

## FCC TEST REPORT

For

SBD TECHNOLOGY HK CO.,LTD

Smart Glasses

Model No.: SG2

Additional Model No.: SG2-01, SG2-02, SG2-03

Prepared for : SBD TECHNOLOGY HK CO.,LTD  
Address : Unit A5,9/F Silvercorp International Tower,707-713 Nathan Road,  
Mongkok, Kowloon,Hong kong

Prepared by : Shenzhen LCS Compliance Testing Laboratory Ltd.  
Address : 1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue,  
Bao'an District, Shenzhen, Guangdong, China  
Tel : (+86)755-82591330  
Fax : (+86)755-82591332  
Web : www.LCS-cert.com  
Mail : webmaster@LCS-cert.com

Date of receipt of test sample : January 19, 2016  
Number of tested samples : 1  
Serial number : Prototype  
Date of Test : January 19, 2016 – January 22, 2016  
Date of Report : January 22, 2016

**FCC TEST REPORT**  
**FCC CFR 47 PART 15 C(15.247): 2015**

**Report Reference No. .... : LCS1601181191E**

Date of Issue ..... : January 22, 2016

**Testing Laboratory Name..... : Shenzhen LCS Compliance Testing Laboratory Ltd.**

Address ..... : 1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue,  
Bao'an District, Shenzhen, Guangdong, China

Testing Location/ Procedure..... : Full application of Harmonised standards ☒  
Partial application of Harmonised standards ☐  
Other standard testing method ☐

**Applicant's Name ..... : SBD TECHNOLOGY HK CO.,LTD**

Address ..... : Unit A5,9/F Silvercorp International Tower,707-713 Nathan  
Road, Mongkok, Kowloon,Hong kong

**Test Specification**

Standard ..... : FCC CFR 47 PART 15 C(15.247): 2015

**Test Report Form No. .... : LCSEMC-1.0**

TRF Originator ..... : Shenzhen LCS Compliance Testing Laboratory Ltd.

Master TRF..... : Dated 2011-03

**Shenzhen LCS Compliance Testing Laboratory Ltd. All rights reserved.**

This publication may be reproduced in whole or in part for non-commercial purposes as long as the Shenzhen LCS Compliance Testing Laboratory Ltd. is acknowledged as copyright owner and source of the material. Shenzhen LCS Compliance Testing Laboratory Ltd. takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.

**Test Item Description. .... : Smart Glasses**

Trade Mark ..... : N/A

Model/ Type reference..... : SG2

Ratings ..... : DC 3.7V by battery

Result ..... : **Positive**

**Compiled by:**

*Jacky Li*

Jacky Li/ File administrators

**Supervised by:**

*Glin Lu*

Glin Lu/ Technique principal

**Approved by:**

*Gavin Liang*

Gavin Liang/ Manager

**FCC -- TEST REPORT****Test Report No. : LCS1601181191E**January 22, 2016

Date of issue

Type / Model..... : SG2

EUT..... : Smart Glasses

**Applicant..... : SBD TECHNOLOGY HK CO.,LTD**Address..... : Unit A5,9/F Silvercorp International Tower,707-713 Nathan Road,  
Mongkok, Kowloon,Hong kong

Telephone..... : /

Fax..... : /

**Manufacturer..... : Shenzhen Spardar Smart Technology Co.,ltd**Address..... : 5/F,Business Building,Longsheng Road 2# ,Longhua New District,  
Shenzhen City, Guangdong Province, China

Telephone..... : /

Fax..... : /

**Factory..... : Shenzhen Spardar Smart Technology Co.,ltd**Address..... : 5/F,Business Building,Longsheng Road 2# ,Longhua New District,  
Shenzhen City, Guangdong Province, China

Telephone..... : /

Fax..... : /

**Test Result****Positive**

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

## TABLE OF CONTENTS

|  |           |
|--|-----------|
| <b>1. GENERAL INFORMATION.....</b>                         | <b>5</b>  |
| 1.1. DESCRIPTION OF DEVICE (EUT) .....                     | 5         |
| 1.2. HOST SYSTEM CONFIGURATION LIST AND DETAILS .....      | 5         |
| 1.3. EXTERNAL I/O CABLE.....                               | 5         |
| 1.4. DESCRIPTION OF TEST FACILITY .....                    | 6         |
| 1.5. STATEMENT OF THE MEASUREMENT UNCERTAINTY .....        | 6         |
| 1.6. MEASUREMENT UNCERTAINTY .....                         | 6         |
| 1.7. DESCRIPTION OF TEST MODES.....                        | 7         |
| <b>2. TEST METHODOLOGY .....</b>                           | <b>8</b>  |
| 2.1. EUT CONFIGURATION.....                                | 8         |
| 2.2. EUT EXERCISE.....                                     | 8         |
| 2.3. GENERAL TEST PROCEDURES.....                          | 8         |
| <b>3. SYSTEM TEST CONFIGURATION.....</b>                   | <b>9</b>  |
| 3.1. JUSTIFICATION .....                                   | 9         |
| 3.2. EUT EXERCISE SOFTWARE .....                           | 9         |
| 3.3. SPECIAL ACCESSORIES .....                             | 9         |
| 3.4. BLOCK DIAGRAM/SCHEMATICS .....                        | 9         |
| 3.5. EQUIPMENT MODIFICATIONS .....                         | 9         |
| 3.6. TEST SETUP.....                                       | 9         |
| <b>4. SUMMARY OF TEST RESULTS.....</b>                     | <b>10</b> |
| <b>5. TEST RESULT .....</b>                                | <b>11</b> |
| 5.1. MAXIMUM CONDUCTED OUTPUT POWER MEASUREMENT.....       | 11        |
| 5.2. POWER SPECTRAL DENSITY MEASUREMENT .....              | 14        |
| 5.3. 6 dB SPECTRUM BANDWIDTH MEASUREMENT .....             | 20        |
| 5.4. RADIATED EMISSIONS MEASUREMENT .....                  | 26        |
| 5.5. CONDUCTED SPURIOUS EMISSIONS AND BAND EDGES TEST..... | 42        |
| 5.6. POWER LINE CONDUCTED EMISSIONS .....                  | 53        |
| 5.7. ANTENNA REQUIREMENTS .....                            | 56        |
| <b>6. LIST OF MEASURING EQUIPMENTS .....</b>               | <b>57</b> |

## 1. GENERAL INFORMATION

### 1.1. Description of Device (EUT)

|                       |  |
|-----------------------|--|
| EUT                   | : Smart Glasses  |
| Model Number          | : SG2  |
| Power Supply          | : DC 3.7V by battery   |
| Frequency Range       | : 2412.00-2462.00MHz for 802.11b/g/n   |
| Channel Spacing       | : 5MHz for 802.11b/g/n   |
| Channel Number        | : 11 Channels for 20MHz Bandwidth;<br>7 Channels for 40MHz Bandwidth   |
| Modulation Technology | : IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK)<br>IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK)<br>IEEE 802.11n: OFDM (64QAM, 16QAM,QPSK,BPSK) |
| Data Rates            | : IEEE 802.11b: 1-11Mbps<br>IEEE 802.11g: 6-54Mbps<br>IEEE 802.11n: MCS0-MCS7  |
| Antenna Type And Gain | : PIFA antenna, 2.0 dBi  |

### 1.2. Host System Configuration List and Details

| Manufacturer | Description | Model | Serial Number | Certificate |
|--------------|-------------|-------|---------------|-------------|
| Lenovo       | PC          | B470  | --            | DOC         |

### 1.3. External I/O Cable

| I/O Port Description | Quantity | Cable          |
|----------------------|----------|----------------|
| DC                   | 1        | N/A            |
| USB                  | 1        | 0.8m, Shielded |
| TF Card              | 1        | N/A            |
| Earphone             | 1        | N/A            |

## 1.4. Description of Test Facility

### Site Description EMC Lab.

: CNAS Registration Number. is L4595.  
FCC Registration Number. is 899208.  
Industry Canada Registration Number. is 9642A-1.  
VCCI Registration Number. is C-4260 and R-3804.  
ESMD Registration Number. is ARCB0108.  
UL Registration Number. is 100571-492.  
TUV SUD Registration Number. is SCN1081.  
TUV RH Registration Number. is UA 50296516-001

## 1.5. Statement of The Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the LCS quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

## 1.6. Measurement Uncertainty

| Test Item              |   | Frequency Range | Uncertainty         | Note |
|------------------------|---|-----------------|---------------------|------|
| Radiation Uncertainty  | : | 9KHz~30MHz      | $\pm 3.10\text{dB}$ | (1)  |
|                        |   | 30MHz~200MHz    | $\pm 2.96\text{dB}$ | (1)  |
|                        |   | 200MHz~1000MHz  | $\pm 3.10\text{dB}$ | (1)  |
|                        |   | 1GHz~26.5GHz    | $\pm 3.80\text{dB}$ | (1)  |
|                        |   | 26.5GHz~40GHz   | $\pm 3.90\text{dB}$ | (1)  |
| Conduction Uncertainty | : | 150kHz~30MHz    | $\pm 1.63\text{dB}$ | (1)  |
| Power disturbance      | : | 30MHz~300MHz    | $\pm 1.60\text{dB}$ | (1)  |

(1). This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .

## 1.7. Description Of Test Modes

The EUT has been tested under operating condition.

This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.

Worst-case mode and channel used for 150kHz-30 MHz power line conducted emissions was the mode and channel with the highest output power, that was determined to be 802.11b mode(High Channel).

Worst-case mode and channel used for 9kHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be 802.11b mode(High Channel).

Worst-Case data rates were utilized from preliminary testing of the Chipset, worst-case data rates used during the testing are as follows:

802.11b Mode : 1 Mbps, DSSS.

802.11g Mode : 6 Mbps, OFDM.

802.11n Mode HT20: MCS0, OFDM.

802.11n Mode HT40: MCS0, OFDM.

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

### Channel List & Frequency

#### 802.11b/g/n(HT20)

| Frequency Band | Channel No. | Frequency(MHz) | Channel No. | Frequency(MHz) |
|----------------|-------------|----------------|-------------|----------------|
| 2412~2462MHz   | 1           | 2412           | 7           | 2442           |
|                | 2           | 2417           | 8           | 2447           |
|                | 3           | 2422           | 9           | 2452           |
|                | 4           | 2427           | 10          | 2457           |
|                | 5           | 2432           | 11          | 2462           |
|                | 6           | 2437           | --          | --             |

#### 802.11b/g/n(HT40)

| Frequency Band | Channel No. | Frequency(MHz) | Channel No. | Frequency(MHz) |
|----------------|-------------|----------------|-------------|----------------|
| 2422~2452MHz   | 1           | --             | 7           | 2442           |
|                | 2           | --             | 8           | 2447           |
|                | 3           | 2422           | 9           | 2452           |
|                | 4           | 2427           | 10          | --             |
|                | 5           | 2432           | 11          | --             |
|                | 6           | 2437           | --          | --             |

## 2. TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10: 2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Shenzhen LCS Compliance Testing Laboratory Ltd..

### 2.1. EUT Configuration

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

### 2.2. EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to FCC's request, Test Procedure KDB558074 D01 DTS Meas. Guidance v03r03 is required to be used for this kind of FCC 15.247 digital modulation device.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

### 2.3. General Test Procedures

#### 2.3.1 Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

#### 2.3.2 Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013



### **3. SYSTEM TEST CONFIGURATION**

#### **3.1. Justification**

The system was configured for testing in a continuous transmit condition.

#### **3.2. EUT Exercise Software**

N/A

#### **3.3. Special Accessories**

N/A

#### **3.4. Block Diagram/Schematics**

Please refer to the related document

#### **3.5. Equipment Modifications**

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

#### **3.6. Test Setup**

Please refer to the test setup photo.

## 4. SUMMARY OF TEST RESULTS

| Applied Standard: FCC Part 15 Subpart C |   |           |
|---|---|-----------|
| FCC Rules                               | Description of Test                       | Result    |
| §15.247(b)                              | Maximum Conducted Output Power            | Compliant |
| §15.247(e)                              | Power Spectral Density                    | Compliant |
| §15.247(a)(2)                           | 6dB Bandwidth                             | Compliant |
| §15.247(a)                              | Occupied Bandwidth                        | Compliant |
| §15.209, §15.247(d)                     | Radiated and Conducted Spurious Emissions | Compliant |
| §15.205                                 | Emissions at Restricted Band              | Compliant |
| §15.207(a)                              | Conducted Emissions                       | Compliant |
| §15.203                                 | Antenna Requirements                      | Compliant |

## 5. TEST RESULT

### 5.1. Maximum Conducted Output Power Measurement

#### 5.1.1. Standard Applicable

According to §15.247(b): For systems using digital modulation in the 2400-2483.5 MHz and 5725-5850 MHz band, the limit for maximum peak conducted output power is 30dBm. The limit has to be reduced by the amount in dB that the gain of the antenna exceeds 6dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi without any corresponding reduction in transmitter peak output power.

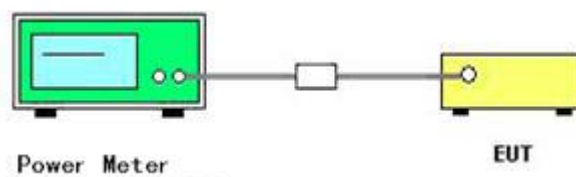
#### 5.1.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of the power meter.

#### 5.1.3. Test Procedures

The transmitter output (antenna port) was connected to the power meter.

#### 5.1.4. Test Setup Layout



#### 5.1.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

## 5.1.6. Test Result of Maximum Conducted Output Power

|               |       |                |             |
|---------------|-------|----------------|-------------|
| Temperature   | 25°C  | Humidity       | 60%         |
| Test Engineer | Jacky | Configurations | 802.11b/g/n |

## 802.11b

| Channel | Frequency (MHz) | Conducted Peak Power (dBm) | Max. Limit (dBm) | Result   |
|---------|-----------------|----------------------------|------------------|----------|
| 1       | 2412            | 7.51                       | 30               | Complies |
| 6       | 2437            | 7.04                       | 30               | Complies |
| 11      | 2462            | 7.32                       | 30               | Complies |

## 802.11g

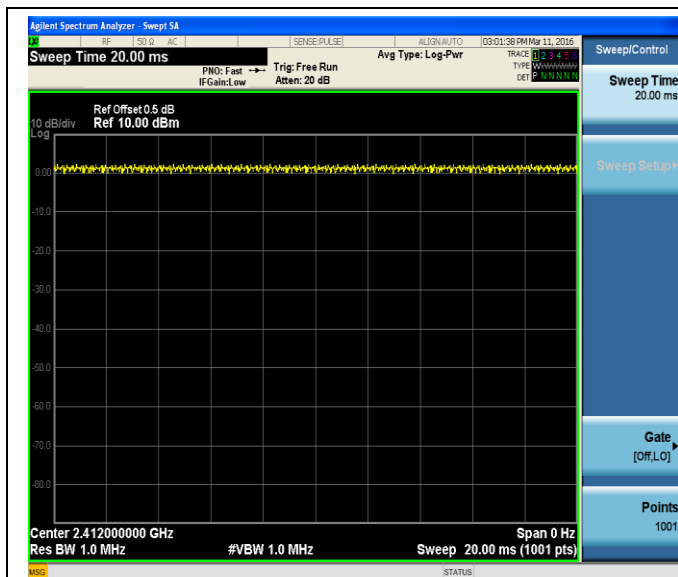
| Channel | Frequency (MHz) | Conducted Peak Power (dBm) | Max. Limit (dBm) | Result   |
|---------|-----------------|----------------------------|------------------|----------|
| 1       | 2412            | 7.27                       | 30               | Complies |
| 6       | 2437            | 6.88                       | 30               | Complies |
| 11      | 2462            | 7.19                       | 30               | Complies |

## 802.11n HT20

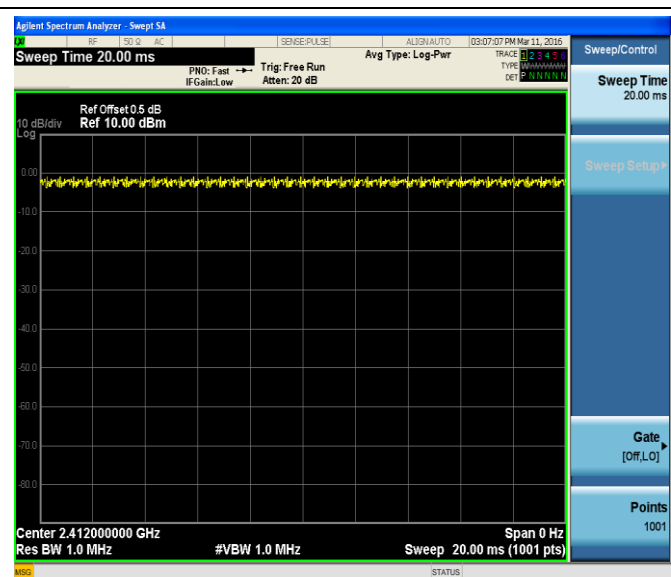
| Channel | Frequency (MHz) | Conducted Peak Power (dBm) | Max. Limit (dBm) | Result   |
|---------|-----------------|----------------------------|------------------|----------|
| 1       | 2412            | 6.98                       | 30               | Complies |
| 6       | 2437            | 6.54                       | 30               | Complies |
| 11      | 2462            | 6.94                       | 30               | Complies |

## 802.11n HT40

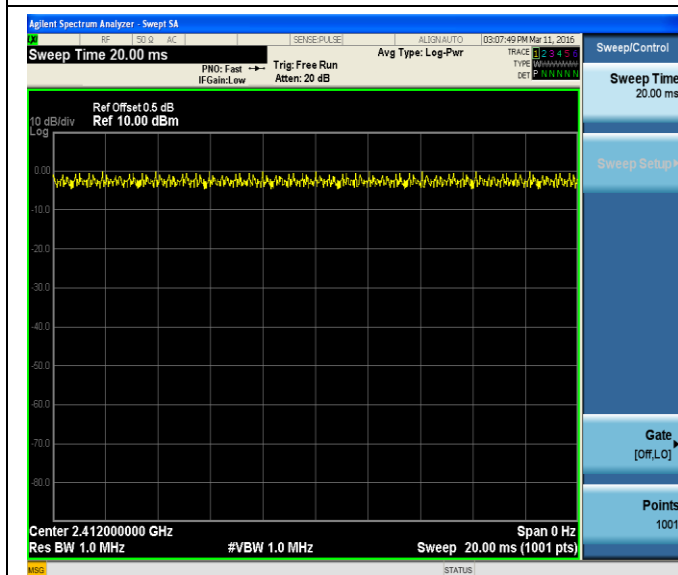
| Channel | Frequency (MHz) | Conducted Peak Power (dBm) | Max. Limit (dBm) | Result   |
|---------|-----------------|----------------------------|------------------|----------|
| 3       | 2422            | 6.96                       | 30               | Complies |
| 6       | 2437            | 6.82                       | 30               | Complies |
| 9       | 2452            | 7.04                       | 30               | Complies |



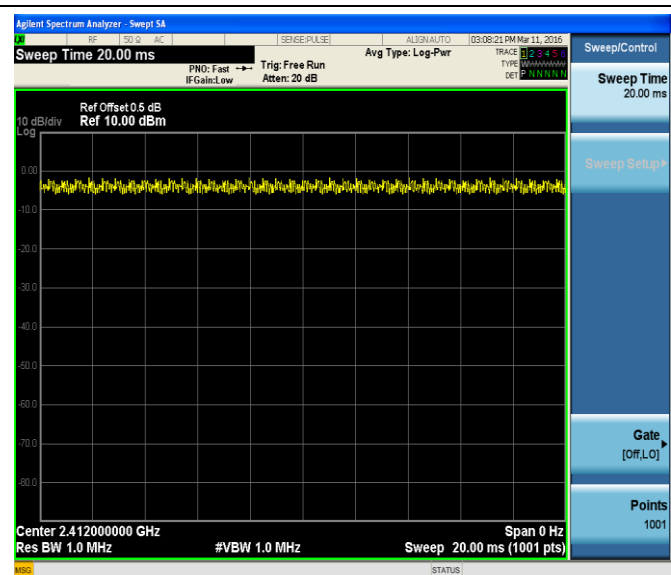
Test plot of duty cycle for 802.11b



Test plot of duty cycle for 802.11g



Test plot of duty cycle for 802.11n-HT20



Test plot of duty cycle for 802.11n-HT40

## 5.2. Power Spectral Density Measurement

### 5.2.1. Standard Applicable

According to §15.247(e): For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

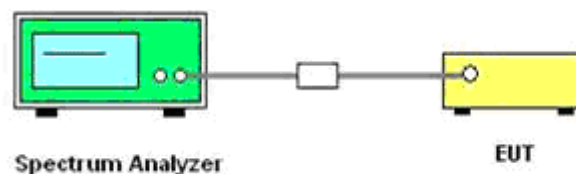
### 5.2.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of Spectrum Analyzer.

### 5.2.3. Test Procedures

1. The transmitter was connected directly to a Spectrum Analyzer through a directional couple.
2. The power was monitored at the coupler port with a Spectrum Analyzer. The power level was set to the maximum level.
3. Set the RBW = 3 kHz.
4. Set the VBW  $\geq 3 \times$  RBW
5. Set the span to 1.5 times the DTS channel bandwidth.
6. Detector = peak.
7. Sweep time = auto couple.
8. Trace mode = max hold.
9. Allow trace to fully stabilize.
10. Use the peak marker function to determine the maximum power level in any 3 kHz band segment within the fundamental EBW.

### 5.2.4. Test Setup Layout



### 5.2.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

## 5.2.6. Test Result of Power Spectral Density

|               |       |                |             |
|---------------|-------|----------------|-------------|
| Temperature   | 25°C  | Humidity       | 60%         |
| Test Engineer | Jakcy | Configurations | 802.11b/g/n |

## 802.11b

| Channel | Frequency (MHz) | Power Density (dBm/3KHz) | Max. Limit (dBm/3KHz) | Result   |
|---------|-----------------|--------------------------|-----------------------|----------|
| 1       | 2412            | -21.014                  | 8                     | Complies |
| 6       | 2437            | -22.640                  | 8                     | Complies |
| 11      | 2462            | -21.789                  | 8                     | Complies |

## 802.11g

| Channel | Frequency (MHz) | Power Density (dBm/3KHz) | Max. Limit (dBm/3KHz) | Result   |
|---------|-----------------|--------------------------|-----------------------|----------|
| 1       | 2412            | -27.075                  | 8                     | Complies |
| 6       | 2437            | -26.363                  | 8                     | Complies |
| 11      | 2462            | -26.588                  | 8                     | Complies |

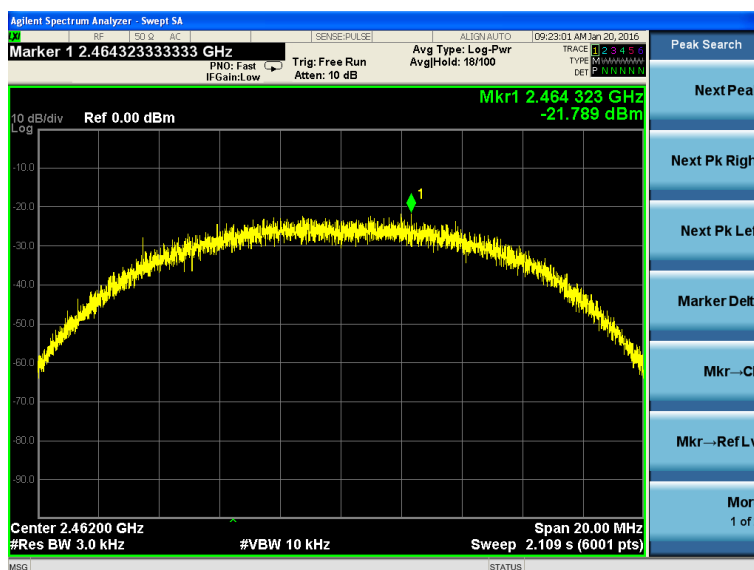
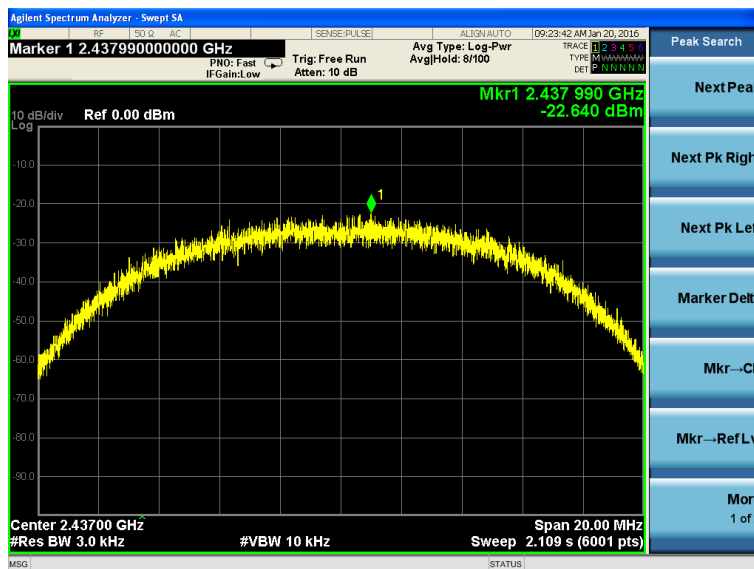
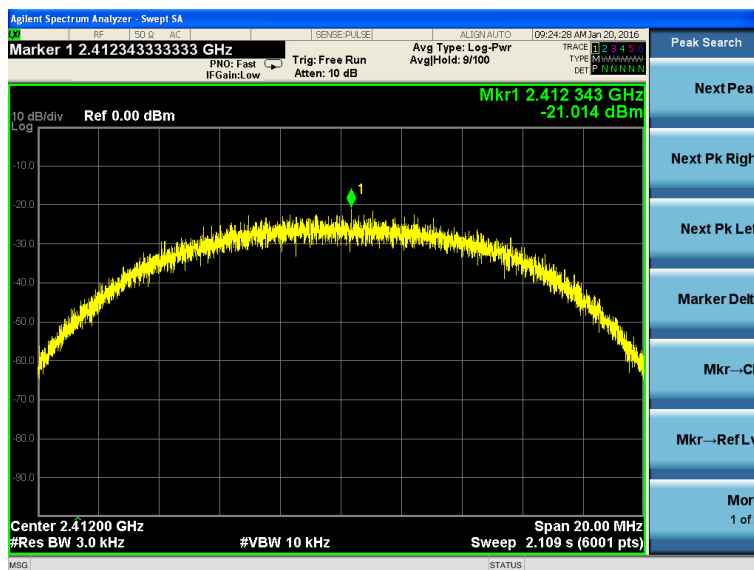
## 802.11n HT20

| Channel | Frequency (MHz) | Power Density (dBm/3KHz) | Max. Limit (dBm/3KHz) | Result   |
|---------|-----------------|--------------------------|-----------------------|----------|
| 1       | 2412            | -27.278                  | 8                     | Complies |
| 6       | 2437            | -27.050                  | 8                     | Complies |
| 11      | 2462            | -27.267                  | 8                     | Complies |

## 802.11n HT40

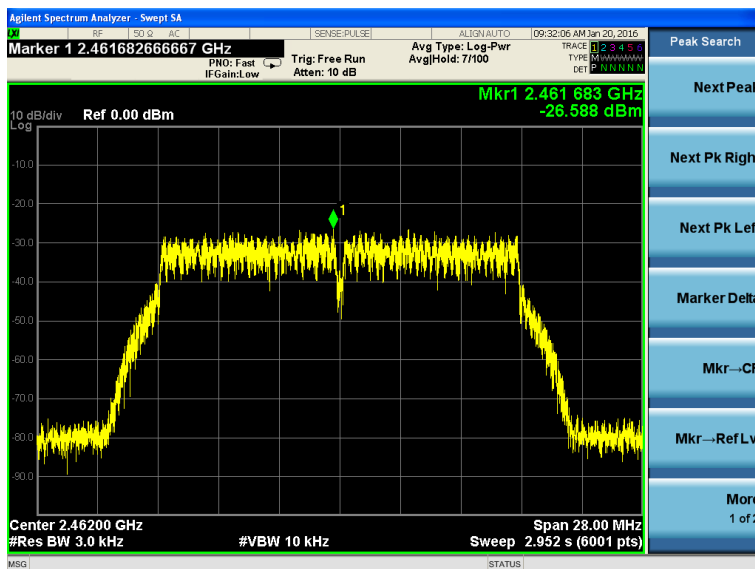
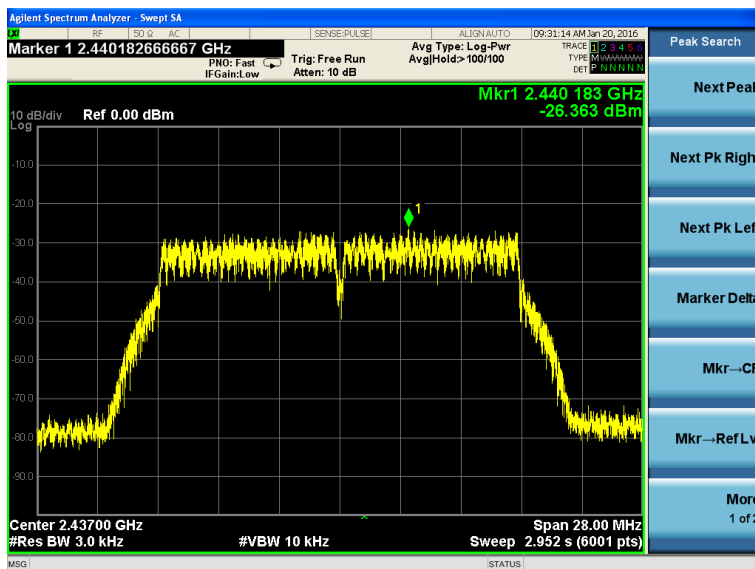
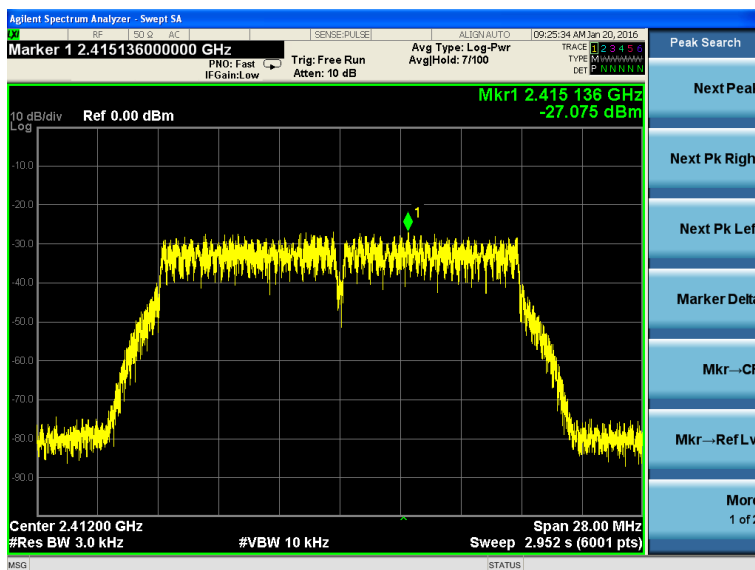
| Channel | Frequency (MHz) | Power Density (dBm/3KHz) | Max. Limit (dBm/3KHz) | Result   |
|---------|-----------------|--------------------------|-----------------------|----------|
| 3       | 2422            | -29.228                  | 8                     | Complies |
| 6       | 2437            | -28.606                  | 8                     | Complies |
| 9       | 2452            | -28.335                  | 8                     | Complies |

## 802.11b power density

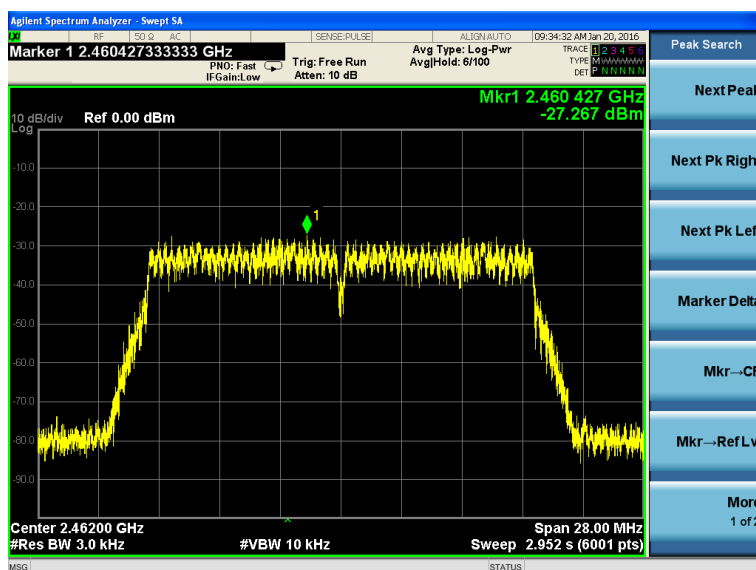
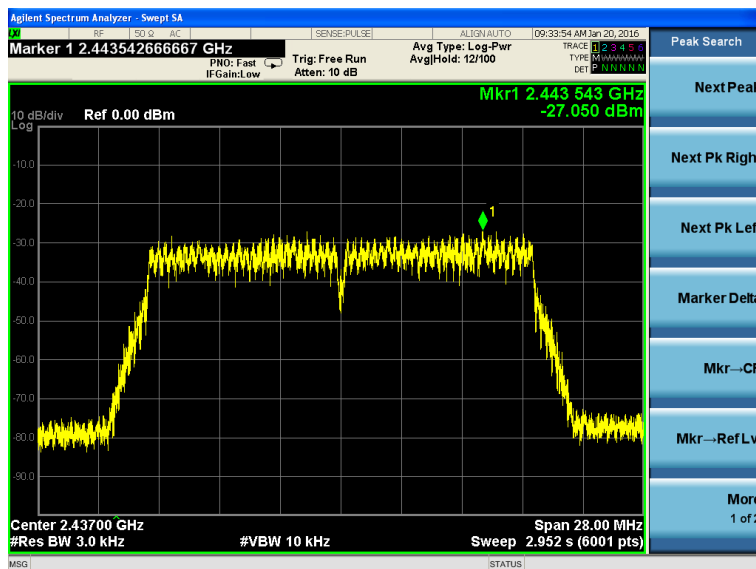
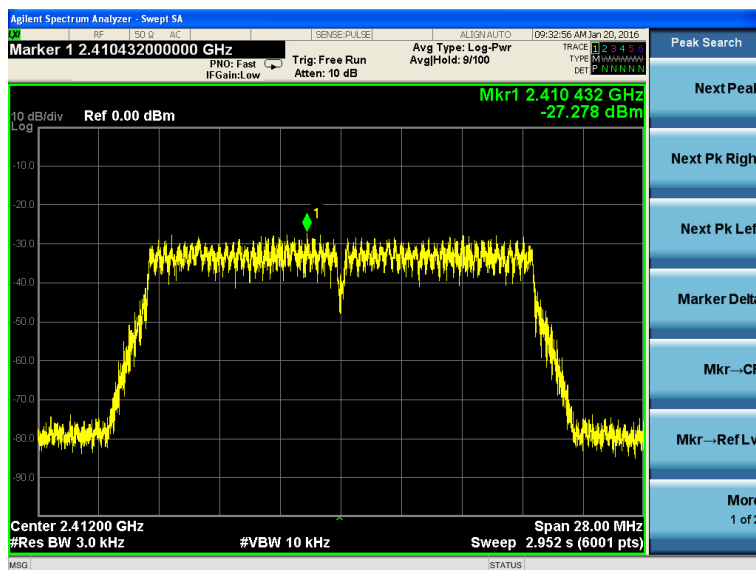




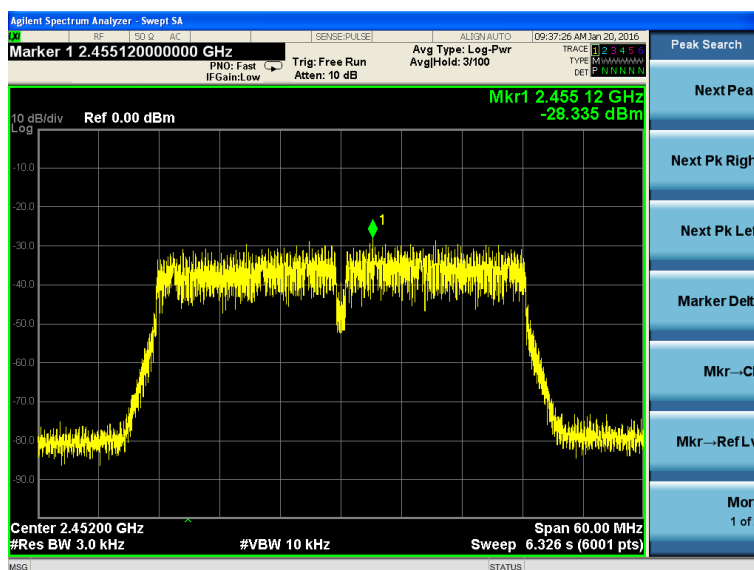
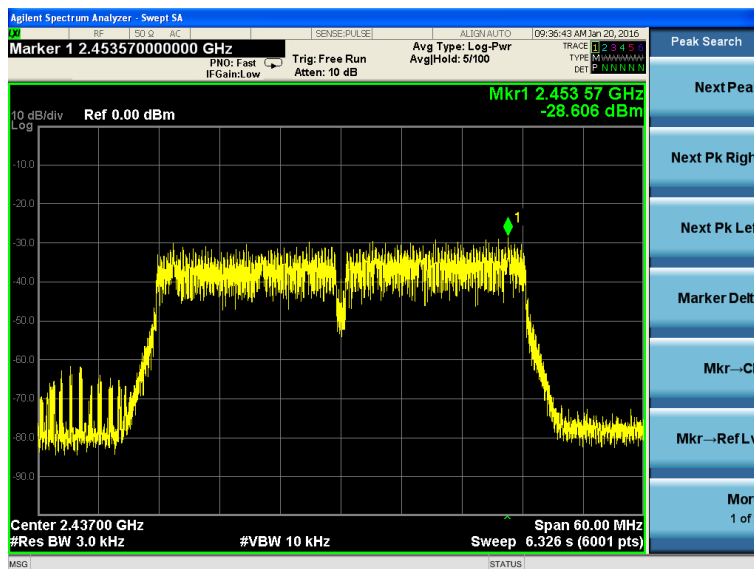
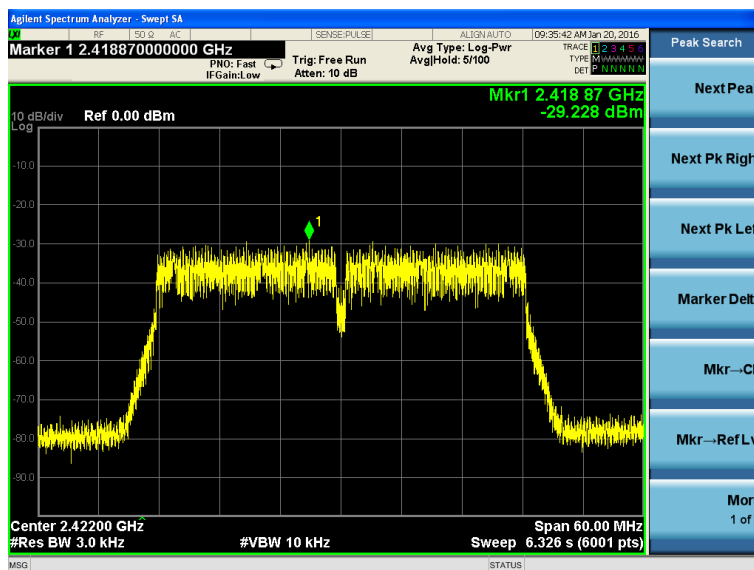
## 802.11g power density



## 802.11n HT20 power density



## 802.11n HT40 power density



### 5.3. 6 dB Spectrum Bandwidth Measurement

#### 5.3.1. Standard Applicable

According to §15.247(a)(2): For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

#### 5.3.2. Measuring Instruments and Setting

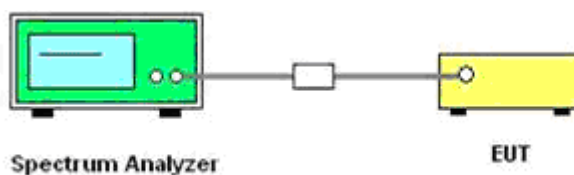
Please refer to section 6 of equipments list in this report. The following table is the setting of the Spectrum Analyzer.

| Spectrum Parameter | Setting  |
|--------------------|----------|
| Attenuation        | Auto     |
| Span Frequency     | > RBW    |
| Detector           | Peak     |
| Trace              | Max Hold |
| Sweep Time         | 100ms    |

#### 5.3.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
2. The resolution bandwidth and the video bandwidth were set according to KDB558074.
3. Measured the spectrum width with power higher than 6dB below carrier.

#### 5.3.4. Test Setup Layout



#### 5.3.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

## 5.3.6. Test Result of 6dB Spectrum Bandwidth

|               |       |                |             |
|---------------|-------|----------------|-------------|
| Temperature   | 25°C  | Humidity       | 60%         |
| Test Engineer | Jacky | Configurations | 802.11b/g/n |

## 802.11b

| Channel | Frequency | 6dB Bandwidth (MHz) | Min. Limit (MHz) | Result   |
|---------|-----------|---------------------|------------------|----------|
| 1       | 2412      | 10.320              | 0.5              | Complies |
| 6       | 2437      | 9.499               | 0.5              | Complies |
| 11      | 2462      | 10.120              | 0.5              | Complies |

## 802.11g

| Channel | Frequency | 6dB Bandwidth (MHz) | Min. Limit (MHz) | Result   |
|---------|-----------|---------------------|------------------|----------|
| 1       | 2412      | 16.530              | 0.5              | Complies |
| 6       | 2437      | 16.510              | 0.5              | Complies |
| 11      | 2462      | 16.480              | 0.5              | Complies |

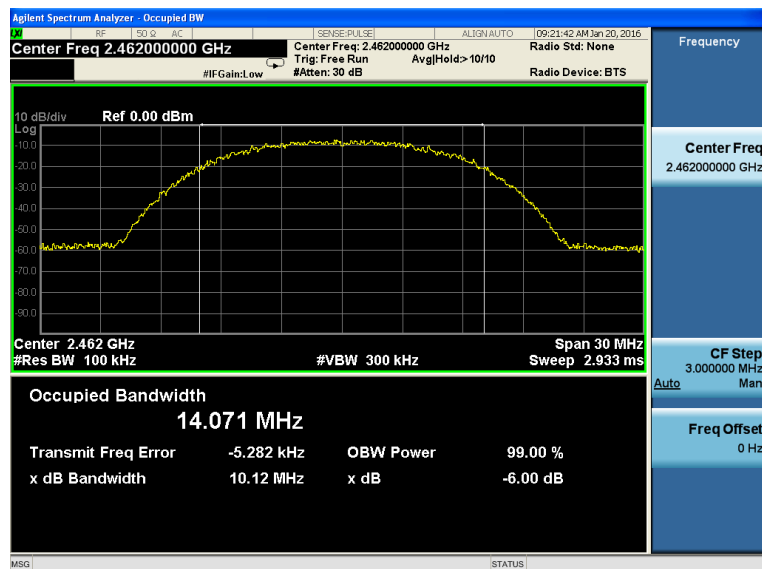
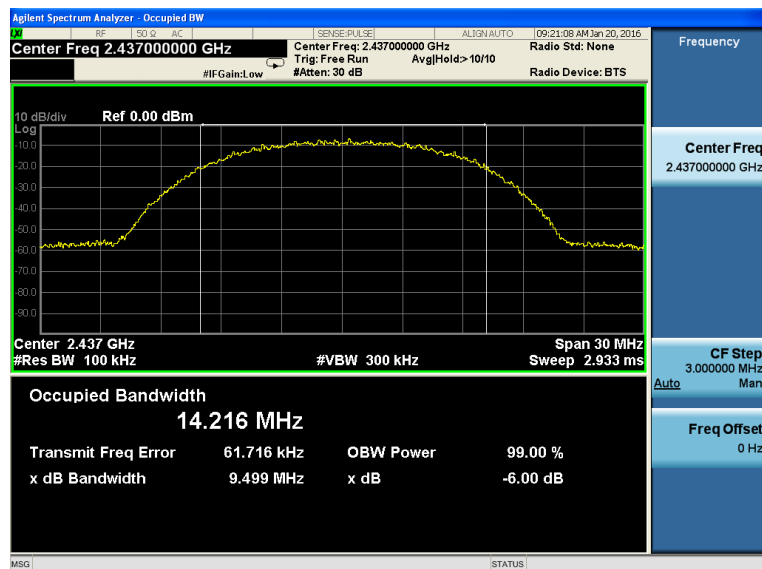
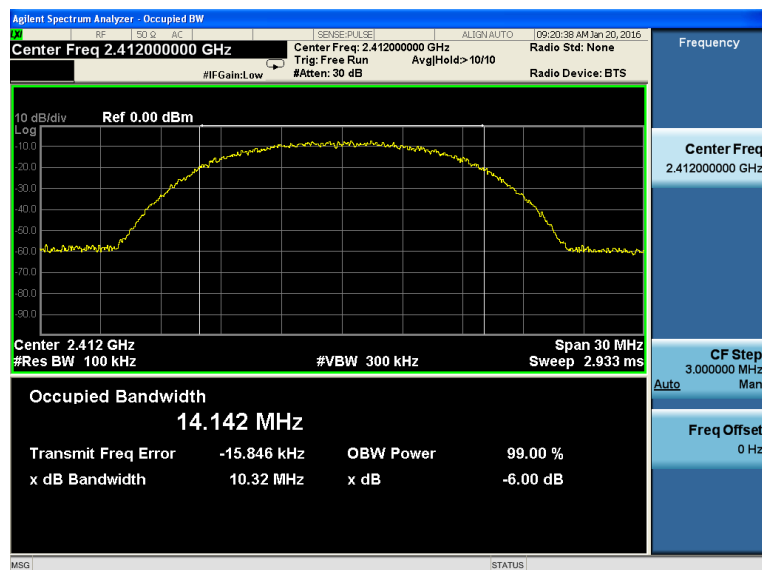
## 802.11n HT20

| Channel | Frequency | 6dB Bandwidth (MHz) | Min. Limit (MHz) | Result   |
|---------|-----------|---------------------|------------------|----------|
| 1       | 2412      | 17.600              | 0.5              | Complies |
| 6       | 2437      | 17.690              | 0.5              | Complies |
| 11      | 2462      | 17.610              | 0.5              | Complies |

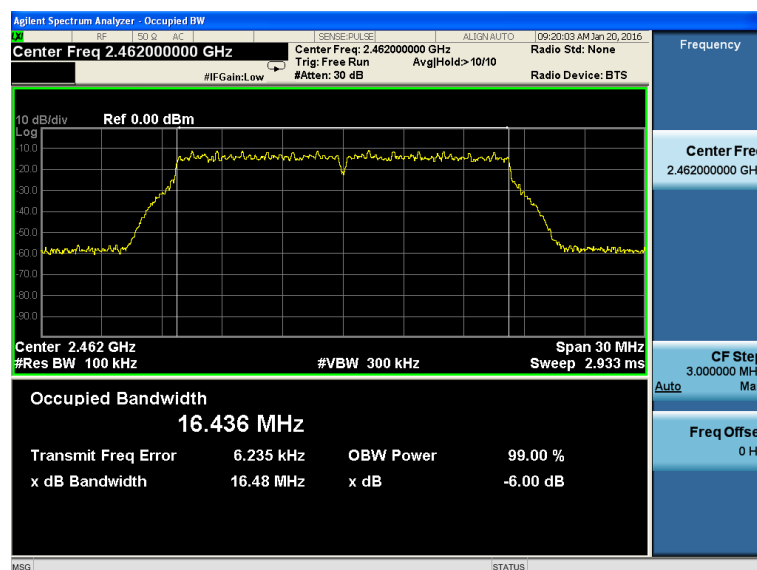
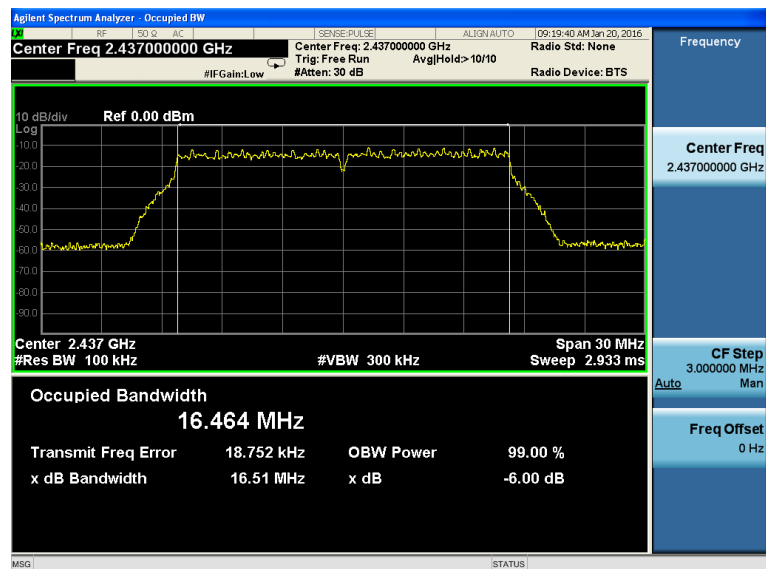
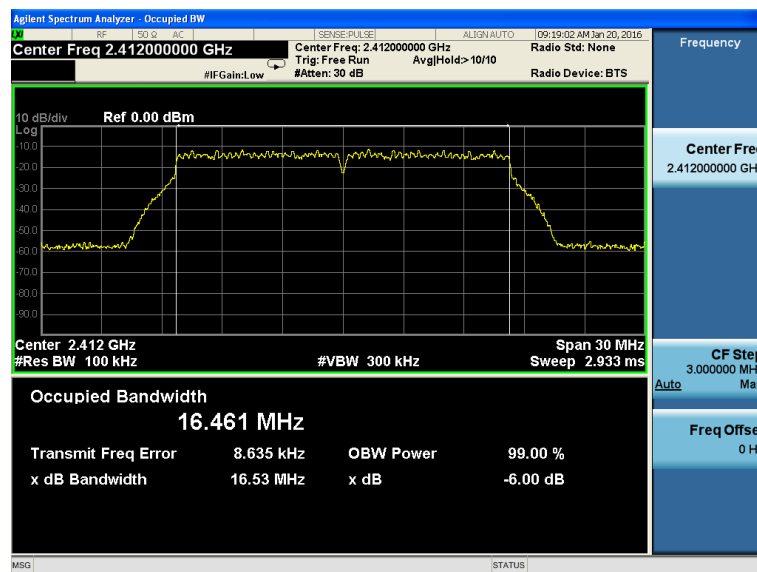
## 802.11n HT40

| Channel | Frequency | 6dB Bandwidth (MHz) | Min. Limit (MHz) | Result   |
|---------|-----------|---------------------|------------------|----------|
| 3       | 2422      | 36.350              | 0.5              | Complies |
| 6       | 2437      | 35.960              | 0.5              | Complies |
| 9       | 2452      | 35.580              | 0.5              | Complies |

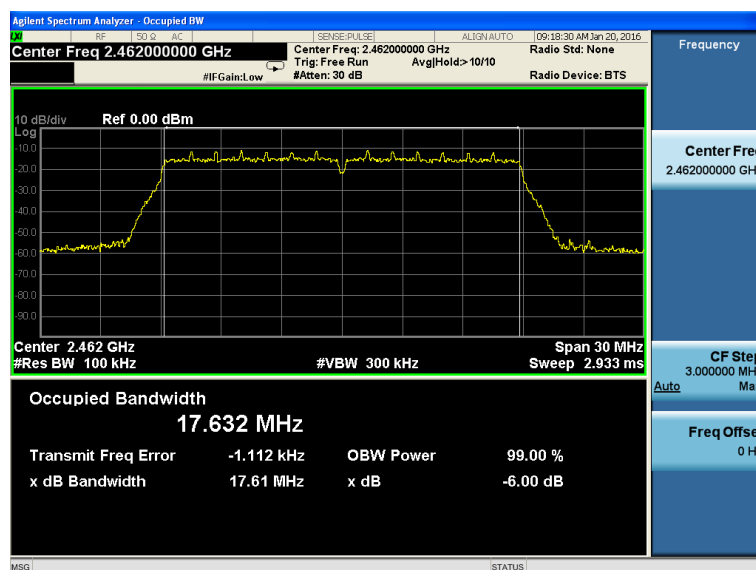
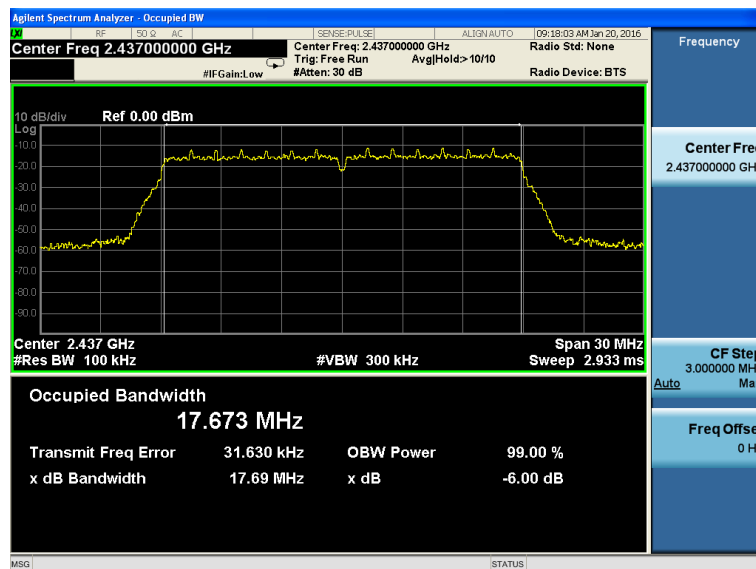
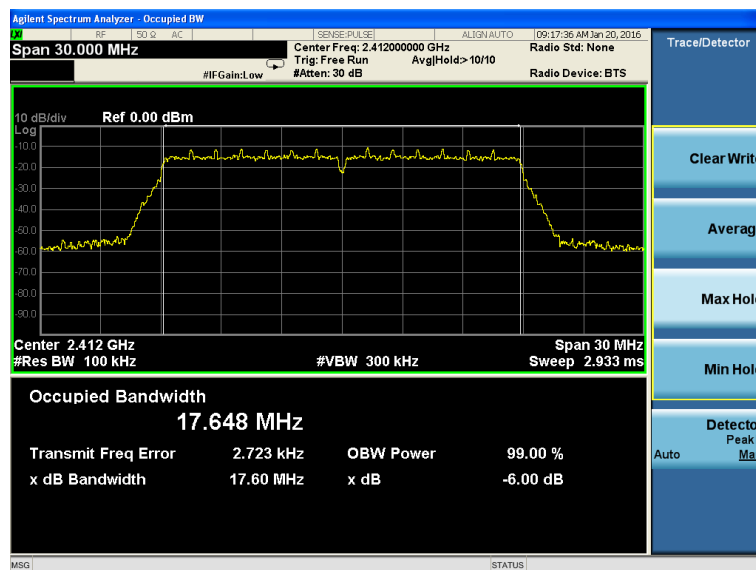
## 802.11b channel, 6dB bandwidth



## 802.11g channel, 6dB bandwidth

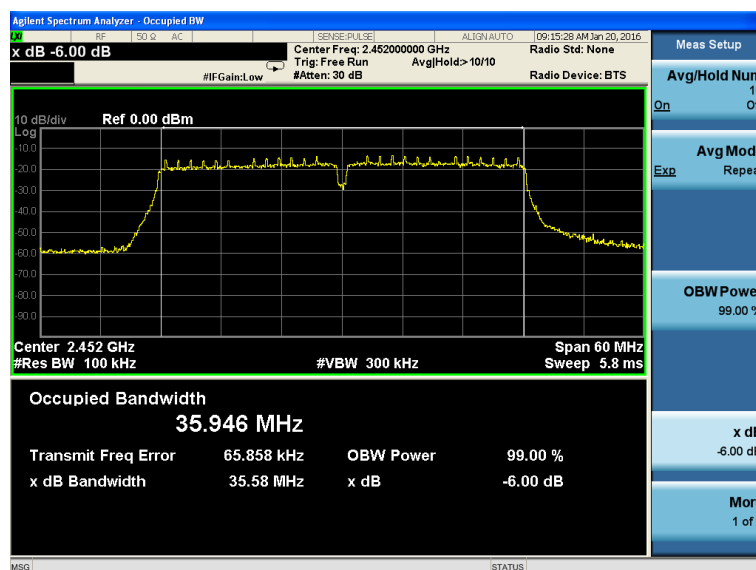
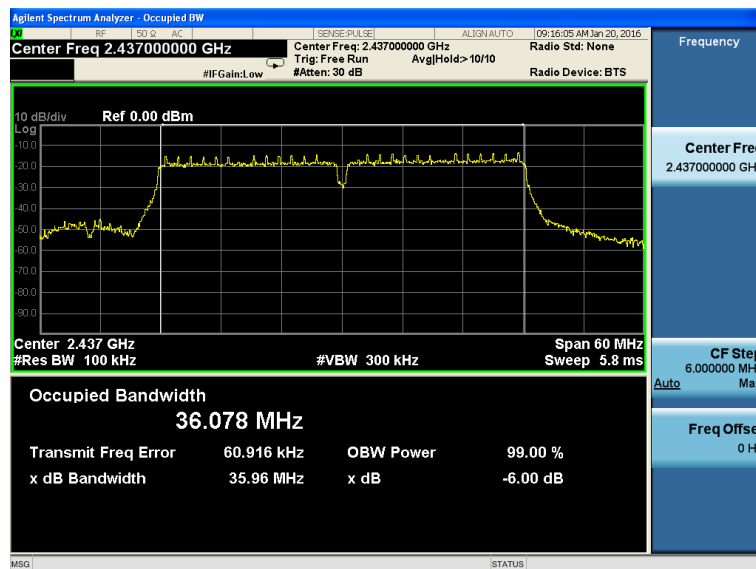
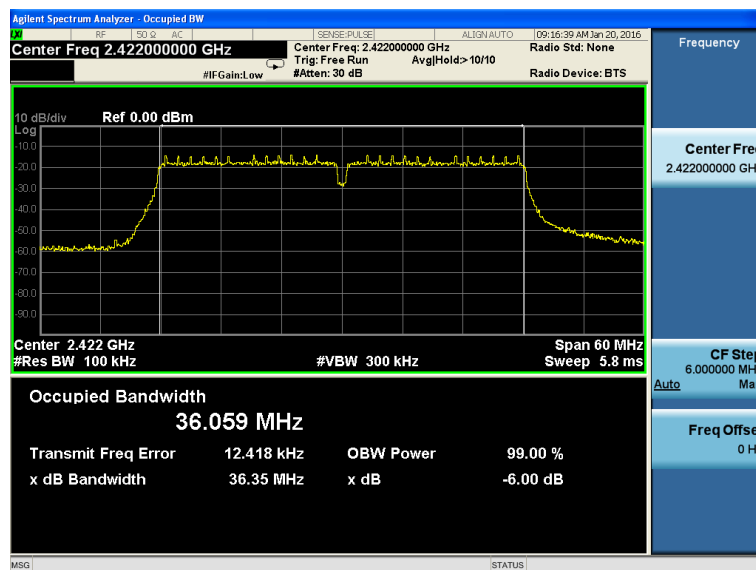


## 802.11n HT20 channel, 6dB bandwidth





## 802.11n HT40 channel, 6dB bandwidth



## 5.4. Radiated Emissions Measurement

### 5.4.1. Standard Applicable

According to §15.247 (d): 20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

| Frequencies(MHz) | Field Strength(microvolts/meter) | Measurement Distance(meters) |
|------------------|----------------------------------|------------------------------|
| 0.009~0.490      | 2400/F(KHz)                      | 300                          |
| 0.490~1.705      | 24000/F(KHz)                     | 30                           |
| 1.705~30.0       | 30                               | 30                           |
| 30~88            | 100                              | 3                            |
| 88~216           | 150                              | 3                            |
| 216~960          | 200                              | 3                            |
| Above 960        | 500                              | 3                            |

### 5.4.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of spectrum analyzer and receiver.

| Spectrum Parameter                        | Setting  |
|---|--|
| Attenuation                               | Auto   |
| Start Frequency                           | 1000 MHz                                       |
| Stop Frequency                            | 10th carrier harmonic                          |
| RB / VB (Emission in restricted band)     | 1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average |
| RB / VB (Emission in non-restricted band) | 1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average |

| Receiver Parameter     | Setting                          |
|------------------------|----------------------------------|
| Attenuation            | Auto                             |
| Start ~ Stop Frequency | 9kHz~150kHz / RB 200Hz for QP    |
| Start ~ Stop Frequency | 150kHz~30MHz / RB 9kHz for QP    |
| Start ~ Stop Frequency | 30MHz~1000MHz / RB 100kHz for QP |

### 5.4.3. Test Procedures

#### 1) Sequence of testing 9 kHz to 30 MHz

##### **Setup:**

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.
- If the EUT is a floor standing device, it is placed on the ground.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

##### **Premeasurement:**

- The turntable rotates from 0 ° to 315 ° using 45 ° steps.
- The antenna height is 1.5 meter.
- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

##### **Final measurement:**

- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0 ° to 360 °) and by rotating the elevation axes (0 ° to 360 °).
- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

## 2) Sequence of testing 30 MHz to 1 GHz

### Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

### Premeasurement:

- The turntable rotates from 0 ° to 315 ° using 45 ° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 to 3 meter.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

### Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ( $\pm 45^\circ$ ) and antenna movement between 1 and 4 meter.
- The final measurement will be done with QP detector with an EMI receiver.
- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

### 3) Sequence of testing 1 GHz to 18 GHz

#### Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

#### Premeasurement:

- The turntable rotates from 0 ° to 315 ° using 45 ° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height scan range is 1 meter to 2.5 meter.
- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

#### Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ( $\pm 45^\circ$ ) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.
- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

#### 4) Sequence of testing above 18 GHz

**Setup:**

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 1 meter.
- The EUT was set into operation.

**Premeasurement:**

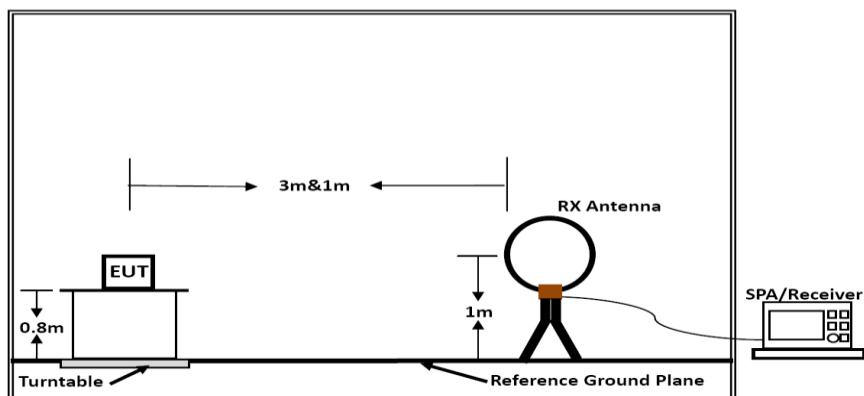
- The antenna is moved spherical over the EUT in different polarisations of the antenna.

**Final measurement:**

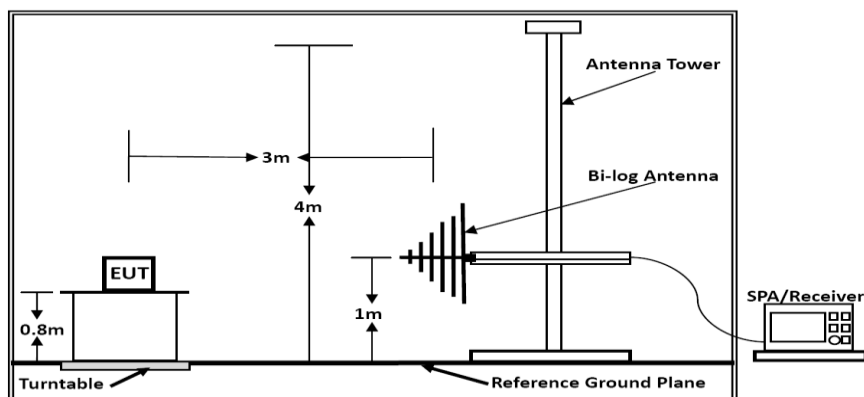
- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

#### 5.4.4. Test Setup Layout

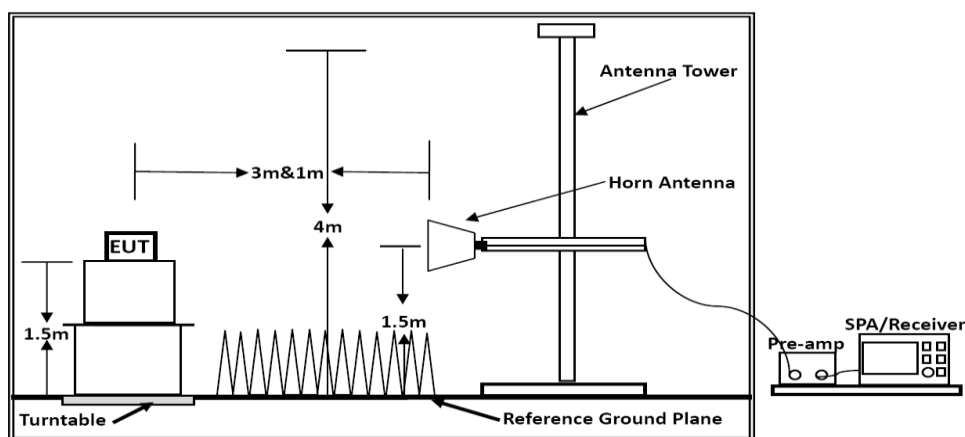
For radiated emissions below 30MHz



**Below 30MHz**



**Below 1GHz**



**Above 1GHz**

Above 10 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade from 3m to 1.5m.

Distance extrapolation factor =  $20 \log (\text{specific distance [3m]} / \text{test distance [1.5m]})$  (dB);

Limit line = specific limits (dBUV) + distance extrapolation factor [6 dB].

## 5.4.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

## 5.4.6. Results of Radiated Emissions (9kHz~30MHz)

|               |       |                |             |
|---------------|-------|----------------|-------------|
| Temperature   | 25°C  | Humidity       | 60%         |
| Test Engineer | Jacky | Configurations | 802.11b/g/n |

| Freq. (MHz) | Level (dBuV) | Over Limit (dB) | Over Limit (dBuV) | Remark   |
|-------------|--------------|-----------------|-------------------|----------|
| -           | -            | -               | -                 | See Note |

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

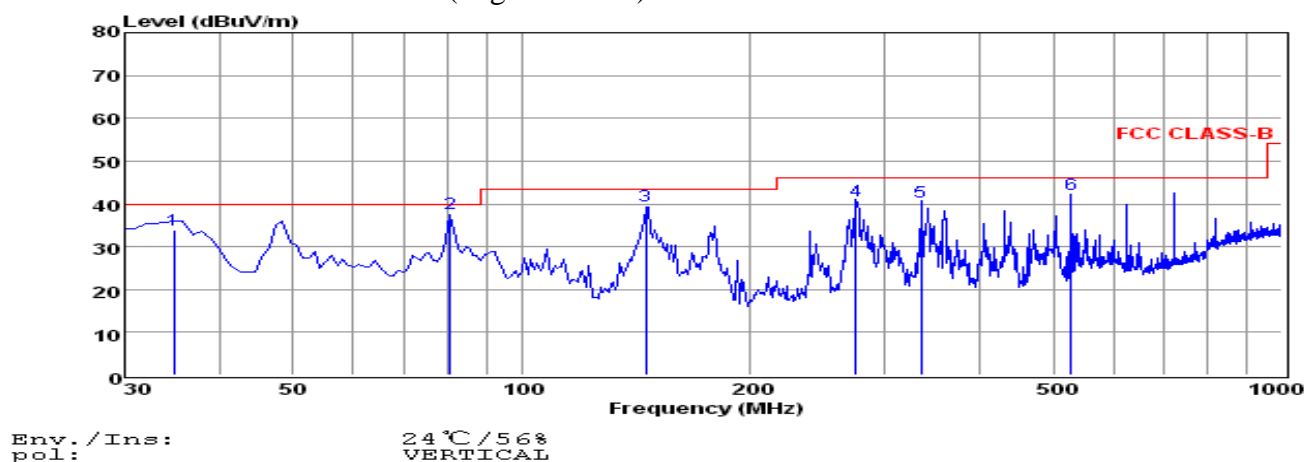
Distance extrapolation factor =  $40 \log (\text{specific distance} / \text{test distance})$  (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

## 5.4.7. Results of Radiated Emissions (30MHz~1GHz)

|               |       |                |                    |
|---------------|-------|----------------|--------------------|
| Temperature   | 25°C  | Humidity       | 60%                |
| Test Engineer | Jacky | Configurations | 802.11b ( High CH) |

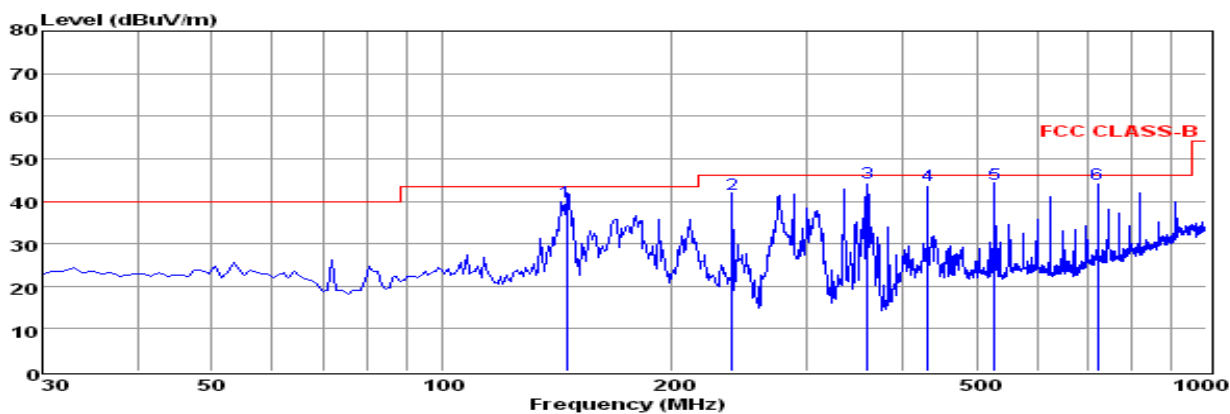
Test result for 802.11b (High Channel)



|   | Freq   | Reading | CabLos | Antfac | Measured | Limit  | Over  | Remark |
|---|--------|---------|--------|--------|----------|--------|-------|--------|
|   | MHz    | dBuV    | dB     | dB/m   | dBuV/m   | dBuV/m | dB    |        |
| 1 | 34.85  | 21.25   | 0.41   | 12.30  | 33.96    | 40.00  | -6.04 | QP     |
| 2 | 80.44  | 28.41   | 0.65   | 8.70   | 37.76    | 40.00  | -2.24 | QP     |
| 3 | 145.43 | 30.62   | 0.77   | 8.23   | 39.62    | 43.50  | -3.88 | QP     |
| 4 | 275.41 | 27.30   | 1.00   | 12.53  | 40.83    | 46.00  | -5.17 | QP     |
| 5 | 335.55 | 25.36   | 1.09   | 13.94  | 40.39    | 46.00  | -5.61 | QP     |
| 6 | 528.58 | 23.76   | 1.46   | 17.11  | 42.33    | 46.00  | -3.67 | QP     |

Note: 1. All readings are Quasi-peak values.  
2. Measured= Reading + Antenna Factor + Cable Loss  
3. The emission that are 20dB below the official limit are not reported





Env./Ins:  
pol:

24°C/56%  
HORIZONTAL

|   | Freq   | Reading | CabLos | Antfac | Measured | Limit  | Over  | Remark |
|---|--------|---------|--------|--------|----------|--------|-------|--------|
|   | MHz    | dBuV    | dB     | dB/m   | dBuV/m   | dBuV/m | dB    |        |
| 1 | 145.43 | 30.81   | 0.77   | 8.23   | 39.81    | 43.50  | -3.69 | QP     |
| 2 | 239.52 | 28.41   | 1.01   | 12.07  | 41.49    | 46.00  | -4.51 | QP     |
| 3 | 359.80 | 28.72   | 1.18   | 14.43  | 44.33    | 46.00  | -1.67 | QP     |
| 4 | 431.58 | 26.92   | 1.28   | 15.52  | 43.72    | 46.00  | -2.28 | QP     |
| 5 | 528.58 | 25.33   | 1.46   | 17.11  | 43.90    | 46.00  | -2.10 | QP     |
| 6 | 720.64 | 23.30   | 1.63   | 19.07  | 44.00    | 46.00  | -2.00 | QP     |

Note: 1. All readings are Quasi-peak values.

2. Measured= Reading + Antenna Factor + Cable Loss

3. The emission that are 20db below the official limit are not reported

Note:

Pre-scan all mode and recorded the worst case results in this report (802.11b (High Channel)).

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

## 5.4.8. Results for Radiated Emissions (Above 1GHz)

802.11b

## Channel 1

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4824.00   | 55.15        | 33.06          | 35.04        | 3.94         | 57.11           | 74           | -16.89    | Peak    | Horizontal |
| 4824.00   | 40.40        | 33.06          | 35.04        | 3.94         | 42.36           | 54           | -11.64    | Average | Horizontal |
| 4824.00   | 53.18        | 33.06          | 35.04        | 3.94         | 55.14           | 74           | -18.86    | Peak    | Vertical   |
| 4824.00   | 38.32        | 33.06          | 35.04        | 3.94         | 40.28           | 54           | -13.72    | Average | Vertical   |

## Channel 6

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4874.00   | 55.59        | 33.16          | 35.15        | 3.96         | 57.69           | 74           | -16.31    | Peak    | Horizontal |
| 4874.00   | 40.63        | 33.16          | 35.15        | 3.96         | 42.73           | 54           | -11.27    | Average | Horizontal |
| 4874.00   | 54.18        | 33.16          | 35.15        | 3.96         | 56.28           | 74           | -17.72    | Peak    | Vertical   |
| 4874.00   | 38.91        | 33.16          | 35.15        | 3.96         | 41.01           | 54           | -12.99    | Average | Vertical   |

## Channel 11

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4924.00   | 55.33        | 33.26          | 35.14        | 3.98         | 57.43           | 74           | -16.57    | Peak    | Horizontal |
| 4924.00   | 40.68        | 33.26          | 35.14        | 3.98         | 42.78           | 54           | -11.22    | Average | Horizontal |
| 4924.00   | 55.26        | 33.26          | 35.14        | 3.98         | 57.36           | 74           | -16.64    | Peak    | Vertical   |
| 4924.00   | 39.91        | 33.26          | 35.14        | 3.98         | 42.01           | 54           | -11.99    | Average | Vertical   |

802.11g

## Channel 1

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4824.00   | 54.07        | 33.06          | 35.04        | 3.94         | 56.03           | 74           | -17.97    | Peak    | Horizontal |
| 4824.00   | 39.16        | 33.06          | 35.04        | 3.94         | 41.12           | 54           | -12.88    | Average | Horizontal |
| 4824.00   | 54.81        | 33.06          | 35.04        | 3.94         | 56.77           | 74           | -17.23    | Peak    | Vertical   |
| 4824.00   | 39.80        | 33.06          | 35.04        | 3.94         | 41.76           | 54           | -12.24    | Average | Vertical   |

## Channel 6

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4874.00   | 55.89        | 33.16          | 35.15        | 3.96         | 57.86           | 74           | -16.14    | Peak    | Horizontal |
| 4874.00   | 39.45        | 33.16          | 35.15        | 3.96         | 41.42           | 54           | -12.58    | Average | Horizontal |
| 4874.00   | 54.10        | 33.16          | 35.15        | 3.96         | 56.07           | 74           | -17.93    | Peak    | Vertical   |
| 4874.00   | 38.39        | 33.16          | 35.15        | 3.96         | 40.36           | 54           | -13.64    | Average | Vertical   |

## Channel 11

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4924.00   | 54.67        | 33.26          | 35.14        | 3.98         | 56.77           | 74           | -17.23    | Peak    | Horizontal |
| 4924.00   | 39.36        | 33.26          | 35.14        | 3.98         | 41.46           | 54           | -12.54    | Average | Horizontal |
| 4924.00   | 53.98        | 33.26          | 35.14        | 3.98         | 56.08           | 74           | -17.92    | Peak    | Vertical   |
| 4924.00   | 38.01        | 33.26          | 35.14        | 3.98         | 40.11           | 54           | -13.89    | Average | Vertical   |

## 802.11n HT20

## Channel 1

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4824.00   | 54.91        | 33.06          | 35.04        | 3.94         | 56.87           | 74           | -17.13    | Peak    | Horizontal |
| 4824.00   | 39.92        | 33.06          | 35.04        | 3.94         | 41.88           | 54           | -12.12    | Average | Horizontal |
| 4824.00   | 53.50        | 33.06          | 35.04        | 3.94         | 55.46           | 74           | -18.54    | Peak    | Vertical   |
| 4824.00   | 38.87        | 33.06          | 35.04        | 3.94         | 40.83           | 54           | -13.17    | Average | Vertical   |

## Channel 6

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4874.00   | 54.38        | 33.16          | 35.15        | 3.96         | 56.35           | 74           | -17.65    | Peak    | Horizontal |
| 4874.00   | 38.25        | 33.16          | 35.15        | 3.96         | 40.22           | 54           | -13.78    | Average | Horizontal |
| 4874.00   | 53.81        | 33.16          | 35.15        | 3.96         | 55.78           | 74           | -18.22    | Peak    | Vertical   |
| 4874.00   | 38.17        | 33.16          | 35.15        | 3.96         | 40.14           | 54           | -13.86    | Average | Vertical   |

## Channel 11

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4924.00   | 54.34        | 33.26          | 35.14        | 3.98         | 56.44           | 74           | -17.56    | Peak    | Horizontal |
| 4924.00   | 39.29        | 33.26          | 35.14        | 3.98         | 41.39           | 54           | -12.61    | Average | Horizontal |
| 4924.00   | 53.18        | 33.26          | 35.14        | 3.98         | 55.28           | 74           | -18.72    | Peak    | Vertical   |
| 4924.00   | 38.04        | 33.26          | 35.14        | 3.98         | 40.14           | 54           | -13.86    | Average | Vertical   |

## 802.11n HT40

## Channel 3

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4844.00   | 54.14        | 33.06          | 35.04        | 3.94         | 56.10           | 74           | -17.90    | Peak    | Horizontal |
| 4844.00   | 38.82        | 33.06          | 35.04        | 3.94         | 40.78           | 54           | -13.22    | Average | Horizontal |
| 4844.00   | 53.60        | 33.06          | 35.04        | 3.94         | 55.56           | 74           | -18.44    | Peak    | Vertical   |
| 4844.00   | 38.25        | 33.06          | 35.04        | 3.94         | 40.21           | 54           | -13.79    | Average | Vertical   |

## Channel 6

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4874.00   | 53.06        | 33.16          | 35.15        | 3.96         | 55.03           | 74           | -18.97    | Peak    | Horizontal |
| 4874.00   | 38.66        | 33.16          | 35.15        | 3.96         | 40.63           | 54           | -13.37    | Average | Horizontal |
| 4874.00   | 53.47        | 33.16          | 35.15        | 3.96         | 55.44           | 74           | -18.56    | Peak    | Vertical   |
| 4874.00   | 38.05        | 33.16          | 35.15        | 3.96         | 40.02           | 54           | -13.98    | Average | Vertical   |

## Channel 9

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4904.00   | 53.68        | 33.26          | 35.14        | 3.98         | 55.78           | 74           | -18.22    | Peak    | Horizontal |
| 4904.00   | 38.31        | 33.26          | 35.14        | 3.98         | 40.41           | 54           | -13.59    | Average | Horizontal |
| 4904.00   | 53.68        | 33.26          | 35.14        | 3.98         | 55.78           | 74           | -18.22    | Peak    | Vertical   |
| 4904.00   | 38.26        | 33.26          | 35.14        | 3.98         | 40.36           | 54           | -13.64    | Average | Vertical   |

**Notes:**

1. Measuring frequencies from 9k~10th harmonic or 26.5GHz (which is less), were made with an instrument using Peak detector mode. No emission found between lowest internal used/generated frequency to 30MHz.
2. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

## 5.4.9. Results of Band Edges Test (Radiated)

802.11b

Tx-2412

| Freq. MHz | Reading Level dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 2390.00   | 49.73              | 32.89          | 35.16        | 3.51         | 50.97           | 74           | -23.03    | Peak    | Horizontal |
| 2390.00   | 33.78              | 32.89          | 35.16        | 3.51         | 35.02           | 54           | -18.98    | Average | Horizontal |
| 2400.00   | 52.11              | 32.92          | 35.16        | 3.54         | 53.41           | 74           | -20.59    | Peak    | Horizontal |
| 2400.00   | 38.59              | 32.92          | 35.16        | 3.54         | 39.89           | 54           | -14.11    | Average | Horizontal |
| 2390.00   | 49.13              | 32.89          | 35.16        | 3.51         | 50.37           | 74           | -23.63    | Peak    | Vertical   |
| 2390.00   | 33.96              | 32.89          | 35.16        | 3.51         | 35.20           | 54           | -18.80    | Average | Vertical   |
| 2400.00   | 53.15              | 32.92          | 35.16        | 3.54         | 54.45           | 74           | -19.55    | Peak    | Vertical   |
| 2400.00   | 37.71              | 32.92          | 35.16        | 3.54         | 39.01           | 54           | -14.99    | Average | Vertical   |

Tx-2462

| Freq. MHz | Reading Level dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 2483.50   | 50.96              | 33.06          | 35.18        | 3.60         | 52.44           | 74           | -21.56    | Peak    | Horizontal |
| 2483.50   | 35.99              | 33.06          | 35.18        | 3.60         | 37.47           | 54           | -16.53    | Average | Horizontal |
| 2483.50   | 50.78              | 33.06          | 35.18        | 3.60         | 52.26           | 74           | -21.74    | Peak    | Vertical   |
| 2483.50   | 35.86              | 33.06          | 35.18        | 3.60         | 37.34           | 54           | -16.66    | Average | Vertical   |

802.11g

Tx-2412

| Freq. MHz | Reading Level dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 2390.00   | 49.09              | 32.89          | 35.16        | 3.51         | 50.33           | 74           | -23.67    | Peak    | Horizontal |
| 2390.00   | 33.78              | 32.89          | 35.16        | 3.51         | 35.02           | 54           | -18.98    | Average | Horizontal |
| 2400.00   | 52.54              | 32.92          | 35.16        | 3.54         | 53.84           | 74           | -20.16    | Peak    | Horizontal |
| 2400.00   | 36.75              | 32.92          | 35.16        | 3.54         | 38.05           | 54           | -15.95    | Average | Horizontal |
| 2390.00   | 48.89              | 32.89          | 35.16        | 3.51         | 50.13           | 74           | -23.87    | Peak    | Vertical   |
| 2390.00   | 34.2               | 32.89          | 35.16        | 3.51         | 35.44           | 54           | -18.56    | Average | Vertical   |
| 2400.00   | 51.72              | 32.92          | 35.16        | 3.54         | 53.02           | 74           | -20.98    | Peak    | Vertical   |
| 2400.00   | 37.49              | 32.92          | 35.16        | 3.54         | 38.79           | 54           | -15.21    | Average | Vertical   |

Tx-2462

| Freq. MHz | Reading Level dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 2483.50   | 50.54              | 33.06          | 35.18        | 3.60         | 52.02           | 74           | -21.98    | Peak    | Horizontal |
| 2483.50   | 35.63              | 33.06          | 35.18        | 3.60         | 37.11           | 54           | -16.89    | Average | Horizontal |
| 2483.50   | 49.96              | 33.06          | 35.18        | 3.60         | 51.44           | 74           | -22.56    | Peak    | Vertical   |
| 2483.50   | 35.30              | 33.06          | 35.18        | 3.60         | 36.78           | 54           | -17.22    | Average | Vertical   |

802.11n(HT20)

Tx-2412

| Freq. MHz | Reading Level dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 2390.00   | 49.50              | 32.89          | 35.16        | 3.51         | 50.74           | 74           | -23.26    | Peak    | Horizontal |
| 2390.00   | 34.45              | 32.89          | 35.16        | 3.51         | 35.69           | 54           | -18.31    | Average | Horizontal |
| 2400.00   | 51.98              | 32.92          | 35.16        | 3.54         | 53.28           | 74           | -20.72    | Peak    | Horizontal |
| 2400.00   | 36.93              | 32.92          | 35.16        | 3.54         | 38.23           | 54           | -15.77    | Average | Horizontal |
| 2390.00   | 49.43              | 32.89          | 35.16        | 3.51         | 50.67           | 74           | -23.33    | Peak    | Vertical   |
| 2390.00   | 34.04              | 32.89          | 35.16        | 3.51         | 35.28           | 54           | -18.72    | Average | Vertical   |
| 2400.00   | 52.11              | 32.92          | 35.16        | 3.54         | 53.41           | 74           | -20.59    | Peak    | Vertical   |
| 2400.00   | 36.64              | 32.92          | 35.16        | 3.54         | 37.94           | 54           | -16.06    | Average | Vertical   |

Tx-2462

| Freq. MHz | Reading Level dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 2483.50   | 50.98              | 33.06          | 35.18        | 3.60         | 52.46           | 74           | -21.54    | Peak    | Horizontal |
| 2483.50   | 35.94              | 33.06          | 35.18        | 3.60         | 37.42           | 54           | -16.58    | Average | Horizontal |
| 2483.50   | 50.31              | 33.06          | 35.18        | 3.60         | 51.79           | 74           | -22.21    | Peak    | Vertical   |
| 2483.50   | 35.21              | 33.06          | 35.18        | 3.60         | 36.69           | 54           | -17.31    | Average | Vertical   |



802.11n(HT40)

Tx-2422

| Freq. MHz | Reading Level dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 2390.00   | 48.90              | 32.89          | 35.16        | 3.51         | 50.14           | 74           | -23.86    | Peak    | Horizontal |
| 2390.00   | 34.12              | 32.89          | 35.16        | 3.51         | 35.36           | 54           | -18.64    | Average | Horizontal |
| 2400.00   | 50.97              | 32.92          | 35.16        | 3.54         | 52.27           | 74           | -21.73    | Peak    | Horizontal |
| 2400.00   | 36.57              | 32.92          | 35.16        | 3.54         | 37.87           | 54           | -16.13    | Average | Horizontal |
| 2390.00   | 49.09              | 32.89          | 35.16        | 3.51         | 50.33           | 74           | -23.67    | Peak    | Vertical   |
| 2390.00   | 33.77              | 32.89          | 35.16        | 3.51         | 35.01           | 54           | -18.99    | Average | Vertical   |
| 2400.00   | 51.48              | 32.92          | 35.16        | 3.54         | 52.78           | 74           | -21.22    | Peak    | Vertical   |
| 2400.00   | 35.75              | 32.92          | 35.16        | 3.54         | 37.05           | 54           | -16.95    | Average | Vertical   |

Tx-2452

| Freq. MHz | Reading Level dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 2483.50   | 48.78              | 33.06          | 35.18        | 3.60         | 50.26           | 74           | -23.74    | Peak    | Horizontal |
| 2483.50   | 33.88              | 33.06          | 35.18        | 3.60         | 35.36           | 54           | -18.64    | Average | Horizontal |
| 2483.50   | 48.93              | 33.06          | 35.18        | 3.60         | 50.41           | 74           | -23.59    | Peak    | Vertical   |
| 2483.50   | 34.10              | 33.06          | 35.18        | 3.60         | 35.58           | 54           | -18.42    | Average | Vertical   |

## 5.5. Conducted Spurious Emissions and Band Edges Test

### 5.5.1. Standard Applicable

According to §15.247 (d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

### 5.5.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of the spectrum analyzer.

| Spectrum Parameter                        | Setting       |
|---|---------------|
| Detector                                  | Peak          |
| Attenuation                               | Auto          |
| RB / VB (Emission in restricted band)     | 100KHz/300KHz |
| RB / VB (Emission in non-restricted band) | 100KHz/300KHz |

### 5.5.3. Test Procedures

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz

The spectrum from 9kHz to 40GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

### 5.5.4. Test Setup Layout

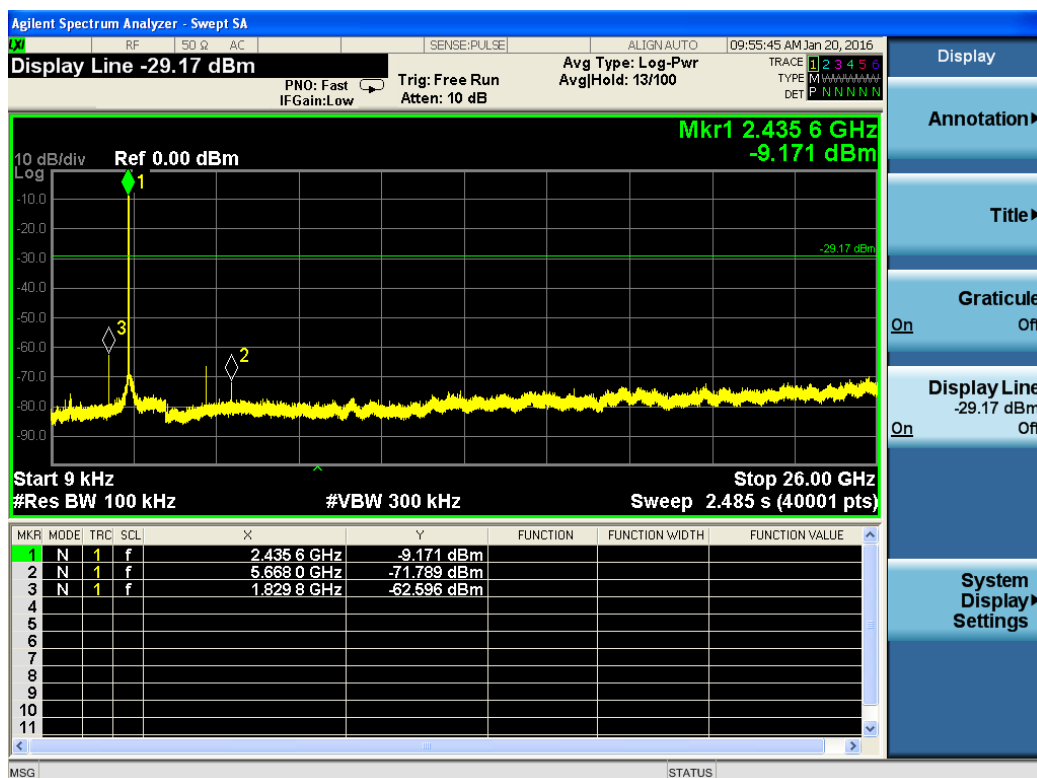
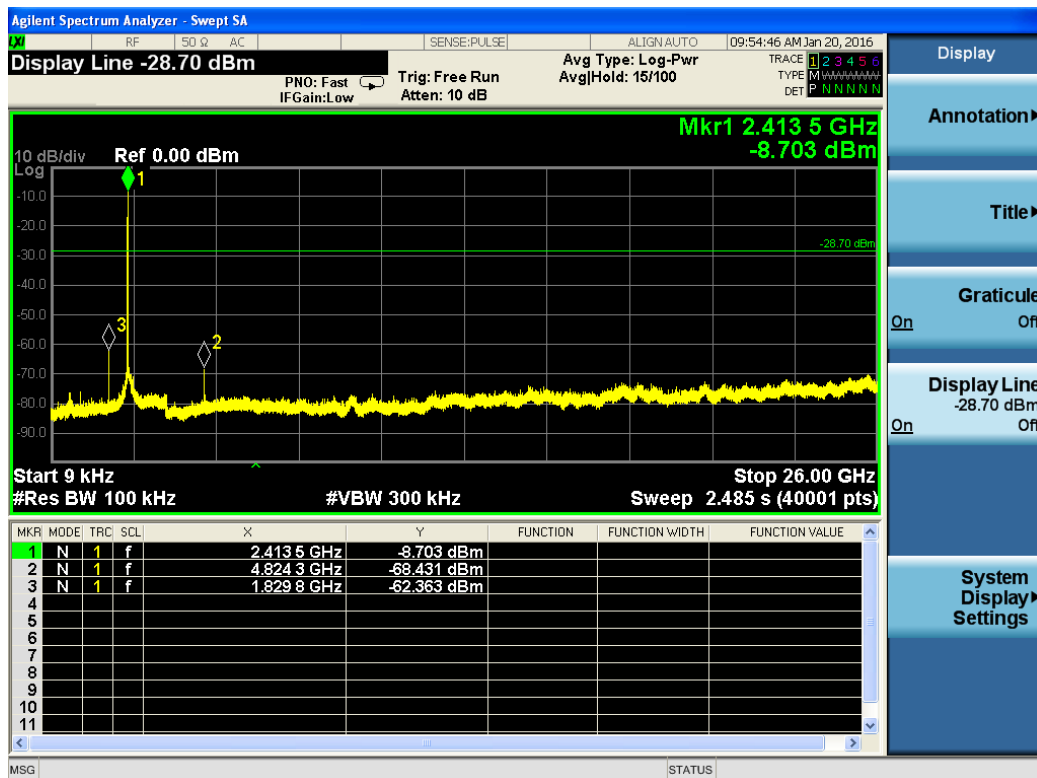
This test setup layout is the same as that shown in section 5.4.4.

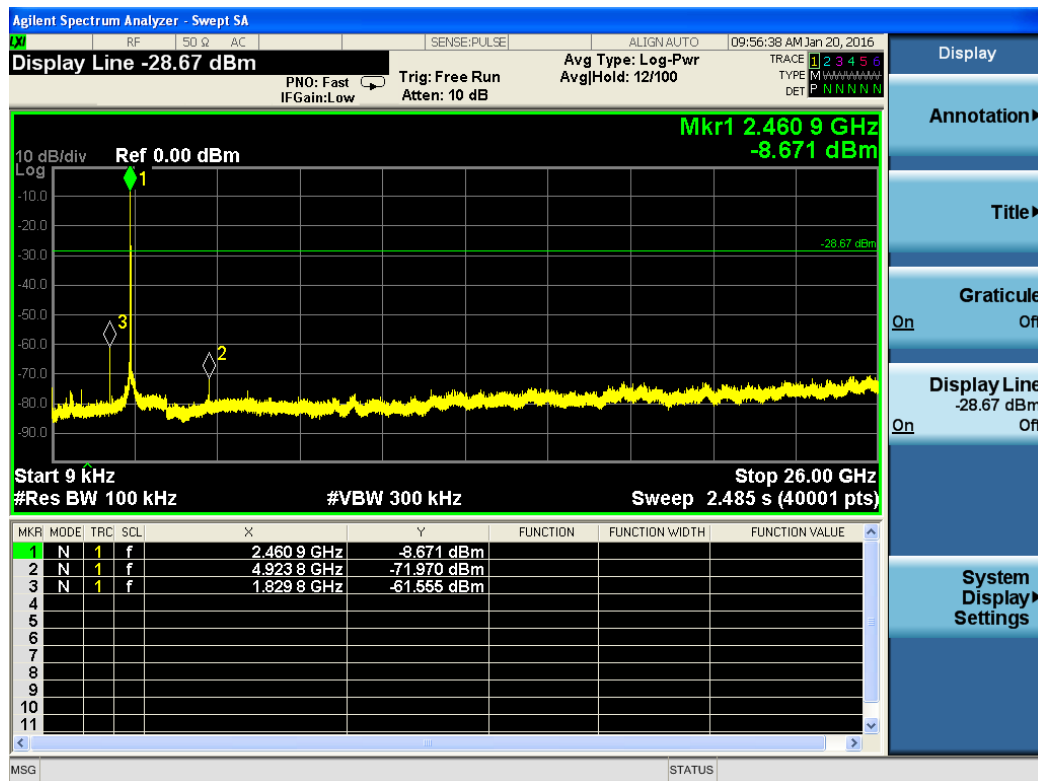
### 5.5.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

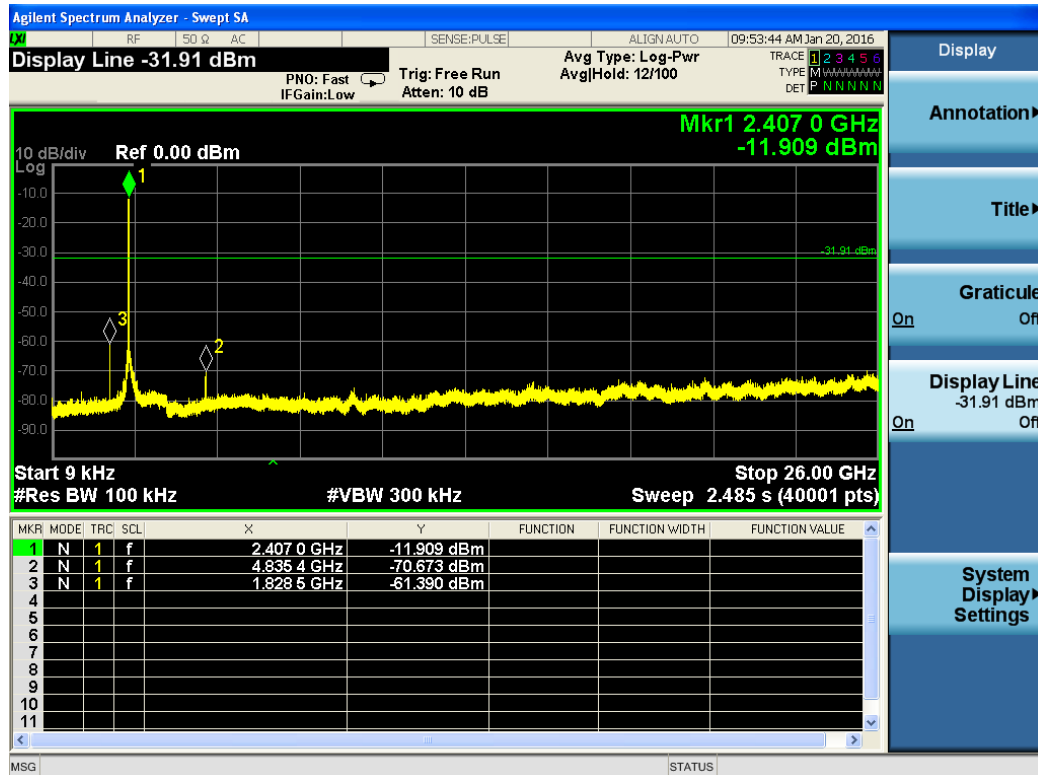
## 5.5.6. Test Results of Conducted Spurious Emissions

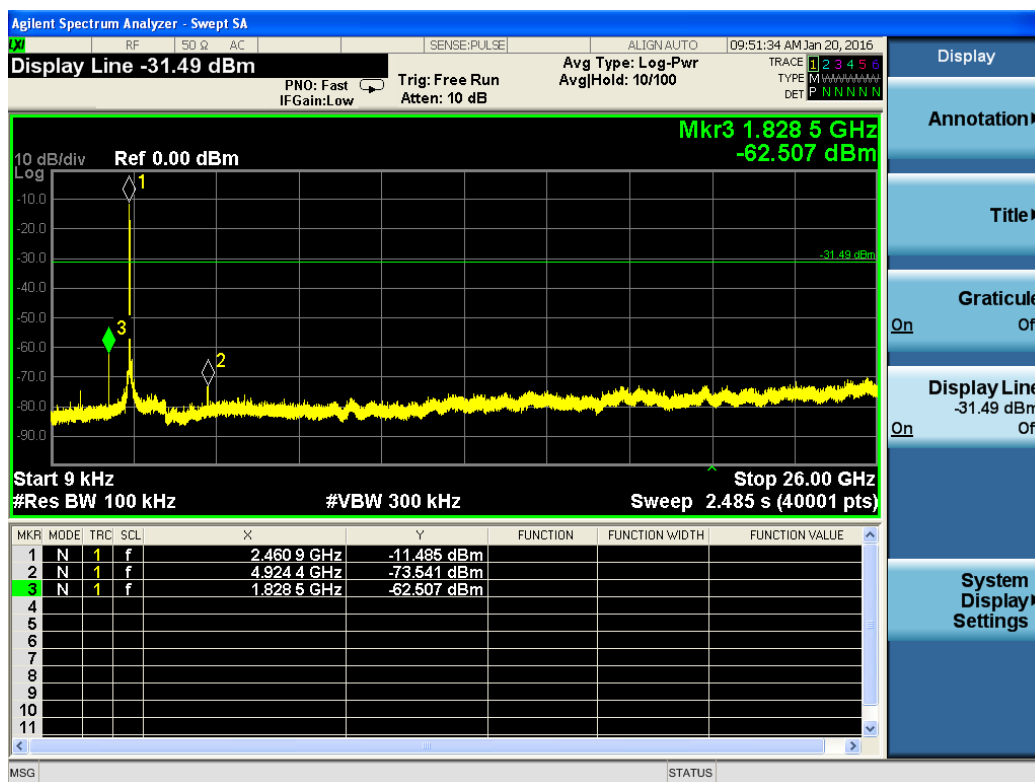
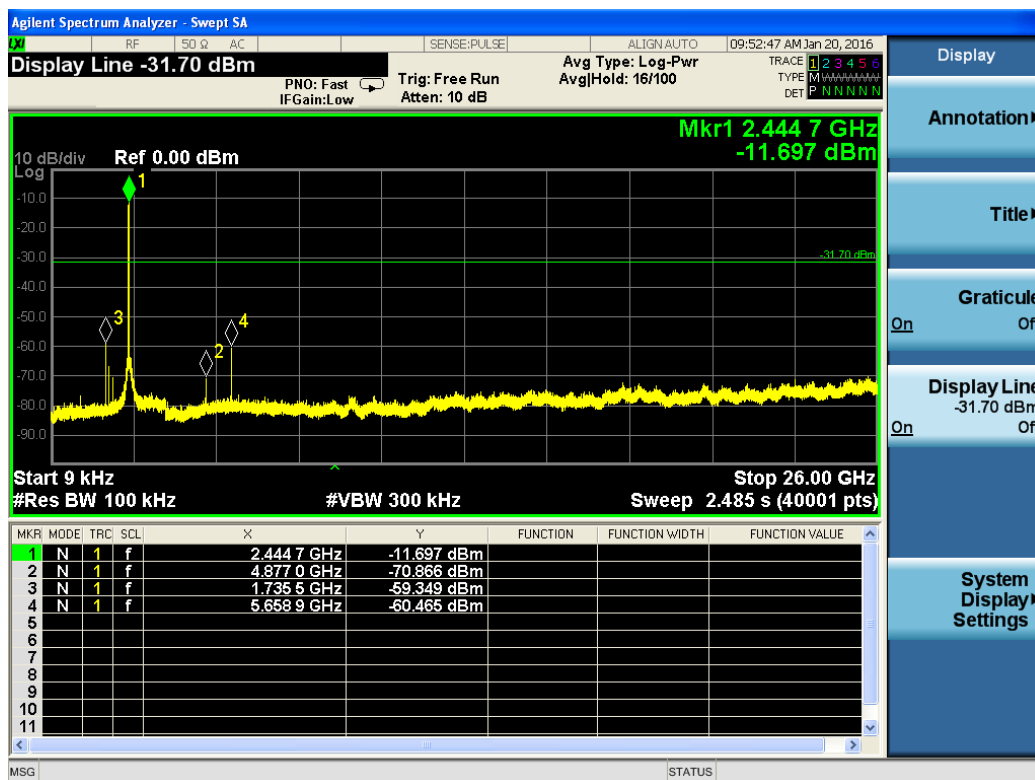
## 802.11b



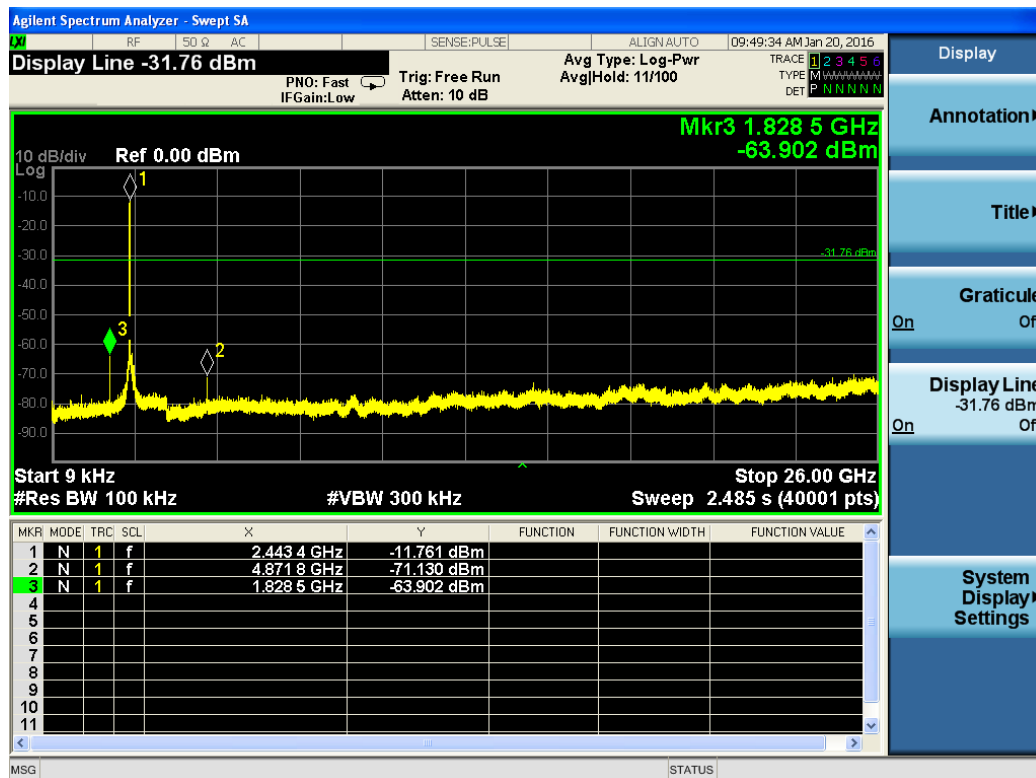
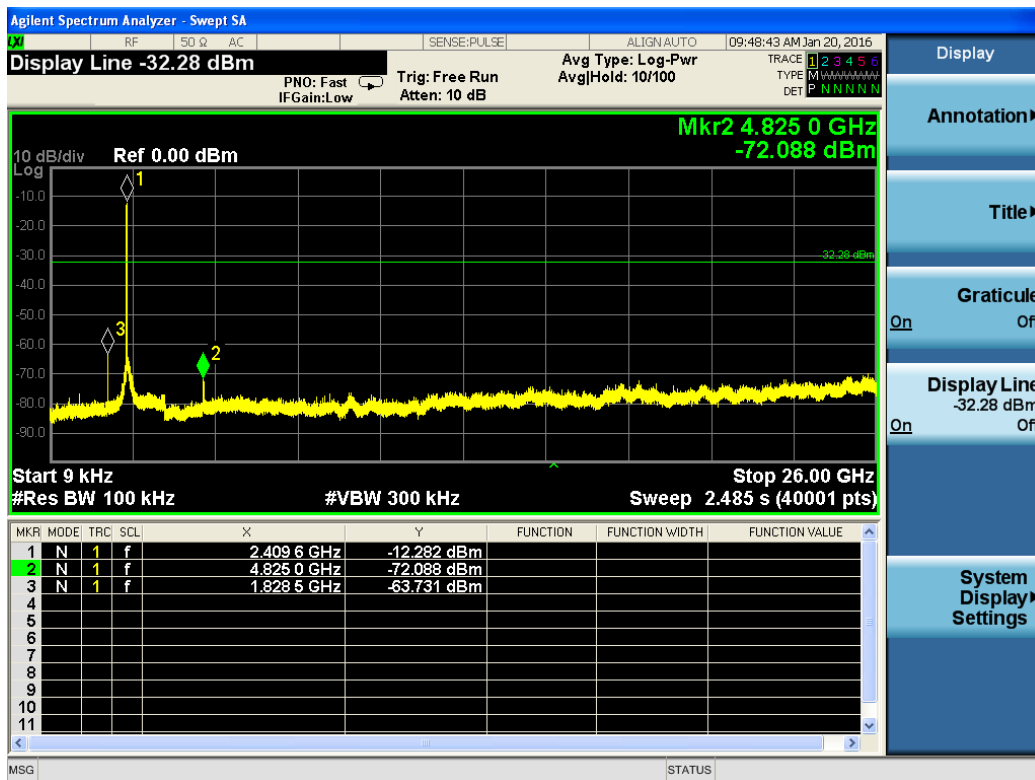


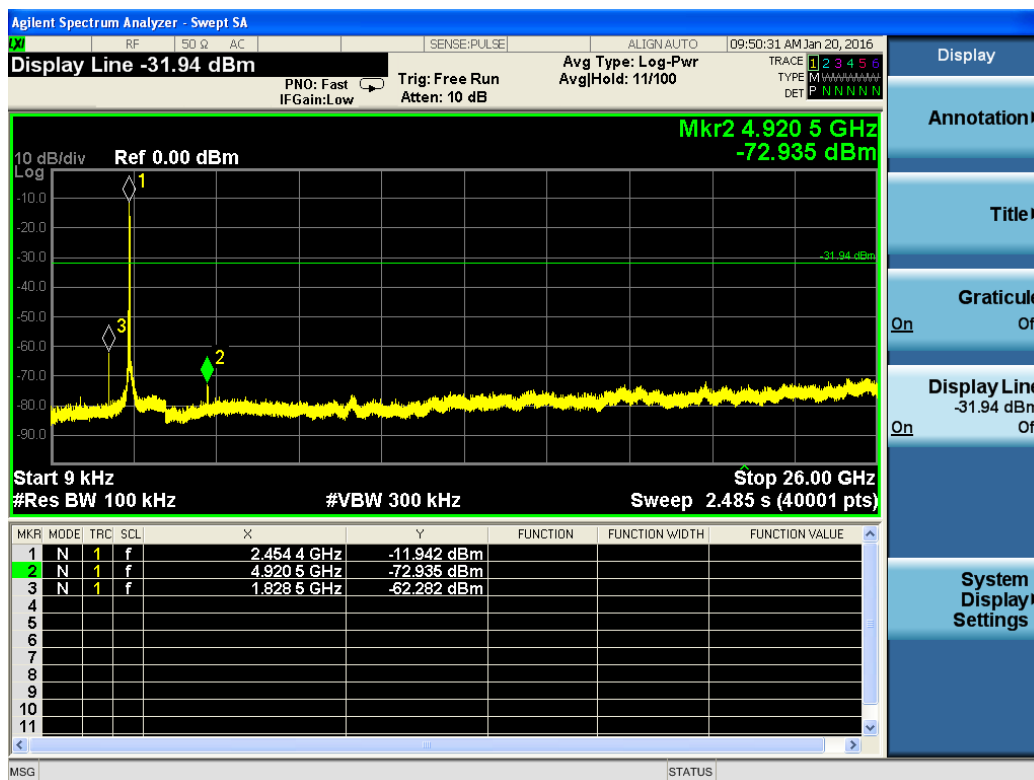
## 802.11g



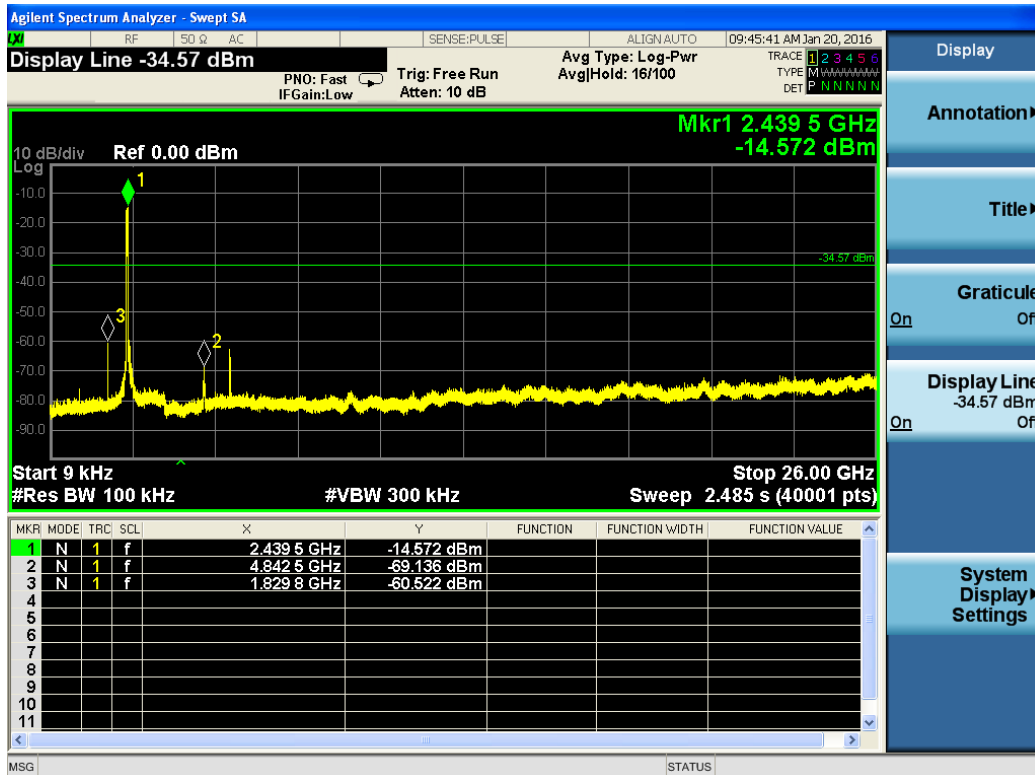


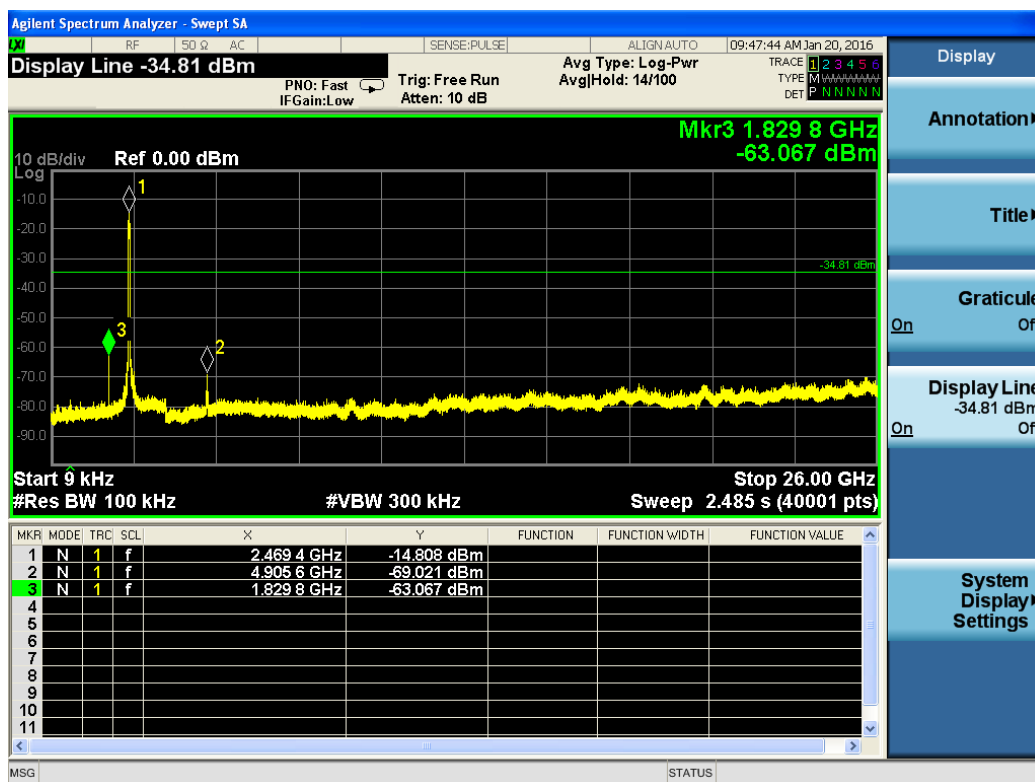
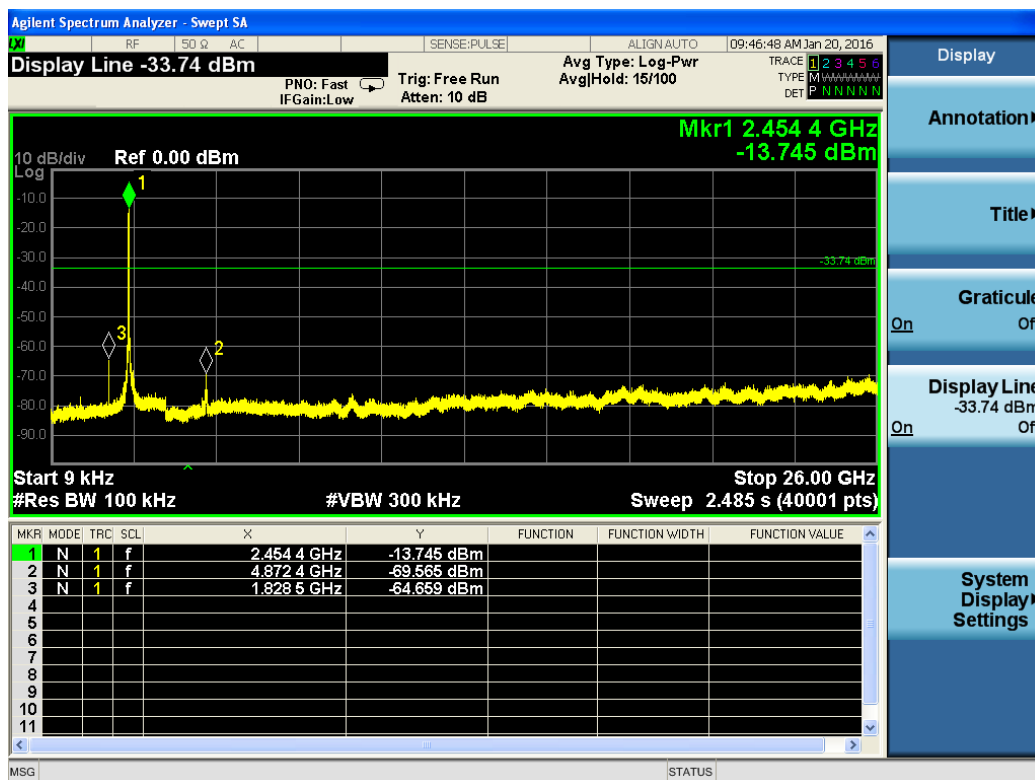
## 802.11n HT20





## 802.11n HT40

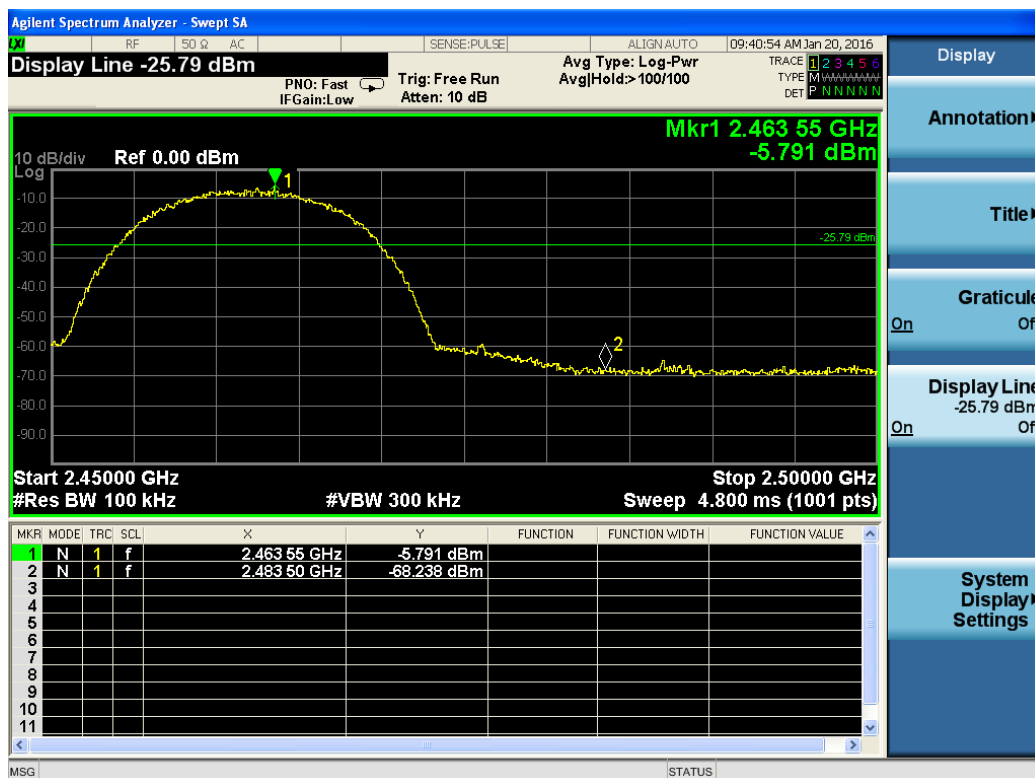
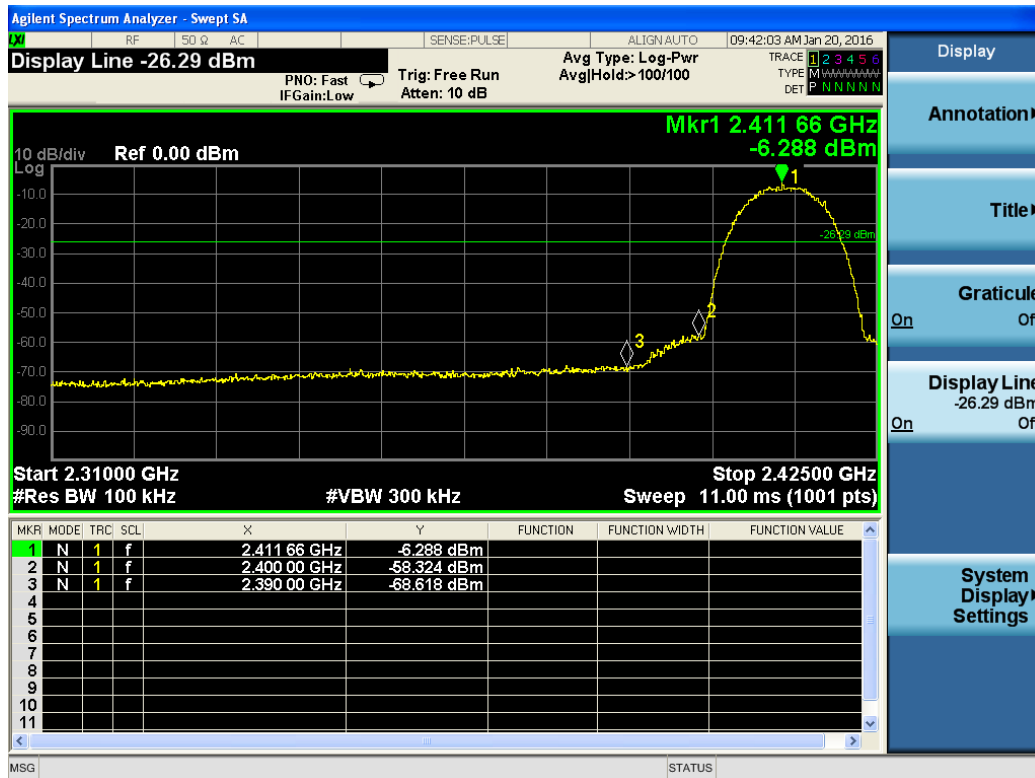




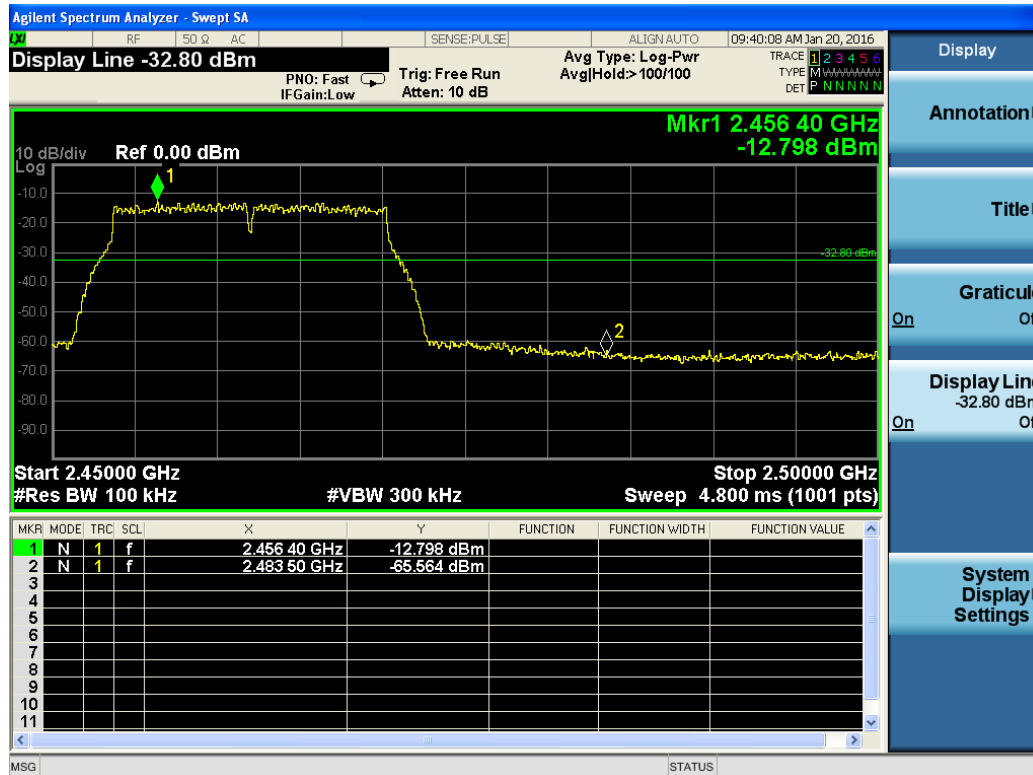
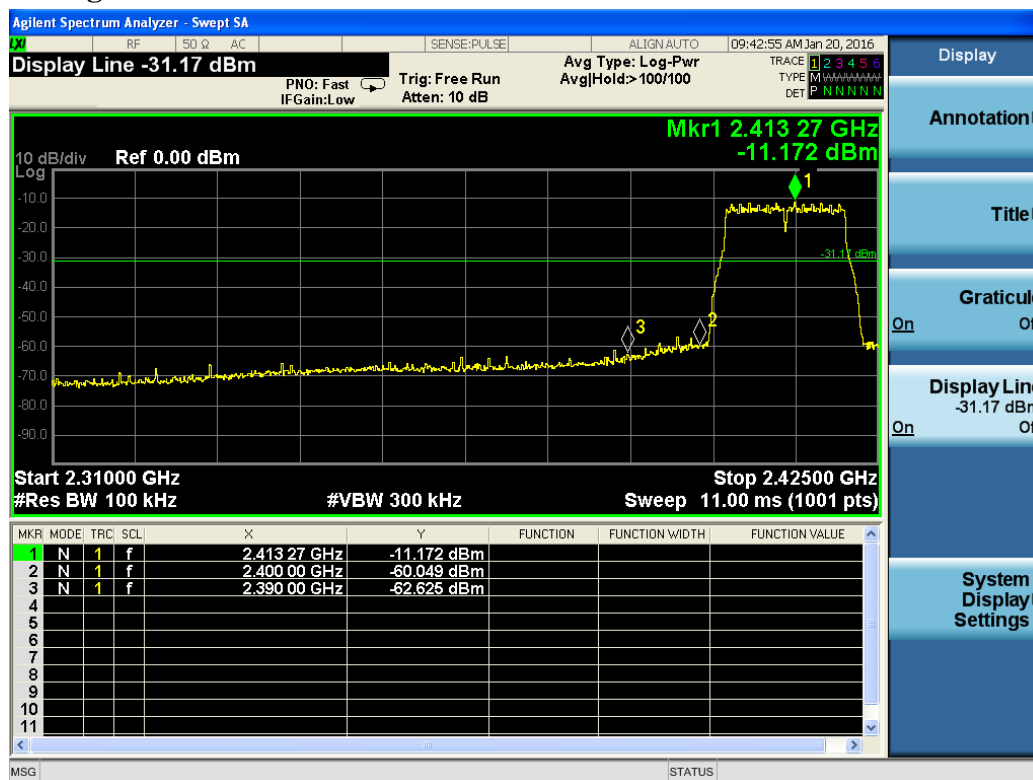


## 5.5.7. Test Results of Band Edges Test

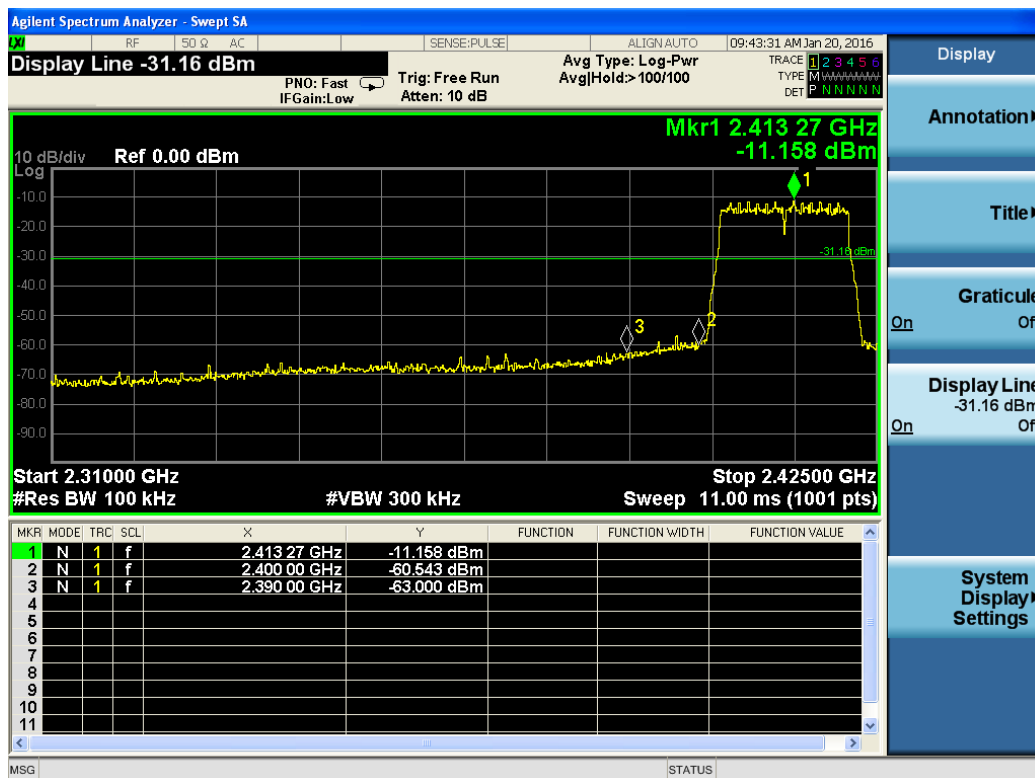
## 802.11b



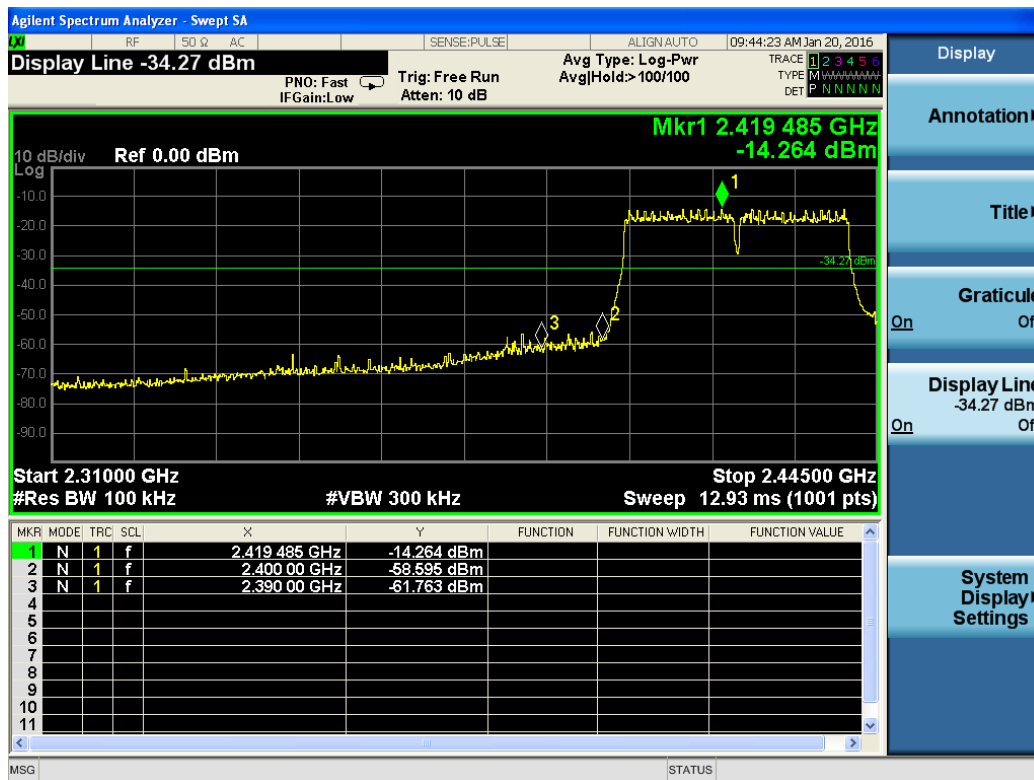
## 802.11g



## 802.11n HT20



## 802.11n HT40



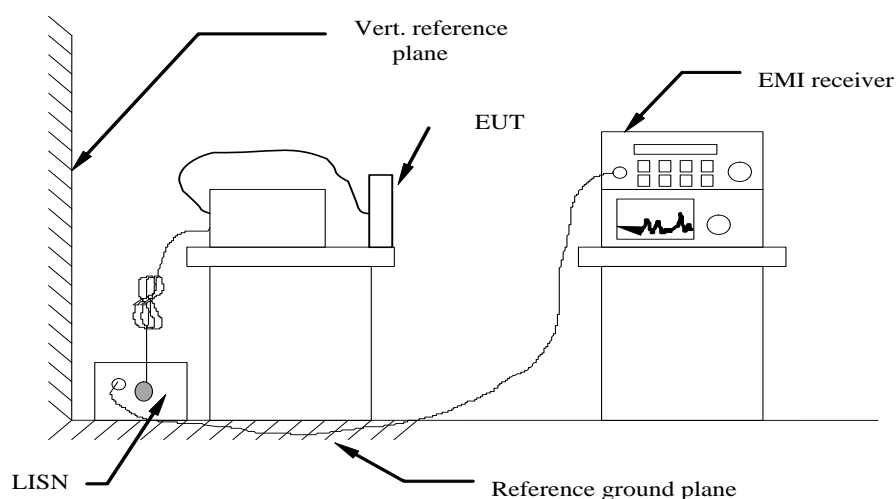
## 5.6. Power line conducted emissions

### 5.6.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which 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 or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

| Frequency Range (MHz) | Limits (dB $\mu$ V) |          |
|-----------------------|---------------------|----------|
|                       | Quasi-peak          | Average  |
| 0.15 to 0.50          | 66 to 56            | 56 to 46 |
| 0.50 to 5             | 56                  | 46       |
| 5 to 30               | 60                  | 50       |

### 5.6.2 Block Diagram of Test Setup

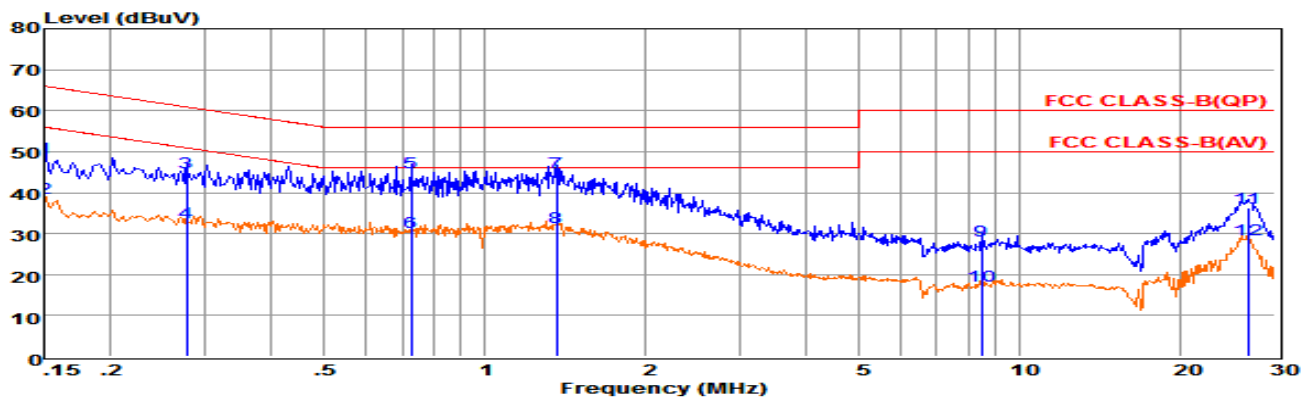


### 5.6.3 Test Results

PASS.

The test data please refer to following page.

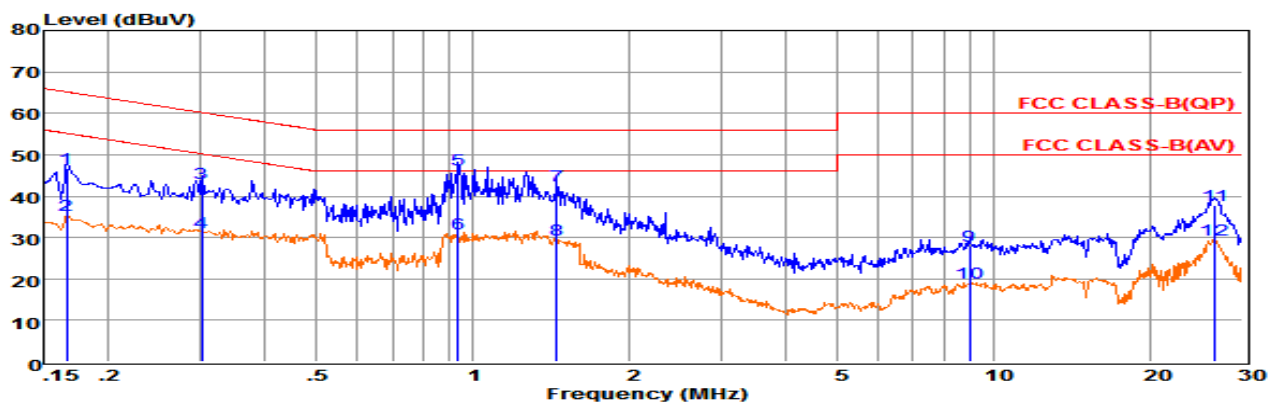
## Test result for 802.11b(AC 120V)



Env. Ins: 24\*/56%  
Pol: LINE

|    | Freq       | Reading | LisnFac | CabLos | Atten_Fac | Measured | Limit | Over   | Remark  |
|----|------------|---------|---------|--------|-----------|----------|-------|--------|---------|
|    | MHz        | dBuV    | dB      | dB     | dB        | dBuV     | dBuV  | dB     |         |
| 1  | 0.15000    | 28.82   | 9.57    | 0.02   | 10.00     | 48.41    | 66.00 | -17.59 | QP      |
| 2  | 0.15010    | 19.12   | 9.57    | 0.02   | 10.00     | 38.71    | 55.99 | -17.28 | Average |
| 3  | 0.27734    | 25.26   | 9.63    | 0.03   | 10.00     | 44.92    | 60.90 | -15.98 | QP      |
| 4  | 0.27744    | 12.99   | 9.63    | 0.03   | 10.00     | 32.65    | 50.89 | -18.24 | Average |
| 5  | 0.72744    | 25.28   | 9.64    | 0.04   | 10.00     | 44.96    | 56.00 | -11.04 | QP      |
| 6  | 0.72754    | 10.51   | 9.64    | 0.04   | 10.00     | 30.19    | 46.00 | -15.81 | Average |
| 7  | 1.35931    | 25.10   | 9.63    | 0.05   | 10.00     | 44.78    | 56.00 | -11.22 | QP      |
| 8  | 1.36031    | 11.83   | 9.63    | 0.05   | 10.00     | 31.51    | 46.00 | -14.49 | Average |
| 9  | 8.50112    | 8.39    | 9.69    | 0.08   | 10.00     | 28.16    | 60.00 | -31.84 | QP      |
| 10 | 8.50212    | -2.44   | 9.69    | 0.08   | 10.00     | 17.33    | 50.00 | -32.67 | Average |
| 11 | 1126.69922 | 16.47   | 9.71    | 0.13   | 10.00     | 36.31    | 60.00 | -23.69 | QP      |
| 12 | 1226.70022 | 8.85    | 9.71    | 0.13   | 10.00     | 28.69    | 50.00 | -21.31 | Average |

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten\_Fac.  
2. The emission levels that are 20dB below the official limit are not reported.

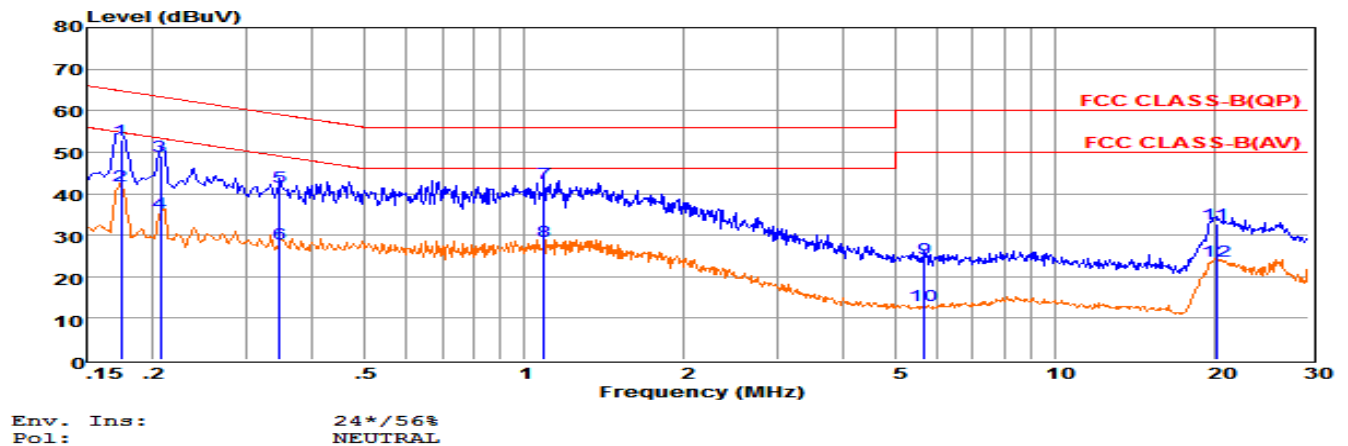


Env. Ins: 24\*/56%  
Pol: NEUTRAL

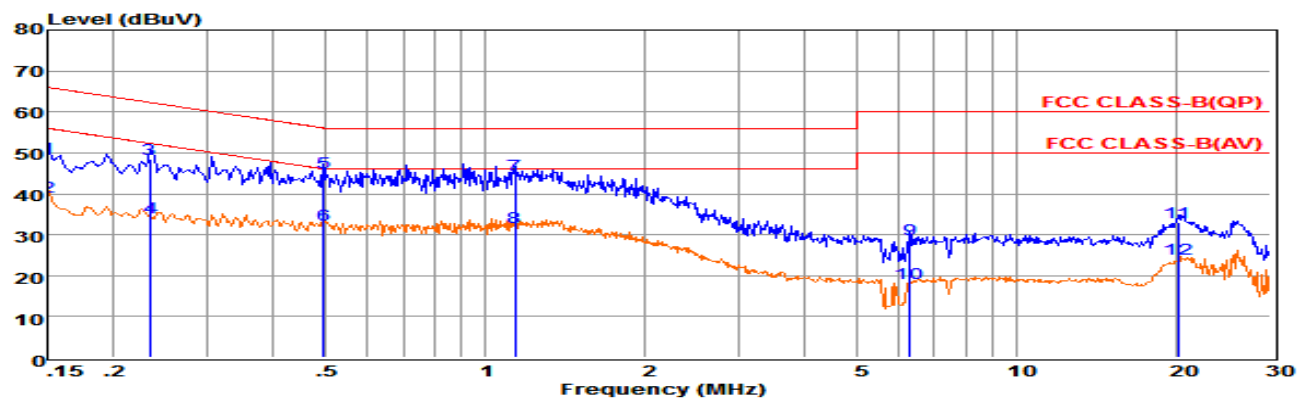
|    | Freq       | Reading | LisnFac | CabLos | Atten_Fac | Measured | Limit | Over   | Remark  |
|----|------------|---------|---------|--------|-----------|----------|-------|--------|---------|
|    | MHz        | dBuV    | dB      | dB     | dB        | dBuV     | dBuV  | dB     |         |
| 1  | 0.16589    | 26.99   | 9.66    | 0.02   | 10.00     | 46.67    | 65.16 | -18.49 | QP      |
| 2  | 0.16599    | 15.80   | 9.66    | 0.02   | 10.00     | 35.48    | 55.16 | -19.68 | Average |
| 3  | 0.30188    | 23.42   | 9.60    | 0.03   | 10.00     | 43.05    | 60.19 | -17.14 | QP      |
| 4  | 0.30198    | 11.54   | 9.60    | 0.03   | 10.00     | 31.17    | 50.19 | -19.02 | Average |
| 5  | 0.93810    | 26.64   | 9.63    | 0.05   | 10.00     | 46.32    | 56.00 | -9.68  | QP      |
| 6  | 0.93820    | 11.22   | 9.63    | 0.05   | 10.00     | 30.90    | 46.00 | -15.10 | Average |
| 7  | 1.44855    | 22.98   | 9.63    | 0.05   | 10.00     | 42.66    | 56.00 | -13.34 | QP      |
| 8  | 1.44955    | 9.90    | 9.63    | 0.05   | 10.00     | 29.58    | 46.00 | -16.42 | Average |
| 9  | 8.96368    | 8.24    | 9.71    | 0.08   | 10.00     | 28.03    | 60.00 | -31.97 | QP      |
| 10 | 8.96468    | -0.61   | 9.71    | 0.08   | 10.00     | 19.18    | 50.00 | -30.82 | Average |
| 11 | 1126.55813 | 17.68   | 9.83    | 0.13   | 10.00     | 37.64    | 60.00 | -22.36 | QP      |
| 12 | 1226.55913 | 9.44    | 9.83    | 0.13   | 10.00     | 29.40    | 50.00 | -20.60 | Average |

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten\_Fac.  
2. The emission levels that are 20dB below the official limit are not reported.

## Test result for 802.11b(AC 240V)



Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten\_Fac.  
2. The emission levels that are 20dB below the official limit are not reported.



Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten\_Fac.  
2. The emission levels that are 20dB below the official limit are not reported.

\*\*\*Note: Pre-scan all mode and recorded the worst case results in this report (802.11b).

## 5.7. Antenna Requirements

### 5.7.1 Standard Applicable

According to antenna requirement of §15.203. An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

### 5.7.2 Antenna Connected Construction

#### 5.7.2.1. Standard Applicable

According to § 15.203 & RSS-Gen, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

#### 5.7.2.2. Antenna Connector Construction

The directional gains of antenna used for transmitting is 2.0dBi, and the PIFA antenna is connect to PCB board and no consideration of replacement. Please see EUT photo for details.

#### 5.7.2.3. Results: Compliance.



## 6. LIST OF MEASURING EQUIPMENTS

| Instrument               | Manufacturer   | Model No.                        | Serial No.  | Characteristics | Cal Date         | Due Date         |
|--------------------------|----------------|----------------------------------|-------------|-----------------|------------------|------------------|
| EMC Receiver             | R&S            | ESCS 30                          | 100174      | 9kHz – 2.75GHz  | June 18, 2015    | June 17, 2016    |
| Signal analyzer          | Agilent        | E4448A(External mixers to 40GHz) | US44300469  | 9kHz~40GHz      | July 16, 2015    | July 15, 2016    |
| Signal analyzer          | Agilent        | N9020A                           | MY50510140  | 9kHz~26.5GHz    | October 27, 2015 | October 26, 2016 |
| LISN                     | MESS Tec       | NNB-2/16Z                        | 99079       | 9KHz-30MHz      | June 18, 2015    | June 17, 2016    |
| LISN (Support Unit)      | EMCO           | 3819/2NM                         | 9703-1839   | 9KHz-30MHz      | June 18, 2015    | June 17, 2016    |
| RF Cable-CON             | UTIFLEX        | 3102-26886-4                     | CB049       | 9KHz-30MHz      | June 18, 2015    | June 17, 2016    |
| ISN                      | SCHAFFNER      | ISN ST08                         | 21653       | 9KHz-30MHz      | June 18, 2015    | June 17, 2016    |
| 3m Semi Anechoic Chamber | SIDT FRANKONIA | SAC-3M                           | 03CH03-HY   | 30M-1GHz<br>3m  | June 18, 2015    | June 17, 2016    |
| Amplifier                | SCHAFFNER      | COA9231A                         | 18667       | 9kHz-2GHz       | June 18, 2015    | June 17, 2016    |
| Amplifier                | Agilent        | 8449B                            | 3008A02120  | 1GHz-26.5GHz    | July 16, 2015    | July 15, 2016    |
| Amplifier                | MITEQ          | AMF-6F-260400                    | 9121372     | 26.5GHz-40GHz   | July 16, 2015    | July 15, 2016    |
| Loop Antenna             | R&S            | HFH2-Z2                          | 860004/001  | 9k-30MHz        | June 18, 2015    | June 17, 2016    |
| By-log Antenna           | SCHWARZBECK    | VULB9163                         | 9163-470    | 30MHz-1GHz      | June 10, 2015    | June 09, 2016    |
| Horn Antenna             | EMCO           | 3115                             | 6741        | 1GHz-18GHz      | June 10, 2015    | June 09, 2016    |
| Horn Antenna             | SCHWARZBECK    | BBHA9170                         | BBHA9170154 | 15GHz-40GHz     | June 10, 2015    | June 09, 2016    |
| RF Cable-R03m            | Jye Bao        | RG142                            | CB021       | 30MHz-1GHz      | June 18, 2015    | June 17, 2016    |
| RF Cable-HIGH            | SUHNER         | SUCOFLEX 106                     | 03CH03-HY   | 1GHz-40GHz      | June 18, 2015    | June 17, 2016    |
| Spectrum Meter           | R&S            | FSP 30                           | 100023      | 9kHz-30GHz      | July 16, 2015    | July 15, 2016    |
| Power Meter              | R&S            | NRVS                             | 100444      | DC-40GHz        | June 18, 2015    | June 17, 2016    |
| Power Sensor             | R&S            | NRV-Z51                          | 100458      | DC-30GHz        | June 18, 2015    | June 17, 2016    |
| Power Sensor             | R&S            | NRV-Z32                          | 10057       | 30MHz-6GHz      | June 18, 2015    | June 17, 2016    |
| AC Power Source          | HPC            | HPA-500E                         | HPA-9100024 | AC 0~300V       | June 18, 2015    | June 17, 2016    |
| DC power Source          | GW             | GPC-6030D                        | C671845     | DC 1V-60V       | June 18, 2015    | June 17, 2016    |
| Temp. and Humidity       | Giant Force    | GTH-225-20-S                     | MAB0103-00  | N/A             | June 18, 2015    | June 17, 2016    |
| RF CABLE-1m              | JYE Bao        | RG142                            | CB034-1m    | 20MHz-7GHz      | June 18, 2015    | June 17, 2016    |
| RF CABLE-2m              | JYE Bao        | RG142                            | CB)35-2m    | 20MHz-1GHz      | June 18, 2015    | June 17, 2016    |
| Vector signal Generator  | R&S            | SMU200A                          | 102098      | 100kHz~6GHz     | June 18, 2015    | June 17, 2016    |
| Signal Generator         | R&S            | SMR40                            | 10016       | 10MHz~40GHz     | July 16, 2015    | July 15, 2016    |

Note: All equipment through GRGT EST calibration

-----THE END OF REPORT-----