# FCC RADIO TEST REPORT

| | | |
|---|---|---|
| **FCC ID** | : | **IHDT56XJ1** |
| **Equipment** | : | **Mobile Cellular Phone** |
| **Brand Name** | : | **Motorola** |
| **Applicant** | : | **Motorola Mobility LLC**<br>**222 W, Merchandise Mart Plaza, Chicago IL 60654 USA** |
| **Manufacturer** | : | **Motorola Mobility LLC**<br>**222 W, Merchandise Mart Plaza, Chicago IL 60654 USA** |
| **Standard** | : | **FCC Part 15 Subpart C §15.247** |

**The product was received on May 29, 2018 and testing was started from Jun. 14, 2018 and completed on Jun. 28, 2018. 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 report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.**

**The test results in this partial report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERTIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.**

Jones Tsai

**Approved by: Jones Tsai**

***SPORTON INTERTIONAL INC. EMC & Wireless Communications Laboratory***
*No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)*

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**Appendix B. Radiated Spurious Emission**

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# History of this test report

| Report No. | Version | Description | Issued Date |
|---|---|---|---|
| FR852917C | 01 | Initial issue of report | Jul. 26, 2018 |
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# Summary of Test Result

| Report Clause | Ref Std. Clause | Test Items | Result (PASS/FAIL) | Remark |
|---|---|---|---|---|
| 3.1 | 15.247(d) | Radiated Band Edges and Spurious Emission | Pass | Under limit 3.20 dB at2483.680 MHz |
| 3.2 | 15.207 | AC Conducted Emission | Pass | Under limit 4.54 dB at 0.209 MHz |

**Reviewed by: Joseph Lin**

**Report Producer: Maggie Chiang**

# 1 General Description

## 1.1 Product Feature of Equipment Under Test

| Product Feature | |
|---|---|
| **Equipment** | Mobile Cellular Phone |
| **Brand Name** | Motorola |
| **FCC ID** | IHDT56XJ1 |
| **IMEI Code** | Conduction : 355550090017364<br>Radiation : 355550090015608 |
| **EUT supports Radios application** | CDMA/EV-DO/GSM/EGPRS/WCDMA/HSPA/LTE/GNSS/NFC<br>WLAN 11b/g/n HT20<br>WLAN 11a/n HT20/HT40<br>WLAN 11ac VHT20/VHT40/VHT80<br>Bluetooth BR/EDR/LE |
| **HW Version** | DVT2 |
| **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.

| Accessory List | | |
|---|---|---|
| **WPC Cover** | **Brand Name :** | Motorola |
| | **Model Name :** | MD100W |

## 1.2 Product Specification of Equipment Under Test

| Standards-related Product Specification | |
|---|---|
| **Tx/Rx Channel Frequency Range** | 2412 MHz ~ 2462 MHz |
| **Antenna Type / Gain** | Fixed Internal Antenna type with gain 0.5 dBi |
| **Type of Modulation** | 802.11b : DSSS (DBPSK / DQPSK / CCK)<br>802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) |

## 1.3 Modification of EUT

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

## 1.4 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1190 and TW0007 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

| | |
|---|---|
| **Test Site** | SPORTON INTERNATIONAL INC. |
| **Test Site Location** | No.52, Huaya 1st Rd., Guishan Dist.,<br>Taoyuan City, Taiwan (R.O.C.)<br>TEL: +886-3-327-3456<br>FAX: +886-3-328-4978 |
| **Test Site No.** | **Sporton Site No.** |
| | CO05-HY |

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

| | |
|---|---|
| **Test Site** | SPORTON INTERNATIONAL INC. |
| **Test Site Location** | No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist.,<br>Taoyuan City, Taiwan (R.O.C.)<br>TEL: +886-3-327-0868<br>FAX: +886-3-327-0855 |
| **Test Site No.** | **Sporton Site No.** |
| | 03CH11-HY |

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

## 1.5 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 v04
- 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).

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

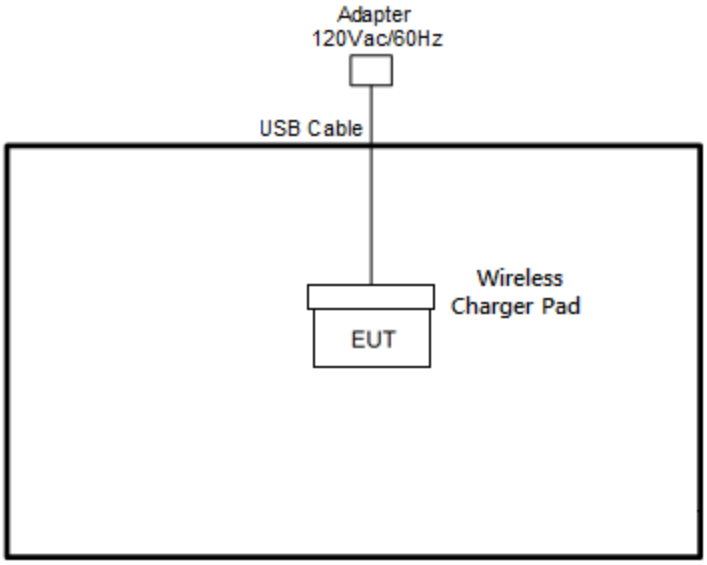
**Final test modes are considering the modulation and worse data rates as below table.**

| Modulation | Data Rate |
|---|---|
| **802.11n HT20** | **MCS0** |

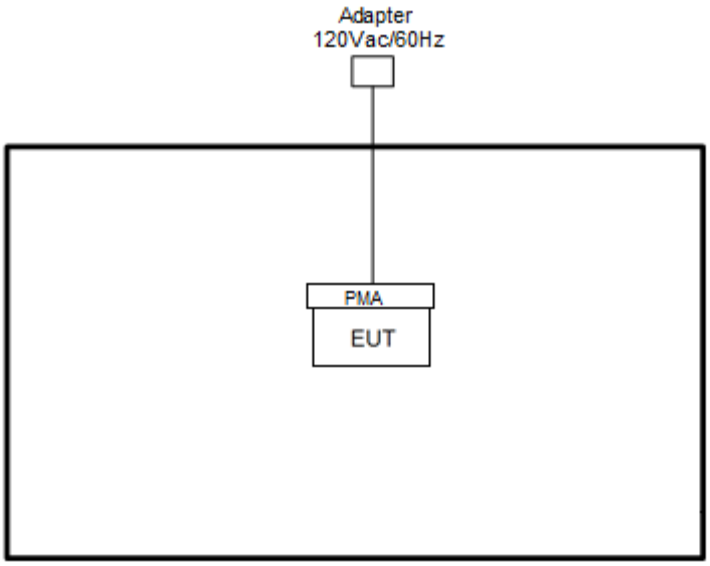
| Test Cases | |
|---|---|
| **AC Conducted Emission** | Mode 1 GSM1900 Idle + Bluetooth Link + WLAN (2.4GHz) Link + Camera + WPC Back Cover + Battery + LG Charging pad + USB Cable (Charging from Adapter)<br>Mode 2 WCDMA Band V Idle + Bluetooth Link + WLAN (2.4GHz) Link + MPEG4 + WPC Back Cover + Battery + PMA Charging pad + Adapter |
| **Remark:** The worst case of conducted emission is mode 2; only the test data of it was reported. | |

## 2.3 Connection Diagram of Test System

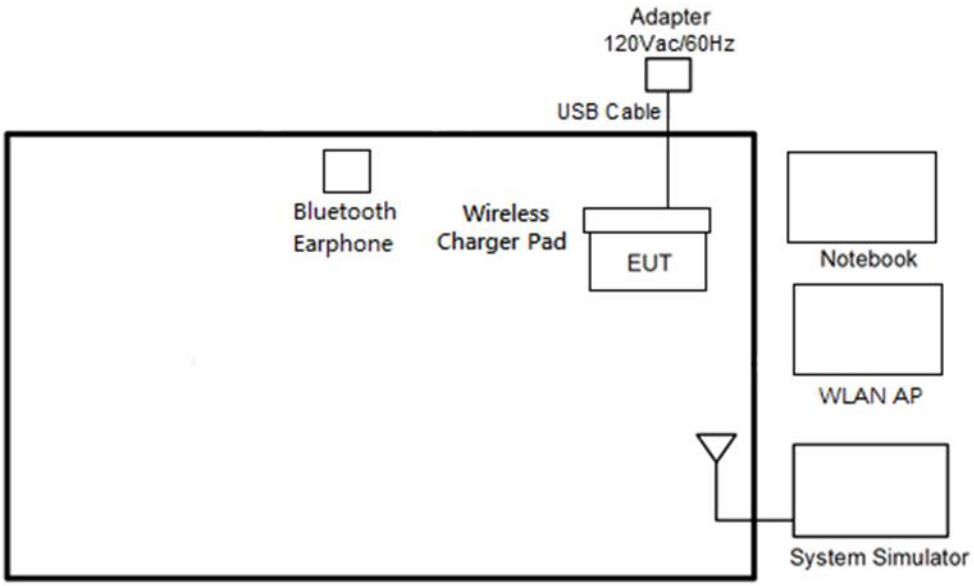
**<WLAN Tx with WPC Charging Mode>**



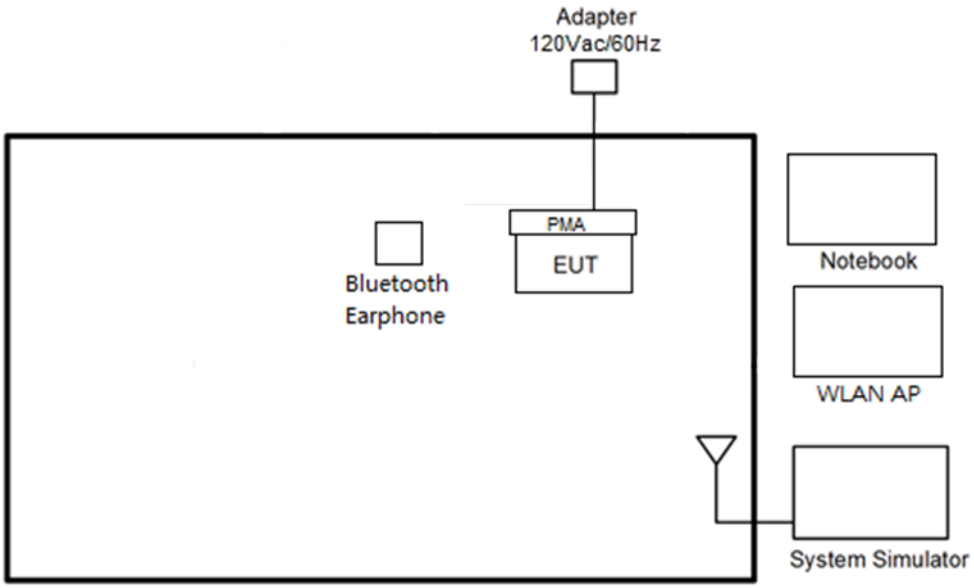

**<WLAN Tx with PMA Charging Mode>**



**<AC Conducted Emission with WPC Charging Mode>**




**<AC Conducted Emissions with PMA Charging Mode>**



## 2.4 Support Unit used in test configuration and system

| Item | Equipment | Trade Name | Model No. | FCC ID | Data Cable | Power Cord |
|---|---|---|---|---|---|---|
| 1. | System Simulator | Anritsu | MT8820C | N/A | N/A | Unshielded, 1.8 m |
| 2. | Bluetooth Earphone | Sony Ericsson | MW600 | PY7DDA-2029 | N/A | N/A |
| 3. | WLAN AP | ASUS | RT-AC66U | MSQ-RTAC66U | N/A | Unshielded,1.8m |
| 4. | Notebook | DELL | Latitude E6320 | FCC DoC/ Contains FCC ID: QDS-BRCM1054 | N/A | AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m |
| 5. | SD Card | SanDisk | MicroSD HC | FCC DoC | N/A | N/A |
| 6. | LG Charging Pad | LG | WCD-110 | FCC DoC | N/A | N/A |
| 7. | PMA Charging Pad | DURACELL | M-018B518A | FCC DoC | N/A | N/A |
| 8. | USB Cable | N/A | N/A | N/A | N/A | N/A |
| 9. | Adapter | N/A | N/A | N/A | N/A | N/A |

## 2.5 EUT Operation Test Setup

The RF test items, utility “QRCT” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

# 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 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

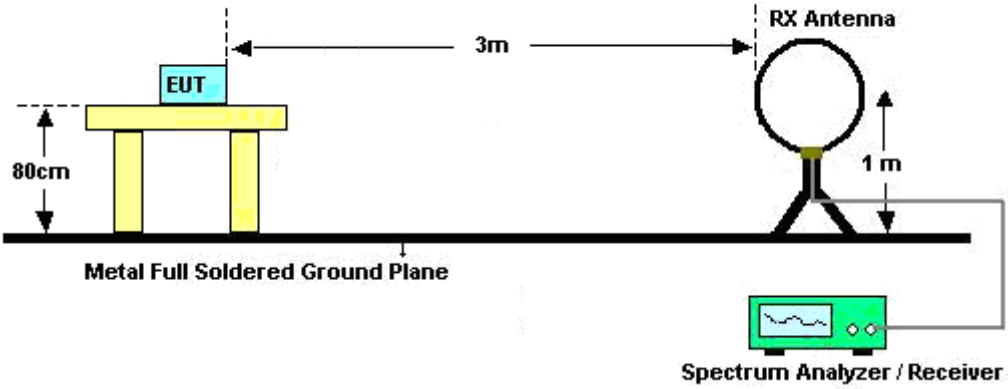
See list of measuring equipment of this test report.

### 3.1.3 Test Procedures

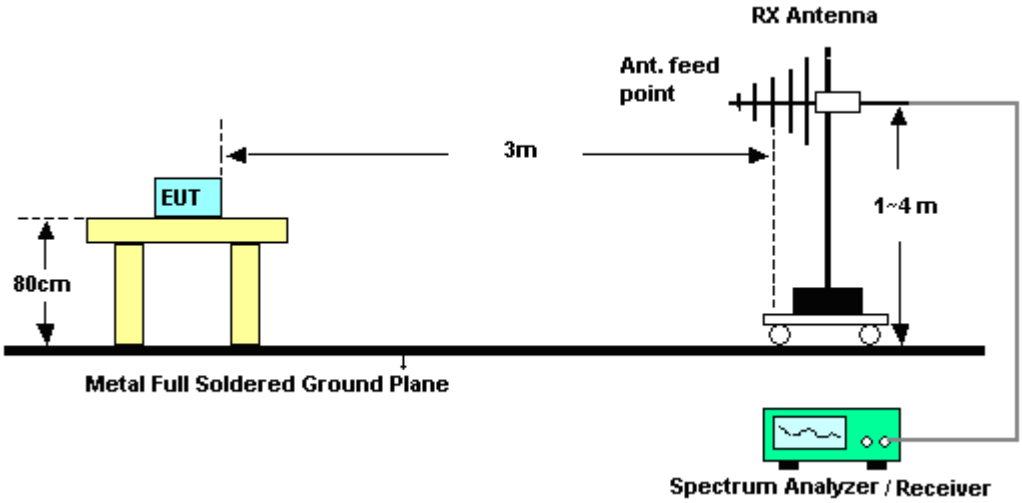
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test 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 ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 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

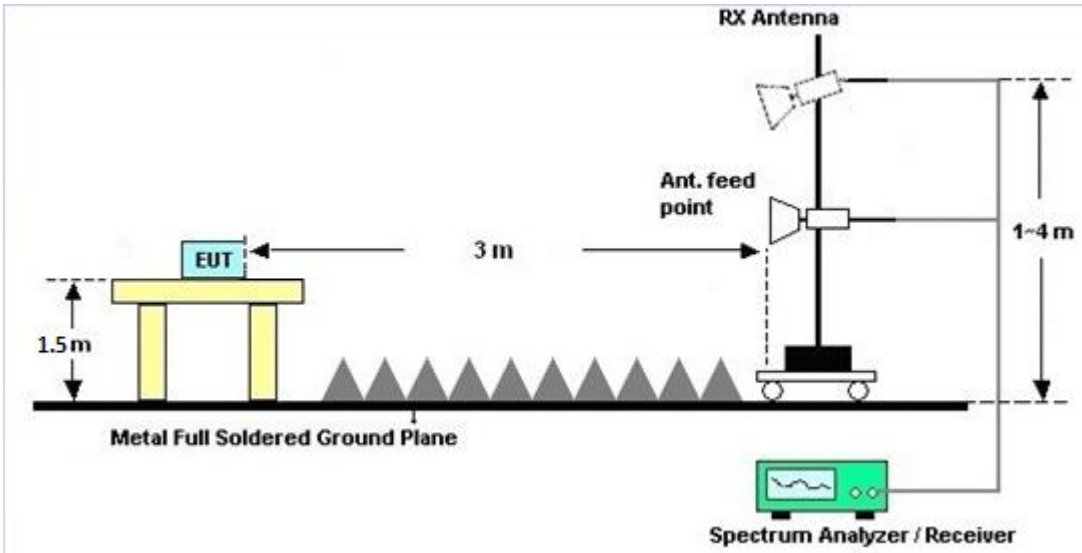
**For radiated emissions below 30MHz**




**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 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.

## 3.1.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B and C.

## 3.1.7 Duty Cycle

Please refer to Appendix D.

## 3.1.8 Test Result of Radiated Spurious Emission (30MHz ~ 10$^{th}$ Harmonic)

Please refer to Appendix B and C.

## 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.

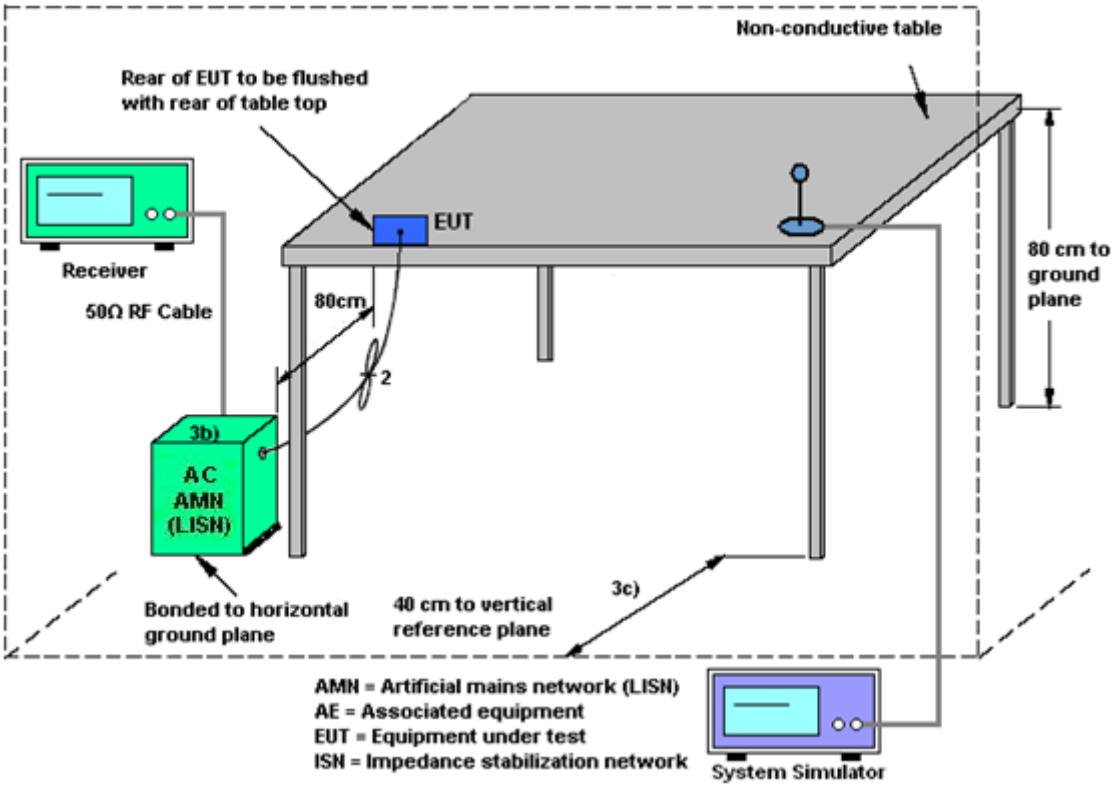
### 3.2.2 Measuring Instruments

See list of measuring equipment 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

Please refer to Appendix A.

# 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 | Jun. 14, 2018 | N/A | Conduction (CO05-HY) |
| EMI Test Receiver | Rohde & Schwarz | ESR3 | 102388 | 3.6GHz | Dec. 08, 2017 | Jun. 14, 2018 | Dec. 07, 2018 | Conduction (CO05-HY) |
| LISN | Rohde & Schwarz | ENV216 | 100080 | 9kHz~30MHz | Nov. 30, 2017 | Jun. 14, 2018 | Nov. 29, 2018 | Conduction (CO05-HY) |
| Software | Rohde & Schwarz | EMC32 V10.30 | N/A | N/A | N/A | Jun. 14, 2018 | N/A | Conduction (CO05-HY) |
| LF Cable | HUBER + SUHNER | RG-214/U | LF01 | N/A | Jan. 03, 2018 | Jun. 14, 2018 | Jan. 02, 2019 | Conduction (CO05-HY) |
| Pulse Limiter | Rohde & Schwarz | ESH3-Z2 | 100851 | N/A | Jan. 03, 2018 | Jun. 14, 2018 | Jan. 02, 2019 | Conduction (CO05-HY) |
| Amplifier | MITEQ | TTA1840-35-HG | 1871923 | 18GHz~40GHz, VSWR : 2.5:1 max | Jul. 18, 2017 | Jun. 27, 2018~ Jun. 28, 2018 | Jul. 17, 2018 | Radiation (03CH11-HY) |
| Amplifier | SONOMA | 310N | 187312 | 9kHz~1GHz | Nov. 10, 2016 | Jun. 27, 2018~ Jun. 28, 2018 | Nov. 09, 2018 | Radiation (03CH11-HY) |
| Bilog Antenna | TESEQ | CBL 6111D&N-6-06 | 35414&AT-N0602 | 30MHz~1GHz | Oct. 14, 2017 | Jun. 27, 2018~ Jun. 28, 2018 | Oct. 13, 2018 | Radiation (03CH11-HY) |
| Horn Antenna | SCHWARZBECK | BBHA 9120 D | 9120D-1326 | 1GHz ~ 18GHz | Oct. 16, 2017 | Jun. 27, 2018~ Jun. 28, 2018 | Oct. 15, 2018 | Radiation (03CH11-HY) |
| Loop Antenna | Rohde & Schwarz | HFH2-Z2 | 100488 | 9 kHz~30 MHz | Nov. 23, 2017 | Jun. 27, 2018~ Jun. 28, 2018 | Nov. 22, 2019 | Radiation (03CH11-HY) |
| Preamplifier | Keysight | 83017A | MY53270080 | 1GHz~26.5GHz | Nov. 10, 2016 | Jun. 27, 2018~ Jun. 28, 2018 | Nov. 09, 2018 | Radiation (03CH11-HY) |
| Spectrum Analyzer | Keysight | N9010A | MY54200486 | 10Hz ~ 44GHz | Oct. 19, 2017 | Jun. 27, 2018~ Jun. 28, 2018 | Oct. 18, 2018 | Radiation (03CH11-HY) |
| Antenna Mast | EMEC | AM-BS-4500-B | N/A | 1~4m | N/A | Jun. 27, 2018~ Jun. 28, 2018 | N/A | Radiation (03CH11-HY) |
| Turn Table | EMEC | TT 2000 | N/A | 0~360 Degree | N/A | Jun. 27, 2018~ Jun. 28, 2018 | N/A | Radiation (03CH11-HY) |
| Preamplifier | Jet-Power | JPA0118-55-303K | 1710001800054002 | 1GHz~18GHz | Apr. 17, 2018 | Jun. 27, 2018~ Jun. 28, 2018 | Apr. 16, 2019 | Radiation (03CH11-HY) |
| EMI Test Receiver | Agilent | N9038A (MXE) | MY53290053 | 20Hz to 26.5GHz | Jan. 16, 2018 | Jun. 27, 2018~ Jun. 28, 2018 | Jan. 15, 2019 | Radiation (03CH11-HY) |
| SHF-EHF Horn Antenna | SCHWARZBECK | BBHA 9170 | BBHA9170584 | 18GHz- 40GHz | Nov. 27, 2017 | Jun. 27, 2018~ Jun. 28, 2018 | Nov. 26, 2018 | Radiation (03CH11-HY) |
| Software | Audix | E3 6.2009-8-24 | RK-001042 | NA | NA | Jun. 27, 2018~ Jun. 28, 2018 | NA | Radiation (03CH11-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)) | 5.2 |

**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)**

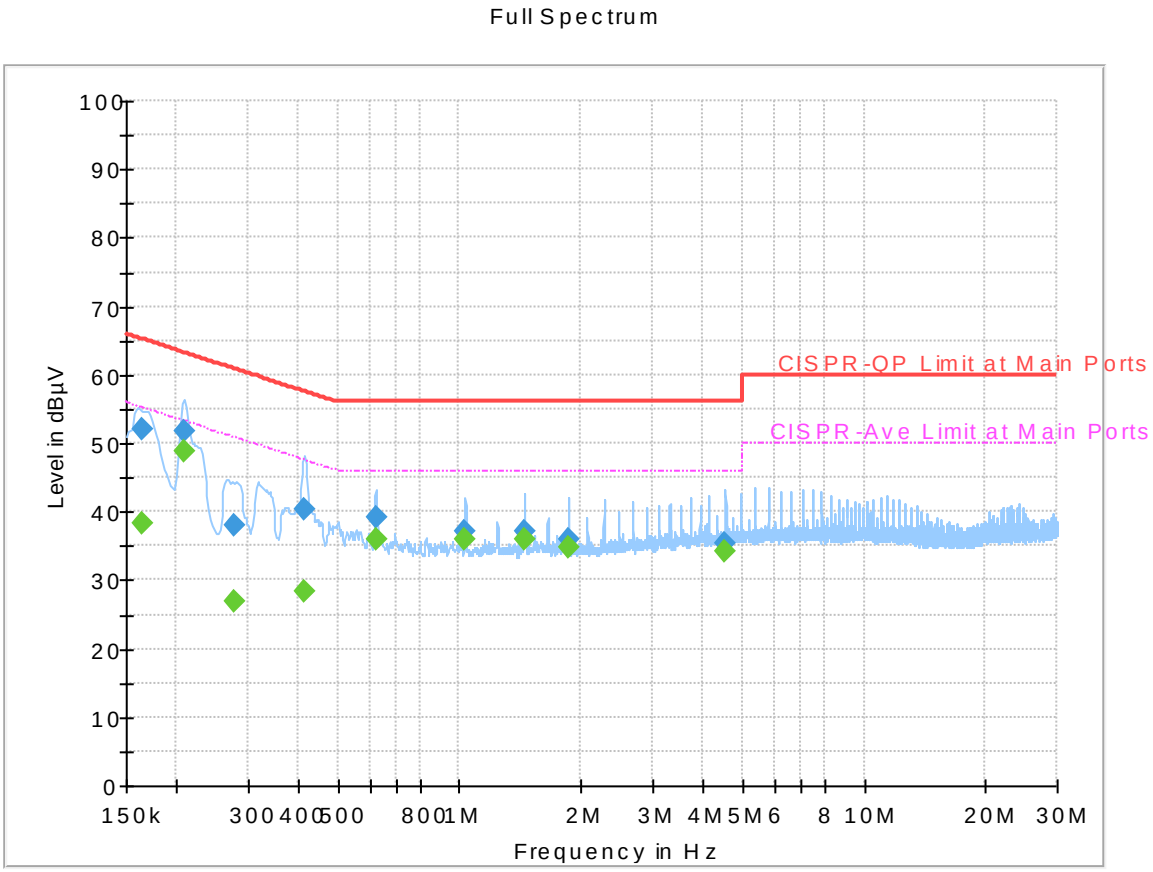
| | |
|---|---|
| Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y)) | 5.2 |

# Appendix A. AC Conducted Emission Test Results

| | | | |
|---|---|---|---|
| **Test Engineer :** | Kai-Chun Chu | **Temperature :** | 25~27℃ |
| | | **Relative Humidity :** | 50~52% |

# EUT Information

| | |
|---|---|
| Report NO : | 852917 |
| Test Mode : | Mode 2 |
| Test Voltage : | 120Vac/60Hz |
| Phase : | Line |

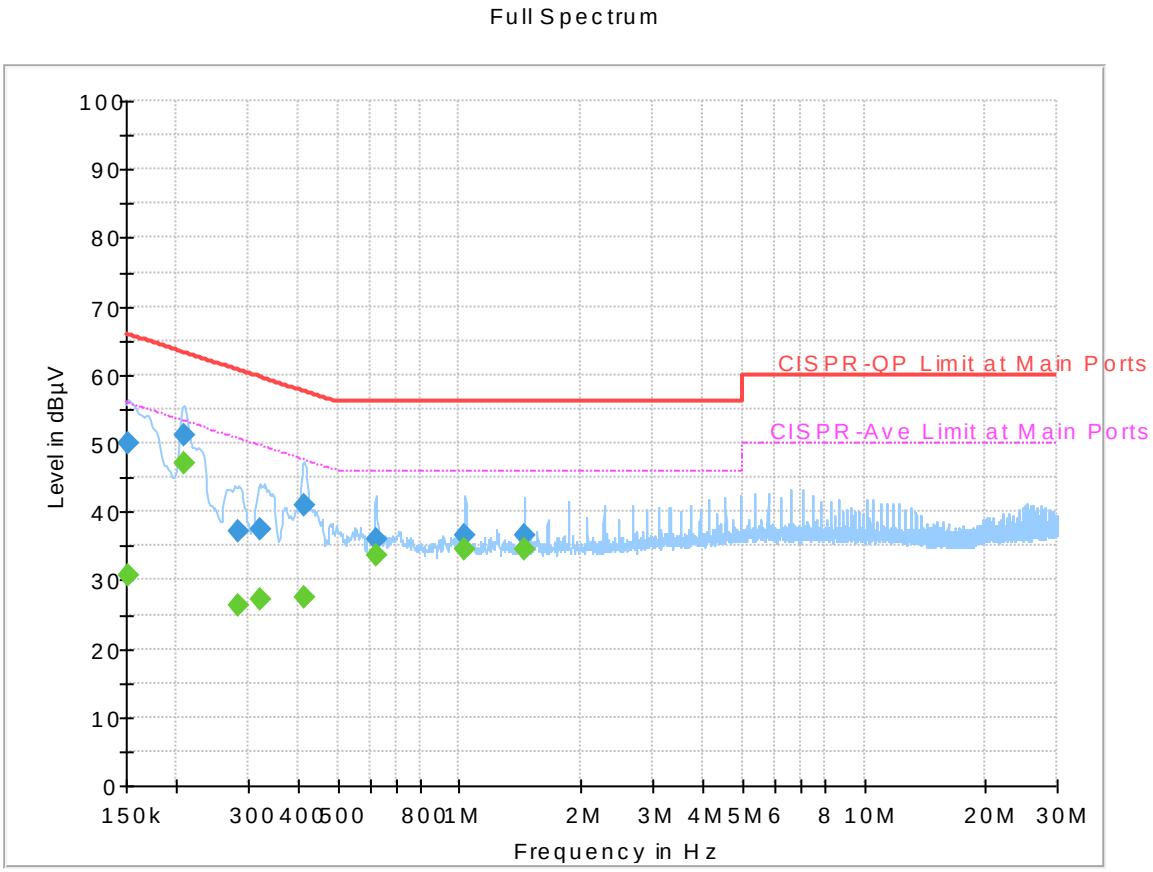



# Final_Result

| Frequency (MHz) | QuasiPeak (dBµV) | CAverage (dBµV) | Limit (dBµV) | Margin (dB) | Line | Filter | Corr. (dB) |
|---|---|---|---|---|---|---|---|
| 0.163500 | --- | 38.25 | 55.28 | 17.03 | L1 | OFF | 19.5 |
| 0.163500 | 51.97 | --- | 65.28 | 13.31 | L1 | OFF | 19.5 |
| 0.208500 | --- | 48.73 | 53.27 | 4.54 | L1 | OFF | 19.5 |
| 0.208500 | 51.70 | --- | 63.27 | 11.57 | L1 | OFF | 19.5 |
| 0.278250 | --- | 26.99 | 50.87 | 23.88 | L1 | OFF | 19.5 |
| 0.278250 | 37.94 | --- | 60.87 | 22.93 | L1 | OFF | 19.5 |
| 0.415500 | --- | 28.43 | 47.54 | 19.11 | L1 | OFF | 19.5 |
| 0.415500 | 40.50 | --- | 57.54 | 17.04 | L1 | OFF | 19.5 |
| 0.620250 | --- | 35.88 | 46.00 | 10.12 | L1 | OFF | 19.6 |
| 0.620250 | 39.04 | --- | 56.00 | 16.96 | L1 | OFF | 19.6 |
| 1.034250 | --- | 35.97 | 46.00 | 10.03 | L1 | OFF | 19.6 |
| 1.034250 | 37.25 | --- | 56.00 | 18.75 | L1 | OFF | 19.6 |
| 1.448250 | --- | 35.86 | 46.00 | 10.14 | L1 | OFF | 19.6 |
| 1.448250 | 37.09 | --- | 56.00 | 18.91 | L1 | OFF | 19.6 |
| 1.862250 | --- | 34.71 | 46.00 | 11.29 | L1 | OFF | 19.6 |
| 1.862250 | 35.91 | --- | 56.00 | 20.09 | L1 | OFF | 19.6 |
| 4.551000 | --- | 34.25 | 46.00 | 11.75 | L1 | OFF | 19.7 |
| 4.551000 | 35.52 | --- | 56.00 | 20.48 | L1 | OFF | 19.7 |

# EUT Information

| | |
|---|---|
| Report NO : | 852917 |
| Test Mode : | Mode 2 |
| Test Voltage : | 120Vac/60Hz |
| Phase : | Neutral |




# Final_Result

| Frequency (MHz) | QuasiPeak (dBµV) | CAverage (dBµV) | Limit (dBµV) | Margin (dB) | Line | Filter | Corr. (dB) |
|---|---|---|---|---|---|---|---|
| 0.152250 | --- | 30.60 | 55.88 | 25.28 | N | OFF | 19.5 |
| 0.152250 | 50.06 | --- | 65.88 | 15.82 | N | OFF | 19.5 |
| 0.208500 | --- | 46.99 | 53.27 | 6.28 | N | OFF | 19.5 |
| 0.208500 | 51.06 | --- | 63.27 | 12.21 | N | OFF | 19.5 |
| 0.285000 | --- | 26.32 | 50.67 | 24.35 | N | OFF | 19.5 |
| 0.285000 | 37.20 | --- | 60.67 | 23.47 | N | OFF | 19.5 |
| 0.321000 | --- | 27.06 | 49.68 | 22.62 | N | OFF | 19.5 |
| 0.321000 | 37.52 | --- | 59.68 | 22.16 | N | OFF | 19.5 |
| 0.413250 | --- | 27.52 | 47.58 | 20.06 | N | OFF | 19.5 |
| 0.413250 | 40.86 | --- | 57.58 | 16.72 | N | OFF | 19.5 |
| 0.620250 | --- | 33.71 | 46.00 | 12.29 | N | OFF | 19.6 |
| 0.620250 | 35.96 | --- | 56.00 | 20.04 | N | OFF | 19.6 |
| 1.034250 | --- | 34.59 | 46.00 | 11.41 | N | OFF | 19.6 |
| 1.034250 | 36.53 | --- | 56.00 | 19.47 | N | OFF | 19.6 |
| 1.446000 | --- | 34.61 | 46.00 | 11.39 | N | OFF | 19.6 |
| 1.446000 | 36.60 | --- | 56.00 | 19.40 | N | OFF | 19.6 |

# Appendix B. Radiated Spurious Emission

| Test Engineer : | Hao Hsu, Chuan Chu, and Ken Wu | Temperature : | 22~24°C |
|---|---|---|---|
| | | Relative Humidity : | 48~52% |

**<WPC Charging Mode>**

**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 ) | Path Loss ( dB ) | Preamp Factor ( dB ) | Ant Pos ( cm ) | Table Pos ( deg ) | Peak Avg. (P/A) | Pol. (H/V) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 802.11n HT20 CH 11 2462MHz | * | 2462 | 104.82 | - | - | 94.78 | 27.31 | 16.31 | 33.58 | 278 | 43 | P | H |
| | * | 2462 | 96.85 | - | - | 86.81 | 27.31 | 16.31 | 33.58 | 278 | 43 | A | H |
| | | 2484.24 | 61.84 | -12.16 | 74 | 51.74 | 27.36 | 16.32 | 33.58 | 278 | 43 | P | H |
| | | 2483.52 | 49.1 | -4.9 | 54 | 39.01 | 27.36 | 16.31 | 33.58 | 278 | 43 | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | * | 2462 | 106.69 | - | - | 96.65 | 27.31 | 16.31 | 33.58 | 274 | 107 | P | V |
| | * | 2462 | 98.84 | - | - | 88.8 | 27.31 | 16.31 | 33.58 | 274 | 107 | A | V |
| | | 2484.2 | 63.69 | -10.31 | 74 | 53.59 | 27.36 | 16.32 | 33.58 | 274 | 107 | P | V |
| | | 2483.68 | 50.8 | -3.2 | 54 | 40.71 | 27.36 | 16.31 | 33.58 | 274 | 107 | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found.<br>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 ) | Path Loss ( dB ) | Preamp Factor ( dB ) | Ant Pos ( cm ) | Table Pos ( deg ) | Peak Avg. (P/A) | Pol. (H/V) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 802.11n HT20 CH 11 2462MHz | | 4924 | 41.08 | -32.92 | 74 | 56.14 | 31.48 | 9.99 | 56.53 | 100 | 0 | P | H |
| | | 7386 | 41.31 | -32.69 | 74 | 49.28 | 36.47 | 11.68 | 56.12 | 100 | 0 | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 4924 | 40.77 | -33.23 | 74 | 55.83 | 31.48 | 9.99 | 56.53 | 100 | 0 | P | V |
| | | 7386 | 41.21 | -32.79 | 74 | 49.18 | 36.47 | 11.68 | 56.12 | 100 | 0 | P | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found.<br>2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |

## Emission below 1GHz

## 2.4GHz WIFI 802.11n HT20 (LF)

| WIFI Ant. 1 | Note | Frequency ( MHz ) | Level ( dBμV/m ) | Over Limit ( dB ) | Limit Line ( dBμV/m ) | Read Level (dBμV) | Antenna Factor ( dB/m ) | Path Loss ( dB ) | Preamp Factor ( dB ) | Ant Pos ( cm ) | Table Pos ( deg ) | Peak Avg. (P/A) | Pol. (H/V) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.4GHz 802.11n HT20 LF | | 93.72 | 25.18 | -18.32 | 43.5 | 41.38 | 15.04 | 1.24 | 32.48 | - | - | P | H |
| | | 200.64 | 25.94 | -17.56 | 43.5 | 41.67 | 14.88 | 1.78 | 32.39 | - | - | P | H |
| | | 272.19 | 20.58 | -25.42 | 46 | 31.71 | 19.08 | 2.17 | 32.38 | - | - | P | H |
| | | 440 | 24.81 | -21.19 | 46 | 31.63 | 22.79 | 2.74 | 32.35 | - | - | P | H |
| | | 641.6 | 28.08 | -17.92 | 46 | 30.9 | 26.33 | 3.31 | 32.46 | - | - | P | H |
| | | 887.3 | 31.75 | -14.25 | 46 | 30.53 | 29.06 | 3.89 | 31.73 | 100 | 0 | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 30.27 | 36.27 | -3.73 | 40 | 43.75 | 24.17 | 0.85 | 32.5 | 100 | 0 | P | V |
| | | 40.8 | 35.59 | -4.41 | 40 | 48.57 | 18.68 | 0.83 | 32.49 | - | - | P | V |
| | | 63.48 | 32.07 | -7.93 | 40 | 51.84 | 11.69 | 1.03 | 32.49 | - | - | P | V |
| | | 513.5 | 25.2 | -20.8 | 46 | 30.87 | 23.75 | 2.97 | 32.39 | - | - | P | V |
| | | 739.6 | 29.21 | -16.79 | 46 | 30.31 | 27.72 | 3.53 | 32.35 | - | - | P | V |
| | | 946.1 | 33.46 | -12.54 | 46 | 30.35 | 30.36 | 3.99 | 31.24 | - | - | P | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found.<br>2. All results are PASS against limit line. | | | | | | | | | | | | |

**<PMA Charging Mode>**

**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 ) | Path Loss ( dB ) | Preamp Factor ( dB ) | Ant Pos ( cm ) | Table Pos ( deg ) | Peak Avg. (P/A) | Pol. (H/V) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 802.11n HT20 CH 11 2462MHz | * | 2462 | 106.32 | - | - | 96.28 | 27.31 | 16.31 | 33.58 | 298 | 86 | P | H |
| | * | 2462 | 98.24 | - | - | 88.2 | 27.31 | 16.31 | 33.58 | 298 | 86 | A | H |
| | | 2484.12 | 61.74 | -12.26 | 74 | 51.65 | 27.36 | 16.31 | 33.58 | 298 | 86 | P | H |
| | | 2483.88 | 50.15 | -3.85 | 54 | 40.06 | 27.36 | 16.31 | 33.58 | 298 | 86 | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | * | 2462 | 106.69 | - | - | 96.65 | 27.31 | 16.31 | 33.58 | 386 | 101 | P | V |
| | * | 2462 | 98.78 | - | - | 88.74 | 27.31 | 16.31 | 33.58 | 386 | 101 | A | V |
| | | 2483.52 | 63.21 | -10.79 | 74 | 53.12 | 27.36 | 16.31 | 33.58 | 386 | 101 | P | V |
| | | 2483.52 | 49.58 | -4.42 | 54 | 39.49 | 27.36 | 16.31 | 33.58 | 386 | 101 | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| **Remark** | 1. No other spurious found.<br>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 ) | Path Loss ( dB ) | Preamp Factor ( dB ) | Ant Pos ( cm ) | Table Pos ( deg ) | Peak Avg. (P/A) | Pol. (H/V) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 802.11n HT20 CH 11 2462MHz | | 4924 | 41.34 | -32.66 | 74 | 56.4 | 31.48 | 9.99 | 56.53 | 100 | 0 | P | H |
| | | 7386 | 43.63 | -30.37 | 74 | 51.6 | 36.47 | 11.68 | 56.12 | 100 | 0 | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 4924 | 39.45 | -34.55 | 74 | 54.51 | 31.48 | 9.99 | 56.53 | 100 | 0 | P | V |
| | | 7386 | 42.09 | -31.91 | 74 | 50.06 | 36.47 | 11.68 | 56.12 | 100 | 0 | P | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found.<br>2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |

## Emission below 1GHz

## 2.4GHz WIFI 802.11n HT20 (LF)

| WIFI Ant. 1 | Note | Frequency ( MHz ) | Level ( dBμV/m ) | Over Limit ( dB ) | Limit Line ( dBμV/m ) | Read Level (dBμV) | Antenna Factor ( dB/m ) | Path Loss ( dB ) | Preamp Factor ( dB ) | Ant Pos ( cm ) | Table Pos ( deg ) | Peak Avg. (P/A) | Pol. (H/V) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.4GHz 802.11n HT20 LF | | 86.43 | 25.69 | -14.31 | 40 | 42.94 | 13.99 | 1.24 | 32.48 | - | - | P | H |
| | | 159.6 | 27.93 | -15.57 | 43.5 | 42.37 | 16.28 | 1.71 | 32.43 | - | - | P | H |
| | | 271.92 | 27.18 | -18.82 | 46 | 38.26 | 19.13 | 2.17 | 32.38 | - | - | P | H |
| | | 342.7 | 33.33 | -12.67 | 46 | 43.27 | 19.97 | 2.44 | 32.35 | - | - | P | H |
| | | 724.9 | 34.14 | -11.86 | 46 | 35.95 | 27.06 | 3.53 | 32.4 | - | - | P | H |
| | | 820.8 | 40.23 | -5.77 | 46 | 40.81 | 27.8 | 3.69 | 32.07 | 100 | 0 | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 30 | 36.46 | -3.54 | 40 | 43.94 | 24.17 | 0.85 | 32.5 | 100 | 0 | P | V |
| | | 50.25 | 36.3 | -3.7 | 40 | 53.69 | 14.07 | 1.03 | 32.49 | - | - | P | V |
| | | 63.48 | 31.57 | -8.43 | 40 | 51.34 | 11.69 | 1.03 | 32.49 | - | - | P | V |
| | | 343.4 | 27.47 | -18.53 | 46 | 37.38 | 20 | 2.44 | 32.35 | - | - | P | V |
| | | 465.2 | 28.94 | -17.06 | 46 | 35.25 | 23.24 | 2.81 | 32.36 | - | - | P | V |
| | | 865.6 | 31.12 | -14.88 | 46 | 30.08 | 29.06 | 3.82 | 31.84 | - | - | P | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| **Remark** | 1. No other spurious found.<br>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 | **P**eak or **A**verage |
| H/V | **H**orizontal or **V**ertical |

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

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

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) =

Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

**For Peak Limit @ 2390MHz:**

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path 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)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

**For Average Limit @ 2390MHz:**

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path 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)

2. 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. Radiated Spurious Emission Plots

| | | | |
|---|---|---|---|
| **Test Engineer :** | Hao Hsu, Chuan Chu, and Ken Wu | **Temperature :** | 22~24°C |
| | | **Relative Humidity :** | 48~52% |

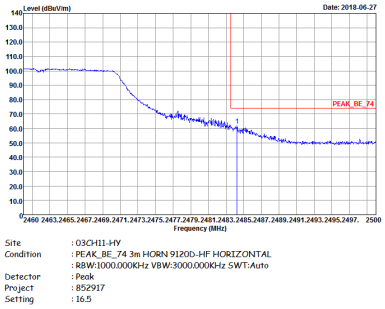
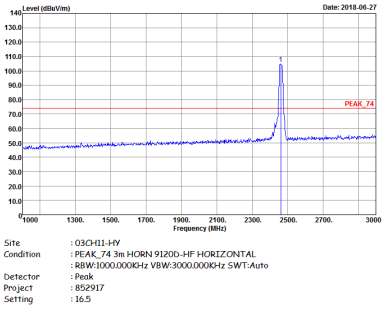
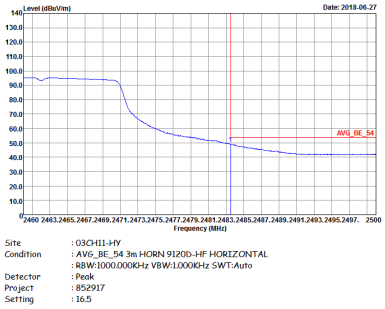
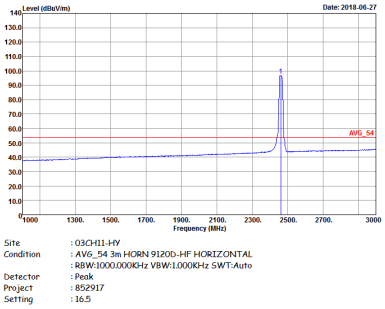
## Note symbol

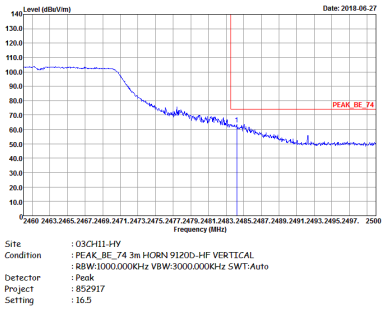
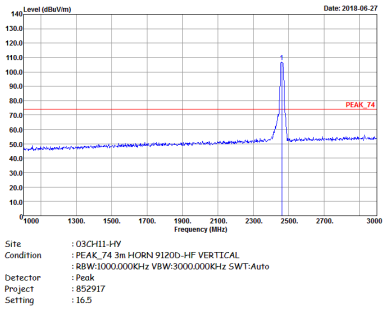
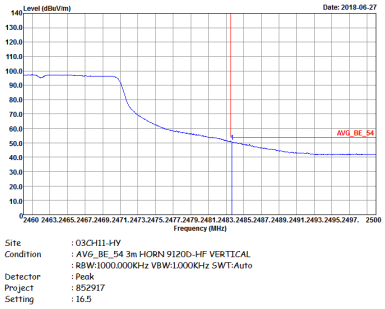
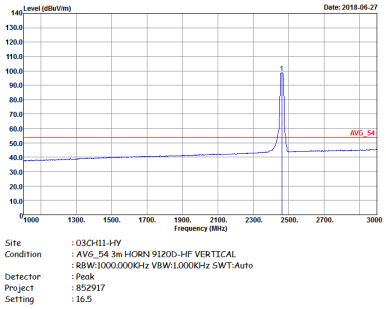
| | |
|---|---|
| -L | **Low channel location** |
| -R | **High channel location** |

## <WPC Charging Mode>

## 2.4GHz 2400~2483.5MHz

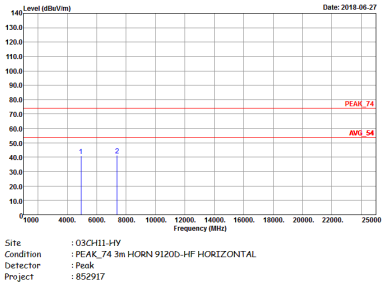
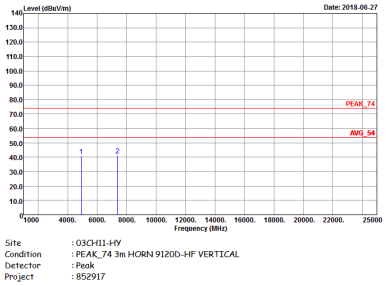
## WIFI 802.11n HT20 (Band Edge @ 3m)

| WIFI | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| ANT | 802.11n HT20 CH11 2462MHz | |
| 1 | Horizontal | Fundamental |
| Peak |  |  |
| Avg. |  |  |

| WIFI | 2.4GHz 2400~2483.5MHz Fundamental @ 3m | |
|---|---|---|
| ANT | 802.11n HT20 CH11 2462MHz | |
| 1 | Vertical | Fundamental |
| Peak |  |  |
| Avg. |  |  |

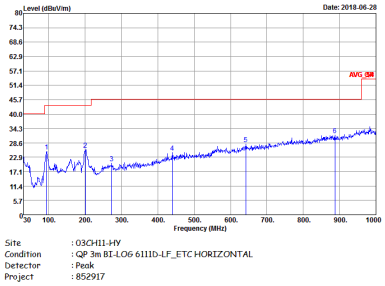
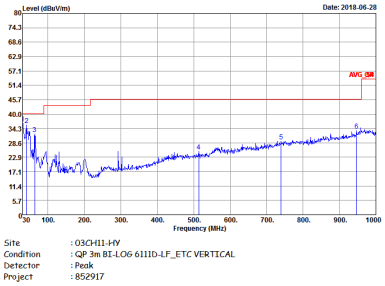
## 2.4GHz 2400~2483.5MHz

## WIFI 802.11n HT20 (Harmonic @ 3m)

| WIFI | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|---|---|---|
| ANT | 802.11n HT20 CH11 2462MHz | |
| 1 | Horizontal | Vertical |
| Peak<br>Avg. |  |  |

## Emission below 1GHz

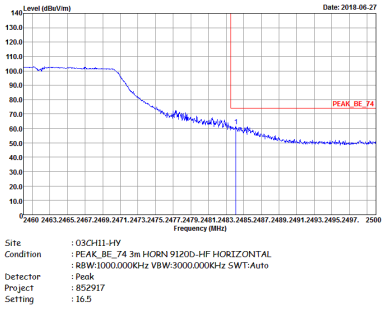
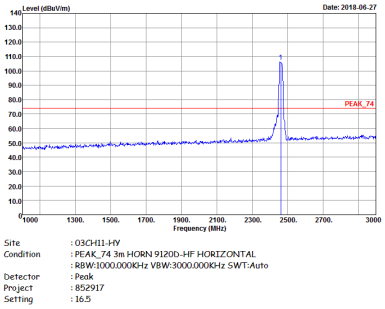
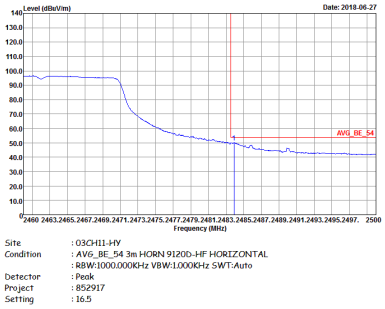
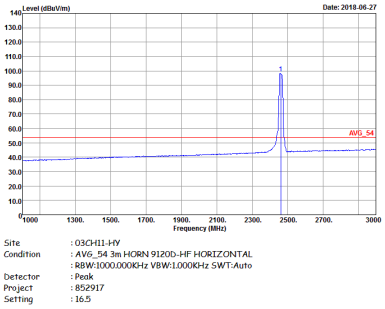
## 2.4GHz WIFI 802.11n HT20 (LF)

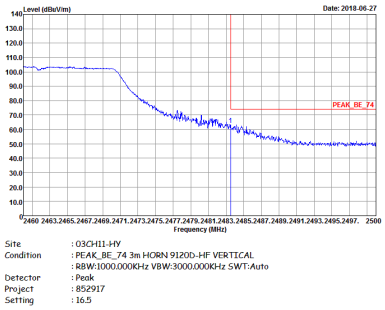
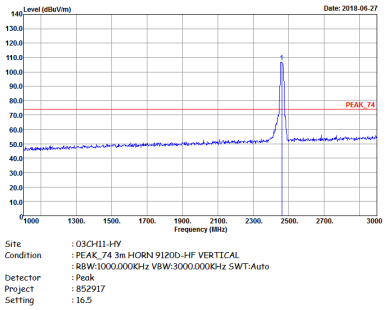
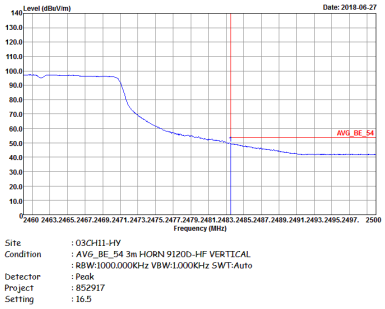
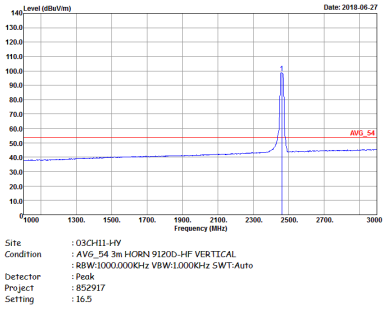
| WIFI | 2.4GHz 2400~2483.5MHz | |
|---|---|---|
| ANT | 802.11n HT20 LF | |
| 1 | Horizontal | Vertical |
| QP / Peak |  |  |

## <PMA Charging Mode>

## 2.4GHz 2400~2483.5MHz

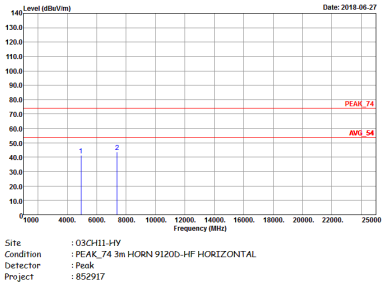
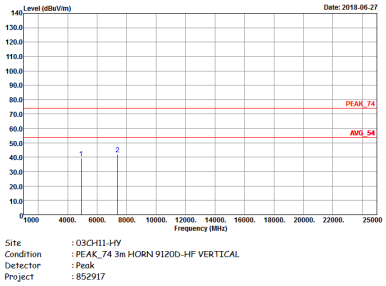
## WIFI 802.11n HT20 (Band Edge @ 3m)

| WIFI | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| ANT | 802.11n HT20 CH11 2462MHz | |
| 1 | Horizontal | Fundamental |
| Peak |  |  |
| Avg. |  |  |

| WIFI | 2.4GHz 2400~2483.5MHz Fundamental @ 3m | |
|---|---|---|
| ANT | 802.11n HT20 CH11 2462MHz | |
| 1 | Vertical | Fundamental |
| Peak |  |  |
| Avg. |  |  |

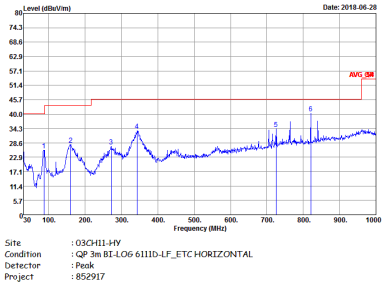
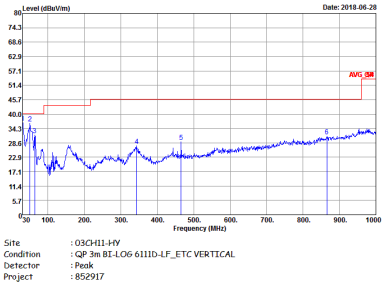
## 2.4GHz 2400~2483.5MHz

## WIFI 802.11n HT20 (Harmonic @ 3m)

| WIFI | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|---|---|---|
| ANT | 802.11n HT20 CH11 2462MHz | |
| 1 | Horizontal | Vertical |
| Peak<br>Avg. |  |  |

## Emission below 1GHz

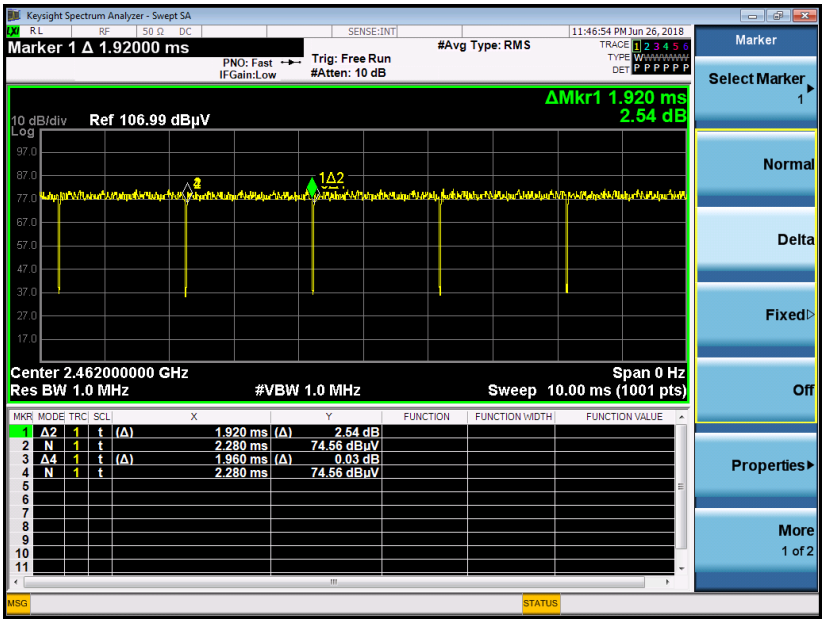
## 2.4GHz WIFI 802.11n HT20 (LF)

| WIFI | 2.4GHz 2400~2483.5MHz | |
|---|---|---|
| ANT | 802.11n HT20 LF | |
| 1 | Horizontal | Vertical |
| QP / Peak |  |  |

# Appendix D. Duty Cycle Plots

| Band | Duty Cycle(%) | T(us) | 1/T(kHz) | VBW Setting | Duty Factor(dB) |
|---|---|---|---|---|---|
| 2.4GHz 802.11n HT20 | 84.2 | 1920.00 | 0.52 | 1kHz | 0.75 |

**802.11n HT20**




———THE END———