

Partial FCC Test Report

Report No.: RF191224C11-1

FCC ID: C3K1900

Test Model: 1900

**Contains Wi-Fi
Module Model No.:** 1900

Contains FCC ID: C3K1900

Received Date: Dec. 24, 2019

Test Date: Jan. 22, 2020 ~ Apr. 08, 2020

Issued Date: Apr. 13, 2020

Applicant: Microsoft Corporation

Address: One Microsoft Way Redmond, WA 98052-6399, U.S.A

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lin Kou Laboratories

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33383, Taiwan

**FCC Registration /
Designation Number:** 788550 / TW0003



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Table of Contents

| | |
|---|-----------|
| Release Control Record | 3 |
| 1 Certificate of Conformity | 4 |
| 2 Summary of Test Results..... | 5 |
| 2.1 Modification Record | 5 |
| 3 General Information | 6 |
| 3.1 General Description of EUT | 6 |
| 3.2 Description of Test Modes..... | 8 |
| 3.2.1 Test Mode Applicability and Tested Channel Detail | 11 |
| 3.3 General Description of Applied Standards and References | 13 |
| 4 Test Types and Results | 16 |
| 4.1 Radiated Emission and Bandedge Measurement | 16 |
| 4.1.1 Limits of Radiated Emission and Bandedge Measurement | 16 |
| 4.1.2 Test Instruments | 18 |
| 4.1.3 Test Procedures..... | 19 |
| 4.1.4 Deviation from Test Standard | 19 |
| 4.1.5 Test Setup..... | 20 |
| 4.1.6 EUT Operating Conditions..... | 21 |
| 4.1.7 Test Results | 22 |
| 4.2 Transmit Power Measurement..... | 38 |
| 4.2.1 Limits of Transmit Power Measurement | 38 |
| 4.2.2 Test Setup..... | 38 |
| 4.2.3 Test Instruments | 39 |
| 4.2.4 Test Procedure | 39 |
| 4.2.5 Deviation from Test Standard | 39 |
| 4.2.6 EUT Operating Conditions..... | 39 |
| 4.2.7 Test Results | 40 |
| 4.3 Conducted Bandedge Measurement..... | 41 |
| 4.3.1 Limits of Conducted Bandedge Measurement | 41 |
| 4.3.2 Test Procedure Measurement | 41 |
| 4.3.3 Test Setup..... | 42 |
| 4.3.4 Test Instruments | 42 |
| 4.3.5 Deviation from Test Standard | 42 |
| 4.3.6 EUT Operating Condition | 42 |
| 5 Pictures of Test Arrangements..... | 60 |
| Appendix – Information of the Testing Laboratories | 61 |

Release Control Record

| Issue No. | Description | Date Issued |
|---------------|------------------|---------------|
| RF191224C11-1 | Original Release | Apr. 13, 2020 |

1 Certificate of Conformity

Product: Portable Computing Device

Brand: Microsoft

Test Model: 1900

Sample Status: Engineering Sample

Applicant: Microsoft Corporation

Test Date: Jan. 22, 2020 ~ Apr. 08, 2020

Standards: 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 RF characteristics under the conditions specified in this report.

Prepared by : Rona Chen, **Date:** Apr. 13, 2020
Rona Chen / Specialist

Approved by : Dylan Chiou, **Date:** Apr. 13, 2020
Dylan Chiou / Senior Project Engineer

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 | N/A | Refer to Note |
| 15.407(b) (1/2/3/4(i/ii)/6) | Radiated Emissions Measurement | Pass | Meet the requirement of limit. Minimum passing margin is -5.82 dB at 470.8 MHz. |
| | Conducted Band Edge Measurement | Pass | Meet the requirement of limit. |
| 15.407(a)(1/2/3) | Max Average Transmit Power | Pass | Meet the requirement of limit. |
| 15.407(a)(1/2/3) | Peak Power Spectral Density | N/A | Refer to Note |
| 15.407(e) | 6 dB Bandwidth | N/A | Refer to Note |
| 15.407(g) | Frequency Stability | N/A | Refer to Note |
| 15.203 | Antenna Requirement | N/A | Refer to Note |

Note:

1. This report is issued as a partial report. The test item, test mode, and test method are in accordance with client's requirement. Only Radiated Emissions, Max Average Transmit Power and Conducted Band Edge test results were recorded in this report.
2. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

| | |
|--|--|
| Product | Portable Computing Device |
| Brand | Microsoft |
| Test Model | 1900 |
| FCC ID | C3K1900 |
| Contains Wi-Fi Module Model No. | 1900 |
| Contains FCC ID | C3K1900 |
| Status of EUT | Engineering Sample |
| Power Supply Rating | 120 Vac (Adapter) |
| Modulation Type | 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM 1024QAM for OFDMA |
| Modulation Technology | OFDM, OFDMA |
| Transfer Rate | 802.11a: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0 Mbps 802.11n: up to 300 Mbps 802.11ac: up to 1733.3 Mbps 802.11ax: up to 2402 Mbps |
| Operating Frequency | 5180 ~ 5250 MHz, 5250 ~ 5320 MHz, 5500 ~ 5720 MHz, 5745 ~ 5825 MHz |
| Number of Channel | 5180 ~ 5250 MHz: 4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20) 2 for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40) 1 for 802.11ac (VHT80), 802.11ax (HE80) 1 for 802.11ac (VHT160), 802.11ax (HE160) 5250 ~ 5320 MHz: 4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20) 2 for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40) 1 for 802.11ac (VHT80), 802.11ax (HE80) 1 for 802.11ac (VHT160), 802.11ax (HE160) 5500 ~ 5720 MHz: 12 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20) 6 for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40) 3 for 802.11ac (VHT80), 802.11ax (HE80) 1 For 802.11ac (VHT160), 802.11ax (HE160) 5745 ~ 5825 MHz: 5 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20) 2 for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40) 1 for 802.11ac (VHT80), 802.11ax (HE80) |
| Output Power | 69.909 mW |
| Antenna Type | Refer to Note as below |
| Antenna Connector | N/A |
| Accessory Device | Refer to Note as below |
| Data Cable Supplied | Refer to Note as below |

Note:

1. The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and two receivers.

| Modulation Mode | TX Function |
|-------------------|-------------|
| 802.11a | 1TX (SISO) |
| 802.11n (HT20) | 2TX (MIMO) |
| 802.11n (HT40) | 2TX (MIMO) |
| 802.11ac (VHT20) | 2TX (MIMO) |
| 802.11ac (VHT40) | 2TX (MIMO) |
| 802.11ac (VHT80) | 2TX (MIMO) |
| 802.11ac (VHT160) | 2TX (MIMO) |
| 802.11ax (HE20) | 2TX (MIMO) |
| 802.11ax (HE40) | 2TX (MIMO) |
| 802.11ax (HE80) | 2TX (MIMO) |
| 802.11ax (HE160) | 2TX (MIMO) |

2. The EUT contains following accessory devices.

| Product | Brand | Model | Description |
|--------------|---------------------|-----------|---|
| Adapter | Microsoft (Chicony) | 1798 | I/P: 100-240 Vac, 50-60 Hz, 1.5 A O/P: 15 Vdc, 6.33 A / 5 Vdc, 1.5 A 1.74m power cable w/o core |
| Top Battery | Simplo | G3HTA044H | 7.5 Vdc |
| Base Battery | Simplo | G3HTA065H | 11.36 Vdc |

3. The antenna information is listed as below.

| Ant. Type | Manufacturer | Parts Number | Antenna Gain (dBi) | | | | |
|-----------|--------------|----------------------------|--------------------|---------------|---------------|----------------|----------------|
| | | | 2.4 GHz | 5.15-5.25 GHz | 5.25-5.35 GHz | 5.47-5.725 GHz | 5.725-5.85 GHz |
| PIFA | FIT | Main Antenna: 1415-07H50QS | 1.83 | 3.17 | 3.30 | 3.56 | 3.02 |
| | | Aux. Antenna: 1415-07H10QS | 2.05 | 3.36 | 3.25 | 2.29 | 2.64 |

4. Test Cable Loss is listed as below.

| Frequency (MHz) | Mini lpx (dB) |
|-----------------|---------------|
| 5150 | -1.36 |
| 5200 | -1.38 |
| 5250 | -1.43 |
| 5300 | -1.54 |
| 5350 | -1.64 |
| 5400 | -1.77 |
| 5450 | -1.83 |
| 5500 | -1.86 |
| 5550 | -1.91 |
| 5600 | -1.98 |

5. 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 Test Modes

For 5180 ~ 5250 MHz

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

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|
| 36 | 5180 | 44 | 5220 |
| 40 | 5200 | 48 | 5240 |

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

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|
| 38 | 5190 | 46 | 5230 |

1 channel is provided for 802.11ac (VHT80):

| Channel | Frequency (MHz) |
|---------|-----------------|
| 42 | 5210 |

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

| Channel | Frequency (MHz) |
|---------|-----------------|
| 50 | 5250 |

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

| Channel | Frequency (MHz) |
|---------|-----------------|
| 50 | 5250 |

For 5250 ~ 5320 MHz

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

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|
| 52 | 5260 | 60 | 5300 |
| 56 | 5280 | 64 | 5320 |

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

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|
| 54 | 5270 | 62 | 5310 |

1 channel is provided for 802.11ac (VHT80):

| Channel | Frequency (MHz) |
|---------|-----------------|
| 58 | 5290 |

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

| Channel | Frequency (MHz) |
|---------|-----------------|
| 50 | 5250 |

For 5500 ~ 5720 MHz

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

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

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

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

3 channels are provided for 802.11ac (VHT80):

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|
| 106 | 5530 | 138 | 5690 |
| 122 | 5610 | | |

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

| Channel | Frequency (MHz) |
|---------|-----------------|
| 114 | 5570 |

For 5745 ~ 5825 MHz:

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

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

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

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

1 channel is provided for 802.11ac (VHT80):

| Channel | Frequency (MHz) |
|---------|-----------------|
| 155 | 5775 |

3.2.1 Test Mode Applicability and Tested Channel Detail

| EUT Configure Mode | Applicable To | | Description |
|--------------------|---------------|------|-------------|
| | RE | APCM | |
| - | √ | √ | - |

Where **APCM**: Antenna Port Conducted Measurement **RE**: Radiated Emission

Radiated 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.

| EUT Configure Mode | Frequency Band (MHz) | Mode | Available Channel | Tested Channel | Modulation Technology | Modulation Type | Data Rate (Mbps) |
|--------------------|----------------------|-------------------|-------------------|----------------|-----------------------|-----------------|------------------|
| - | 5180-5250 | 802.11ac (VHT80) | 42 | 42 | OFDM | BPSK | 29.3 |
| - | | 802.11ac (VHT160) | 50 | 50 | OFDM | BPSK | 58.5 |
| - | | 802.11ax (HE80) | 42 | 42 | OFDMA | BPSK | MCS0 |
| - | | 802.11ax (HE160) | 50 | 50 | OFDMA | BPSK | MCS0 |
| - | 5250-5320 | 802.11ac (VHT80) | 58 | 58 | OFDM | BPSK | 29.3 |
| - | | 802.11ax (HE80) | 58 | 58 | OFDMA | BPSK | MCS0 |
| - | 5500-5720 | 802.11ac (VHT160) | 114 | 114 | OFDM | BPSK | 58.5 |
| - | | 802.11ax (HE160) | 114 | 114 | OFDMA | BPSK | MCS0 |

* After the pretest, only the worst case channel was presented in the report.

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.

| EUT Configure Mode | Frequency Band (MHz) | Mode | Available Channel | Tested Channel | Modulation Technology | Modulation Type | Data Rate (Mbps) |
|--------------------|----------------------|-------------------|-------------------|----------------|-----------------------|-----------------|------------------|
| - | 5180-5250 | 802.11ac (VHT80) | 42 | 42 | OFDM | BPSK | 29.3 |
| - | | 802.11ac (VHT160) | 50 | 50 | OFDM | BPSK | 58.5 |
| - | | 802.11ax (HE80) | 42 | 42 | OFDMA | BPSK | MCS0 |
| - | | 802.11ax (HE160) | 50 | 50 | OFDMA | BPSK | MCS0 |
| - | 5250-5320 | 802.11ac (VHT80) | 58 | 58 | OFDM | BPSK | 29.3 |
| - | | 802.11ax (HE80) | 58 | 58 | OFDMA | BPSK | MCS0 |
| - | 5500-5720 | 802.11ac (VHT160) | 114 | 114 | OFDM | BPSK | 58.5 |
| - | | 802.11ax (HE160) | 114 | 114 | OFDMA | BPSK | MCS0 |

Bandedge 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.

| EUT Configure Mode | Frequency Band (MHz) | Mode | Available Channel | Tested Channel | Modulation Technology | Modulation Type | Data Rate (Mbps) |
|--------------------|----------------------|-------------------|-------------------|----------------|-----------------------|-----------------|------------------|
| - | 5180-5250 | 802.11ac (VHT80) | 42 | 42 | OFDM | BPSK | 29.3 |
| - | | 802.11ac (VHT160) | 50 | 50 | OFDM | BPSK | 58.5 |
| - | | 802.11ax (HE80) | 42 | 42 | OFDMA | BPSK | MCS0 |
| - | | 802.11ax (HE160) | 50 | 50 | OFDMA | BPSK | MCS0 |
| - | 5250-5320 | 802.11ac (VHT80) | 58 | 58 | OFDM | BPSK | 29.3 |
| - | | 802.11ax (HE80) | 58 | 58 | OFDMA | BPSK | MCS0 |
| - | 5500-5720 | 802.11ac (VHT160) | 114 | 114 | OFDM | BPSK | 58.5 |
| - | | 802.11ax (HE160) | 114 | 114 | OFDMA | BPSK | MCS0 |

Test Condition:

| Applicable To | Environmental Conditions | Input Power | Tested by |
|---------------|--------------------------|----------------|---------------|
| APCM | 25 deg. C, 65 % RH | 120 Vac, 60 Hz | Leo Tsai |
| RE | 25 deg. C, 65 % RH | 120 Vac, 60 Hz | Charles Hsiao |

3.3 Duty Cycle of Test Signal

MODULATION TYPE: BPSK

802.11a: Duty cycle = $2.082/2.129 = 0.98$, Duty factor = $10 * \log(1/0.98) = 0.10$

802.11n (HT20): Duty cycle of test signal is > 98 %, duty factor is not required.

802.11n (HT40): Duty cycle of test signal is > 98 %, duty factor is not required.

802.11ac (VHT20): Duty cycle = $3.95/4.015 = 0.98$, Duty factor = $10 * \log(1/0.98) = 0.07$

802.11ac (VHT40): Duty cycle = $3.93/4 = 0.98$, Duty factor = $10 * \log(1/0.98) = 0.08$

802.11ac (VHT80): Duty cycle of test signal is > 98 %, duty factor is not required.



802.11ax (HE20): Duty cycle = $3.96/4.045 = 0.98$, Duty factor = $10 * \log(1/0.98) = 0.09$

802.11ax (HE40): Duty cycle = $3.96/4.035 = 0.98$, Duty factor = $10 * \log(1/0.98) = 0.08$

802.11ax (HE80): Duty cycle = $3.96/4.03 = 0.98$, Duty factor = $10 * \log(1/0.98) = 0.08$



3.4 General Description of Applied Standards 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 Procedures 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 1000 MHz, 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 20 dB under any condition of modulation.

Limits of Unwanted Emission Out of the Restricted Bands

| Applicable To | | Limit | |
|--|---|---|---|
| 789033 D02 General UNII Test Procedures New Rules v02r01 | | Field Strength at 3 m | |
| | | PK: 74 (dBµV/m) | AV: 54 (dBµV/m) |
| Frequency Band | Applicable To | EIRP Limit | Equivalent Field Strength at 3 m |
| 5150~5250 MHz | 15.407(b)(1) | PK: -27 (dBm/MHz) | PK: 68.2 (dBµV/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) ^{*1} PK:10 (dBm/MHz) ^{*2} PK:15.6 (dBm/MHz) ^{*3} PK:27 (dBm/MHz) ^{*4} | PK: 68.2 (dBµV/m) ^{*1} PK:105.2 (dBµV/m) ^{*2} PK: 110.8 (dBµV/m) ^{*3} PK:122.2 (dBµV/m) ^{*4} |
| | <input type="checkbox"/> 15.407(b)(4)(ii) | Emission limits in section 15.247(d) | |

^{*1} beyond 75 MHz or more above of the band edge.

^{*2} below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above.

^{*3} below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above.

^{*4} 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:

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

4.1.2 Test Instruments

| Description & Manufacturer | Model No. | Serial No. | Date of Calibration | Due Date of Calibration |
|--|----------------------------|---|---------------------|-------------------------|
| Test Receiver Agilent | N9038A | MY51210203 | Mar. 18, 2020 | Mar. 17, 2021 |
| Spectrum Analyzer Agilent | N9010A | MY52220314 | Dec. 12, 2019 | Dec. 11, 2020 |
| Spectrum Analyzer ROHDE & SCHWARZ | FSV40 | 100980 | Apr. 23, 2019 | Apr. 22, 2020 |
| Broadband Horn Antenna SCHWARZBECK | BBHA 9170 | 148 | Nov. 24, 2019 | Nov. 23, 2020 |
| HORN Antenna SCHWARZBECK | BBHA 9120D | 9120D-969 | Nov. 24, 2019 | Nov. 23, 2020 |
| BILOG Antenna SCHWARZBECK | VULB 9168 | 9168-472 | Nov. 08, 2019 | Nov. 07, 2020 |
| Fixed Attenuator WORKEN | MDCS18N-10 | MDCS18N-10-01 | Apr. 15, 2019 | Apr. 14, 2020 |
| Preamplifier EMCI | EMC001340 | 980201 | Oct. 14, 2019 | Oct. 13, 2020 |
| Preamplifier EMCI | EMC 012645 | 980115 | Oct. 08, 2019 | Oct. 07, 2020 |
| Preamplifier EMCI | EMC 184045 | 980116 | Oct. 08, 2019 | Oct. 07, 2020 |
| Preamplifier EMCI | EMC 330H | 980112 | Oct. 08, 2019 | Oct. 07, 2020 |
| Peak Power Analyzer KEYSIGHT | 8990B | MY51000485 | Jan. 14, 2020 | Jan. 13, 2021 |
| USB Wideband Power Sensor KEYSIGHT | U2021XA | MY55050005/MY55 190004/MY551900 07/MY55210005 | Jul. 15, 2019 | Jul 14, 2020 |
| RF Coaxial Cable HUBER+SUHNNER | EMC104-SM-SM-8 000&3000 | 140811+170717 | Oct. 08, 2019 | Oct. 07, 2020 |
| RF Coaxial Cable HUBER+SUHNNER | SUCOFLEX 104 | EMC104-SM-SM-1 000(140807) | Oct. 08, 2019 | Oct. 07, 2020 |
| RF Coaxial Cable WOKEN | 8D-FB | Cable-Ch10-01 | Oct. 08, 2019 | Oct. 07, 2020 |
| Boresight Antenna Fixture | FBA-01 | FBA-SIP01 | NA | NA |
| Software BV ADT | E3 6.120103 | NA | NA | NA |
| Antenna Tower MF | MFA-440H | NA | NA | NA |
| Turn Table MF | MFT-201SS | NA | NA | NA |
| Antenna Tower & Turn Table Controller MF | MF-7802 | NA | NA | NA |

- 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 HwaYa Chamber 10.

4.1.3 Test Procedures

For Radiated Emission below 30 MHz

- 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 9 kHz at frequency below 30 MHz.

For Radiated Emission above 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) / 1.5 meters (for above 1 GHz) 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 detected 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:

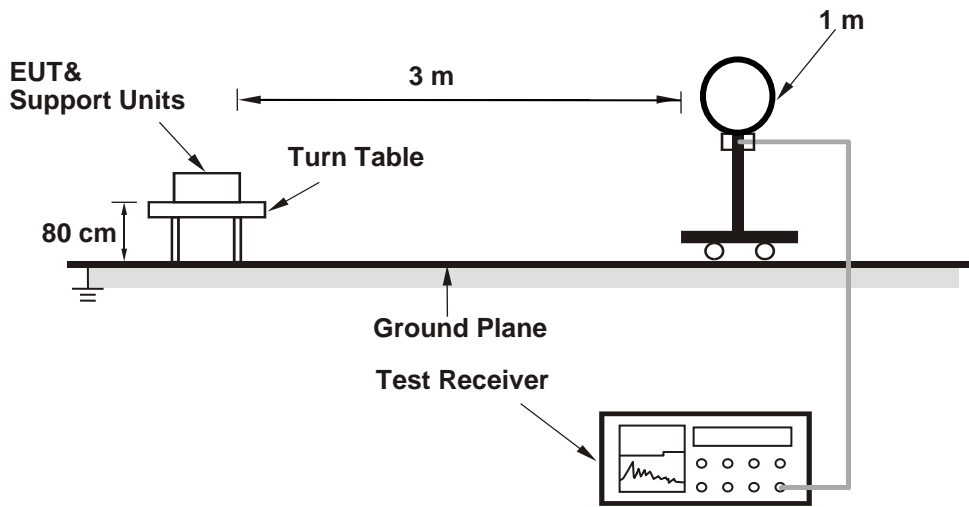
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK)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

4.1.4 Deviation from Test Standard

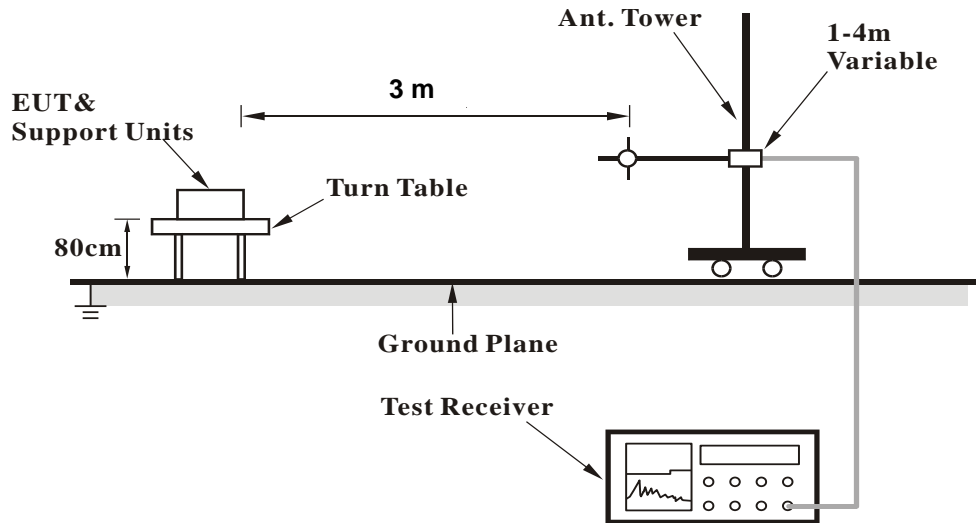
No deviation.

4.1.5 Test Setup

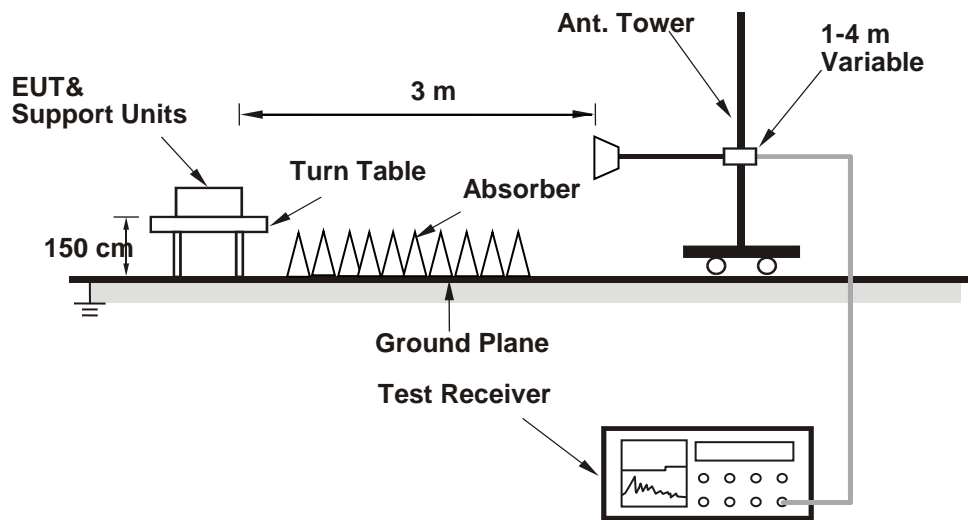
<Radiated Emission below 30 MHz>



<Radiated Emission 30 MHz to 1 GHz>



<Radiated Emission above 1 GHz>



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

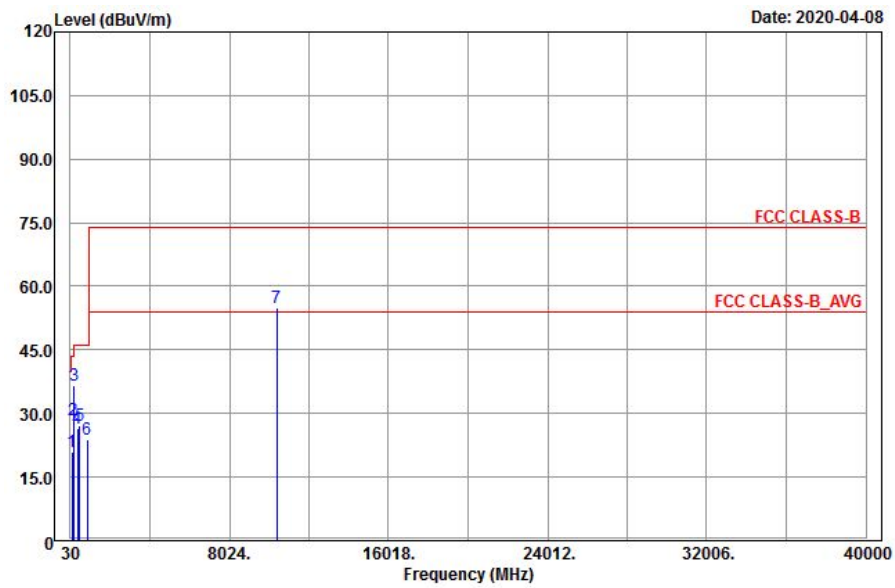
4.1.6 EUT Operating Conditions

- a. Placed the EUT on a testing table.
- b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

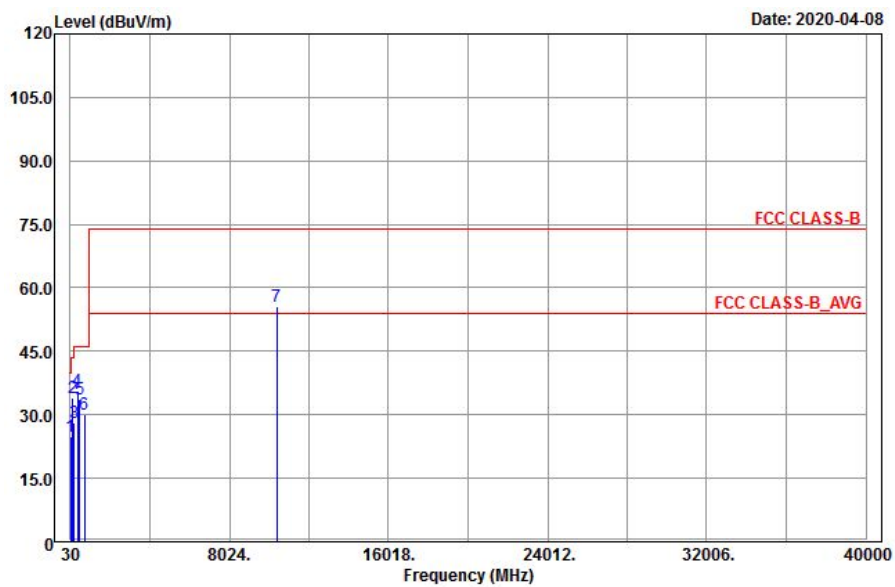
4.1.7 Test Results
802.11ac (VHT80)

| EUT Test Condition | | Measurement Detail | |
|--------------------------|--------------------|--------------------|---------------------------|
| Channel | Channel 42 | Frequency Range | 30 MHz ~ 40 GHz |
| Input Power | 120 Vac, 60 Hz | Detector Function | Peak (PK) Average (AV) |
| Environmental Conditions | 25 deg. C, 65 % RH | Tested By | Charles Hsiao |

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m

| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|--------|
| 115.32 | 20.91 | 39.19 | -18.28 | 43.5 | -22.59 | 153 | 229 | Peak |
| 190.92 | 28.55 | 47.2 | -18.65 | 43.5 | -14.95 | 175 | 131 | Peak |
| 217.11 | 36.7 | 54.62 | -17.92 | 46 | -9.3 | 120 | 38 | Peak |
| 403.6 | 26.48 | 40.35 | -13.87 | 46 | -19.52 | 144 | 137 | Peak |
| 499.5 | 27.04 | 39.35 | -12.31 | 46 | -18.96 | 186 | 291 | Peak |
| 864.2 | 23.85 | 30.34 | -6.49 | 46 | -22.15 | 154 | 112 | Peak |
| *10420 | 54.88 | 38.72 | 16.16 | 68.2 | -13.32 | 204 | 105 | Peak |

Antenna Polarity & Test Distance: Vertical at 3 m

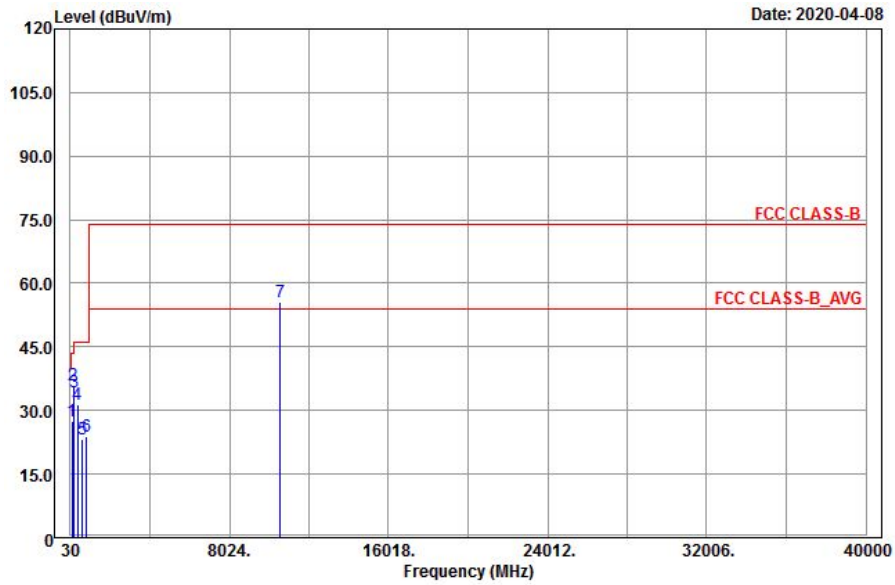
| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|--------|
| 55.92 | 24.81 | 40.44 | -15.63 | 40 | -15.19 | 120 | 143 | Peak |
| 164.46 | 34.04 | 54.53 | -20.49 | 43.5 | -9.46 | 195 | 128 | Peak |
| 218.46 | 28.27 | 46.17 | -17.9 | 46 | -17.73 | 167 | 154 | Peak |
| 400.1 | 35.49 | 49.41 | -13.92 | 46 | -10.51 | 130 | 88 | Peak |
| 502.3 | 33.75 | 46.04 | -12.29 | 46 | -12.25 | 189 | 235 | Peak |
| 757.1 | 30.24 | 38.57 | -8.33 | 46 | -15.76 | 122 | 45 | Peak |
| *10420 | 55.55 | 39.39 | 16.16 | 68.2 | -12.65 | 175 | 168 | Peak |

Remarks:

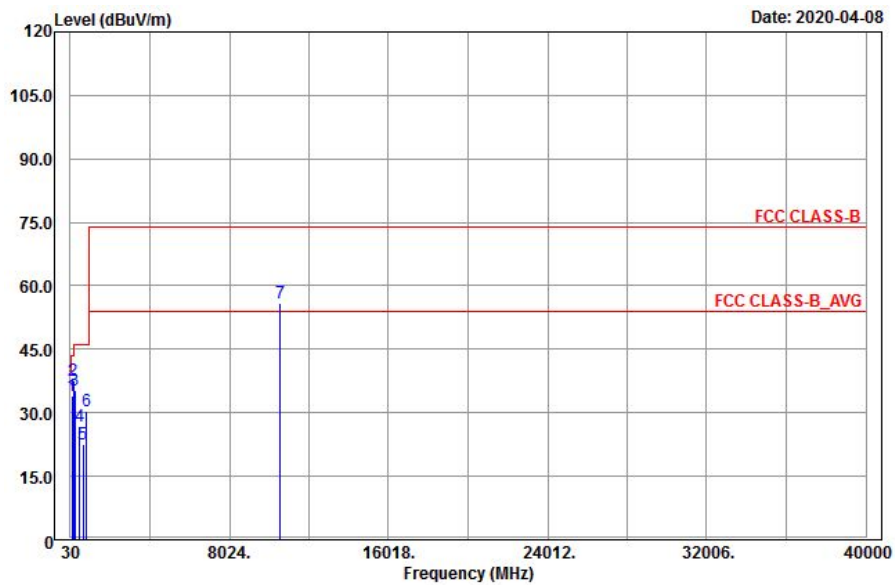
- Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
- *: Out of Restricted Band
- The emission levels of other frequencies were very low against the limit

| EUT Test Condition | | Measurement Detail | |
|--------------------------|--------------------|--------------------|---------------------------|
| Channel | Channel 58 | Frequency Range | 30 MHz ~ 40 GHz |
| Input Power | 120 Vac, 60 Hz | Detector Function | Peak (PK) Average (AV) |
| Environmental Conditions | 25 deg. C, 65 % RH | Tested By | Charles Hsiao |

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m

| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|--------|
| 128.55 | 27.58 | 47.97 | -20.39 | 43.5 | -15.92 | 157 | 155 | Peak |
| 184.98 | 36.1 | 55.25 | -19.15 | 43.5 | -7.4 | 168 | 35 | Peak |
| 228.18 | 34.35 | 51.83 | -17.48 | 46 | -11.65 | 104 | 179 | Peak |
| 406.4 | 31.53 | 45.35 | -13.82 | 46 | -14.47 | 128 | 352 | Peak |
| 639.5 | 23.13 | 33.43 | -10.3 | 46 | -22.87 | 177 | 4 | Peak |
| 860 | 23.92 | 30.48 | -6.56 | 46 | -22.08 | 130 | 58 | Peak |
| *10580 | 55.6 | 39.89 | 15.71 | 68.2 | -12.6 | 216 | 101 | Peak |

Antenna Polarity & Test Distance: Vertical at 3 m

| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|--------|
| 111.54 | 34.04 | 51.82 | -17.78 | 43.5 | -9.46 | 148 | 121 | Peak |
| 198.21 | 37.62 | 55.93 | -18.31 | 43.5 | -5.88 | 190 | 124 | Peak |
| 250.05 | 35.3 | 52.13 | -16.83 | 46 | -10.7 | 175 | 196 | Peak |
| 483.4 | 26.87 | 39.52 | -12.65 | 46 | -19.13 | 168 | 226 | Peak |
| 674.5 | 22.63 | 32.21 | -9.58 | 46 | -23.37 | 150 | 143 | Peak |
| 839.7 | 30.57 | 37.54 | -6.97 | 46 | -15.43 | 142 | 118 | Peak |
| *10580 | 55.94 | 40.23 | 15.71 | 68.2 | -12.26 | 146 | 198 | Peak |

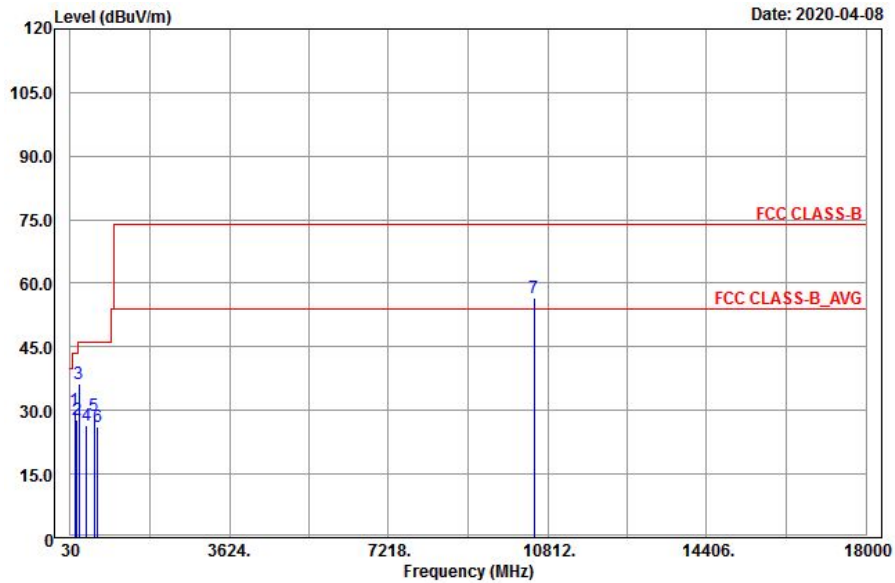
Remarks:

- Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
- *: Out of Restricted Band
- The emission levels of other frequencies were very low against the limit

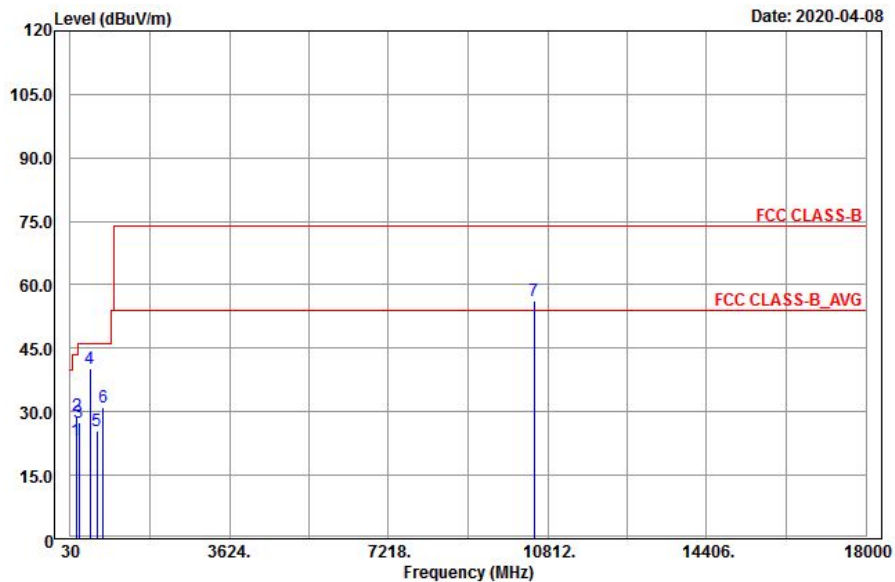
802.11ac (VHT160)

| EUT Test Condition | | Measurement Detail | |
|--------------------------|--------------------|--------------------|---------------------------|
| Channel | Channel 50 | Frequency Range | 30 MHz ~ 40 GHz |
| Input Power | 120 Vac, 60 Hz | Detector Function | Peak (PK) Average (AV) |
| Environmental Conditions | 25 deg. C, 65 % RH | Tested By | Charles Hsiao |

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m

| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|--------|
| 133.41 | 30.13 | 50.8 | -20.67 | 43.5 | -13.37 | 162 | 131 | Peak |
| 184.44 | 27.71 | 46.95 | -19.24 | 43.5 | -15.79 | 158 | 172 | Peak |
| 218.19 | 36.42 | 54.32 | -17.9 | 46 | -9.58 | 120 | 43 | Peak |
| 404.3 | 26.45 | 40.3 | -13.85 | 46 | -19.55 | 140 | 86 | Peak |
| 562.5 | 28.74 | 40.06 | -11.32 | 46 | -17.26 | 155 | 172 | Peak |
| 640.2 | 26.18 | 36.47 | -10.29 | 46 | -19.82 | 189 | 123 | Peak |
| *10500 | 56.42 | 40.59 | 15.83 | 68.2 | -11.78 | 168 | 24 | Peak |

Antenna Polarity & Test Distance: Vertical at 3 m

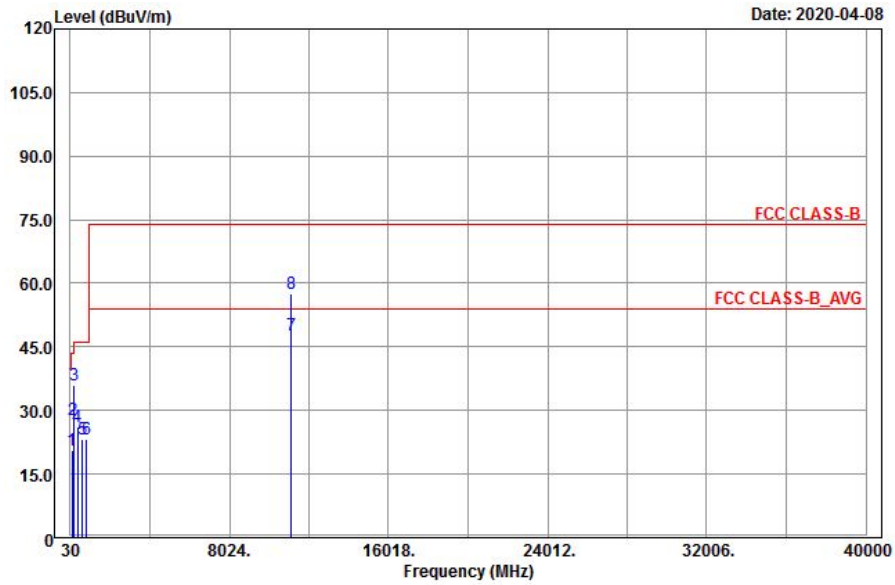
| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|--------|
| 156.63 | 23.08 | 43.79 | -20.71 | 43.5 | -20.42 | 112 | 145 | Peak |
| 184.71 | 29.24 | 48.48 | -19.24 | 43.5 | -14.26 | 169 | 253 | Peak |
| 224.13 | 27.35 | 45.01 | -17.66 | 46 | -18.65 | 122 | 107 | Peak |
| 470.8 | 40.18 | 53.13 | -12.95 | 46 | -5.82 | 125 | 117 | Peak |
| 638.8 | 25.51 | 35.81 | -10.3 | 46 | -20.49 | 189 | 43 | Peak |
| 771.1 | 31.14 | 39.38 | -8.24 | 46 | -14.86 | 165 | 227 | Peak |
| *10500 | 56.25 | 40.42 | 15.83 | 68.2 | -11.95 | 157 | 118 | Peak |

Remarks:

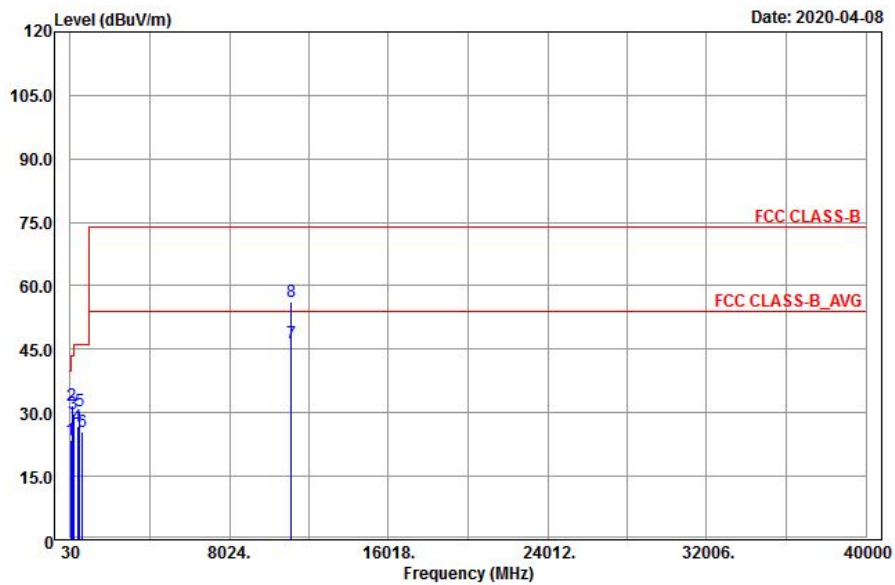
1. Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
2. *: Out of Restricted Band
3. The emission levels of other frequencies were very low against the limit

| EUT Test Condition | | Measurement Detail | |
|--------------------------|--------------------|--------------------|---------------------------|
| Channel | Channel 114 | Frequency Range | 30 MHz ~ 40 GHz |
| Input Power | 120 Vac, 60 Hz | Detector Function | Peak (PK) Average (AV) |
| Environmental Conditions | 25 deg. C, 65 % RH | Tested By | Charles Hsiao |

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m

| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|---------|
| 113.7 | 20.47 | 38.5 | -18.03 | 43.5 | -23.03 | 174 | 154 | Peak |
| 196.05 | 27.75 | 46.11 | -18.36 | 43.5 | -15.75 | 165 | 283 | Peak |
| 217.65 | 35.87 | 53.79 | -17.92 | 46 | -10.13 | 122 | 54 | Peak |
| 403.6 | 26.07 | 39.94 | -13.87 | 46 | -19.93 | 137 | 68 | Peak |
| 639.5 | 23.28 | 33.58 | -10.3 | 46 | -22.72 | 166 | 85 | Peak |
| 835.5 | 23.2 | 30.21 | -7.01 | 46 | -22.8 | 170 | 154 | Peak |
| 11140 | 47.84 | 31.5 | 16.34 | 54 | -6.16 | 136 | 291 | Average |
| 11140 | 57.48 | 41.14 | 16.34 | 74 | -16.52 | 136 | 291 | Peak |

Antenna Polarity & Test Distance: Vertical at 3 m

| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|---------|
| 55.92 | 23.61 | 39.24 | -15.63 | 40 | -16.39 | 165 | 104 | Peak |
| 115.32 | 31.65 | 49.93 | -18.28 | 43.5 | -11.85 | 198 | 215 | Peak |
| 184.44 | 29.67 | 48.91 | -19.24 | 43.5 | -13.83 | 115 | 46 | Peak |
| 405.7 | 26.9 | 40.74 | -13.84 | 46 | -19.1 | 168 | 259 | Peak |
| 498.1 | 30.41 | 42.74 | -12.33 | 46 | -15.59 | 134 | 115 | Peak |
| 644.4 | 25.53 | 35.74 | -10.21 | 46 | -20.47 | 140 | 225 | Peak |
| 11140 | 46.49 | 30.15 | 16.34 | 54 | -7.51 | 175 | 128 | Average |
| 11140 | 56.08 | 39.74 | 16.34 | 74 | -17.92 | 175 | 128 | Peak |

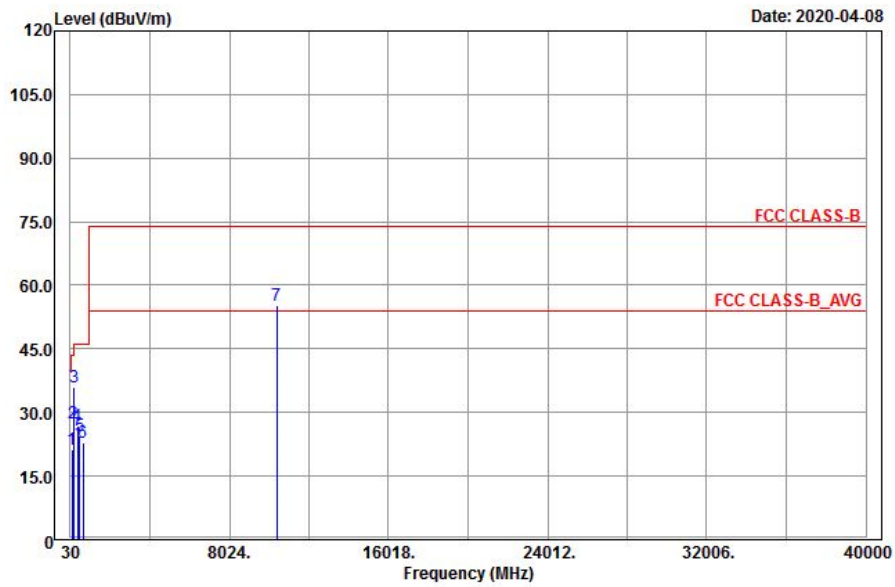
Remarks:

- Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
- *: Out of Restricted Band
- The emission levels of other frequencies were very low against the limit

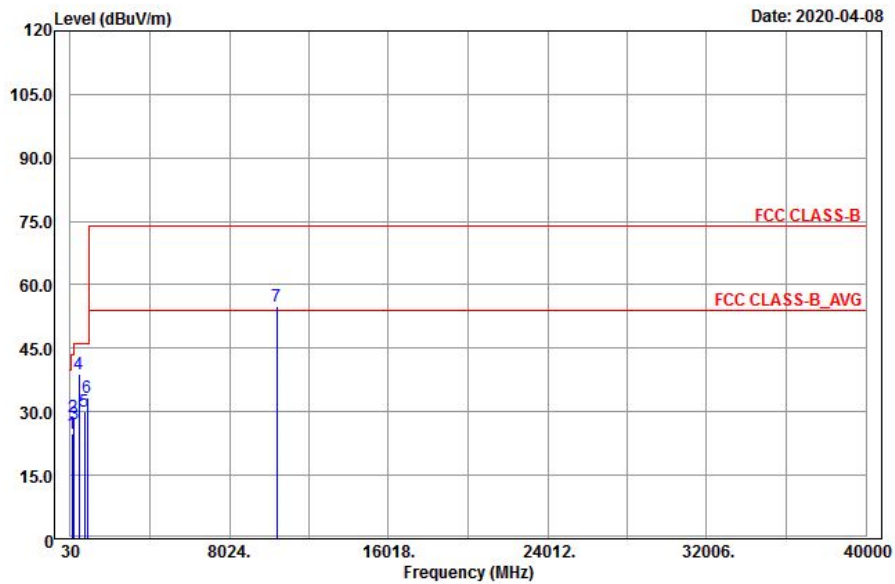
802.11ax (HE80)

| EUT Test Condition | | Measurement Detail | |
|--------------------------|--------------------|--------------------|---------------------------|
| Channel | Channel 42 | Frequency Range | 30 MHz ~ 40 GHz |
| Input Power | 120 Vac, 60 Hz | Detector Function | Peak (PK) Average (AV) |
| Environmental Conditions | 25 deg. C, 65 % RH | Tested By | Charles Hsiao |

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m

| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|--------|
| 115.05 | 21.36 | 39.64 | -18.28 | 43.5 | -22.14 | 172 | 115 | Peak |
| 183.63 | 27.4 | 46.74 | -19.34 | 43.5 | -16.1 | 189 | 235 | Peak |
| 222.51 | 35.87 | 53.63 | -17.76 | 46 | -10.13 | 175 | 114 | Peak |
| 405 | 26.96 | 40.8 | -13.84 | 46 | -19.04 | 101 | 43 | Peak |
| 483.4 | 24.44 | 37.09 | -12.65 | 46 | -21.56 | 186 | 235 | Peak |
| 672.4 | 22.95 | 32.56 | -9.61 | 46 | -23.05 | 175 | 134 | Peak |
| *10420 | 55.38 | 39.22 | 16.16 | 68.2 | -12.82 | 209 | 104 | Peak |

Antenna Polarity & Test Distance: Vertical at 3 m

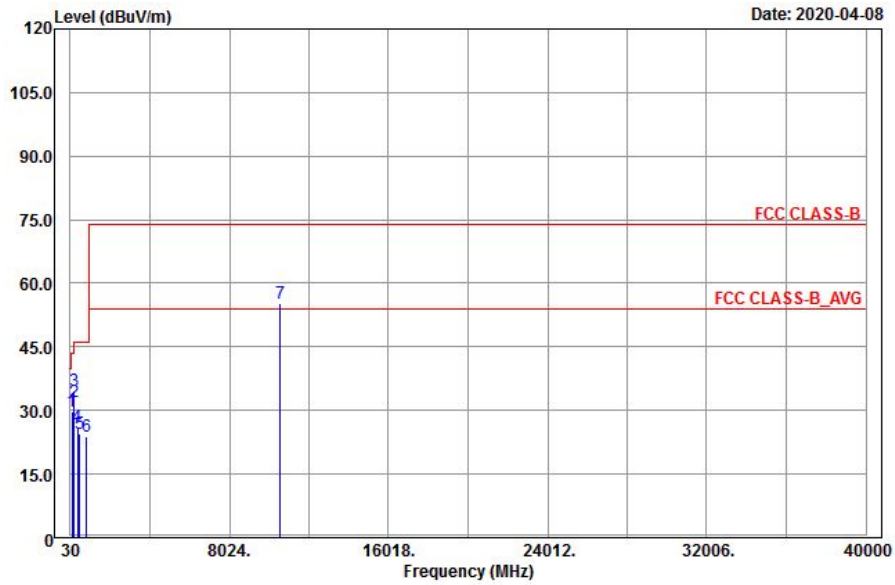
| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|--------|
| 107.22 | 24.89 | 42.26 | -17.37 | 43.5 | -18.61 | 138 | 26 | Peak |
| 183.9 | 28.79 | 48.03 | -19.24 | 43.5 | -14.71 | 177 | 154 | Peak |
| 217.65 | 27.3 | 45.22 | -17.92 | 46 | -18.7 | 186 | 235 | Peak |
| 463.8 | 39.06 | 52.13 | -13.07 | 46 | -6.94 | 148 | 117 | Peak |
| 731.2 | 30.11 | 38.77 | -8.66 | 46 | -15.89 | 169 | 230 | Peak |
| 893.6 | 33.21 | 39.22 | -6.01 | 46 | -12.79 | 121 | 156 | Peak |
| *10420 | 55.07 | 38.91 | 16.16 | 68.2 | -13.13 | 169 | 154 | Peak |

Remarks:

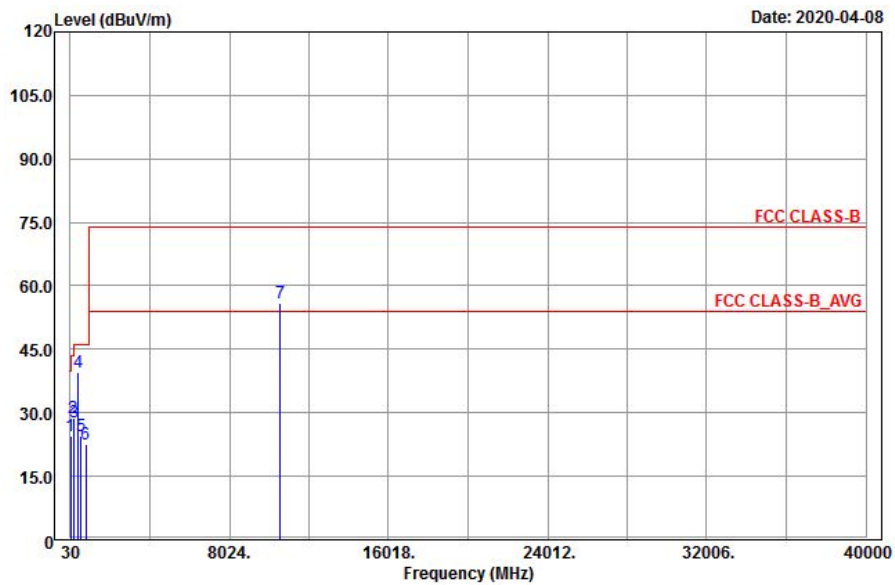
- Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
- *: Out of Restricted Band
- The emission levels of other frequencies were very low against the limit

| EUT Test Condition | | Measurement Detail | |
|--------------------------|--------------------|--------------------|---------------------------|
| Channel | Channel 58 | Frequency Range | 30 MHz ~ 40 GHz |
| Input Power | 120 Vac, 60 Hz | Detector Function | Peak (PK) Average (AV) |
| Environmental Conditions | 25 deg. C, 65 % RH | Tested By | Charles Hsiao |

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m

| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|--------|
| 130.71 | 29.7 | 50.2 | -20.5 | 43.5 | -13.8 | 148 | 112 | Peak |
| 208.2 | 32.15 | 50.3 | -18.15 | 43.5 | -11.35 | 179 | 36 | Peak |
| 224.67 | 34.72 | 52.34 | -17.62 | 46 | -11.28 | 150 | 143 | Peak |
| 405 | 26.27 | 40.11 | -13.84 | 46 | -19.73 | 186 | 229 | Peak |
| 500.9 | 24.48 | 36.77 | -12.29 | 46 | -21.52 | 188 | 134 | Peak |
| 846 | 23.9 | 30.77 | -6.87 | 46 | -22.1 | 127 | 154 | Peak |
| *10580 | 55.17 | 39.46 | 15.71 | 68.2 | -13.03 | 146 | 135 | Peak |

Antenna Polarity & Test Distance: Vertical at 3 m

| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|--------|
| 55.65 | 24.62 | 40.11 | -15.49 | 40 | -15.38 | 102 | 341 | Peak |
| 184.17 | 28.74 | 47.98 | -19.24 | 43.5 | -14.76 | 167 | 265 | Peak |
| 221.16 | 27.64 | 45.45 | -17.81 | 46 | -18.36 | 121 | 132 | Peak |
| 430.2 | 39.6 | 53.12 | -13.52 | 46 | -6.4 | 166 | 87 | Peak |
| 554.1 | 24.67 | 36.18 | -11.51 | 46 | -21.33 | 143 | 251 | Peak |
| 806.1 | 22.66 | 30.18 | -7.52 | 46 | -23.34 | 150 | 72 | Peak |
| *10580 | 55.77 | 40.06 | 15.71 | 68.2 | -12.43 | 166 | 195 | Peak |

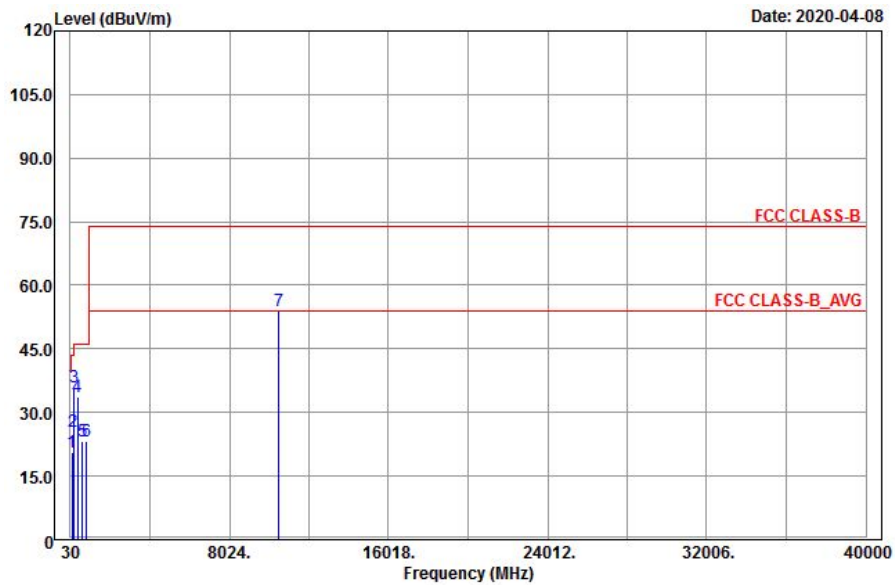
Remarks:

- Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
- *: Out of Restricted Band
- The emission levels of other frequencies were very low against the limit

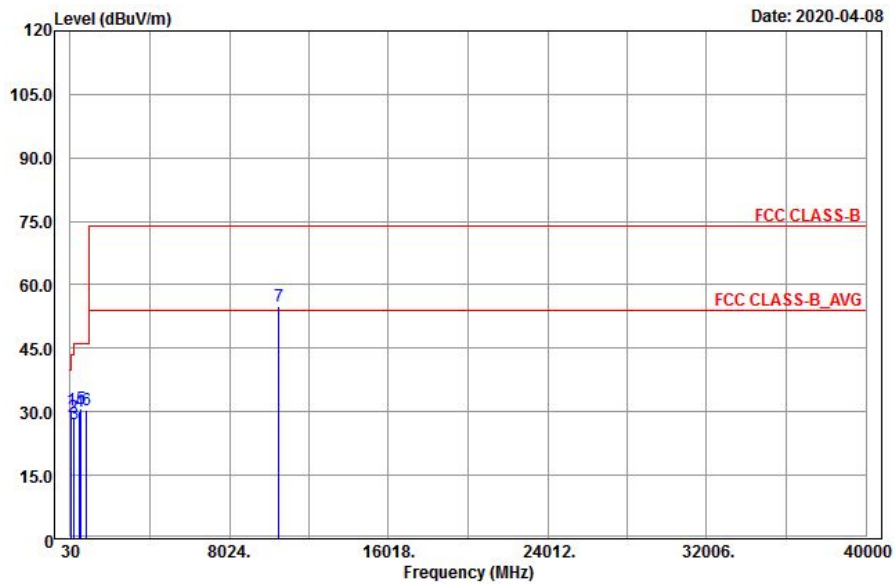
802.11ax (HE160)

| EUT Test Condition | | Measurement Detail | |
|--------------------------|--------------------|--------------------|---------------------------|
| Channel | Channel 50 | Frequency Range | 30 MHz ~ 40 GHz |
| Input Power | 120 Vac, 60 Hz | Detector Function | Peak (PK) Average (AV) |
| Environmental Conditions | 25 deg. C, 65 % RH | Tested By | Charles Hsiao |

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m

| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|--------|
| 112.89 | 20.73 | 38.64 | -17.91 | 43.5 | -22.77 | 145 | 117 | Peak |
| 177.69 | 25.61 | 45.44 | -19.83 | 43.5 | -17.89 | 163 | 226 | Peak |
| 218.73 | 35.84 | 53.72 | -17.88 | 46 | -10.16 | 120 | 173 | Peak |
| 406.4 | 33.62 | 47.44 | -13.82 | 46 | -12.38 | 165 | 121 | Peak |
| 639.5 | 23.27 | 33.57 | -10.3 | 46 | -22.73 | 130 | 25 | Peak |
| 834.8 | 23.06 | 30.07 | -7.01 | 46 | -22.94 | 145 | 188 | Peak |
| *10500 | 54.06 | 38.23 | 15.83 | 68.2 | -14.14 | 159 | 204 | Peak |

Antenna Polarity & Test Distance: Vertical at 3 m

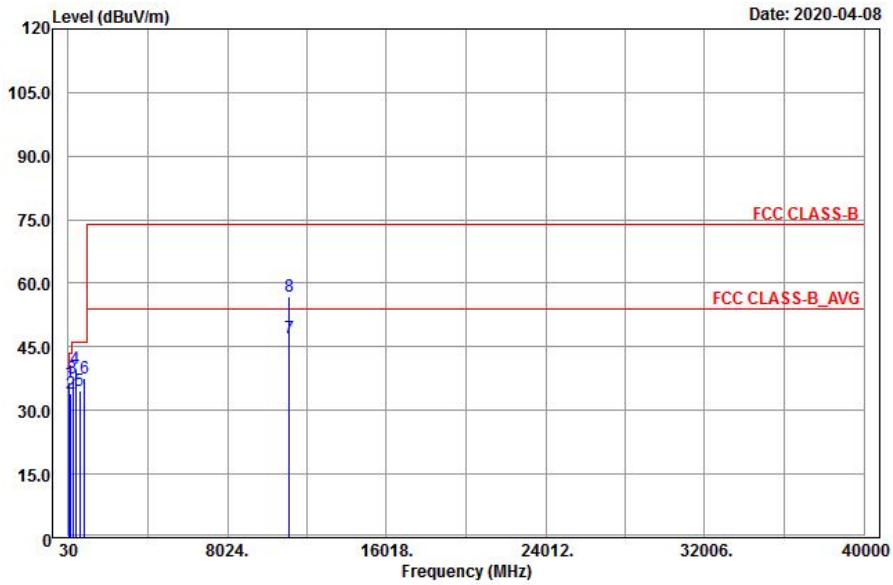
| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|--------|
| 65.37 | 30.37 | 47.88 | -17.51 | 40 | -9.63 | 130 | 87 | Peak |
| 184.17 | 28.67 | 47.91 | -19.24 | 43.5 | -14.83 | 174 | 156 | Peak |
| 222.78 | 27.16 | 44.87 | -17.71 | 46 | -18.84 | 165 | 297 | Peak |
| 491.1 | 29.96 | 42.45 | -12.49 | 46 | -16.04 | 161 | 76 | Peak |
| 552 | 30.73 | 42.27 | -11.54 | 46 | -15.27 | 100 | 105 | Peak |
| 843.9 | 30.41 | 37.31 | -6.9 | 46 | -15.59 | 121 | 134 | Peak |
| *10500 | 54.89 | 39.06 | 15.83 | 68.2 | -13.31 | 142 | 171 | Peak |

Remarks:

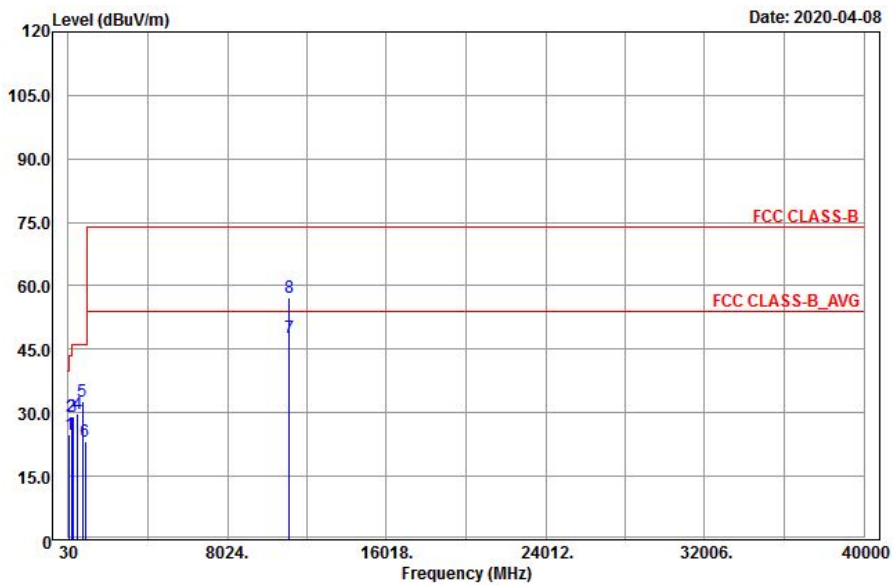
- Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
- *: Out of Restricted Band
- The emission levels of other frequencies were very low against the limit

| EUT Test Condition | | Measurement Detail | |
|--------------------------|--------------------|--------------------|---------------------------|
| Channel | Channel 114 | Frequency Range | 30 MHz ~ 40 GHz |
| Input Power | 120 Vac, 60 Hz | Detector Function | Peak (PK) Average (AV) |
| Environmental Conditions | 25 deg. C, 65 % RH | Tested By | Charles Hsiao |

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m

| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|---------|
| 93.18 | 36.74 | 55.05 | -18.31 | 43.5 | -6.76 | 120 | 76 | Peak |
| 165.27 | 33.94 | 54.39 | -20.45 | 43.5 | -9.56 | 195 | 243 | Peak |
| 250.32 | 37.49 | 54.32 | -16.83 | 46 | -8.51 | 154 | 112 | Peak |
| 396.6 | 40.01 | 54.02 | -14.01 | 46 | -5.99 | 145 | 112 | Peak |
| 603.1 | 34.7 | 45.22 | -10.52 | 46 | -11.3 | 184 | 356 | Peak |
| 848.8 | 37.73 | 44.56 | -6.83 | 46 | -8.27 | 120 | 142 | Peak |
| 11140 | 47.21 | 30.87 | 16.34 | 54 | -6.79 | 124 | 166 | Average |
| 11140 | 56.77 | 40.43 | 16.34 | 74 | -17.23 | 124 | 166 | Peak |

Antenna Polarity & Test Distance: Vertical at 3 m

| Frequency (MHz) | Emission Level (dBuV/m) | Read Level (dBuV) | Factor (dB/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (cm) | Table Angle (Degree) | Remark |
|-----------------|-------------------------|-------------------|---------------|----------------|-------------|---------------------|----------------------|---------|
| 74.01 | 24.85 | 45.73 | -20.88 | 40 | -15.15 | 163 | 129 | Peak |
| 184.44 | 29.04 | 48.28 | -19.24 | 43.5 | -14.46 | 149 | 124 | Peak |
| 239.52 | 29.26 | 46.31 | -17.05 | 46 | -16.74 | 115 | 181 | Peak |
| 482.7 | 29.88 | 42.53 | -12.65 | 46 | -16.12 | 177 | 125 | Peak |
| 743.1 | 32.69 | 41.23 | -8.54 | 46 | -13.31 | 164 | 128 | Peak |
| 864.2 | 23.06 | 29.55 | -6.49 | 46 | -22.94 | 155 | 87 | Peak |
| 11140 | 47.68 | 31.34 | 16.34 | 54 | -6.32 | 161 | 27 | Average |
| 11140 | 57.14 | 40.8 | 16.34 | 74 | -16.86 | 161 | 27 | Peak |

Remarks:

- Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
- *: Out of Restricted Band
- The emission levels of other frequencies were very low against the limit

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) (Max. e.i.r.p \leq 125 mW (21 dBm) at any elevation angle above 30 degrees as measured from the horizon) |
| | Fixed point-to-point Access Point | 1 Watt (30 dBm) |
| | Indoor Access Point | 1 Watt (30 dBm) |
| | √ Mobile and Portable client device | 250 mW (24 dBm) |
| U-NII-2A | √ | 250 mW (24 dBm) or 11 dBm + 10 log B* |
| U-NII-2C | √ | 250 mW (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 $N_{ANT} \leq 4$;

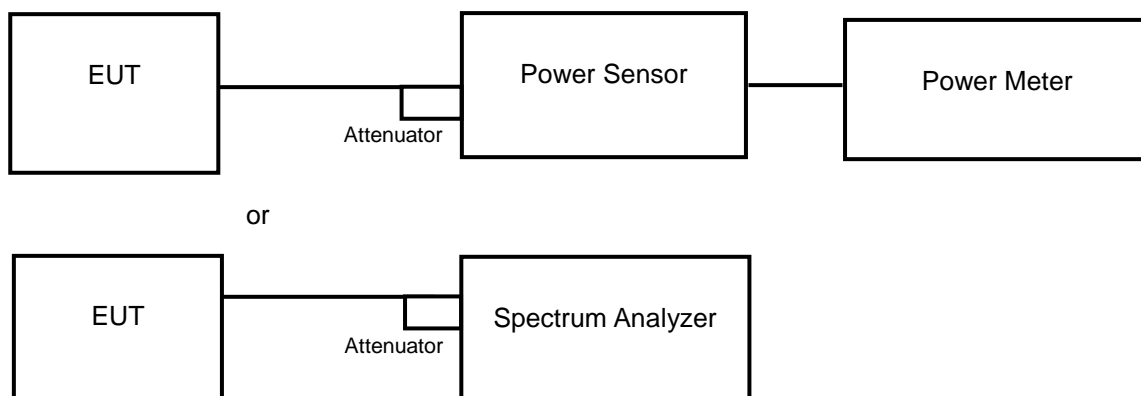
Array Gain = 0 dB (i.e., no array gain) for channel widths \geq 40 MHz for any N_{ANT} ;

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

<Power Output Measurement>



4.2.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.2.4 Test Procedure

Average Power Measurement

<802.11a, 802.11n (HT20), 802.11n (HT40), 802.11ac (VHT80), 802.11HE (VHT160)>

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 Conditions

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

Power Output:

802.11ac (VHT80)

| Channel | Frequency (MHz) | Maximum Conducted Power (dBm) | | Total Power (mW) | Total Power (dBm) | Power Limit (dBm) | Pass / Fail |
|---------|-----------------|-------------------------------|---------|------------------|-------------------|-------------------|-------------|
| | | Chain 0 | Chain 1 | | | | |
| 42 | 5210 | 15.44 | 15.37 | 69.43 | 18.42 | 24 | Pass |
| 58 | 5290 | 13.94 | 13.99 | 49.835 | 16.98 | 24 | Pass |

802.11ac (VHT160)

| Channel | Frequency (MHz) | Maximum Conducted Power (dBm) | | Total Power (mW) | Total Power (dBm) | Power Limit (dBm) | Pass / Fail |
|---------|-----------------|-------------------------------|---------|------------------|-------------------|-------------------|-------------|
| | | Chain 0 | Chain 1 | | | | |
| 50 | 5250 | 12.18 | 12.17 | 33.001 | 15.19 | 24 | Pass |
| 114 | 5570 | 12.69 | 12.73 | 37.328 | 15.72 | 24 | Pass |

802.11ax (HE80)

| Channel | Frequency (MHz) | Maximum Conducted Power (dBm) | | Total Power (mW) | Total Power (dBm) | Power Limit (dBm) | Pass / Fail |
|---------|-----------------|-------------------------------|---------|------------------|-------------------|-------------------|-------------|
| | | Chain 0 | Chain 1 | | | | |
| 42 | 5210 | 15.42 | 15.45 | 69.909 | 18.45 | 24 | Pass |
| 58 | 5290 | 13.78 | 13.96 | 48.767 | 16.88 | 24 | Pass |

802.11ax (HE160)

| Channel | Frequency (MHz) | Maximum Conducted Power (dBm) | | Total Power (mW) | Total Power (dBm) | Power Limit (dBm) | Pass / Fail |
|---------|-----------------|-------------------------------|---------|------------------|-------------------|-------------------|-------------|
| | | Chain 0 | Chain 1 | | | | |
| 50 | 5250 | 12.17 | 12.04 | 32.477 | 15.12 | 24 | Pass |
| 114 | 5570 | 12.69 | 12.61 | 36.817 | 15.66 | 24 | Pass |

4.3 Conducted Bandedge Measurement

4.3.1 Limits of Conducted Bandedge Measurement

| Radiated versus Conducted Measurement | |
|---|---|
| <input checked="" type="checkbox"/> Conducted measurement | <input type="checkbox"/> Radiated measurement |
| <p><u>For Radiated measurement:</u> 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> 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. (Composite gain = 3.62dBi + 10log(2) = 6.63dBi)</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>d. In restricted bands below 1000 MHz, add upper bound on ground plane reflection: For f = 30 – 1000 MHz, add 4.7 dB.</p> <p>Note: The conducted emission test was considered some factor to compute test result.</p> |

4.3.2 Test Procedure Measurement

Following FCC KDB 558074 D01 DTS Meas. Guidance :

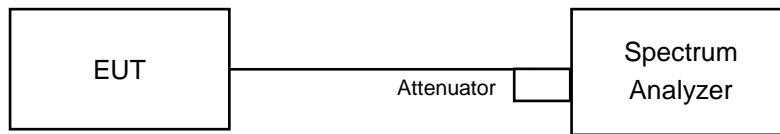
Radiated versus Conducted Measurements.

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)

4.3.3 Test Setup



4.3.4 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

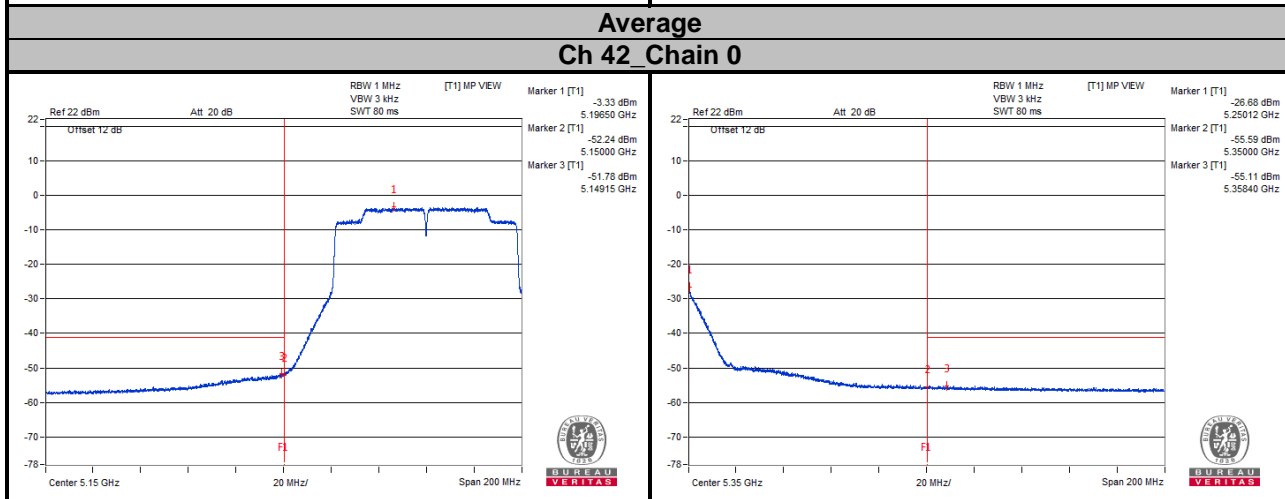
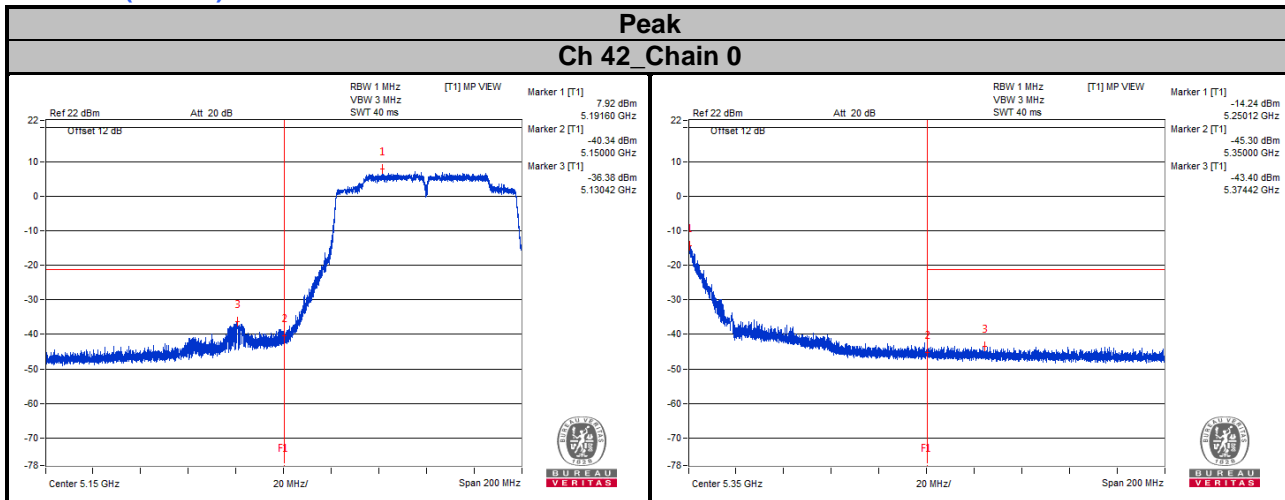
4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Condition

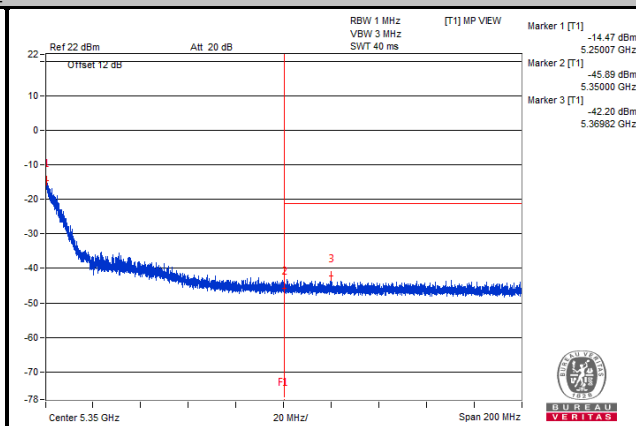
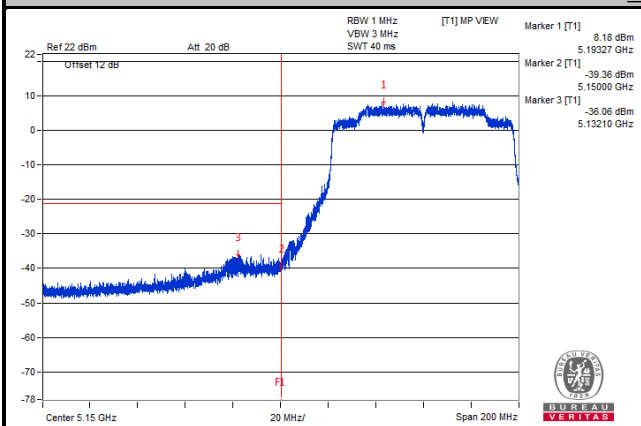
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

802.11ac (VHT80)

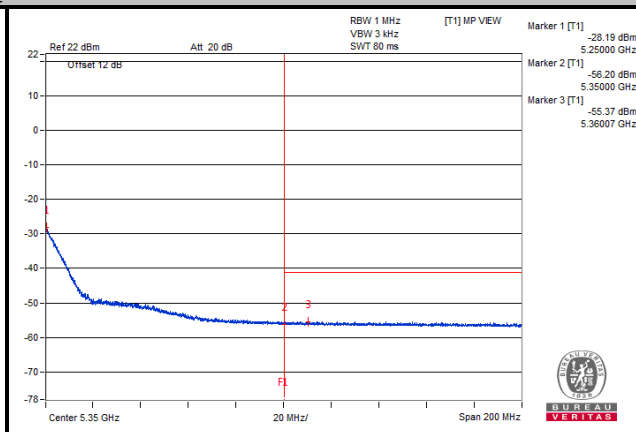
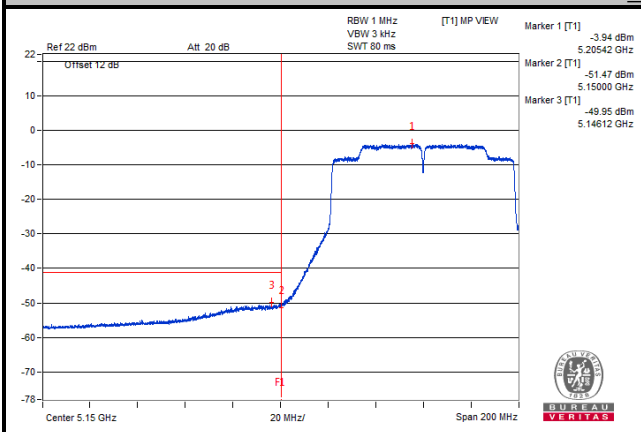


Note: VIEW is just to prevent pulse from entering. The method is using maxhold first, wait to waveform stable then view.

Peak Ch 42 Chain 1

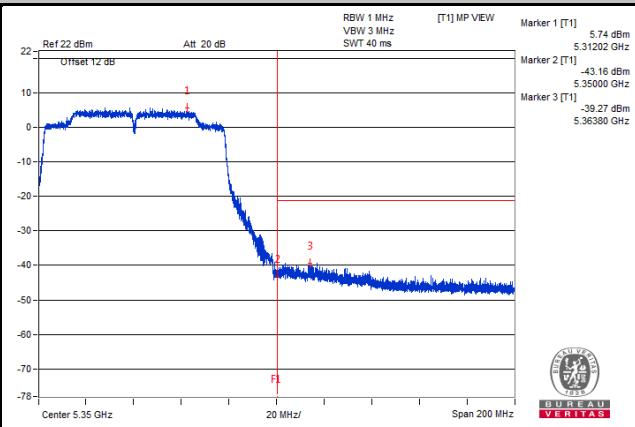
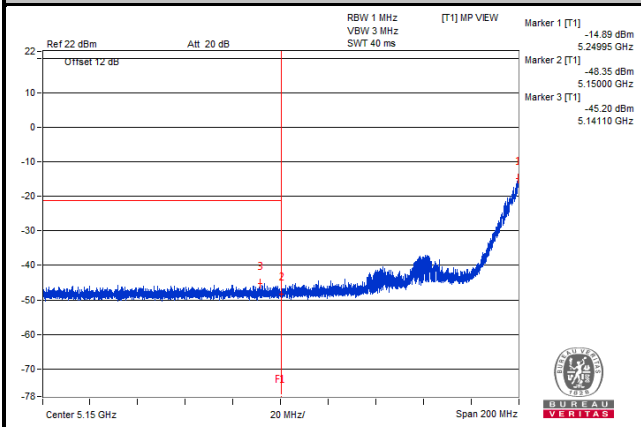


Average Ch 42 Chain 1

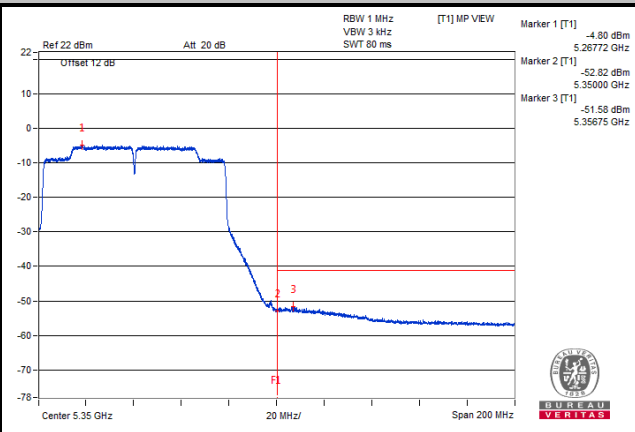
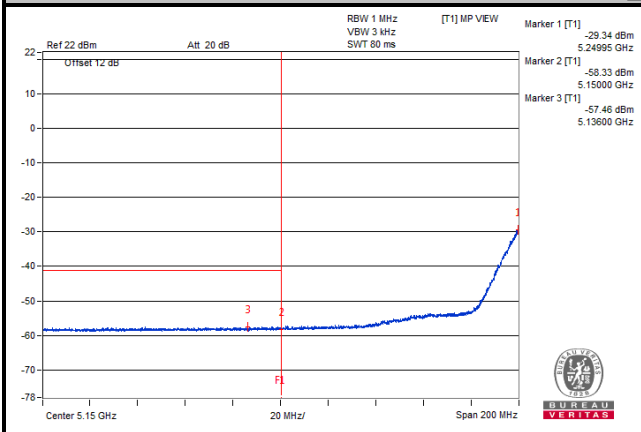


Note: VIEW is just to prevent pulse from entering. The method is using maxhold first, wait to waveform stable then view.

Peak Ch 58 Chain 0

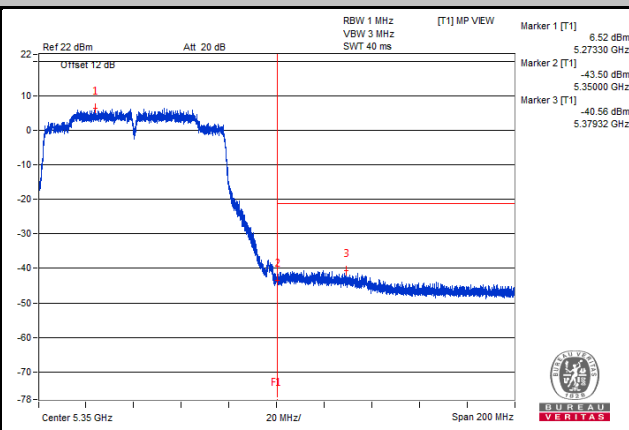
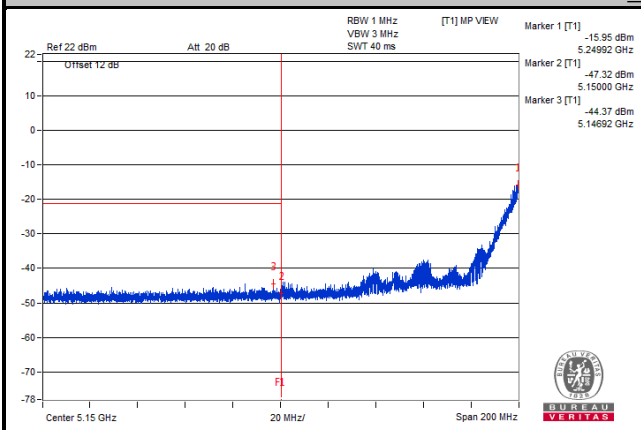


Average Ch 58 Chain 0

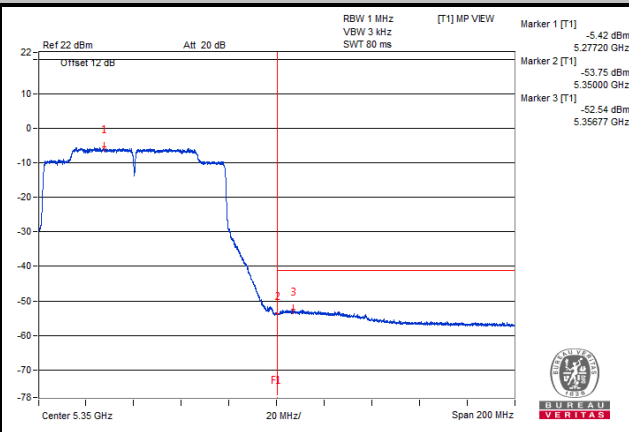
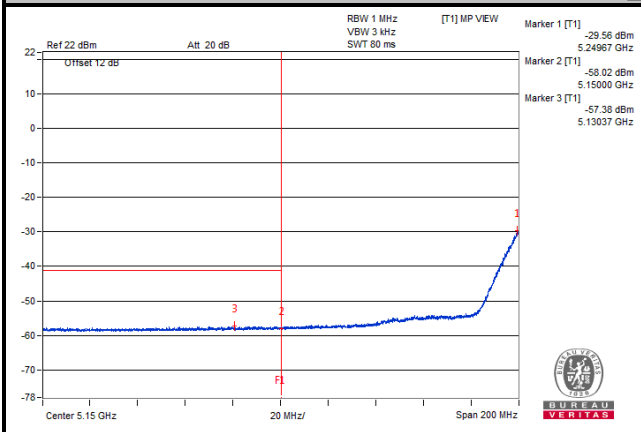


Note: VIEW is just to prevent pulse from entering. The method is using maxhold first, wait to waveform stable then view.

Peak Ch 58 Chain 1

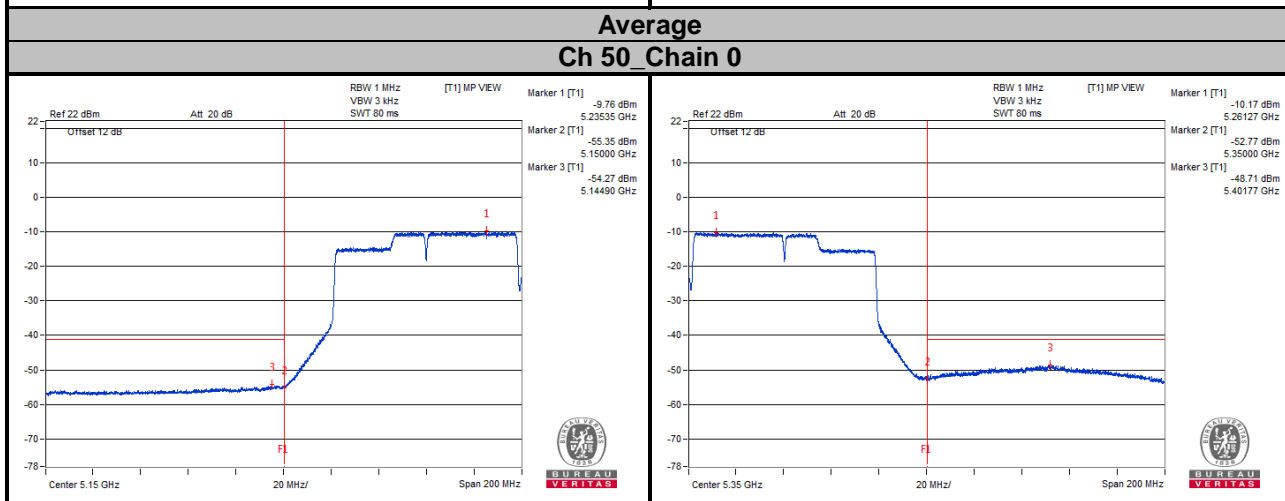
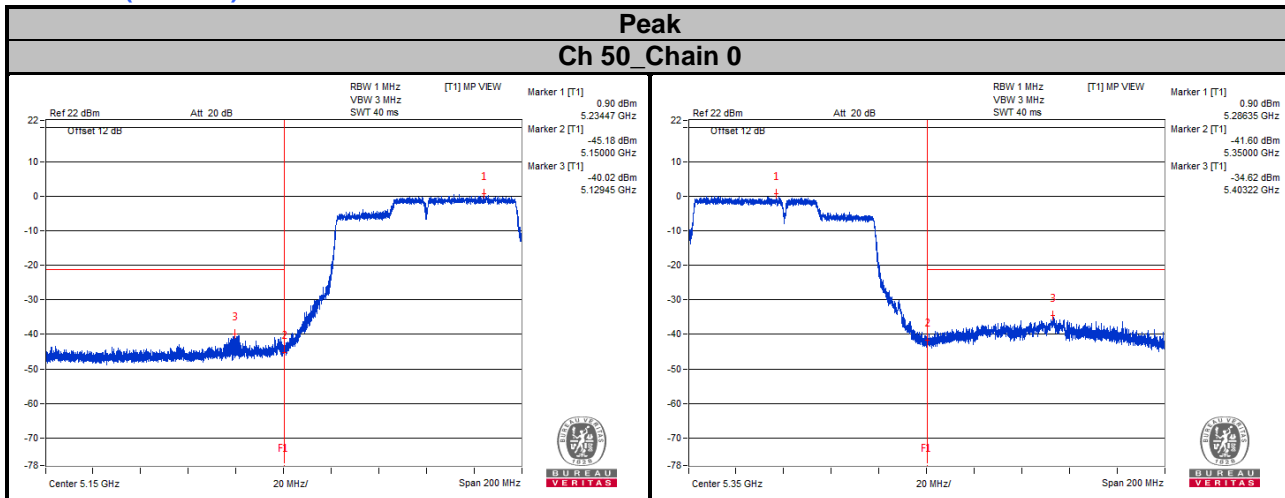


Average Ch 58 Chain 1



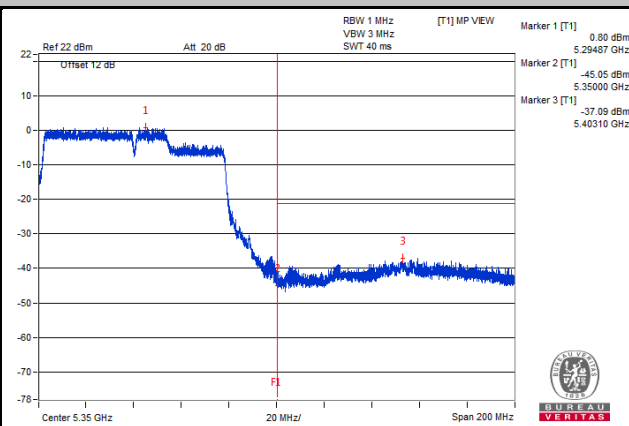
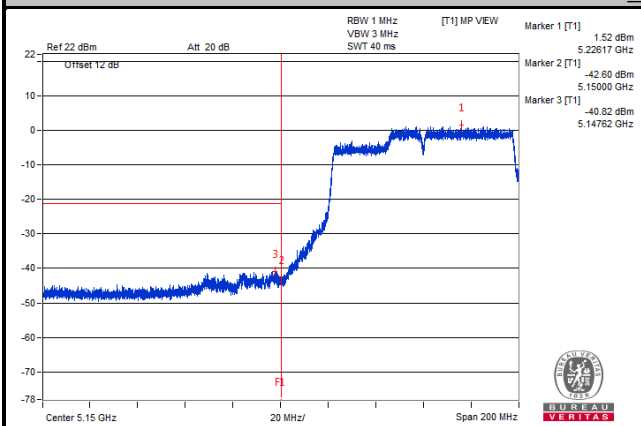
Note: VIEW is just to prevent pulse from entering. The method is using maxhold first, wait to waveform stable then view.

802.11ac (VHT160)

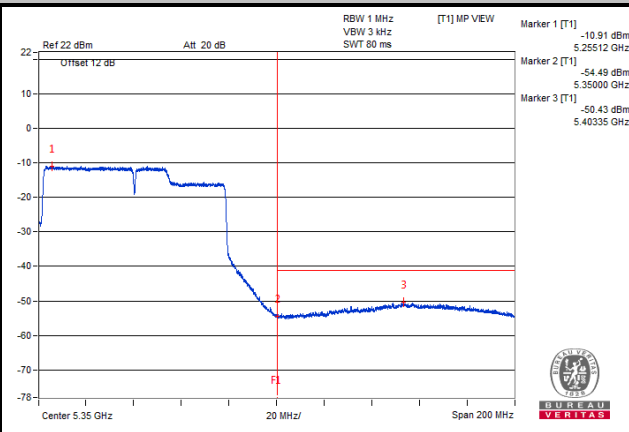
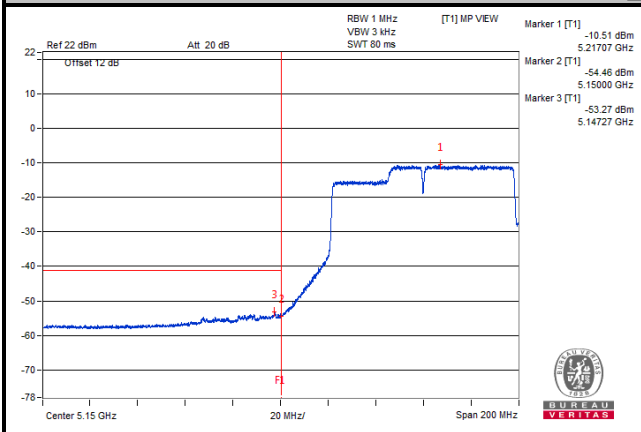


Note: VIEW is just to prevent pulse from entering. The method is using maxhold first, wait to waveform stable then view.

Peak Ch 50 Chain 1

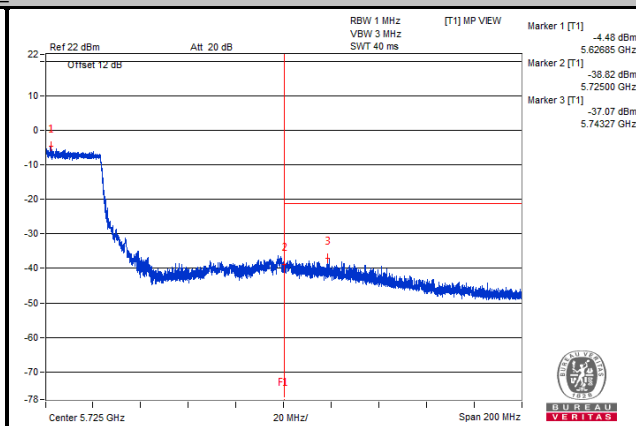
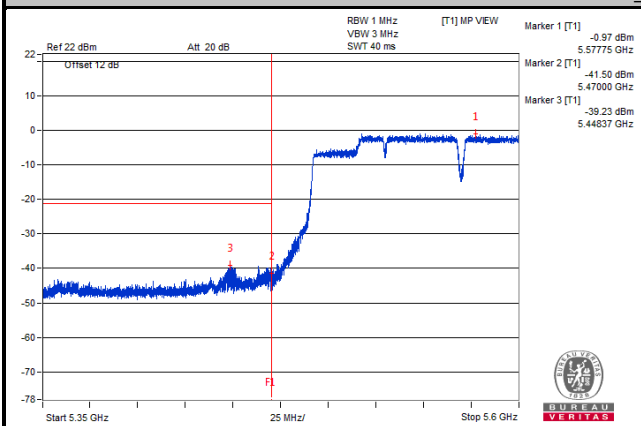


Average Ch 50 Chain 1

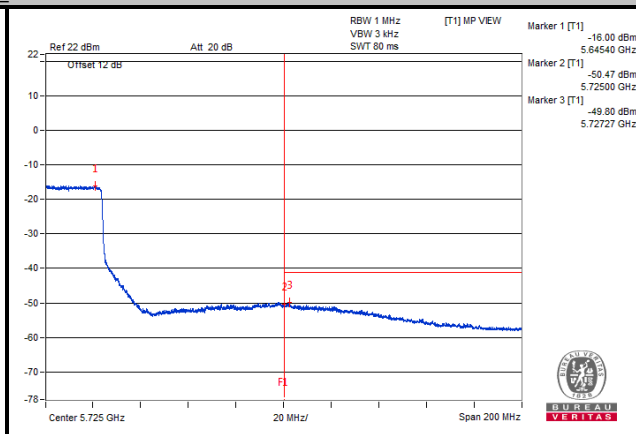
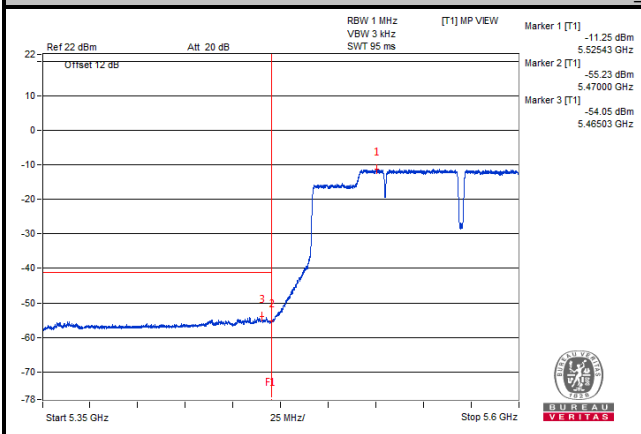


Note: VIEW is just to prevent pulse from entering. The method is using maxhold first, wait to waveform stable then view.

Peak Ch 114 Chain 0

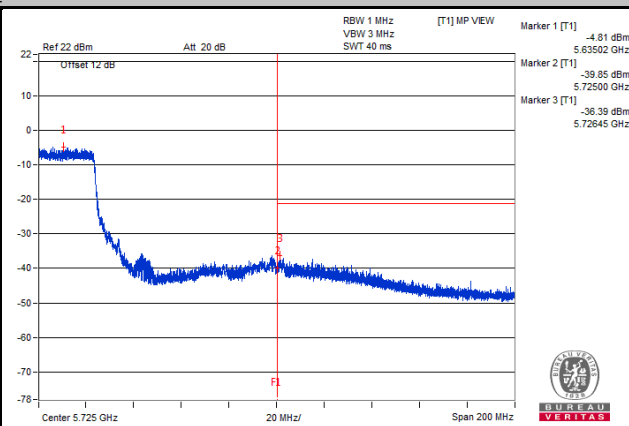
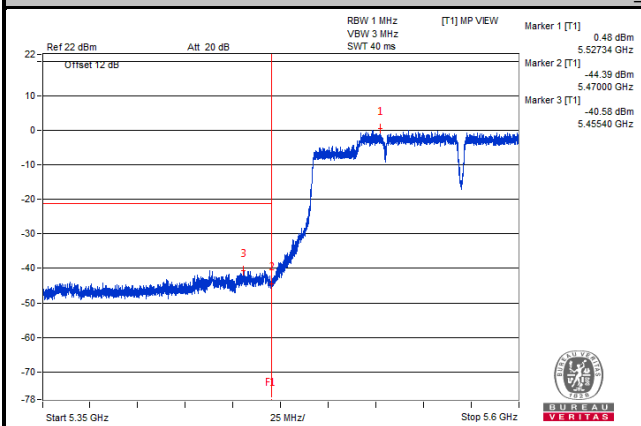


Average Ch 114 Chain 0

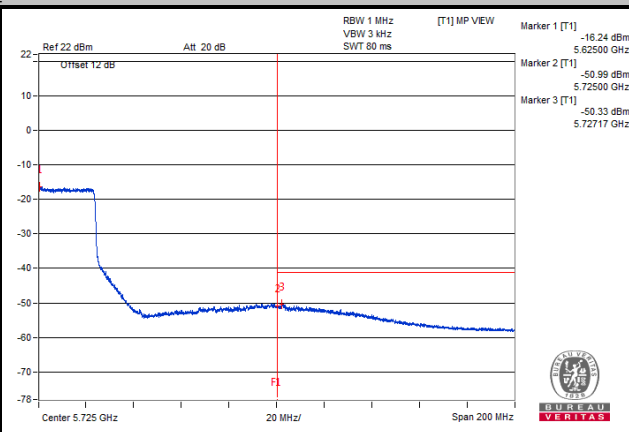
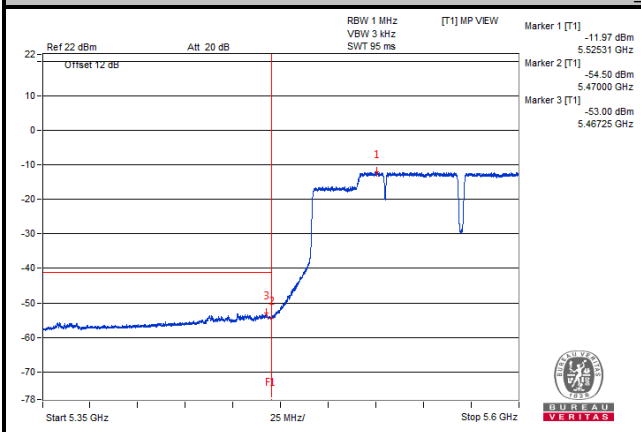


Note: VIEW is just to prevent pulse from entering. The method is using maxhold first, wait to waveform stable then view.

Peak Ch 114 Chain 1

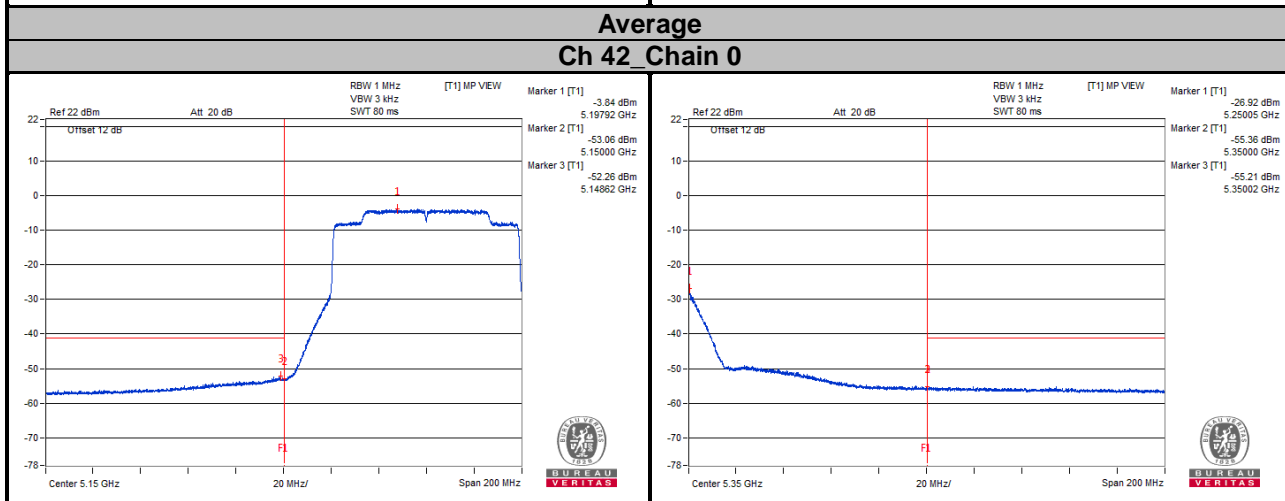
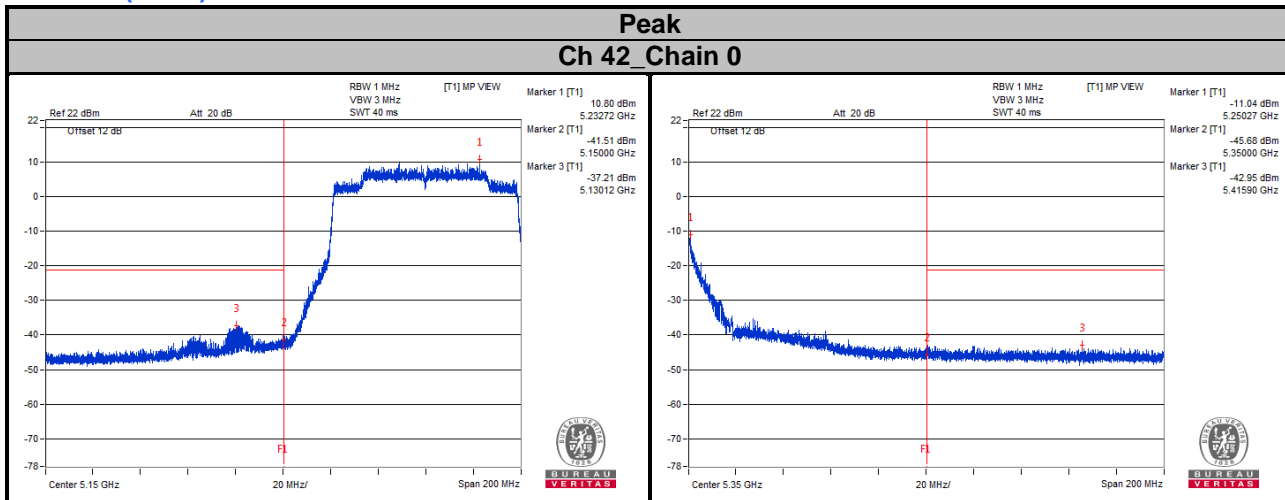


Average Ch 114 Chain 1



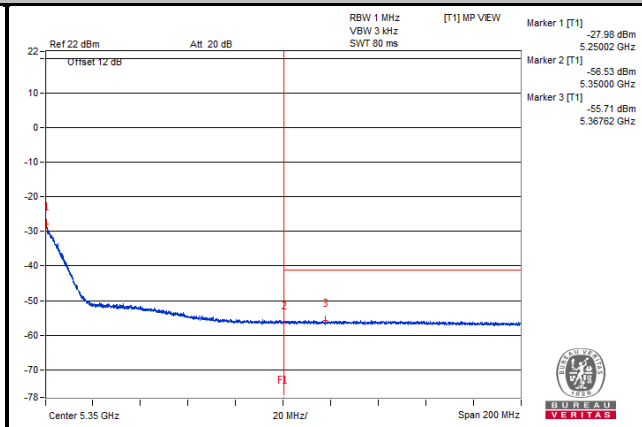
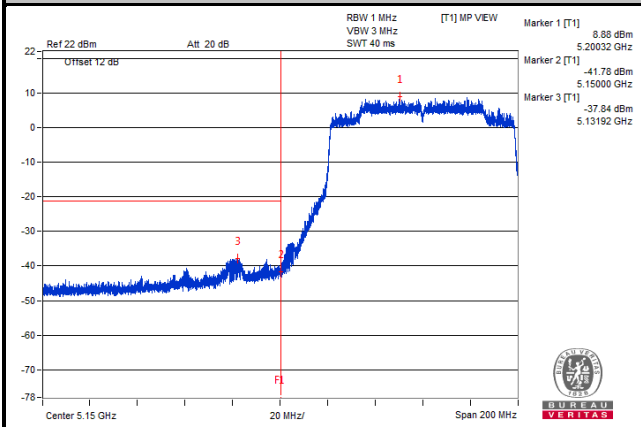
Note: VIEW is just to prevent pulse from entering. The method is using maxhold first, wait to waveform stable then view.

802.11ax (HE80)

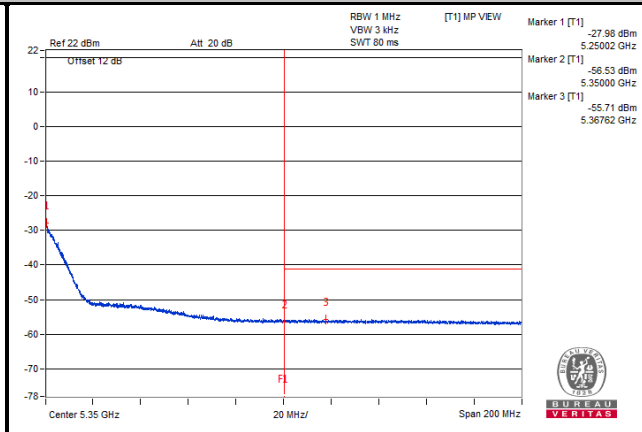
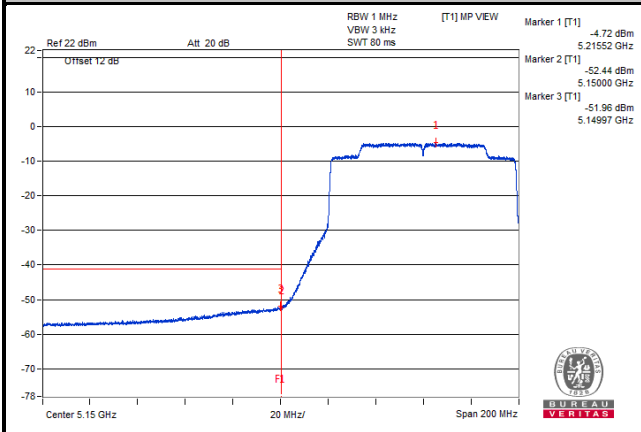


Note: VIEW is just to prevent pulse from entering. The method is using maxhold first, wait to waveform stable then view.

Peak Ch 42_Chain 1

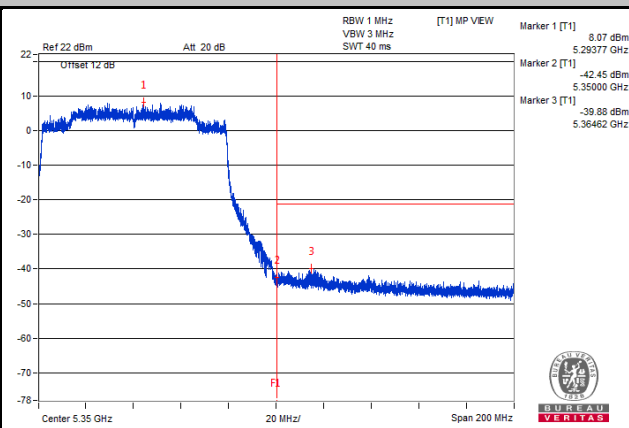
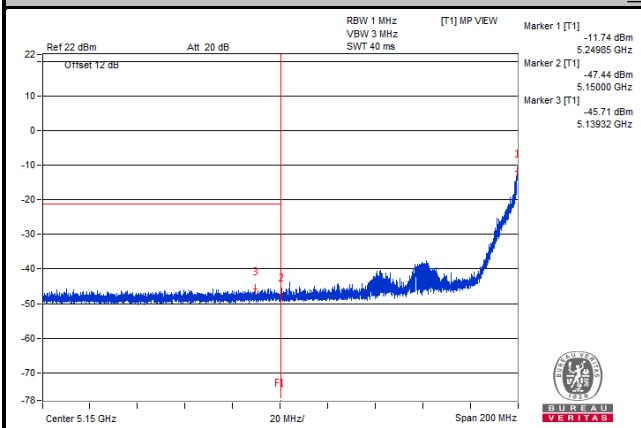


Average Ch 42_Chain 1

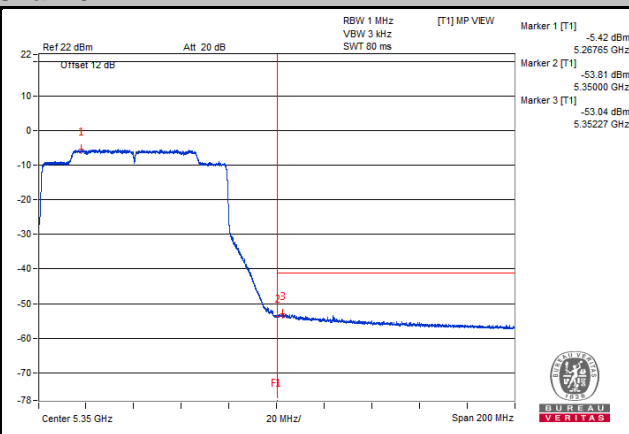
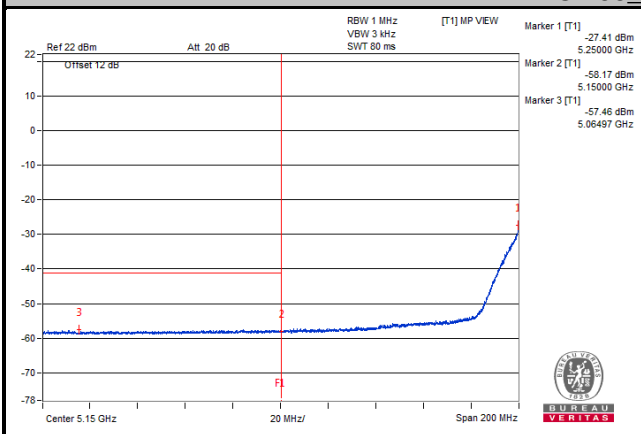


Note: VIEW is just to prevent pulse from entering. The method is using maxhold first, wait to waveform stable then view.

Peak Ch 58 Chain 0

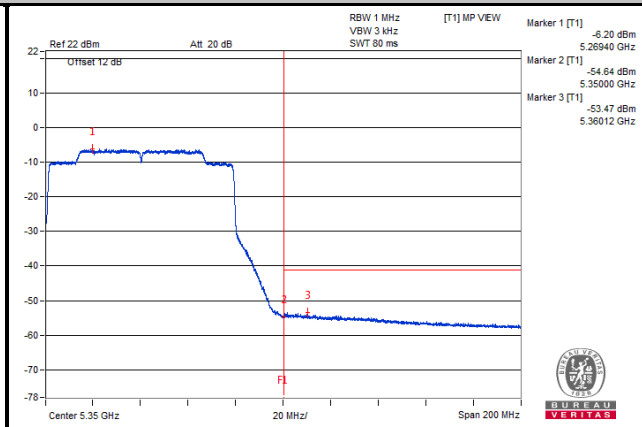
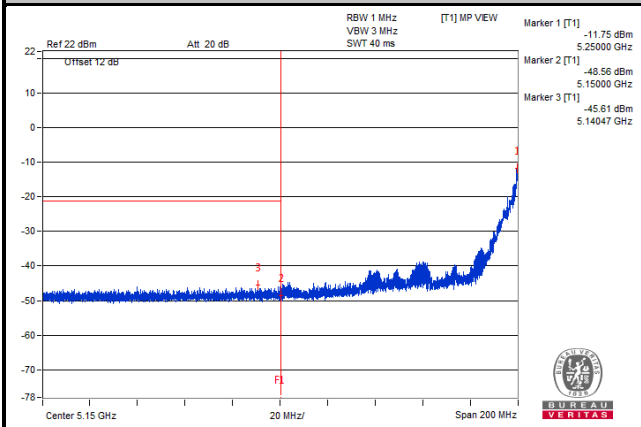


Average Ch 58 Chain 0

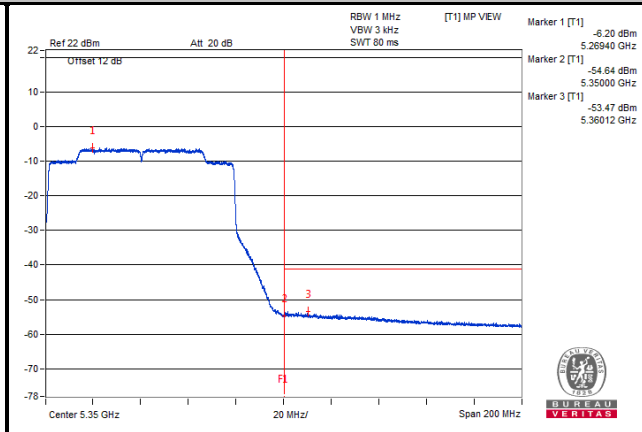
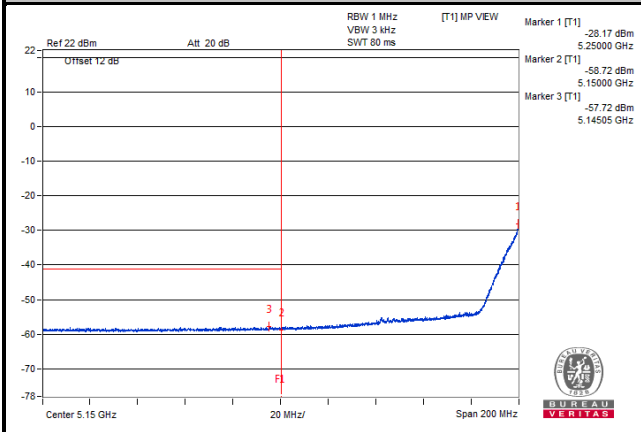


Note: VIEW is just to prevent pulse from entering. The method is using maxhold first, wait to waveform stable then view.

Peak Ch 58 Chain 1

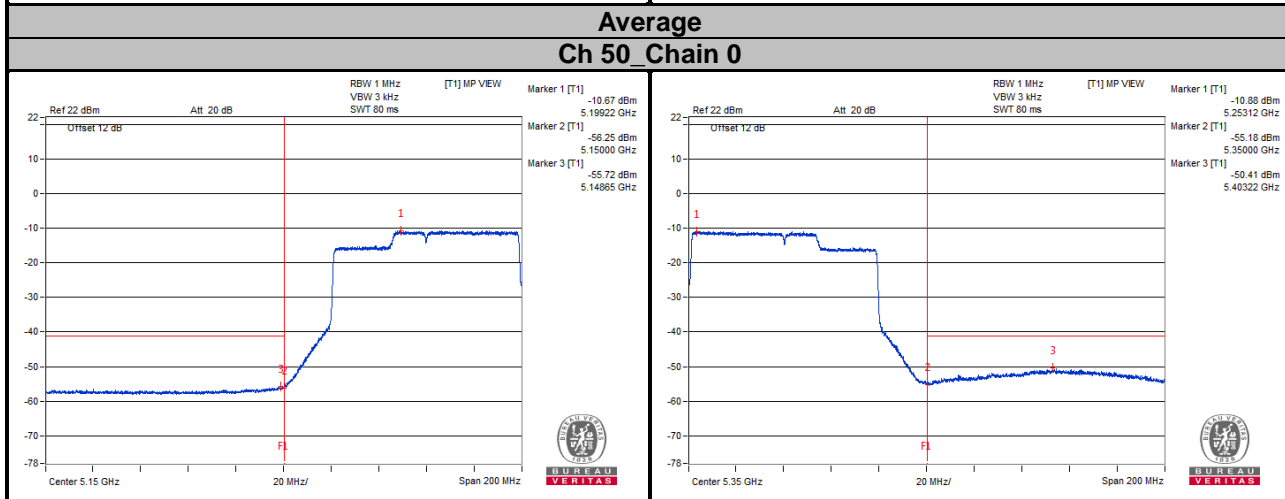
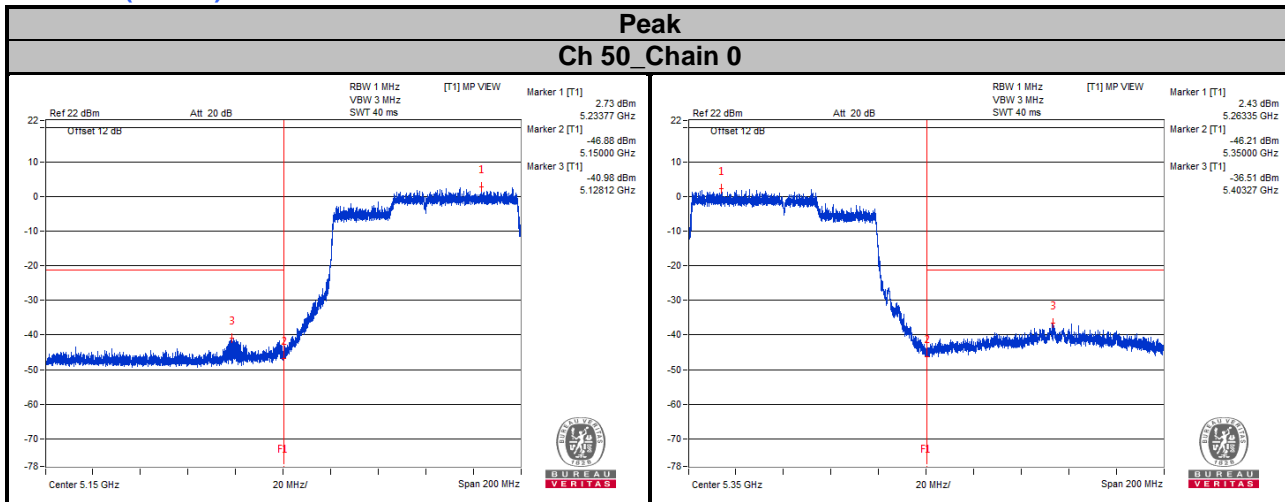


Average Ch 58 Chain 1



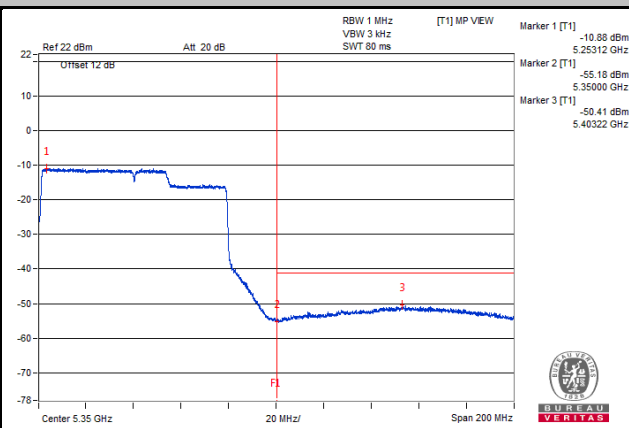
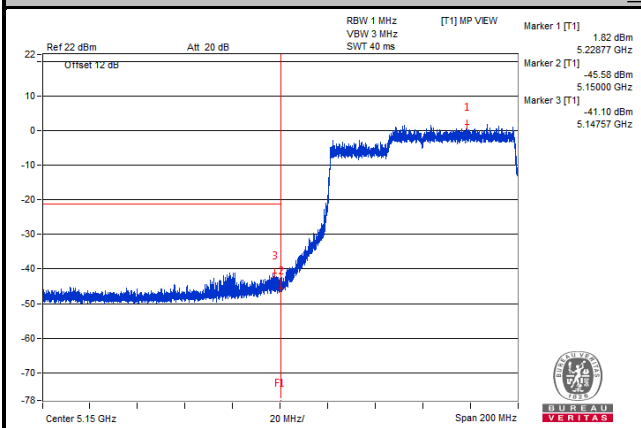
Note: VIEW is just to prevent pulse from entering. The method is using maxhold first, wait to waveform stable then view.

802.11ax (HE160)

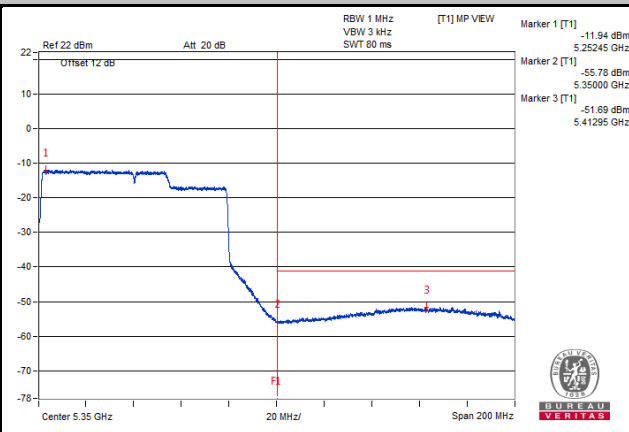
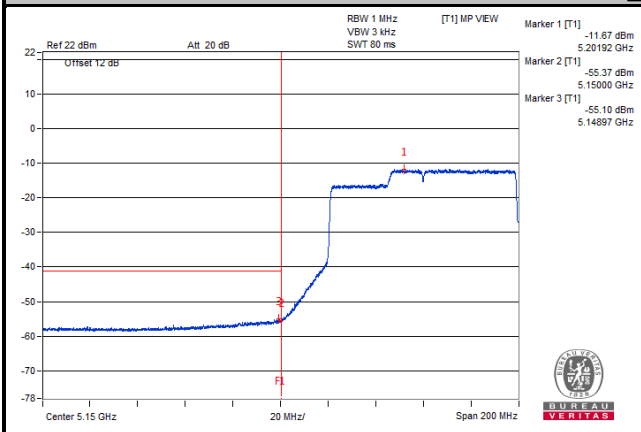


Note: VIEW is just to prevent pulse from entering. The method is using maxhold first, wait to waveform stable then view.

Peak Ch 50_Chain 1

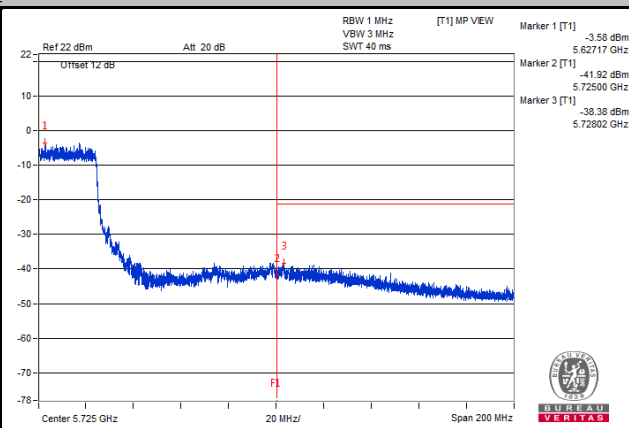
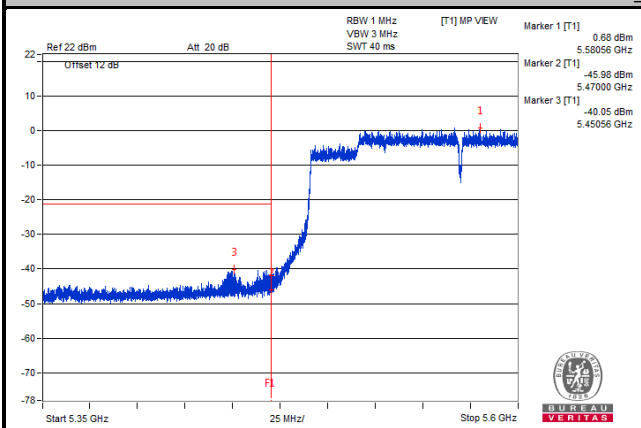


Average Ch 50_Chain 1

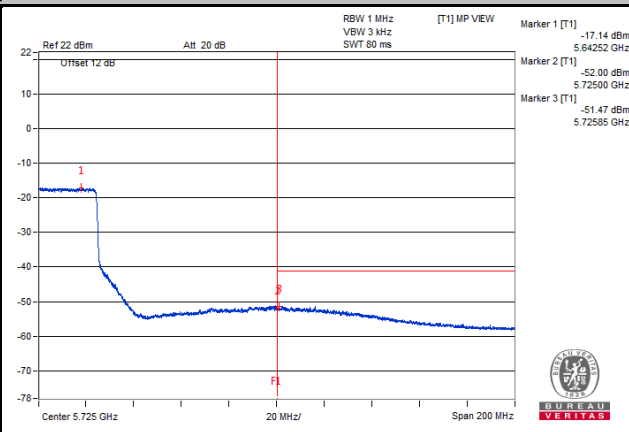
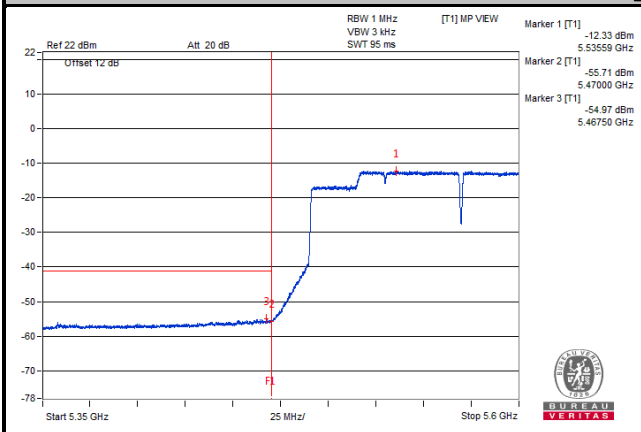


Note: VIEW is just to prevent pulse from entering. The method is using maxhold first, wait to waveform stable then view.

Peak Ch 114 Chain 0

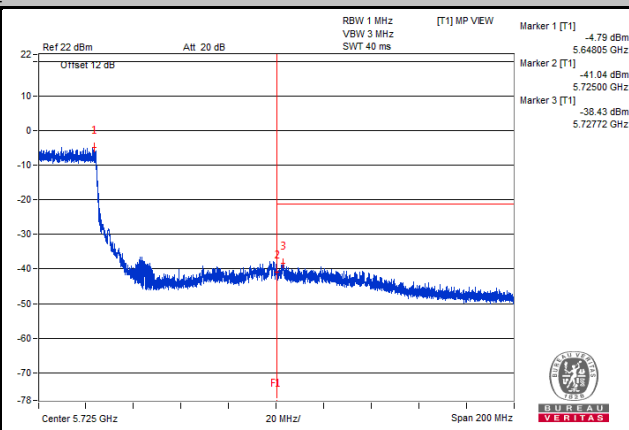
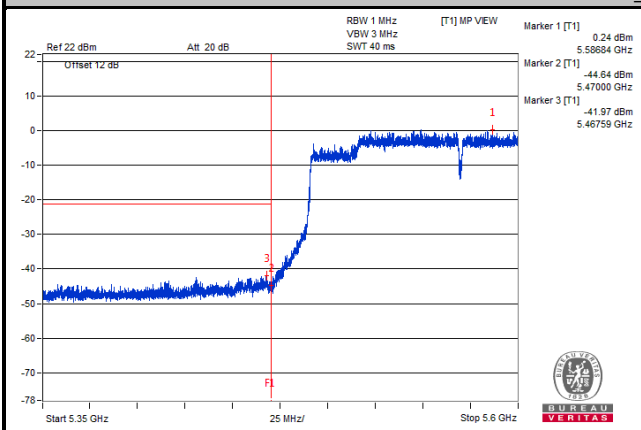


Average Ch 114 Chain 0

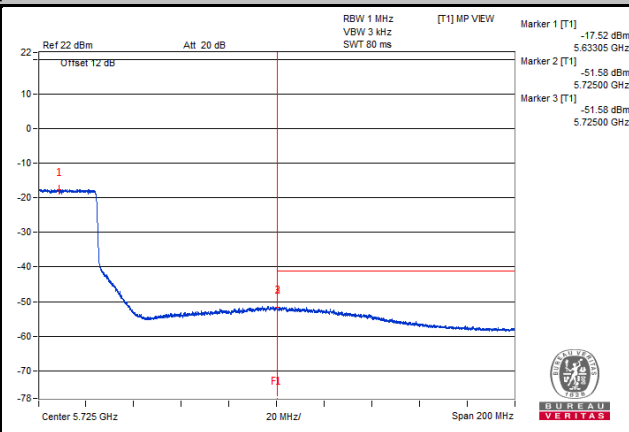
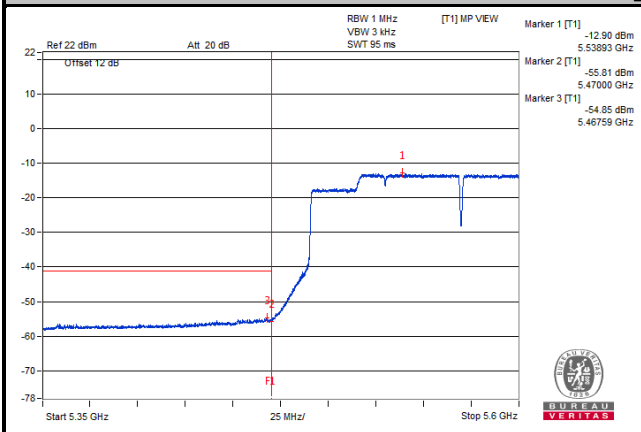


Note: VIEW is just to prevent pulse from entering. The method is using maxhold first, wait to waveform stable then view.

Peak Ch 114 Chain 1



Average Ch 114 Chain 1



Note: VIEW is just to prevent pulse from entering. The method is using maxhold first, wait to waveform stable then view.

| Band edge Frequency (MHz) | Channel | Mode | BW | Conducted Bandedge | | Caravel Antenna Peak Gain (dBi) | | EIRP (dBm) | | EIRP (10 ⁻⁵ *mW) | | EIRP Combine (10 ⁻⁵ *mW) | EIRP Combine (dBm) | Conversion Factor | Field Strength Combine (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---------------------------|---------|-----------|-----|--------------------|---------------|---------------------------------|-----------|------------|-----------|-----------------------------|-----------|-------------------------------------|--------------------|-------------------|---------------------------------|----------------|-------------|
| | | | | Chain A (dBm) | Chain B (dBm) | Chain (A) | Chain (B) | Chain (A) | Chain (B) | Chain (A) | Chain (B) | | | | | | |
| 2462 | 11F | 11n_HTO | 40 | -53.54 | -53.81 | 2.12 | 2.26 | -51.42 | -51.55 | 0.72 | 0.70 | 1.42 | -48.47 | 95.20 | 46.73 | 54.00 | -7.27 |
| 2462 | 11 | 11ax_MCS0 | 20 | -57.07 | -57.1 | 2.12 | 2.26 | -54.95 | -54.84 | 0.32 | 0.33 | 0.65 | -51.88 | 95.20 | 43.32 | 54.00 | -10.68 |
| 2467 | 12 | 11ax_MCS0 | 20 | -51.26 | -50.19 | 2.12 | 2.26 | -49.14 | -47.93 | 1.22 | 1.61 | 2.83 | -45.48 | 95.20 | 49.72 | 54.00 | -4.28 |
| 2472 | 13 | 11ax_MCS0 | 20 | -48.66 | -49.18 | 2.12 | 2.26 | -46.54 | -46.92 | 2.22 | 2.03 | 4.25 | -43.72 | 95.20 | 51.48 | 54.00 | -2.52 |
| 2462 | 11F | 11ax_MCS0 | 40 | -53.22 | -53.75 | 2.12 | 2.26 | -51.1 | -51.49 | 0.78 | 0.71 | 1.49 | -48.28 | 95.20 | 46.92 | 54.00 | -7.08 |
| 5210 | 42 | 11ac_VHT0 | 80 | -51.78 | -49.95 | 3.34 | 3.36 | -48.44 | -46.59 | 1.43 | 2.19 | 3.62 | -44.41 | 95.20 | 50.79 | 54.00 | -3.21 |
| 5290 | 58 | 11ac_VHT0 | 80 | -51.58 | -52.54 | 3.34 | 3.31 | -48.24 | -49.23 | 1.50 | 1.19 | 2.69 | -45.70 | 95.20 | 49.50 | 54.00 | -4.50 |
| 5250 | 50 | 11ac_VHT0 | 160 | -48.71 | -50.43 | 3.34 | 3.36 | -45.37 | -47.07 | 2.90 | 1.96 | 4.87 | -43.13 | 95.20 | 52.07 | 54.00 | -1.93 |
| 5570 | 114 | 11ac_VHT0 | 160 | -49.8 | -50.33 | 3.12 | 3.47 | -46.68 | -46.86 | 2.15 | 2.06 | 4.21 | -43.76 | 95.20 | 51.44 | 54.00 | -2.56 |
| 5210 | 42 | 11ax_MCS0 | 80 | -52.26 | -51.96 | 3.34 | 3.36 | -48.92 | -48.6 | 1.28 | 1.38 | 2.66 | -45.75 | 95.20 | 49.45 | 54.00 | -4.55 |
| 5290 | 58 | 11ax_MCS0 | 80 | -53.04 | -53.47 | 3.34 | 3.31 | -49.7 | -50.16 | 1.07 | 0.96 | 2.04 | -46.91 | 95.20 | 48.29 | 54.00 | -5.71 |
| 5250 | 50 | 11ax_MCS0 | 160 | -50.41 | -51.69 | 3.34 | 3.36 | -47.07 | -48.33 | 1.96 | 1.47 | 3.43 | -44.64 | 95.20 | 50.56 | 54.00 | -3.44 |
| 5570 | 114 | 11ax_MCS0 | 160 | -51.47 | -51.58 | 3.12 | 3.47 | -48.35 | -48.11 | 1.46 | 1.55 | 3.01 | -45.22 | 95.20 | 49.98 | 54.00 | -4.02 |

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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Web Site: www.bureauveritas-adt.com

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

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