# FCC TEST REPORT
for
Makeblock Co., Ltd.

Wi-Fi Block
Model No.: NU001WF

| | | |
|---|---|---|
| Prepared For | : | Makeblock Co., Ltd. |
| Address | : | 4th Floor, Building C3, Nanshan iPark, No.1001 Xueyuan Avenue, Nanshan District, Shenzhen, Guangdong Province, 518057, China |

| | | |
|---|---|---|
| Prepared By | : | Shenzhen Anbotek Compliance Laboratory Limited |
| Address | : | 1/F., Building 1, SEC Industrial Park, No.0409 Qianhai Road, Nanshan District, Shenzhen, Guangdong, China<br>Tel: (86) 755-26066544<br>Fax: (86) 755-26014772 |

| | | |
|---|---|---|
| Report Number | : | R0217060007W |
| Date of Test | : | Jun. 01~23, 2017 |
| Date of Report | : | Jun. 23, 2017 |

# TABLE OF CONTENT

Description

Page

Test Report

# TEST REPORT

| | | |
|---|---|---|
| Applicant | : | Makeblock Co., Ltd. |
| Manufacturer | : | Shenzhen TOP-TEK Electronics Co., Ltd. |
| EUT | : | Wi-Fi Block |
| Model No. | : | NU001WF |
| Serial No. | : | N.A. |
| Trade Mark | : | N.A. |
| Rating | : | Input DC 5V, 2000mA |

Measurement Procedure Used:
FCC Part15 Subpart C 2016, Paragraph 15.247
KDB558074 D01 DTS Meas Guidance v04

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart C requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Test : Jun. 01~23, 2017

Prepared by : (Tested Engineer / Winkey Wang)

Reviewer : (Project Manager / Amy Ding)

Approved & Authorized Signer : (Manager / Tom Chen)

# 1. GENERAL INFORMATION

## 1.1. Description of Device (EUT)

| | | |
|---|---|---|
| EUT | : | Wi-Fi Block |
| Model Number | : | NU001WF |
| Test Power Supply | : | AC 120V, 60Hz for adapter/<br>AC 240V, 60Hz for adapter |
| RF Transmission Frequency | : | 2412MHz~2462MHz (802.11b/802.11g/802.11n(HT20)) |
| Channels | : | 11 For (802.11b/802.11g/802.11n(HT20)) |
| Modulation | : | WiFi: 802.11b CCK; 802.11g OFDM; 802.11n MCS |
| Antenna Type | : | Ceramic Antenna |
| Antenna Gain: | : | 1.5 dBi |
| Applicant | : | Makeblock Co., Ltd. |
| Address | : | 4th Floor, Building C3, Nanshan iPark, No.1001 Xueyuan Avenue, Nanshan District, Shenzhen, Guangdong Province, 518057, China |
| Manufacturer | : | Shenzhen TOP-TEK Electronics Co., Ltd. |
| Address | : | Jufa Industrial Park, Liaokeng Village, Shiyan Town, Bao'an, Shenzhen, China |
| Date of receipt | : | Jun. 01, 2017 |
| Date of Test | : | Jun. 01~23, 2017 |

## 1.2. Auxiliary Equipment Used during Test

| | | |
|---|---|---|
| Adapter | : | Manufacturer: ZTE<br>M/N: STC-A2050I1000USBA-C<br>S/N: 201202102100876<br>Input: 100-240V~50/60Hz 0.3A<br>Output: DC 5V, 1000mA |
| Loudspeaker | : | Manufacturer: Shenzhen TOP-TEK Electronics Co., Ltd. |
| Laser Pointer | : | Manufacturer: Shenzhen TOP-TEK Electronics Co., Ltd. |

## 1.3. Description of Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

**FCC-Registration No.: 752021**

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registed and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 752021, July 06, 2016.

**IC-Registration No.: 8058A-1**

Shenzhen Anbotek Compliance Laboratory Limited., EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada. The acceptance letter from the IC is maintained in our files. Registration 8058A, June 13, 2016.

**Test Location**

All Emissions tests were performed at
Shenzhen Anbotek Compliance Laboratory Limited. at 1/F., Building 1, SEC Industrial Park, No.0409 Qianhai Road, Nanshan District, Shenzhen, Guangdong, China

## 1.4. Measurement Uncertainty

| | | |
|---|---|---|
| Radiation Uncertainty | : | Ur = 4.1 dB (Horizontal)<br>Ur = 4.3 dB (Vertical) |
| Conduction Uncertainty | : | Uc = 3.4dB |

# 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10: 2013 and FCC Part 15, Paragraph 15.247.

## 2.1. Summary of Test Results

The EUT has been tested according to the following specifications:

| Standard | Test Type | Result | Notes |
|---|---|---|---|
| FCC Part 15, Paragraph 15.107, 15.207 | Conducted Emission Test | PASS | Complies |
| FCC Part 15, Paragraph 15.247(b)(1) | Maximum Output Power | PASS | Complies |
| FCC Part 15, Paragraph 15.247(a)(2) | 6dB Bandwidth | PASS | Complies |
| FCC Part 15, Paragraph 15.247(c) | 100kHz Bandwidth of Frequency Band Edges | PASS | Complies |
| FCC Part 15, Paragraph 15.209(a)(f) | Spurious Emission | PASS | Complies |
| FCC Part 15, Paragraph 15.247(a)(1) | Frequency Separation | - | N/A |
| FCC Part 15, Paragraph 15.247(a)(1)(iii) | Number of Hopping Frequency | - | N/A |
| FCC Part 15, Paragraph 15.247(a)(1)(iii) | Time of Occupancy | - | N/A |
| FCC Part 15, Paragraph 15.247(c) | Peak Power Density | PASS | Complies |

## 2.2. Description of Test Modes

The EUT has been tested under operating condition.
Software used to control the EUT for staying in continuous transmitting and receiving mode is programmed.
IEEE802.11b: Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with 1 Mbps lowest data rate (worst case) are chosen for the final testing.
IEEE802.11g: Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with 6 Mbps lowest data rate (the worst case) are chosen for the final testing.
IEEE802.11n (HT20): Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with MCS 0 Mbps lowest data rate (the worst case) are chosen for the final testing.

The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%

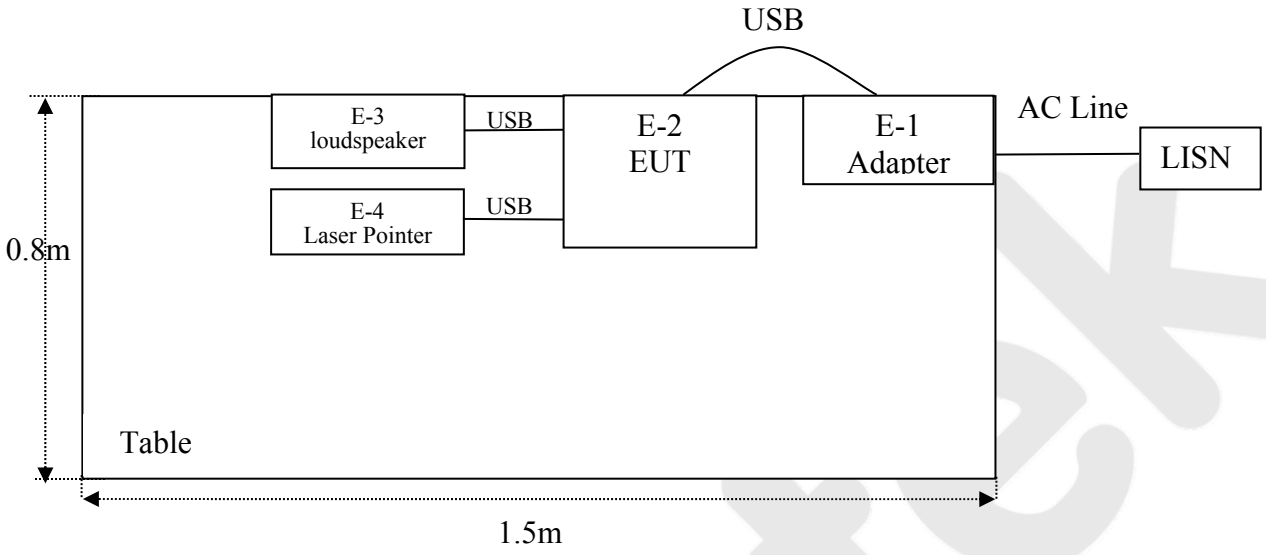
## 2.3. List of channels:

√ - available
X - tested

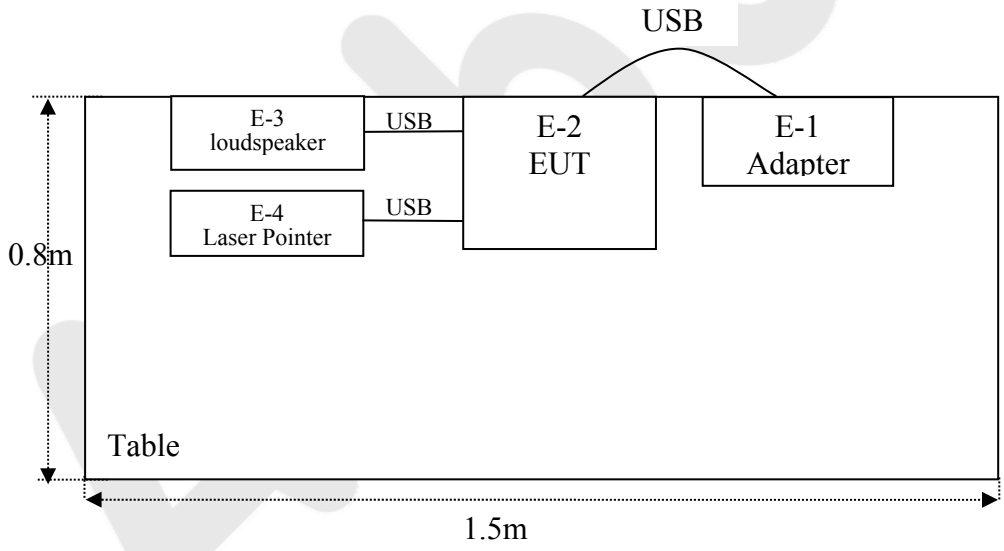
| Number | Frequency(MHz) | | 802.11 b/g/n （HT20） |
|---|---|---|---|
| 1 | 2412 | √ | X |
| 2 | 2417 | √ | |
| 3 | 2422 | √ | |
| 4 | 2427 | √ | |
| 5 | 2432 | √ | |
| 6 | 2437 | √ | X |
| 7 | 2442 | √ | |
| 8 | 2447 | √ | |
| 9 | 2452 | √ | |
| 10 | 2457 | √ | |
| 11 | 2462 | √ | X |

## 2.4. Description Of Test Setup

CE



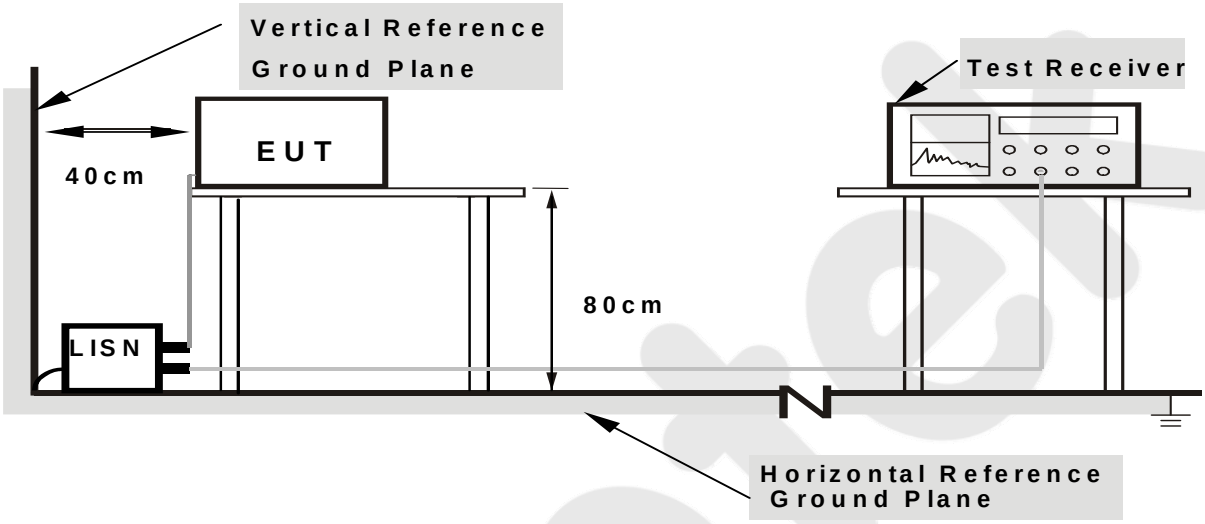

RE



# 3. Conducted Emission Test

## 3.1. Block Diagram of Test Setup

### 3.1.1. Block diagram of connection between the EUT and simulators




Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

## 3.2 Power Line Conducted Emission Measurement Limits (15.207)

| Frequency MHz | Limits dB(μV) | |
|---|---|---|
| | Quasi-peak Level | Average Level |
| 0.15 ~ 0.50 | 66 ~ 56* | 56 ~ 46* |
| 0.50 ~ 5.00 | 56 | 46 |
| 5.00 ~ 30.00 | 60 | 50 |

Notes: 1. *Decreasing linearly with logarithm of frequency.
2. The lower limit shall apply at the transition frequencies.

## 3.3. Configuration of EUT on Measurement

The following equipments are installed on Power Line Conducted Emission Measurement to meet the commission requirement and operating regulations in a manner which tends to maximize its emission characteristics in a normal application.

## 3.4. Operating Condition of EUT

3.4.1. Setup the EUT and simulator as shown as Section 3.1.

3.4.2. Turn on the power of all equipment.

3.4.3. Let the EUT work in test mode (TX Mode) and measure it.

## 3.5. Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.10-2013 on Conducted Emission Measurement.

The bandwidth of test receiver (ESCI) set at 9KHz.

The frequency range from 150KHz to 30MHz is checked.

The test results are reported on Section 3.6.

## 3.6. Test equipment

| Item | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|---|---|---|---|---|---|---|
| 1. | Two-Line V-network | Rohde & Schwarz | ENV216 | 100055 | Jul. 19, 2016 | 1 Year |
| 2. | EMI Test Receiver | Rohde & Schwarz | ESCI | 100627 | Jun. 17, 2017 | 1 Year |
| 3. | RF Switching Unit | Compliance Direction | RSU-M2 | 38303 | Jun. 17, 2017 | 1 Year |

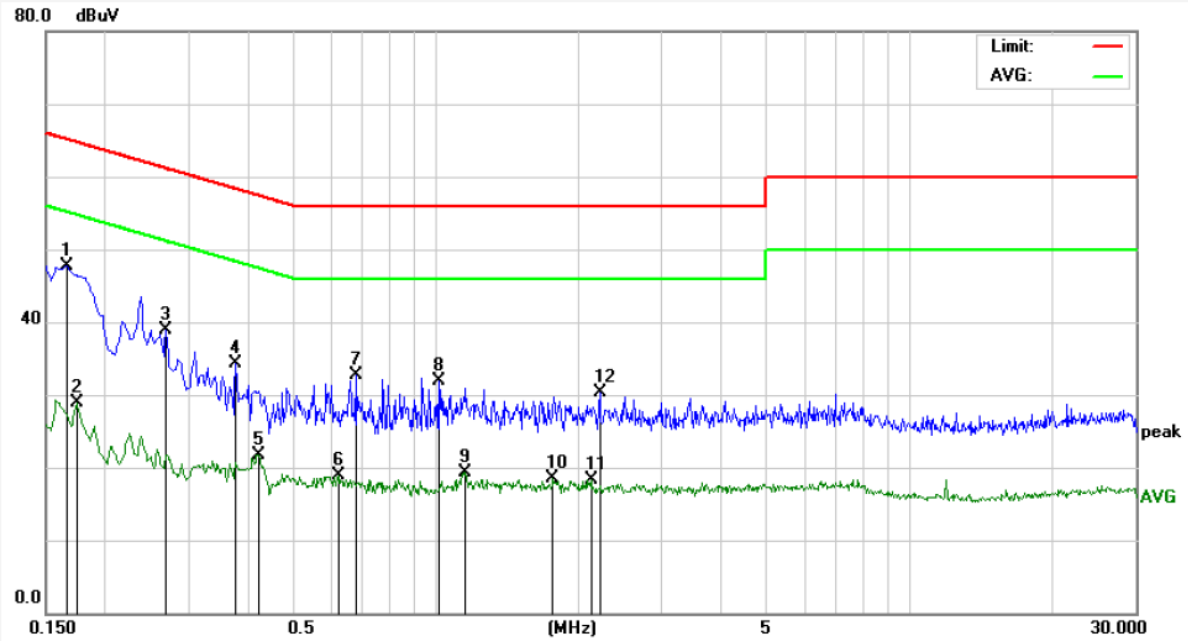
## 3.7. Power Line Conducted Emission Measurement Results

**PASS.**

The frequency range from 150KHz to 30 MHz is investigated.
Please refer the following pages.

## *CONDUCTED EMISSION TEST DATA*

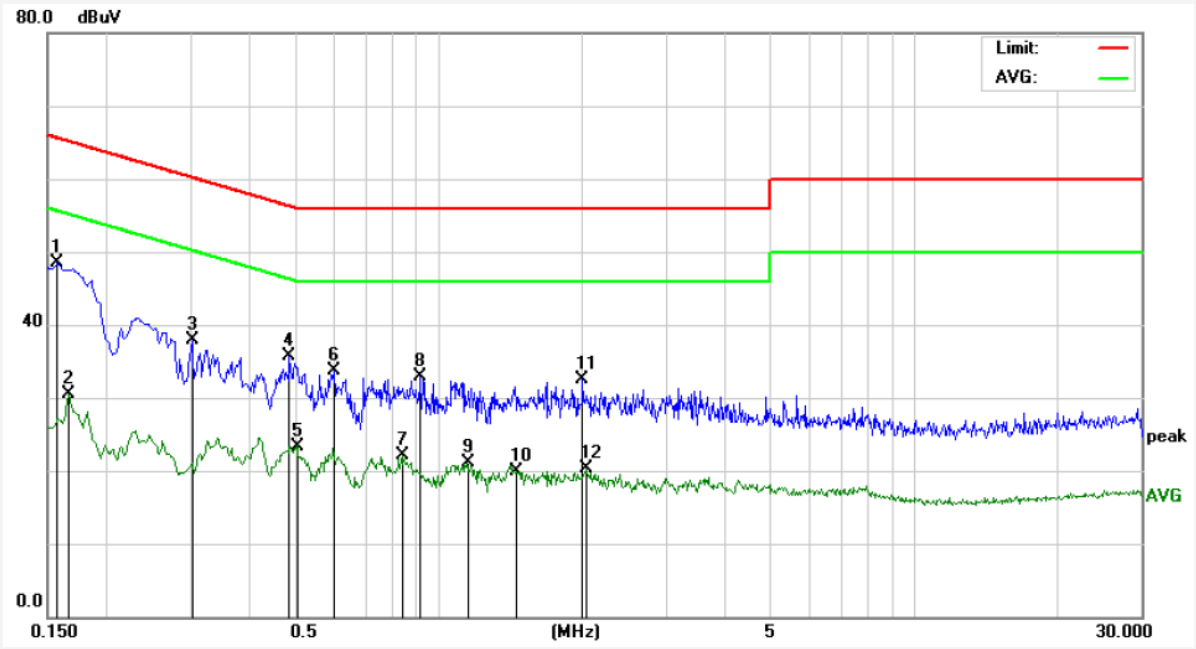
| | |
|---|---|
| Test Site: | 1# Shielded Room |
| Operating Condition: | TX Mode |
| Test Specification: | AC 120V, 60Hz for adapter |
| Comment: | Live Line |
| | Tem.:25℃ Hum.:50% |




| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit dBuV | Over Limit (dB) | Detector | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.1660 | 27.83 | 19.90 | 47.73 | 65.15 | -17.42 | QP | |
| 2 | 0.1740 | 9.10 | 19.90 | 29.00 | 54.76 | -25.76 | AVG | |
| 3 | 0.2700 | 18.95 | 19.89 | 38.84 | 61.12 | -22.28 | QP | |
| 4 | 0.3780 | 14.38 | 19.93 | 34.31 | 58.32 | -24.01 | QP | |
| 5 | 0.4220 | 1.77 | 19.94 | 21.71 | 47.41 | -25.70 | AVG | |
| 6 | 0.6260 | -1.20 | 20.02 | 18.82 | 46.00 | -27.18 | AVG | |
| 7 | 0.6780 | 12.65 | 20.03 | 32.68 | 56.00 | -23.32 | QP | |
| 8 | 1.0140 | 11.86 | 20.12 | 31.98 | 56.00 | -24.02 | QP | |
| 9 | 1.1539 | -0.72 | 20.12 | 19.40 | 46.00 | -26.60 | AVG | |
| 10 | 1.7700 | -1.71 | 20.14 | 18.43 | 46.00 | -27.57 | AVG | |
| 11 | 2.1220 | -1.85 | 20.14 | 18.29 | 46.00 | -27.71 | AVG | |
| 12 | 2.2220 | 10.14 | 20.14 | 30.28 | 56.00 | -25.72 | QP | |

## *CONDUCTED EMISSION TEST DATA*

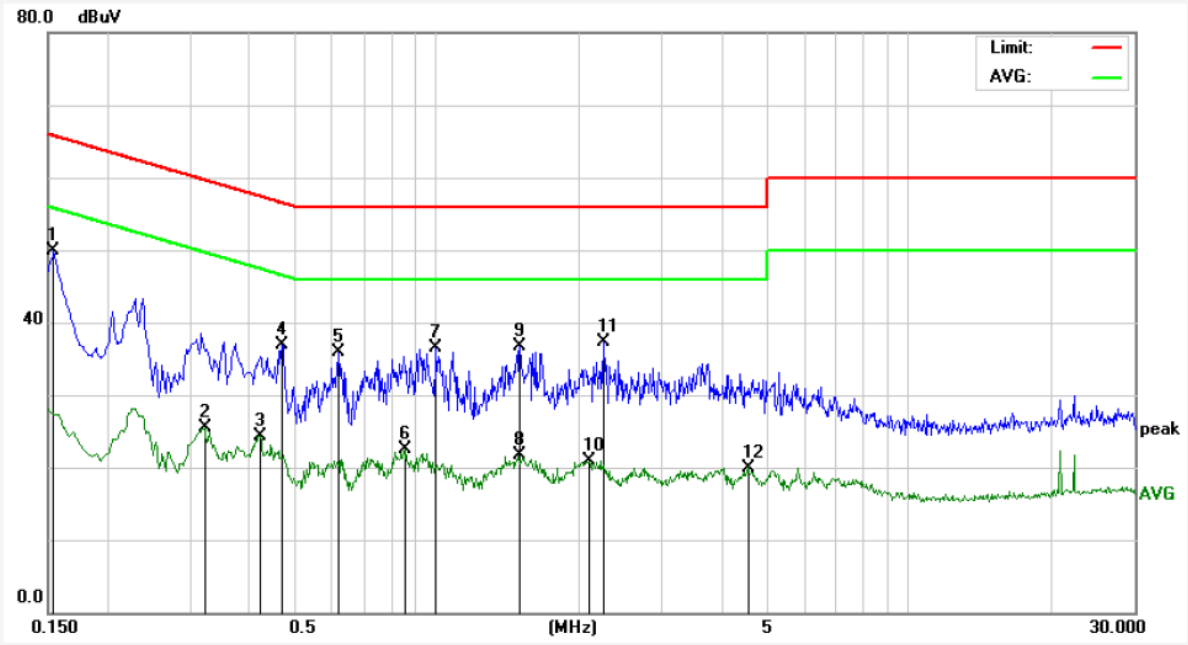
| | |
|---|---|
| Test Site: | 1# Shielded Room |
| Operating Condition: | TX Mode |
| Test Specification: | AC 120V, 60Hz for adapter |
| Comment: | Neutral Line |
| | Tem.:25℃ Hum.:50% |




| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit dBuV | Over Limit (dB) | Detector | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.1580 | 28.54 | 19.90 | 48.44 | 65.56 | -17.12 | QP | |
| 2 | 0.1660 | 10.57 | 19.90 | 30.47 | 55.15 | -24.68 | AVG | |
| 3 | 0.3020 | 17.98 | 19.89 | 37.87 | 60.19 | -22.32 | QP | |
| 4 | 0.4860 | 15.66 | 19.97 | 35.63 | 56.24 | -20.61 | QP | |
| 5 | 0.5020 | 3.42 | 19.98 | 23.40 | 46.00 | -22.60 | AVG | |
| 6 | 0.6020 | 13.64 | 20.01 | 33.65 | 56.00 | -22.35 | QP | |
| 7 | 0.8380 | 1.95 | 20.08 | 22.03 | 46.00 | -23.97 | AVG | |
| 8 | 0.9140 | 12.77 | 20.10 | 32.87 | 56.00 | -23.13 | QP | |
| 9 | 1.1460 | 0.97 | 20.12 | 21.09 | 46.00 | -24.91 | AVG | |
| 10 | 1.4500 | -0.15 | 20.13 | 19.98 | 46.00 | -26.02 | AVG | |
| 11 | 2.0059 | 12.45 | 20.14 | 32.59 | 56.00 | -23.41 | QP | |
| 12 | 2.0420 | 0.14 | 20.14 | 20.28 | 46.00 | -25.72 | AVG | |

## *CONDUCTED EMISSION TEST DATA*

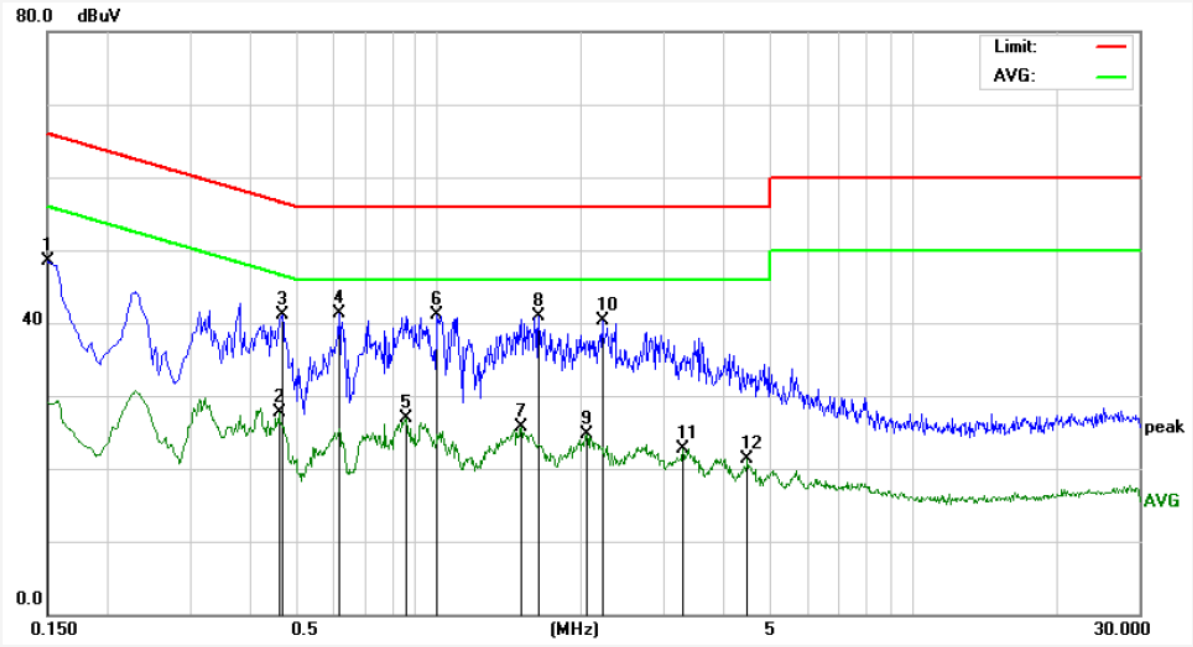
| | |
|---|---|
| Test Site: | 1# Shielded Room |
| Operating Condition: | TX Mode |
| Test Specification: | AC 240V, 60Hz for adapter |
| Comment: | Live Line |
| | Tem.:25℃ Hum.:50% |




| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit dBuV | Over Limit (dB) | Detector | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.1539 | 30.03 | 19.90 | 49.93 | 65.78 | -15.85 | QP | |
| 2 | 0.3220 | 5.52 | 19.90 | 25.42 | 49.65 | -24.23 | AVG | |
| 3 | 0.4220 | 4.38 | 19.94 | 24.32 | 47.41 | -23.09 | AVG | |
| 4 | 0.4700 | 16.95 | 19.97 | 36.92 | 56.51 | -19.59 | QP | |
| 5 | 0.6180 | 15.87 | 20.02 | 35.89 | 56.00 | -20.11 | QP | |
| 6 | 0.8580 | 2.35 | 20.08 | 22.43 | 46.00 | -23.57 | AVG | |
| 7 | 0.9980 | 16.30 | 20.12 | 36.42 | 56.00 | -19.58 | QP | |
| 8 | 1.4940 | 1.48 | 20.13 | 21.61 | 46.00 | -24.39 | AVG | |
| 9 | 1.5020 | 16.66 | 20.13 | 36.79 | 56.00 | -19.21 | QP | |
| 10 | 2.1099 | 0.72 | 20.14 | 20.86 | 46.00 | -25.14 | AVG | |
| 11 | 2.2500 | 17.20 | 20.14 | 37.34 | 56.00 | -18.66 | QP | |
| 12 | 4.5700 | -0.20 | 20.20 | 20.00 | 46.00 | -26.00 | AVG | |

## *CONDUCTED EMISSION TEST DATA*

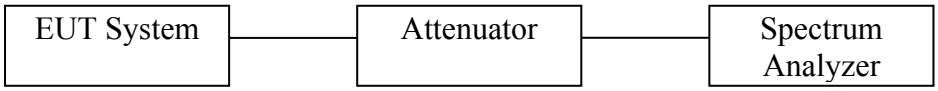
| | |
|---|---|
| Test Site: | 1# Shielded Room |
| Operating Condition: | TX Mode |
| Test Specification: | AC 240V, 60Hz for adapter |
| Comment: | Neutral Line |
| | Tem.:25℃ Hum.:50% |




| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit dBuV | Over Limit (dB) | Detector | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.1500 | 28.52 | 19.90 | 48.42 | 65.99 | -17.57 | QP | |
| 2 | 0.4620 | 7.78 | 19.96 | 27.74 | 46.66 | -18.92 | AVG | |
| 3 | 0.4700 | 21.08 | 19.97 | 41.05 | 56.51 | -15.46 | QP | |
| 4 | 0.6180 | 21.24 | 20.02 | 41.26 | 56.00 | -14.74 | QP | |
| 5 | 0.8580 | 6.81 | 20.08 | 26.89 | 46.00 | -19.11 | AVG | |
| 6 | 0.9980 | 20.90 | 20.12 | 41.02 | 56.00 | -14.98 | QP | |
| 7 | 1.5020 | 5.50 | 20.13 | 25.63 | 46.00 | -20.37 | AVG | |
| 8 | 1.6300 | 20.70 | 20.13 | 40.83 | 56.00 | -15.17 | QP | |
| 9 | 2.0579 | 4.50 | 20.14 | 24.64 | 46.00 | -21.36 | AVG | |
| 10 | 2.2139 | 20.08 | 20.14 | 40.22 | 56.00 | -15.78 | QP | |
| 11 | 3.2780 | 2.60 | 20.17 | 22.77 | 46.00 | -23.23 | AVG | |
| 12 | 4.4820 | 1.16 | 20.19 | 21.35 | 46.00 | -24.65 | AVG | |

# 4. FCC Part 15.247 Requirements for DSSS & OFDM Modulation

## 4.1 Test Setup




## 4.2 6dB Bandwidth & 20dB Bandwidth

**6dB Bandwidth**

**a. Limit**

For the direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz.

**b.Test Procedure**

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as:
   RBW = 100kHz, VBW≥3*RBW =300kHz,
   Detector= Peak
   Trace mode= Max hold.
   Sweep- auto couple.
4. Mark the peak frequency and –6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

**20dB Bandwidth:**

**C63.10**

**Occupied Bandwidth (OBW=20dB Bandwidth**

1. Set RBW=1%~5% OBW
2. Set the VBW≥3*RBW
3. Set the span range between 2 times and 5 times of the OBW
4. Sweep Time= Auto
   Detector= Peak
   Trace= Max hold
5. Once the reference level is established, the equipment is conditioned with typical modulating signals to produce the worst case (i.e. the widest) bandwidth. Unless otherwise specified for an unlicensed wireless device, measure the bandwidth at the -20dB levels with respect to the reference level.

**c. Test Setup See 4.1**

**d. Test Equipment**

| Item | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|---|---|---|---|---|---|---|
| 1. | Spectrum Analysis | Agilent | E4407B | US39390582 | Jul. 12, 2016 | 1 Year |
| 2. | Preamplifier | Instruments corporation | EMC011830 | 980100 | Jun. 17, 2017 | 1 Year |
| 3. | EMI Test Receiver | Rohde & Schwarz | ESPI | 101604 | Jun. 17, 2017 | 1 Year |
| 4. | Double Ridged Horn Antenna | Instruments corporation | GTH-0118 | 351600 | May 06, 2017 | 1 Year |
| 5. | Bilog Broadband Antenna | Schwarzbeck | VULB9163 | VULB 9163-289 | May 06, 2017 | 1 Year |
| 6. | Pre-amplifier | SONOMA | 310N | 186860 | Jun. 17, 2017 | 1 Year |
| 7. | EMI Test Software EZ-EMC | SHURPLE | N/A | N/A | N/A | N/A |
| 8 | Power Sensor | Agilent | KFSW150502 | 15I00041SN045 | Jun. 17, 2017 | 1 Year |
| 9 | MXA Spectrum Analysis | Agilent | N9020A | MY51170037 | Jun. 17, 2017 | 1 Year |
| 10 | MXG RF Vector Signal Generator | Agilent | N5182A | MY48180656 | Jun. 17, 2017 | 1 Year |
| 11 | Signal Generator | Agilent | E4421B | MY41000743 | Jun. 17, 2017 | 1 Year |
| 12 | DC Power supply | IV | IV-8080 | YQSB0096 | Jun. 17, 2017 | 1 Year |
| 13 | TEMP&HUMI PROGRAMMABLE CHAMBER | Bell Group | BE-THK-150M8 | SE-0137 | Jun. 17, 2017 | 1 Year |

**e. Test Results**

Pass.

**f. Test Data**

**6dB Bandwidth**

Test mode: IEEE 802.11b

| Channel | Frequency (MHz) | Bandwidth (MHz) | Limit (kHz) | Results |
|---|---|---|---|---|
| Low | 2412 | 9.572 | | Pass |
| Mid | 2437 | 9.044 | >500 | Pass |
| High | 2462 | 9.072 | | Pass |

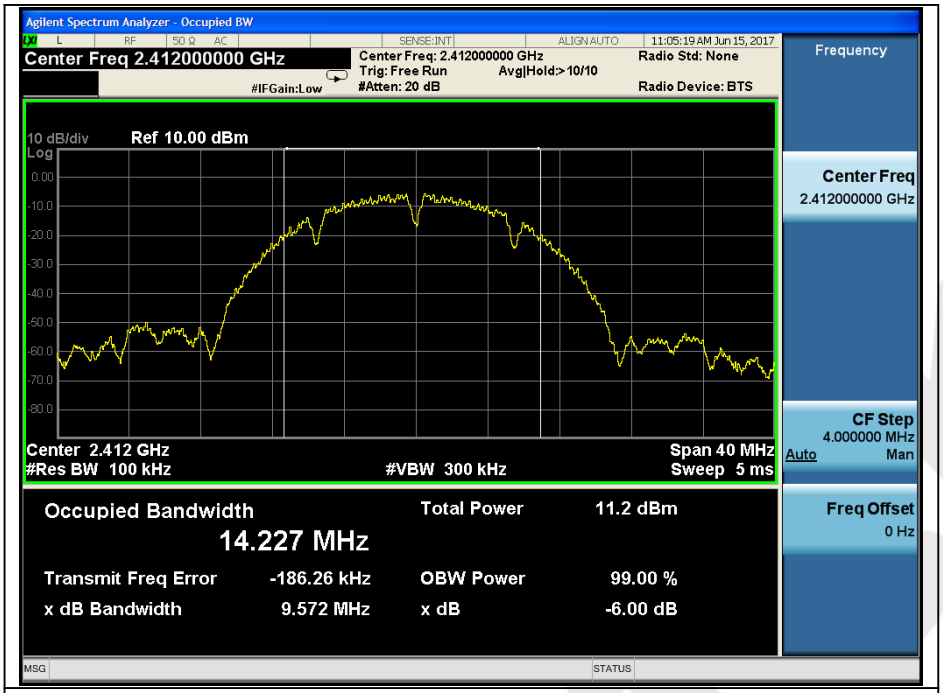
Test mode: IEEE 802.11g

| Channel | Frequency (MHz) | Bandwidth (MHz) | Limit (kHz) | Results |
|---|---|---|---|---|
| Low | 2412 | 16.06 | | Pass |
| Mid | 2437 | 16.07 | >500 | Pass |
| High | 2462 | 16.06 | | Pass |

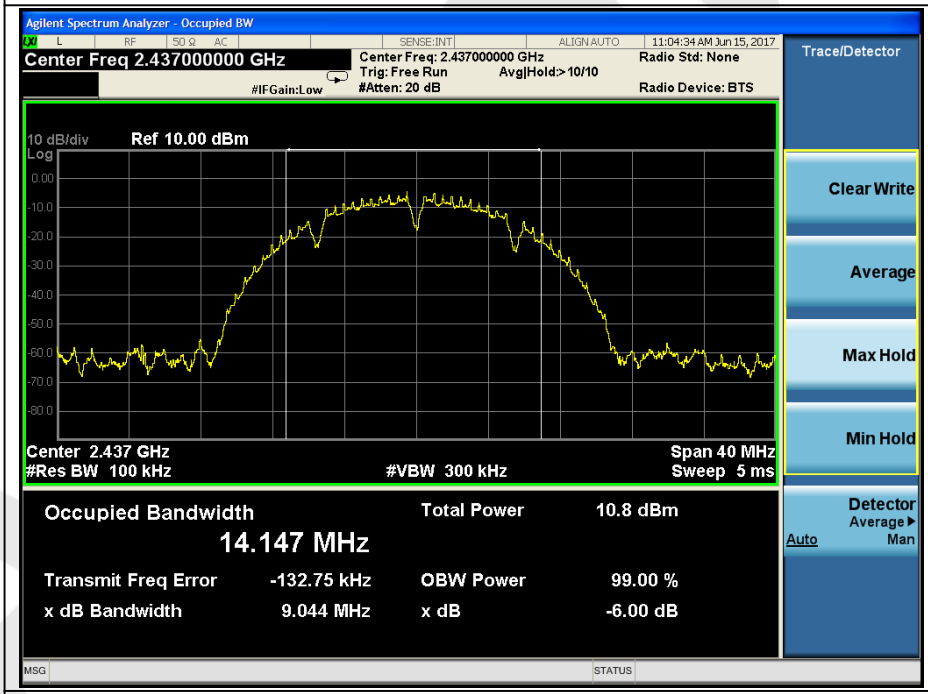
Test mode: IEEE 802.11n (HT20)

| Channel | Frequency (MHz) | Bandwidth (MHz) | Limit (kHz) | Results |
|---|---|---|---|---|
| Low | 2412 | 16.30 | | Pass |
| Mid | 2437 | 17.34 | >500 | Pass |
| High | 2462 | 17.31 | | Pass |

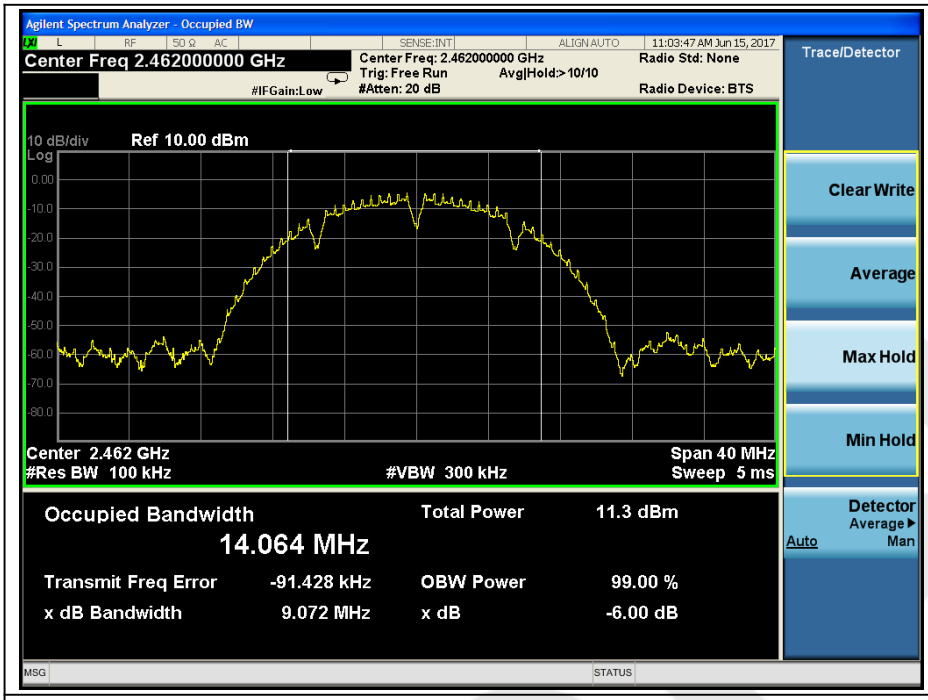
Test Plots See the following page.



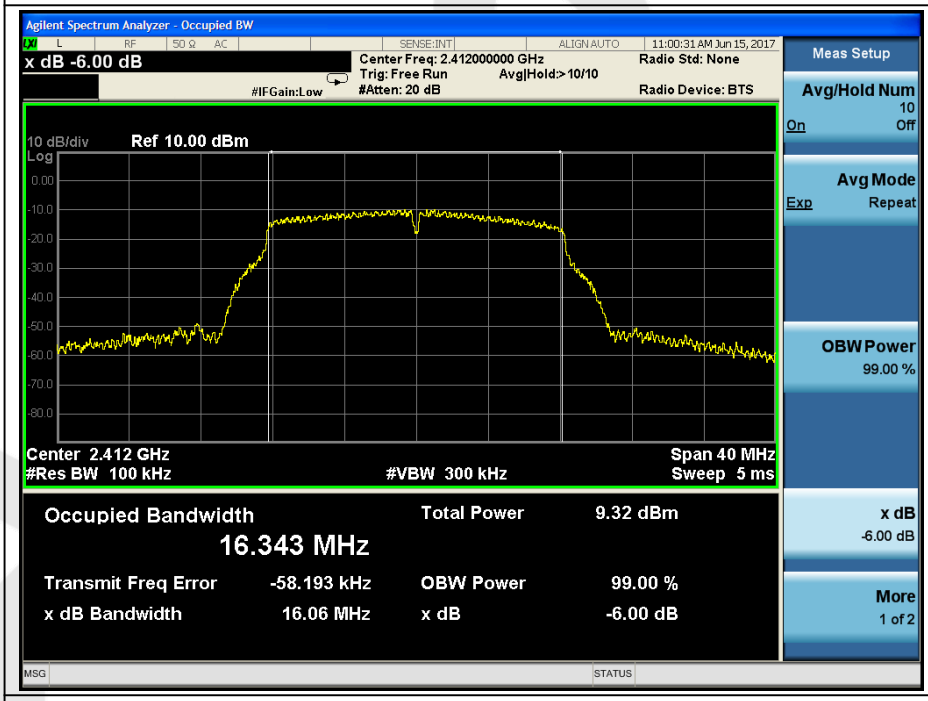

Test Mode: 802.11b---Low



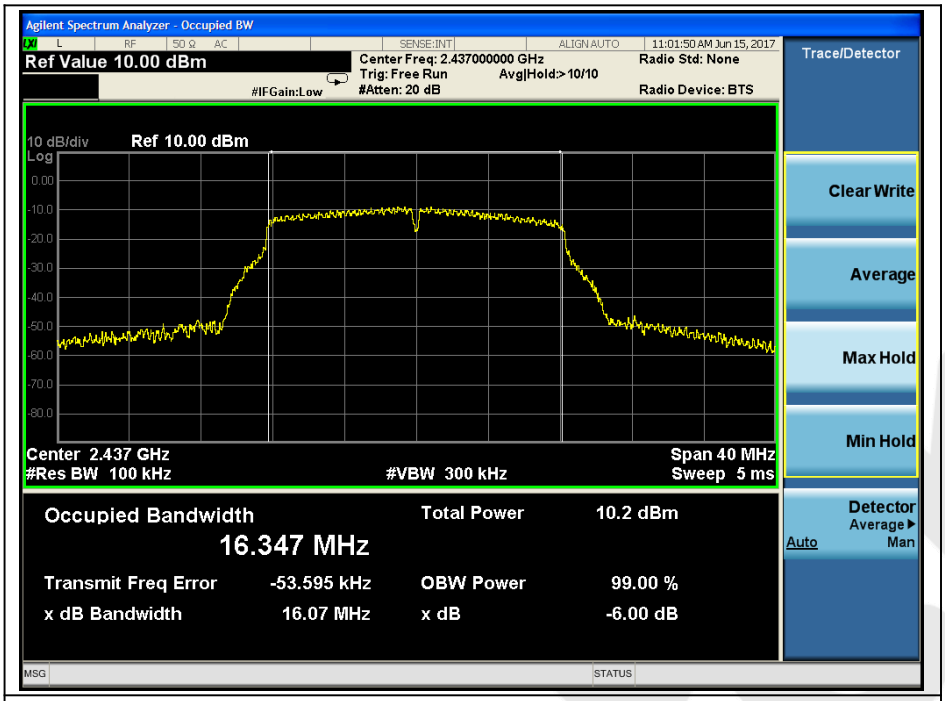

Test Mode: 802.11b---Mid



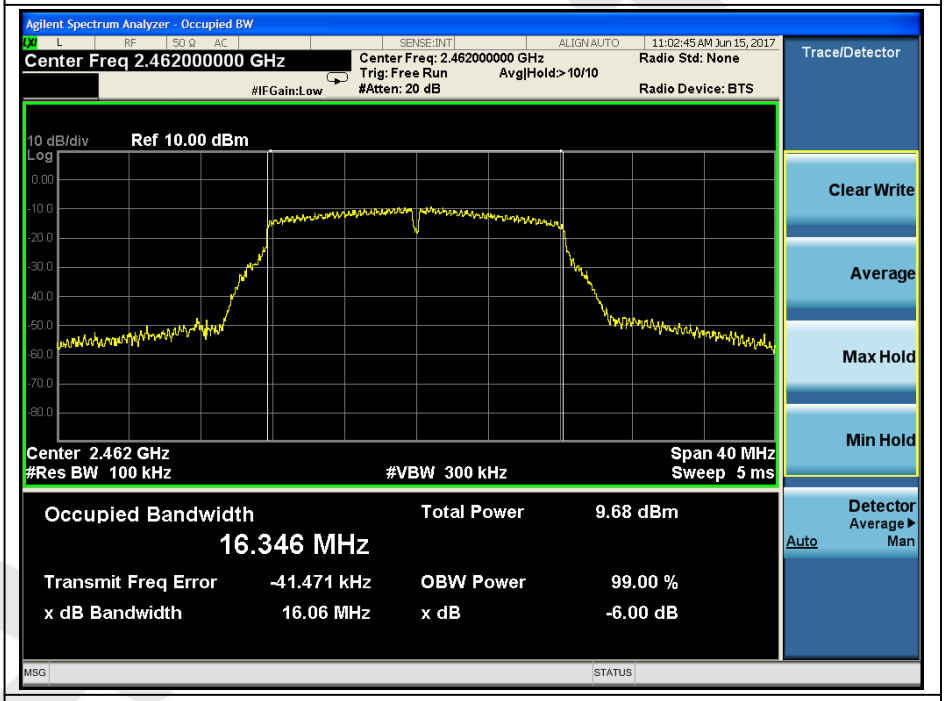

Test Mode: 802.11b---High



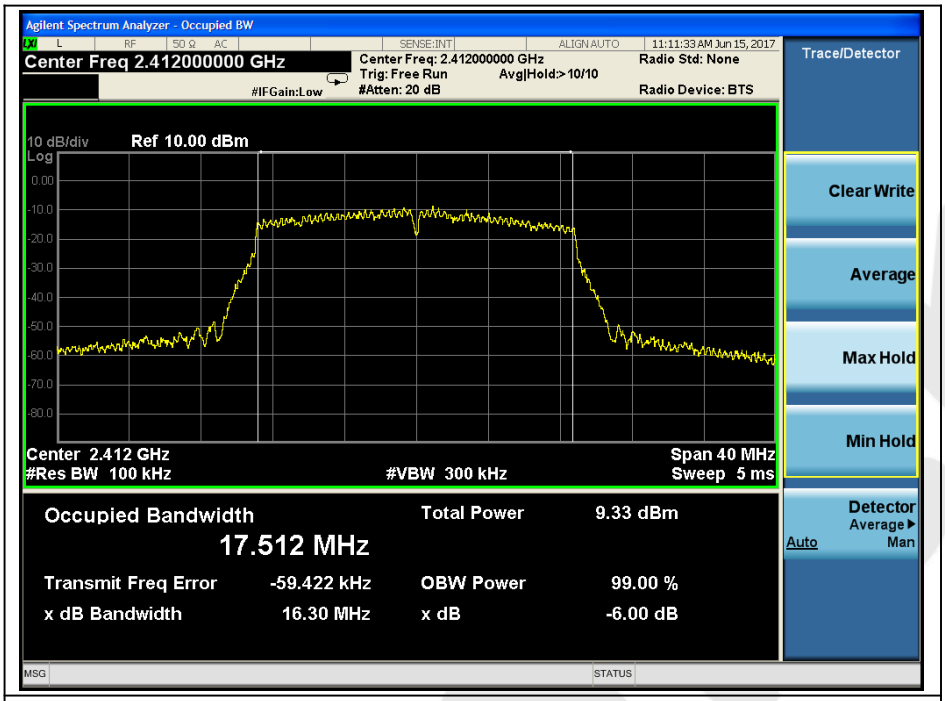

Test Mode: 802.11g---Low



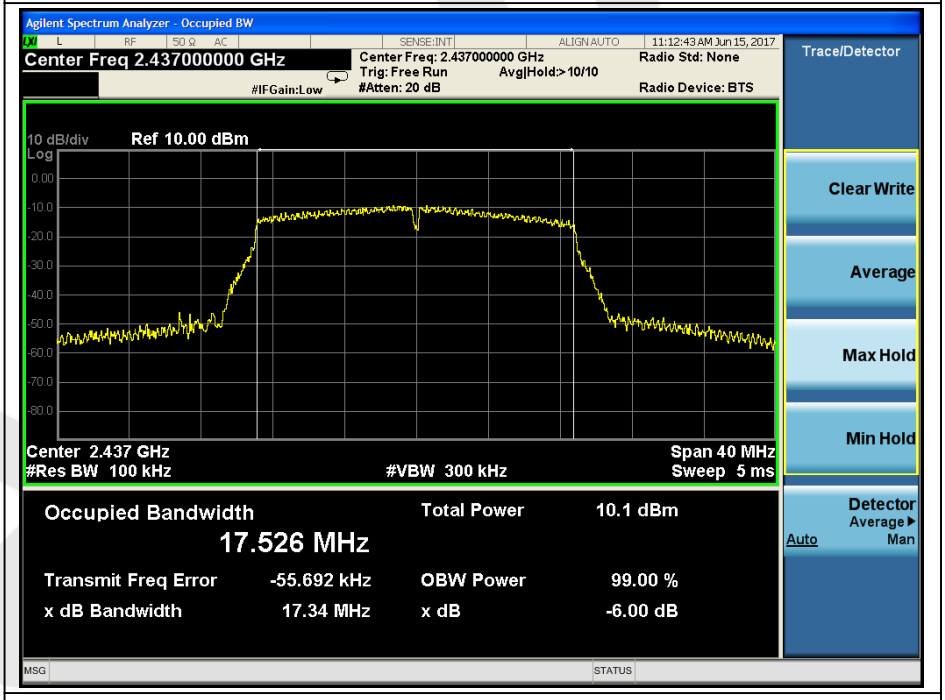

Test Mode: 802.11g---Mid



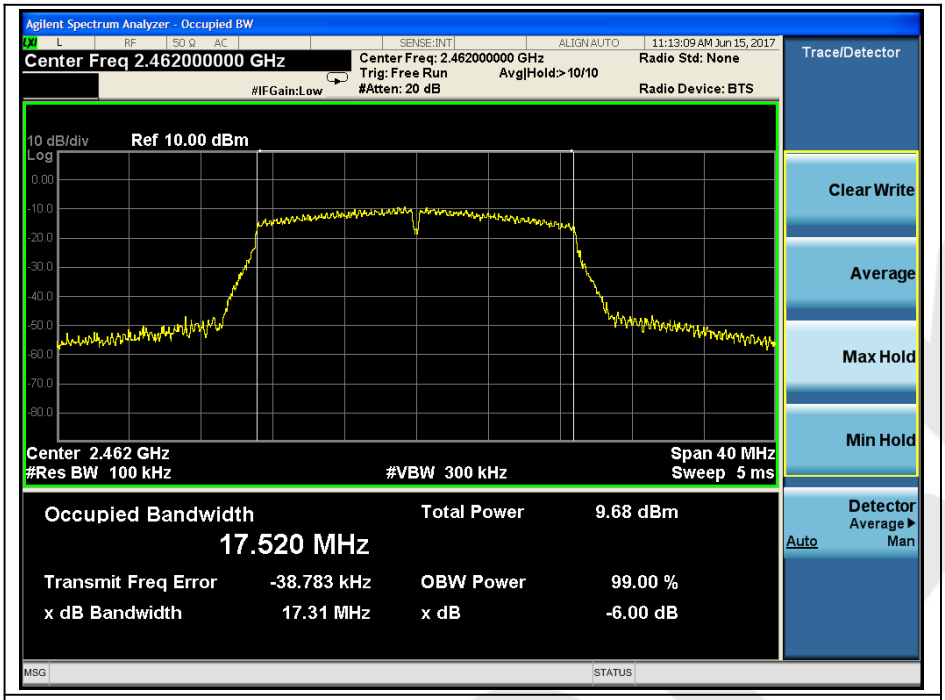

Test Mode: 802.11g---High




Test Mode: 802.11n20---Low




Test Mode: 802.11n20---Mid




Test Mode: 802.11n20---High

**20dB Bandwidth**

Test mode: IEEE 802.11b

| Channel | Frequency (MHz) | Bandwidth (MHz) | Results |
|---|---|---|---|
| Low | 2412 | 16.21 | Pass |
| Mid | 2437 | 16.24 | Pass |
| High | 2462 | 16.22 | Pass |

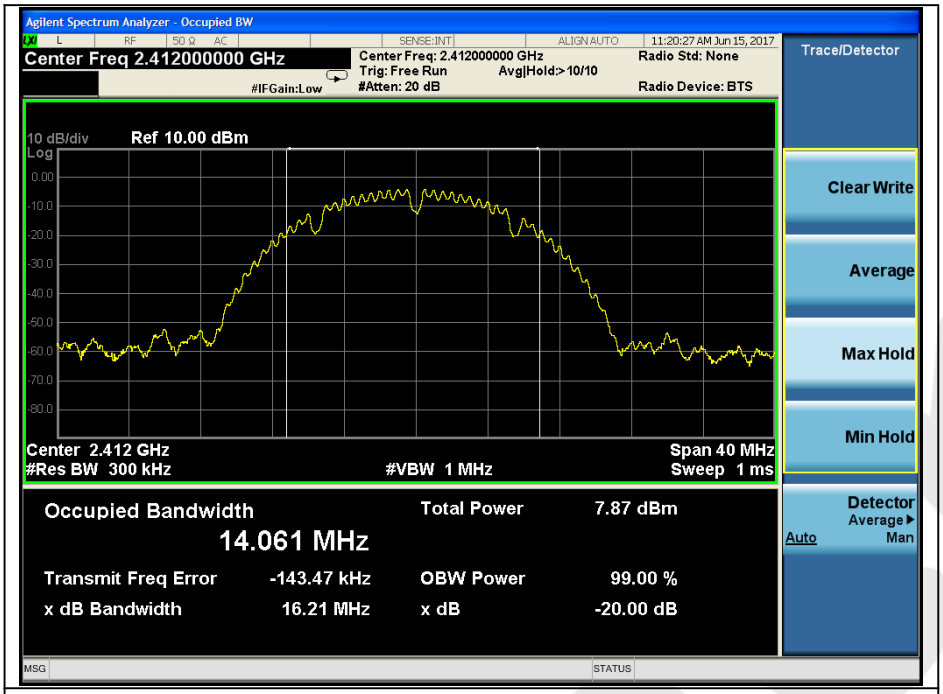
Test mode: IEEE 802.11g

| Channel | Frequency (MHz) | Bandwidth (MHz) | Results |
|---|---|---|---|
| Low | 2412 | 19.03 | Pass |
| Mid | 2437 | 19.01 | Pass |
| High | 2462 | 18.64 | Pass |

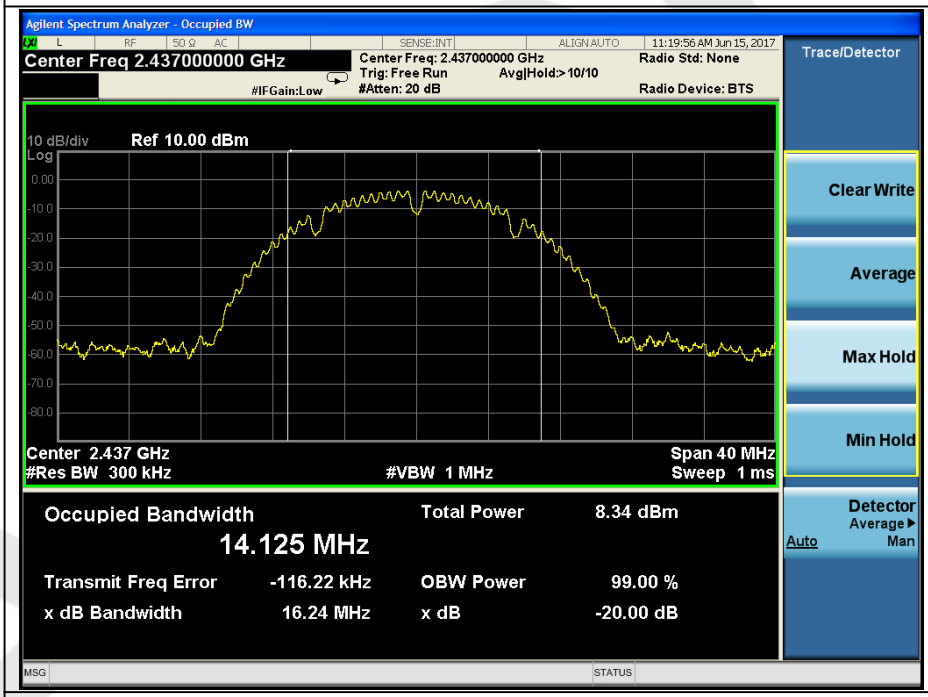
Test mode: IEEE 802.11n (HT20)

| Channel | Frequency (MHz) | Bandwidth (MHz) | Results |
|---|---|---|---|
| Low | 2412 | 19.42 | Pass |
| Mid | 2437 | 19.33 | Pass |
| High | 2462 | 19.41 | Pass |

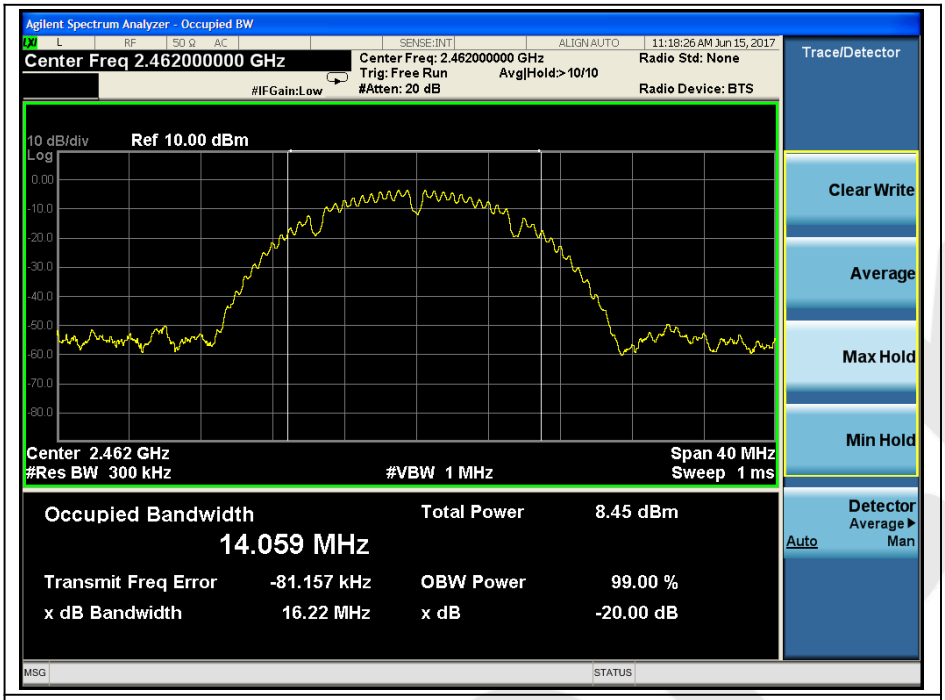
Test Plots See the following page.



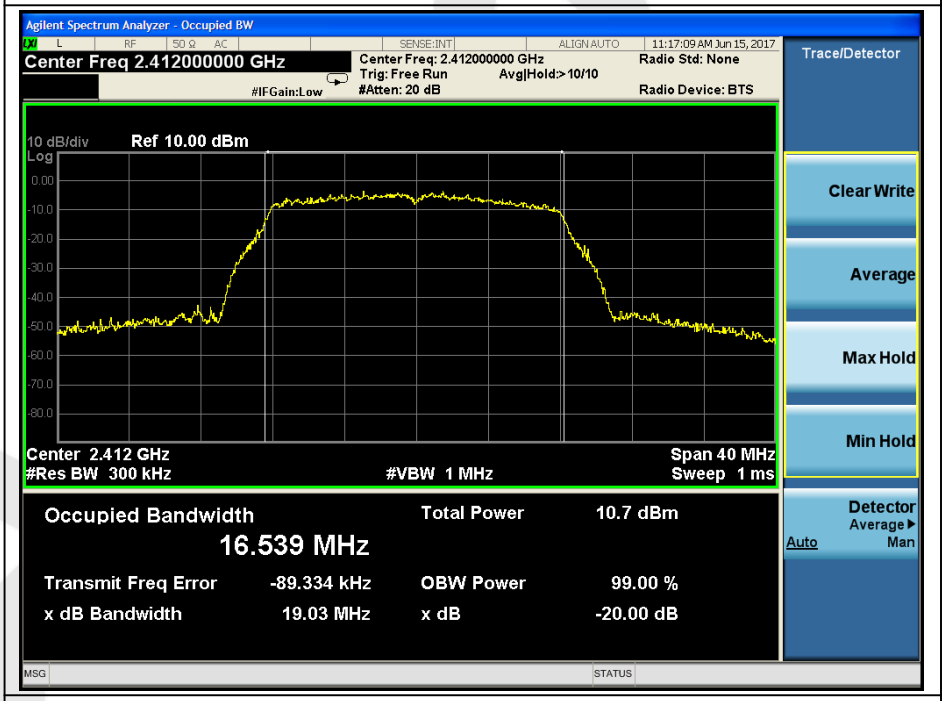

Test Mode: 802.11b---Low



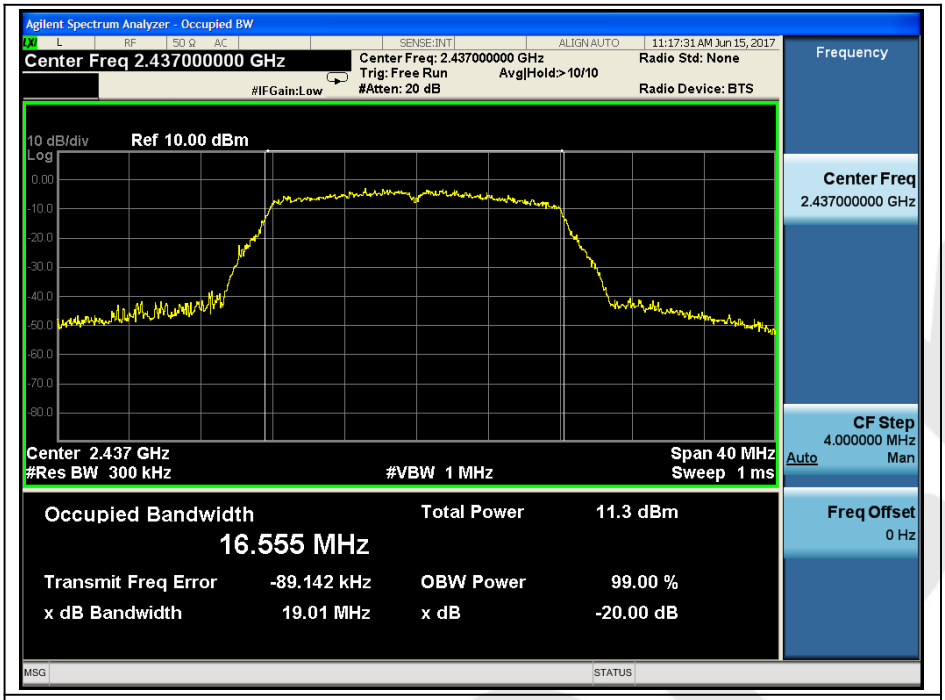

Test Mode: 802.11b---Mid



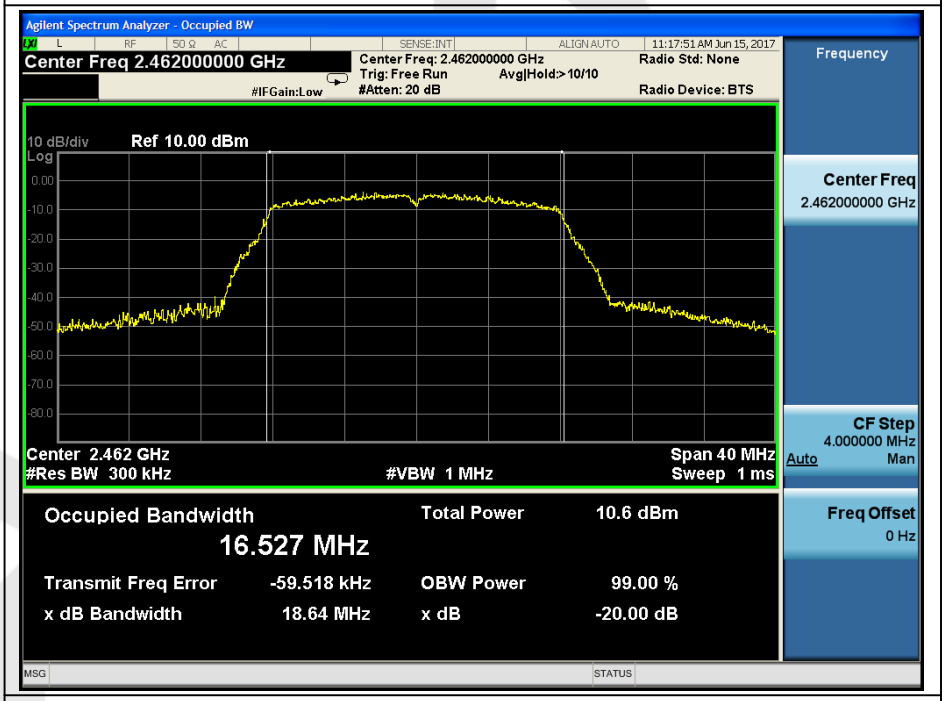

Test Mode: 802.11b---High



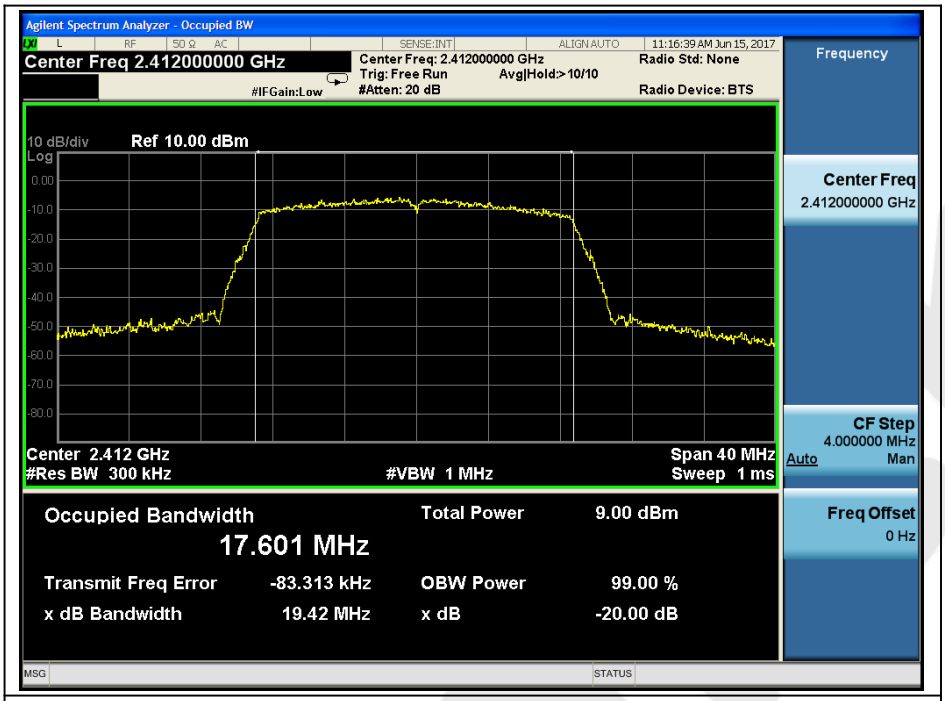

Test Mode: 802.11g---Low



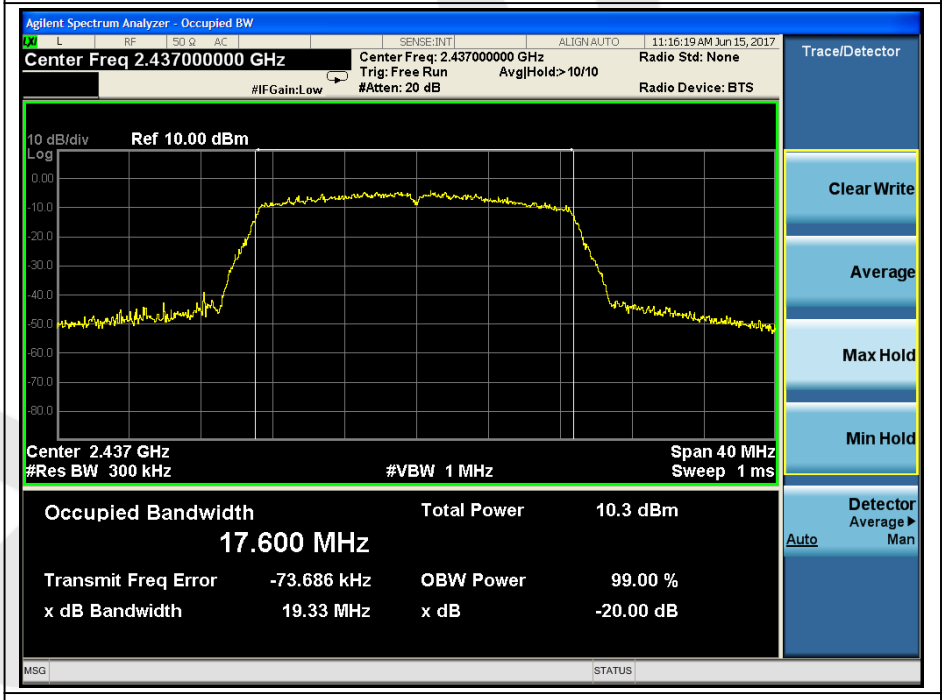

Test Mode: 802.11g---Mid



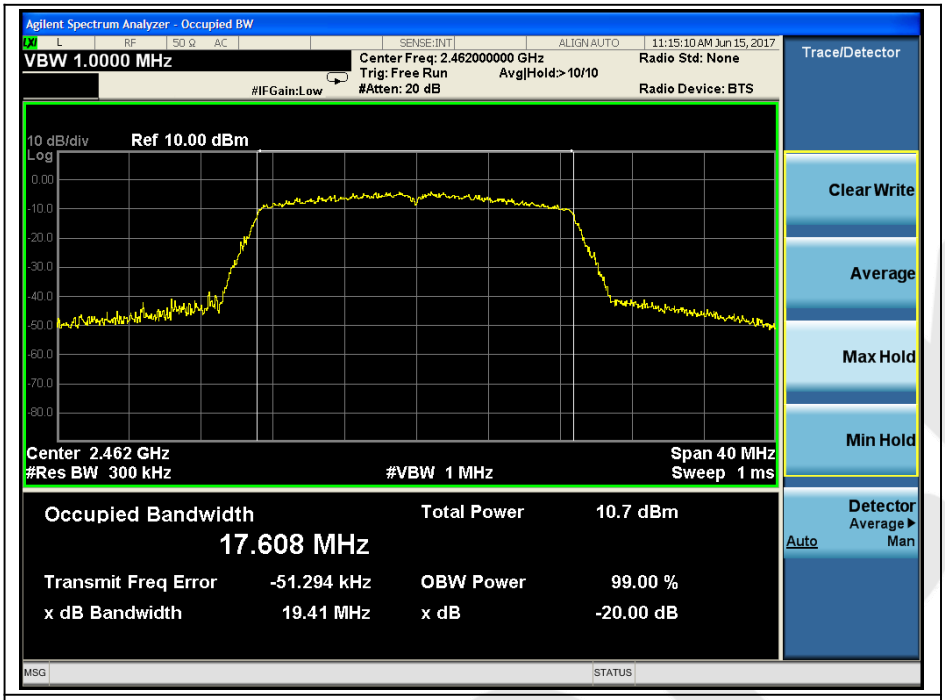

Test Mode: 802.11g---High




Test Mode: 802.11n20---Low




Test Mode: 802.11n20---Mid




Test Mode: 802.11n20---High

## 4.3. Maximum Output Power Test

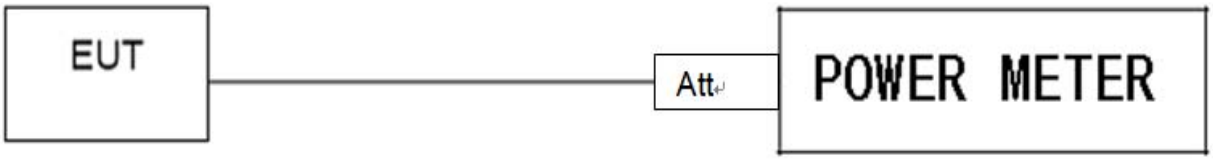
**a. Limits**

For systems using digital modulation in the 2400~2483.5MHz, The out put Power shall not exceed 1W (30dBm)

**b. Test procedure**

1.The Transmitter output (antenna port) was connected to the power meter.
2.Turn on the EUT and power meter and then record the power value.
3.Repeat above procedures on all channels needed to be tested.
Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

**c. TEST SETUP**




**d. Test Results**

Pass.

**e. Test Data**

| Test Mode | Test Channel | Frequency (MHz) | Maximum Peak Conducted Output Power (dBm) | LIMIT dBm |
|---|---|---|---|---|
| 802.11b | CH01 | 2412 | 6.31 | 30 |
| | CH06 | 2437 | 6.32 | 30 |
| | CH11 | 2462 | 7.09 | 30 |
| 802.11g | CH01 | 2412 | 9.00 | 30 |
| | CH06 | 2437 | 9.48 | 30 |
| | CH11 | 2462 | 9.49 | 30 |
| 802.11n(HT20) | CH01 | 2412 | 9.25 | 30 |
| | CH06 | 2437 | 9.28 | 30 |
| | CH11 | 2462 | 9.31 | 30 |

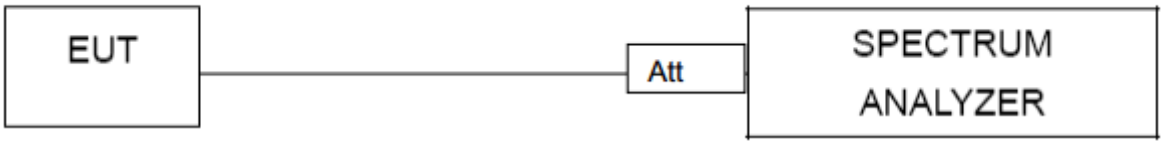
**Note: For power test the duty cycle is 100% in continous transmitting mode.**

## 4.4. Duty Cycle

**a. Test Procedure**

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal.
Set the center frequency of the instrument to the center frequency of the transmission.
Set RBW ≥OBW if possible; otherwise, set RBW to the largest available value.
Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)
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.
Set to the maximum power setting and enable the EUT transmit continuously.
The EUT was operating in controlled its channel.
Use the following spectrum analyzer settings:
Span = Zero Span
RBW = 8MHz
VBW =8MHz
Number of points in Sweep >100
Detector function = peak
Trace = Clear write Measure Ttotal and Ton
Calculate Duty Cycle = Ton / Ttotal and Duty Cycle Factor=10*log(1/Duty Cycle)

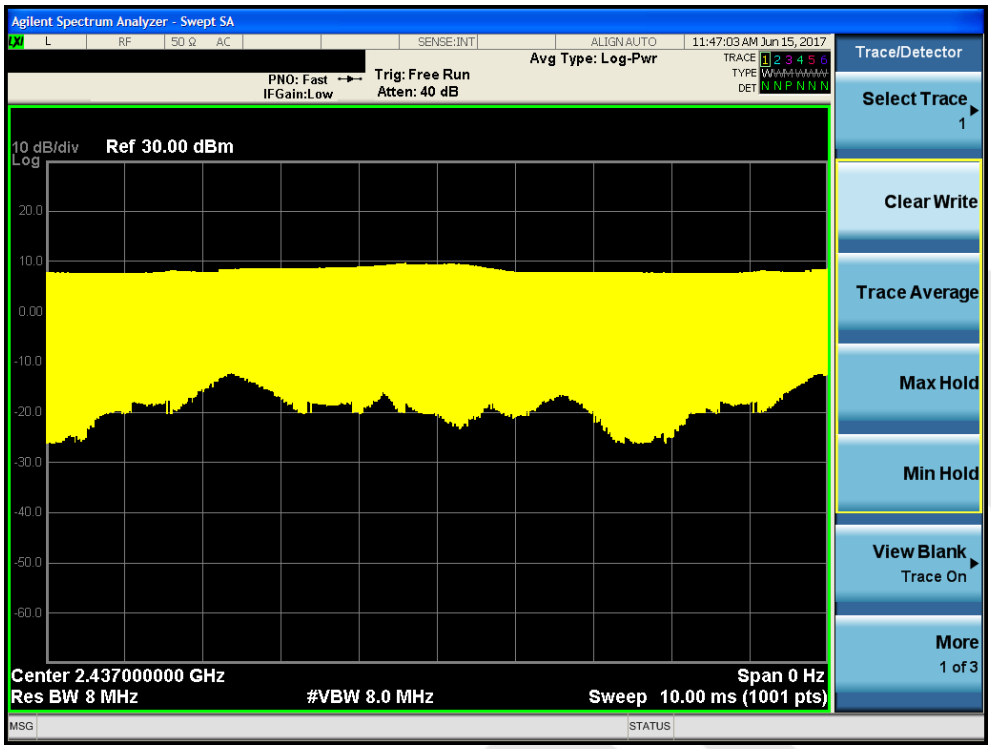
**b. Test Setup**



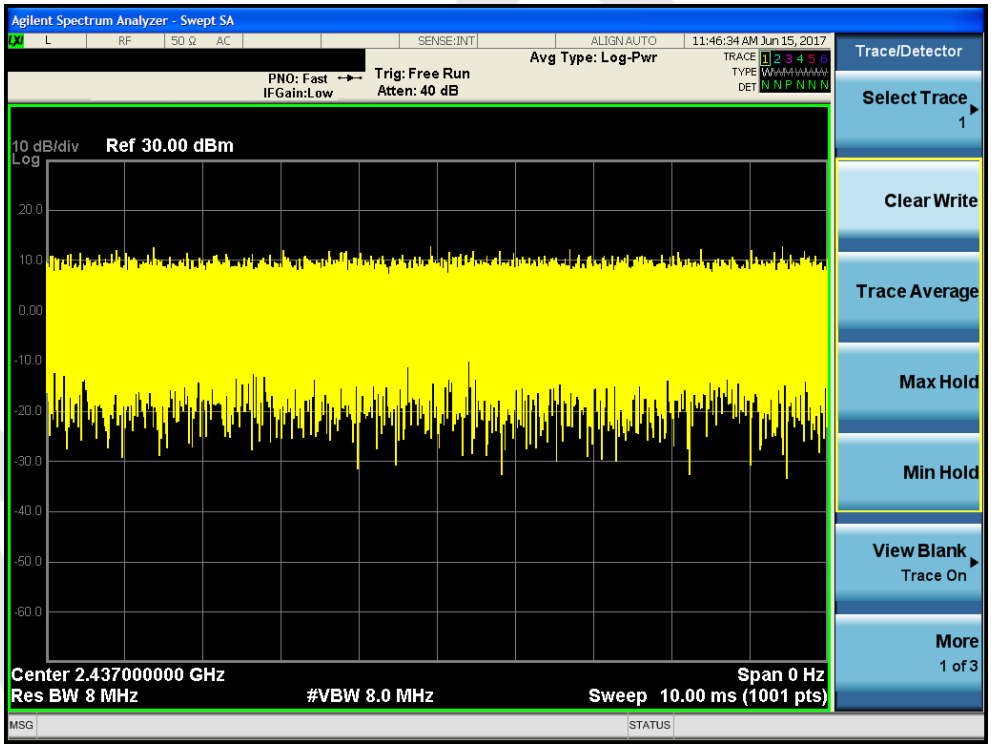

**c. Test Data**

| Test Mode | Frequency (MHz) | $T_{on}$ (ms) | $T_{total}$ (ms) | Duty Cycle |
|---|---|---|---|---|
| 802.11b | 2437 | 10 | 10 | 100% |
| 802.11g | 2437 | 10 | 10 | 100% |
| 802.11n(HT20) | 2437 | 10 | 10 | 100% |

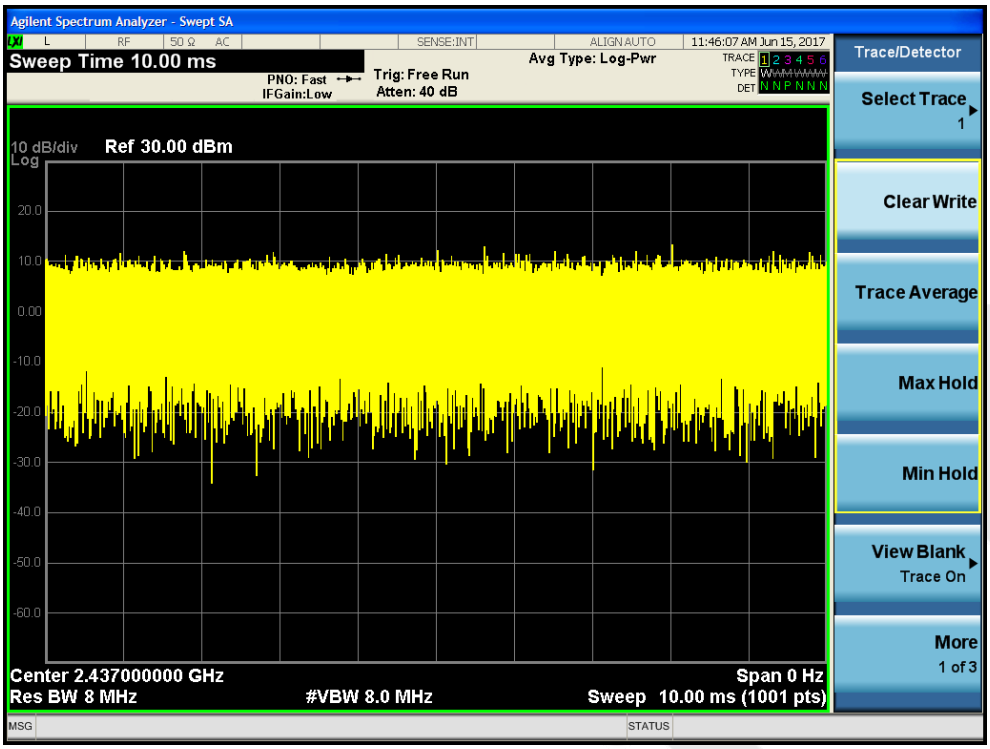
The maximum duty cycle is not less than 98%




Test Mode: 802.11 b




Test Mode: 802.11 g




Test Mode: 802.11 n(HT20)

## 4.5. 100 kHz bandwidth outside the frequency Measurement

**f. Applicable Standard**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

**g. Measurement Procedure**

The EUT must have its hopping/Non-hopping function enabled. Using the following spectrum analyzer setting:

1. Set the RBW = 100KHz.
2. Set the VBW = 300KHz.
3. Sweep time = auto couple.
4. Detector function = peak.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.

**h. Test Equipment**

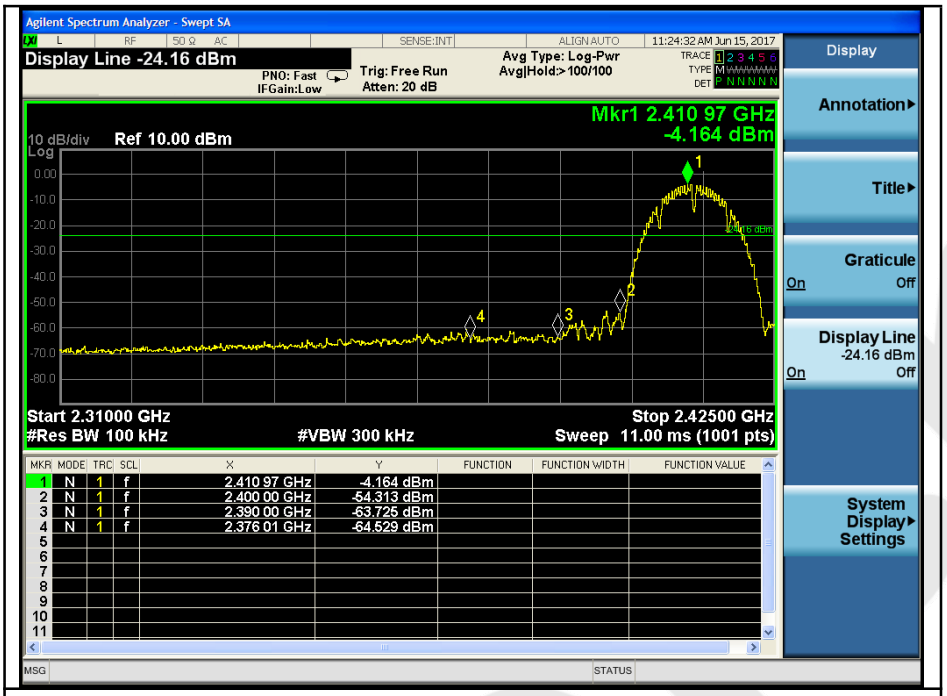
Same as the equipment listed in 4.2.

**i. Test Setup**

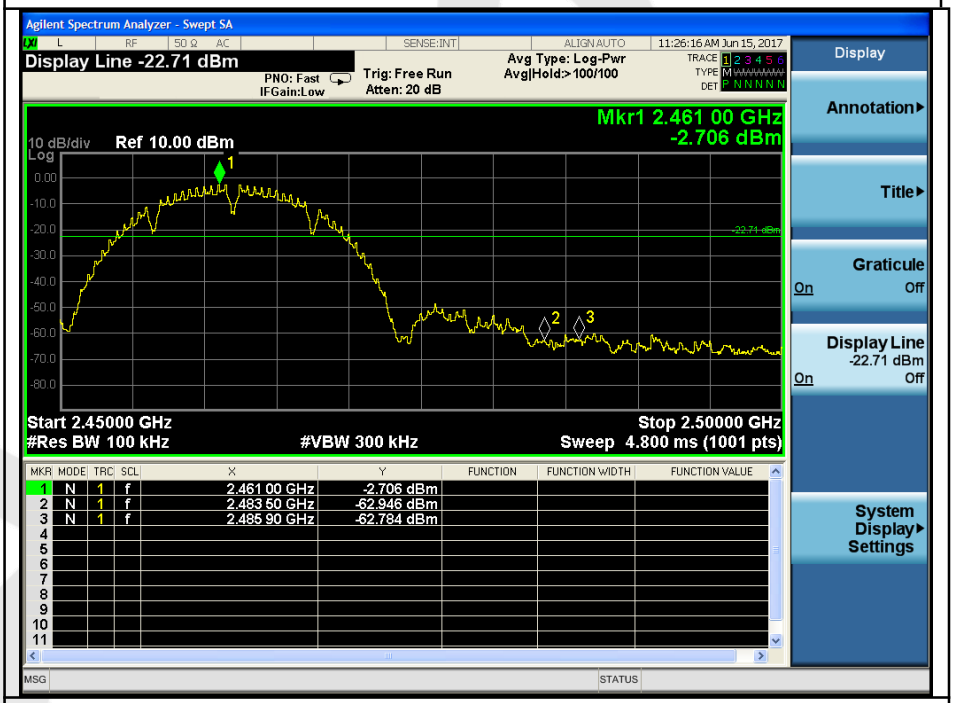
See 4.1

**Test Results:**

| Mode | Frequency Band | Delta Peak to band emission (dBc) | Limit (dBc) | Result |
|---|---|---|---|---|
| 802.11b mode | 2400 | 50.149 | 30 | Pass |
| | 2483.5 | 60.240 | 30 | Pass |
| 802.11g mode | 2400 | 41.509 | 30 | Pass |
| | 2483.5 | 48.732 | 30 | Pass |
| 802.11n(HT20) mode | 2400 | 41.054 | 30 | Pass |
| | 2483.5 | 46.908 | 30 | Pass |




Test Mode: 802.11b---Low




Test Mode: 802.11b---High


Test Mode: 802.11g---Low


Test Mode: 802.11g---High


Test Mode: 802.11n20---Low


Test Mode: 802.11n20---High

## 4.6. Peak Power Spectral Density

**a. Limit**

1. For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.
2. The direct sequence operating of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

**b. Test Procedure**

1. Place the EUT on the table and set it in transmitting mode. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 3.0kHz, VBW = 10kHz, Span = 1.5xDTS BW
3. Record the max. reading.
4. Repeat the above procedure until the measurements for all frequencies are completed.

**c. Test Equipment**

Same as the equipment listed in 4.2.

**d. Test Setup**

See 4.1

**Test Results:**

Test mode: IEEE 802.11b

| Channel | Frequency (MHz) | PPSD (dBm/3KHz) | ∑PPSD (dBm/3KHz) | Limit (dBm) | Result |
|---|---|---|---|---|---|
| Low | 2412 | -18.044 | - | | Pass |
| Mid | 2437 | -17.533 | - | 8.00 | Pass |
| High | 2462 | -18.637 | - | | Pass |

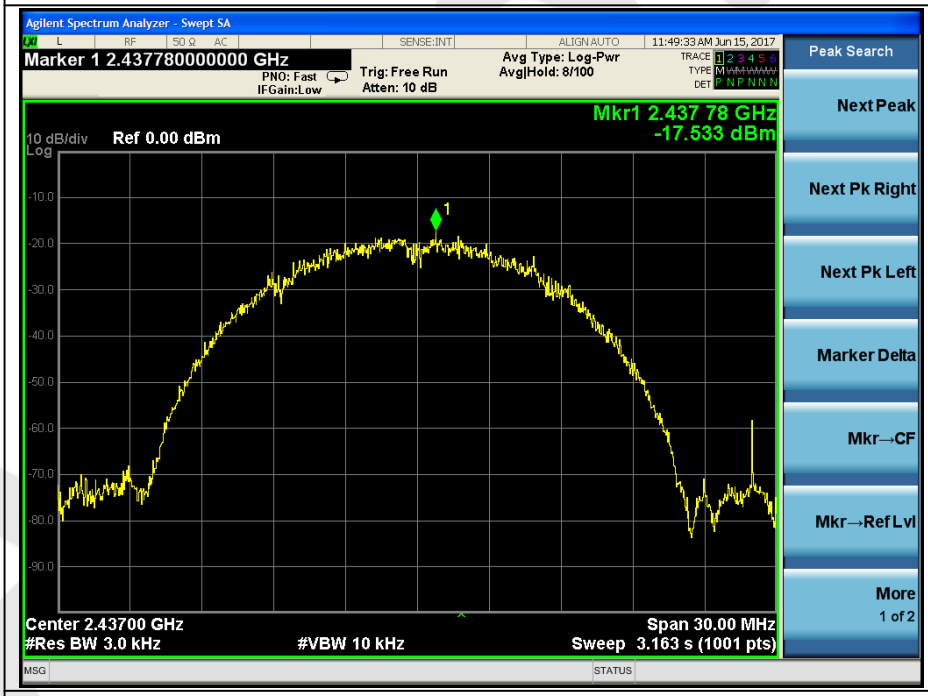
Test mode: IEEE 802.11g

| Channel | Frequency (MHz) | PPSD (dBm) | ∑PPSD (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|---|
| Low | 2412 | -21.190 | - | | Pass |
| Mid | 2437 | -20.136 | - | 8.00 | Pass |
| High | 2462 | -19.350 | - | | Pass |

Test mode: IEEE 802.11n (HT20)

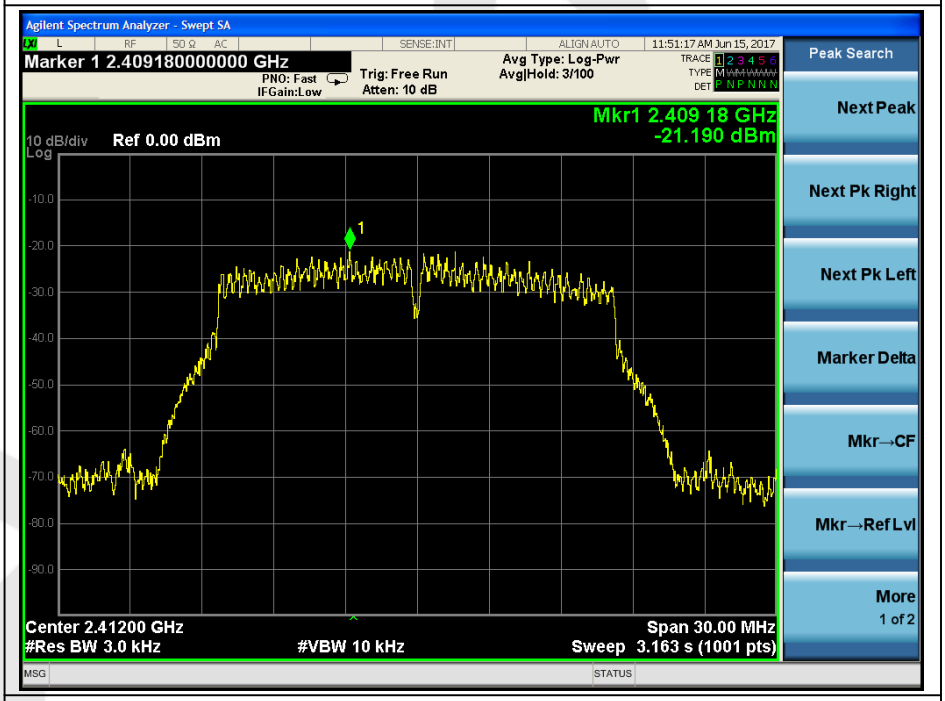
| Channel | Frequency (MHz) | PPSD (dBm/3KHz) | ∑PPSD (dBm/3KHz) | Limit (dBm) | Result |
|---|---|---|---|---|---|
| Low | 2412 | -19.875 | - | | Pass |
| Mid | 2437 | -20.051 | - | 8.00 | Pass |
| High | 2462 | -19.993 | - | | Pass |


Test Mode: 802.11b---Low

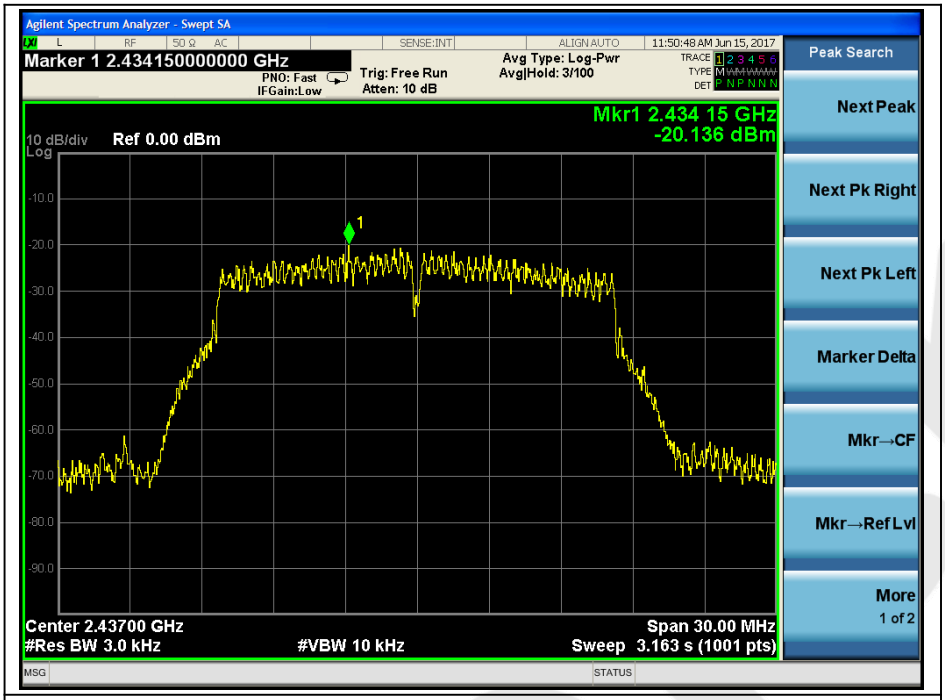



Test Mode: 802.11b---Mid

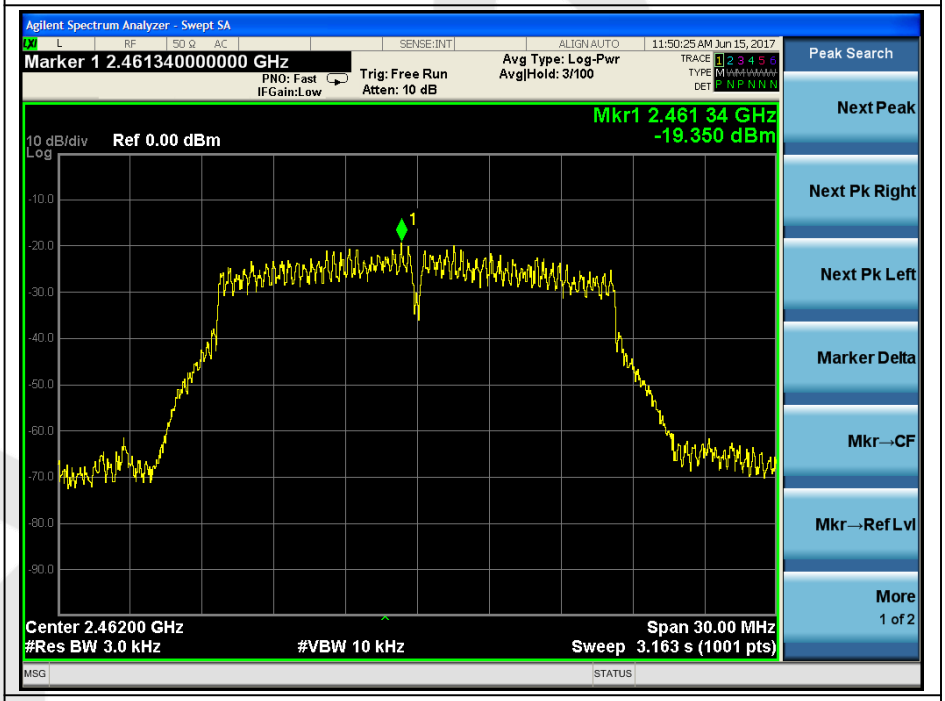

Test Mode: 802.11b---High



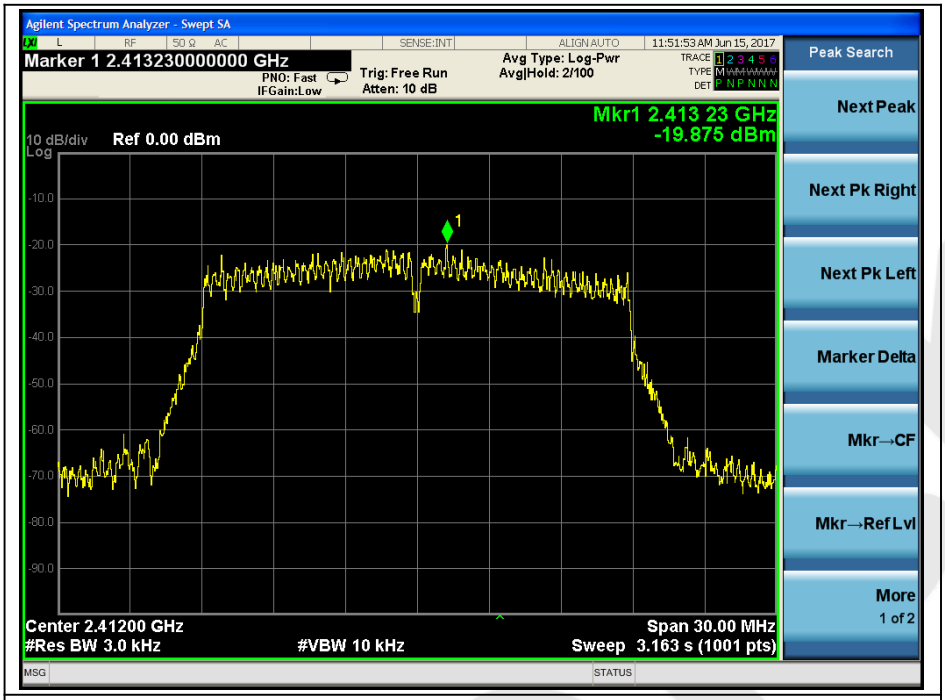

Test Mode: 802.11g---Low



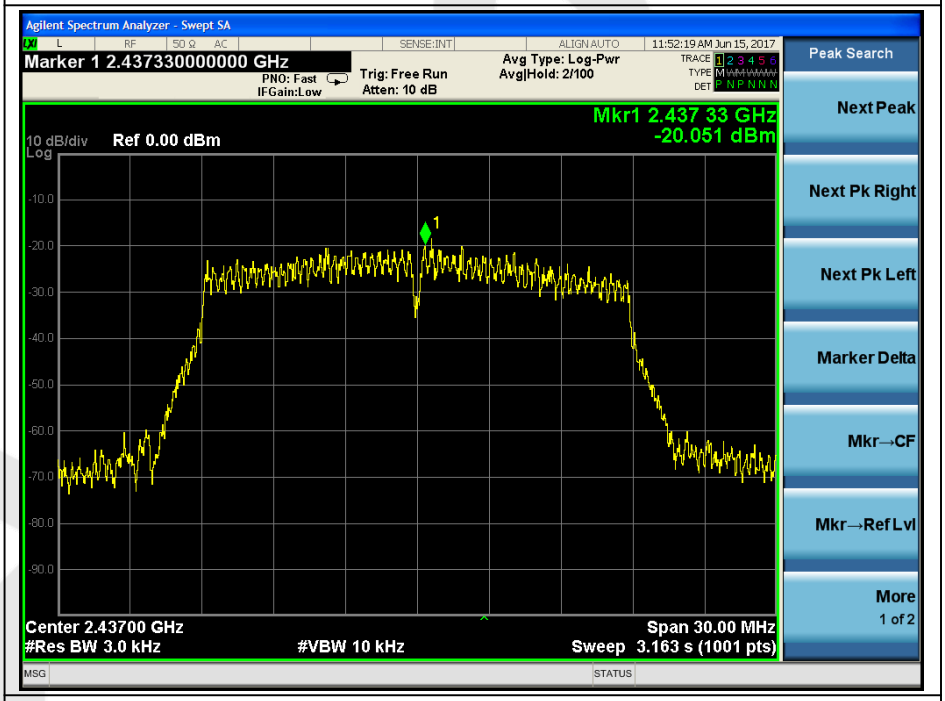

Test Mode: 802.11g---Mid



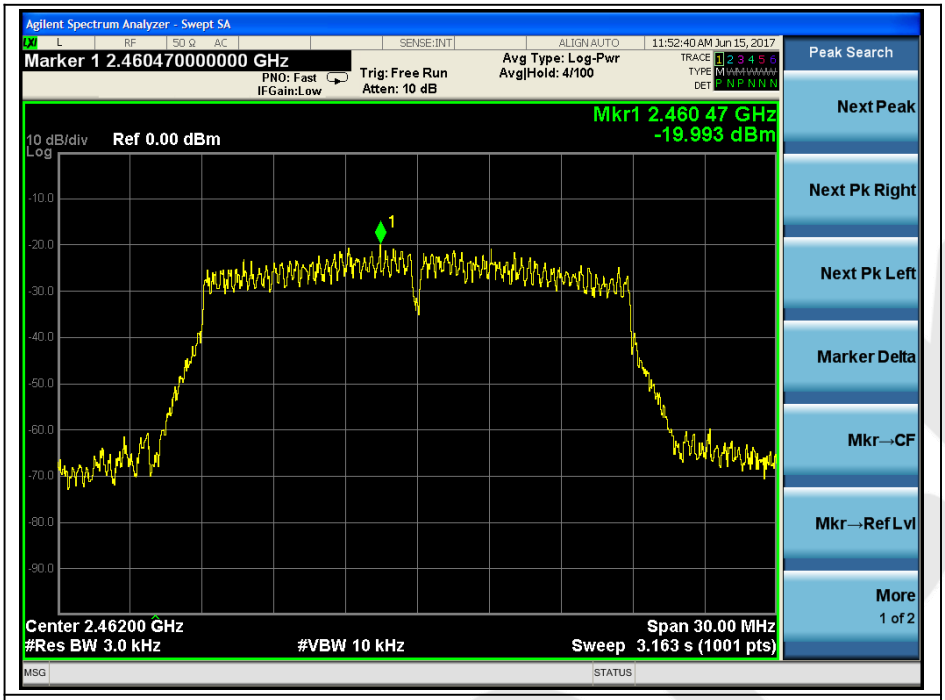

Test Mode: 802.11g---High




Test Mode: 802.11n20---Low




Test Mode: 802.11n20---Mid




Test Mode: 802.11n20---High

## 4.7. Radiated Emissions and Band Edge Measurement

4.7.1.1. Test Limits (< 30 MHZ)

| Frequency (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meter) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 30 |

4.7.1.2. Test Limits (≥ 30 MHZ)

| FIELD STRENGTH of Fundamental: @3M | FIELD STRENGTH of Harmonics | S15.209 | |
|---|---|---|---|
| 902-928 MHZ | | 88 - 216 MHz | 43.5 |
| 2.4-2.4835 GHz | | 216 - 960 MHz | 46 |
| 94 dBμV/m @3m | 54 dBμV/m @3m | ABOVE 960 MHz | 54dBuV/m |

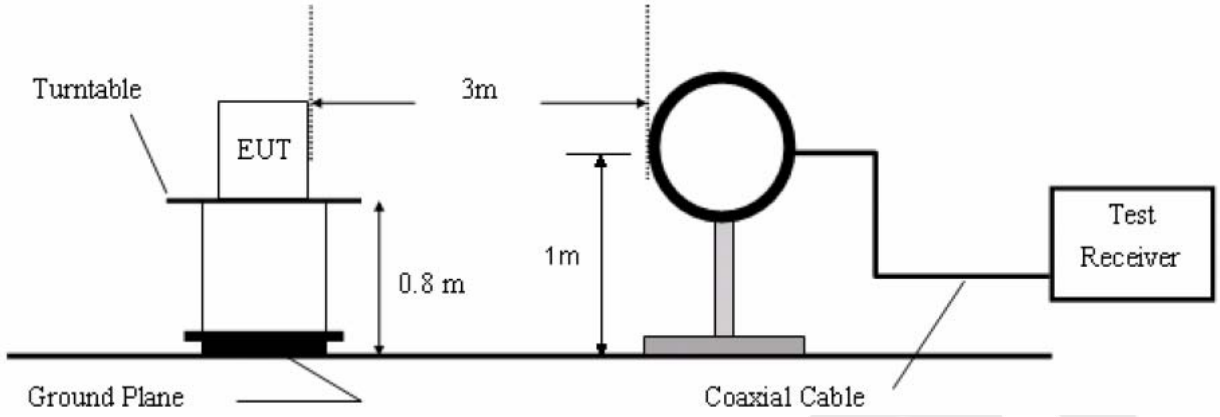
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Test Equipment

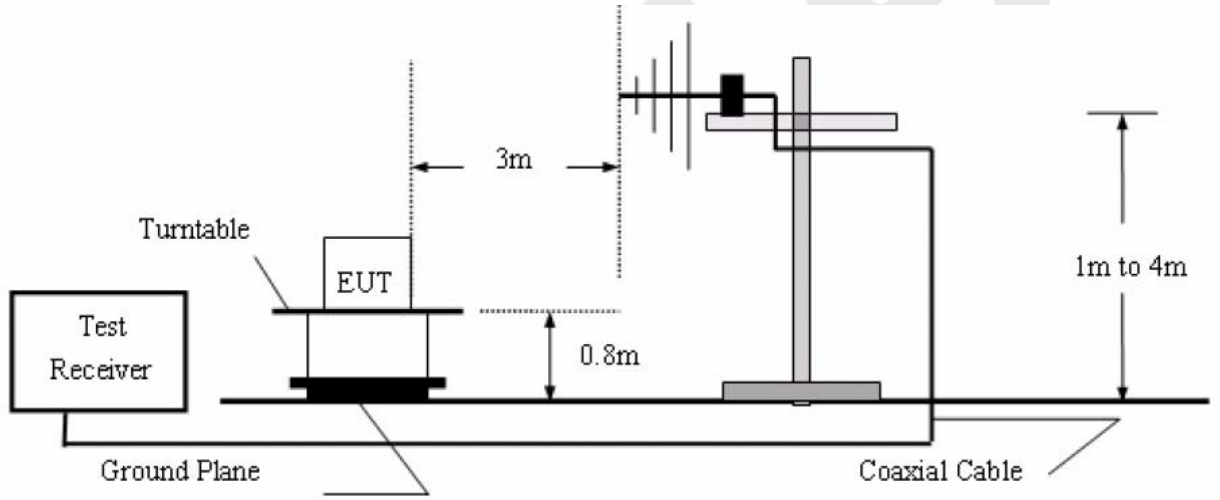
| Item | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|---|---|---|---|---|---|---|
| 1. | Spectrum Analysis | Agilent | E4407B | US39390582 | Jul. 12, 2016 | 1 Year |
| 2. | Preamplifier | Instruments corporation | EMC011830 | 980100 | Jun. 17, 2017 | 1 Year |
| 3. | EMI Test Receiver | Rohde & Schwarz | ESPI | 101604 | Jun. 17, 2017 | 1 Year |
| 4. | Double Ridged Horn Antenna | Instruments corporation | GTH-0118 | 351600 | May 06, 2017 | 1 Year |
| 5. | Bilog Broadband Antenna | Schwarzbeck | VULB9163 | VULB 9163-289 | May 06, 2017 | 1 Year |
| 6. | Pre-amplifier | SONOMA | 310N | 186860 | Jun. 17, 2017 | 1 Year |
| 7. | EMI Test Software EZ-EMC | SHURPLE | N/A | N/A | N/A | N/A |
| 8 | Power Sensor | Agilent | KFSW150502 | 15I00041SN045 | Jun. 17, 2017 | 1 Year |
| 9 | MXA Spectrum Analysis | Agilent | N9020A | MY51170037 | Jun. 17, 2017 | 1 Year |
| 10 | MXG RF Vector Signal Generator | Agilent | N5182A | MY48180656 | Jun. 17, 2017 | 1 Year |
| 11 | Signal Generator | Agilent | E4421B | MY41000743 | Jun. 17, 2017 | 1 Year |
| 12 | DC Power supply | IV | IV-8080 | YQSB0096 | Jun. 17, 2017 | 1 Year |
| 13 | TEMP&HUMI PROGRAMMABLE CHAMBER | Bell Group | BE-THK-150M8 | SE-0137 | Jun. 17, 2017 | 1 Year |

## 4.7.2. Test Configuration:

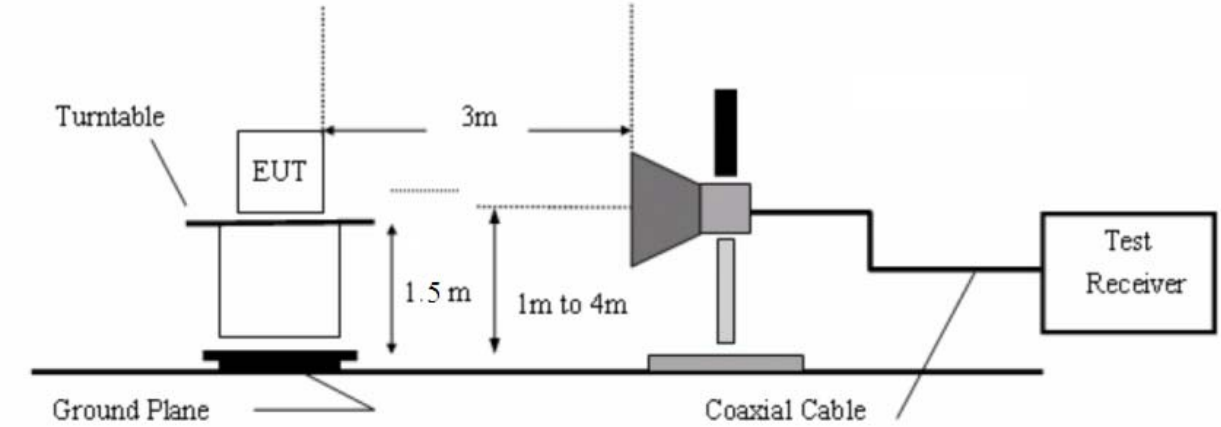
### 4.7.2.1. 9k to 30MHz emissions:




### 4.7.2.2. 30M to 1G emissions:




### 4.7.2.3. 1G to 40G emissions:



### 4.7.3. Test Procedure

For below 1GHz: The EUT is placed on a turntable, which is 0.8m above the ground plane.
For above 1GHz: The EUT is placed on a turntable, which is 1.5m above the ground plane.
The turn table can rotate 360 degrees to determine the position of the maximum emission level.
The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower.
The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Both horizontal and vertical polarization of the antenna are set on test.

Measurements are made on 9KHz to 30MHz and 30MHz to 26GHz range with the transmitter set to the lowest, middle, and highest channels.

For 9kHz to 150kHz, Set the spectrum analyzer as:
RBW = 200Hz, VBW =1kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 150kHz to 30MHz, Set the spectrum analyzer as:
RBW = 9KHz, VBW =30kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 30MHz to 1000MHz, Set the spectrum analyzer as:
RBW = 100kHz, VBW =300kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For above 1GHz, Set the spectrum analyzer as:
For Peak Reading measurement:
RBW =1MHz, VBW =3MHz, Detector= Peak, Trace mode= Max hold, Sweep- auto couple.
For Average Reading measurement:
If Duty cycle≥98%: RBW =1MHz, VBW =10Hz,
If Duty cycle<98%: RBW =1MHz, VBW =1/T (T is min transmission duration)

The EUT is tested in 9*6*6 Chamber. The device is evaluated in xyz orientation.

The test results are listed in Section 4.7.4.

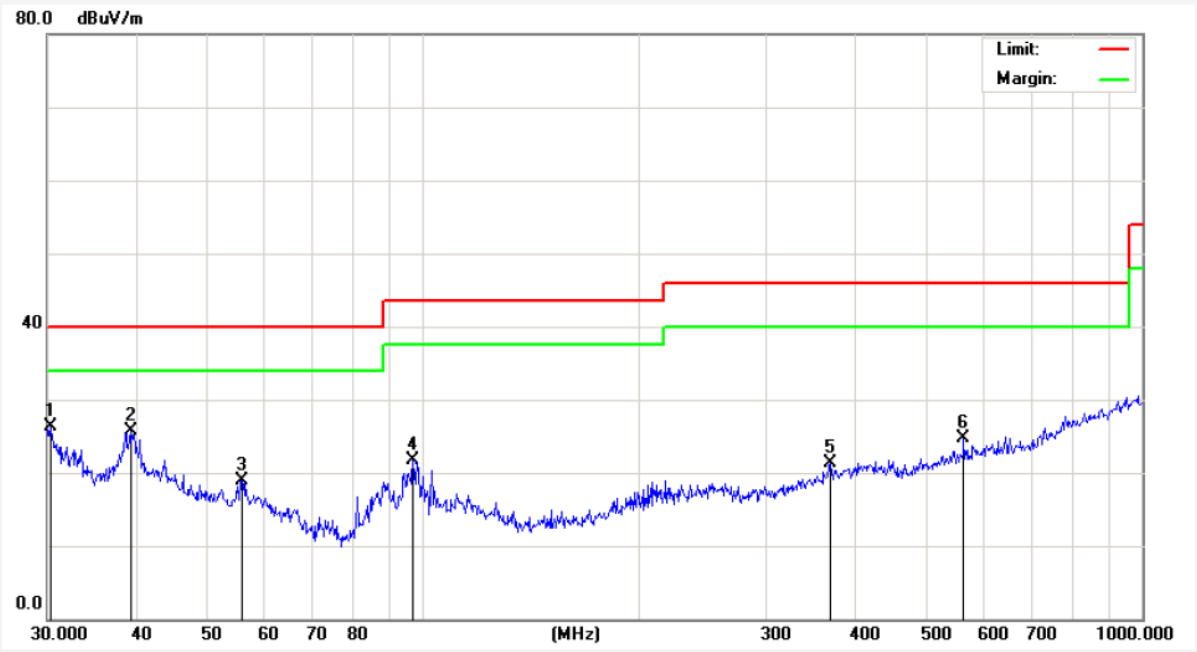
### 4.7.4. Test Results

Please refer the following pages. Only the worst case (x orientation).

The test results of 9kHz-30MHz and above 18000MHz are attenuated more than 20dB below the permissible limits, so the results don't record in the report.

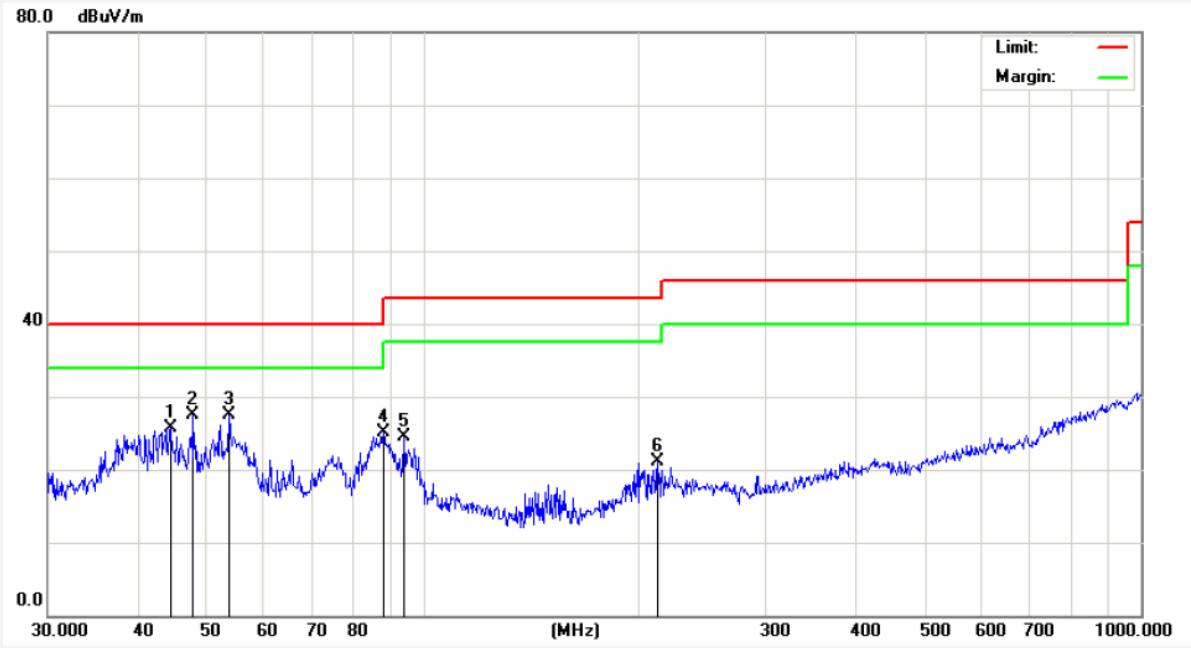
**Test Results (30~1000MHz)**

| | | | |
|---|---|---|---|
| **Job No.:** | **0217060007W** | **Polarization:** | **Horizontal** |
| **Standard:** | **FCC PART15 C** | **Power Source:** | **AC 120V, 60Hz for adapter** |
| **Test item:** | **Radiation Test** | **Temp.(C)/Hum.(%RH):** | **24.3(C)/55%RH** |
| **Test Mode:** | **TX Mode** | **Distance:** | **3m** |




| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 30.3173 | 42.98 | -16.77 | 26.21 | 40.00 | -13.79 | peak | | | |
| 2 | 39.1616 | 36.78 | -11.03 | 25.75 | 40.00 | -14.25 | peak | | | |
| 3 | 56.0007 | 34.03 | -15.03 | 19.00 | 40.00 | -21.00 | peak | | | |
| 4 | 96.7749 | 42.55 | -20.93 | 21.62 | 43.50 | -21.88 | peak | | | |
| 5 | 368.1116 | 34.90 | -13.50 | 21.40 | 46.00 | -24.60 | peak | | | |
| 6 | 564.6389 | 35.78 | -11.14 | 24.64 | 46.00 | -21.36 | peak | | | |

| | | | |
|---|---|---|---|
| **Job No.:** | **0217060007W** | **Polarization:** | **Vertical** |
| **Standard:** | **FCC PART15 C** | **Power Source:** | **AC 120V, 60Hz for adapter** |
| **Test item:** | **Radiation Test** | **Temp.(C)/Hum.(%RH):** | **24.3(C)/55%RH** |
| **Test Mode:** | **TX Mode** | **Distance:** | **3m** |




| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 44.4307 | 37.80 | -12.11 | 25.69 | 40.00 | -14.31 | peak | | | |
| 2 | 47.8260 | 41.05 | -13.60 | 27.45 | 40.00 | -12.55 | peak | | | |
| 3 | 53.6931 | 42.30 | -14.84 | 27.46 | 40.00 | -12.54 | peak | | | |
| 4 | 88.0328 | 43.26 | -18.06 | 25.20 | 43.50 | -18.30 | peak | | | |
| 5 | 94.0978 | 40.81 | -16.35 | 24.46 | 43.50 | -19.04 | peak | | | |
| 6 | 212.2694 | 36.41 | -15.40 | 21.01 | 43.50 | -22.49 | peak | | | |

**Test Results (Above 1000MHz)**

| Test mode: | 802.11b | Test channel: | Low CH |
|---|---|---|---|

Peak value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 4824.00 | 39.83 | 34.13 | 6.61 | 34.09 | 46.48 | 74.00 | -27.52 | Vertical |
| 7236.00 | 33.92 | 37.14 | 7.74 | 34.51 | 44.29 | 74.00 | -29.71 | Vertical |
| 9648.00 | 32.50 | 39.35 | 9.26 | 34.80 | 46.31 | 74.00 | -27.69 | Vertical |
| 12060.00 | * | | | | | 74.00 | | Vertical |
| 14472.00 | * | | | | | 74.00 | | Vertical |
| 16884.00 | * | | | | | 74.00 | | Vertical |
| 4824.00 | 38.57 | 34.13 | 6.61 | 34.09 | 45.22 | 74.00 | -28.78 | Horizontal |
| 7236.00 | 33.71 | 37.14 | 7.74 | 34.51 | 44.08 | 74.00 | -29.92 | Horizontal |
| 9648.00 | 32.10 | 39.35 | 9.26 | 34.80 | 45.91 | 74.00 | -28.09 | Horizontal |
| 12060.00 | * | | | | | 74.00 | | Horizontal |
| 14472.00 | * | | | | | 74.00 | | Horizontal |
| 16884.00 | * | | | | | 74.00 | | Horizontal |

Average value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 4824.00 | 28.95 | 34.13 | 6.61 | 34.09 | 35.60 | 54.00 | -18.40 | Vertical |
| 7236.00 | 22.80 | 37.14 | 7.74 | 34.51 | 33.17 | 54.00 | -20.83 | Vertical |
| 9648.00 | 22.86 | 39.35 | 9.26 | 34.80 | 36.67 | 54.00 | -17.33 | Vertical |
| 12060.00 | * | | | | | 54.00 | | Vertical |
| 14472.00 | * | | | | | 54.00 | | Vertical |
| 16884.00 | * | | | | | 54.00 | | Vertical |
| 4824.00 | 28.13 | 34.13 | 6.61 | 34.09 | 34.78 | 54.00 | -19.22 | Horizontal |
| 7236.00 | 22.30 | 37.14 | 7.74 | 34.51 | 32.67 | 54.00 | -21.33 | Horizontal |
| 9648.00 | 21.85 | 39.35 | 9.26 | 34.80 | 35.66 | 54.00 | -18.34 | Horizontal |
| 12060.00 | * | | | | | 54.00 | | Horizontal |
| 14472.00 | * | | | | | 54.00 | | Horizontal |
| 16884.00 | * | | | | | 54.00 | | Horizontal |

Note:

1, Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

2, "*", means this data is the too weak instrument of signal is unable to test.

| Test mode: | 802.11b | Test channel: | Mid CH |
|---|---|---|---|

Peak value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 4874.00 | 38.96 | 34.35 | 6.67 | 34.09 | 45.89 | 74.00 | -28.11 | Vertical |
| 7311.00 | 34.05 | 37.21 | 7.77 | 34.53 | 44.50 | 74.00 | -29.50 | Vertical |
| 9748.00 | 33.56 | 39.45 | 9.33 | 34.80 | 47.54 | 74.00 | -26.46 | Vertical |
| 12185.00 | * | | | | | 74.00 | | Vertical |
| 14622.00 | * | | | | | 74.00 | | Vertical |
| 17059.00 | * | | | | | 74.00 | | Vertical |
| 4874.00 | 39.50 | 34.35 | 6.67 | 34.09 | 46.43 | 74.00 | -27.57 | Horizontal |
| 7311.00 | 32.72 | 37.21 | 7.77 | 34.53 | 43.17 | 74.00 | -30.83 | Horizontal |
| 9748.00 | 33.46 | 39.45 | 9.33 | 34.80 | 47.44 | 74.00 | -26.56 | Horizontal |
| 12185.00 | * | | | | | 74.00 | | Horizontal |
| 14622.00 | * | | | | | 74.00 | | Horizontal |
| 17059.00 | * | | | | | 74.00 | | Horizontal |

Average value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 4874.00 | 29.85 | 34.35 | 6.67 | 34.09 | 36.78 | 54.00 | -17.22 | Vertical |
| 7311.00 | 22.37 | 37.21 | 7.77 | 34.53 | 32.82 | 54.00 | -21.18 | Vertical |
| 9748.00 | 22.82 | 39.45 | 9.33 | 34.80 | 36.80 | 54.00 | -17.20 | Vertical |
| 12185.00 | * | | | | | 54.00 | | Vertical |
| 14622.00 | * | | | | | 54.00 | | Vertical |
| 17059.00 | * | | | | | 54.00 | | Vertical |
| 4874.00 | 29.64 | 34.35 | 6.67 | 34.09 | 36.57 | 54.00 | -17.43 | Horizontal |
| 7311.00 | 21.81 | 37.21 | 7.77 | 34.53 | 32.26 | 54.00 | -21.74 | Horizontal |
| 9748.00 | 23.18 | 39.45 | 9.33 | 34.80 | 37.16 | 54.00 | -16.84 | Horizontal |
| 12185.00 | * | | | | | 54.00 | | Horizontal |
| 14622.00 | * | | | | | 54.00 | | Horizontal |
| 17059.00 | * | | | | | 54.00 | | Horizontal |

Note:

1, Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

2, “*”, means this data is the too weak instrument of signal is unable to test.

| Test mode: | 802.11b | Test channel: | High CH |
|---|---|---|---|

Peak value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 4924.00 | 44.21 | 34.57 | 6.74 | 34.09 | 51.43 | 74.00 | -22.57 | Vertical |
| 7386.00 | 34.54 | 37.29 | 7.80 | 34.55 | 45.08 | 74.00 | -28.92 | Vertical |
| 9848.00 | 36.73 | 39.55 | 9.41 | 34.81 | 50.88 | 74.00 | -23.12 | Vertical |
| 12310.00 | * | | | | | 74.00 | | Vertical |
| 14772.00 | * | | | | | 74.00 | | Vertical |
| 17234.00 | * | | | | | 74.00 | | Vertical |
| 4924.00 | 43.62 | 34.57 | 6.74 | 34.09 | 50.84 | 74.00 | -23.16 | Horizontal |
| 7386.00 | 33.50 | 37.29 | 7.80 | 34.55 | 44.04 | 74.00 | -29.96 | Horizontal |
| 9848.00 | 32.92 | 39.55 | 9.41 | 34.81 | 47.07 | 74.00 | -26.93 | Horizontal |
| 12310.00 | * | | | | | 74.00 | | Horizontal |
| 14772.00 | * | | | | | 74.00 | | Horizontal |
| 17234.00 | * | | | | | 74.00 | | Horizontal |

Average value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 4924.00 | 35.18 | 34.57 | 6.74 | 34.09 | 42.40 | 54.00 | -11.60 | Vertical |
| 7386.00 | 24.47 | 37.29 | 7.80 | 34.55 | 35.01 | 54.00 | -18.99 | Vertical |
| 9848.00 | 25.24 | 39.55 | 9.41 | 34.81 | 39.39 | 54.00 | -14.61 | Vertical |
| 12310.00 | * | | | | | 54.00 | | Vertical |
| 14772.00 | * | | | | | 54.00 | | Vertical |
| 17234.00 | * | | | | | 54.00 | | Vertical |
| 4924.00 | 34.02 | 34.57 | 6.74 | 34.09 | 41.24 | 54.00 | -12.76 | Horizontal |
| 7386.00 | 22.90 | 37.29 | 7.80 | 34.55 | 33.44 | 54.00 | -20.56 | Horizontal |
| 9848.00 | 22.19 | 39.55 | 9.41 | 34.81 | 36.34 | 54.00 | -17.66 | Horizontal |
| 12310.00 | * | | | | | 54.00 | | Horizontal |
| 14772.00 | * | | | | | 54.00 | | Horizontal |
| 17234.00 | * | | | | | 54.00 | | Horizontal |

Note:

1, During the test, pre-scan the 802.11b,g,n(HT20N) mode, and found the 802.11b mode is worse case, , the report only record this mode.

2, Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

3, "*", means this data is the too weak instrument of signal is unable to test.

**Radiated band edge:**

| Test mode: | 802.11b | Test channel: | Low CH |
|---|---|---|---|

Peak value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 2390.00 | 49.20 | 29.15 | 3.41 | 34.01 | 47.75 | 74.00 | -26.25 | Horizontal |
| 2400.00 | 47.98 | 29.16 | 3.43 | 34.01 | 46.56 | 74.00 | -27.44 | Horizontal |
| 2390.00 | 46.58 | 29.15 | 3.41 | 34.01 | 45.13 | 74.00 | -28.87 | Vertical |
| 2400.00 | 49.67 | 29.16 | 3.43 | 34.01 | 48.25 | 74.00 | -25.75 | Vertical |

Average value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 2390.00 | 38.36 | 29.15 | 3.41 | 34.01 | 36.91 | 54.00 | -17.09 | Horizontal |
| 2400.00 | 46.65 | 29.16 | 3.43 | 34.01 | 45.23 | 54.00 | -8.77 | Horizontal |
| 2390.00 | 40.17 | 29.15 | 3.41 | 34.01 | 38.72 | 54.00 | -15.28 | Vertical |
| 2400.00 | 47.77 | 29.16 | 3.43 | 34.01 | 46.35 | 54.00 | -7.65 | Vertical |

| Test mode: | 802.11b | Test channel: | High CH |
|---|---|---|---|

Peak value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 2483.50 | 52.20 | 29.28 | 3.53 | 34.03 | 50.98 | 74.00 | -23.02 | Horizontal |
| 2500.00 | 48.05 | 29.30 | 3.56 | 34.03 | 46.88 | 74.00 | -27.12 | Horizontal |
| 2483.50 | 54.45 | 29.28 | 3.53 | 34.03 | 53.23 | 74.00 | -20.77 | Vertical |
| 2500.00 | 50.55 | 29.30 | 3.56 | 34.03 | 49.38 | 74.00 | -24.62 | Vertical |

Average value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 2483.50 | 38.71 | 29.28 | 3.53 | 34.03 | 37.49 | 54.00 | -16.51 | Horizontal |
| 2500.00 | 34.83 | 29.30 | 3.56 | 34.03 | 33.66 | 54.00 | -20.34 | Horizontal |
| 2483.50 | 40.65 | 29.28 | 3.53 | 34.03 | 39.43 | 54.00 | -14.57 | Vertical |
| 2500.00 | 36.71 | 29.30 | 3.56 | 34.03 | 35.54 | 54.00 | -18.46 | Vertical |

| Test mode: | 802.11g | Test channel: | Low CH |
|---|---|---|---|

Peak value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 2390.00 | 48.08 | 27.53 | 3.41 | 33.92 | 45.10 | 74.00 | -28.90 | Horizontal |
| 2400.00 | 46.49 | 27.55 | 3.43 | 29.93 | 47.54 | 74.00 | -26.46 | Horizontal |
| 2390.00 | 45.39 | 27.53 | 3.41 | 33.92 | 42.41 | 74.00 | -31.59 | Vertical |
| 2400.00 | 47.88 | 27.55 | 3.43 | 29.93 | 48.93 | 74.00 | -25.07 | Vertical |

Average value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 2390.00 | 37.57 | 27.53 | 3.41 | 33.92 | 34.59 | 54.00 | -19.41 | Horizontal |
| 2400.00 | 45.73 | 27.55 | 3.43 | 29.93 | 46.78 | 54.00 | -7.22 | Horizontal |
| 2390.00 | 39.29 | 27.53 | 3.41 | 33.92 | 36.31 | 54.00 | -17.69 | Vertical |
| 2400.00 | 46.77 | 27.55 | 3.43 | 29.93 | 47.82 | 54.00 | -6.18 | Vertical |

| Test mode: | 802.11g | Test channel: | High CH |
|---|---|---|---|

Peak value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 2483.50 | 50.61 | 29.28 | 3.53 | 34.03 | 49.39 | 74.00 | -24.61 | Horizontal |
| 2500.00 | 46.82 | 29.30 | 3.56 | 34.03 | 45.65 | 74.00 | -28.35 | Horizontal |
| 2483.50 | 52.63 | 29.28 | 3.53 | 34.03 | 51.41 | 74.00 | -22.59 | Vertical |
| 2500.00 | 49.10 | 29.30 | 3.56 | 34.03 | 47.93 | 74.00 | -26.07 | Vertical |

Average value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 2483.50 | 37.75 | 29.28 | 3.53 | 34.03 | 36.53 | 54.00 | -17.47 | Horizontal |
| 2500.00 | 34.08 | 29.30 | 3.56 | 34.03 | 32.91 | 54.00 | -21.09 | Horizontal |
| 2483.50 | 39.59 | 29.28 | 3.53 | 34.03 | 38.37 | 54.00 | -15.63 | Vertical |
| 2500.00 | 35.91 | 29.30 | 3.56 | 34.03 | 34.74 | 54.00 | -19.26 | Vertical |

| Test mode: | 802.11n (HT20) | Test channel: | Low CH |
|---|---|---|---|

Peak value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 2390.00 | 48.35 | 27.53 | 3.41 | 33.92 | 45.37 | 74.00 | -28.63 | Horizontal |
| 2400.00 | 46.84 | 27.55 | 3.43 | 29.93 | 47.89 | 74.00 | -26.11 | Horizontal |
| 2390.00 | 45.67 | 27.53 | 3.41 | 33.92 | 42.69 | 74.00 | -31.31 | Vertical |
| 2400.00 | 48.31 | 27.55 | 3.43 | 29.93 | 49.36 | 74.00 | -24.64 | Vertical |

Average value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 2390.00 | 37.75 | 27.53 | 3.41 | 33.92 | 34.77 | 54.00 | -19.23 | Horizontal |
| 2400.00 | 45.95 | 27.55 | 3.43 | 29.93 | 47.00 | 54.00 | -7.00 | Horizontal |
| 2390.00 | 39.50 | 27.53 | 3.41 | 33.92 | 36.52 | 54.00 | -17.48 | Vertical |
| 2400.00 | 47.00 | 27.55 | 3.43 | 29.93 | 48.05 | 54.00 | -5.95 | Vertical |

| Test mode: | 802.11n (HT20) | Test channel: | High CH |
|---|---|---|---|

Peak value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 2483.50 | 50.99 | 29.28 | 3.53 | 34.03 | 49.77 | 74.00 | -24.23 | Horizontal |
| 2500.00 | 47.11 | 29.30 | 3.56 | 34.03 | 45.94 | 74.00 | -28.06 | Horizontal |
| 2483.50 | 53.06 | 29.28 | 3.53 | 34.03 | 51.84 | 74.00 | -22.16 | Vertical |
| 2500.00 | 49.45 | 29.30 | 3.56 | 34.03 | 48.28 | 74.00 | -25.72 | Vertical |

Average value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 2483.50 | 37.98 | 29.28 | 3.53 | 34.03 | 36.76 | 54.00 | -17.24 | Horizontal |
| 2500.00 | 34.26 | 29.30 | 3.56 | 34.03 | 33.09 | 54.00 | -20.91 | Horizontal |
| 2483.50 | 39.84 | 29.28 | 3.53 | 34.03 | 38.62 | 54.00 | -15.38 | Vertical |
| 2500.00 | 36.10 | 29.30 | 3.56 | 34.03 | 34.93 | 54.00 | -19.07 | Vertical |

# 5. ANTENNA APPLICATION

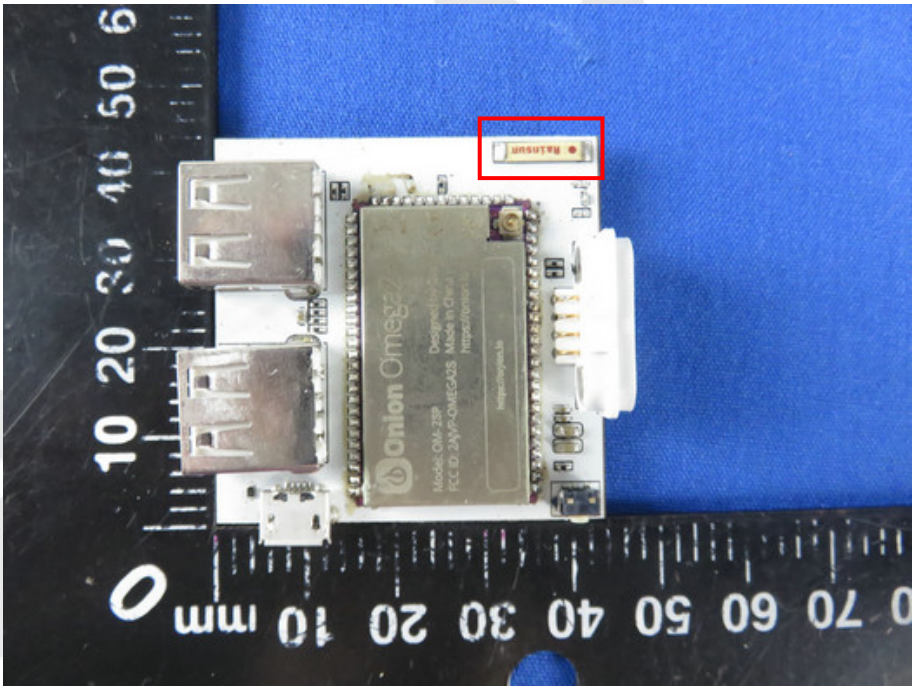
## 5.1. Antenna requirement

The EUT'S antenna is met the requirement of FCC part 15C section 15.203.

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. 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 provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

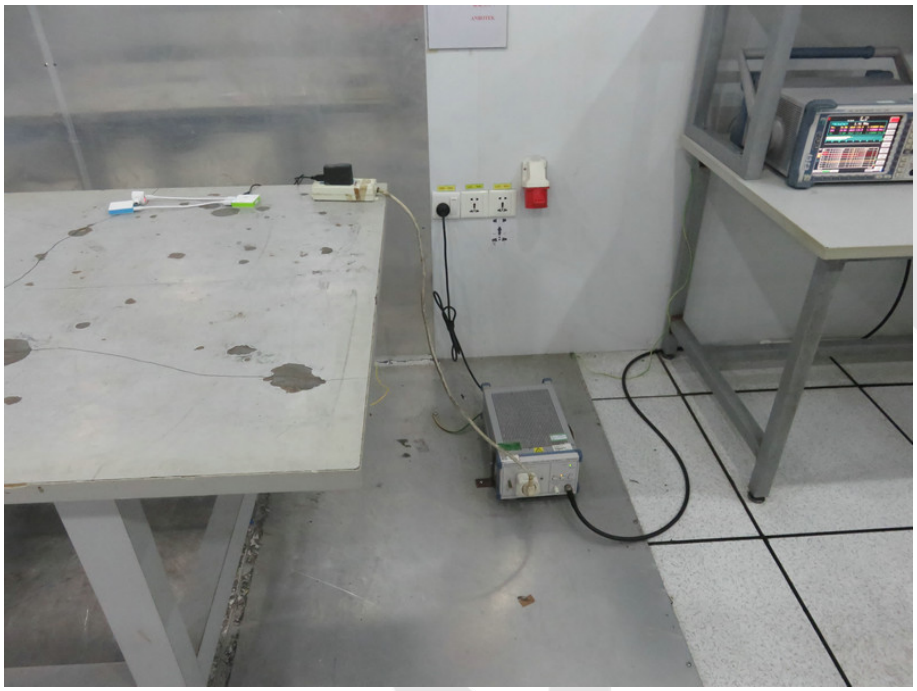
## 5.2. Result

The EUT's antenna used a ceramic antenna which is permanently attached, The antenna's gain is 1.5dBi and meets the requirement.

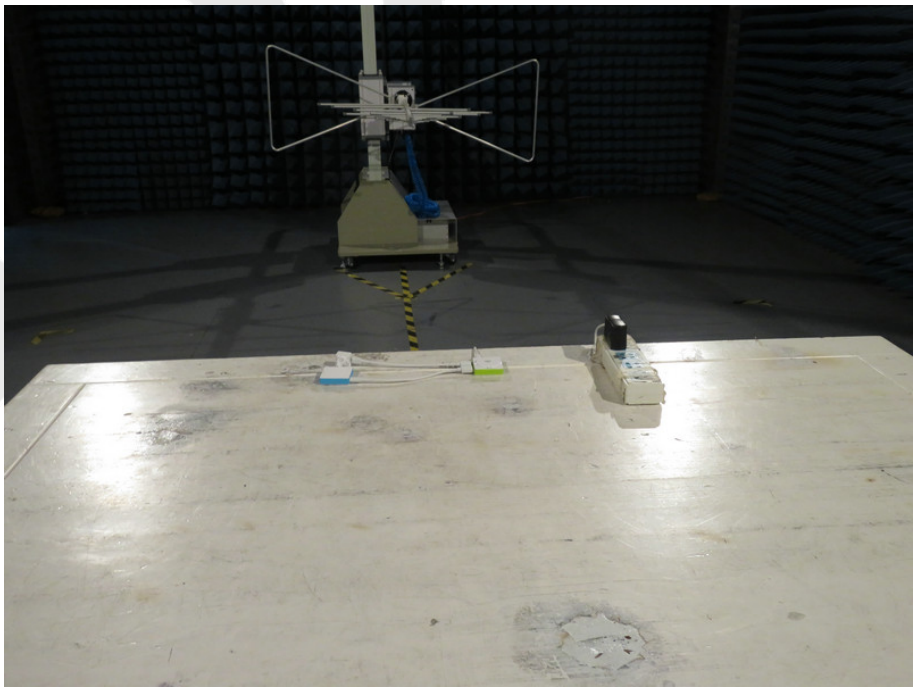


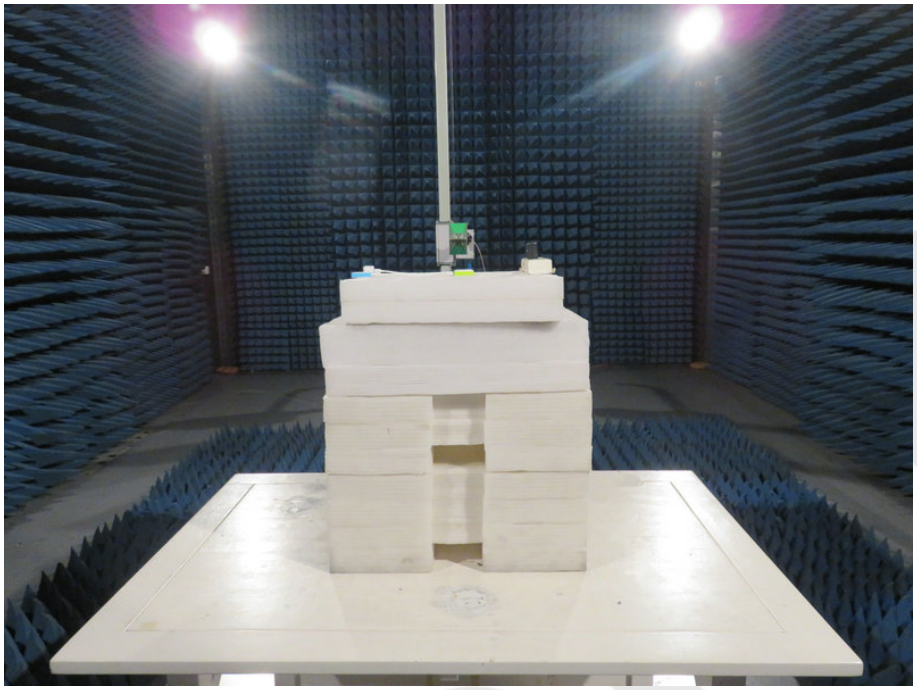
# 6. PHOTOGRAPH

## 6.1. Photo of Conducted Emission Measurement

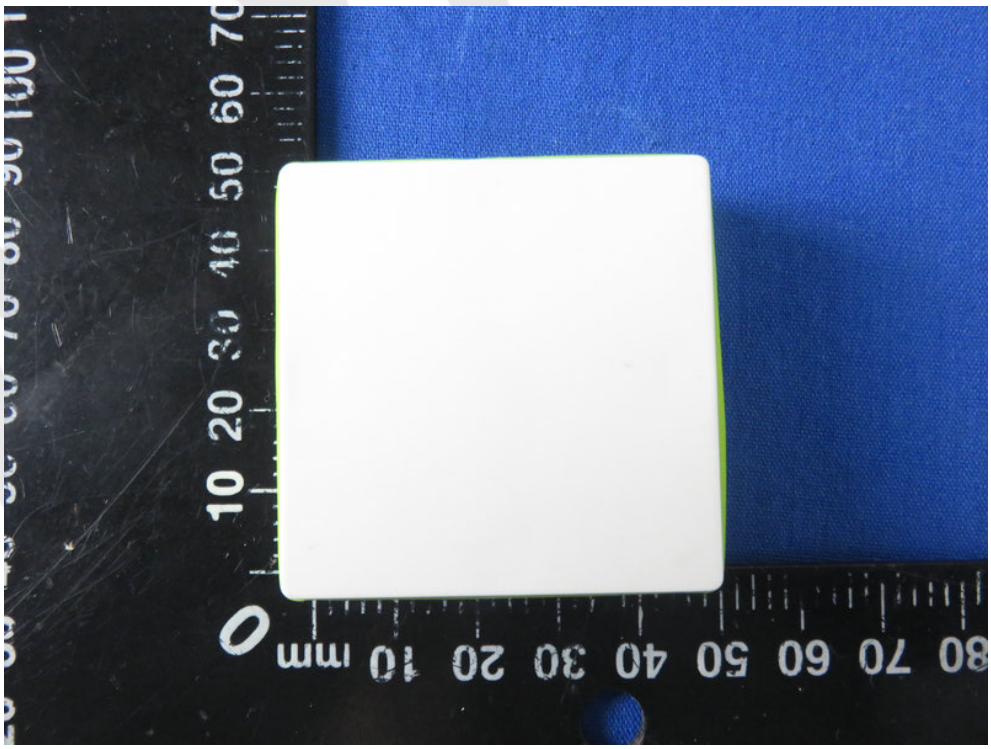


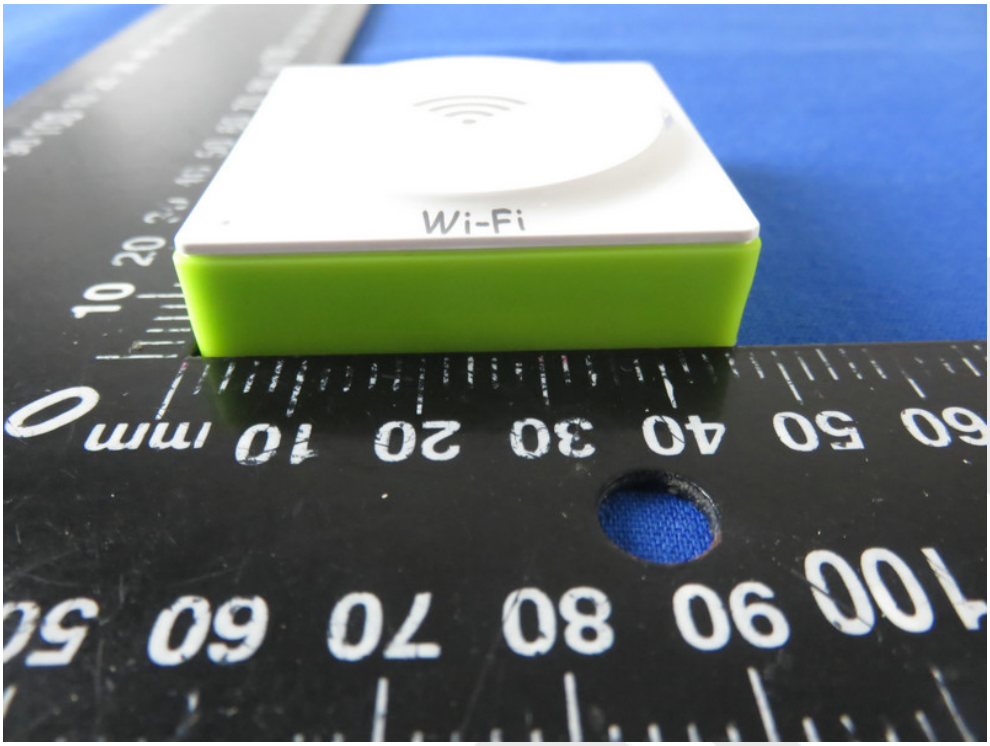
## 6.2. Photo of Radiation Emission Test

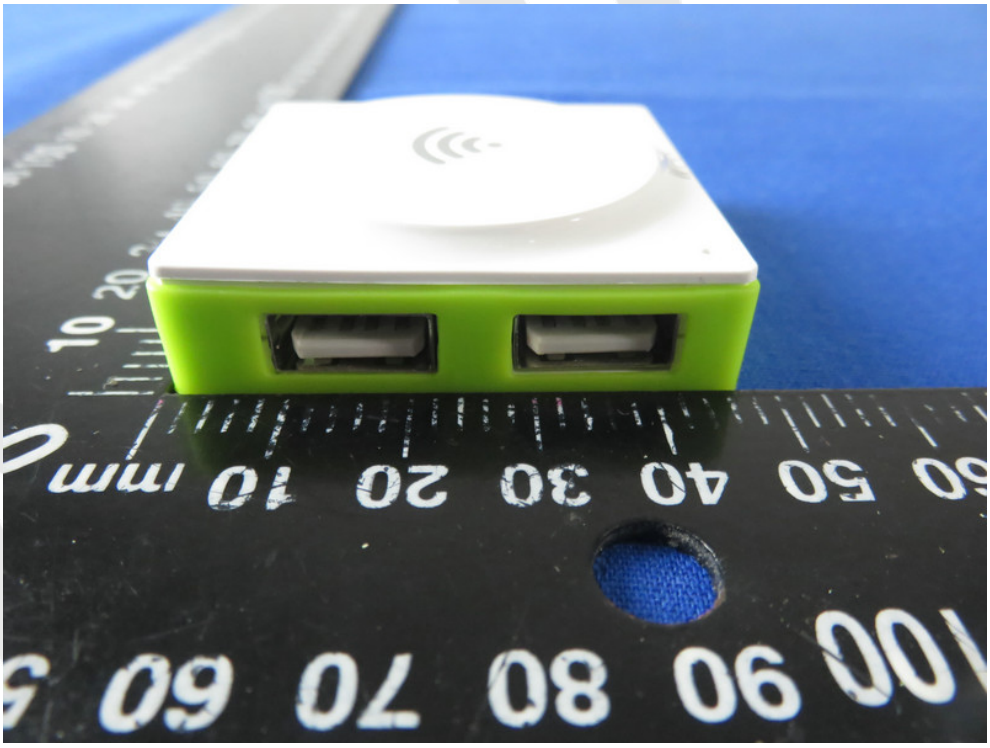


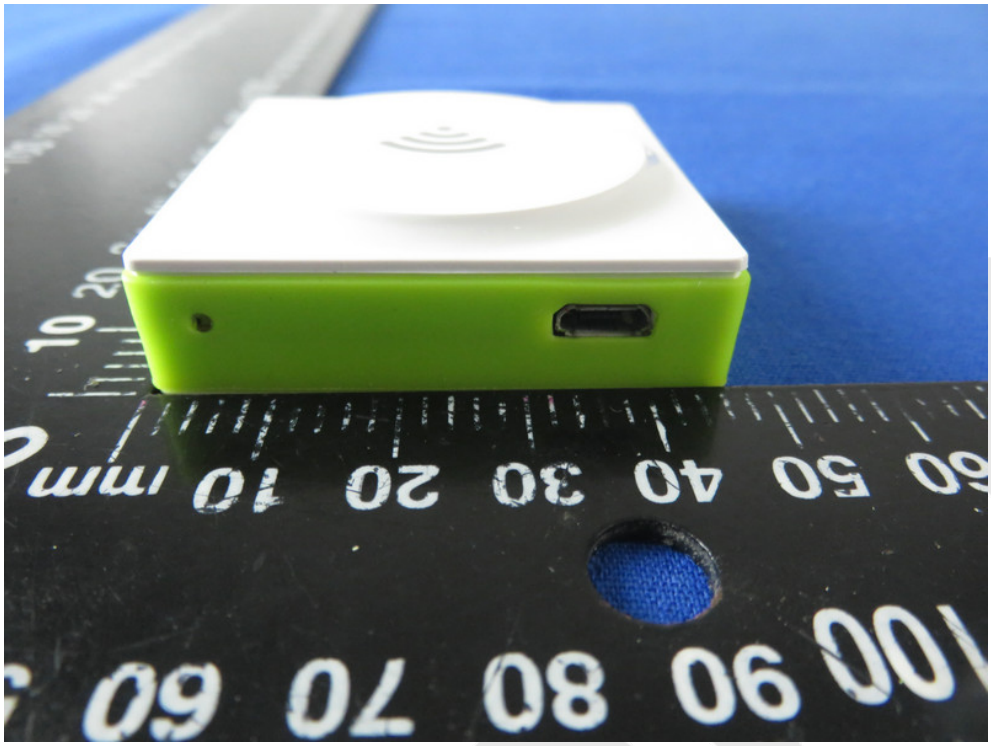


# APPENDIX II (EXTERNAL PHOTOS)

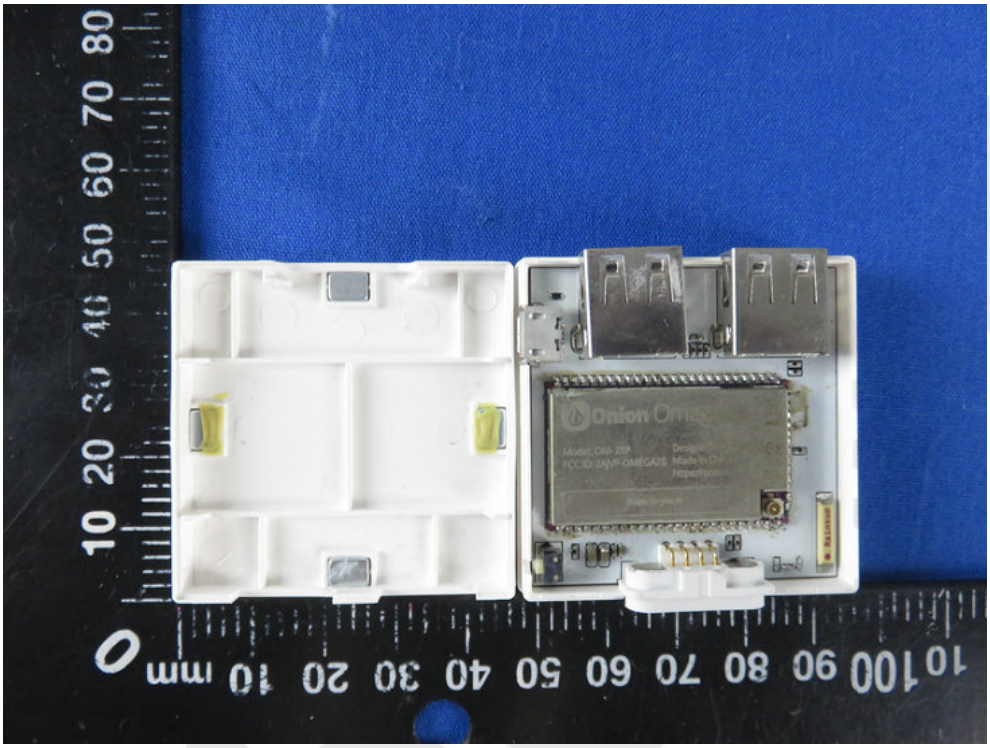



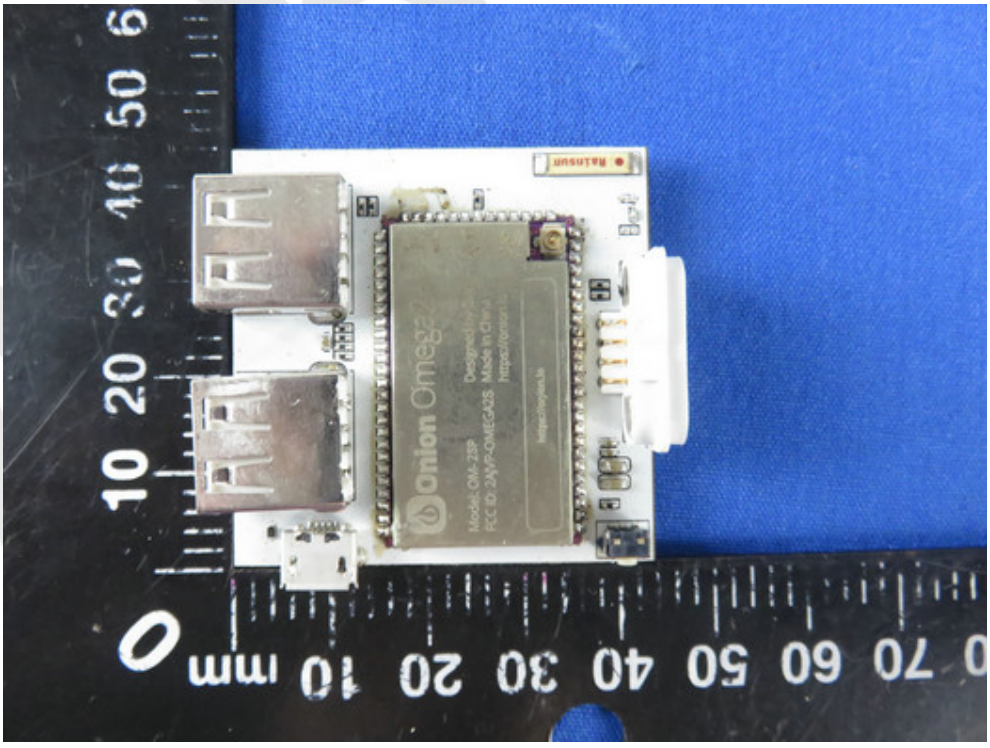

Wi-Fi

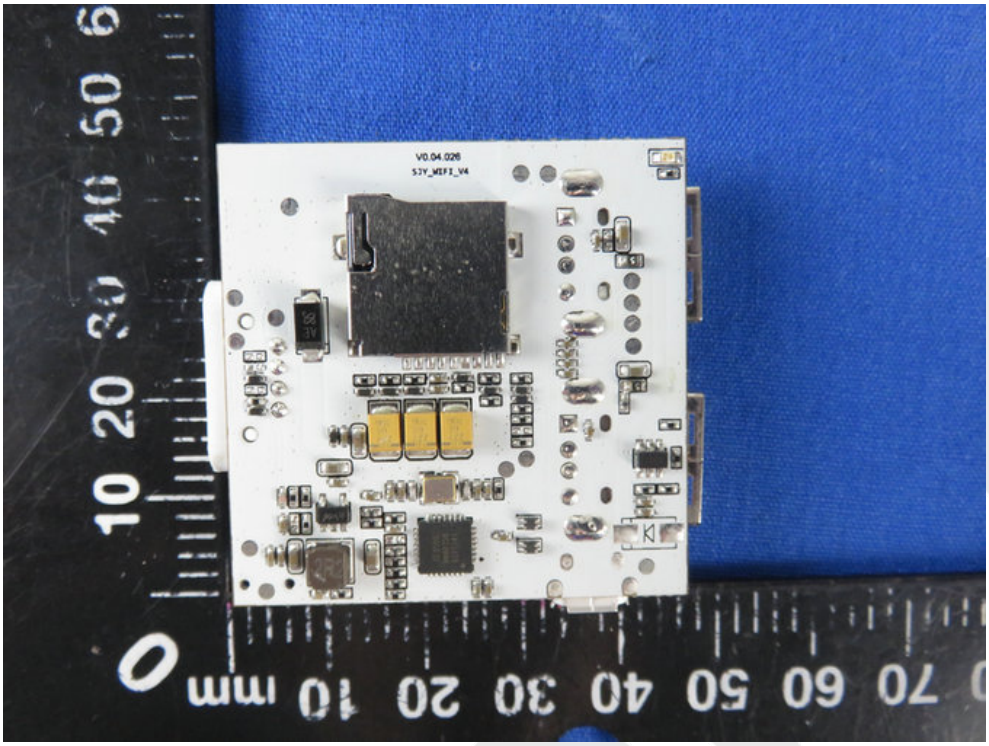


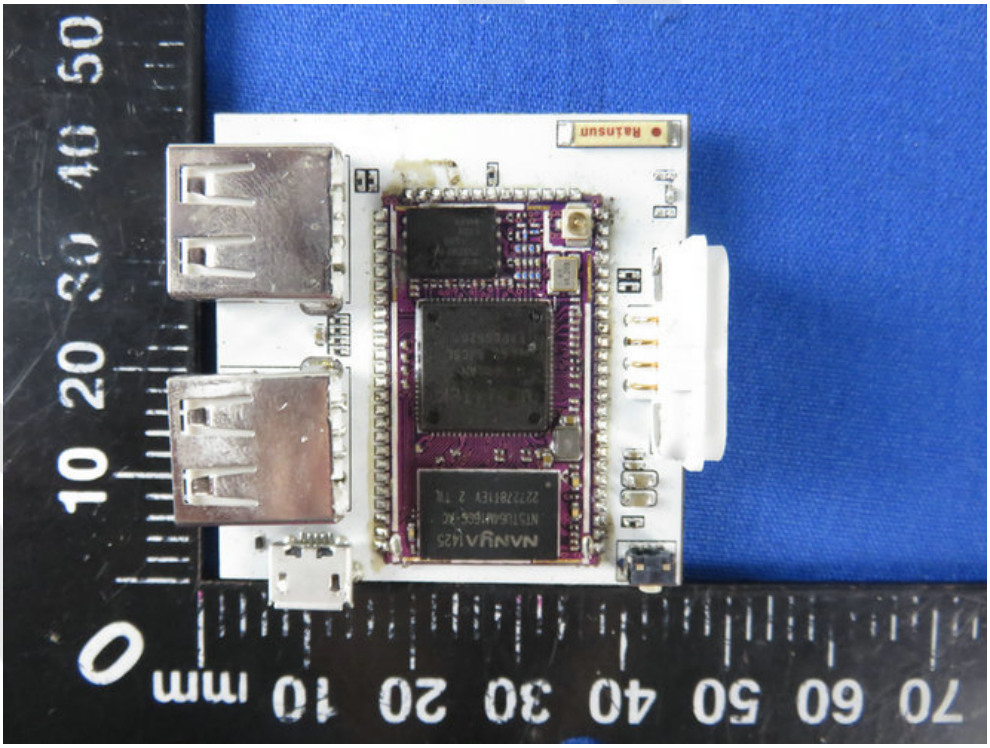


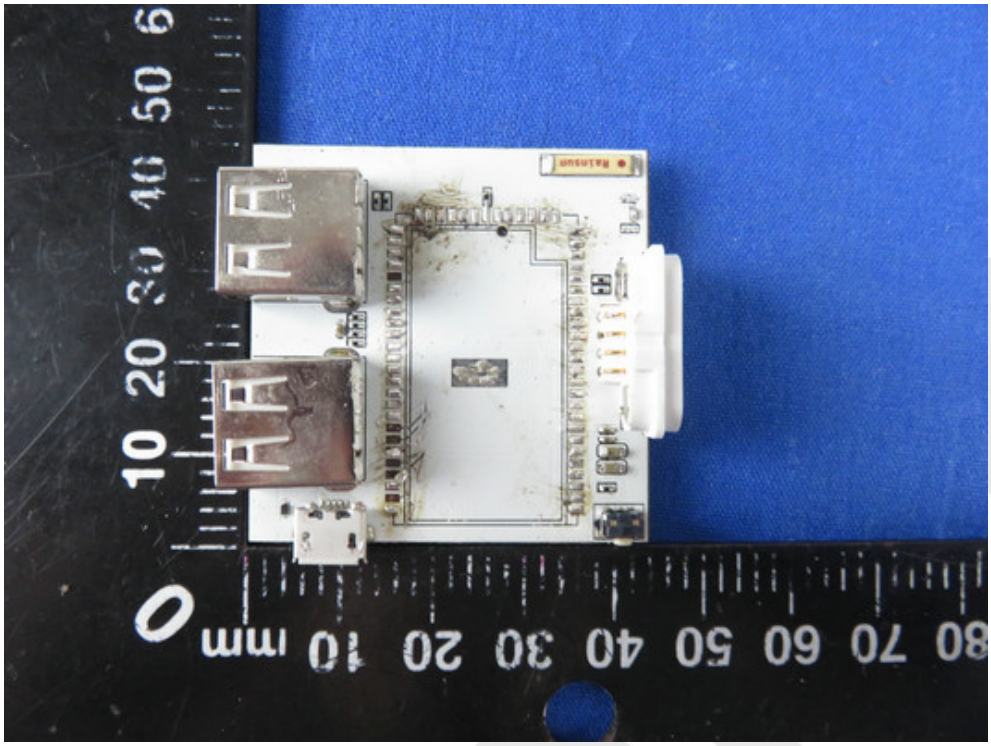
# APPENDIX III(INTERNAL PHOTOS)

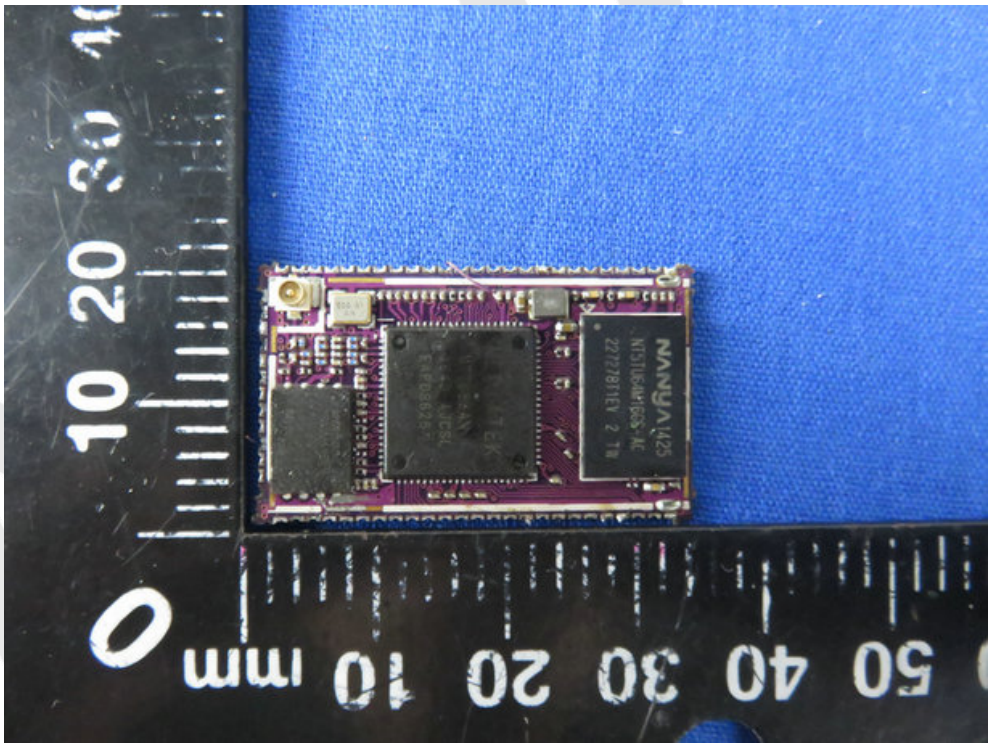


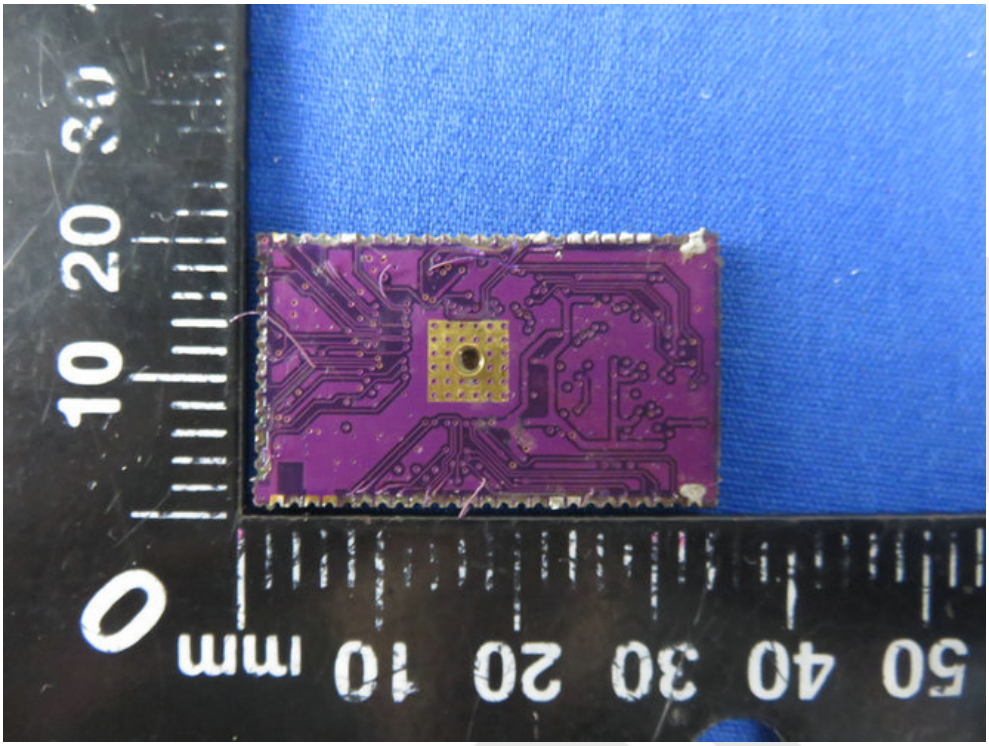








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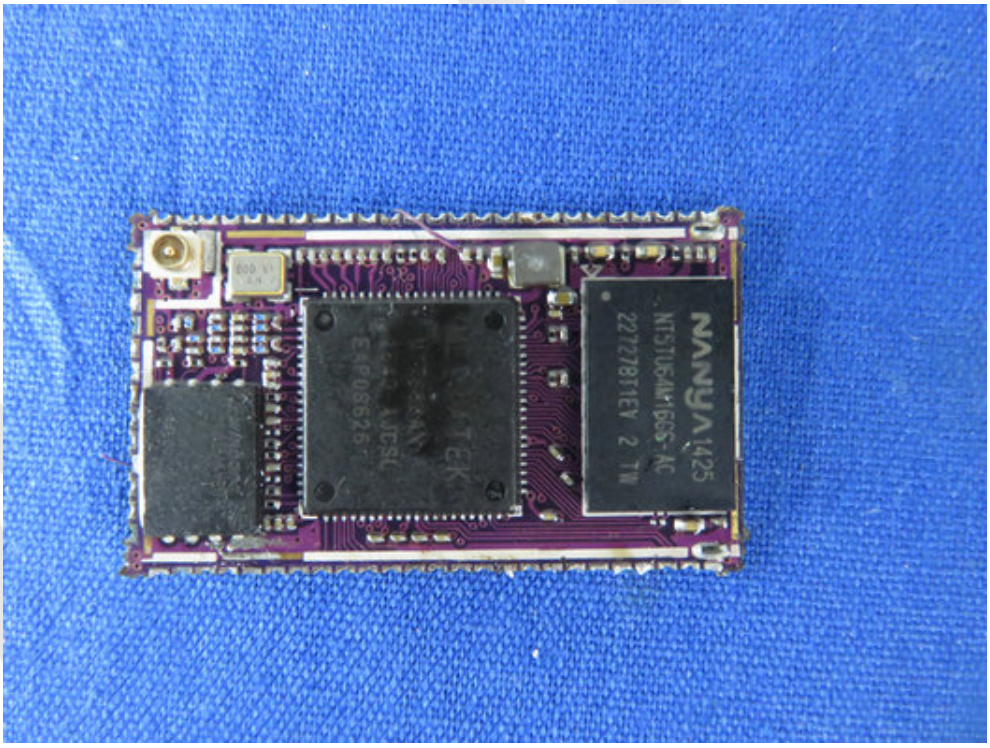
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