



Report No.SH16120037W06

# FCC RF TEST REPORT

*Issued to*

**Shanghai MXCHIP Information Technology Co., Ltd**

*For*

**Embedded WiFi & Bluetooth module**

Model Name : EMW3239-P, EMW3239-E  
Trade Name : MXCHIP  
Brand Name : MXCHIP  
Standard : 47 CFR Part 15, Subpart C  
ANSI C63.10-2013  
FCC ID : P53-EMW3239  
Test date : Jan.3,2017 to Feb.20,2017  
Issue date : Feb.21,2017



Tested by An Peng

Approved by Gm Xeping

Review by Menglan Gu

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**Change History**

| Issue | Date       | Reason for change |
|-------|------------|-------------------|
| 1.0   | Jan.9,2017 | First edition     |
|       |            |                   |
|       |            |                   |
|       |            |                   |
|       |            |                   |
|       |            |                   |



## 1. General Information

### 1.1 Applicant

**Shanghai MXCHIP Information Technology Co., Ltd**

9th Floor,No.5,Lane2145 JinshaJiang Road,Putuo District,ShangHai,China (200333)

### 1.2 Manufacturer

**Shanghai MXCHIP Information Technology Co., Ltd**

9th Floor,No.5,Lane2145 JinshaJiang Road,Putuo District,ShangHai,China (200333)

### 1.3 Description of EUT

EUT Name.....: Embedded WiFi & Bluetooth module  
Model Name .....: EMW3239-P, EMW3239-E  
Brand Name.....: MXCHIP  
Trade Name .....: MXCHIP  
Hardware Version .....: EMW3239 V1.0  
Software Version .....: EMW3239\_1 v3.0 921600  
Modulation Type .....: DSSS (802.11b), OFDM (802.11g/n)  
Frequency Range.....: 2.412GHz - 2.462GHz (at interval of 5 MHz)  
Channel Number.....: 11  
Antenna Type.....: PCB / External antenna  
Antenna Gain.....: PCB: 2 dBi / External: 2dBi

#### NOTE 1:

*The EUT is a WiFi & Bluetooth module operating at 2.4GHz ISM band; it supports 802.11b, 802.11g, 802.11n(20MHz) and they are all tested in this report. The frequencies allocated is  $F$  (MHz)  $=2412+5*(n-1)$  ( $1 \leq n \leq 11$ ). The lowest, middle, highest channel numbers of the EUT used and tested in this report are separately 1 (2412MHz), 6 (2437MHz) and 11 (2462MHz).*

#### NOTE 2:

*EMW3239-P used PCB antenna, EMW3239-E used External antenna.*

#### NOTE 3:

*For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacture.*



## 2. Facilities and Accreditations

### 2.1 Test Facility

Shanghai Skylabs Co., Ltd. Skylabs Laboratory is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L6644. A 9\*6\*6(m) full/semi-anechoic chamber was used for the radiated emissions test.

### 2.2 Environmental Conditions

Ambient temperature: 15~35°C

Relative humidity: 30~60%

Atmosphere pressure: 86-106kPa

### 2.3 Measurement Uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

Uncertainty of Conducted Emission:  $\pm 1.76\text{dB}$

Uncertainty of Radiated Emission:  $\pm 3.16\text{dB}$



## 2.4 List of Equipments Used

| Description                 | Manufacturer  | Model          | Serial No.   | Cal. Date | Cal. Due |
|-----------------------------|---------------|----------------|--------------|-----------|----------|
| Service Simulator           | Agilent       | N4010A         | MY47230669   | 2016.9.21 | 1year    |
| Spectrum Analyzer           | R&S           | FSU26          | 200880       | 2016.2.25 | 1year    |
| Power Splitter              | Weinschel     | 1506A          | NW521        | (n.a.)    | (n.a.)   |
| Power Splitter              | Mini-Circuits | ZFRSC-183-S+   | 76500F1016   | (n.a.)    | (n.a.)   |
| Attenuator 1                | Resnet        | 10dB           | (n.a.)       | (n.a.)    | (n.a.)   |
| Attenuator 2                | Resnet        | 3dB            | (n.a.)       | (n.a.)    | (n.a.)   |
| Power supplier              | NF            | ES2000S        | 9087735      | 2016.9.24 | 1year    |
| Full/Semi-Anechoic Chamber  | CHENGYU       | 9.2×6.25×6.15m | SAR          | 2015.9.14 | 3year    |
| EMI Test Receiver           | R&S           | ESCI7          | 100787       | 2016.2.55 | 1year    |
| LISN                        | TESEQ         | NNB 51         | 33285        | 2016.2.25 | 1year    |
| Personal Computer           | HP            | 6300P          | CNG24296YW   | (n.a.)    | (n.a.)   |
| Test Antenna-Horn           | Schwarzbeck   | BBHA9170       | BBHA91970171 | 2016.9.21 | 1year    |
| Test Antenna-Log            | Schwarzbeck   | VULB 9163      | 9163-561     | 2016.9.24 | 1year    |
| Test Antenna-Loop           | Rohde&Schwarz | FMZB 1519      | 1519-025     | 2016.9.21 | 1year    |
| Test Antenna-Horn           | Schwarzbeck   | BBHA 9120D     | 9120D-1033   | 2016.7.24 | 1year    |
| EPM Series Power Meter      | Agilent       | E4418B         | GB43318055   | 2016.5.23 | 1year    |
| Power Sensor                | Agilent       | 8482A          | MY41091706   | 2016.5.23 | 1year    |
| Temporary Antenna Connector | Farpu         | SMA-K          | (n.a.)       | (n.a.)    | (n.a.)   |
| RF Cable                    | (n.a.)        | 0-25G          | (n.a.)       | (n.a.)    | (n.a.)   |

### NOTE:

*Equipments listed above have been calibrated and are in the period of validation.*

### Supporting Accessories

| Description           | Manufacturer | Model                  | Serial No.                 |
|-----------------------|--------------|------------------------|----------------------------|
| Laptop                | ACER         | Aspire 4376ZG          | LXPFY0C004<br>935291221601 |
| Laptop Adapter        | LITEON       | PA-1650-22             | 9801016502                 |
| Test Evaluation board | MX           | MiCOKit-3166/3239 V1.0 | (n.a.)                     |

### Accessory for Conducted Emission:

| Equipment     | Model     | Input                       | Output     | Manufacturer |
|---------------|-----------|-----------------------------|------------|--------------|
| Power adapter | MDY-08-EH | 100-240V AC<br>50/60Hz 0.5A | 5V DC 2.5A | AOHAI GROUP  |



### 3. Test Standards and Results

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

FCC Part 15 Subpart C §15.247

ANSI C63.10-2013

June 2015 KDB558074

**NOTE:**

*(1)All test items were verified and recorded according to the standards and without any deviation during the test.*

*(2)This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart C (WIFI, 2.4GHz ISM band radiators), recorded in a separate test report.*

Test items and the results are as bellow:

| No. | FCC Rules        | Description                               | Result |
|-----|------------------|-------------------------------------------|--------|
| 1   | 15.203           | Antenna Requirement                       | Pass   |
| 2   | 15.247(b)        | Peak Output power                         | Pass   |
| 3   | 15.247(b)        | Average power                             | Pass   |
| 4   | 15.247(a)        | 6dB & 20dB Bandwidth                      | Pass   |
| 5   | 15.247(d)        | Conducted Spurious Emission and Band Edge | Pass   |
| 6   | 15.247(d)        | Restricted Frequency Bands                | Pass   |
| 7   | 15.207           | Conducted Emission                        | Pass   |
| 8   | 15.247(d) 15.209 | Radiated Emission                         | Pass   |
| 9   | 15.247(e)        | Power Spectral Density (PSD)              | Pass   |



## **4. 47 CFR Part 15C**

### **4.1 Antenna requirement**

#### **4.1.1 Applicable standard**

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by 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.

#### **4.1.2 Result: Compliant**

EMW3239-P: The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal and external photos.

EMW3239-E: The EUT has no standard external antenna jack or electrical connector, only professional users can access to and obtain materials and equipments to install of an external antenna. Please refer to User Manual.



## 5. Test Result

### 5.1 Peak Output Power

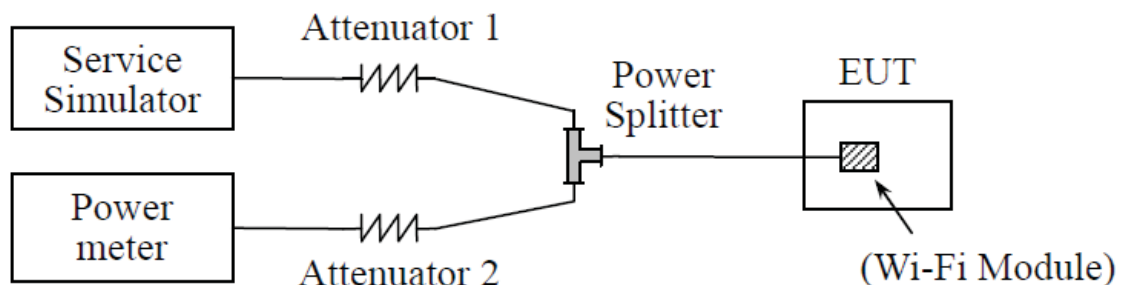
#### 5.1.1 Requirement

According to FCC section 15.247(b)(3), For systems using digital modulation in the 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz bands: The maximum peak conducted output power of the intentional radiator shall not exceed 1 Watt.

#### 5.1.2 Test Description

The measured output power was calculated by the reading of the spectrum analyzer and calibration.

##### A. Test Setup:



The EUT (Equipment under the test) is coupled to the Power Meter; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in power meter.



### 5.1.3 Test Result

The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module.(Duty cycle > 98%)

#### A. Test Verdict:

| Mode               | Channel | Frequency<br>(MHz) | Measured Output Peak Power |         | Limit |   | Verdict |
|--------------------|---------|--------------------|----------------------------|---------|-------|---|---------|
|                    |         |                    | dBm                        | W       | dBm   | W |         |
| 802.11b            | 1       | 2412               | 20.04                      | 0.10093 | 30    | 1 | Pass    |
|                    | 6       | 2437               | 20.14                      | 0.10328 |       |   | Pass    |
|                    | 11      | 2462               | 20.09                      | 0.10209 |       |   | Pass    |
| 802.11g            | 1       | 2412               | 21.24                      | 0.13305 |       |   | Pass    |
|                    | 6       | 2437               | 21.40                      | 0.13804 |       |   | Pass    |
|                    | 11      | 2462               | 21.10                      | 0.12882 |       |   | Pass    |
| 802.11n<br>(20MHz) | 1       | 2412               | 20.65                      | 0.11614 |       |   | Pass    |
|                    | 6       | 2437               | 20.79                      | 0.11995 |       |   | Pass    |
|                    | 11      | 2462               | 20.62                      | 0.11535 |       |   | Pass    |



## 5.2 Average Power

### 5.2.1 Requirement

None; for reporting purposes only.

### 5.2.2 Test Description

Refer to 6.1.2.

### 5.2.3 Test Results

| Mode               | Channel | Frequency<br>(MHz) | Measured Output Average Power |         |
|--------------------|---------|--------------------|-------------------------------|---------|
|                    |         |                    | dBm                           | W       |
| 802.11b            | 1       | 2412               | 17.44                         | 0.05546 |
|                    | 6       | 2437               | 17.39                         | 0.05483 |
|                    | 11      | 2462               | 17.40                         | 0.05495 |
| 802.11g            | 1       | 2412               | 10.30                         | 0.01072 |
|                    | 6       | 2437               | 10.69                         | 0.01172 |
|                    | 11      | 2462               | 10.32                         | 0.01076 |
| 802.11n<br>(20MHz) | 1       | 2412               | 9.78                          | 0.00951 |
|                    | 6       | 2437               | 9.89                          | 0.00975 |
|                    | 11      | 2462               | 9.96                          | 0.00991 |

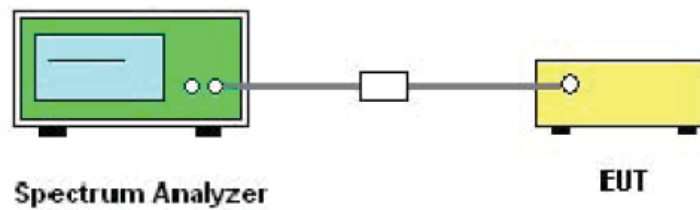


## 5.3 6dB & 20dB Bandwidth

### 5.3.1 Requirement

According to FCC section 15.247(a) (2), 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.

### 5.3.2 Test Description



### 5.3.3 Test Result

The lowest, middle and highest channels are selected to perform testing to record the 6 dB bandwidth of the Module.

#### A. Test Verdict:

##### 802.11b Test mode

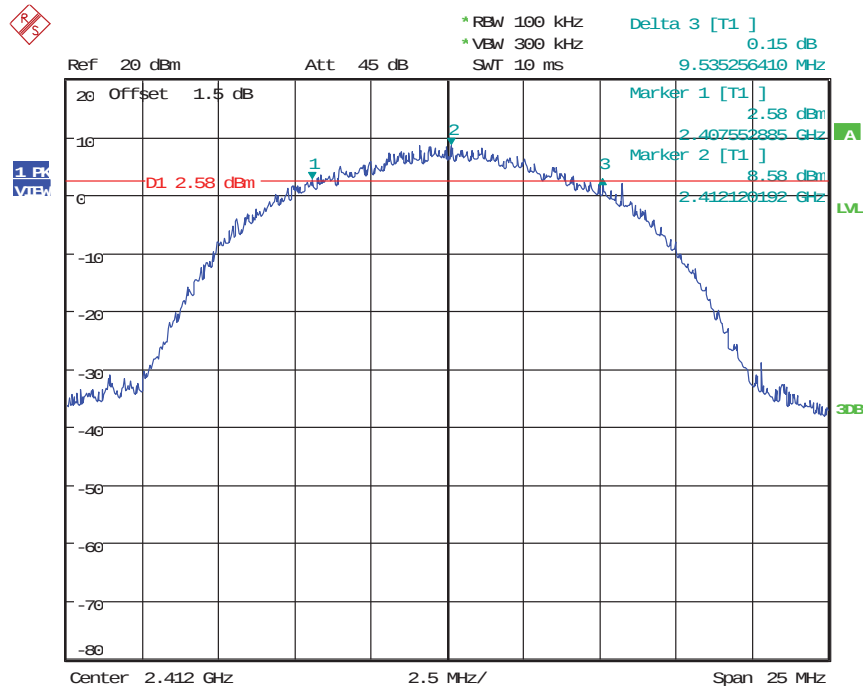
| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | Refer to plot | 20dB Bandwidth (MHz) | Refer to plot | Limit (KHz) | Result |
|---------|-----------------|---------------------|---------------|----------------------|---------------|-------------|--------|
| 1       | 2412            | 9.535               | Plot A1       | 15.464               | Plot A2       | $\geq 500$  | Pass   |
| 6       | 2437            | 8.613               | Plot B1       | 15.705               | Plot B2       | $\geq 500$  | Pass   |
| 11      | 2462            | 8.854               | Plot C1       | 15.665               | Plot C2       | $\geq 500$  | Pass   |

##### 802.11g Test mode

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | Refer to plot | 20dB Bandwidth (MHz) | Refer to plot | Limit (KHz) | Result |
|---------|-----------------|---------------------|---------------|----------------------|---------------|-------------|--------|
| 1       | 2412            | 15.785              | Plot D1       | 17.104               | Plot D2       | $\geq 500$  | Pass   |
| 6       | 2437            | 16.065              | Plot E1       | 17.347               | Plot E2       | $\geq 500$  | Pass   |
| 11      | 2462            | 16.065              | Plot F1       | 17.548               | Plot F2       | $\geq 500$  | Pass   |

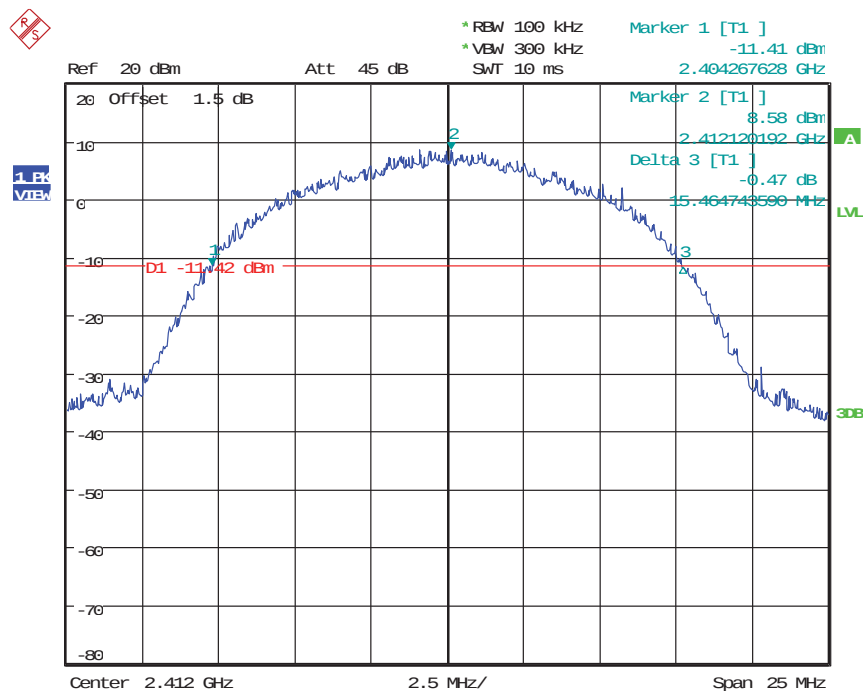
##### 802.11n (20MHz) Test mode

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | Refer to plot | 20dB Bandwidth (MHz) | Refer to plot | Limit (KHz) | Result |
|---------|-----------------|---------------------|---------------|----------------------|---------------|-------------|--------|
| 1       | 2412            | 16.225              | Plot G1       | 18.349               | Plot G2       | $\geq 500$  | Pass   |
| 6       | 2437            | 16.346              | Plot H1       | 18.429               | Plot H2       | $\geq 500$  | Pass   |
| 11      | 2462            | 16.586              | Plot I1       | 18.349               | Plot I2       | $\geq 500$  | Pass   |

**B. Test Plots:**

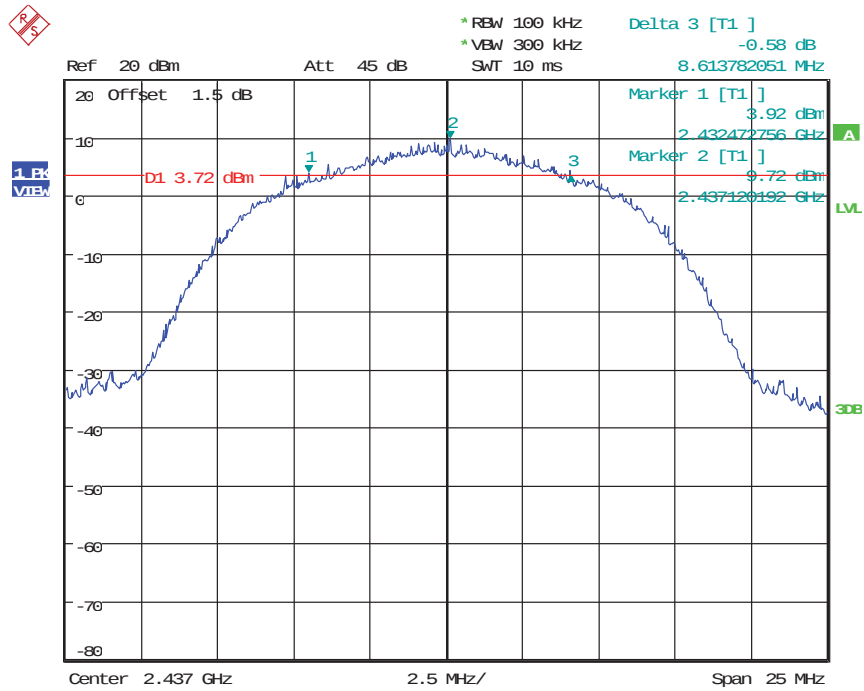
Date: 3.JAN.2017 18:23:08

Plot A1



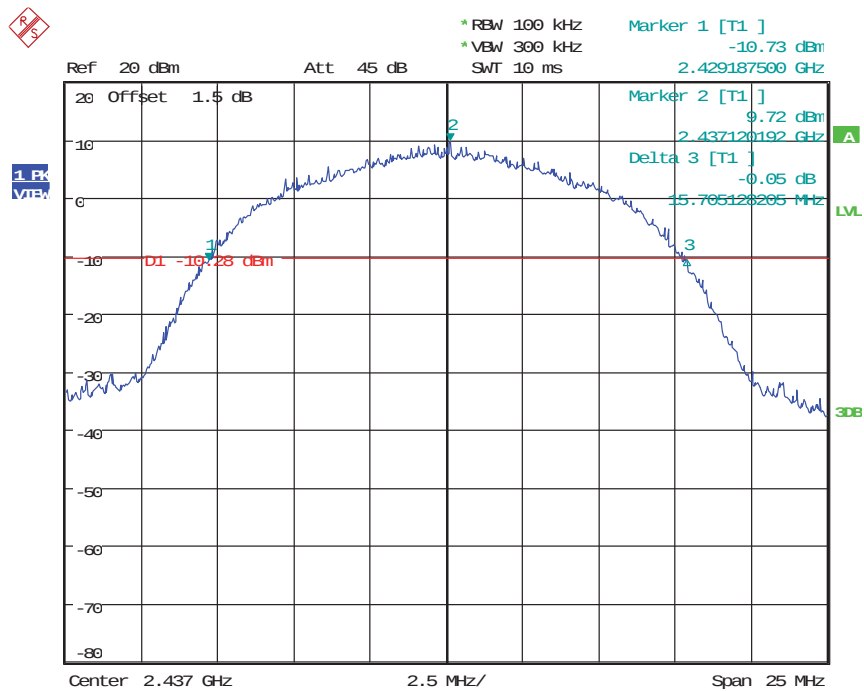
Date: 3.JAN.2017 18:23:50

Plot A2



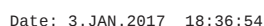
Date: 3.JAN.2017 18:31:12

Plot B1

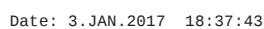


Date: 3.JAN.2017 18:32:07

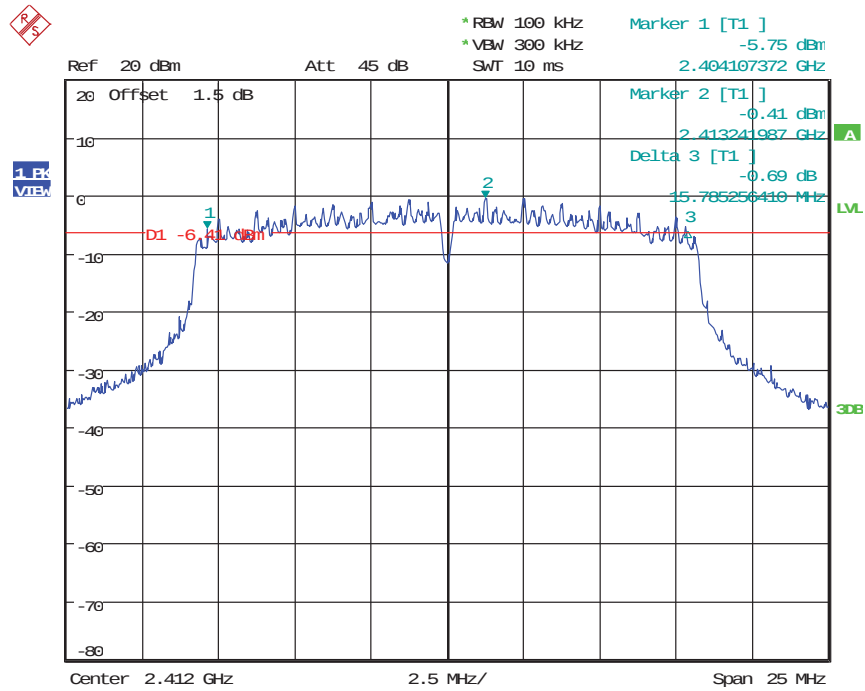
Plot B2



### Plot C1

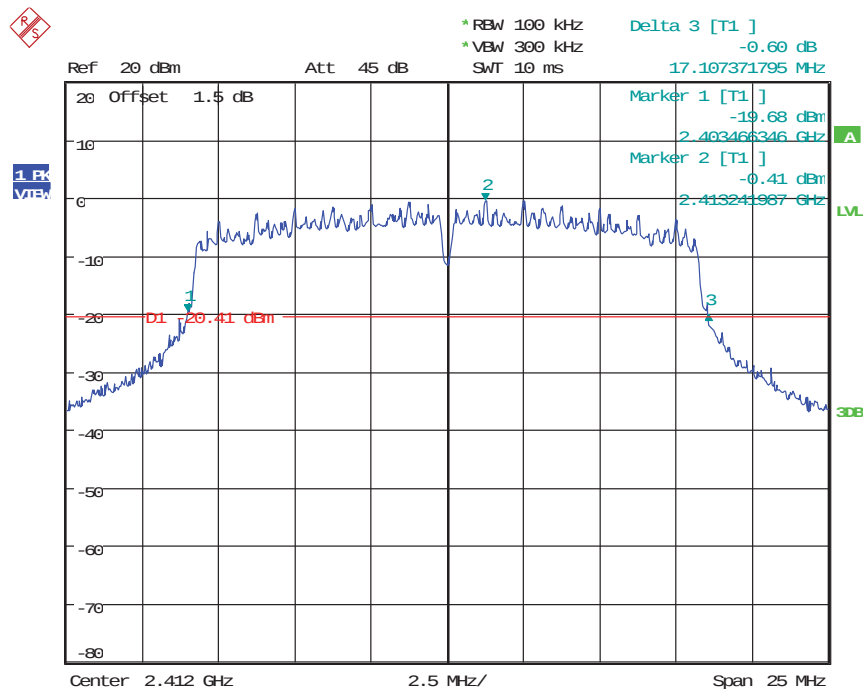


### Plot C2



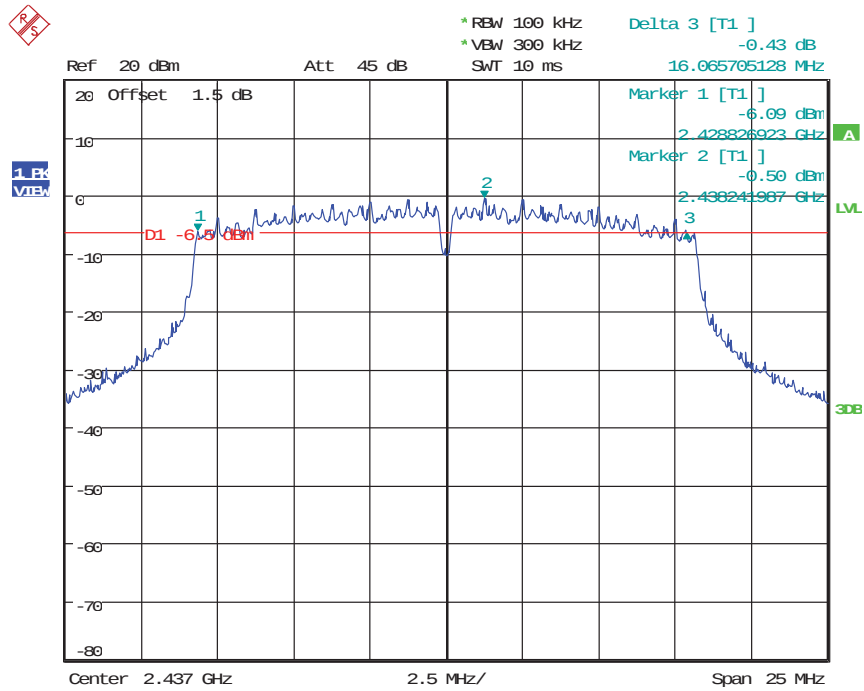
Date: 3.JAN.2017 18:26:00

Plot D1



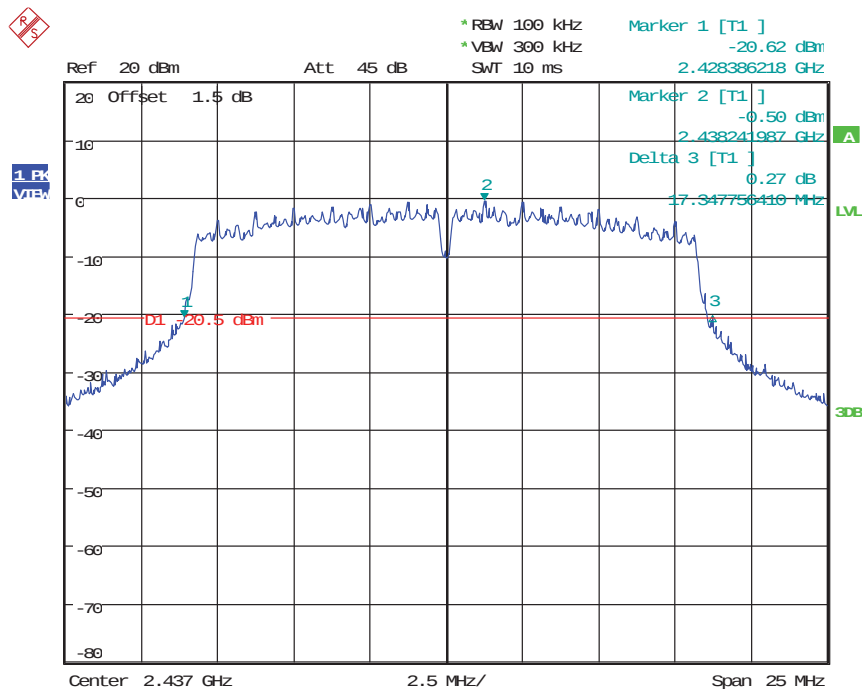
Date: 3.JAN.2017 18:26:27

Plot D2



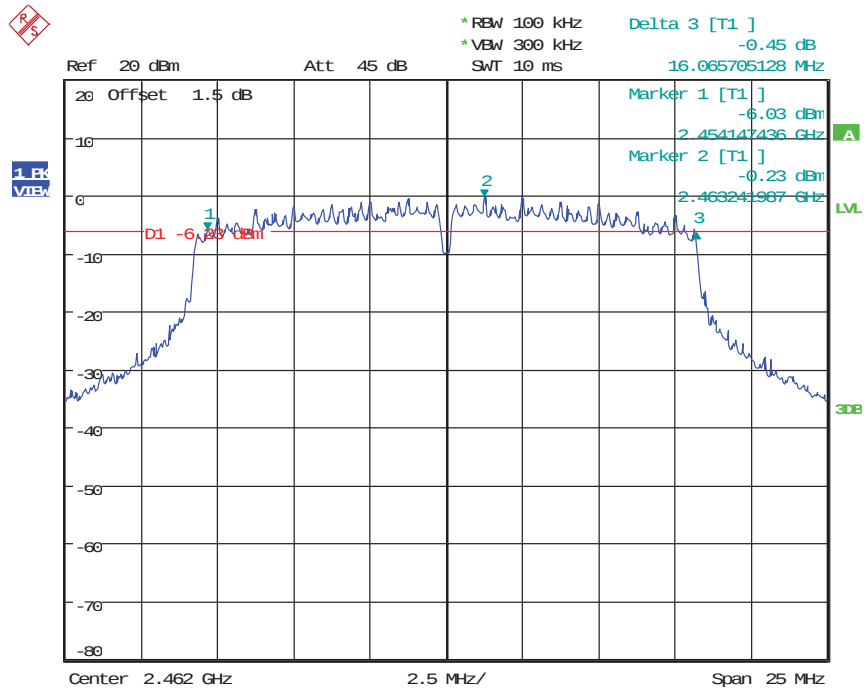
Date: 3.JAN.2017 18:33:31

Plot E1



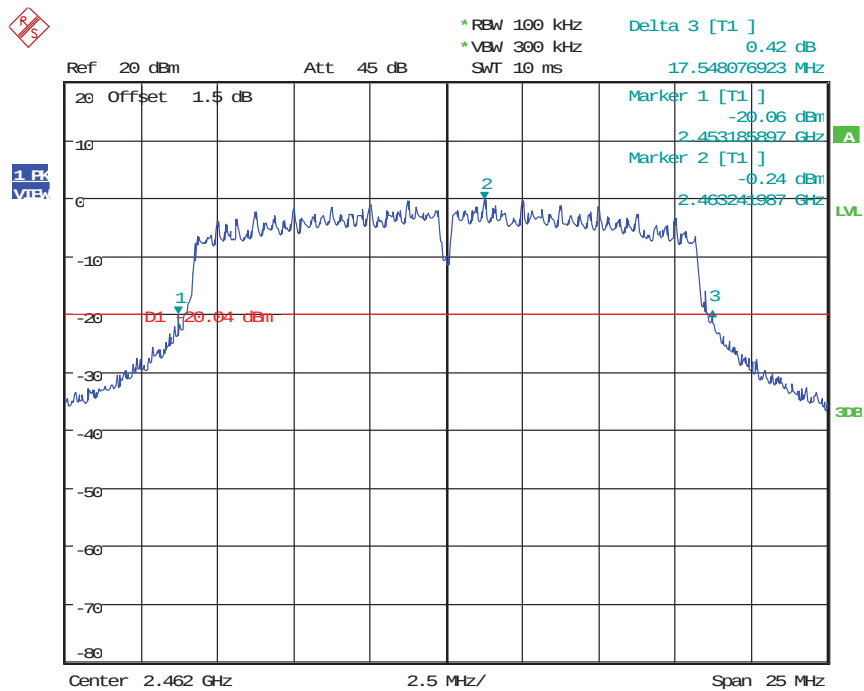
Date: 3.JAN.2017 18:34:18

Plot E2



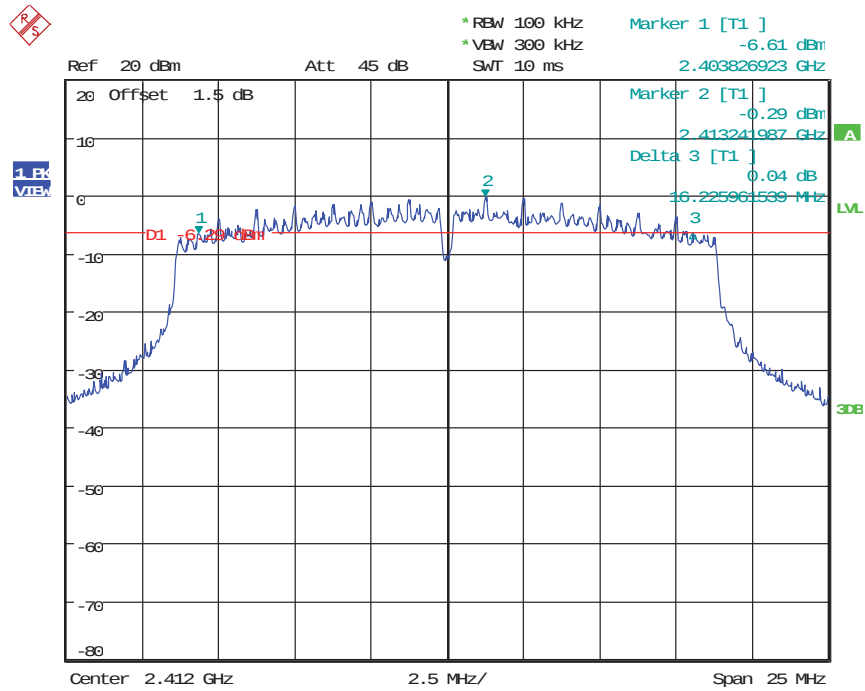
Date: 3.JAN.2017 18:39:19

Plot F1



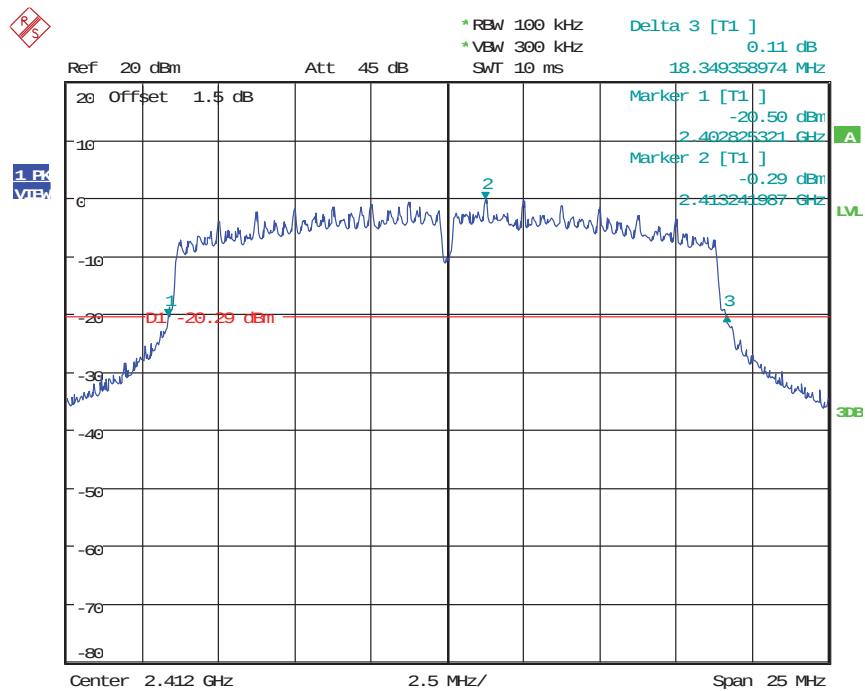
Date: 3.JAN.2017 18:40:07

Plot F2



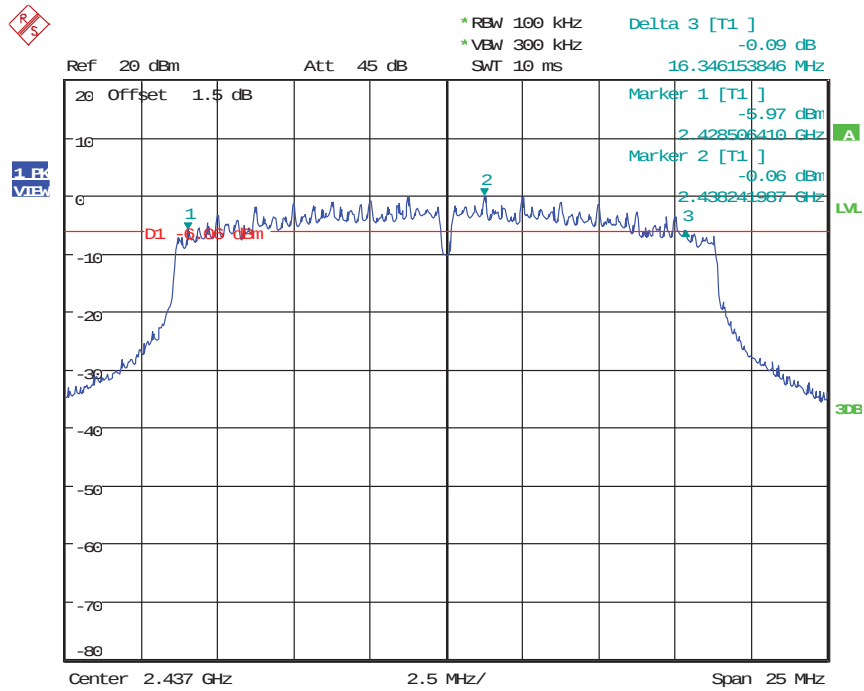
Date: 3.JAN.2017 18:28:32

Plot G1



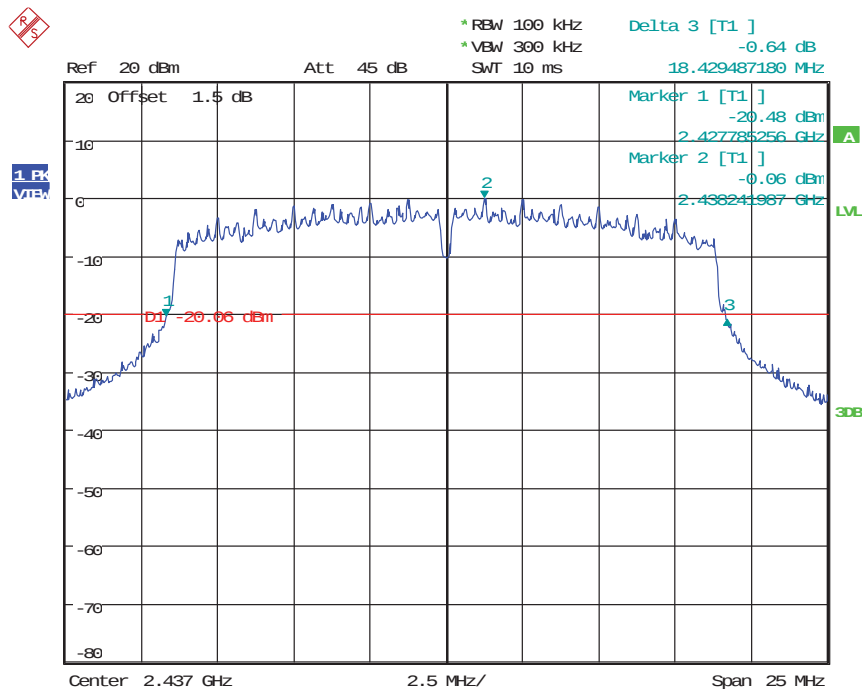
Date: 3.JAN.2017 18:28:57

Plot G2



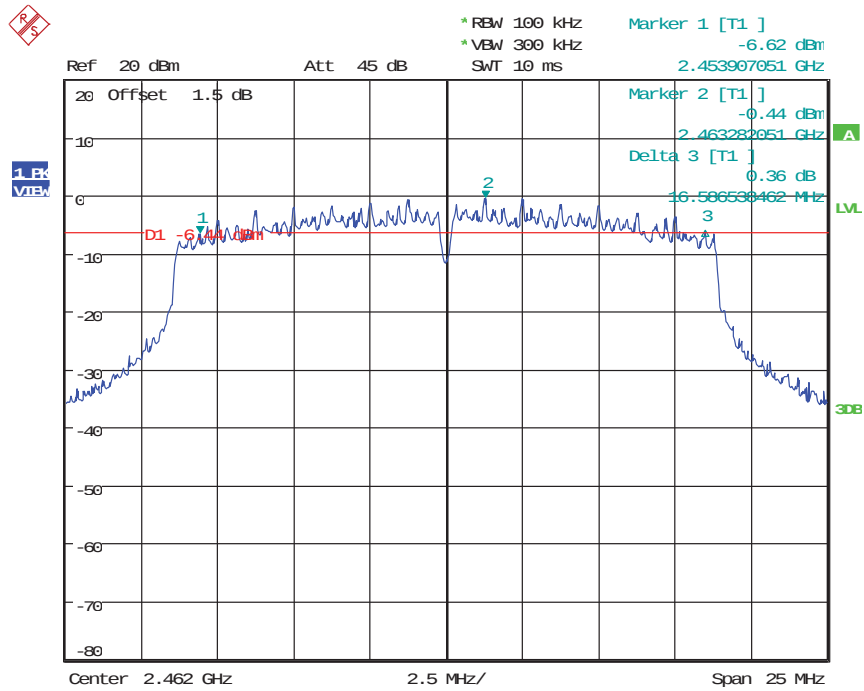
Date: 3.JAN.2017 18:35:24

Plot H1



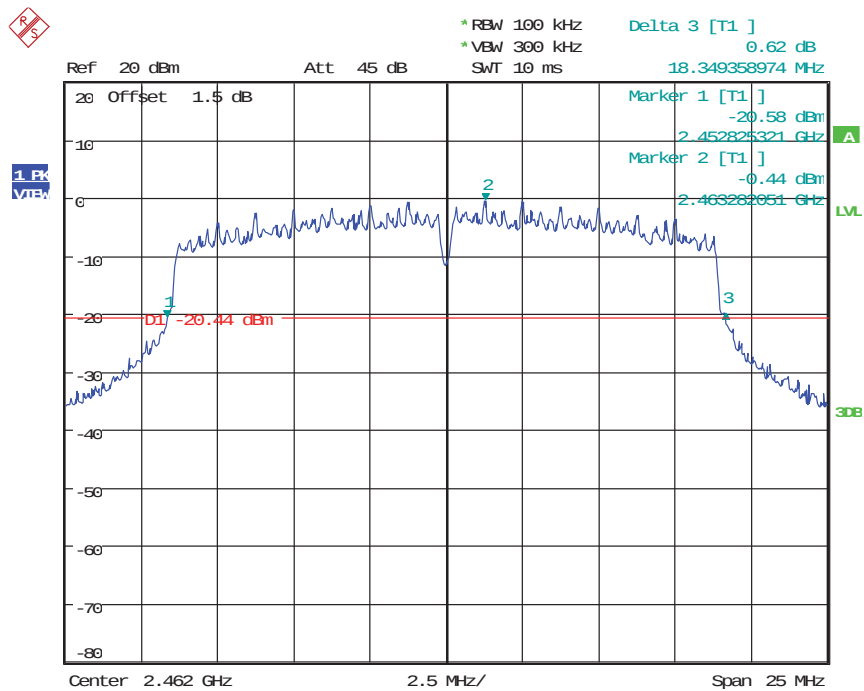
Date: 3.JAN.2017 18:35:51

Plot H2



Date: 3.JAN.2017 18:41:10

Plot I1



Date: 3.JAN.2017 18:41:41

Plot I2

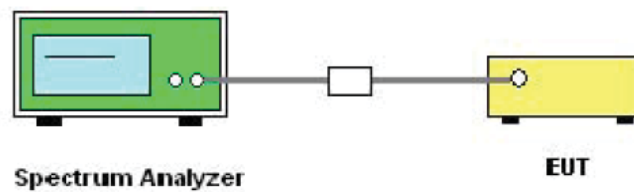


## 5.4 Conducted Spurious Emissions and Band Edge

### 5.4.1 Requirement

According to FCC section 15.247(d), in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

### 5.4.2 Test Description



### 5.4.3 Test Result

The Wifi Module operates at hopping-off test mode. The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions.

#### A. Test Verdict:

##### 802.11b Test mode

| Channel | Frequency (MHz) | Measured max out of band emission(dBm) | Refer to plot | Limit(dBm)    |                        | Result |
|---------|-----------------|----------------------------------------|---------------|---------------|------------------------|--------|
|         |                 |                                        |               | Carrier level | Calculated 20dBc limit |        |
| 1       | 2412            | -36.55                                 | Plot A1/A2    | 7.62          | -12.38                 | Pass   |
| 6       | 2437            | -36.04                                 | Plot B        | 7.76          | -12.24                 | Pass   |
| 11      | 2462            | -36.62                                 | Plot C1/C2    | 8.21          | -11.79                 | Pass   |

##### 802.11g Test mode

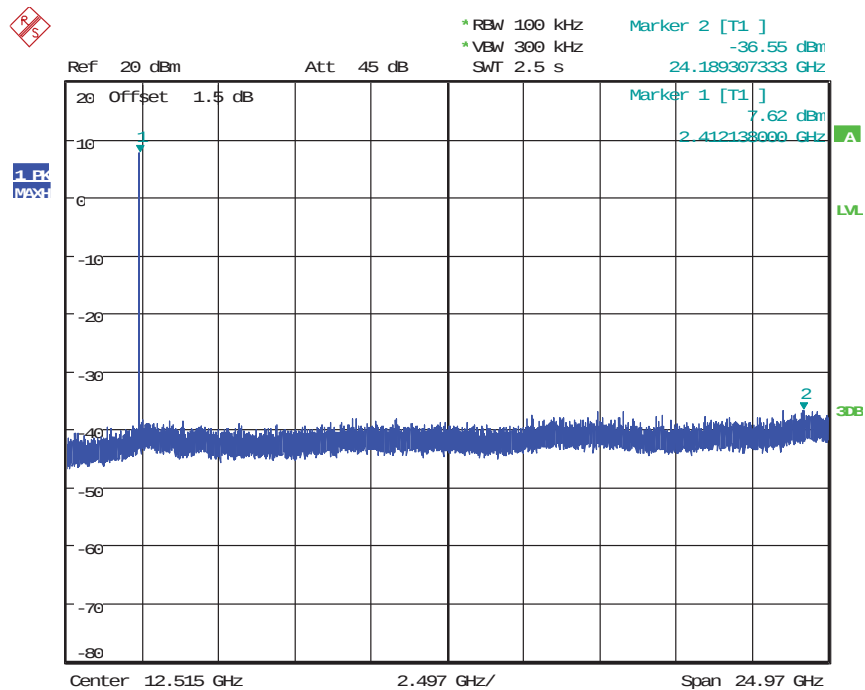
| Channel | Frequency (MHz) | Measured max out of band emission(dBm) | Refer to plot | Limit(dBm)    |                        | Result |
|---------|-----------------|----------------------------------------|---------------|---------------|------------------------|--------|
|         |                 |                                        |               | Carrier level | Calculated 20dBc limit |        |
| 1       | 2412            | -36.98                                 | Plot D1/D2    | -1.53         | -21.53                 | Pass   |
| 6       | 2437            | -36.01                                 | Plot E        | -1.40         | -21.40                 | Pass   |
| 11      | 2462            | -36.53                                 | Plot F1/F2    | -2.62         | -22.62                 | Pass   |



## 802.11n (20MHz) Test mode

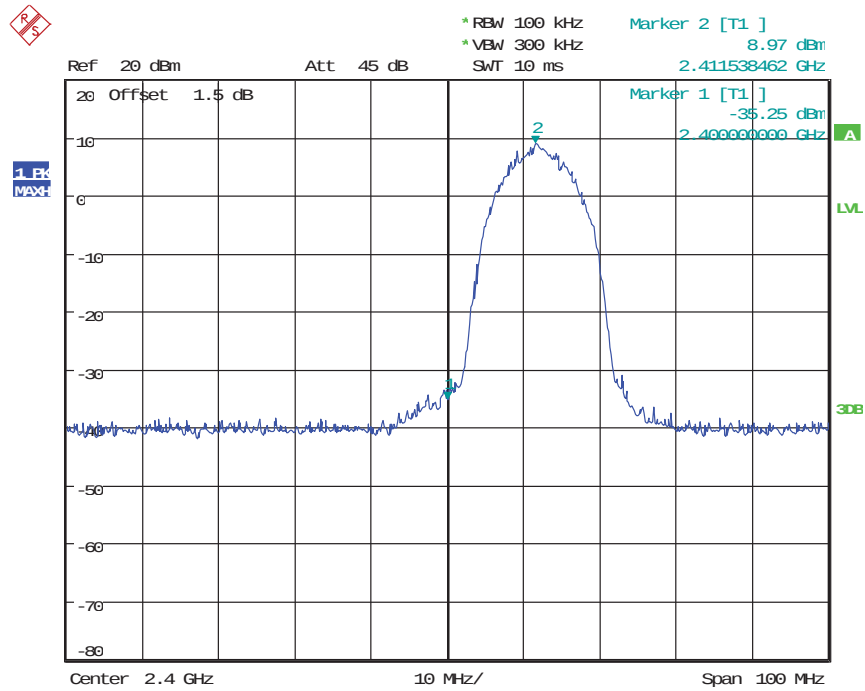
| Channel | Frequency (MHz) | Measured max out of band emission(dBm) | Refer to plot | Limit(dBm)    |                        | Result |
|---------|-----------------|----------------------------------------|---------------|---------------|------------------------|--------|
|         |                 |                                        |               | Carrier level | Calculated 20dBc limit |        |
| 1       | 2412            | -36.28                                 | Plot G1/G2    | -1.05         | -21.05                 | Pass   |
| 6       | 2437            | -36.51                                 | Plot H        | -1.41         | -21.41                 | Pass   |
| 11      | 2462            | -36.64                                 | Plot I1/I2    | -0.52         | -20.52                 | Pass   |

## B. Test Plot:



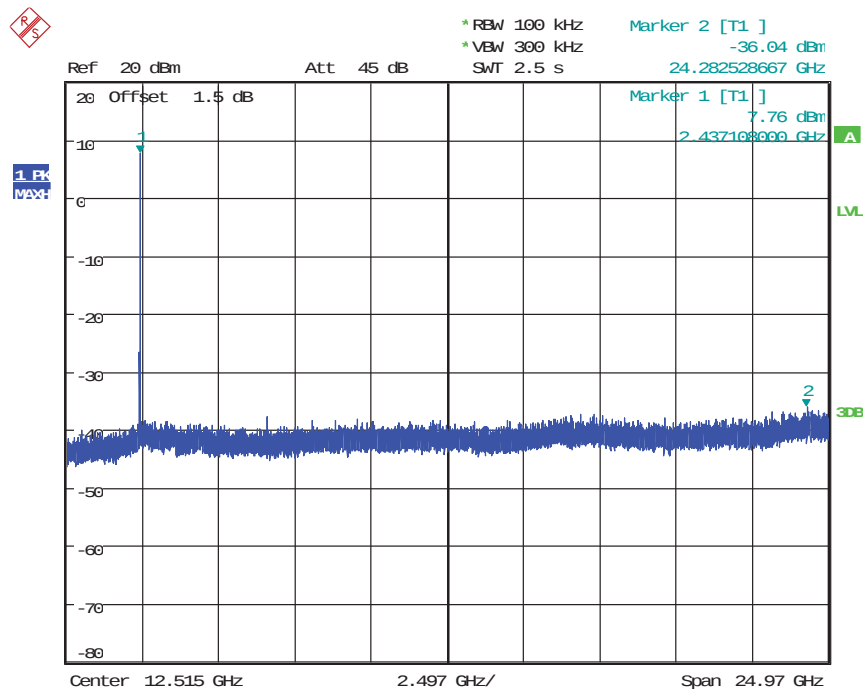
Date: 3.JAN.2017 18:49:12

Plot A1 802.11b Channel 1 30MHz~25GHz



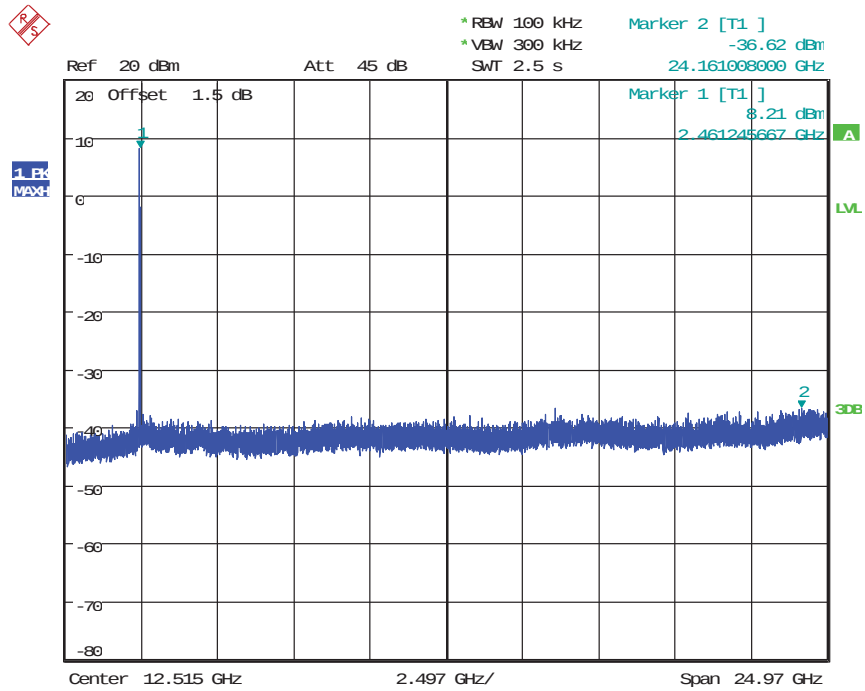
Date: 3.JAN.2017 18:57:33

Plot A2 802.11b Channel 1 Band Edge



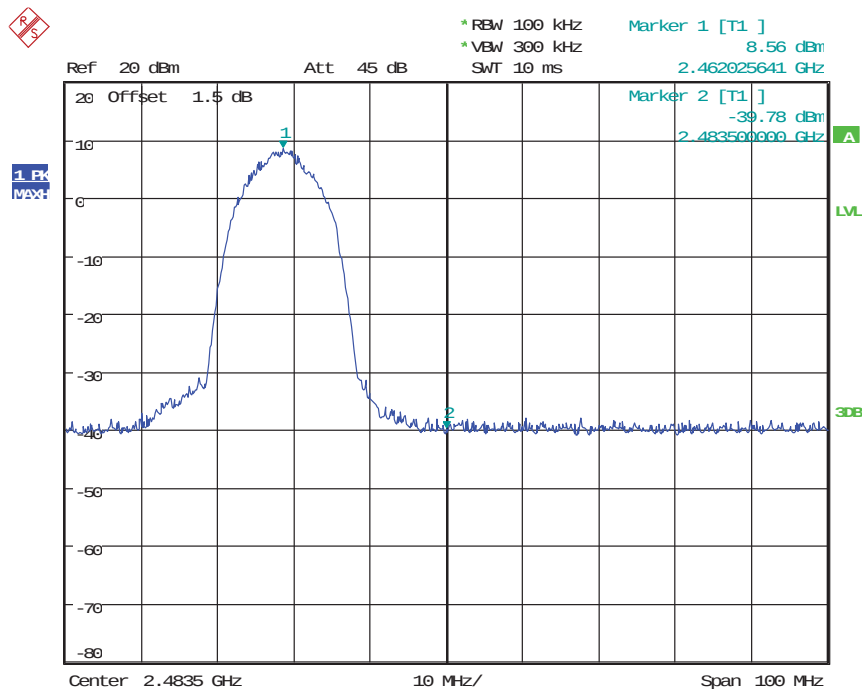
Date: 3.JAN.2017 18:51:32

Plot B 802.11b Channel 6 30MHz~25GHz



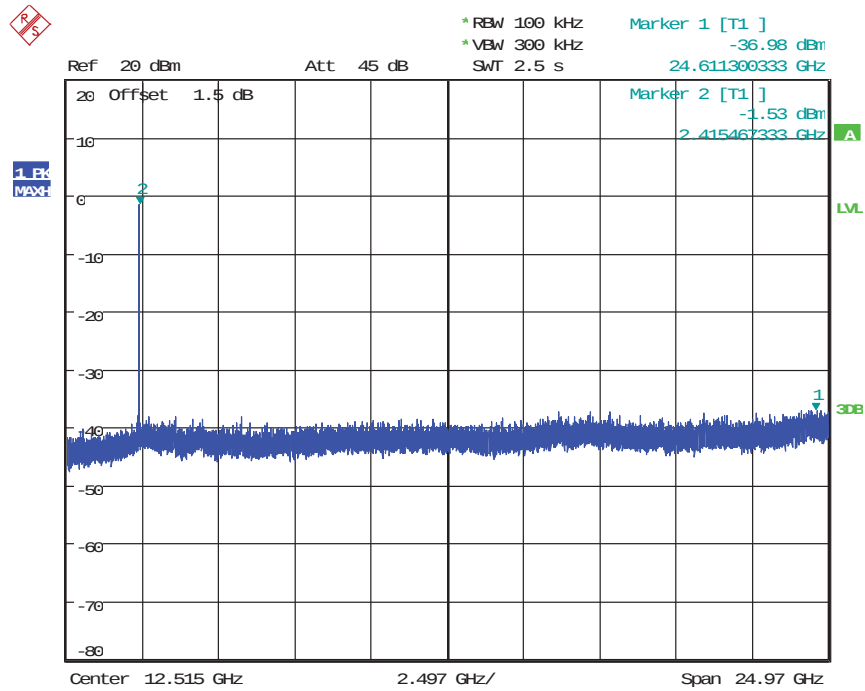
Date: 3.JAN.2017 18:54:08

Plot C1 802.11b Channel 11 30MHz~25GHz



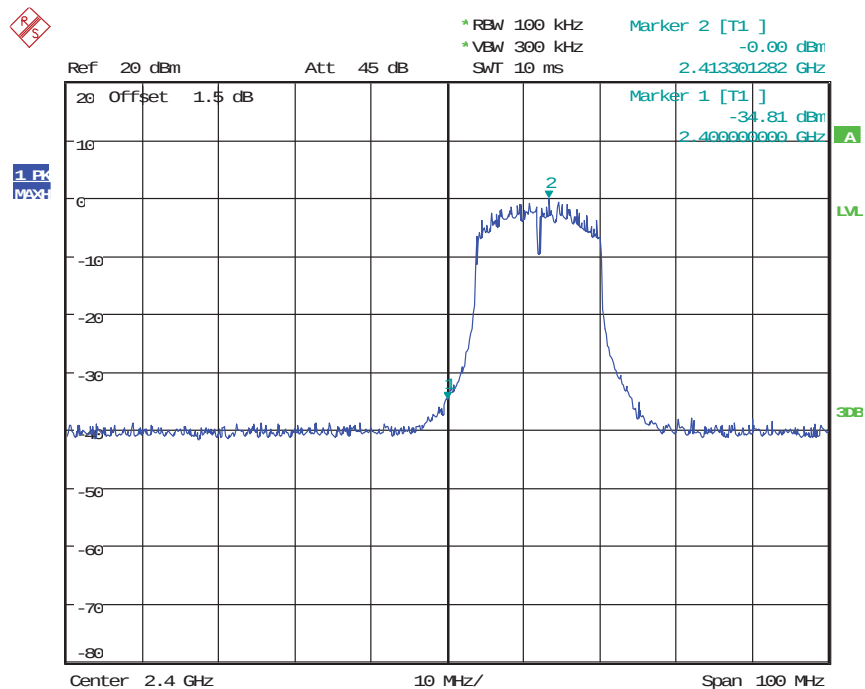
Date: 3.JAN.2017 18:59:46

Plot C2 802.11b Channel 11 Band Edge



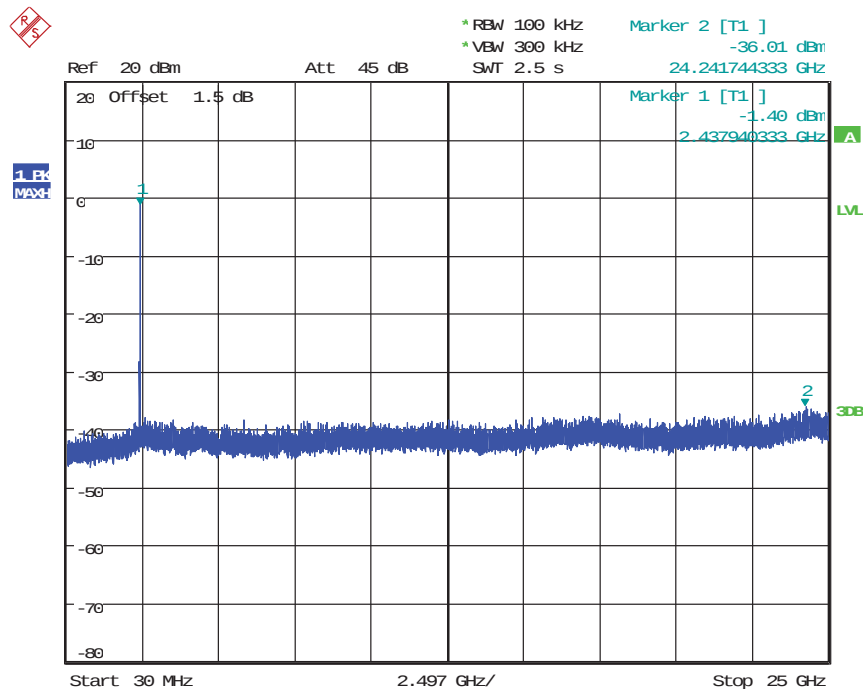
Date: 3.JAN.2017 18:50:05

Plot D1 802.11g Channel 1 30MHz~25GHz



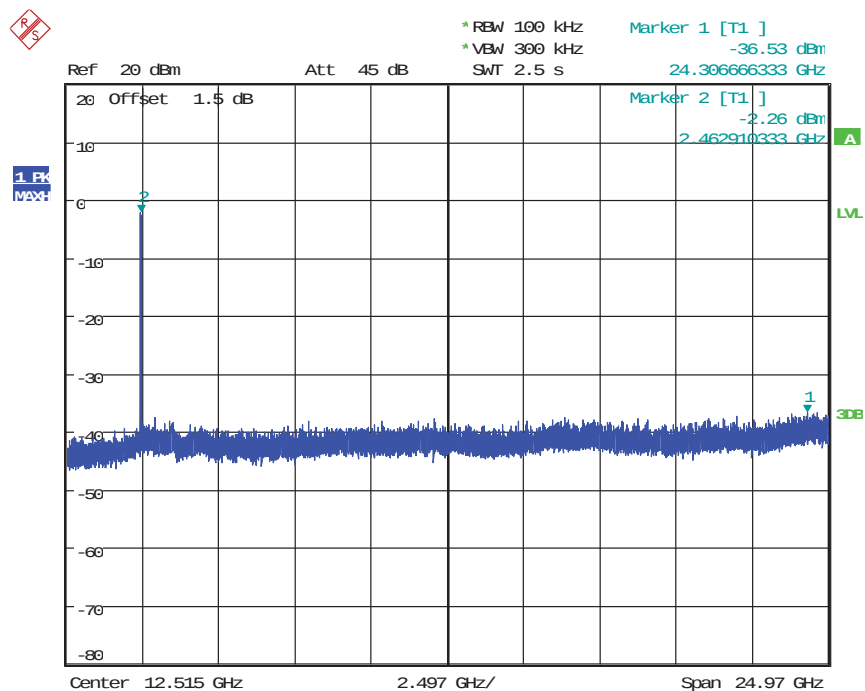
Date: 3.JAN.2017 18:58:37

Plot D2 802.11g Channel 1 Band Edge



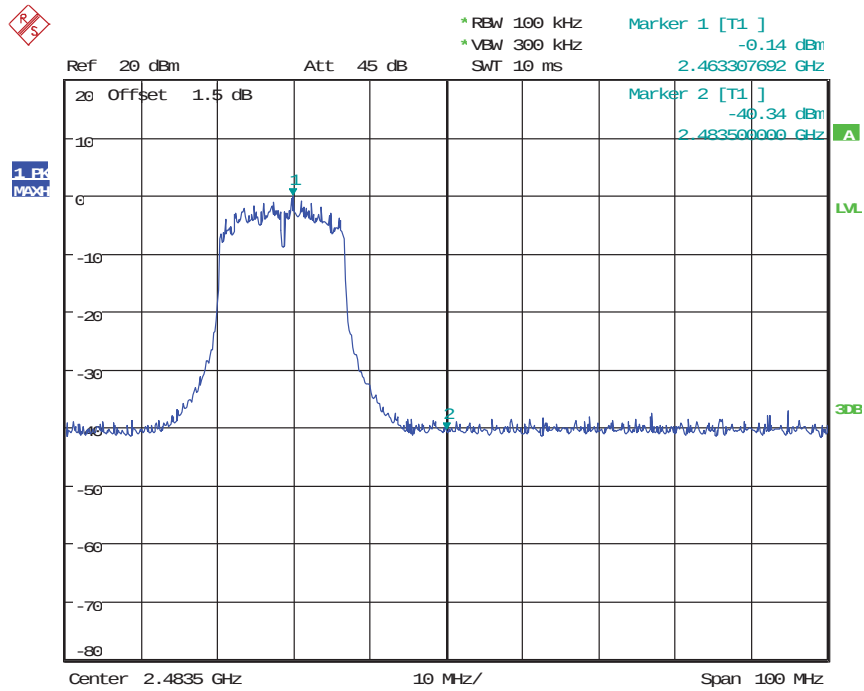
Date: 3.JAN.2017 18:52:18

Plot E 802.11g Channel 6 30MHz~25GHz



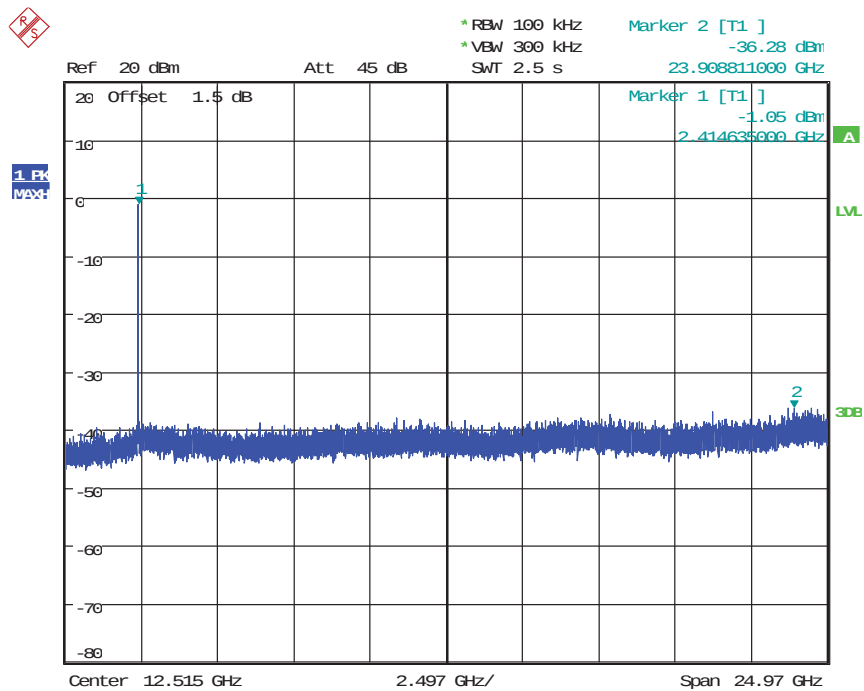
Date: 3.JAN.2017 18:55:04

Plot F1 802.11g Channel 11 30MHz~25GHz



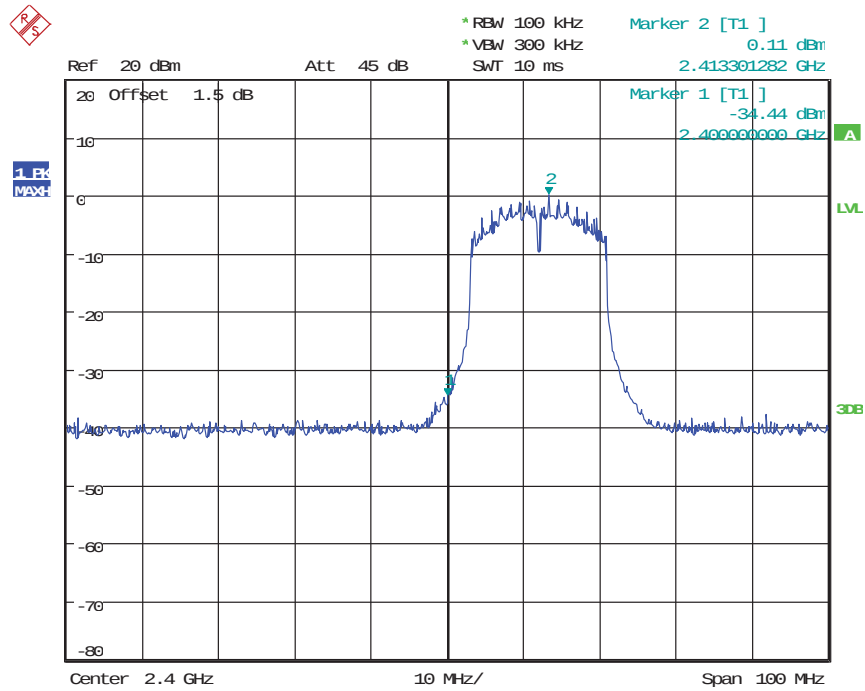
Date: 3.JAN.2017 19:00:12

Plot F2 802.11g Channel 11 Band Edge



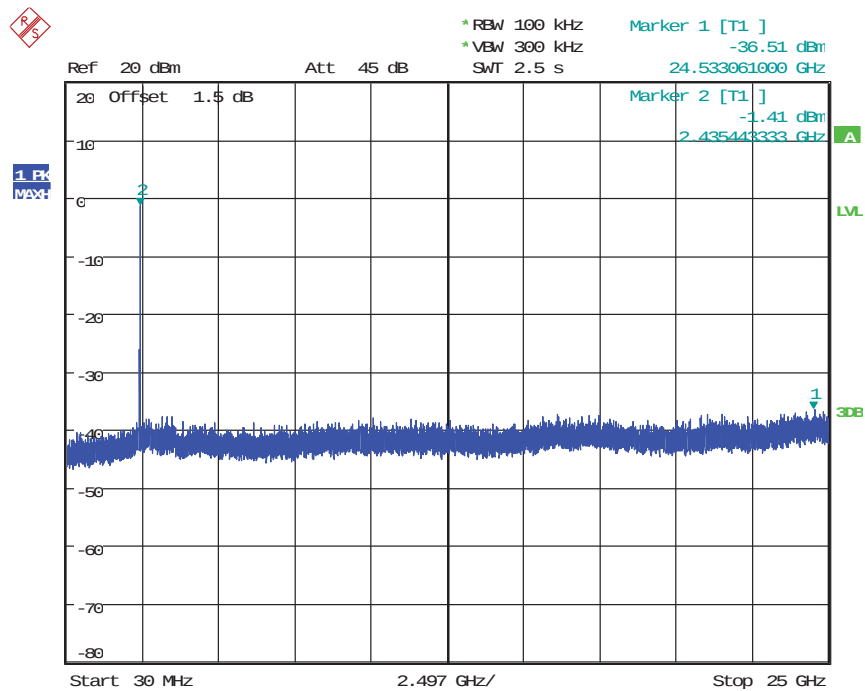
Date: 3.JAN.2017 18:50:43

Plot G1 802.11n-20 Channel 1 30MHz~25GHz



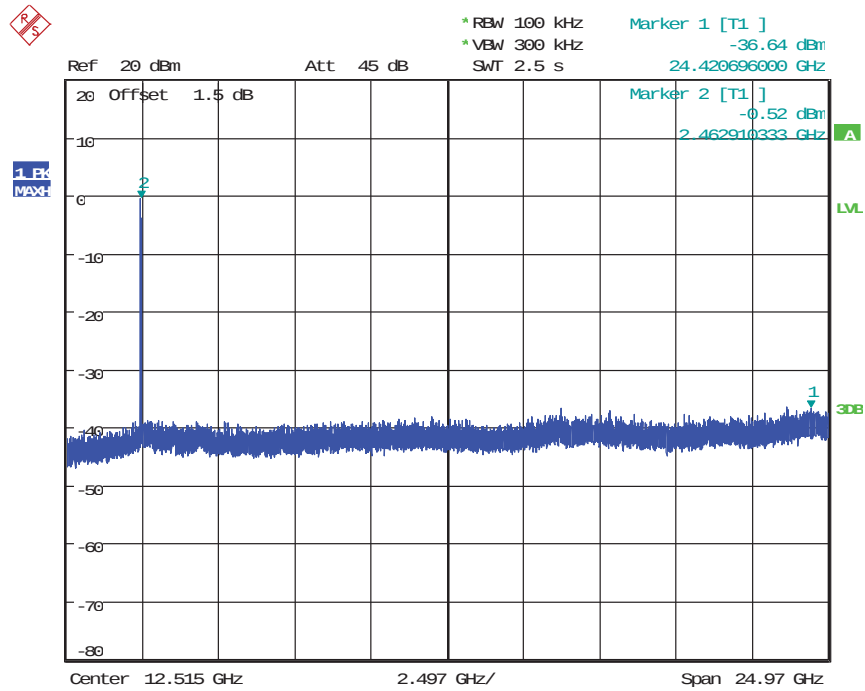
Date: 3.JAN.2017 18:59:11

Plot G2 802.11n-20 Channel 1 Band Edge



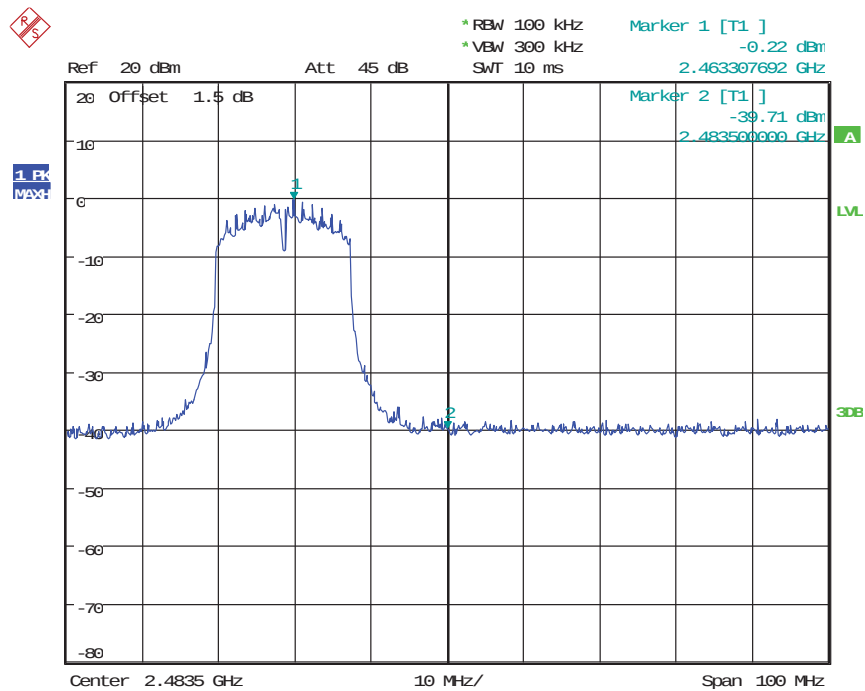
Date: 3.JAN.2017 18:53:13

Plot H 802.11n-20 Channel 6 30MHz~25GHz



Date: 3.JAN.2017 18:56:03

Plot I1 802.11n-20 Channel 11 30MHz~25GHz



Date: 3.JAN.2017 19:00:39

Plot I2 802.11n-20 Channel 11 Band Edge

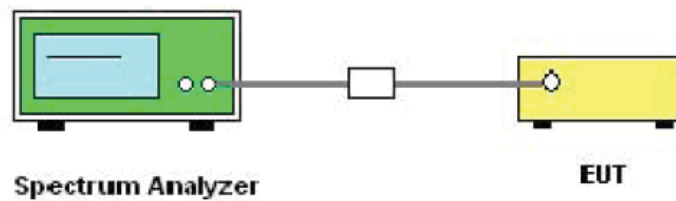


## 5.5 Power Spectral Density (PSD)

### 5.5.1 Requirement

According to FCC section 15.247(e), the same method of determining the conducted output power shall be used to determine the power spectral density. If a peak output power is measured, then a peak power spectral density measurement is required. If an average output power is measured, then an average power spectral density measurement should be used

### 5.5.2 Test Description



### 5.5.3 Test Result

#### A. Test Verdict

##### 802.11b Test mode

| Channel | Frequency (MHz) | Measured PSD (dBm/3kHz) | Refer to plot | Limit (dBm/3kHz) | Result |
|---------|-----------------|-------------------------|---------------|------------------|--------|
| 1       | 2412            | -5.88                   | Plot A        | 8                | Pass   |
| 6       | 2437            | -6.06                   | Plot B        | 8                | Pass   |
| 11      | 2462            | -6.08                   | Plot C        | 8                | Pass   |

##### 802.11g Test mode

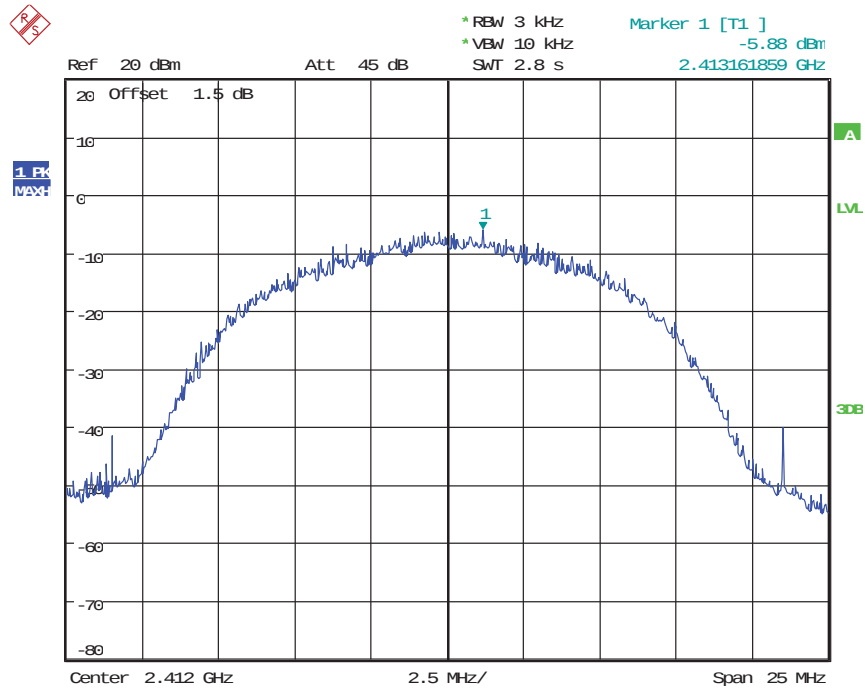
| Channel | Frequency (MHz) | Measured PSD (dBm/3kHz) | Refer to plot | Limit (dBm/3kHz) | Result |
|---------|-----------------|-------------------------|---------------|------------------|--------|
| 1       | 2412            | -14.38                  | Plot D        | 8                | Pass   |
| 6       | 2437            | -14.87                  | Plot E        | 8                | Pass   |
| 11      | 2462            | -13.71                  | Plot F        | 8                | Pass   |

##### 802.11n (20MHz) Test mode

| Channel | Frequency (MHz) | Measured PSD (dBm/3kHz) | Refer to plot | Limit (dBm/3kHz) | Result |
|---------|-----------------|-------------------------|---------------|------------------|--------|
| 1       | 2412            | -14.84                  | Plot G        | 8                | Pass   |
| 6       | 2437            | -13.63                  | Plot H        | 8                | Pass   |
| 11      | 2462            | -14.53                  | Plot I        | 8                | Pass   |

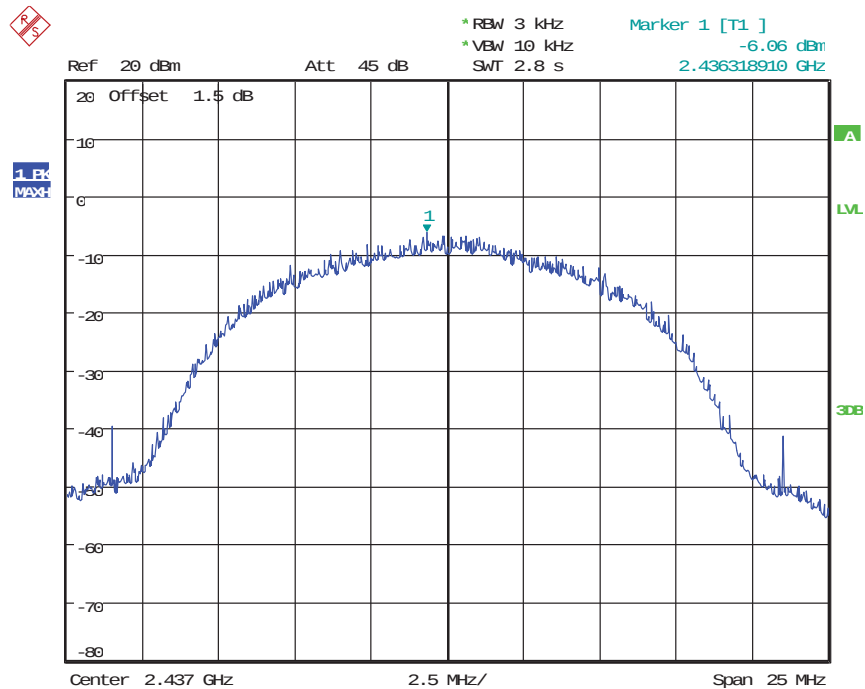


## B. Test Plot



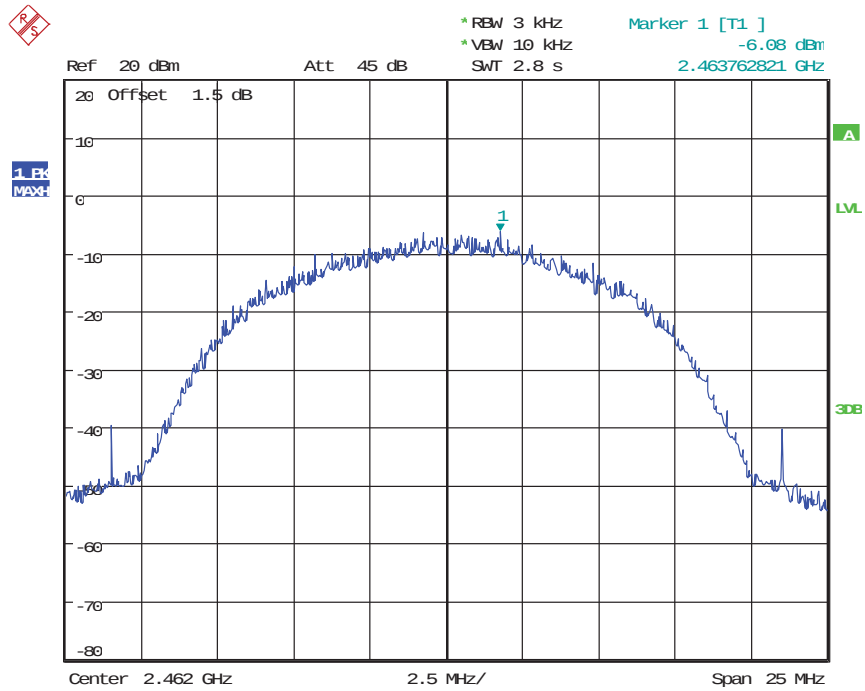
Date: 3.JAN.2017 19:02:12

Plot A



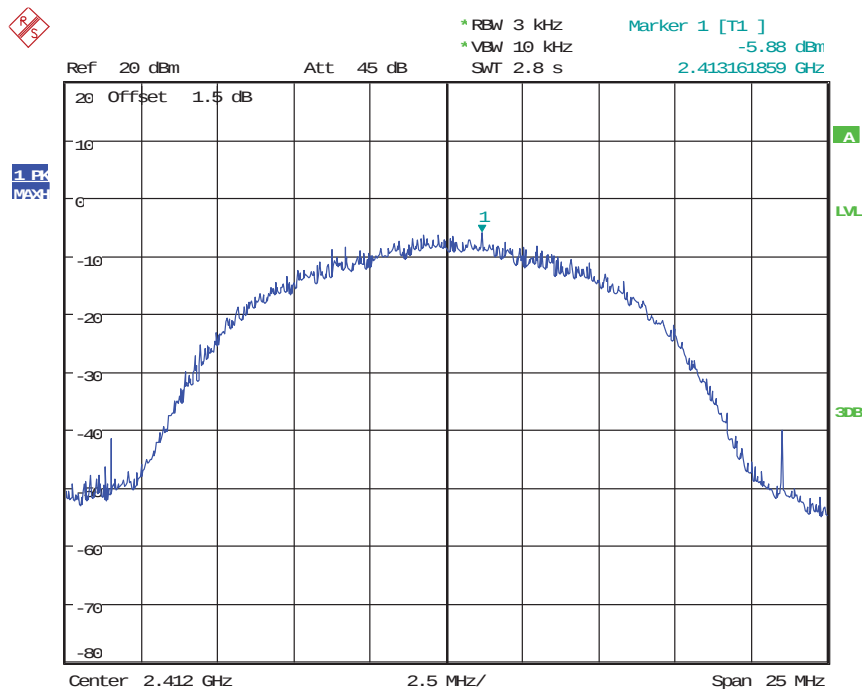
Date: 3.JAN.2017 19:04:02

Plot B



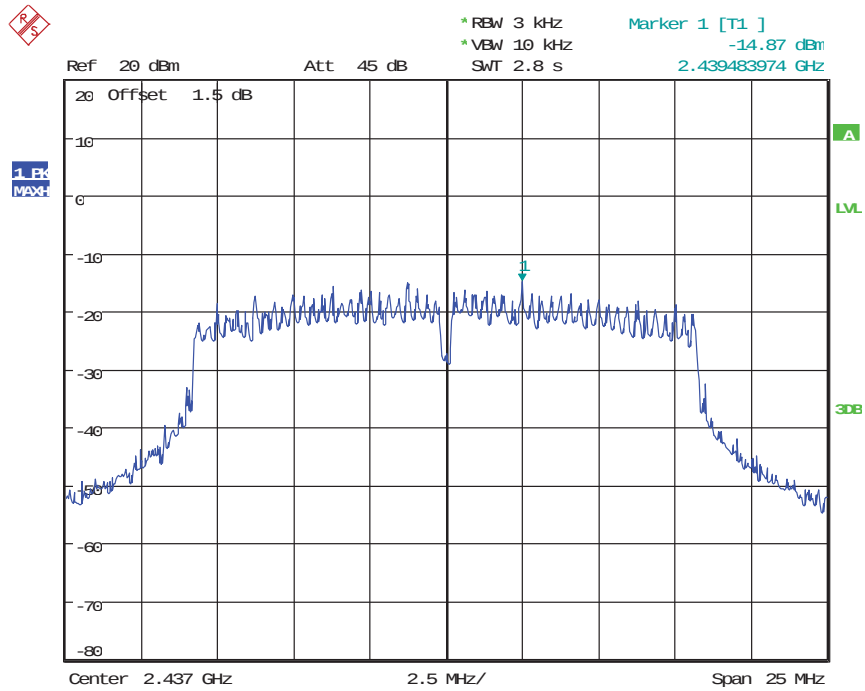
Date: 3.JAN.2017 19:05:37

Plot C



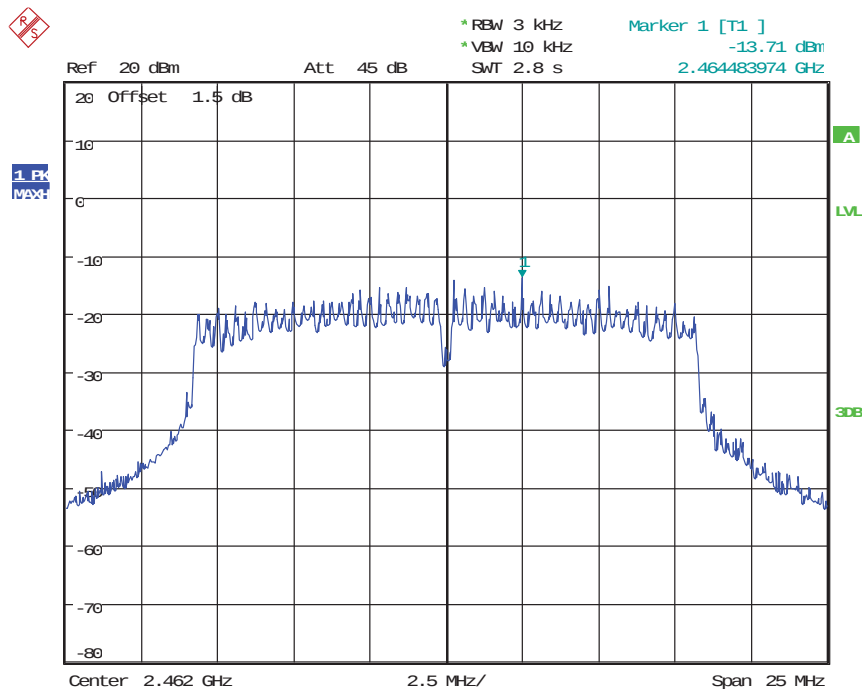
Date: 3.JAN.2017 19:02:12

Plot D



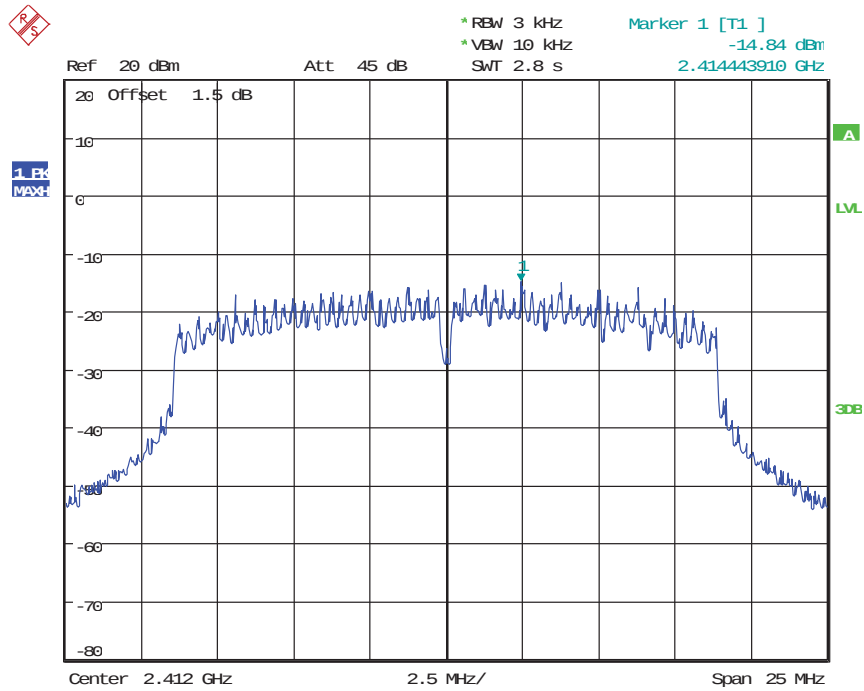
Date: 3.JAN.2017 19:04:31

Plot E



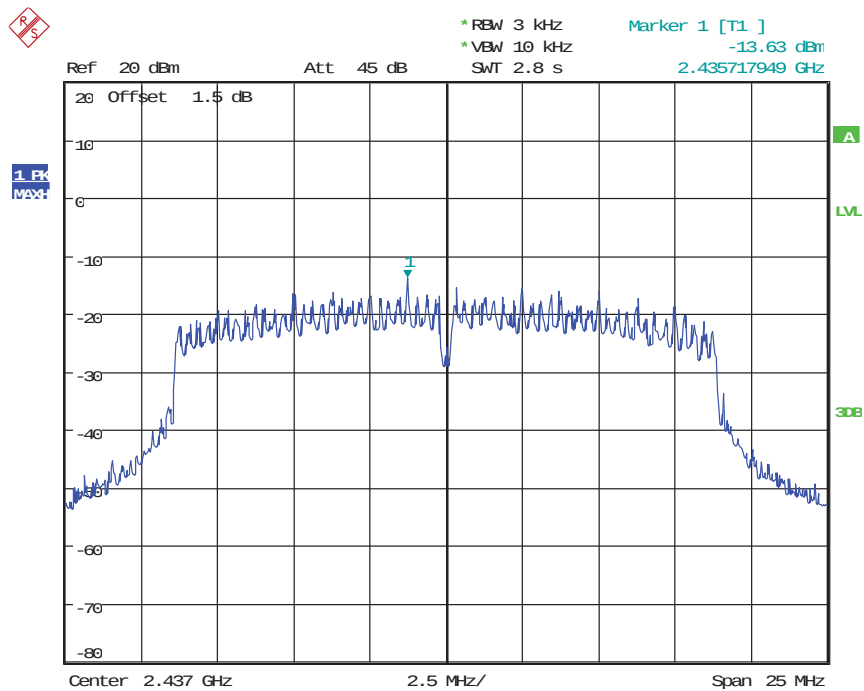
Date: 3.JAN.2017 19:06:04

Plot F



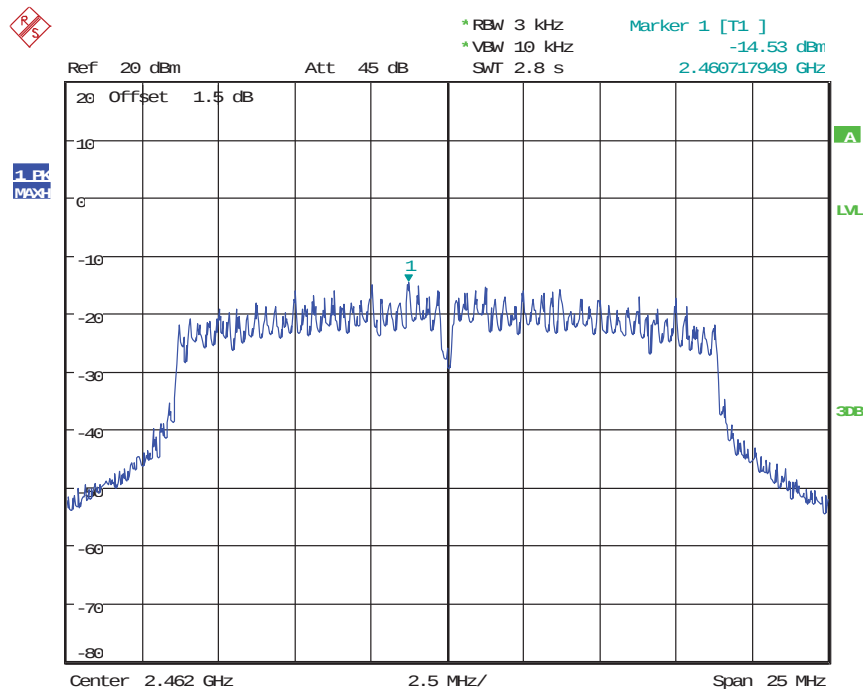
Date: 3.JAN.2017 19:03:24

Plot G



Date: 3.JAN.2017 19:05:00

Plot H



Date: 3.JAN.2017 19:06:34

Plot I

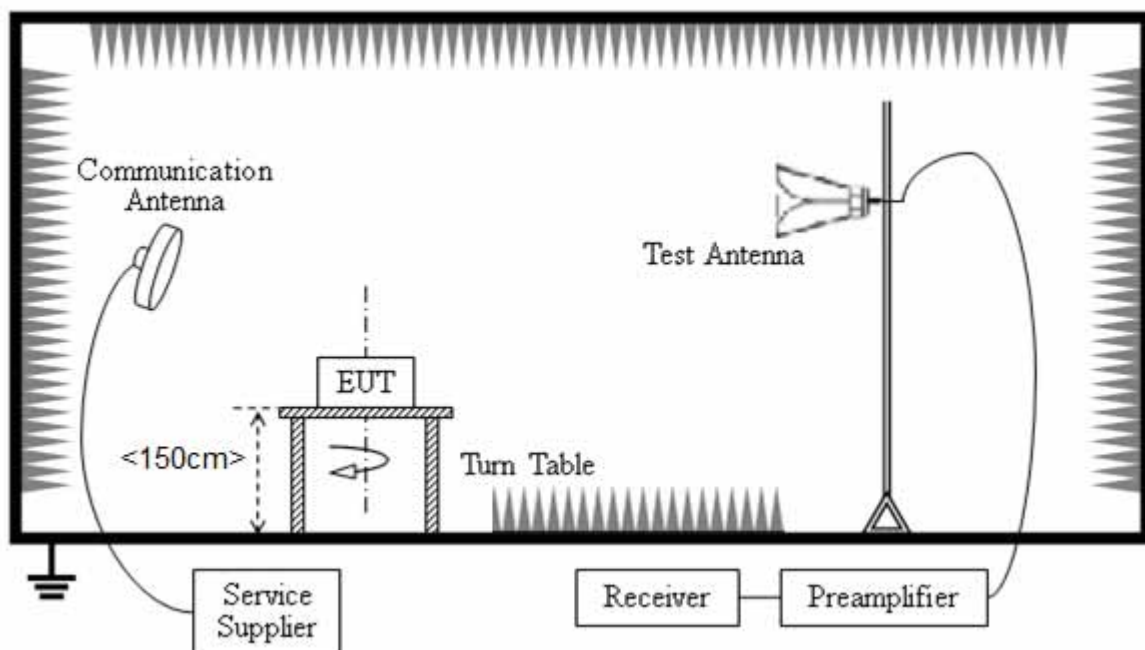


## 5.6 Restricted Frequency Bands

### 5.6.1 Requirement

According to FCC section 15.247(d), in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired 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).

### 5.6.2 Test Description



The Module is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading.

For the Test Antenna:

Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength.

### 5.6.3 Test Result

The lowest and highest channels are tested to verify the Restricted Frequency Bands.

The measurement results are obtained as below:

$$E \text{ [dBV/m]} = UR + AT + A\text{Factor [dB]}; AT = LCable \text{ loss [dB]} - G\text{preamp [dB]}$$

AT: Total correction Factor except Antenna

UR: Receiver Reading

Gpreamp: Preamplifier Gain

AFactor: Antenna Factor at 3m

Note: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (vertical) was recorded in this test report.

The lowest and highest channels are tested to verify the Restricted Frequency Bands



## External Antenna

## 802.11b Test mode

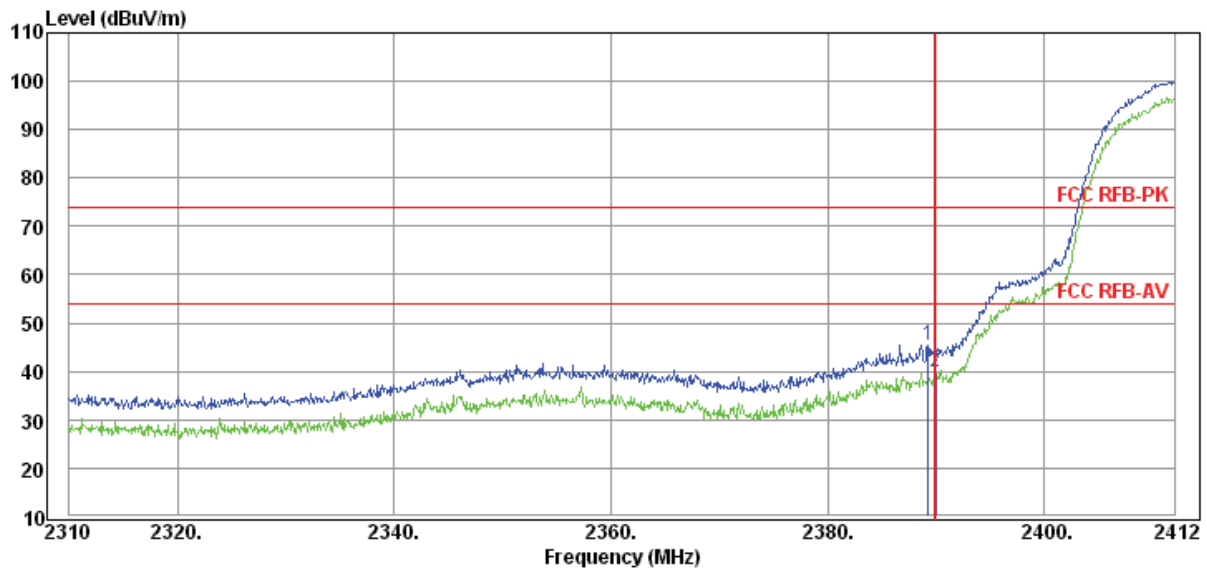
| Ch | Frequency (MHz) | Detector PK/AV | Max. Emission (dBuV/m) | Limit (dBuV/m) | Plot    | Result |
|----|-----------------|----------------|------------------------|----------------|---------|--------|
| 1  | 2389.25         | PK             | 45.43                  | 74             | Plot A1 | Pass   |
| 1  | 2389.97         | AV             | 39.81                  | 54             |         | Pass   |
| 11 | 2483.89         | PK             | 46.67                  | 74             | Plot B1 | Pass   |
| 11 | 2483.74         | AV             | 40.65                  | 54             |         | Pass   |

## 802.11g Test mode

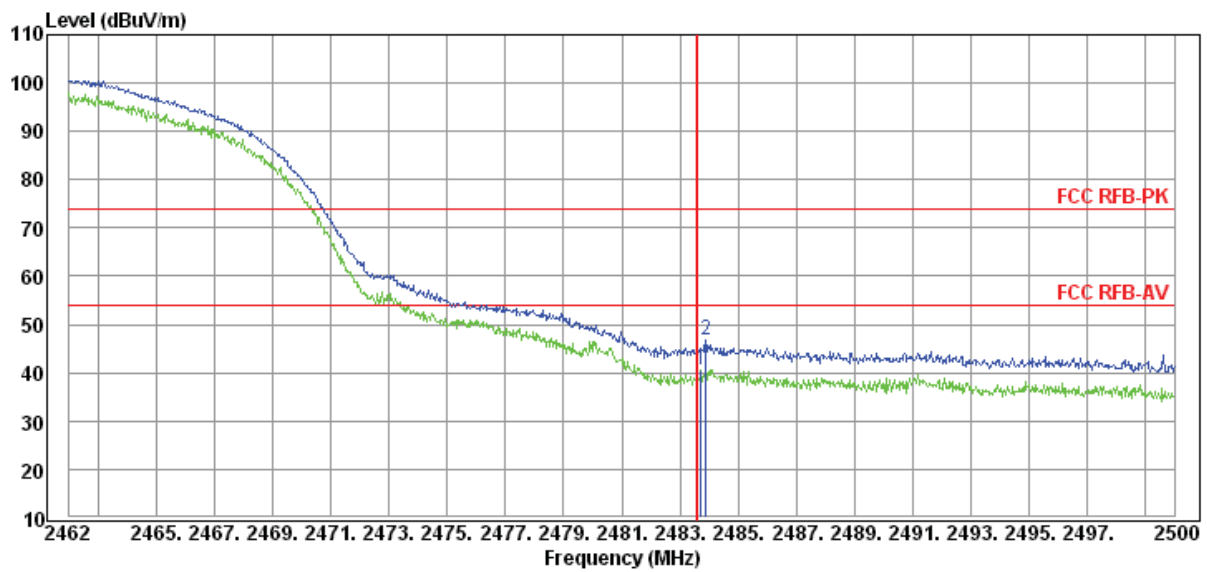
| Ch | Frequency (MHz) | Detector PK/AV | Max. Emission (dBuV/m) | Limit (dBuV/m) | Plot    | Result |
|----|-----------------|----------------|------------------------|----------------|---------|--------|
| 1  | 2389.76         | PK             | 43.70                  | 74             | Plot C1 | Pass   |
| 1  | 2389.97         | AV             | 39.22                  | 54             |         | Pass   |
| 11 | 2483.62         | PK             | 49.17                  | 74             | Plot D1 | Pass   |
| 11 | 2483.66         | AV             | 41.02                  | 54             |         | Pass   |

## 802.11n (20MHz) Test mode

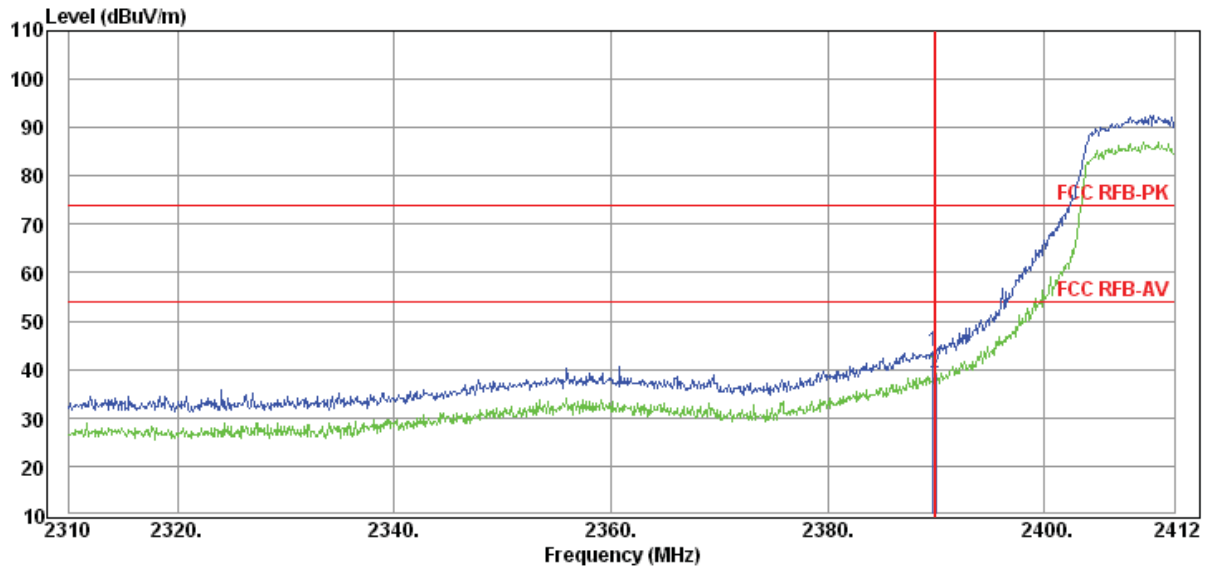
| Ch | Frequency (MHz) | Detector PK/AV | Max. Emission (dBuV/m) | Limit (dBuV/m) | Plot    | Result |
|----|-----------------|----------------|------------------------|----------------|---------|--------|
| 1  | 2389.87         | PK             | 45.50                  | 74             | Plot E1 | Pass   |
| 1  | 2389.46         | AV             | 39.08                  | 54             |         | Pass   |
| 11 | 2483.66         | PK             | 45.39                  | 74             | Plot F1 | Pass   |
| 11 | 2484.80         | AV             | 40.56                  | 54             |         | Pass   |



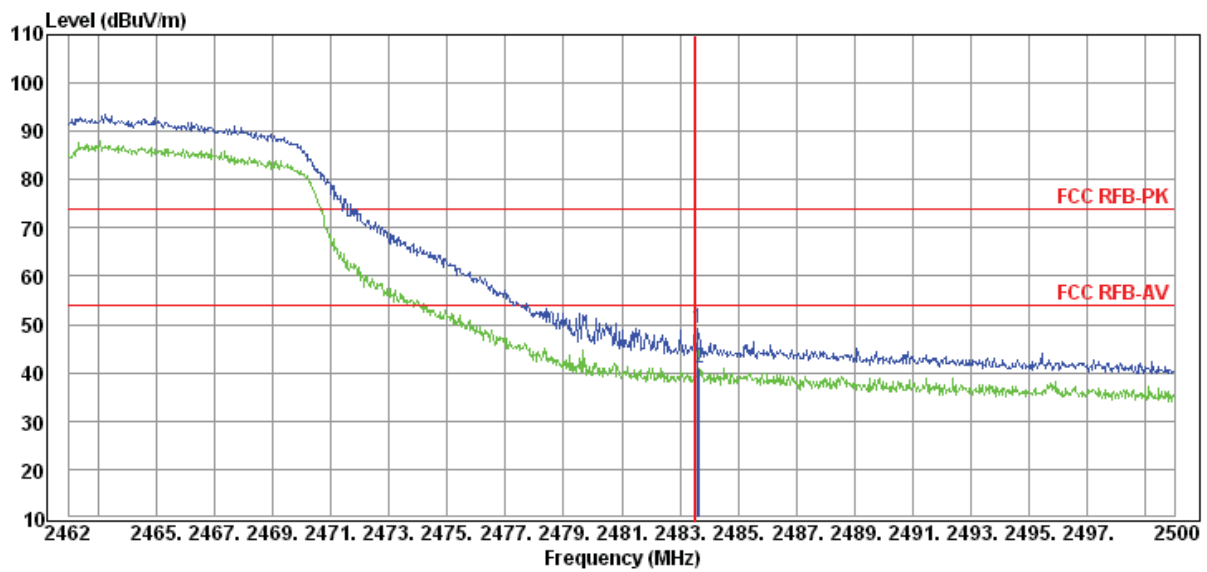
Plot A1



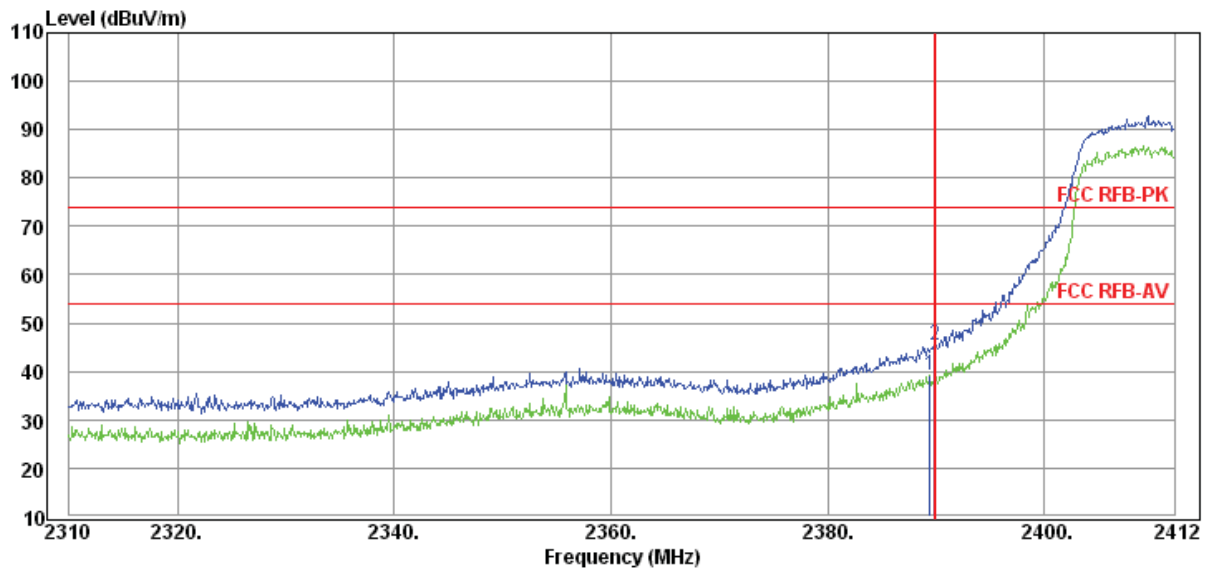
Plot B1



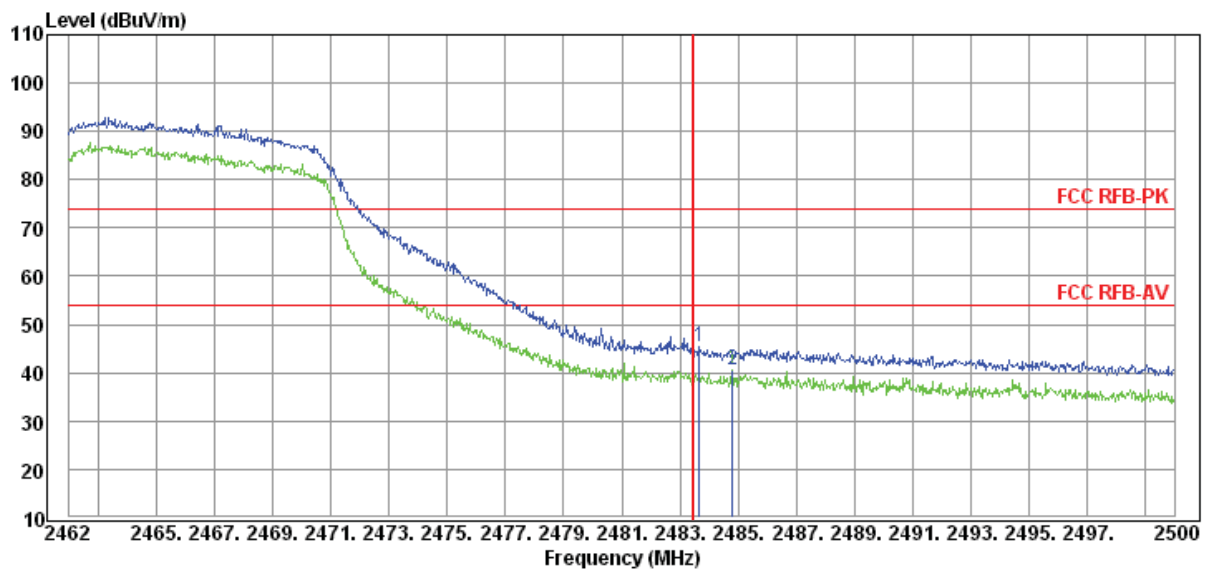
Plot C1



Plot D1



Plot E1



Plot F1



## PCB Antenna

## 802.11b Test mode

| Ch | Frequency (MHz) | Detector PK/AV | Max. Emission (dBuV/m) | Limit (dBuV/m) | Plot    | Result |
|----|-----------------|----------------|------------------------|----------------|---------|--------|
| 1  | 2389.66         | PK             | 39.81                  | 74             | Plot A2 | Pass   |
| 1  | 2388.64         | AV             | 35.76                  | 54             |         | Pass   |
| 11 | 2491.91         | PK             | 43.39                  | 74             | Plot B2 | Pass   |
| 11 | 2490.69         | AV             | 38.32                  | 54             |         | Pass   |

## 802.11g Test mode

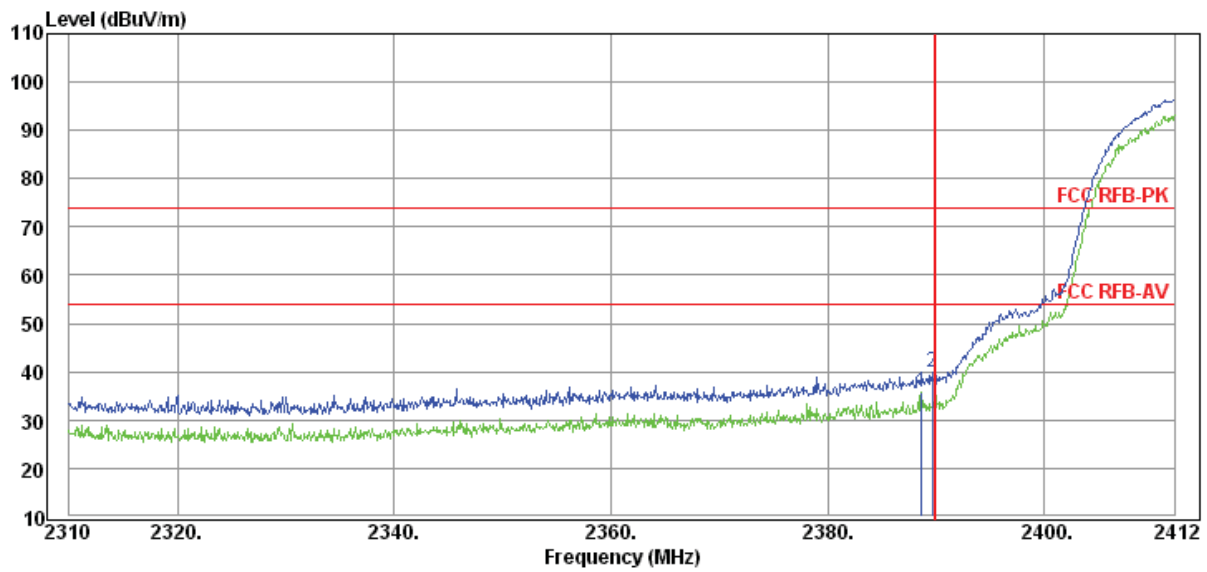
| Ch | Frequency (MHz) | Detector PK/AV | Max. Emission (dBuV/m) | Limit (dBuV/m) | Plot    | Result |
|----|-----------------|----------------|------------------------|----------------|---------|--------|
| 1  | 2389.46         | PK             | 38.56                  | 74             | Plot C2 | Pass   |
| 1  | 2389.46         | AV             | 34.01                  | 54             |         | Pass   |
| 11 | 2484.27         | PK             | 41.76                  | 74             | Plot D2 | Pass   |
| 11 | 2499.13         | AV             | 36.64                  | 54             |         | Pass   |

## 802.11n (20MHz) Test mode

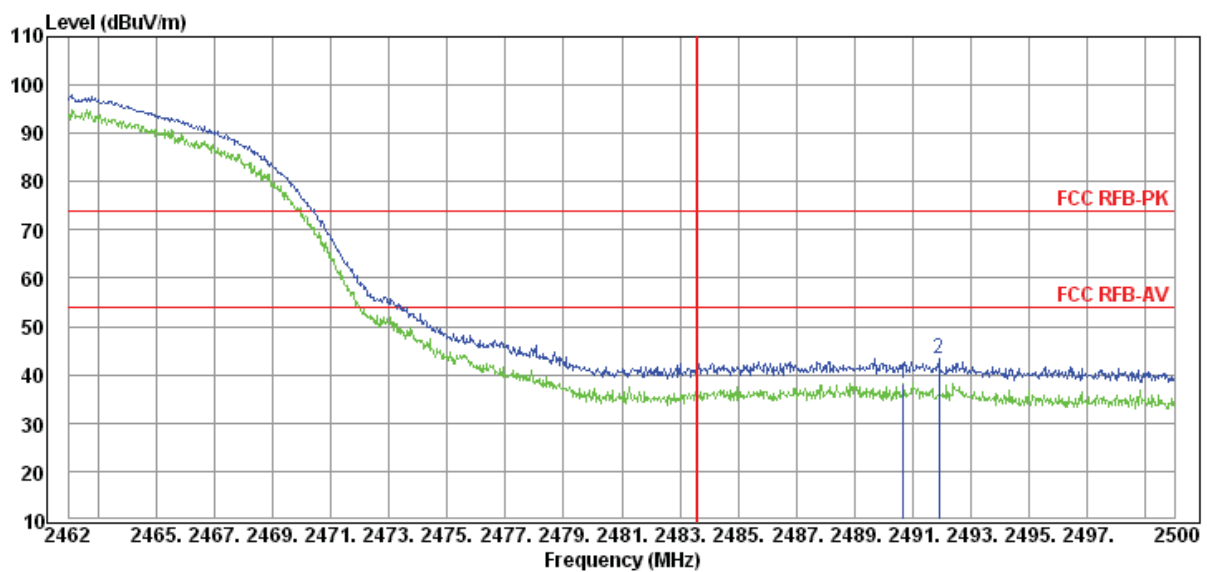
| Ch | Frequency (MHz) | Detector PK/AV | Max. Emission (dBuV/m) | Limit (dBuV/m) | Plot    | Result |
|----|-----------------|----------------|------------------------|----------------|---------|--------|
| 1  | 2389.87         | PK             | 39.71                  | 74             | Plot E2 | Pass   |
| 1  | 2389.46         | AV             | 34.85                  | 54             |         | Pass   |
| 11 | 2488.22         | PK             | 42.75                  | 74             | Plot F2 | Pass   |
| 11 | 2489.44         | AV             | 36.48                  | 54             |         | Pass   |



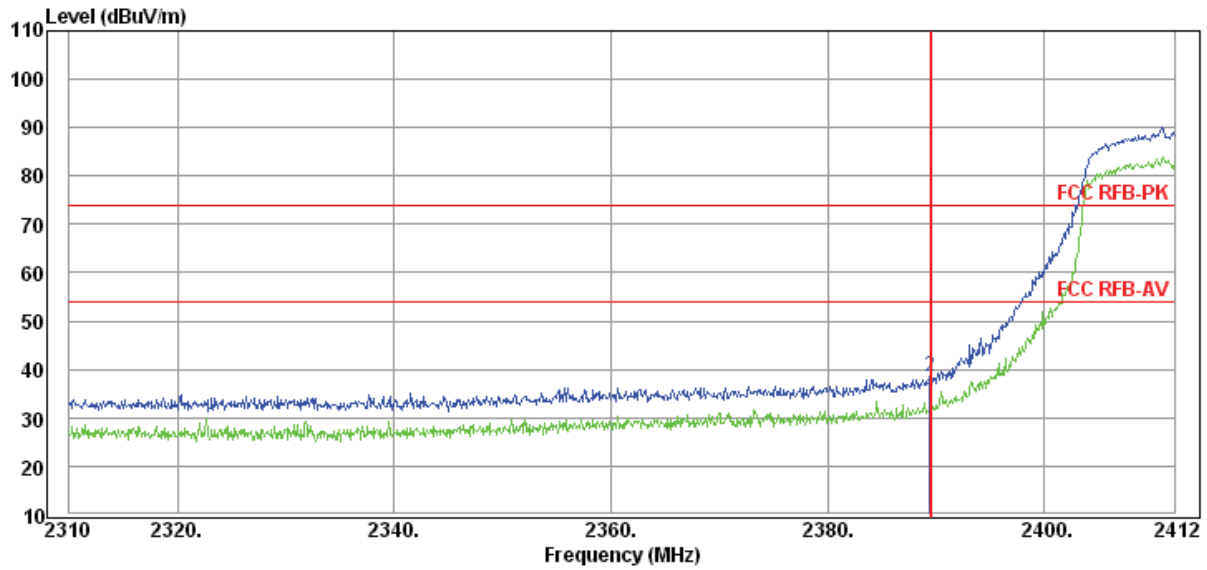
## A. Test Plot



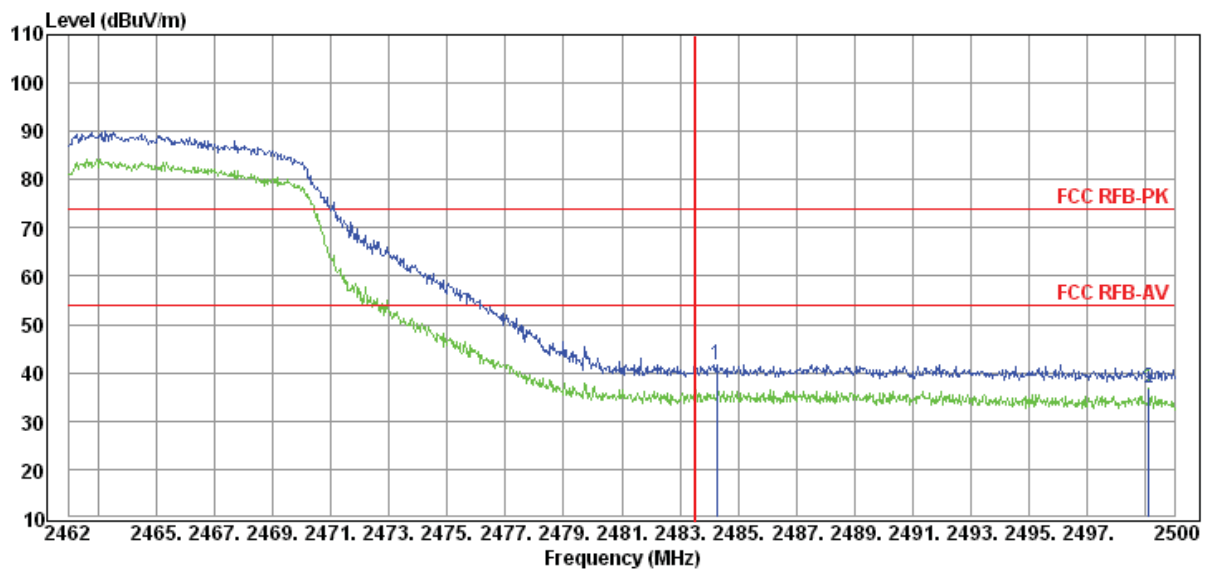
Plot A



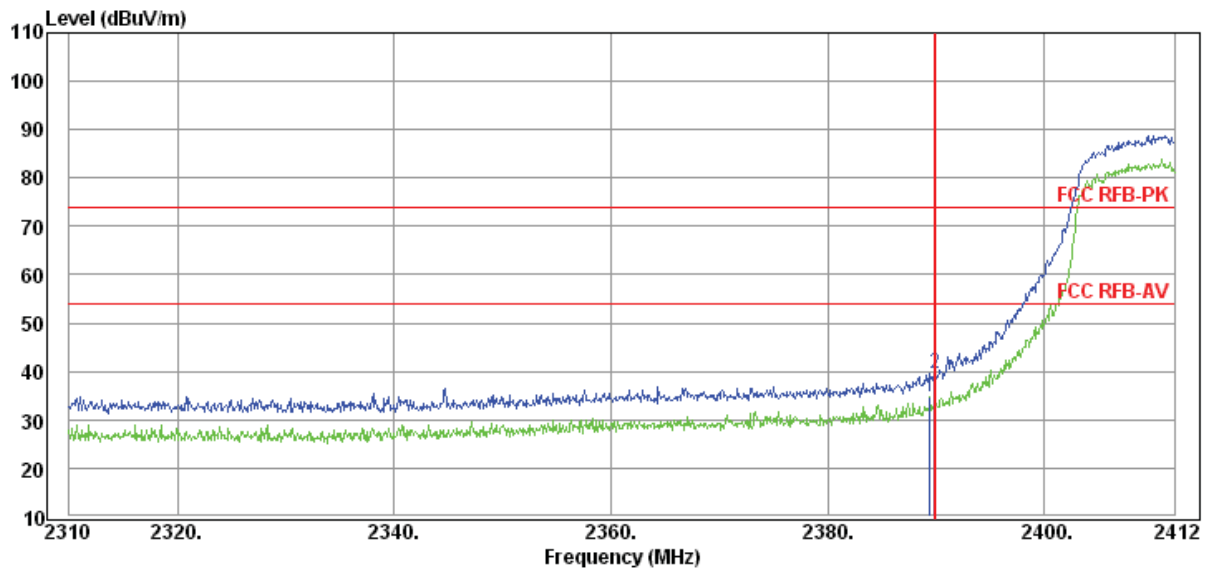
Plot B



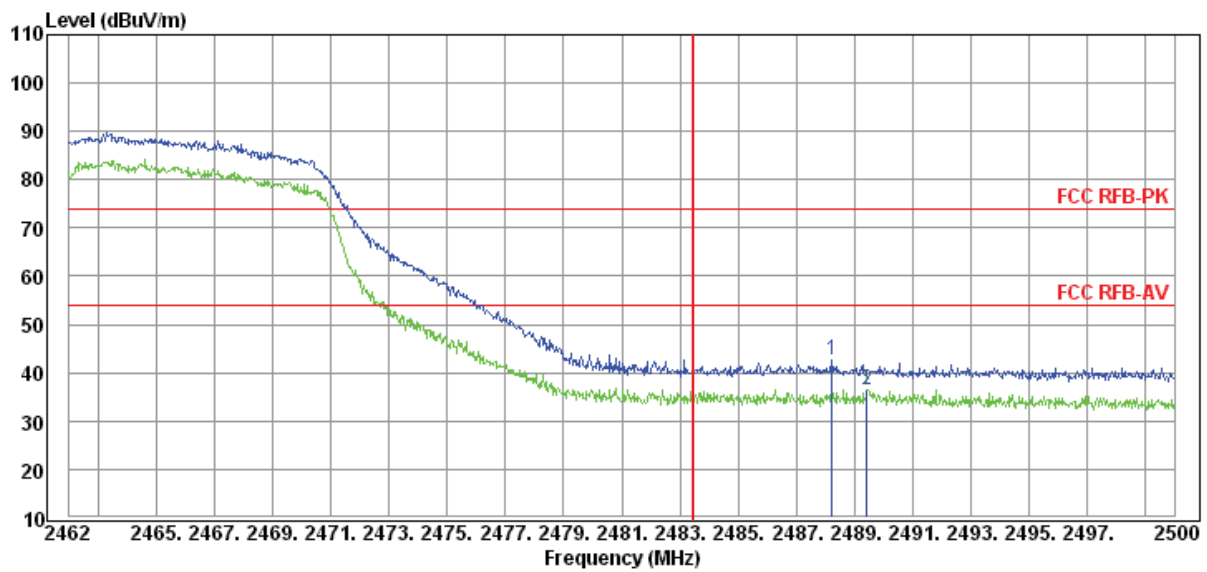
Plot C



Plot D



Plot E



Plot F



## 5.7 Conducted Emission

### 5.7.1 Requirement

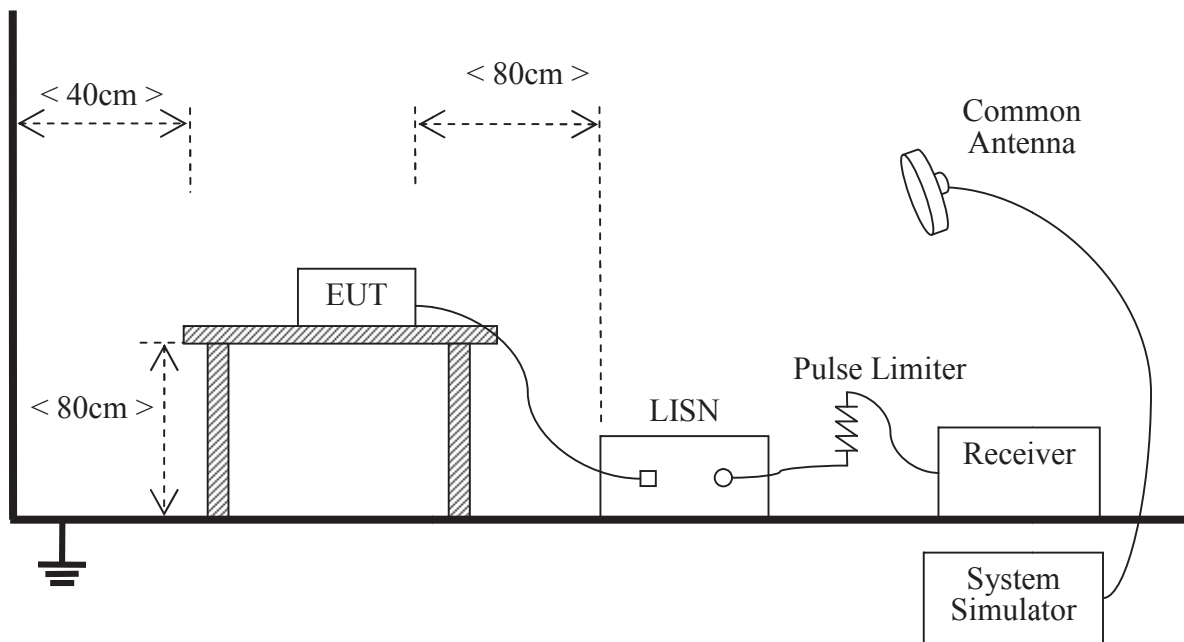
According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50 $\mu$ H/50 $\Omega$  line impedance stabilization network(LISN).

| Frequency range (MHz) | Conducted Limit (dB $\mu$ V) |          |
|-----------------------|------------------------------|----------|
|                       | Quai-peak                    | Average  |
| 0.15 - 0.50           | 66 to 56                     | 56 to 46 |
| 0.50 - 5              | 56                           | 46       |
| 5 - 30                | 60                           | 50       |

NOTE:

- (a) The lower limit shall apply at the band edges.
- (b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

### 5.7.2 Test Description



The EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. Power supplier is setting to 5V. The set-up and test methods were according to ANSI C63.10:2013

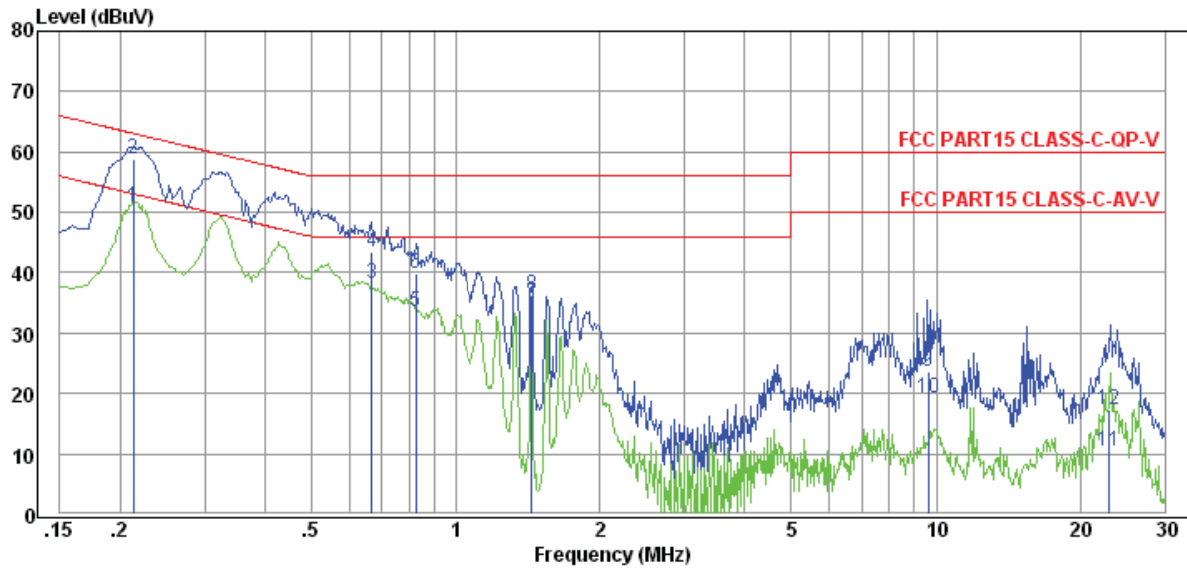


### 5.7.3 Test result

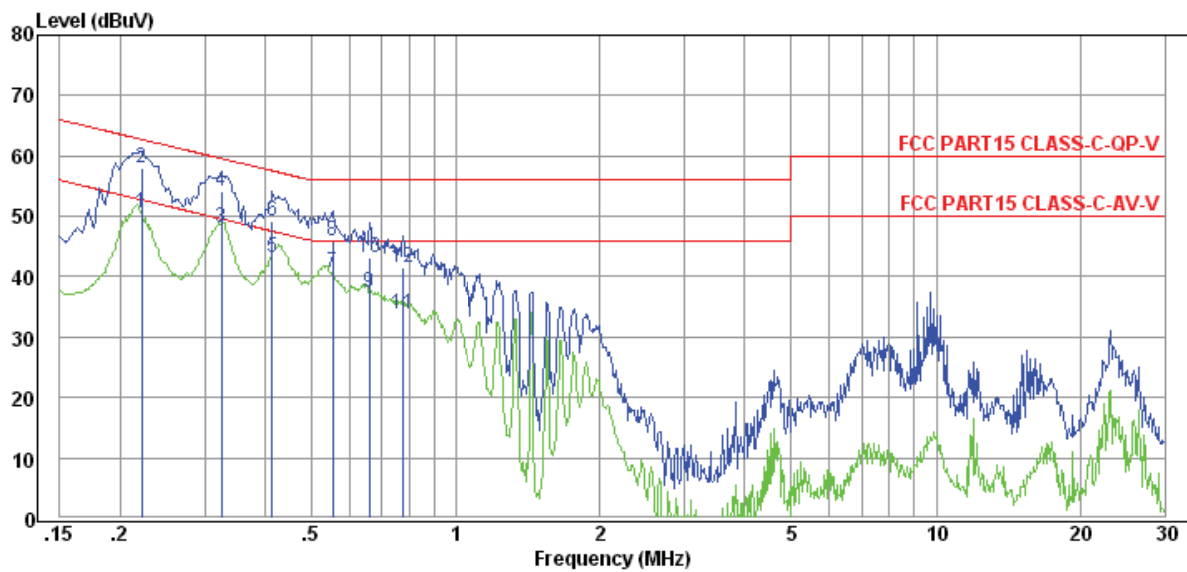
Test Verdict Recorded for Suspicious Points:

EMW3239-E

| Frequency<br>(MHz) | Result<br>(dBuV) | Limit Line<br>(dBuV) | Margin<br>(dB) | Phase line | Detector |
|--------------------|------------------|----------------------|----------------|------------|----------|
| 0.21               | 50.84            | 53.06                | 2.22           | L          | Average  |
| 0.21               | 58.92            | 63.06                | 4.14           | L          | QP       |
| 0.67               | 38.29            | 46.00                | 7.71           | L          | Average  |
| 0.67               | 43.35            | 56.00                | 12.65          | L          | QP       |
| 0.82               | 33.58            | 46.00                | 12.42          | L          | Average  |
| 0.82               | 39.73            | 56.00                | 16.27          | L          | QP       |
| 1.44               | 34.91            | 46.00                | 11.09          | L          | Average  |
| 1.44               | 36.32            | 56.00                | 19.68          | L          | QP       |
| 9.64               | 23.57            | 50.00                | 26.43          | L          | Average  |
| 9.64               | 19.29            | 60.00                | 40.71          | L          | QP       |
| 23.04              | 10.39            | 50.00                | 39.61          | L          | Average  |
| 23.04              | 17.22            | 60.00                | 42.78          | L          | QP       |
| 0.22               | 50.63            | 52.74                | 2.11           | N          | Average  |
| 0.22               | 57.99            | 62.74                | 4.75           | N          | QP       |
| 0.33               | 48.22            | 49.57                | 1.35           | N          | Average  |
| 0.33               | 54.08            | 59.57                | 5.49           | N          | QP       |
| 0.41               | 43.26            | 47.55                | 4.29           | N          | Average  |
| 0.41               | 49.20            | 57.55                | 8.35           | N          | QP       |
| 0.56               | 40.66            | 46.00                | 5.34           | N          | Average  |
| 0.56               | 45.89            | 56.00                | 10.11          | N          | QP       |
| 0.66               | 37.46            | 46.00                | 8.54           | N          | Average  |
| 0.66               | 43.21            | 56.00                | 12.79          | N          | QP       |
| 0.78               | 33.86            | 46.00                | 12.14          | N          | Average  |
| 0.78               | 41.60            | 56.00                | 14.40          | N          | QP       |



L Line

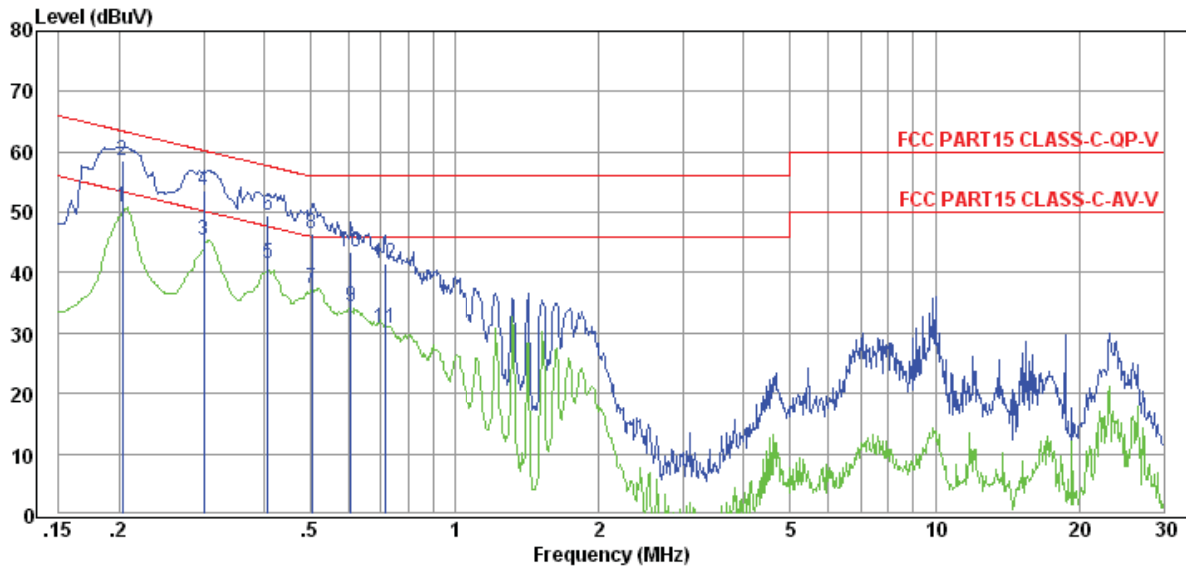


N Line

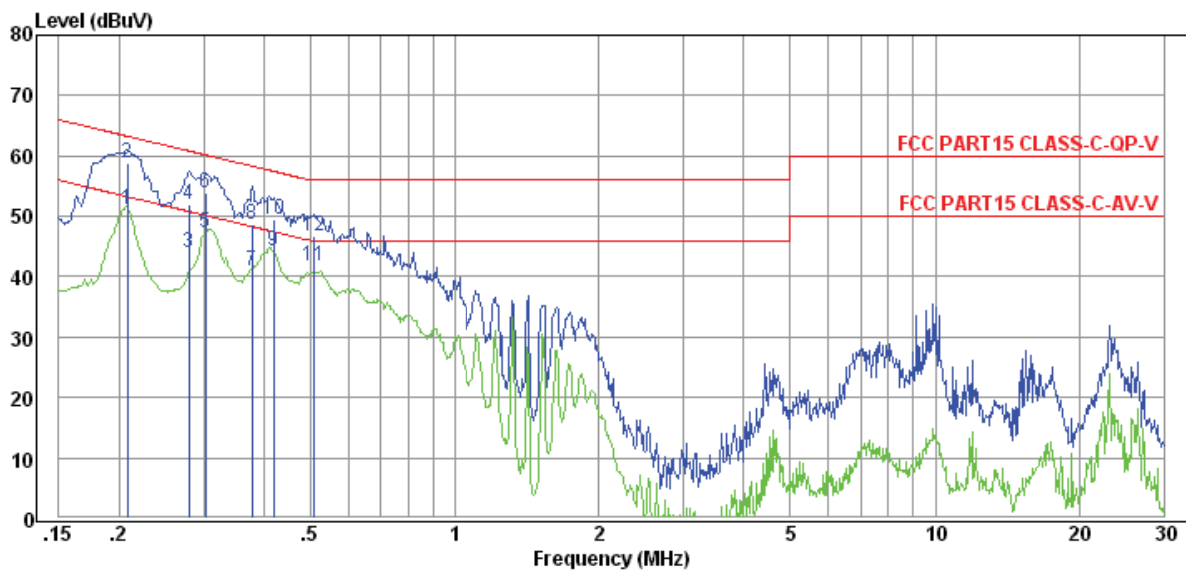


## EMW3239-P

| Frequency<br>(MHz) | Result<br>(dBuV) | Limit Line<br>(dBuV) | Margin<br>(dB) | Phase line | Detector |
|--------------------|------------------|----------------------|----------------|------------|----------|
| 0.20               | 50.74            | 53.45                | 2.71           | L          | Average  |
| 0.20               | 58.56            | 63.45                | 4.89           | L          | QP       |
| 0.30               | 45.23            | 50.24                | 5.01           | L          | Average  |
| 0.30               | 53.65            | 60.24                | 6.59           | L          | QP       |
| 0.41               | 41.40            | 47.68                | 6.28           | L          | Average  |
| 0.41               | 49.56            | 57.68                | 8.12           | L          | QP       |
| 0.50               | 37.31            | 46.00                | 8.69           | L          | Average  |
| 0.50               | 46.39            | 56.00                | 9.61           | L          | QP       |
| 0.61               | 34.35            | 46.00                | 11.65          | L          | Average  |
| 0.61               | 43.43            | 56.00                | 12.57          | L          | QP       |
| 0.72               | 30.86            | 46.00                | 15.14          | L          | Average  |
| 0.72               | 41.58            | 56.00                | 14.42          | L          | QP       |
| 0.21               | 51.12            | 53.27                | 2.15           | N          | Average  |
| 0.21               | 58.90            | 63.27                | 4.37           | N          | QP       |
| 0.28               | 44.06            | 50.81                | 6.75           | N          | Average  |
| 0.28               | 52.01            | 60.81                | 8.80           | N          | QP       |
| 0.30               | 47.35            | 50.15                | 2.80           | N          | Average  |
| 0.30               | 54.00            | 60.15                | 6.15           | N          | QP       |
| 0.38               | 41.09            | 48.30                | 7.21           | N          | Average  |
| 0.38               | 48.72            | 58.30                | 9.58           | N          | QP       |
| 0.42               | 44.37            | 47.46                | 3.09           | N          | Average  |
| 0.42               | 49.61            | 57.46                | 7.85           | N          | QP       |
| 0.51               | 41.71            | 46.00                | 4.29           | N          | Average  |
| 0.51               | 46.60            | 56.00                | 9.40           | N          | QP       |



L Line



N Line



## 5.8 Radiated Emission

### 5.8.1 Requirement

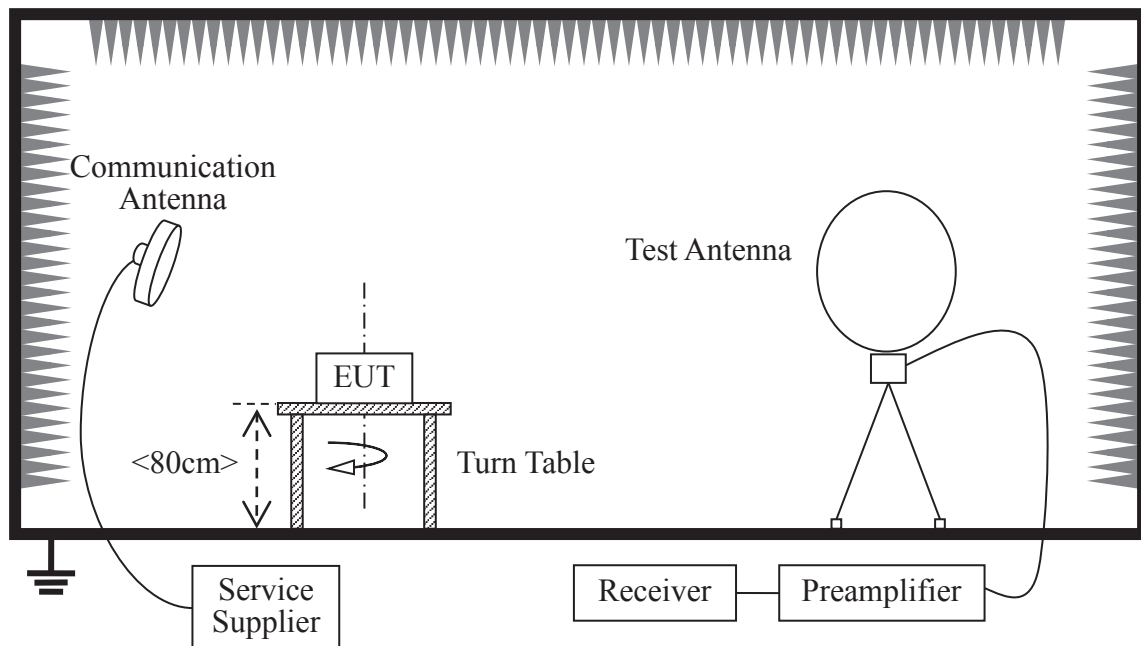
According to FCC section 15.247(c), radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

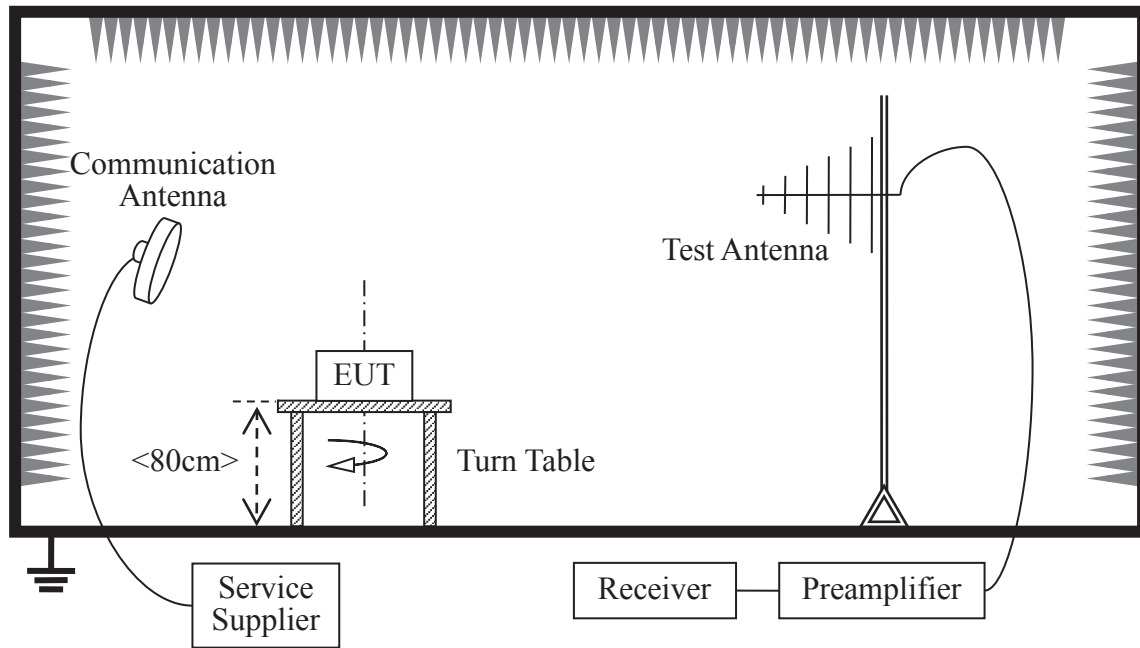
| Frequency (MHz) | Field Strength ( $\mu\text{V/m}$ ) | Measurement Distance (m) | Limit(dB $\mu\text{V/m}$ ) | Detector |
|-----------------|------------------------------------|--------------------------|----------------------------|----------|
| 0.009-0.490     | 2400/F(kHz)                        | 300                      | /                          | /        |
| 0.490-1.705     | 24000/F(kHz)                       | 30                       | /                          | /        |
| 1.705-30        | 30                                 | 30                       | /                          | /        |
| 30 - 88         | 100                                | 3                        | 40                         | QP       |
| 88 - 216        | 150                                | 3                        | 43.5                       | QP       |
| 216 - 960       | 200                                | 3                        | 46                         | QP       |
| 960 - 1000      | 500                                | 3                        | 54                         | QP       |
| Above 1000      | 500                                | 3                        | 54                         | AV       |

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table)

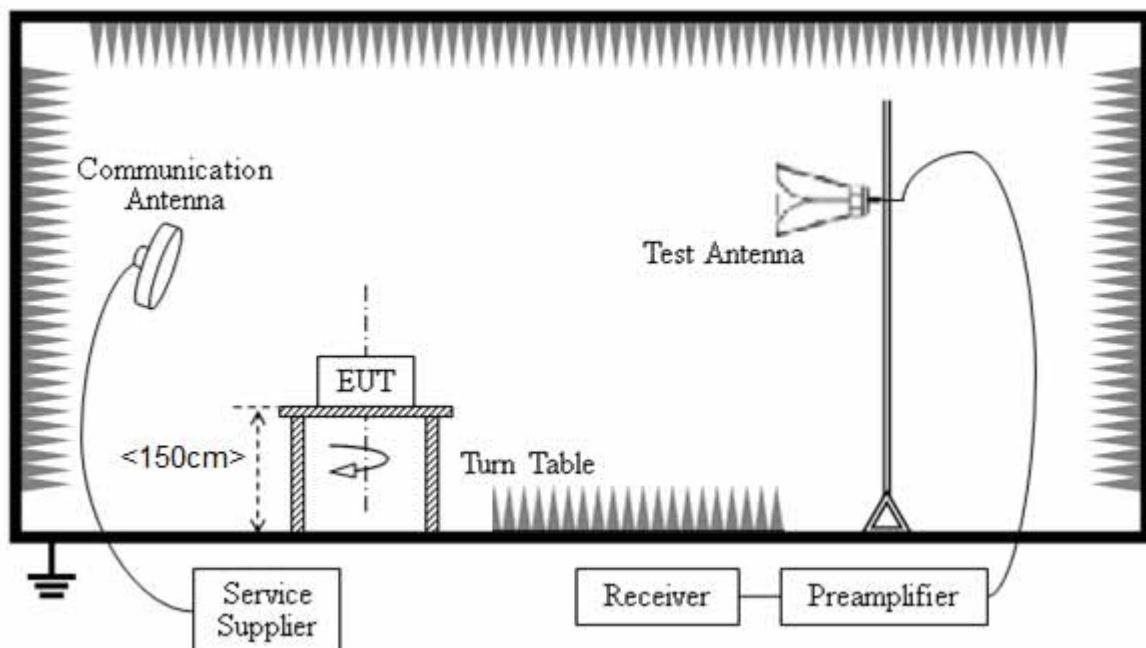
### 5.8.2 Test setup



Radiated Emissions Below 30MHz



Radiated Emissions 30-1000MHz



Radiated Emissions above 1000MHz

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.10-2013. Below 1GHz, the EUT was set-up on insulator 80cm above the Ground Plane. Above 1GHz, the EUT was set-up on insulator 150cm above the Ground Plane. The set-up and test methods were according to ANSI C63.10

The EUT is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading. During the measurement, the Wifi Module is activated and controlled by the Wifi Service Supplier (SS) via a Common Antenna, and is set to



operate under transmitting at maximum power.

For the Test Antenna: In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength, the azimuth range of turntable was 0o to 360o, the receive antenna has two polarizations horizontal and vertical. When doing measurements above 1GHz, the EUT was placed within the 3dB beam width range of the horn antenna, and the EUT was tested in 3 orthogonal positions as recommended in ANSI C63.10 for Radiated Emissions and the worst-case data was presented.

### 5.8.3 Test Result

#### A. Test Result for 9kHz~30MHz

| Frequency (MHz) | Level (dBuV) | Over Limit (dB) | Limit Line (dBuV) | Remark   |
|-----------------|--------------|-----------------|-------------------|----------|
| --              | --           | 20              | --                | See Note |

Note:

- The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.*
- Distance extrapolation factor =  $40 \log (\text{specific distance} / \text{test distance})$  (dB);*
- Limit line = specific limits (dBuV) + distance extrapolation factor.*

#### B. Test Result for above 30MHz ~ 10th Harmonic

EMW3239-E

| Frequency (MHz) | Reading (dBuV) | Limit Line (dBuV) | Margin (dB) | Antenna Polarization | Detector | Result |
|-----------------|----------------|-------------------|-------------|----------------------|----------|--------|
| 56.99           | 19.66          | 40.00             | 20.34       | Vertical             | QP       | QP     |
| 103.81          | 19.51          | 43.50             | 23.99       | Vertical             | QP       | QP     |
| 247.68          | 19.57          | 46.00             | 26.43       | Vertical             | QP       | QP     |
| 400.43          | 28.33          | 46.00             | 17.67       | Vertical             | QP       | QP     |
| 601.43          | 26.78          | 46.00             | 19.22       | Vertical             | QP       | QP     |
| 848.06          | 30.69          | 46.00             | 15.31       | Vertical             | QP       | QP     |
| 1378.13         | 21.10          | 54.00             | 32.90       | Vertical             | Average  | PASS   |
| 1496.53         | 21.38          | 54.00             | 32.62       | Vertical             | Average  | PASS   |
| 1724.08         | 19.82          | 54.00             | 34.18       | Vertical             | Average  | PASS   |
| 2371.75         | 34.49          | 54.00             | 19.51       | Vertical             | Average  | PASS   |
| 4997.81         | 27.44          | 54.00             | 26.56       | Vertical             | Average  | PASS   |
| 58.00           | 17.66          | 40.00             | 22.34       | Horizontal           | QP       | QP     |
| 92.46           | 17.85          | 43.50             | 25.65       | Horizontal           | QP       | QP     |
| 234.17          | 21.26          | 46.00             | 24.74       | Horizontal           | QP       | QP     |
| 400.43          | 28.33          | 46.00             | 17.67       | Horizontal           | Average  | PASS   |



| Frequency (MHz) | Reading (dBuV) | Limit Line (dBuV) | Margin (dB) | Antenna Polarization | Detector | Result |
|-----------------|----------------|-------------------|-------------|----------------------|----------|--------|
| 601.43          | 26.78          | 46.00             | 19.22       | Horizontal           | Average  | PASS   |
| 827.49          | 29.82          | 46.00             | 16.18       | Horizontal           | Average  | PASS   |
| 2350.60         | 27.90          | 54.00             | 26.10       | Horizontal           | Average  | PASS   |
| 4821.88         | 26.41          | 54.00             | 27.59       | Horizontal           | Average  | PASS   |

## EMW3239-P

| Frequency (MHz) | Level (dBuV) | Limit Line (dBuV) | Margin (dB) | Antenna Polarization | Detector | Result |
|-----------------|--------------|-------------------|-------------|----------------------|----------|--------|
| 47.00           | 26.92        | 40.00             | 13.08       | Vertical             | QP       | PASS   |
| 70.09           | 21.94        | 40.00             | 18.06       | Vertical             | QP       | PASS   |
| 84.11           | 22.93        | 40.00             | 17.07       | Vertical             | QP       | PASS   |
| 183.84          | 18.76        | 43.50             | 24.74       | Vertical             | QP       | PASS   |
| 400.43          | 25.33        | 46.00             | 20.67       | Vertical             | QP       | PASS   |
| 755.39          | 28.94        | 46.00             | 17.06       | Vertical             | QP       | PASS   |
| 1198.38         | 19.72        | 54.00             | 34.28       | Vertical             | QP       | PASS   |
| 1596.24         | 26.70        | 54.00             | 27.30       | Vertical             | Average  | PASS   |
| 2000.53         | 23.26        | 54.00             | 30.74       | Vertical             | Average  | PASS   |
| 2440.73         | 23.30        | 54.00             | 30.70       | Vertical             | Average  | PASS   |
| 3620.03         | 23.38        | 54.00             | 30.62       | Vertical             | Average  | PASS   |
| 68.87           | 18.92        | 40.00             | 21.08       | Horizontal           | QP       | PASS   |
| 102.00          | 19.48        | 43.50             | 24.02       | Horizontal           | QP       | PASS   |
| 193.77          | 26.10        | 43.50             | 17.40       | Horizontal           | QP       | PASS   |
| 329.04          | 25.56        | 46.00             | 20.44       | Horizontal           | QP       | PASS   |
| 420.58          | 24.89        | 46.00             | 21.11       | Horizontal           | QP       | PASS   |
| 782.35          | 29.22        | 46.00             | 16.78       | Horizontal           | QP       | PASS   |
| 1273.65         | 17.75        | 54.00             | 36.25       | Horizontal           | Average  | PASS   |
| 1438.68         | 17.86        | 54.00             | 36.14       | Horizontal           | Average  | PASS   |
| 2308.86         | 20.06        | 54.00             | 33.94       | Horizontal           | Average  | PASS   |
| 3176.20         | 22.05        | 54.00             | 31.95       | Horizontal           | Average  | PASS   |
| 3895.98         | 23.81        | 54.00             | 30.19       | Horizontal           | Average  | PASS   |

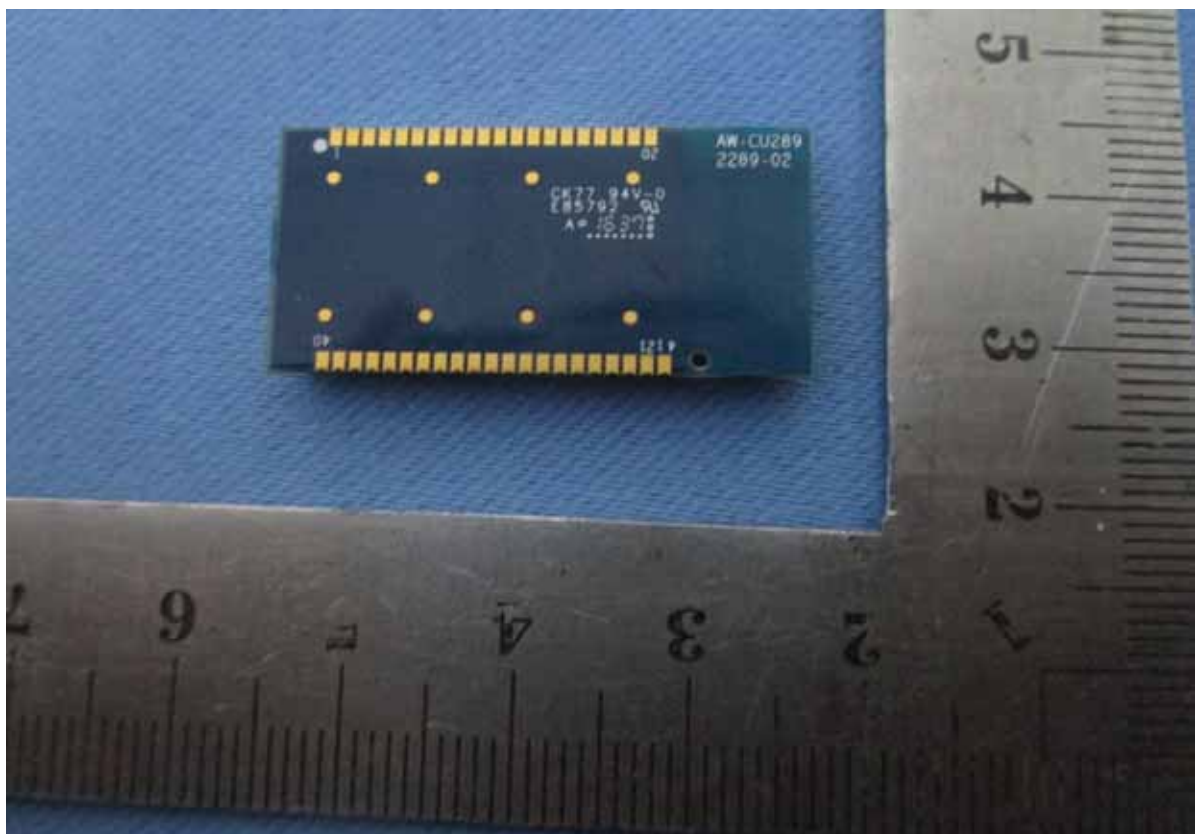
Note:

*The worst case(802.11g Channe6:2437MHz)is recorded in the report.*



## Annex A Photos of the EUT

### EMW3239-E





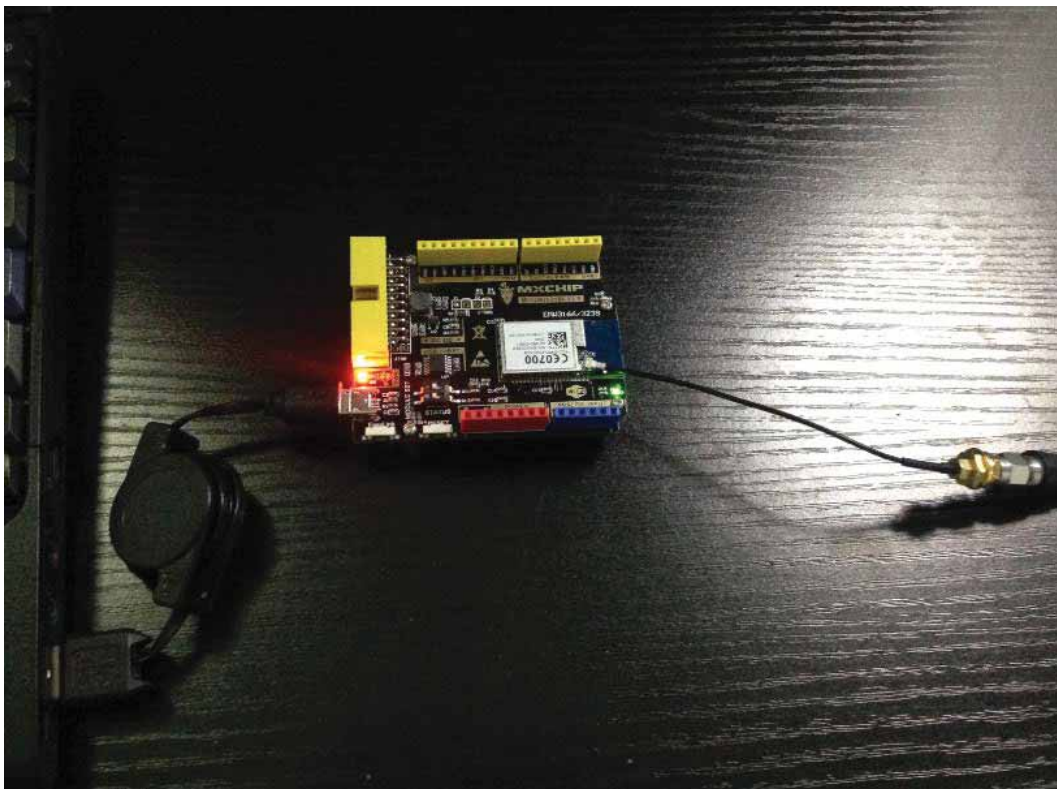
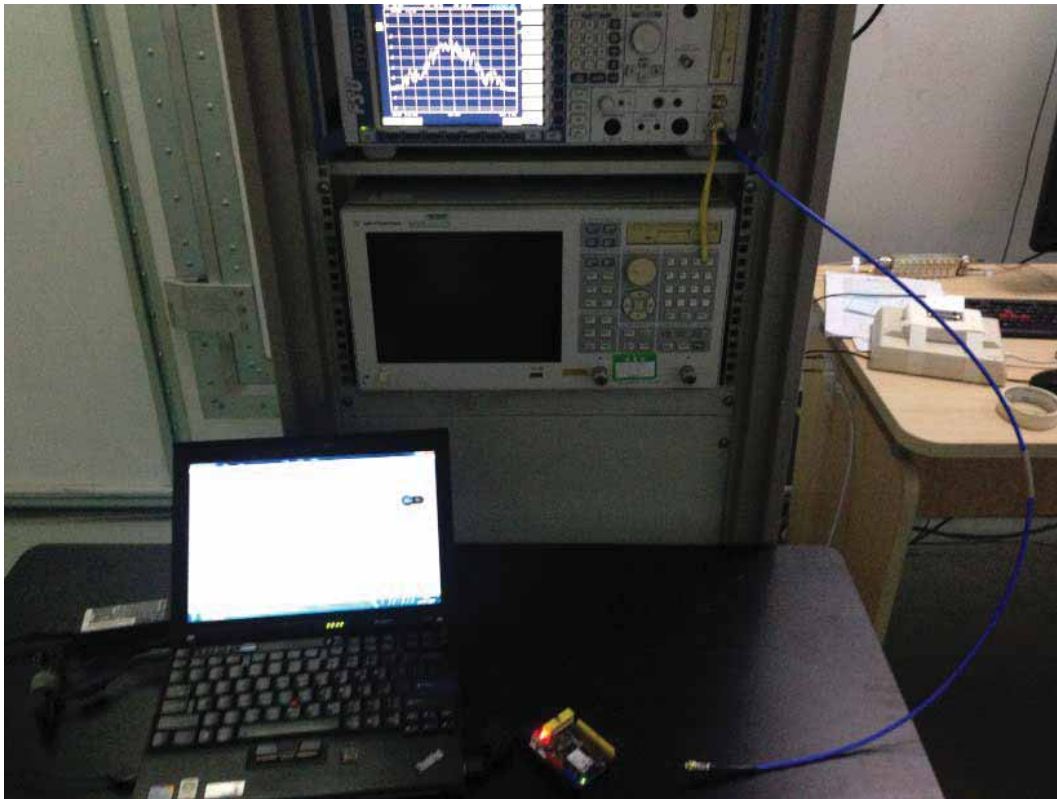
## EMW3239-P





## Annex B Photos of Setup

### 1. RF

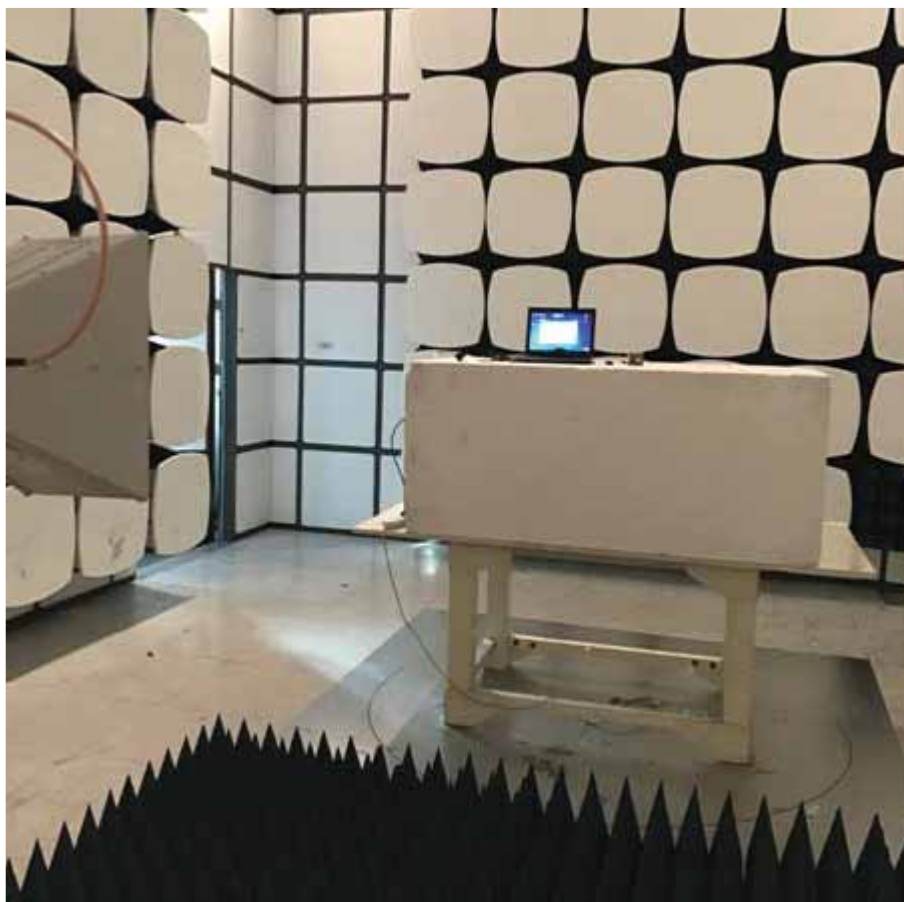




## 2. Conducted Emission



## 3. Radiated Emission



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