



FCC RF Test Report

APPLICANT : Plume Design Inc
EQUIPMENT : Plume Pod
BRAND NAME : Plume Design Inc
MODEL NAME : A2A
MARKETING NAME : PLUME ADAPTIVE WIFI
FCC ID : 2AG7G-A2A
STANDARD : FCC Part 15 Subpart E §15.407
CLASSIFICATION : (NII) Unlicensed National Information Infrastructure

The product was received on Jun. 28, 2018 and testing was completed on Oct. 25, 2018. We, Sporton International (Kunshan) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

This report contains data that were produced under subcontract by Laboratory SPORTON INTERNATIONAL INC.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (Kunshan) Inc., the test report shall not be reproduced except in full.



Approved by: James Huang / Manager

Sporton International (Kunshan) Inc.
No. 1098, Pengxi North Road, Kunshan Economic Development Zone,
Jiangsu Province 215335, China



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REVISION HISTORY

| REPORT NO. | VERSION | DESCRIPTION | ISSUED DATE |
|------------|---------|-------------------------|---------------|
| FR860502C | Rev. 01 | Initial issue of report | Oct. 30, 2018 |
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SUMMARY OF TEST RESULT

| Report Section | FCC Rule | Description | Limit | Result | Remark |
|----------------|--------------------|--|--------------------------|--------|-------------------------------------|
| 3.1 | 2.1049 & 15.403(i) | 26dB & 99% Bandwidth | - | Pass | - |
| 3.2 | 15.407(a) | Maximum Conducted Output Power | ≤ 30 dBm | Pass | - |
| 3.3 | 15.407(a) | Power Spectral Density | ≤ 17 dBm | Pass | - |
| 3.4 | 15.407(b) | Unwanted Emissions | 15.407(b) & 15.209(a) | Pass | Under limit 1.00 dB at 5149.280 MHz |
| 3.5 | 15.207 | AC Conducted Emission | 15.207(a) | Pass | Under limit 5.19 dB at 0.375 MHz |
| 3.6 | 15.407(c) | Automatically Discontinue Transmission | Discontinue Transmission | Pass | - |
| 3.7 | 15.203 & 15.407(a) | Antenna Requirement | N/A | Pass | - |



1 General Description

1.1 Applicant

Plume Design Inc
290 California Ave, Suite 200, Palo Alto, CA 94306, USA

1.2 Manufacturer

Plume Design Inc
290 California Ave, Suite 200, Palo Alto, CA 94306, USA

1.3 Product Feature of Equipment Under Test

| Product Feature | |
|---------------------------------|--|
| Equipment | Plume Pod |
| Brand Name | Plume Design Inc |
| Model Name | A2A |
| Marketing Name | Plume Adaptive WiFi |
| FCC ID | 2AG7G-A2A |
| EUT supports Radios application | WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 Bluetooth LE |
| HW Version | N/A |
| SW Version | N/A |
| EUT Stage | Production Unit |

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.



1.4 Product Specification of Equipment Under Test

| Standards-related Product Specification | |
|--|--|
| Tx/Rx Frequency Range | 5180 MHz ~ 5240 MHz |
| Maximum Output Power to Antenna <CDD Modes> | <p><Ant 1> <5180 MHz ~ 5240 MHz> 802.11a : 17.57 dBm / 0.0571 W 802.11n HT20 : 19.68 dBm / 0.0929 W 802.11n HT40 : 21.29 dBm / 0.1346 W 802.11ac VHT20 : 19.65 dBm / 0.0923 W 802.11ac VHT40 : 21.26 dBm / 0.1337 W 802.11ac VHT80 : 14.80 dBm / 0.0302 W</p> <p>MIMO <Ant 1+2> <5180 MHz ~ 5240 MHz> 802.11a : 19.73 dBm / 0.0940 W 802.11n HT20 : 19.91 dBm / 0.0979 W 802.11n HT40 : 22.73 dBm / 0.1875 W 802.11ac VHT20 : 19.87 dBm / 0.0971 W 802.11ac VHT40 : 22.69 dBm / 0.1858 W 802.11ac VHT80 : 16.66 dBm / 0.0463 W</p> |
| Maximum Output Power to Antenna <Beamforming Modes> | <p>MIMO <Ant 1+2> <5180 MHz ~ 5240 MHz> 802.11a : 13.96 dBm / 0.0249 W 802.11n HT20 : 15.09 dBm / 0.0323 W 802.11n HT40 : 15.48 dBm / 0.0353 W 802.11ac VHT80 : 15.33 dBm / 0.0341 W</p> |
| 99% Occupied Bandwidth <CDD Modes> | <p><Ant 1> <5180 MHz ~ 5240 MHz> 802.11a : 17.08 MHz 802.11n HT20 : 18.48 MHz 802.11n HT40 : 39.06 MHz 802.11ac VHT80 : 75.76 MHz</p> <p>MIMO <Ant 1+2> <5180 MHz ~ 5240 MHz> 802.11a : 17.13 MHz 802.11n HT20 : 18.23 MHz 802.11n HT40 : 36.26 MHz 802.11ac VHT80 : 75.64 MHz</p> |
| 99% Occupied Bandwidth <Beamforming Modes> | <p>MIMO <Ant 1+2> <5180 MHz ~ 5240 MHz> 802.11a : 17.18 MHz 802.11n HT20 : 18.23 MHz 802.11n HT40 : 36.36 MHz 802.11ac VHT80 : 76.12 MHz</p> |
| Antenna Gain / Gain | <p><5180 MHz ~ 5240 MHz> <Ant. 1> : Loop Antenna with gain 2.44 dBi <Ant. 2> : Loop Antenna with gain 1.97 dBi</p> |
| Type of Modulation | 802.11a/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM) |



| | | | |
|-------------------------------------|-----------------------|--------|--------|
| Antenna Function Description | | Ant. 1 | Ant. 2 |
| | 802.11 a/n/ac | V | - |
| | 802.11 a/n/ac MIMO | V | V |

Note:

1. MIMO Ant. 1+2 is a calculated result from sum of the power MIMO Ant. 1 and MIMO Ant. 2.
2. For 802.11n HT20 / ac VHT20 and 802.11n HT40 / ac VHT40 mode, the whole testing is assessed only 802.11n HT20/ HT40 by referring to their higher conducted power.

1.5 Modification of EUT

No modifications are made to the EUT during all test items.



1.6 Testing Location

SPORTON INTERNATIONAL INC. is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and under the FCC-recognized accredited testing laboratories by Mutual Recognition Agreement (MRA) in FCC Test.

| | | | |
|---------------------------|--|--|--|
| Test Site | SPORTON INTERNATIONAL INC. | | |
| Test Site Location | No. 52, Hwa Ya 1 st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978 | | |
| Test Site No. | Sporton Site No. | | |
| | CO05-HY | | |

Note: Test data subcontracted: Conducted Emission in section 3.5 of this report.

Sporton International (Kunshan) Inc. is accredited to ISO 17025 by National Voluntary Laboratory Accreditation Program (NVLAP code: 600155-0).

| | | | |
|---------------------------|---|----------------------------|---------------------------------------|
| Test Site | Sporton International (Kunshan) Inc. | | |
| Test Site Location | No. 1098, Pengxi North Road, Kunshan Economic Development Zone, Jiangsu Province 215335, China TEL : 86-512-57900158 FAX : 86-512-57900958 | | |
| Test Site No. | Sporton Site No. | FCC designation No. | FCC Test Firm Registration No. |
| | TH01-KS 03CH04-KS/03CH02-KS | CN5013 | 630927 |

1.7 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ FCC Part 15 Subpart E
- ♦ FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- ♦ FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ♦ ANSI C63.10-2013

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.



2 Test Configuration of Equipment Under Test

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases were recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

2.1 Carrier Frequency and Channel

| Frequency Band | Channel | Freq. (MHz) | Channel | Freq. (MHz) |
|--------------------------------------|---------|-------------|---------|-------------|
| 5180-5240 MHz Band 1 (U-NII-1) | 36 | 5180 | 44 | 5220 |
| | 38* | 5190 | 46* | 5230 |
| | 40 | 5200 | 48 | 5240 |
| | 42# | 5210 | | |

Note:

1. The above Frequency and Channel in "*" were 802.11n HT40 and 802.11ac VHT40.
2. The above Frequency and Channel in "#n" were 802.11ac VHT80.



2.2 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

MIMO Mode

| Modulation | Data Rate |
|----------------|-----------|
| 802.11a | 6 Mbps |
| 802.11n HT20 | MCS0 |
| 802.11n HT40 | MCS0 |
| 802.11ac VHT80 | MCS0 |

TXBF Mode

| Modulation | Data Rate |
|----------------|-----------|
| 802.11n HT20 | MCS0 |
| 802.11n HT40 | MCS0 |
| 802.11ac VHT80 | MCS0 |

| Test Cases | |
|---|--|
| AC Conducted Emission | Mode 1 : WLAN Link(5G) + Bluetooth Link + Lan Link(Ping) Mode 2 : WLAN Link(5G) + Bluetooth Link + Lan Link(TX) |
| Remark: The worst case of conducted emission is mode 2; only the test data of it was reported. | |



| Ch. # | | Band I : 5180-5240 MHz | |
|-------|--------|------------------------|--|
| | | 802.11a | |
| L | Low | 36 | |
| M | Middle | 44 | |
| H | High | 48 | |

| Ch. # | | Band I : 5180-5240 MHz | |
|-------|--------|------------------------|--|
| | | 802.11n HT20 | |
| L | Low | 36 | |
| M | Middle | 44 | |
| H | High | 48 | |

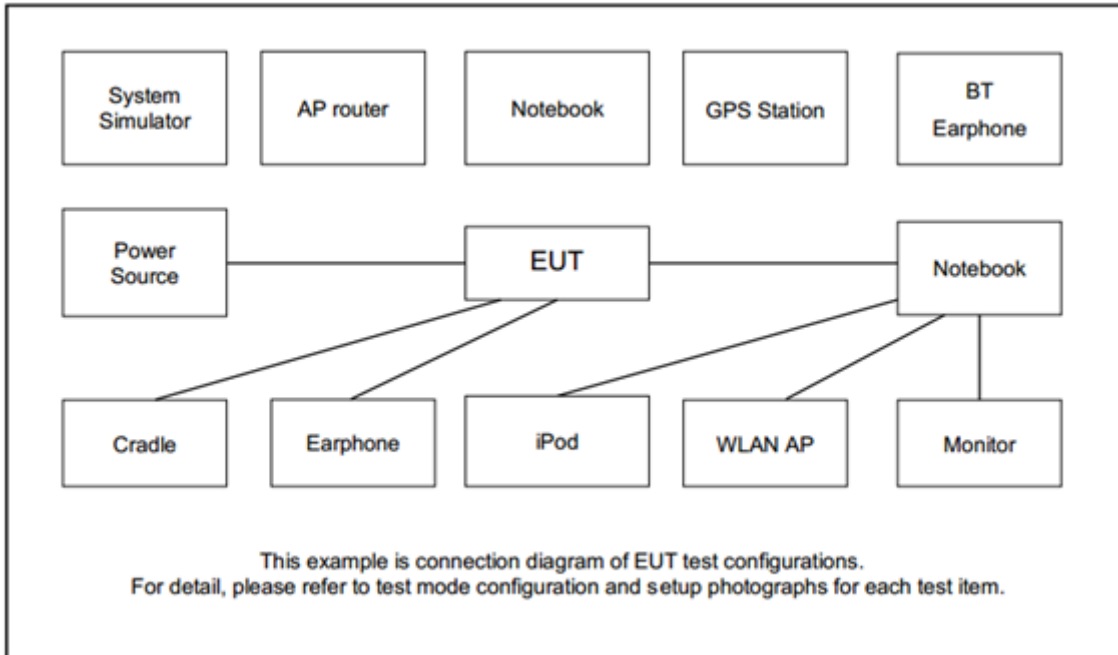
| Ch. # | | Band I : 5180-5240 MHz | |
|-------|--------|------------------------|--|
| | | 802.11n HT40 | |
| L | Low | 38 | |
| M | Middle | - | |
| H | High | 46 | |

| Ch. # | | Band I : 5180-5240 MHz | |
|-------|--------|------------------------|--|
| | | 802.11ac VHT20 | |
| L | Low | 36 | |
| M | Middle | 44 | |
| H | High | 48 | |

| Ch. # | | Band I : 5180-5240 MHz | |
|-------|--------|------------------------|--|
| | | 802.11ac VHT40 | |
| L | Low | 38 | |
| M | Middle | - | |
| H | High | 46 | |

| Ch. # | | Band I : 5180-5240 MHz | |
|-------|--------|------------------------|--|
| | | 802.11ac VHT80 | |
| L | Low | - | |
| M | Middle | 42 | |
| H | High | - | |

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

| Item | Equipment | Trade Name | Model Name | FCC ID | Data Cable | Power Cord |
|------|-------------|------------|------------|---------|----------------|--|
| 1. | Notebook | Dell | E5570 | FCC DoC | N/A | AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m |
| 2. | Notebook | Dell | E3340 | FCC DoC | N/A | AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m |
| 3. | LCD MONITOR | Asus | PB27UQ | FCC DoC | Shielded, 1.6m | Unshielded 1.8m |
| 4. | iPod | Apple | A1285 | FCC DoC | Shielded, 1.0m | N/A |



2.5 EUT Operation Test Setup

For WLAN RF test items, an engineering test program was provided and enabled to make EUT continuously transmit/receive.

For AC power line conducted emissions, the EUT was set to connect with the Notebook under large package sizes transmission.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss.

Offset = RF cable loss.

Following shows an offset computation example with cable loss 6.1 dB.

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)}. \\ &= 6.1 \text{ (dB)} \end{aligned}$$

3 Test Result

3.1 26dB & 99% Occupied Bandwidth Measurement

3.1.1 Description of 26dB & 99% Occupied Bandwidth

This section is for reporting purpose only.

There is no restriction limits for bandwidth.

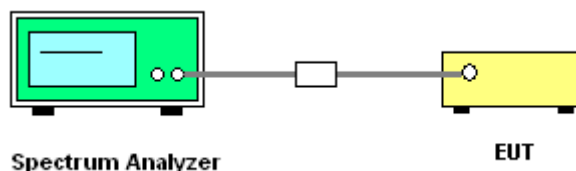
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section C) Emission bandwidth
2. Set RBW = approximately 1% of the emission bandwidth.
3. Set the VBW > RBW.
4. Detector = Peak.
5. Trace mode = max hold
6. 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%.
7. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1MHz and set the Video bandwidth (VBW) $\geq 3 * RBW$.
8. Measure and record the results in the test report.

3.1.4 Test Setup

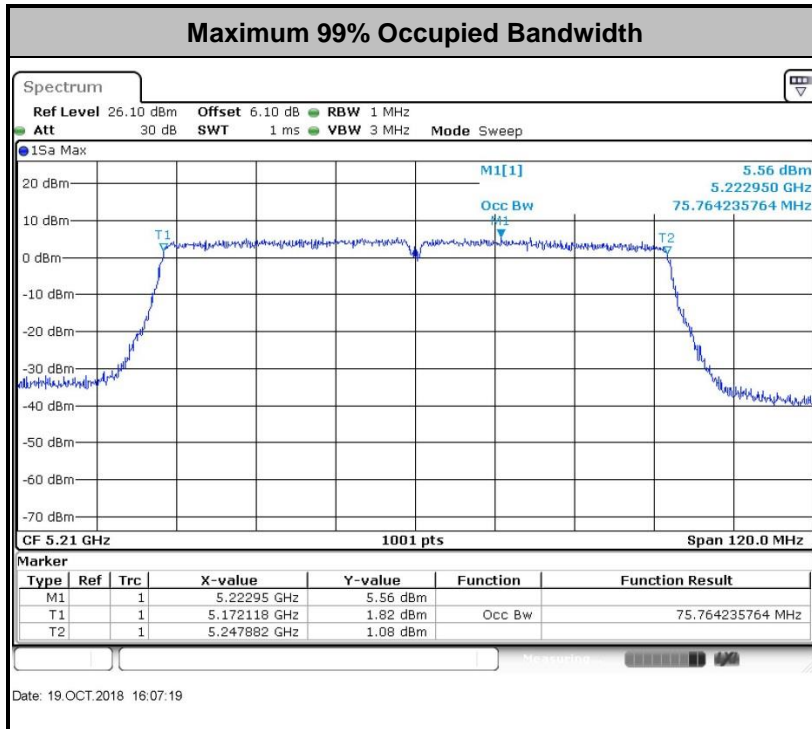
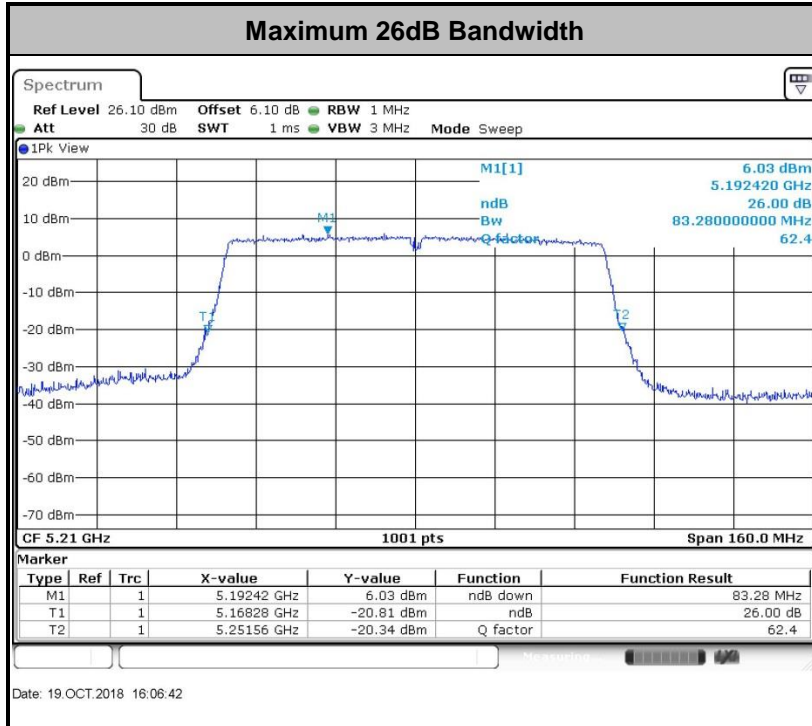


3.1.5 Test Result of 26dB & 99% Occupied Bandwidth

Please refer to Appendix A.



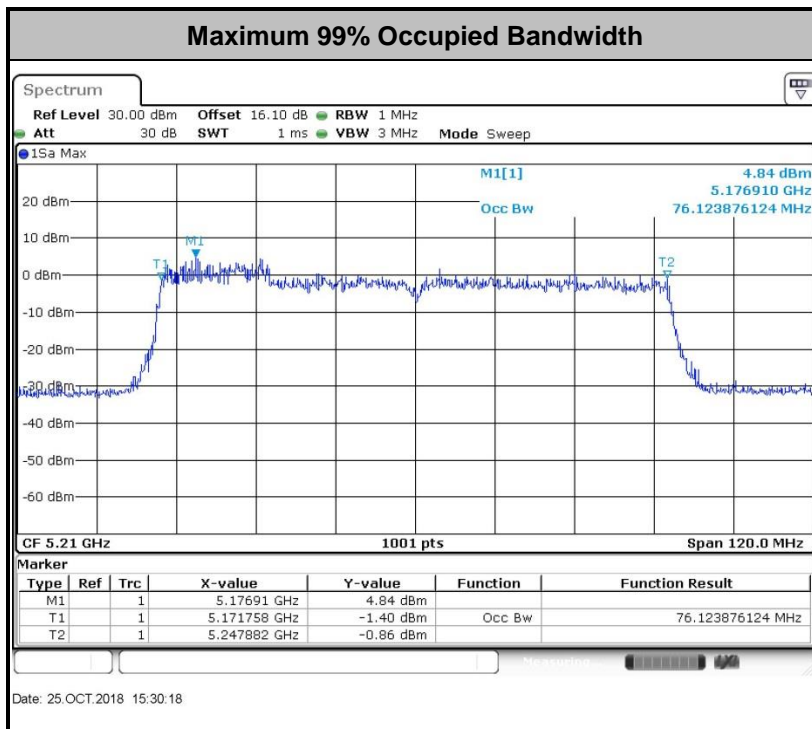
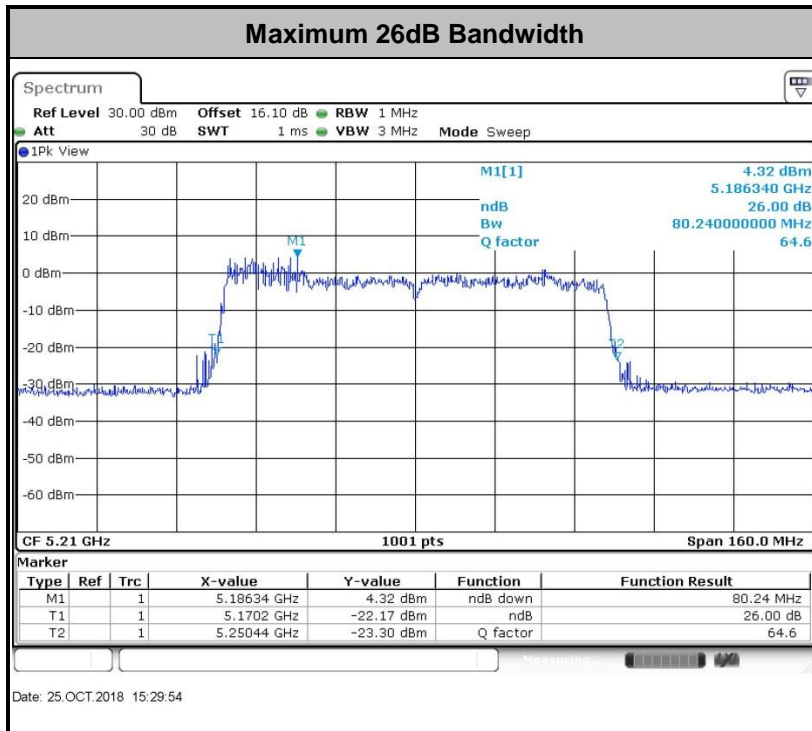
<CDD Mode>



Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.



<TXBF Mode>



Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.



3.2 Maximum Conducted Output Power Measurement

3.2.1 Limit of Maximum Conducted Output Power

<FCC 14-30 CFR 15.407>

For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.2.3 Test Procedures

<CDD Mode>

The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

Method PM (Measurement using an RF average power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.
3. Measure the average power of the transmitter, and the average power is corrected with duty factor, $10 \log(1/x)$, where x is the duty cycle.

<TXBF Mode>

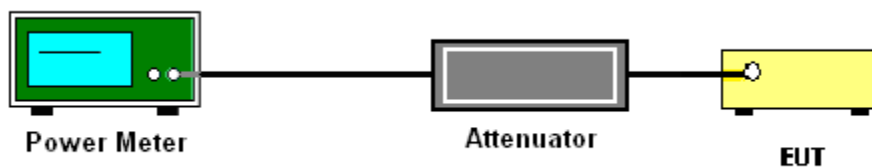
The testing follows Method PM-G of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01 for TXBF modes.

Method PM-G (Measurement using a gated RF average power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit at its maximum power control level.
3. Measure the average power of the transmitter
4. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

3.2.4 Test Setup

For normal channel:



3.2.5 Test Result of Maximum Conducted Output Power

Please refer to Appendix A.



3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

<FCC 14-30 CFR 15.407>

For an indoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
Section F) Maximum power spectral density.

<CDD/ TXBF Mode>

Method SA-2

(trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

- Measure the duty cycle.
 - Set span to encompass the entire emission bandwidth (EBW) of the signal.
 - Set RBW = 1 MHz.
 - Set VBW \geq 3 MHz.
 - Number of points in sweep \geq 2 Span / RBW.
 - Sweep time = auto.
 - Detector = RMS
 - Trace average at least 100 traces in power averaging mode.
 - Add $10 \log(1/x)$, where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times. For example, add $10 \log(1/0.25) = 6$ dB if the duty cycle is 25 percent.
1. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
 2. Each plot has already offset with cable loss, and attenuator loss. Measure the PPSD and record it.
 3. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

Method (a): Measure and sum the spectra across the outputs.

The total final Power Spectral Density is from a device with 2 transmitter outputs. The spectrum measurements of the individual outputs are all performed with the same span and number of points, the spectrum value in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 to obtain the value for the first frequency bin of the summed spectrum.

3.3.4 Test Setup

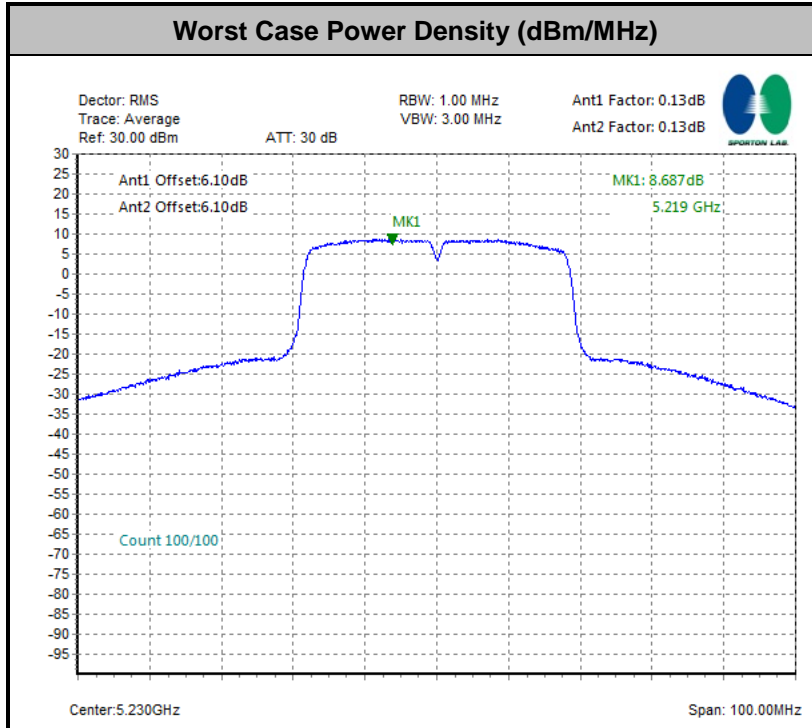




3.3.5 Test Result of Power Spectral Density

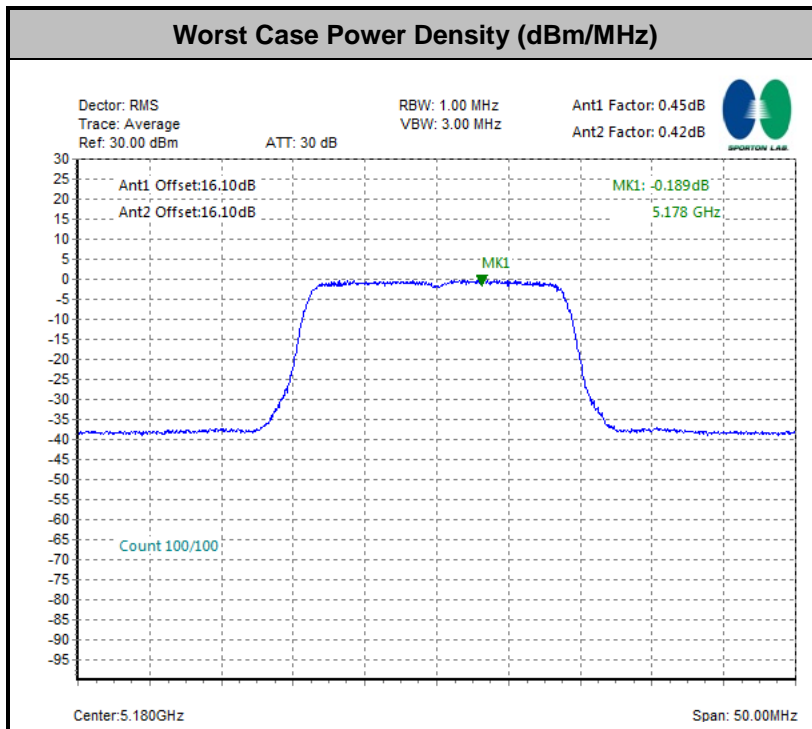
Please refer to Appendix A.

<CDD Mode>



Note: Average Power Density (dB) = Measured value+ Duty Factor

<TXBF Mode>



Note: Average Power Density (dB) = Measured value+ Duty Factor



3.4 Unwanted Emissions Measurement

This section is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement.

3.4.1 Limit of Unwanted Emissions

- (1) For transmitters operating in the 5150-5250 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of -27dBm/MHz.
- (2) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table,

| Frequency (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 |

| EIRP (dBm) | Field Strength at 3m (dBµV/m) |
|------------|-------------------------------|
| - 27 | 68.3 |

Note: The following formula is used to convert the EIRP to field strength.

$$EIRP = E_{Meas} + 20\log(d_{Meas}) - 104.7$$

where

EIRP is the equivalent isotropically radiated power, in dBm

E_{Meas} is the field strength of the emission at the measurement distance, in dBµV/m

d_{Meas} is the measurement distance, in m

3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

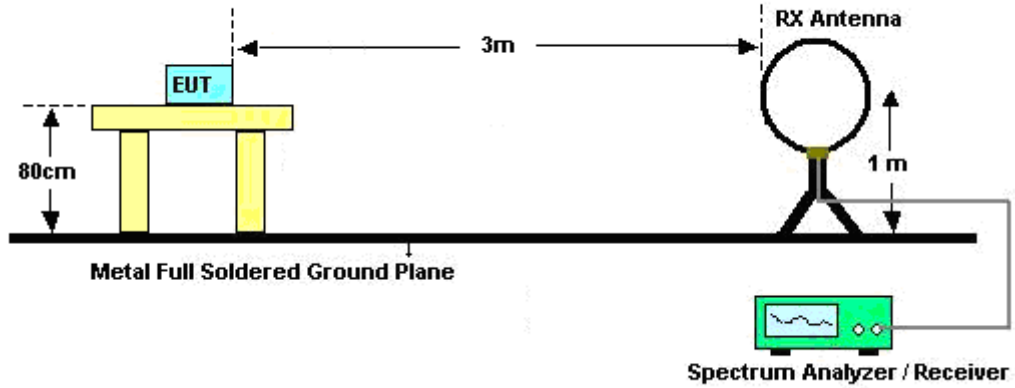


3.4.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section G) Unwanted emissions measurement.
 - (1) Procedure for Unwanted Emissions Measurements Below 1000MHz
 - RBW = 120 kHz
 - VBW = 300 kHz
 - Detector = Peak
 - Trace mode = max hold
 - (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz
 - RBW = 1 MHz
 - VBW \geq 3 MHz
 - Detector = Peak
 - Sweep time = auto
 - Trace mode = max hold
 - (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz
 - RBW = 1 MHz
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW \geq 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

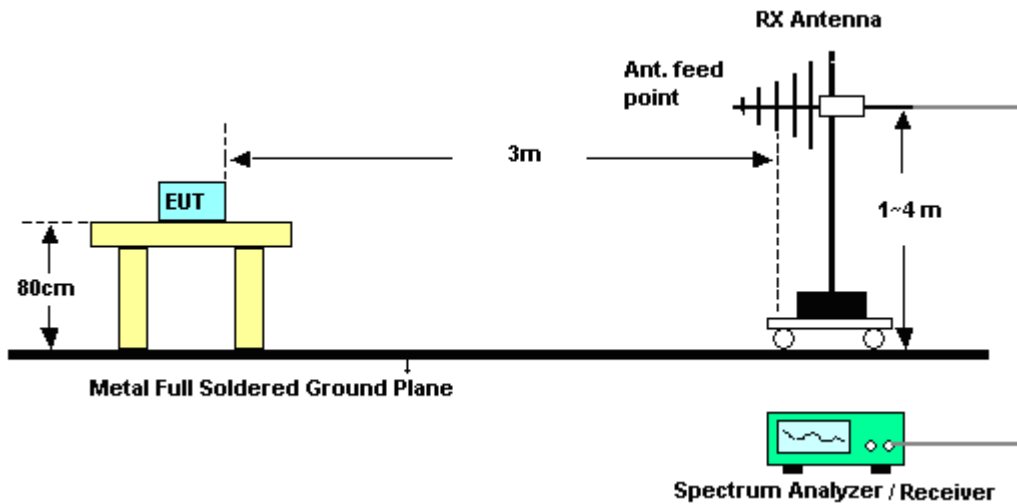
3.4.4 Test Setup

For radiated emissions below 30MHz

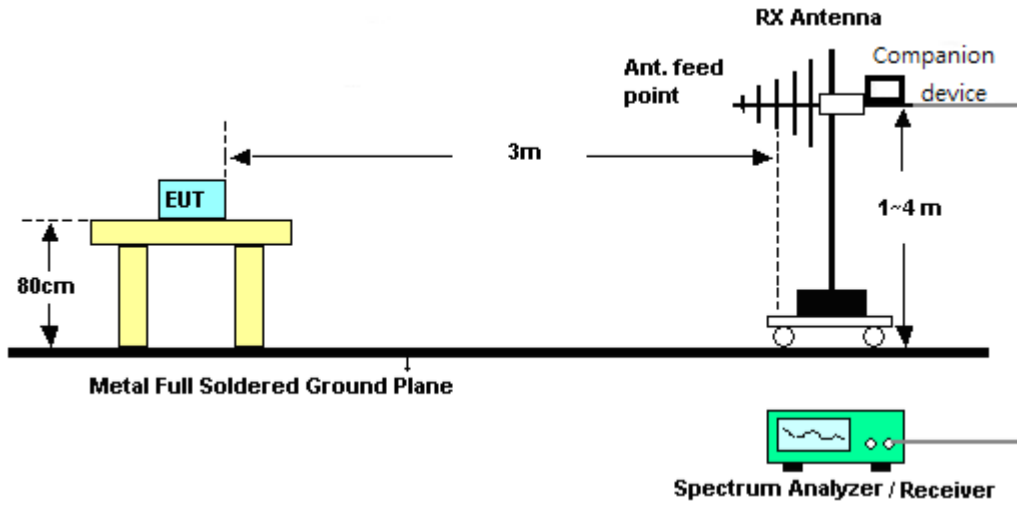


For radiated emissions from 30MHz to 1GHz

<CDD Mode>

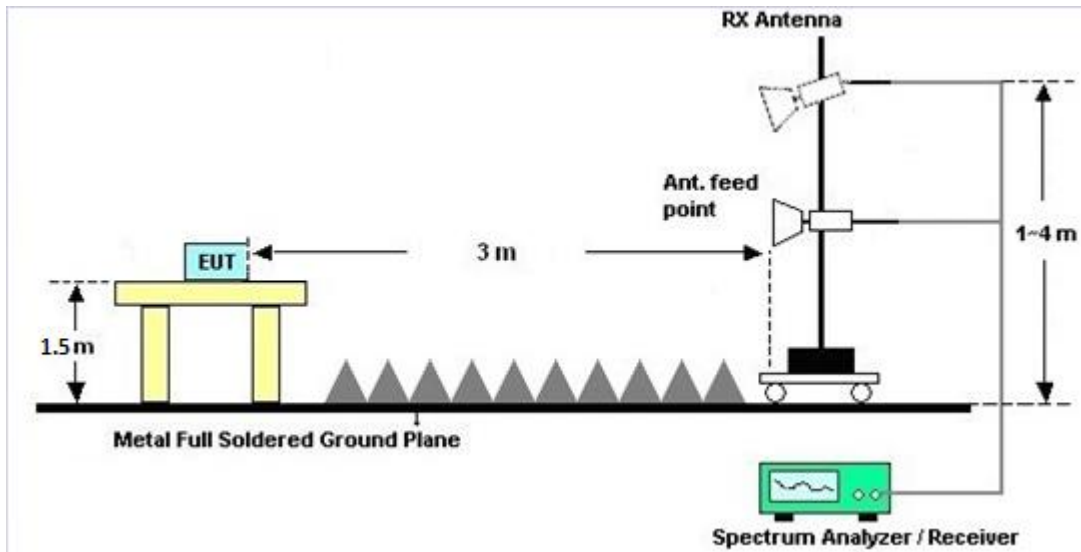


<TXBF Mode>

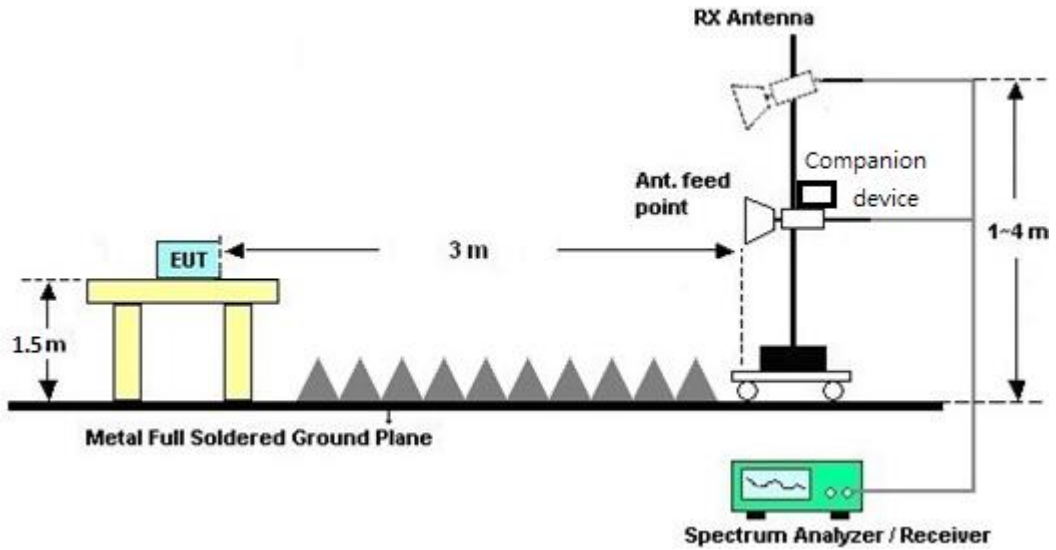


For radiated emissions above 1GHz

<CDD Mode>



<TXBF Modes>



3.4.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.4.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C.

3.4.7 Duty Cycle

Please refer to Appendix D.

3.4.8 Test Result of Radiated Spurious Emissions (30MHz ~ 10th Harmonic)

Please refer to Appendix C.



3.5 AC Conducted Emission Measurement

3.5.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

| Frequency of emission (MHz) | Conducted limit (dBµV) | |
|-----------------------------|------------------------|-----------|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

*Decreases with the logarithm of the frequency.

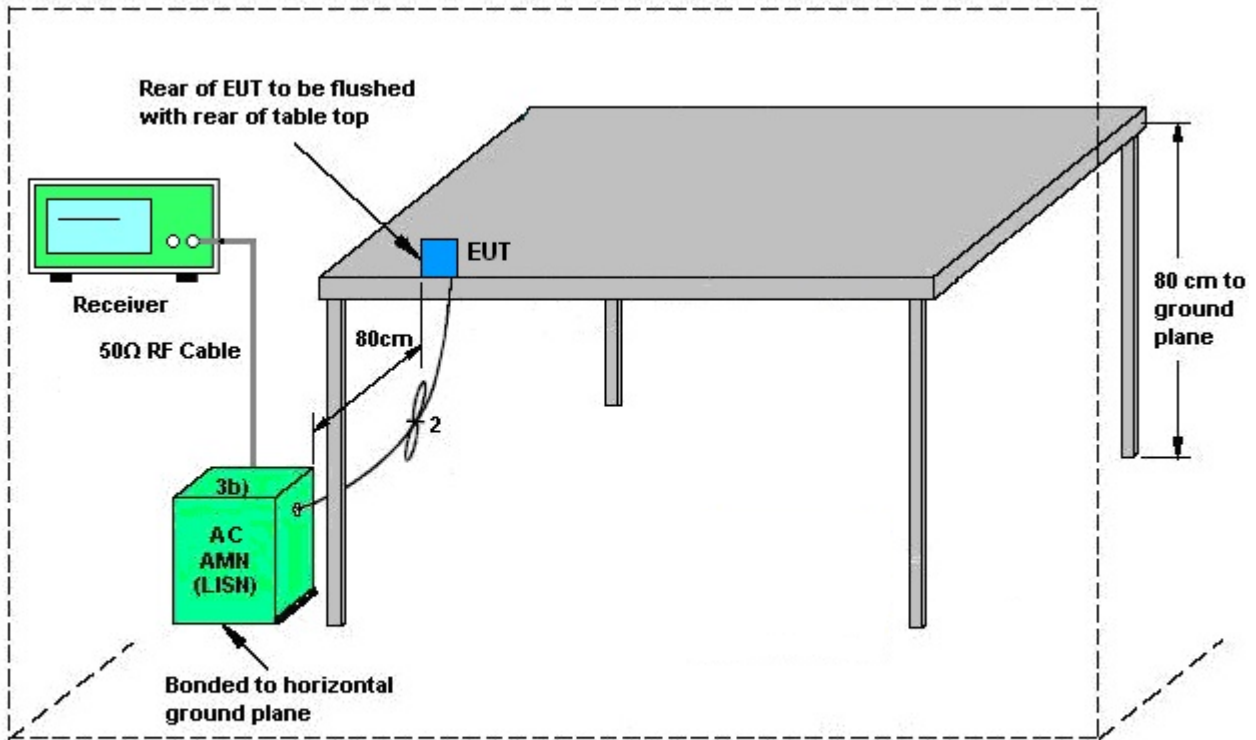
3.5.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

3.5.4 Test Setup



AMN = Artificial mains network (LISH)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network

3.5.5 Test Result of AC Conducted Emission

Please refer to Appendix B.



3.6 Automatically Discontinue Transmission

3.6.1 Limit of Automatically Discontinue Transmission

The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signaling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization to describe how this requirement is met.

3.6.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.6.3 Test Result of Automatically Discontinue Transmission

While the EUT is not transmitting any information, the EUT can automatically discontinue transmission and become standby mode for power saving. The EUT can detect the controlling signal of ACK message transmitting from remote device and verify whether it shall resend or discontinue transmission.



3.7 Antenna Requirements

3.7.1 Standard Applicable

If transmitting antenna directional gain is greater than 6 dBi, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

<CDD Modes >

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

For CDD transmissions, directional gain is calculated as

Directional gain = GANT + Array Gain, where Array Gain is as follows.

For power spectral density (PSD) measurements on all devices,

Array Gain = 10 log(NANT/NSS=1) dB.

For power measurements on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4.

Directional gain may be calculated by using the formulas applicable to equal gain antennas with GANT set equal to the gain of the antenna having the highest gain;

The EUT supports CDD mode.

For power, the directional gain GANT is set equal to the antenna having the highest gain, i.e., F)2)f)i).

For PSD, the directional gain calculation is following F)2)f)ii) of KDB 662911 D01 v02r01.

The power and PSD limit should be modified if the directional gain of EUT is over 6 dBi,

The directional gain "DG" is calculated as following table.

| <CDD Modes> | | | | | | |
|-------------|-----------------|-----------------|-----------------------------|---------------------------|-------------------------------------|-----------------------------------|
| | Ant. 1 (dBi) | Ant. 2 (dBi) | DG for Power (dBi) | DG for PSD (dBi) | Power Limit Reduction (dB) | PSD Limit Reduction (dB) |
| Band I | 2.44 | 1.97 | 2.44 | 5.22 | 0.00 | 0.00 |

Power limit reduction = Composite gain – 6dBi, (min = 0)

PSD limit reduction = Composite gain + PSD Array gain – 6dBi, (min = 0)

TXBF modes

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

For CDD transmissions, directional gain is calculated as

$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

where

Each antenna is driven by no more than one spatial stream;

N_{SS} = the number of independent spatial streams of data;

N_{ANT} = the total number of antennas

$g_{j,k} = 10^{G_k / 20}$ if the k th antenna is being fed by spatial stream j , or zero if it is not;
 G_k is the gain in dBi of the k th antenna.

The EUT supports beamforming for 802.11ac modes.

The directional gain calculation is following F2)e)ii) of KDB 662911 D01 v02r01.

The power and PSD limit should be modified if the directional gain of EUT is over 6 dBi,

The directional gain “DG” is calculated as following table.

| | | | DG | DG | Power | PSD |
|---------------|--------------|--------------|--------------|--------------|------------------|------------------|
| | | | for | for | Limit | Limit |
| | Ant 1 | Ant 2 | Power | PSD | Reduction | Reduction |
| | (dBi) | (dBi) | (dBi) | (dBi) | (dB) | (dB) |
| Band I | 2.44 | 1.97 | 5.22 | 5.22 | 0.00 | 0.00 |

$Power\ Limit\ Reduction = DG(Power) - 6dBi, (min = 0)$

$PSD\ Limit\ Reduction = DG(PSD) - 6dBi, (min = 0)$



4 List of Measuring Equipment

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|-----------------------|-----------------|-------------------|-------------------|-----------------------------------|------------------|---------------------------------|---------------|-----------------------|
| Spectrum Analyzer | R&S | FSV40 | 101040 | 10Hz~40GHz | Aug. 07, 2018 | Oct. 19, 2018~ Oct. 25, 2018 | Aug. 06, 2019 | Conducted (TH01-KS) |
| Pulse Power Sensor | Anritsu | MA2411B | 0917070 | 300MHz~40GHz | Jan. 18, 2018 | Oct. 19, 2018~ Oct. 25, 2018 | Jan. 17, 2019 | Conducted (TH01-KS) |
| Power Meter | Anritsu | ML2495A | 1005002 | 50MHz Bandwidth | Jan. 18, 2018 | Oct. 19, 2018~ Oct. 25, 2018 | Jan. 17, 2019 | Conducted (TH01-KS) |
| USB RFPower Sensor | Dare | RPR3006W | 15100041S NO93 | 50MHz~6GHz , -50dBm~ +10dBm | Jan. 18, 2018 | Oct. 19, 2018~ Oct. 25, 2018 | Jan. 17, 2019 | Conducted (TH01-KS) |
| USB RFPower Sensor | Dare | RPR3006W | 15100041S NO94 | 50MHz~6GHz , -50dBm~ +10dBm | Jan. 18, 2018 | Oct. 19, 2018~ Oct. 25, 2018 | Jan. 17, 2019 | Conducted (TH01-KS) |
| EMI Test Receiver | R&S | ESR7 | 101403 | 9kHz~7GHz;Ma x 30dBm | Aug. 07, 2018 | Oct. 10, 2018~ Oct. 11, 2018 | Aug. 06, 2019 | Radiation (03CH02-KS) |
| Loop Antenna | R&S | HFH2-Z2 | 100321 | 9kHz~30MHz | Oct. 22, 2017 | Oct. 10, 2018~ Oct. 11, 2018 | Oct. 21, 2018 | Radiation (03CH02-KS) |
| Bilog Antenna | TeseQ | CBL6112D | 23182 | 30MHz-2GHz | Jan. 29, 2018 | Oct. 10, 2018~ Oct. 11, 2018 | Jan. 28, 2019 | Radiation (03CH02-KS) |
| Amplifier | SONOMA | 310N | 187289 | 9KHz-1GHz | Aug. 06, 2018 | Oct. 10, 2018~ Oct. 11, 2018 | Aug. 05, 2019 | Radiation (03CH02-KS) |
| AC Power Source | Chroma | 61601 | 616010002 473 | N/A | NCR | Oct. 10, 2018~ Oct. 11, 2018 | NCR | Radiation (03CH02-KS) |
| Turn Table | MF | MF7802 | N/A | 0~360 degree | NCR | Oct. 10, 2018~ Oct. 11, 2018 | NCR | Radiation (03CH02-KS) |
| Antenna Mast | MF | MF7802 | N/A | 1 m~4 m | NCR | Oct. 10, 2018~ Oct. 11, 2018 | NCR | Radiation (03CH02-KS) |
| EMI Test Receiver | Keysight | N9038A | MY564000 23 | 3Hz~8.5GHz;M ax 30dBm | Oct. 19, 2017 | Oct. 10, 2018~ Oct. 11, 2018 | Oct. 18, 2018 | Radiation (03CH04-KS) |
| EXA Spectrum Analyzer | Keysight | N9010A | MY553705 28 | 10Hz-44GHz | Oct. 14, 2017 | Oct. 10, 2018~ Oct. 11, 2018 | Oct. 13, 2018 | Radiation (03CH04-KS) |
| Horn Antenna | Schwarzbeck | BBHA9120D | 1648 | 1GHz~18GHz | Dec. 16, 2017 | Oct. 10, 2018~ Oct. 11, 2018 | Dec. 15, 2018 | Radiation (03CH04-KS) |
| SHF-EHF Horn | Schwarzbeck | BBHA 9170 | BBHA1702 49 | 15GHz~40GHz | Feb. 07, 2018 | Oct. 10, 2018~ Oct. 11, 2018 | Feb. 06, 2019 | Radiation (03CH04-KS) |
| Amplifier | Keysight | 83017A | MY532702 03 | 500MHz~26.5G Hz | Dec. 16, 2017 | Oct. 10, 2018~ Oct. 11, 2018 | Dec. 15, 2018 | Radiation (03CH04-KS) |
| Amplifier | MITEQ | TTA1840-35- HG | 2014749 | 18~40GHz | Feb. 08, 2018 | Oct. 10, 2018~ Oct. 11, 2018 | Feb. 07, 2019 | Radiation (03CH04-KS) |
| AC Power Source | Chroma | 61601 | F1040900 04 | N/A | NCR | Oct. 10, 2018~ Oct. 11, 2018 | NCR | Radiation (03CH04-KS) |
| Turn Table | ChamPro | EM 1000-T | 060762-T | 0~360 degree | NCR | Oct. 10, 2018~ Oct. 11, 2018 | NCR | Radiation (03CH04-KS) |
| Antenna Mast | ChamPro | EM 1000-A | 060762-A | 1 m~4 m | NCR | Oct. 10, 2018~ Oct. 11, 2018 | NCR | Radiation (03CH04-KS) |
| AC Power Source | ChainTek | APC-1000W | N/A | N/A | NCR | Jul. 11, 2018 | NCR | Conduction (CO05-HY) |
| EMI Test Receiver | Rohde & Schwarz | ESR3 | 102388 | 3.6GHz | Dec. 08, 2017 | Jul. 11, 2018 | Dec. 07, 2018 | Conduction (CO05-HY) |
| Hygrometer | Testo | 608-H1 | 34913912 | N/A | Mar. 06, 2018 | Jul. 11, 2018 | Mar. 05, 2019 | Conduction (CO05-HY) |
| LISN | Rohde & Schwarz | ENV216 | 100080 | 9kHz~30MHz | Nov. 30, 2017 | Jul. 11, 2018 | Nov. 29, 2018 | Conduction (CO05-HY) |
| LISN | Rohde & Schwarz | ENV216 | 100081 | 9kHz~30MHz | Dec. 08, 2017 | Jul. 11, 2018 | Dec. 07, 2018 | Conduction (CO05-HY) |
| Software | Rohde & Schwarz | EMC32 V10.30 | N/A | N/A | NCR | Jul. 11, 2018 | NCR | Conduction (CO05-HY) |
| LF Cable | HUBER + SUHNER | RG-214/U | LF01 | N/A | Jan. 03, 2018 | Jul. 11, 2018 | Jan. 02, 2019 | Conduction (CO05-HY) |
| Pulse Limiter | Rohde & Schwarz | ESH3-Z2 | 100851 | N/A | Jan. 03, 2018 | Jul. 11, 2018 | Jan. 02, 2019 | Conduction (CO05-HY) |

NCR: No Calibration Required



5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz) for CO05-HY

| | |
|---|-------|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 2.7dB |
|---|-------|

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz) for 03CH02-KS

| | |
|---|-------|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 4.8dB |
|---|-------|

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz) for 03CH04-KS

| | |
|---|-------|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 5.0dB |
|---|-------|

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz) for 03CH04-KS

| | |
|---|-------|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 5.0dB |
|---|-------|



Appendix A. Conducted Test Results

| | | | | |
|----------------|-----------------------|--------------------|-------|----|
| Test Engineer: | Smile Wang | Temperature: | 21~25 | °C |
| Test Date: | 2018/10/19~2018/10/25 | Relative Humidity: | 51~54 | % |

TEST RESULTS DATA
26dB and 99% OBW
CDD Modes

| Band I | | | | | | | | | | | | | |
|--------|-----------|-----|-----|-------------|---------------------|-------|-----------------------|-------|------------------------------------|-------|-----------------------------------|-------|------|
| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | 99% Bandwidth (MHz) | | 26 dB Bandwidth (MHz) | | IC 99% Bandwidth Power Limit (dBm) | | IC 99% Bandwidth EIRP Limit (dBm) | | Note |
| | | | | | Ant 1 | Ant 2 | Ant 1 | Ant 2 | Ant 1 | Ant 2 | Ant 1 | Ant 2 | |
| 11a | 6Mbps | 1 | 36 | 5180 | 17.08 | | 20.68 | | - | | 22.33 | | |
| 11a | 6Mbps | 1 | 44 | 5220 | 17.08 | | 20.48 | | - | | 22.33 | | |
| 11a | 6Mbps | 1 | 48 | 5240 | 17.08 | | 20.88 | | - | | 22.33 | | |
| HT20 | MCS0 | 1 | 36 | 5180 | 18.23 | | 21.58 | | - | | 22.61 | | |
| HT20 | MCS0 | 1 | 44 | 5220 | 18.48 | | 22.68 | | - | | 22.67 | | |
| HT20 | MCS0 | 1 | 48 | 5240 | 18.13 | | 21.83 | | - | | 22.58 | | |
| HT40 | MCS0 | 1 | 38 | 5190 | 36.06 | | 40.55 | | - | | 23.01 | | |
| HT40 | MCS0 | 1 | 46 | 5230 | 39.06 | | 73.64 | | - | | 23.01 | | |
| VHT80 | MCS0 | 1 | 42 | 5210 | 75.76 | | 83.28 | | - | | 23.01 | | |
| 11a | 6Mbps | 2 | 36 | 5180 | 17.13 | 17.13 | 20.63 | 20.48 | - | | 22.34 | | |
| 11a | 6Mbps | 2 | 44 | 5220 | 17.13 | 17.08 | 20.78 | 20.43 | - | | 22.33 | | |
| 11a | 6Mbps | 2 | 48 | 5240 | 17.13 | 17.08 | 20.63 | 20.43 | - | | 22.33 | | |
| HT20 | MCS0 | 2 | 36 | 5180 | 18.13 | 18.23 | 21.58 | 21.63 | - | | 22.58 | | |
| HT20 | MCS0 | 2 | 44 | 5220 | 18.18 | 18.18 | 21.53 | 21.53 | - | | 22.60 | | |
| HT20 | MCS0 | 2 | 48 | 5240 | 18.23 | 18.23 | 21.78 | 21.48 | - | | 22.61 | | |
| HT40 | MCS0 | 2 | 38 | 5190 | 36.16 | 36.16 | 40.55 | 40.64 | - | | 23.01 | | |
| HT40 | MCS0 | 2 | 46 | 5230 | 36.26 | 36.26 | 41.00 | 41.09 | - | | 23.01 | | |
| VHT80 | MCS0 | 2 | 42 | 5210 | 75.64 | 75.64 | 83.28 | 82.32 | - | | 23.01 | | |

TEST RESULTS DATA
Average Power Table
CDD Modes

| FCC Band I | | | | | | | | | | | | | | |
|------------|-----------|-----|-----|-------------|------------------|-------|-------------------------------|-------|-------|---------------------------------|-------|----------|-------|-----------|
| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | Duty Factor (dB) | | Average Conducted Power (dBm) | | | FCC Conducted Power Limit (dBm) | | DG (dBi) | | Pass/Fail |
| | | | | | Ant 1 | Ant 2 | Ant 1 | Ant 2 | SUM | Ant 1 | Ant 2 | Ant 1 | Ant 2 | |
| 11a | 6Mbps | 1 | 36 | 5180 | 0.12 | | 17.17 | | | 30.00 | 30.00 | 2.44 | 1.97 | Pass |
| 11a | 6Mbps | 1 | 44 | 5220 | 0.12 | | 16.74 | | | 30.00 | 30.00 | 2.44 | 1.97 | Pass |
| 11a | 6Mbps | 1 | 48 | 5240 | 0.12 | | 17.57 | | | 30.00 | 30.00 | 2.44 | 1.97 | Pass |
| HT20 | MCS0 | 1 | 36 | 5180 | 0.05 | | 16.80 | | | 30.00 | 30.00 | 2.44 | 1.97 | Pass |
| HT20 | MCS0 | 1 | 44 | 5220 | 0.05 | | 19.68 | | | 30.00 | 30.00 | 2.44 | 1.97 | Pass |
| HT20 | MCS0 | 1 | 48 | 5240 | 0.05 | | 18.24 | | | 30.00 | 30.00 | 2.44 | 1.97 | Pass |
| HT40 | MCS0 | 1 | 38 | 5190 | 0.10 | | 15.79 | | | 30.00 | 30.00 | 2.44 | 1.97 | Pass |
| HT40 | MCS0 | 1 | 46 | 5230 | 0.10 | | 21.29 | | | 30.00 | 30.00 | 2.44 | 1.97 | Pass |
| VHT20 | MCS0 | 1 | 36 | 5180 | 0.04 | | 16.77 | | | 30.00 | 30.00 | 2.44 | 1.97 | Pass |
| VHT20 | MCS0 | 1 | 44 | 5220 | 0.04 | | 19.65 | | | 30.00 | 30.00 | 2.44 | 1.97 | Pass |
| VHT20 | MCS0 | 1 | 48 | 5240 | 0.04 | | 18.22 | | | 30.00 | 30.00 | 2.44 | 1.97 | Pass |
| VHT40 | MCS0 | 1 | 38 | 5190 | 0.13 | | 15.78 | | | 30.00 | 30.00 | 2.44 | 1.97 | Pass |
| VHT40 | MCS0 | 1 | 46 | 5230 | 0.13 | | 21.26 | | | 30.00 | 30.00 | 2.44 | 1.97 | Pass |
| VHT80 | MCS0 | 1 | 42 | 5210 | 0.24 | | 14.80 | | | 30.00 | 30.00 | 2.44 | 1.97 | Pass |
| 11a | 6Mbps | 2 | 36 | 5180 | 0.12 | 0.12 | 16.25 | 16.55 | 19.42 | 30.00 | | 2.44 | | Pass |
| 11a | 6Mbps | 2 | 44 | 5220 | 0.12 | 0.12 | 16.27 | 16.37 | 19.33 | 30.00 | | 2.44 | | Pass |
| 11a | 6Mbps | 2 | 48 | 5240 | 0.12 | 0.12 | 16.63 | 16.80 | 19.73 | 30.00 | | 2.44 | | Pass |
| HT20 | MCS0 | 2 | 36 | 5180 | 0.05 | 0.05 | 15.88 | 16.40 | 19.16 | 30.00 | | 2.44 | | Pass |
| HT20 | MCS0 | 2 | 44 | 5220 | 0.05 | 0.05 | 16.33 | 16.76 | 19.56 | 30.00 | | 2.44 | | Pass |
| HT20 | MCS0 | 2 | 48 | 5240 | 0.05 | 0.05 | 16.73 | 17.06 | 19.91 | 30.00 | | 2.44 | | Pass |
| HT40 | MCS0 | 2 | 38 | 5190 | 0.13 | 0.13 | 14.81 | 15.18 | 18.01 | 30.00 | | 2.44 | | Pass |
| HT40 | MCS0 | 2 | 46 | 5230 | 0.13 | 0.13 | 19.57 | 19.86 | 22.73 | 30.00 | | 2.44 | | Pass |
| VHT20 | MCS0 | 2 | 36 | 5180 | 0.03 | 0.04 | 15.78 | 16.35 | 19.08 | 30.00 | | 2.44 | | Pass |
| VHT20 | MCS0 | 2 | 44 | 5220 | 0.03 | 0.04 | 16.26 | 16.66 | 19.47 | 30.00 | | 2.44 | | Pass |
| VHT20 | MCS0 | 2 | 48 | 5240 | 0.03 | 0.04 | 16.71 | 17.00 | 19.87 | 30.00 | | 2.44 | | Pass |
| VHT40 | MCS0 | 2 | 38 | 5190 | 0.13 | 0.13 | 14.78 | 15.14 | 17.97 | 30.00 | | 2.44 | | Pass |
| VHT40 | MCS0 | 2 | 46 | 5230 | 0.13 | 0.13 | 19.54 | 19.82 | 22.69 | 30.00 | | 2.44 | | Pass |
| VHT80 | MCS0 | 2 | 42 | 5210 | 0.22 | 0.24 | 13.67 | 13.62 | 16.66 | 30.00 | | 2.44 | | Pass |

TEST RESULTS DATA
Power Spectral Density
CDD Modes

| FCC Band I | | | | | | | | | | | | | | |
|------------|-----------|-----|-----|-------------|------------------|-------|---------------------------------|-------|-------|-----------------------------|-------|----------|-------|------------|
| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | Duty Factor (dB) | | Average Power Density (dBm/MHz) | | | Average PSD Limit (dBm/MHz) | | DG (dBi) | | Pass /Fail |
| | | | | | Ant 1 | Ant 2 | Ant 1 | Ant 2 | SUM | Ant 1 | Ant 2 | Ant 1 | Ant 2 | |
| 11a | 6Mbps | 1 | 36 | 5180 | 0.12 | | 5.88 | | | 17.00 | 17.00 | 2.44 | 1.97 | Pass |
| 11a | 6Mbps | 1 | 44 | 5220 | 0.12 | | 5.61 | | | 17.00 | 17.00 | 2.44 | 1.97 | Pass |
| 11a | 6Mbps | 1 | 48 | 5240 | 0.12 | | 6.42 | | | 17.00 | 17.00 | 2.44 | 1.97 | Pass |
| HT20 | MCS0 | 1 | 36 | 5180 | 0.05 | | 5.56 | | | 17.00 | 17.00 | 2.44 | 1.97 | Pass |
| HT20 | MCS0 | 1 | 44 | 5220 | 0.05 | | 8.31 | | | 17.00 | 17.00 | 2.44 | 1.97 | Pass |
| HT20 | MCS0 | 1 | 48 | 5240 | 0.05 | | 6.93 | | | 17.00 | 17.00 | 2.44 | 1.97 | Pass |
| HT40 | MCS0 | 1 | 38 | 5190 | 0.10 | | 1.85 | | | 17.00 | 17.00 | 2.44 | 1.97 | Pass |
| HT40 | MCS0 | 1 | 46 | 5230 | 0.10 | | 7.23 | | | 17.00 | 17.00 | 2.44 | 1.97 | Pass |
| VHT80 | MCS0 | 1 | 42 | 5210 | 0.24 | | -2.44 | | | 17.00 | 17.00 | 2.44 | 1.97 | Pass |
| 11a | 6Mbps | 2 | 36 | 5180 | 0.12 | 0.12 | | | 8.02 | 17.00 | | 5.22 | | Pass |
| 11a | 6Mbps | 2 | 44 | 5220 | 0.12 | 0.12 | | | 8.21 | 17.00 | | 5.22 | | Pass |
| 11a | 6Mbps | 2 | 48 | 5240 | 0.12 | 0.12 | | | 8.42 | 17.00 | | 5.22 | | Pass |
| HT20 | MCS0 | 2 | 36 | 5180 | 0.05 | 0.05 | | | 7.50 | 17.00 | | 5.22 | | Pass |
| HT20 | MCS0 | 2 | 44 | 5220 | 0.05 | 0.05 | | | 8.04 | 17.00 | | 5.22 | | Pass |
| HT20 | MCS0 | 2 | 48 | 5240 | 0.05 | 0.05 | | | 8.21 | 17.00 | | 5.22 | | Pass |
| HT40 | MCS0 | 2 | 38 | 5190 | 0.13 | 0.13 | | | 3.94 | 17.00 | | 5.22 | | Pass |
| HT40 | MCS0 | 2 | 46 | 5230 | 0.13 | 0.13 | | | 8.69 | 17.00 | | 5.22 | | Pass |
| VHT80 | MCS0 | 2 | 42 | 5210 | 0.22 | 0.24 | | | -1.01 | 17.00 | | 5.22 | | Pass |

TEST RESULTS DATA
26dB and 99% OBW
Beamforming Modes

| Band I | | | | | | | | | | | | | |
|--------|-----------|-----|-----|-------------|---------------------|-------|-----------------------|-------|------------------------------------|-------|-----------------------------------|-------|------|
| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | 99% Bandwidth (MHz) | | 26 dB Bandwidth (MHz) | | IC 99% Bandwidth Power Limit (dBm) | | IC 99% Bandwidth EIRP Limit (dBm) | | Note |
| | | | | | Ant 1 | Ant 2 | Ant 1 | Ant 2 | Ant 1 | Ant 2 | Ant 1 | Ant 2 | |
| 11a | 6Mbps | 2 | 36 | 5180 | 17.08 | 17.08 | 20.63 | 20.38 | - | - | 22.33 | 22.33 | |
| 11a | 6Mbps | 2 | 44 | 5220 | 17.18 | 17.03 | 20.68 | 20.53 | - | - | 22.31 | 22.31 | |
| 11a | 6Mbps | 2 | 48 | 5240 | 17.13 | 17.08 | 20.68 | 20.48 | - | - | 22.33 | 22.33 | |
| HT20 | MCS0 | 2 | 36 | 5180 | 18.13 | 18.18 | 21.08 | 21.48 | - | - | 22.58 | 22.58 | |
| HT20 | MCS0 | 2 | 44 | 5220 | 18.18 | 18.23 | 21.58 | 21.53 | - | - | 22.60 | 22.60 | |
| HT20 | MCS0 | 2 | 48 | 5240 | 18.18 | 18.18 | 21.73 | 21.58 | - | - | 22.60 | 22.60 | |
| HT40 | MCS0 | 2 | 38 | 5190 | 36.06 | 36.36 | 39.29 | 39.56 | - | - | 23.01 | 23.01 | |
| HT40 | MCS0 | 2 | 46 | 5230 | 36.26 | 36.16 | 39.65 | 39.74 | - | - | 23.01 | 23.01 | |
| VHT80 | MCS0 | 2 | 42 | 5210 | 76.12 | 76.12 | 80.24 | 79.60 | - | - | 23.01 | 23.01 | |

TEST RESULTS DATA
Average Power Table
Beamforming Modes

| FCC Band I | | | | | | | | | | | | |
|------------|-----------|-----|-----|-------------|-------------------------------|-------|-------|---------------------------------|-------|----------|-------|-----------|
| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | Average Conducted Power (dBm) | | | FCC Conducted Power Limit (dBm) | | DG (dBi) | | Pass/Fail |
| | | | | | Ant 1 | Ant 2 | SUM | Ant 1 | Ant 2 | Ant 1 | Ant 2 | |
| 11a | 6Mbps | 2 | 36 | 5180 | 10.86 | 10.66 | 13.77 | 30.00 | | 5.22 | Pass | |
| 11a | 6Mbps | 2 | 44 | 5220 | 11.05 | 10.68 | 13.88 | 30.00 | | 5.22 | Pass | |
| 11a | 6Mbps | 2 | 48 | 5240 | 11.15 | 10.75 | 13.96 | 30.00 | | 5.22 | Pass | |
| HT20 | MCS0 | 2 | 36 | 5180 | 12.21 | 11.59 | 14.92 | 30.00 | | 5.22 | Pass | |
| HT20 | MCS0 | 2 | 44 | 5220 | 12.40 | 11.74 | 15.09 | 30.00 | | 5.22 | Pass | |
| HT20 | MCS0 | 2 | 48 | 5240 | 12.46 | 11.64 | 15.08 | 30.00 | | 5.22 | Pass | |
| HT40 | MCS0 | 2 | 38 | 5190 | 12.62 | 12.24 | 15.44 | 30.00 | | 5.22 | Pass | |
| HT40 | MCS0 | 2 | 46 | 5230 | 12.55 | 12.39 | 15.48 | 30.00 | | 5.22 | Pass | |
| VHT80 | MCS0 | 2 | 42 | 5210 | 12.66 | 11.95 | 15.33 | 30.00 | | 5.22 | Pass | |

TEST RESULTS DATA
Power Spectral Density
Beamforming Modes

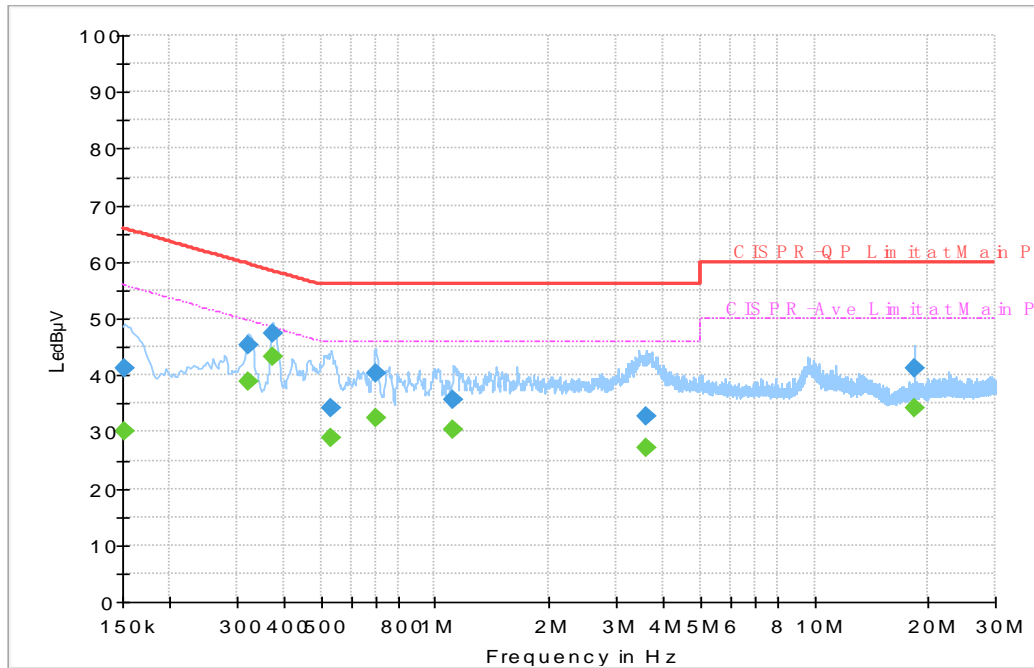
| FCC Band I | | | | | | | | | | | | |
|------------|-----------|-----|-----|-------------|---------------------------------|-------|--------|-----------------------------|-------|----------|-------|------------|
| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | Average Power Density (dBm/MHz) | | | Average PSD Limit (dBm/MHz) | | DG (dBi) | | Pass /Fail |
| | | | | | Ant 1 | Ant 2 | SUM | Ant 1 | Ant 2 | Ant 1 | Ant 2 | |
| 11a | 6Mbps | 2 | 36 | 5180 | | | -0.72 | 17.00 | 5.22 | | Pass | |
| 11a | 6Mbps | 2 | 44 | 5220 | | | -0.70 | 17.00 | 5.22 | | Pass | |
| 11a | 6Mbps | 2 | 48 | 5240 | | | -0.48 | 17.00 | 5.22 | | Pass | |
| HT20 | MCS0 | 2 | 36 | 5180 | | | -0.19 | 17.00 | 5.22 | | Pass | |
| HT20 | MCS0 | 2 | 44 | 5220 | | | -0.35 | 17.00 | 5.22 | | Pass | |
| HT20 | MCS0 | 2 | 48 | 5240 | | | -0.54 | 17.00 | 5.22 | | Pass | |
| HT40 | MCS0 | 2 | 38 | 5190 | | | -5.78 | 17.00 | 5.22 | | Pass | |
| HT40 | MCS0 | 2 | 46 | 5230 | | | -5.63 | 17.00 | 5.22 | | Pass | |
| VHT80 | MCS0 | 2 | 42 | 5210 | | | -12.29 | 17.00 | 5.22 | | Pass | |



Appendix B. AC Conducted Emission Test Results

| | | | |
|-----------------|---------------|---------------------|---------|
| Test Engineer : | Kai-Chun Chu | Temperature : | 25~26°C |
| | | Relative Humidity : | 52~54% |
| Test Voltage : | 120Vac / 60Hz | Phase : | Line |

Full Spectrum



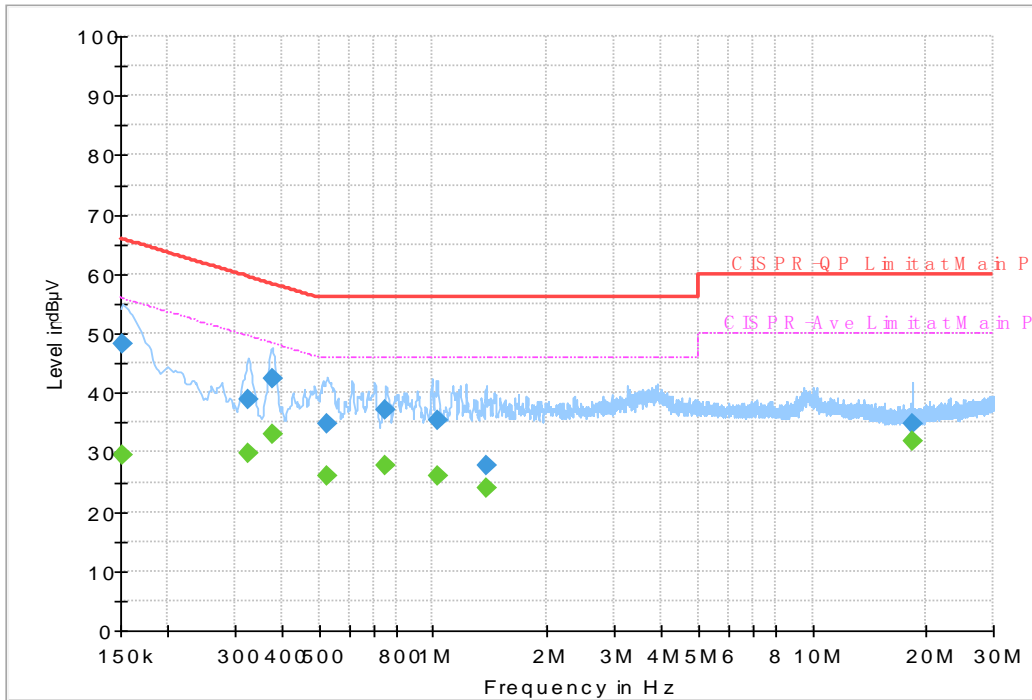
Final Result

| Frequency (MHz) | Quasi-Peak (dBµV) | CAverage (dBµV) | Limit (dBµV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|-------------------|-----------------|--------------|-------------|------|--------|------------|
| 0.152250 | --- | 30.24 | 55.88 | 25.64 | L1 | OFF | 19.5 |
| 0.152250 | 41.09 | --- | 65.88 | 24.79 | L1 | OFF | 19.5 |
| 0.323250 | --- | 38.88 | 49.62 | 10.74 | L1 | OFF | 19.5 |
| 0.323250 | 45.36 | --- | 59.62 | 14.26 | L1 | OFF | 19.5 |
| 0.375000 | --- | 43.20 | 48.39 | 5.19 | L1 | OFF | 19.5 |
| 0.375000 | 47.37 | --- | 58.39 | 11.02 | L1 | OFF | 19.5 |
| 0.532500 | --- | 29.04 | 46.00 | 16.96 | L1 | OFF | 19.5 |
| 0.532500 | 34.11 | --- | 56.00 | 21.89 | L1 | OFF | 19.5 |
| 0.696750 | --- | 32.50 | 46.00 | 13.50 | L1 | OFF | 19.6 |
| 0.696750 | 40.26 | --- | 56.00 | 15.74 | L1 | OFF | 19.6 |
| 1.119750 | --- | 30.35 | 46.00 | 15.65 | L1 | OFF | 19.6 |
| 1.119750 | 35.56 | --- | 56.00 | 20.44 | L1 | OFF | 19.6 |
| 3.599250 | --- | 27.16 | 46.00 | 18.84 | L1 | OFF | 19.7 |
| 3.599250 | 32.82 | --- | 56.00 | 23.18 | L1 | OFF | 19.7 |
| 18.431250 | --- | 34.28 | 50.00 | 15.72 | L1 | OFF | 20.2 |
| 18.431250 | 41.36 | --- | 60.00 | 18.64 | L1 | OFF | 20.2 |



| | | | |
|-----------------|---------------|---------------------|---------|
| Test Engineer : | Kai-Chun Chu | Temperature : | 25~26°C |
| | | Relative Humidity : | 52~54% |
| Test Voltage : | 120Vac / 60Hz | Phase : | Neutral |

Full Spectrum



Final Result

| Frequency (MHz) | Quasi-Peak (dBµV) | CAverage (dBµV) | Limit (dBµV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|-------------------|-----------------|--------------|-------------|------|--------|------------|
| 0.152250 | --- | 29.59 | 55.88 | 26.29 | N | OFF | 19.5 |
| 0.152250 | 48.12 | --- | 65.88 | 17.76 | N | OFF | 19.5 |
| 0.325500 | --- | 29.85 | 49.57 | 19.72 | N | OFF | 19.5 |
| 0.325500 | 39.02 | --- | 59.57 | 20.55 | N | OFF | 19.5 |
| 0.377250 | --- | 32.90 | 48.34 | 15.44 | N | OFF | 19.5 |
| 0.377250 | 42.54 | --- | 58.34 | 15.80 | N | OFF | 19.5 |
| 0.528000 | --- | 26.17 | 46.00 | 19.83 | N | OFF | 19.5 |
| 0.528000 | 34.94 | --- | 56.00 | 21.06 | N | OFF | 19.5 |
| 0.750750 | --- | 27.83 | 46.00 | 18.17 | N | OFF | 19.6 |
| 0.750750 | 37.03 | --- | 56.00 | 18.97 | N | OFF | 19.6 |
| 1.025250 | --- | 26.14 | 46.00 | 19.86 | N | OFF | 19.6 |
| 1.025250 | 35.24 | --- | 56.00 | 20.76 | N | OFF | 19.6 |
| 1.378500 | --- | 23.91 | 46.00 | 22.09 | N | OFF | 19.6 |
| 1.378500 | 27.64 | --- | 56.00 | 28.36 | N | OFF | 19.6 |
| 18.431250 | --- | 31.94 | 50.00 | 18.06 | N | OFF | 20.3 |
| 18.431250 | 34.73 | --- | 60.00 | 25.27 | N | OFF | 20.3 |



Appendix C. Radiated Spurious Emission

For CDD Modes

Band 1 - 5150~5250MHz WIFI 802.11a (Band Edge @ 3m)

| WIFI Ant. | Note | Frequency (MHz) | Level (dBμV/m) | Over Limit (dB) | Limit Line (dBμV/m) | Read Level (dBμV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Ant Pos (cm) | Table Pos (deg) | Peak Avg. (P/A) | Pol. (H/V) |
|-----------------------------|---|-------------------|------------------|-------------------|-----------------------|---------------------|-------------------------|-------------------|----------------------|----------------|-------------------|-------------------|--------------|
| 802.11a CH 36 5180MHz | | 5149.76 | 60.3 | -13.7 | 74 | 50.17 | 35.39 | 7.99 | 33.25 | 239 | 29 | P | H |
| | | 5150 | 49.69 | -4.31 | 54 | 39.56 | 35.39 | 7.99 | 33.25 | 239 | 29 | A | H |
| | * | 5178 | 108.65 | - | - | 98.55 | 35.36 | 7.99 | 33.25 | 239 | 29 | P | H |
| | | 5178 | 100.19 | - | - | 90.09 | 35.36 | 7.99 | 33.25 | 239 | 29 | A | H |
| | | 5149.28 | 62.53 | -11.47 | 74 | 52.4 | 35.39 | 7.99 | 33.25 | 111 | 179 | P | V |
| | | 5150 | 52.4 | -1.6 | 54 | 42.27 | 35.39 | 7.99 | 33.25 | 111 | 179 | A | V |
| | * | 5182 | 111.75 | - | - | 101.65 | 35.36 | 7.99 | 33.25 | 111 | 179 | P | V |
| | | 5182 | 102.83 | - | - | 92.73 | 35.36 | 7.99 | 33.25 | 111 | 179 | A | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



Band 1 5150~5250MHz

WIFI 802.11a (Harmonic @ 3m)

| WIFI Ant. 1 | Note | Frequency (MHz) | Level (dBμV/m) | Over Limit (dB) | Limit Line (dBμV/m) | Read Level (dBμV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Ant Pos (cm) | Table Pos (deg) | Peak Avg. (P/A) | Pol. (H/V) |
|-------------|---|-------------------|------------------|-------------------|-----------------------|-------------------|-------------------------|-------------------|----------------------|----------------|-------------------|-----------------|------------|
| 802.11a | | 10360 | 58.83 | -9.47 | 68.3 | 74.57 | 38.47 | 11.94 | 66.15 | 100 | 360 | P | H |
| CH 36 | | 10360 | 63.38 | -4.92 | 68.3 | 79.12 | 38.47 | 11.94 | 66.15 | 100 | 360 | P | V |
| 5180MHz | | | | | | | | | | | | | |
| 802.11a | | 10440 | 66.86 | -1.44 | 68.3 | 82.35 | 38.52 | 12.09 | 66.1 | 297 | 1 | P | H |
| CH 44 | | 10440 | 66.23 | -2.07 | 68.3 | 81.72 | 38.52 | 12.09 | 66.1 | 258 | 325 | P | V |
| 5220MHz | | | | | | | | | | | | | |
| 802.11a | | 10480 | 67 | -1.3 | 68.3 | 82.3 | 38.56 | 12.21 | 66.07 | 285 | 0 | P | H |
| CH 48 | | 10480 | 66.54 | -1.76 | 68.3 | 81.84 | 38.56 | 12.21 | 66.07 | 260 | 317 | P | V |
| 5240MHz | | | | | | | | | | | | | |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



Band 1 5150~5250MHz
WIFI 802.11n HT20 (Band Edge @ 3m)

Table with 14 columns: WIFI Ant. 1, Note, Frequency (MHz), Level (dBµV/m), Over Limit (dB), Limit Line (dBµV/m), Read Level (dBµV), Antenna Factor (dB/m), Cable Loss (dB), Preamp Factor (dB), Ant Pos (cm), Table Pos (deg), Peak Avg. (P/A), Pol. (H/V). Rows include test results for 802.11n HT20 CH 36 5180MHz and a Remark section.



Band 1 5150~5250MHz
WIFI 802.11n HT20 (Harmonic @ 3m)

Table with 14 columns: WIFI Ant. 1, Note, Frequency (MHz), Level (dBµV/m), Over Limit (dB), Limit Line (dBµV/m), Read Level (dBµV), Antenna Factor (dB/m), Cable Loss (dB), Preamp Factor (dB), Ant Pos (cm), Table Pos (deg), Peak Avg. (P/A), Pol. (H/V). Rows include test results for 802.11n HT20 CH 36 (5180MHz) and CH 44 (5220MHz), and 802.11n HT20 CH 48 (5240MHz).

Remark

- 1. No other spurious found.
2. All results are PASS against Peak and Average limit line.



Band 1 5150~5250MHz
WIFI 802.11n HT40 (Band Edge @ 3m)

| WIFI Ant. 1 | Note | Frequency (MHz) | Level (dBμV/m) | Over Limit (dB) | Limit Line (dBμV/m) | Read Level (dBμV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Ant Pos (cm) | Table Pos (deg) | Peak Avg. (P/A) | Pol. (H/V) |
|----------------------------|---|-------------------|------------------|-------------------|-----------------------|-------------------|-------------------------|-------------------|----------------------|----------------|-------------------|-----------------|------------|
| 802.11n HT40 CH 38 5190MHz | | 5146.88 | 62.66 | -11.34 | 74 | 52.53 | 35.39 | 7.99 | 33.25 | 360 | 88 | P | H |
| | | 5149.6 | 51.25 | -2.75 | 54 | 41.12 | 35.39 | 7.99 | 33.25 | 360 | 88 | A | H |
| | * | 5198 | 105.92 | - | - | 95.83 | 35.35 | 7.99 | 33.25 | 360 | 88 | P | H |
| | | 5198 | 98.28 | - | - | 88.19 | 35.35 | 7.99 | 33.25 | 360 | 88 | A | H |
| | | 5378.4 | 51.72 | -22.28 | 74 | 41.45 | 35.2 | 8.28 | 33.21 | 360 | 88 | P | H |
| | | 5353.74 | 42.25 | -11.75 | 54 | 32.02 | 35.23 | 8.22 | 33.22 | 360 | 88 | A | H |
| | | 5143.36 | 63.13 | -10.87 | 74 | 53 | 35.39 | 7.99 | 33.25 | 117 | 194 | P | V |
| | | 5148.8 | 52.53 | -1.47 | 54 | 42.4 | 35.39 | 7.99 | 33.25 | 117 | 194 | A | V |
| | * | 5200 | 106.06 | - | - | 95.97 | 35.35 | 7.99 | 33.25 | 117 | 194 | P | V |
| | | 5200 | 99.36 | - | - | 89.27 | 35.35 | 7.99 | 33.25 | 117 | 194 | A | V |
| | | 5398.2 | 52.51 | -21.49 | 74 | 42.23 | 35.19 | 8.3 | 33.21 | 117 | 194 | P | V |
| | | 5350 | 42.89 | -11.11 | 54 | 32.66 | 35.23 | 8.22 | 33.22 | 117 | 194 | A | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



Band 1 5150~5250MHz
WIFI 802.11n HT40 (Harmonic @ 3m)

Table with 14 columns: WIFI Ant. 1, Note, Frequency (MHz), Level (dBµV/m), Over Limit (dB), Limit Line (dBµV/m), Read Level (dBµV), Antenna Factor (dB/m), Cable Loss (dB), Preamp Factor (dB), Ant Pos (cm), Table Pos (deg), Peak Avg. (P/A), Pol. (H/V). Rows include data for 10380 MHz and 10460 MHz channels.



Band 1 5150~5250MHz
WIFI 802.11ac VHT80 (Band Edge @ 3m)

Table with 14 columns: WIFI Ant. 1, Note, Frequency (MHz), Level (dBµV/m), Over Limit (dB), Limit Line (dBµV/m), Read Level (dBµV), Antenna Factor (dB/m), Cable Loss (dB), Preamp Factor (dB), Ant Pos (cm), Table Pos (deg), Peak Avg. (P/A), Pol. (H/V). Rows include test results for frequencies like 5144.16, 5142.56, 5208, 5360.04, 5351.22, 5145.76, 5148.16, 5194, 5351.4, 5350.14.

Remark

- 1. No other spurious found.
2. All results are PASS against Peak and Average limit line.



Band 1 5150~5250MHz

WIFI 802.11ac VHT80 (Harmonic @ 3m)

| WIFI Ant. 1 | Note | Frequency (MHz) | Level (dBμV/m) | Over Limit (dB) | Limit Line (dBμV/m) | Read Level (dBμV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Ant Pos (cm) | Table Pos (deg) | Peak Avg. (P/A) | Pol. (H/V) |
|------------------------------|---|-------------------|------------------|-------------------|-----------------------|-------------------|-------------------------|-------------------|----------------------|----------------|-------------------|-----------------|------------|
| 802.11ac VHT80 CH 42 5210MHz | | 10420 | 49.9 | -18.4 | 68.3 | 65.45 | 38.51 | 12.06 | 66.12 | 100 | 360 | P | H |
| | | 10420 | 51.77 | -16.53 | 68.3 | 67.32 | 38.51 | 12.06 | 66.12 | 100 | 360 | P | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



Emission below 1GHz

5GHz WIFI 802.11n HT20 (LF @ 3m)

| WIFI | Note | Frequency | Level | Over | Limit | Read | Antenna | Cable | Preamp | Ant | Table | Peak | Pol. |
|-----------------------|--|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|
| Ant. | | | | Limit | Line | Level | Factor | Loss | Factor | Pos | Pos | Avg. | |
| 1 | | (MHz) | (dBμV/m) | (dB) | (dBμV/m) | (dBμV) | (dB/m) | (dB) | (dB) | (cm) | (deg) | (P/A) | (H/V) |
| 802.11n HT20 LF | | 30 | 21.99 | -18.01 | 40 | 28.79 | 24.5 | 0.61 | 31.91 | - | - | P | H |
| | | 162.89 | 20.25 | -23.25 | 43.5 | 34.81 | 15.71 | 1.3 | 31.57 | - | - | P | H |
| | | 262.8 | 30.56 | -15.44 | 46 | 40.74 | 19.21 | 1.76 | 31.15 | - | - | P | H |
| | | 672.14 | 30.53 | -15.47 | 46 | 32.22 | 24.52 | 2.6 | 28.81 | - | - | P | H |
| | | 710.94 | 34.02 | -11.98 | 46 | 35.17 | 24.73 | 2.67 | 28.55 | - | - | P | H |
| | | 773.02 | 34.36 | -11.64 | 46 | 34.25 | 25.47 | 2.8 | 28.16 | 100 | 54 | P | H |
| | | 30 | 22.5 | -17.5 | 40 | 29.3 | 24.5 | 0.61 | 31.91 | - | - | P | V |
| | | 121.18 | 17.53 | -25.97 | 43.5 | 30.05 | 18.06 | 1.12 | 31.7 | - | - | P | V |
| | | 261.83 | 28.58 | -17.42 | 46 | 38.74 | 19.24 | 1.76 | 31.16 | - | - | P | V |
| | | 547.01 | 27.62 | -18.38 | 46 | 31.04 | 23.71 | 2.47 | 29.6 | - | - | P | V |
| | | 710.94 | 29.18 | -16.82 | 46 | 30.33 | 24.73 | 2.67 | 28.55 | - | - | P | V |
| | | 773.02 | 31.38 | -14.62 | 46 | 31.27 | 25.47 | 2.8 | 28.16 | 100 | 65 | P | V |
| Remark | 1. No other spurious found. 2. All results are PASS against limit line. | | | | | | | | | | | | |



Band 1 - 5150~5250MHz
WIFI 802.11a (Band Edge @ 3m)

Table with 14 columns: WIFI, Note, Frequency, Level, Over, Limit, Read, Antenna, Cable, Preamp, Ant, Table, Peak, Pol. It contains 8 rows of test data for 802.11a CH 36 5180MHz.



Band 1 5150~5250MHz
WIFI 802.11a (Harmonic @ 3m)

| WIFI Ant. 1+2 | Note | Frequency (MHz) | Level (dBμV/m) | Over Limit (dB) | Limit Line (dBμV/m) | Read Level (dBμV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Ant Pos (cm) | Table Pos (deg) | Peak Avg. (P/A) | Pol. (H/V) |
|-----------------------------|---|-------------------|------------------|-------------------|-----------------------|-------------------|-------------------------|-------------------|----------------------|----------------|-------------------|-----------------|------------|
| 802.11a CH 36 5180MHz | | 10360 | 59.78 | -8.52 | 68.3 | 75.52 | 38.47 | 11.94 | 66.15 | 100 | 360 | P | H |
| | | 10360 | 61.32 | -6.98 | 68.3 | 77.06 | 38.47 | 11.94 | 66.15 | 100 | 360 | P | V |
| 802.11a CH 44 5220MHz | | 10440 | 67.05 | -1.25 | 68.3 | 82.54 | 38.52 | 12.09 | 66.1 | 298 | 239 | P | H |
| | | 15660 | 44.09 | -29.91 | 74 | 54.71 | 40.78 | 14.15 | 65.55 | 100 | 0 | P | H |
| | | 10440 | 66.51 | -1.79 | 68.3 | 82 | 38.52 | 12.09 | 66.1 | 324 | 216 | P | V |
| | | 15660 | 44.54 | -29.46 | 74 | 55.16 | 40.78 | 14.15 | 65.55 | 100 | 0 | P | V |
| 802.11a CH 48 5240MHz | | 10485 | 67.08 | -1.22 | 68.3 | 82.38 | 38.56 | 12.21 | 66.07 | 299 | 238 | P | H |
| | | 15720 | 47.64 | -26.36 | 74 | 58.47 | 40.72 | 14.2 | 65.75 | 100 | 0 | P | H |
| | | 10480 | 66.2 | -2.1 | 68.3 | 81.5 | 38.56 | 12.21 | 66.07 | 321 | 220 | P | V |
| | | 15720 | 45.43 | -28.57 | 74 | 56.26 | 40.72 | 14.2 | 65.75 | 100 | 0 | P | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



Band 1 5150~5250MHz
WIFI 802.11n HT20 (Band Edge @ 3m)

Table with 14 columns: WIFI Ant. 1+2, Note, Frequency (MHz), Level (dBµV/m), Over Limit (dB), Limit Line (dBµV/m), Read Level (dBµV), Antenna Factor (dB/m), Cable Loss (dB), Preamp Factor (dB), Ant Pos (cm), Table Pos (deg), Peak Avg. (P/A), Pol. (H/V). Rows include data for 802.11n HT20 CH 36 5180MHz.



Band 1 5150~5250MHz
WIFI 802.11n HT20 (Harmonic @ 3m)

Table with 14 columns: WIFI Ant. 1+2, Note, Frequency (MHz), Level (dBµV/m), Over Limit (dB), Limit Line (dBµV/m), Read Level (dBµV), Antenna Factor (dB/m), Cable Loss (dB), Preamp Factor (dB), Ant Pos (cm), Table Pos (deg), Peak Avg. (P/A), Pol. (H/V). Rows include data for 802.11n HT20 CH 36 (5180MHz) and 802.11n HT20 CH 44 (5220MHz).

Remark
1. No other spurious found.
2. All results are PASS against Peak and Average limit line.



Band 1 5150~5250MHz
WIFI 802.11n HT40 (Band Edge @ 3m)

Table with 14 columns: WIFI Ant. 1+2, Note, Frequency (MHz), Level (dBµV/m), Over Limit (dB), Limit Line (dBµV/m), Read Level (dBµV), Antenna Factor (dB/m), Cable Loss (dB), Preamp Factor (dB), Ant Pos (cm), Table Pos (deg), Peak Avg. (P/A), Pol. (H/V). Rows include data for 802.11n HT40 CH 38 5190MHz and a Remark section.



Band 1 5150~5250MHz
WIFI 802.11n HT40 (Harmonic @ 3m)

| WIFI Ant. 1+2 | Note | Frequency (MHz) | Level (dBμV/m) | Over Limit (dB) | Limit Line (dBμV/m) | Read Level (dBμV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Ant Pos (cm) | Table Pos (deg) | Peak Avg. (P/A) | Pol. (H/V) |
|----------------------------|---|-------------------|------------------|-------------------|-----------------------|-------------------|-------------------------|-------------------|----------------------|----------------|-------------------|-----------------|------------|
| 802.11n HT40 CH 38 5190MHz | | 10380 | 61.38 | -6.92 | 68.3 | 77.06 | 38.48 | 11.98 | 66.14 | 296 | 264 | P | H |
| | | 10385 | 61.08 | -7.22 | 68.3 | 76.76 | 38.48 | 11.98 | 66.14 | 390 | 213 | P | V |
| 802.11n HT40 CH 46 5230MHz | | 10465 | 65.64 | -2.66 | 68.3 | 81 | 38.55 | 12.17 | 66.08 | 278 | 233 | P | H |
| | | 15696 | 49.89 | -24.11 | 74 | 60.62 | 40.75 | 14.17 | 65.65 | 100 | 0 | P | H |
| | | 10460 | 64.44 | -3.86 | 68.3 | 79.87 | 38.53 | 12.13 | 66.09 | 100 | 195 | P | V |
| | | 15690 | 48.09 | -25.91 | 74 | 58.82 | 40.75 | 14.17 | 65.65 | 100 | 0 | P | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



Band 1 5150~5250MHz
WIFI 802.11ac VHT80 (Band Edge @ 3m)

Table with 14 columns: WIFI Ant. 1+2, Note, Frequency (MHz), Level (dBµV/m), Over Limit (dB), Limit Line (dBµV/m), Read Level (dBµV), Antenna Factor (dB/m), Cable Loss (dB), Preamp Factor (dB), Ant Pos (cm), Table Pos (deg), Peak Avg. (P/A), Pol. (H/V). Rows include test data for 802.11ac VHT80 CH 42 5210MHz and a Remark section.



Band 1 5150~5250MHz

WIFI 802.11ac VHT80 (Harmonic @ 3m)

| WIFI Ant. 1+2 | Note | Frequency (MHz) | Level (dBμV/m) | Over Limit (dB) | Limit Line (dBμV/m) | Read Level (dBμV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Ant Pos (cm) | Table Pos (deg) | Peak Avg. (P/A) | Pol. (H/V) |
|------------------------------|---|-------------------|------------------|-------------------|-----------------------|-------------------|-------------------------|-------------------|----------------------|----------------|-------------------|-----------------|------------|
| 802.11ac VHT80 CH 42 5210MHz | | 10420 | 51.8 | -16.5 | 68.3 | 67.35 | 38.51 | 12.06 | 66.12 | 100 | 360 | P | H |
| | | 10420 | 51.2 | -17.1 | 68.3 | 66.75 | 38.51 | 12.06 | 66.12 | 100 | 360 | P | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



Emission below 1GHz

5GHz WIFI 802.11ac VHT80 (LF @ 3m)

| WIFI | Note | Frequency | Level | Over | Limit | Read | Antenna | Cable | Preamp | Ant | Table | Peak | Pol. |
|-----------------------|--|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|
| Ant. | | | | Limit | Line | Level | Factor | Loss | Factor | Pos | Pos | Avg. | |
| 1+2 | | (MHz) | (dBμV/m) | (dB) | (dBμV/m) | (dBμV) | (dB/m) | (dB) | (dB) | (cm) | (deg) | (P/A) | (H/V) |
| 802.11n HT40 LF | | 30 | 22.3 | -17.7 | 40 | 29.1 | 24.5 | 0.61 | 31.91 | - | - | P | H |
| | | 143.49 | 22.59 | -20.91 | 43.5 | 36.09 | 16.93 | 1.22 | 31.65 | - | - | P | H |
| | | 215.27 | 23.46 | -20.04 | 43.5 | 38.13 | 15.15 | 1.53 | 31.35 | - | - | P | H |
| | | 263.77 | 31.56 | -14.44 | 46 | 41.76 | 19.19 | 1.76 | 31.15 | - | - | P | H |
| | | 710.94 | 34.31 | -11.69 | 46 | 35.46 | 24.73 | 2.67 | 28.55 | 100 | 64 | P | H |
| | | 773.02 | 34.14 | -11.86 | 46 | 34.03 | 25.47 | 2.8 | 28.16 | - | - | P | H |
| | | 30 | 22.69 | -17.31 | 40 | 29.49 | 24.5 | 0.61 | 31.91 | - | - | P | V |
| | | 256.01 | 27.84 | -18.16 | 46 | 38.35 | 18.92 | 1.75 | 31.18 | - | - | P | V |
| | | 430.61 | 25.69 | -20.31 | 46 | 31.79 | 22.09 | 2.09 | 30.28 | - | - | P | V |
| | | 539.25 | 29.22 | -16.78 | 46 | 32.78 | 23.63 | 2.45 | 29.64 | - | - | P | V |
| | | 710.94 | 32.8 | -13.2 | 46 | 33.95 | 24.73 | 2.67 | 28.55 | 100 | 69 | P | V |
| | | 773.02 | 31.53 | -14.47 | 46 | 31.42 | 25.47 | 2.8 | 28.16 | - | - | P | V |
| Remark | 1. No other spurious found. 2. All results are PASS against limit line. | | | | | | | | | | | | |



For Beamforming Modes

Band 1 - 5150~5250MHz

WIFI 802.11n HT20 (Band Edge @ 3m)

| WIFI Ant. | Note | Frequency | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Ant Pos | Table Pos | Peak Avg. | Pol. |
|----------------------------|------|-----------|------------|------------|------------|------------|----------------|------------|---------------|---------|-----------|-----------|---------|
| 1+2 | | (MHz) | (dBμV/m) | (dB) | (dBμV/m) | (dBμV) | (dB/m) | (dB) | (dB) | (cm) | (deg) | (P/A) | (H/V) |
| 802.11n HT20 CH 36 5180MHz | | 5142.88 | 56.79 | -17.21 | 74 | 46.66 | 35.39 | 7.99 | 33.25 | 301 | 65 | P | H |
| | | 5137.92 | 47.75 | -6.25 | 54 | 37.61 | 35.41 | 7.99 | 33.26 | 301 | 65 | A | H |
| | * | 5184 | 111.27 | - | - | 101.17 | 35.36 | 7.99 | 33.25 | 301 | 65 | P | H |
| | | 5184 | 103.54 | - | - | 93.44 | 35.36 | 7.99 | 33.25 | 301 | 65 | A | H |
| | | 5137.6 | 58.01 | -15.99 | 74 | 47.87 | 35.41 | 7.99 | 33.26 | 101 | 168 | P | V |
| | | 5144 | 48.08 | -5.92 | 54 | 37.95 | 35.39 | 7.99 | 33.25 | 101 | 168 | A | V |
| | * | 5182 | 112.05 | - | - | 101.95 | 35.36 | 7.99 | 33.25 | 101 | 168 | P | V |
| | 5182 | 103.45 | - | - | 93.35 | 35.36 | 7.99 | 33.25 | 101 | 168 | A | V | |



Band 1 5150~5250MHz
WIFI 802.11n HT20 (Harmonic @ 3m)

Table with 13 columns: WIFI Ant. 1+2, Note, Frequency (MHz), Level (dBµV/m), Over Limit (dB), Limit Line (dBµV/m), Read Level (dBµV), Antenna Factor (dB/m), Cable Loss (dB), Preamp Factor (dB), Ant Pos (cm), Table Pos (deg), Peak Avg. (P/A), Pol. (H/V). Rows include test results for frequencies 10360, 10440, and 10480 MHz.



Band 1 5150~5250MHz
WIFI 802.11n HT40 (Band Edge @ 3m)

Table with 14 columns: WIFI Ant. 1+2, Note, Frequency (MHz), Level (dBµV/m), Over Limit (dB), Limit Line (dBµV/m), Read Level (dBµV), Antenna Factor (dB/m), Cable Loss (dB), Preamp Factor (dB), Ant Pos (cm), Table Pos (deg), Peak Avg. (P/A), Pol. (H/V). Rows include test data for 802.11n HT40 CH 38 5190MHz and a Remark section.



Band 1 5150~5250MHz
WIFI 802.11n HT40 (Harmonic @ 3m)

| WIFI Ant. 1+2 | Note | Frequency (MHz) | Level (dBμV/m) | Over Limit (dB) | Limit Line (dBμV/m) | Read Level (dBμV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Ant Pos (cm) | Table Pos (deg) | Peak Avg. (P/A) | Pol. (H/V) |
|----------------------------|---|-------------------|------------------|-------------------|-----------------------|-------------------|-------------------------|-------------------|----------------------|----------------|-------------------|-----------------|------------|
| 802.11n HT40 CH 38 5190MHz | | 10380 | 53.31 | -14.99 | 68.3 | 68.99 | 38.48 | 11.98 | 66.14 | 100 | 360 | P | H |
| | | 10380 | 55.07 | -13.23 | 68.3 | 70.75 | 38.48 | 11.98 | 66.14 | 100 | 360 | P | V |
| 802.11n HT40 CH 46 5230MHz | | 10460 | 50.88 | -17.42 | 68.3 | 66.31 | 38.53 | 12.13 | 66.09 | 100 | 360 | P | H |
| | | 10460 | 61.53 | -6.77 | 68.3 | 76.96 | 38.53 | 12.13 | 66.09 | 100 | 360 | P | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



Band 1 5150~5250MHz
WIFI 802.11ac VHT80 (Band Edge @ 3m)

| WIFI Ant. 1+2 | Note | Frequency (MHz) | Level (dBμV/m) | Over Limit (dB) | Limit Line (dBμV/m) | Read Level (dBμV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Ant Pos (cm) | Table Pos (deg) | Peak Avg. (P/A) | Pol. (H/V) |
|------------------------------|---|-------------------|------------------|-------------------|-----------------------|---------------------|-------------------------|-------------------|----------------------|----------------|-------------------|-------------------|--------------|
| 802.11ac VHT80 CH 42 5210MHz | | 5114.4 | 55.64 | -18.36 | 74 | 45.49 | 35.42 | 7.99 | 33.26 | 277 | 255 | P | H |
| | | 5142.56 | 50.68 | -3.32 | 54 | 40.55 | 35.39 | 7.99 | 33.25 | 277 | 255 | A | H |
| | * | 5230 | 94.28 | - | - | 84.16 | 35.32 | 8.04 | 33.24 | 277 | 255 | P | H |
| | | 5230 | 92.71 | - | - | 82.59 | 35.32 | 8.04 | 33.24 | 277 | 255 | A | H |
| | | 5392.08 | 51.97 | -22.03 | 74 | 41.7 | 35.2 | 8.28 | 33.21 | 277 | 255 | P | H |
| | | 5350.14 | 42.64 | -11.36 | 54 | 32.41 | 35.23 | 8.22 | 33.22 | 277 | 255 | A | H |
| | | 5149.92 | 56.95 | -17.05 | 74 | 46.82 | 35.39 | 7.99 | 33.25 | 219 | 310 | P | V |
| | | 5142.88 | 52.54 | -1.46 | 54 | 42.41 | 35.39 | 7.99 | 33.25 | 219 | 310 | A | V |
| | * | 5224 | 103.49 | - | - | 93.38 | 35.34 | 8.01 | 33.24 | 100 | 217 | P | V |
| | | 5224 | 97.32 | - | - | 87.21 | 35.34 | 8.01 | 33.24 | 100 | 217 | A | V |
| | | 5351.76 | 52.22 | -21.78 | 74 | 41.99 | 35.23 | 8.22 | 33.22 | 219 | 310 | P | V |
| | | 5351.76 | 44.12 | -9.88 | 54 | 33.89 | 35.23 | 8.22 | 33.22 | 219 | 310 | A | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



Band 1 5150~5250MHz

WIFI 802.11ac VHT80 (Harmonic @ 3m)

| WIFI Ant. 1+2 | Note | Frequency (MHz) | Level (dBμV/m) | Over Limit (dB) | Limit Line (dBμV/m) | Read Level (dBμV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Ant Pos (cm) | Table Pos (deg) | Peak Avg. (P/A) | Pol. (H/V) |
|------------------------------|---|-------------------|------------------|-------------------|-----------------------|-------------------|-------------------------|-------------------|----------------------|----------------|-------------------|-----------------|------------|
| 802.11ac VHT80 CH 42 5210MHz | | 10420 | 52.34 | -15.96 | 68.3 | 67.89 | 38.51 | 12.06 | 66.12 | 100 | 360 | P | H |
| | | 10420 | 55.09 | -13.21 | 68.3 | 70.64 | 38.51 | 12.06 | 66.12 | 100 | 0 | P | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



Emission below 1GHz

5GHz WIFI 802.11n HT40 (LF @ 3m)

| WIFI | Note | Frequency | Level | Over | Limit | Read | Antenna | Cable | Preamp | Ant | Table | Peak | Pol. |
|-----------------------|--|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|
| Ant. | | | | Limit | Line | Level | Factor | Loss | Factor | Pos | Pos | Avg. | |
| 1+2 | | (MHz) | (dBμV/m) | (dB) | (dBμV/m) | (dBμV) | (dB/m) | (dB) | (dB) | (cm) | (deg) | (P/A) | (H/V) |
| 802.11n HT40 LF | | 30 | 22.82 | -17.18 | 40 | 29.62 | 24.5 | 0.61 | 31.91 | - | - | P | H |
| | | 171.62 | 23.65 | -19.85 | 43.5 | 38.4 | 15.46 | 1.33 | 31.54 | - | - | P | H |
| | | 263.77 | 27.69 | -18.31 | 46 | 37.89 | 19.19 | 1.76 | 31.15 | - | - | P | H |
| | | 578.05 | 28.37 | -17.63 | 46 | 31.21 | 24.05 | 2.54 | 29.43 | - | - | P | H |
| | | 773.02 | 32.99 | -13.01 | 46 | 32.88 | 25.47 | 2.8 | 28.16 | 100 | 298 | P | H |
| | | 805.03 | 30.39 | -15.61 | 46 | 29.63 | 25.83 | 2.88 | 27.95 | - | - | P | H |
| | | 30 | 22.08 | -17.92 | 40 | 28.88 | 24.5 | 0.61 | 31.91 | - | - | P | V |
| | | 162.89 | 21.85 | -21.65 | 43.5 | 36.41 | 15.71 | 1.3 | 31.57 | - | - | P | V |
| | | 261.83 | 27.52 | -18.48 | 46 | 37.68 | 19.24 | 1.76 | 31.16 | - | - | P | V |
| | | 664.38 | 29.89 | -16.11 | 46 | 31.67 | 24.49 | 2.59 | 28.86 | - | - | P | V |
| | | 710.94 | 33.73 | -12.27 | 46 | 34.88 | 24.73 | 2.67 | 28.55 | 100 | 264 | P | V |
| | | 773.02 | 32.43 | -13.57 | 46 | 32.32 | 25.47 | 2.8 | 28.16 | - | - | P | V |
| Remark | 1. No other spurious found. 2. All results are PASS against limit line. | | | | | | | | | | | | |



Note symbol

| | |
|-----|--|
| * | Fundamental Frequency which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency. |
| ! | Test result is over limit line. |
| P/A | Peak or Average |
| H/V | Horizontal or Vertical |



A calculation example for radiated spurious emission is shown as below:

| WIFI | Note | Frequency | Level | Over | Limit | Read | Antenna | Cable | Preamp | Ant | Table | Peak | Pol. |
|---------|------|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|
| Ant. | | | | Limit | Line | Level | Factor | Loss | Factor | Pos | Pos | Avg. | |
| 1+2 | | (MHz) | (dBμV/m) | (dB) | (dBμV/m) | (dBμV) | (dB/m) | (dB) | (dB) | (cm) | (deg) | (P/A) | (H/V) |
| 802.11b | | 2390 | 55.45 | -18.55 | 74 | 54.51 | 32.22 | 4.58 | 35.86 | 103 | 308 | P | H |
| CH 01 | | | | | | | | | | | | | |
| 2412MHz | | 2390 | 43.54 | -10.46 | 54 | 42.6 | 32.22 | 4.58 | 35.86 | 103 | 308 | A | H |

- Level(dBμV/m) =
Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
- Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

- Level(dBμV/m)
= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)
= 55.45 (dBμV/m)
- Over Limit(dB)
= Level(dBμV/m) – Limit Line(dBμV/m)
= 55.45(dBμV/m) – 74(dBμV/m)
= -18.55(dB)

For Average Limit @ 2390MHz:

- Level(dBμV/m)
= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)
= 43.54 (dBμV/m)
- Over Limit(dB)
= Level(dBμV/m) – Limit Line(dBμV/m)
= 43.54(dBμV/m) – 54(dBμV/m)
= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is “PASS”.



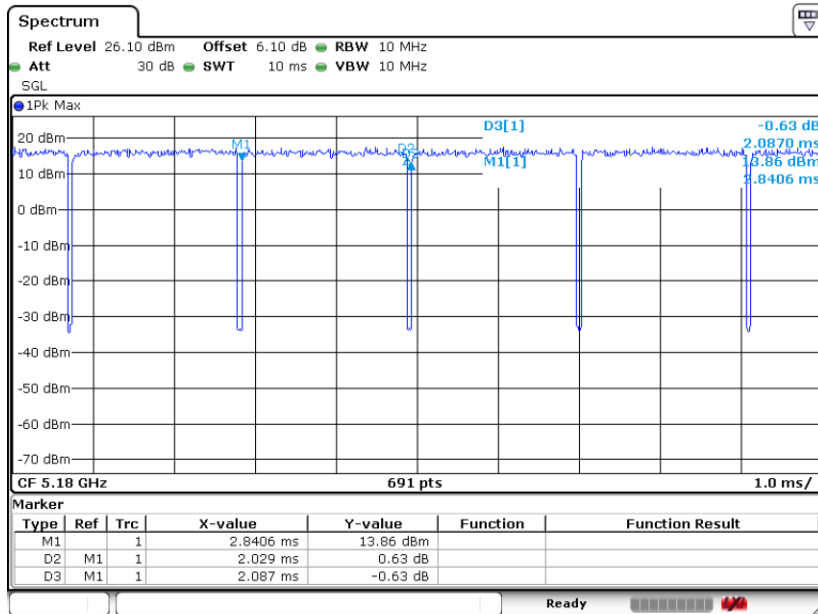
Appendix D. Duty Cycle Plots

For CDD Modes

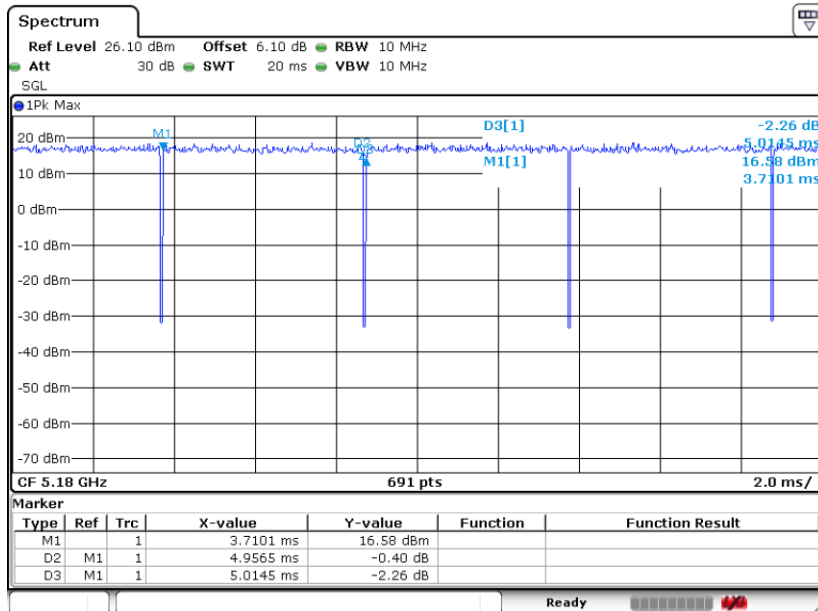
| Antenna | Band | Duty Cycle(%) | T(ms) | 1/T(kHz) | VBW Setting |
|---------|----------------|---------------|-------|----------|-------------|
| 1 | 802.11a | 97.22 | 2.029 | 0.493 | 0.51KHz |
| 1 | 802.11n HT20 | 98.84 | - | - | 10Hz |
| 1 | 802.11n HT40 | 97.66 | 2.420 | 0.413 | 0.43KHz |
| 1 | 802.11ac VHT80 | 94.58 | 1.138 | 0.879 | 0.91KHz |
| 1+2 | 802.11a | 97.22 | 2.029 | 0.493 | 0.51KHz |
| 1+2 | 802.11n HT20 | 98.85 | - | - | 10Hz |
| 1+2 | 802.11n HT40 | 97.07 | 2.406 | 0.416 | 0.43KHz |
| 1+2 | 802.11ac VHT80 | 94.55 | 1.130 | 0.885 | 0.91KHz |



802.11a Antenna 1

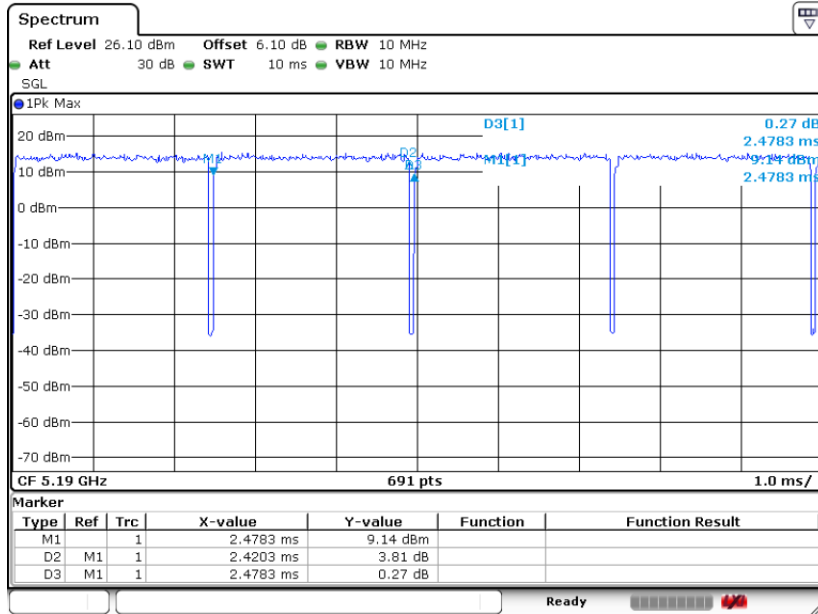


802.11n HT20 Antenna 1

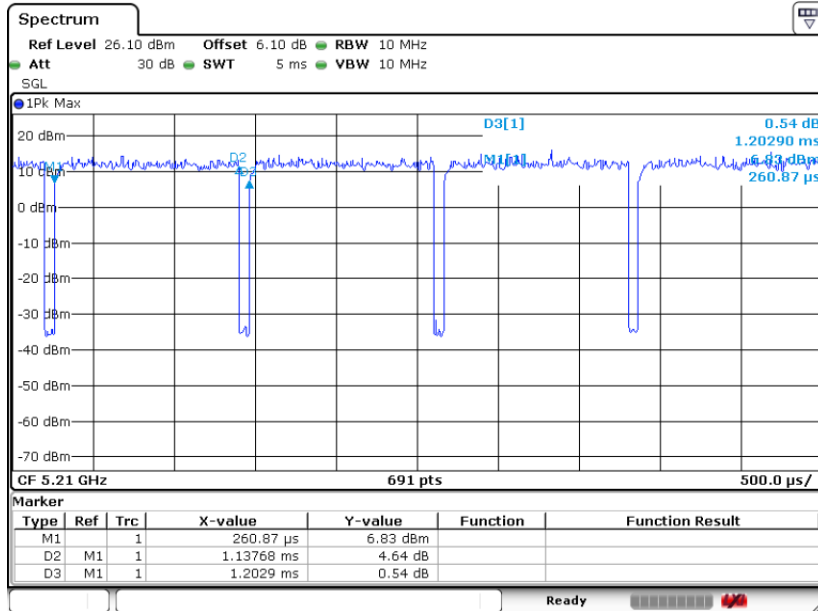




802.11n HT40 Antenna 1

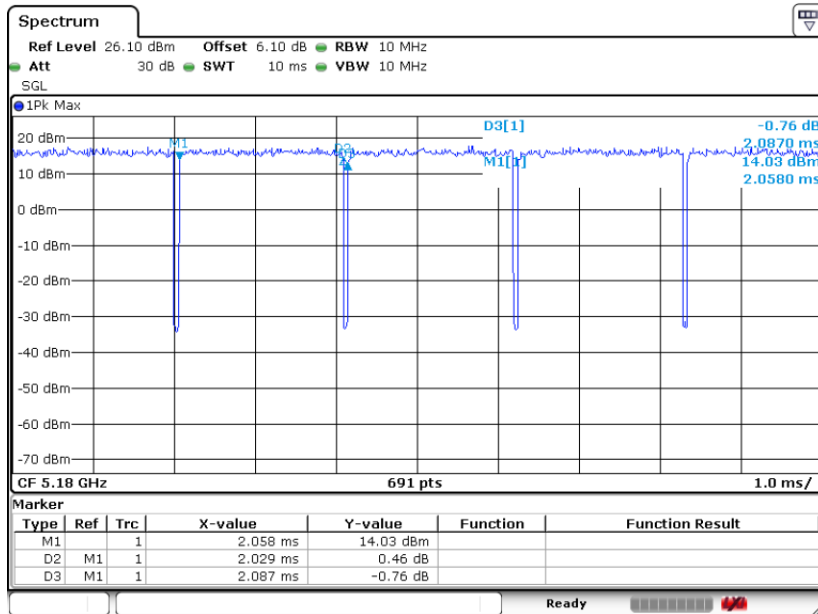


802.11ac VHT80 Antenna 1

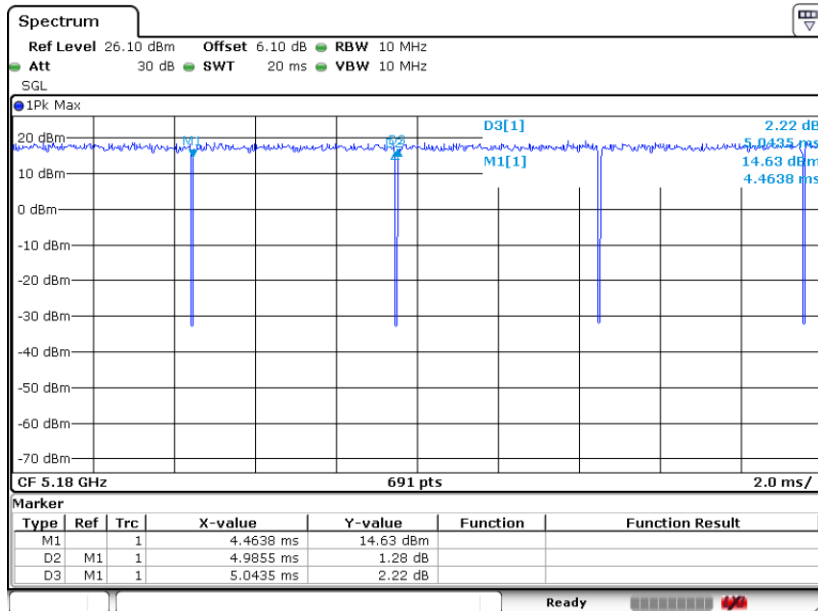




802.11a Antenna 1+2

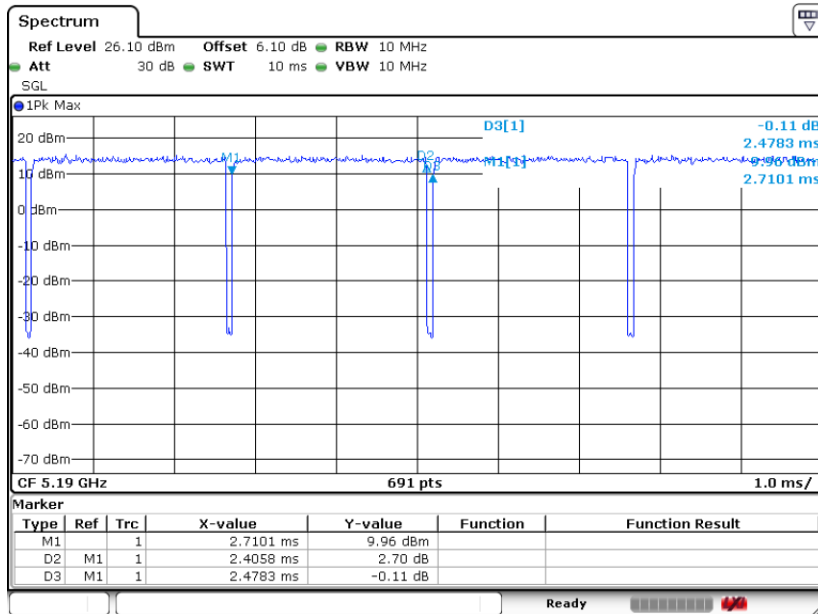


802.11n HT20 Antenna 1+2

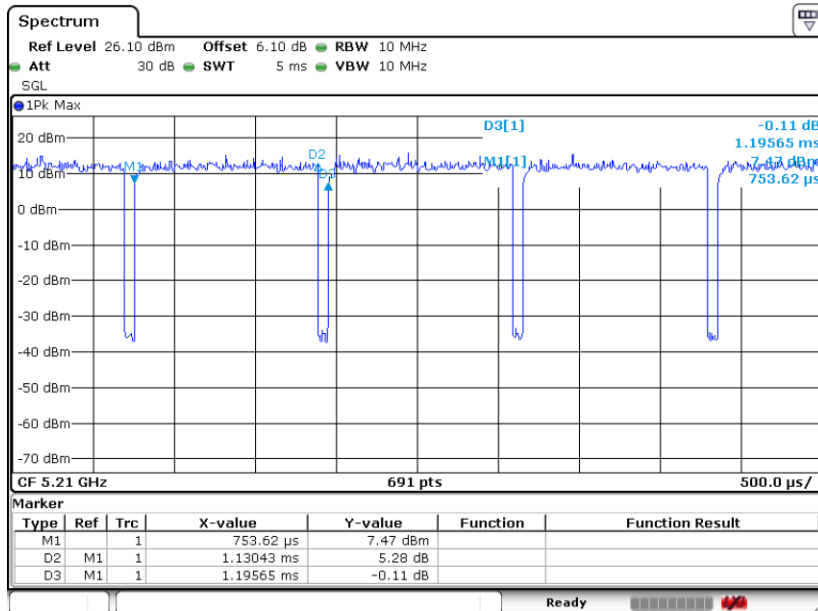




802.11n HT40 Antenna 1+2



802.11ac VHT80 Antenna 1+2



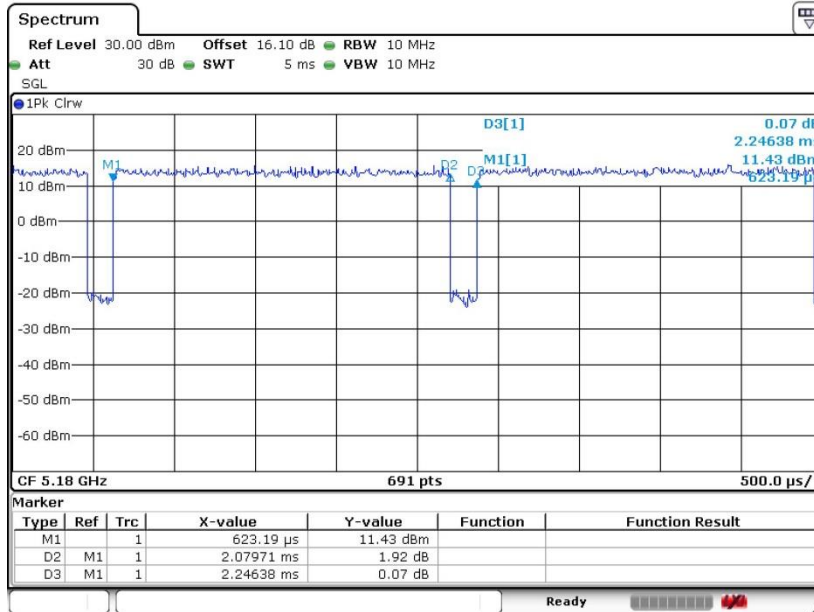


For Beamforming Modes

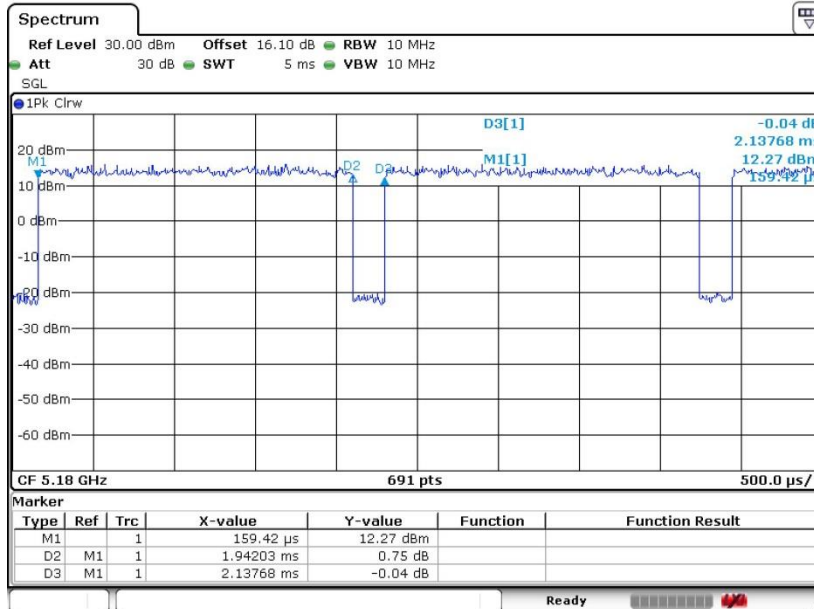
| Antenna | Band | Duty Cycle(%) | T(ms) | 1/T(kHz) | VBW Setting |
|---------|----------------|---------------|-------|----------|-------------|
| 1+2 | 802.11a | 92.581 | 2.077 | 0.481 | 0.51KHz |
| 1+2 | 802.11n HT20 | 90.848 | 1.942 | 0.515 | 0.51KHz |
| 1+2 | 802.11n HT40 | 90.910 | 1.884 | 0.531 | 0.56KHz |
| 1+2 | 802.11ac VHT80 | 92.124 | 1.949 | 0.513 | 0.56KHz |



802.11a Antenna 1+2

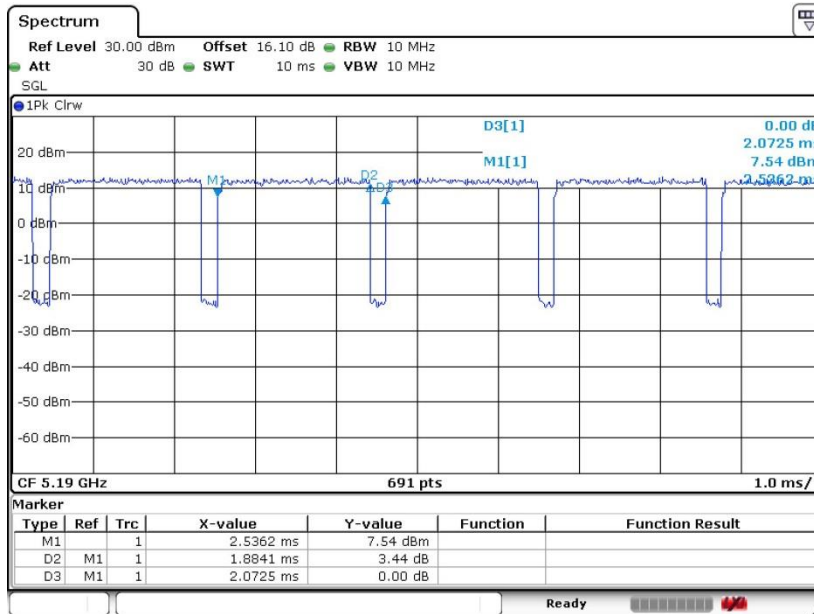


802.11n HT20 Antenna 1+2





802.11n HT40 Antenna 1+2



802.11ac VHT80 Antenna 1+2

