



# TEST REPORT

No. I21N04075-WLAN

**HMD Global Oy**

**Smart Phone**

**Model Name: TA-1471**

**with**

**Hardware Version: V01**

**Software Version: 00WW\_0\_031**

**FCC ID: 2AJOTTA-1471**

**Issued Date: 2022-03-22**

**Designation Number: CN1210**

**Note:**

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of SAICT.

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## **1. Summary of Test Report**

### **1.1. Test Items**

|                     |               |
|---------------------|---------------|
| Product Name        | Smart Phone   |
| Model Name          | TA-1471       |
| Applicant's name    | HMD Global Oy |
| Manufacturer's Name | HMD Global Oy |

### **1.2. Test Standards**

FCC Part15-2019; ANSI C63.10-2013

### **1.3. Test Result**

**Pass**

Please refer to 5.2 Test Results.

### **1.4. Testing Location**

Address: Building G, Shenzhen International Innovation Center, No.1006 Shennan Road, Futian District, Shenzhen, Guangdong, P. R. China

### **1.5. Project data**

|                     |            |
|---------------------|------------|
| Testing Start Date: | 2022-02-23 |
| Testing End Date:   | 2022-03-22 |

### **1.6. Signature**

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**Lin Zechuang**  
**(Prepared this test report)**

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**An Ran**  
**(Reviewed this test report)**

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**Zhang Bojun**  
**(Approved this test report)**



## **2. Client Information**

### **2.1. Applicant Information**

Company Name: HMD Global Oy  
Address: Bertel Jungin aukio 9, 02600 Espoo, Finland  
Contact Person: Reza Serafat  
E-Mail: reza.serafat@hmdglobal.com  
Telephone: +393 31 6272922  
FAX: /

### **2.2. Manufacturer Information**

Company Name: HMD Global Oy  
Address: Bertel Jungin aukio 9, 02600 Espoo, Finland  
Contact Person: Reza Serafat  
E-Mail: reza.serafat@hmdglobal.com  
Telephone: +393 31 6272922  
FAX: /

### **3. Equipment Under Test (EUT) and Ancillary Equipment (AE)**

#### **3.1. About EUT**

|                              |                              |
|------------------------------|------------------------------|
| Product Name                 | Smart Phone                  |
| Model Name                   | TA-1471                      |
| RF Protocol                  | IEEE 802.11b/g/n-HT20/n-HT40 |
| Operating Frequency          | 2412MHz~2462MHz              |
| Number of Channels           | 11                           |
| Antenna Type                 | Integrated                   |
| Antenna Gain                 | -2.0dBi                      |
| Power Supply                 | 3.6V DC by Battery           |
| FCC ID                       | 2AJOTTA-1471                 |
| Condition of EUT as received | No abnormality in appearance |

#### **3.2. Internal Identification of EUT**

| <b>EUT ID*</b> | <b>IMEI</b>     | <b>HW Version</b> | <b>SW Version</b> | <b>Receive Date</b> |
|----------------|-----------------|-------------------|-------------------|---------------------|
| UT01aa         | 353906800005705 | V01               | 00WW_0_031        | 2022-02-14          |
| UT05aa         | 353906800005689 | V01               | 00WW_0_031        | 2022-02-14          |

\*EUT ID: is used to identify the test sample in the lab internally.

\*UT01aa is used for Conduction test; UT05aa is used for Radiation test and AC Power line Conducted Emission test.

#### **3.3. Internal Identification of AE**

| <b>AE ID*</b> | <b>Description</b> | <b>AE ID*</b> |
|---------------|--------------------|---------------|
| AE1           | Battery            | /             |
| AE2           | Charger            | /             |
| AE3           | USB Cable          | /             |
| AE4           | Headset            | /             |

##### **AE1**

|                 |                                       |
|-----------------|---------------------------------------|
| Model           | GH5781                                |
| Manufacturer    | Shenzhen Aerospace Electronic Co.,Ltd |
| Capacity        | 2400mAh                               |
| Nominal Voltage | 3.8V                                  |

##### **AE2**

|              |                                    |
|--------------|------------------------------------|
| Model        | A806A-050100U-EU1                  |
| Manufacturer | Dongguan Aohai Technology Co., Ltd |

##### **AE3**

|              |                                      |
|--------------|--------------------------------------|
| Model        | MO34B1000100                         |
| Manufacturer | FKY-QY Electronic Technology Co. Ltd |

##### **AE4**

|       |               |
|-------|---------------|
| Model | JWEP1199-M01H |
|-------|---------------|



No. I21N04075-WLAN

Manufacturer JUWEI ELECTRONICS CO.,LTD

\*AE ID: is used to identify the test sample in the lab internally.

### **3.4. General Description**

The Equipment under Test (EUT) is a model of Mobile Phone with integrated antenna and battery. It consists of normal options: Lithium Battery, Charger, USB Cable and Headset. Manual and specifications of the EUT were provided to fulfil the test. Samples undergoing test were selected by the client.



#### **4. Reference Documents**

##### **4.1. Documents supplied by applicant**

EUT feature information is supplied by the applicant or manufacturer, which is the basis of testing.

##### **4.2. Reference Documents for testing**

The following documents listed in this section are referred for testing.

| <b>Reference</b> | <b>Title</b>                                                                                                                                                                                                              | <b>Version</b> |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| FCC Part15       | FCC CFR 47, Part 15, Subpart C:<br>15.205 Restricted bands of operation;<br>15.209 Radiated emission limits, general requirements;<br>15.247 Operation within the bands 902-928MHz, 2400-2483.5<br>MHz, and 5725-5850 MHz | 2019           |
| ANSI C63.10      | American National Standard of Procedures for Compliance<br>Testing of Unlicensed Wireless Devices                                                                                                                         | 2013           |

## 5. Test Results

### 5.1. Testing Environment

Normal Temperature: 15~35°C

Relative Humidity: 20~75%

### 5.2. Test Results

| No | Test cases                  | Sub-clause of Part 15C | Verdict |
|----|-----------------------------|------------------------|---------|
| 0  | Antenna Requirement         | 15.203                 | P       |
| 1  | Maximum Output Power        | 15.247 (b)             | P       |
| 2  | Peak Power Spectral Density | 15.247 (e)             | P       |
| 3  | 6dB Bandwidth               | 15.247 (a)             | P       |
| 4  | Band Edges Compliance       | 15.247 (d)             | P       |
| 5  | Conducted Emission          | 15.247 (d)             | P       |
| 6  | Radiated Emission           | 15.247, 15.205, 15.209 | P       |
| 7  | AC Power line Conducted     | 15.107, 15.207         | P       |

See **ANNEX A** for details.

### 5.3. Statements

SAICT has evaluated the test cases requested by the applicant/manufacture as listed in section 5.2 of this report, for the EUT specified in section 3, according to the standards or reference documents listed in section 4.2.

Disclaimer:

A. After confirmation with the customer, the sample information provided by the customer may affect the validity of the measurement results in this report, and the impact and consequences arising therefrom shall be borne by the customer.

B. The samples in this report are provided by the customer, and the test results are only applicable to the samples received.

## 6. Test Equipments Utilized

### Conducted test system

| No. | Equipment              | Model    | Serial Number | Manufacturer    | Calibration Due date | Calibration Period |
|-----|------------------------|----------|---------------|-----------------|----------------------|--------------------|
| 1   | Vector Signal Analyzer | FSV40    | 100903        | Rohde & Schwarz | 2022-12-29           | 1 year             |
| 2   | Power Sensor           | U2021XA  | MY55430013    | Keysight        | 2022-12-29           | 1 year             |
| 3   | Data Acquisition       | U2531A   | TW55443507    | Keysight        | /                    | /                  |
| 4   | RF Control Unit        | JS0806-2 | 21C8060398    | Tonscend        | 2022-05-09           | 1 year             |
| 5   | Test Receiver          | ESCI     | 100701        | Rohde & Schwarz | 2022-08-08           | 1 year             |
| 6   | LISN                   | ENV216   | 102067        | Rohde & Schwarz | 2022-07-15           | 1 year             |

### Radiated test system

| No. | Equipment         | Model               | Serial Number | Manufacturer    | Calibration Due date | Calibration Period |
|-----|-------------------|---------------------|---------------|-----------------|----------------------|--------------------|
| 1   | Loop Antenna      | HLA6120             | 35779         | TESEQ           | 2022-04-25           | 3 years            |
| 2   | BiLog Antenna     | 3142E               | 0224831       | ETS-Lindgren    | 2024-05-27           | 3 years            |
| 3   | Horn Antenna      | 3117                | 00066577      | ETS-Lindgren    | 2022-04-02           | 3 years            |
| 4   | Horn Antenna      | QSH-SL-18-26-S-20   | 17013         | Q-par           | 2023-01-06           | 3 years            |
| 5   | Horn Antenna      | QSH-SL-8-26-40-K-20 | 17014         | Q-par           | 2023-01-06           | 3 years            |
| 6   | Test Receiver     | ESR7                | 101676        | Rohde & Schwarz | 2022-11-24           | 1 year             |
| 7   | Spectrum Analyser | FSV40               | 101192        | Rohde & Schwarz | 2023-01-12           | 1 year             |
| 8   | Chamber           | FACT3-2.0           | 1285          | ETS-Lindgren    | 2023-05-29           | 2 years            |

### Test software

| No. | Equipment        | Manufacturer    | Version  |
|-----|------------------|-----------------|----------|
| 1   | TechMgr Software | CAICT           | 2.1.1    |
| 2   | EMC32            | Rohde & Schwarz | 10.50.40 |

EUT is engineering software provided by the customer to control the transmitting signal.  
The EUT was programmed to be in continuously transmitting mode.

### Anechoic chamber

Fully anechoic chamber by ETS-Lindgren

## 7. Laboratory Environment

### Semi-anechoic chamber

|                                   |                                            |
|-----------------------------------|--------------------------------------------|
| Temperature                       | Min. = 15 °C, Max. = 35 °C                 |
| Relative humidity                 | Min. = 20 %, Max. = 75 %                   |
| Shielding effectiveness           | 0.014MHz-1MHz> 60 dB; 1MHz-18000MHz>90 dB  |
| Electrical insulation             | > 2MΩ                                      |
| Ground system resistance          | < 4 Ω                                      |
| Normalised site attenuation (NSA) | < ±4 dB, 3 m distance, from 30 to 1000 MHz |

### Shielded room

|                          |                                          |
|--------------------------|------------------------------------------|
| Temperature              | Min. = 15 °C, Max. = 35 °C               |
| Relative humidity        | Min. = 20 %, Max. = 75 %                 |
| Shielding effectiveness  | 0.014MHz-1MHz> 60 dB; 1MHz-1000MHz>90 dB |
| Electrical insulation    | > 2MΩ                                    |
| Ground system resistance | < 4 Ω                                    |

### Fully-anechoic chamber

|                                    |                                           |
|------------------------------------|-------------------------------------------|
| Temperature                        | Min. = 15 °C, Max. = 35 °C                |
| Relative humidity                  | Min. = 20 %, Max. = 75 %                  |
| Shielding effectiveness            | 0.014MHz-1MHz> 60 dB; 1MHz-18000MHz>90 dB |
| Electrical insulation              | > 2MΩ                                     |
| Ground system resistance           | < 4 Ω                                     |
| Voltage Standing Wave Ratio (VSWR) | ≤ 6 dB, from 1 to 18 GHz, 3 m distance    |
| Uniformity of field strength       | Between 0 and 6 dB, from 80 to 6000 MHz   |

## 8. Measurement Uncertainty

| Test Name                                    | Uncertainty ( $k=2$ )                    |        |
|----------------------------------------------|------------------------------------------|--------|
| 1. Maximum Peak Output Power                 | 1.32dB                                   |        |
| 2. Peak Power Spectral Density               | 2.32dB                                   |        |
| 3. 6dB Bandwidth                             | 66Hz                                     |        |
| 4. Band Edges Compliance                     | 1.92dB                                   |        |
| 5. Transmitter Spurious Emission - Conducted | $30\text{MHz} \leq f < 1\text{GHz}$      | 1.41dB |
|                                              | $1\text{GHz} \leq f < 7\text{GHz}$       | 1.92dB |
|                                              | $7\text{GHz} \leq f < 13\text{GHz}$      | 2.31dB |
|                                              | $13\text{GHz} \leq f \leq 26\text{GHz}$  | 2.61dB |
| 6. Transmitter Spurious Emission - Radiated  | $9\text{kHz} \leq f < 30\text{MHz}$      | 1.79dB |
|                                              | $30\text{MHz} \leq f < 1\text{GHz}$      | 4.86dB |
|                                              | $1\text{GHz} \leq f < 18\text{GHz}$      | 4.50dB |
|                                              | $18\text{GHz} \leq f \leq 40\text{GHz}$  | 2.90dB |
| 7. AC Power line Conducted Emission          | $150\text{kHz} \leq f \leq 30\text{MHz}$ | 2.62dB |

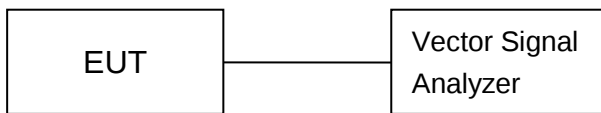
## **ANNEX A: Detailed Test Results**

### **Test Configuration**

The measurement is made according to ANSI C63.10.

#### **1) Conducted Measurements**

1. Connect the EUT to the test system correctly.
2. Set the EUT to the required work mode.
3. Set the EUT to the required channel.
4. Set the spectrum analyzer to start measurement.
5. Record the values.

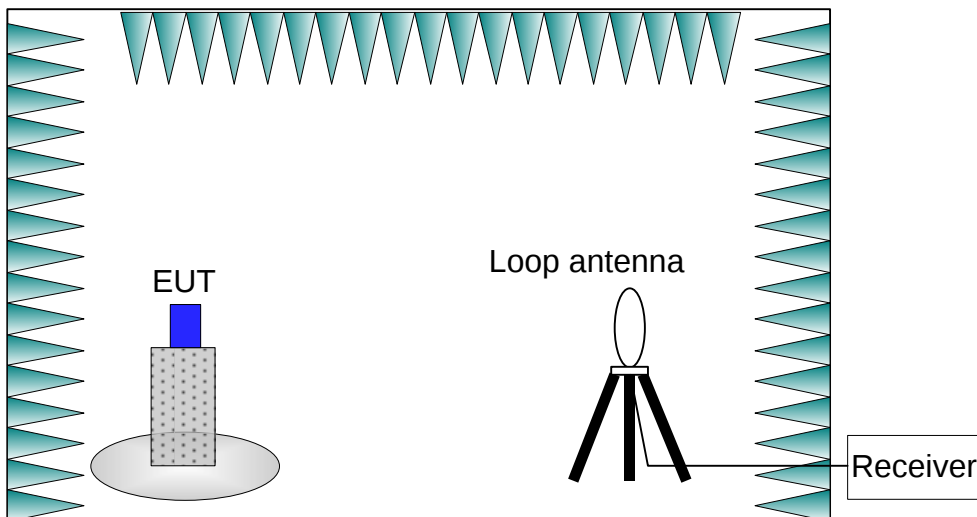


#### **2) Radiated Measurements**

**Test setup:**

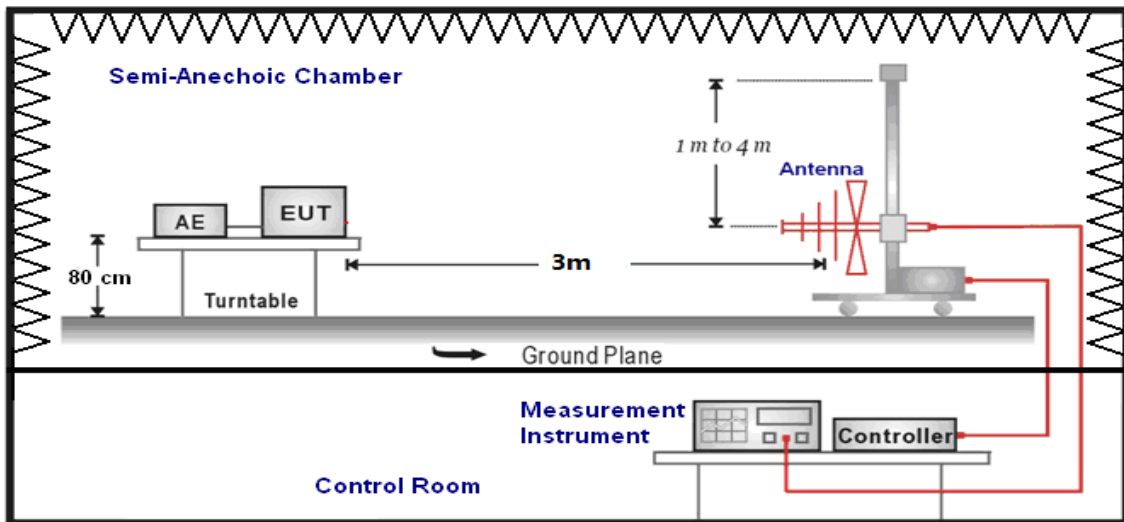
**9kHz-30MHz:**

The EUT are measured in a semi-anechoic chamber. The EUT is placed on a non-conductive stand of 80cm high, and at a measurement distance of 3m from the receiving antenna. The center of the receiving loop antenna is 1.0 meter above the ground. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT and adjusting the receiver antenna polarization.



### 30MHz-1GHz:

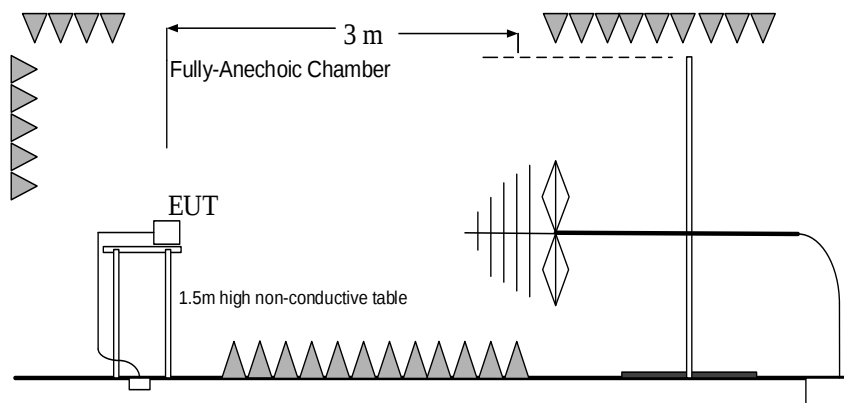
The EUT are measured in a semi-anechoic chamber. The EUT is placed on a non-conductive stand of 80cm high, and at a measurement distance of 3m from the receiving antenna. The center of the receiving antenna is 1.0 meter to 4.0 meter above the ground. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT and adjusting the receiver antenna polarization.



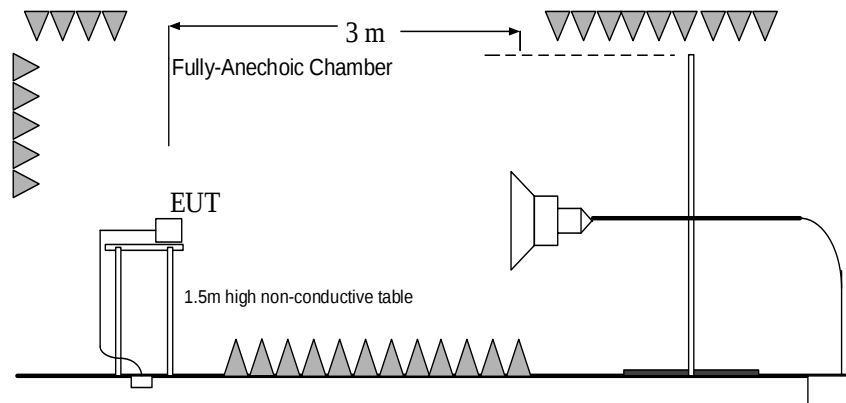
### Above 1GHz:

EUT was placed on a 1.5 meter high non-conductive table at a 3 meter test distance from the receive antenna. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT and adjusting the receiving antenna polarization.

### 1GHz-3GHz:

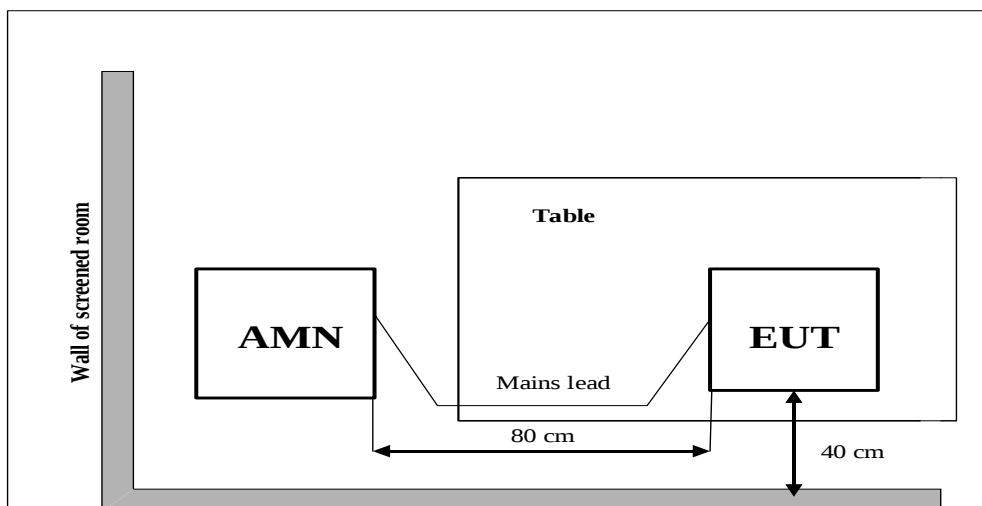


### 3GHz-40GHz:



### 3) AC Power line Conducted Emission Measurement

For WLAN, the EUT is working under test mode. The EUT is commanded to operate at maximum transmitting power.



**A.0 Antenna requirement****Measurement Limit:**

| Standard            | Requirement                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FCC CRF Part 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. |

**Conclusion: The Directional gains of antenna used for transmitting is -2.0dBi.**

**The RF transmitter uses an integrate antenna without connector.**

## A.1 Maximum Output Power

### Measurement of method : See ANSI C63.10-Clause 11.9.2.3.2

Method AVGPM-G is a measurement using a gated RF average power meter.

Alternatively, measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Because the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

### Measurement Limit:

| Standard               | Limit (dBm) | E.I.R.P Limit (dBm) |
|------------------------|-------------|---------------------|
| FCC CRF Part 15.247(b) | < 30        | < 36                |

### Measurement Results:

| Mode         | RF output power (dBm) |               |                |
|--------------|-----------------------|---------------|----------------|
|              | 2412MHz (Ch1)         | 2437MHz (Ch6) | 2462MHz (Ch11) |
| 802.11b      | 15.80                 | 16.40         | 15.47          |
| 802.11g      | 14.72                 | 15.16         | 14.55          |
| 802.11n-HT20 | 14.72                 | 15.35         | 14.07          |
|              | 2422MHz (Ch3)         | 2437MHz (Ch6) | 2452MHz (Ch9)  |
| 802.11n-HT40 | 13.40                 | 13.53         | 13.49          |

Note: The data rate 1Mbps (11b mode), 6Mbps (11g mode) and MCS0 (11n mode) are selected as the Worst-Case. The following cases and test graphs are performed with this condition. The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

### E.I.R.P

| Mode         | RF output power (dBm) |               |                |
|--------------|-----------------------|---------------|----------------|
|              | 2412MHz (Ch1)         | 2437MHz (Ch6) | 2462MHz (Ch11) |
| 802.11b      | 13.80                 | 14.40         | 13.47          |
| 802.11g      | 12.72                 | 13.16         | 12.55          |
| 802.11n-HT20 | 12.72                 | 13.35         | 12.07          |
|              | 2422MHz (Ch3)         | 2437MHz (Ch6) | 2452MHz (Ch9)  |
| 802.11n-HT40 | 11.40                 | 11.53         | 11.49          |

Note: E.I.R.P value= Conducted values (with conducted samples) + Antenna Gain.

**Conclusion: Pass**



## A.2 Peak Power Spectral Density

### Measurement Limit:

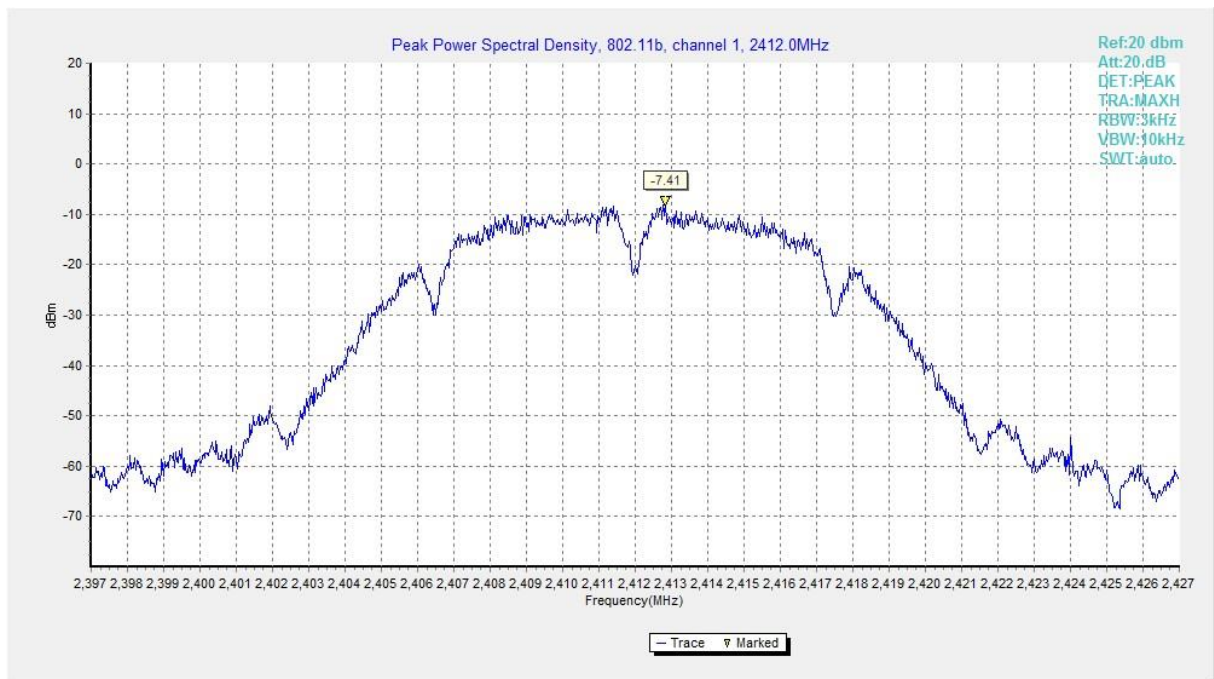
| Standard               | Limit         |
|------------------------|---------------|
| FCC CRF Part 15.247(e) | < 8 dBm/3 kHz |

### Measurement Results:

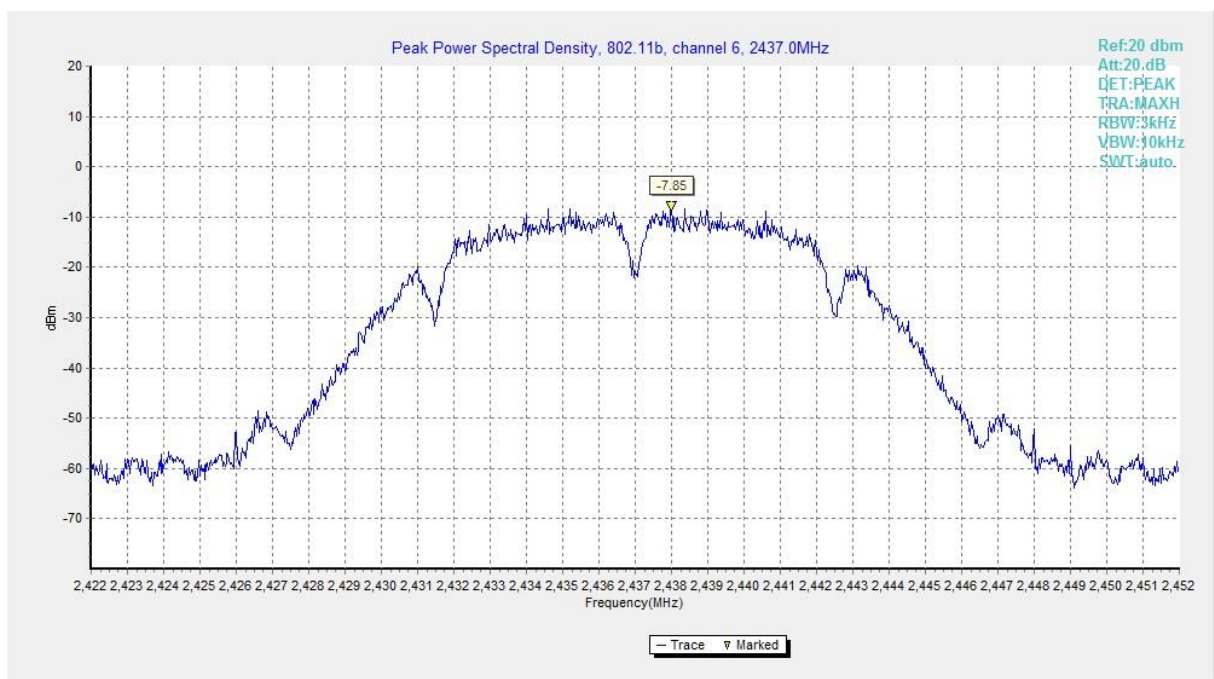
| Mode             | Channel | Frequency (MHz) | Test Results (dBm) |        | Conclusion |
|------------------|---------|-----------------|--------------------|--------|------------|
| 802.11b          | CH 1    | 2412            | Fig.1              | -7.41  | P          |
|                  | CH 6    | 2437            | Fig.2              | -7.85  | P          |
|                  | CH 11   | 2462            | Fig.3              | -8.51  | P          |
| 802.11g          | CH 1    | 2412            | Fig.4              | -10.74 | P          |
|                  | CH 6    | 2437            | Fig.5              | -10.83 | P          |
|                  | CH 11   | 2462            | Fig.6              | -10.43 | P          |
| 802.11n<br>-HT20 | CH 1    | 2412            | Fig.7              | -10.74 | P          |
|                  | CH 6    | 2437            | Fig.8              | -10.85 | P          |
|                  | CH 11   | 2462            | Fig.9              | -11.14 | P          |
| 802.11n<br>-HT40 | CH 3    | 2422            | Fig.10             | -15.05 | P          |
|                  | CH 6    | 2437            | Fig.11             | -15.27 | P          |
|                  | CH 9    | 2452            | Fig.12             | -13.73 | P          |

See below for test graphs.

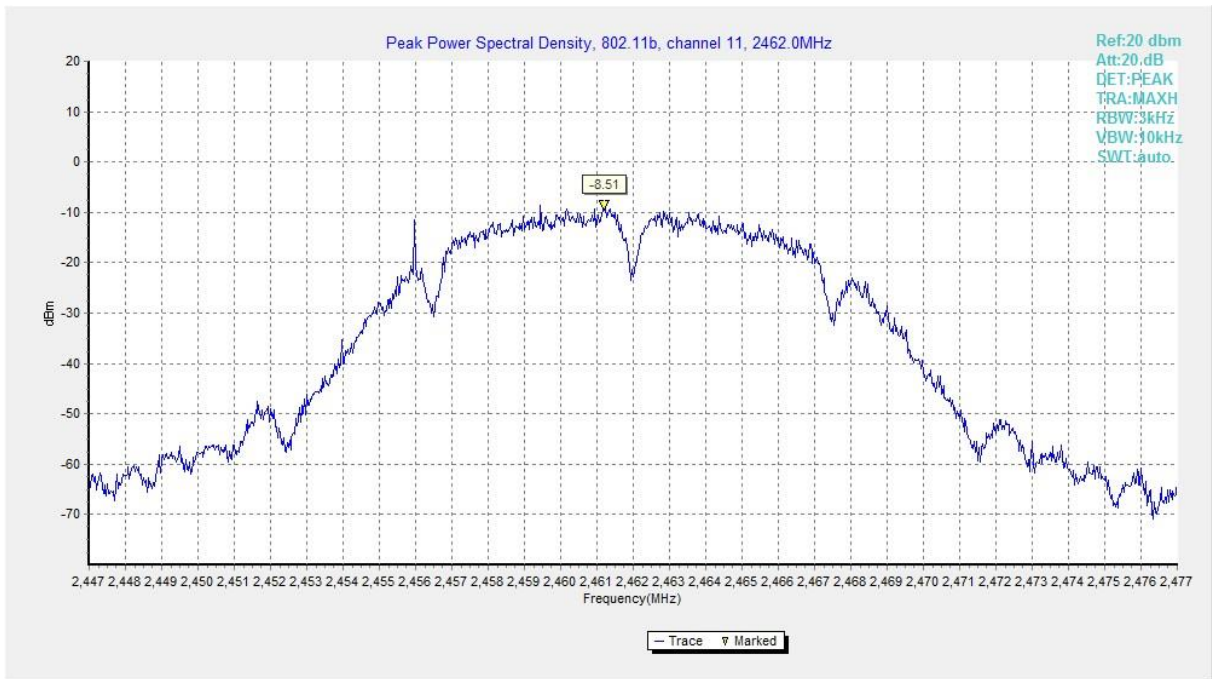
Conclusion: PASS



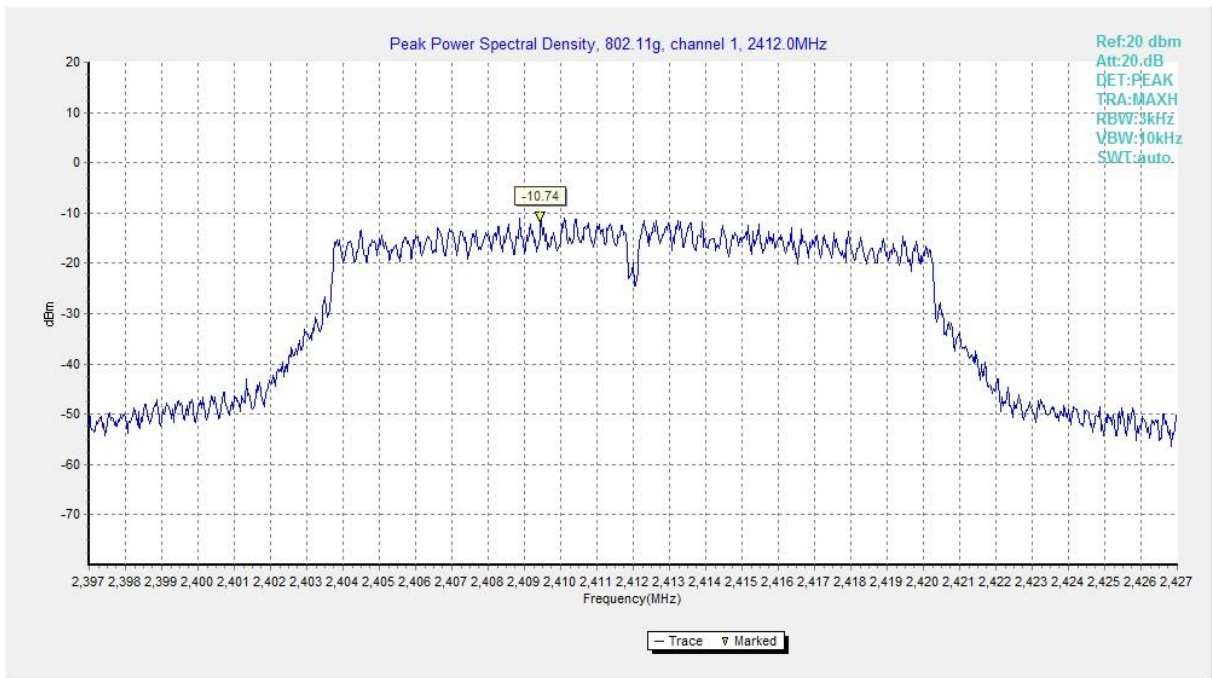
**Fig.1 Power Spectral Density (802.11b, CH 1)**



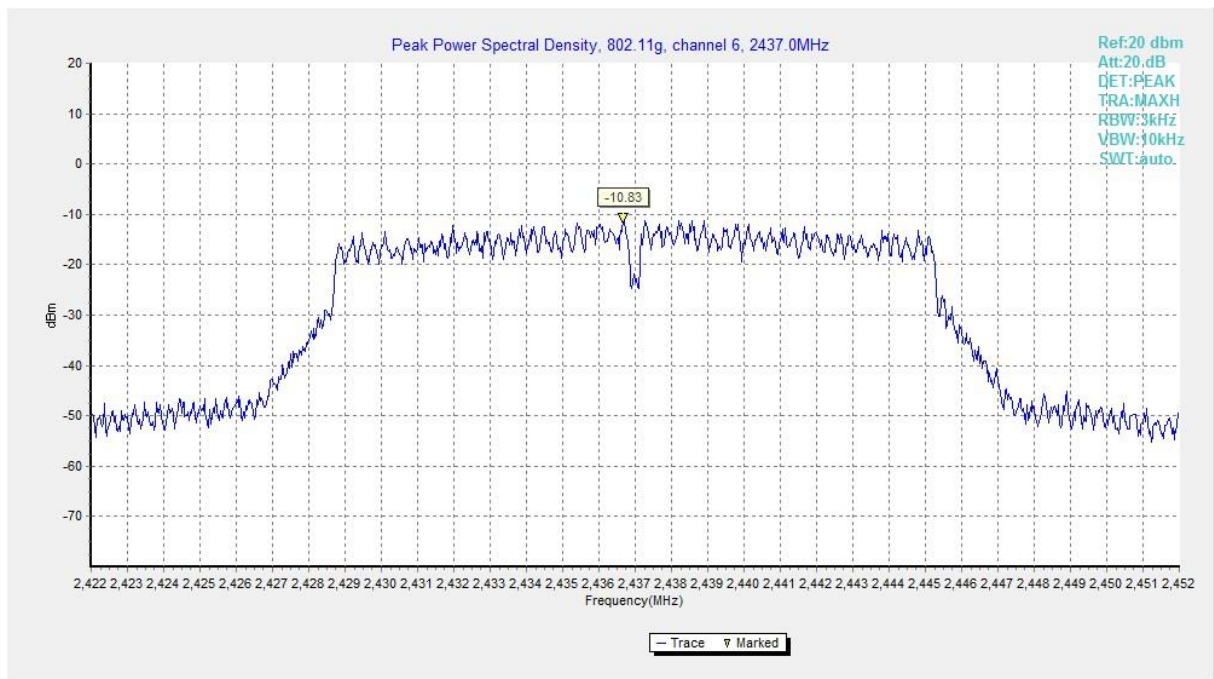
**Fig.2 Power Spectral Density (802.11b, CH 6)**



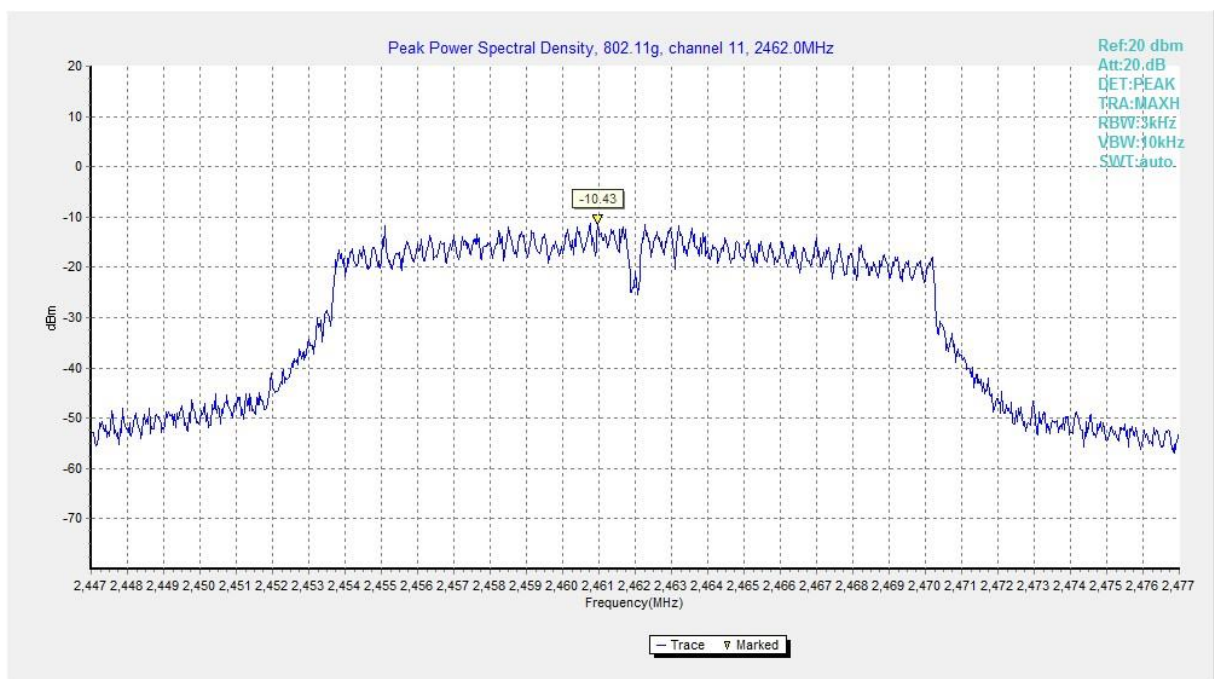
**Fig.3 Power Spectral Density (802.11b, CH 11)**



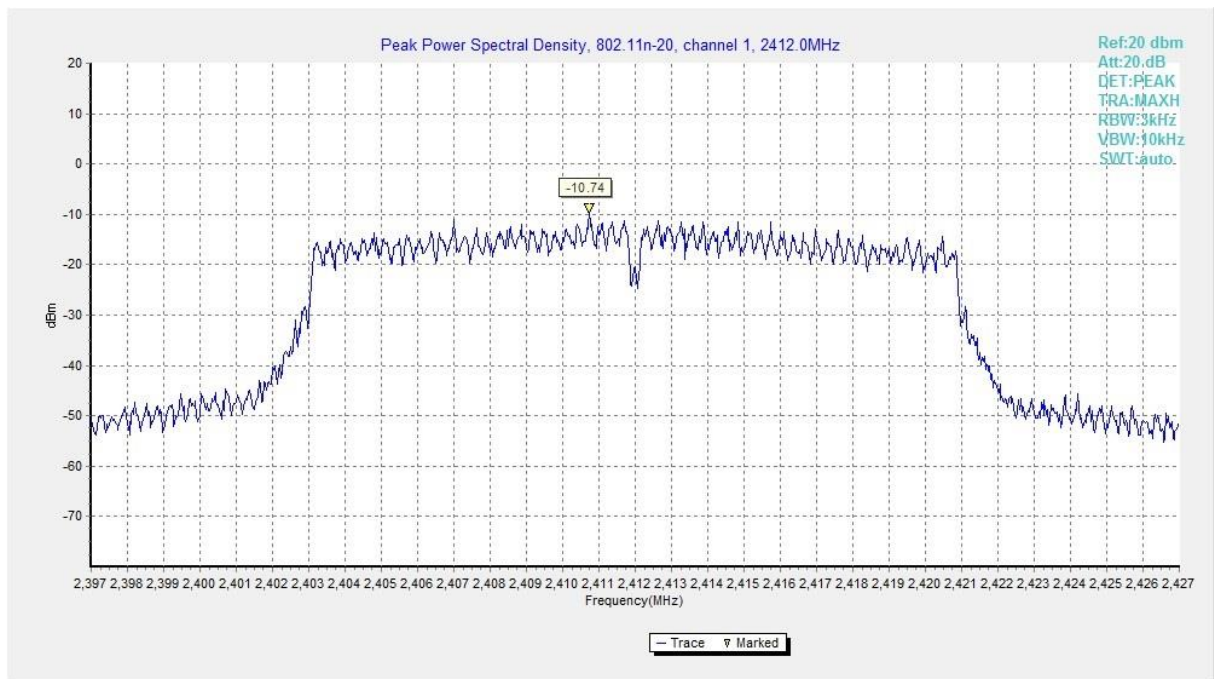
**Fig.4 Power Spectral Density (802.11g, CH 1)**



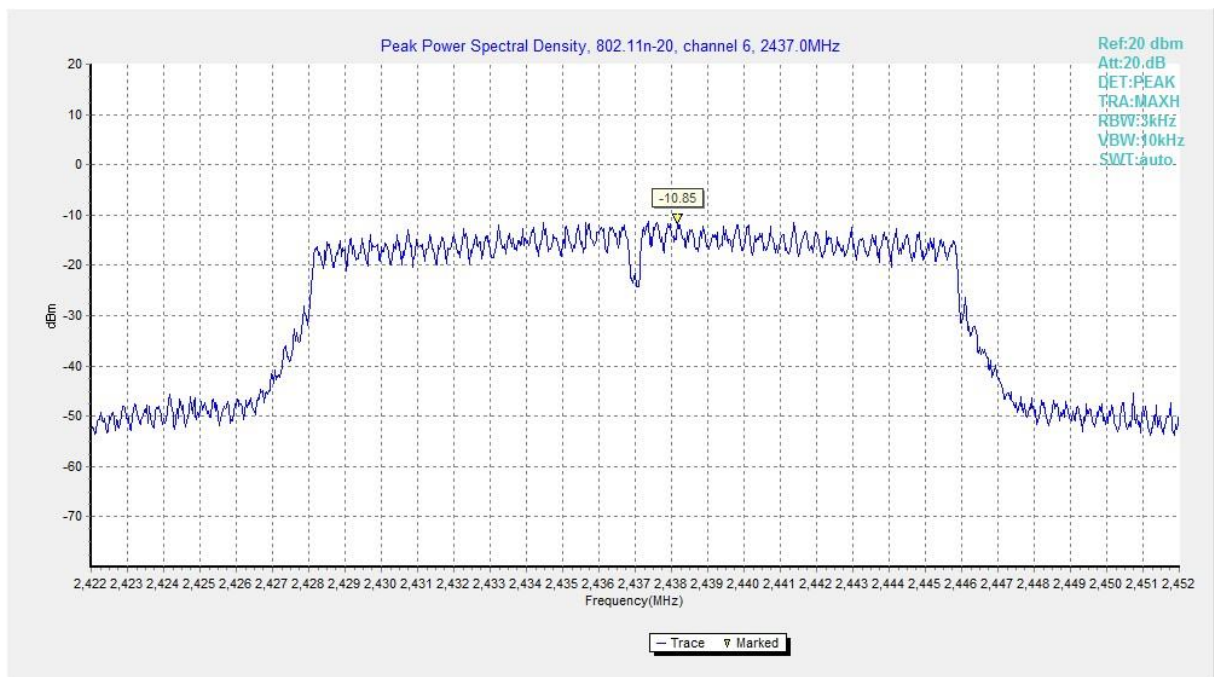
**Fig.5 Power Spectral Density (802.11g, CH 6)**



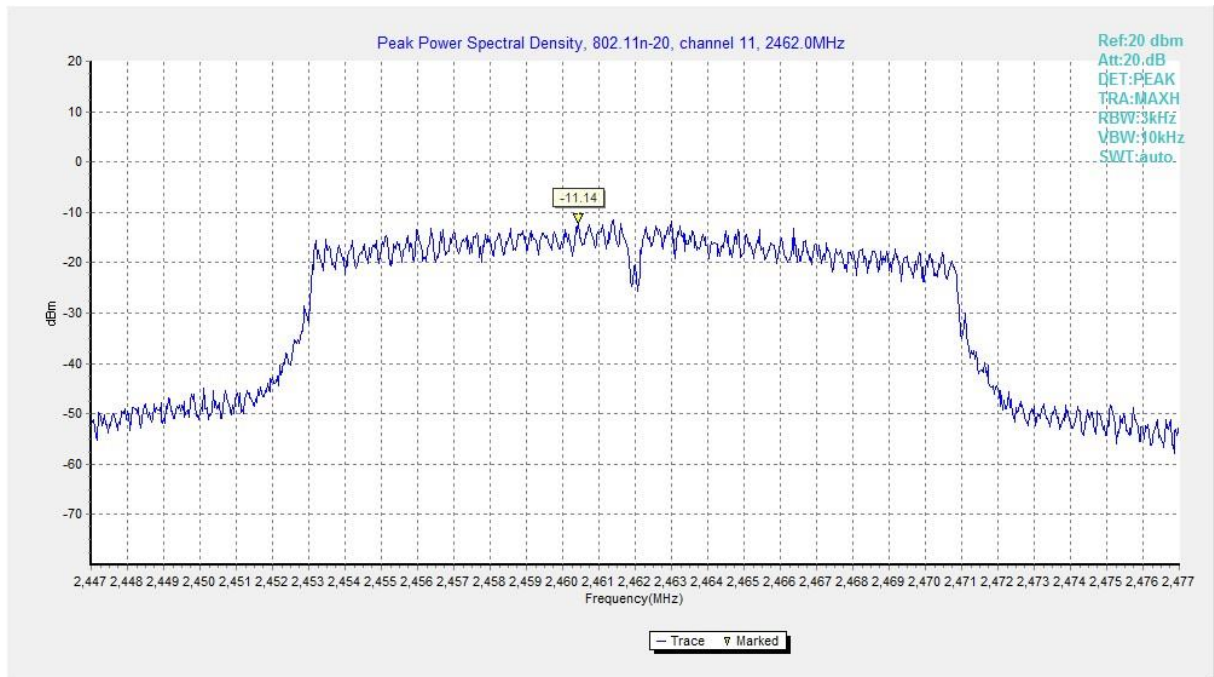
**Fig.6 Power Spectral Density (802.11g, CH 11)**



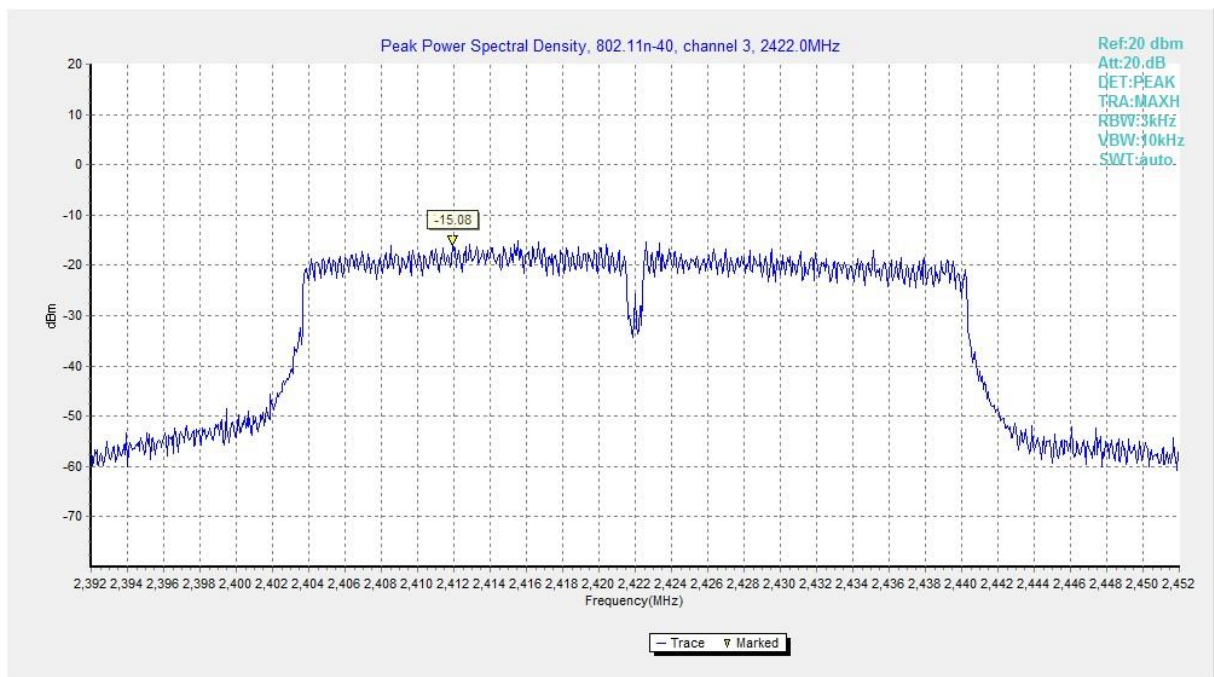
**Fig.7 Power Spectral Density (802.11n-HT20, CH 1)**



**Fig.8 Power Spectral Density (802.11n-HT20, CH 6)**



**Fig.9 Power Spectral Density (802.11n-HT20, CH 11)**



**Fig.10 Power Spectral Density (802.11n-HT40, CH 3)**

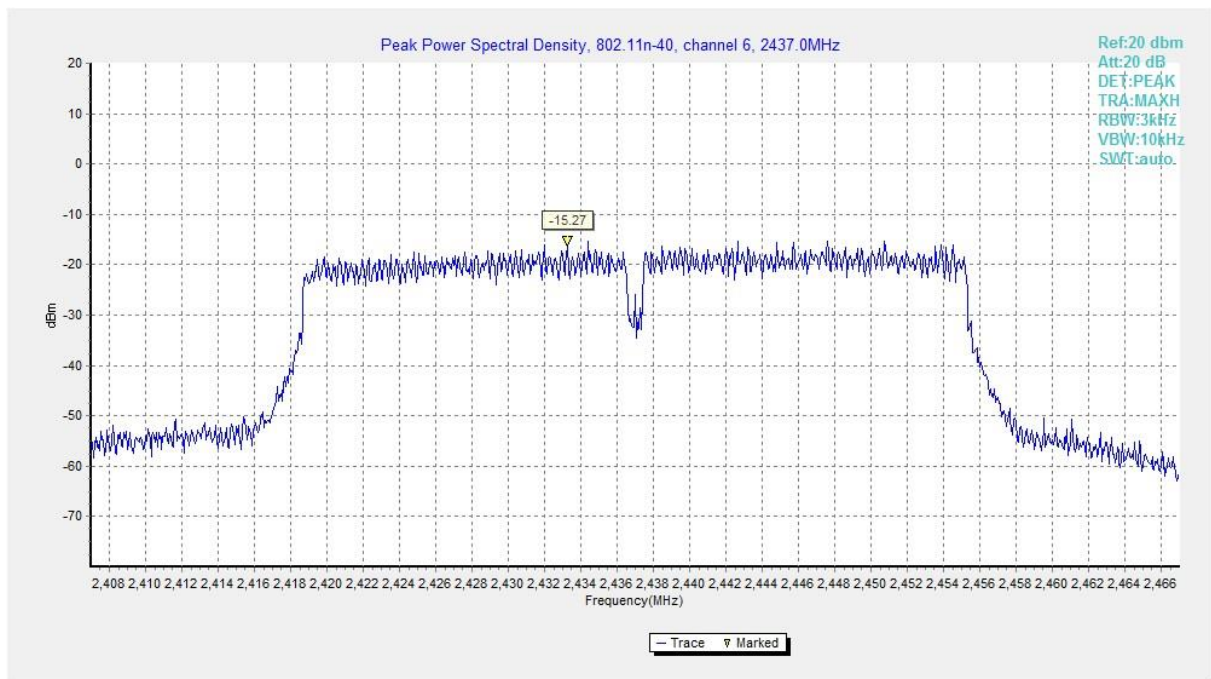


Fig.11 Power Spectral Density (802.11n-HT40, CH 6)

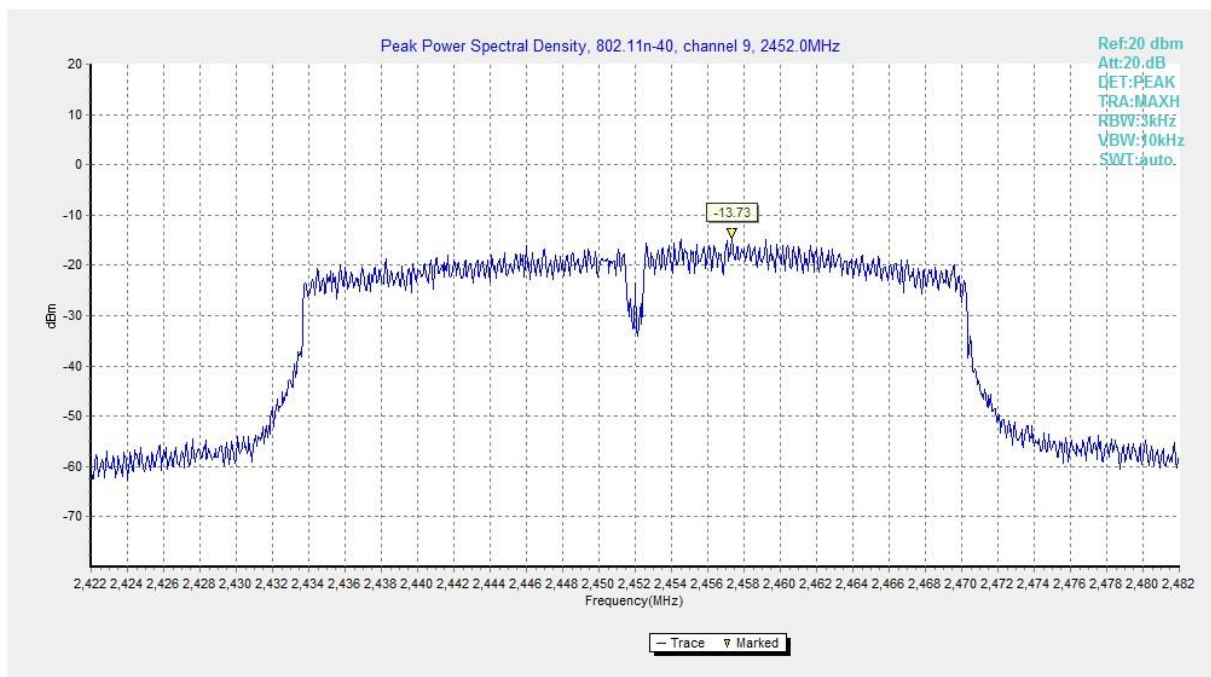


Fig.12 Power Spectral Density (802.11n-HT40, CH 9)



### A.3 6dB Bandwidth

#### Measurement Limit:

| Standard                   | Limit (kHz) |
|----------------------------|-------------|
| FCC 47 CFR Part 15.247 (a) | ≥ 500       |

#### Measurement Result:

| Mode             | Channel | Frequency (MHz) | Test Results (kHz) |       | Conclusion |
|------------------|---------|-----------------|--------------------|-------|------------|
| 802.11b          | CH 1    | 2412            | Fig.13             | 9600  | P          |
|                  | CH 6    | 2437            | Fig.14             | 9550  | P          |
|                  | CH 11   | 2462            | Fig.15             | 9050  | P          |
| 802.11g          | CH 1    | 2412            | Fig.16             | 15150 | P          |
|                  | CH 6    | 2437            | Fig.17             | 15400 | P          |
|                  | CH 11   | 2462            | Fig.18             | 15050 | P          |
| 802.11n<br>-HT20 | CH 1    | 2412            | Fig.19             | 15100 | P          |
|                  | CH 6    | 2437            | Fig.20             | 15950 | P          |
|                  | CH 11   | 2462            | Fig.21             | 15050 | P          |
| 802.11n<br>-HT40 | CH 3    | 2422            | Fig.22             | 35200 | P          |
|                  | CH 6    | 2437            | Fig.23             | 35760 | P          |
|                  | CH 9    | 2452            | Fig.24             | 35040 | P          |

See below for test graphs.

Conclusion: PASS

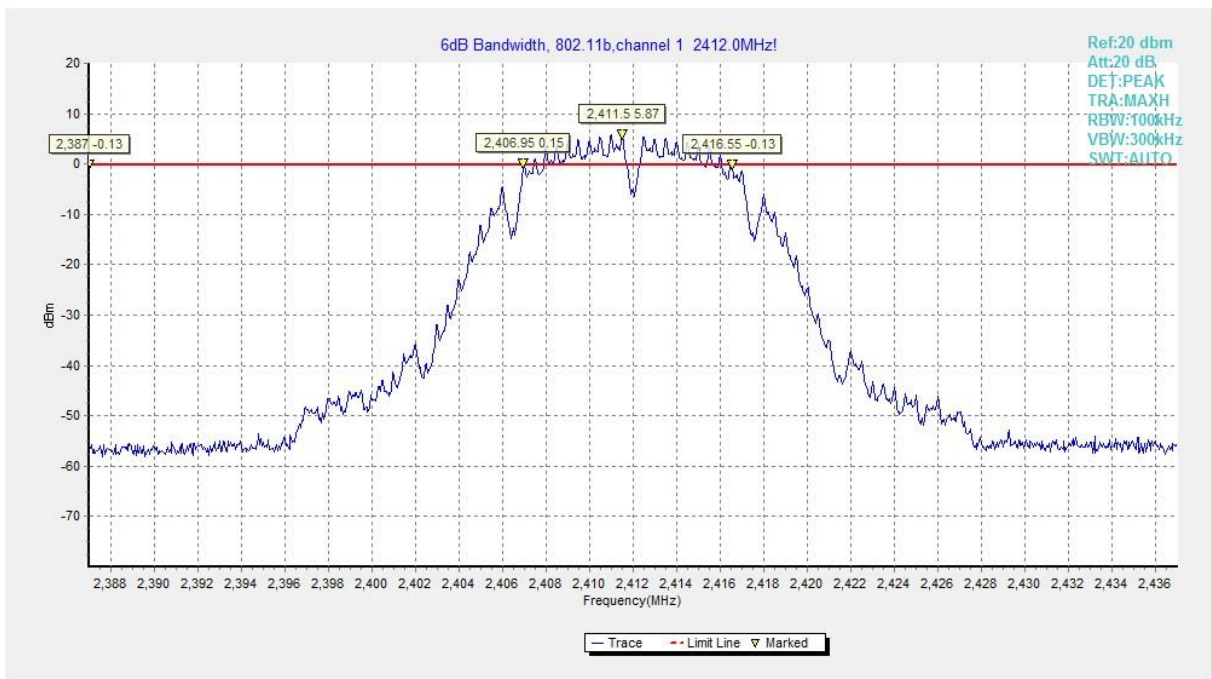


Fig.13 6dB Bandwidth (802.11b, CH 1)

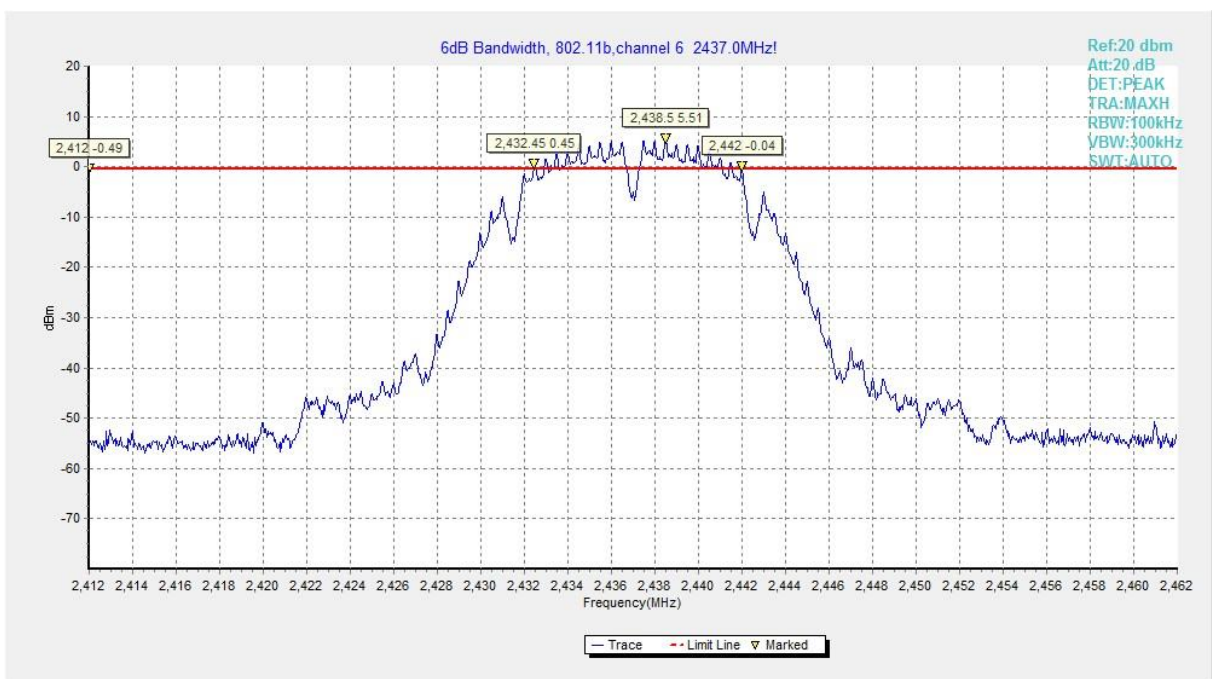


Fig.14 6dB Bandwidth (802.11b, CH 6)



Fig.15 6dB Bandwidth (802.11b, CH 11)

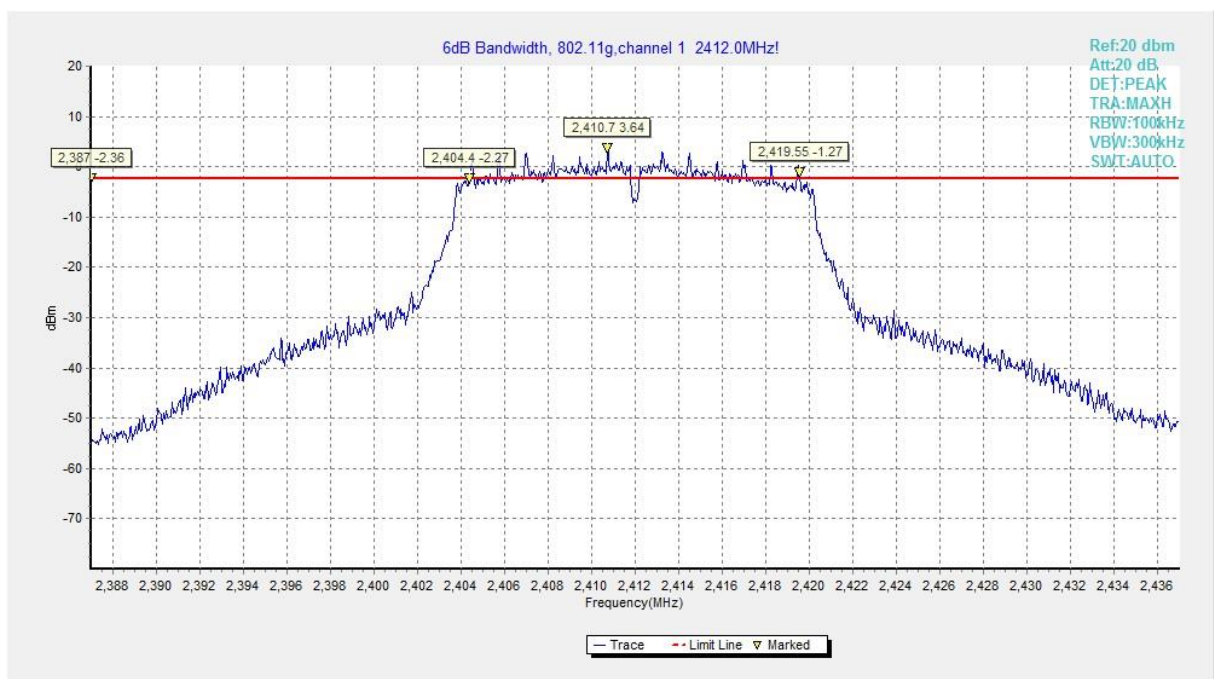


Fig.16 6dB Bandwidth (802.11g, CH 1)

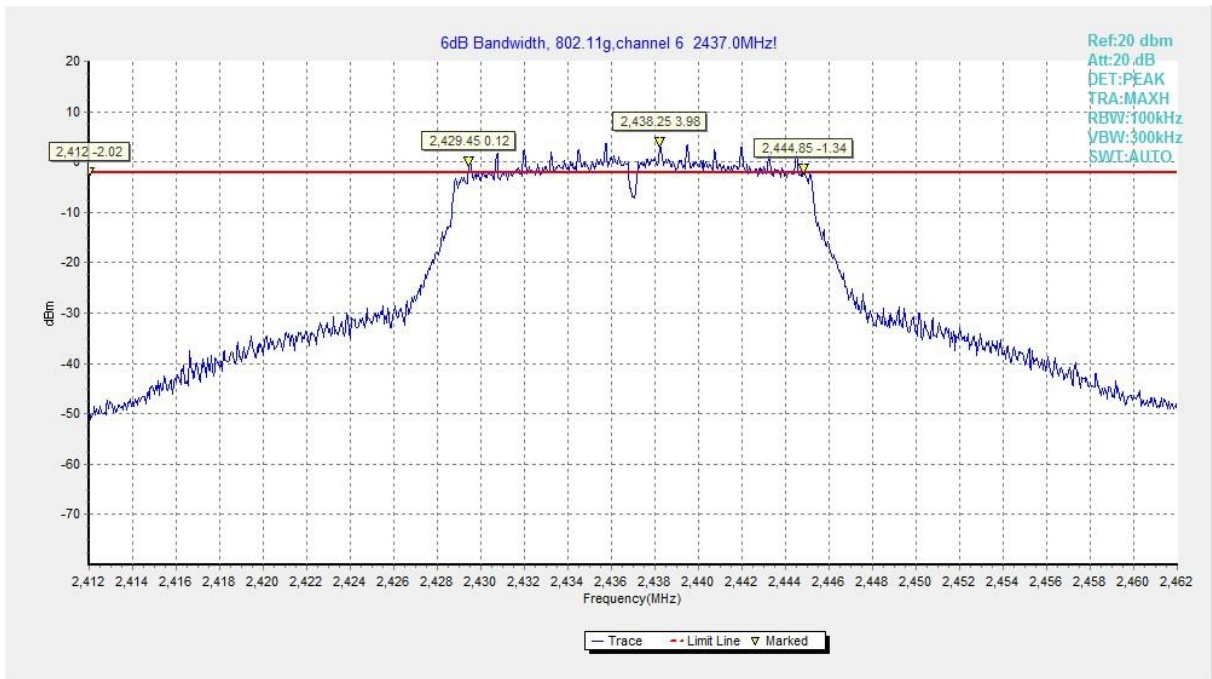


Fig.17 6dB Bandwidth (802.11g, CH 6)

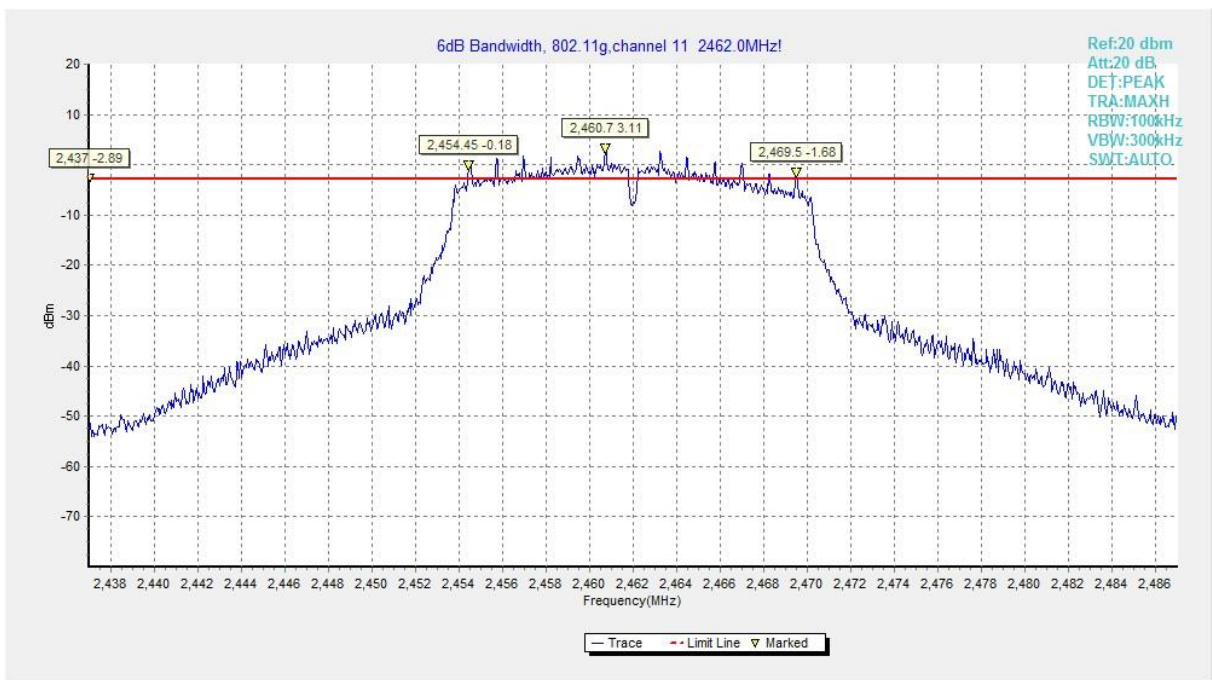


Fig.18 6dB Bandwidth (802.11g, CH 11)

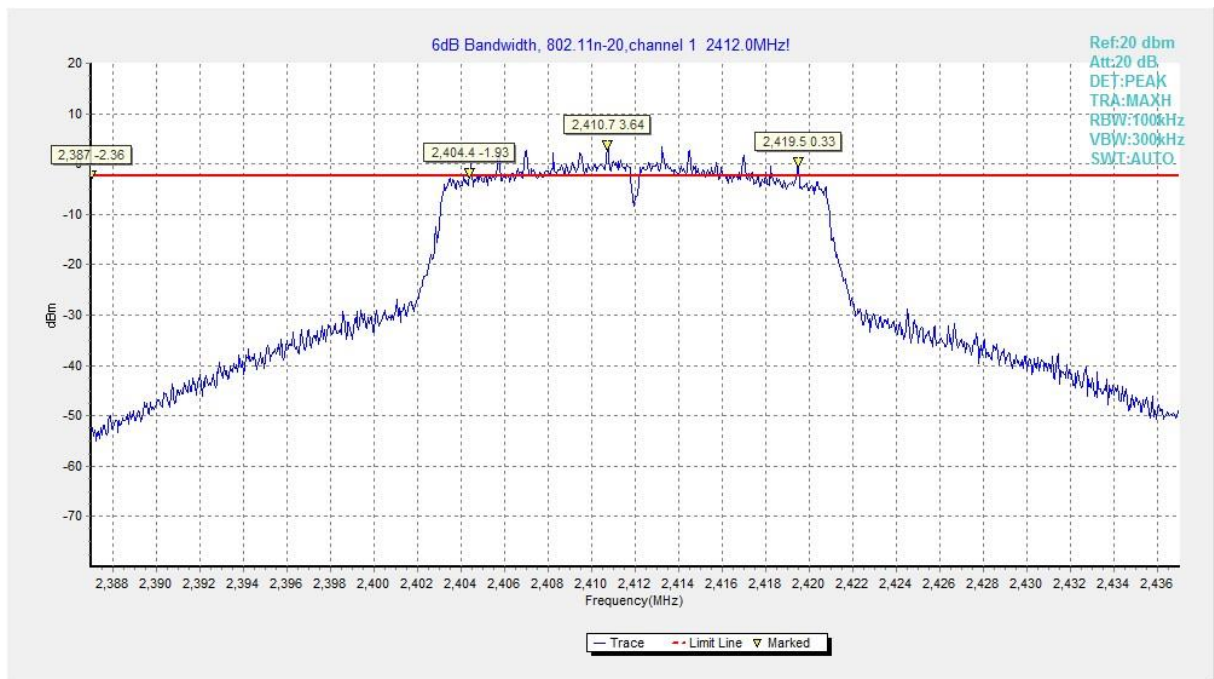


Fig.19 6dB Bandwidth (802.11n-HT20, CH 1)

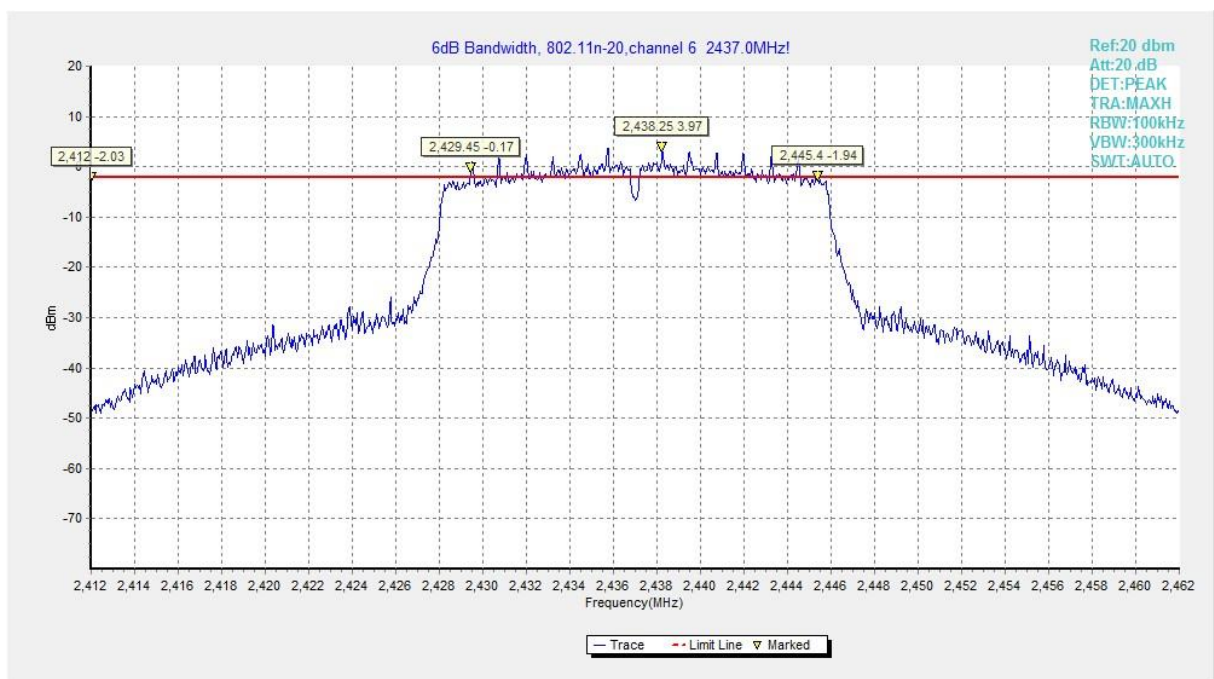


Fig.20 6dB Bandwidth (802.11n-HT20, CH 6)

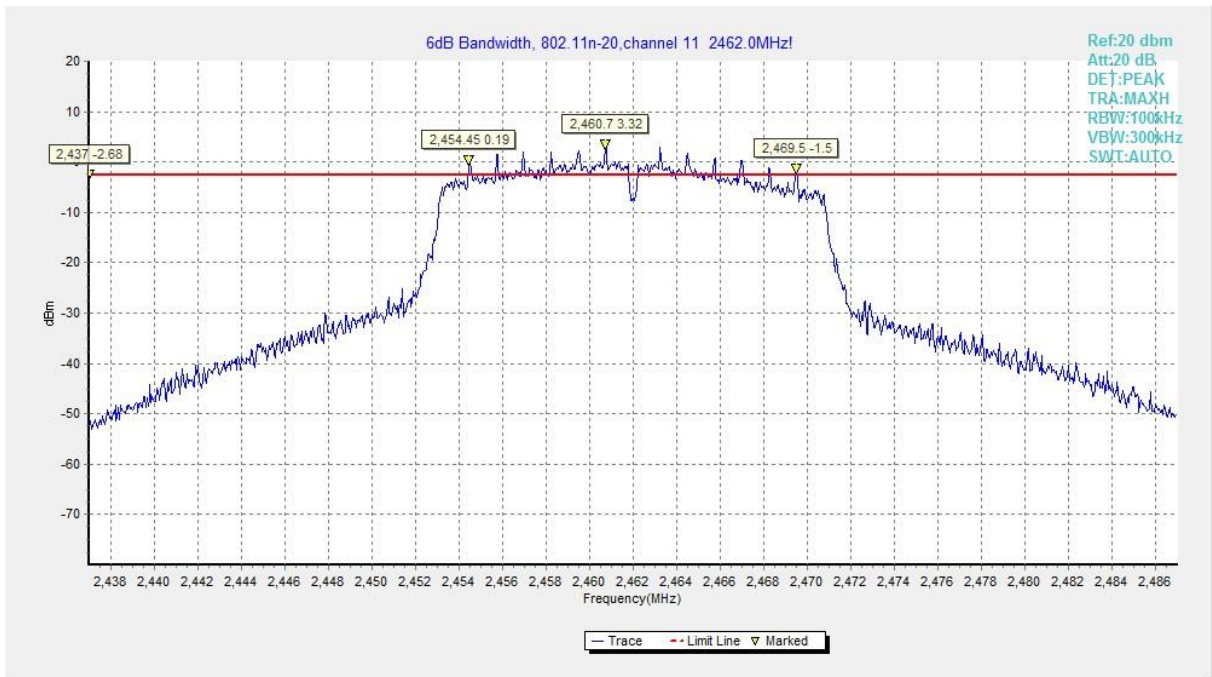


Fig.21 6dB Bandwidth (802.11n-HT20, CH 11)

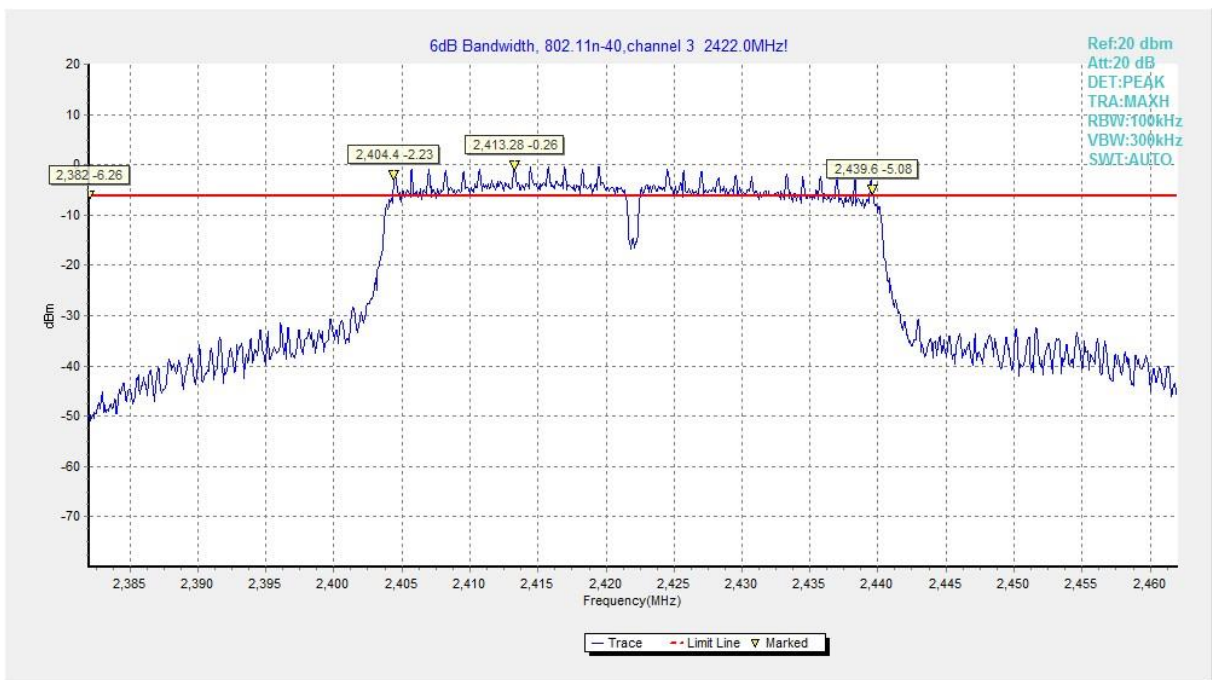


Fig.22 6dB Bandwidth (802.11n-HT40, CH 3)

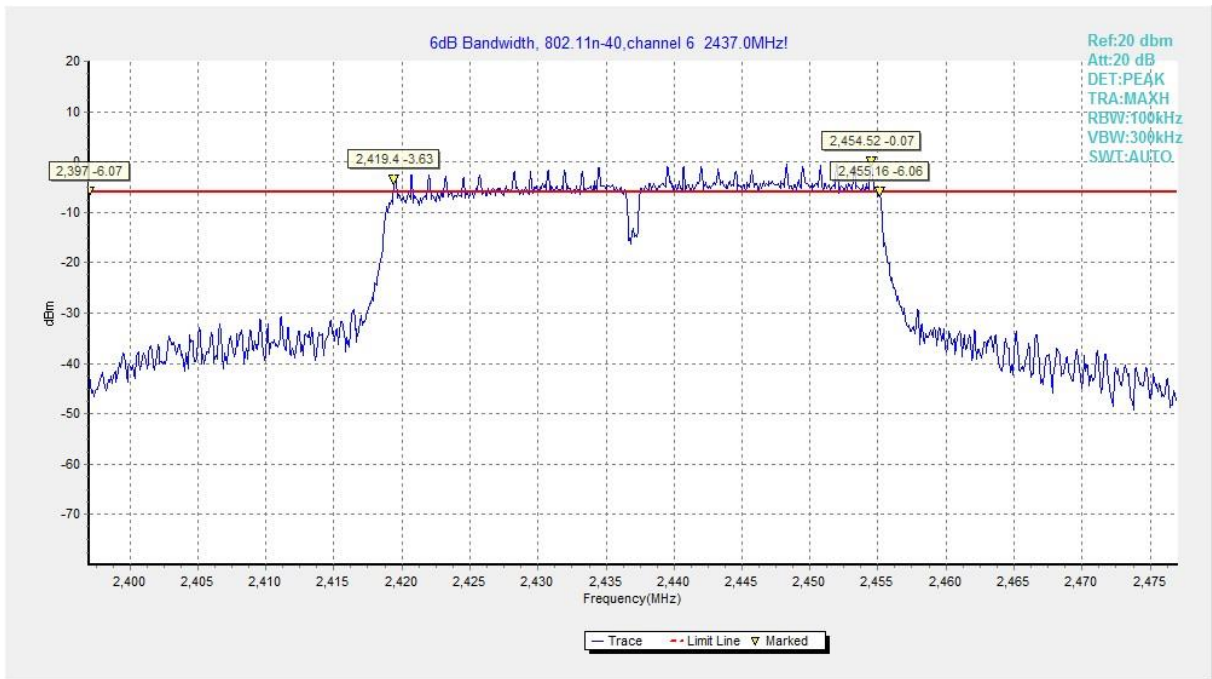


Fig.23 6dB Bandwidth (802.11n-HT40, CH 6)

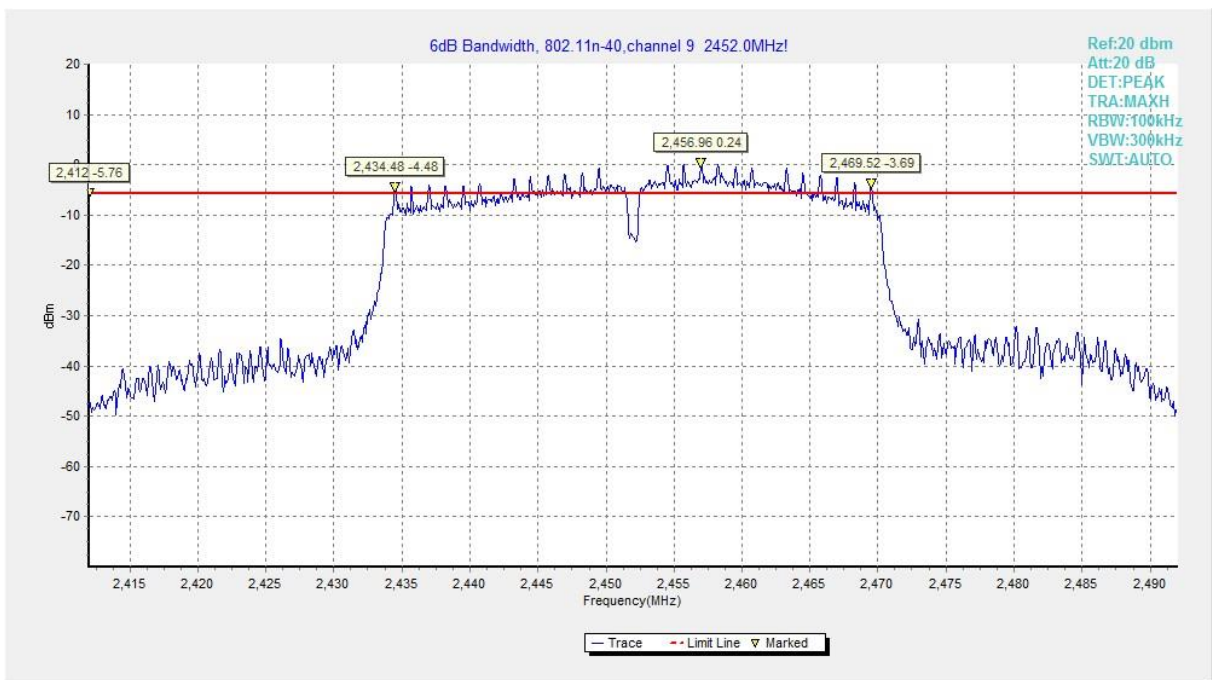


Fig.24 6dB Bandwidth (802.11n-HT40, CH 9)

## A.4 Band Edges Compliance

### Measurement Limit:

| Standard                   | Limit (dB) |
|----------------------------|------------|
| FCC 47 CFR Part 15.247 (d) | > 20       |

### Measurement Result:

| Mode             | Channel | Frequency (MHz) | Test Results (dB) |       | Conclusion |
|------------------|---------|-----------------|-------------------|-------|------------|
| 802.11b          | CH 1    | 2412            | Fig.25            | 48.72 | P          |
|                  | CH 11   | 2462            | Fig.26            | 61.20 | P          |
| 802.11g          | CH 1    | 2412            | Fig.27            | 33.25 | P          |
|                  | CH 11   | 2462            | Fig.28            | 50.46 | P          |
| 802.11n<br>-HT20 | CH 1    | 2412            | Fig.29            | 34.47 | P          |
|                  | CH 11   | 2462            | Fig.30            | 46.91 | P          |
| 802.11n<br>-HT40 | CH 3    | 2422            | Fig.31            | 32.89 | P          |
|                  | CH 9    | 2452            | Fig.32            | 38.92 | P          |

See below for test graphs.

Conclusion: PASS

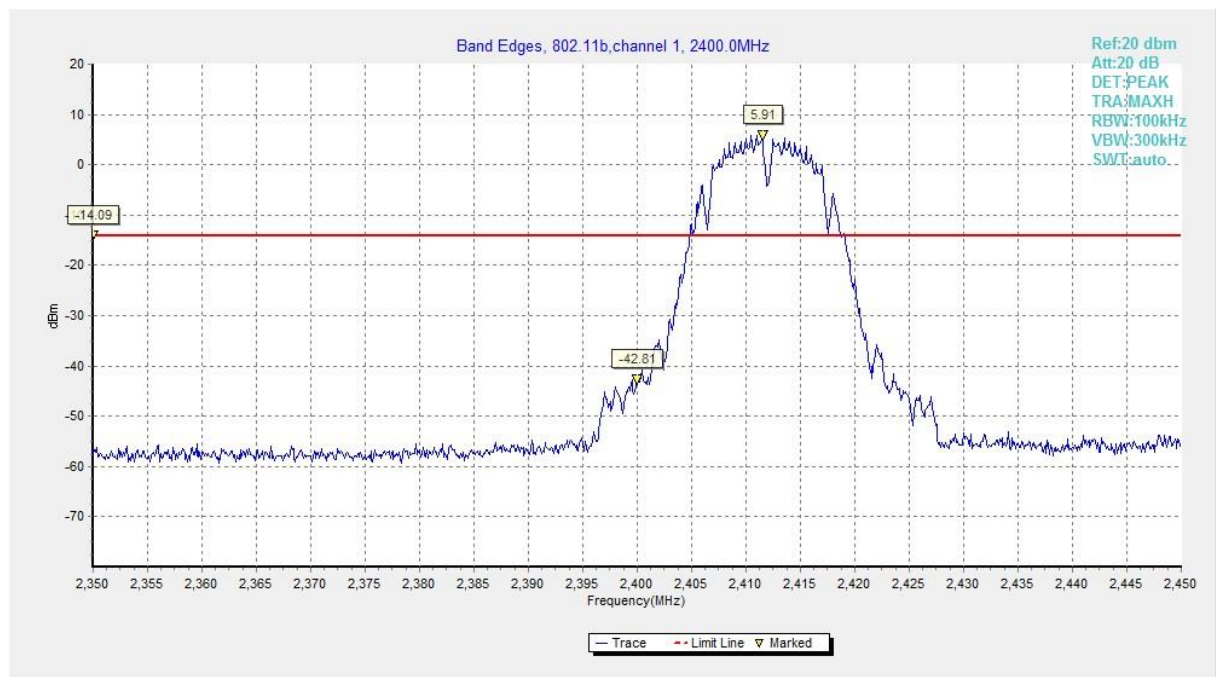


Fig.25 Band Edges (802.11b, CH 1)

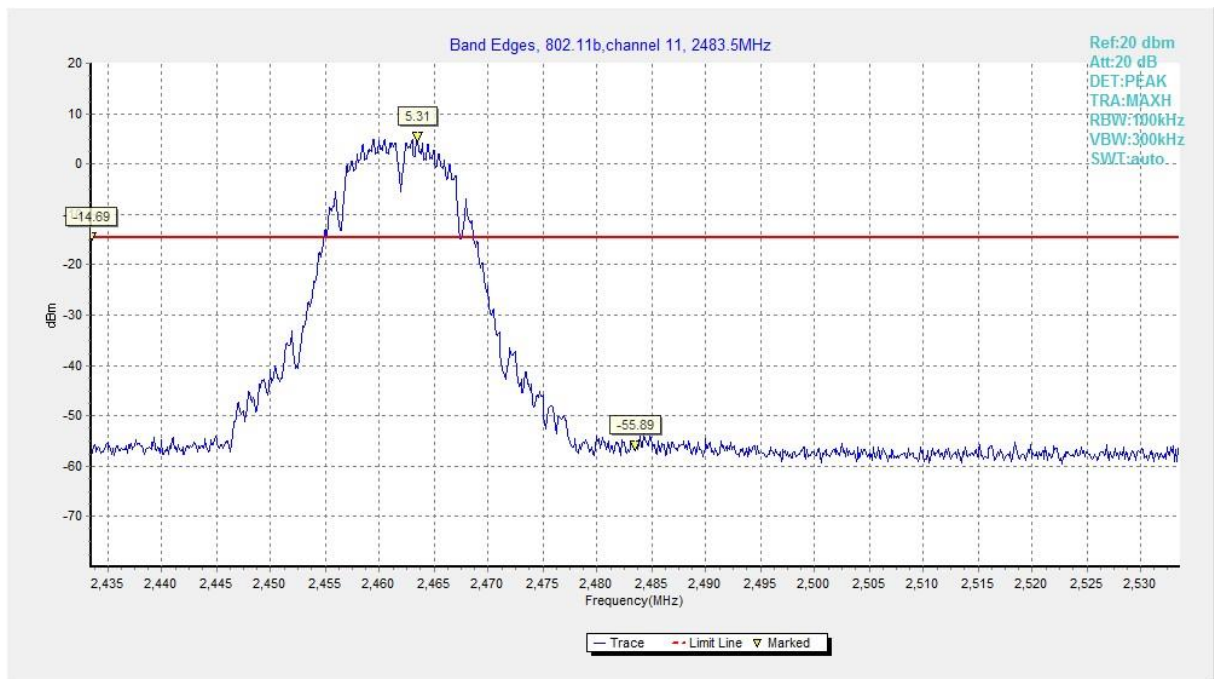


Fig.26 Band Edges (802.11b, CH 11)

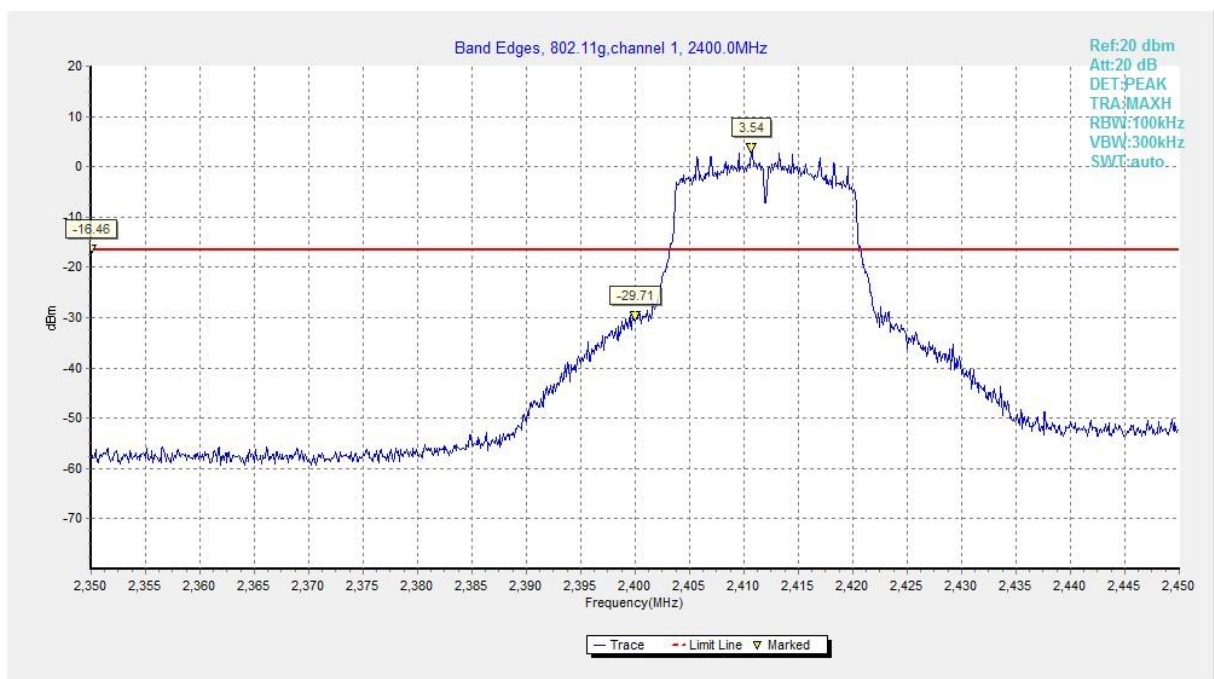


Fig.27 Band Edges (802.11g, CH 1)

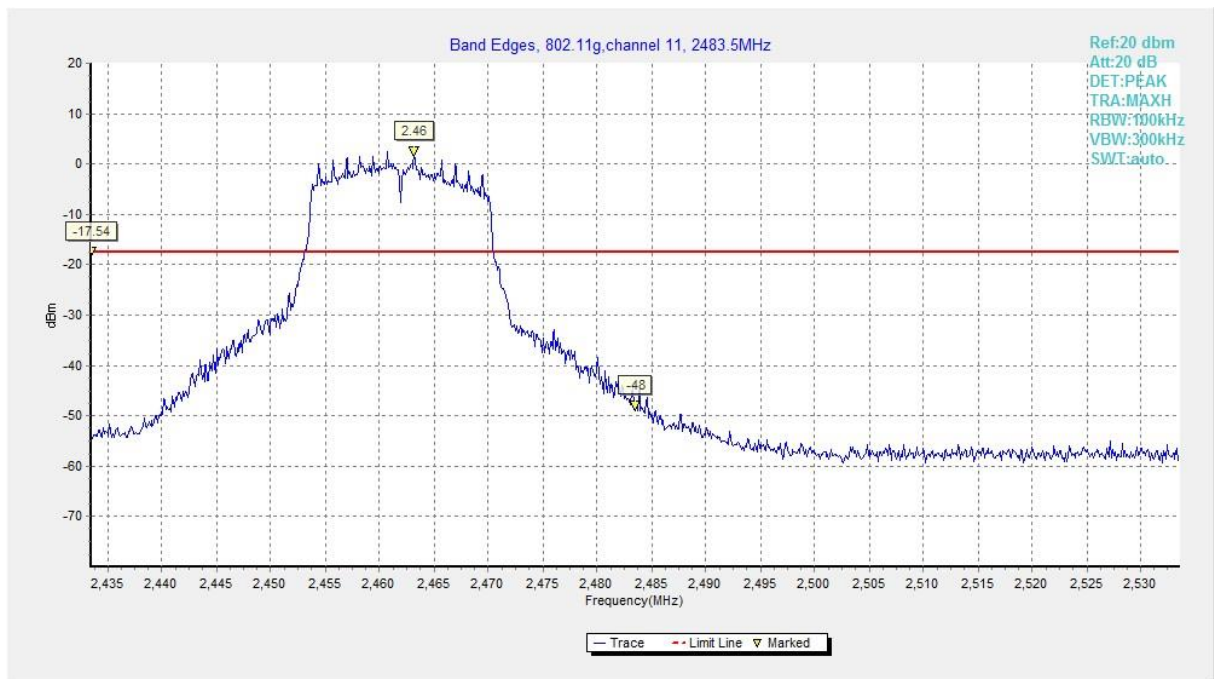


Fig.28 Band Edges (802.11g, CH 11)

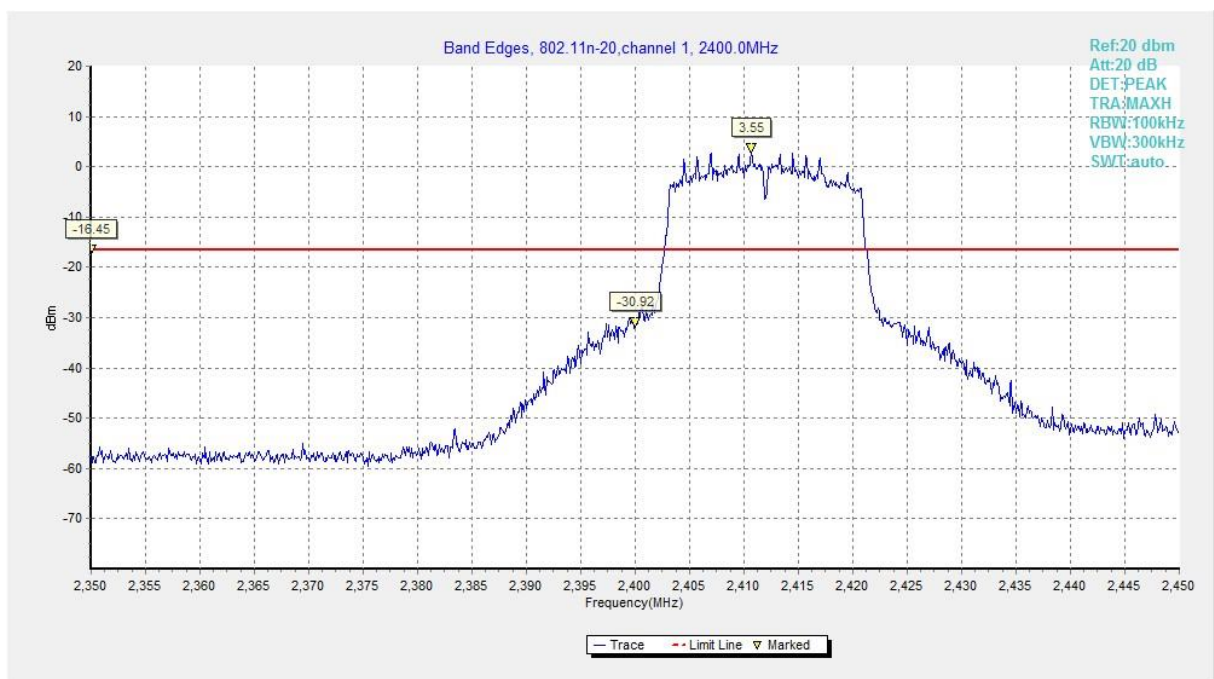
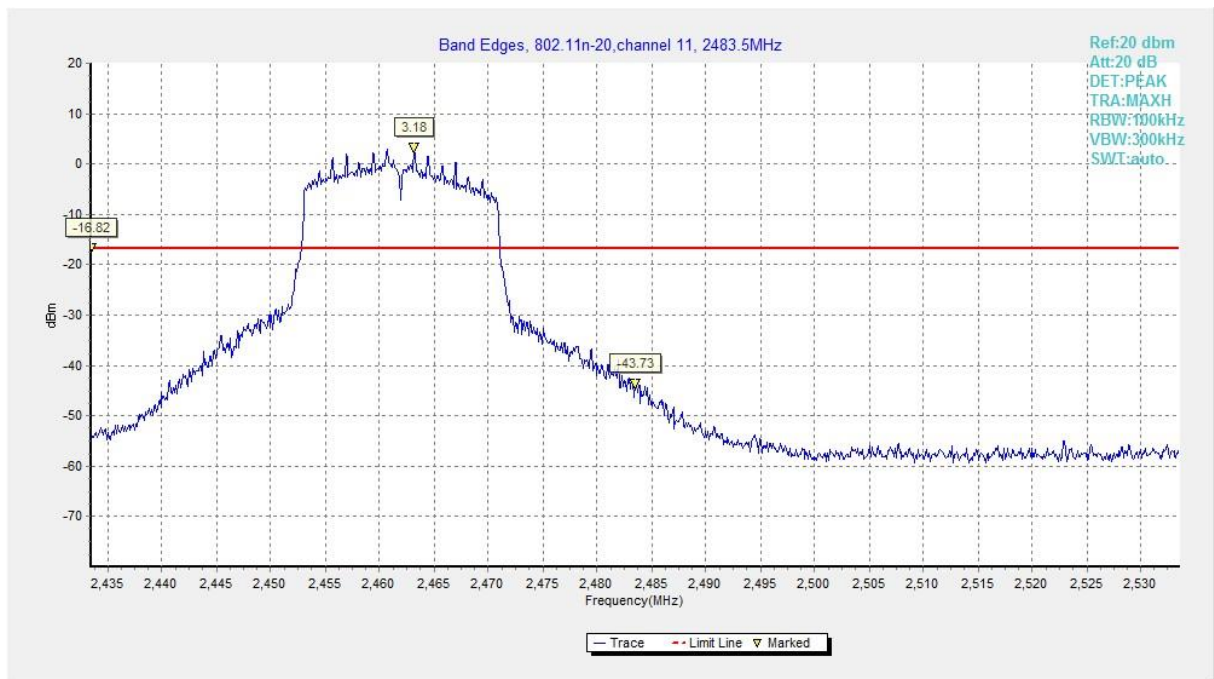
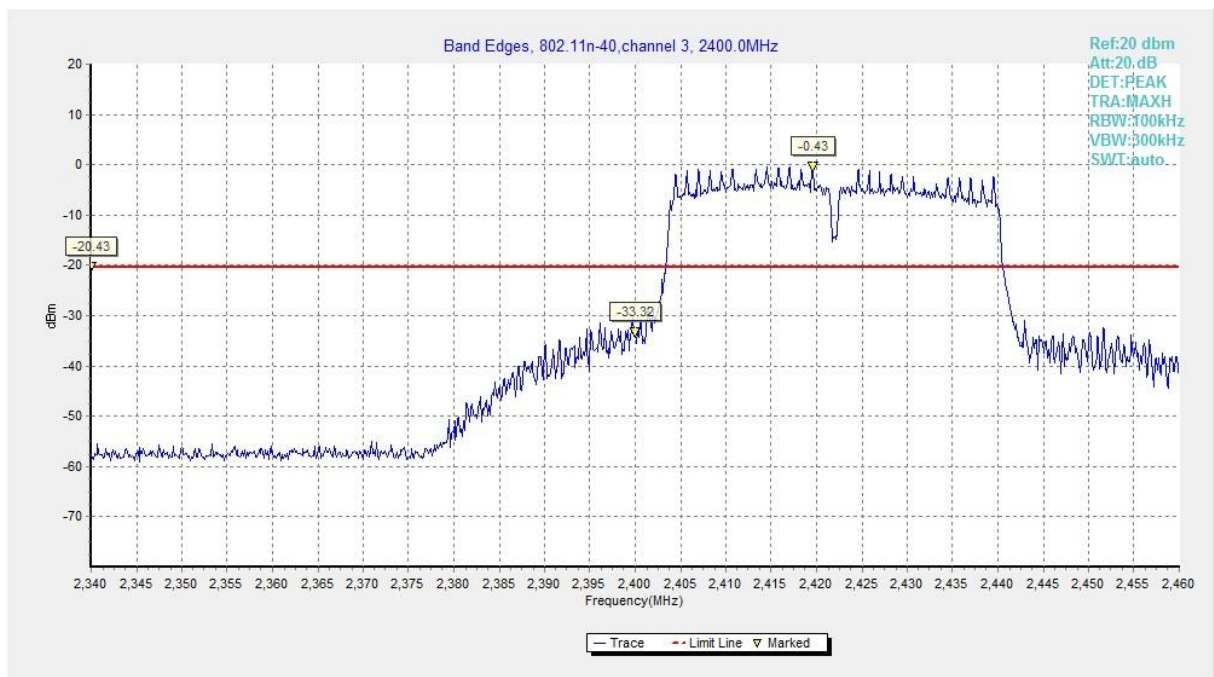


Fig.29 Band Edges (802.11n-HT20, CH 1)



**Fig.30 Band Edges (802.11n-HT20, CH 11)**



**Fig.31 Band Edges (802.11n-HT40, CH 3)**

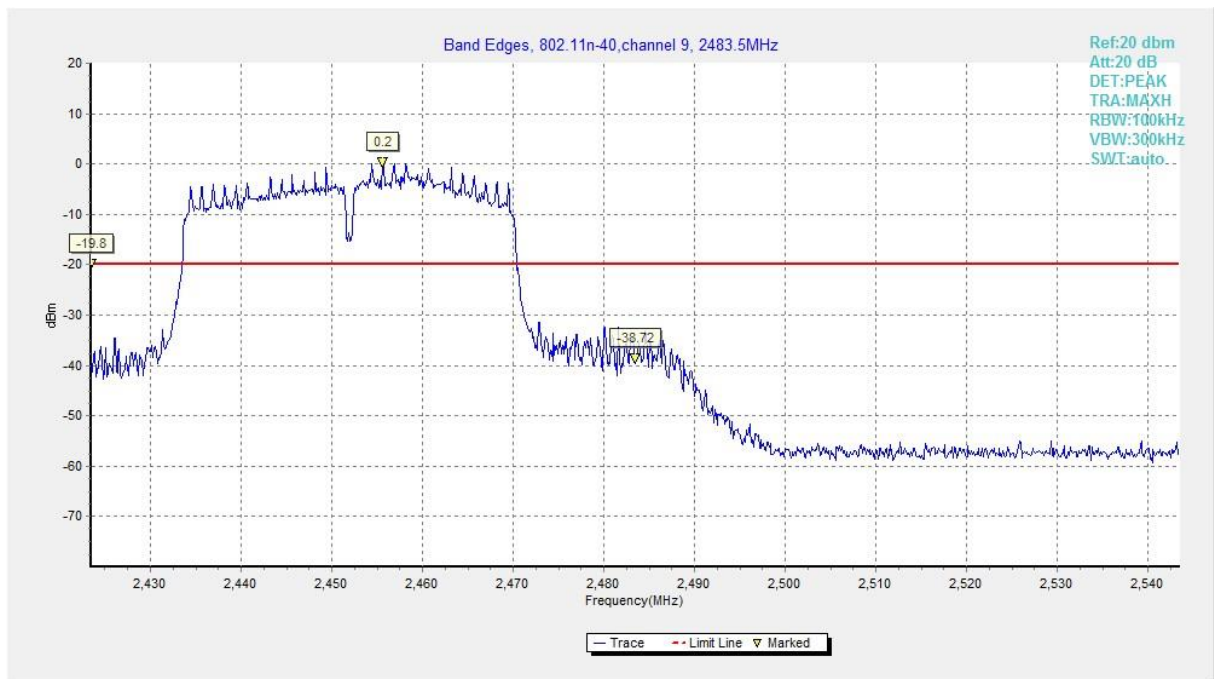


Fig.32 Band Edges (802.11n-HT40, CH 9)



## A.5 Conducted Emission

### Measurement Limit:

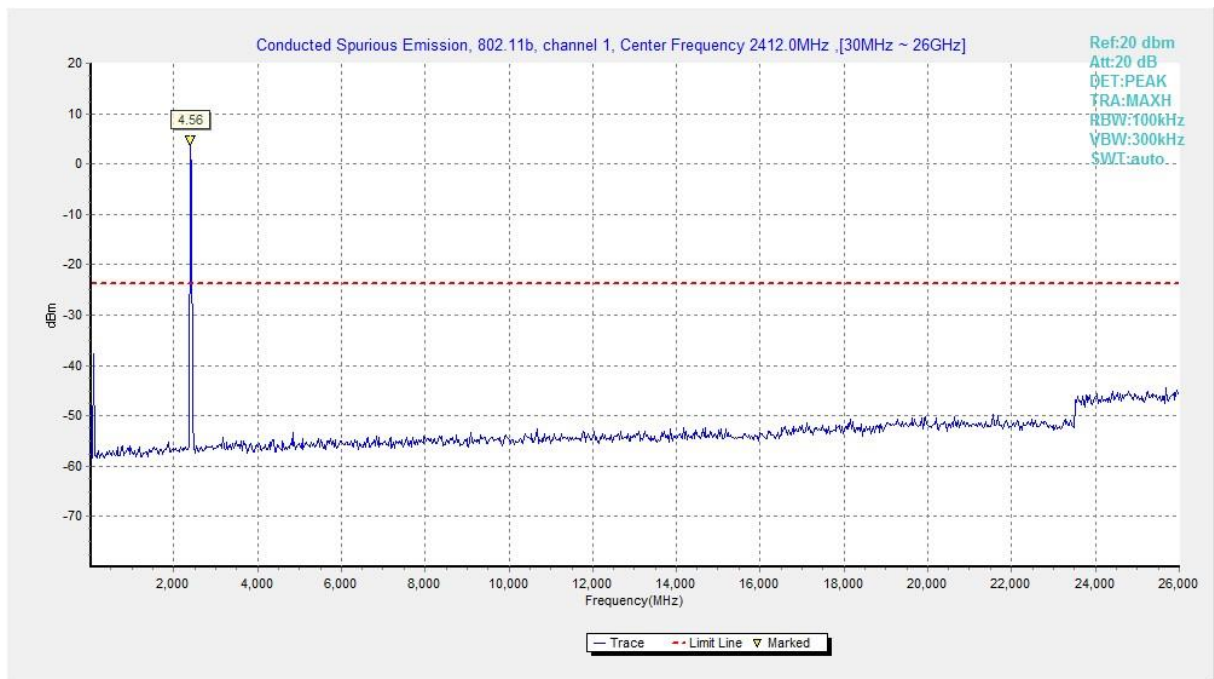
| Standard                   | Limit                                            |
|----------------------------|--------------------------------------------------|
| FCC 47 CFR Part 15.247 (d) | 30dB below peak output power in 100kHz bandwidth |

### Measurement Results:

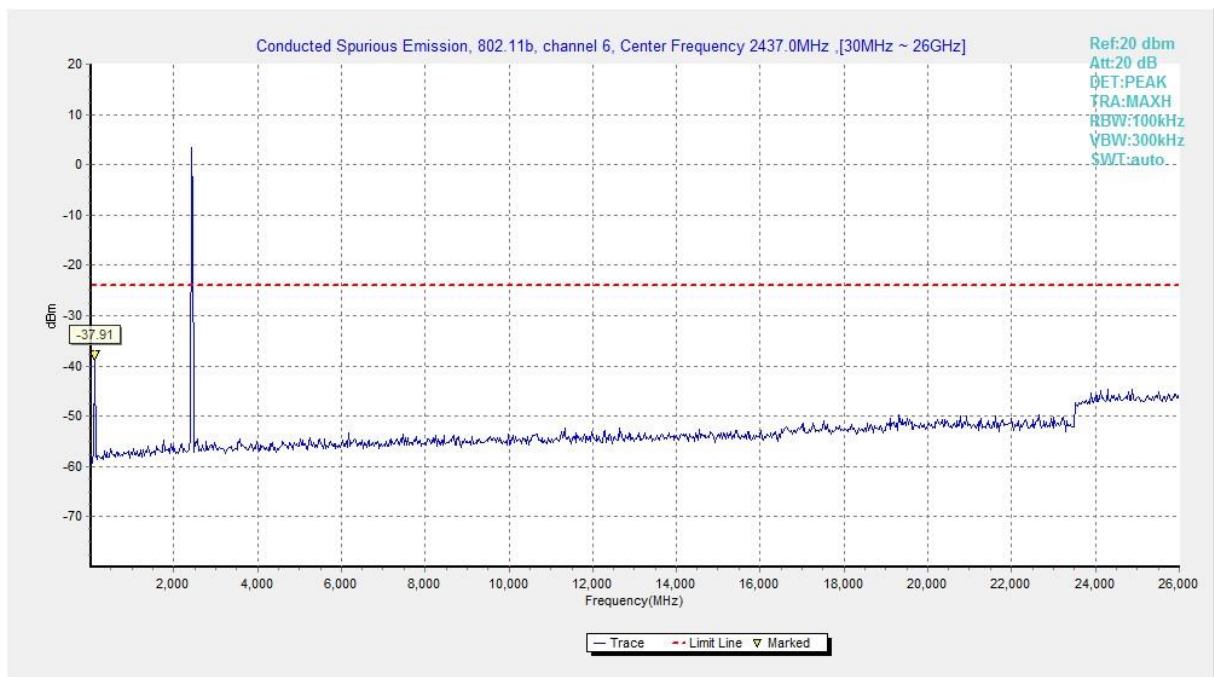
| Mode             | Channel | Frequency (MHz) | Frequency Range | Test Results | Conclusion |
|------------------|---------|-----------------|-----------------|--------------|------------|
| 802.11b          | CH 1    | 2412            | 30MHz-26GHz     | Fig.33       | <b>P</b>   |
|                  | CH 6    | 2437            | 30MHz-26GHz     | Fig.34       | <b>P</b>   |
|                  | CH 11   | 2462            | 30MHz-26GHz     | Fig.35       | <b>P</b>   |
| 802.11g          | CH 1    | 2412            | 30MHz-26GHz     | Fig.36       | <b>P</b>   |
|                  | CH 6    | 2437            | 30MHz-26GHz     | Fig.37       | <b>P</b>   |
|                  | CH 11   | 2462            | 30MHz-26GHz     | Fig.38       | <b>P</b>   |
| 802.11n<br>-HT20 | CH 1    | 2412            | 30MHz-26GHz     | Fig.39       | <b>P</b>   |
|                  | CH 6    | 2437            | 30MHz-26GHz     | Fig.40       | <b>P</b>   |
|                  | CH 11   | 2462            | 30MHz-26GHz     | Fig.41       | <b>P</b>   |
| 802.11n<br>-HT40 | CH 3    | 2422            | 30MHz-26GHz     | Fig.42       | <b>P</b>   |
|                  | CH 6    | 2437            | 30MHz-26GHz     | Fig.43       | <b>P</b>   |
|                  | CH 9    | 2452            | 30MHz-26GHz     | Fig.44       | <b>P</b>   |

See below for test graphs.

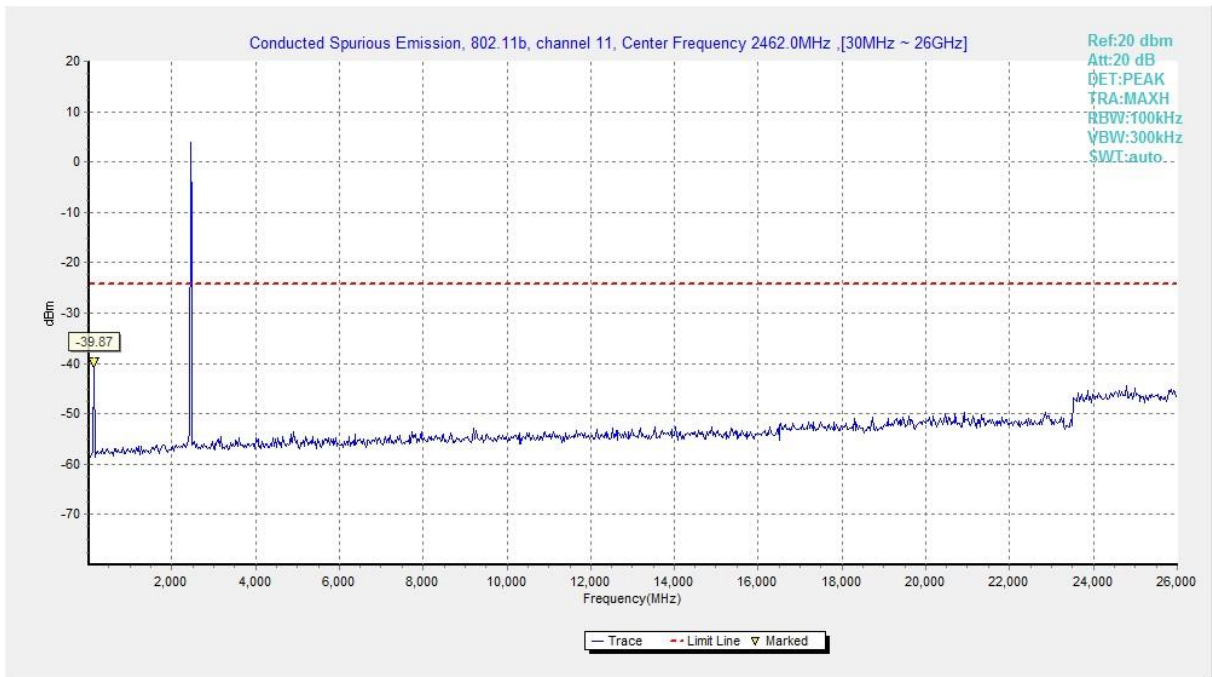
**Conclusion: PASS**



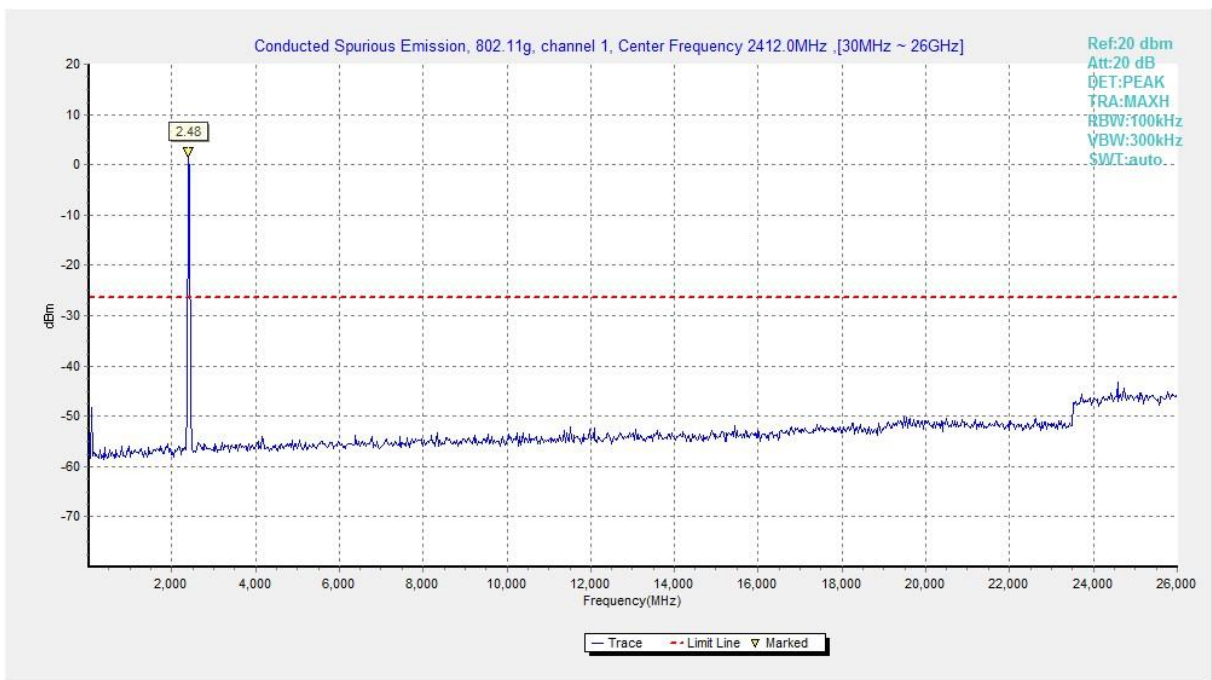
**Fig.33 Conducted Spurious Emission (802.11b, CH1)**



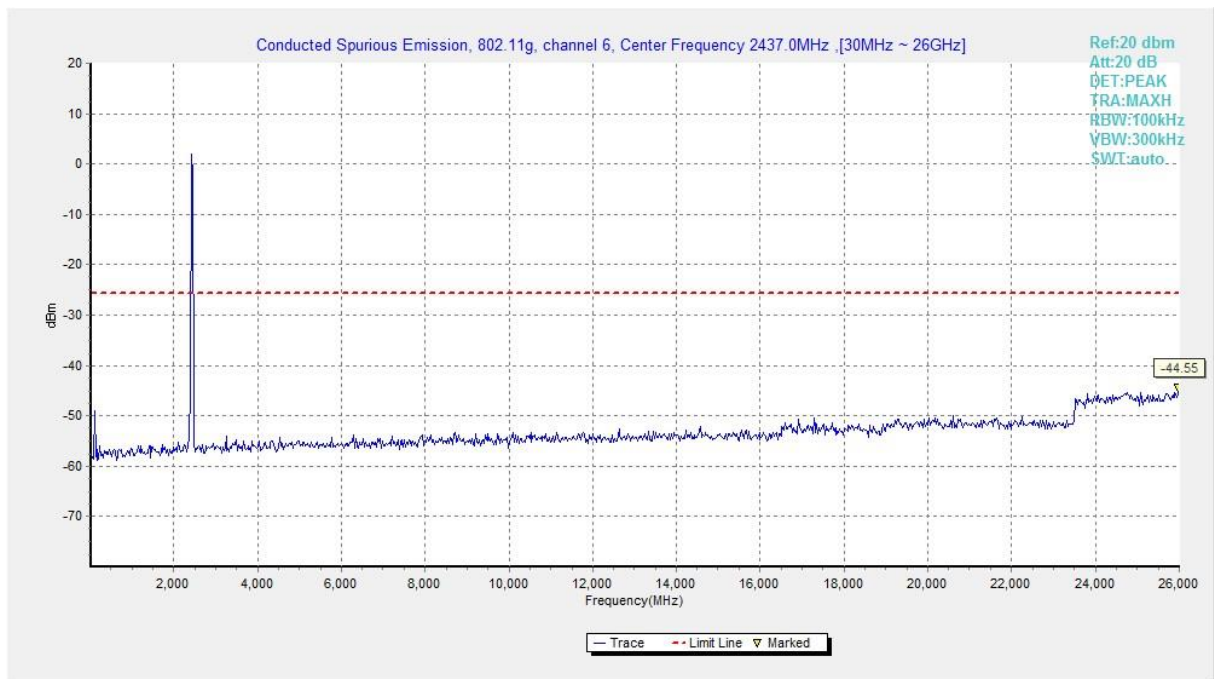
**Fig.34 Conducted Spurious Emission (802.11b, CH6)**



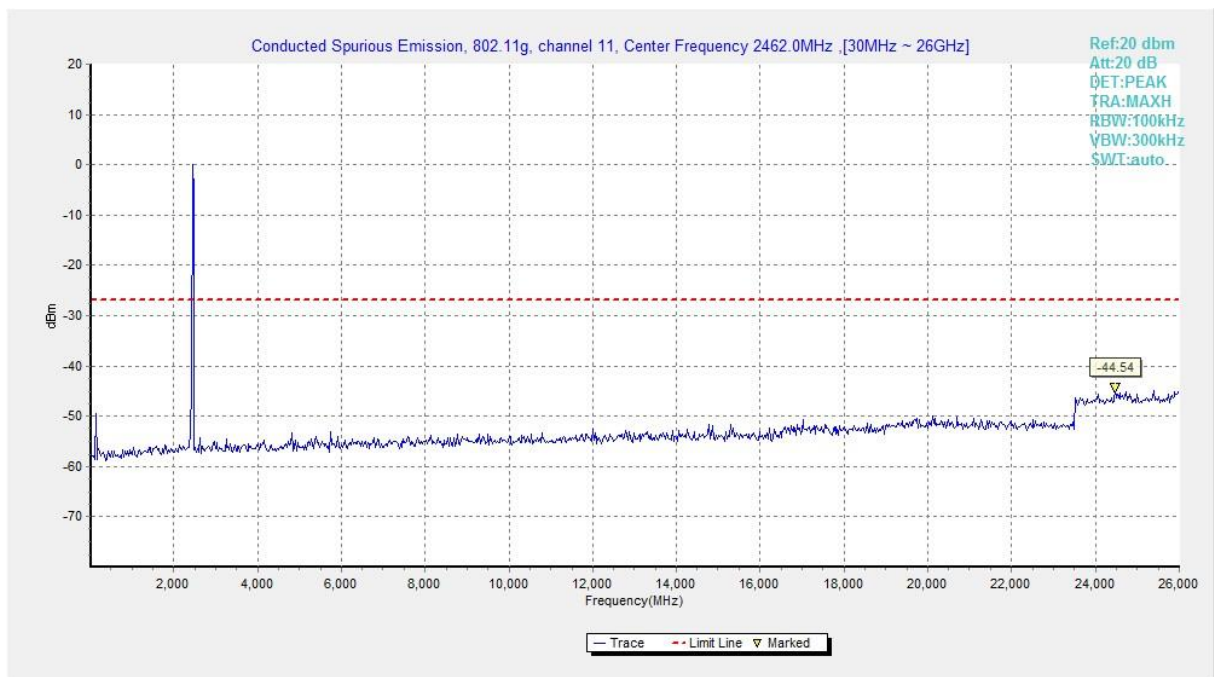
**Fig.35 Conducted Spurious Emission (802.11b, CH11)**



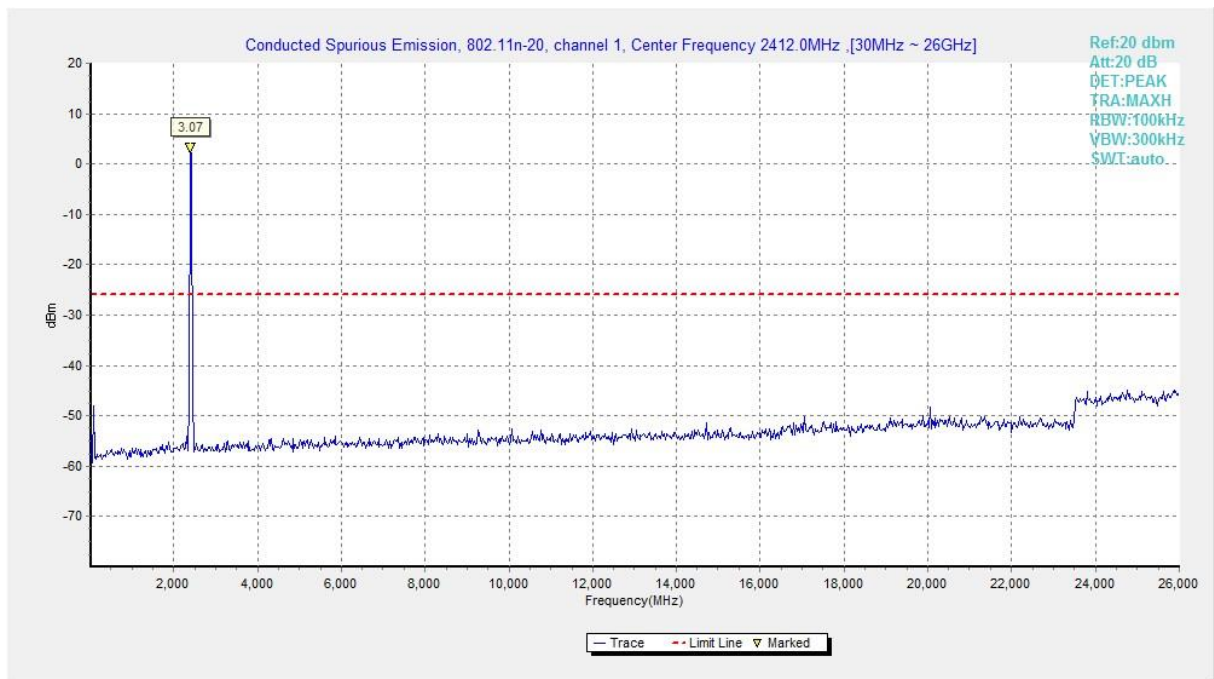
**Fig.36 Conducted Spurious Emission (802.11g, CH1)**



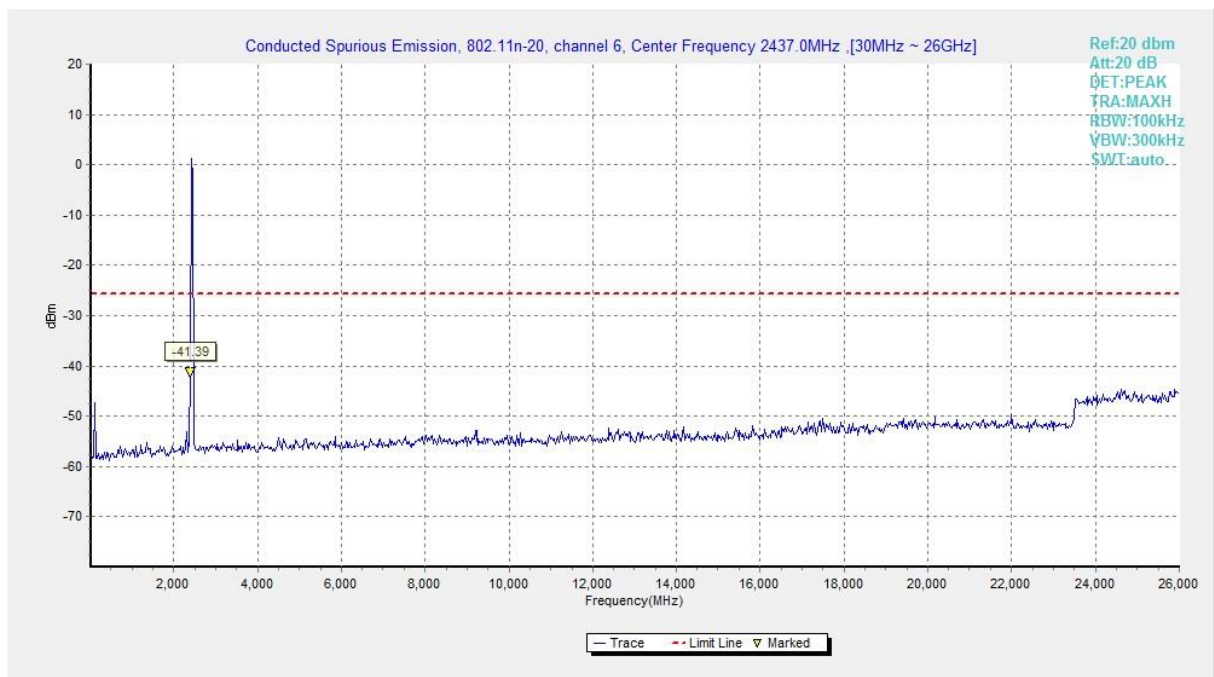
**Fig.37 Conducted Spurious Emission (802.11g, CH6)**



**Fig.38 Conducted Spurious Emission (802.11g, CH11)**



**Fig.39 Conducted Spurious Emission (802.11n-HT20, CH1)**



**Fig.40 Conducted Spurious Emission (802.11n-HT20, CH6)**

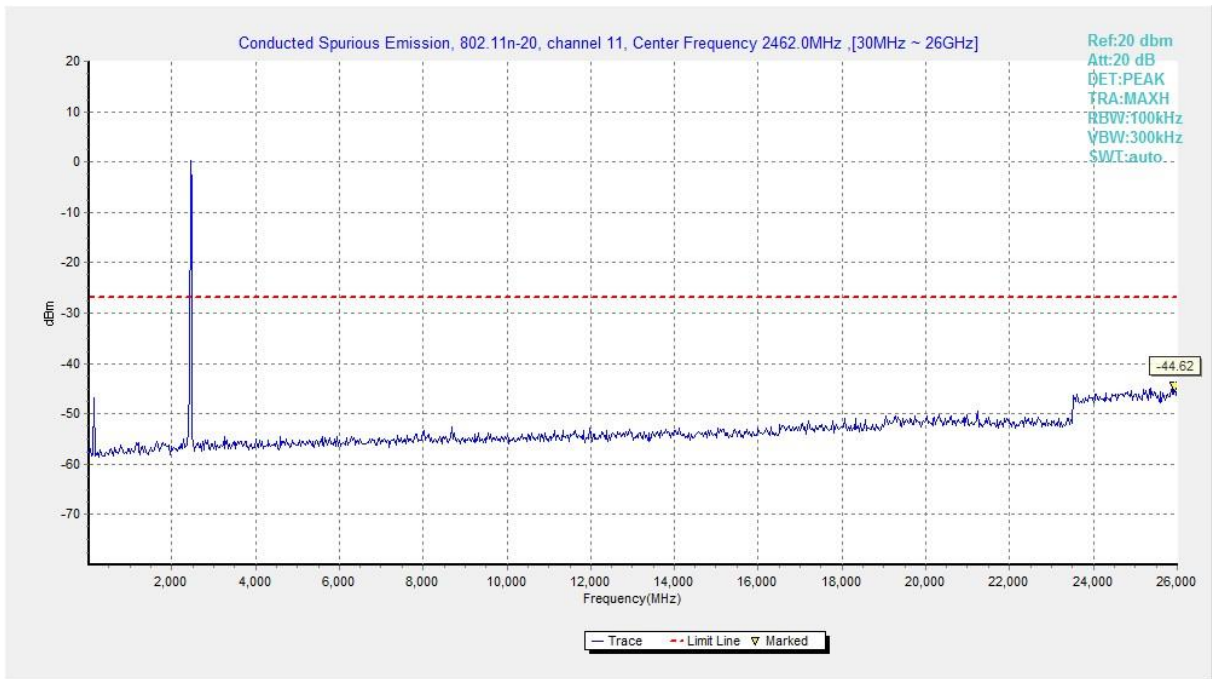


Fig.41 Conducted Spurious Emission (802.11n-HT20, CH11)

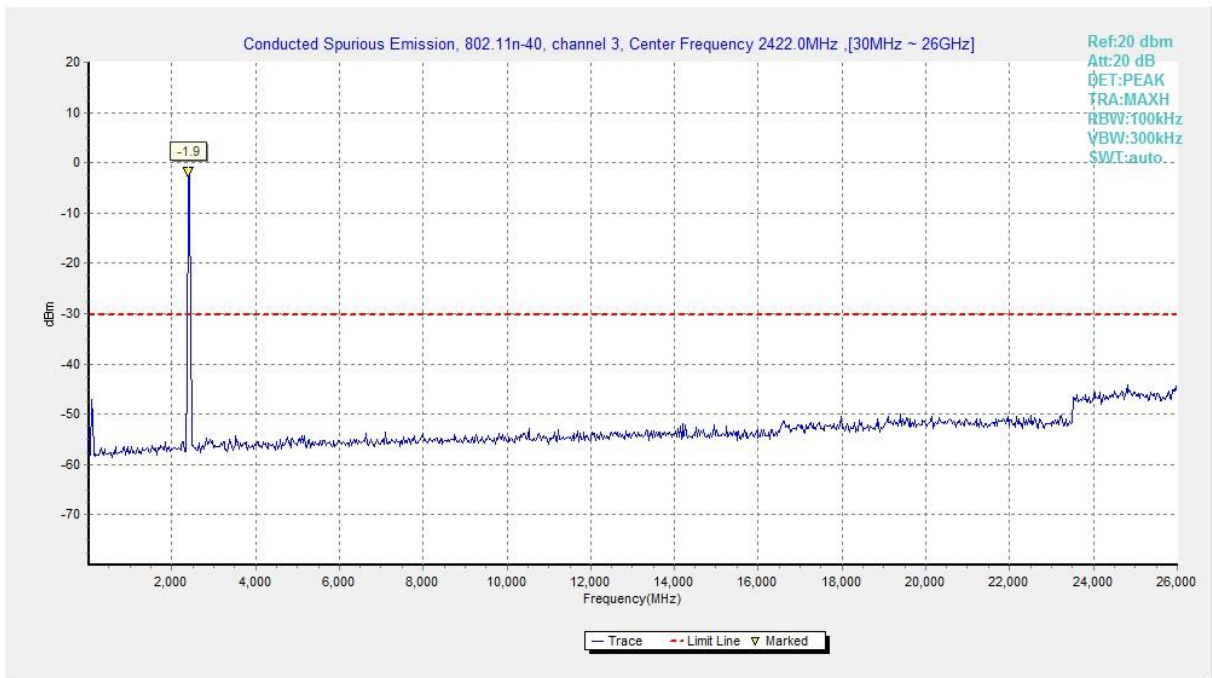
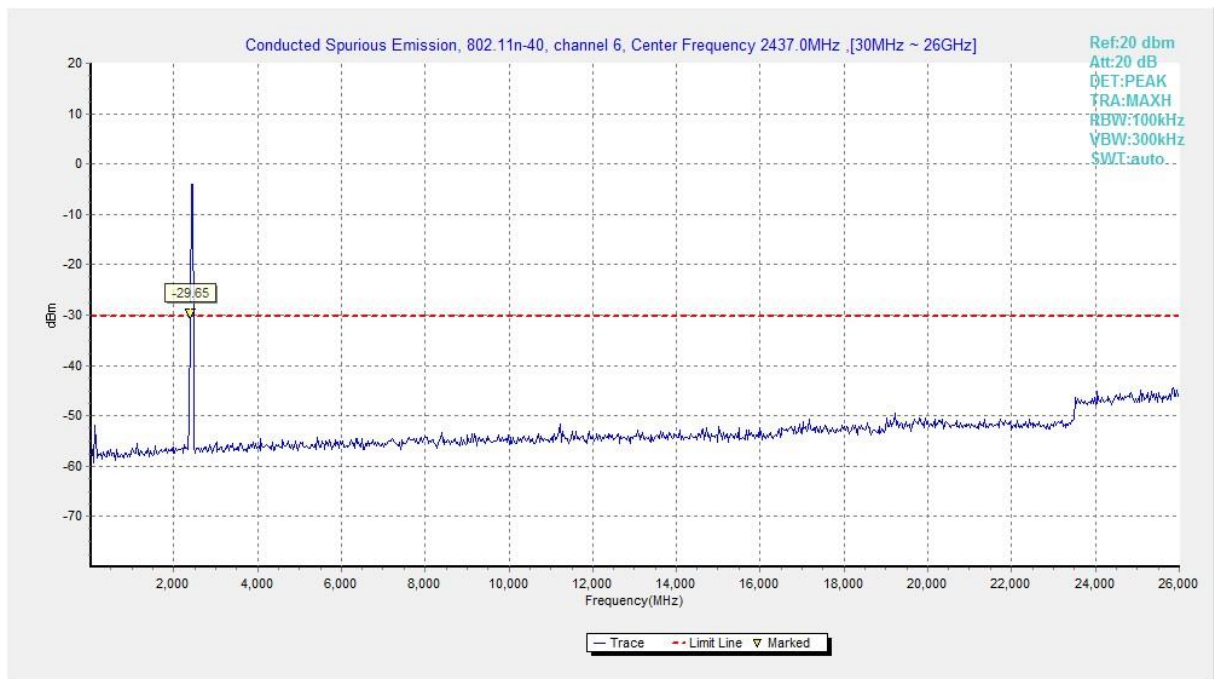
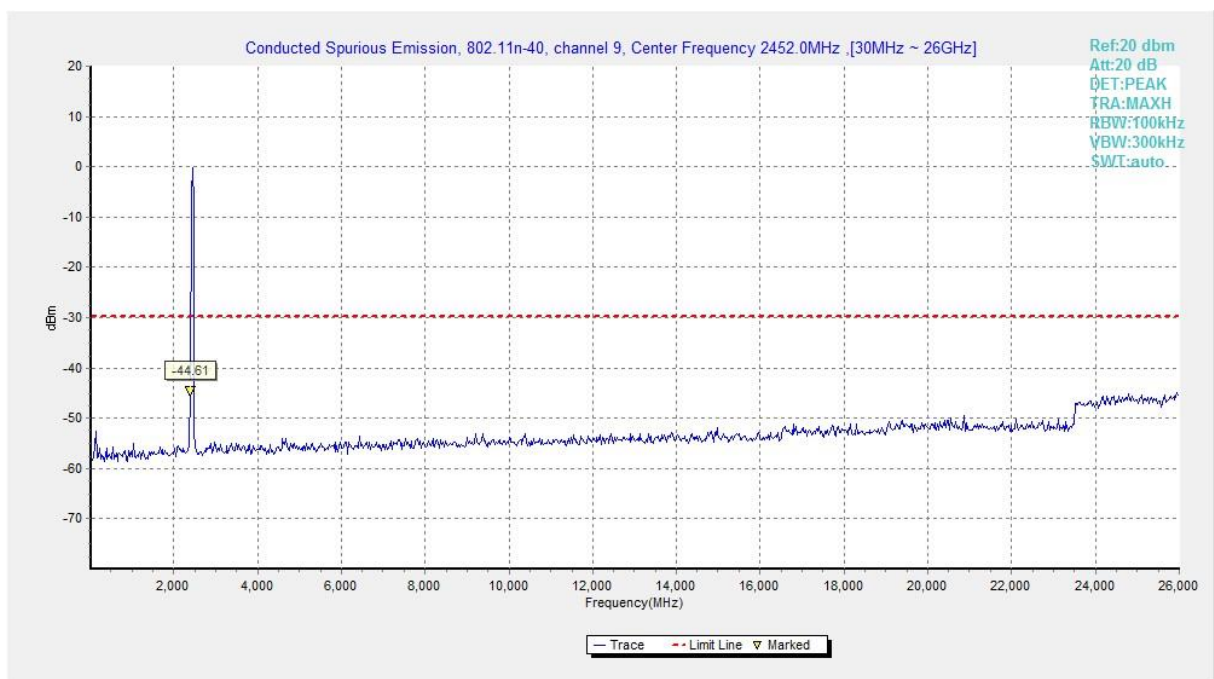


Fig.42 Conducted Spurious Emission (802.11n-HT40, CH3)



**Fig.43 Conducted Spurious Emission (802.11n-HT40, CH6)**



**Fig.44 Conducted Spurious Emission (802.11n-HT40, CH9)**

## A.6 Radiated Emission

### Measurement Limit:

| Standard                               | Limit                        |
|----------------------------------------|------------------------------|
| FCC 47 CFR Part 15.247, 15.205, 15.209 | 20dB below peak output power |

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)).

### Limit in restricted band:

| Frequency of emission (MHz) | Field strength (μV/m) | Measurement distance (meters) |
|-----------------------------|-----------------------|-------------------------------|
| 0.009-0.490                 | 2400/F(kHz)           | 300                           |
| 0.490-1.705                 | 24000/F(kHz)          | 30                            |
| 1.705-30.0                  | 30                    | 30                            |
| 30-88                       | 100                   | 3                             |
| 88-216                      | 150                   | 3                             |
| 216-960                     | 200                   | 3                             |
| Above 960                   | 500                   | 3                             |

### Test Condition:

The EUT was placed on a non-conductive table. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

| Frequency of emission (MHz) | RBW/VBW       | Sweep Time (s) |
|-----------------------------|---------------|----------------|
| 30-1000                     | 120kHz/300kHz | 5              |
| 1000-4000                   | 1MHz/3MHz     | 15             |
| 4000-18000                  | 1MHz/3MHz     | 40             |
| 18000-26500                 | 1MHz/3MHz     | 20             |

Note: According to the performance evaluation, the radiated emission margin of EUT is over 20dB in the band from 9kHz to 30MHz. Therefore, the measurement starts from 30MHz to tenth harmonic. The measurement results include the horizontal polarization and vertical polarization measurements.

**Measurement Results:**

| Mode             | Channel                | Frequency Range     | Test Results | Conclusion |
|------------------|------------------------|---------------------|--------------|------------|
| 802.11b          | CH 1                   | 1 GHz ~ 18 GHz      | Fig.45       | <b>P</b>   |
|                  | CH 6                   | 1 GHz ~ 18 GHz      | Fig.46       | <b>P</b>   |
|                  | CH 11                  | 1 GHz ~ 18 GHz      | Fig.47       | <b>P</b>   |
|                  | Restricted Band (CH1)  | 2.38 GHz ~ 2.45 GHz | Fig.48       | <b>P</b>   |
|                  | Restricted Band (CH11) | 2.45 GHz ~ 2.5 GHz  | Fig.49       | <b>P</b>   |
| 802.11g          | CH 1                   | 1 GHz ~ 18 GHz      | Fig.50       | <b>P</b>   |
|                  | CH 6                   | 1 GHz ~ 18 GHz      | Fig.51       | <b>P</b>   |
|                  | CH 11                  | 1 GHz ~ 18 GHz      | Fig.52       | <b>P</b>   |
|                  | Restricted Band (CH1)  | 2.38 GHz ~ 2.45 GHz | Fig.53       | <b>P</b>   |
|                  | Restricted Band (CH11) | 2.45 GHz ~ 2.5 GHz  | Fig.54       | <b>P</b>   |
| 802.11n-<br>HT20 | CH 1                   | 1 GHz ~ 18 GHz      | Fig.55       | <b>P</b>   |
|                  | CH 6                   | 1 GHz ~ 18 GHz      | Fig.56       | <b>P</b>   |
|                  | CH 11                  | 1 GHz ~ 18 GHz      | Fig.57       | <b>P</b>   |
|                  | Restricted Band (CH1)  | 2.38 GHz ~ 2.45 GHz | Fig.58       | <b>P</b>   |
|                  | Restricted Band (CH11) | 2.45 GHz ~ 2.5 GHz  | Fig.59       | <b>P</b>   |
| 802.11n-<br>HT40 | CH 3                   | 1 GHz ~ 18 GHz      | Fig.60       | <b>P</b>   |
|                  | CH 6                   | 1 GHz ~ 18 GHz      | Fig.61       | <b>P</b>   |
|                  | CH 9                   | 1 GHz ~ 18 GHz      | Fig.62       | <b>P</b>   |
|                  | Restricted Band (CH3)  | 2.38 GHz ~ 2.45 GHz | Fig.63       | <b>P</b>   |
|                  | Restricted Band (CH9)  | 2.45 GHz ~ 2.5 GHz  | Fig.64       | <b>P</b>   |
| /                | All Channels           | 9 kHz ~ 30 MHz      | Fig.65       | <b>P</b>   |
|                  |                        | 30 MHz ~ 1 GHz      | Fig.66       | <b>P</b>   |
|                  |                        | 18 GHz ~ 26.5 GHz   | Fig.67       | <b>P</b>   |

**Worst-Case Result:**
**802.11b CH6 (1-18GHz)**

| Frequency (MHz) | MaxPeak (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 9495.428572     | 46.35            | 74.00          | 27.65       | H   | 7.0        |
| 10478.142857    | 48.17            | 74.00          | 25.83       | V   | 8.9        |
| 12163.285714    | 49.40            | 74.00          | 24.60       | V   | 10.7       |
| 13473.857143    | 48.55            | 74.00          | 25.45       | V   | 11.5       |
| 14834.142857    | 51.02            | 74.00          | 22.98       | V   | 12.9       |
| 16981.285714    | 54.37            | 74.00          | 19.63       | V   | 18.3       |

| Frequency (MHz) | Average (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 9495.428572     | 38.83            | 54.00          | 15.17       | H   | 7.0        |
| 10478.142857    | 38.23            | 54.00          | 15.77       | V   | 8.9        |
| 12163.285714    | 39.45            | 54.00          | 14.55       | V   | 10.7       |
| 13473.857143    | 39.16            | 54.00          | 14.84       | V   | 11.5       |
| 14834.142857    | 40.56            | 54.00          | 13.44       | V   | 12.9       |
| 16981.285714    | 43.95            | 54.00          | 10.05       | V   | 18.3       |

**802.11g CH6 (1-18GHz)**

| Frequency (MHz) | MaxPeak (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 8274.857143     | 45.83            | 74.00          | 28.17       | V   | 6.0        |
| 9581.142857     | 45.35            | 74.00          | 28.65       | V   | 7.3        |
| 10450.714286    | 48.34            | 74.00          | 25.66       | V   | 9.0        |
| 12430.285714    | 48.85            | 74.00          | 25.15       | H   | 11.4       |
| 14871.000000    | 51.65            | 74.00          | 22.35       | V   | 13.0       |
| 17205.857143    | 55.27            | 74.00          | 18.73       | H   | 18.3       |

| Frequency (MHz) | Average (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 8274.857143     | 36.73            | 54.00          | 17.27       | V   | 6.0        |
| 9581.142857     | 36.53            | 54.00          | 17.47       | V   | 7.3        |
| 10450.714286    | 38.52            | 54.00          | 15.48       | V   | 9.0        |
| 12430.285714    | 38.47            | 54.00          | 15.53       | H   | 11.4       |
| 14871.000000    | 40.84            | 54.00          | 13.16       | V   | 13.0       |
| 17205.857143    | 44.38            | 54.00          | 9.62        | H   | 18.3       |

**802.11n-HT20 CH6 (1-18GHz)**

| Frequency (MHz) | MaxPeak (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 10430.142857    | 47.69            | 74.00          | 26.31       | V   | 9.0        |
| 11275.285714    | 47.28            | 74.00          | 26.72       | H   | 9.7        |
| 12456.428572    | 48.50            | 74.00          | 25.50       | V   | 11.4       |
| 14839.714286    | 50.13            | 74.00          | 23.87       | V   | 13.0       |
| 15529.714286    | 50.60            | 74.00          | 23.40       | H   | 12.9       |
| 16922.571429    | 54.76            | 74.00          | 19.24       | H   | 18.1       |

| Frequency (MHz) | Average (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 10430.142857    | 38.34            | 54.00          | 15.66       | V   | 9.0        |
| 11275.285714    | 38.96            | 54.00          | 15.04       | H   | 9.7        |
| 12456.428572    | 38.32            | 54.00          | 15.68       | V   | 11.4       |
| 14839.714286    | 40.31            | 54.00          | 13.69       | V   | 13.0       |
| 15529.714286    | 40.31            | 54.00          | 13.69       | H   | 12.9       |
| 16922.571429    | 44.35            | 54.00          | 9.65        | H   | 18.1       |

**802.11n-HT40 CH6 (1-18GHz)**

| Frequency (MHz) | MaxPeak (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 9501.000000     | 46.21            | 74.00          | 27.79       | V   | 7.0        |
| 10425.000000    | 48.20            | 74.00          | 25.80       | V   | 9.0        |
| 11493.428572    | 48.25            | 74.00          | 25.75       | V   | 10.1       |
| 13407.857143    | 49.07            | 74.00          | 24.93       | V   | 11.5       |
| 14815.714286    | 51.21            | 74.00          | 22.79       | V   | 12.9       |
| 17166.857143    | 54.96            | 74.00          | 19.04       | V   | 18.4       |

| Frequency (MHz) | Average (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 9501.000000     | 36.88            | 54.00          | 17.12       | V   | 7.0        |
| 10425.000000    | 38.43            | 54.00          | 15.57       | V   | 9.0        |
| 11493.428572    | 38.18            | 54.00          | 15.82       | V   | 10.1       |
| 13407.857143    | 40.65            | 54.00          | 13.35       | V   | 11.5       |
| 14815.714286    | 42.32            | 54.00          | 11.68       | V   | 12.9       |
| 17166.857143    | 44.62            | 54.00          | 9.38        | V   | 18.4       |

Note:

A "reference path loss" is established and the  $A_{Rpl}$  is the attenuation of "reference path loss", and Antenna Factor, the gain of the preamplifier, the cable loss.  $P_{Mea}$  is the field strength recorded from the instrument.

The measurement results are obtained as described below:

Result =  $P_{Mea}$  + Cable Loss + Antenna Factor - Gain of the preamplifier

See below for test graphs.

Conclusion: PASS

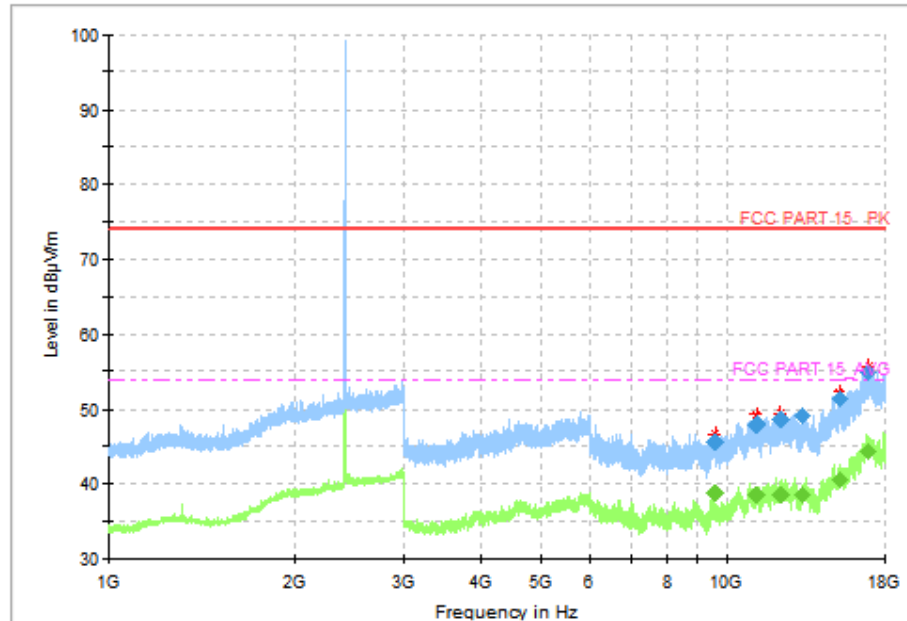


Fig.45 Radiated Spurious Emission (802.11b, CH1, 1GHz-18GHz)

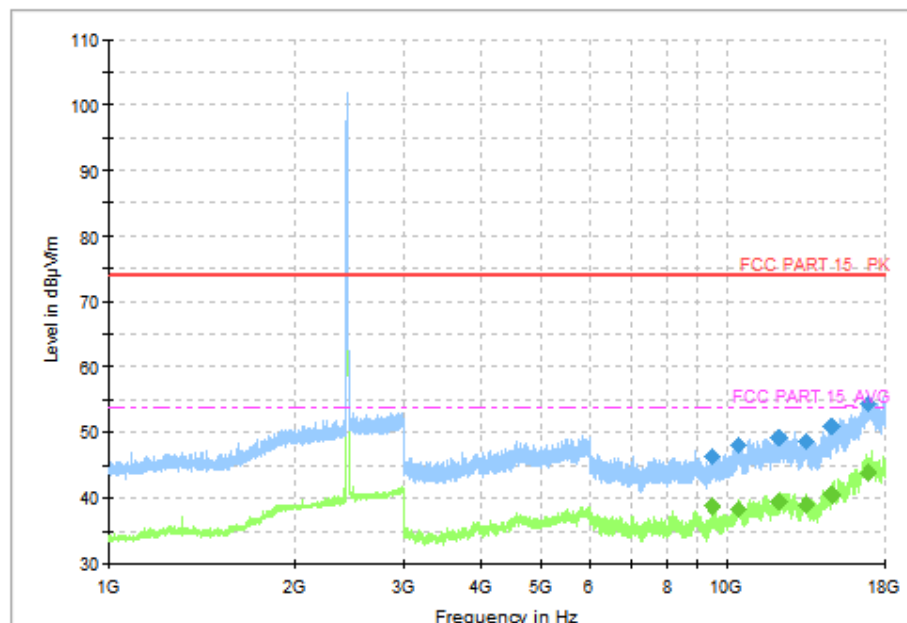


Fig.46 Radiated Spurious Emission (802.11b, CH6, 1GHz-18GHz)

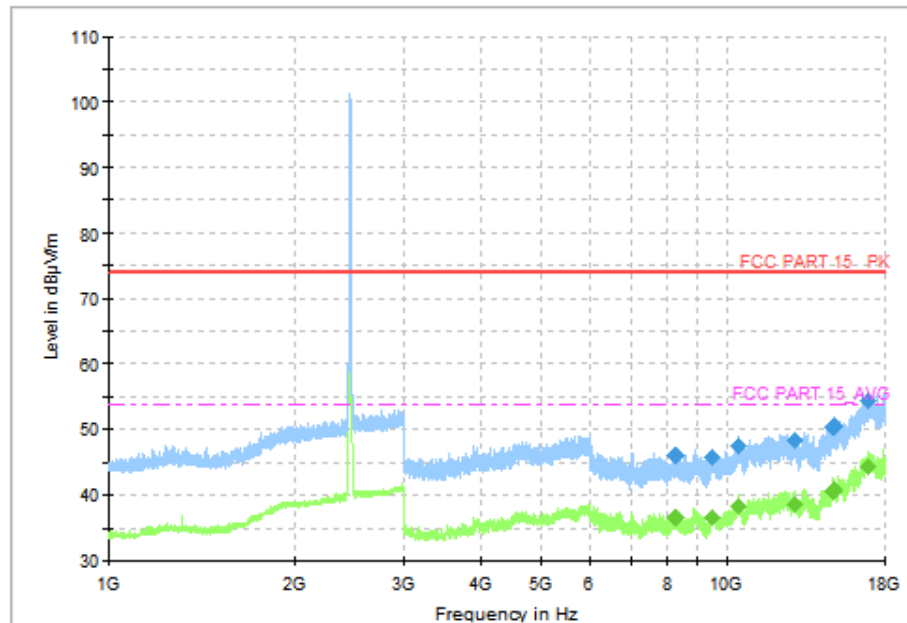


Fig.47 Radiated Spurious Emission (802.11b, CH11, 1GHz-18GHz)

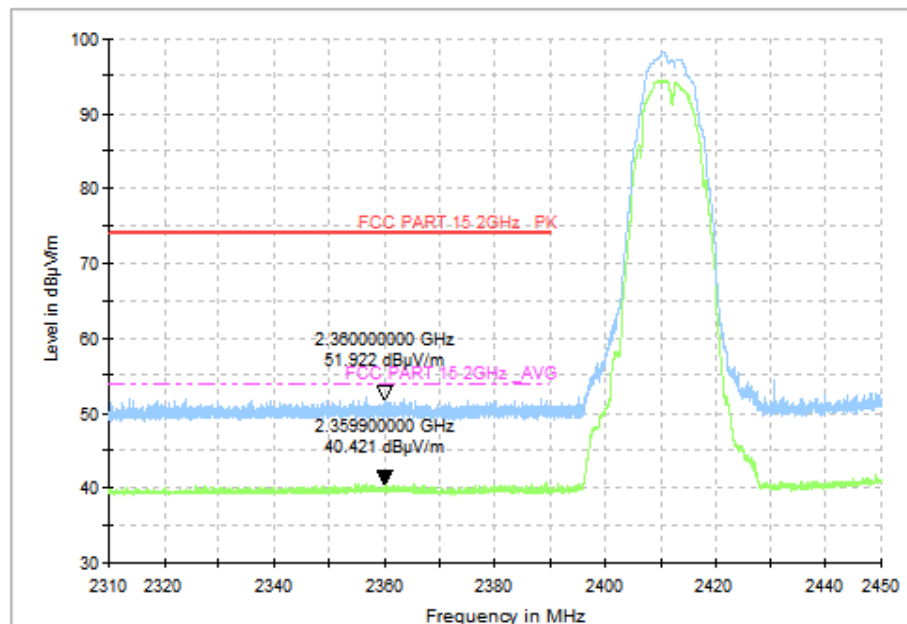


Fig.48 Radiated Restricted Band (802.11b, CH1, 2.38GHz~2.45GHz)

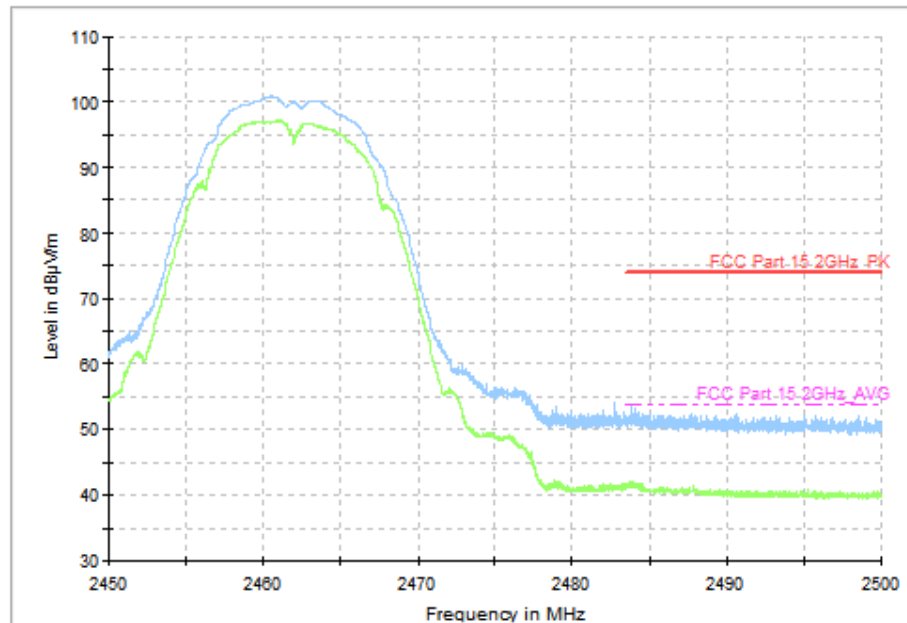


Fig.49 Radiated Restricted Band (802.11b, CH11, 2.45GHz~2.5GHz)

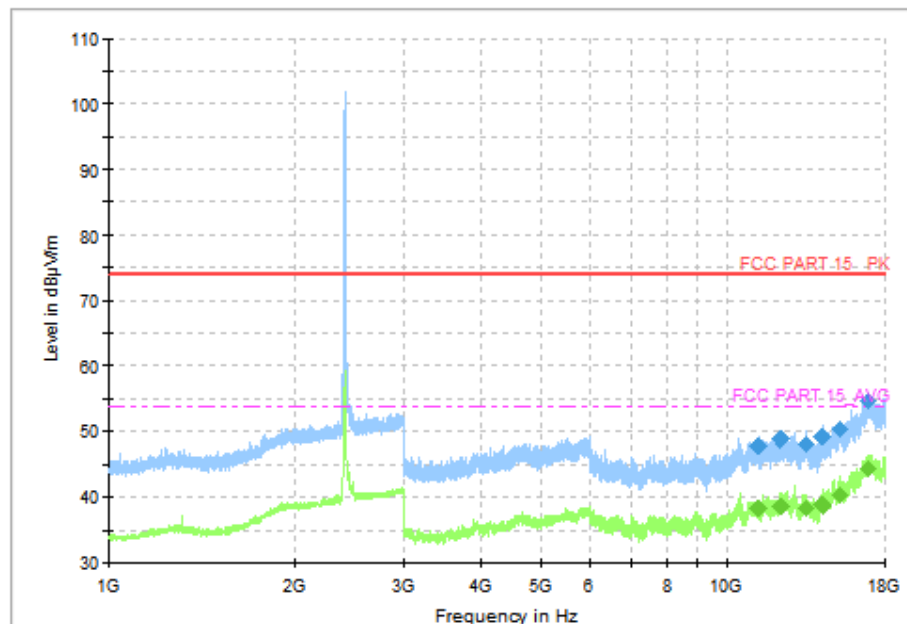
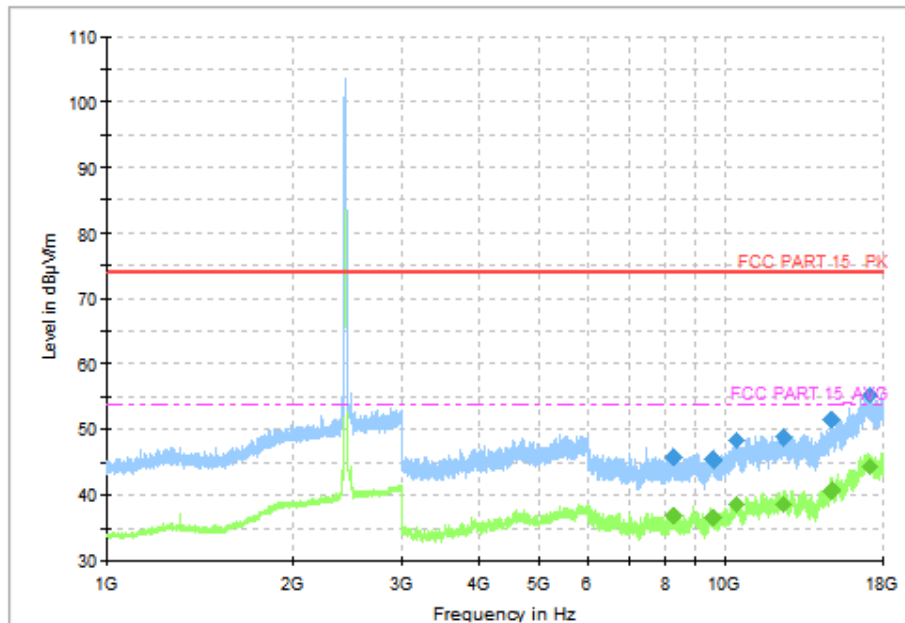
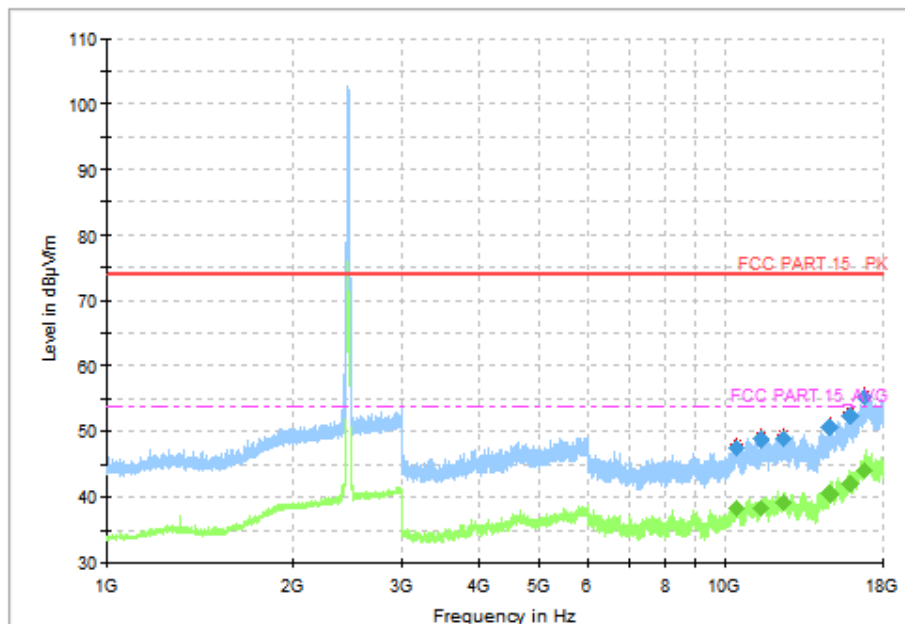


Fig.50 Radiated Spurious Emission (802.11g, CH1, 1GHz~18GHz)



**Fig.51 Radiated Spurious Emission (802.11g, CH6, 1GHz-18GHz)**



**Fig.52 Radiated Spurious Emission (802.11g, CH11, 1GHz-18GHz)**

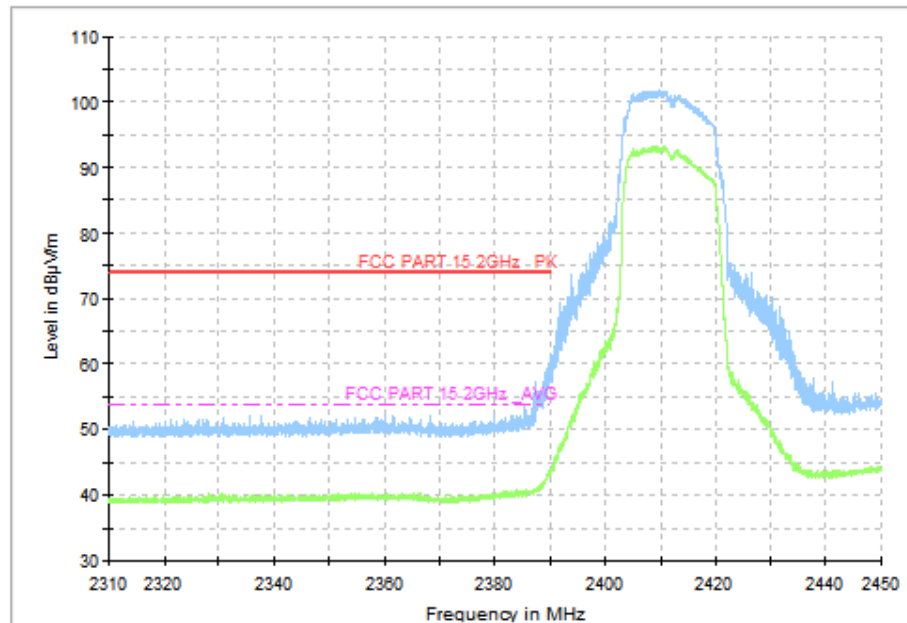


Fig.53 Radiated Restricted Band (802.11g, CH1, 2.38GHz~2.45GHz)

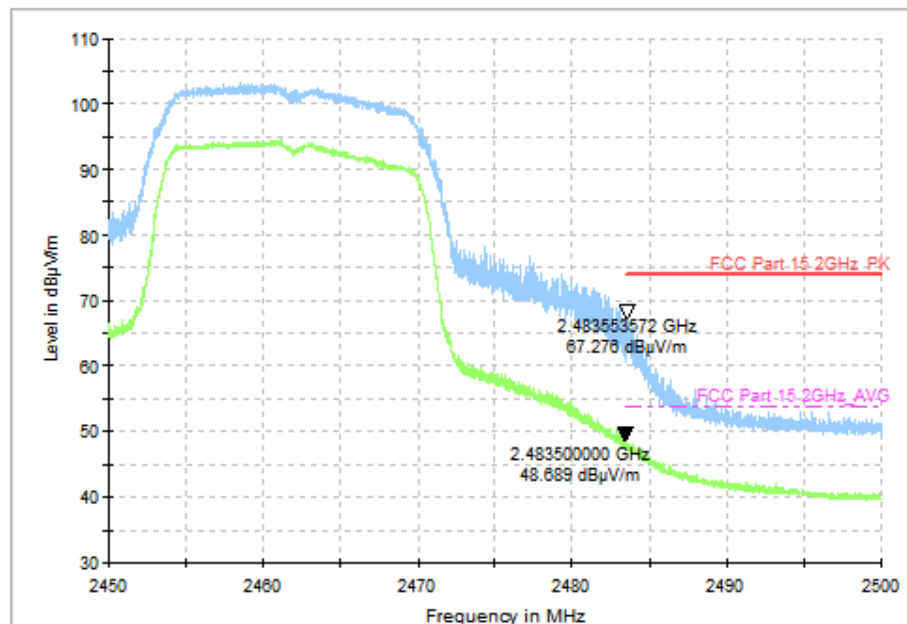
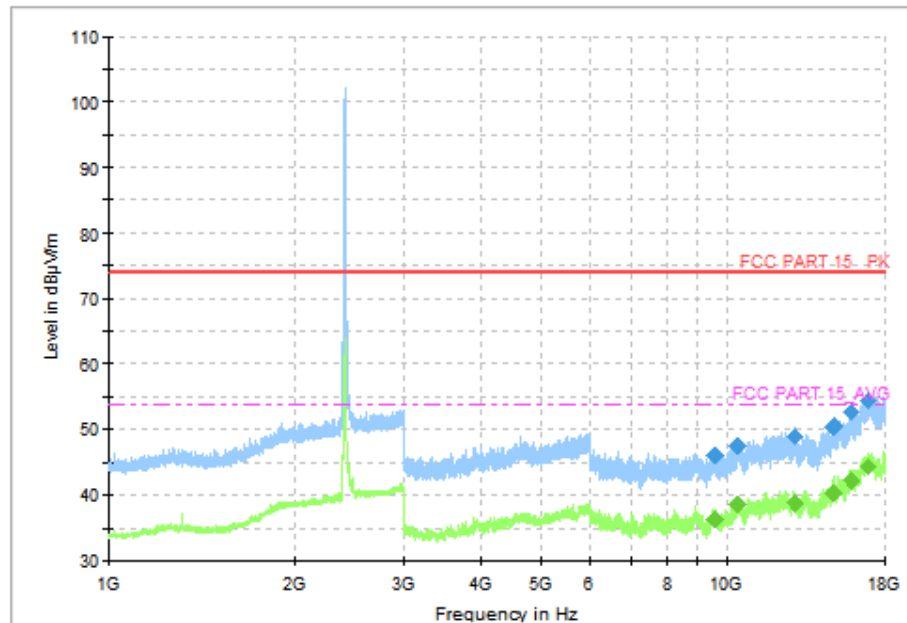
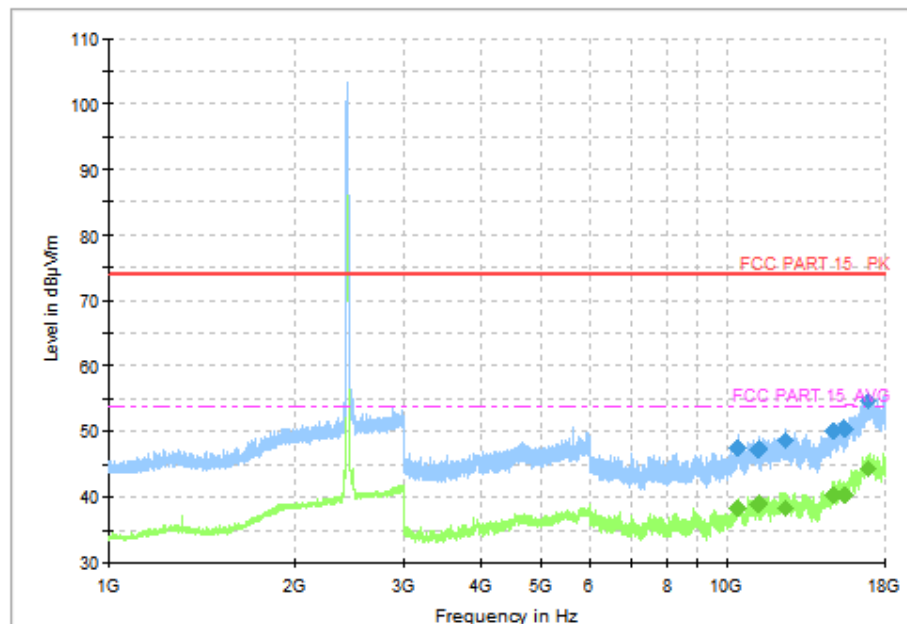


Fig.54 Radiated Restricted Band (802.11g, CH11, 2.45GHz~2.5GHz)



**Fig.55 Radiated Spurious Emission (802.11n-HT20, CH1, 1GHz-18GHz)**



**Fig.56 Radiated Spurious Emission (802.11n-HT20, CH6, 1GHz-18GHz)**

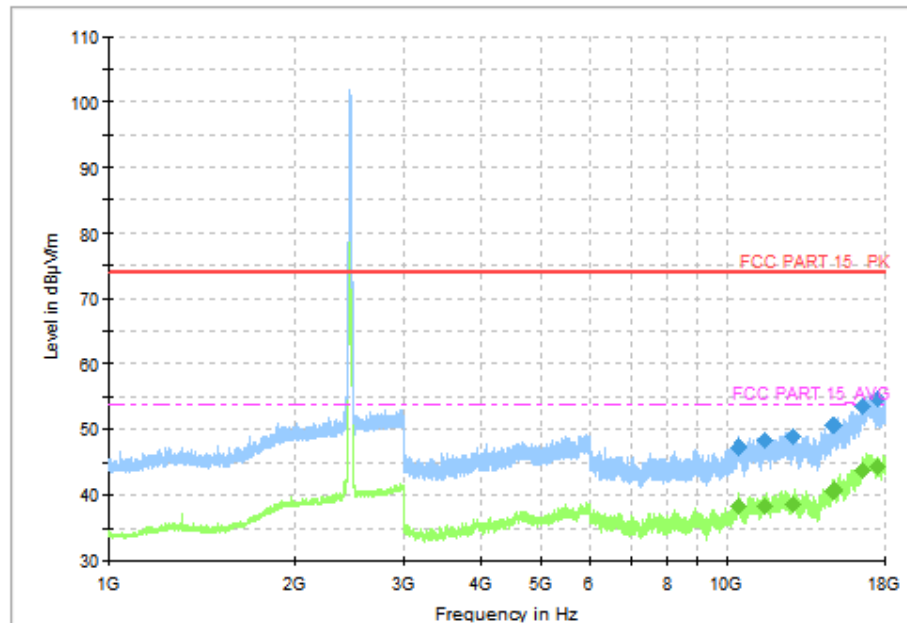


Fig.57 Radiated Spurious Emission (802.11n-HT20, CH11, 1GHz-18GHz)

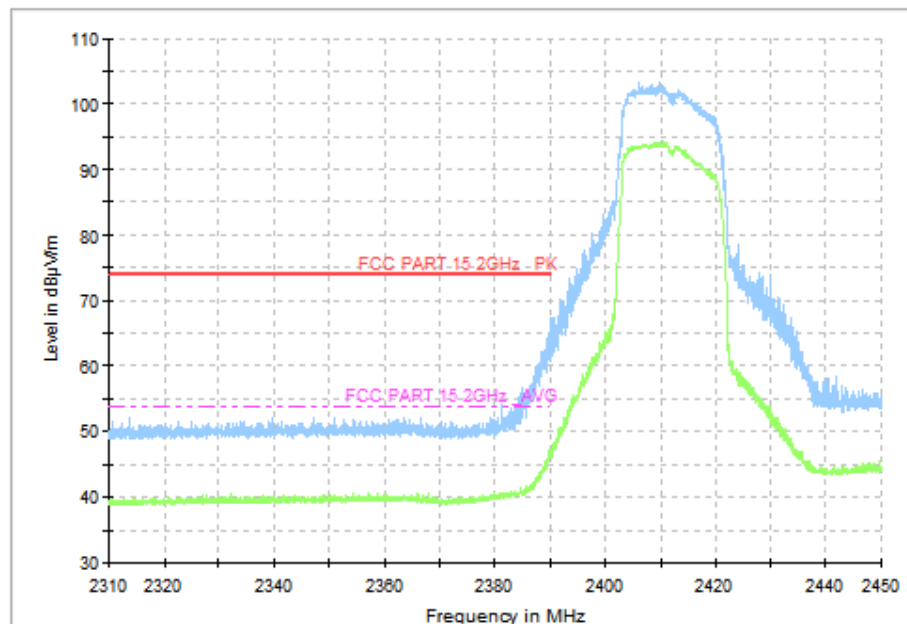


Fig.58 Radiated Restricted Band (802.11n-HT20, CH1, 2.38GHz~2.45GHz)

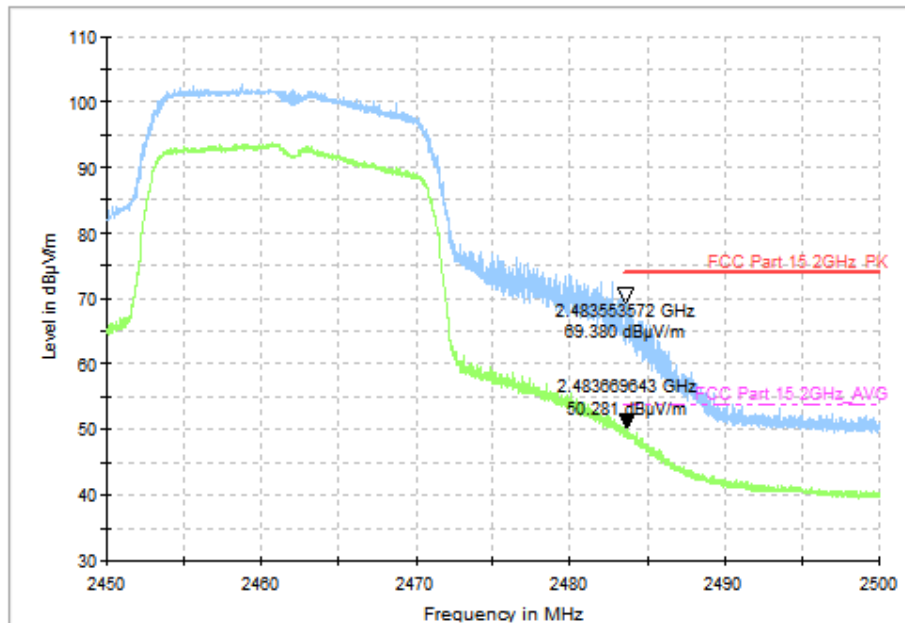


Fig.59 Radiated Restricted Band (802.11n-HT20, CH11, 2.45GHz~2.5GHz)

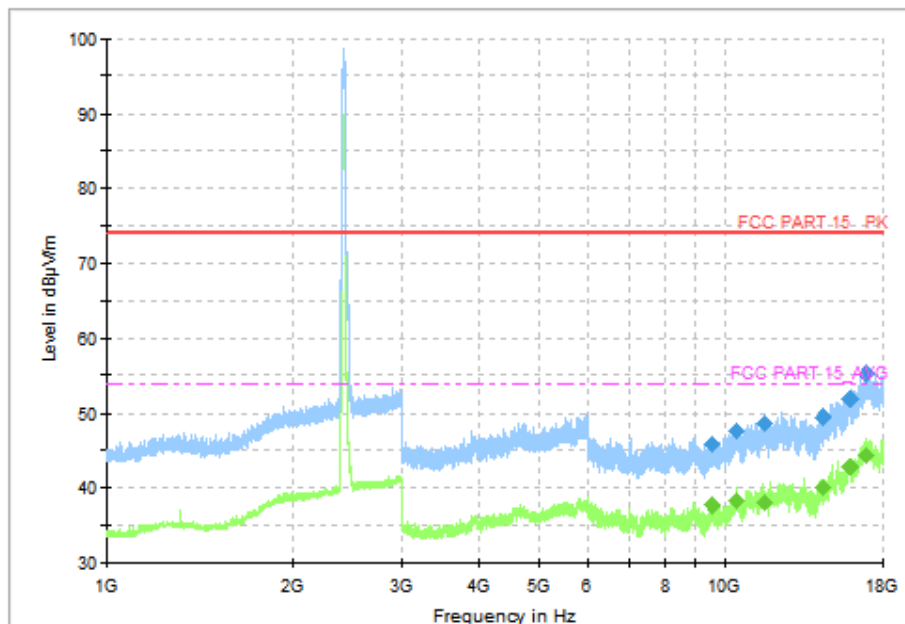
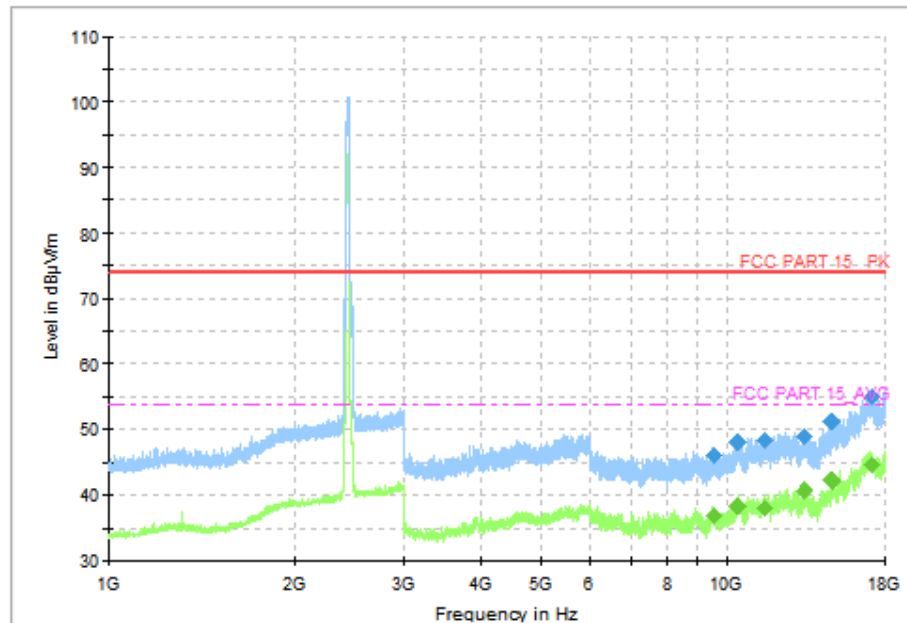
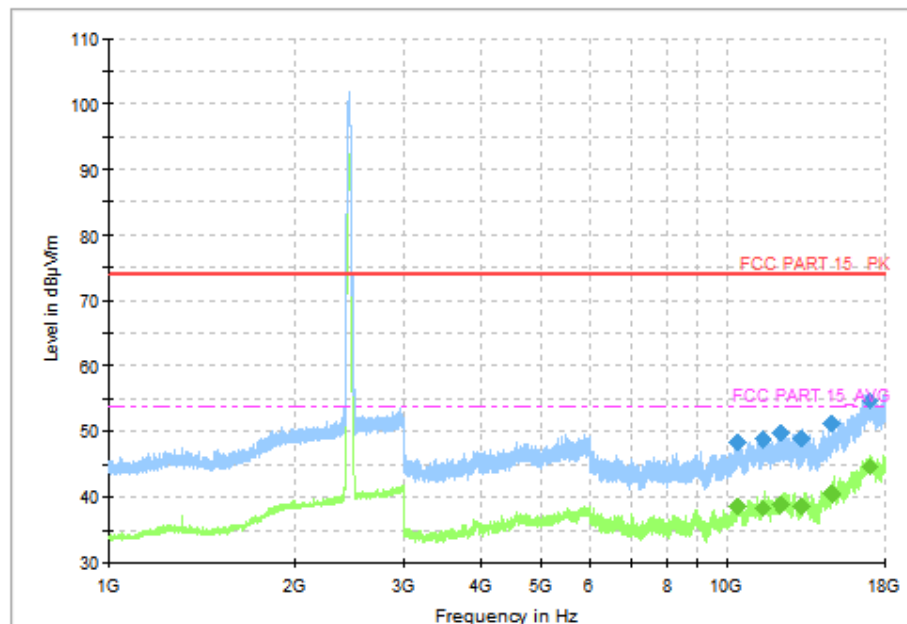


Fig.60 Radiated Spurious Emission (802.11n-HT40, CH3, 1GHz-18GHz)



**Fig.61 Radiated Spurious Emission (802.11n-HT40, CH6, 1GHz-18GHz)**



**Fig.62 Radiated Spurious Emission (802.11n-HT40, CH9, 1GHz-18GHz)**

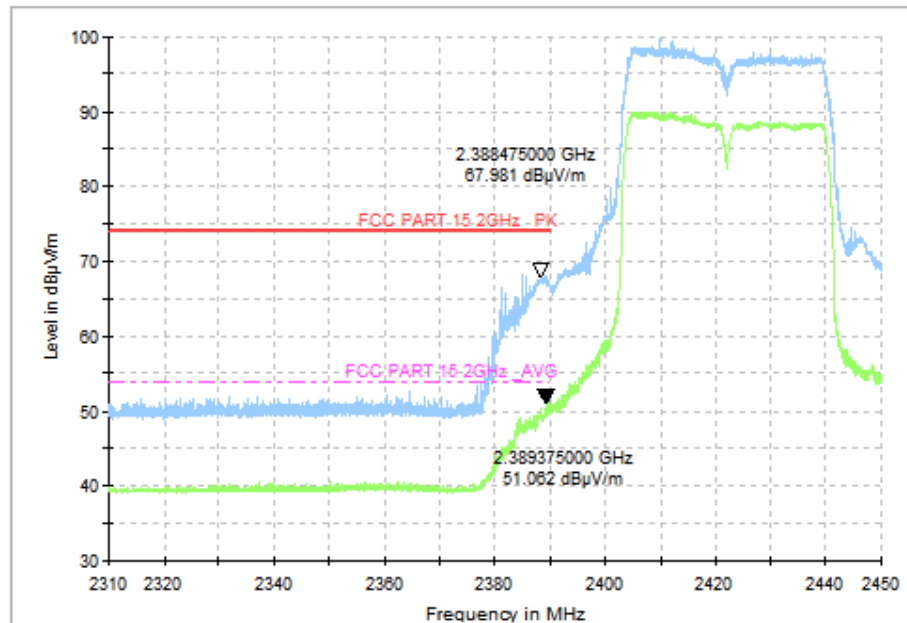


Fig.63 Radiated Restricted Band (802.11n-HT40, CH3, 2.38GHz~2.45GHz)

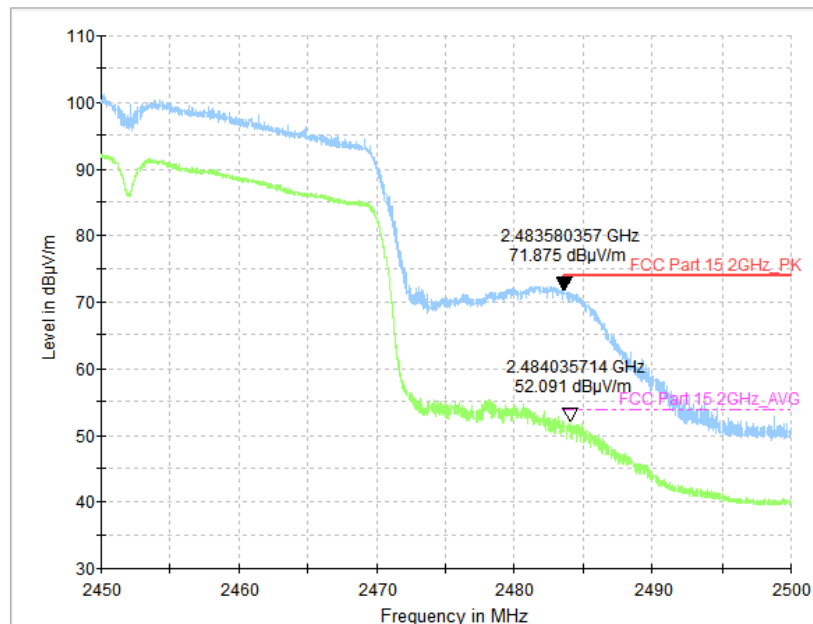
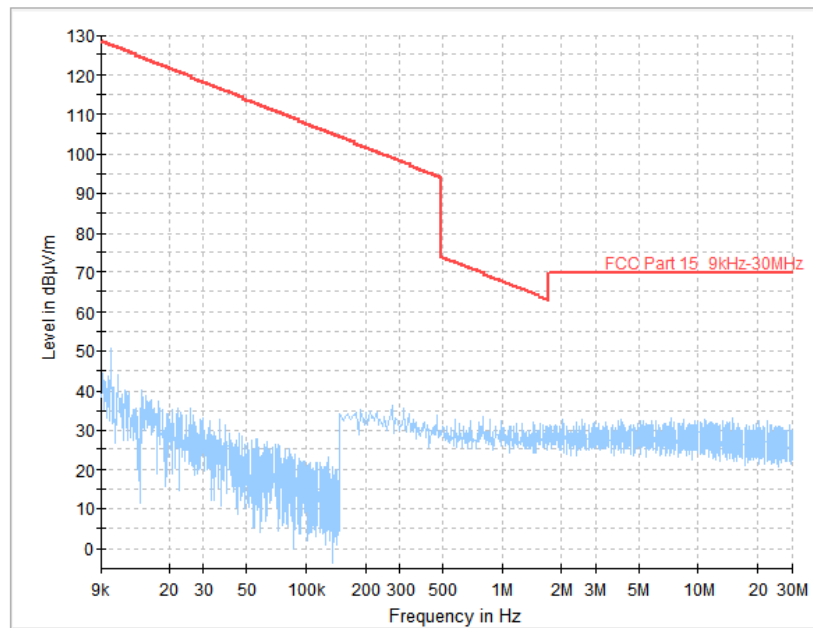
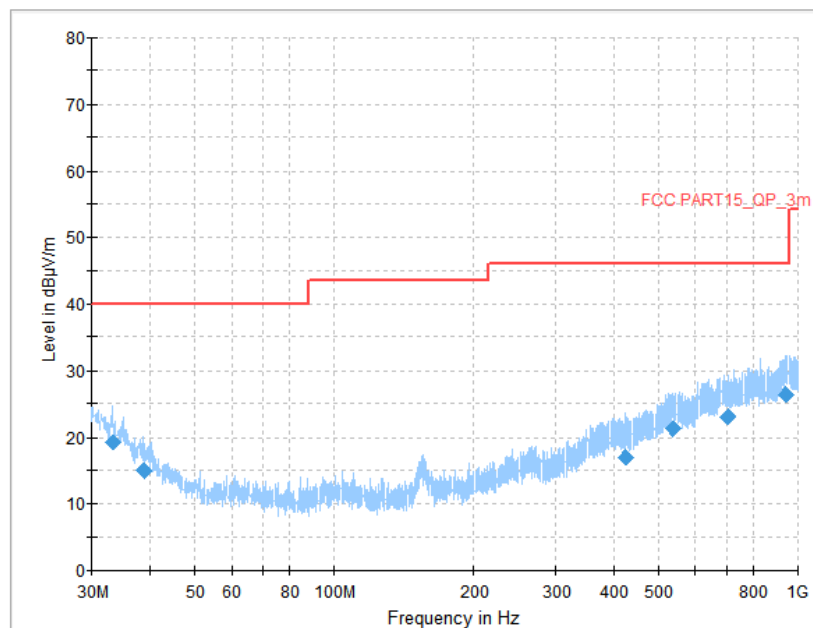


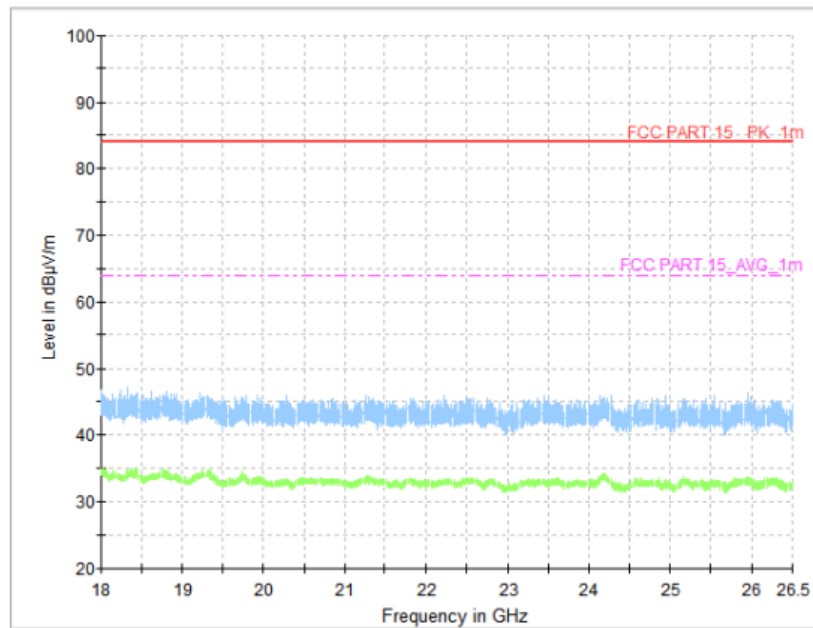
Fig.64 Radiated Restricted Band (802.11n-HT40, CH9, 2.45GHz~2.5GHz)



**Fig.65 Radiated Spurious Emission (All Channels, 9kHz-30MHz)**



**Fig.66 Radiated Spurious Emission (All Channels, 30MHz-1GHz)**



**Fig.67 Radiated Spurious Emission (All Channels, 18GHz-26.5GHz)**

## A.7 AC Power line Conducted Emission

Test Condition:

| Voltage (V) | Frequency (Hz) |
|-------------|----------------|
| 120         | 60             |

Measurement Result and limit:

WLAN - AE2, AE3, AE4

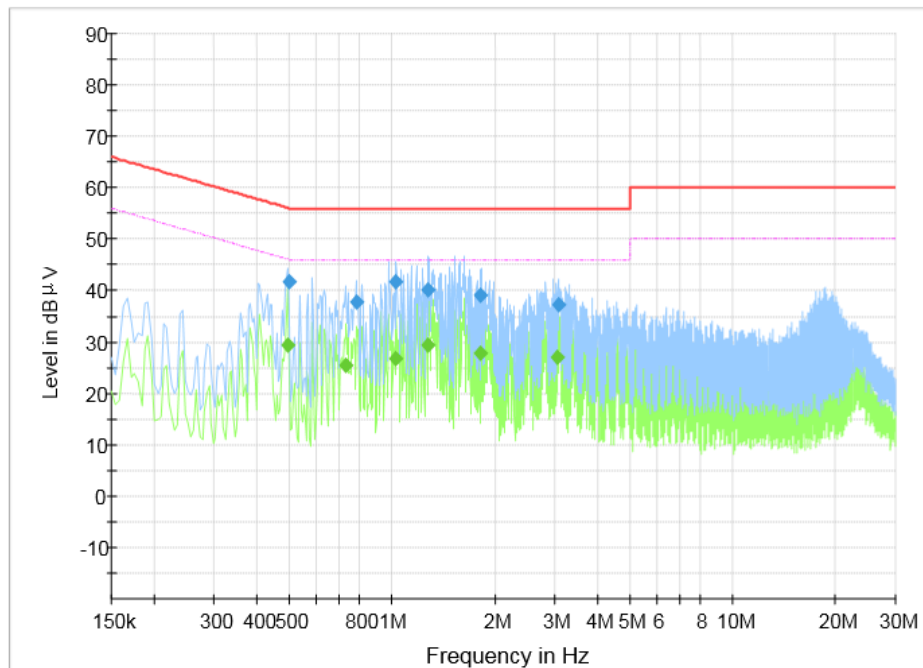
| Frequency range<br>(MHz) | Quasi-peak<br>Limit (dB $\mu$ V) | Average-peak<br>Limit (dB $\mu$ V) | Result (dB $\mu$ V) |        | Conclusion |
|--------------------------|----------------------------------|------------------------------------|---------------------|--------|------------|
|                          |                                  |                                    | Traffic             | Idle   |            |
| 0.15 to 0.5              | 66 to 56                         | 56 to 46                           | Fig.68              | Fig.69 | <b>P</b>   |
| 0.5 to 5                 | 56                               | 46                                 |                     |        |            |
| 5 to 30                  | 60                               | 50                                 |                     |        |            |

NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

**Note:** The measurement results include the L1 and N measurements.

See below for test graphs.

**Conclusion: PASS**



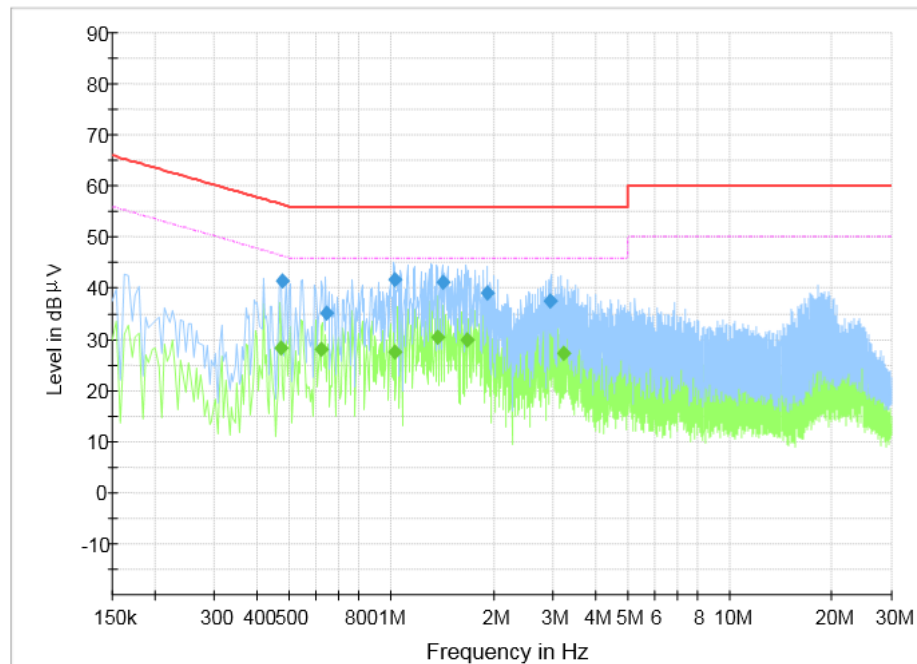
**Fig.68 AC Power line Conducted Emission (Traffic)**

#### Measurement Results: Quasi Peak

| Frequency (MHz) | Quasi Peak (dBµV) | Limit (dBµV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|-------------------|--------------|-------------|------|--------|------------|
| 0.499907        | 41.73             | 56.00        | 14.27       | L1   | ON     | 9.5        |
| 0.785379        | 37.78             | 56.00        | 18.22       | L1   | ON     | 9.5        |
| 1.023943        | 41.64             | 56.00        | 14.36       | L1   | ON     | 9.6        |
| 1.275771        | 40.17             | 56.00        | 15.83       | L1   | ON     | 9.6        |
| 1.821364        | 38.96             | 56.00        | 17.04       | L1   | ON     | 9.6        |
| 3.071036        | 37.27             | 56.00        | 18.73       | L1   | ON     | 9.6        |

#### Measurement Results: Average

| Frequency (MHz) | Average (dBµV) | Limit (dBµV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|----------------|--------------|-------------|------|--------|------------|
| 0.495407        | 29.3           | 46.08        | 16.78       | L1   | ON     | 9.5        |
| 0.734207        | 25.37          | 46.00        | 20.63       | L1   | ON     | 9.5        |
| 1.023943        | 26.72          | 46.00        | 19.28       | L1   | ON     | 9.6        |
| 1.275536        | 29.27          | 46.00        | 16.73       | L1   | ON     | 9.6        |
| 1.821364        | 27.70          | 46.00        | 18.30       | L1   | ON     | 9.6        |
| 3.066536        | 26.99          | 46.00        | 19.01       | L1   | ON     | 9.6        |



**Fig.69 AC Power line Conducted Emission (Idle)**

#### Measurement Results: Quasi Peak

| Frequency (MHz) | Quasi Peak (dBμV) | Limit (dBμV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|-------------------|--------------|-------------|------|--------|------------|
| 0.478586        | 41.45             | 56.36        | 14.91       | L1   | ON     | 9.5        |
| 0.644893        | 35.21             | 56.00        | 20.79       | N    | ON     | 9.5        |
| 1.020150        | 41.65             | 56.00        | 14.35       | L1   | ON     | 9.6        |
| 1.420993        | 41.07             | 56.00        | 14.93       | L1   | ON     | 9.6        |
| 1.919914        | 39.14             | 56.00        | 16.86       | L1   | ON     | 9.6        |
| 2.955664        | 37.42             | 56.00        | 18.58       | L1   | ON     | 9.6        |

#### Measurement Results: Average

| Frequency (MHz) | Average (dBμV) | Limit (dBμV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|----------------|--------------|-------------|------|--------|------------|
| 0.474321        | 28.25          | 46.44        | 18.18       | L1   | ON     | 9.5        |
| 0.623100        | 28.14          | 46.00        | 17.86       | L1   | ON     | 9.5        |
| 1.020150        | 27.51          | 46.00        | 18.49       | L1   | ON     | 9.6        |
| 1.369821        | 30.47          | 46.00        | 15.53       | L1   | ON     | 9.6        |
| 1.668321        | 29.95          | 46.00        | 16.05       | L1   | ON     | 9.6        |
| 3.211993        | 27.19          | 46.00        | 18.81       | L1   | ON     | 9.6        |

**\*\*\*END OF REPORT\*\*\***