-3 Band)** |
|  |  |
| **802.11ax (HE40)_Chain 3 / CH142 (U-NII-3 Band)** | **802.11ax (HE80)_Chain 0 / CH138 (U-NII-3 Band)** |
|  |  |

Note: The 6dB bandwidth above 5725MHz = Marker 1 + Delta 2 - 5725MHz

## 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.

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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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