



FCC RF Test Report

APPLICANT : Lenovo (Shanghai) Electronics Technology Co., Ltd.
EQUIPMENT : Portable Tablet Computer
BRAND NAME : Lenovo
MODEL NAME : Lenovo TB-8505X
FCC ID : O57TB8505X
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DTS) Digital Transmission System

The product was received on Aug. 12, 2019 and testing was completed on Sep. 13, 2019. 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.

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.

Jason Jia

Reviewed by: Jason Jia / Supervisor

James Huang

Approved by: James Huang / Manager



Sporton International (Kunshan) Inc.

**No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300
People's Republic of China**



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SUMMARY OF TEST RESULT

| Report Section | FCC Rule | Description | Limit | Result | Remark |
|----------------|--------------------|--|-----------------------|--------|-------------------------------------|
| 3.1 | 15.247(a)(2) | 6dB Bandwidth | ≥ 0.5MHz | Pass | - |
| 3.1 | - | 99% Bandwidth | - | Pass | - |
| 3.2 | 15.247(b) | Power Output Measurement | ≤ 30dBm | Pass | - |
| 3.3 | 15.247(e) | Power Spectral Density | ≤ 8dBm/3kHz | Pass | - |
| 3.4 | 15.247(d) | Conducted Band Edges | ≤ 20dBc | Pass | - |
| | | Conducted Spurious Emission | | Pass | - |
| 3.5 | 15.247(d) | Radiated Band Edges and Radiated Spurious Emission | 15.209(a) & 15.247(d) | Pass | Under limit 3.11 dB at 4824.000 MHz |
| 3.6 | 15.203 & 15.247(b) | Antenna Requirement | N/A | Pass | - |

| |
|--|
| Declaration of Conformity: |
| The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. |
| Comments and Explanations: |
| The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification. |



1 General Description

1.1 Applicant

Lenovo (Shanghai) Electronics Technology Co., Ltd.

Section 304-305, Building No. 4, # 222, Meiyue Road, China (Shanghai) Pilot Free Trade Zone

1.2 Manufacturer

Lenovo PC HK Limited

23/F, Lincoln House, Taikoo Place 979 King's Road, Quarry Bay, Hong Kong P.R.CHINA

1.3 Product Feature of Equipment Under Test

| Product Feature | |
|--|--|
| Equipment | Portable Tablet Computer |
| Brand Name | Lenovo |
| Model Name | Lenovo TB-8505X |
| FCC ID | O57TB8505X |
| EUT supports Radios application | GSM/WCDMA/LTE WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 Bluetooth BR / EDR / LE FM Receiver and GNSS |
| HW Version | Lenovo TB-8505X |
| SW Version | TB-8505X_RF01_190817 |
| EUT Stage | Identical Prototype |

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 Channel Frequency Range | 2412 MHz ~ 2462 MHz |
| Maximum (Peak) Output Power to antenna | 802.11b : 20.34 dBm (0.1081 W) 802.11g : 24.98 dBm (0.3148 W) 802.11n HT20 : 25.26 dBm (0.3357 W) 802.11n HT40 : 25.12 dBm (0.3251 W) |
| 99% Occupied Bandwidth | 802.11b : 13.54MHz 802.11g : 18.33MHz 802.11n HT20 : 19.03MHz 802.11n HT40 : 36.86MHz |
| Antenna Type / Gain | IFA Antenna type with gain -3.0 dBi |
| Type of Modulation | 802.11b : DSSS (BPSK / QPSK / CCK) 802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) |

1.5 Modification of EUT

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



1.6 Re-use of Measured Data

1.6.1 Introduction Section

This application re-uses data collected on a similar device. The subject device of this application (Model: Lenovo TB-8505X, FCC ID: O57TB8505X) is electrically identical to the reference device (Model: Lenovo TB-8505FS, FCC ID: O57TB8505FS) for the portions of the circuitry corresponding to the data being re-used, as treated by KDB Publication 484596 D01.

1.6.2 Difference Section

For details concerning the similarity with respect to component placement, mechanical/electrical design etc., please refer to the Product Equality Declaration.

The re-used RF data includes the following bands provided in Appendix E (Sporton RF Report No. FR981204-03C for the reference device Model: Lenovo TB-8505FS, FCC ID: O57TB8505FS).

1.6.3 Reference detail Section:

| Equipment Class | Reference FCC ID | Folder Test | Report Title/Section |
|-----------------|------------------|-----------------------|--|
| DTS (WLAN) | O57TB8505FS | Part15C(FR981204-03C) | Conduction sections applicable; Other test items for full testing |

1.6.4 Spot Check Verification Data Section

In order to confirm hardware similarity of the subject device with the reference device, all test item for full test except conduction.

Assertions concerning the similarity of these devices are based on representations by the applicant. The applicant accepts full responsibility for the validity of the similarity claim, and for the determination that verification test data are sufficient to support it.



1.7 Testing Location

Sporton International (Kunshan) Inc. is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

| | | | |
|---------------------------|--|----------------------------|---------------------------------------|
| Test Firm | Sporton International (Kunshan) Inc. | | |
| Test Site Location | No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of 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 03CH06-KS | CN1257 | 314309 |

1.8 Applicable Standards

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

- ♦ 47 CFR Part 15 Subpart C §15.247
- ♦ FCC KDB 558074 D01 15.247 Meas Guidance v05r02
- ♦ ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.



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 (Y plane) 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) |
|-----------------|---------|-------------|---------|-------------|
| 2400-2483.5 MHz | 1 | 2412 | 7 | 2442 |
| | 2 | 2417 | 8 | 2447 |
| | 3 | 2422 | 9 | 2452 |
| | 4 | 2427 | 10 | 2457 |
| | 5 | 2432 | 11 | 2462 |
| | 6 | 2437 | | |

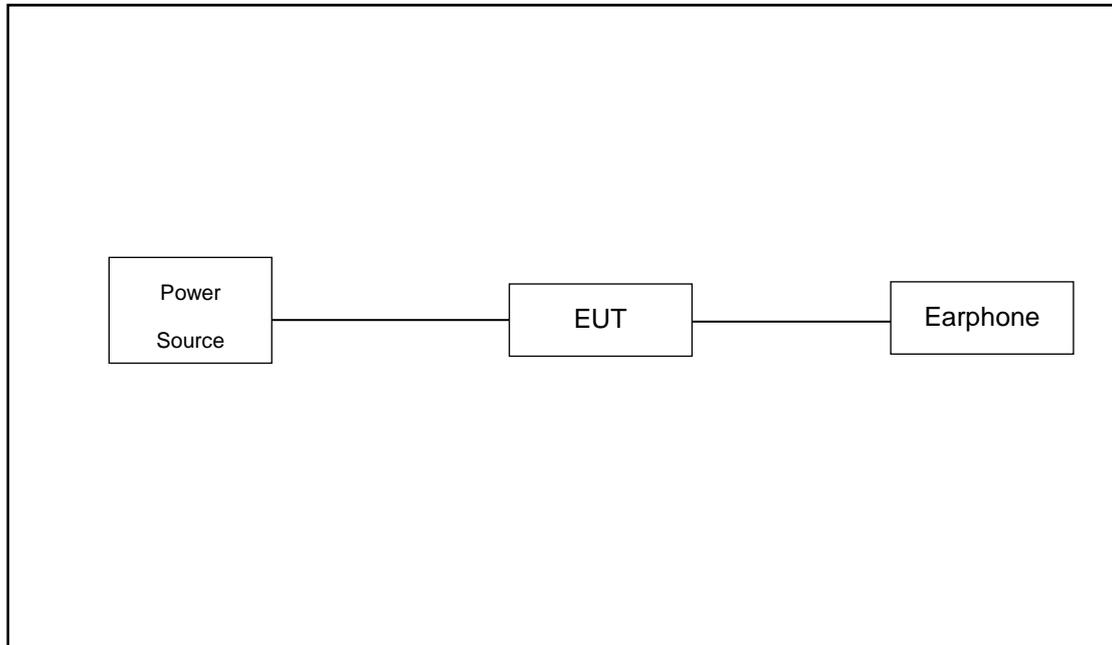
2.2 Test Mode

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

| Modulation | Data Rate |
|--------------|-----------|
| 802.11b | 1 Mbps |
| 802.11g | 6 Mbps |
| 802.11n HT20 | MCS0 |
| 802.11n HT40 | MCS0 |

2.3 Connection Diagram of Test System

For Radiation



2.4 EUT Operation Test Setup

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



2.5 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 6.4 dB attenuator.

Offset(dB) = RF cable loss(dB).

= 6.4 (dB)

3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

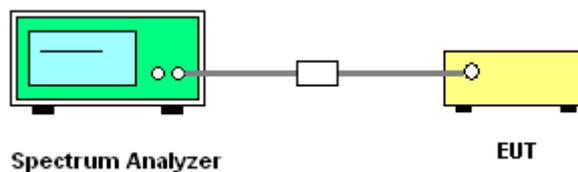
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 11.8
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) = 1MHz and set the Video bandwidth (VBW) = 3MHz.
6. Measure and record the results in the test report.

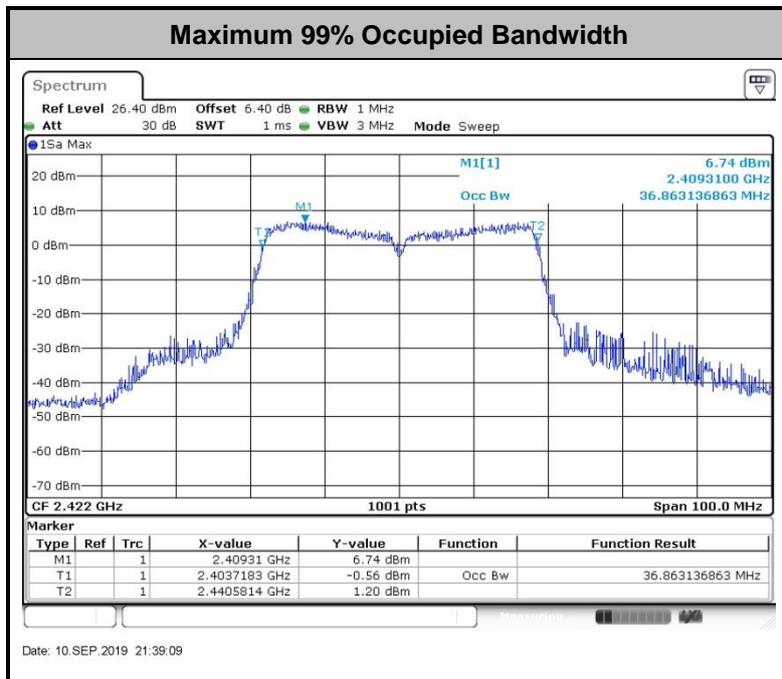
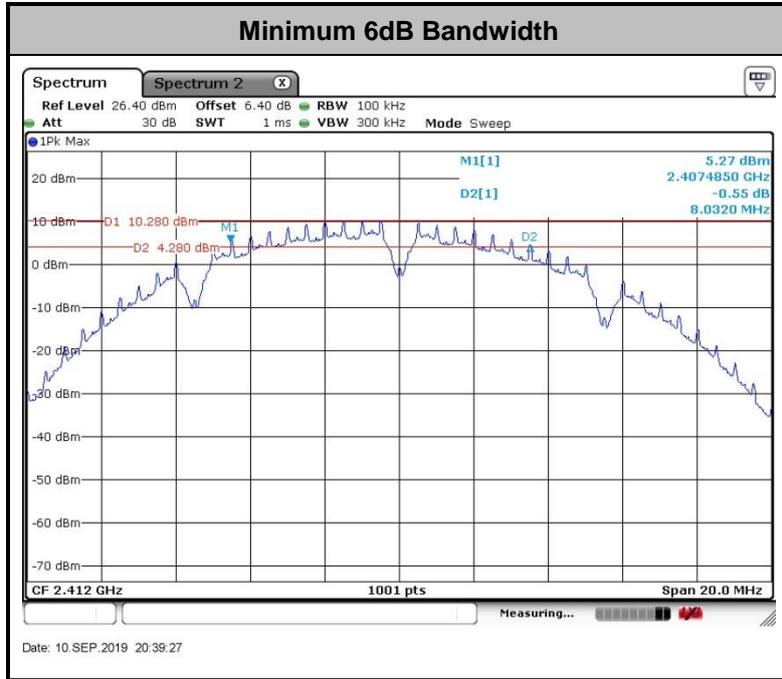
3.1.4 Test Setup





3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Please refer to Appendix A.



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

3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna with directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

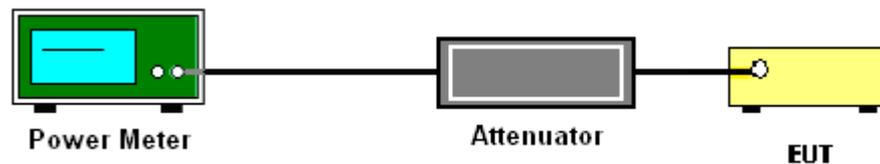
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

1. The testing follows the Measurement Procedure of ANSI C63.10-2013 clause 11.9.1.3 PKPM1 Peak power meter or ANSI C63.10-2013 clause 11.9.2.3.2 Method AVGPM-G method.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup



3.2.5 Test Result of Peak Output Power

Please refer to Appendix A.

3.2.6 Test Result of Average output Power (Reporting Only)

Please refer to Appendix A.

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

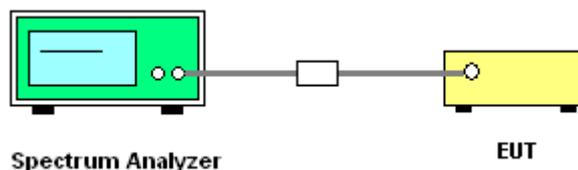
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

1. The testing follows Measurement Procedure of ANSI C63.10-2013 clause 11.10.2 Method PKPSD.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.

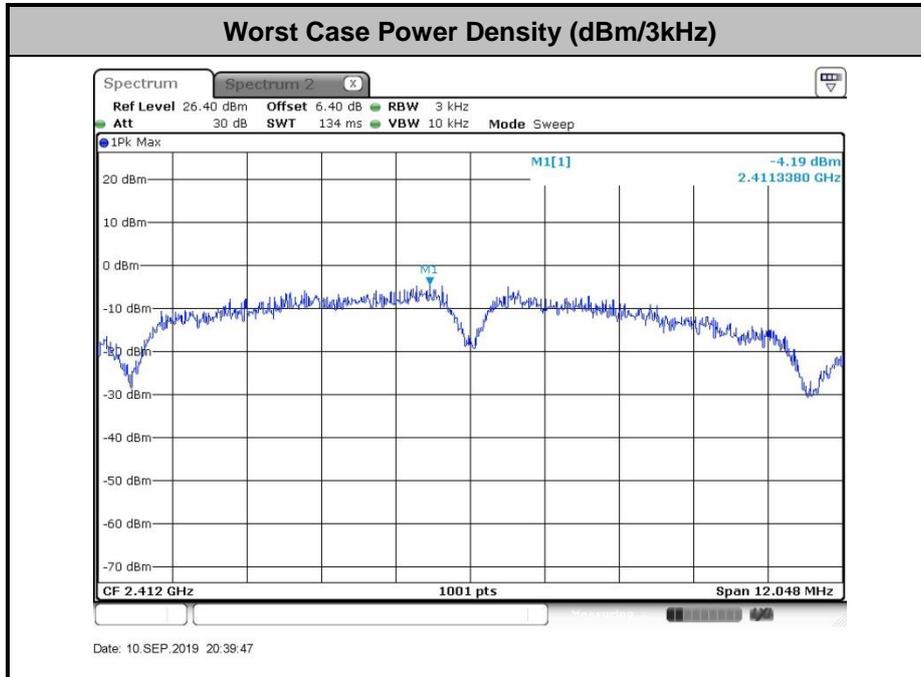
3.3.4 Test Setup





3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.



3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement.

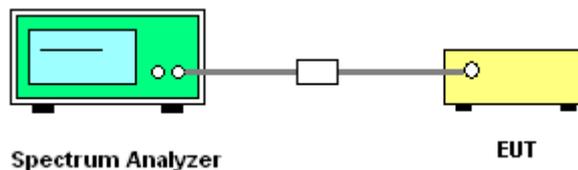
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 11.13
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup

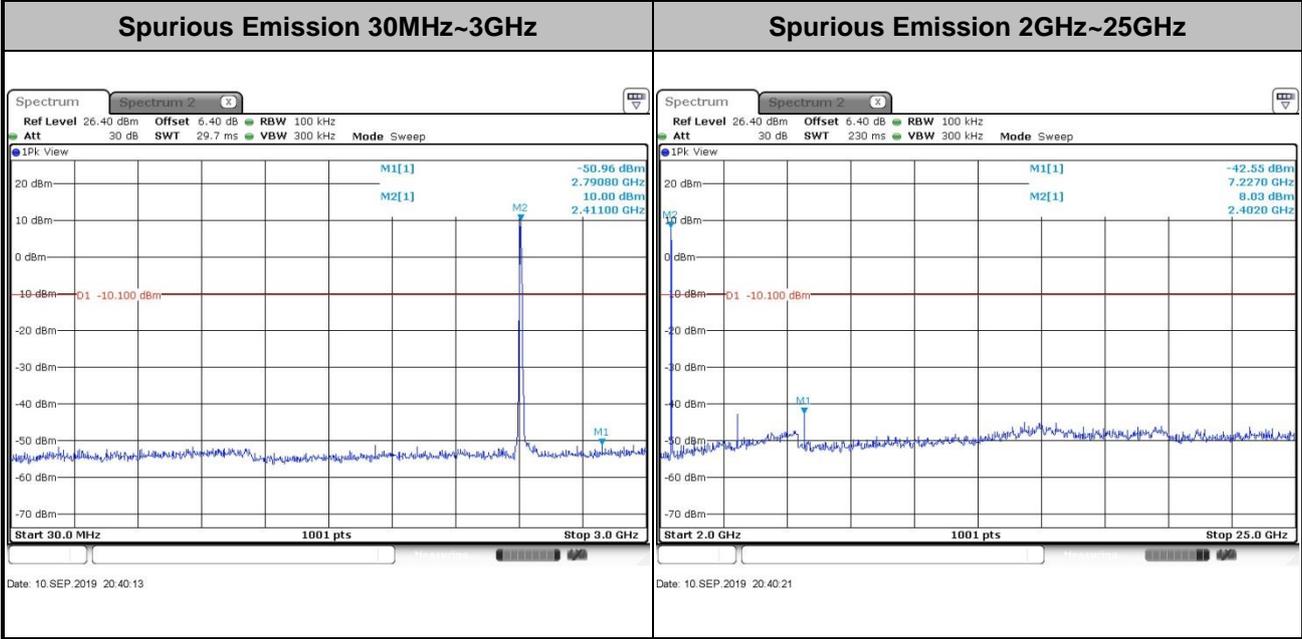
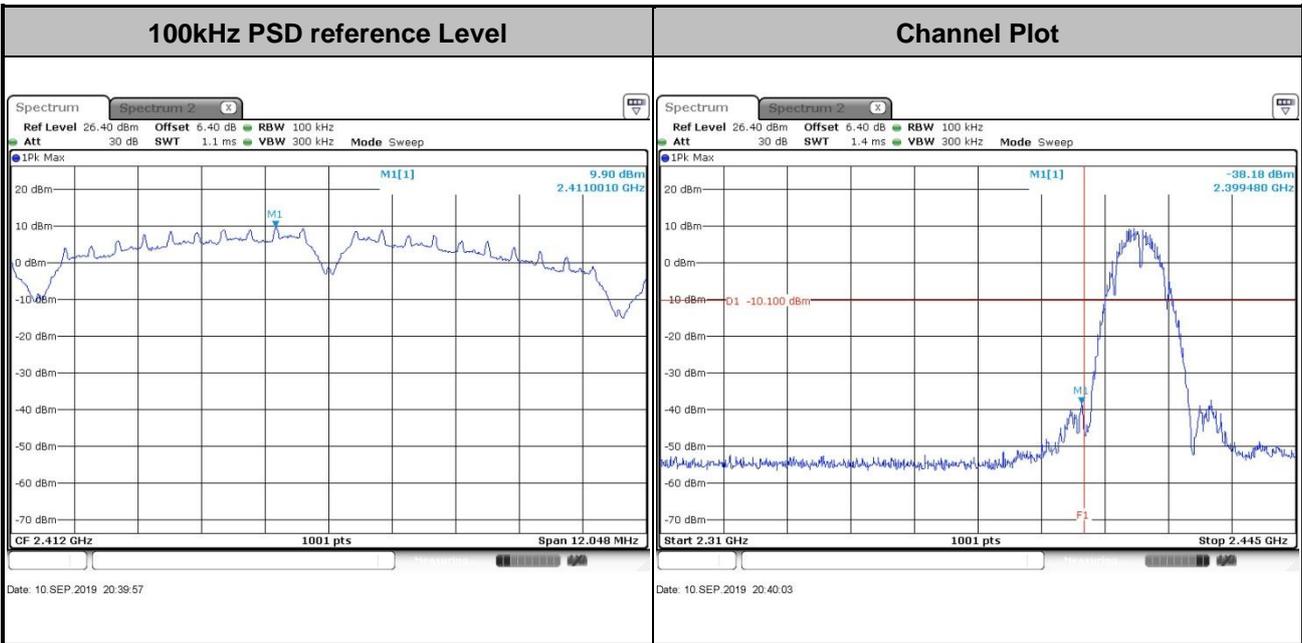




3.4.5 Test Result of Conducted Band Edges and Spurious Emission

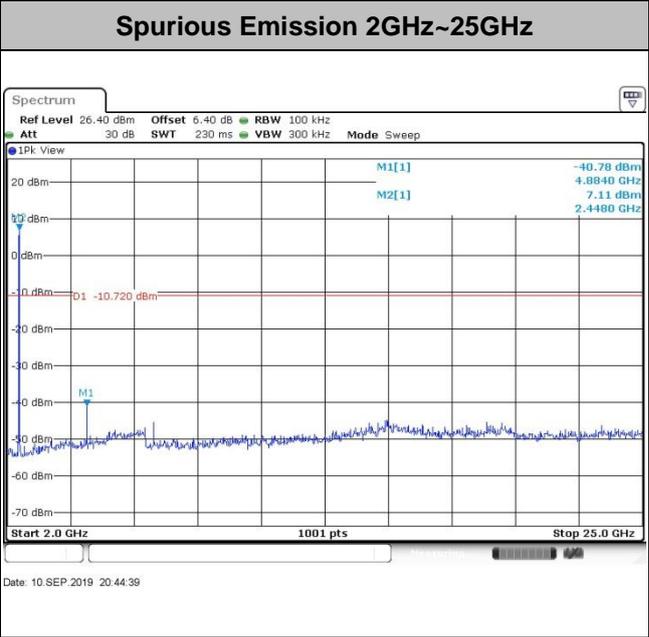
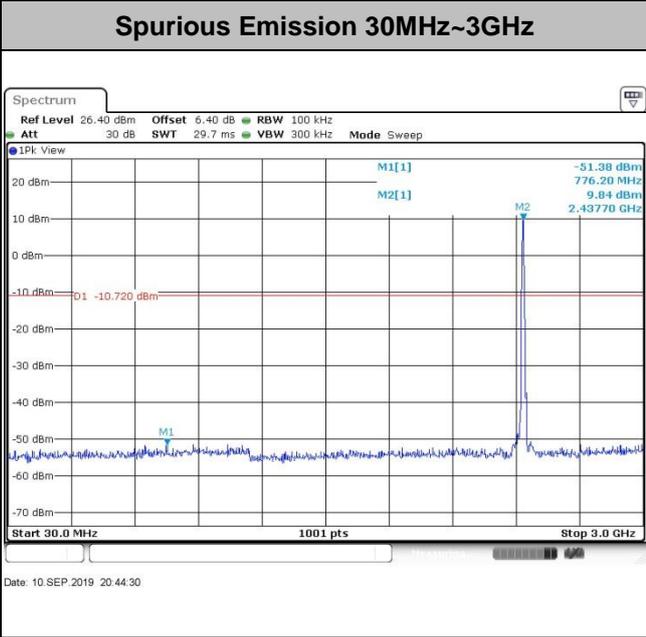
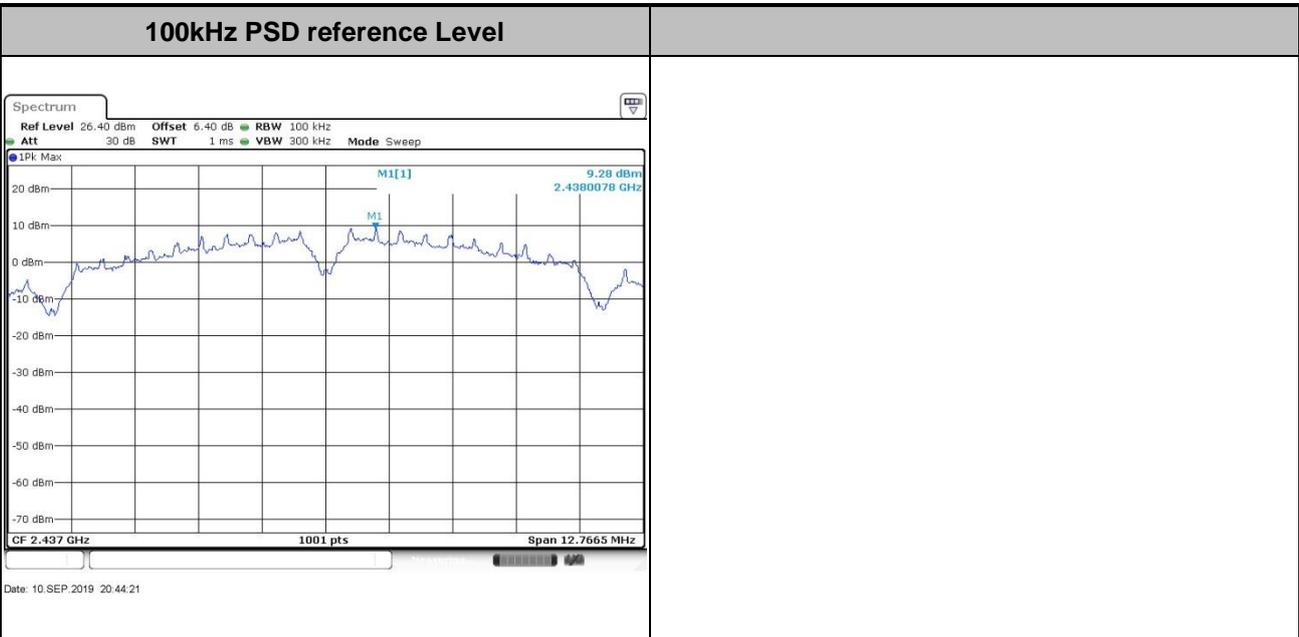
| | | |
|---------------------------|---------------------|---------|
| Test Engineer : Asa Cheng | Temperature : | 21~25°C |
| | Relative Humidity : | 51~54% |

| | | | |
|-------------|---------|----------------|----|
| Test Mode : | 802.11b | Test Channel : | 01 |
|-------------|---------|----------------|----|



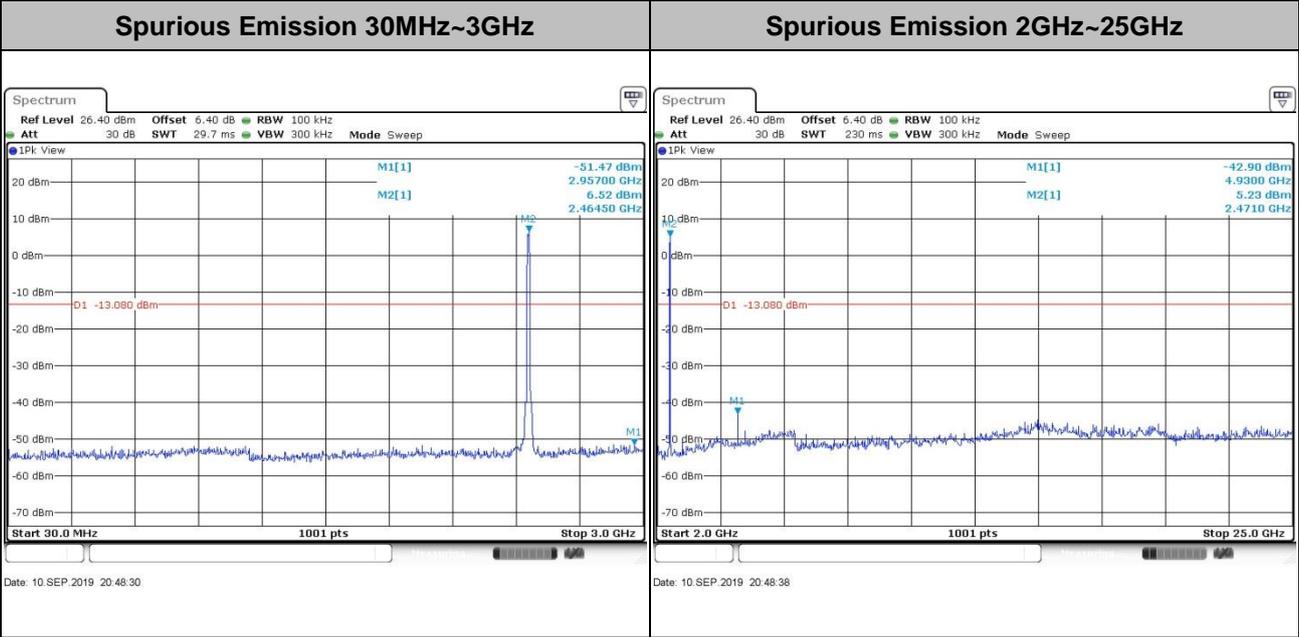
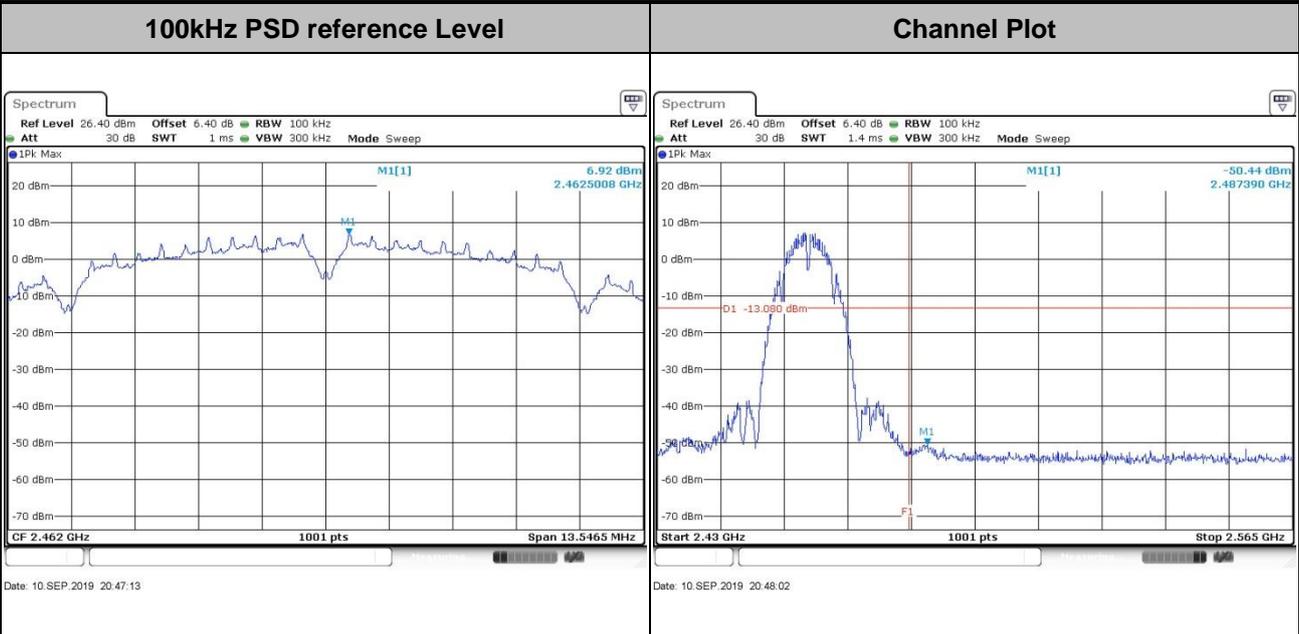


| | | | |
|-------------|---------|----------------|----|
| Test Mode : | 802.11b | Test Channel : | 06 |
|-------------|---------|----------------|----|



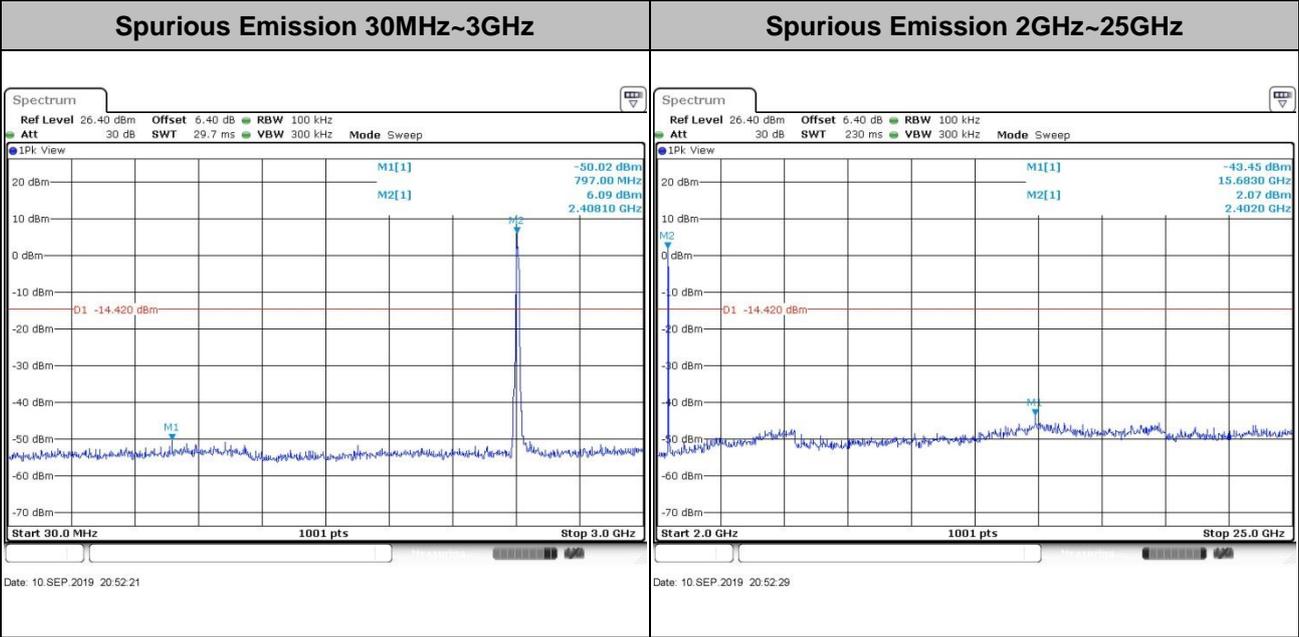
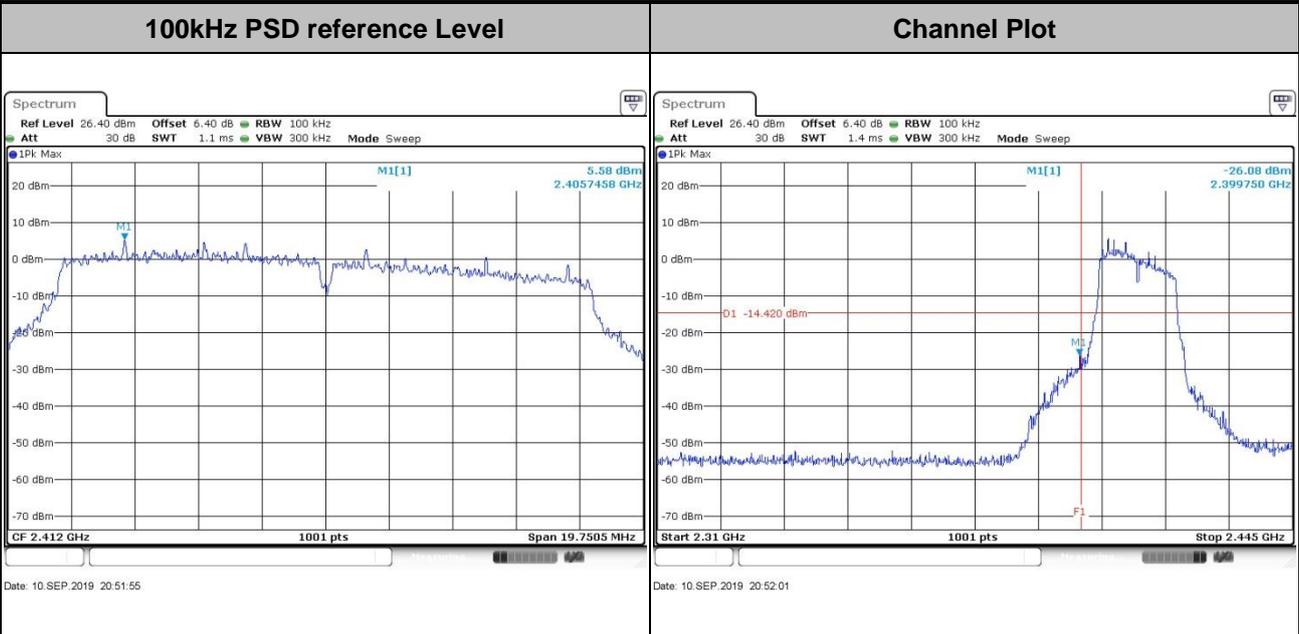


| | | | |
|-------------|---------|----------------|----|
| Test Mode : | 802.11b | Test Channel : | 11 |
|-------------|---------|----------------|----|



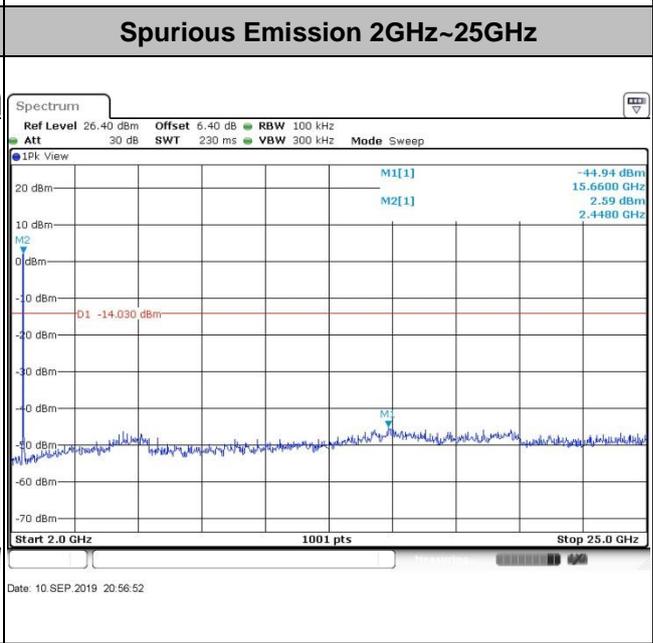
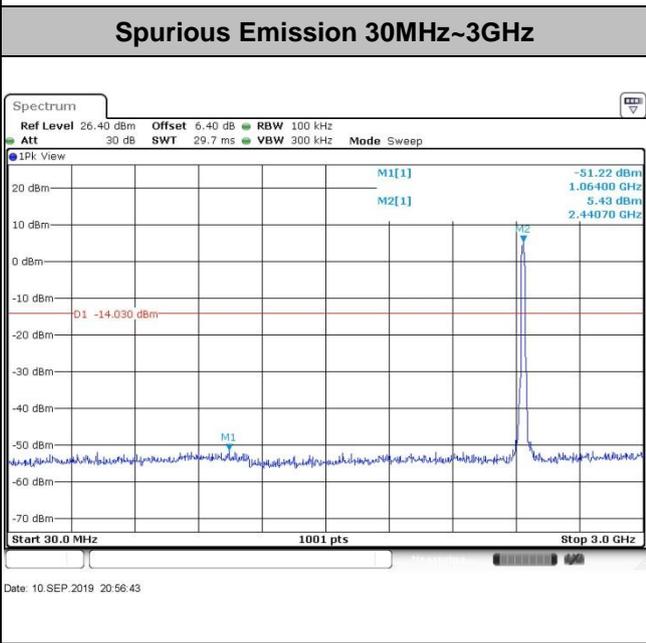
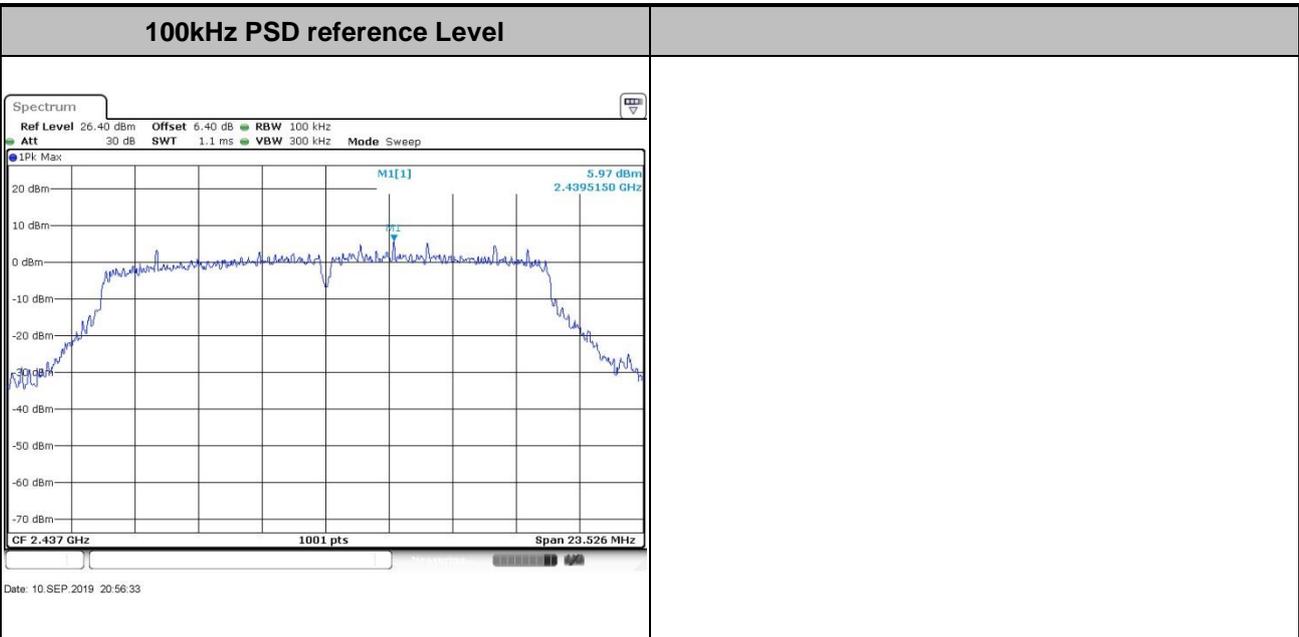


Test Mode : 802.11g Test Channel : 01



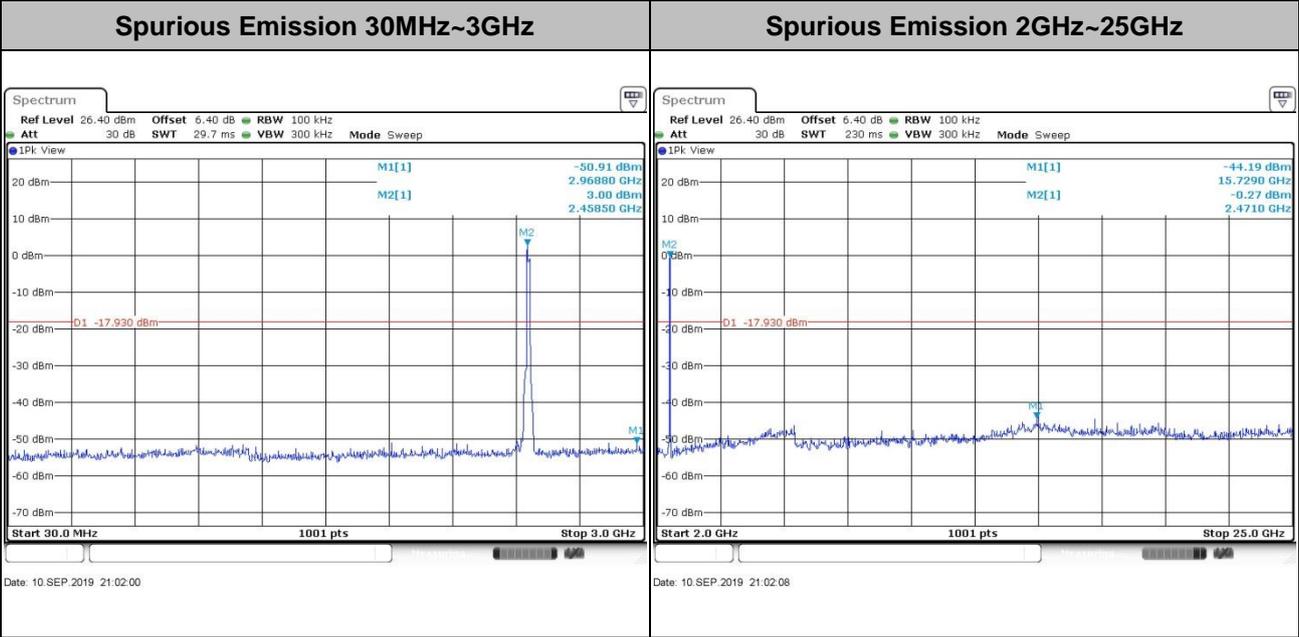
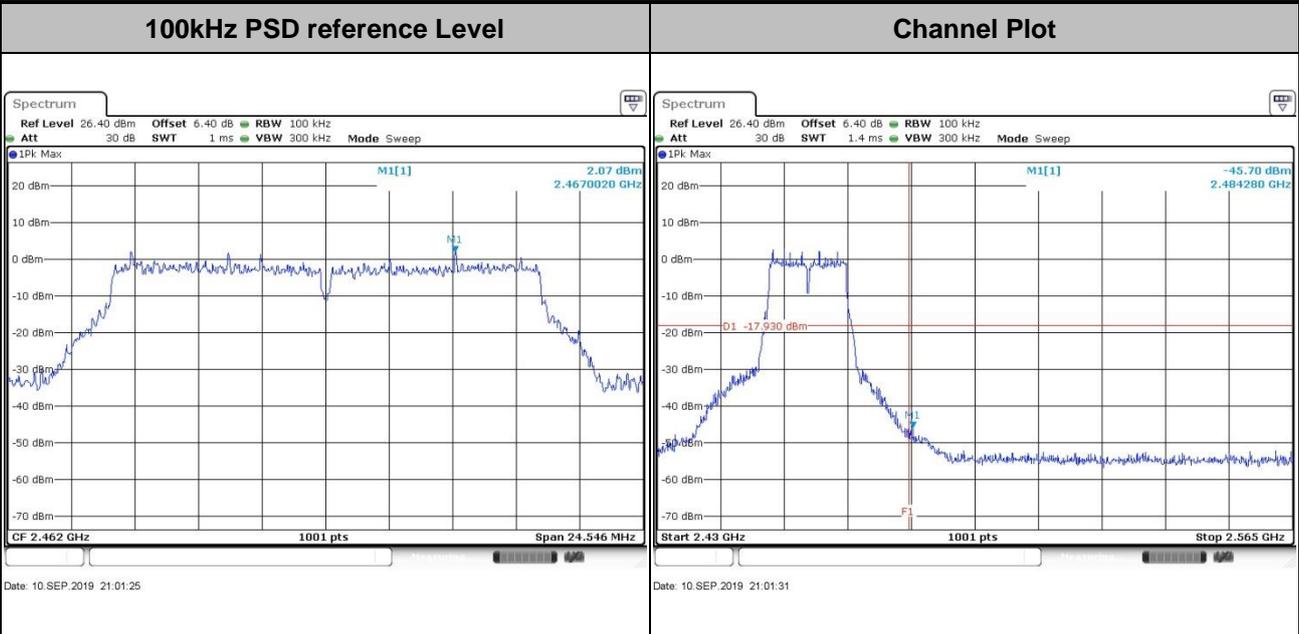


| | | | |
|-------------|---------|----------------|----|
| Test Mode : | 802.11g | Test Channel : | 06 |
|-------------|---------|----------------|----|



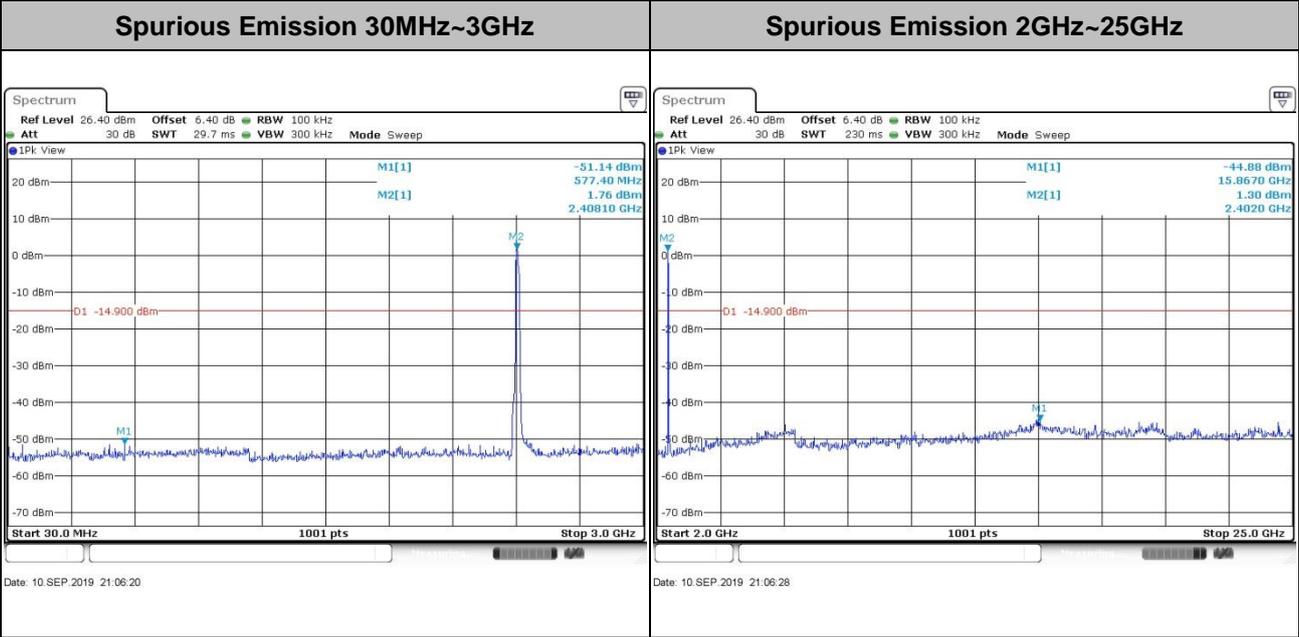
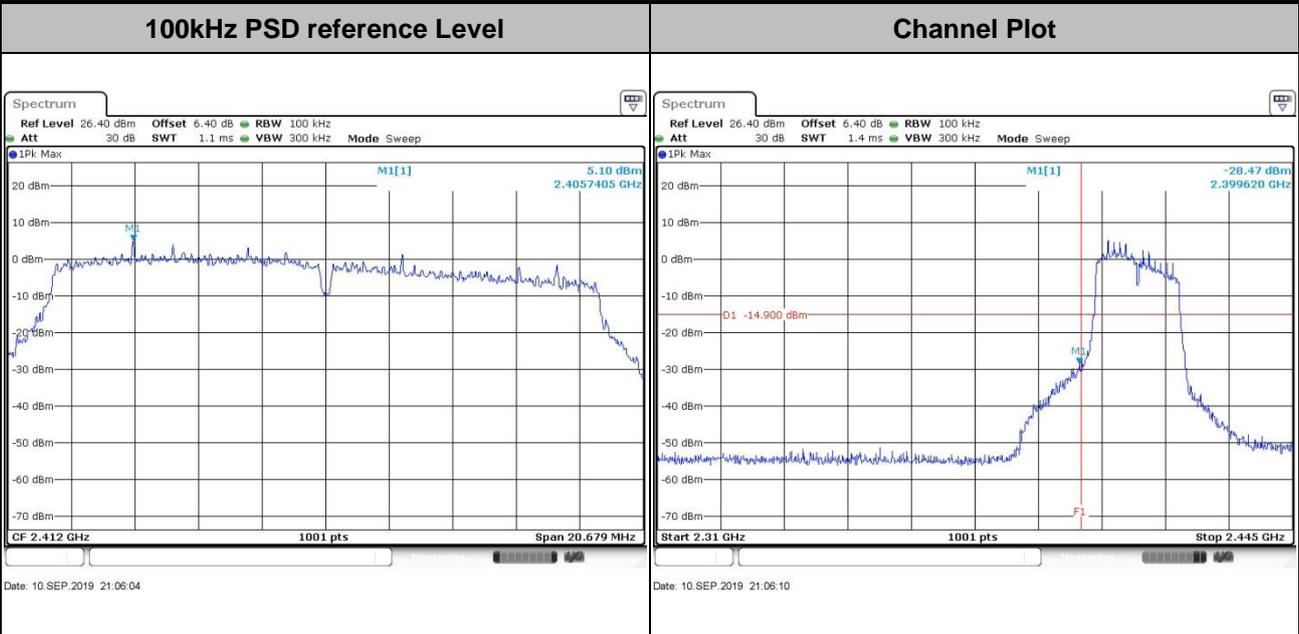


| | |
|----------------------------|--------------------------|
| Test Mode : 802.11g | Test Channel : 11 |
|----------------------------|--------------------------|



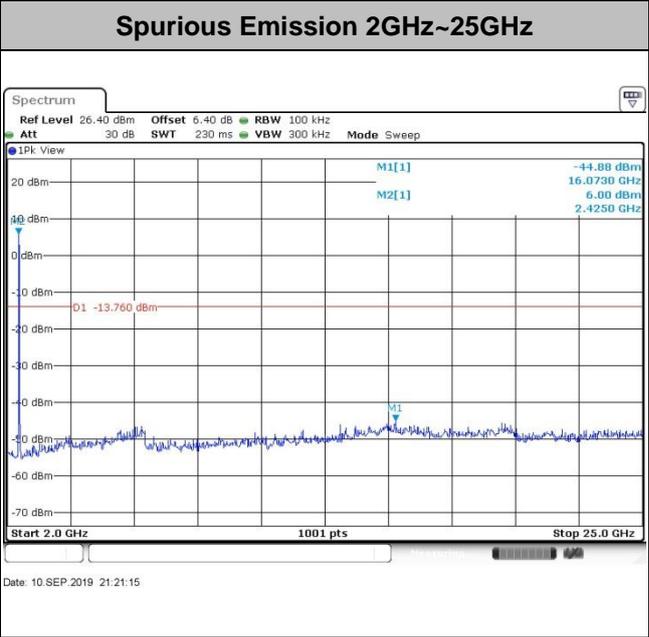
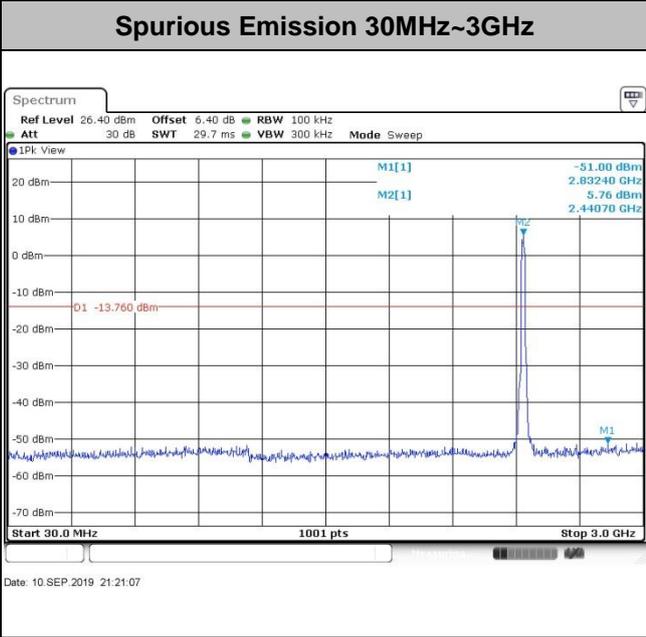
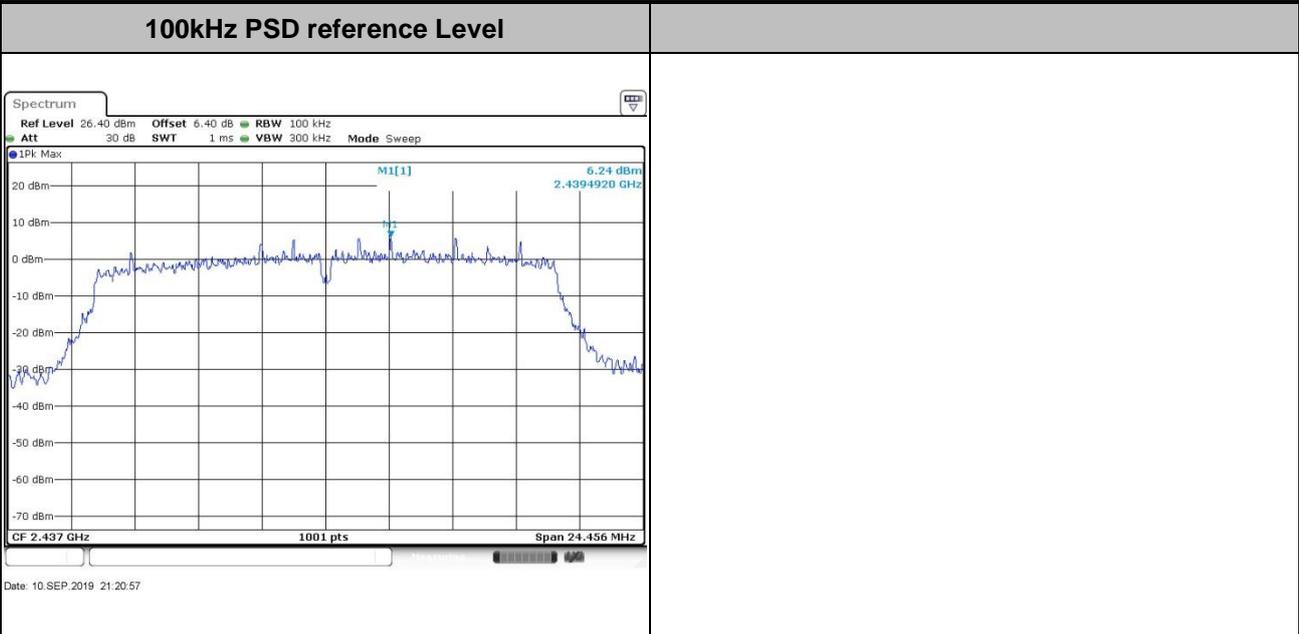


| | | | |
|-------------|--------------|----------------|----|
| Test Mode : | 802.11n HT20 | Test Channel : | 01 |
|-------------|--------------|----------------|----|



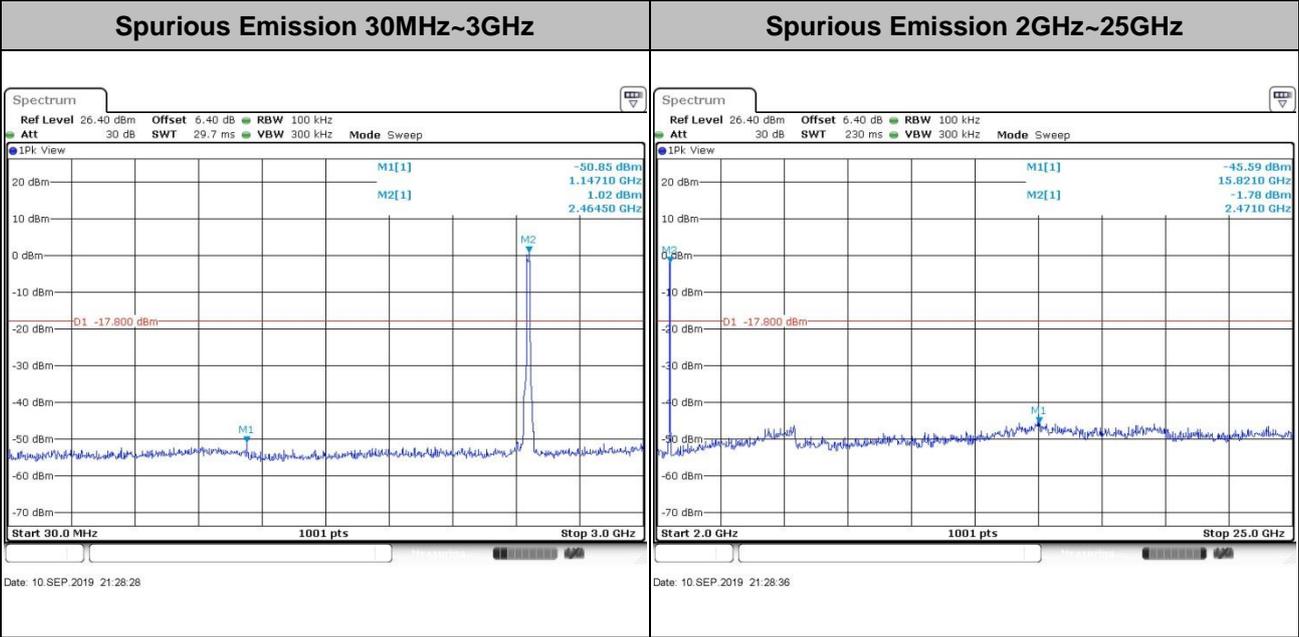
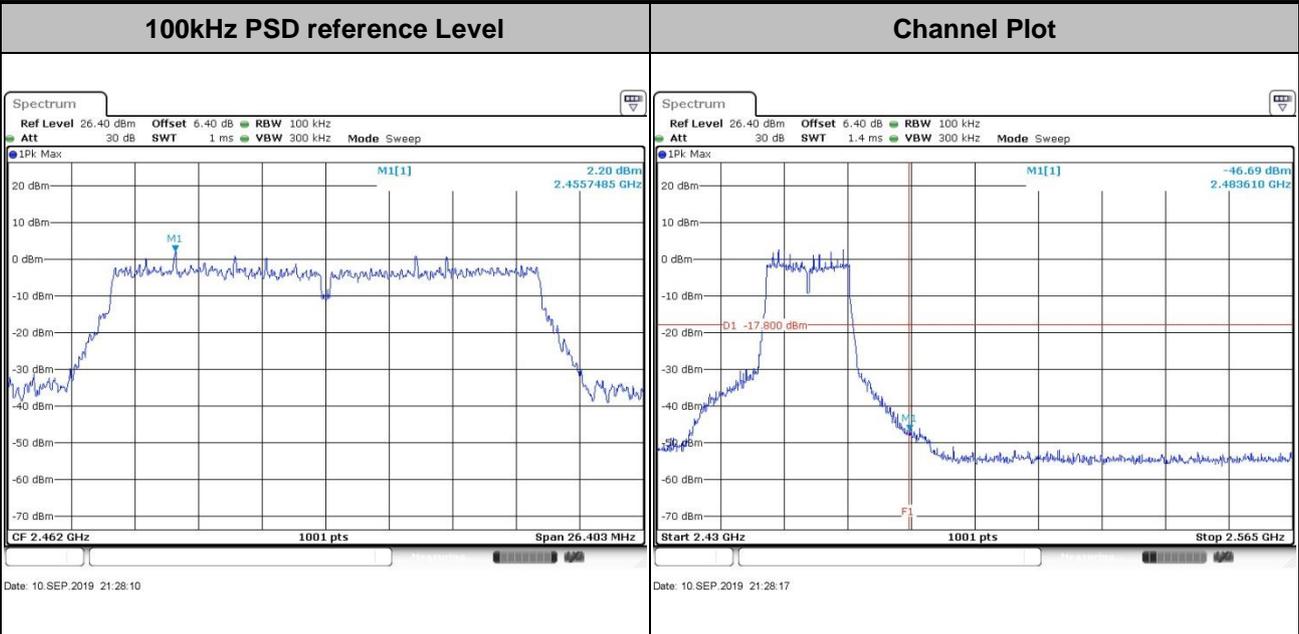


| | | | |
|-------------|--------------|----------------|----|
| Test Mode : | 802.11n HT20 | Test Channel : | 06 |
|-------------|--------------|----------------|----|



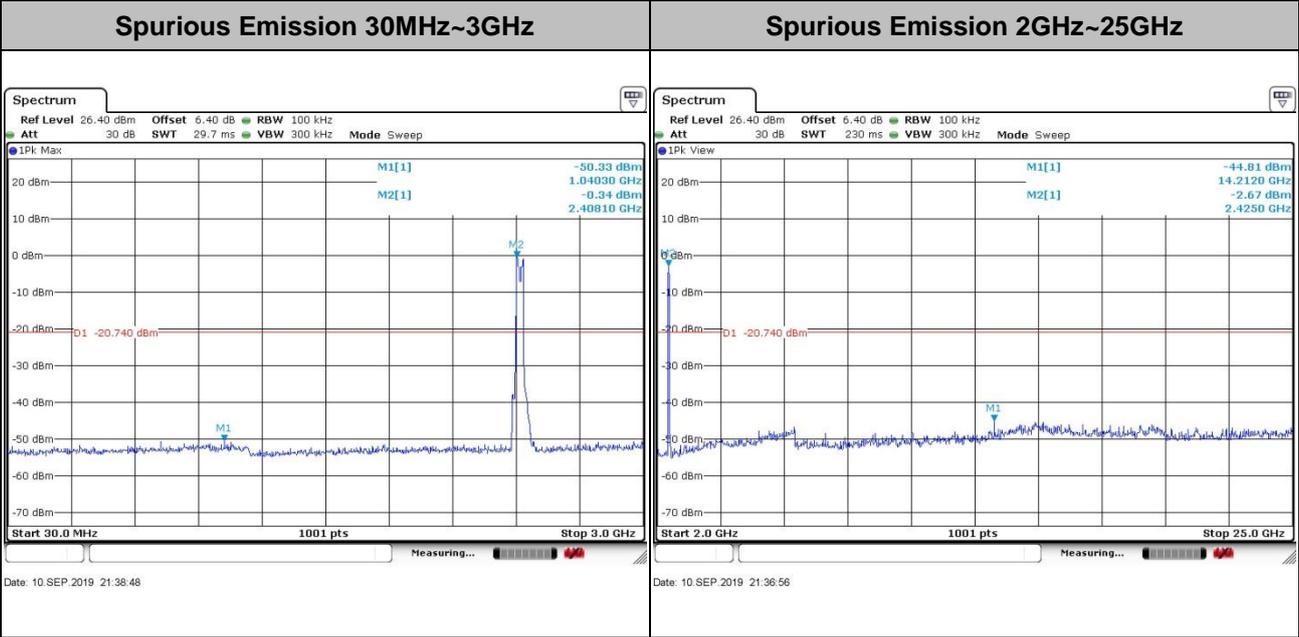
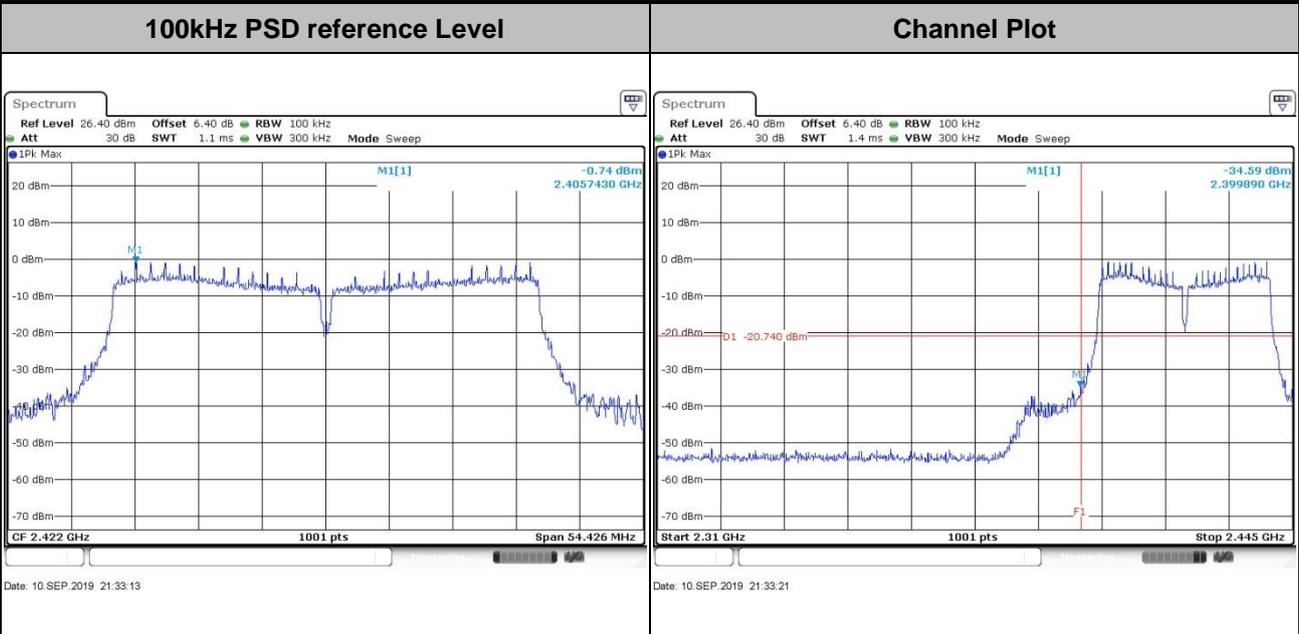


| | | | |
|-------------|--------------|----------------|----|
| Test Mode : | 802.11n HT20 | Test Channel : | 11 |
|-------------|--------------|----------------|----|



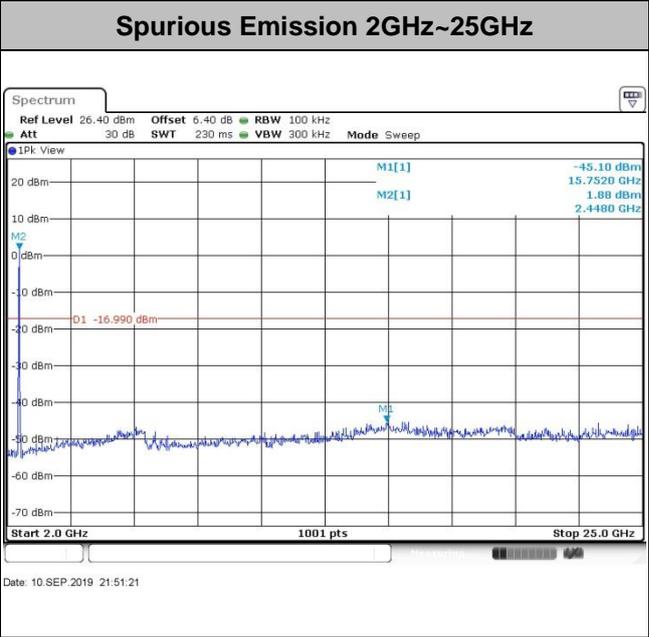
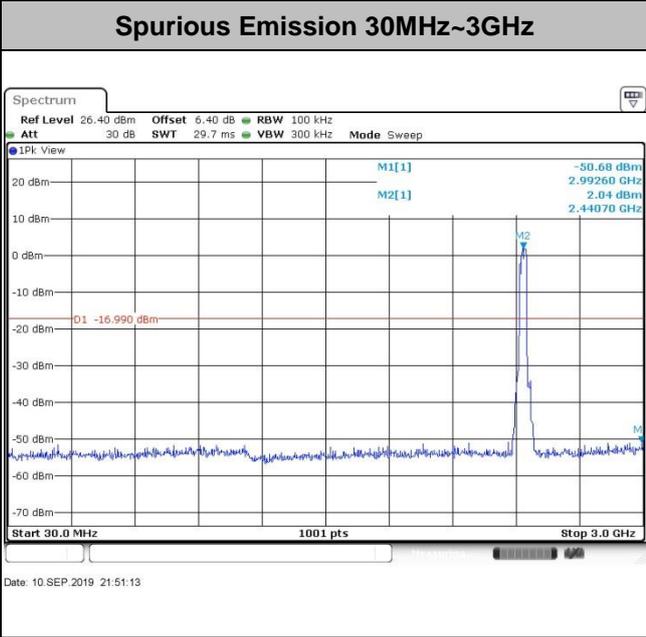
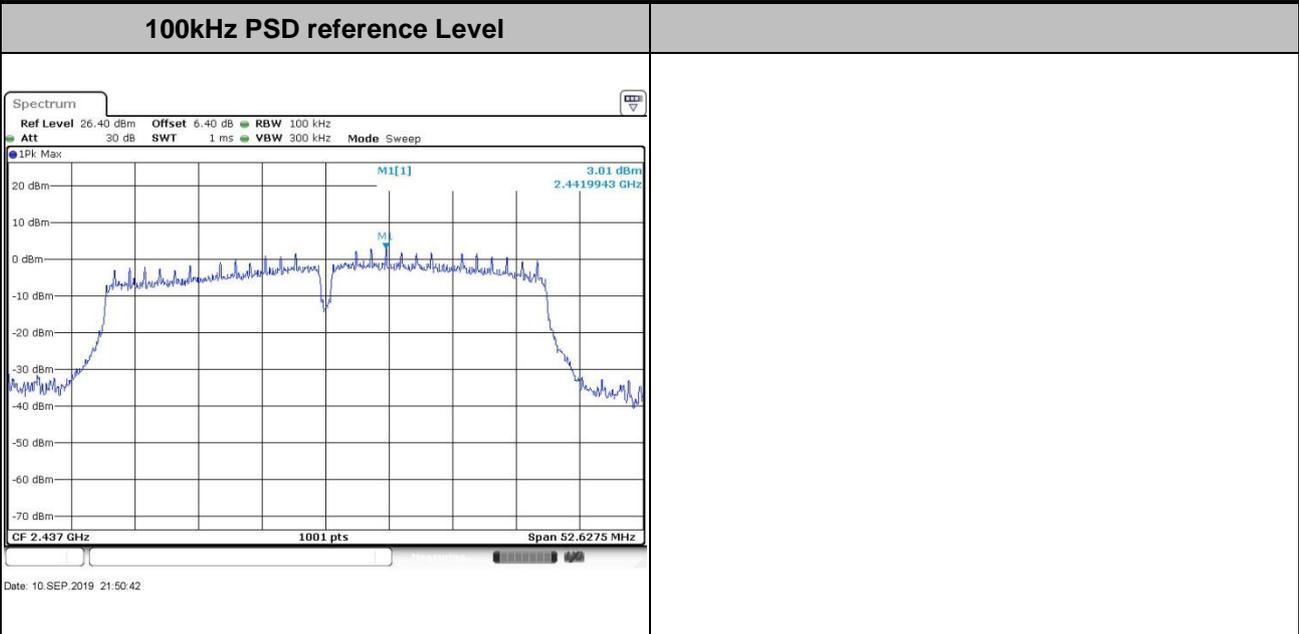


Test Mode : 802.11n HT40 Test Channel : 03



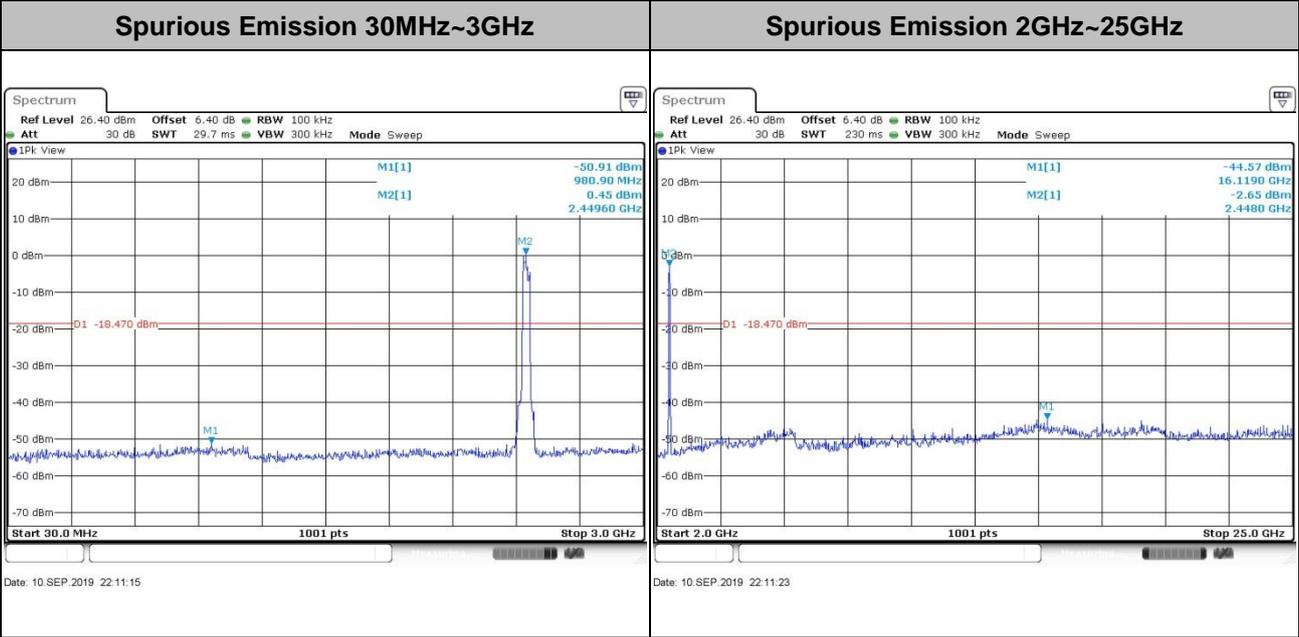
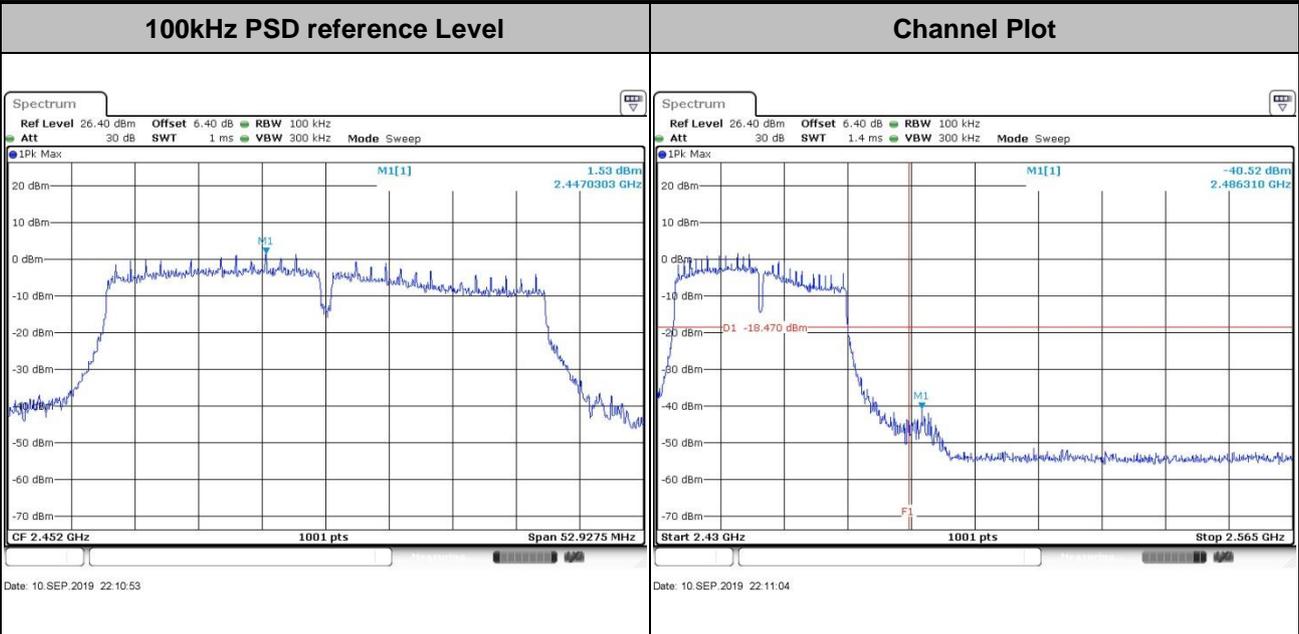


| | | | |
|-------------|--------------|----------------|----|
| Test Mode : | 802.11n HT40 | Test Channel : | 06 |
|-------------|--------------|----------------|----|





Test Mode : 802.11n HT40 Test Channel : 09





3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated band edge and Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

| 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 |

3.5.2 Measuring Instruments

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

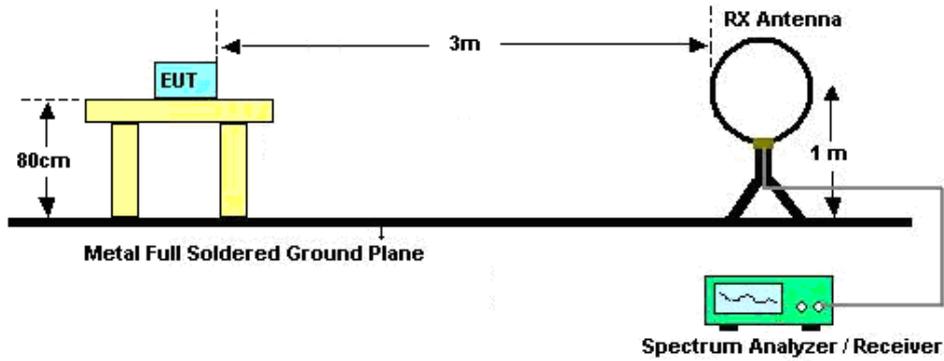


3.5.3 Test Procedures

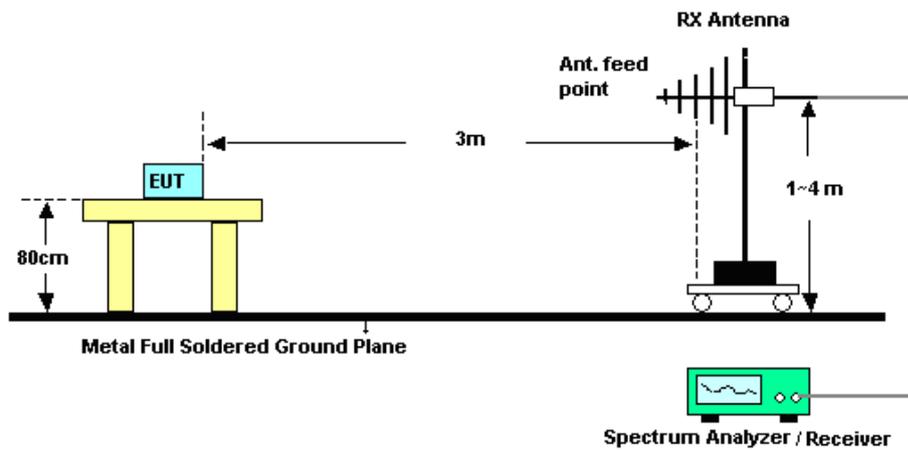
1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. 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.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
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.
8. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 kHz for $f < 1$ GHz; VBW \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3MHz for $f \geq 1$ GHz for peak measurement.
For average measurement:
 - 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.

3.5.4 Test Setup

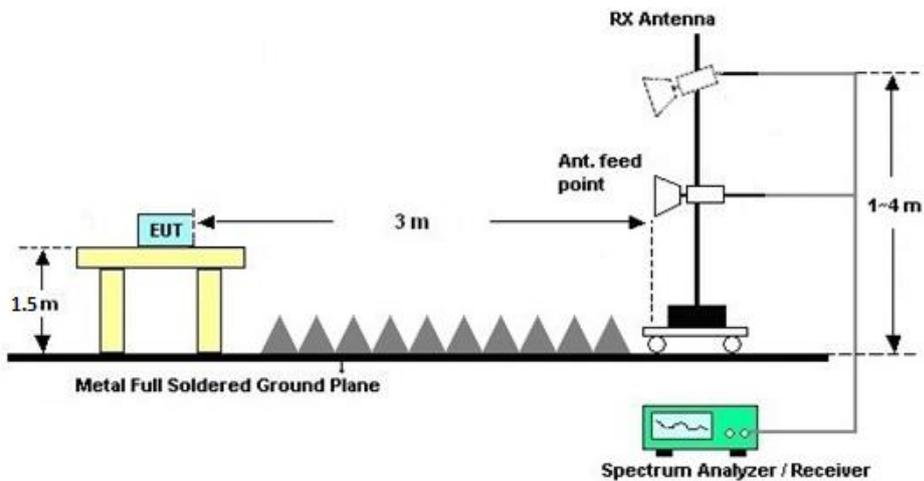
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz





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

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.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B.

3.5.7 Duty Cycle

Please refer to Appendix C.

3.5.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix B.



3.6 Antenna Requirements

3.6.1 Standard Applicable

If directional gain of transmitting Antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached Antenna or of an Antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

3.6.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.6.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



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, 2019 | Sep. 10, 2019 | Aug. 06, 2020 | Conducted (TH01-KS) |
| Pulse Power Sensor | Anritsu | MA2411B | 0917070 | 300MHz~40GHz | Jan. 14, 2019 | Sep. 10, 2019 | Jan. 13, 2020 | Conducted (TH01-KS) |
| Power Meter | Anritsu | ML2495A | 1005002 | 50MHz Bandwidth | Jan. 14, 2019 | Sep. 10, 2019 | Jan. 13, 2020 | Conducted (TH01-KS) |
| EMI Test Receiver | Keysight | N9038A | MY56400023 | 3Hz~8.5GHz;Max 30dBm | Oct. 12, 2018 | Sep. 13, 2019 | Oct. 11, 2019 | Radiation (03CH06-KS) |
| EXA Spectrum Analyzer | Keysight | N9010A | MY55150208 | 10Hz-44GHz | Apr. 16, 2019 | Sep. 13, 2019 | Apr. 15, 2020 | Radiation (03CH06-KS) |
| Loop Antenna | R&S | HFH2-Z2 | 100321 | 9kHz~30MHz | Oct. 19, 2018 | Sep. 13, 2019 | Oct. 18, 2019 | Radiation (03CH06-KS) |
| Bilog Antenna | TeseQ | CBL6111D | 44483 | 30MHz-1GHz | Dec. 28, 2018 | Sep. 13, 2019 | Dec. 27, 2019 | Radiation (03CH06-KS) |
| Double Ridge Horn Antenna | ETS-Lindgren | 3117 | 75957 | 1GHz~18GHz | Oct. 20, 2018 | Sep. 13, 2019 | Oct. 19, 2019 | Radiation (03CH06-KS) |
| SHF-EHF Horn | Com-power | AH-840 | 101070 | 18GHz~40GHz | Jan. 05, 2019 | Sep. 13, 2019 | Jan. 04, 2020 | Radiation (03CH06-KS) |
| Amplifier | SONOMA | 310N | 187289 | 9KHz ~1GHZ | Aug. 06, 2019 | Sep. 13, 2019 | Aug. 05, 2020 | Radiation (03CH06-KS) |
| Amplifier | MITEQ | TTA1840-35-HG | 2014749 | 18~40GHz | Jan. 14, 2019 | Sep. 13, 2019 | Jan. 13, 2020 | Radiation (03CH06-KS) |
| high gain Amplifier | MITEQ | AMF-7D-0010 1800-30-10P | 2025788 | 1Ghz-18Ghz | Aug. 16, 2019 | Sep. 13, 2019 | Aug. 15, 2020 | Radiation (03CH06-KS) |
| Amplifier | Keysight | 83017A | MY53270203 | 500MHz~26.5GHz | Apr. 15, 2019 | Sep. 13, 2019 | Apr. 14, 2020 | Radiation (03CH06-KS) |
| AC Power Source | Chroma | 61601 | F104090004 | N/A | NCR | Sep. 13, 2019 | NCR | Radiation (03CH06-KS) |
| Turn Table | ChamPro | EM 1000-T | 060762-T | 0~360 degree | NCR | Sep. 13, 2019 | NCR | Radiation (03CH06-KS) |
| Antenna Mast | ChamPro | EM 1000-A | 060762-A | 1 m~4 m | NCR | Sep. 13, 2019 | NCR | Radiation (03CH06-KS) |

NCR: No Calibration Required



5 Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz)

| | |
|---|-------|
| Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y)) | 2.9dB |
|---|-------|

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

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

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

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

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

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



Appendix A. Conducted Test Results

A1 - DTS Part

| | | | | |
|----------------|-----------|--------------------|-------|----|
| Test Engineer: | Asa Cheng | Temperature: | 21~25 | °C |
| Test Date: | 2019/9/10 | Relative Humidity: | 51~54 | % |

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

| 2.4GHz Band | | | | | | | | |
|-------------|-----------|-----------------|-----|-------------|-----------------------|--------------|--------------------|-----------|
| Mod. | Data Rate | N _{TX} | CH. | Freq. (MHz) | 99% Occupied BW (MHz) | 6dB BW (MHz) | 6dB BW Limit (MHz) | Pass/Fail |
| 11b | 1Mbps | 1 | 1 | 2412 | 12.89 | 8.03 | 0.50 | Pass |
| 11b | 1Mbps | 1 | 6 | 2437 | 12.89 | 8.51 | 0.50 | Pass |
| 11b | 1Mbps | 1 | 11 | 2462 | 13.54 | 9.03 | 0.50 | Pass |
| 11g | 6Mbps | 1 | 1 | 2412 | 17.48 | 13.17 | 0.50 | Pass |
| 11g | 6Mbps | 1 | 6 | 2437 | 17.53 | 15.68 | 0.50 | Pass |
| 11g | 6Mbps | 1 | 11 | 2462 | 18.33 | 16.36 | 0.50 | Pass |
| HT20 | MCS0 | 1 | 1 | 2412 | 18.43 | 13.79 | 0.50 | Pass |
| HT20 | MCS0 | 1 | 6 | 2437 | 18.33 | 16.30 | 0.50 | Pass |
| HT20 | MCS0 | 1 | 11 | 2462 | 19.03 | 17.60 | 0.50 | Pass |
| HT40 | MCS0 | 1 | 3 | 2422 | 36.86 | 36.28 | 0.50 | Pass |
| HT40 | MCS0 | 1 | 6 | 2437 | 36.16 | 35.09 | 0.50 | Pass |
| HT40 | MCS0 | 1 | 9 | 2452 | 36.46 | 35.29 | 0.50 | Pass |

TEST RESULTS DATA
Peak Power Table

| 2.4GHz Band | | | | | | | | | | |
|-------------|-----------|-----|-----|-------------|----------------------------|-----------------------------|----------|------------------|------------------------|------------|
| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | Peak Conducted Power (dBm) | Conducted Power Limit (dBm) | DG (dBi) | EIRP Power (dBm) | EIRP Power Limit (dBm) | Pass /Fail |
| 11b | 1Mbps | 1 | 1 | 2412 | 20.34 | 30.00 | -3.00 | 17.34 | 36.00 | Pass |
| 11b | 1Mbps | 1 | 6 | 2437 | 20.19 | 30.00 | -3.00 | 17.19 | 36.00 | Pass |
| 11b | 1Mbps | 1 | 11 | 2462 | 17.79 | 30.00 | -3.00 | 14.79 | 36.00 | Pass |
| 11g | 6Mbps | 1 | 1 | 2412 | 24.38 | 30.00 | -3.00 | 21.38 | 36.00 | Pass |
| 11g | 6Mbps | 1 | 6 | 2437 | 24.98 | 30.00 | -3.00 | 21.98 | 36.00 | Pass |
| 11g | 6Mbps | 1 | 11 | 2462 | 23.58 | 30.00 | -3.00 | 20.58 | 36.00 | Pass |
| HT20 | MCS0 | 1 | 1 | 2412 | 24.42 | 30.00 | -3.00 | 21.42 | 36.00 | Pass |
| HT20 | MCS0 | 1 | 6 | 2437 | 25.26 | 30.00 | -3.00 | 22.26 | 36.00 | Pass |
| HT20 | MCS0 | 1 | 11 | 2462 | 23.74 | 30.00 | -3.00 | 20.74 | 36.00 | Pass |
| HT40 | MCS0 | 1 | 3 | 2422 | 23.84 | 30.00 | -3.00 | 20.84 | 36.00 | Pass |
| HT40 | MCS0 | 1 | 6 | 2437 | 25.12 | 30.00 | -3.00 | 22.12 | 36.00 | Pass |
| HT40 | MCS0 | 1 | 9 | 2452 | 24.45 | 30.00 | -3.00 | 21.45 | 36.00 | Pass |

TEST RESULTS DATA
Average Power Table
(Reporting Only)

| 2.4GHz Band | | | | | | |
|-------------|-----------|-----------------|-----|-------------|------------------|-------------------------------|
| Mod. | Data Rate | N _{TX} | CH. | Freq. (MHz) | Duty Factor (dB) | Average Conducted Power (dBm) |
| 11b | 1Mbps | 1 | 1 | 2412 | 0.00 | 17.72 |
| 11b | 1Mbps | 1 | 6 | 2437 | 0.00 | 17.69 |
| 11b | 1Mbps | 1 | 11 | 2462 | 0.00 | 15.64 |
| 11g | 6Mbps | 1 | 1 | 2412 | 0.13 | 14.96 |
| 11g | 6Mbps | 1 | 6 | 2437 | 0.13 | 16.25 |
| 11g | 6Mbps | 1 | 11 | 2462 | 0.13 | 13.55 |
| HT20 | MCS0 | 1 | 1 | 2412 | 0.14 | 14.36 |
| HT20 | MCS0 | 1 | 6 | 2437 | 0.14 | 16.12 |
| HT20 | MCS0 | 1 | 11 | 2462 | 0.14 | 13.16 |
| HT40 | MCS0 | 1 | 3 | 2422 | 0.28 | 12.11 |
| HT40 | MCS0 | 1 | 6 | 2437 | 0.28 | 14.97 |
| HT40 | MCS0 | 1 | 9 | 2452 | 0.28 | 13.66 |

TEST RESULTS DATA
Peak Power Density

| 2.4GHz Band | | | | | | | | |
|-------------|-----------|-----|-----|-------------|----------------------|----------|----------------------------|-----------|
| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | Peak PSD (dBm /3kHz) | DG (dBi) | Peak PSD Limit (dBm /3kHz) | Pass/Fail |
| 11b | 1Mbps | 1 | 1 | 2412 | -4.19 | -3.00 | 8.00 | Pass |
| 11b | 1Mbps | 1 | 6 | 2437 | -4.37 | -3.00 | 8.00 | Pass |
| 11b | 1Mbps | 1 | 11 | 2462 | -6.57 | -3.00 | 8.00 | Pass |
| 11g | 6Mbps | 1 | 1 | 2412 | -9.18 | -3.00 | 8.00 | Pass |
| 11g | 6Mbps | 1 | 6 | 2437 | -8.25 | -3.00 | 8.00 | Pass |
| 11g | 6Mbps | 1 | 11 | 2462 | -10.88 | -3.00 | 8.00 | Pass |
| HT20 | MCS0 | 1 | 1 | 2412 | -9.93 | -3.00 | 8.00 | Pass |
| HT20 | MCS0 | 1 | 6 | 2437 | -8.47 | -3.00 | 8.00 | Pass |
| HT20 | MCS0 | 1 | 11 | 2462 | -10.87 | -3.00 | 8.00 | Pass |
| HT40 | MCS0 | 1 | 3 | 2422 | -15.43 | -3.00 | 8.00 | Pass |
| HT40 | MCS0 | 1 | 6 | 2437 | -13.37 | -3.00 | 8.00 | Pass |
| HT40 | MCS0 | 1 | 9 | 2452 | -14.29 | -3.00 | 8.00 | Pass |



Appendix B. Radiated Spurious Emission

2.4GHz 2400~2483.5MHz

WIFI 802.11b (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 | | (MHz) | (dBμV/m) | (dB) | (dBμV/m) | (dBμV) | (dB/m) | (dB) | (dB) | (cm) | (deg) | (P/A) | (H/V) |
| 802.11b CH 01 2412MHz | | 2386.44 | 55.71 | -18.29 | 74 | 48.54 | 32 | 6.59 | 31.42 | 299 | 156 | P | H |
| | | 2387.61 | 45.03 | -8.97 | 54 | 37.86 | 32 | 6.59 | 31.42 | 299 | 156 | A | H |
| | * | 2412 | 108.26 | - | - | 100.95 | 32.13 | 6.59 | 31.41 | 299 | 156 | P | H |
| | * | 2412 | 105.06 | - | - | 97.75 | 32.13 | 6.59 | 31.41 | 299 | 156 | A | H |
| | | 2375.78 | 55.44 | -18.56 | 74 | 48.28 | 32.03 | 6.55 | 31.42 | 305 | 278 | P | V |
| | | 2386.96 | 44.28 | -9.72 | 54 | 37.11 | 32 | 6.59 | 31.42 | 305 | 278 | A | V |
| | * | 2412 | 104.8 | - | - | 97.49 | 32.13 | 6.59 | 31.41 | 305 | 278 | P | V |
| | * | 2412 | 101.68 | - | - | 94.37 | 32.13 | 6.59 | 31.41 | 305 | 278 | A | V |
| 802.11b CH 11 2462MHz | | 2494.12 | 55.22 | -18.78 | 74 | 47.59 | 32.2 | 6.81 | 31.38 | 100 | 158 | P | H |
| | | 2486.62 | 44.59 | -9.41 | 54 | 36.9 | 32.27 | 6.81 | 31.39 | 100 | 158 | A | H |
| | * | 2462 | 102.08 | - | - | 94.45 | 32.33 | 6.7 | 31.4 | 100 | 158 | P | H |
| | * | 2460 | 99.01 | - | - | 91.38 | 32.33 | 6.7 | 31.4 | 100 | 158 | A | H |
| | | 2486.8 | 56.28 | -17.72 | 74 | 48.59 | 32.27 | 6.81 | 31.39 | 320 | 270 | P | V |
| | | 2486.44 | 44.73 | -9.27 | 54 | 37.04 | 32.27 | 6.81 | 31.39 | 320 | 270 | A | V |
| | * | 2462 | 101.59 | - | - | 93.96 | 32.33 | 6.7 | 31.4 | 320 | 270 | P | V |
| | * | 2460 | 98.45 | - | - | 90.82 | 32.33 | 6.7 | 31.4 | 320 | 270 | A | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



2.4GHz 2400~2483.5MHz

WIFI 802.11b (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) |
|-------------|---|-------------------|------------------|-------------------|-----------------------|---------------------|-------------------------|-------------------|----------------------|----------------|-------------------|-----------------|------------|
| 802.11b | | 4824 | 53.8 | -20.2 | 74 | 71.3 | 34.2 | 9.9 | 61.6 | 317 | 204 | P | H |
| CH 01 | | 4824 | 50.89 | -3.11 | 54 | 68.39 | 34.2 | 9.9 | 61.6 | 317 | 204 | A | H |
| 2412MHz | | 4824 | 42.53 | -31.47 | 74 | 60.03 | 34.2 | 9.9 | 61.6 | 100 | 360 | P | V |
| 802.11b | | 4872 | 53.49 | -20.51 | 74 | 71.07 | 34.13 | 9.9 | 61.61 | 301 | 169 | P | H |
| CH 06 | | 4872 | 50.59 | -3.41 | 54 | 68.17 | 34.13 | 9.9 | 61.61 | 301 | 169 | A | H |
| 2437MHz | | 7308 | 40.53 | -33.47 | 74 | 54.41 | 36.6 | 11.85 | 62.33 | 100 | 360 | P | H |
| | | 4872 | 46.96 | -27.04 | 74 | 64.54 | 34.13 | 9.9 | 61.61 | 300 | 4 | P | V |
| | | 7308 | 39.94 | -34.06 | 74 | 53.82 | 36.6 | 11.85 | 62.33 | 300 | 4 | P | V |
| 802.11b | | 4926 | 52.93 | -21.07 | 74 | 70.55 | 34.1 | 9.91 | 61.63 | 308 | 194 | P | H |
| CH 11 | | 4926 | 50.37 | -3.63 | 54 | 67.99 | 34.1 | 9.91 | 61.63 | 308 | 194 | A | H |
| 2462MHz | | 7386 | 39.08 | -34.92 | 74 | 52.92 | 36.5 | 12.03 | 62.37 | 308 | 194 | P | H |
| | | 4926 | 46.16 | -27.84 | 74 | 63.78 | 34.1 | 9.91 | 61.63 | 300 | 360 | P | V |
| | | 7386 | 40.73 | -33.27 | 74 | 54.57 | 36.5 | 12.03 | 62.37 | 300 | 360 | P | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



2.4GHz 2400~2483.5MHz
WIFI 802.11g (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) |
|-----------------------------|--|-------------------|------------------|-------------------|-----------------------|---------------------|-------------------------|-------------------|----------------------|----------------|-------------------|-------------------|--------------|
| 802.11g CH 01 2412MHz | | 2389.95 | 67.31 | -6.69 | 74 | 60.13 | 32 | 6.59 | 31.41 | 115 | 36 | P | H |
| | | 2389.95 | 50.51 | -3.49 | 54 | 43.33 | 32 | 6.59 | 31.41 | 115 | 36 | A | H |
| | * | 2408 | 106.94 | - | - | 99.63 | 32.13 | 6.59 | 31.41 | 115 | 36 | P | H |
| | * | 2408 | 99.33 | - | - | 92.02 | 32.13 | 6.59 | 31.41 | 115 | 36 | A | H |
| | | 2389.3 | 59.89 | -14.11 | 74 | 52.72 | 32 | 6.59 | 31.42 | 303 | 258 | P | V |
| | | 2389.95 | 47.1 | -6.9 | 54 | 39.92 | 32 | 6.59 | 31.41 | 303 | 258 | A | V |
| | * | 2410 | 101.91 | - | - | 94.6 | 32.13 | 6.59 | 31.41 | 303 | 258 | P | V |
| | * | 2408 | 94.22 | - | - | 86.91 | 32.13 | 6.59 | 31.41 | 303 | 258 | A | V |
| 802.11g CH 11 2462MHz | | 2484.52 | 68.21 | -5.79 | 74 | 60.52 | 32.27 | 6.81 | 31.39 | 100 | 41 | P | H |
| | | 2483.56 | 50 | -4 | 54 | 42.31 | 32.27 | 6.81 | 31.39 | 100 | 41 | A | H |
| | * | 2456 | 106.49 | - | - | 98.86 | 32.33 | 6.7 | 31.4 | 100 | 41 | P | H |
| | * | 2456 | 98.78 | - | - | 91.15 | 32.33 | 6.7 | 31.4 | 100 | 41 | A | H |
| | | 2484.22 | 63.85 | -10.15 | 74 | 56.16 | 32.27 | 6.81 | 31.39 | 300 | 291 | P | V |
| | | 2483.5 | 47.24 | -6.76 | 54 | 39.55 | 32.27 | 6.81 | 31.39 | 300 | 291 | A | V |
| | * | 2456 | 101.35 | - | - | 93.72 | 32.33 | 6.7 | 31.4 | 300 | 291 | P | V |
| | * | 2456 | 93.74 | - | - | 86.11 | 32.33 | 6.7 | 31.4 | 300 | 291 | A | V |
| Remark | <p>1. No other spurious found.</p> <p>2. All results are PASS against Peak and Average limit line.</p> | | | | | | | | | | | | |



2.4GHz 2400~2483.5MHz

WIFI 802.11g (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) |
|-----------------------------|---|-------------------|------------------|-------------------|-----------------------|---------------------|-------------------------|-------------------|----------------------|----------------|-------------------|-----------------|------------|
| 802.11g CH 01 2412MHz | | 4824 | 42.75 | -31.25 | 74 | 60.25 | 34.2 | 9.9 | 61.6 | 300 | 0 | P | H |
| | | 4824 | 40.44 | -33.56 | 74 | 57.94 | 34.2 | 9.9 | 61.6 | 105 | 37 | P | V |
| 802.11g CH 06 2437MHz | | 4872 | 50.68 | -23.32 | 74 | 68.26 | 34.13 | 9.9 | 61.61 | 308 | 200 | P | H |
| | | 4872 | 38.97 | -15.03 | 54 | 56.55 | 34.13 | 9.9 | 61.61 | 308 | 200 | A | H |
| | | 7308 | 40.88 | -33.12 | 74 | 54.76 | 36.6 | 11.85 | 62.33 | 300 | 0 | P | H |
| | | 4872 | 44.4 | -29.6 | 74 | 61.98 | 34.13 | 9.9 | 61.61 | 300 | 360 | P | V |
| | | 7308 | 40.6 | -33.4 | 74 | 54.48 | 36.6 | 11.85 | 62.33 | 300 | 360 | P | V |
| 802.11g CH 11 2462MHz | | 4926 | 41.97 | -32.03 | 74 | 59.59 | 34.1 | 9.91 | 61.63 | 300 | 0 | P | H |
| | | 7386 | 40.79 | -33.21 | 74 | 54.63 | 36.5 | 12.03 | 62.37 | 300 | 0 | P | H |
| | | 4926 | 39.45 | -34.55 | 74 | 57.07 | 34.1 | 9.91 | 61.63 | 300 | 360 | P | V |
| | | 7386 | 40.21 | -33.79 | 74 | 54.05 | 36.5 | 12.03 | 62.37 | 300 | 360 | P | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



2.4GHz 2400~2483.5MHz
WIFI 802.11n HT20 (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 HT20 CH 01 2412MHz | | 2389.95 | 68.46 | -5.54 | 74 | 61.28 | 32 | 6.59 | 31.41 | 100 | 151 | P | H |
| | | 2389.43 | 49.93 | -4.07 | 54 | 42.76 | 32 | 6.59 | 31.42 | 100 | 151 | A | H |
| | * | 2408 | 105.27 | - | - | 97.96 | 32.13 | 6.59 | 31.41 | 100 | 151 | P | H |
| | * | 2408 | 97.63 | - | - | 90.32 | 32.13 | 6.59 | 31.41 | 100 | 151 | A | H |
| | | 2389.43 | 65.89 | -8.11 | 74 | 58.72 | 32 | 6.59 | 31.42 | 346 | 282 | P | V |
| | | 2389.95 | 50.75 | -3.25 | 54 | 43.57 | 32 | 6.59 | 31.41 | 346 | 282 | A | V |
| | * | 2406 | 104.33 | - | - | 97.02 | 32.13 | 6.59 | 31.41 | 346 | 282 | P | V |
| | * | 2408 | 96.35 | - | - | 89.04 | 32.13 | 6.59 | 31.41 | 346 | 282 | A | V |
| 802.11n HT20 CH 11 2462MHz | | 2484.58 | 70.72 | -3.28 | 74 | 63.03 | 32.27 | 6.81 | 31.39 | 100 | 37 | P | H |
| | | 2483.68 | 50.2 | -3.8 | 54 | 42.51 | 32.27 | 6.81 | 31.39 | 100 | 37 | A | H |
| | * | 2456 | 105.56 | - | - | 97.93 | 32.33 | 6.7 | 31.4 | 100 | 37 | P | H |
| | * | 2454 | 97.75 | - | - | 90.12 | 32.33 | 6.7 | 31.4 | 100 | 37 | A | H |
| | | 2484.1 | 66.7 | -7.3 | 74 | 59.01 | 32.27 | 6.81 | 31.39 | 300 | 291 | P | V |
| | | 2483.68 | 46.68 | -7.32 | 54 | 38.99 | 32.27 | 6.81 | 31.39 | 300 | 291 | A | V |
| | * | 2454 | 100.12 | - | - | 92.49 | 32.33 | 6.7 | 31.4 | 300 | 291 | P | V |
| | * | 2454 | 92.63 | - | - | 85 | 32.33 | 6.7 | 31.4 | 300 | 291 | A | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



2.4GHz 2400~2483.5MHz

WIFI 802.11n HT20 (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) |
|-------------------------------|---|-------------------|------------------|-------------------|-----------------------|---------------------|-------------------------|-------------------|----------------------|----------------|-------------------|-----------------|------------|
| 802.11n HT20 CH 01 2412MHz | | 4824 | 41.22 | -32.78 | 74 | 58.72 | 34.2 | 9.9 | 61.6 | 300 | 0 | P | H |
| | | 4824 | 39.97 | -34.03 | 74 | 57.47 | 34.2 | 9.9 | 61.6 | 300 | 209 | P | V |
| 802.11n HT20 CH 06 2437MHz | | 4872 | 48.45 | -25.55 | 74 | 66.03 | 34.13 | 9.9 | 61.61 | 300 | 0 | P | H |
| | | 7308 | 40.35 | -33.65 | 74 | 54.23 | 36.6 | 11.85 | 62.33 | 300 | 0 | P | H |
| | | 4872 | 40.58 | -33.42 | 74 | 58.16 | 34.13 | 9.9 | 61.61 | 101 | 1 | P | V |
| | | 7308 | 39.57 | -34.43 | 74 | 53.45 | 36.6 | 11.85 | 62.33 | 101 | 1 | P | V |
| 802.11n HT20 CH 11 2462MHz | | 4926 | 41.73 | -32.27 | 74 | 59.35 | 34.1 | 9.91 | 61.63 | 300 | 0 | P | H |
| | | 7386 | 40.89 | -33.11 | 74 | 54.73 | 36.5 | 12.03 | 62.37 | 300 | 0 | P | H |
| | | 4926 | 38.48 | -35.52 | 74 | 56.1 | 34.1 | 9.91 | 61.63 | 300 | 302 | P | V |
| | | 7386 | 40.48 | -33.52 | 74 | 54.32 | 36.5 | 12.03 | 62.37 | 300 | 302 | P | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



2.4GHz 2400~2483.5MHz
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 03 2422MHz | | 2388.78 | 67.35 | -6.65 | 74 | 60.18 | 32 | 6.59 | 31.42 | 100 | 149 | P | H |
| | | 2389.17 | 50.1 | -3.9 | 54 | 42.93 | 32 | 6.59 | 31.42 | 100 | 149 | A | H |
| | | 2483.5 | 57.32 | -16.68 | 74 | 49.63 | 32.27 | 6.81 | 31.39 | 100 | 149 | P | H |
| | | 2485.78 | 45.59 | -8.41 | 54 | 37.9 | 32.27 | 6.81 | 31.39 | 100 | 149 | A | H |
| | * | 2440 | 100.33 | - | - | 92.63 | 32.4 | 6.7 | 31.4 | 100 | 149 | P | H |
| | * | 2440 | 92.81 | - | - | 85.11 | 32.4 | 6.7 | 31.4 | 100 | 149 | A | H |
| | | 2388.52 | 65.02 | -8.98 | 74 | 57.85 | 32 | 6.59 | 31.42 | 303 | 283 | P | V |
| | | 2389.3 | 48.09 | -5.91 | 54 | 40.92 | 32 | 6.59 | 31.42 | 303 | 283 | A | V |
| | | 2488 | 55.5 | -18.5 | 74 | 47.88 | 32.2 | 6.81 | 31.39 | 303 | 283 | P | V |
| | | 2498.08 | 45.06 | -8.94 | 54 | 37.43 | 32.2 | 6.81 | 31.38 | 303 | 283 | A | V |
| | * | 2408 | 96.75 | - | - | 89.44 | 32.13 | 6.59 | 31.41 | 303 | 283 | P | V |
| * | 2408 | 88.7 | - | - | 81.39 | 32.13 | 6.59 | 31.41 | 303 | 283 | A | V | |
| 802.11n HT40 CH 06 2437MHz | | 2389.69 | 57.59 | -16.41 | 74 | 50.42 | 32 | 6.59 | 31.42 | 100 | 150 | P | H |
| | | 2388.13 | 45.63 | -8.37 | 54 | 38.46 | 32 | 6.59 | 31.42 | 100 | 150 | A | H |
| | | 2483.5 | 65.77 | -8.23 | 74 | 58.08 | 32.27 | 6.81 | 31.39 | 100 | 150 | P | H |
| | | 2483.56 | 50.58 | -3.42 | 54 | 42.89 | 32.27 | 6.81 | 31.39 | 100 | 150 | A | H |
| | * | 2446 | 105.3 | - | - | 97.6 | 32.4 | 6.7 | 31.4 | 100 | 150 | P | H |
| | * | 2448 | 97.6 | - | - | 89.9 | 32.4 | 6.7 | 31.4 | 100 | 150 | A | H |
| | | 2388.26 | 56 | -18 | 74 | 48.83 | 32 | 6.59 | 31.42 | 301 | 275 | P | V |
| | | 2389.69 | 45.03 | -8.97 | 54 | 37.86 | 32 | 6.59 | 31.42 | 301 | 275 | A | V |
| | | 2483.5 | 60.53 | -13.47 | 74 | 52.84 | 32.27 | 6.81 | 31.39 | 301 | 275 | P | V |
| | | 2483.56 | 47.21 | -6.79 | 54 | 39.52 | 32.27 | 6.81 | 31.39 | 301 | 275 | A | V |
| | * | 2450 | 101.54 | - | - | 93.84 | 32.4 | 6.7 | 31.4 | 301 | 275 | P | V |
| * | 2448 | 93.35 | - | - | 85.65 | 32.4 | 6.7 | 31.4 | 301 | 275 | A | V | |



| | | | | | | | | | | | | | |
|---|---|---------|--------|--------|----|-------|-------|------|-------|-----|-----|---|---|
| 802.11n HT40 CH 09 2452MHz | | 2389.69 | 58.71 | -15.29 | 74 | 51.54 | 32 | 6.59 | 31.42 | 100 | 149 | P | H |
| | | 2389.3 | 45.25 | -8.75 | 54 | 38.08 | 32 | 6.59 | 31.42 | 100 | 149 | A | H |
| | | 2483.98 | 62.86 | -11.14 | 74 | 55.17 | 32.27 | 6.81 | 31.39 | 100 | 149 | P | H |
| | | 2483.74 | 49.61 | -4.39 | 54 | 41.92 | 32.27 | 6.81 | 31.39 | 100 | 149 | A | H |
| | * | 2448 | 104.17 | - | - | 96.47 | 32.4 | 6.7 | 31.4 | 100 | 149 | P | H |
| | * | 2446 | 96.45 | - | - | 88.75 | 32.4 | 6.7 | 31.4 | 100 | 149 | A | H |
| | | 2389.56 | 56.83 | -17.17 | 74 | 49.66 | 32 | 6.59 | 31.42 | 300 | 274 | P | V |
| | | 2389.95 | 44.65 | -9.35 | 54 | 37.47 | 32 | 6.59 | 31.41 | 300 | 274 | A | V |
| | | 2484.94 | 59.64 | -14.36 | 74 | 51.95 | 32.27 | 6.81 | 31.39 | 300 | 274 | P | V |
| | | 2483.68 | 46.82 | -7.18 | 54 | 39.13 | 32.27 | 6.81 | 31.39 | 300 | 274 | A | V |
| | * | 2448 | 100.26 | - | - | 92.56 | 32.4 | 6.7 | 31.4 | 300 | 274 | P | V |
| | * | 2448 | 92.22 | - | - | 84.52 | 32.4 | 6.7 | 31.4 | 300 | 274 | A | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



2.4GHz 2400~2483.5MHz

WIFI 802.11n HT40 (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) |
|-------------|---|-------------------|------------------|-------------------|-----------------------|---------------------|-------------------------|-------------------|----------------------|----------------|-------------------|-----------------|------------|
| 802.11n | | 4842 | 39.03 | -34.97 | 74 | 56.53 | 34.2 | 9.9 | 61.6 | 130 | 132 | P | H |
| HT40 | | 7266 | 39.22 | -34.78 | 74 | 53.25 | 36.53 | 11.76 | 62.32 | 130 | 132 | P | H |
| CH 03 | | 4842 | 38.82 | -35.18 | 74 | 56.32 | 34.2 | 9.9 | 61.6 | 106 | 5 | P | V |
| 2422MHz | | 7266 | 40.34 | -33.66 | 74 | 54.37 | 36.53 | 11.76 | 62.32 | 106 | 5 | P | V |
| 802.11n | | 4872 | 40.65 | -33.35 | 74 | 58.23 | 34.13 | 9.9 | 61.61 | 300 | 0 | P | H |
| HT40 | | 7308 | 40.91 | -33.09 | 74 | 54.79 | 36.6 | 11.85 | 62.33 | 300 | 0 | P | H |
| CH 06 | | 4872 | 40.39 | -33.61 | 74 | 57.97 | 34.13 | 9.9 | 61.61 | 300 | 360 | P | V |
| 2437MHz | | 7308 | 40.14 | -33.86 | 74 | 54.02 | 36.6 | 11.85 | 62.33 | 300 | 360 | P | V |
| 802.11n | | 4902 | 39.19 | -34.81 | 74 | 56.82 | 34.1 | 9.89 | 61.62 | 300 | 0 | P | H |
| HT40 | | 7356 | 40.53 | -33.47 | 74 | 54.35 | 36.6 | 11.94 | 62.36 | 300 | 0 | P | H |
| CH 09 | | 4902 | 38.17 | -35.83 | 74 | 55.8 | 34.1 | 9.89 | 61.62 | 300 | 360 | P | V |
| 2452MHz | | 7356 | 40.92 | -33.08 | 74 | 54.74 | 36.6 | 11.94 | 62.36 | 300 | 360 | P | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



2.4GHz 2400~2483.5MHz

Emission below 1GHz

2.4GHz WIFI 802.11b (LF)

| 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 | | (MHz) | (dBμV/m) | (dB) | (dBμV/m) | (dBμV) | (dB/m) | (dB) | (dB) | (cm) | (deg) | (P/A) | (H/V) |
| 2.4GHz 802.11b LF | | 65.89 | 14.57 | -25.43 | 40 | 34.07 | 12.62 | 0.82 | 32.94 | - | - | P | H |
| | | 95.96 | 19.42 | -24.08 | 43.5 | 35.29 | 16.06 | 1 | 32.93 | - | - | P | H |
| | | 187.14 | 19.95 | -23.55 | 43.5 | 36.02 | 15.41 | 1.44 | 32.92 | - | - | P | H |
| | | 255.04 | 29.58 | -16.42 | 46 | 41.6 | 19.23 | 1.74 | 32.99 | 100 | 0 | P | H |
| | | 388.9 | 22.06 | -23.94 | 46 | 31.65 | 21.43 | 2.09 | 33.11 | - | - | P | H |
| | | 757.5 | 25.03 | -20.97 | 46 | 29.56 | 25.59 | 2.97 | 33.09 | - | - | P | H |
| | | 32.91 | 28.58 | -11.42 | 40 | 38.57 | 22.36 | 0.61 | 32.96 | 100 | 360 | P | V |
| | | 69.77 | 21.64 | -18.36 | 40 | 41.05 | 12.7 | 0.82 | 32.93 | - | - | P | V |
| | | 95.96 | 24.34 | -19.16 | 43.5 | 40.21 | 16.06 | 1 | 32.93 | - | - | P | V |
| | | 142.52 | 19.45 | -24.05 | 43.5 | 34.08 | 17.09 | 1.23 | 32.95 | - | - | P | V |
| | | 256.98 | 26.71 | -19.29 | 46 | 38.49 | 19.46 | 1.75 | 32.99 | - | - | P | V |
| | 370.47 | 19.85 | -26.15 | 46 | 29.95 | 20.97 | 2.03 | 33.1 | - | - | 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. | |
| 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 | | 2390 | 43.54 | -10.46 | 54 | 42.6 | 32.22 | 4.58 | 35.86 | 103 | 308 | A | H |
| 2412MHz | | | | | | | | | | | | | |

- 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)

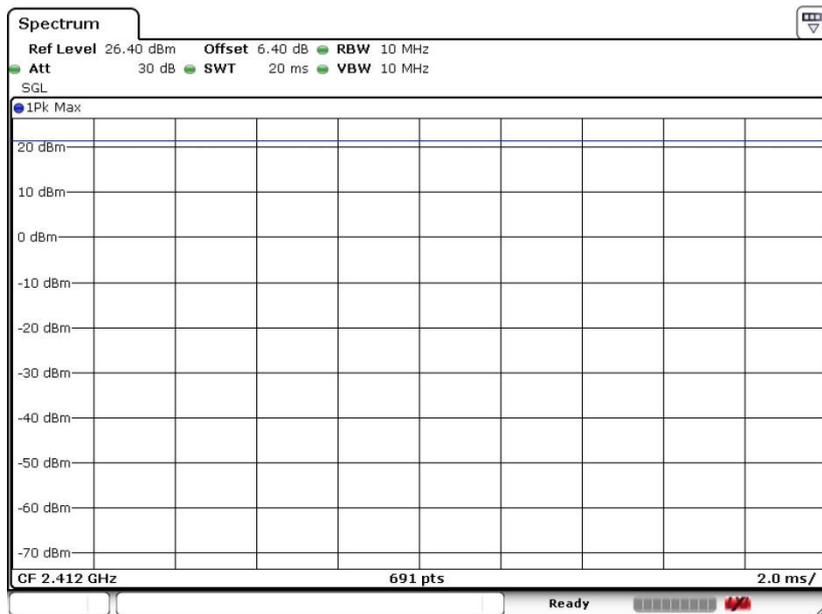
Both peak and average measured complies with the limit line, so test result is “PASS”.



Appendix C. Duty Cycle Plots

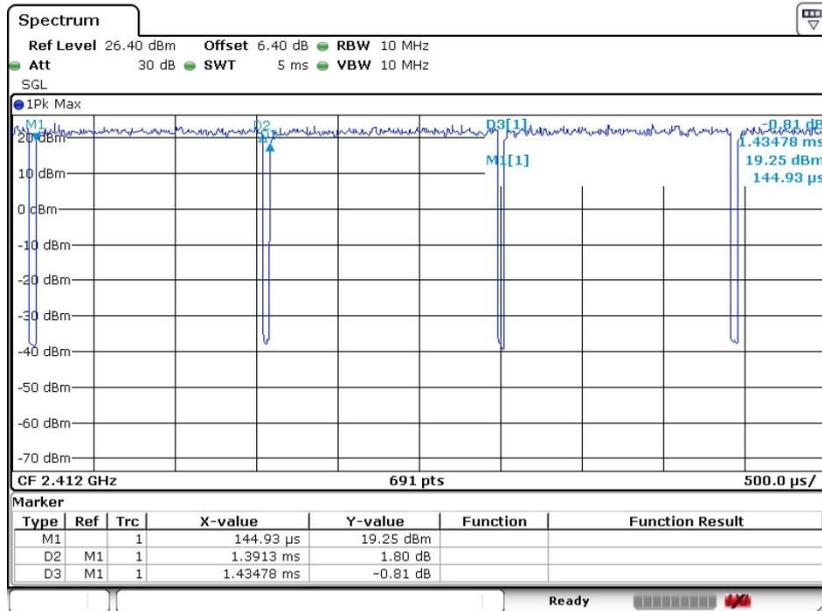
| Band | Duty Cycle(%) | T(ms) | 1/T(kHz) | VBW Setting |
|--------------|---------------|--------|----------|-------------|
| 802.11b | 100 | - | - | 10Hz |
| 802.11g | 96.97 | 1.3913 | 0.7188 | 0.75KHz |
| 802.11n HT20 | 96.76 | 1.2971 | 0.7710 | 0.82KHz |
| 802.11n HT40 | 93.74 | 0.6507 | 1.5368 | 1.6KHz |

802.11b

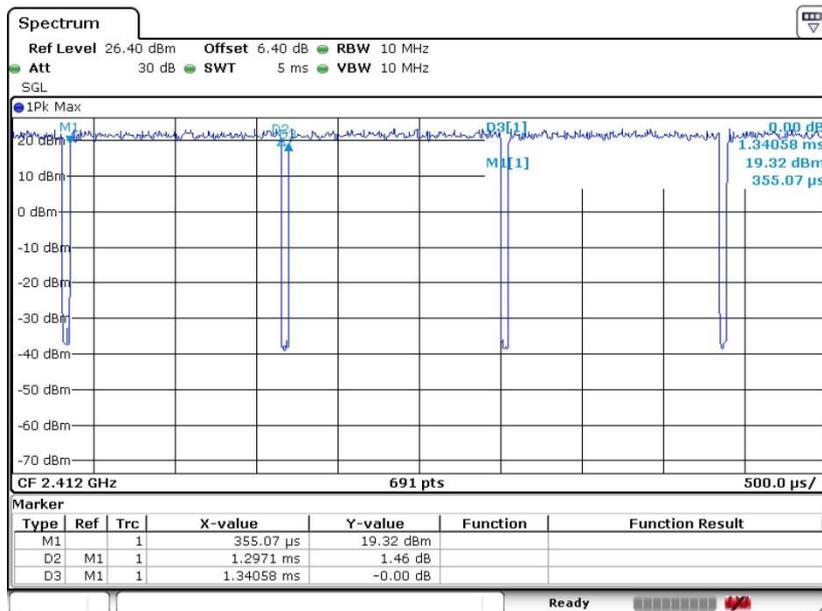




802.11g

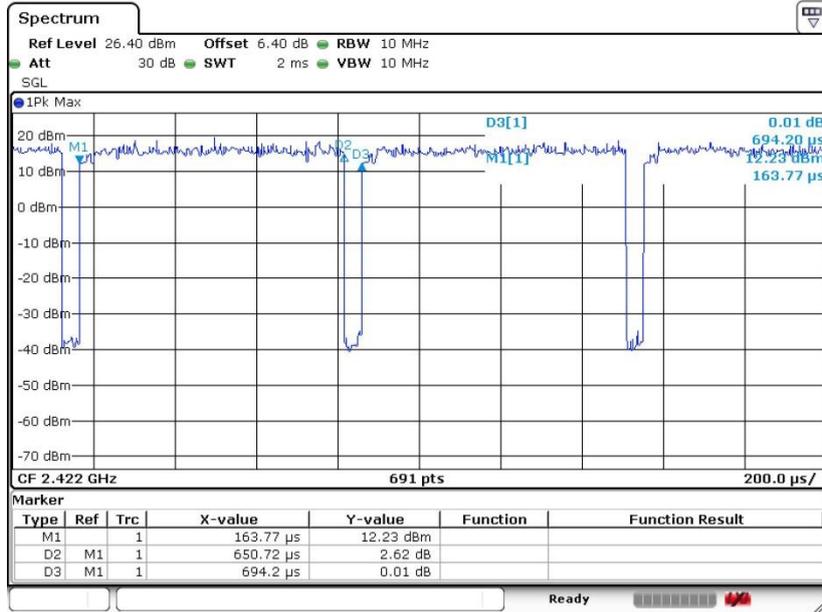


802.11n HT20





802.11n HT40





Appendix E. Reference Report

Please refer to Sporton report number FR981204-03C which is issued separately.