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## FCC PART 15 SUBPART C TEST REPORT

### Part 15.247

Report Reference No.....: **CTL1606082150-WF**

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Name of the organization performing the tests

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Tracy Qi

Date of issue.....: June 27, 2016

Test Laboratory Name .....: **Shenzhen CTL Testing Technology Co., Ltd.**

Address .....: Floor 1-A, Baisha Technology Park, No.3011, Shahe Xi Road, Nanshan District, Shenzhen, China 518055

Applicant's name.....: **Hangzhou Miotlink Technology Co., Ltd.**

Address .....: 5# Building, No.1 Weiye Road, Binjiang District, Hangzhou City, Zhejiang Province, China

#### Test specification:

Standard .....: FCC Part 15.247: Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

TRF Originator.....: Shenzhen CTL Testing Technology Co., Ltd.

Master TRF.....: Dated 2011-01

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Test item description .....: WIFI module

FCC ID.....: 2AD6F-M10

Trade Mark .....: N/A

Model/Type reference .....: M10, M10C, M10D, M10E

Modulation .....: 802.11b DSSS, 802.11g/n: OFDM

Work Frequency Range .....: 802.11b/g/n(20MHz): 2412~2462MHz

Antenna Type .....: Internal

Antenna Gain.....: Antenna 1: 0.5dBi

Antenna 2: 0dBi

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

**TEST REPORT**

|                                           |                                |
|-------------------------------------------|--------------------------------|
| <b>Test Report No. :</b> CTL1606082150-WF | June 27, 2016<br>Date of issue |
|-------------------------------------------|--------------------------------|

Equipment under Test : WIFI module

Model /Type : M10, M10C, M10D, M10E

**Applicant** : Hangzhou Miotlink Technology Co., Ltd.

Address : 5# Building, No.1 Weiye Road, Binjiang District, Hangzhou City,  
Zhejiang Province, China

**Manufacturer** : Hangzhou Miotlink Technology Co., Ltd.

Address : 5# Building, No.1 Weiye Road, Binjiang District, Hangzhou City,  
Zhejiang Province, China

**Test Result** according to the  
standards on page 4:

**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.

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## **1. TEST STANDARDS**

The tests were performed according to following standards:

**FCC Part 15.247:** Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

**ANSI C63.10-2013:** American National Standard for Testing Unlicensed Wireless Devices.

**ANSI C63.4-2014**

**KDB Publication No. 558074 D01 v03r03 Guidance on Measurements for Digital Transmission Systems**



## 2. SUMMARY

### 2.1. General Remarks

|                                |   |               |
|--------------------------------|---|---------------|
| Date of receipt of test sample | : | June 08, 2016 |
|                                |   |               |
| Testing commenced on           | : | June 08, 2016 |
|                                |   |               |
| Testing concluded on           | : | June 24, 2016 |

### 2.2. Equipment Under Test

#### Power supply system utilised

|                      |   |                                                                   |                                   |
|----------------------|---|-------------------------------------------------------------------|-----------------------------------|
| Power supply voltage | : | <input type="radio"/> 120V / 60 Hz                                | <input type="radio"/> 115V / 60Hz |
|                      |   | <input type="radio"/> 12 V DC                                     | <input type="radio"/> 24 V DC     |
|                      |   | <input checked="" type="radio"/> Other (specified in blank below) |                                   |

DC 3.3V

#### Description of the test mode

IEEE 802.11b/g/n(HT20): Thirteen channels are provided to the EUT, but only eleventh channels used for USA.

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

### 2.3. Description of the Equipment under Test (EUT)

|                       |                                                |
|-----------------------|------------------------------------------------|
| Product Name:         | WIFI module                                    |
| Model/Type reference: | M10                                            |
| Power supply:         | DC 3.3V                                        |
| <b>WIFI</b>           |                                                |
| Supported type:       | 802.11b/802.11g/802.11n(HT20)                  |
| Modulation:           | 802.11b: DSSS<br>802.11g/802.11n(HT20): OFDM   |
| Operation frequency:  | 802.11b/802.11g/802.11n(HT20): 2412MHz~2462MHz |
| Channel number:       | 802.11b/802.11g/802.11n(HT20): 11              |
| Channel separation:   | 5MHz                                           |
| Antenna gain:         | Antenna 1: 0.5dBi<br>Antenna 2: 0dBi           |

Note: 1. This WIFI module has SISO function only.

2. For more detailed features description, please refer to the manufacturer's specifications or the User's Manual .

## 2.4. EUT operation mode

Test Mode:

1. The EUT has been tested under normal operating condition.
2. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed. Channel low (2412MHz), mid (2437MHz) and high (2462MHz) for 802.11b/g/n(HT20) with highest data rate are chosen for full testing.
3. Test Mode:

| Test Mode(TM) | Description  | Antenna | Remark                                        |
|---------------|--------------|---------|-----------------------------------------------|
| 1             | Transmitting | 1       | 802.11 b<br>2412MHz, 2437MHz,<br>2462MHz      |
| 2             | Transmitting | 1       | 802.11 g<br>2412MHz, 2437MHz,<br>2462MHz      |
| 3             | Transmitting | 1       | 802.11 n HT20<br>2412MHz, 2437MHz,<br>2462MHz |
| 4             | Transmitting | 2       | 802.11 b<br>2412MHz, 2437MHz,<br>2462MHz      |
| 5             | Transmitting | 2       | 802.11 g<br>2412MHz, 2437MHz,<br>2462MHz      |
| 6             | Transmitting | 2       | 802.11 n HT20<br>2412MHz, 2437MHz,<br>2462MHz |

## 2.5. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- - supplied by the manufacturer
- - supplied by the lab
- Test board (FCC DOC approved)

Manufacturer: Hangzhou Miotlink Technology Co., Ltd.  
Model No.: USB to TTL

## 2.6. NOTE

1. The EUT is a 802.11b/g/n WIFI module ,The functions of the EUT listed as below:

|                         | Test Standards                           | Reference Report |
|-------------------------|------------------------------------------|------------------|
| WLAN 802.11b/g, 802.11n | FCC Part 15 Subpart C<br>(Section15.247) | CTL1606082150-WF |

2. The frequency bands used in this EUT are listed as follows:

| Frequency Band(MHz) | 2400-2483.5 | 5150-5350 | 5470-5725 | 5725-5850 |
|---------------------|-------------|-----------|-----------|-----------|
| 802.11b             | √           | —         | —         | —         |
| 802.11g             | √           | —         | —         | —         |
| 802.11n(20MHz)      | √           | —         | —         | —         |

3. The EUT incorporates a SISO function, Physically, the EUT provides one completed transmitter and one completed receivers.

| Modulation Mode | TX Function |
|-----------------|-------------|
| 802.11b         | 1TX         |
| 802.11g         | 1TX         |
| 802.11n (20MHz) | 1TX         |

## 2.7. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCCID: 2AD6F-M10 filing to comply with of the FCC part15.247 Rules.

## 2.8. Modifications

No modifications were implemented to meet testing criteria.



3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Shenzhen CTL Testing Technology Co., Ltd.  
Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, China 518055

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10 (2013) and CISPR Publication 22.

3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

IC Registration No.: 9618B

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 9618B on November 13, 2013.

FCC-Registration No.: 970318

Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 970318, December 19, 2013.

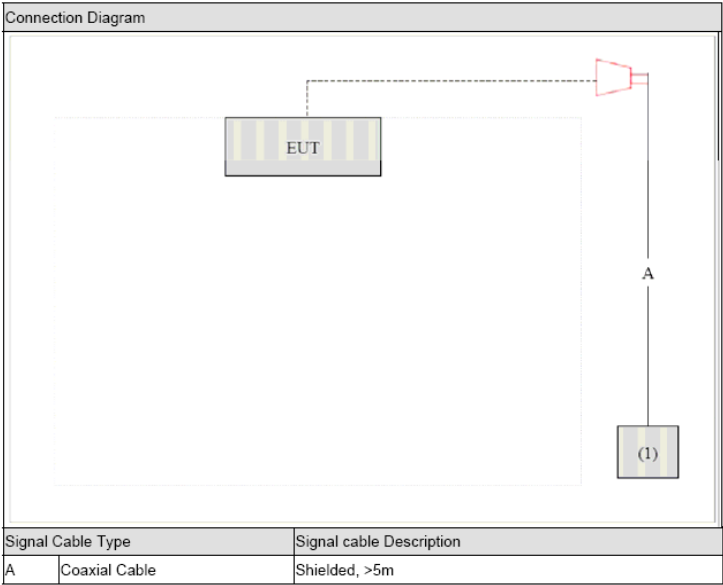
3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

|                       |              |
|-----------------------|--------------|
| Temperature:          | 15-35 ° C    |
| Humidity:             | 30-60 %      |
| Atmospheric pressure: | 950-1050mbar |

3.4. Configuration of Tested System

Fig. 2-1 Configuration of Tested System



### 3.5. Duty Cycle

| Operated Mode for Worst Duty Cycle                                          |                |                  |
|-----------------------------------------------------------------------------|----------------|------------------|
| <input type="checkbox"/> Operated normally mode for worst duty cycle        |                |                  |
| <input checked="" type="checkbox"/> Operated test mode for worst duty cycle |                |                  |
| Mode                                                                        | Duty Cycle (%) | Duty Factor (dB) |
| 11b                                                                         | 100            | 0                |
| 11g                                                                         | 100            | 0                |
| 11n HT20                                                                    | 100            | 0                |

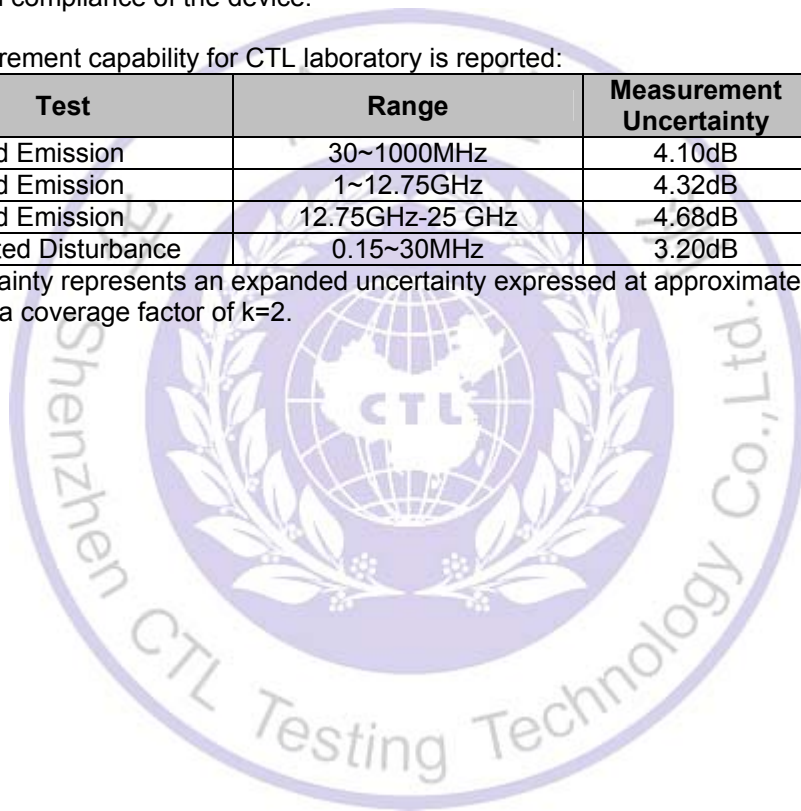
### 3.6. Statement of the measurement uncertainty

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 Shenzhen CTL Testing Technology Co., Ltd. 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.

Hereafter the best measurement capability for CTL laboratory is reported:

| Test                  | Range           | Measurement Uncertainty | Notes |
|-----------------------|-----------------|-------------------------|-------|
| Radiated Emission     | 30~1000MHz      | 4.10dB                  | (1)   |
| Radiated Emission     | 1~12.75GHz      | 4.32dB                  | (1)   |
| Radiated Emission     | 12.75GHz-25 GHz | 4.68dB                  | (1)   |
| Conducted Disturbance | 0.15~30MHz      | 3.20dB                  | (1)   |

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



### 3.7. Equipments Used during the Test

| Test Equipment             | Manufacturer         | Model No.             | Serial No.   | Calibration Date | Calibration Due Date |
|----------------------------|----------------------|-----------------------|--------------|------------------|----------------------|
| ULTRA-ROADBAND ANTENNA     | Sunol Sciences Corp. | JB1                   | A061713      | 2016/06/02       | 2017/06/01           |
| EMI Test Receiver          | R&S                  | ESCI                  | 103710       | 2016/06/02       | 2017/06/01           |
| Spectrum Analyzer          | Agilent              | E4407B                | MY41440676   | 2016/05/21       | 2017/05/20           |
| Controller                 | EM Electronics       | Controller EM 1000    | N/A          | 2016/05/21       | 2017/05/20           |
| Horn Antenna               | Sunol Sciences Corp. | DRH-118               | A062013      | 2016/05/19       | 2017/05/18           |
| Active Loop Antenna        | Daze                 | ZN30900A              | N/A          | 2016/05/19       | 2017/05/18           |
| LISN                       | R&S                  | ENV216                | 3560.6550.12 | 2016/06/02       | 2017/06/01           |
| LISN                       | R&S                  | ESH2-Z5               | 860014/010   | 2016/06/02       | 2017/06/01           |
| ISN                        | FCC                  | F-071115-1057-1-09    | 11229        | 2016/05/19       | 2017/05/18           |
| Amplifier                  | Agilent              | 8349B                 | 3008A02306   | 2016/05/19       | 2017/05/18           |
| Amplifier                  | Agilent              | 8447D                 | 2944A10176   | 2016/05/19       | 2017/05/18           |
| Transient Limiter          | SCHWARZCECK          | VTSD 9561F            | 9666         | 2016/06/02       | 2017/06/01           |
| Radio Communication Tester | R&S                  | CMU200                | 115419       | 2016/05/22       | 2017/05/21           |
| Temperature/Humidity Meter | Gangxing             | CTH-608               | 02           | 2016/05/20       | 2017/05/19           |
| SIGNAL GENERATOR           | Agilent              | E4421B                | US40051744   | 2016/05/20       | 2017/05/19           |
| Power Meter                | Agilent              | U2531A                | TW53323507   | 2016/05/21       | 2017/05/20           |
| Power Sensor               | Agilent              | U2021XA               | MY5365004    | 2016/05/21       | 2017/05/20           |
| Climate Chamber            | ESPEC                | EL-10KA               | A20120523    | 2016/05/20       | 2017/05/19           |
| High-Pass Filter           | K&L                  | 9SH10-2700/X12750-O/O | N/A          | 2016/05/20       | 2017/05/19           |
| High-Pass Filter           | K&L                  | 41H10-1375/U12750-O/O | N/A          | 2016/05/20       | 2017/05/19           |
| RF Cable                   | HUBER+SUHNER         | RG214                 | N/A          | 2016/05/20       | 2017/05/19           |

### 3.8. Summary of Test Result

| FCC PART 15                     |                                     |      |
|---------------------------------|-------------------------------------|------|
| FCC Part 15.207                 | AC Power Conducted Emission         | PASS |
| FCC Part 15.247(a)(2)           | 6dB Bandwidth                       | PASS |
| FCC Part 15.247(d)              | Spurious RF Conducted Emission      | PASS |
| FCC Part 15.247(b)              | Maximum Peak Output Power           | PASS |
| FCC Part 15.247(e)              | Power Spectral Density              | PASS |
| FCC Part 15.109/ 15.205/ 15.209 | Radiated Emissions                  | PASS |
| FCC Part 15.247(d)              | Band Edge Compliance of RF Emission | PASS |
| FCC Part 15.203/15.247 (b)      | Antenna Requirement                 | PASS |

Remark: The measurement uncertainty is not included in the test result.

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

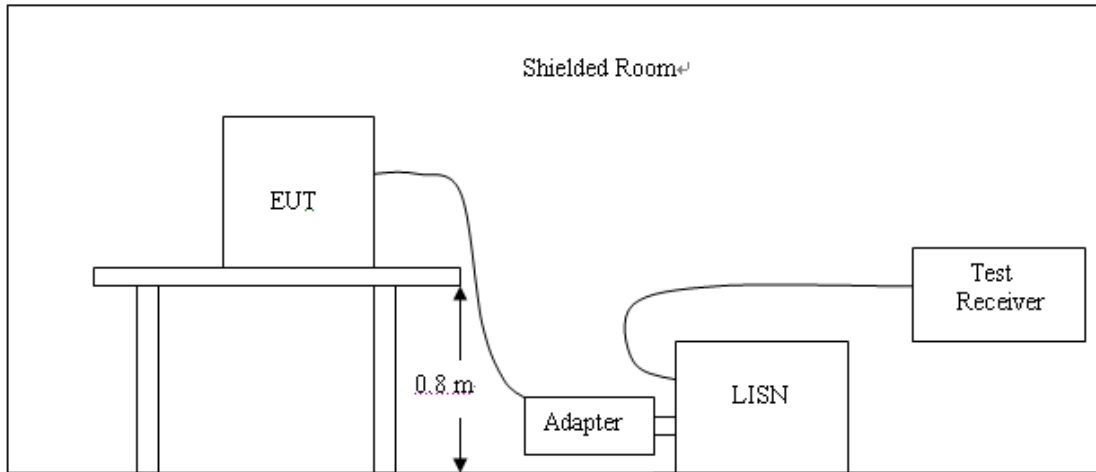
| Test Items                           | Mode            | Data Rate | Channel |
|--------------------------------------|-----------------|-----------|---------|
| AC Power Conducted Emission          | Normal Link     | 11 Mbps   | 1       |
| Maximum Peak Conducted Output Power  | 11b/DSSS        | 11 Mbps   | 1/6/11  |
| Power Spectral Density               | 11g/OFDM        | 54 Mbps   | 1/6/11  |
| 6dB Bandwidth                        | 11n(20MHz)/OFDM | 65Mbps    | 1/6/11  |
| Spurious RF conducted emission       | 11b/DSSS        | 11 Mbps   | 1/6/11  |
| Radiated Emission 30MHz~1GHz         | 11g/OFDM        | 54 Mbps   | 1/6/11  |
|                                      | 11n(20MHz)/OFDM | 65Mbps    | 1/6/11  |
|                                      | 11b/DSSS        | 11 Mbps   | 1/6/11  |
| Radiated Emission 1GHz~10th Harmonic | 11g/OFDM        | 54 Mbps   | 1/6/11  |
|                                      | 11n(20MHz)/OFDM | 65Mbps    | 1/6/11  |
|                                      | 11b/DSSS        | 11 Mbps   | 1/11    |
| Band Edge Compliance of RF Emission  | 11g/OFDM        | 54 Mbps   | 1/11    |
|                                      | 11n(20MHz)/OFDM | 65Mbps    | 1/11    |
|                                      | 11b/DSSS        | 11 Mbps   | 1/11    |

Note1: According exploratory test, EUT will have maximum output power in those data rate, so those data rate were used for all test.

## 4. TEST CONDITIONS AND RESULTS

### 4.1. Conducted Emissions Test

#### TEST CONFIGURATION



#### TEST PROCEDURE

For unintentional device, according to § 15.107(a) Line Conducted Emission Limits is as following:

| Frequency<br>(MHz) | Maximum RF Line Voltage (dBμV) |      |         |        |
|--------------------|--------------------------------|------|---------|--------|
|                    | CLASS A                        |      | CLASS B |        |
|                    | Q.P.                           | Ave. | Q.P.    | Ave.   |
| 0.15 - 0.50        | 79                             | 66   | 66-56*  | 56-46* |
| 0.50 - 5.00        | 73                             | 60   | 56      | 46     |
| 5.00 - 30.0        | 73                             | 60   | 60      | 50     |

\* Decreasing linearly with the logarithm of the frequency

For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

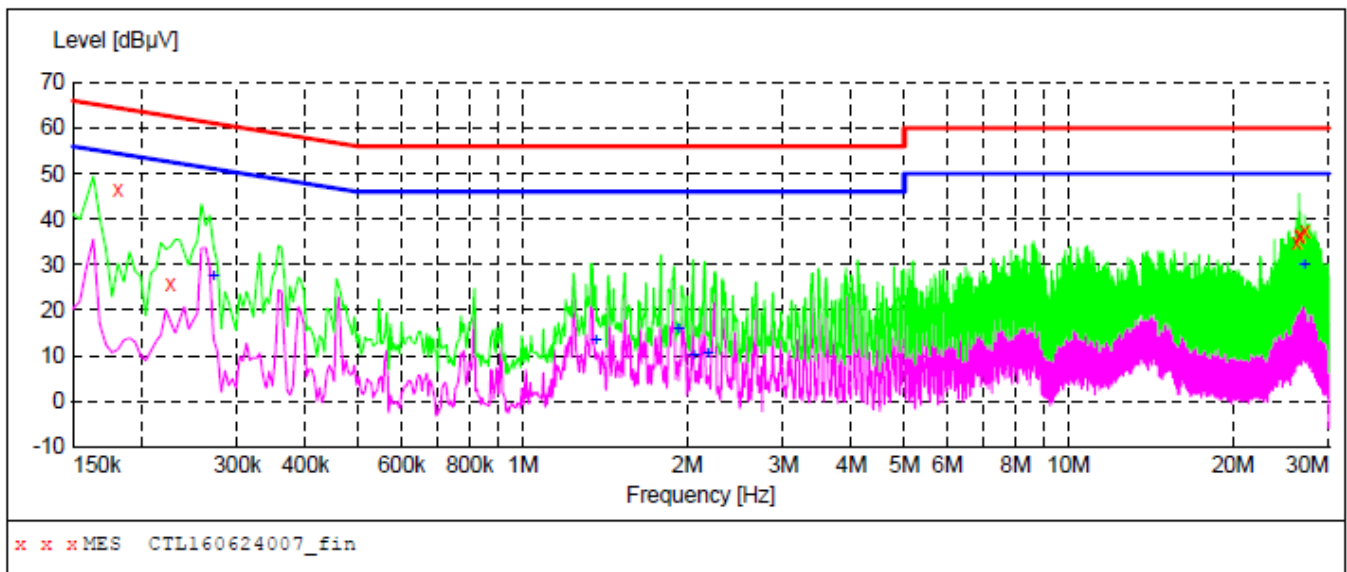
1. Please follow the guidelines in ANSI C63.10-2013.
2. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
3. Connect EUT to the power mains through a line impedance stabilization network (LISN).
4. All the support units are connecting to the other LISN.
5. The LISN provides 50 ohm coupling impedance for the measuring instrument.
6. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
7. Both sides of AC line were checked for maximum conducted interference.
8. The frequency range from 150 kHz to 30 MHz was searched.
9. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

**The RBW/VBW for 150KHz to 30MHz: 9KHz**

#### TEST RESULTS

**SCAN TABLE: "Voltage (9K-30M)FIN"**

Short Description: 150K-30M Voltage

**MEASUREMENT RESULT: "CTL160624007\_fin"**

6/24/2016 10:13AM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.181501         | 46.60         | 10.2         | 64            | 17.8         | QP       | L1   | GND |
| 0.226501         | 25.90         | 10.2         | 63            | 36.7         | QP       | L1   | GND |
| 26.173501        | 34.70         | 11.2         | 60            | 25.3         | QP       | L1   | GND |
| 26.416501        | 36.30         | 11.2         | 60            | 23.7         | QP       | L1   | GND |
| 26.533501        | 36.70         | 11.2         | 60            | 23.3         | QP       | L1   | GND |
| 27.073501        | 37.40         | 11.2         | 60            | 22.6         | QP       | L1   | GND |

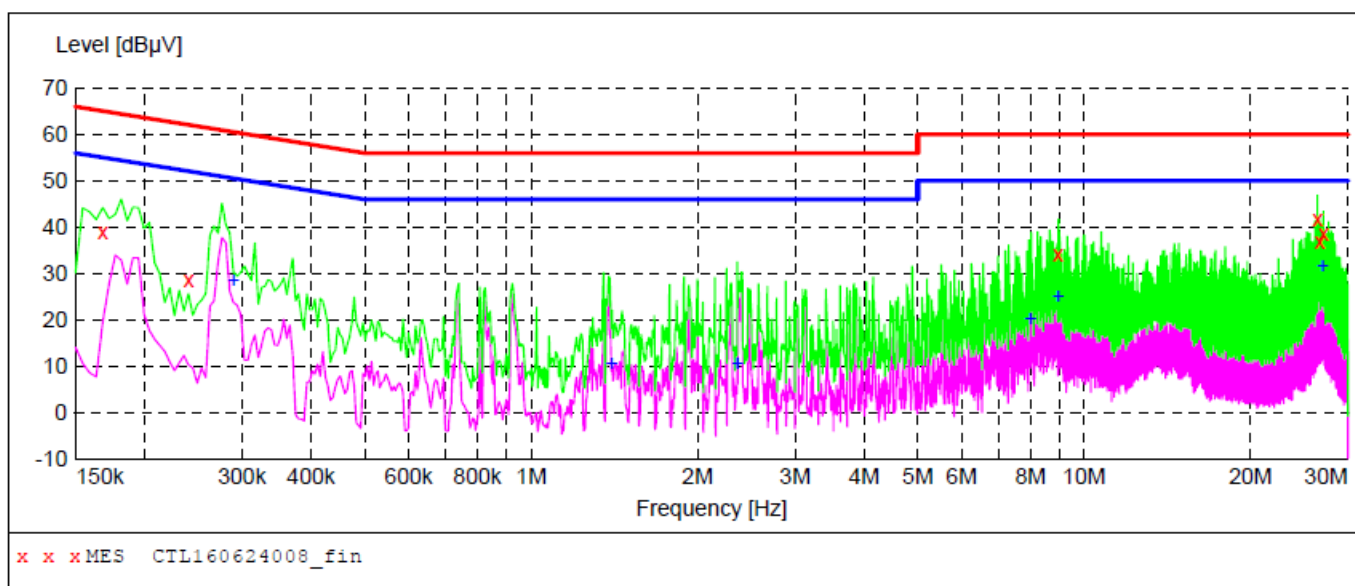
**MEASUREMENT RESULT: "CTL160624007\_fin2"**

6/24/2016 10:13AM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.271501         | 27.60         | 10.2         | 51            | 23.5         | AV       | L1   | GND |
| 1.360501         | 13.30         | 10.3         | 46            | 32.7         | AV       | L1   | GND |
| 1.927501         | 16.00         | 10.3         | 46            | 30.0         | AV       | L1   | GND |
| 2.058001         | 9.90          | 10.4         | 46            | 36.1         | AV       | L1   | GND |
| 2.179501         | 10.30         | 10.4         | 46            | 35.7         | AV       | L1   | GND |
| 27.015001        | 29.70         | 11.2         | 50            | 20.3         | AV       | L1   | GND |

**SCAN TABLE: "Voltage (9K-30M) FIN"**

Short Description: 150K-30M Voltage

**MEASUREMENT RESULT: "CTL160624008\_fin"**

6/24/2016 10:16AM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.168001         | 39.10         | 10.2         | 65            | 26.0         | QP       | N    | GND |
| 0.240001         | 28.50         | 10.2         | 62            | 33.6         | QP       | N    | GND |
| 8.956501         | 34.10         | 10.6         | 60            | 25.9         | QP       | N    | GND |
| 26.412001        | 41.80         | 11.2         | 60            | 18.2         | QP       | N    | GND |
| 26.655001        | 36.90         | 11.2         | 60            | 23.1         | QP       | N    | GND |
| 27.073501        | 38.50         | 11.2         | 60            | 21.5         | QP       | N    | GND |

**MEASUREMENT RESULT: "CTL160624008\_fin2"**

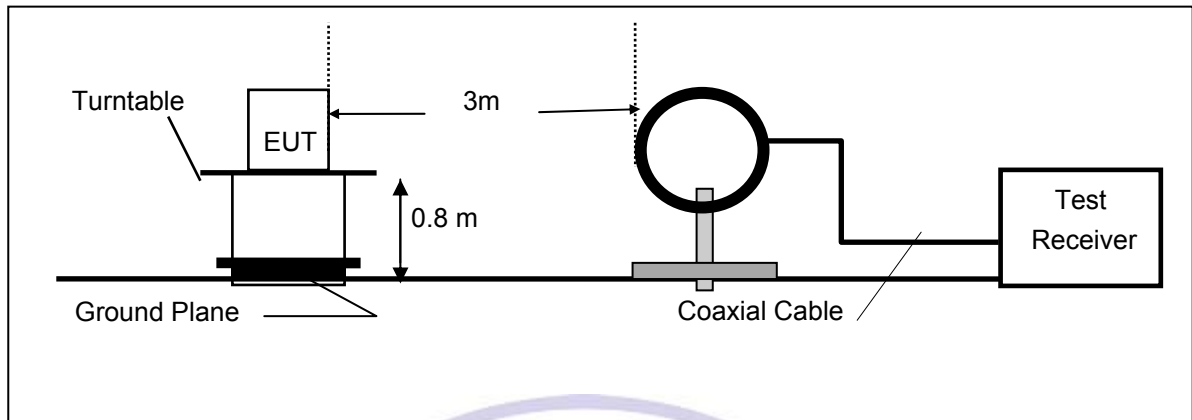
6/24/2016 10:16AM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.289501         | 28.50         | 10.2         | 51            | 22.0         | AV       | N    | GND |
| 1.396501         | 10.60         | 10.3         | 46            | 35.4         | AV       | N    | GND |
| 2.359501         | 10.80         | 10.4         | 46            | 35.2         | AV       | N    | GND |
| 7.998001         | 20.30         | 10.5         | 50            | 29.7         | AV       | N    | GND |
| 8.974501         | 25.30         | 10.6         | 50            | 24.7         | AV       | N    | GND |
| 27.015001        | 31.70         | 11.2         | 50            | 18.3         | AV       | N    | GND |

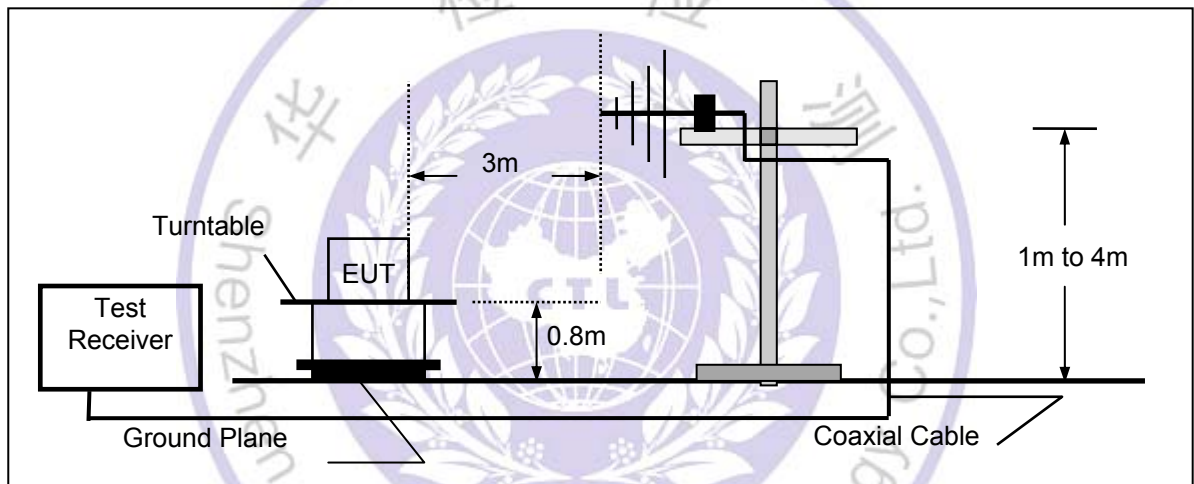
## 4.2. Radiated Emission and Bandedge Test

### TEST CONFIGURATION

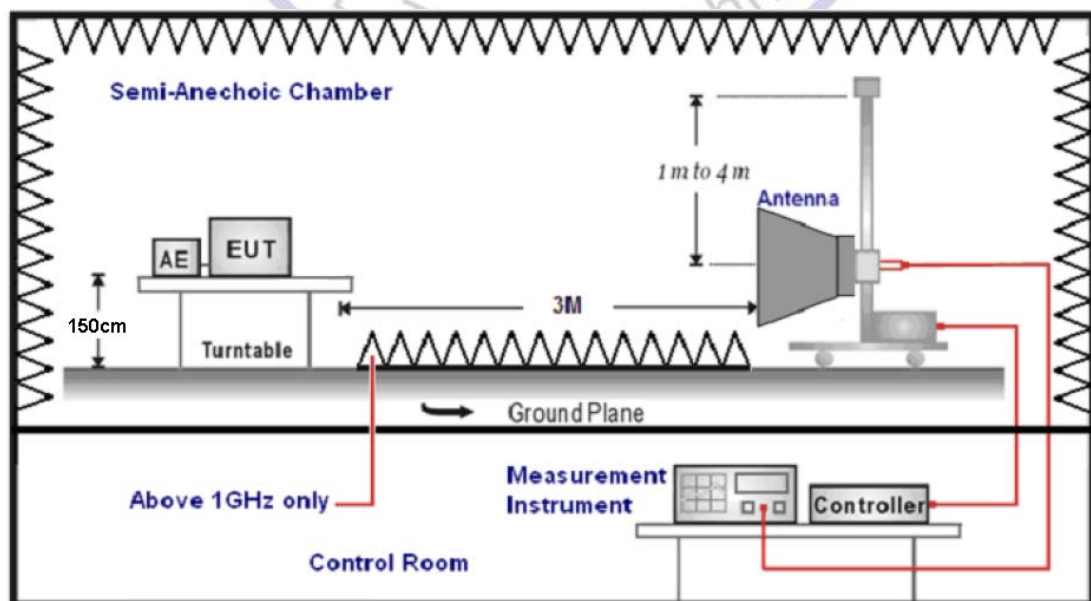
#### (A) Radiated Emission Test Set-Up, Frequency Below 30MHz



#### (B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



#### (C) Radiated Emission Test Set-Up, Frequency above 1000MHz



## **FIELD STRENGTH CALCULATION**

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

|                           |                                            |
|---------------------------|--------------------------------------------|
| Where FS = Field Strength | CL = Cable Attenuation Factor (Cable Loss) |
| RA = Reading Amplitude    | AG = Amplifier Gain                        |
| AF = Antenna Factor       |                                            |

## **TEST PROCEDURE**

1. The EUT is placed on a turntable, which is 0.8m above ground plane below 1GHz and 1.5m above ground plane above 1GHz.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. For the radiated emission test above 1GHz: Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. Repeat above procedures until the measurements for all frequencies are complete.
8. Based on the Frequency Generator in the device include 16MHz. The test frequency range from 9KHz to 25GHz per FCC PART 15.33(a).

**Note:** 1. Three axes are chosen for pretest, the Y axis is the worst mode for final test.

2. When doing emission measurement above 1GHz, the horn antenna will be bended down a little (as horn antenna has the narrow beamwidth) in order to keeping the antenna in the "cone of radiation" of EUT. The 3dB beamwidth is 60 degrees for H-plane and 90 degrees for E-plane.

## **LIMIT**

For unintentional device, according to § 15.109(a), except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

| Frequency<br>(MHz) | Distance<br>(Meters) | Radiated<br>(dBµV/m) | Radiated<br>(µV/m) |
|--------------------|----------------------|----------------------|--------------------|
| 30-88              | 3                    | 40.0                 | 100                |
| 88-216             | 3                    | 43.5                 | 150                |
| 216-960            | 3                    | 46.0                 | 200                |
| Above 960          | 3                    | 54.0                 | 500                |

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT 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 desired power.

**TEST RESULTS****9KHz-30MHz:**

| Freq.<br>(MHz) | Level<br>(dBuV) | Over Limit<br>(dB) | Limit Line<br>(dBuV) | Remark   |
|----------------|-----------------|--------------------|----------------------|----------|
| -              | -               | -                  | -                    | 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 (specific distance/ test distance) (dB);

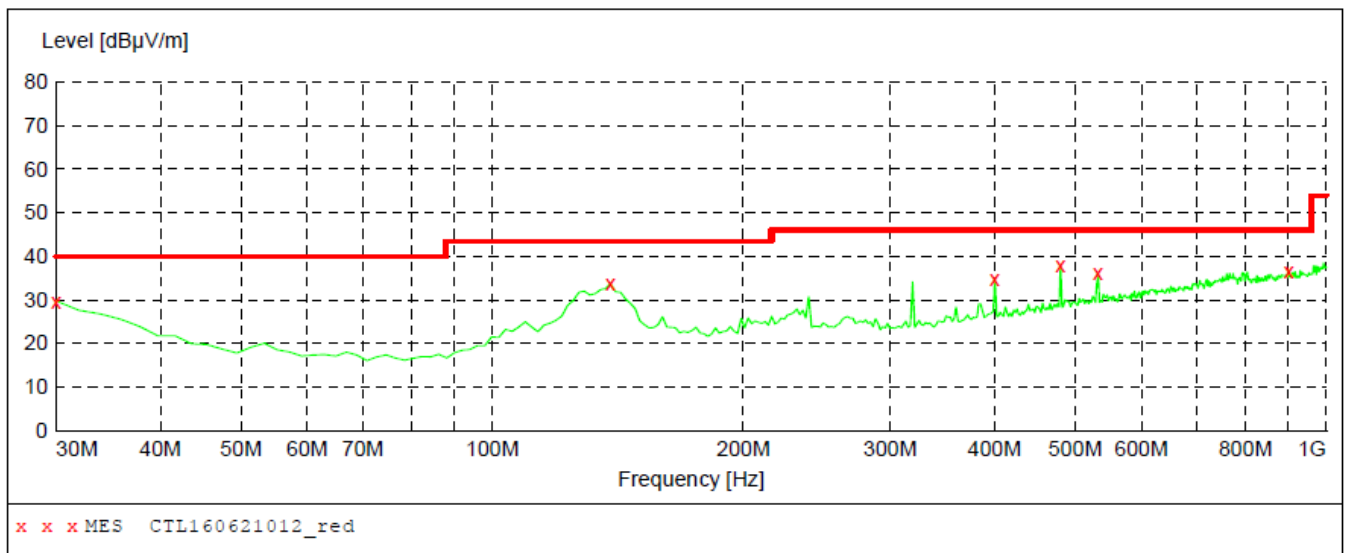
Limit line= specific limits (dBuV) + distance extrapolation factor.

**Below 1GHz(antenna 1):**

The radiated measurement are performed the each test mode (b/g/n) and channel (low/mid/high), the datum recorded below (802.11b mode, the middle channel) is the worst case for all the test mode and channel.

***SWEEP TABLE: "test (30M-1G)"***

| Short Description: |           | Field Strength |            |           |            |
|--------------------|-----------|----------------|------------|-----------|------------|
| Start              | Stop      | Detector       | Meas. Time | IF Bandw. | Transducer |
| Frequency          | Frequency |                |            |           |            |
| 30.0 MHz           | 1.0 GHz   | MaxPeak        | 300.0 ms   | 120 kHz   | JB1        |

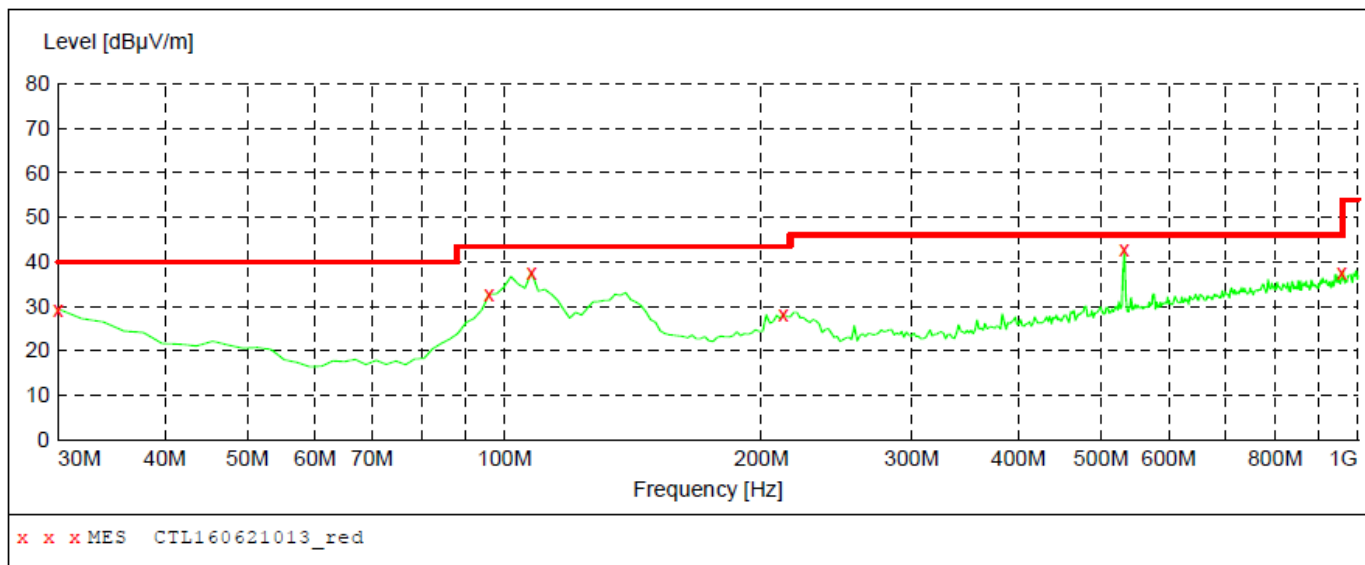
***MEASUREMENT RESULT: "CTL160621012\_red"***

6/21/2016 9:37AM

| Frequency<br>MHz | Level<br>dBuV/m | Transd<br>dB | Limit<br>dBuV/m | Margin<br>dB | Det. | Height<br>cm | Azimuth<br>deg | Polarization |
|------------------|-----------------|--------------|-----------------|--------------|------|--------------|----------------|--------------|
| 30.000000        | 29.70           | 20.8         | 40.0            | 10.3         | ---  | 0.0          | 0.00           | HORIZONTAL   |
| 138.640000       | 33.80           | 14.3         | 43.5            | 9.7          | ---  | 0.0          | 0.00           | HORIZONTAL   |
| 400.540000       | 34.80           | 17.9         | 46.0            | 11.2         | ---  | 0.0          | 0.00           | HORIZONTAL   |
| 480.080000       | 37.80           | 20.0         | 46.0            | 8.2          | ---  | 0.0          | 0.00           | HORIZONTAL   |
| 532.460000       | 36.10           | 20.5         | 46.0            | 9.9          | ---  | 0.0          | 0.00           | HORIZONTAL   |
| 901.060000       | 36.70           | 26.0         | 46.0            | 9.3          | ---  | 0.0          | 0.00           | HORIZONTAL   |

***SWEEP TABLE: "test (30M-1G)"***

| Short Description: |                   | Field Strength |            |           |            |
|--------------------|-------------------|----------------|------------|-----------|------------|
| Start              | Stop              | Detector       | Meas. Time | IF Bandw. | Transducer |
| Frequency 30.0 MHz | Frequency 1.0 GHz | MaxPeak        | 300.0 ms   | 120 kHz   | JB1        |

***MEASUREMENT RESULT: "CTL160621013\_red"***

6/21/2016 9:38AM

| Frequency<br>MHz | Level<br>dBμV/m | Transd<br>dB | Limit<br>dBμV/m | Margin<br>dB | Det. | Height<br>cm | Azimuth<br>deg | Polarization |
|------------------|-----------------|--------------|-----------------|--------------|------|--------------|----------------|--------------|
| 30.000000        | 29.40           | 20.8         | 40.0            | 10.6         | ---  | 0.0          | 0.00           | VERTICAL     |
| 95.960000        | 32.70           | 10.2         | 43.5            | 10.8         | ---  | 0.0          | 0.00           | VERTICAL     |
| 107.600000       | 37.60           | 12.9         | 43.5            | 5.9          | ---  | 0.0          | 0.00           | VERTICAL     |
| 212.360000       | 28.10           | 14.0         | 43.5            | 15.4         | ---  | 0.0          | 0.00           | VERTICAL     |
| 532.460000       | 42.70           | 20.5         | 46.0            | 3.3          | ---  | 0.0          | 0.00           | VERTICAL     |
| 957.320000       | 37.60           | 26.6         | 46.0            | 8.4          | ---  | 0.0          | 0.00           | VERTICAL     |

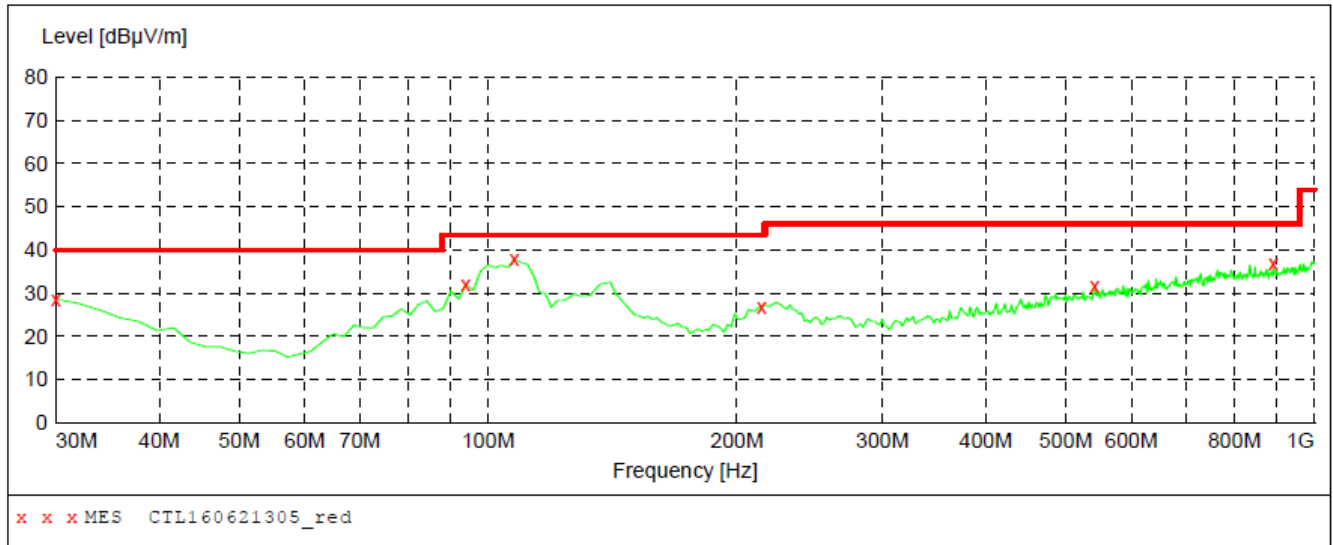
CTL Testing Technology

Below 1GHz(antenna 2):

The radiated measurement are performed the each test mode (b/g/n) and channel (low/mid/high), the datum recorded below (802.11b mode, the middle channel) is the worst case for all the test mode and channel.

**SWEEP TABLE: "test (30M-1G)"**

| Short Description: |           | Field Strength |          |         |            |
|--------------------|-----------|----------------|----------|---------|------------|
| Start              | Stop      | Detector       | Meas.    | IF      | Transducer |
| Frequency          | Frequency |                | Time     | Bandw.  |            |
| 30.0 MHz           | 1.0 GHz   | MaxPeak        | 300.0 ms | 120 kHz | JB1        |



**MEASUREMENT RESULT: "CTL160712305\_red"**

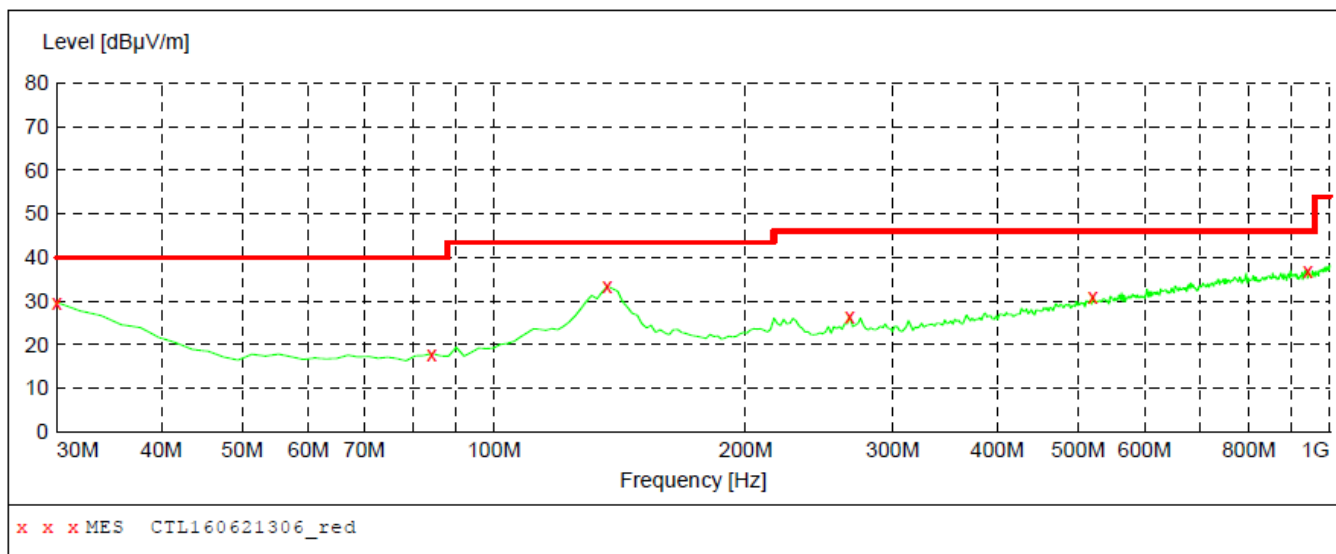
6/21/2016 5:29PM

| Frequency<br>MHz | Level<br>dBμV/m | Transd<br>dB | Limit<br>dBμV/m | Margin<br>dB | Det. | Height<br>cm | Azimuth<br>deg | Polarization |
|------------------|-----------------|--------------|-----------------|--------------|------|--------------|----------------|--------------|
| 30.000000        | 28.50           | 20.8         | 40.0            | 11.5         | ---  | 0.0          | 0.00           | VERTICAL     |
| 94.020000        | 31.90           | 9.9          | 43.5            | 11.6         | ---  | 0.0          | 0.00           | VERTICAL     |
| 107.600000       | 37.80           | 12.9         | 43.5            | 5.7          | ---  | 0.0          | 0.00           | VERTICAL     |
| 214.300000       | 26.80           | 14.0         | 43.5            | 16.7         | ---  | 0.0          | 0.00           | VERTICAL     |
| 542.160000       | 31.80           | 20.7         | 46.0            | 14.2         | ---  | 0.0          | 0.00           | VERTICAL     |
| 891.360000       | 36.90           | 25.8         | 46.0            | 9.1          | ---  | 0.0          | 0.00           | VERTICAL     |

Testing Techn

***SWEEP TABLE: "test (30M-1G)"***

|                    |           |                |          |         |            |
|--------------------|-----------|----------------|----------|---------|------------|
| Short Description: |           | Field Strength |          |         |            |
| Start              | Stop      | Detector       | Meas.    | IF      | Transducer |
| Frequency          | Frequency |                | Time     | Bandw.  |            |
| 30.0 MHz           | 1.0 GHz   | MaxPeak        | 300.0 ms | 120 kHz | JB1        |

***MEASUREMENT RESULT: "CTL160621306\_red"***

6/21/2016 5:31PM

| Frequency<br>MHz | Level<br>dBμV/m | Transd<br>dB | Limit<br>dBμV/m | Margin<br>dB | Det. | Height<br>cm | Azimuth<br>deg | Polarization |
|------------------|-----------------|--------------|-----------------|--------------|------|--------------|----------------|--------------|
| 30.000000        | 29.60           | 20.8         | 40.0            | 10.4         | ---  | 0.0          | 0.00           | HORIZONTAL   |
| 84.320000        | 17.90           | 8.8          | 40.0            | 22.1         | ---  | 0.0          | 0.00           | HORIZONTAL   |
| 136.700000       | 33.30           | 14.4         | 43.5            | 10.2         | ---  | 0.0          | 0.00           | HORIZONTAL   |
| 266.680000       | 26.50           | 14.9         | 46.0            | 19.5         | ---  | 0.0          | 0.00           | HORIZONTAL   |
| 520.820000       | 31.10           | 20.3         | 46.0            | 14.9         | ---  | 0.0          | 0.00           | HORIZONTAL   |
| 941.800000       | 37.00           | 26.4         | 46.0            | 9.0          | ---  | 0.0          | 0.00           | HORIZONTAL   |



**Above 1GHz (Antenna 1):**

802.11b

| CH | Antenna | Frequency (MHz) | Reading Level (dBuV/m) | Factor (dB) | Measure Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|----|---------|-----------------|------------------------|-------------|------------------------|----------------|-------------|----------|
| 1  | V       | 2412            | 84.6                   | 30.8        | 115.4                  | Fundamental    | /           | PK       |
|    | V       | 3200            | 13.1                   | 31.1        | 44.2                   | 54(note3)      | 9.8         | PK       |
|    | V       | 2390            | 37.5                   | 32.2        | 69.7                   | 74             | 4.3         | PK       |
|    | V       | 2390            | 17.9                   | 32.2        | 50.1                   | 54             | 3.9         | AV       |
|    | V       | 2400            | 39.2                   | 32.1        | 71.3                   | 74             | 2.7         | PK       |
|    | V       | 2400            | 18.8                   | 32.1        | 50.9                   | 54             | 3.1         | AV       |
|    | V       | 4824            | 6.3                    | 42.6        | 48.9                   | 54(note3)      | 5.1         | PK       |
|    | V       | 7236            | 19.3                   | 46.5        | 65.8                   | 74             | 8.2         | PK       |
|    | V       | 7236            | 2.2                    | 46.5        | 48.7                   | 54             | 5.3         | AV       |
|    | H       | 24000           | 11.7                   | 38.9        | 50.6                   | 54             | 3.4         | PK       |
| 6  | V       | 2437            | 83.2                   | 31.2        | 114.4                  | Fundamental    | /           | PK       |
|    | V       | 3200            | 12.6                   | 31.1        | 43.7                   | 54(note3)      | 10.3        | PK       |
|    | V       | 4876            | 16.1                   | 32.8        | 48.9                   | 54(note3)      | 5.1         | PK       |
|    | V       | 7311            | 19.4                   | 46.8        | 66.2                   | 74             | 7.8         | PK       |
|    | V       | 7311            | 1.0                    | 46.1        | 47.1                   | 54             | 6.9         | AV       |
|    | H       | 24000           | 11.7                   | 38.9        | 50.6                   | 54             | 3.4         | PK       |
| 11 | V       | 2462.3          | 83.8                   | 30.9        | 114.7                  | Fundamental    | /           | PK       |
|    | V       | 3200            | 11.4                   | 31.1        | 42.5                   | 54(note3)      | 11.5        | PK       |
|    | V       | 2483.5          | 33.9                   | 30.2        | 64.1                   | 74             | 9.9         | PK       |
|    | V       | 2483.5          | 16.0                   | 30.2        | 46.2                   | 54             | 7.8         | AV       |
|    | V       | 4927            | 16.2                   | 32.5        | 48.7                   | 54(note3)      | 5.3         | PK       |
|    | V       | 7386            | 20.5                   | 46.3        | 66.8                   | 74             | 7.2         | PK       |
|    | V       | 7386            | 2.2                    | 46.3        | 48.5                   | 54             | 5.5         | AV       |
|    | H       | 24000           | 11.7                   | 38.9        | 50.6                   | 54             | 3.4         | PK       |

Note: 1. Measure Level = Reading Level + Factor.

2. The test results which are attenuated more than 20 dB below the permissible value limit (the test frequency range: 9kHz~30MHz, 18GHz~25GHz), therefore no data appear in the report.

3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

Remark: RBW 1MHz VBW 3MHz peak detector for PK value, RMS detector for AV value

4. We have tested both horizontal and vertical antenna polarization and recorded the worst case only.

802.11g

| CH | Antenna | Frequency (MHz) | Reading Level (dBUV/m) | Factor (dB) | Measure Level (dBUV/m) | Limit (dBUV/m) | Margin (dB) | Detector |
|----|---------|-----------------|------------------------|-------------|------------------------|----------------|-------------|----------|
| 1  | V       | 2411.9          | 83.1                   | 30.8        | 113.9                  | Fundamental    | /           | PK       |
|    | V       | 3200            | 13.5                   | 31.1        | 44.6                   | 54(note3)      | 9.4         | PK       |
|    | V       | 2390            | 38.3                   | 32.2        | 70.5                   | 74             | 3.5         | PK       |
|    | V       | 2390            | 17.9                   | 32.2        | 50.1                   | 54             | 3.9         | AV       |
|    | V       | 2400            | 39.6                   | 32.1        | 71.7                   | 74             | 2.3         | PK       |
|    | V       | 2400            | 18.8                   | 32.1        | 50.9                   | 54             | 3.1         | AV       |
|    | V       | 4824            | 5.9                    | 42.6        | 48.5                   | 54(note3)      | 5.5         | PK       |
|    | V       | 7236            | 22.1                   | 46.5        | 68.6                   | 74             | 5.4         | PK       |
|    | V       | 7236            | -1.1                   | 46.5        | 45.4                   | 54             | 8.6         | AV       |
|    | H       | 24000           | 11.7                   | 38.9        | 50.6                   | 54             | 3.4         | PK       |
| 6  | V       | 2437            | 82.5                   | 31.2        | 113.7                  | Fundamental    | /           | PK       |
|    | V       | 3200            | 14.0                   | 31.1        | 45.1                   | 54(note3)      | 8.9         | PK       |
|    | V       | 4876            | 16.9                   | 32.8        | 49.7                   | 54(note3)      | 4.3         | PK       |
|    | V       | 7311            | 21.1                   | 46.8        | 67.9                   | 74             | 6.1         | PK       |
|    | V       | 7311            | 0.3                    | 46.1        | 46.4                   | 54             | 7.6         | AV       |
|    | H       | 24000           | 11.7                   | 38.9        | 50.6                   | 54             | 3.4         | PK       |
| 11 | V       | 2462.3          | 82.9                   | 30.9        | 113.8                  | Fundamental    | /           | PK       |
|    | V       | 3200            | 13.5                   | 31.1        | 44.6                   | 54(note3)      | 9.4         | PK       |
|    | V       | 2483.5          | 33.9                   | 30.2        | 64.1                   | 74             | 9.9         | PK       |
|    | V       | 2483.5          | 18.4                   | 30.2        | 48.6                   | 54             | 5.4         | AV       |
|    | V       | 4927            | 13.6                   | 32.5        | 46.1                   | 54(note3)      | 7.9         | PK       |
|    | V       | 7386            | 21.4                   | 46.3        | 67.7                   | 74             | 6.3         | PK       |
|    | V       | 7386            | 0.5                    | 46.3        | 46.8                   | 54             | 7.2         | AV       |
|    | H       | 24000           | 11.7                   | 38.9        | 50.6                   | 54             | 3.4         | PK       |

Note: 1. Measure Level = Reading Level + Factor.

2. The test results which are attenuated more than 20 dB below the permissible value limit (the test frequency range: 9kHz~30MHz, 18GHz~25GHz), therefore no data appear in the report.

3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

Remark: RBW 1MHz VBW 3MHz peak detector for PK value, RMS detector for AV value

4. We have tested both horizontal and vertical antenna polarization and recorded the worst case only.

## 802.11n(20MHz)

| CH | Antenna | Frequency (MHz) | Reading Level (dBuV/m) | Factor (dB) | Measure Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|----|---------|-----------------|------------------------|-------------|------------------------|----------------|-------------|----------|
| 1  | V       | 2411.9          | 81.8                   | 30.8        | 112.6                  | Fundamental    | /           | PK       |
|    | V       | 3200            | 13.5                   | 31.1        | 44.6                   | 54(note3)      | 9.4         | PK       |
|    | V       | 2390            | 38.3                   | 32.2        | 70.5                   | 74             | 3.5         | PK       |
|    | V       | 2390            | 17.6                   | 32.2        | 49.8                   | 54             | 4.2         | AV       |
|    | V       | 2400            | 39.0                   | 32.1        | 71.1                   | 74             | 2.9         | PK       |
|    | V       | 2400            | 18.5                   | 32.1        | 50.6                   | 54             | 3.4         | AV       |
|    | V       | 4824            | 7.1                    | 42.6        | 49.7                   | 54(note3)      | 4.3         | PK       |
|    | V       | 7236            | 21.6                   | 46.5        | 68.1                   | 74             | 5.9         | PK       |
|    | V       | 7236            | 0.9                    | 46.5        | 47.4                   | 54             | 6.6         | AV       |
|    | H       | 24000           | 11.7                   | 38.9        | 50.6                   | 54             | 3.4         | PK       |
| 6  | V       | 2437            | 81.3                   | 31.2        | 112.5                  | Fundamental    | /           | PK       |
|    | V       | 3200            | 13.6                   | 31.1        | 44.7                   | 54(note3)      | 9.3         | PK       |
|    | V       | 4876            | 16.1                   | 32.8        | 48.9                   | 54(note3)      | 5.1         | PK       |
|    | V       | 7311            | 22.6                   | 46.8        | 69.4                   | 74             | 4.6         | PK       |
|    | V       | 7311            | 3.0                    | 46.1        | 49.1                   | 54             | 4.9         | AV       |
|    | H       | 24000           | 11.7                   | 38.9        | 50.6                   | 54             | 3.4         | PK       |
| 11 | V       | 2462.3          | 82.0                   | 30.9        | 112.9                  | Fundamental    | /           | PK       |
|    | V       | 3200            | 14.1                   | 31.1        | 45.2                   | 54(note3)      | 8.8         | PK       |
|    | V       | 2483.5          | 34.0                   | 30.2        | 64.2                   | 74             | 9.8         | PK       |
|    | V       | 2483.5          | 16.5                   | 30.2        | 46.7                   | 54             | 7.3         | AV       |
|    | V       | 4927            | 16.4                   | 32.5        | 48.9                   | 54(note3)      | 5.1         | PK       |
|    | V       | 7386            | 21.3                   | 46.3        | 67.6                   | 74             | 6.4         | PK       |
|    | V       | 7386            | 0.4                    | 46.3        | 46.7                   | 54             | 7.3         | AV       |
|    | H       | 24000           | 11.7                   | 38.9        | 50.6                   | 54             | 3.4         | PK       |

Note: 1. Measure Level = Reading Level + Factor.

2. The test results which are attenuated more than 20 dB below the permissible value limit (the test frequency range: 9kHz~30MHz, 18GHz~25GHz), therefore no data appear in the report.

3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

Remark: RBW 1MHz VBW 3MHz peak detector for PK value, RMS detector for AV value

4. We have tested both horizontal and vertical antenna polarization and recorded the worst case only.

## Above 1GHz (Antenna 2):

802.11b

| CH | Antenna | Frequency (MHz) | Reading Level (dBuV/m) | Factor (dB) | Measure Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|----|---------|-----------------|------------------------|-------------|------------------------|----------------|-------------|----------|
| 1  | V       | 2412            | 83.9                   | 30.8        | 114.7                  | Fundamental    | /           | PK       |
|    | V       | 3200            | 12.0                   | 31.1        | 43.1                   | 54(note3)      | 10.9        | PK       |
|    | V       | 2390            | 37.3                   | 32.2        | 69.5                   | 74             | 4.5         | PK       |
|    | V       | 2390            | 17.5                   | 32.2        | 49.7                   | 54             | 4.3         | AV       |
|    | V       | 2400            | 39.1                   | 32.1        | 71.2                   | 74             | 2.8         | PK       |
|    | V       | 2400            | 19.3                   | 32.1        | 51.4                   | 54             | 2.6         | AV       |
|    | V       | 4824            | 5.8                    | 42.6        | 48.4                   | 54(note3)      | 5.6         | PK       |
|    | V       | 7236            | 19.6                   | 46.5        | 66.1                   | 74             | 7.9         | PK       |
|    | V       | 7236            | 1.7                    | 46.5        | 48.2                   | 54             | 5.8         | AV       |
|    | H       | 24000           | 11.7                   | 38.9        | 50.6                   | 54             | 3.4         | PK       |
| 6  | V       | 2437            | 83.1                   | 31.2        | 114.3                  | Fundamental    | /           | PK       |
|    | V       | 3200            | 11.7                   | 31.1        | 42.8                   | 54(note3)      | 11.2        | PK       |
|    | V       | 4876            | 15.8                   | 32.8        | 48.6                   | 54(note3)      | 5.4         | PK       |
|    | V       | 7311            | 19.1                   | 46.8        | 65.9                   | 74             | 8.1         | PK       |
|    | V       | 7311            | 1.6                    | 46.1        | 47.7                   | 54             | 6.3         | AV       |
|    | H       | 24000           | 11.7                   | 38.9        | 50.6                   | 54             | 3.4         | PK       |
| 11 | V       | 2462.3          | 82.9                   | 30.9        | 113.8                  | Fundamental    | /           | PK       |
|    | V       | 3200            | 11.7                   | 31.1        | 42.8                   | 54(note3)      | 11.2        | PK       |
|    | V       | 2483.5          | 33.0                   | 30.2        | 63.2                   | 74             | 10.8        | PK       |
|    | V       | 2483.5          | 15.4                   | 30.2        | 45.6                   | 54             | 8.4         | AV       |
|    | V       | 4927            | 15.6                   | 32.5        | 48.1                   | 54(note3)      | 5.9         | PK       |
|    | V       | 7386            | 20.5                   | 46.3        | 66.8                   | 74             | 7.2         | PK       |
|    | V       | 7386            | 1.9                    | 46.3        | 48.2                   | 54             | 5.8         | AV       |
|    | H       | 24000           | 11.7                   | 38.9        | 50.6                   | 54             | 3.4         | PK       |

Note: 1. Measure Level = Reading Level + Factor.

2. The test results which are attenuated more than 20 dB below the permissible value limit (the test frequency range: 9kHz~30MHz, 18GHz~25GHz), therefore no data appear in the report.

3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

Remark: RBW 1MHz VBW 3MHz peak detector for PK value, RMS detector for AV value

4. We have tested both horizontal and vertical antenna polarization and recorded the worst case only.

802.11g

| CH | Antenna | Frequency (MHz) | Reading Level (dBUV/m) | Factor (dB) | Measure Level (dBUV/m) | Limit (dBUV/m) | Margin (dB) | Detector |
|----|---------|-----------------|------------------------|-------------|------------------------|----------------|-------------|----------|
| 1  | V       | 2411.9          | 83.0                   | 30.8        | 113.8                  | Fundamental    | /           | PK       |
|    | V       | 3200            | 12.0                   | 31.1        | 43.1                   | 54(note3)      | 10.9        | PK       |
|    | V       | 2390            | 38.2                   | 32.2        | 70.4                   | 74             | 3.6         | PK       |
|    | V       | 2390            | 17.0                   | 32.2        | 49.2                   | 54             | 4.8         | AV       |
|    | V       | 2400            | 39.4                   | 32.1        | 71.5                   | 74             | 2.5         | PK       |
|    | V       | 2400            | 18.6                   | 32.1        | 50.7                   | 54             | 3.3         | AV       |
|    | V       | 4824            | 4.8                    | 42.6        | 47.4                   | 54(note3)      | 6.6         | PK       |
|    | V       | 7236            | 20.6                   | 46.5        | 67.1                   | 74             | 6.9         | PK       |
|    | V       | 7236            | -0.7                   | 46.5        | 45.8                   | 54             | 8.2         | AV       |
|    | H       | 24000           | 11.7                   | 38.9        | 50.6                   | 54             | 3.4         | PK       |
| 6  | V       | 2437            | 82.1                   | 31.2        | 113.3                  | Fundamental    | /           | PK       |
|    | V       | 3200            | 13.1                   | 31.1        | 44.2                   | 54(note3)      | 9.8         | PK       |
|    | V       | 4876            | 15.5                   | 32.8        | 48.3                   | 54(note3)      | 5.7         | PK       |
|    | V       | 7311            | 21.7                   | 46.8        | 68.5                   | 74             | 5.5         | PK       |
|    | V       | 7311            | 0.7                    | 46.1        | 46.8                   | 54             | 7.2         | AV       |
|    | H       | 24000           | 11.7                   | 38.9        | 50.6                   | 54             | 3.4         | PK       |
| 11 | V       | 2462.3          | 82.6                   | 30.9        | 113.5                  | Fundamental    | /           | PK       |
|    | V       | 3200            | 11.7                   | 31.1        | 42.8                   | 54(note3)      | 11.2        | PK       |
|    | V       | 2483.5          | 33.7                   | 30.2        | 63.9                   | 74             | 10.1        | PK       |
|    | V       | 2483.5          | 17.0                   | 30.2        | 47.2                   | 54             | 6.8         | AV       |
|    | V       | 4927            | 14.0                   | 32.5        | 46.5                   | 54(note3)      | 7.5         | PK       |
|    | V       | 7386            | 20.8                   | 46.3        | 67.1                   | 74             | 6.9         | PK       |
|    | V       | 7386            | 0.1                    | 46.3        | 46.4                   | 54             | 7.6         | AV       |
|    | H       | 24000           | 11.7                   | 38.9        | 50.6                   | 54             | 3.4         | PK       |

Note: 1. Measure Level = Reading Level + Factor.

2. The test results which are attenuated more than 20 dB below the permissible value limit (the test frequency range: 9kHz~30MHz, 18GHz~25GHz), therefore no data appear in the report.

3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

Remark: RBW 1MHz VBW 3MHz peak detector for PK value, RMS detector for AV value

4. We have tested both horizontal and vertical antenna polarization and recorded the worst case only.

802.11n(20MHz)

| CH | Antenna | Frequency (MHz) | Reading Level (dBuV/m) | Factor (dB) | Measure Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|----|---------|-----------------|------------------------|-------------|------------------------|----------------|-------------|----------|
| 1  | V       | 2411.9          | 81.6                   | 30.8        | 112.4                  | Fundamental    | /           | PK       |
|    | V       | 3200            | 14.8                   | 31.1        | 45.9                   | 54(note3)      | 8.1         | PK       |
|    | V       | 2390            | 37.9                   | 32.2        | 70.1                   | 74             | 3.9         | PK       |
|    | V       | 2390            | 17.3                   | 32.2        | 49.5                   | 54             | 4.5         | AV       |
|    | V       | 2400            | 38.6                   | 32.1        | 70.7                   | 74             | 3.3         | PK       |
|    | V       | 2400            | 18.1                   | 32.1        | 50.2                   | 54             | 3.8         | AV       |
|    | V       | 4824            | 6.6                    | 42.6        | 49.2                   | 54(note3)      | 4.8         | PK       |
|    | V       | 7236            | 21.1                   | 46.5        | 67.6                   | 74             | 6.4         | PK       |
|    | V       | 7236            | 1.4                    | 46.5        | 47.9                   | 54             | 6.1         | AV       |
|    | H       | 24000           | 11.7                   | 38.9        | 50.6                   | 54             | 3.4         | PK       |
| 6  | V       | 2437            | 81.6                   | 31.2        | 112.8                  | Fundamental    | /           | PK       |
|    | V       | 3200            | 12.3                   | 31.1        | 43.4                   | 54(note3)      | 10.6        | PK       |
|    | V       | 4876            | 15.8                   | 32.8        | 48.6                   | 54(note3)      | 5.4         | PK       |
|    | V       | 7311            | 22.3                   | 46.8        | 69.1                   | 74             | 4.9         | PK       |
|    | V       | 7311            | 2.4                    | 46.1        | 48.5                   | 54             | 5.5         | AV       |
|    | H       | 24000           | 11.7                   | 38.9        | 50.6                   | 54             | 3.4         | PK       |
| 11 | V       | 2462.3          | 81.7                   | 30.9        | 112.6                  | Fundamental    | /           | PK       |
|    | V       | 3200            | 13.4                   | 31.1        | 44.5                   | 54(note3)      | 9.5         | PK       |
|    | V       | 2483.5          | 33.7                   | 30.2        | 63.9                   | 74             | 10.1        | PK       |
|    | V       | 2483.5          | 16.2                   | 30.2        | 46.4                   | 54             | 7.6         | AV       |
|    | V       | 4927            | 16.3                   | 32.5        | 48.8                   | 54(note3)      | 5.2         | PK       |
|    | V       | 7386            | 20.9                   | 46.3        | 67.2                   | 74             | 6.8         | PK       |
|    | V       | 7386            | -0.2                   | 46.3        | 46.1                   | 54             | 7.9         | AV       |
|    | H       | 24000           | 11.7                   | 38.9        | 50.6                   | 54             | 3.4         | PK       |

Note: 1. Measure Level = Reading Level + Factor.

2. The test results which are attenuated more than 20 dB below the permissible value limit (the test frequency range: 9kHz~30MHz, 18GHz~25GHz), therefore no data appear in the report.

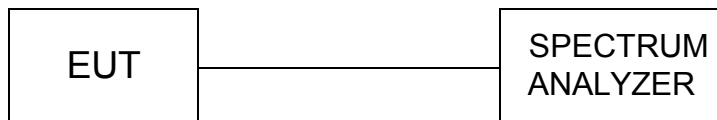
3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

Remark: RBW 1MHz VBW 3MHz peak detector for PK value, RMS detector for AV value

4. We have tested both horizontal and vertical antenna polarization and recorded the worst case only.

### 4.3. 6dB Bandwidth Measurement

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The testing follows FCC KDB Publication No. 558074 D01 v03r03 (Measurement Guidelines of DTS).
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW. The 6 dB bandwidth must be greater than 500 kHz.
4. The marker-delta reading at this point is the 6 dB bandwidth of the emission.

#### LIMIT

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

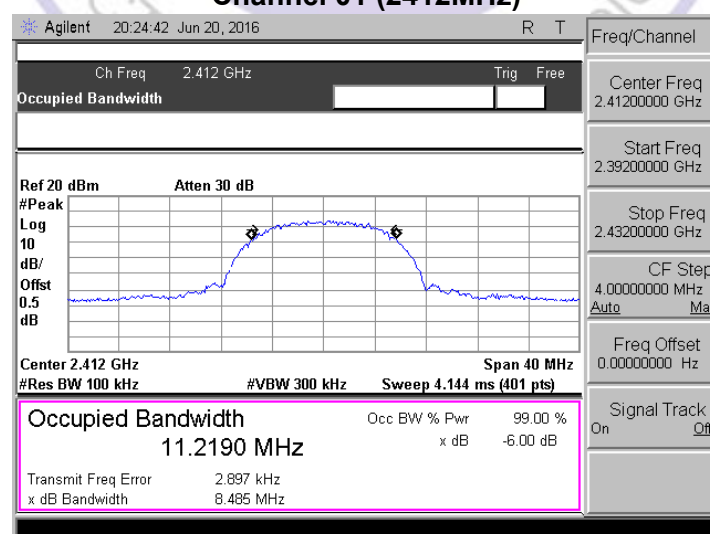
#### TEST RESULTS

Note: We have tested both antenna 1 and antenna 2 and recorded the worst case only.

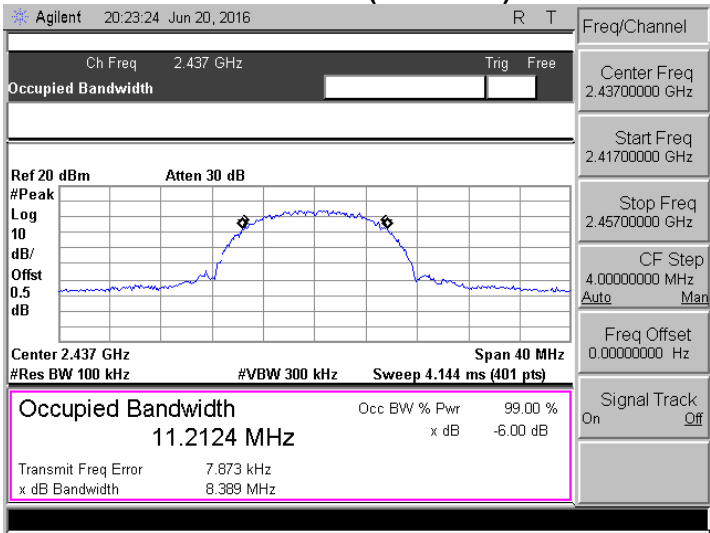
|           |   |                             |
|-----------|---|-----------------------------|
| Product   | : | WIFI module                 |
| Test Item | : | 6dB Occupied Bandwidth      |
| Test Mode | : | Mode 1: Transmit by 802.11b |

| Channel No. | Frequency (MHz) | Occupied Bandwidth (kHz) | Limit (kHz) | Result |
|-------------|-----------------|--------------------------|-------------|--------|
| 01          | 2412            | 8485                     | 500         | Pass   |
| 06          | 2437            | 8389                     | 500         | Pass   |
| 11          | 2462            | 8427                     | 500         | Pass   |

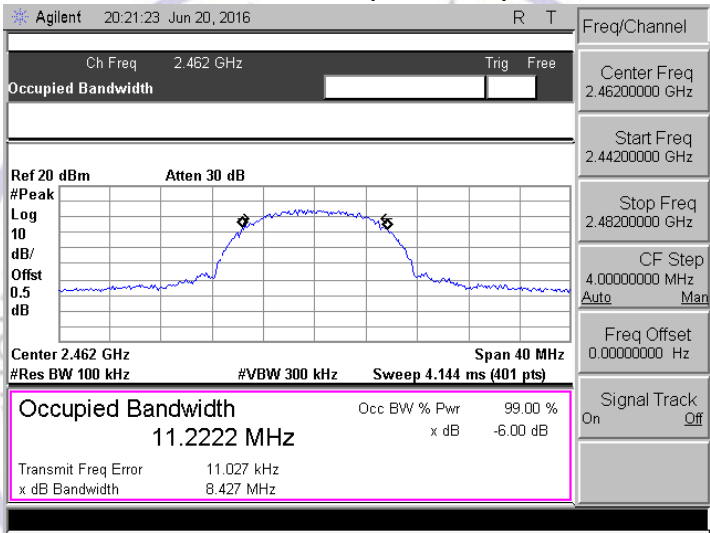
#### Channel 01 (2412MHz)



Channel 06 (2437MHz)



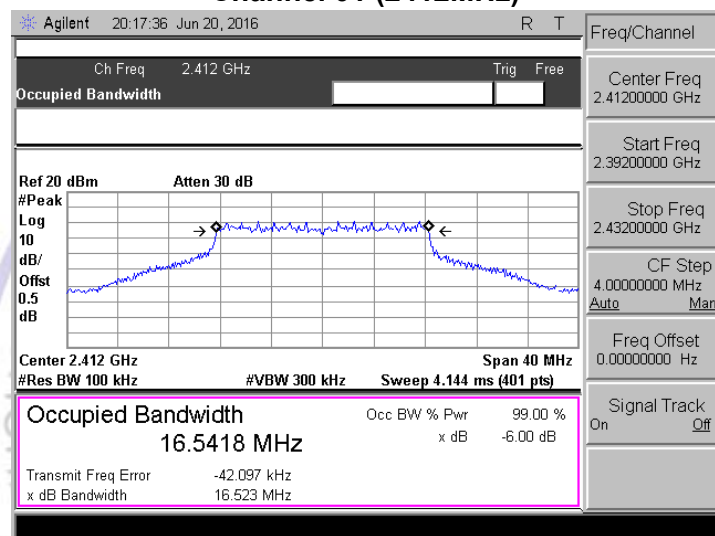
Channel 11 (2462MHz)



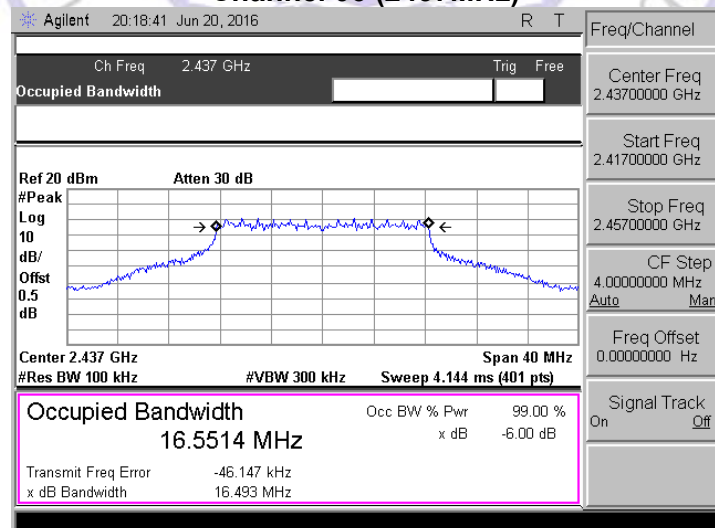
|           |   |                             |
|-----------|---|-----------------------------|
| Product   | : | WIFI module                 |
| Test Item | : | 6dB Occupied Bandwidth      |
| Test Mode | : | Mode 2: Transmit by 802.11g |

| Channel No. | Frequency (MHz) | Occupied Bandwidth (kHz) | Limit (kHz) | Result |
|-------------|-----------------|--------------------------|-------------|--------|
| 01          | 2412            | 16523                    | 500         | Pass   |
| 06          | 2437            | 16493                    | 500         | Pass   |
| 11          | 2462            | 16505                    | 500         | Pass   |

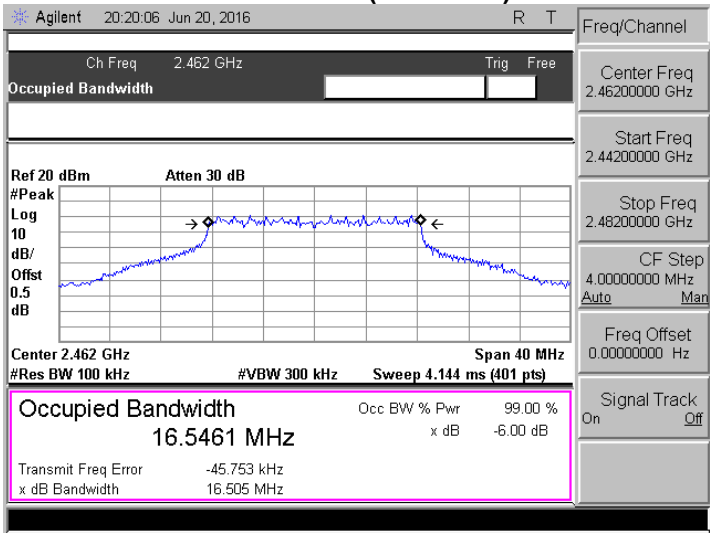
### Channel 01 (2412MHz)



### Channel 06 (2437MHz)



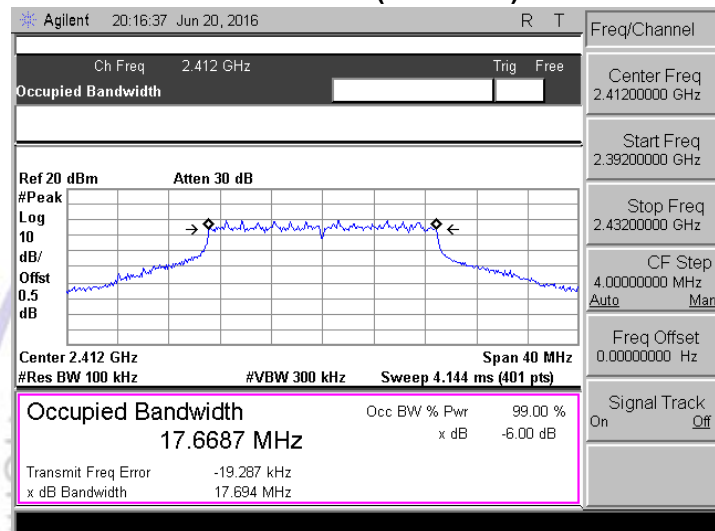
Channel 11 (2462MHz)



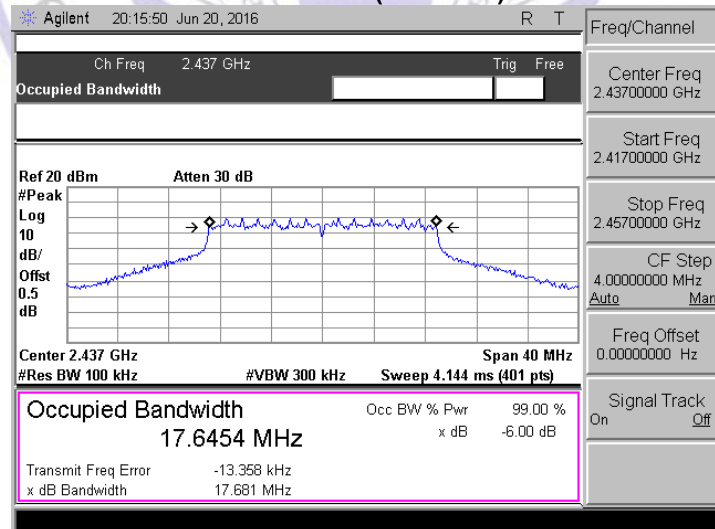
|           |   |                                     |
|-----------|---|-------------------------------------|
| Product   | : | WIFI module                         |
| Test Item | : | 6dB Occupied Bandwidth              |
| Test Mode | : | Mode 3: Transmit by 802.11n (20MHz) |

| Channel No. | Frequency (MHz) | Occupied Bandwidth (kHz) | Limit (kHz) | Result |
|-------------|-----------------|--------------------------|-------------|--------|
| 01          | 2412            | 17694                    | 500         | Pass   |
| 06          | 2437            | 17681                    | 500         | Pass   |
| 11          | 2462            | 17722                    | 500         | Pass   |

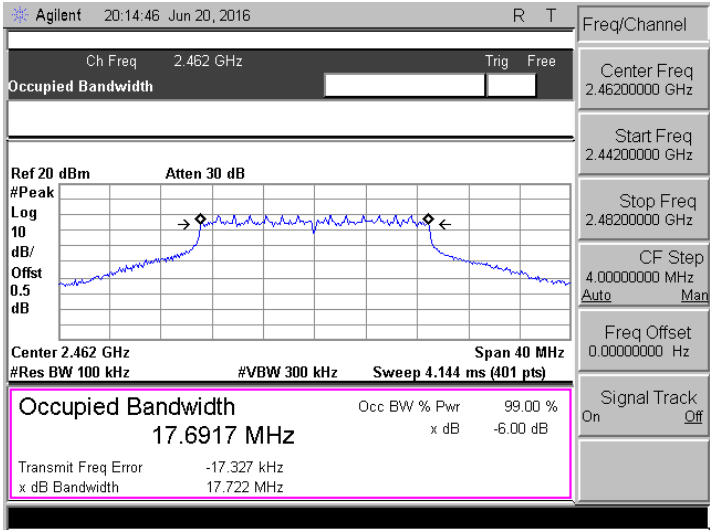
## Channel 01 (2412MHz)



## Channel 06 (2437MHz)

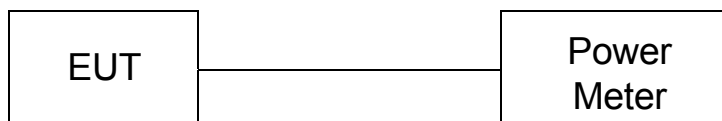


Channel 11 (2462MHz)



#### 4.4. Maximum Peak Output Power

##### TEST CONFIGURATION



##### TEST PROCEDURE

According to C63.10 -2013 and KDB558074 D01 v03r03, The EUT was directly connected to the power meter / spectrum analyzer and antenna output port as show in the block diagram as TEST CONFIGURATION shows.

Use the wideband power meter to test peak power and record the result.

##### LIMIT

The Peak Output Power Measurement limits are 30dBm.

##### TEST RESULTS

Note: We have tested both antenna 1 and antenna 2 and recoreded the worst case(Antenan 1) only.

|           |   |                             |
|-----------|---|-----------------------------|
| Product   | : | WIFI module                 |
| Test Item | : | Power Output                |
| Test Mode | : | Mode 1: Transmit by 802.11b |

| Channel No. | Frequency (MHz) | Measurement Power Output (dBm) | Limit (dBm) | Result |
|-------------|-----------------|--------------------------------|-------------|--------|
| 1           | 2412            | 19.05                          | 30.00       | Pass   |
| 6           | 2437            | 19.14                          | 30.00       | Pass   |
| 11          | 2462            | 19.11                          | 30.00       | Pass   |

|           |   |                             |
|-----------|---|-----------------------------|
| Product   | : | WIFI module                 |
| Test Item | : | Power Output                |
| Test Mode | : | Mode 2: Transmit by 802.11g |

| Channel No. | Frequency (MHz) | Measurement Power Output (dBm) | Limit (dBm) | Result |
|-------------|-----------------|--------------------------------|-------------|--------|
| 1           | 2412            | 19.05                          | 30.00       | Pass   |
| 6           | 2437            | 19.04                          | 30.00       | Pass   |
| 11          | 2462            | 18.99                          | 30.00       | Pass   |

|           |   |                                    |
|-----------|---|------------------------------------|
| Product   | : | WIFI module                        |
| Test Item | : | Power Output                       |
| Test Mode | : | Mode 3: Transmit by 802.11n(20MHz) |

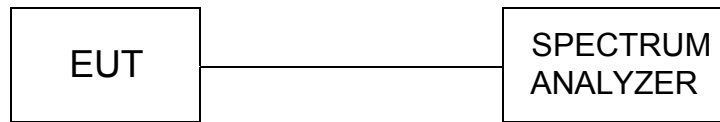
| Channel No. | Frequency<br>(MHz) | Measurement Power Output<br>(dBm) | Limit<br>(dBm) | Result |
|-------------|--------------------|-----------------------------------|----------------|--------|
| 1           | 2412               | 17.92                             | 30.00          | Pass   |
| 6           | 2437               | 17.96                             | 30.00          | Pass   |
| 11          | 2462               | 17.94                             | 30.00          | Pass   |

**Note:** The test results including the cable lose.



## 4.5. Power Spectral Density Measurement

### TEST CONFIGURATION



### TEST PROCEDURE

The EUT was tested according to KDB558074 D01 v03r03 for compliance to FCC 47CFR 15.247 and requirements. Set RBW= 3 kHz, VBW $\geq$ 10KHz, SPAN to 1.5 times greater than the EBW,.

### LIMIT

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.

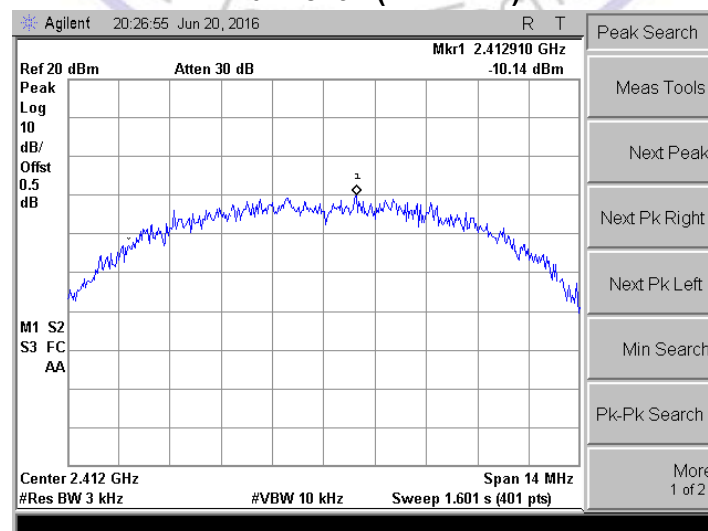
### TEST RESULTS

Note: We have tested both antenna 1 and antenna 2 and recorded the worst case(Antenan 1) only.

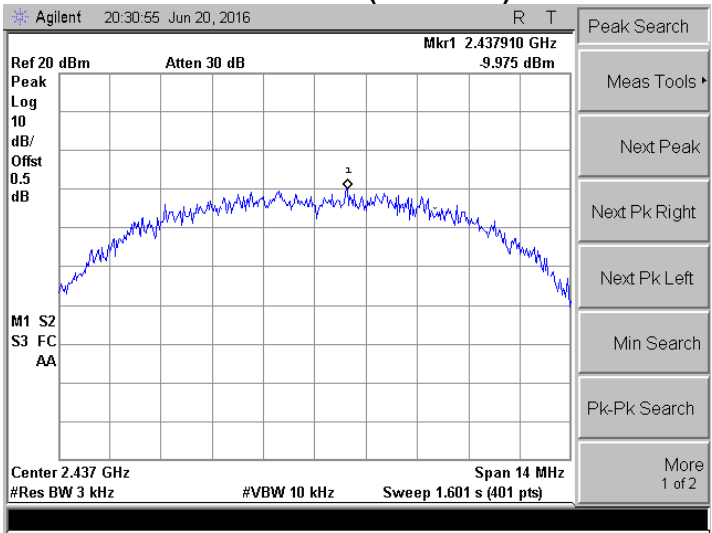
|           |   |                             |
|-----------|---|-----------------------------|
| Product   | : | WIFI module                 |
| Test Item | : | Power Spectral Density      |
| Test Mode | : | Mode 1: Transmit by 802.11b |

| Channel No. | Frequency (MHz) | Measurement<br>PPSD<br>(dBm/3KHz) | Limit<br>(dBm/3KHz) | Result |
|-------------|-----------------|-----------------------------------|---------------------|--------|
| 01          | 2412            | -10.14                            | 8                   | Pass   |
| 06          | 2437            | -9.975                            | 8                   | Pass   |
| 11          | 2462            | -10.07                            | 8                   | Pass   |

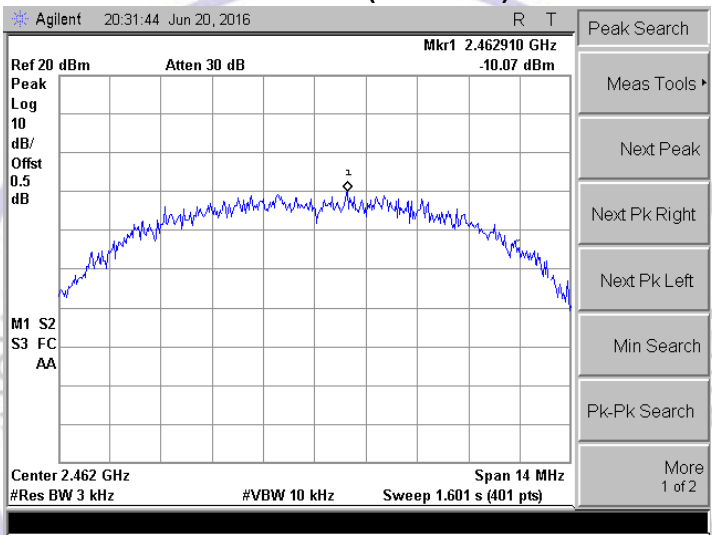
Channel 01 (2412MHz)



Channel 06 (2437MHz)



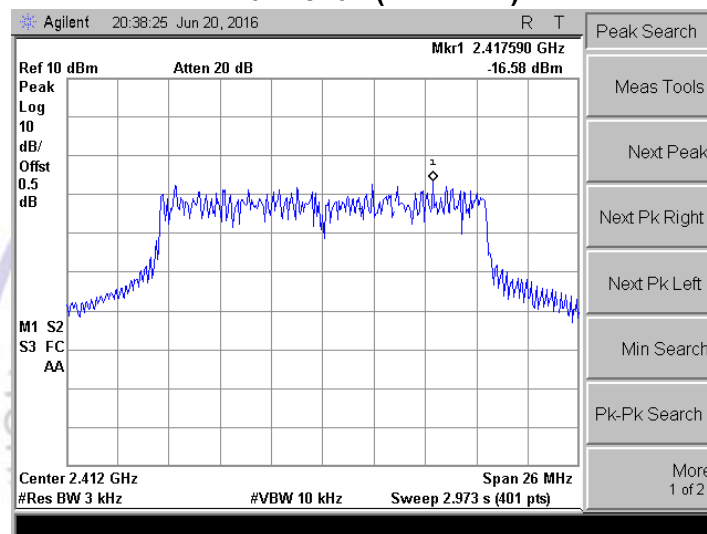
Channel 11 (2462MHz)



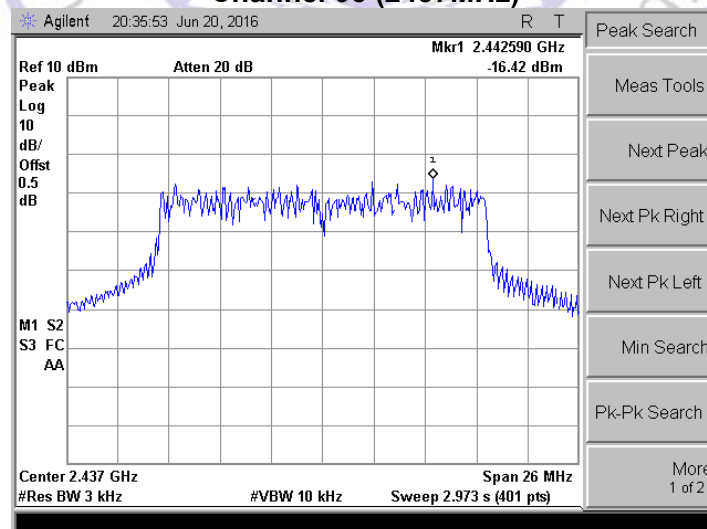
|           |   |                             |
|-----------|---|-----------------------------|
| Product   | : | WIFI module                 |
| Test Item | : | Power Spectral Density      |
| Test Mode | : | Mode 2: Transmit by 802.11g |

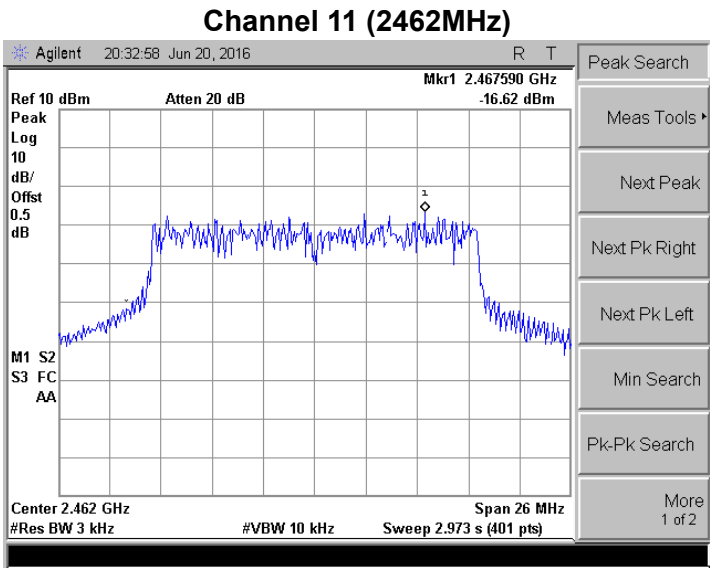
| Channel No. | Frequency (MHz) | Measurement PPSD (dBm/3KHz) | Limit (dBm/3KHz) | Result |
|-------------|-----------------|-----------------------------|------------------|--------|
| 01          | 2412            | -16.58                      | 8                | Pass   |
| 06          | 2437            | -16.42                      | 8                | Pass   |
| 11          | 2462            | -16.62                      | 8                | Pass   |

Channel 01 (2412MHz)



Channel 06 (2437MHz)

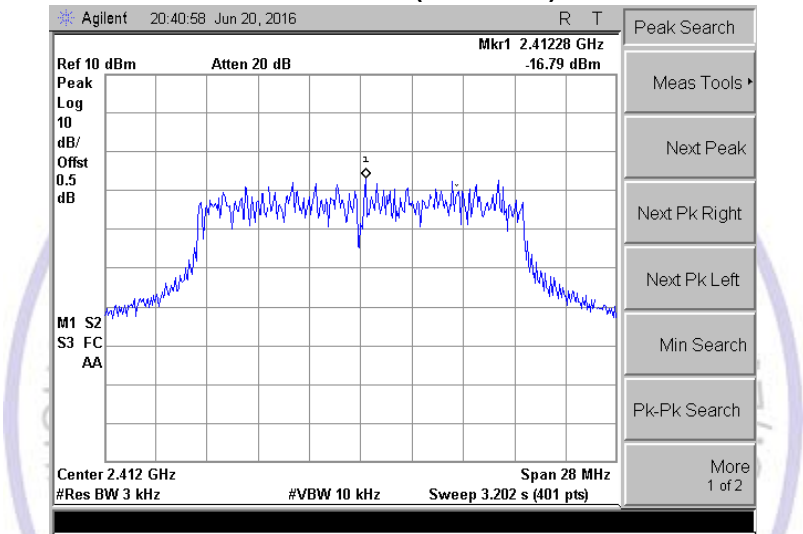




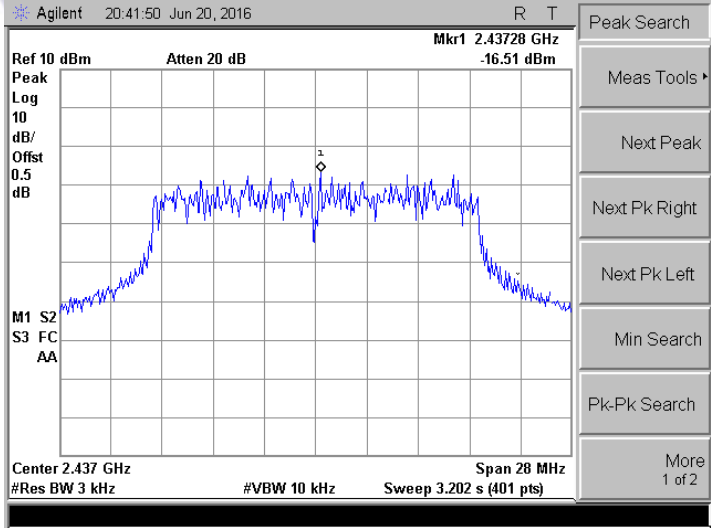
|           |   |                                     |
|-----------|---|-------------------------------------|
| Product   | : | WIFI module                         |
| Test Item | : | Power Spectral Density              |
| Test Mode | : | Mode 3: Transmit by 802.11n (20MHz) |

| Channel No. | Frequency (MHz) | Measurement<br>PPSD<br>(dBm/3KHz) | Limit<br>(dBm/3KHz) | Result |
|-------------|-----------------|-----------------------------------|---------------------|--------|
| 01          | 2412            | -16.79                            | 8                   | Pass   |
| 06          | 2437            | -16.51                            | 8                   | Pass   |
| 11          | 2462            | -16.51                            | 8                   | Pass   |

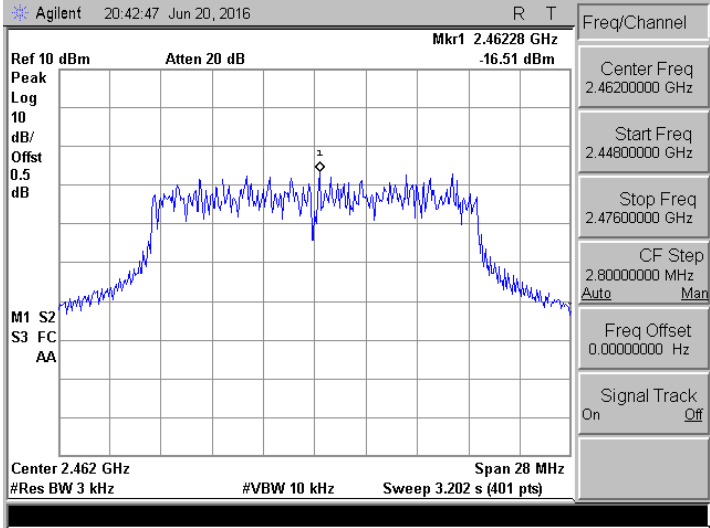
Channel 01 (2412MHz)



Channel 06 (2437MHz)

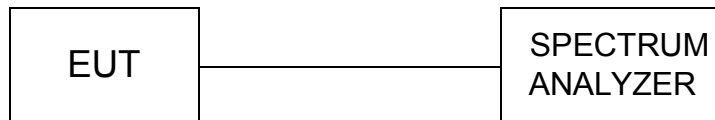


Channel 11 (2462MHz)



## 4.6. Spurious RF Conducted Emission and bandedge Test

### TEST CONFIGURATION



### TEST PROCEDURE

The EUT was tested according to KDB558074 D01 v03r03 for compliance to FCC 47CFR 15.247 requirements.

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW=100kHz and VBM= 300KHz to measure the peak field strength, and measure frequency range from 30MHz to 26.5GHz.

### LIMIT

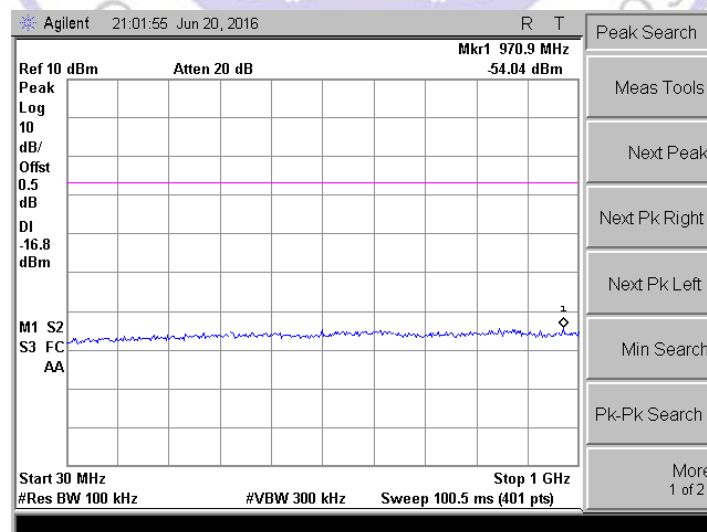
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

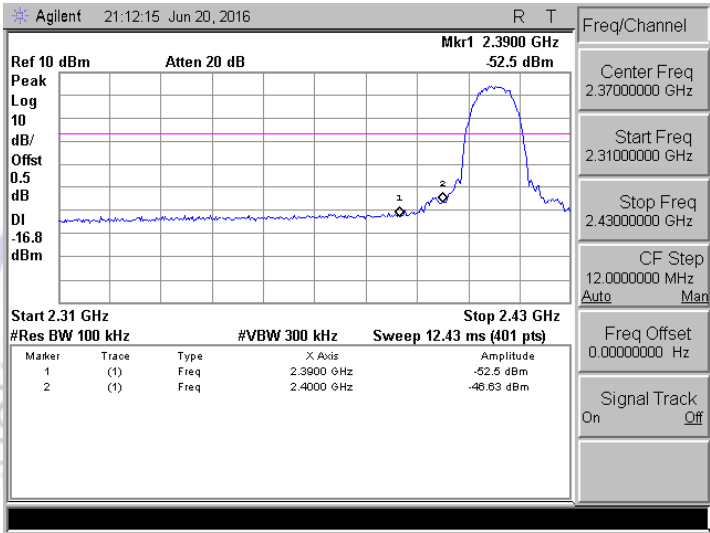
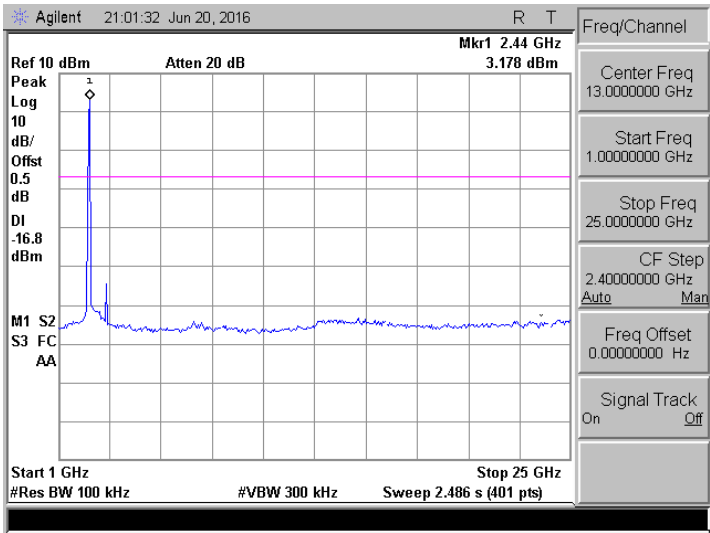
### TEST RESULTS

Note: We have tested both antenna 1 and antenna 2 and recorded the worst case(Antenan 1) only.

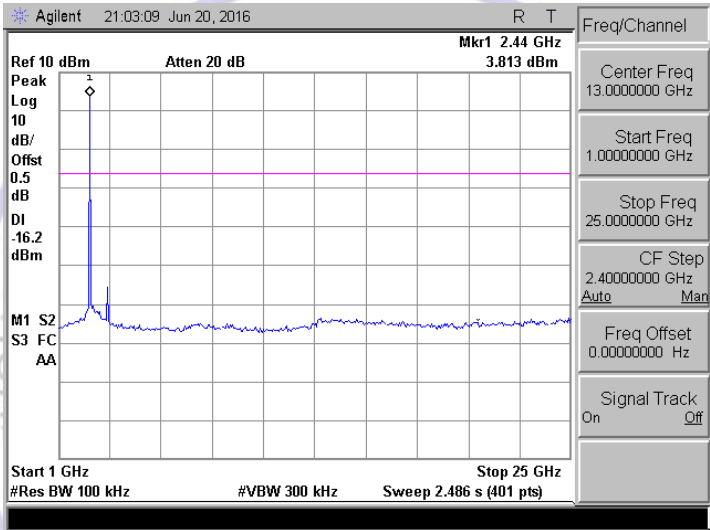
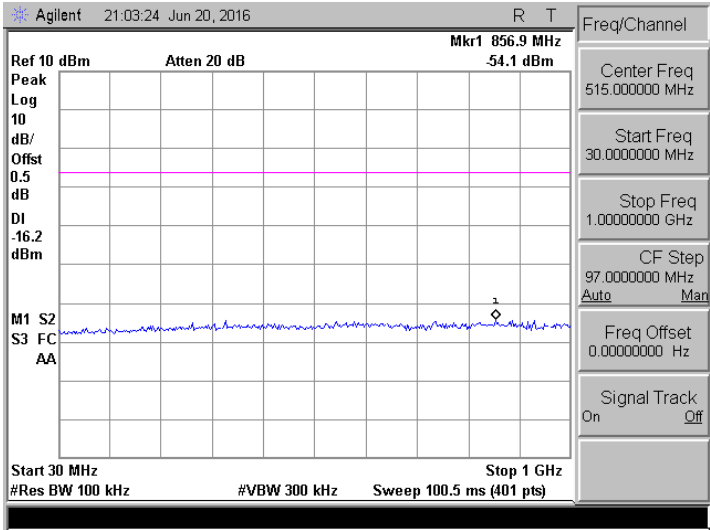
|           |   |                               |
|-----------|---|-------------------------------|
| Product   | : | WIFI module                   |
| Test Item | : | RF Antenna Conducted Spurious |
| Test Mode | : | Mode 1: Transmit by 802.11b   |

### Channel 01 (2412MHz)

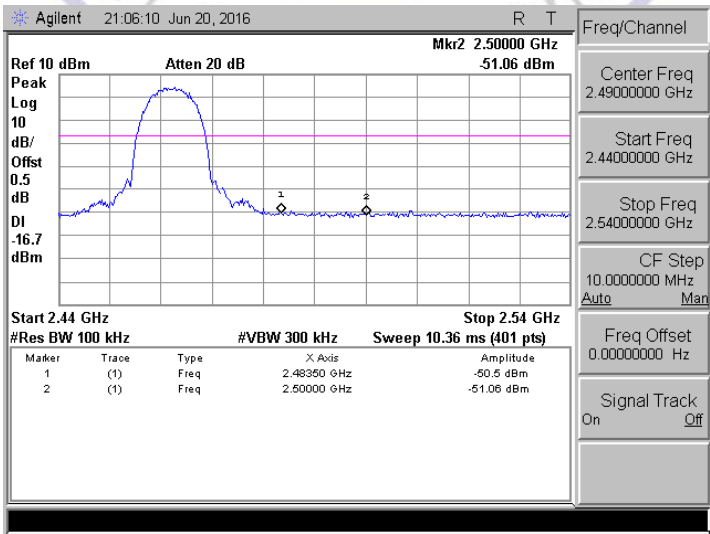
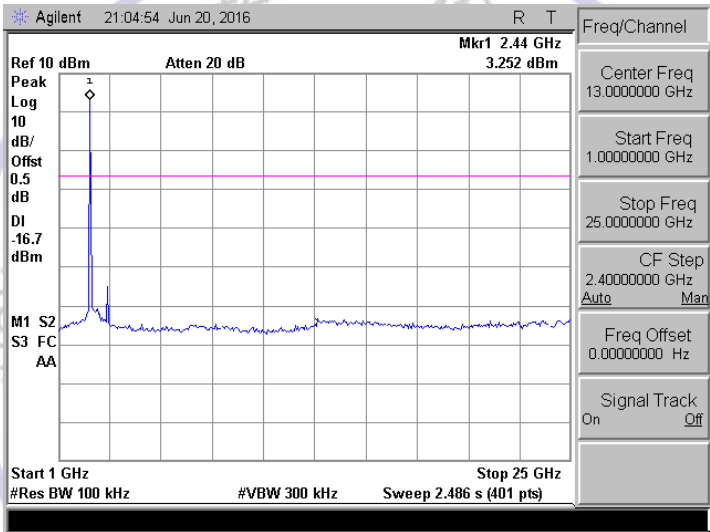
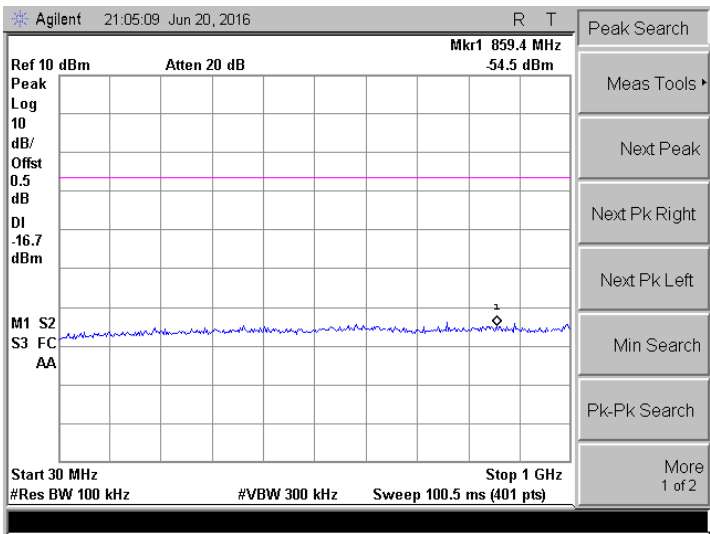




Channel 06 (2437MHz)

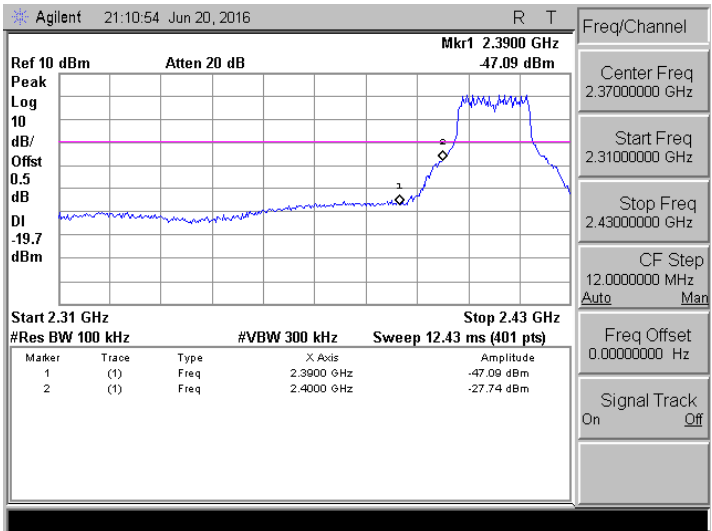
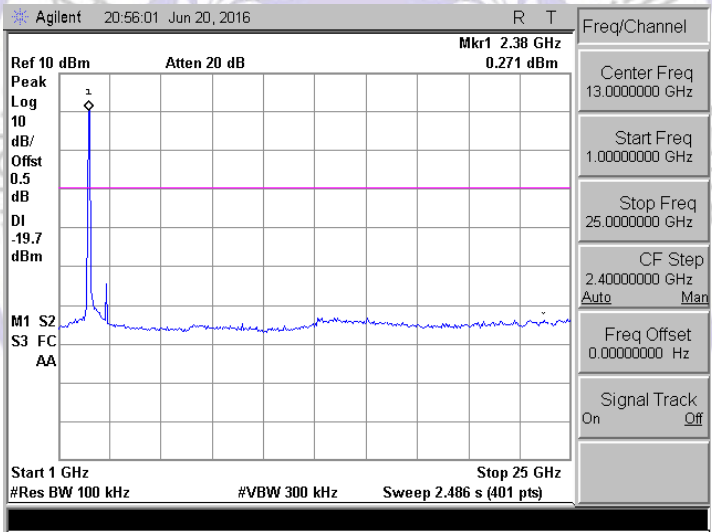
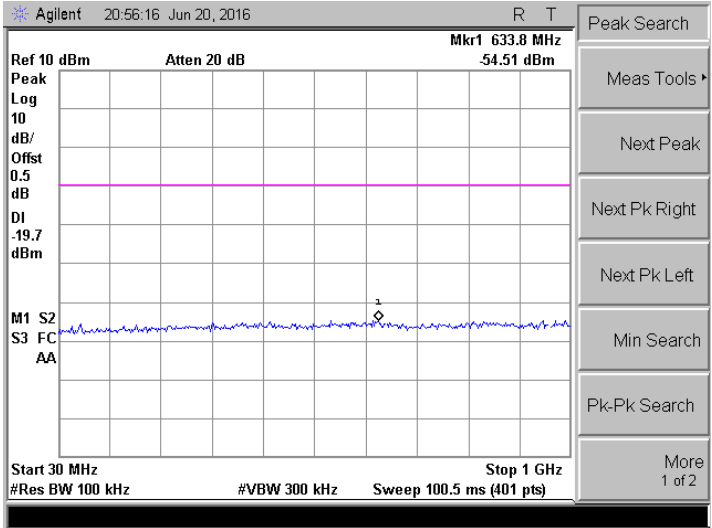


Channel 11 (2462MHz)

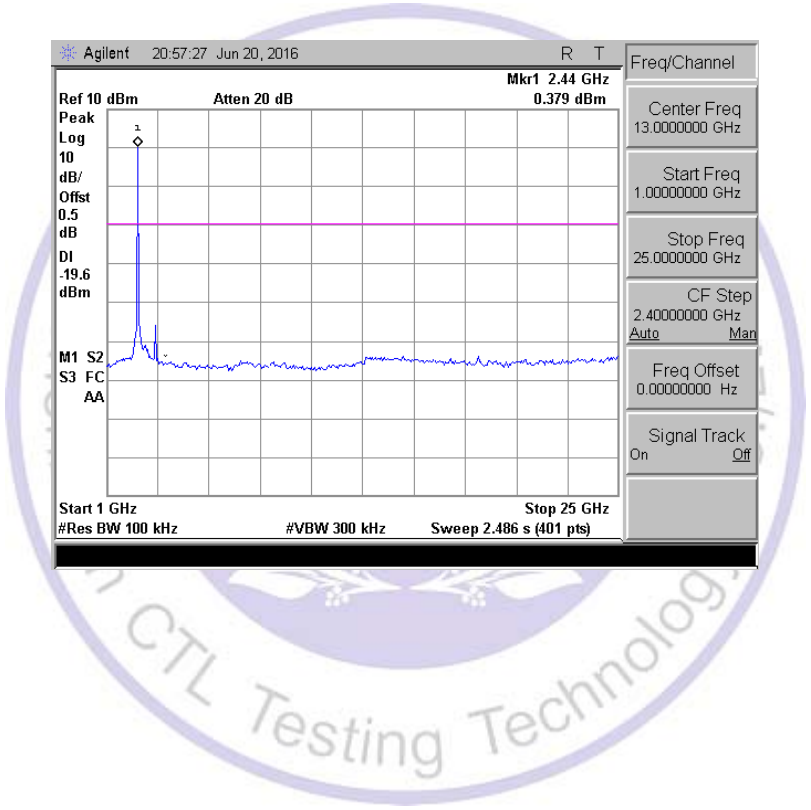
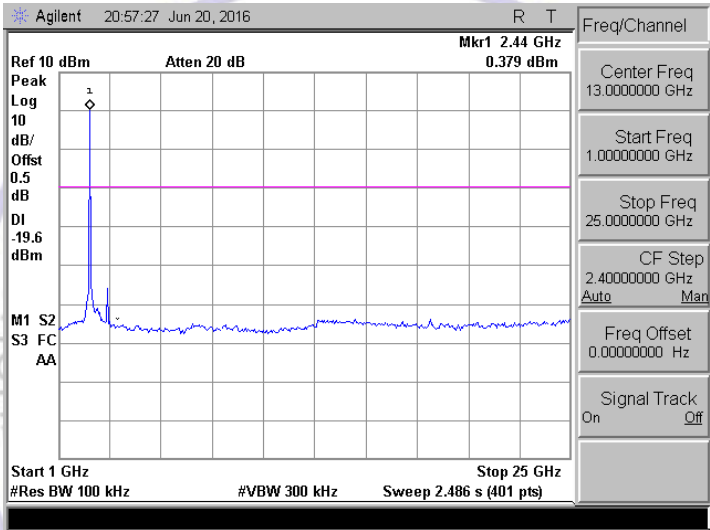
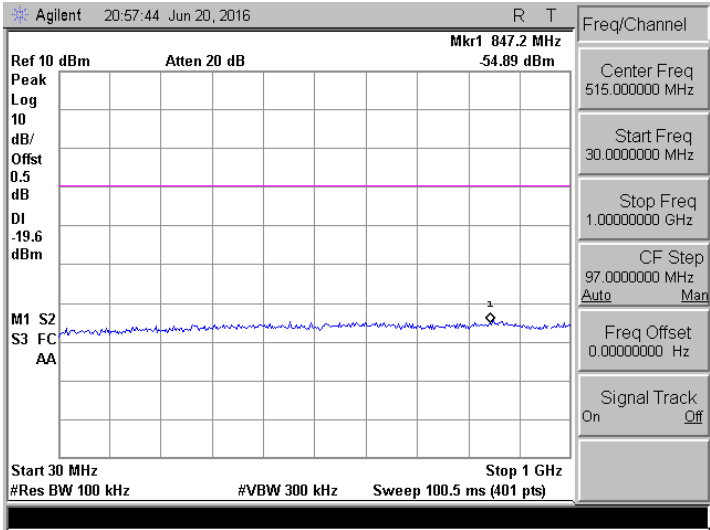


|           |   |                               |
|-----------|---|-------------------------------|
| Product   | : | WIFI module                   |
| Test Item | : | RF Antenna Conducted Spurious |
| Test Mode | : | Mode 2: Transmit by 802.11g   |

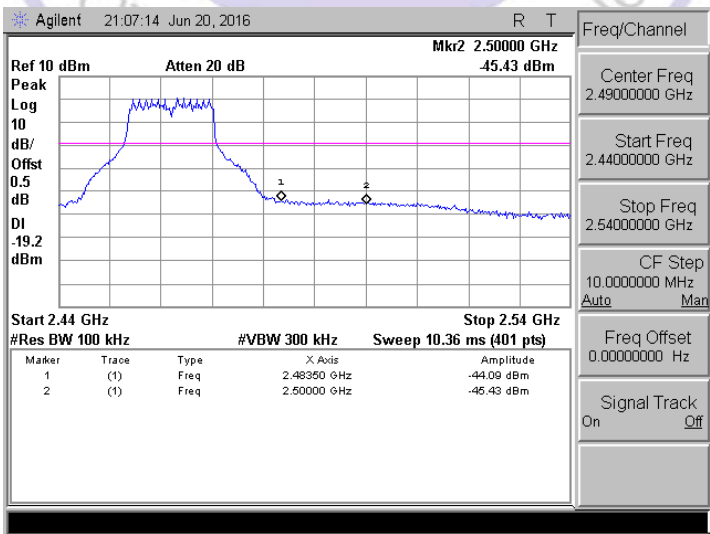
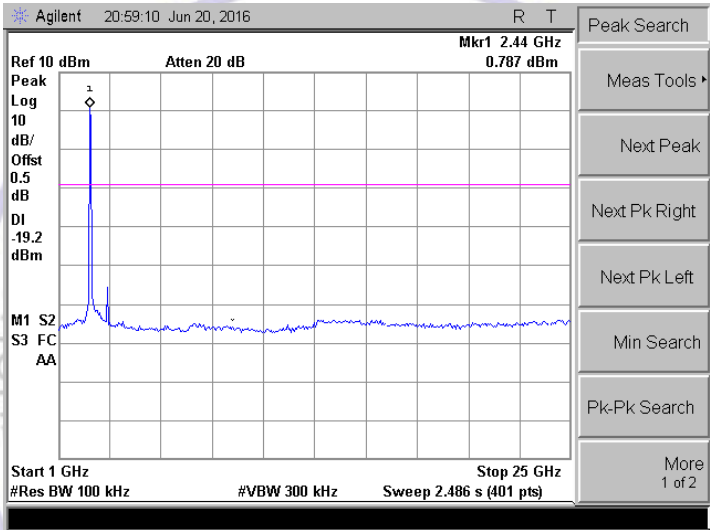
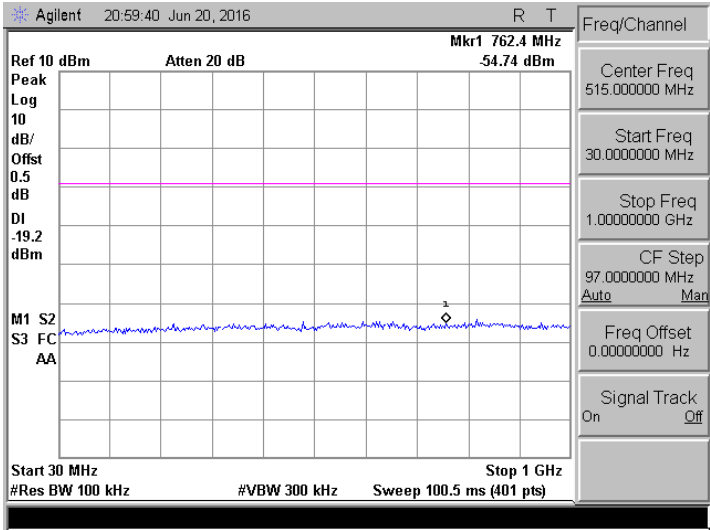
Channel 01 (2412MHz)



Channel 06 (2437MHz)

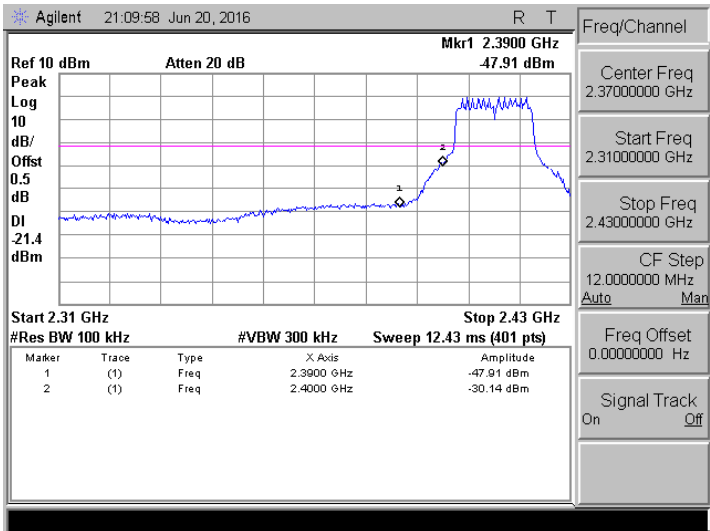
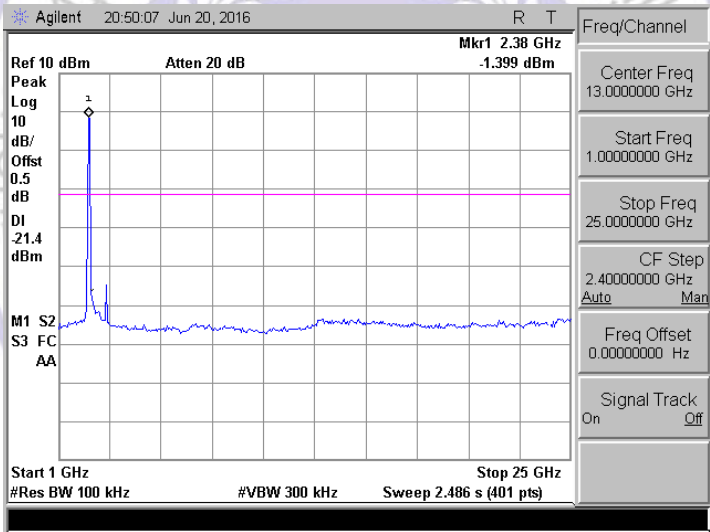
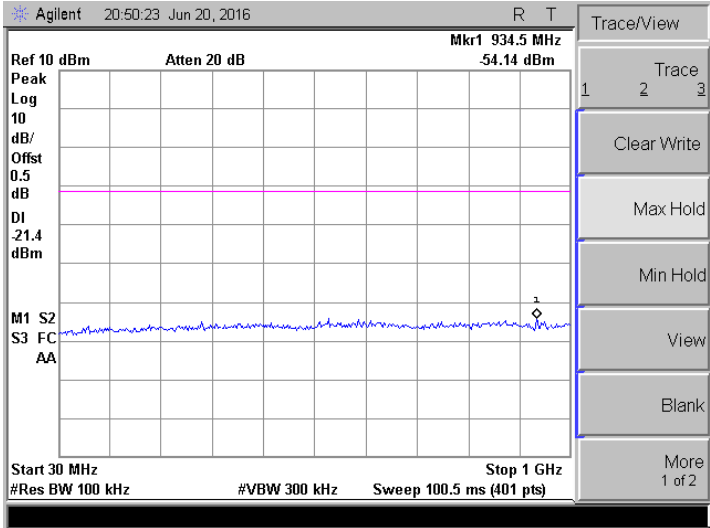


Channel 11 (2462MHz)

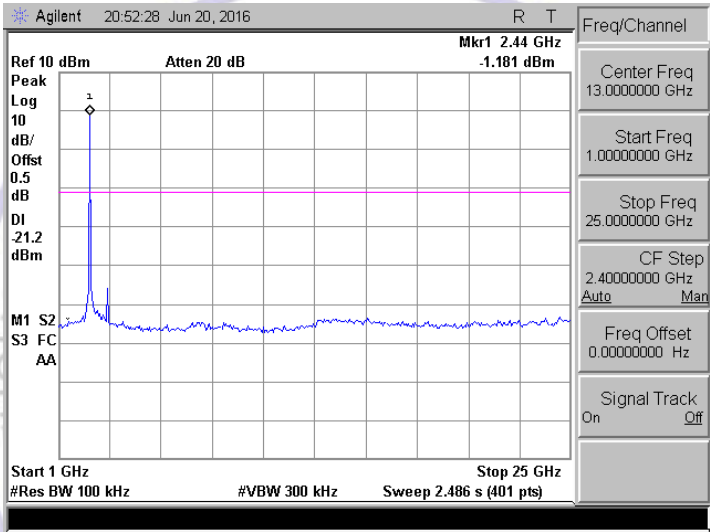
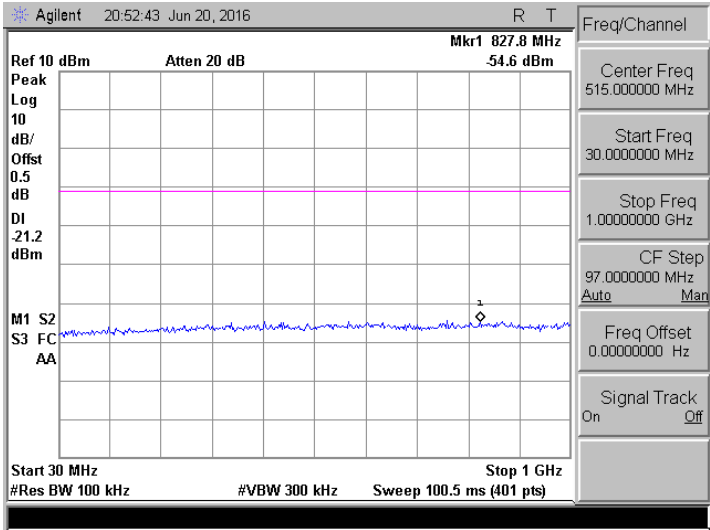


|           |   |                                     |
|-----------|---|-------------------------------------|
| Product   | : | WIFI module                         |
| Test Item | : | RF Antenna Conducted Spurious       |
| Test Mode | : | Mode 3: Transmit by 802.11n (20MHz) |

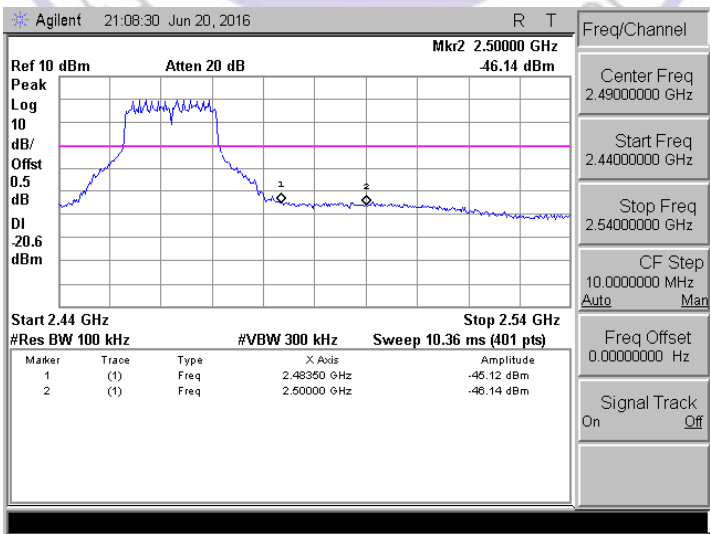
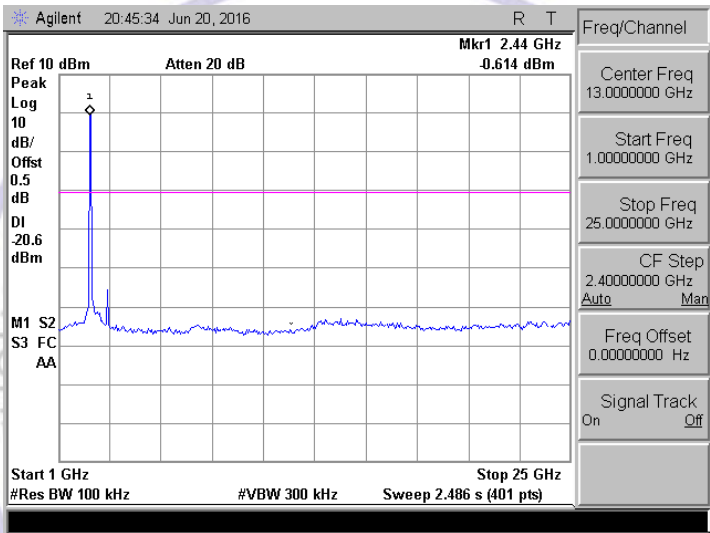
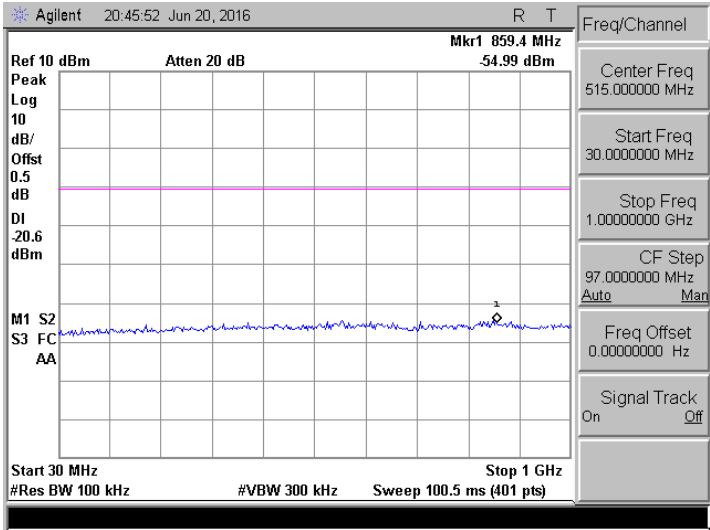
Channel 01 (2412MHz)



Channel 06 (2437MHz)



Channel 11 (2462MHz)



## 4.8. Antenna Requirement

### **STANDARD APPLICABLE**

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

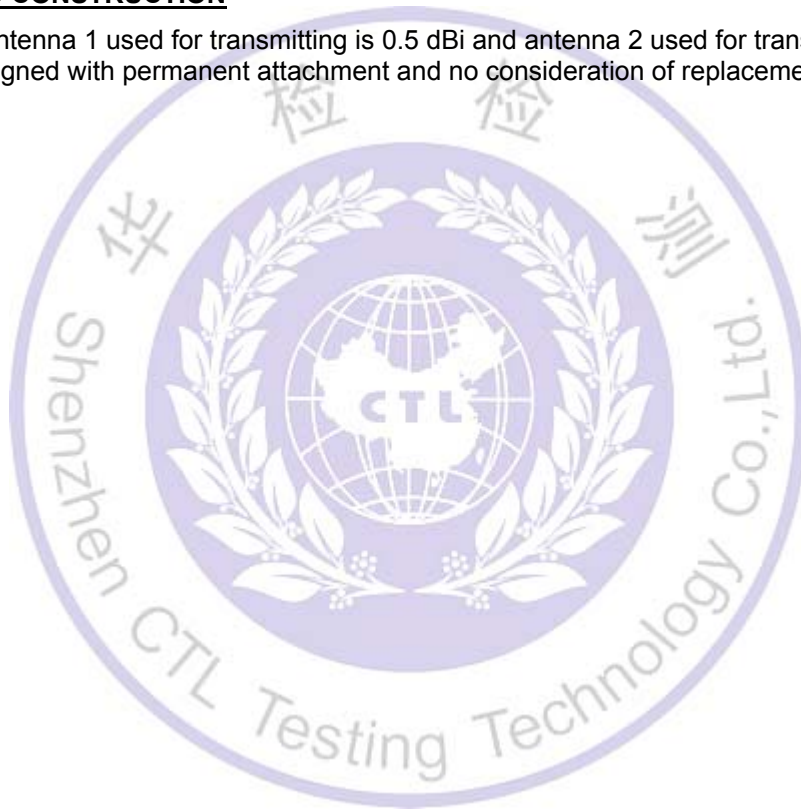
And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

**Refer to statement below for compliance.**

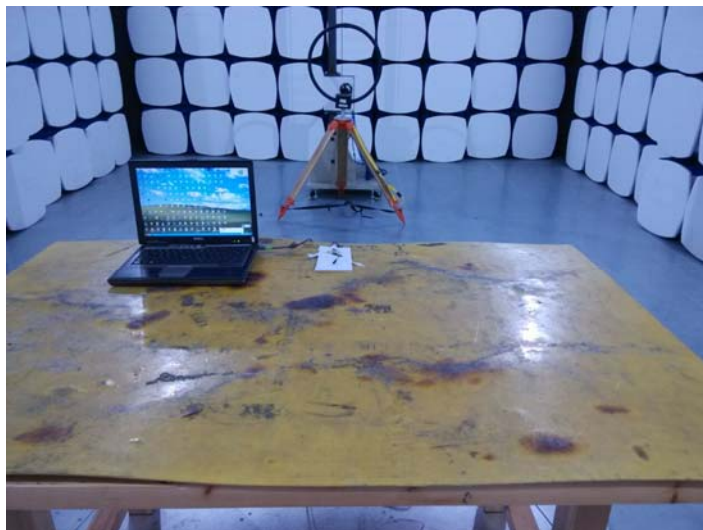
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

### **ANTENNA CONNECTED CONSTRUCTION**

The directional gains of antenna 1 used for transmitting is 0.5 dBi and antenna 2 used for transmitting is 0 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.

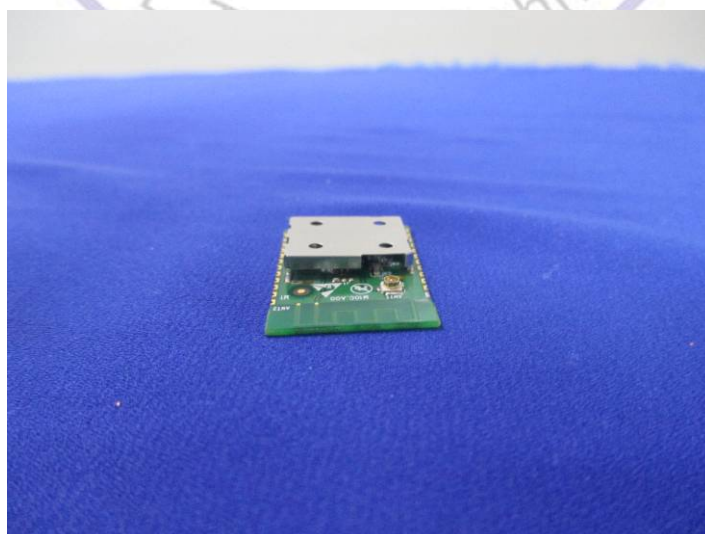
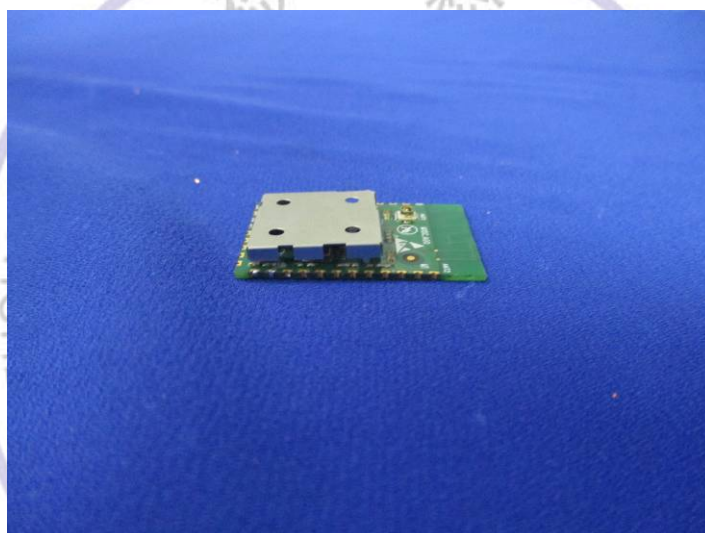
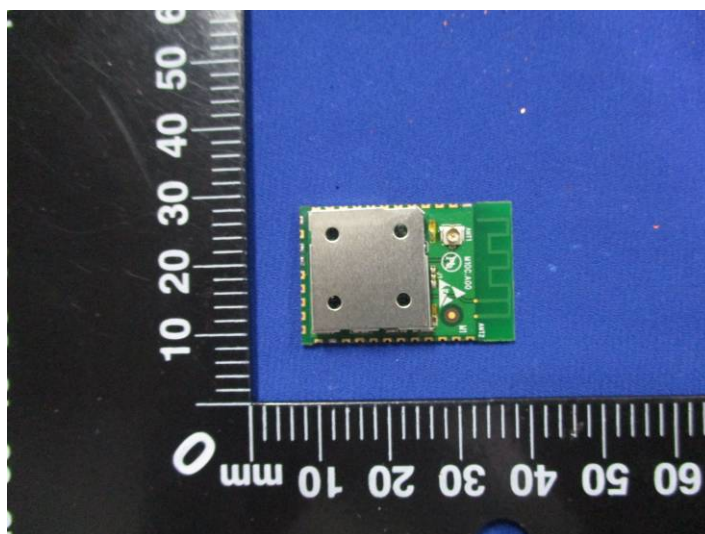


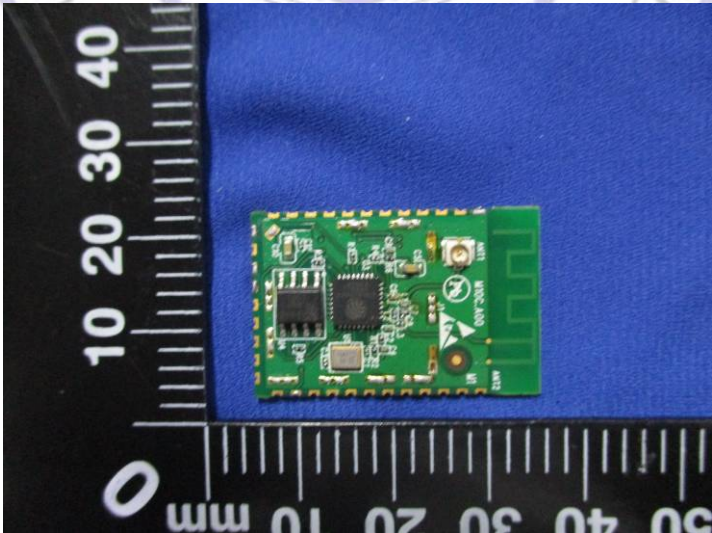
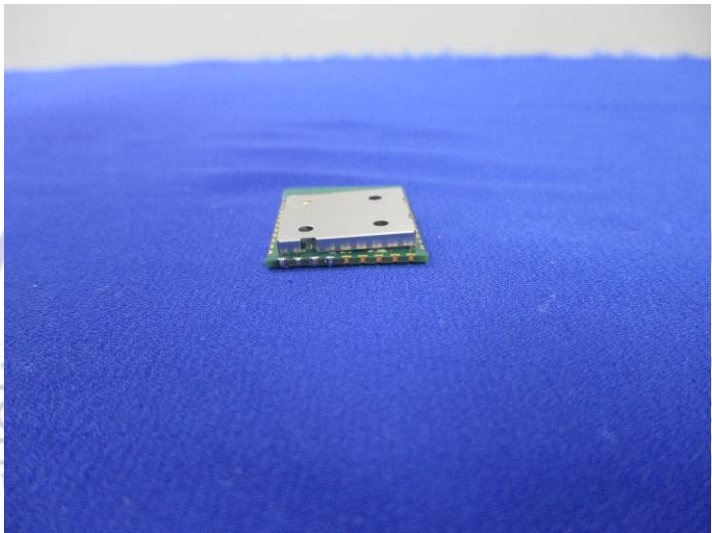
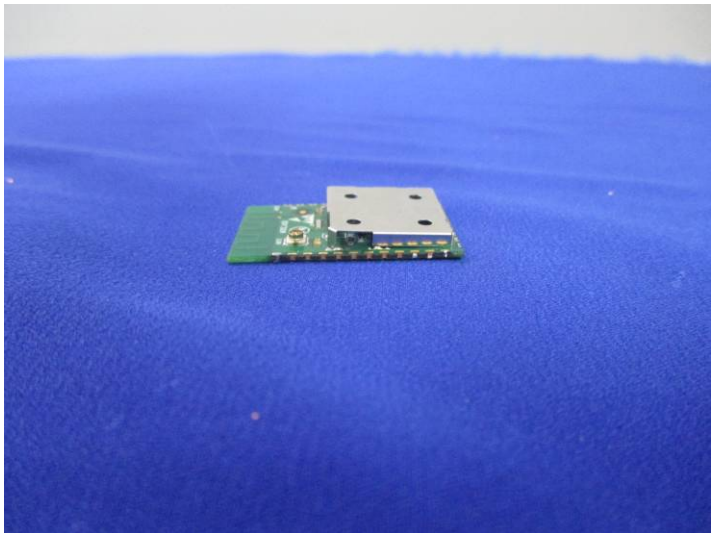
## 5. Test Setup Photos of the EUT

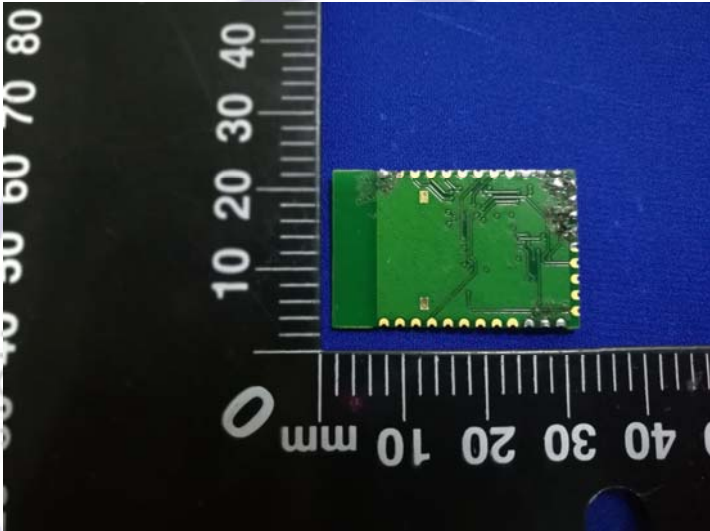
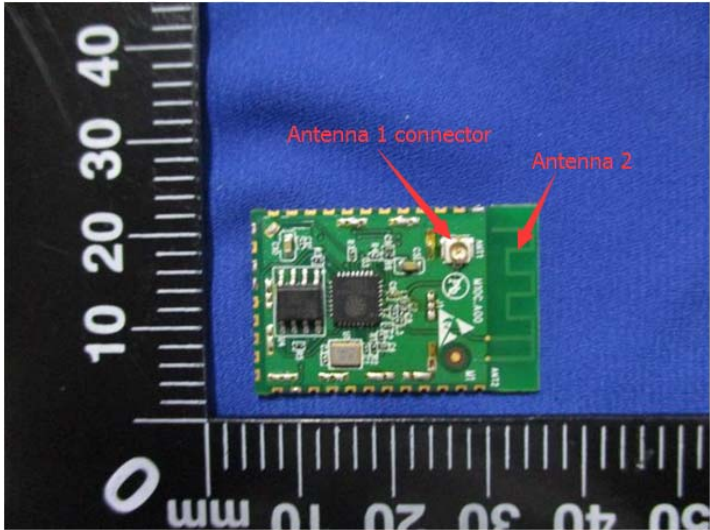




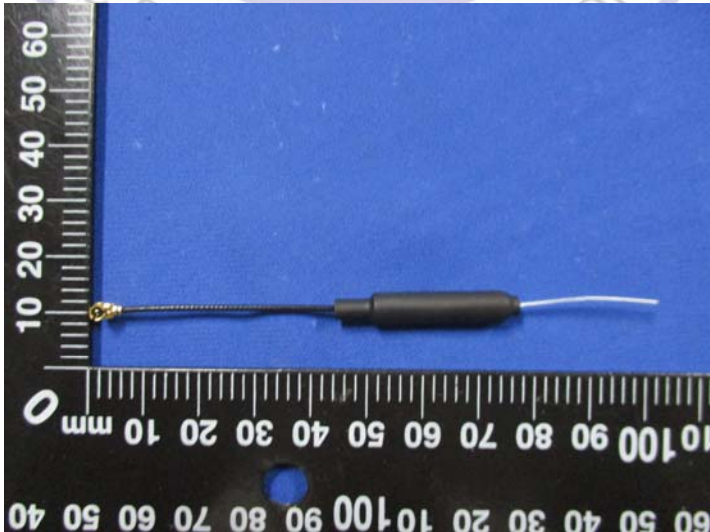
## 6. External and Internal Photos of the EUT







Antenna 1



.....End of Report.....