

Report No.SH16030055W38

# FCC RF TEST REPORT

*Issued to*

**TRIMBLE EUROPE B.V.**

*For*

**Rugged Smart Phone**

Model Name : TDC100\_4G  
Trade Name : Trimble  
Brand Name : Trimble  
Standard : 47 CFR Part 15, Subpart C  
ANSI C63.10-2013  
RSS 247 Issue 1  
RSS GEN Issue 4  
FCC ID : NZI-10900320  
IC ID : 9288A-10900320  
Test date : Apr.8,2016 to Apr.9,2016  
Issue date : Jul.12,2016

*by*

**Shanghai Skylabs Co., Ltd.**

Tested by

*Wu Hongfei*

Approved by

*Guo Yeqiang*

Review by

*Leonard Bao*



*The report refers only to the sample tested and does not apply to the bulk. This report is issued in confidence to the client and it will be strictly treated as such by the Shanghai Skylabs Co., Ltd. It may not be reproduced rather in its entirety or in part and it may not be used for advertising. The client to whom the report is issued may, however, show or send it or a certified copy thereof prepared by the Shanghai Skylabs Co., Ltd to his customer. Supplier or others persons directly concerned. Shanghai Skylabs Co., Ltd will not, without the consent of the client enter into any discussion of correspondence with any third party concerning the contents of the report. In the event of the improper use of the report, Shanghai Skylabs Co., Ltd reserves the rights to withdraw it and to adopt any other remedies which may be appropriate.*



## DIRECTORY

|                |                                            |           |
|----------------|--------------------------------------------|-----------|
| <b>1.</b>      | <b>General Information .....</b>           | <b>4</b>  |
| <b>1.1</b>     | Applicant .....                            | 4         |
| <b>1.2</b>     | Manufacturer .....                         | 4         |
| <b>1.3</b>     | Description of EUT .....                   | 4         |
| <b>2.</b>      | <b>Facilities and Accreditations .....</b> | <b>5</b>  |
| <b>2.1</b>     | Test Facility .....                        | 5         |
| <b>2.2</b>     | Environmental Conditions .....             | 5         |
| <b>2.3</b>     | Measurement Uncertainty .....              | 5         |
| <b>2.4</b>     | List of Equipments Used .....              | 6         |
| <b>3.</b>      | <b>Test Standards and Results .....</b>    | <b>7</b>  |
| <b>4.</b>      | <b>47 CFR Part 15C .....</b>               | <b>8</b>  |
| <b>4.1</b>     | Antenna requirement .....                  | 8         |
| <b>5.</b>      | <b>Test Result.....</b>                    | <b>9</b>  |
| <b>5.1</b>     | Peak Output Power.....                     | 9         |
| <b>5.2</b>     | 6dB & 20dB Bandwidth.....                  | 11        |
| <b>5.3</b>     | Conducted Spurious Emissions.....          | 21        |
| <b>5.4</b>     | Power Spectral Density (PSD) .....         | 27        |
| <b>5.5</b>     | Band Edge .....                            | 33        |
| <b>5.6</b>     | Conducted Emission .....                   | 41        |
| <b>5.7</b>     | Radiated Emission.....                     | 44        |
| <b>Annex A</b> | <b>Photos of the EUT .....</b>             | <b>47</b> |
| <b>Annex B</b> | <b>Photos of Setup .....</b>               | <b>48</b> |

**Change History**

| Issue | Date        | Reason for change |
|-------|-------------|-------------------|
| 1.0   | Apr.10,2016 | First edition     |
| 2.0   | Jul.12,2016 | Second edition    |
|       |             |                   |
|       |             |                   |
|       |             |                   |
|       |             |                   |



## 1. General Information

### 1.1 Applicant

**TRIMBLE EUROPE B.V.**

European Regional Fulfilment Centre  
Meerheide, 45  
5521DZ Eersel  
THE NETHERLANDS

### 1.2 Manufacturer

**TRIMBLE EUROPE B.V.**

European Regional Fulfilment Centre  
Meerheide, 45  
5521DZ Eersel  
THE NETHERLANDS

### 1.3 Description of EUT

EUT Name.....: Rugged Smart Phone  
Model Name.....: TDC100\_4G  
Brand Name.....: Trimble  
Trade Name .....: Trimble  
Hardware Version.....: TDC100.4G\_V1.0  
Software Version .....: TDC100.4G.16.22.08  
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.....: ABS Frame and FPC antenna  
Antenna Gain.....: 0.44 dBi

**NOTE 1:**

*The EUT contains WIFI 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)  $= 2412 + 5 \cdot (n - 1)$  ( $1 \leq n \leq 11$ ). 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:**

*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                 | 2015.9.22  | 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.)   |
| 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    |
| Antenna                     | R&S           | HL562          | 100385                     | 2015.6.17  | 1year    |
| Antenna                     | R&S           | HF906          | 100565                     | 2015.6.17  | 1year    |
| LISN                        | TESEQ         | NNB 51         | 33285                      | 2016.2.25  | 1year    |
| Personal Computer           | HP            | (n.a.)         | (n.a.)                     | (n.a.)     | (n.a.)   |
| Test Antenna-Horn           | Schwarzbeck   | BBHA9170       | BBHA91970171               | 2015.9.22  | 1year    |
| Test Antenna-Log            | Schwarzbeck   | VULB 9163      | 9163-561                   | 2015.9.25  | 1year    |
| Test Antenna-Loop           | Rohde&Schwarz | HFH2-Z2        | 860004/001                 | 2015.9.22  | 1year    |
| Test Antenna-Horn           | Schwarzbeck   | BBHA 9120D     | 9120D-1033                 | 2015.7.25  | 1year    |
| EPM Series Power Meter      | Agilent       | E4418B         | GB43318055                 | 2015.5.24  | 1year    |
| Power Sensor                | Agilent       | 8482A          | MY41091706                 | 2015.5.24  | 1year    |
| Temporary Antenna Connector | Farpu         | SMA-K          | (n.a.)                     | (n.a.)     | (n.a.)   |
| RF Cable                    | (n.a.)        | (n.a.)         | (n.a.)                     | (n.a.)     | (n.a.)   |
| Power Supplier              | NF            | ES2000S        | 9087735                    | 2015.09.25 | 1year    |
| Laptop                      | ACER          | Aspire 4376ZG  | LXPFY0C004<br>935291221601 | (n.a.)     | (n.a.)   |
| Laptop Adapter              | LITEON        | PA-1650-22     | 9801016502                 | (n.a.)     | (n.a.)   |
| USB Data Cable              | (n.a.)        | (n.a.)         | (n.a.)                     | (n.a.)     | (n.a.)   |

**NOTE:**

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



### 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

INDUSTRY CANADA RSS 247 Issue 1

INDUSTRY CANADA RSS GEN Issue 4

**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           | IC Rules                    | Description                  | Result |
|-----|---------------------|-----------------------------|------------------------------|--------|
| 1   | 15.203              | RSS-GEN 7.1.2               | Antenna Requirement          | Pass   |
| 2   | 15.247(b)           | RSS-247 5.4(4)              | Peak Output power            | Pass   |
| 3   | 15.247(a)           | RSS-247 5.4(4)              | 6dB & 20dB Bandwidth         | Pass   |
| 4   | 15.247(d)           | RSS-247 5.2(1)              | Conducted Spurious Emission  | Pass   |
| 5   | 15.247(d)           | RSS-247 5.5<br>RSS-GEN 8.10 | Band Edge                    | Pass   |
| 6   | 15.207              | RSS-GEN 8.8                 | Conducted Emission           | Pass   |
| 7   | 15.247(d)<br>15.209 | RSS-247 5.5<br>RSS-GEN 8.9  | Radiated Emission            | Pass   |
| 8   | 15.247(e)           | RSS-247 5.2(2)              | 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**

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.



## 5. Test Result

### 5.1 Peak Output Power

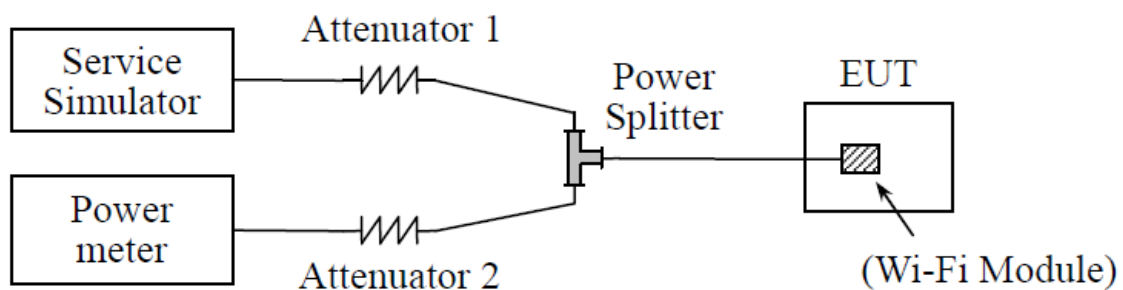
#### 5.1.1 Requirement

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               | 19.10                      | 0.08128 | 30    | 1 | Pass    |
|                    | 6       | 2437               | 19.07                      | 0.08072 |       |   | Pass    |
|                    | 11      | 2462               | 19.47                      | 0.08851 |       |   | Pass    |
| 802.11g            | 1       | 2412               | 20.26                      | 0.10617 |       |   | Pass    |
|                    | 6       | 2437               | 20.60                      | 0.11482 |       |   | Pass    |
|                    | 11      | 2462               | 20.45                      | 0.11092 |       |   | Pass    |
| 802.11n<br>(20MHz) | 1       | 2412               | 19.64                      | 0.09204 |       |   | Pass    |
|                    | 6       | 2437               | 18.92                      | 0.07798 |       |   | Pass    |
|                    | 11      | 2462               | 19.34                      | 0.08590 |       |   | Pass    |

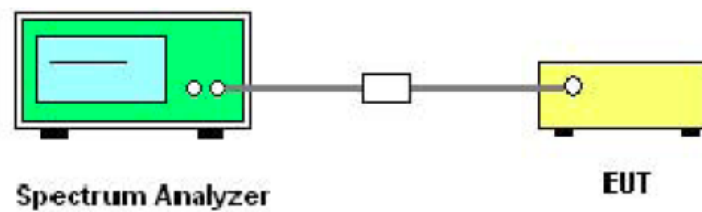


## 5.2 6dB & 20dB Bandwidth

### 5.2.1 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.

### 5.2.2 Test Description



### 5.2.3 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

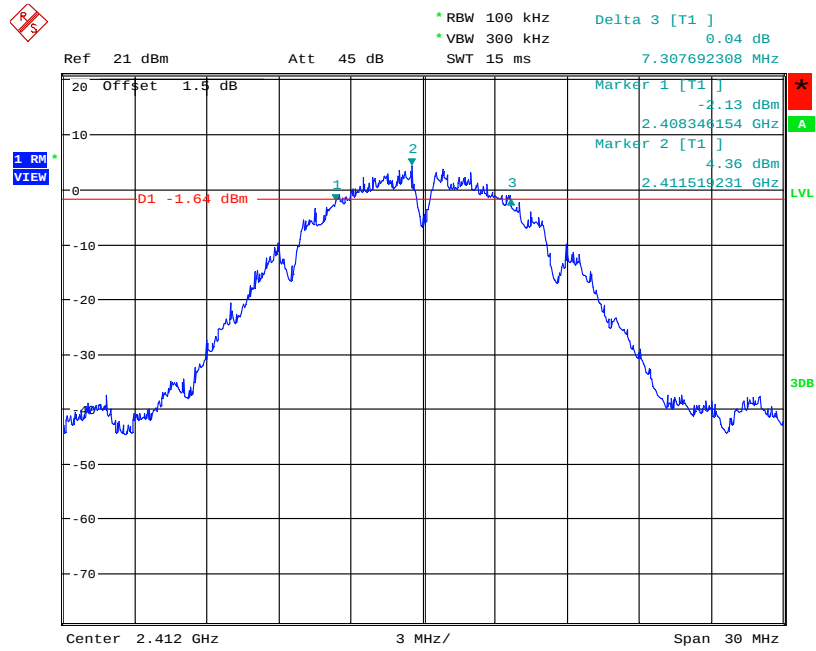
| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | Refer to plot | 20dB Bandwidth (MHz) | Refer to plot | Limit (KHz) | Result |
|---------|-----------------|---------------------|---------------|----------------------|---------------|-------------|--------|
| 1       | 2412            | 7.307               | Plot A1       | 14.038               | Plot A2       | $\geq 500$  | Pass   |
| 6       | 2437            | 7.548               | Plot B1       | 14.134               | Plot B2       | $\geq 500$  | Pass   |
| 11      | 2462            | 7.596               | Plot C1       | 13.750               | 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            | 16.586              | Plot D1       | 18.750               | Plot D2       | $\geq 500$  | Pass   |
| 6       | 2437            | 16.538              | Plot E1       | 17.884               | Plot E2       | $\geq 500$  | Pass   |
| 11      | 2462            | 16.490              | Plot F1       | 17.826               | Plot F2       | $\geq 500$  | Pass   |

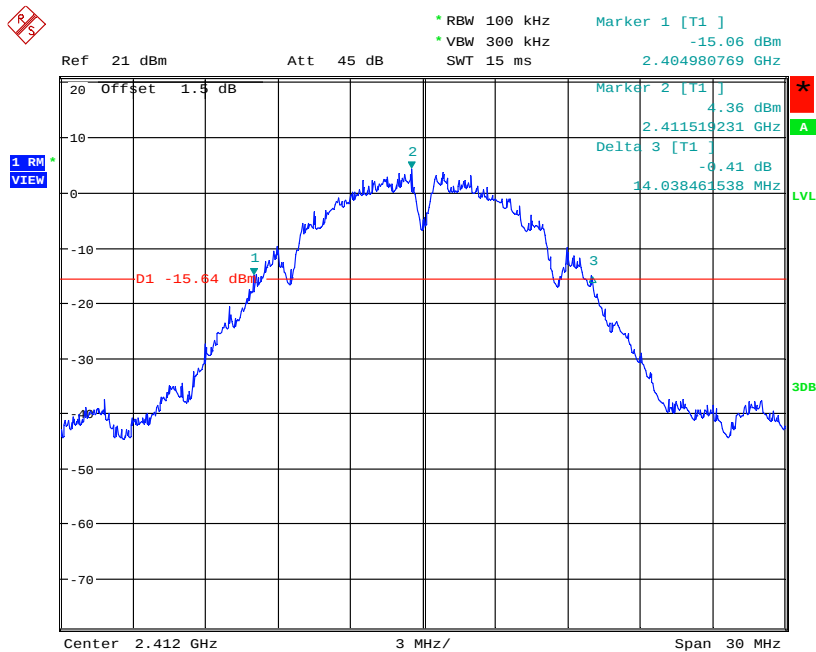
##### 802.11n (20MHz) Test mode

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | Refer to plot | 20dB Bandwidth (MHz) | Refer to plot | Limit (KHz) | Result |
|---------|-----------------|---------------------|---------------|----------------------|---------------|-------------|--------|
| 1       | 2412            | 17.788              | Plot G1       | 19.663               | Plot G2       | $\geq 500$  | Pass   |
| 6       | 2437            | 17.788              | Plot H1       | 18.653               | Plot H2       | $\geq 500$  | Pass   |
| 11      | 2462            | 17.708              | Plot I1       | 18.717               | Plot I2       | $\geq 500$  | Pass   |

**B. Test Plots:**

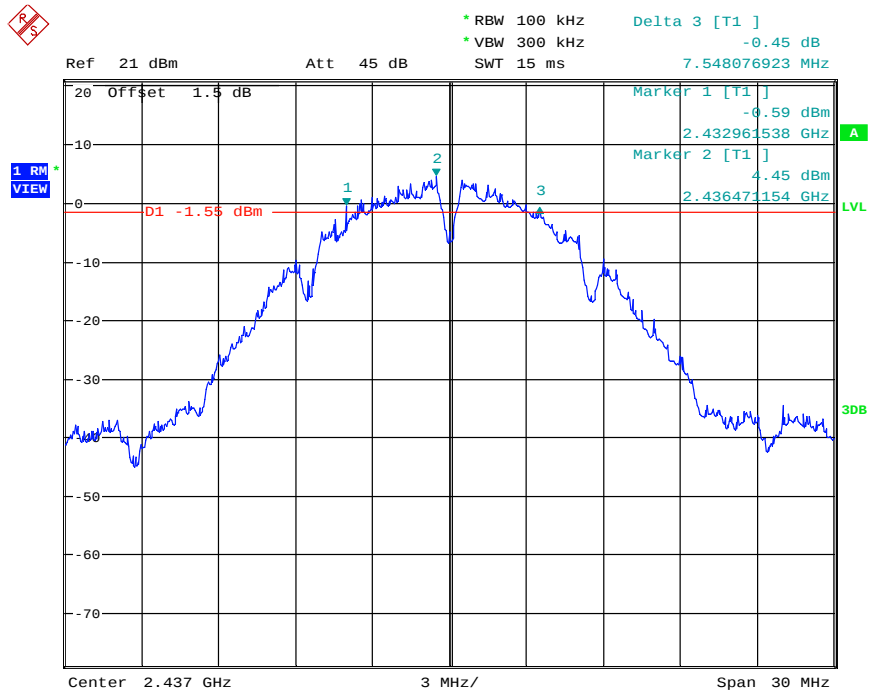
Date: 8.APR.2016 18:24:47

Plot A1



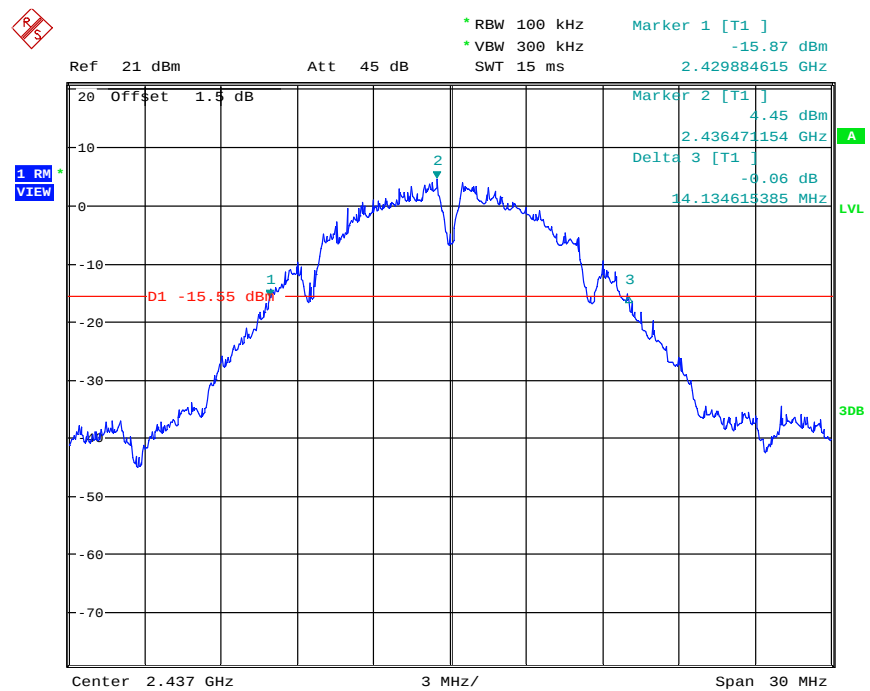
Date: 8.APR.2016 18:26:00

Plot A2



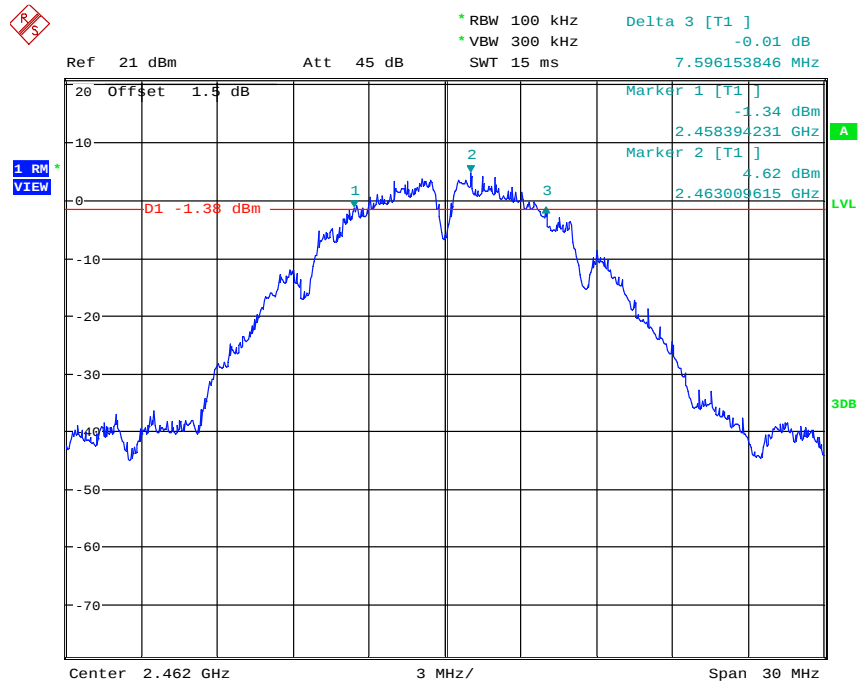
Date: 8.APR.2016 18:22:49

Plot B1



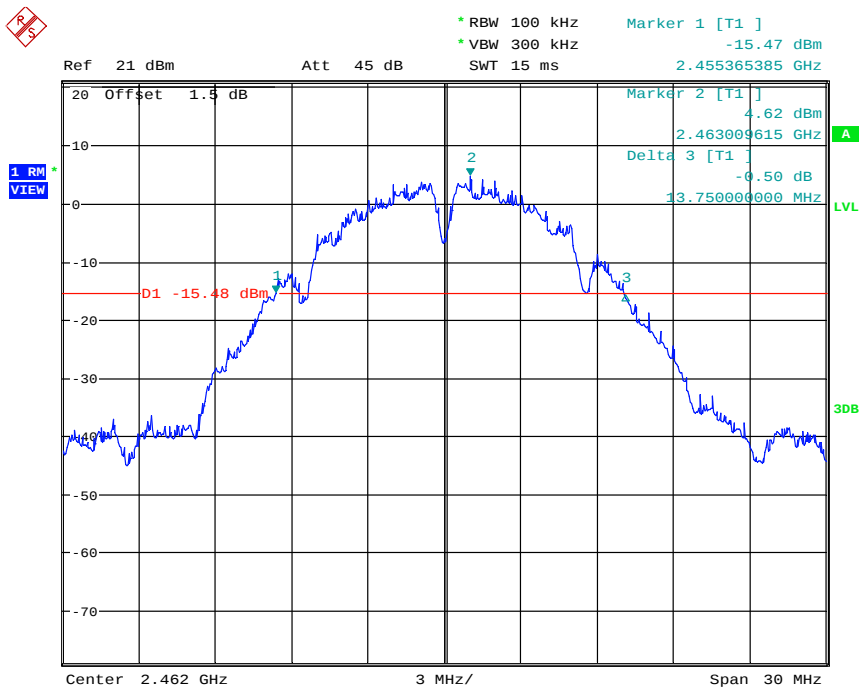
Date: 8.APR.2016 18:23:46

Plot B2



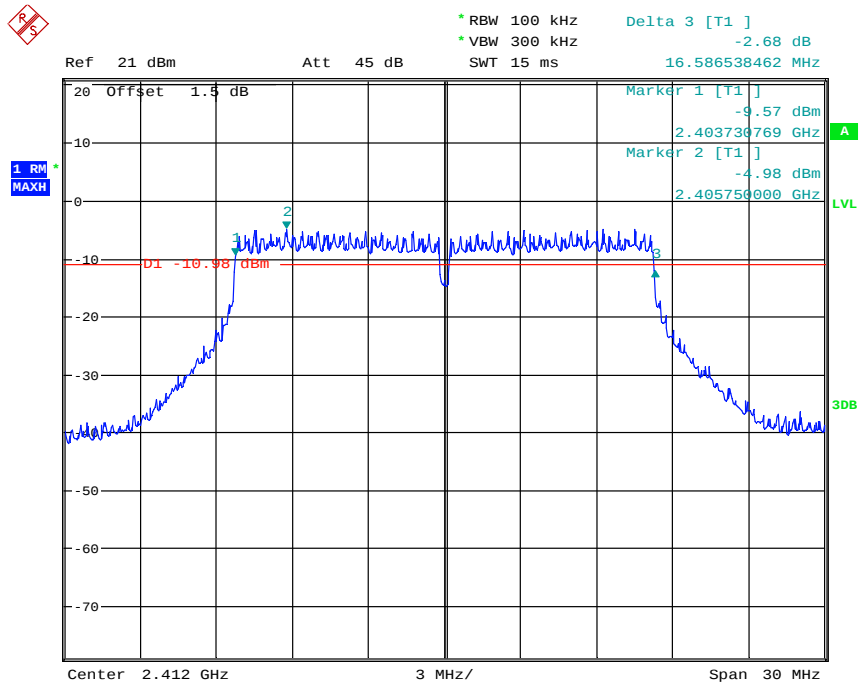
Date: 8.APR.2016 18:19:40

Plot C1



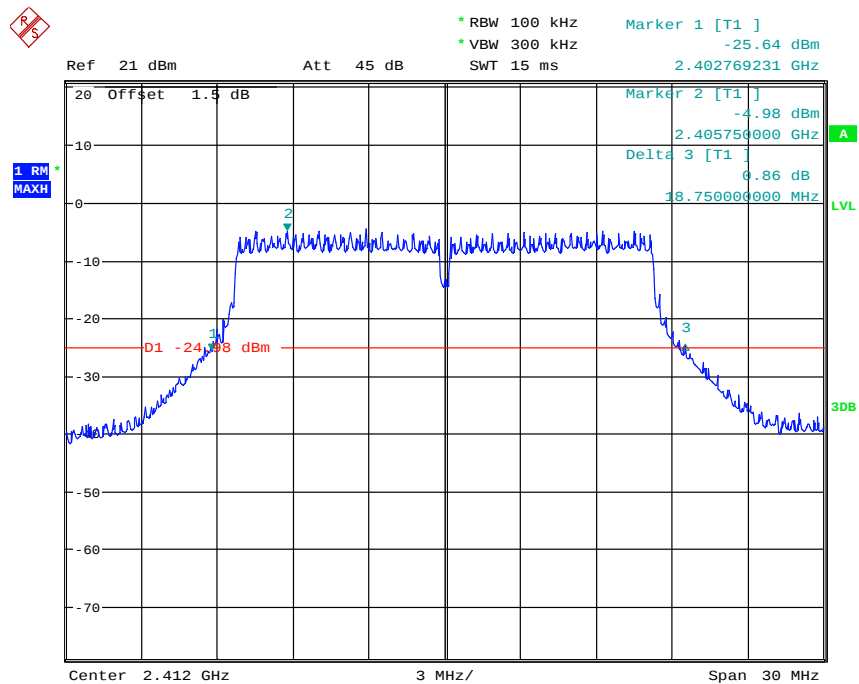
Date: 8.APR.2016 18:21:29

Plot C2



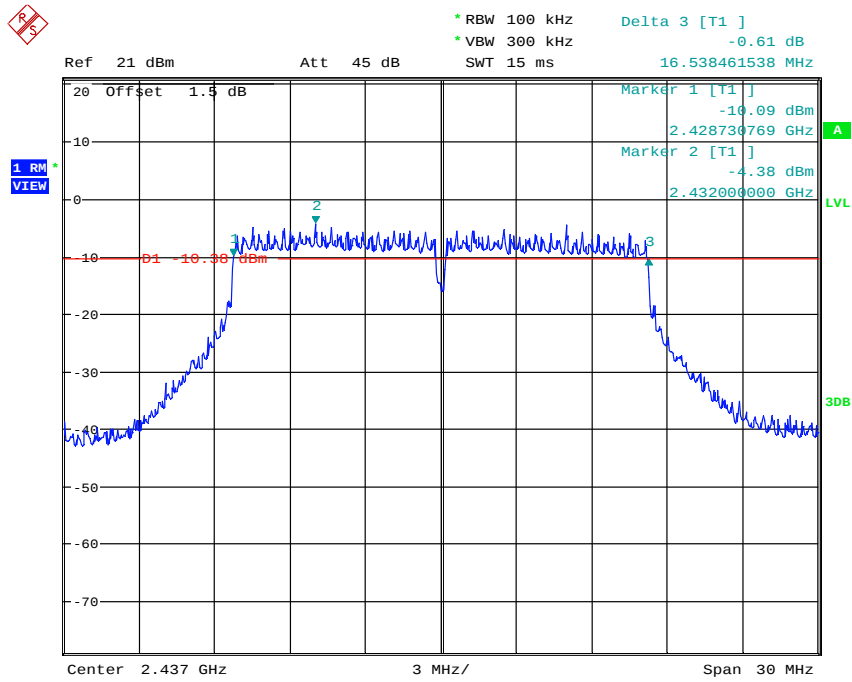
Date: 8.APR.2016 18:05:03

Plot D1



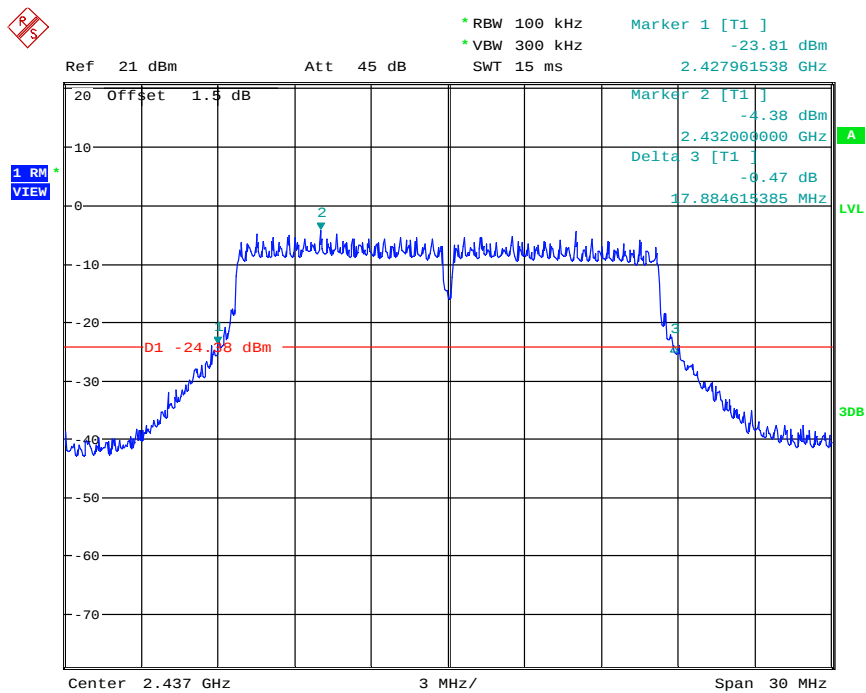
Date: 8.APR.2016 18:06:31

Plot D2



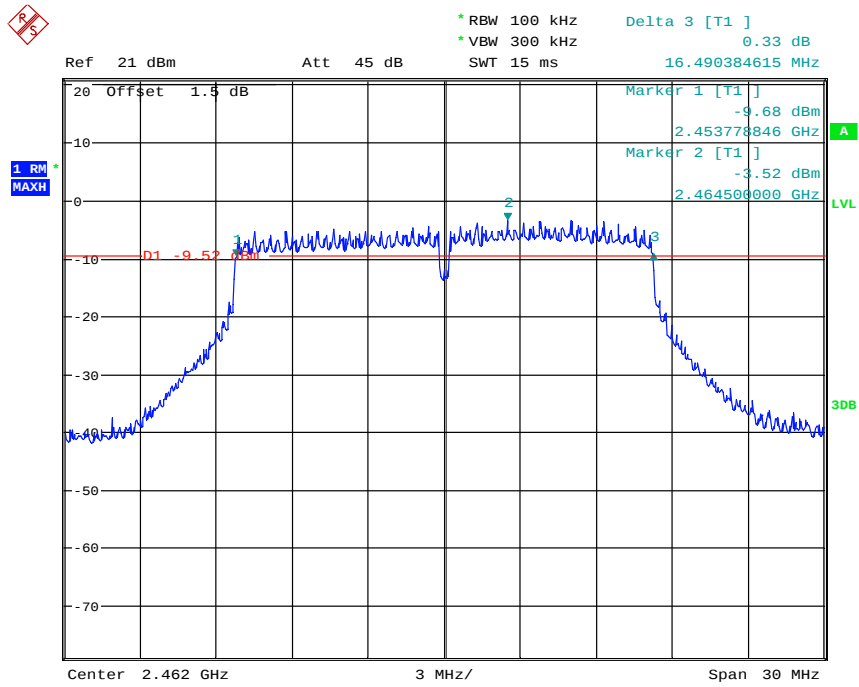
Date: 8.APR.2016 18:10:09

Plot E1



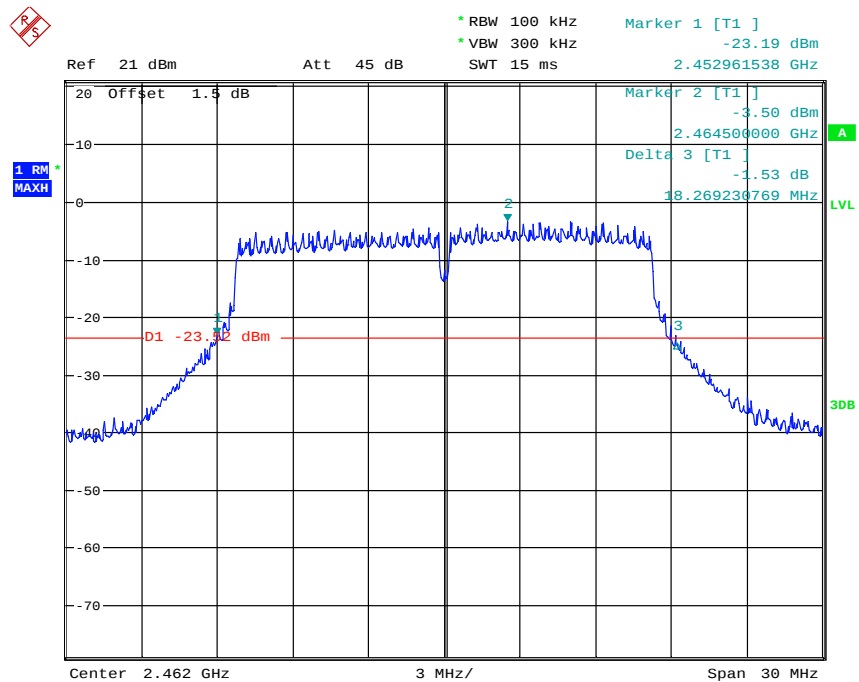
Date: 8.APR.2016 18:11:50

Plot E2



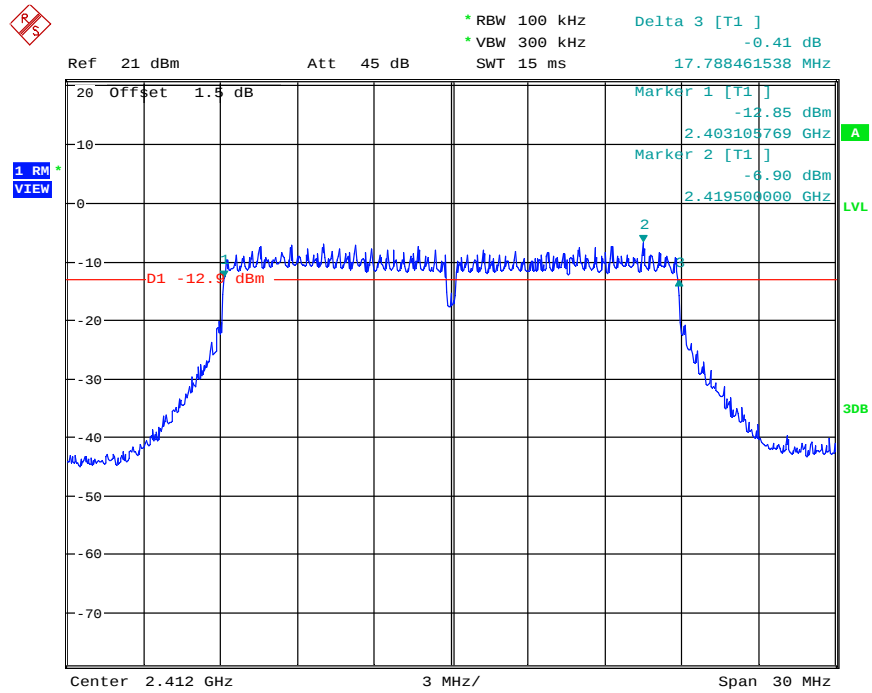
Date: 8.APR.2016 18:15:52

Plot F1



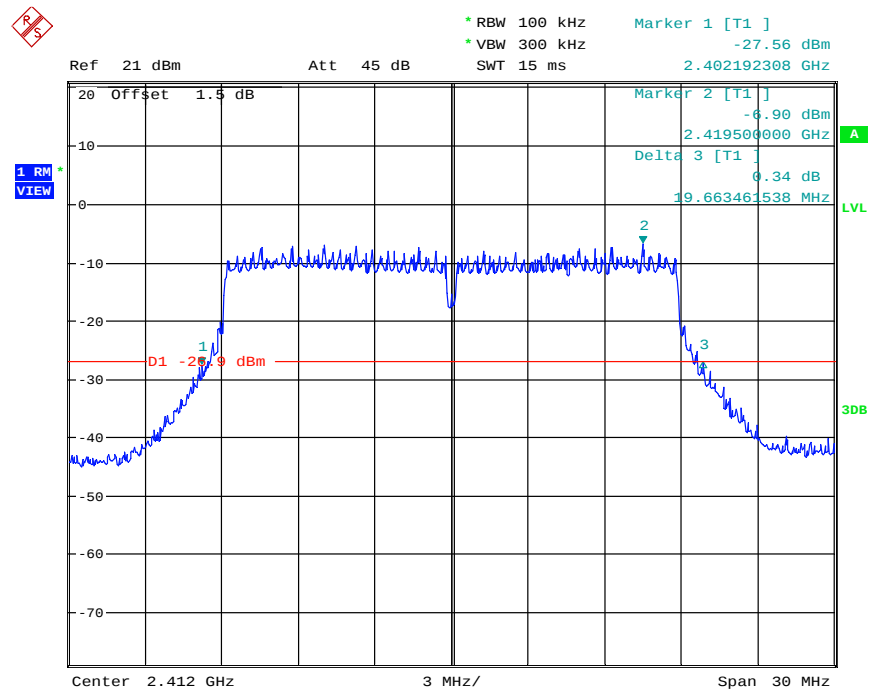
Date: 8.APR.2016 18:17:09

Plot F2



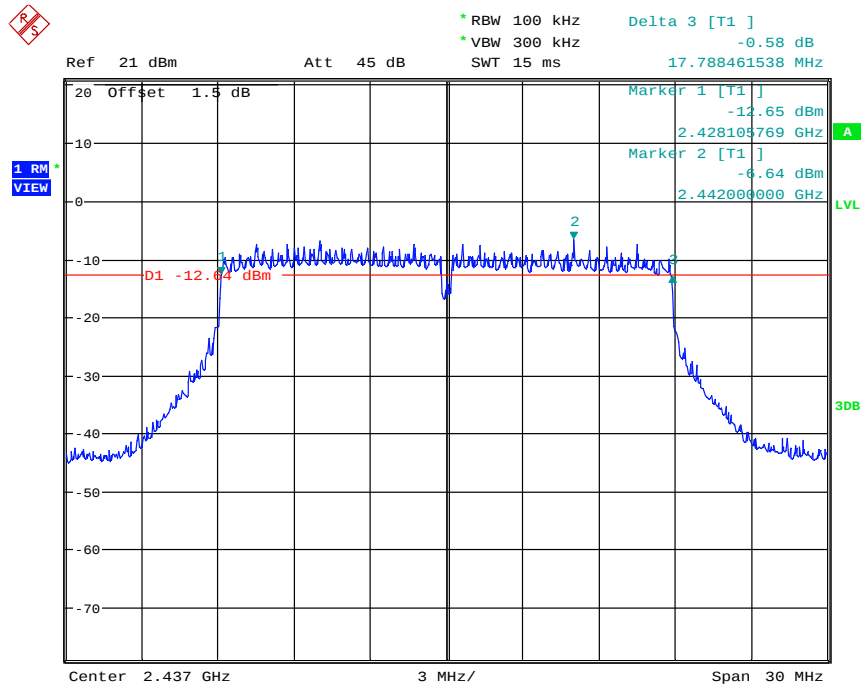
Date: 8.APR.2016 18:02:06

Plot G1



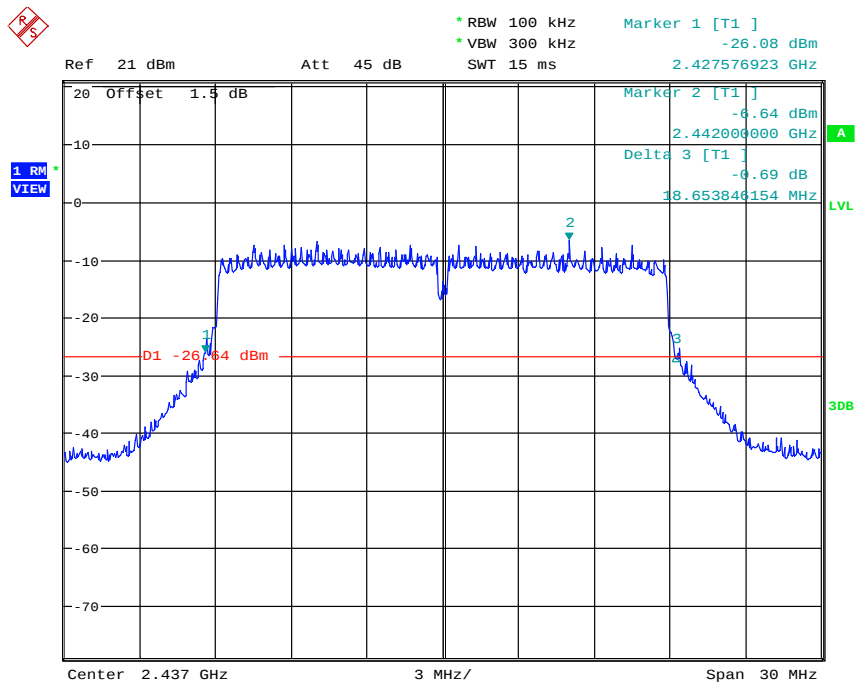
Date: 8.APR.2016 18:02:49

Plot G2



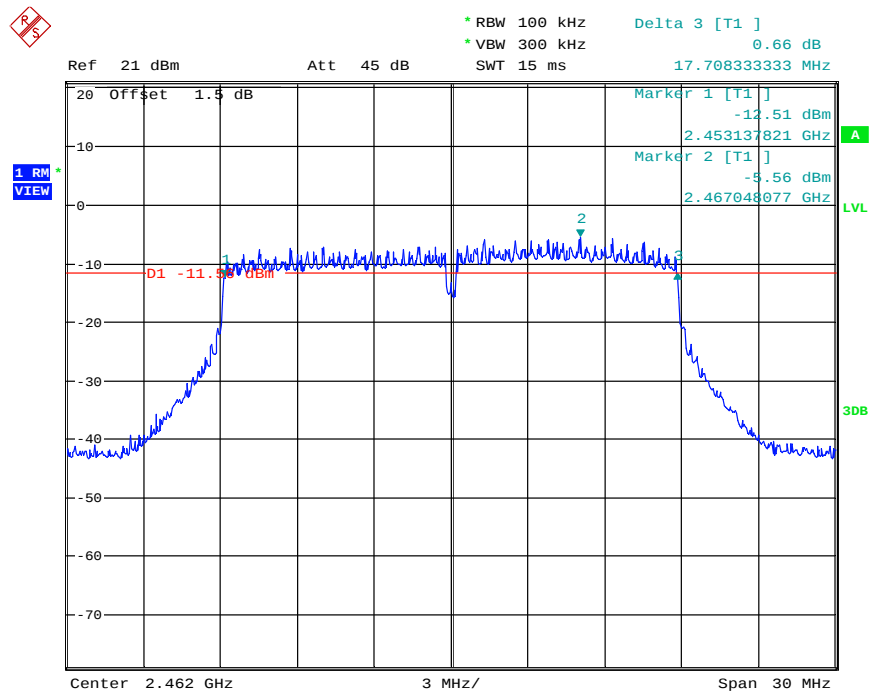
Date: 8.APR.2016 17:59:56

Plot H1



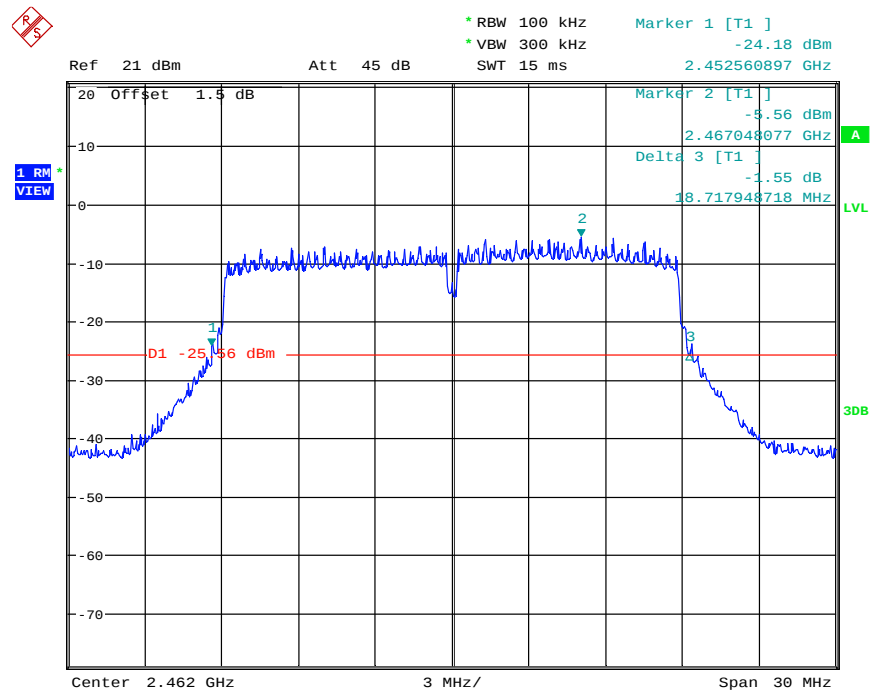
Date: 8.APR.2016 18:00:42

Plot H2



Date: 8.APR.2016 17:57:08

Plot I1



Date: 8.APR.2016 17:58:07

Plot I2

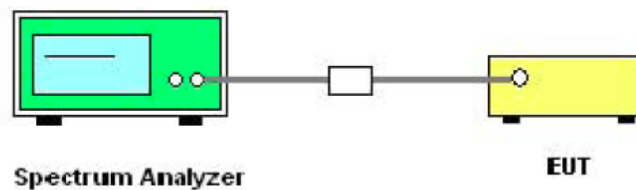


## 5.3 Conducted Spurious Emissions

### 5.3.1 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.

### 5.3.2 Test Description



### 5.3.3 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            | -41.51                                 | Plot A        | 4.40          | -15.60                 | Pass   |
| 6       | 2437            | -42.01                                 | Plot B        | 3.31          | -16.69                 | Pass   |
| 11      | 2462            | -41.38                                 | Plot C        | 3.99          | -16.01                 | Pass   |

##### 802.11g Test mode

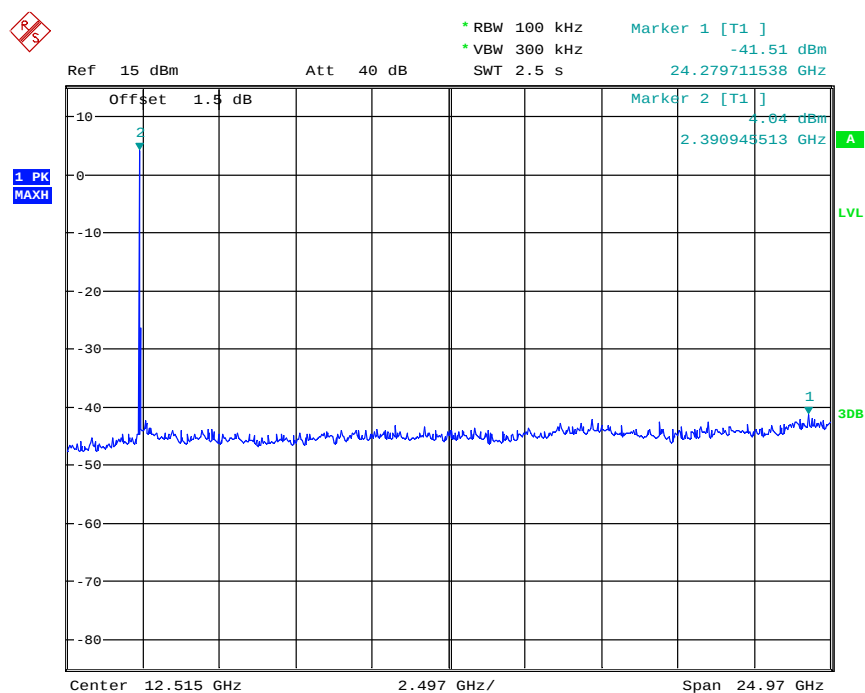
| Channel | Frequency (MHz) | Measured max out of band emission(dBm) | Refer to plot | Limit(dBm)    |                        | Result |
|---------|-----------------|----------------------------------------|---------------|---------------|------------------------|--------|
|         |                 |                                        |               | Carrier level | Calculated 20dBc limit |        |
| 1       | 2412            | -41.98                                 | Plot D        | -3.80         | -23.80                 | Pass   |
| 6       | 2437            | -42.13                                 | Plot E        | -4.12         | -24.12                 | Pass   |
| 11      | 2462            | -41.62                                 | Plot F        | -2.90         | -22.90                 | Pass   |



## 802.11n (20MHz) Test mode

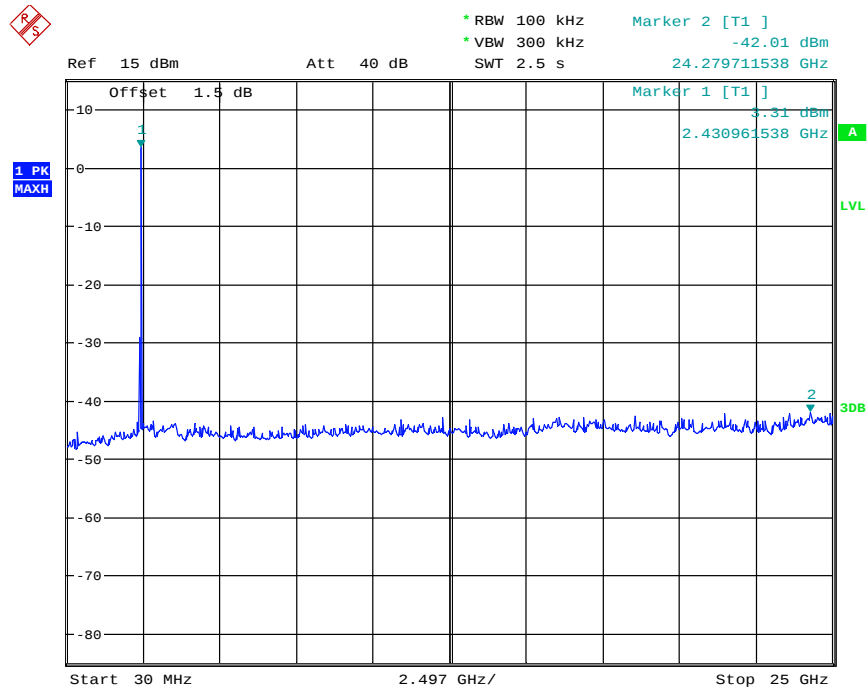
| Channel | Frequency (MHz) | Measured max out of band emission(dBm) | Refer to plot | Limit(dBm)    |                        | Result |
|---------|-----------------|----------------------------------------|---------------|---------------|------------------------|--------|
|         |                 |                                        |               | Carrier level | Calculated 20dBc limit |        |
| 1       | 2412            | -41.75                                 | Plot G        | -4.86         | -24.86                 | Pass   |
| 6       | 2437            | -41.90                                 | Plot H        | -3.99         | -23.99                 | Pass   |
| 11      | 2462            | -41.44                                 | Plot I        | -3.40         | -23.40                 | Pass   |

## B. Test Plot:



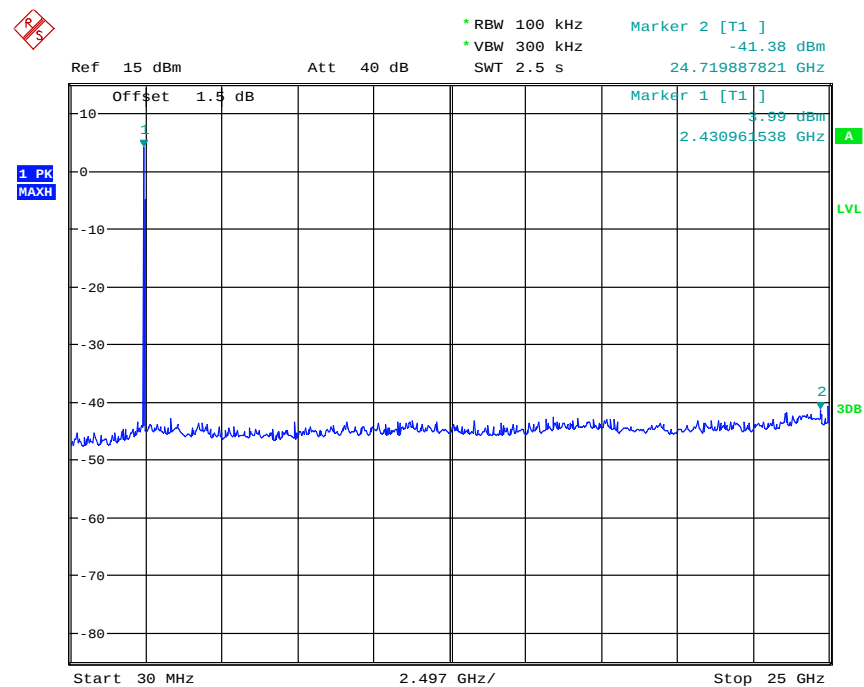
Date: 8.APR.2016 19:44:28

Plot A



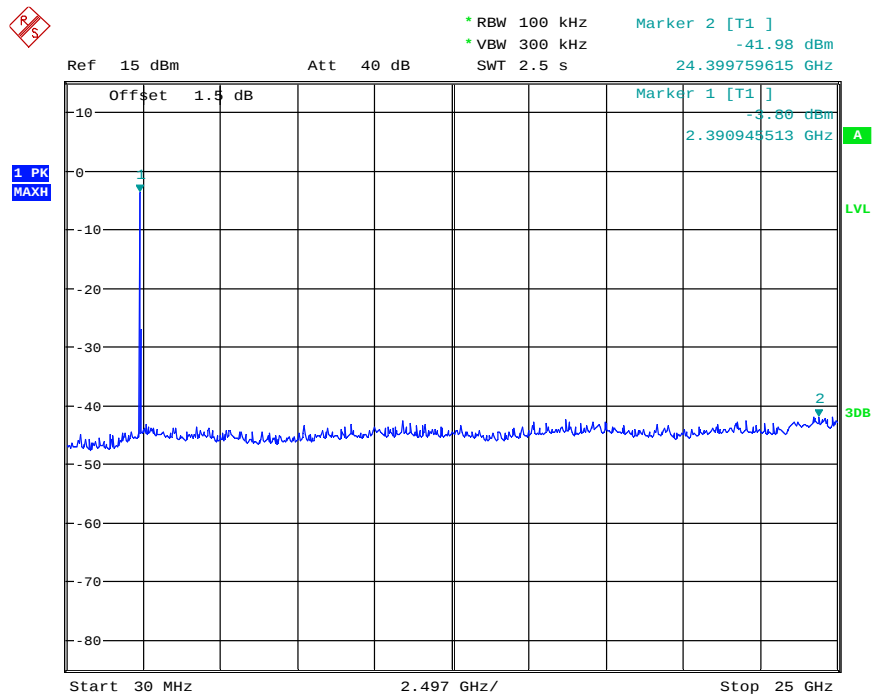
Date: 8.APR.2016 19:43:26

Plot B



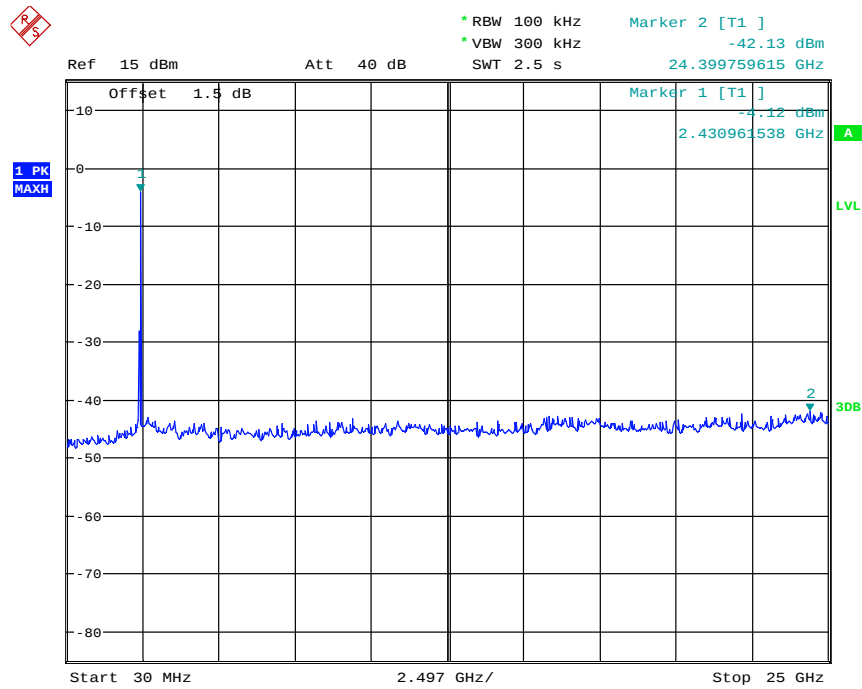
Date: 8.APR.2016 19:42:39

Plot C



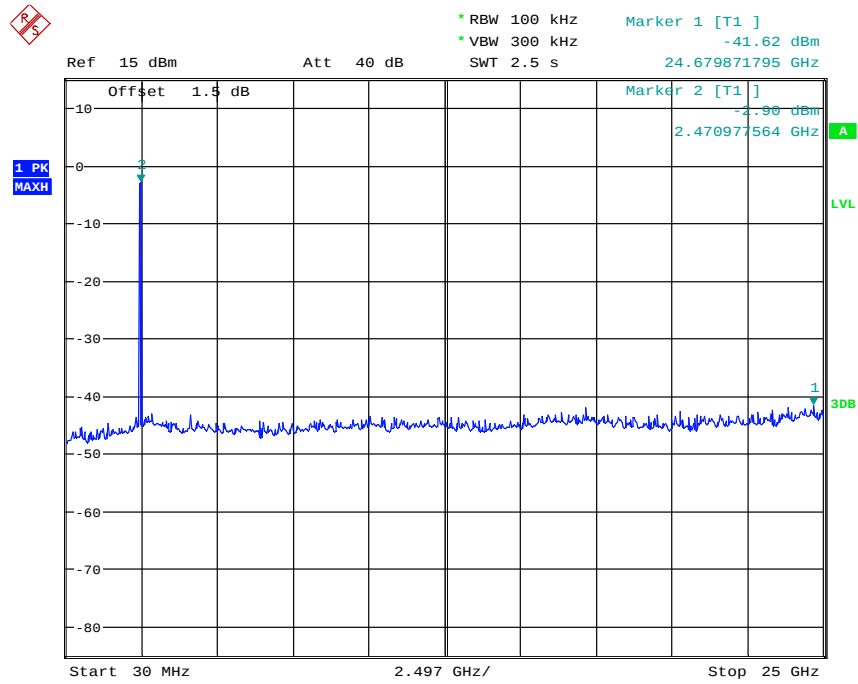
Date: 8.APR.2016 19:40:25

Plot D



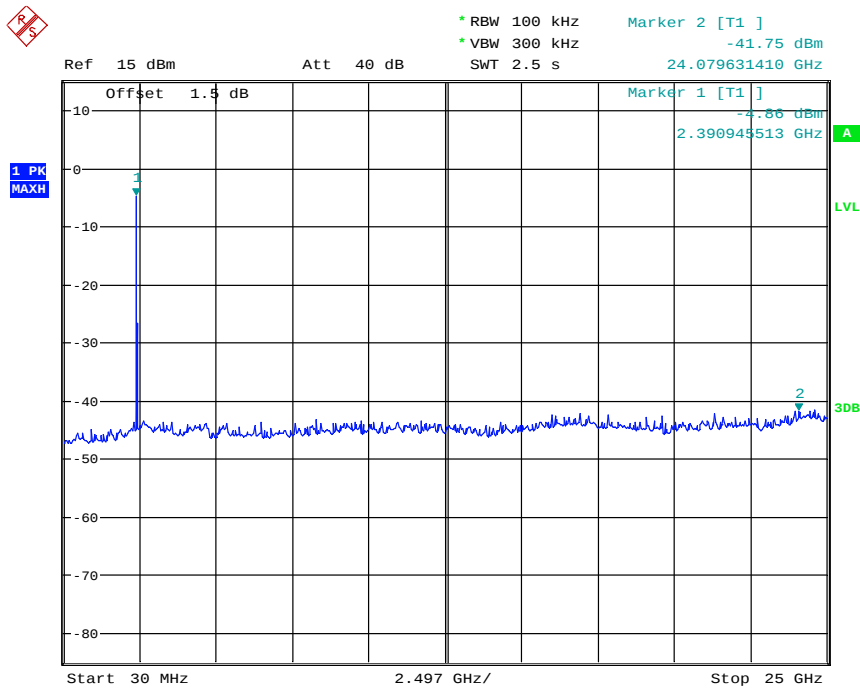
Date: 8.APR.2016 19:41:08

Plot E



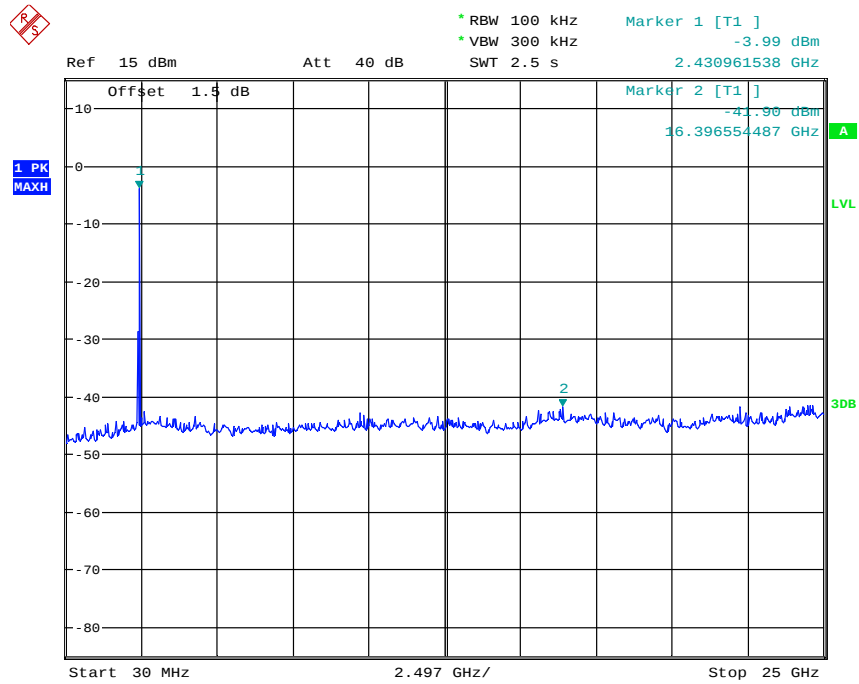
Date: 8.APR.2016 19:41:42

Plot F



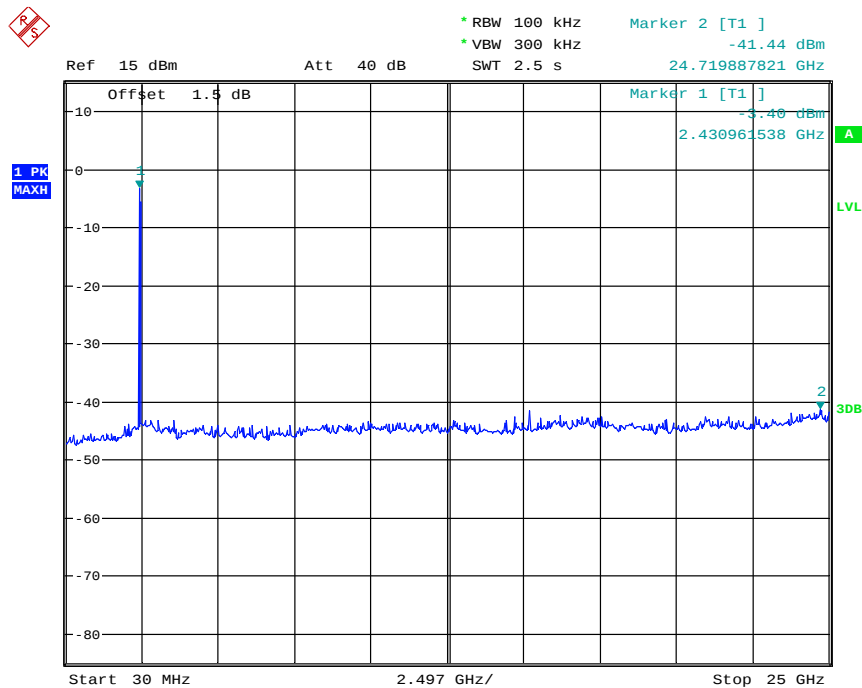
Date: 8.APR.2016 19:39:37

Plot G



Date: 8.APR.2016 19:38:43

Plot H



Date: 8.APR.2016 19:37:45

Plot I

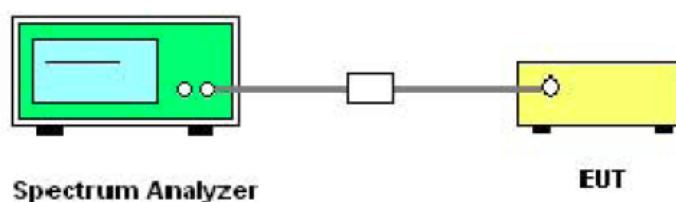


## 5.4 Power Spectral Density (PSD)

### 5.4.1 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

### 5.4.2 Test Description



### 5.4.3 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            | -9.29                   | Plot A        | 8                | Pass   |
| 6       | 2437            | -8.82                   | Plot B        | 8                | Pass   |
| 11      | 2462            | -7.40                   | Plot C        | 8                | Pass   |

##### 802.11g Test mode

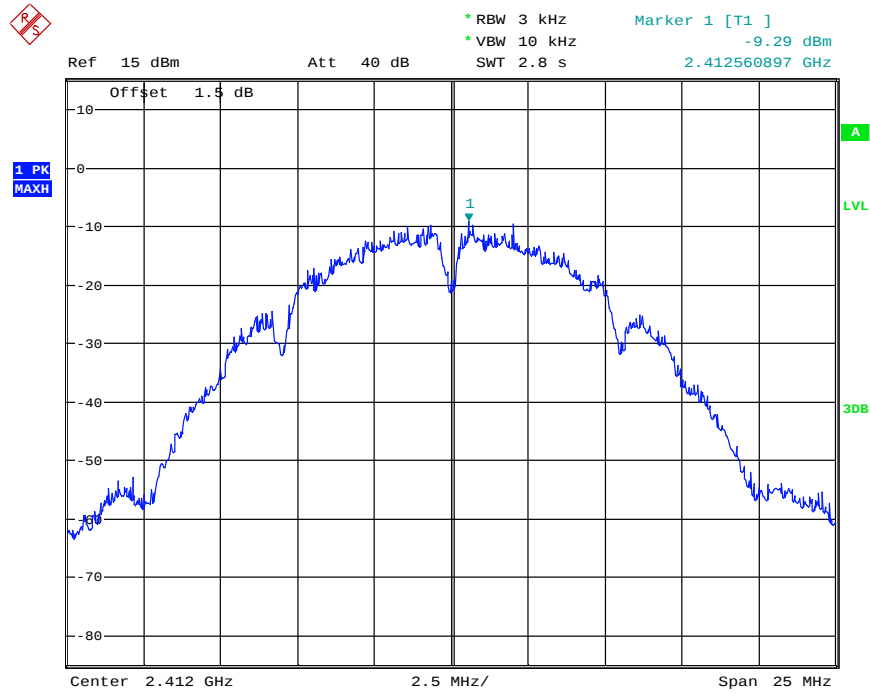
| Channel | Frequency (MHz) | Measured PSD (dBm/3kHz) | Refer to plot | Limit (dBm/3kHz) | Result |
|---------|-----------------|-------------------------|---------------|------------------|--------|
| 1       | 2412            | -14.74                  | Plot D        | 8                | Pass   |
| 6       | 2437            | -13.47                  | Plot E        | 8                | Pass   |
| 11      | 2462            | -13.88                  | 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            | -16.99                  | Plot G        | 8                | Pass   |
| 6       | 2437            | -15.60                  | Plot H        | 8                | Pass   |
| 11      | 2462            | -15.00                  | Plot I        | 8                | Pass   |

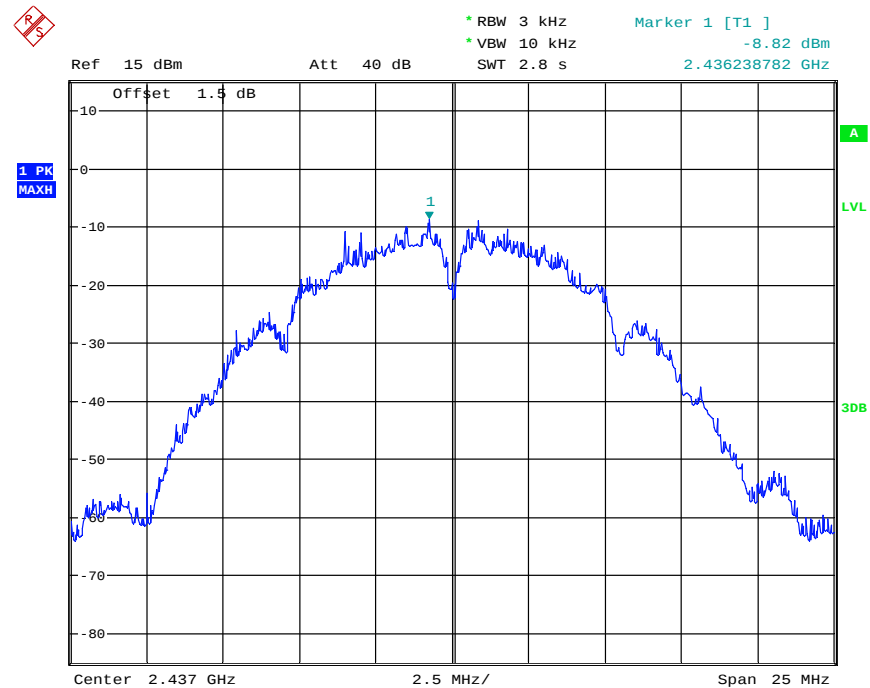


## B. Test Plot



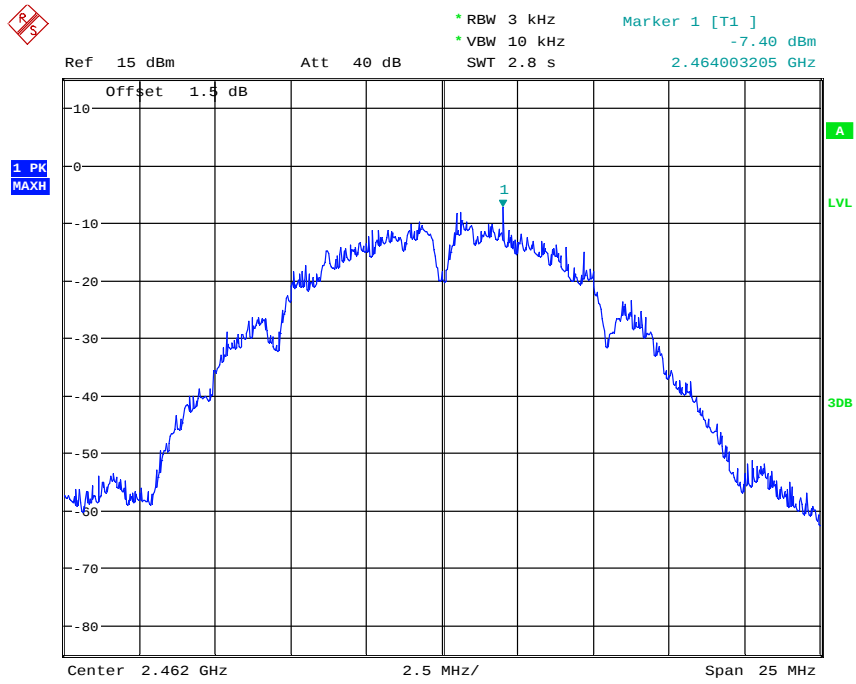
Date: 8.APR.2016 19:46:01

Plot A



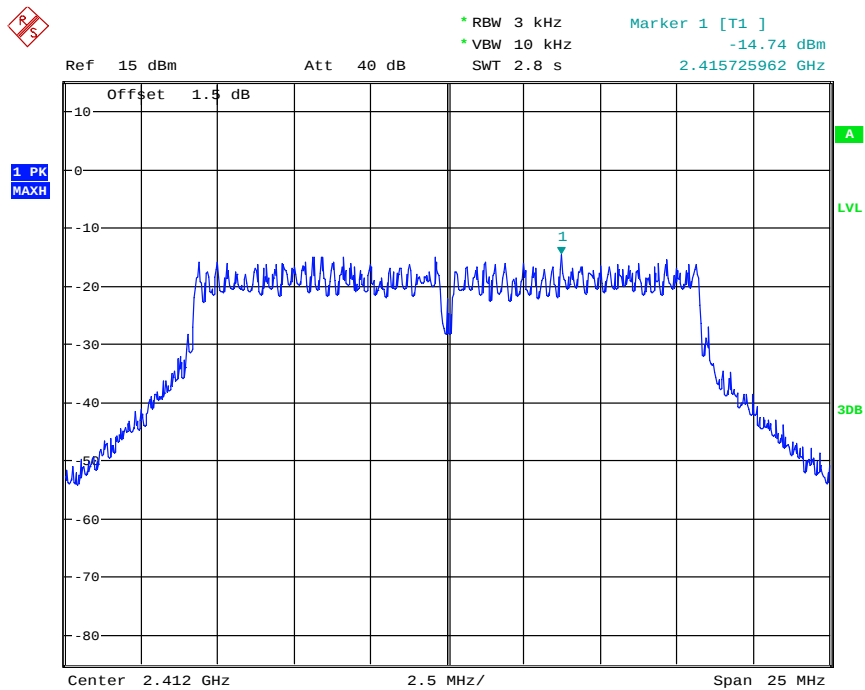
Date: 8.APR.2016 19:46:38

Plot B



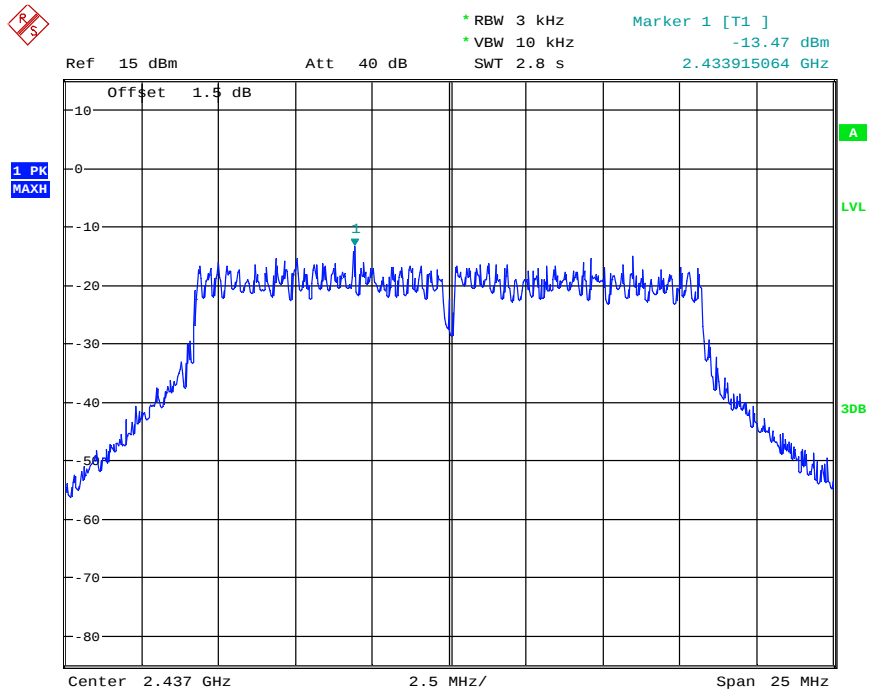
Date: 8.APR.2016 19:47:05

Plot C



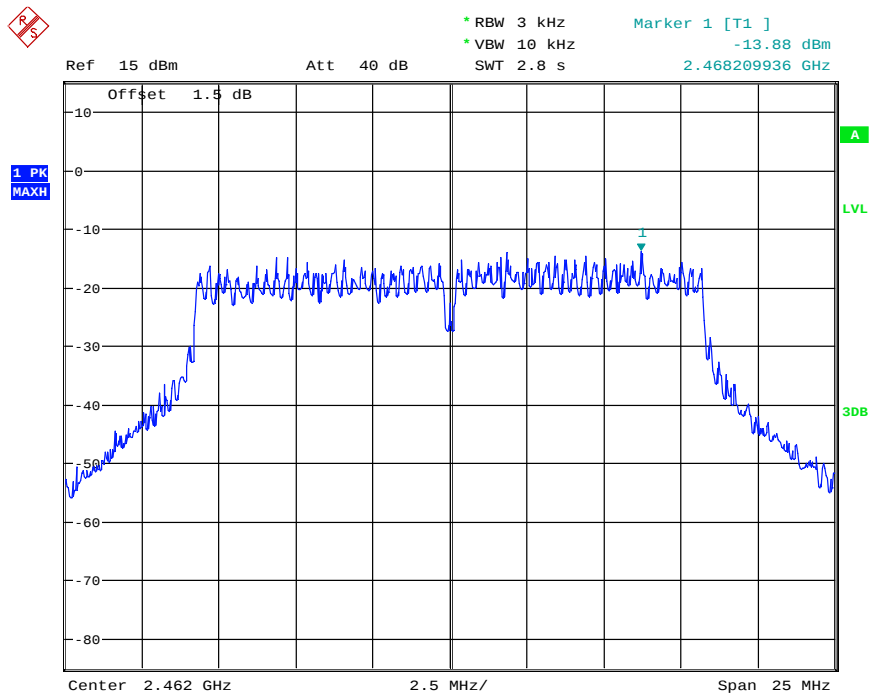
Date: 8.APR.2016 19:49:12

Plot D



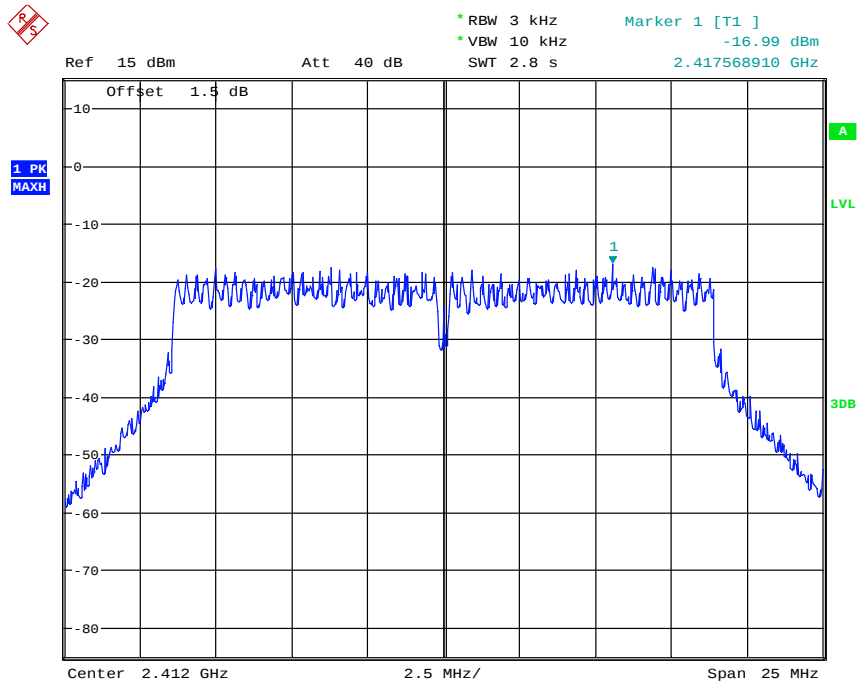
Date: 8.APR.2016 19:48:17

Plot E



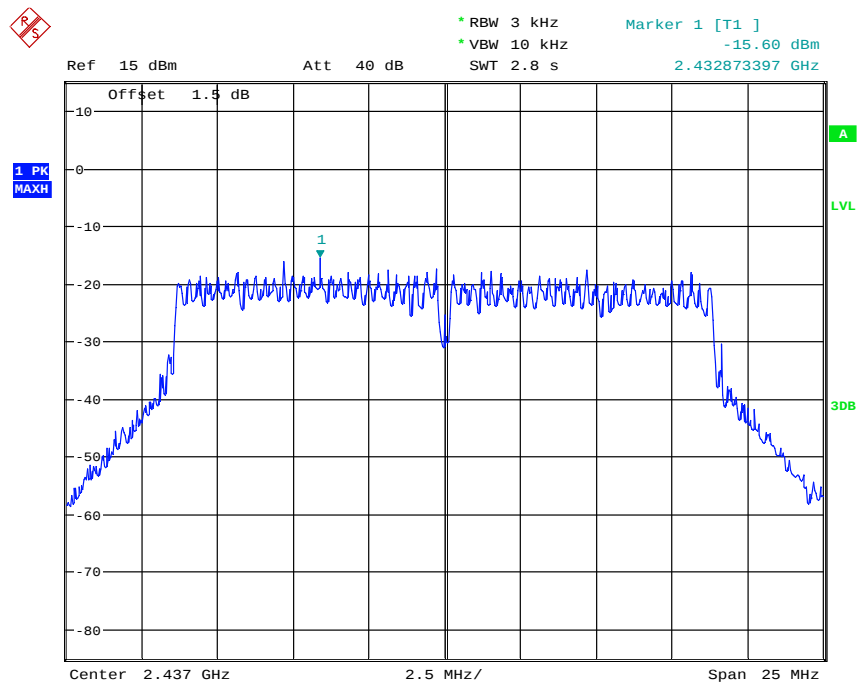
Date: 8.APR.2016 19:47:35

Plot F



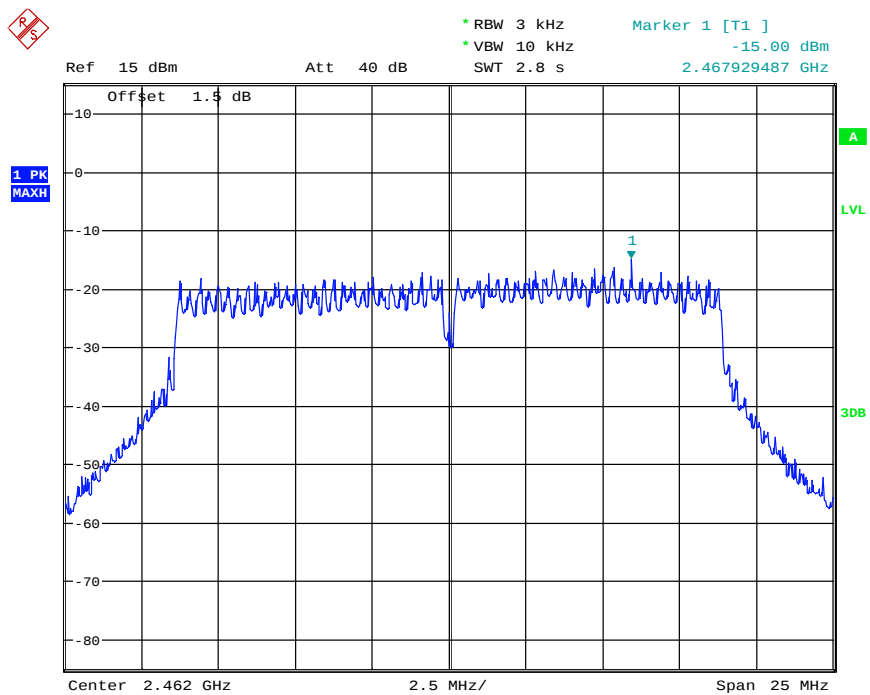
Date: 8.APR.2016 19:49:42

Plot G



Date: 8.APR.2016 19:50:24

Plot H



Date: 8.APR.2016 19:50:54

Plot I

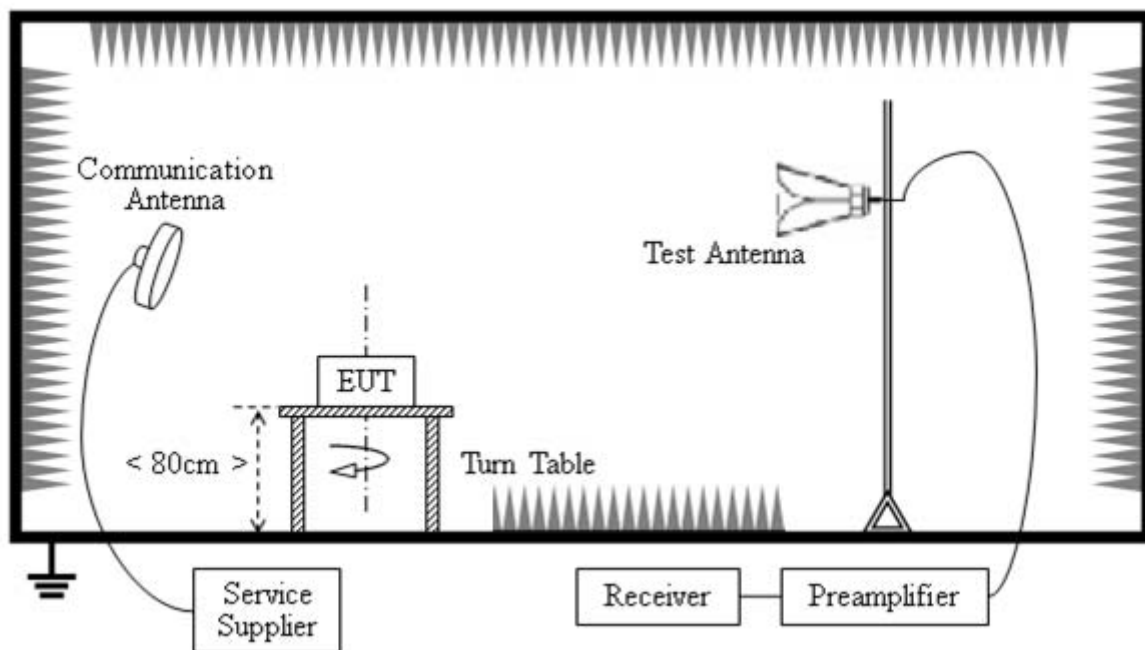


## 5.5 Band Edge

### 5.5.1 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).

### 5.5.2 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.

### 5.5.3 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

**A. Test Verdict****802.11b Test mode**

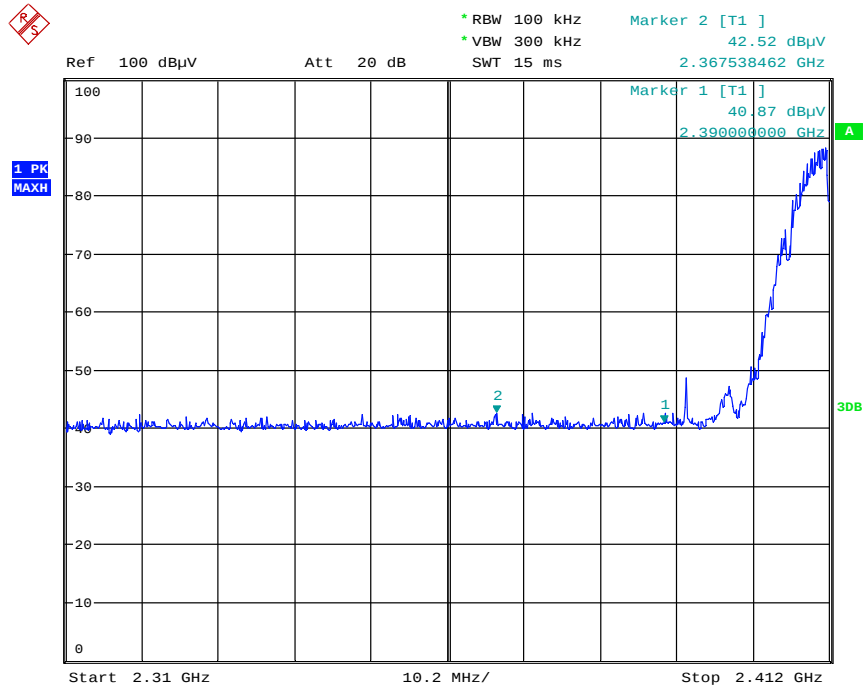
| Ch | Frequency (MHz) | Detector PK/AV | Receiver Reading UR (dBuV/m) | AT (dB) | Afactor (dB@3m) | Max. Emission (dBuV/m) | Limit (dBuV/m) | Result |
|----|-----------------|----------------|------------------------------|---------|-----------------|------------------------|----------------|--------|
| 1  | 2367.53         | PK             | 42.52                        | -32.2   | 32.56           | 42.88                  | 74             | Pass   |
| 1  | 2366.23         | AV             | 38.14                        | -32.2   | 32.56           | 38.50                  | 54             | Pass   |
| 11 | 2489.22         | PK             | 41.99                        | -30.7   | 32.50           | 43.79                  | 74             | Pass   |
| 11 | 2487.08         | AV             | 37.39                        | -30.7   | 32.50           | 39.19                  | 54             | Pass   |

**802.11g Test mode**

| Ch | Frequency (MHz) | Detector PK/AV | Receiver Reading UR (dBuV/m) | AT (dB) | Afactor (dB@3m) | Max. Emission (dBuV/m) | Limit (dBuV/m) | Result |
|----|-----------------|----------------|------------------------------|---------|-----------------|------------------------|----------------|--------|
| 1  | 2372.93         | PK             | 42.38                        | -32.2   | 32.56           | 42.74                  | 74             | Pass   |
| 1  | 2325.85         | AV             | 38.25                        | -32.2   | 32.56           | 38.61                  | 54             | Pass   |
| 11 | 2483.92         | PK             | 42.94                        | -30.7   | 32.50           | 44.74                  | 74             | Pass   |
| 11 | 3484.53         | AV             | 37.51                        | -30.7   | 32.50           | 39.31                  | 54             | Pass   |

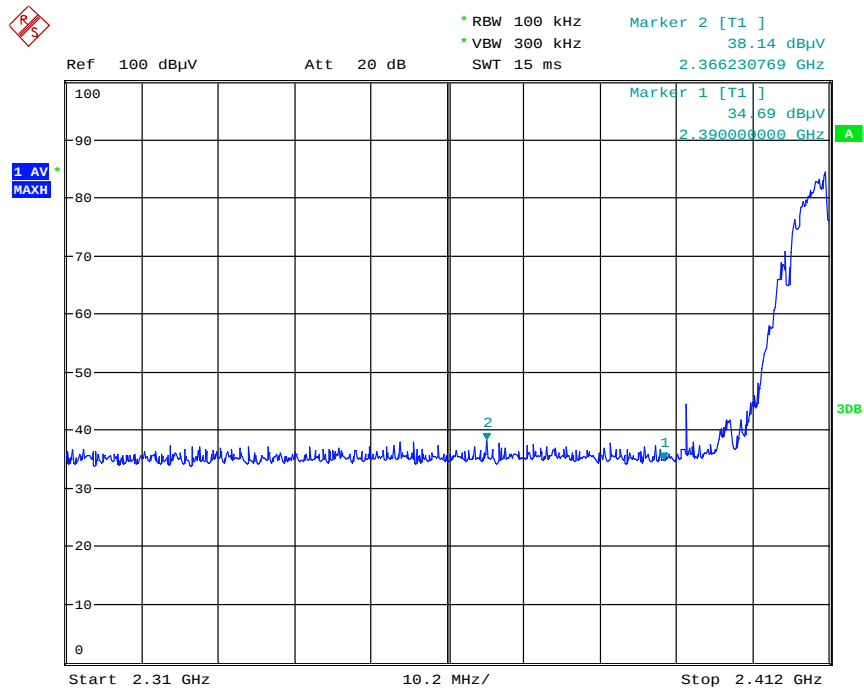
**802.11n (20MHz) Test mode**

| Ch | Frequency (MHz) | Detector PK/AV | Receiver Reading UR (dBuV/m) | AT (dB) | Afactor (dB@3m) | Max. Emission (dBuV/m) | Limit (dBuV/m) | Result |
|----|-----------------|----------------|------------------------------|---------|-----------------|------------------------|----------------|--------|
| 1  | 2366.39         | PK             | 41.84                        | -32.2   | 32.56           | 42.20                  | 74             | Pass   |
| 1  | 2375.87         | AV             | 38.13                        | -32.2   | 32.56           | 38.49                  | 54             | Pass   |
| 11 | 2486.23         | PK             | 42.09                        | -30.7   | 32.50           | 43.89                  | 74             | Pass   |
| 11 | 2489.52         | AV             | 38.04                        | -30.7   | 32.50           | 39.84                  | 54             | Pass   |

**B. Test Plot**

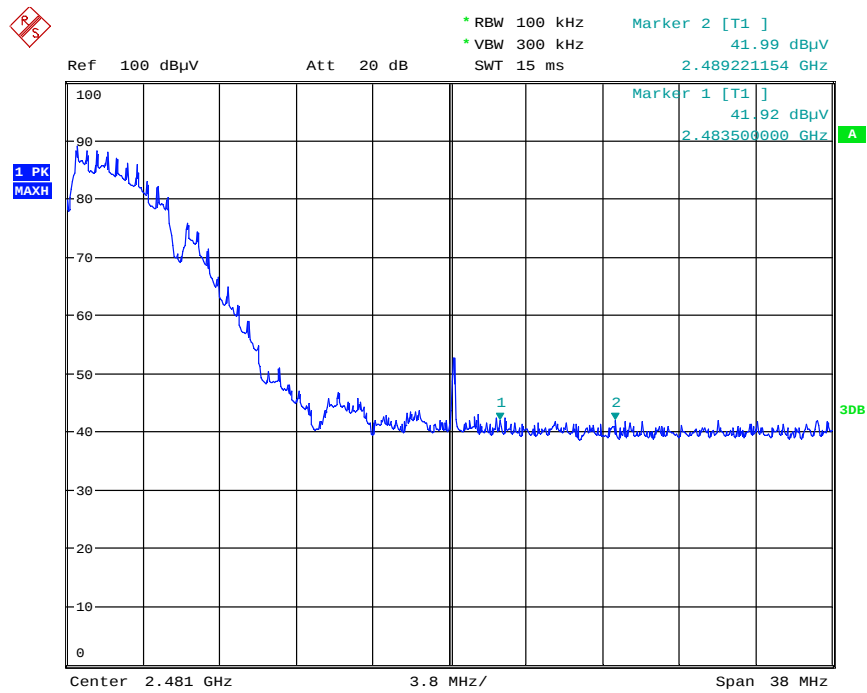
Date: 8.APR.2016 19:56:17

(802.11b Channel = 1 PK)



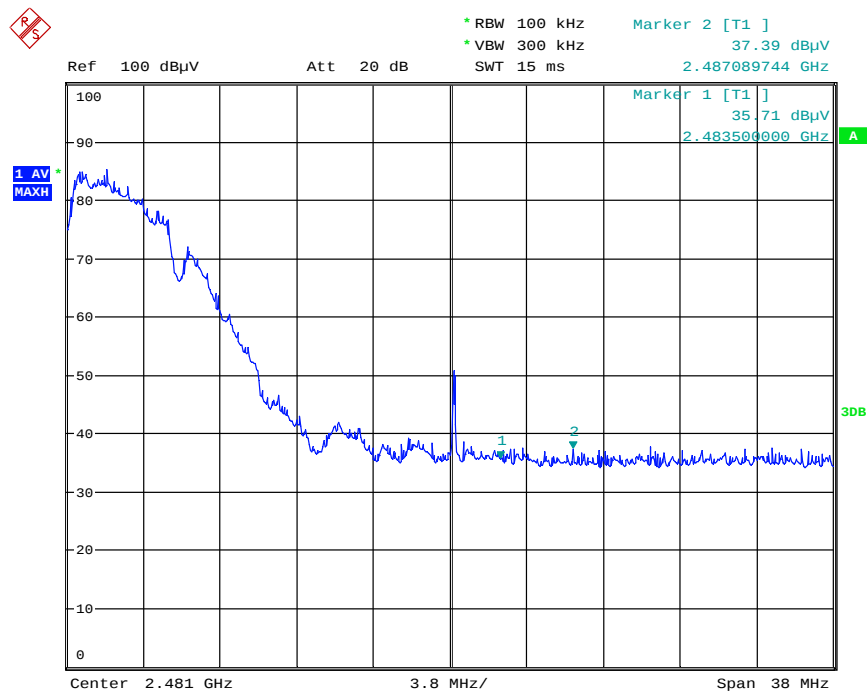
Date: 8.APR.2016 19:57:06

(802.11b Channel = 1 AV)



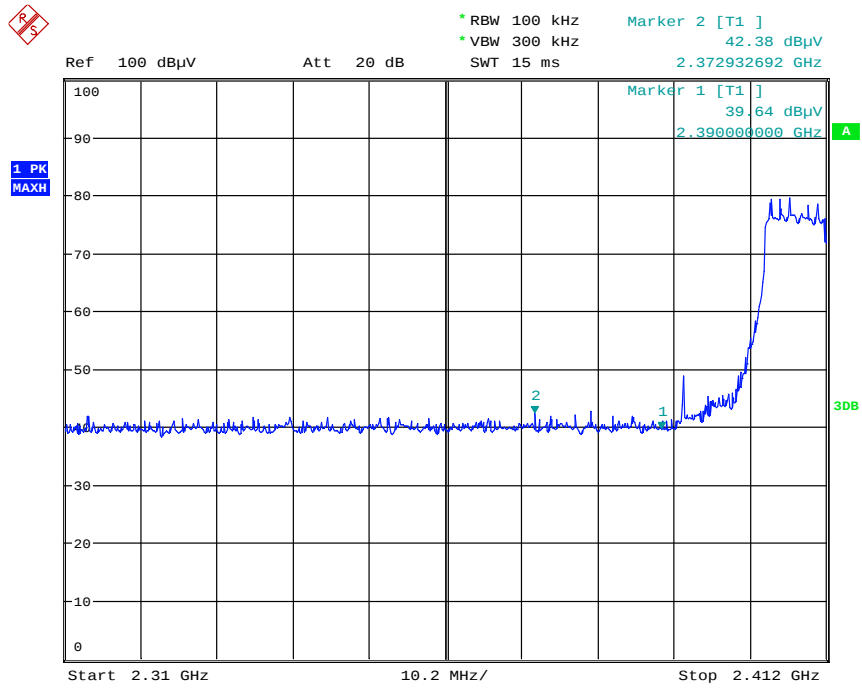
Date: 8.APR.2016 20:07:04

(802.11b Channel = 11 PK)



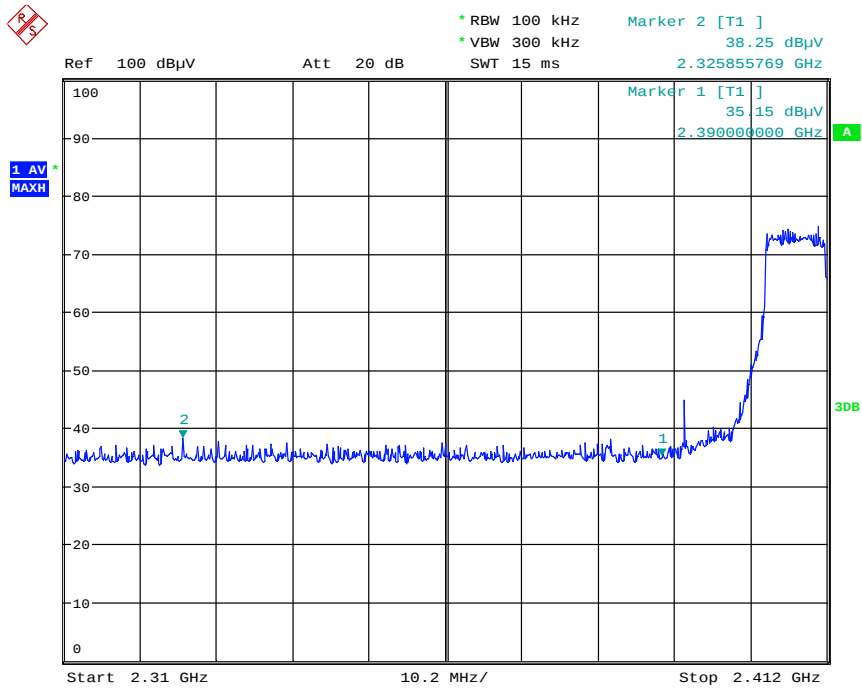
Date: 8.APR.2016 20:06:30

(802.11b Channel = 11 AV)



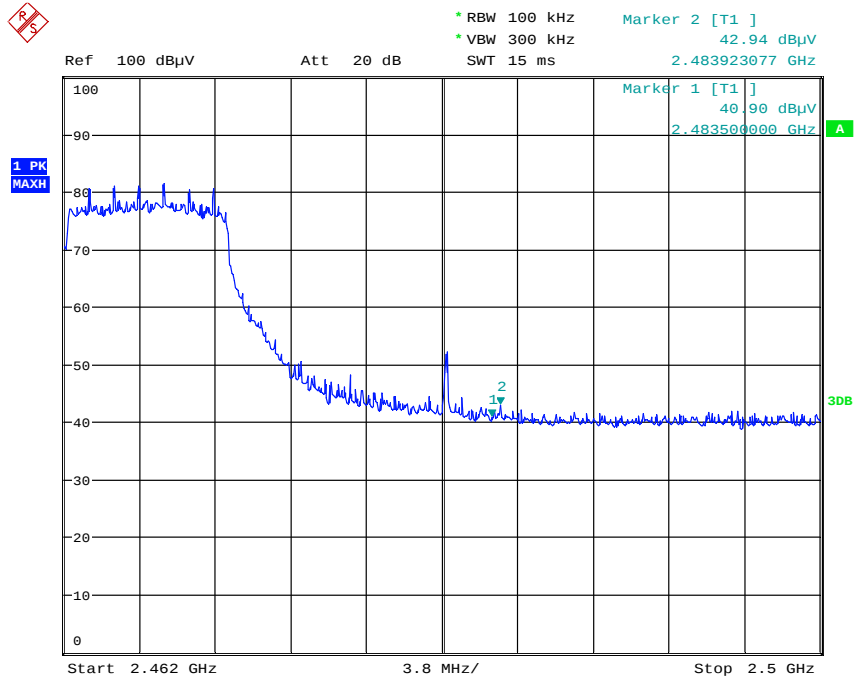
Date: 8.APR.2016 19:59:09

(802.11g Channel = 1 PK)



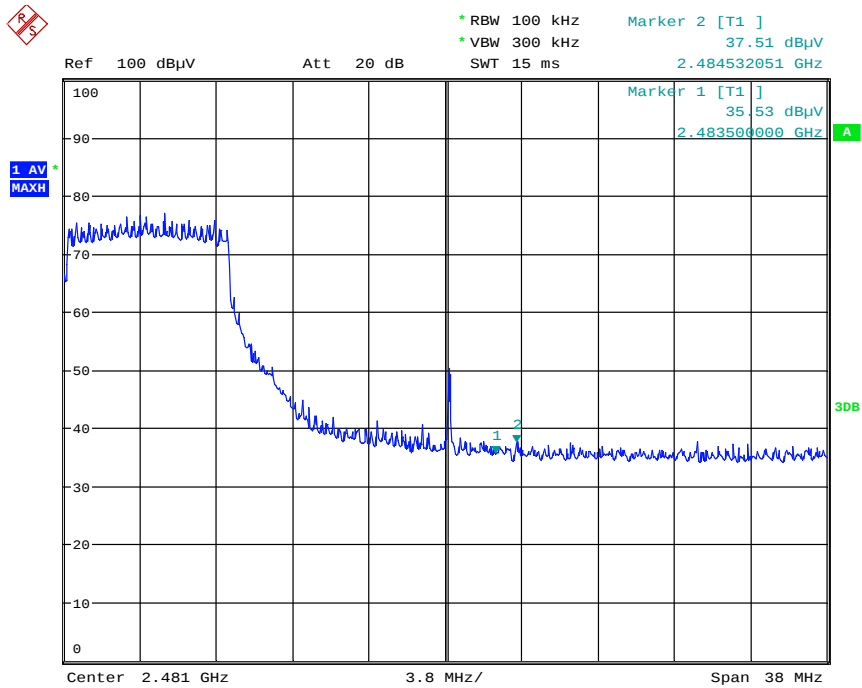
Date: 8.APR.2016 19:58:28

(802.11g Channel = 1 AV)



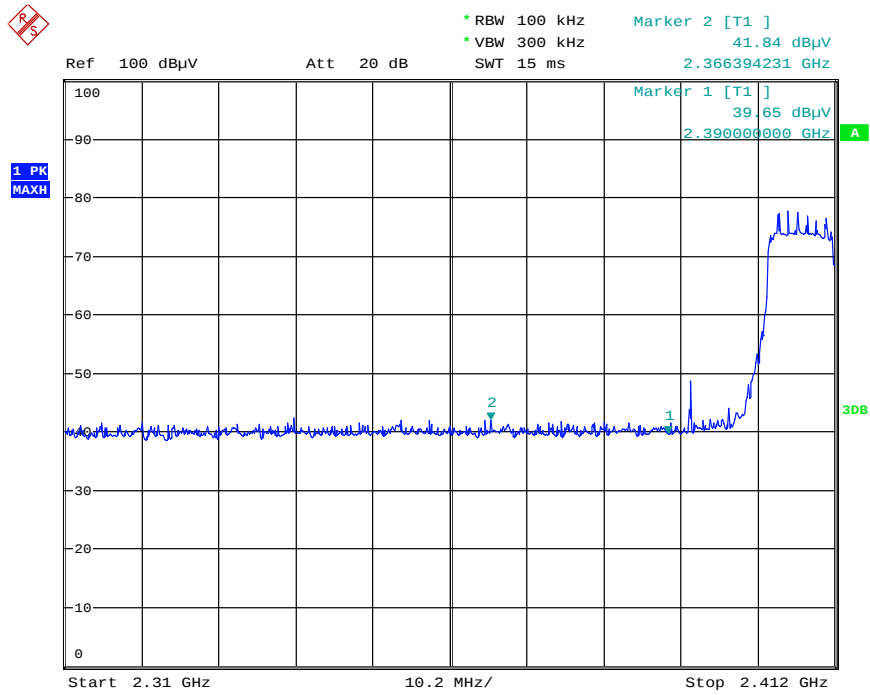
Date: 8.APR.2016 20:04:30

(802.11g Channel = 11 PK)



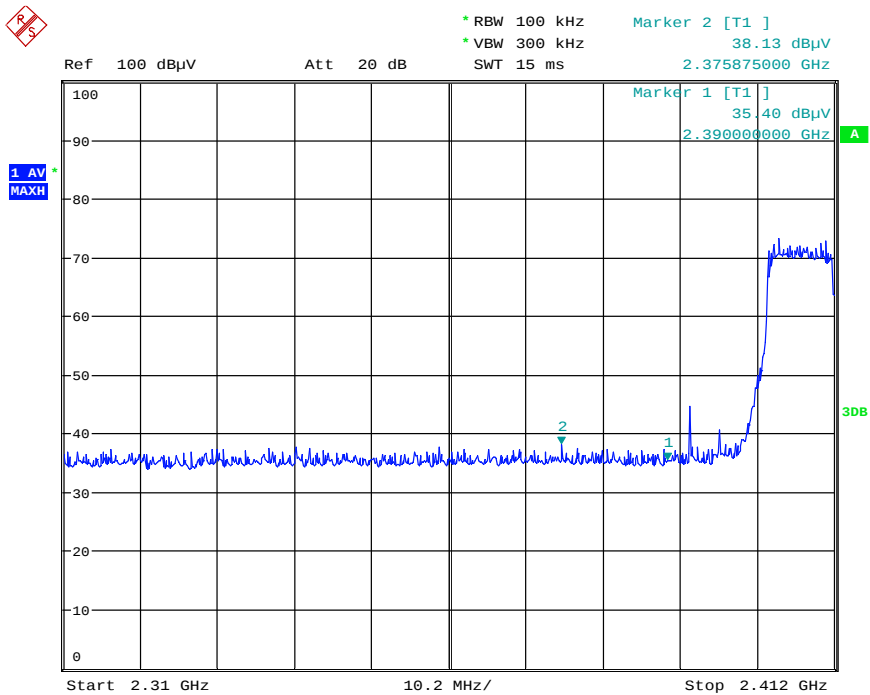
Date: 8.APR.2016 20:05:08

(802.11g Channel = 11 AV)



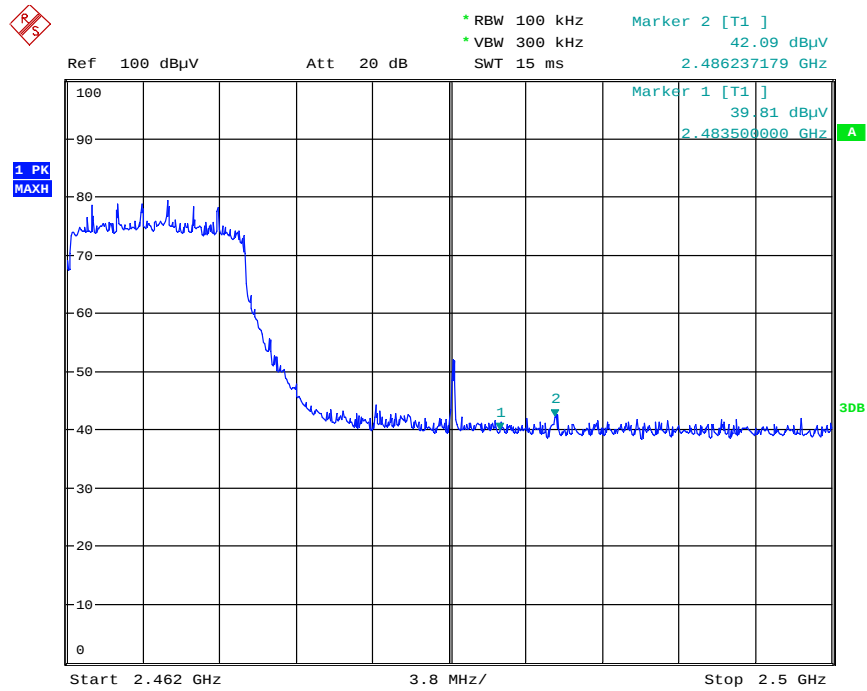
Date: 8.APR.2016 19:59:54

(802.11n-20MHz Channel = 1 PK)



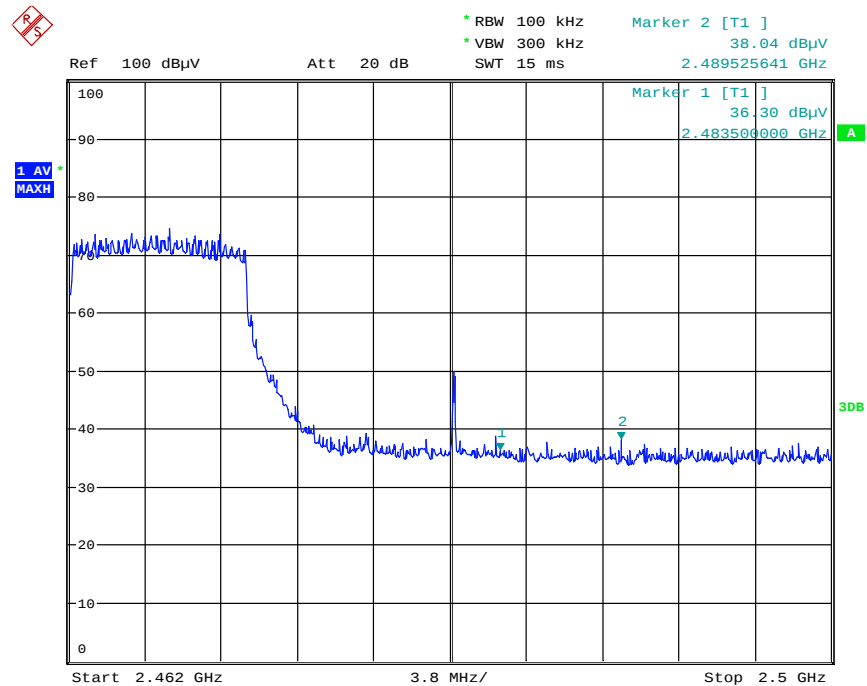
Date: 8.APR.2016 20:00:42

(802.11n-20MHz Channel = 1 AV)



Date: 8.APR.2016 20:03:51

(802.11n-20MHz Channel = 11 PK)



Date: 8.APR.2016 20:03:15

(802.11n-20MHz Channel = 11 AV)



## 5.6 Conducted Emission

### 5.6.1 Requirement

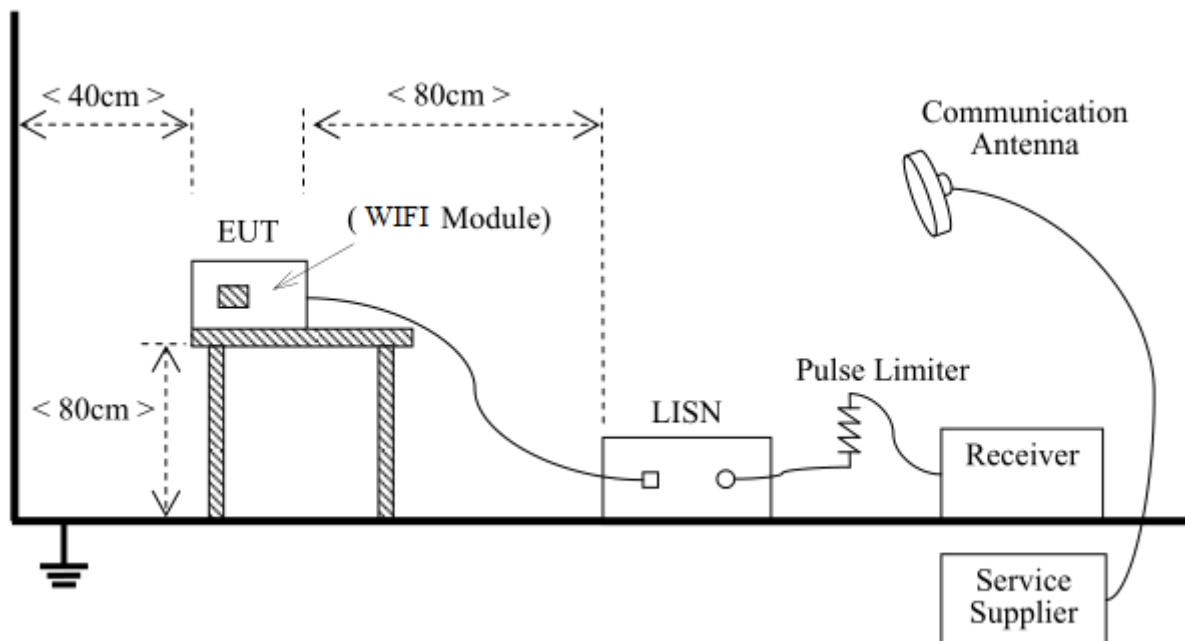
According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following 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.

### 5.6.2 Test Description



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT connected to Class B Computer/Laptop via USB data cable. The Computer/Laptop installed by US power 120V/60Hz, through a Line Impedance Stabilization Network (LISN), which was supplied power source and was grounded to the ground plane.

. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.10-2013

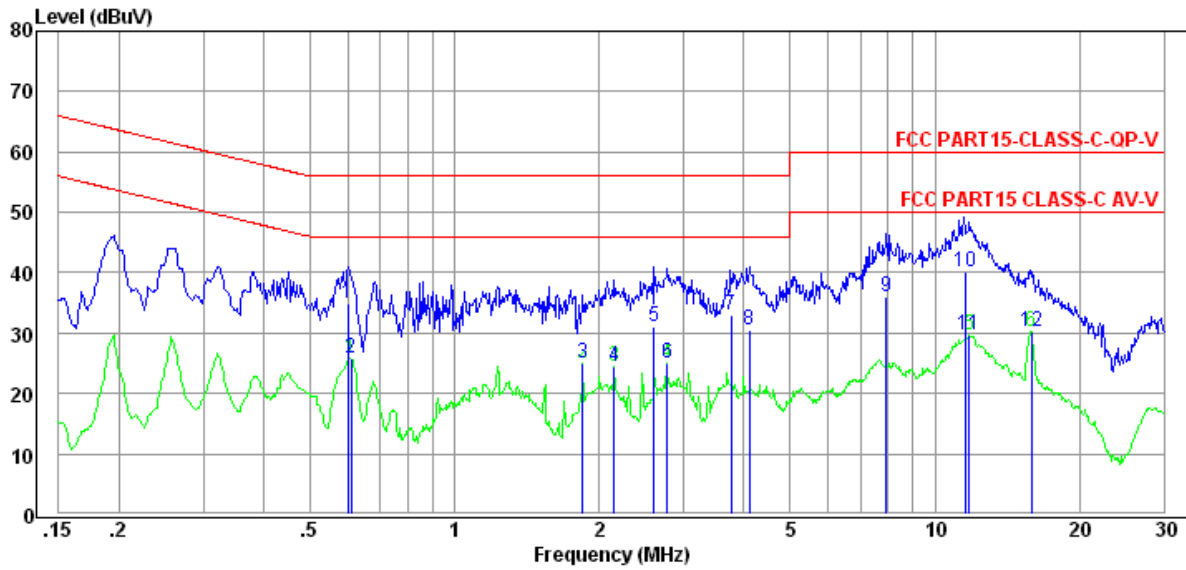


### 5.6.3 Test result

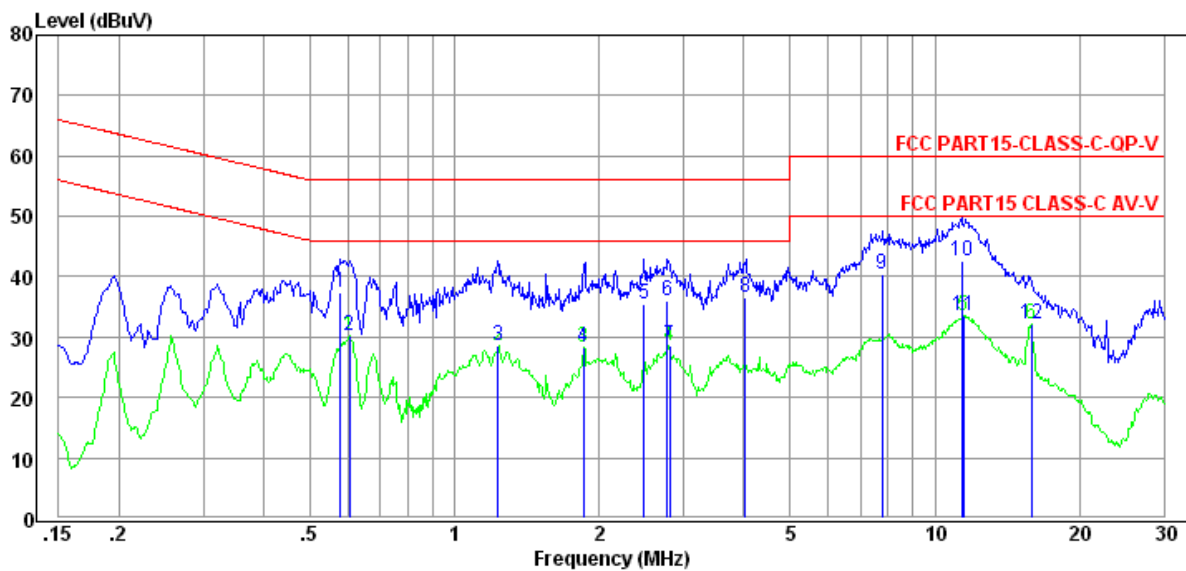
Test Verdict Recorded for Suspicious Points:

| Frequency (MHz) | Level (dBuV) | Limit Line (dBuV) | Margin (dB) | Phase line | Detector |
|-----------------|--------------|-------------------|-------------|------------|----------|
| 0.60            | 34.84        | 56.00             | 21.16       | L          | QP       |
| 0.61            | 25.83        | 56.00             | 30.17       | L          | Average  |
| 1.85            | 24.93        | 56.00             | 31.07       | L          | Average  |
| 2.15            | 24.47        | 56.00             | 31.53       | L          | Average  |
| 2.61            | 31.06        | 56.00             | 24.94       | L          | QP       |
| 2.77            | 25.10        | 56.00             | 30.90       | L          | Average  |
| 3.76            | 32.89        | 56.00             | 23.11       | L          | QP       |
| 4.12            | 30.46        | 56.00             | 25.54       | L          | QP       |
| 7.92            | 36.03        | 60.00             | 23.97       | L          | QP       |
| 11.54           | 40.23        | 60.00             | 19.77       | L          | QP       |
| 0.58            | 37.34        | 56.00             | 18.66       | N          | QP       |
| 0.61            | 30.12        | 46.00             | 15.88       | N          | Average  |
| 1.23            | 28.53        | 46.00             | 17.47       | N          | Average  |
| 1.86            | 28.24        | 46.00             | 17.76       | N          | Average  |
| 2.49            | 35.50        | 56.00             | 20.50       | N          | QP       |
| 2.78            | 36.05        | 56.00             | 19.95       | N          | QP       |
| 2.81            | 28.65        | 46.00             | 17.35       | N          | Average  |
| 4.04            | 36.56        | 56.00             | 19.44       | N          | QP       |
| 7.77            | 40.28        | 60.00             | 19.72       | N          | QP       |
| 11.42           | 42.55        | 60.00             | 17.45       | N          | QP       |
| 11.45           | 33.54        | 50.00             | 16.46       | N          | Average  |
| 15.92           | 32.28        | 50.00             | 17.72       | N          | Average  |

### 5.6.4 Test Plot



L Line



N Line



## 5.7 Radiated Emission

### 5.7.1 Requirement

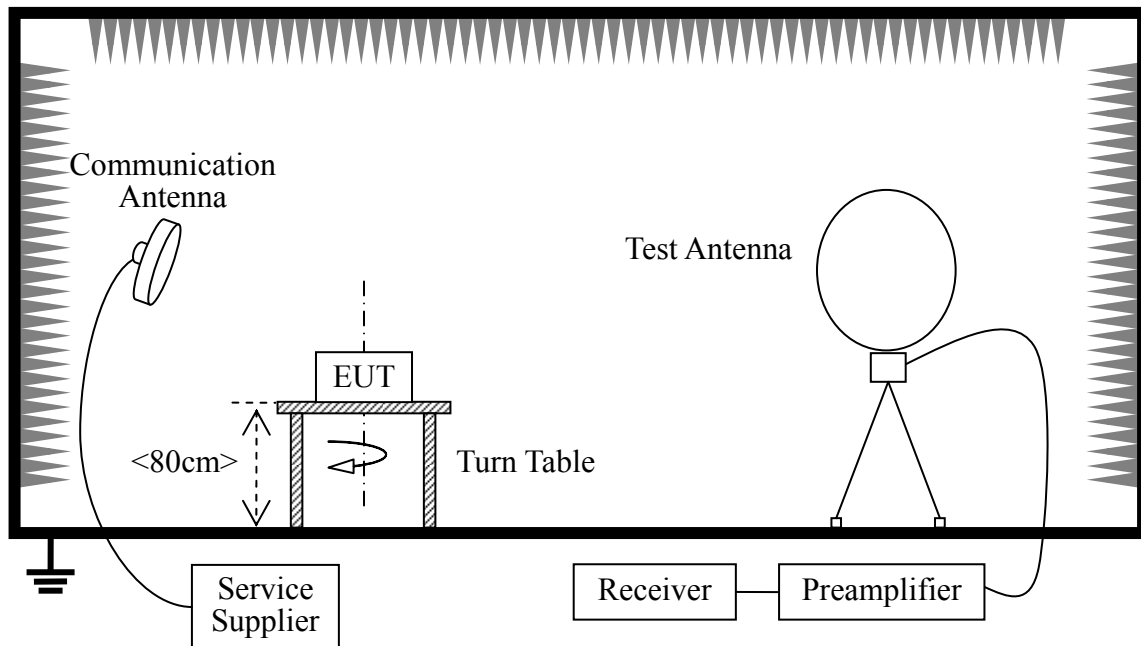
According to FCC section 15.247(c), radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the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

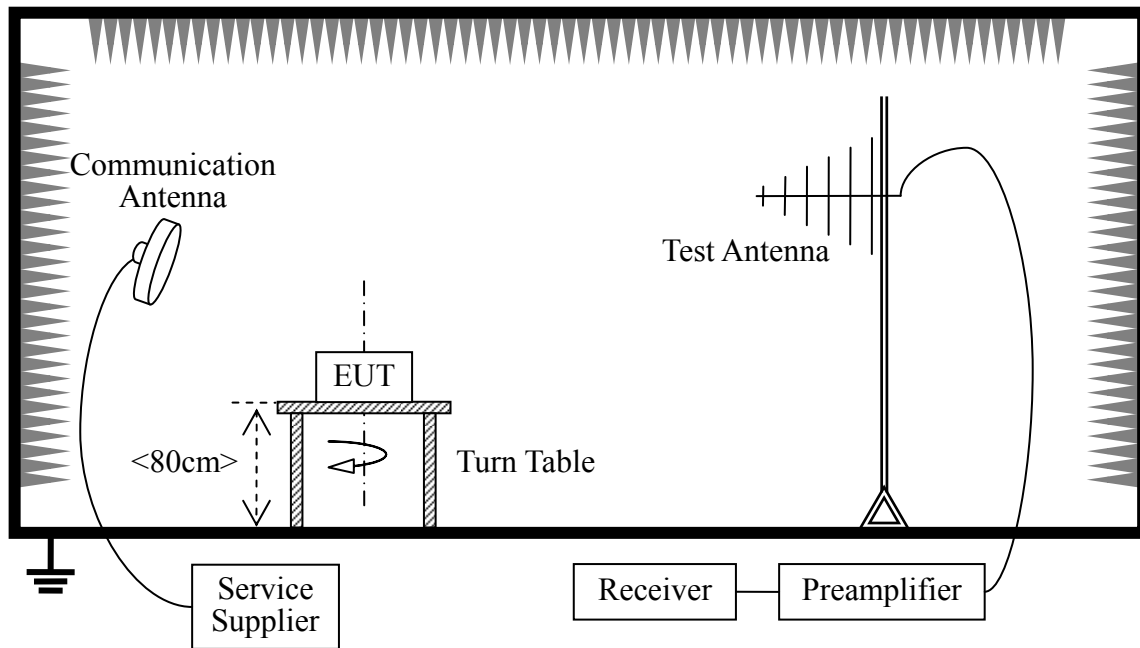
| Frequency (MHz) | Field Strength ( $\mu\text{V/m}$ ) | Measurement Distance (m) | Limit( $\text{dB}\mu\text{V/m}$ ) | Detector |
|-----------------|------------------------------------|--------------------------|-----------------------------------|----------|
| 0.009-0.490     | 2400/F(kHz)                        | 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)

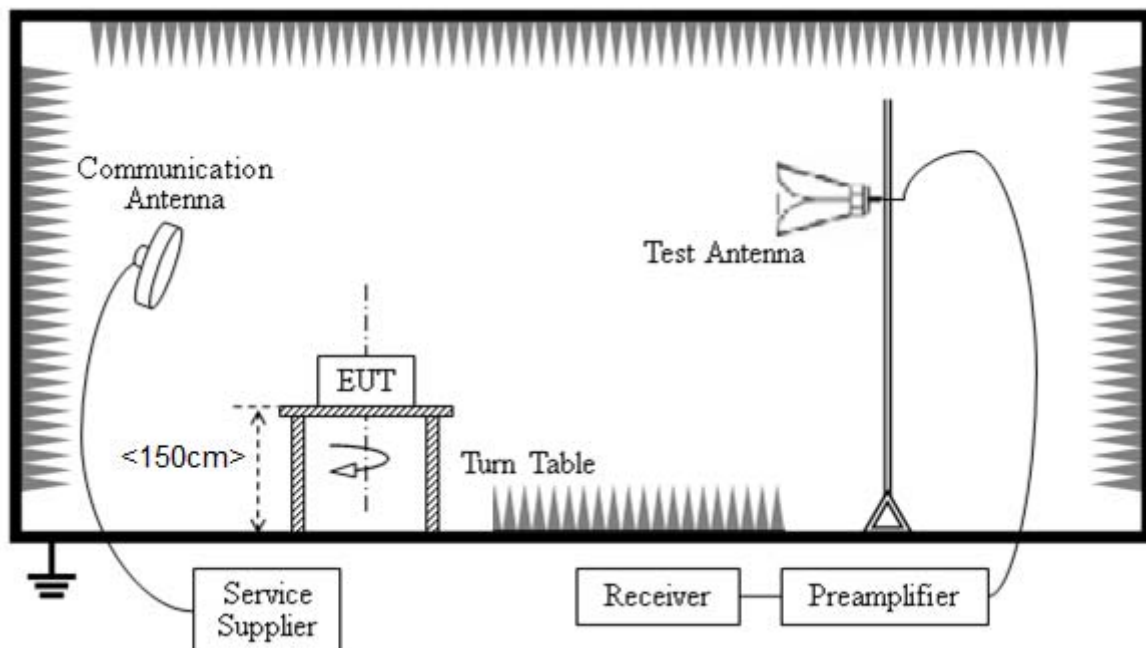
### 5.7.2 Test setup



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 Wifi 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. 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.

### 5.7.3 Test Result

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

| Frequency<br>(MHz) | Level<br>(dBuV) | Over Limit<br>(dB) | Limit Line<br>(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

| Frequency<br>(MHz) | Level<br>(dBuV) | Limit Line<br>(dBuV) | Margin<br>(dB) | Antenna<br>Polarization | Result |
|--------------------|-----------------|----------------------|----------------|-------------------------|--------|
| 53.88              | 21.99           | 40.00                | 18.01          | Horizontal              | PASS   |
| 100.23             | 19.78           | 43.50                | 23.72          | Horizontal              | PASS   |
| 318.82             | 22.47           | 46.00                | 23.53          | Horizontal              | PASS   |
| 3142.24            | 34.69           | 54.00                | 19.31          | Horizontal              | PASS   |
| 3698.71            | 45.34           | 54.00                | 8.66           | Horizontal              | PASS   |
| 4594.17            | 37.84           | 54.00                | 16.16          | Horizontal              | PASS   |
| 4874.00            | 37.85           | 54.00                | 16.15          | Horizontal              | PASS   |
| 53.88              | 21.99           | 40.00                | 18.01          | Vertical                | PASS   |
| 100.23             | 19.78           | 43.50                | 23.72          | Vertical                | PASS   |
| 318.82             | 22.47           | 46.00                | 23.53          | Vertical                | PASS   |
| 3698.71            | 48.88           | 54.00                | 5.12           | Vertical                | PASS   |
| 4284.09            | 35.82           | 54.00                | 18.18          | Vertical                | PASS   |
| 4400.79            | 37.24           | 54.00                | 16.76          | Vertical                | PASS   |
| 4882.74            | 45.01           | 54.00                | 8.99           | Vertical                | PASS   |

Note:

*The worst case (802.11g Channel 6:2437MHz) is recorded in the report.*



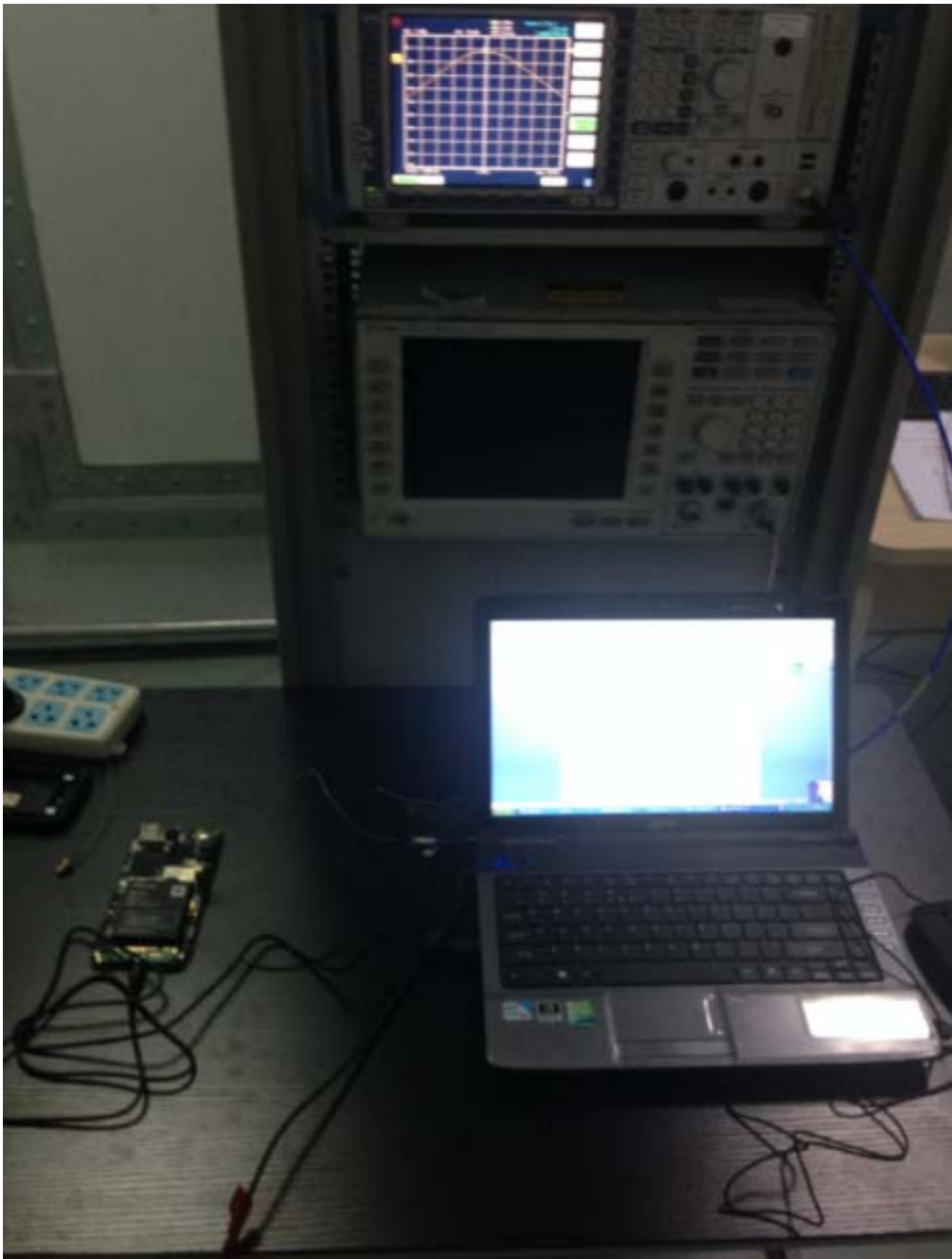
## Annex A Photos of the EUT





## Annex B Photos of Setup

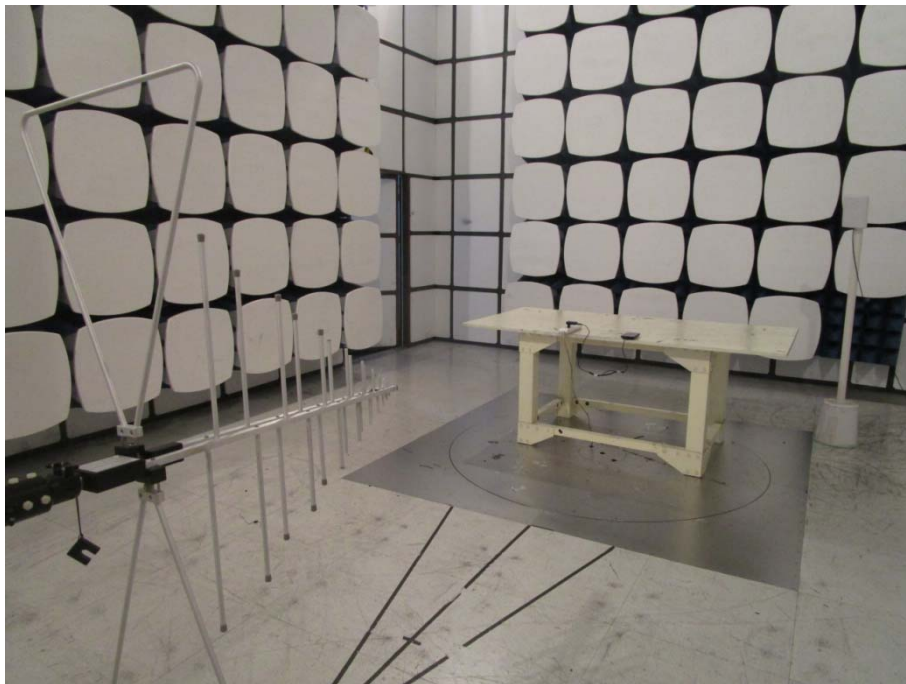
### 1. RF

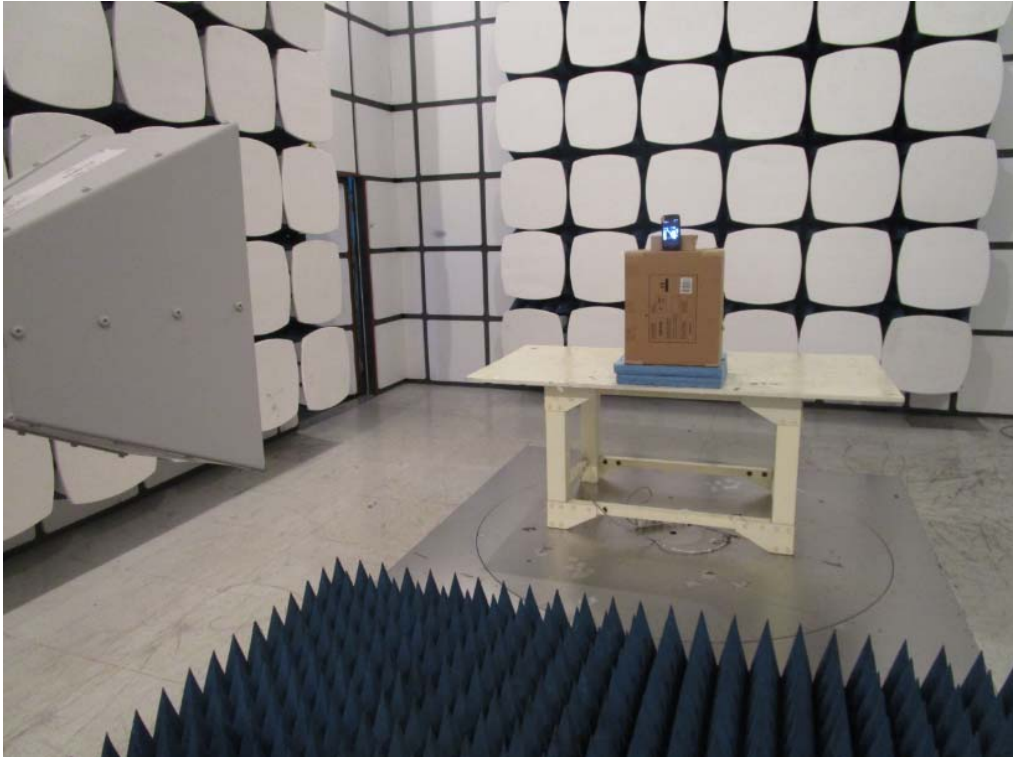


### 2. Conducted Emission



### 3. Radiated Emission





\*\* END OF REPORT \*\*