# FCC TEST REPORT

# FCC ID: 2AQURWF96S

| | | |
|---|---|---|
| Product | : | Wi-Fi Outdoor Smart Plug |
| Model Name | : | WF96S |
| Brand | : | EVA LOGIK |
| Report No. | : | PTC19052900302E-FC01 |

**Prepared for**

NIE-TECH Co., Ltd

Jinlian commercial center 9001, Jinxiu road No.2, Changan Town,Dongguan City, GuangDongProv., CHINA

**Prepared by**

Dongguan Precise Testing & Certification Corp., Ltd.

Building D, Baoding Technology Park, Guangming Road 2, Guangming Community, Dongcheng District, Dongguan, Guangdong, China

# 1 TEST RESULT CERTIFICATION

| | | |
|---|---|---|
| Applicant's name | : | NIE-TECH Co., Ltd |
| Address | : | Jinlian commercial center 9001, Jinxiu road No.2, Changan Town,Dongguan City, GuangDongProv., CHINA |
| Manufacture's name | : | NIE-TECH Co., Ltd |
| Address | : | Ludipu industrial, huaide village, Humen town,Dongguan city, Guangdong Prov. China |
| Product name | : | Wi-Fi Outdoor Smart Plug |
| Model name | : | WF96S |
| Standards | : | FCC CFR47 Part 15 Section 15.247 |
| Test procedure | : | ANSI C63.10:2013 |
| Test Date | : | June 10, 2019 to July 11, 2019 |
| Date of Issue | : | July 15, 2019 |
| Test Result | : | Pass |

This device described above has been tested by PTC, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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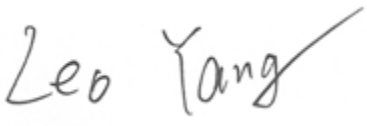
Test Engineer:



Leo Yang / Engineer

Technical Manager:

Chris Du / Manager

# Contents

## 2 Test Summary

| Test Items | Test Requirement | Result |
|---|---|---|
| Conduct Emission | 15.207 | PASS |
| Radiated Spurious Emissions | 15.205(a)<br>15.209<br>15.247(d) | PASS |
| Conducted Spurious Emission | 15.247(d) | PASS |
| Band edge | 15.247(d)<br>15.205(a) | PASS |
| 6dB Bandwidth | 15.247(a)(2) | PASS |
| Maximum Peak Output Power | 15.247(b)(1) | PASS |
| Power Spectral Density | 15.247(e) | PASS |
| Antenna Requirement | 15.203 | PASS |
| Remark:<br>N/A: Not Applicable | | |

# 3 General Information

## 3.1 General Description of E.U.T.

| | | |
|---|---|---|
| Product Name | : | Wi-Fi Outdoor Smart Plug |
| Model Name | : | WF96S |
| Specification | : | 802.11b/g/n HT20 |
| Operation Frequency | : | 2412-2462MHz for 802.11b/g;<br>2412-2462MHz for 802.11n(HT20); |
| Number of Channel | : | 11 channels for 802.11b/g;<br>11 channels for 802.11n(HT20); |
| Type of Modulation | : | DSSS with DBPSK/DQPSK/CCK for 802.11b;<br>OFDM with BPSK/QPSK/16QAM/64QAM for 802.11g/n; |
| Antenna installation | : | Internal PCB Antenna |
| Antenna Gain | : | 1 dBi |
| Power supply | : | AC 120V,60Hz |
| Hardware Version | : | 1.0 |
| Software Version | : | 1.0 |

## 3.2 Channel List

The EUT has been tested under its typical operating condition.

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

Those data rates (802.11b: 1 Mbps; 802.11g: 6 Mbps; 802.11n (HT20): MCS0; were used for all test.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Frequency and Channel list for 802.11 b/g/n (HT20):

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

Test Frequency and Channel for 802.11 b/g/n (HT20):

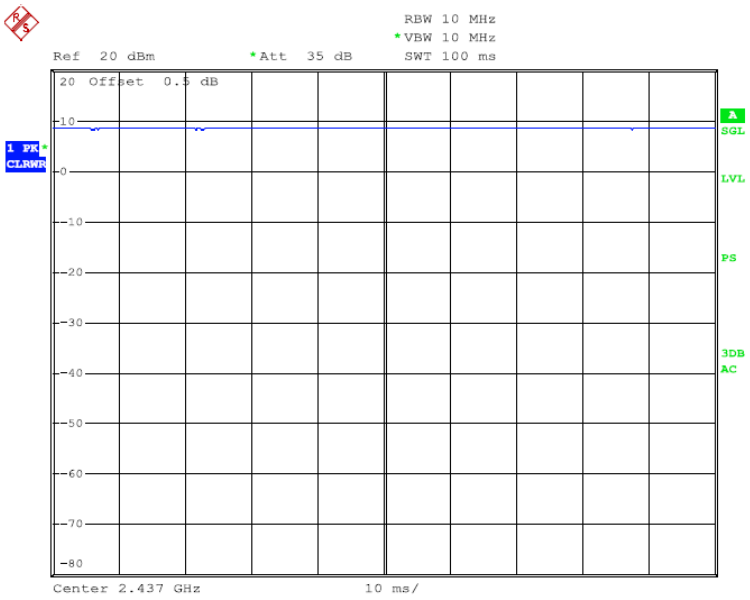
| Lowest Frequency | | Middle Frequency | | Highest Frequency | |
|---|---|---|---|---|---|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 1 | 2412 | 6 | 2437 | 11 | 2462 |

The maximum duty cycle as following table:

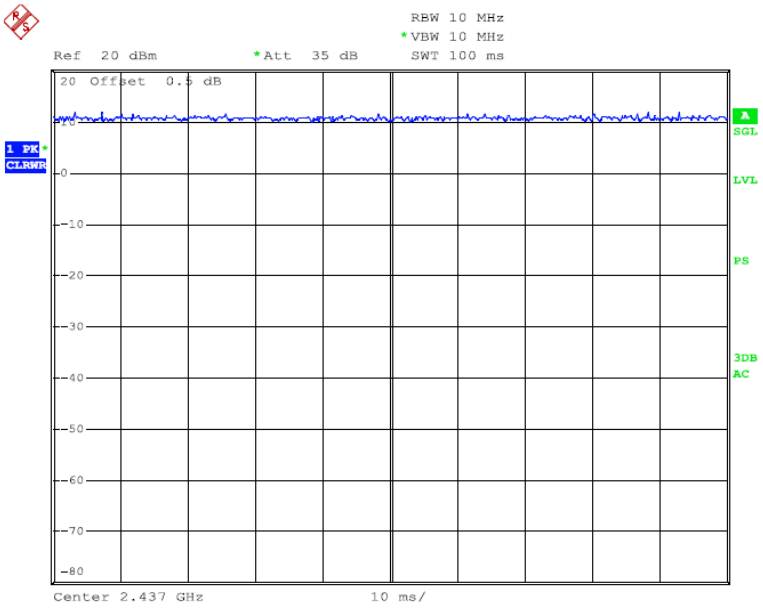
| Test Mode | $T_{on}$(ms) | $T_{on+off}$(ms) | Duty Cycle(%) |
|---|---|---|---|
| 802.11b | 100 | 100 | 100% |
| 802.11g | 100 | 100 | 100% |
| 802.11n(HT20) | 100 | 100 | 100% |

Test Plots:

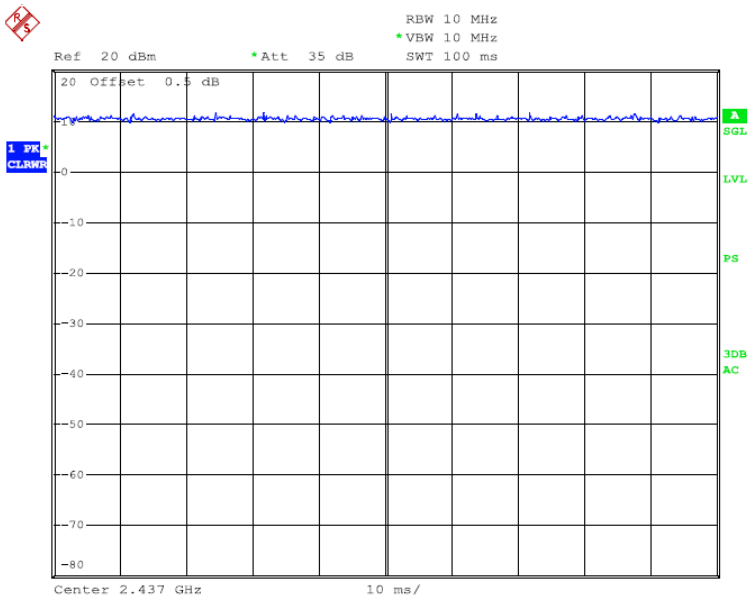
802.11b



802.11g




802.11n(HT20)



## 3.3 Test Site

Dongguan Precise Testing & Certification Corp., Ltd.

Building D, Baoding Technology Park, Guangming Road2, Dongcheng District, Dongguan, Guangdong, China

FCC Registration Number: 790290

A2LA Certificate No.: 4408.01

IC Registration Number: 12191A-1

# 4 Equipment During Test

## 4.1 Equipments List

RF Conducted Test

| Name of Equipment | Manufacturer | Model | Serial No. | Characteristics | Calibration Due |
|---|---|---|---|---|---|
| MXG Signal Analyzer | Agilent | N9020A | MY56070279 | 10Hz-30GHz | Sep. 19, 2019 |
| Coaxial Cable | CDS | 79254 | 46107086 | 10Hz-30GHz | Sep. 19, 2019 |
| Power Meter | Anritsu | ML2495A | 0949003 | 300MHz-40GHz | Sep. 19, 2019 |
| Power Sensor | Anritsu | MA2411B | 0917017 | 300MHz-40GHz | Sep. 19, 2019 |

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

Radiated Emissions(Test Frequency from 9KHz-18GHz)

| Name of Equipment | Manufacturer | Model | Serial No. | Characteristics | Calibration Due |
|---|---|---|---|---|---|
| EMI Test Receiver | Rohde&Schwarz | ESCI | 101417 | 9KHz-3GHz | Sep.19, 2019 |
| Loop Antenna | Schwarzbeck | FMZB 1519 | 012 | 9 KHz -30MHz | Sep.19, 2019 |
| Bilog Antenna | SCHWARZBECK | VULB9160 | 9160-3355 | 25MHz-2GHz | Sep.19, 2019 |
| Preamplifier (low frequency) | SCHWARZBECK | BBV 9475 | 9745-0013 | 1MHz-1GHz | Sep.19, 2019 |
| Cable | Schwarzbeck | PLF-100 | 549489 | 9KHz-3GHz | Sep.19, 2019 |
| Spectrum Analyzer | Agilent | E4407B | MY45109572 | 9KHz-40GHz | Sep.19, 2019 |
| Horn Antenna | SCHWARZBECK | 9120D | 9120D-1246 | 1GHz-18GHz | Sep.19, 2019 |
| Power Amplifier | LUNAR EM | LNA1G18-40 | J10100000081 | 1GHz-26.5GHz | Sep.19, 2019 |
| Horn Antenna | SCHWARZBECK | BBHA 9170 | 9170-181 | 14GHz-40GHz | Sep.25, 2019 |
| Amplifier | SCHWARZBECK | BBV 9721 | 9721-205 | 18GHz-40GHz | Sep.19, 2019 |
| Cable | H+S | CBL-26 | N/A | 1GHz-26.5GHz | Sep.19, 2019 |
| RF Cable | R&S | R204 | R21X | 1GHz-40GHz | Sep.19, 2019 |

Conducted Emissions

| Name of Equipment | Manufacturer | Model | Serial No. | Characteristics | Calibration Due |
|---|---|---|---|---|---|
| EMI Test Receiver | Rohde&Schwarz | ESCI | 101417 | 9KHz-3GHz | Sep. 19, 2019 |
| Artificial Mains Network | Rohde&Schwarz | L2-16B | 000WX31025 | 9KHz-300MHz | Sep. 19, 2019 |
| Artificial Mains Network | Rohde&Schwarz | ENV216 | 101342 | 9KHz-300MHz | Sep. 19, 2019 |

## 4.2 Measurement Uncertainty

| Parameter | Uncertainty |
|---|---|
| RF output power, conducted | ±1.0dB |
| Power Spectral Density, conducted | ±2.2dB |
| Radio Frequency | ± 1 x $10^{-6}$ |
| Bandwidth | ± 1.5 x $10^{-6}$ |
| Time | ±2% |
| Duty Cycle | ±2% |
| Temperature | ±1°C |
| Humidity | ±5% |
| DC and low frequency voltages | ±3% |
| Conducted Emissions (150kHz~30MHz) | ±3.64dB |
| Radiated Emission(30MHz~1GHz) | ±5.03dB |
| Radiated Emission(1GHz~25GHz) | ±4.74dB |

## 4.3 Description of Support Units

| Equipment | Model No. | Series No. |
|---|---|---|
| N/A | N/A | N/A |

# 5 Conducted Emission

| | | |
|---|---|---|
| Test Requirement: | : | FCC CFR 47 Part 15 Section 15.207 |
| Test Method | : | ANSI C63.10: 2013 |
| Test Result | : | PASS |
| Frequency Range | : | 150kHz to 30MHz |
| Class/Severity | : | Class B |

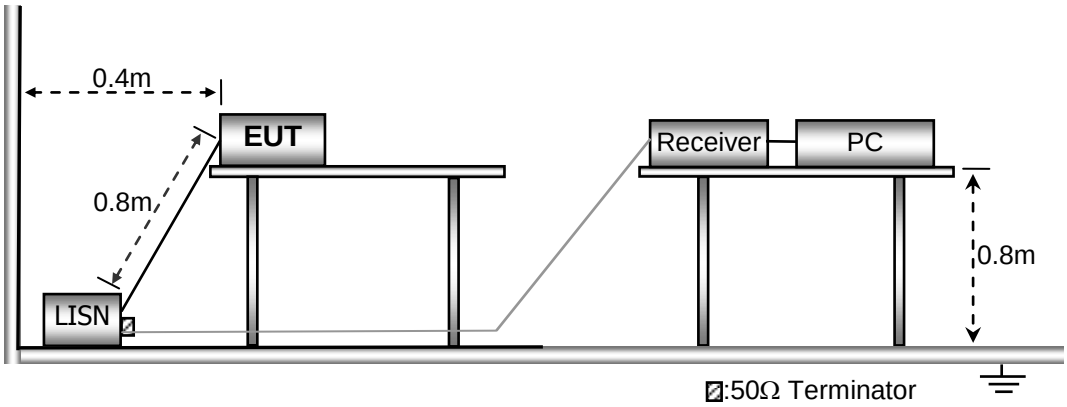
## 5.1 E.U.T. Operation

Operating Environment :

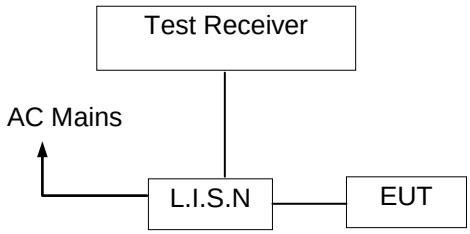
| | | |
|---|---|---|
| Temperature | : | 24.5 °C |
| Humidity | : | 51.3 % RH |
| Atmospheric Pressure | : | 101.11kPa |

## 5.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10:2013.



## 5.3 Test SET-UP (Block Diagram of Configuration)




## 5.4 Measurement Procedure

1. The EUT was placed on a table, which is 0.8m above ground plane.

2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.

3. Repeat above procedures until all frequency measured was complete.

## 5.5 Conducted Emission Limit

**Conducted Emission**

| Frequency(MHz) | Quasi-peak | Average |
|---|---|---|
| 0.15-0.5 | 66-56 | 56-46 |
| 0.5-5.0 | 56 | 46 |
| 5.0-30.0 | 60 | 50 |

**Note:**
1. The lower limit shall apply at the transition frequencies
2.The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

## 5.6 Measurement Description

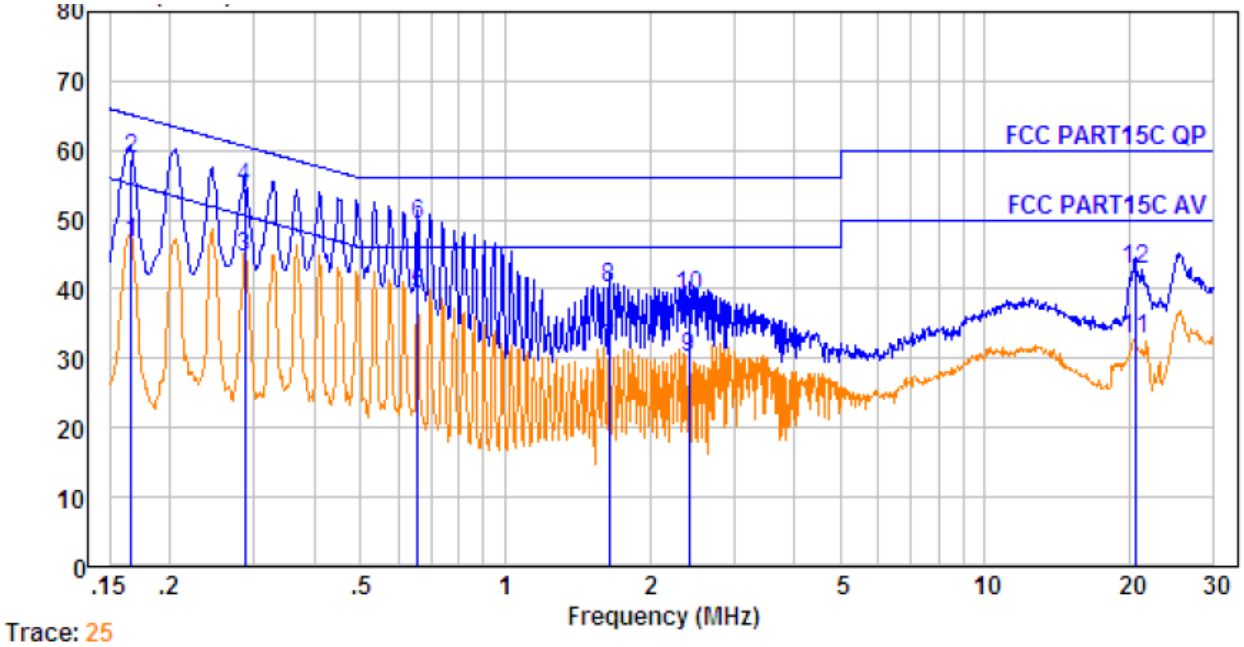
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

## 5.7 Conducted Emission Test Result

Pass.

Please refer to the following pages.

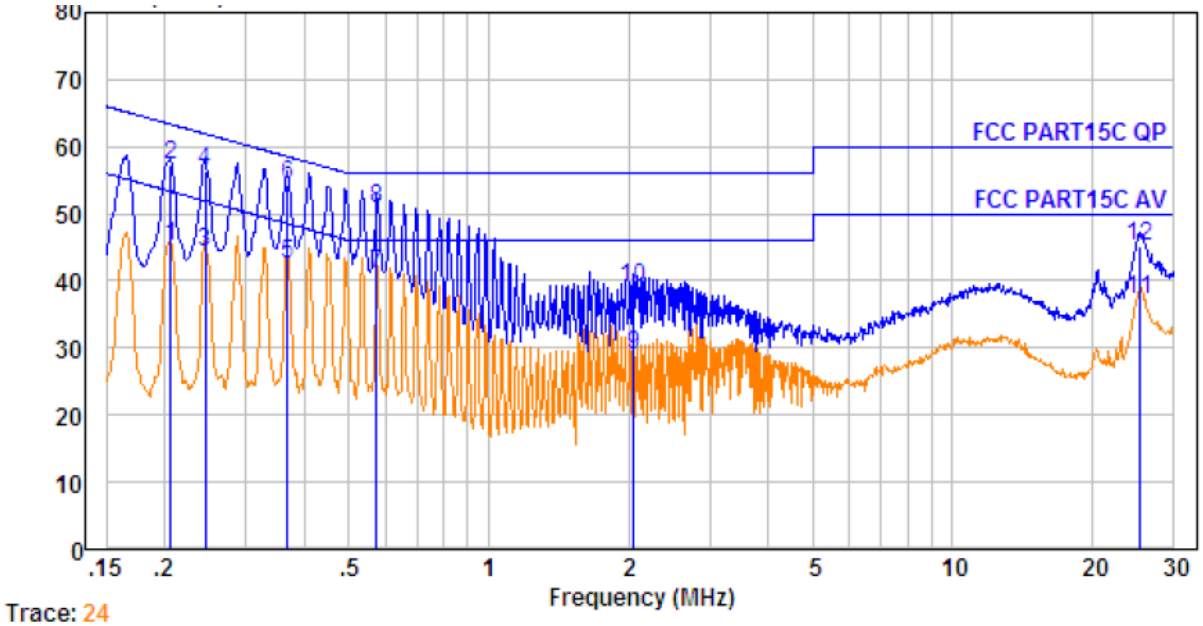
Line-AC 120V/60Hz




Trace: 25

| No. | Freq MHz | Cable Loss dB | AMN Factor dB | Receiver Reading dBµV | Emission Level dBµV | Limit dBµV | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 1. | 0.166 | 0.23 | 9.53 | 36.94 | 46.70 | 55.16 | -8.46 | Average |
| 2. | 0.166 | 0.23 | 9.53 | 48.94 | 58.70 | 65.16 | -6.46 | QP |
| 3. | 0.286 | 0.36 | 9.66 | 34.64 | 44.66 | 50.63 | -5.97 | Average |
| 4. | 0.286 | 0.36 | 9.66 | 44.64 | 54.66 | 60.63 | -5.97 | QP |
| 5. | 0.658 | 0.44 | 9.80 | 29.11 | 39.35 | 46.00 | -6.65 | Average |
| 6. | 0.658 | 0.44 | 9.80 | 39.11 | 49.35 | 56.00 | -6.65 | QP |
| 7. | 1.645 | 0.47 | 9.84 | 20.90 | 31.21 | 46.00 | -14.79 | Average |
| 8. | 1.645 | 0.47 | 9.84 | 29.90 | 40.21 | 56.00 | -15.79 | QP |
| 9. | 2.422 | 0.47 | 9.86 | 19.70 | 30.03 | 46.00 | -15.97 | Average |
| 10. | 2.422 | 0.47 | 9.86 | 28.70 | 39.03 | 56.00 | -16.97 | QP |
| 11. | 20.594 | 0.41 | 9.85 | 22.40 | 32.66 | 50.00 | -17.34 | Average |
| 12. | 20.594 | 0.41 | 9.85 | 32.40 | 42.66 | 60.00 | -17.34 | QP |

Neutral-AC 120V/60Hz




Trace: 24

| No. | Freq MHz | Cable Loss dB | AMN Factor dB | Receiver Reading dBµV | Emission Level dBµV | Limit dBµV | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 1. | 0.206 | 0.29 | 9.63 | 35.24 | 45.16 | 53.36 | -8.20 | Average |
| 2. | 0.206 | 0.29 | 9.63 | 47.24 | 57.16 | 63.36 | -6.20 | QP |
| 3. | 0.246 | 0.33 | 9.66 | 34.43 | 44.42 | 51.91 | -7.49 | Average |
| 4. | 0.246 | 0.33 | 9.66 | 46.43 | 56.42 | 61.91 | -5.49 | QP |
| 5. | 0.369 | 0.39 | 9.75 | 32.29 | 42.43 | 48.52 | -6.09 | Average |
| 6. | 0.369 | 0.39 | 9.75 | 44.29 | 54.43 | 58.52 | -4.09 | QP |
| 7. | 0.573 | 0.43 | 9.82 | 30.67 | 40.92 | 46.00 | -5.08 | Average |
| 8. | 0.573 | 0.43 | 9.82 | 40.67 | 50.92 | 56.00 | -5.08 | QP |
| 9. | 2.055 | 0.47 | 9.88 | 18.68 | 29.03 | 46.00 | -16.97 | Average |
| 10. | 2.055 | 0.47 | 9.88 | 28.68 | 39.03 | 56.00 | -16.97 | QP |
| 11. | 25.321 | 0.54 | 10.06 | 26.65 | 37.25 | 50.00 | -12.75 | Average |
| 12. | 25.321 | 0.54 | 10.06 | 34.65 | 45.25 | 60.00 | -14.75 | QP |

# 6 Radiated Spurious Emissions

Test Requirement : FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method : ANSI C63.10:2013

Test Result : PASS

Measurement Distance : 3m

Limit : See the follow table

| Frequency (MHz) | Field Strength | | Field Strength Limit at 3m Measurement Dist | |
|---|---|---|---|---|
| | uV/m | Distance (m) | uV/m | dBuV/m |
| 0.009 ~ 0.490 | 2400/F(kHz) | 300 | 10000 * 2400/F(kHz) | $20\log^{(2400/F(kHz))} + 80$ |
| 0.490 ~ 1.705 | 24000/F(kHz) | 30 | 100 * 24000/F(kHz) | $20\log^{(24000/F(kHz))} + 40$ |
| 1.705 ~ 30 | 30 | 30 | 100 * 30 | $20\log^{(30)} + 40$ |
| 30 ~ 88 | 100 | 3 | 100 | $20\log^{(100)}$ |
| 88 ~ 216 | 150 | 3 | 150 | $20\log^{(150)}$ |
| 216 ~ 960 | 200 | 3 | 200 | $20\log^{(200)}$ |
| Above 960 | 500 | 3 | 500 | $20\log^{(500)}$ |

## 6.1 EUT Operation

Operating Environment :

Temperature: : 24.5°C

Humidity: : 52 % RH

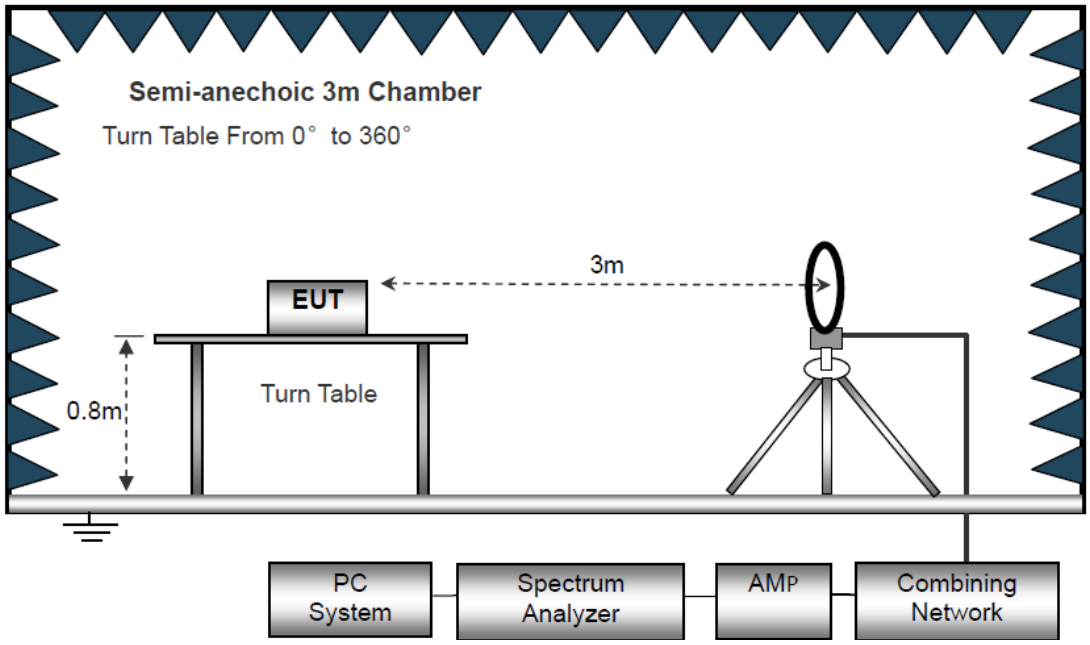
Atmospheric Pressure: : 101.11kPa

Test Voltage : AC 120V 60Hz

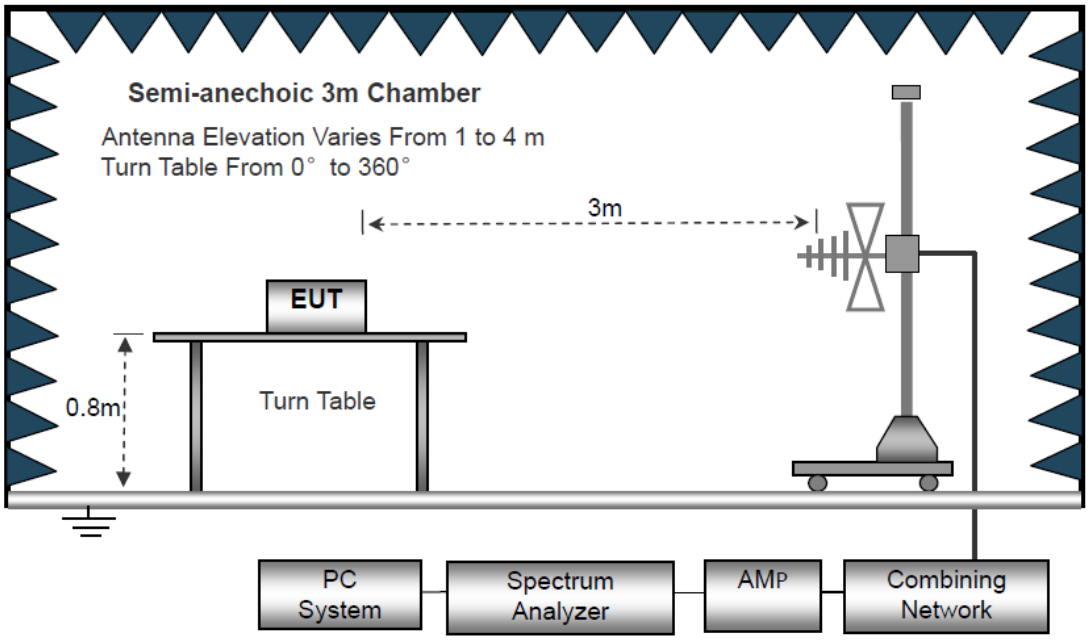
## 6.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site

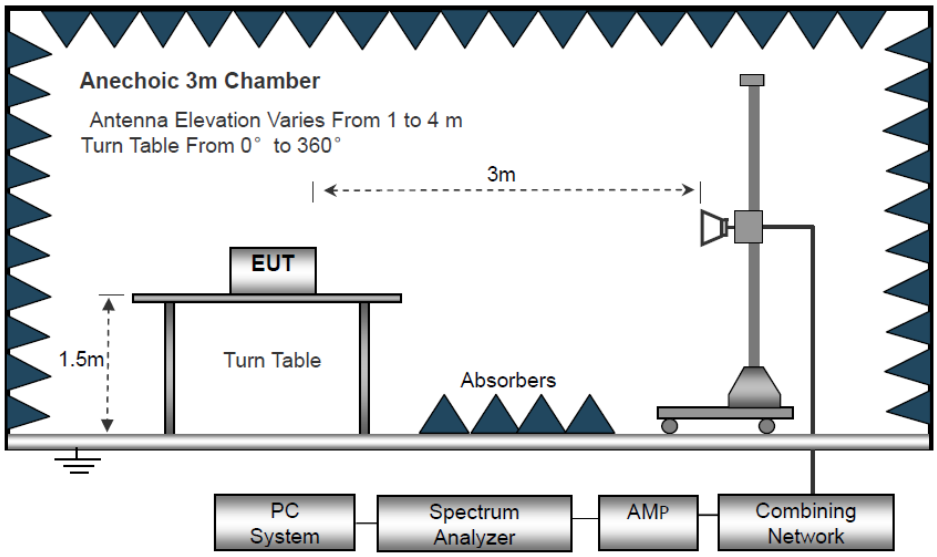
The test setup for emission measurement below 30MHz




The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz




## 6.3 Spectrum Analyzer Setup

| | | | |
|---|---|---|---|
| Below 30MHz | | | |
| IF Bandwidth | : | 10kHz | |
| Resolution Bandwidth | : | 10kHz | |
| Video Bandwidth | : | 10kHz | |
| 30MHz ~ 1GHz | | | |
| Detector | : | PK | QP |
| Resolution Bandwidth | : | 100kHz | 120kHz |
| Video Bandwidth | : | 300kHz | 300kHz |
| Above 1GHz | | | |
| Detector | : | PK | AV |
| Resolution Bandwidth | : | 1MHz | 1MHz |
| Video Bandwidth | : | 3MHz | 10Hz |

## 6.4 Test Procedure

1. Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane, And above 1000MHz, The EUT was placed on a styrofoam table which is 1.5m above ground plane.

2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.

3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.

5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

6. Repeat above procedures until the measurements for all frequencies are complete.

7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

8. The test above 1GHz must be use the fully anechoic room, and the test below 1GHz use the half anechoic room

## 6.5 Summary of Test Results

**Test Frequency: 9KHz-30MHz**

| Freq. (MHz) | Ant.Pol. H/V | Emission Level (dBuV/m) | Limit 3m (dBuV/m) | Over (dB) |
|---|---|---|---|---|
| -- | -- | -- | -- | >20 |

Note:

The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

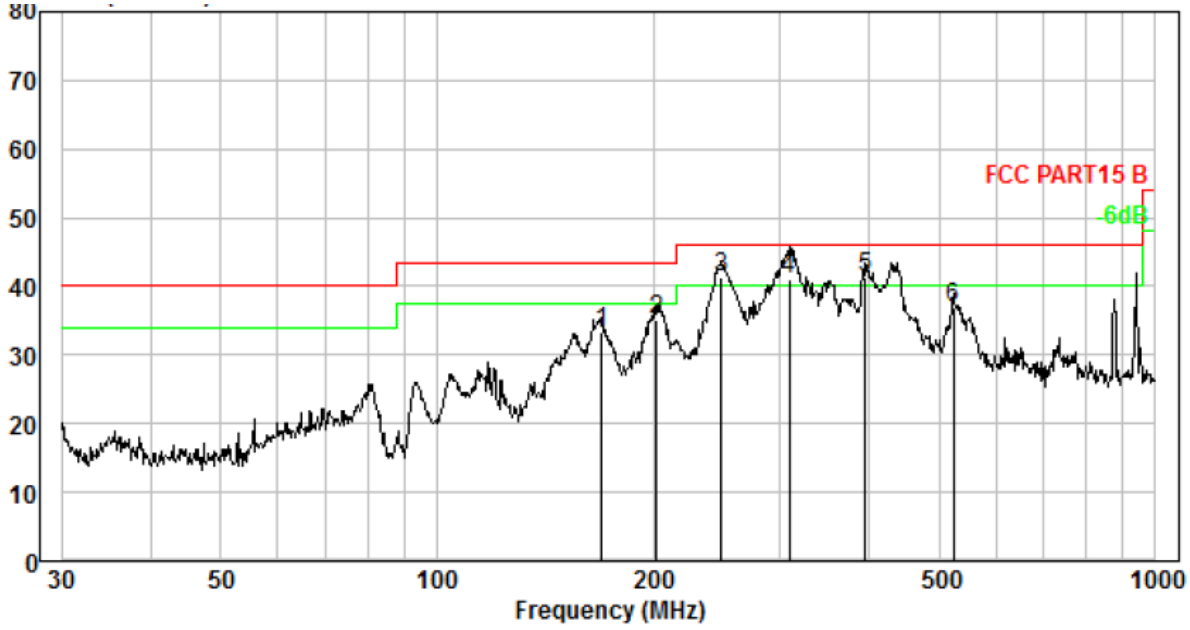
Distance extrapolation factor =40log(Specific distance/ test distance)( dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

**Test Frequency: 30MHz ~ 1GHz**

All the modulation modes were tested the data of the worst mode (TX 802.11b Low Channel) are recorded in the following pages and the others modulation methods do not exceed the limits.

Please refer to the following test plots:

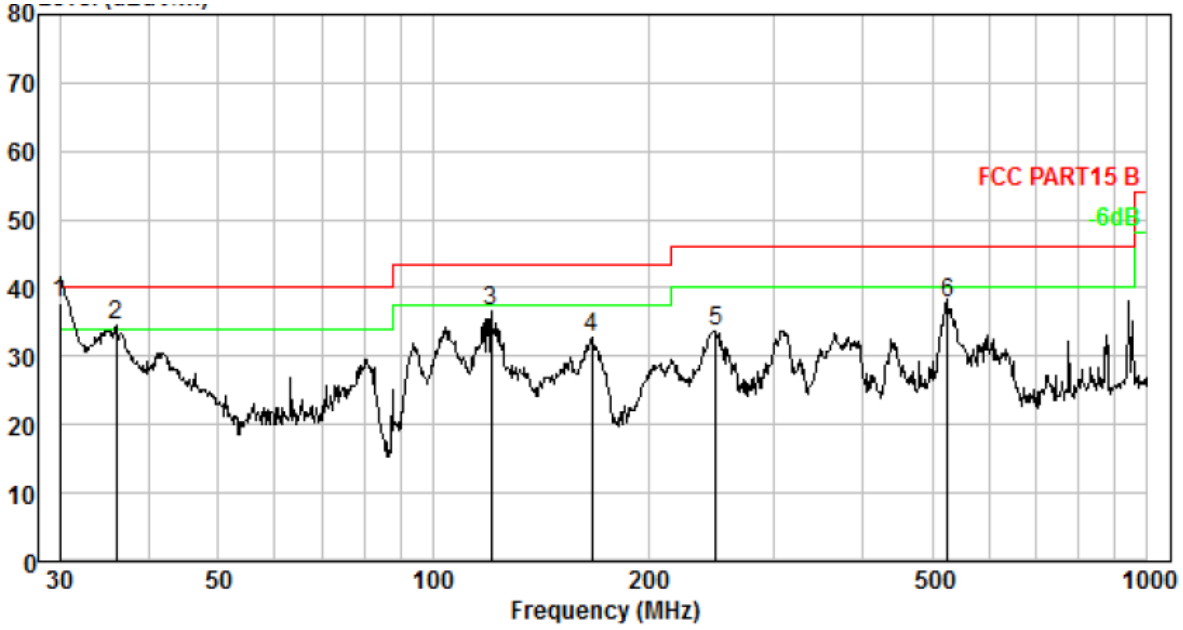
Antenna Polarization: Horizontal




| No. | Freq MHz | Cable Loss dB | ANT Factor dB/m | Receiver Reading dBuV | Preamp Factor dB | Emission Level dBuV/m | Limit dBuV/m | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 169.599 | 4.18 | 13.35 | 46.38 | 30.57 | 33.34 | 43.50 | -10.16 | QP |
| 2. | 202.100 | 4.48 | 10.42 | 50.95 | 30.63 | 35.22 | 43.50 | -8.28 | QP |
| 3. | 248.552 | 4.84 | 11.89 | 55.25 | 30.71 | 41.27 | 46.00 | -4.73 | QP |
| 4. | 308.913 | 5.21 | 13.40 | 53.20 | 30.78 | 41.03 | 46.00 | -4.97 | QP |
| 5. | 394.855 | 5.64 | 15.21 | 51.49 | 30.87 | 41.47 | 46.00 | -4.53 | QP |
| 6. | 524.554 | 6.12 | 17.41 | 44.36 | 30.97 | 36.92 | 46.00 | -9.08 | QP |

Remark:Emission Level=Reading+Cable Loss+ANT Factor-AMP Factor

Antenna Polarization: Vertical




| No. | Freq MHz | Cable Loss dB | ANT Factor dB/m | Receiver Reading dBuV | Preamp Factor dB | Emission Level dBuV/m | Limit dBuV/m | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 30.000 | 1.20 | 13.24 | 53.40 | 29.97 | 37.87 | 40.00 | -2.13 | QP |
| 2. | 36.001 | 1.52 | 13.44 | 49.68 | 30.03 | 34.61 | 40.00 | -5.39 | QP |
| 3. | 120.699 | 3.60 | 12.07 | 51.28 | 30.45 | 36.50 | 43.50 | -7.00 | QP |
| 4. | 166.651 | 4.15 | 13.51 | 45.62 | 30.57 | 32.71 | 43.50 | -10.79 | QP |
| 5. | 248.552 | 4.84 | 11.89 | 47.67 | 30.71 | 33.69 | 46.00 | -12.31 | QP |
| 6. | 526.397 | 6.13 | 17.44 | 45.21 | 30.97 | 37.81 | 46.00 | -8.19 | QP |

Remark:Emission Level=Reading+Cable Loss+ANT Factor-AMP Factor

## Test Frequency: From 1GHz to 18GHz

Low Channel (2412MHz) Worst case 802.11g

| Frequency (MHz) | S.A Reading (dBuV) | Detector (PK/AV) | Polarity (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 4824 | 35.69 | AV | V | 35.16 | 10.55 | 40.05 | 41.35 | 54 | -12.65 |
| 4824 | 36.15 | AV | H | 35.16 | 10.55 | 40.05 | 41.81 | 54 | -12.19 |
| 4824 | 41.45 | PK | V | 35.16 | 10.55 | 40.05 | 47.11 | 74 | -26.89 |
| 4824 | 46.22 | PK | H | 35.16 | 10.55 | 40.05 | 51.88 | 74 | -22.12 |
| 16884 | 34.28 | AV | V | 35.39 | 10.58 | 39.42 | 40.83 | 54 | -13.17 |
| 16884 | 35.02 | AV | H | 35.39 | 10.58 | 39.42 | 41.57 | 54 | -12.43 |
| 16884 | 46.82 | PK | V | 35.39 | 10.58 | 39.42 | 53.37 | 74 | -20.63 |
| 16884 | 48.12 | PK | H | 35.39 | 10.58 | 39.42 | 54.67 | 74 | -19.33 |

Middle Channel (2437MHz) Worst case 802.11b

| Frequency (MHz) | S.A Reading (dBuV) | Detector (PK/AV) | Polarity (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 4874 | 36.15 | AV | V | 35.18 | 10.58 | 40.07 | 41.84 | 54 | -12.16 |
| 4874 | 37.22 | AV | H | 35.18 | 10.58 | 40.07 | 42.91 | 54 | -11.09 |
| 4874 | 45.92 | PK | V | 35.18 | 10.58 | 40.07 | 51.61 | 74 | -22.39 |
| 4874 | 48.17 | PK | H | 35.18 | 10.58 | 40.07 | 53.86 | 74 | -20.14 |
| 17059 | 35.04 | AV | V | 35.42 | 10.62 | 39.16 | 41.92 | 54 | -12.08 |
| 17059 | 36.62 | AV | H | 35.42 | 10.62 | 39.16 | 43.5 | 54 | -10.5 |
| 17059 | 46.92 | PK | V | 35.42 | 10.62 | 39.16 | 53.8 | 74 | -20.2 |
| 17059 | 47.15 | PK | H | 35.42 | 10.62 | 39.16 | 54.03 | 74 | -19.97 |

High Channel (2462MHz) Worst case 802.11 n (HT20)

| Frequency (MHz) | S.A Reading (dBuV) | Detector (PK/AV) | Polarity (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 4924 | 36.32 | AV | V | 35.26 | 10.54 | 40.01 | 42.11 | 54 | -11.89 |
| 4924 | 37.12 | AV | H | 35.26 | 10.54 | 40.01 | 42.91 | 54 | -11.09 |
| 4924 | 46.58 | PK | V | 35.26 | 10.54 | 40.01 | 52.37 | 74 | -21.63 |
| 4924 | 49.67 | PK | H | 35.26 | 10.54 | 40.01 | 55.46 | 74 | -18.54 |
| 17234 | 35.24 | AV | V | 35.67 | 10.66 | 39.04 | 42.53 | 54 | -11.47 |
| 17234 | 36.72 | AV | H | 35.67 | 10.66 | 39.04 | 44.01 | 54 | -9.99 |
| 17234 | 47.12 | PK | V | 35.67 | 10.66 | 39.04 | 54.41 | 74 | -19.59 |
| 17234 | 48.67 | PK | H | 35.67 | 10.66 | 39.04 | 55.96 | 74 | -18.04 |

Note:

1. The testing has been conformed to 10*2462MHz=24620MHz.
2. All other emissions more than 30dB below the limit.
3. Factor = Antenna Factor + Cable Loss – Pre-amplifier.
   Emission Level = Reading + Factor
   Margin=Emission Level-Limit
4. X-Axis, Y-Axis and Z-Axis were investigated. The results above show only the worst case.

Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz

2.4G WiFi (802.11b/g/n)mode have been tested, and the worst result(802.11g) was report as below

| Test Mode: 802.11g Low Channel 2412MHz | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Level (dBuV/m) | Limit (dBuV/m) | Over (dB) | Polarity H/V | Test Value |
| 2310.00 | 26.76 | 27.27 | 6.62 | 60.65 | 74 | -13.35 | V | Peak |
| 2390.00 | 27.29 | 27.53 | 6.75 | 61.57 | 74 | -12.43 | V | |
| 2310.00 | 26.37 | 27.27 | 6.62 | 60.26 | 74 | -13.74 | H | |
| 2390.00 | 26.77 | 27.53 | 6.75 | 61.05 | 74 | -12.95 | H | |
| 2310.00 | 12.91 | 27.27 | 6.62 | 46.80 | 54 | -7.20 | V | Average |
| 2390.00 | 13.21 | 27.53 | 6.75 | 47.49 | 54 | -6.51 | V | |
| 2310.00 | 12.93 | 27.27 | 6.62 | 46.82 | 54 | -7.18 | H | |
| 2390.00 | 14.16 | 27.53 | 6.75 | 48.44 | 54 | -5.56 | H | |

| Test Mode: 802.11g High Channel 2462MHz | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Level (dBuV/m) | Limit (dBuV/m) | Over (dB) | Polarity H/V | Test Value |
| 2483.50 | 25.69 | 27.85 | 6.83 | 60.37 | 74 | -13.63 | V | Peak |
| 2500.00 | 25.68 | 27.9 | 6.84 | 60.42 | 74 | -13.58 | V | |
| 2483.50 | 26.12 | 27.85 | 6.83 | 60.8 | 74 | -13.2 | H | |
| 2500.00 | 26.17 | 27.9 | 6.84 | 60.91 | 74 | -13.09 | H | |
| 2483.50 | 13.03 | 27.85 | 6.83 | 47.71 | 54 | -6.29 | V | Average |
| 2500.00 | 12.7 | 27.9 | 6.84 | 47.44 | 54 | -6.56 | V | |
| 2483.50 | 14.11 | 27.85 | 6.83 | 48.79 | 54 | -5.21 | H | |
| 2500.00 | 12.94 | 27.9 | 6.84 | 47.68 | 54 | -6.32 | H | |

## Test Frequency: From 18GHz to 25GHz

The measurements were more than 20dB below the limit and not reported.

# 7 Conducted Spurious Emission

| | | |
|---|---|---|
| Test Requirement | : | FCC CFR47 Part 15 Section 15.247 |
| Test Method | : | ANSI C63.10:2013 |
| Test Limit | : | Regulation 15.247 (d),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)). |

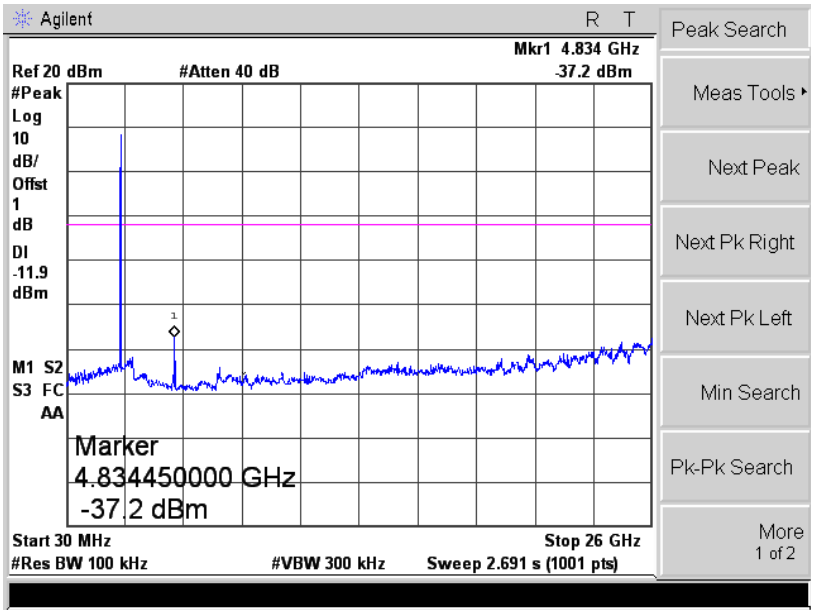
## 7.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto
Detector function = peak, Trace = max hold

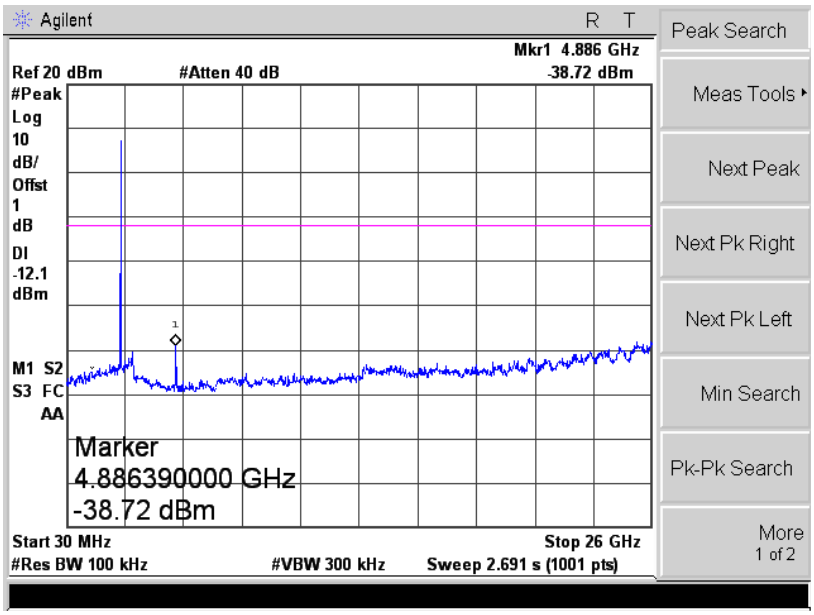
## 7.2 Test Result

802.11 b

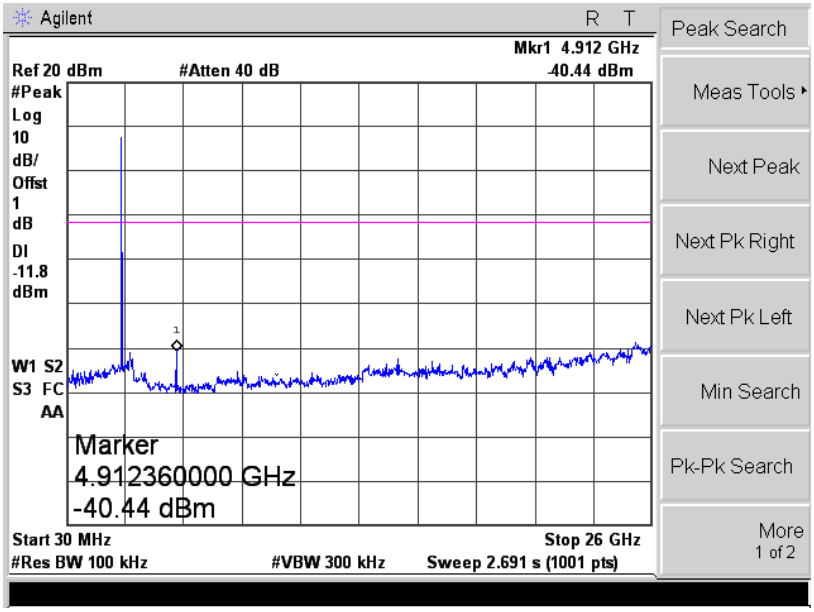
Low Channel




Middle Channel

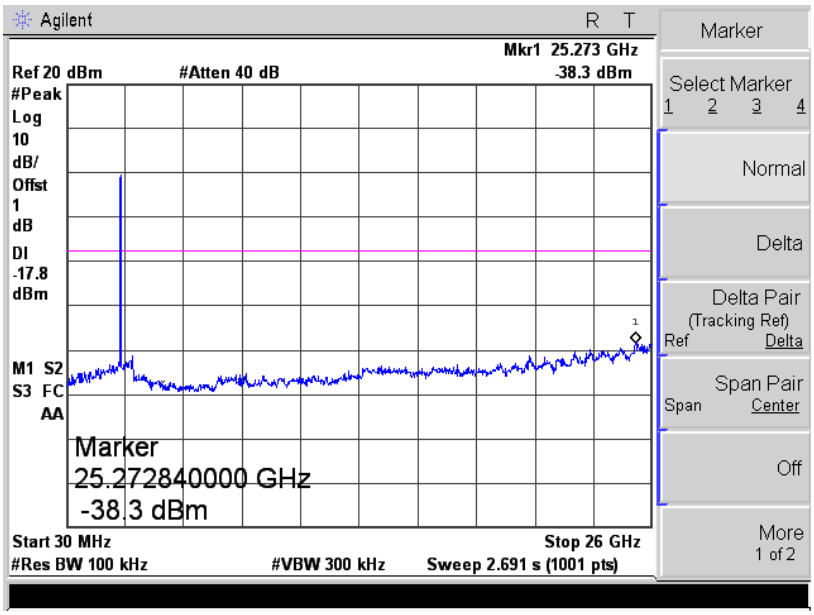


High Channel

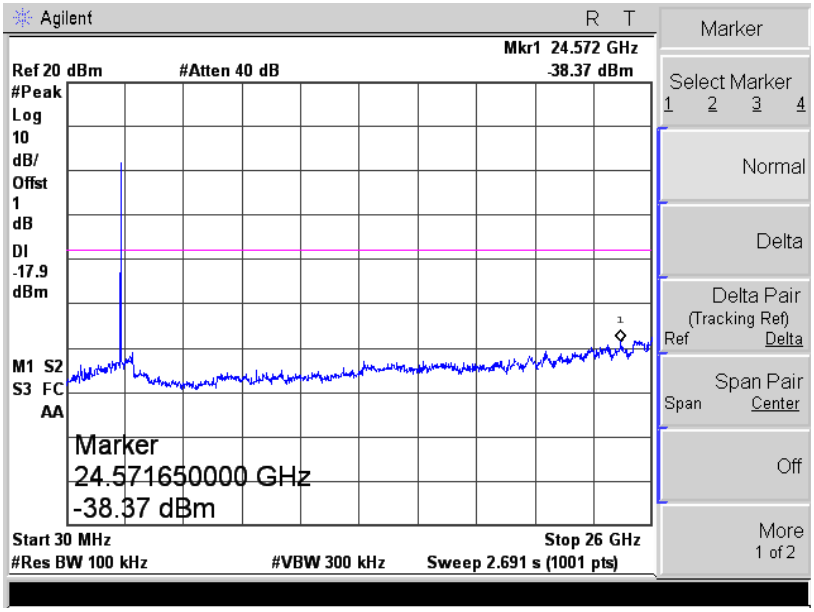



802.11g

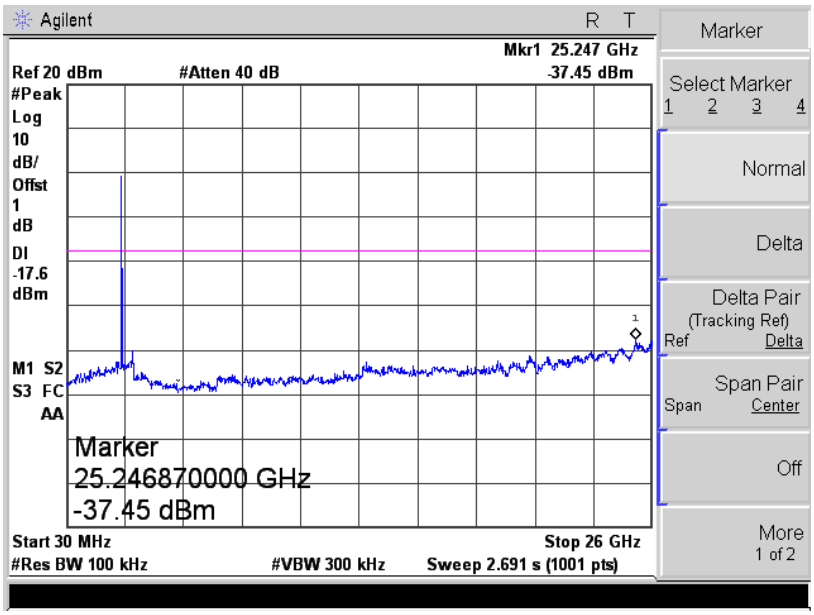
Low Channel



Middle Channel

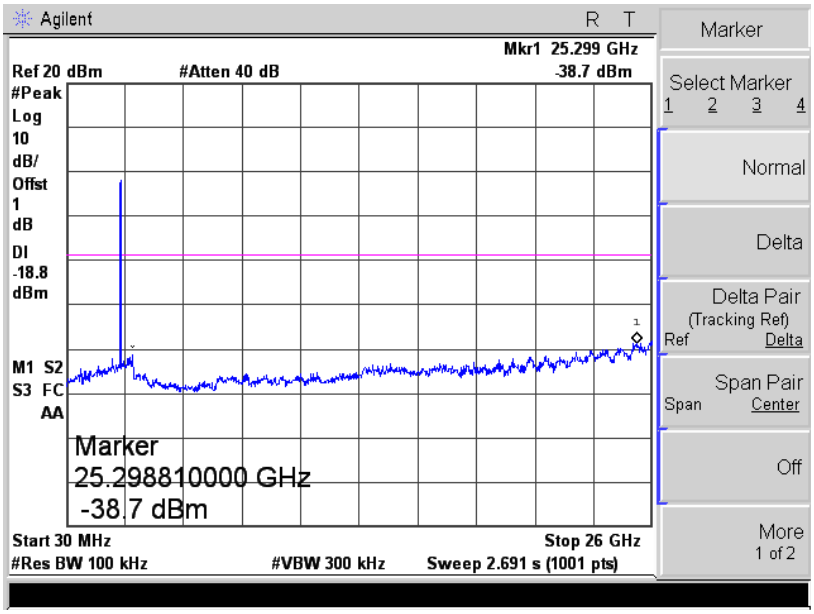



High Channel

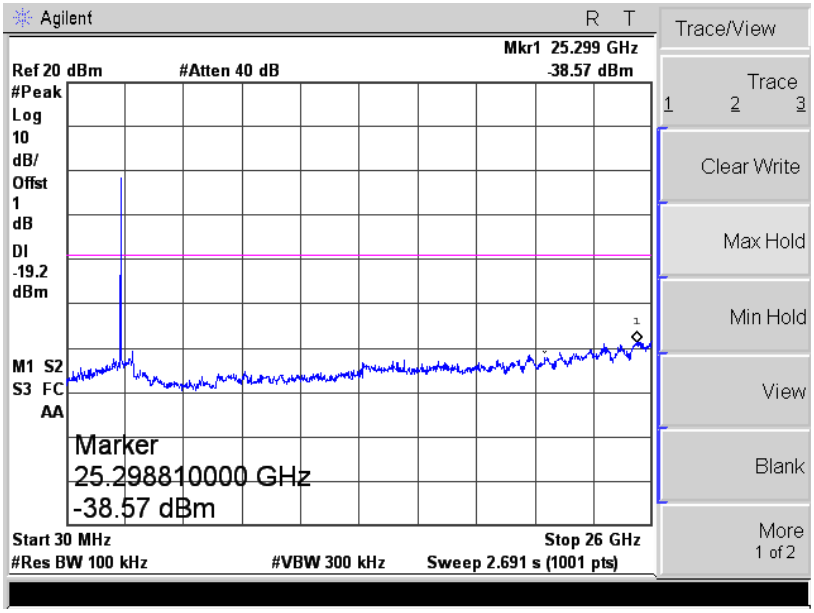


802.11n-HT20

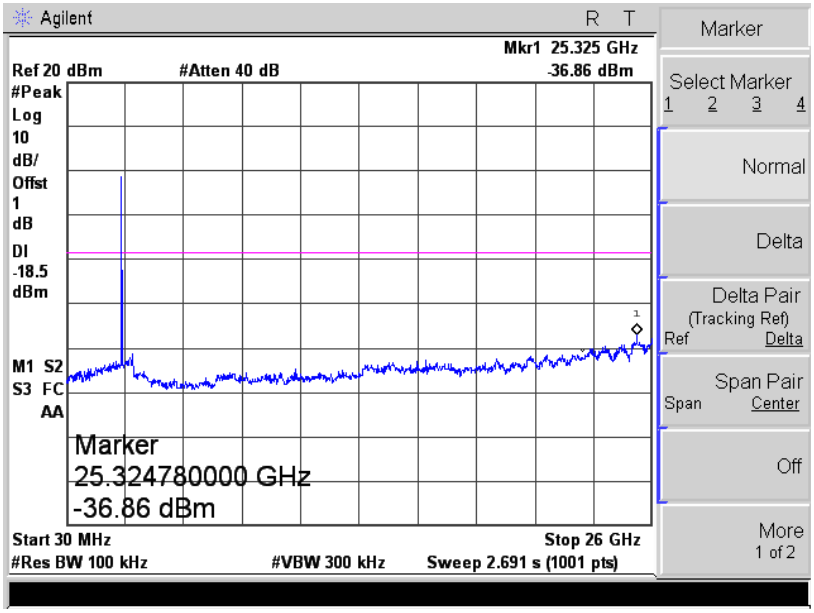
Low Channel




Middle Channel



High Channel



# 8 Band Edge Measurement

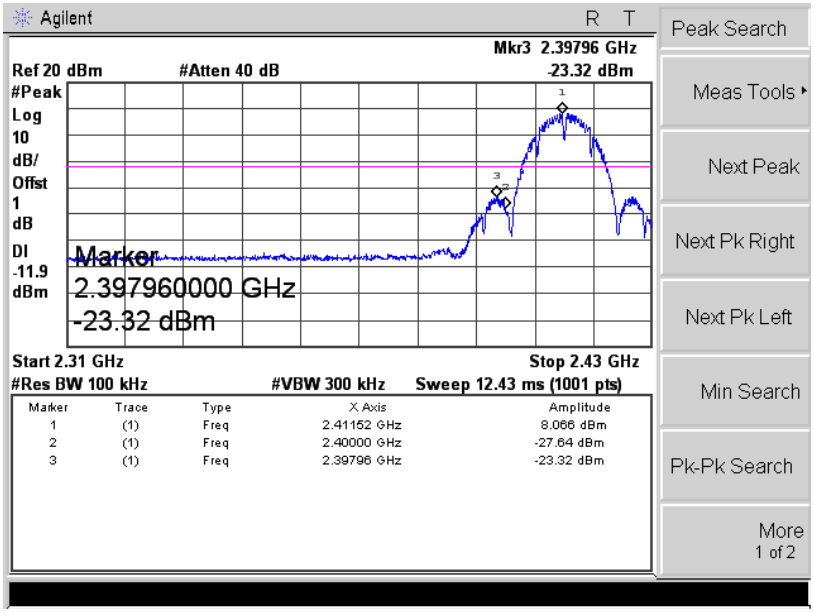
| | | |
|---|---|---|
| Test Requirement | : | Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)). |
| Test Method | : | ANSI C63.10:2013 |
| Test Limit | : | Regulation 15.247 (d),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)). |

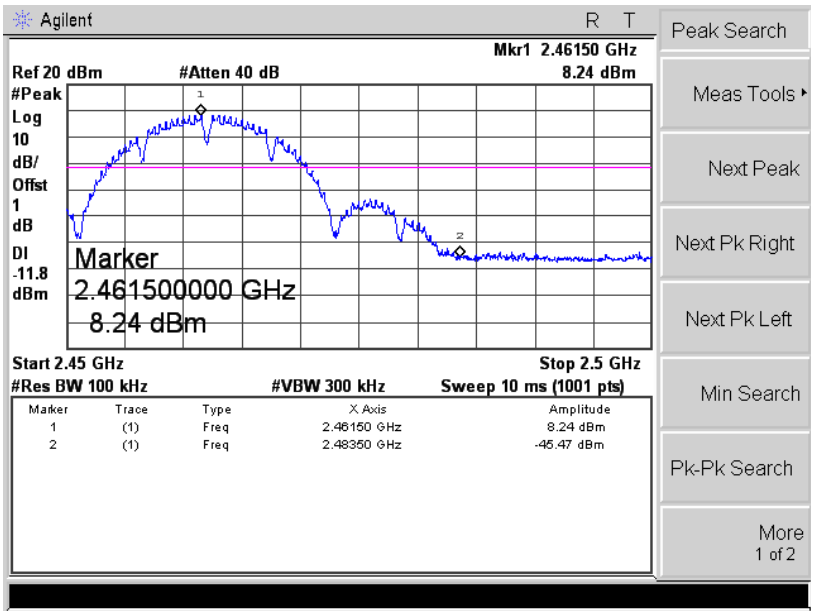
## 8.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto
Detector function = peak, Trace = max hold

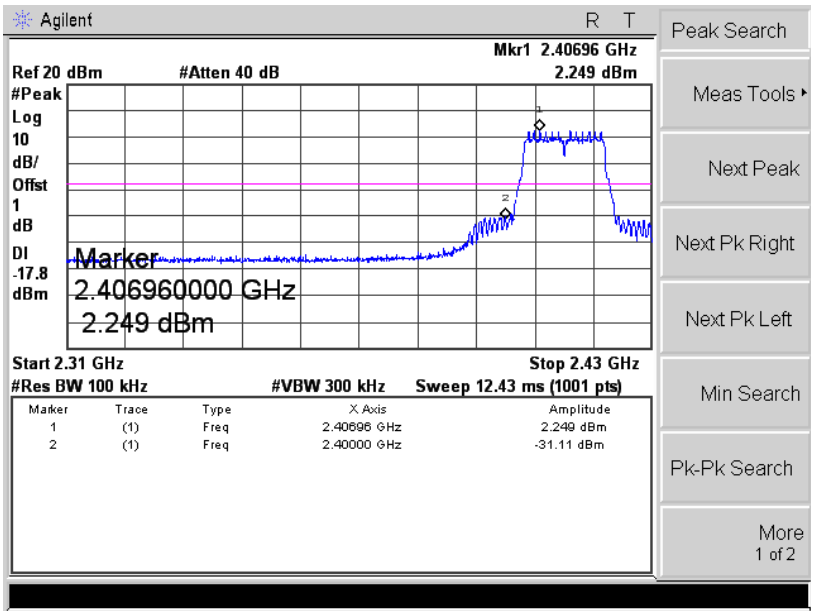
## 8.2 Test Result

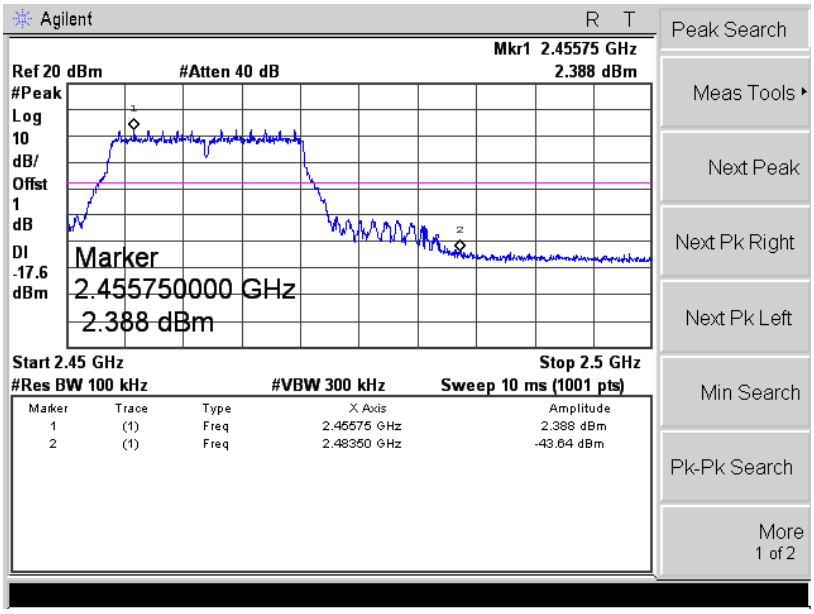
802.11b



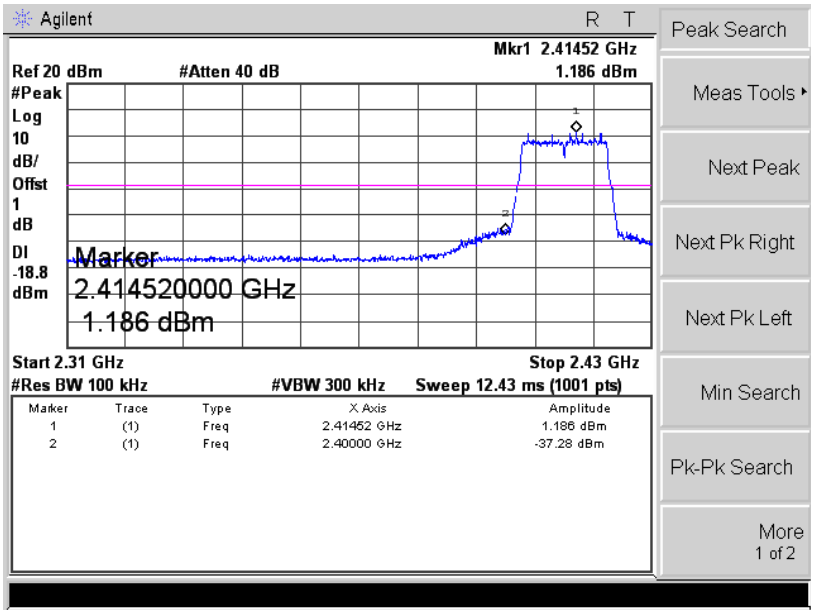



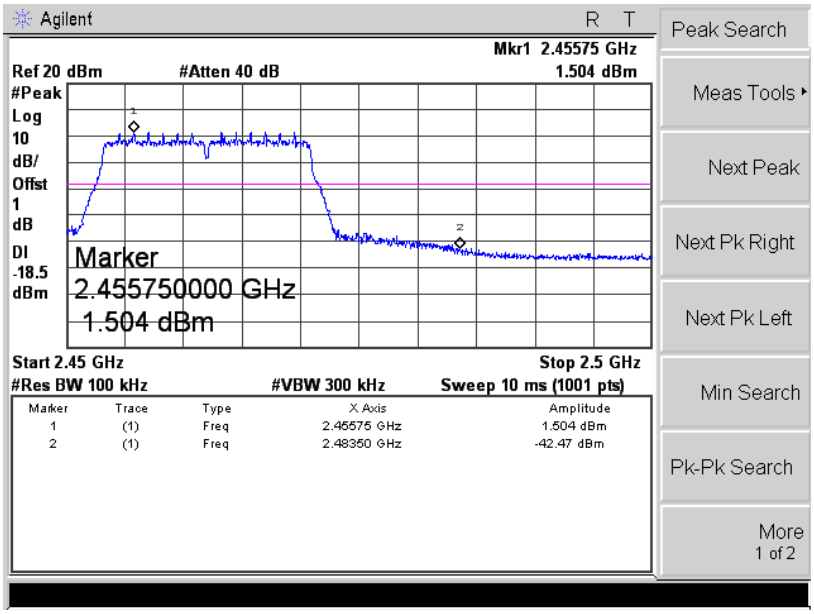
802.11g


Agilent
R T
Mkr1 2.40696 GHz
Ref 20 dBm
#Atten 40 dB
2.249 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-17.8
dBm
Marker
2.406960000 GHz
2.249 dBm
Start 2.31 GHz
Stop 2.43 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 12.43 ms (1001 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.40696 GHz 2.249 dBm
2 (1) Freq 2.40000 GHz -31.11 dBm
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2


Agilent
R T
Mkr1 2.45575 GHz
Ref 20 dBm
#Atten 40 dB
2.388 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-17.6
dBm
Marker
2.455750000 GHz
2.388 dBm
Start 2.45 GHz
Stop 2.5 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 10 ms (1001 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.45575 GHz 2.388 dBm
2 (1) Freq 2.48350 GHz -43.64 dBm
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

802.11n-HT20


Agilent
R T
Mkr1 2.41452 GHz
Ref 20 dBm
#Atten 40 dB
1.186 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-18.8
dBm
Marker
2.414520000 GHz
1.186 dBm
Start 2.31 GHz
Stop 2.43 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 12.43 ms (1001 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.41452 GHz 1.186 dBm
2 (1) Freq 2.40000 GHz -37.28 dBm
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2


Agilent
R T
Mkr1 2.45575 GHz
Ref 20 dBm
#Atten 40 dB
1.504 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-18.5
dBm
Marker
2.455750000 GHz
1.504 dBm
Start 2.45 GHz
Stop 2.5 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 10 ms (1001 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.45575 GHz 1.504 dBm
2 (1) Freq 2.48350 GHz -42.47 dBm
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

# 9 6dB Bandwidth Measurement

| | | |
|---|---|---|
| Test Requirement | : | FCC CFR47 Part 15 Section 15.247 |
| Test Method | : | ANSI C63.10:2013 |
| Test Limit | | Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz. |

## 9.1 Test Procedure

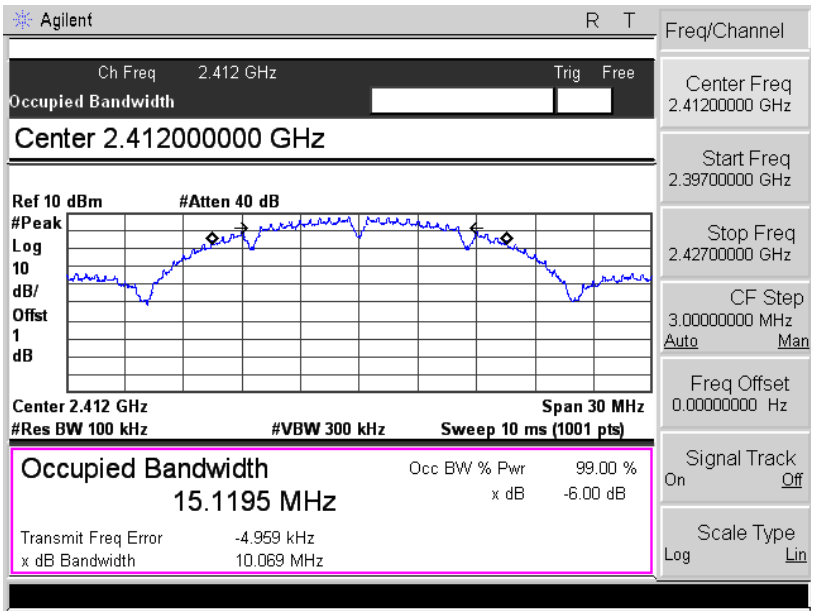
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;

2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

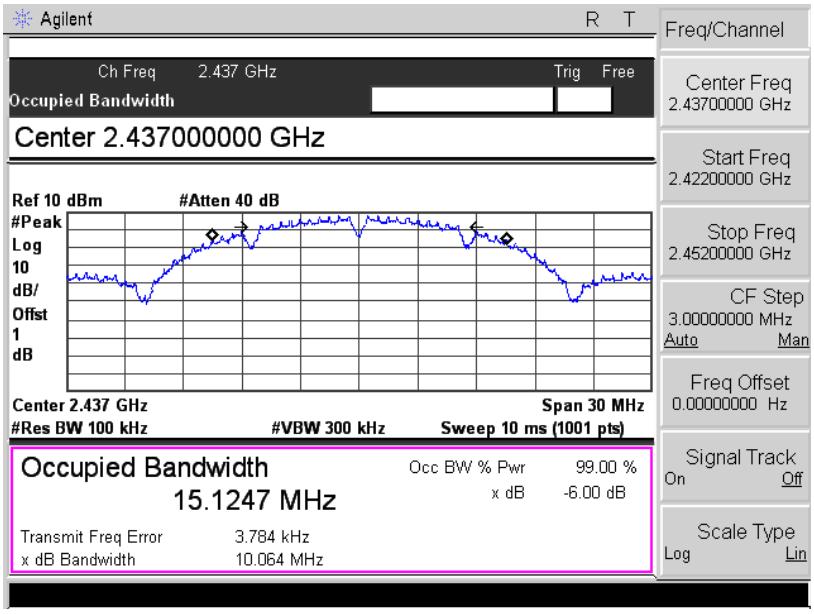
## 9.2 Test Result

| Modulation | Bandwidth(MHz) | | | Limit |
|---|---|---|---|---|
| | Low Channel | Middle Channel | High Channel | |
| 802.11b | 10.069 | 10.064 | 10.073 | ≥500kHz |
| 802.11g | 16.424 | 16.373 | 16.363 | ≥500kHz |
| 802.11n-HT20 | 17.630 | 17.620 | 17.604 | ≥500kHz |

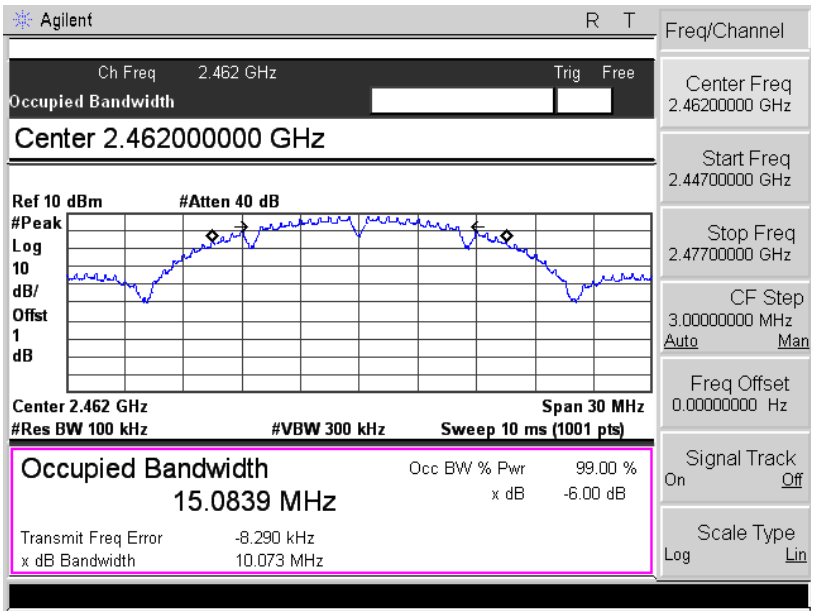
802.11b Low Channel



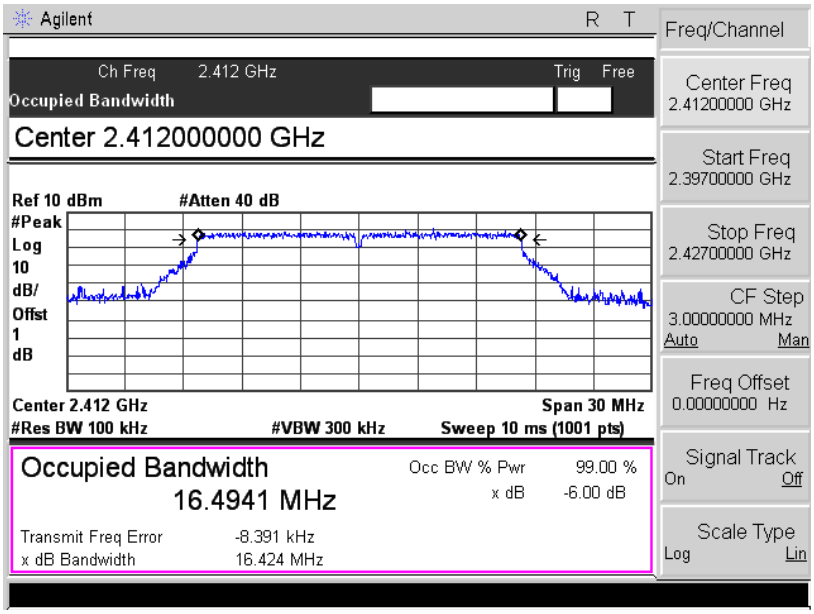

802.11b Middle Channel



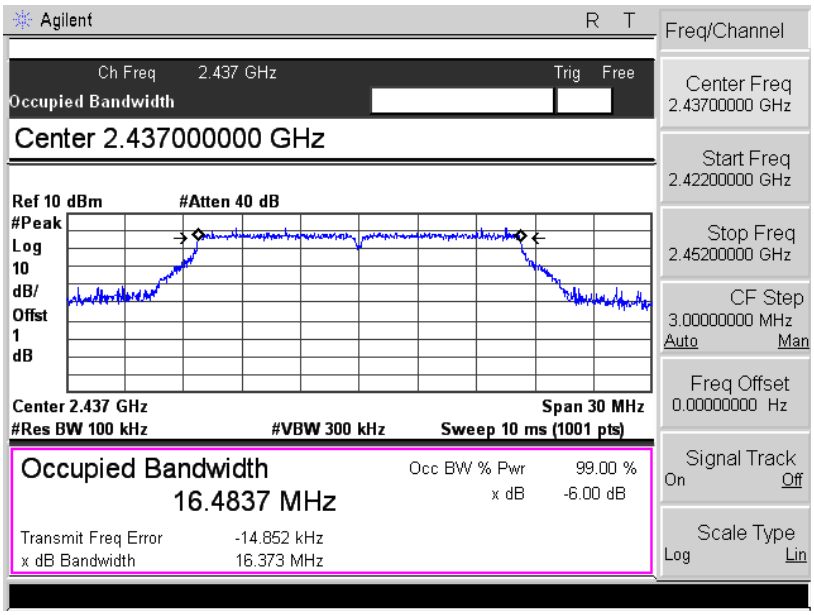
802.11b High Channel



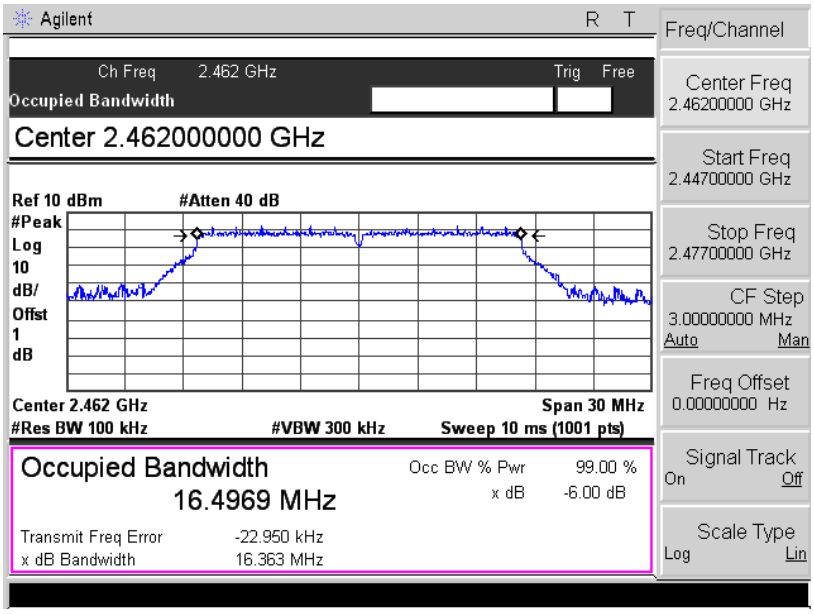

802.11g Low Channel



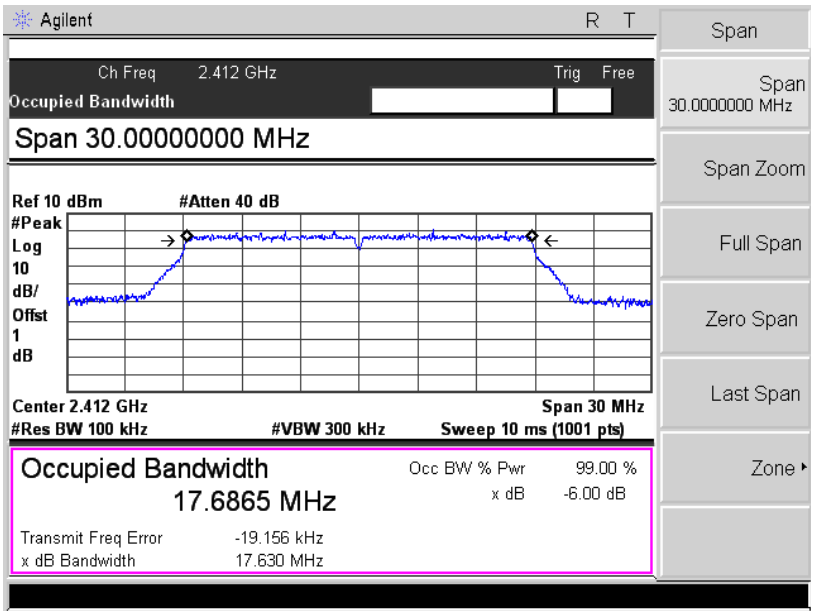
802.11g Middle Channel



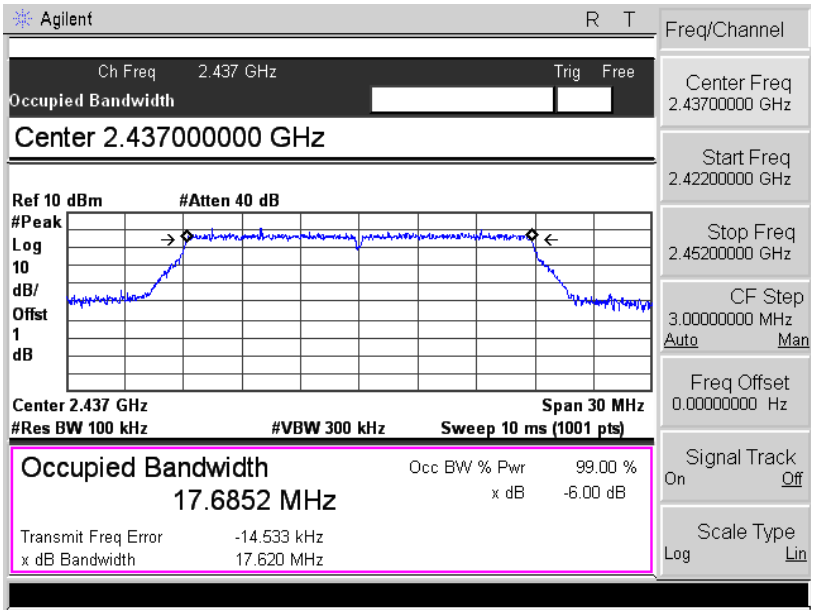

802.11g High Channel



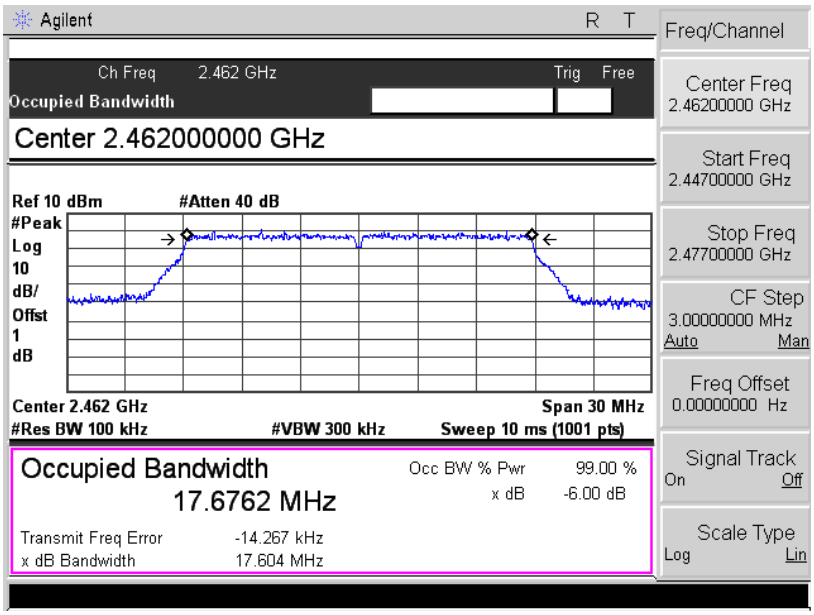
802.11n-HT20 Low Channel




802.11n-HT20 Middle Channel



802.11n-HT20 High Channel



# 10 Maximum Peak Output Power

Test Requirement : FCC CFR47 Part 15 Section 15.247

Test Method : ANSI C63.10:2013

Test Limit : Regulation 15.247 (b)(3), For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power.

## 10.1 Test Procedure

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

## 10.2 Test Result

| Modulation | Maximum Peak Output Power (dBm) | | | Limit |
|---|---|---|---|---|
| | Low Channel | Middle Channel | High Channel | |
| 802.11b | 9.42 | 9.35 | 9.41 | 1W(30dBm) |
| 802.11g | 8.68 | 8.45 | 8.63 | 1W(30dBm) |
| 802.11n-HT20 | 7.65 | 7.74 | 7.66 | 1W(30dBm) |

# 11 Power Spectral density

Test Requirement : FCC CFR47 Part 15 Section 15.247

Test Method : ANSI C63.10:2013

Test Limit : Regulation 15.247(f) The power spectral density conducted from the intentional radiator to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

## 11.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

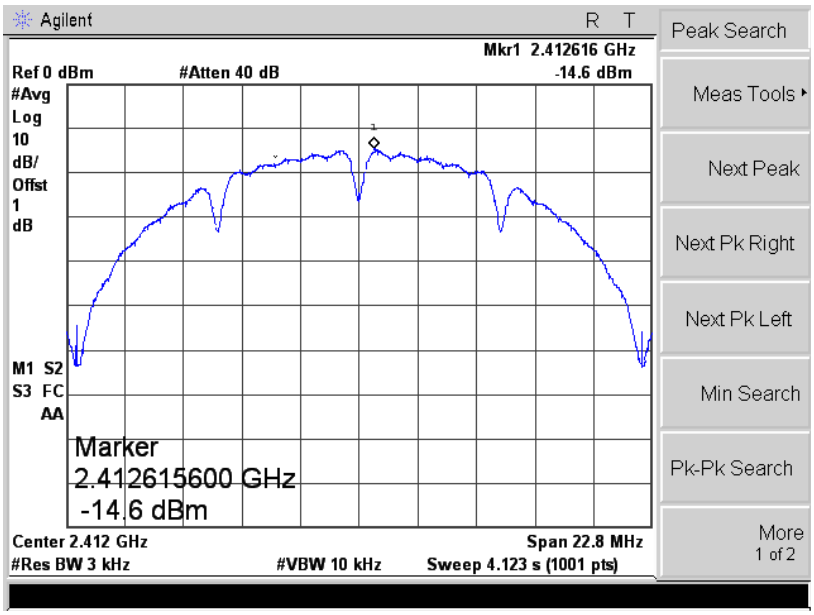
2. Set the spectrum analyzer: RBW = 3kHz. VBW = 10kHz, Span = 1.5 times the DTS channel bandwidth(6 dB bandwidth). Sweep = auto; Detector Function = Peak. Trace = Max hold.

3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

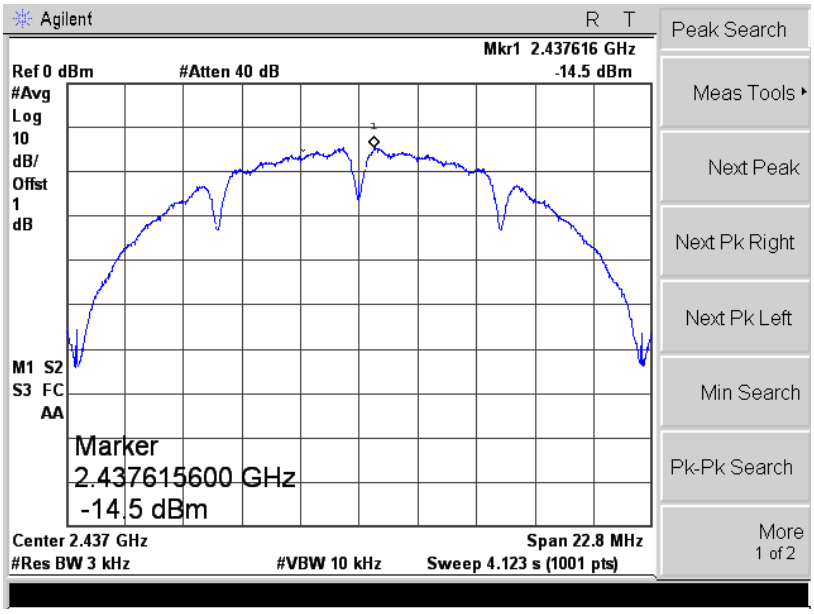
## 11.2 Test Result

| Modulation | Power Spectral density ( dBm/3kHz ) | | | Limit |
|---|---|---|---|---|
| | Low Channel | Middle Channel | High Channel | |
| 802.11b | -14.60 | -14.50 | -13.97 | 8dBm/3kHz |
| 802.11g | -20.70 | -20.71 | -20.40 | 8dBm/3kHz |
| 802.11n-HT20 | -21.88 | -22.16 | -21.58 | 8dBm/3kHz |

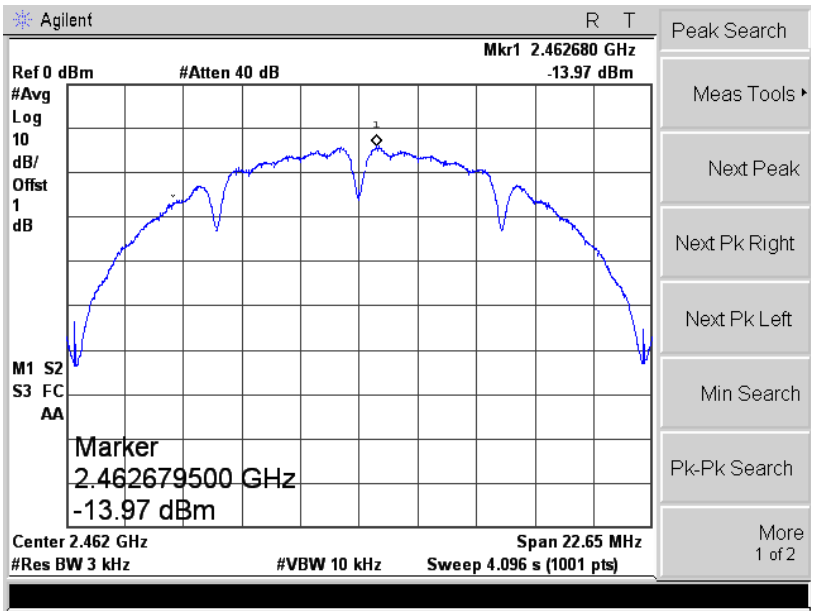
802.11b Low Channel



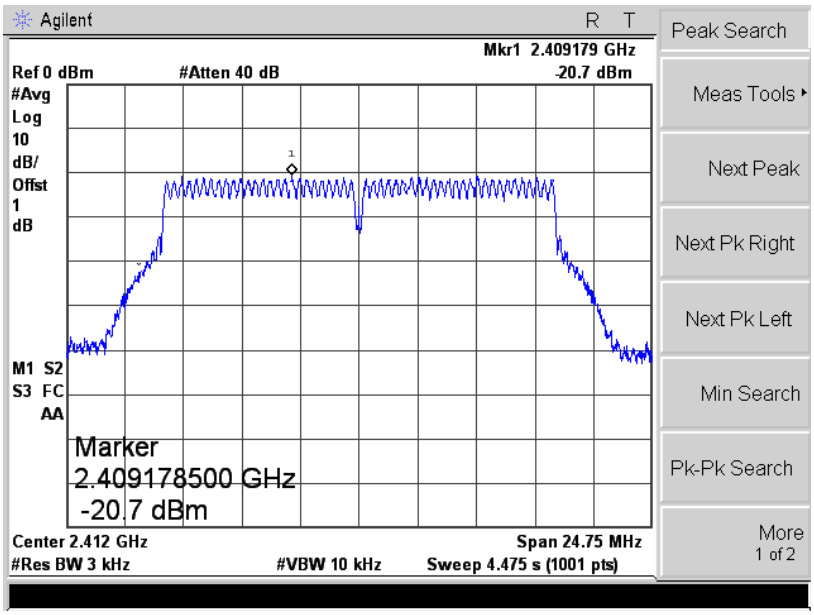

802.11b Middle Channel



802.11b High Channel




802.11g Low Channel



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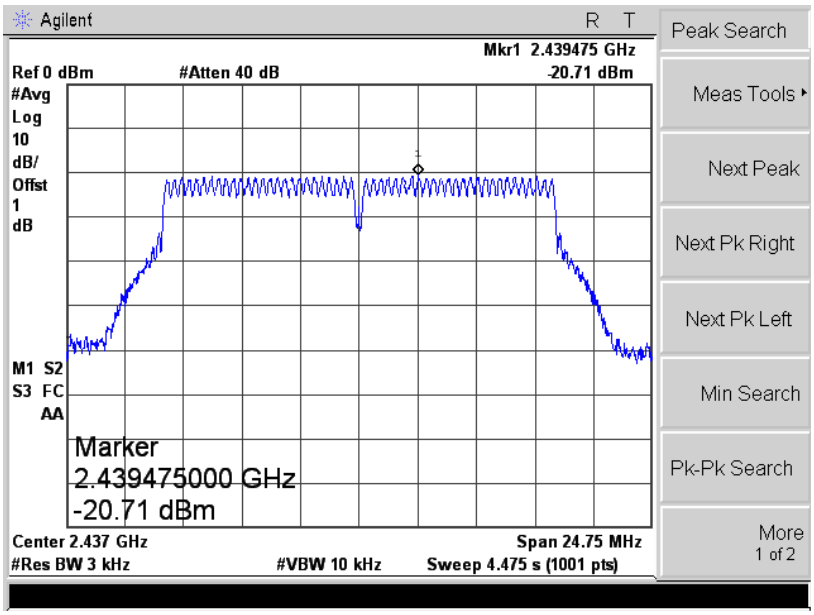
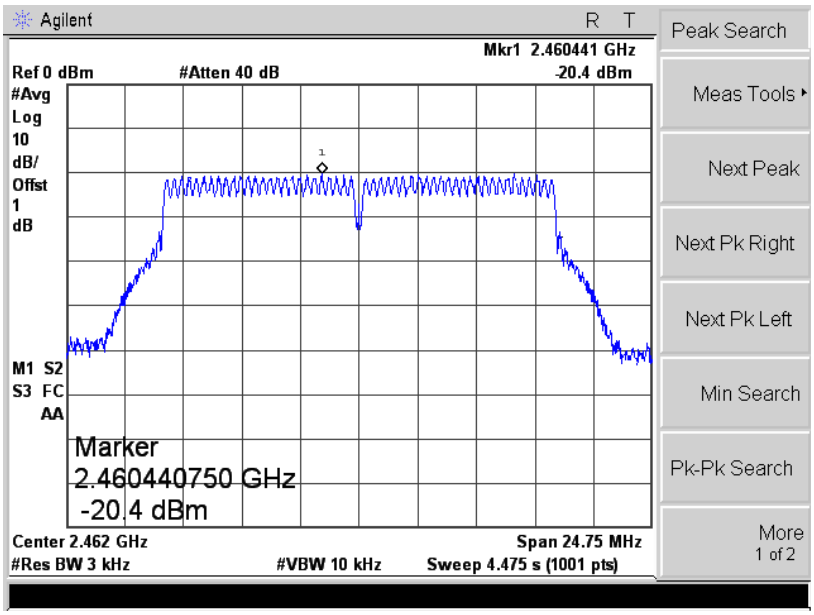
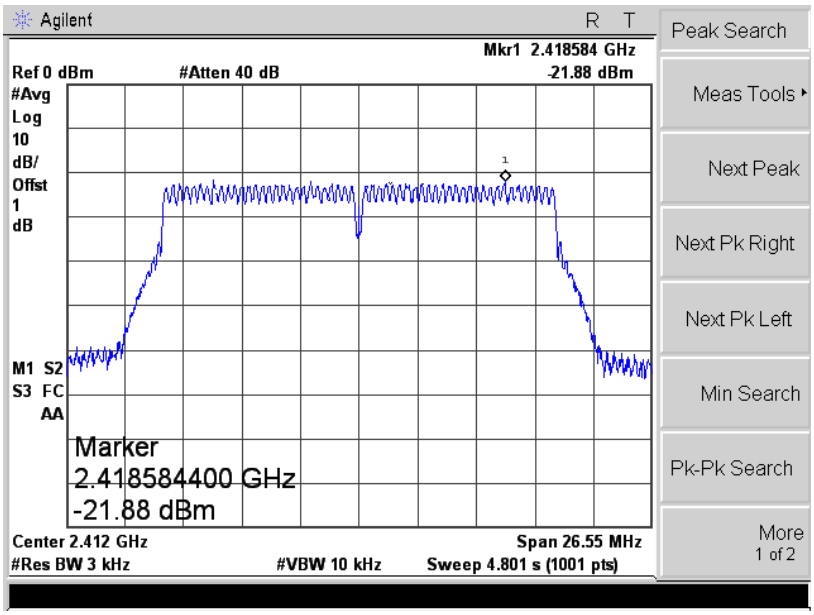


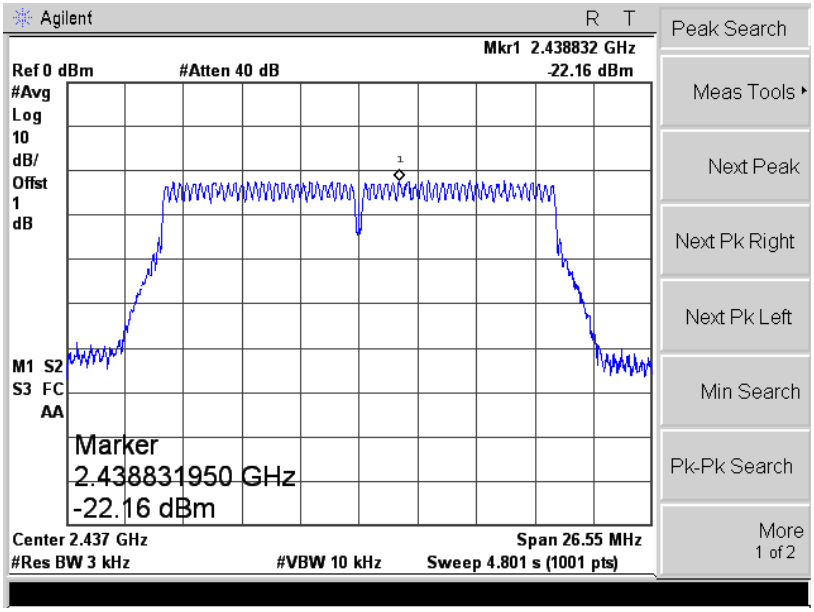

802.11g High Channel



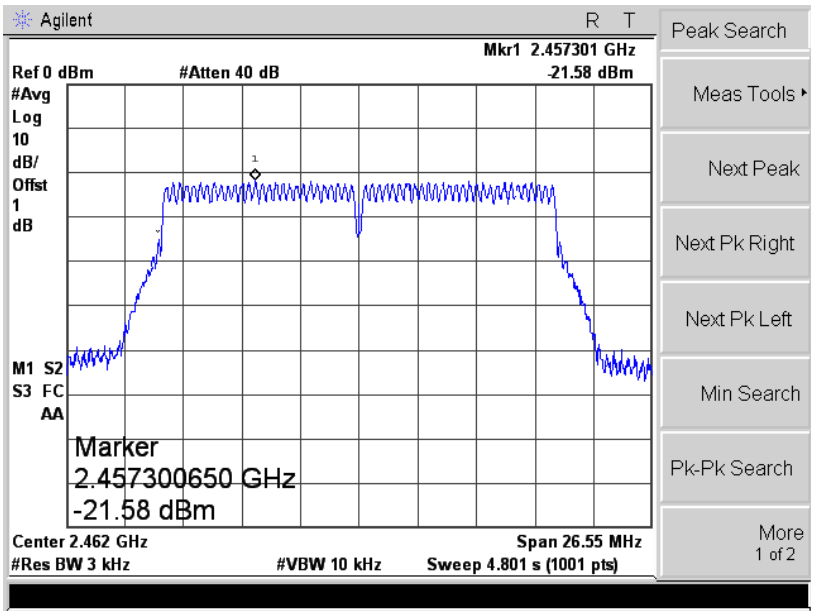
802.11n-HT20 Low Channel




802.11n-HT20 Middle Channel



802.11n-HT20 High Channel



# 12 Antenna Application

## 12.1 Antenna Requirement

For intentional device, according to FCC 47 CFR 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. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

## 12.2 Result

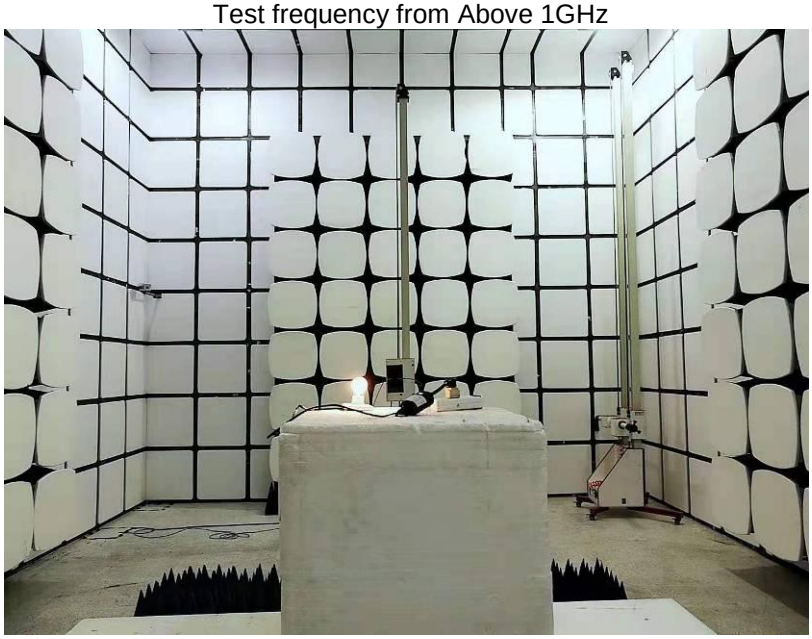
The EUT'S antenna, permanent attached antenna, is internal PCB antenna. The antenna's gain is 1dBi and meets the requirement.

# 13 Test Setup

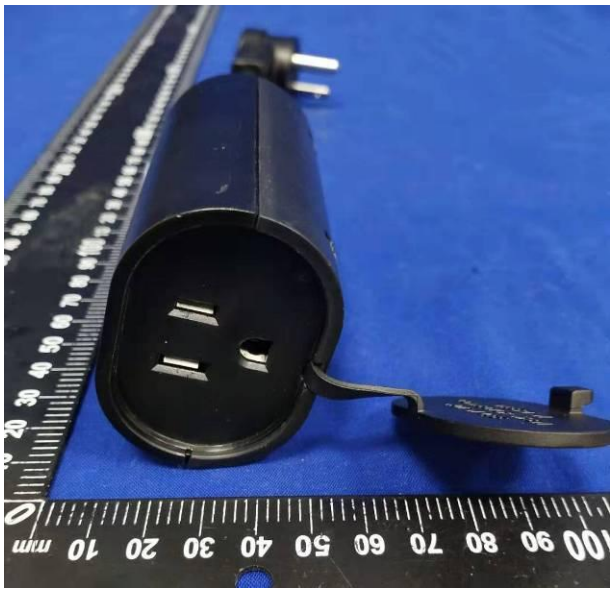
Conducted Emissions

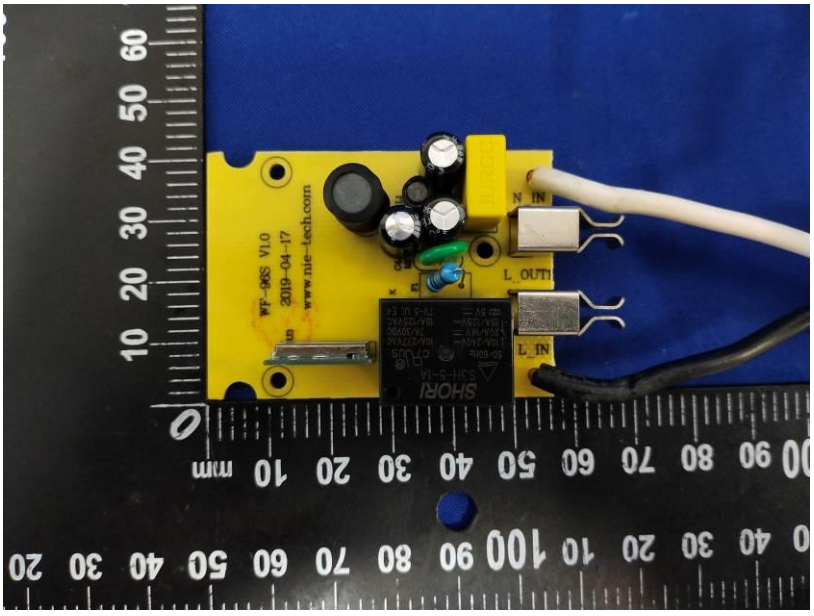
Radiated Spurious Emissions
From 30MHz-1000MHz

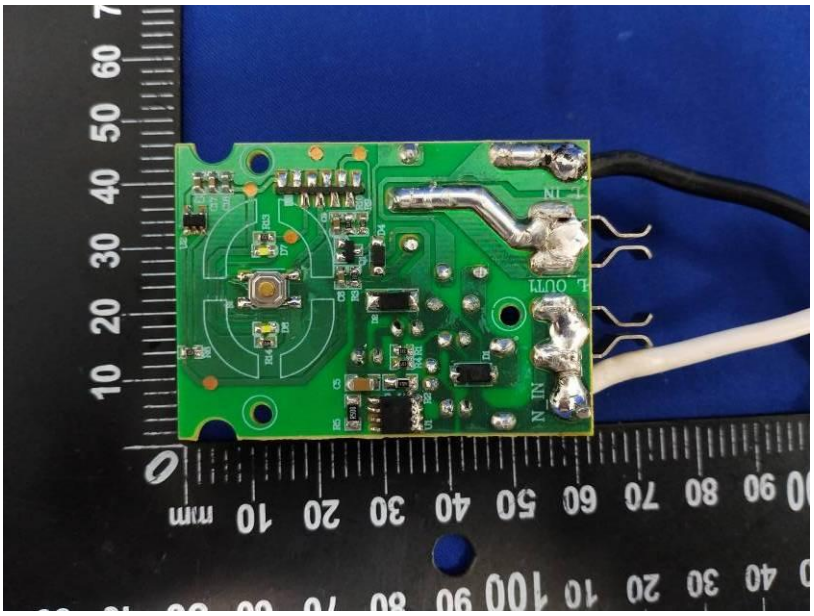
Test frequency from Above 1GHz

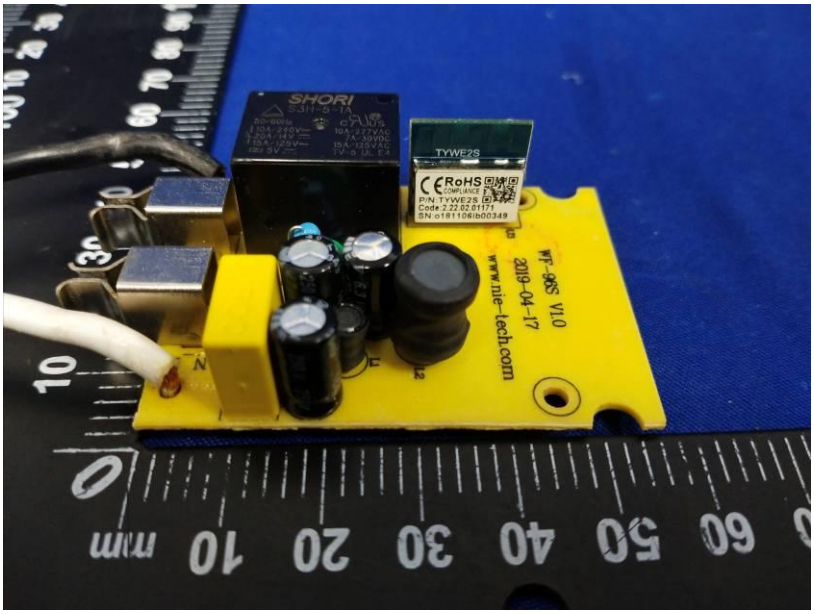


# 14 EUT Photos




WF-9BS V1.0
2019-04-17
www.nie-tech.com
N_IN
L_OUT
L_IN
SHORI

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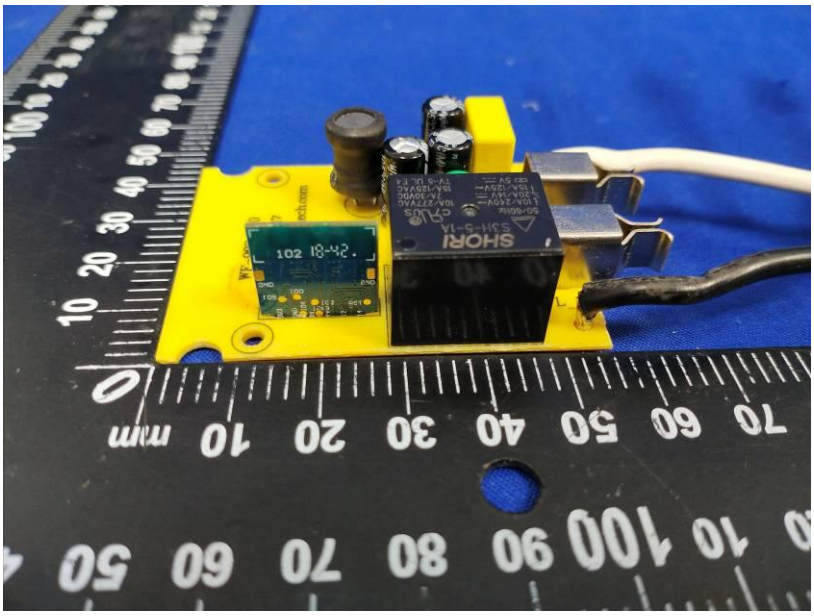
TYWE2S
RoHS
WF-96S V1.0
2019-04-17
www.nie-tech.com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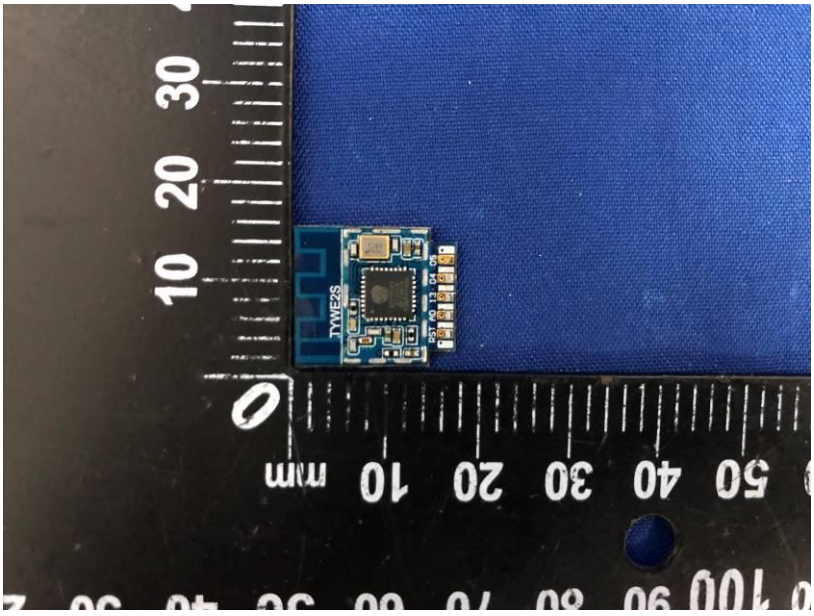
SJH-S-1A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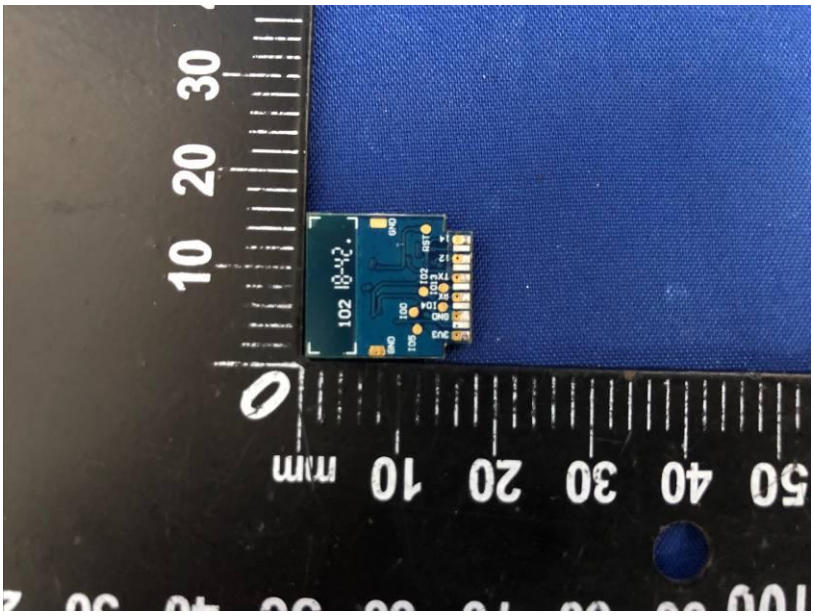

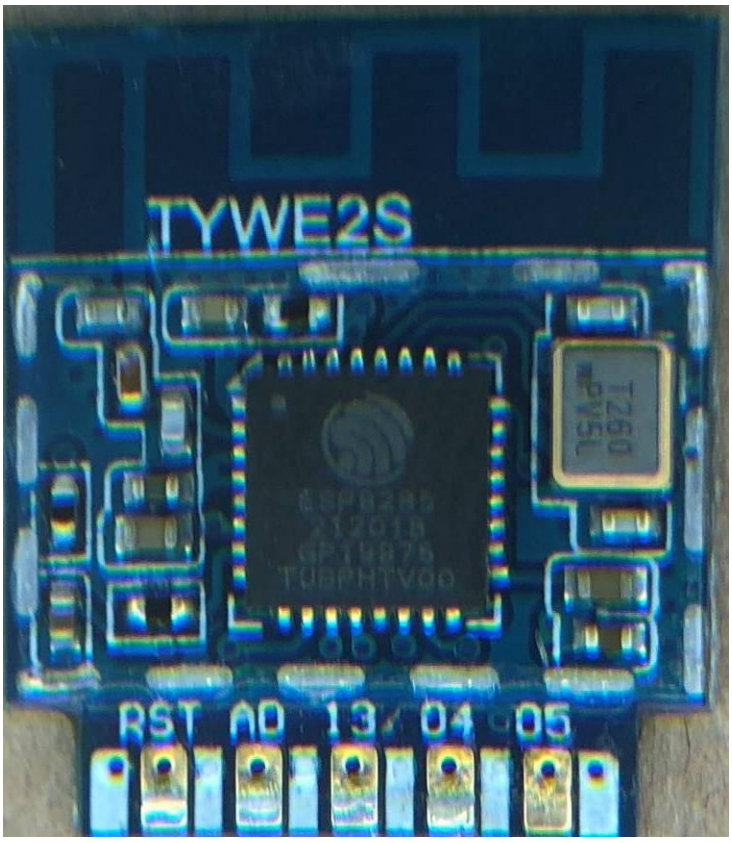
TYWE2S
RST A0 13 04 05

******THE END REPORT******