



FCC RF Test Report

APPLICANT : Wistron Corporation
EQUIPMENT : Tablet PC
BRAND NAME : Lenovo
MODEL NAME : TP00082A
FCC ID : PU5-TP00082ASI
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DTS) Digital Transmission System

Equipment: Sierra Wireless EM7455 and Intel 8265D2W tested inside of Lenovo Tablet PC.
This is a variant report which is only valid together with the original test report. The product was received on Sep. 12, 2016 and testing was completed on Nov. 16, 2016. We, SPORTON INTERNATIONAL 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 INC., the test report shall not be reproduced except in full.

Reviewed by: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager



SPORTON INTERNATIONAL INC.

No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.

SPORTON INTERNATIONAL INC.

TEL : 886-3-327-3456

FAX : 886-3-328-4978

FCC ID : PU5-TP00082ASI

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SUMMARY OF TEST RESULT

| Report Section | FCC Rule | Description | Limit | Result | Remark |
|----------------|--------------------|--|-----------------------|--------|-----------------------------------|
| 3.1 | 15.247(d) | Radiated Band Edges and Radiated Spurious Emission | 15.209(a) & 15.247(d) | Pass | Under limit 4.59 dB at 36.210 MHz |
| 3.2 | 15.207 | AC Conducted Emission | 15.207(a) | Pass | Under limit 5.30 dB at 0.502 MHz |
| 3.3 | 15.203 & 15.247(b) | Antenna Requirement | N/A | Pass | - |



1 General Description

1.1 Applicant

Wistron Corporation

21F, No. 88, Sec. 1, Hsin Tai Wu Rd., Hsichih Dist, New Taipei City 221, Taiwan R.O.C.

1.2 Manufacturer

Wistron Corporation

21F, No. 88, Sec. 1, Hsin Tai Wu Rd., Hsichih Dist, New Taipei City 221, Taiwan R.O.C.

1.3 Product Feature of Equipment Under Test

| Product Feature | |
|---------------------------------|--|
| Equipment | Tablet PC |
| Brand Name | Lenovo |
| Model Name | TP00082A |
| FCC ID | PU5-TP00082ASI |
| Integrated the WLAN Module | Brand Name: Intel Model Name: 8265D2W FCC ID: N7NEM7455 |
| EUT supports Radios application | WCDMA/HSPA/LTE WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE |
| EUT Stage | Production Unit |

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. This is a variant report by TP00082A update its CPU to Intel KabyLake-Y processor and change WLAN module from Intel 8260D2W to Intel 8265D2W. All the test cases were performed on original report which can be referred to Sporton Report Number FR5N2711-09C. Based on the original report, only worst case was verified.



| Antenna Information | | | | |
|---------------------|--------------|----------------------|---------------------------------------|--|
| Antenna | Manufacturer | PULSE | | |
| | Antenna Type | Main: Dipole Antenna | Aux.: Dipole Antenna | |
| | Part number | 025.900FC.0001 | 025.900FD.0001 | |
| | Peak gain | Main Antenna : | Aux. Antenna : | |
| | | WLAN (2.4GHz):-0.82 | WLAN (2.4GHz):1.39 Bluetooth :1.39 | |
| WLAN (5GHz):2.31 | | WLAN (5GHz):3.13 | | |

1.4 Product Specification of Equipment Under Test

| Standards-related Product Specification | | | |
|---|--|--------|--------|
| Tx/Rx Channel Frequency Range | 2412 MHz ~ 2472 MHz | | |
| Antenna Type / Gain | <Ant 1> Dipole Antenna type with gain -0.82 dBi <Ant 2> Dipole Antenna type with gain 1.39 dBi | | |
| Type of Modulation | 802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM) | | |
| Antenna Function for Transmitter | | Ant. 1 | Ant. 2 |
| | 802.11 b/g/n | V | V |
| | 802.11 n MIMO | V | V |

1.5 Modification of EUT

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



1.6 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1022 under the FCC 2.948(e) 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 | 03CH07-HY |

Note: The test site complies with ANSI C63.4 2014 requirement.

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 C §15.247
- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05
- ♦ FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ♦ FCC KDB 644545 D03 Guidance for IEEE 802 11ac New Rules v01
- ♦ 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

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: conducted emission (150 kHz to 30 MHz) and radiated 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 (X plane) were recorded in this report.

2.1 Carrier Frequency and Channel

| Frequency Band | Channel | Freq. (MHz) | Channel | Freq. (MHz) |
|-----------------|---------|-------------|---------|-------------|
| 2400-2483.5 MHz | 1 | 2412 | 8 | 2447 |
| | 2 | 2417 | 9 | 2452 |
| | 3 | 2422 | 10 | 2457 |
| | 4 | 2427 | 11 | 2462 |
| | 5 | 2432 | 12 | 2467 |
| | 6 | 2437 | 13 | 2472 |
| | 7 | 2442 | | |



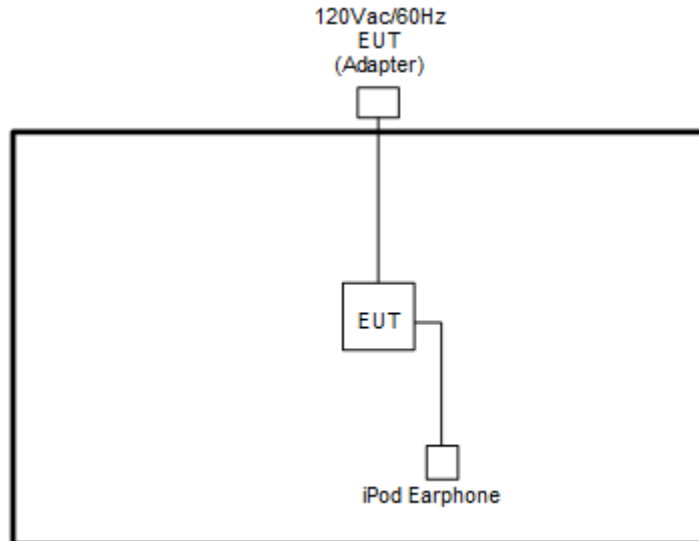
2.2 Test Mode

| Modulation | Data Rate |
|--------------|-----------|
| 802.11n HT40 | MCS0 |

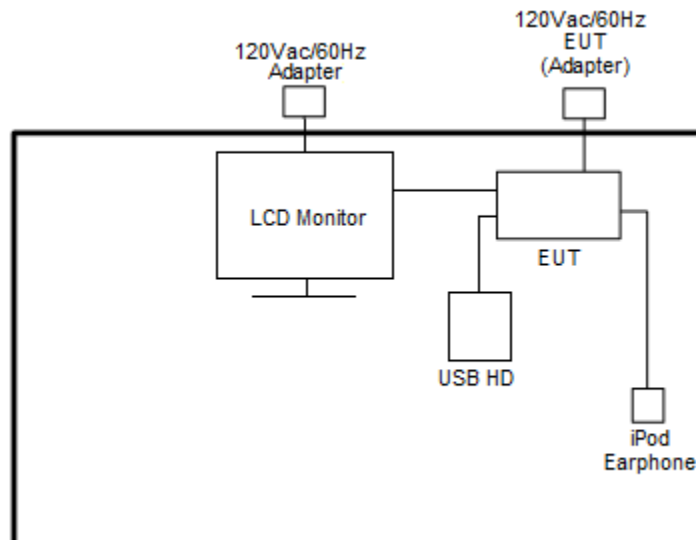
| Test Cases | |
|--|---|
| AC Conducted Emission | Mode 1 :Bluetooth Tx + TF + TC Mode 2 : WLAN (2.4GHz) Tx + TF + TC |
| Remark: 1. TC stands for Test Configuration, and consists of Earphone, USB HD, iPod Earphone, Adapter, SD Card, and DP Cable. 2. TF stands for Test Function, and consists of MPEG4. 3. The worst case of conducted emission is mode 2; only the test data of it was reported. | |

2.3 Connection Diagram of Test System

<WLAN Tx Mode>



<AC Conducted Emission Mode>





2.4 Support Unit used in test configuration and system

| Item | Equipment | Trade Name | Model Name | FCC ID | Data Cable | Power Cord |
|------|-----------------|------------|------------|---------|-----------------|-------------------|
| 1. | LCD Monitor | DELL | U2410 | FCC DoC | Shielded, 1.6 m | Unshielded, 1.8 m |
| 2. | USB HD | PQI | H568V | FCC DoC | Shielded, 0.5 m | N/A |
| 3. | SD Card | SanDisk | MicroSD HC | FCC DoC | N/A | N/A |
| 4. | iPod Earphone | Apple | A1285 | FCC DoC | Shielded, 1.0 m | N/A |
| 5. | iPhone Earphone | Apple | A1387 | FCC DoC | Shielded, 1.2 m | N/A |

2.5 EUT Operation Test Setup

The programmed RF utility “DRTU TOOL”, is installed in EUT to provide channel selection, power level, data rate and the application type. RF Utility can send transmitting signal for all testing. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.



3 Test Result

3.1 Radiated Band Edges and Spurious Emission Measurement

3.1.1 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 FCC section 15.209 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 |

3.1.2 Measuring Instruments

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

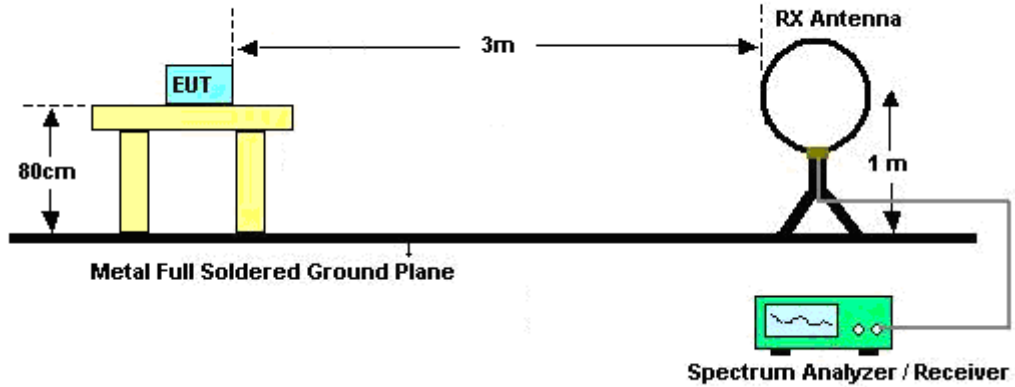


3.1.3 Test Procedures

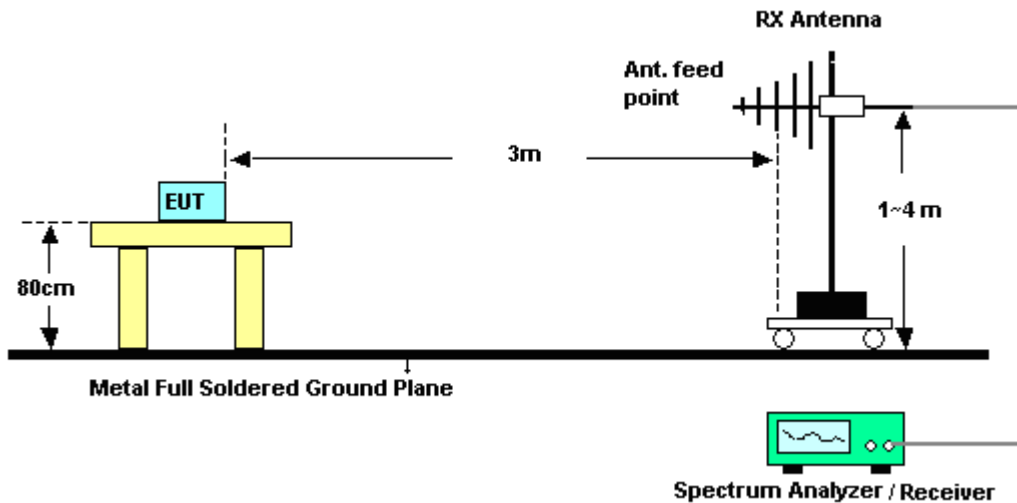
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the 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 measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. 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.

3.1.4 Test Setup

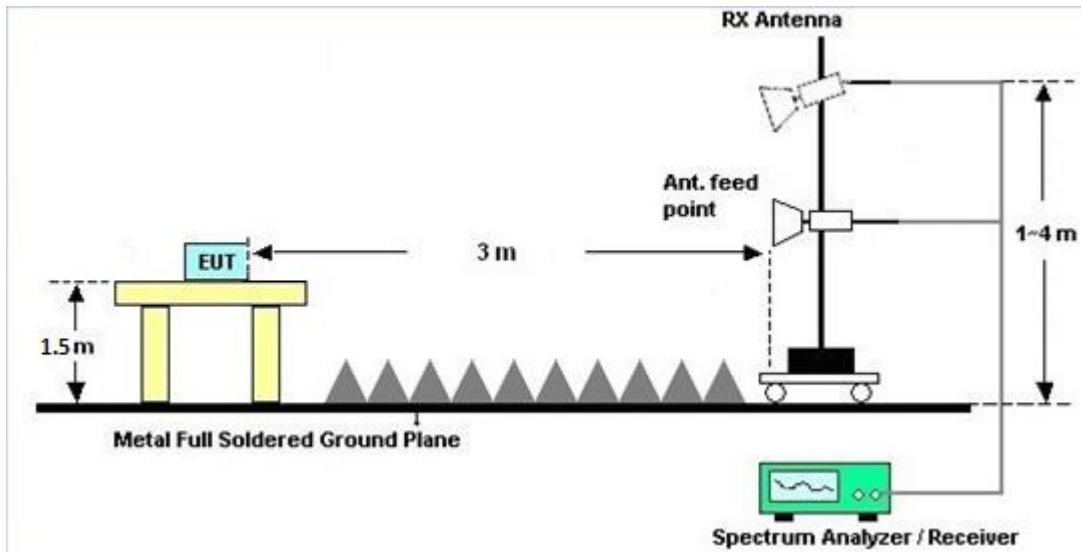
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.1.5 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 per 15.31(o) was not reported.

3.1.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A and B.

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

Please refer to Appendix A and B.



3.2 AC Conducted Emission Measurement

3.2.1 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.

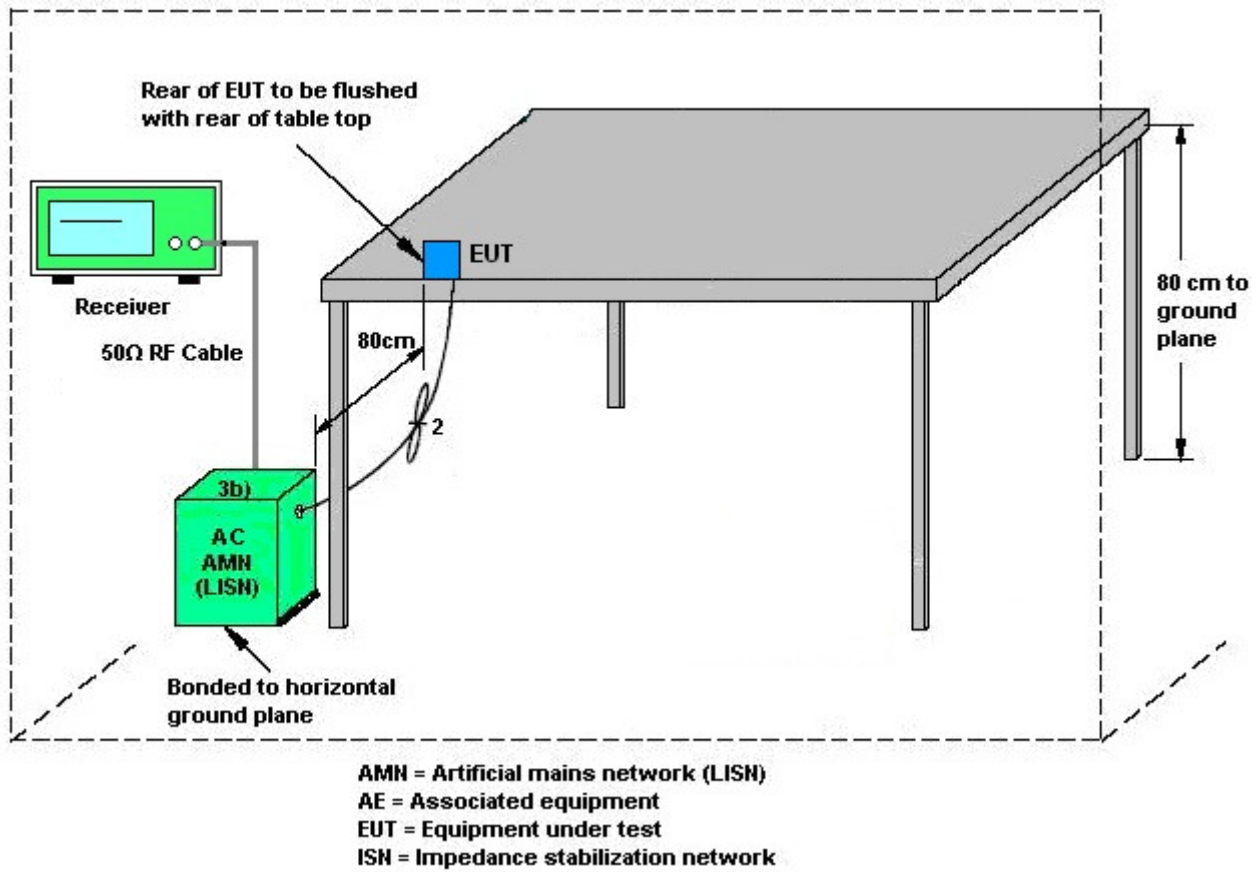
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room, and it 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 (IF bandwidth = 9kHz) with Maximum Hold Mode.

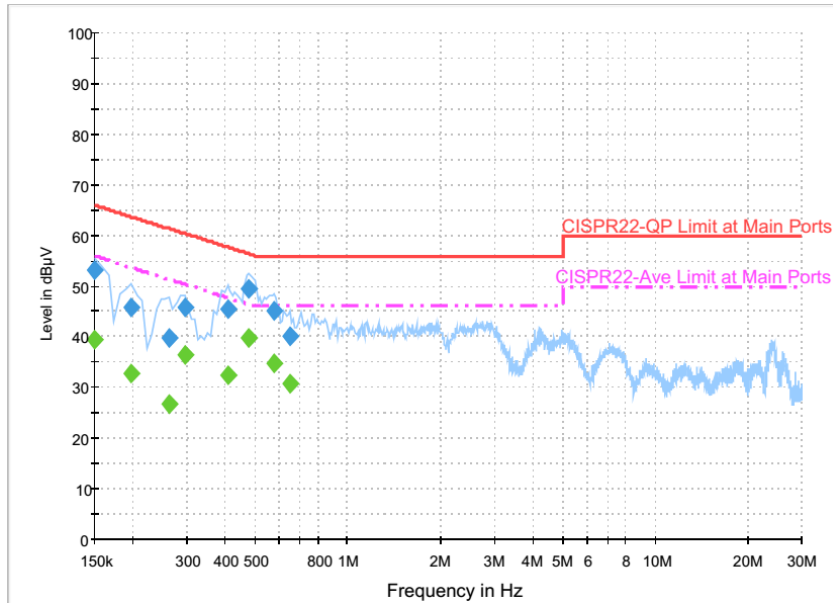
3.2.4 Test Setup





3.2.5 Test Result of AC Conducted Emission

| | | | |
|-----------------|----------------------------|---------------------|---------|
| Test Mode : | Mode 2 | Temperature : | 20~25°C |
| Test Engineer : | James Chiu | Relative Humidity : | 50~55% |
| Test Voltage : | 120Vac / 60Hz | Phase : | Line |
| Function Type : | WLAN (2.4GHz) Tx + TF + TC | | |



Final Result : Quasi-Peak

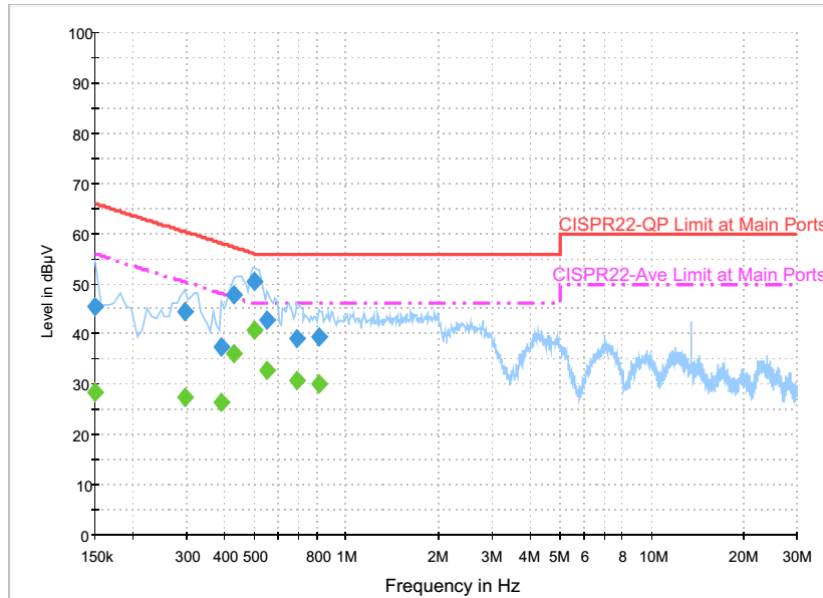
| Frequency (MHz) | Quasi-Peak (dBµV) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) |
|-----------------|-------------------|--------|------|------------|-------------|--------------|
| 0.150000 | 53.0 | Off | L1 | 19.6 | 13.0 | 66.0 |
| 0.198000 | 45.9 | Off | L1 | 19.6 | 17.8 | 63.7 |
| 0.262000 | 39.8 | Off | L1 | 19.6 | 21.6 | 61.4 |
| 0.294000 | 45.9 | Off | L1 | 19.6 | 14.5 | 60.4 |
| 0.406000 | 45.5 | Off | L1 | 19.6 | 12.2 | 57.7 |
| 0.478000 | 49.4 | Off | L1 | 19.6 | 7.0 | 56.4 |
| 0.574000 | 45.2 | Off | L1 | 19.6 | 10.8 | 56.0 |
| 0.646000 | 40.0 | Off | L1 | 19.6 | 16.0 | 56.0 |

Final Result : Average

| Frequency (MHz) | Average (dBµV) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) |
|-----------------|----------------|--------|------|------------|-------------|--------------|
| 0.150000 | 39.6 | Off | L1 | 19.6 | 16.4 | 56.0 |
| 0.198000 | 32.8 | Off | L1 | 19.6 | 20.9 | 53.7 |
| 0.262000 | 26.8 | Off | L1 | 19.6 | 24.6 | 51.4 |
| 0.294000 | 36.3 | Off | L1 | 19.6 | 14.1 | 50.4 |
| 0.406000 | 32.6 | Off | L1 | 19.6 | 15.1 | 47.7 |
| 0.478000 | 39.7 | Off | L1 | 19.6 | 6.7 | 46.4 |
| 0.574000 | 34.7 | Off | L1 | 19.6 | 11.3 | 46.0 |
| 0.646000 | 30.8 | Off | L1 | 19.6 | 15.2 | 46.0 |



| | | | |
|-----------------|----------------------------|---------------------|---------|
| Test Mode : | Mode 2 | Temperature : | 20~25°C |
| Test Engineer : | James Chiu | Relative Humidity : | 50~55%% |
| Test Voltage : | 120Vac / 60Hz | Phase : | Neutral |
| Function Type : | WLAN (2.4GHz) Tx + TF + TC | | |



Final Result : Quasi-Peak

| Frequency (MHz) | Quasi-Peak (dBµV) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) |
|-----------------|-------------------|--------|------|------------|-------------|--------------|
| 0.150000 | 45.4 | Off | N | 19.6 | 20.6 | 66.0 |
| 0.294000 | 44.5 | Off | N | 19.6 | 15.9 | 60.4 |
| 0.390000 | 37.4 | Off | N | 19.6 | 20.7 | 58.1 |
| 0.430000 | 47.8 | Off | N | 19.6 | 9.5 | 57.3 |
| 0.502000 | 50.5 | Off | N | 19.6 | 5.5 | 56.0 |
| 0.550000 | 42.7 | Off | N | 19.6 | 13.3 | 56.0 |
| 0.686000 | 39.2 | Off | N | 19.6 | 16.8 | 56.0 |
| 0.814000 | 39.6 | Off | N | 19.6 | 16.4 | 56.0 |

Final Result : Average

| Frequency (MHz) | Average (dBµV) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) |
|-----------------|----------------|--------|------|------------|-------------|--------------|
| 0.150000 | 28.6 | Off | N | 19.6 | 27.4 | 56.0 |
| 0.294000 | 27.3 | Off | N | 19.6 | 23.1 | 50.4 |
| 0.390000 | 26.5 | Off | N | 19.6 | 21.6 | 48.1 |
| 0.430000 | 36.1 | Off | N | 19.6 | 11.2 | 47.3 |
| 0.502000 | 40.7 | Off | N | 19.6 | 5.3 | 46.0 |
| 0.550000 | 32.6 | Off | N | 19.6 | 13.4 | 46.0 |
| 0.686000 | 30.9 | Off | N | 19.6 | 15.1 | 46.0 |
| 0.814000 | 30.3 | Off | N | 19.6 | 15.7 | 46.0 |



3.3 Antenna Requirements

3.3.1 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. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the Antenna exceeds 6 dBi. 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 FCC rule.

3.3.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.3.3 Antenna Gain

FCC KDB 662911 D01 Multiple Transmitter Output v02r01



4 List of Measuring Equipment

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|---------------------------|-----------------|---------------------------------|-----------------|-----------------|------------------|---------------|---------------|-----------------------|
| AC Power Source | ChainTek | APC-1000W | N/A | N/A | N/A | Nov. 08, 2016 | N/A | Conduction (CO05-HY) |
| EMI Test Receiver | Rohde & Schwarz | ESCI 7 | 100724 | 9kHz~7GHz | Aug. 30, 2016 | Nov. 08, 2016 | Aug. 29, 2017 | Conduction (CO05-HY) |
| LISN | Rohde & Schwarz | ENV216 | 100080 | 9kHz~30MHz | Dec. 02, 2015 | Nov. 08, 2016 | Dec. 01, 2016 | Conduction (CO05-HY) |
| LISN | Rohde & Schwarz | ENV216 | 100081 | 9kHz~30MHz | Dec. 14, 2015 | Nov. 08, 2016 | Dec. 13, 2016 | Conduction (CO05-HY) |
| LF Cable | HUBER + SUHNER | RG-214/U | LF01 | N/A | Jan. 06, 2016 | Nov. 08, 2016 | Jan. 05, 2017 | Conduction (CO05-HY) |
| Pulse Limiter | Rohde & Schwarz | ESH3-Z2 | 100851 | N/A | Jan. 08, 2016 | Nov. 08, 2016 | Jan. 07, 2017 | Conduction (CO05-HY) |
| Bilog Antenna | TESEQ | CBL 6111D&00800 N1D01N-06 | 35419&03 | 30MHz to 1GHz | Jan. 13, 2016 | Nov. 16, 2016 | Jan. 12, 2017 | Radiation (03CH07-HY) |
| Double Ridge Horn Antenna | ESCO | 3117 | 00075962 | 1GHz ~ 18GHz | Aug. 19, 2016 | Nov. 16, 2016 | Aug. 18, 2017 | Radiation (03CH07-HY) |
| EMI Test Receiver | Keysight | N9038A(MXE) | MY541300 85 | 20Hz ~ 8.4GHz | Oct. 26, 2016 | Nov. 16, 2016 | Oct. 25, 2017 | Radiation (03CH07-HY) |
| Loop Antenna | Rohde & Schwarz | HFH2-Z2 | 100315 | 9 kHz~30 MHz | Sep. 02, 2015 | Nov. 16, 2016 | Sep. 01, 2017 | Radiation (03CH07-HY) |
| Preamplifier | MITEQ | AMF-7D-0010 1800-30-10P | 1590075 | 1GHz ~ 18GHz | Apr. 15, 2016 | Nov. 16, 2016 | Apr. 14, 2017 | Radiation (03CH07-HY) |
| Preamplifier | COM-POWER | PA-103A | 161241 | 10MHz-1GHz | Mar. 18, 2016 | Nov. 16, 2016 | Mar. 17, 2017 | Radiation (03CH07-HY) |
| Preamplifier | Agilent | 8449B | 3008A023 62 | 1GHz~ 26.5GHz | Oct. 12, 2016 | Nov. 16, 2016 | Oct. 11, 2017 | Radiation (03CH07-HY) |
| Spectrum Analyzer | Agilent | N9010A | MY534701 18 | 10Hz~44GHz | Feb. 27, 2016 | Nov. 16, 2016 | Feb. 26, 2017 | Radiation (03CH07-HY) |
| Antenna Mast | Max-Full | MFA520BS | N/A | 1m~4m | N/A | Nov. 16, 2016 | N/A | Radiation (03CH07-HY) |
| Turn Table | ChainTek | Chaintek 3000 | N/A | 0~360 Degree | N/A | Nov. 16, 2016 | N/A | Radiation (03CH07-HY) |
| Loop Cable | Rohde & Schwarz | N/A | N/A | 9KHz~30MHz | Dec. 03, 2015 | Nov. 16, 2016 | Dec. 02, 2016 | Radiation (03CH07-HY) |
| Preamplifier | MITEQ | JS44-180040 00-33-8P | 1840917 | 18GHz ~ 40GHz | Jun. 14, 2016 | Nov. 16, 2016 | Jun. 13, 2017 | Radiation (03CH07-HY) |
| SHF-EHF Horn Antenna | SCHWARZBECK | BBHA 9170 | BBHA9170 251 | 18GHz- 40GHz | Oct. 07, 2016 | Nov. 16, 2016 | Oct. 06, 2017 | Radiation (03CH07-HY) |
| Spectrum Analyzer | Rohde & Schwarz | FSP40 | 100055 | 9kHz-40GHz | Jul. 17, 2016 | Sep 14,2016 | Jul. 16, 2017 | Radiation (03CH07-HY) |



5 Uncertainty of Evaluation

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

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

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

| | |
|---|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 5.7 |
|---|-----|

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

| | |
|---|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 5.5 |
|---|-----|

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

| | |
|---|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 5.2 |
|---|-----|



Appendix A. Radiated Spurious Emission

| | | | |
|-----------------|------------|---------------------|---------|
| Test Engineer : | Jesse Wang | Temperature : | 21~24°C |
| | | Relative Humidity : | 50~54% |

2.4GHz 2400~2483.5MHz

WIFI 802.11n HT40 (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) |
|----------------------------|---|-------------------|------------------|-------------------|-----------------------|---------------------|-------------------------|-------------------|----------------------|----------------|-------------------|-------------------|--------------|
| 802.11n HT40 CH 09 2452MHz | | 2347.8 | 54.7 | -19.3 | 74 | 50.4 | 32.03 | 7.24 | 34.97 | 100 | 80 | P | H |
| | | 2389.24 | 45.8 | -8.2 | 54 | 41.27 | 32.19 | 7.31 | 34.97 | 100 | 80 | A | H |
| | * | 2452 | 106.17 | - | - | 101.46 | 32.34 | 7.36 | 34.99 | 100 | 80 | P | H |
| | * | 2452 | 98.26 | - | - | 93.55 | 32.34 | 7.36 | 34.99 | 100 | 80 | A | H |
| | | 2483.62 | 56.4 | -17.6 | 74 | 51.55 | 32.45 | 7.4 | 35 | 100 | 80 | P | H |
| | | 2484.53 | 46.77 | -7.23 | 54 | 41.92 | 32.45 | 7.4 | 35 | 100 | 80 | A | H |
| | | 2384.62 | 54.73 | -19.27 | 74 | 50.25 | 32.14 | 7.31 | 34.97 | 313 | 234 | P | V |
| | | 2332.4 | 45.62 | -8.38 | 54 | 41.42 | 31.98 | 7.18 | 34.96 | 313 | 234 | P | V |
| | * | 2452 | 103.27 | - | - | 98.56 | 32.34 | 7.36 | 34.99 | 313 | 234 | P | V |
| | * | 2452 | 95.59 | - | - | 90.88 | 32.34 | 7.36 | 34.99 | 313 | 234 | P | V |
| | | 2483.62 | 55.28 | -18.72 | 74 | 50.43 | 32.45 | 7.4 | 35 | 313 | 234 | P | V |
| | | 2484.88 | 46.34 | -7.66 | 54 | 41.49 | 32.45 | 7.4 | 35 | 313 | 234 | 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 (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 09 | | 4904 | 38.57 | -35.43 | 74 | 52.6 | 33.47 | 11.37 | 58.87 | 100 | 0 | P | H |
| | | 7356 | 42.54 | -31.46 | 74 | 52.11 | 34.56 | 13.88 | 58.01 | 100 | 0 | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| 2452MHz | | 4904 | 38.55 | -35.45 | 74 | 52.58 | 33.47 | 11.37 | 58.87 | 100 | 0 | P | V |
| | | 7356 | 38.77 | -35.23 | 74 | 48.34 | 34.56 | 13.88 | 58.01 | 100 | 0 | P | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | 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 802.11n HT40 (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+2 | | (MHz) | (dBμV/m) | (dB) | (dBμV/m) | (dBμV) | (dB/m) | (dB) | (dB) | (cm) | (deg) | (P/A) | (H/V) | |
| 2.4GHz 802.11n HT40 LF | | 48.63 | 29.71 | -10.29 | 40 | 44.3 | 15.93 | 1.07 | 31.59 | - | - | P | H | |
| | | 115.59 | 36.75 | -6.75 | 43.5 | 49.08 | 17.63 | 1.55 | 31.51 | 100 | 0 | P | H | |
| | | 287.85 | 38.3 | -7.7 | 46 | 47.65 | 19.62 | 2.32 | 31.29 | - | - | P | H | |
| | | 304.2 | 30.81 | -15.19 | 46 | 39.74 | 19.93 | 2.41 | 31.27 | - | - | P | H | |
| | | 823.6 | 32.72 | -13.28 | 46 | 31.03 | 28.17 | 4.1 | 30.58 | - | - | P | H | |
| | | 932.8 | 33.89 | -12.11 | 46 | 30.5 | 29.8 | 4.12 | 30.53 | - | - | P | H | |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | 36.21 | 35.41 | -4.59 | 40 | 43.05 | 22.72 | 1.07 | 31.43 | 100 | 0 | P | V |
| | | | 215.76 | 29.67 | -13.83 | 43.5 | 42.89 | 16.36 | 1.87 | 31.45 | - | - | P | V |
| | | | 287.85 | 27.26 | -18.74 | 46 | 36.61 | 19.62 | 2.32 | 31.29 | - | - | P | V |
| | | | 768.3 | 30.47 | -15.53 | 46 | 29.9 | 27.38 | 3.82 | 30.63 | - | - | P | V |
| | | | 864.2 | 33.65 | -12.35 | 46 | 31.25 | 28.79 | 4.17 | 30.56 | - | - | P | V |
| | | | 894.3 | 32.6 | -13.4 | 46 | 30 | 28.97 | 4.17 | 30.54 | - | - | P | V |
| | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | | 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 B. Radiated Spurious Emission Plots

| | | | |
|-----------------|------------|---------------------|---------|
| Test Engineer : | Jesse Wang | Temperature : | 21~24°C |
| | | Relative Humidity : | 50~54% |

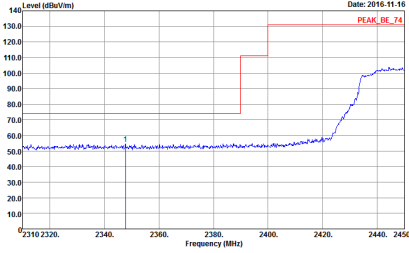
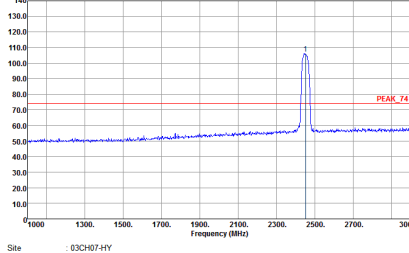
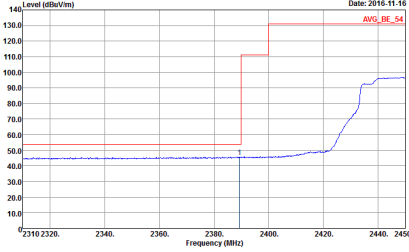
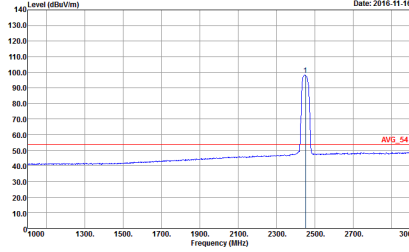
Note symbol

| | |
|----|-----------------------|
| -L | Low channel location |
| -R | High channel location |



2.4GHz 2400~2483.5MHz

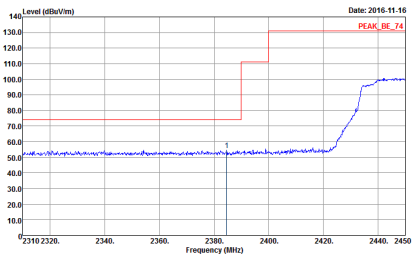
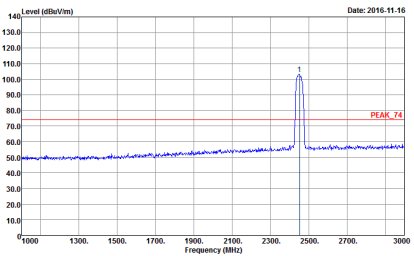
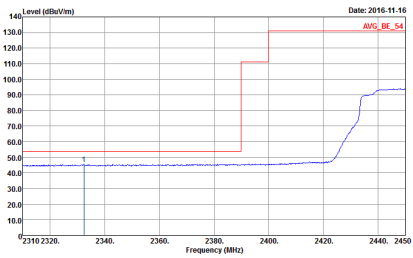
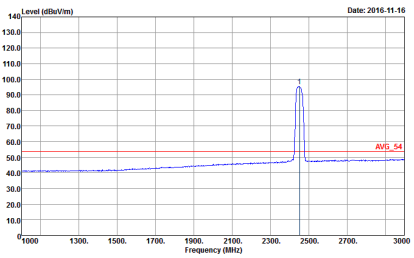
WIFI 802.11n HT40 (Band Edge @ 3m)

| WIFI | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|--|--|
| ANT | 802.11n HT40 CH09 2452MHz - L | |
| 1+2 | Horizontal | Fundamental |
| Peak |  <p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF-ANT_130829 HORIZONTAL RBW:1000.000kHz VBW:3000.000kHz SWT:Auto Detector : Peak Project : SN2711-08 Mode : 33</p> |  <p>Site : 03CH07-HY Condition : PEAK_74 3m HF-ANT_130829 HORIZONTAL RBW:1000.000kHz VBW:3000.000kHz SWT:Auto Detector : Peak Project : SN2711-08 Mode : 33</p> |
| Avg. |  <p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF-ANT_130829 HORIZONTAL RBW:1000.000kHz VBW:3.000kHz SWT:Auto Detector : Peak Project : SN2711-08 Mode : 33</p> |  <p>Site : 03CH07-HY Condition : AVG_54 3m HF-ANT_130829 HORIZONTAL RBW:1000.000kHz VBW:3.000kHz SWT:Auto Detector : Peak Project : SN2711-08 Mode : 33</p> |

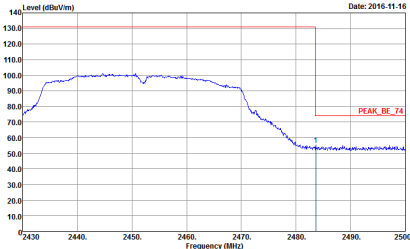
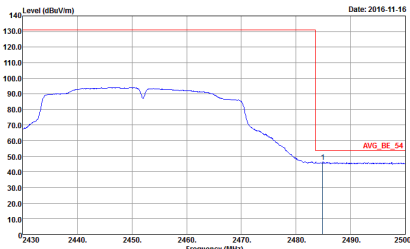


| WIFI | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|--------------------|---|-------------------|
| ANT | 802.11n HT40 CH09 2452MHz - R | |
| 1+2 | Horizontal | Fundamental |
| <p>Peak</p> | <p>Date: 2016-11-16</p> <p>Site : 03CH07HY Condition : PEAK_BE_74 3m HF-ANT_130829 HORIZONTAL Detector : Peak Project : 5N2711-08 Mode : 33</p> | <p>Left blank</p> |
| <p>Avg.</p> | <p>Date: 2016-11-16</p> <p>Site : 03CH07HY Condition : AVG_BE_54 3m HF-ANT_130829 HORIZONTAL Detector : Peak Project : 5N2711-08 Mode : 33</p> | <p>Left blank</p> |



| WIFI | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|--|---|
| ANT | 802.11n HT40 CH09 2452MHz - L | |
| 1+2 | Vertical | Fundamental |
| Peak |  <p>Date: 2016-11-16 PEAK_BE_74</p> <p>Site : 03CH07HY Condition : PEAK_BE_74 3m HF-ANT_130829 VERTICAL RBW: 1000.000kHz VBW: 3000.000kHz SWT: Auto Detector : Peak Project : SN2711-08 Mode : 33</p> |  <p>Date: 2016-11-16 PEAK_74</p> <p>Site : 03CH07HY Condition : PEAK_74 3m HF-ANT_130829 VERTICAL RBW: 1000.000kHz VBW: 3000.000kHz SWT: Auto Detector : Peak Project : SN2711-08 Mode : 33</p> |
| Avg. |  <p>Date: 2016-11-16 AVG_BE_54</p> <p>Site : 03CH07HY Condition : AVG_BE_54 3m HF-ANT_130829 VERTICAL RBW: 1000.000kHz VBW: 3.000kHz SWT: Auto Detector : Peak Project : SN2711-08 Mode : 33</p> |  <p>Date: 2016-11-16 AVG_54</p> <p>Site : 03CH07HY Condition : AVG_54 3m HF-ANT_130829 VERTICAL RBW: 1000.000kHz VBW: 3.000kHz SWT: Auto Detector : Peak Project : SN2711-08 Mode : 33</p> |

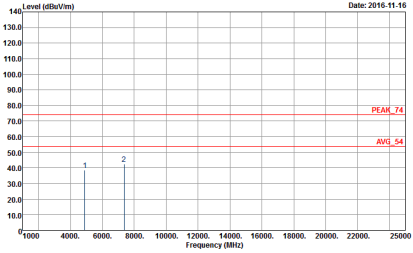
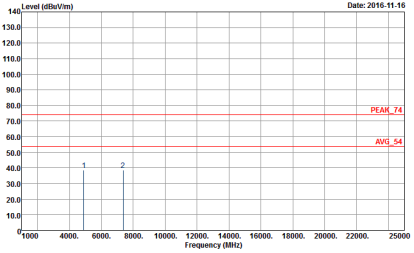


| WIFI | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|---|-------------|
| ANT | 802.11n HT40 CH09 2452MHz - R | |
| 1+2 | Vertical | Fundamental |
| Peak |  <p>Date: 2016-11-16</p> <p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF-ANT_130829 VERTICAL RBW: 1000.000kHz VBW: 3000.000kHz SWT: Auto Detector : Peak Project : 512711-08 Mode : 33</p> | Left blank |
| Avg. |  <p>Date: 2016-11-16</p> <p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF-ANT_130829 VERTICAL RBW: 1000.000kHz VBW: 3.000kHz SWT: Auto Detector : Peak Project : 512711-08 Mode : 33</p> | Left blank |



2.4GHz 2400~2483.5MHz

WIFI 802.11n HT40 (Harmonic @ 3m)

| | | |
|--------------|---|--|
| WIFI | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
| ANT | 802.11n HT40 CH09 2452MHz | |
| 1+2 | Horizontal | Vertical |
| Peak Avg. |  <p>Site : 03CH07HY Condition : PEAK_74 3m SHF-EHF_131029 HORIZONTAL Detector : Peak Project : SN2711-09 Mode : 25 : 9</p> |  <p>Site : 03CH07HY Condition : PEAK_74 3m SHF-EHF_131029 VERTICAL Detector : Peak Project : SN2711-09 Mode : 25 : 9</p> |



Emission below 1GHz
2.4GHz WIFI 802.11n HT40 (LF)

| | | |
|-----------|--|--|
| WIFI | 2.4GHz 2400~2483.5MHz | |
| ANT | 802.11n HT40 LF | |
| 1+2 | Horizontal | Vertical |
| QP / Peak | <p>Site : 03CH07-HY Condition : QP 3m LF-ANT-35419(6) HORIZONTAL RBW: 120.000kHz VBW: 300.000kHz SWT: 0.500sec Detector : Peak Project : 5N2711-08 Mode : F2</p> | <p>Site : 03CH07-HY Condition : QP 3m LF-ANT-35419(6) VERTICAL RBW: 120.000kHz VBW: 300.000kHz SWT: 0.500sec Detector : Peak Project : 5N2711-08 Mode : F2</p> |



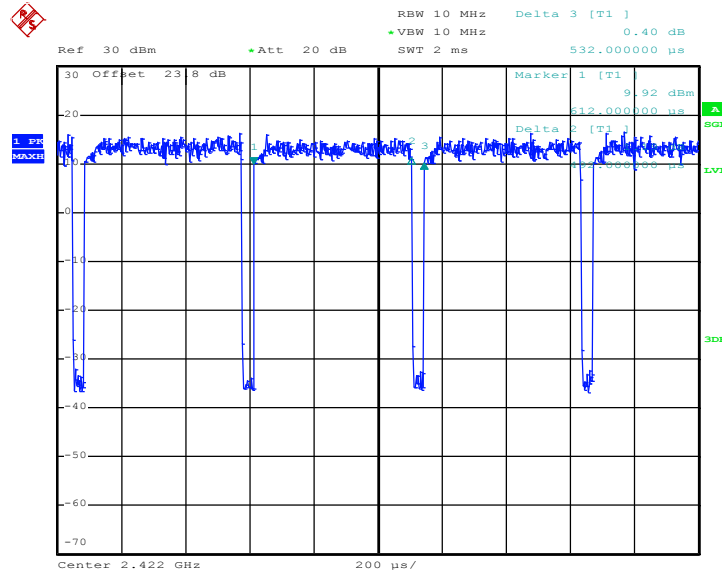
Appendix C. Duty Cycle Plots

| Antenna | Band | Duty Cycle(%) | T(us) | 1/T(kHz) | VBW Setting |
|---------|-------------------------------|---------------|-------|----------|-------------|
| 1+2 | 2.4GHz 802.11n HT40 for Ant 1 | 92.48 | 492 | 2.03 | 3kHz |
| 1+2 | 2.4GHz 802.11n HT40 for Ant 2 | 93.18 | 492 | 2.03 | 3kHz |



MIMO <Ant. 1+2(1)>

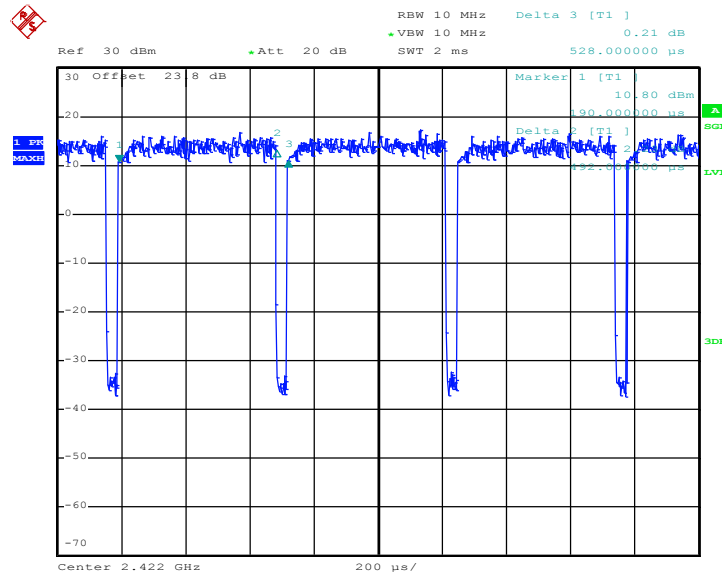
802.11n HT40



Date: 14.SEP.2016 14:26:35

MIMO <Ant. 1+2(2)>

802.11n HT40



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