



## FCC PART 15 SUBPART C TEST REPORT

### FCC PART 15.247

Report Reference No.....: CTA-01-160900102

FCC ID.....: 2AGYM-D2

Compiled by

( position+printed name+signature).....: File administrators Kevin Liu

*Kevin . Liu*

Supervised by

( position+printed name+signature).....: Project Engineer Kevin Liu

*Kevin . Liu*

Approved by

( position+printed name+signature).....: RF Manager Eric Wang

*Eric Wang*

Date of issue.....: September 05, 2016

Representative Laboratory Name ..: **Shenzhen CTA Testing Technology Co., Ltd.**

Address .....: Room 520, 5th Floor, No.1053 Xixiang Baoyuan Road, Baoan District, Shenzhen, China

Testing Laboratory Name .....: **Dongguan Yaxu (AiT) Technology Limited**

Address .....: No. 22,JinQianLing Street 3, JiTiGang Village, Huang-Jiang Town, DongGuan, Guangdong, 523757 China

Applicant's name .....: **SHENZHEN MEIDI ELECTRONIC CO., LIMITED.**

Address .....: 2/F East, Jiancai Bldg, No.11 Lane 3, Liuxian 2nd Rd., No.71 Bao'an District, Shenzhen 518133, 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 CTA Testing Technology Co., Ltd.

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Test item description .....: HD DLP Pocket Projector

Trade Mark .....: MDI

Manufacturer .....: **SHENZHEN MEIDI ELECTRONIC CO., LIMITED.**

Model/Type reference.....: D2

Listed Models .....: D2 Plus

Modulation Type .....: DSSS(CCK,DQPSK,DBPSK),OFDM(64QAM,16QAM,QPSK, BPSK)

Operation Frequency.....: From 2412MHz to 2462MHz

Rating .....: DC 7.40V

Hardware version .....: 2800-AV69S8-06 2016-06-08 V69+S805

Software version .....: V1.0

Result.....: **PASS**

## TEST REPORT

|                   |                  |                    |
|-------------------|------------------|--------------------|
| Test Report No. : | CTA-01-160900102 | September 05, 2016 |
|                   |                  | Date of issue      |

Equipment under Test : HD DLP Pocket Projector

Model /Type : D2

Listed Models : D2 Plus

**Applicant** : **SHENZHEN MEIDI ELECTRONIC CO., LIMITED.**

Address : 2/F East, Jiancai Bldg, No.11 Lane 3, Liuxian 2nd Rd., No.71 Bao'an District, Shenzhen 518133, China

**Manufacturer** : **SHENZHEN MEIDI ELECTRONIC CO., LIMITED.**

Address : 2/F East, Jiancai Bldg, No.11 Lane 3, Liuxian 2nd Rd., No.71 Bao'an District, Shenzhen 518133, China

|                     |             |
|---------------------|-------------|
| <b>Test Result:</b> | <b>PASS</b> |
|---------------------|-------------|

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.

## Revision History

| Revision | Issue Date | Revisions     | Revised By |
|----------|------------|---------------|------------|
| V1.0     | 2016-09-05 | Initial Issue | Eric Wang  |
|          |            |               |            |

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## 1 TEST STANDARDS

The tests were performed according to following standards:

[FCC Rules 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

[KDB558074 D01 V03](#): Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

## 2 SUMMARY

### 2.1 General Remarks

|                                |   |                     |
|--------------------------------|---|---------------------|
| Date of receipt of test sample | : | August. 14, 2016    |
|                                |   |                     |
| Testing commenced on           | : | August. 15, 2016    |
|                                |   |                     |
| Testing concluded on           | : | September. 05, 2016 |

### 2.2 Product Description

The **SHENZHEN MEIDI ELECTRONIC CO., LIMITED.** 's Model: D2 or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

|                              |  |
|------------------------------|--|
| Name of EUT                  | HD DLP Pocket Projector  |
| Model Number                 | D2   |
| WLAN FCC Operation frequency | IEEE 802.11b:2412-2462MHz<br>IEEE 802.11g:2412-2462MHz<br>IEEE 802.11n HT20:2412-2462MHz   |
| WLAN FCC Modulation Type     | IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK)<br>IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK)<br>IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK) |
| Antenna Type                 | Internal   |
| Extreme temp. Tolerance      | -30°C to +50°C   |
| Extreme vol. Limits          | 6.00VDC to 8.40VDC (nominal: 7.40VDC)  |
| Adapter information          | Mode:YeS36W-1200300F<br>Input:AC 100-240V 50/60Hz 1.0A<br>Output:DC12V 3A  |

### 2.3 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 7.40V

### 2.4 Description of the test mode

IEEE 802.11b/g/n: The product support Third channels but only use Eleventh channels in USA.

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

## 2.5 Short description of the Equipment under Test (EUT)

### 2.5.1 Test Modes

| Test Case  | Test Conditions    |   |
|--|--------------------|---|
|  | Configuration      | Description   |
| DTS (6 dB) Bandwidth   | Measurement Method | FCC KDB 558074 §8.2 Option 2  |
|  | Test Environment   | NTNV  |
|  | EUT Configuration  | 11b_L,11b_M,11b_H<br>11g_L,11g_M,11g_H<br>11n HT20_L, 11n HT20_M, 11n HT20_H                    |
| Maximum Peak Conducted Output Power                            | Measurement Method | FCC KDB 558074§9.1.2  |
|  | Test Environment   | NTNV  |
|  | Test Setup         | Test Setup 1  |
| Maximum Power Spectral Density Level                           | EUT Configuration  | 11b_L,11b_M,11b_H<br>11g_L,11g_M,11g_H<br>11n HT20_L, 11n HT20_M, 11n HT20_H                    |
|  | Measurement Method | FCC KDB 558074 §10.2 (peak PSD).  |
|  | Test Environment   | NTNV  |
| Unwanted Emissions into Non-Restricted Frequency Bands         | EUT Configuration  | 11b_L,11b_M,11b_H<br>11g_L,11g_M,11g_H<br>11n HT20_L, 11n HT20_M, 11n HT20_H                    |
|  | Measurement Method | FCC KDB 558074§11.0.  |
|  | Test Environment   | NTNV  |
| Unwanted Emissions into Restricted Frequency Bands (Conducted) | Test Setup         | Test Setup 1  |
|  | EUT Configuration  | 11b_L,11b_M,11b_H<br>11g_L,11g_M,11g_H<br>11n HT20_L, 11n HT20_M, 11n HT20_H                    |
|  | Measurement Method | FCC KDB 558074§12.2, Conducted (antenna-port).  |
| Unwanted Emissions into Restricted Frequency Bands (Conducted) | Test Environment   | NTNV  |
|  | EUT Configuration  | 11b_L,11b_M,11b_H<br>11g_L,11g_M,11g_H<br>11n HT20_L, 11n HT20_M, 11n HT20_H                    |
|  | Measurement Method | FCC KDB 558074§12.1, Radiated(cabinet/case emissions with Impedance matching for antenna-port). |
| Unwanted Emissions into Restricted                             | Test Environment   | NTNV  |
|  | EUT Configuration  | 11b_L,11b_M,11b_H<br>11g_L,11g_M,11g_H<br>11n HT20_L, 11n HT20_M, 11n HT20_H                    |

| Test Case                         | Test Conditions    |                      |
|-----------------------------------|--------------------|----------------------|
|                                   | Configuration      | Description          |
| AC Power Line Conducted Emissions | Measurement Method | AC mains conducted.  |
|                                   | Test Environment   | NTNV                 |
|                                   | EUT Configuration  | 11g_M (Worst Conf.). |

**Note:**

1. For Radiated Emissions, By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "Z axis" position was the worst, then the final test was executed the worst condition and test data were recorded in this report.
2. Typical working modes for each IEEE 802.11 mode are selected to perform tests. The manufacturer provide special test software to control TX duty cycle >98% for TX test; recorded worst case at difference data rate as follows:

| Test Mode | Test Modes Description  |
|-----------|---|
| 11b       | IEEE 802.11b with data rate of 1 Mbps using SISO mode.                      |
| 11g       | IEEE 802.11g with data rate of 6 Mbps using SISO mode.                      |
| 11n HT20  | IEEE 802.11n with data rate of MCS0 and bandwidth of 20MHz using SISO mode. |

## 2.6 EUT operation mode

| Test Mode | RF Ch. | TX Freq. [MHz]      | RX Freq. [MHz] | Ch. BW [MHz] |
|-----------|--------|---------------------|----------------|--------------|
| 11b       | L      | Ch No. 1 / 2412MHz  | ---            | 20           |
|           | M      | Ch No. 6 / 2437 MHz | ---            | 20           |
|           | H      | Ch No. 11/ 2462MHz  | ---            | 20           |
| 11g       | L      | Ch No. 1 / 2412MHz  | ---            | 20           |
|           | M      | Ch No. 6 / 2437 MHz | ---            | 20           |
|           | H      | Ch No. 11/ 2462MHz  | ---            | 20           |
| 11n HT20  | L      | Ch No. 1 / 2412MHz  | ---            | 20           |
|           | M      | Ch No. 6 / 2437 MHz | ---            | 20           |
|           | H      | Ch No. 11/ 2462MHz  | ---            | 20           |

## 2.7 EUT configuration

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

- - supplied by the manufacturer
- - supplied by the lab

|                       |             |                |   |
|-----------------------|-------------|----------------|---|
| <input type="radio"/> | Power Cable | Length (m) :   | / |
|                       |             | Shield :       | / |
|                       |             | Detachable :   | / |
| <input type="radio"/> | Multimeter  | Manufacturer : | / |
|                       |             | Model No. :    | / |

## 2.8 Internal Identification of AE used during the test

| AE ID* | Description |
|--------|-------------|
| AE1    | Notebook    |

Mode:R510V

Trade: ASUS

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

## 2.9 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: 2AGYM-D2** filing to comply with FCC Part 15.247 Rules

## 2.10 Modifications

No modifications were implemented to meet testing criteria.

## 2.11 Test Environments

NOTE: The values used in the test report maybe stringent than the declared.

| Environment Parameter | Selected Values During Tests |         |                   |
|-----------------------|------------------------------|---------|-------------------|
| NTNV                  | Temperature                  | Voltage | Relative Humidity |
|                       | Ambient                      | 7.40VDC | Ambient           |

### 3 TEST ENVIRONMENT

#### 3.1 Address of the test laboratory

##### Dongguan Yaxu (AiT) Technology Limited

Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen 518055 China

There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4, CISPR 22/EN 55022 and CISPR16-4-1 SVSWR requirements.

#### 3.2 Test Facility

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

##### CNAS- Registration No: L6177

Dongguan Yaxu (AiT) technology Limited is accredited to ISO/IEC 17025:2005 general Requirements for the competence of testing and calibration laboratories (CNAS-CL01 Accreditation Criteria for the competence of testing and calibration laboratories) on Apr. 18, 2013

##### FCC- Registration No: 248337

The 3m Semi-Anechoic Chamber, 3m/10m Open Area Test Site and Shielding Room of Dongguan Yaxu (AiT) Technology Limited have been registered by Federal Communications Commission (FCC) on Aug.29, 2014.

##### Industry Canada(IC)-Registration No: IC6819A

The 3m Semi-Anechoic Chamber and 3m/10m Open Area Test Site of Dongguan Yaxu (AiT) Technology Limited have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing on Oct. 01, 2014.

##### VCCI- Registration No: 2705

The 3m/10m Open Area Test Site, Shielding Room and 3m Chamber of Dongguan Yaxu (AiT) technology Limited have been registered by Voluntary Control Council for Interference on Nov. 21, 2012. The Telecommunication Ports Conducted Disturbance Measurement of Asia Institute Technology (Dongguan) Limited have been registered by Voluntary Control Council for Interference on May. 13, 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 Test Description

| Test Item  | FCC Part No.        | Requirements  | Verdict |
|--|---------------------|---|---------|
| DTS (6 dB) Bandwidth   | 15.247(a)(2)        | $\geq 500$ kHz.   | PASS    |
| Maximum Peak Conducted Output Power                            | 15.247(b)(3)        | For directional gain:< 30dBm – (G[dBi] –6 [dB]),peak;<br>Otherwise :< 30dBm, peak.            | PASS    |
| Maximum Power Spectral Density Level                           | 15.247(e)           | For directional gain :< 8dBm/3 kHz – (G[dBi] –6[dB]), peak.<br>Otherwise :< 8dBm/3 kHz, peak. | PASS    |
| Band Edges Compliance  | 15.247(d)           | < -20dB/100 kHz if total peak power $\leq$ power limit.                                       | PASS    |
| Unwanted Emissions into Non-Restricted Frequency Bands         | 15.247(d)           | < -20dB/100 kHz if total peak power $\leq$ power limit.                                       | PASS    |
| Unwanted Emissions into Restricted Frequency Bands (Conducted) | 15.247(d)<br>15.209 | < -20dB/100 kHz if total peak power $\leq$ power limit.                                       | PASS    |
| Unwanted Emissions into Restricted Frequency Bands (Radiated)  | 15.247(d)<br>15.209 | FCC Part 15.209 field strength limit;   | PASS    |
| AC Power Line Conducted Emissions                              | 15.207              | FCC Part 15.207 conducted limit;  | PASS    |

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

### 3.5 Summary of measurement results

| Test Specification clause | Test case                               | Test Mode                          | Test Channel  | Recorded In Report                 |   | Pass   | Fail                     | NA                       | NP                       | Remark   |
|---------------------------|---|------------------------------------|---|------------------------------------|---|--|--------------------------|--------------------------|--------------------------|----------|
| §15.247(b)(4)             | Antenna gain                            | 802.11b                            | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | 802.11b                            | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | <input checked="" type="checkbox"/>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | complies |
| §15.247(e)                | Power spectral density                  | 802.11b<br>802.11g<br>802.11n HT20 | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | 802.11b<br>802.11g<br>802.11n HT20 | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | <input checked="" type="checkbox"/>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | complies |
| §15.247(a)(1)             | Spectrum bandwidth – 6 dB bandwidth     | 802.11b<br>802.11g<br>802.11n HT20 | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | 802.11b<br>802.11g<br>802.11n HT20 | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | <input checked="" type="checkbox"/><br><input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | complies |
| §15.247(b)(1)             | Maximum output power                    | 802.11b<br>802.11g<br>802.11n HT20 | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | 802.11b<br>802.11g<br>802.11n HT20 | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | <input checked="" type="checkbox"/><br><input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | complies |
| §15.247(d)                | Band edge compliance conducted          | 802.11b<br>802.11g<br>802.11n HT20 | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Highest   | 802.11b<br>802.11g<br>802.11n HT20 | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Highest   | <input checked="" type="checkbox"/><br><input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | complies |
| §15.205                   | Band edge compliance radiated           | 802.11b<br>802.11g<br>802.11n HT20 | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Highest   | 802.11b<br>802.11g<br>802.11n HT20 | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Highest   | <input checked="" type="checkbox"/>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | complies |
| §15.247(d)                | TX spurious emissions conducted         | 802.11b<br>802.11g<br>802.11n HT20 | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | 802.11b<br>802.11g<br>802.11n HT20 | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | <input checked="" type="checkbox"/><br><input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | complies |
| §15.247(d)                | TX spurious emissions radiated          | 802.11b<br>802.11g<br>802.11n HT20 | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | 802.11b                            | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | <input checked="" type="checkbox"/>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | complies |
| §15.109                   | RX spurious emissions radiated          | -/-                                | -/-   | -/-                                | -/-   | <input checked="" type="checkbox"/>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | complies |
| §15.209(a)                | TX spurious Emissions radiated < 30 MHz | 802.11b                            | -/-   | 802.11b                            | -/-   | <input checked="" type="checkbox"/>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | complies |
| §15.107(a)<br>§15.207     | Conducted Emissions < 30 MHz            | 802.11b                            | -/-   | 802.11b                            | -/-   | <input checked="" type="checkbox"/>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | complies |

Remark:

1. The measurement uncertainty is not included in the test result.
2. NA = Not Applicable; NP = Not Performed

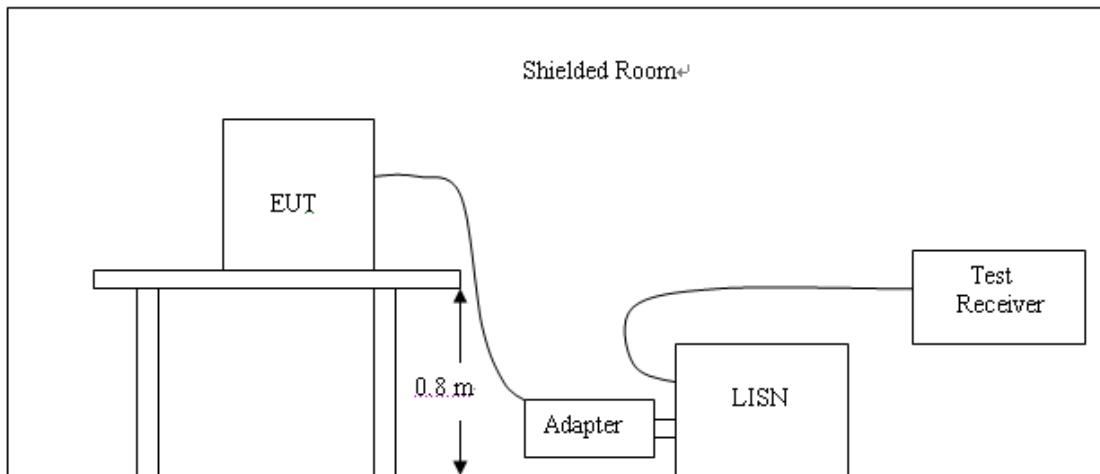
### 3.6 Equipments Used during the Test

| Test Equipment              | Manufacturer         | Model No.             | Serial No.   | Calibration Date | Calibration Due Date |
|-----------------------------|----------------------|-----------------------|--------------|------------------|----------------------|
| LISN                        | R&S                  | ENV216                | 3560.6550.12 | 2016/06/29       | 2017/06/28           |
| LISN                        | R&S                  | ESH2-Z5               | 860014/010   | 2016/06/29       | 2017/06/28           |
| Bilog Antenna               | Sunol Sciences Corp. | JB1                   | A061713      | 2016/06/29       | 2017/06/28           |
| EMI Test Receiver           | R&S                  | ESCI                  | 103710       | 2016/06/29       | 2017/06/28           |
| Spectrum Analyzer           | Agilent              | N9020A                | MY49100067   | 2016/06/29       | 2017/06/28           |
| Controller                  | EM Electronics       | Controller EM 1000    | N/A          | 2016/06/29       | 2017/06/28           |
| Horn Antenna                | Sunol Sciences Corp. | DRH-118               | A062013      | 2016/06/29       | 2017/06/28           |
| Active Loop Antenna         | SCHWARZBECK          | FMZB1519              | 1519-037     | 2016/06/29       | 2017/06/28           |
| Amplifier                   | Agilent              | 8349B                 | 3008A02306   | 2016/06/29       | 2017/06/28           |
| Amplifier                   | Agilent              | 8447D                 | 2944A10176   | 2016/06/29       | 2017/06/28           |
| Temperature/ Humidity Meter | Gangxing             | CTH-608               | 02           | 2016/06/29       | 2017/06/28           |
| High-Pass Filter            | K&L                  | 9SH10-2700/X12750-O/O | N/A          | 2016/06/29       | 2017/06/28           |
| High-Pass Filter            | K&L                  | 41H10-1375/U12750-O/O | N/A          | 2016/06/29       | 2017/06/28           |
| Coaxial Cables              | HUBER+SUHNER         | SUCOFLEX 104PEA-10M   | 10m          | 2016/06/29       | 2017/06/28           |
| Coaxial Cables              | HUBER+SUHNER         | SUCOFLEX 104PEA-3M    | 3m           | 2016/06/29       | 2017/06/28           |
| Coaxial Cables              | HUBER+SUHNER         | SUCOFLEX 104PEA-3M    | 3m           | 2016/06/29       | 2017/06/28           |
| RF Cable                    | Megalon              | RF-A303               | N/A          | 2016/06/29       | 2017/06/28           |
| Power Sensor                | R&S                  | NRP-Z4                | 823.3618.03  | 2016/06/29       | 2017/06/28           |
| Power Meter                 | R&S                  | NRVS                  | 1020.1809.02 | 2016/06/07       | 2017/06/06           |

## 4 TEST CONDITIONS AND RESULTS

### 4.1 AC Power Conducted Emission

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2013.
2. Support equipment, if needed, was placed as per ANSI C63.10-2013
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013
4. The EUT received DC5V power from the adapter, the adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5. All support equipments received AC power from a second LISN, if any.
6. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.

#### AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following:

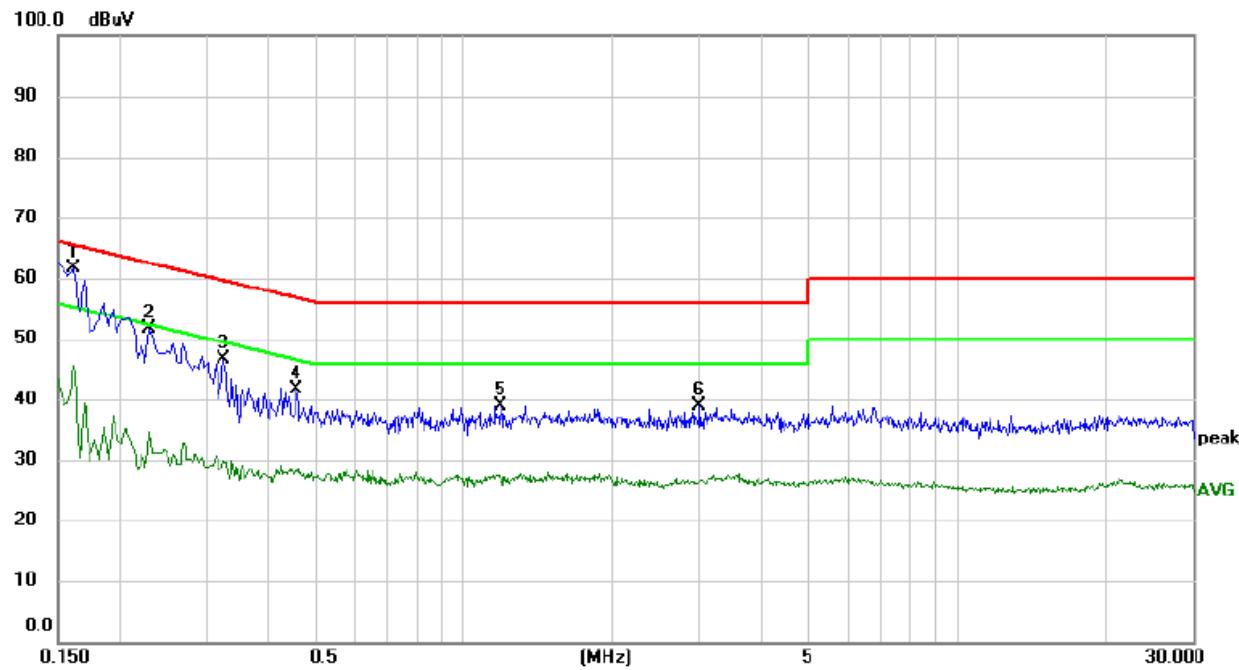
| Frequency<br>(MHz) | Maximum RF Line Voltage (dB $\mu$ V) |      |         |        |
|--------------------|--------------------------------------|------|---------|--------|
|                    | CLASS A                              |      | CLASS B |        |
|                    | Q.P.                                 | 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

#### TEST RESULTS

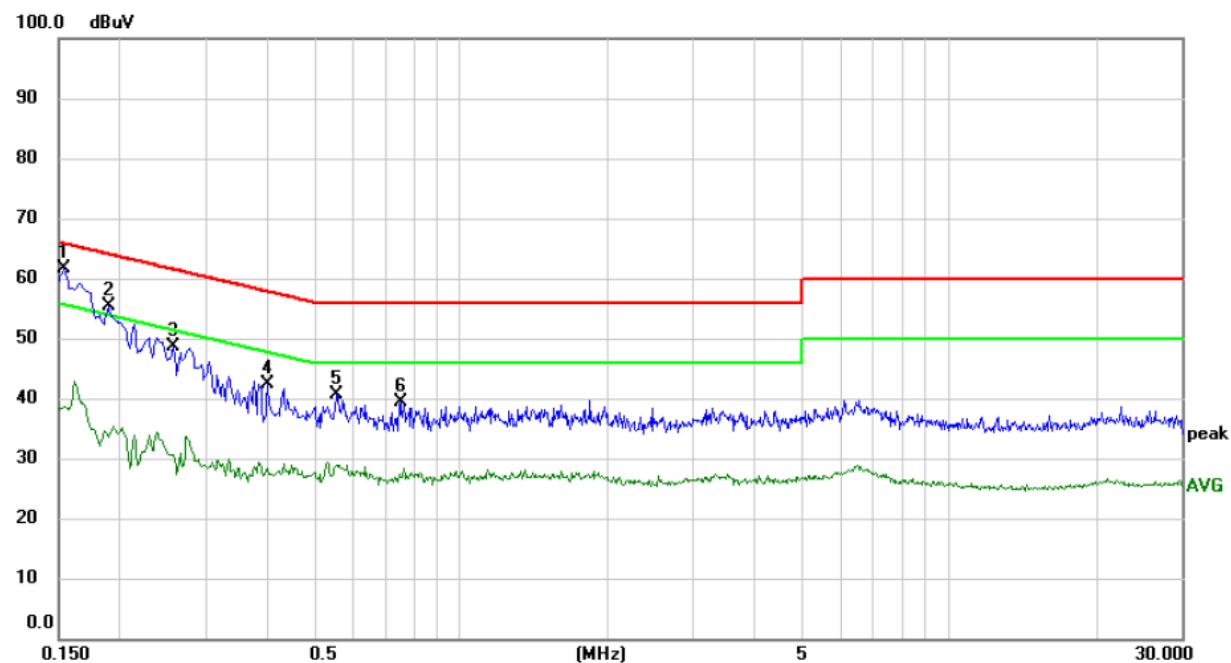
The AC Power Conducted Emission measurement is performed the each test mode (b/g/n) and channel (low/mid/high), the datum recorded below (802.11b mode, the middle channel) is the worst case for all the test modes and channels.

L:



| No. | Mk. | Freq.  | Reading | Correct | Measure- | Limit | Over   | Detector |
|-----|-----|--------|---------|---------|----------|-------|--------|----------|
|     |     |        | Level   | Factor  | ment     |       |        |          |
|     |     | MHz    | dBuV    | dB      | dBuV     | dBuV  | dB     |          |
| 1   | *   | 0.1620 | 31.64   | 30.02   | 61.66    | 65.36 | -3.70  | peak     |
| 2   |     | 0.2300 | 21.62   | 30.02   | 51.64    | 62.45 | -10.81 | peak     |
| 3   |     | 0.3260 | 16.55   | 30.02   | 46.57    | 59.55 | -12.98 | peak     |
| 4   |     | 0.4580 | 11.65   | 30.02   | 41.67    | 56.73 | -15.06 | peak     |
| 5   |     | 1.1900 | 8.93    | 30.02   | 38.95    | 56.00 | -17.05 | peak     |
| 6   |     | 2.9940 | 8.81    | 30.04   | 38.85    | 56.00 | -17.15 | peak     |

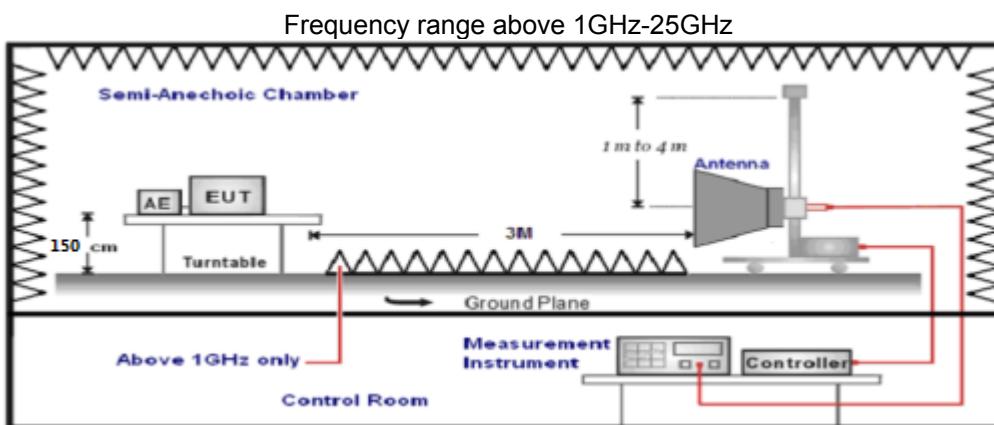
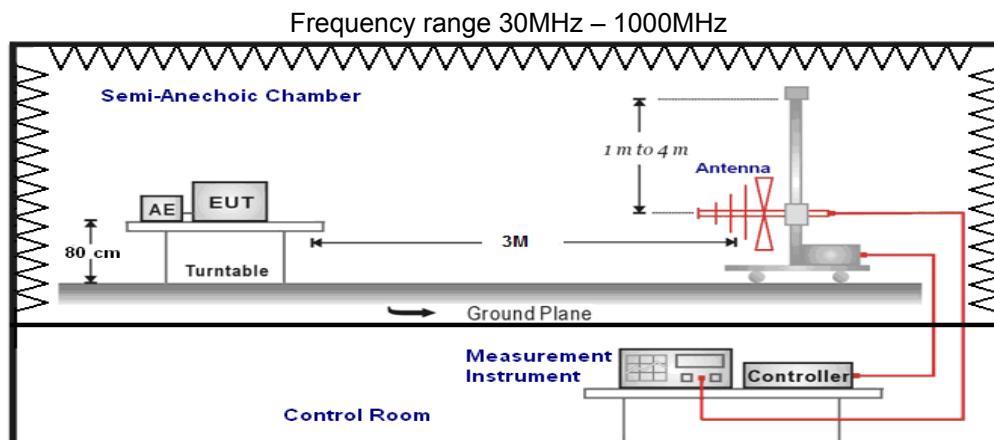
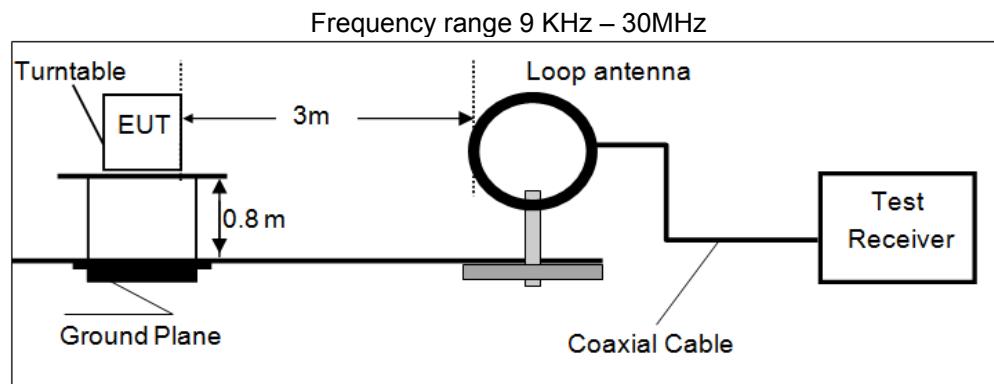
N:



| No. | Mk. | Freq.  | Reading | Correct | Measure- | Limit | Over   | Detector |
|-----|-----|--------|---------|---------|----------|-------|--------|----------|
|     |     |        | Level   | Factor  | ment     |       |        |          |
|     |     | MHz    | dBuV    | dB      | dBuV     | dBuV  | dB     |          |
| 1   | *   | 0.1539 | 31.68   | 30.02   | 61.70    | 65.78 | -4.08  | peak     |
| 2   |     | 0.1900 | 25.27   | 30.02   | 55.29    | 64.03 | -8.74  | peak     |
| 3   |     | 0.2580 | 18.59   | 30.02   | 48.61    | 61.49 | -12.88 | peak     |
| 4   |     | 0.4020 | 12.40   | 30.02   | 42.42    | 57.81 | -15.39 | peak     |
| 5   |     | 0.5580 | 10.71   | 30.02   | 40.73    | 56.00 | -15.27 | peak     |
| 6   |     | 0.7580 | 9.42    | 30.02   | 39.44    | 56.00 | -16.56 | peak     |

## 4.2 Radiated Emission

### TEST CONFIGURATION



### TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m above ground plane for below 1GHz and 1.50m above ground plane for above 1GHz.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0°C to 360°C to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. The EUT minimum operation frequency was 32.768 KHz and maximum operation frequency was 2480MHz.so radiated emission test frequency band from 9 KHz to 25GHz.
6. The distance between test antenna and EUT as following table states:

| Test Frequency range | Test Antenna Type          | Test Distance |
|----------------------|----------------------------|---------------|
| 9KHz-30MHz           | Active Loop Antenna        | 3             |
| 30MHz-1GHz           | Ultra-Broadband Antenna    | 3             |
| 1GHz-18GHz           | Double Ridged Horn Antenna | 3             |
| 18GHz-25GHz          | Horn Antenna               | 1             |

7. Setting test receiver/spectrum as following table states:

| Test Frequency range | Test Receiver/Spectrum Setting                       | Detector |
|----------------------|--|----------|
| 9KHz-150KHz          | RBW=200Hz/VBW=3KHz,Sweep time=Auto                   | QP       |
| 150KHz-30MHz         | RBW=9KHz/VBW=100KHz,Sweep time=Auto                  | QP       |
| 30MHz-1GHz           | RBW=120KHz/VBW=1000KHz,Sweep time=Auto               | QP       |
| 1GHz-40GHz           | Peak Value: RBW=1MHz/VBW=3MHz,<br>Sweep time=Auto    | Peak     |
|                      | Average Value: RBW=1MHz/VBW=10Hz,<br>Sweep time=Auto | Peak     |

More procedure as follows;

### 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.

#### Premasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1.0 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 QP 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.

#### Premasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 to 4 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 maximizes 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.

#### Premasurement:

--- 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.

#### Premasurement:

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

### 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:

$$\text{FS} = \text{RA} + \text{AF} - \text{AG}$$

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

For example

| Frequency (MHz) | FS (dB $\mu$ V/m) | RA (dB $\mu$ V/m) | AF (dB) | CL (dB) | AG (dB) | Transd (dB) |
|-----------------|-------------------|-------------------|---------|---------|---------|-------------|
| 300.00          | 40                | 58.1              | 12.2    | 1.6     | 31.90   | -18.1       |

Transd=AF +CL-AG

### RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission out of authorized band shall not exceed the following table at a 3 meters measurement distance.

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

The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos.

| Frequency (MHz) | Distance (Meters) | Radiated (dB $\mu$ V/m) | Radiated ( $\mu$ V/m) |
|-----------------|-------------------|-------------------------|-----------------------|
| 0.009-0.49      | 300               | 20log(2400/F(KHz))+80   | 2400/F(KHz)           |
| 0.49-1.705      | 30                | 20log(24000/F(KHz))+40  | 24000/F(KHz)          |
| 1.705-30        | 30                | 20log(30)+40            | 30                    |
| 30-88           | 3                 | 40.0                    | 100                   |
| 88-216          | 3                 | 43.5                    | 150                   |
| 216-960         | 3                 | 46.0                    | 200                   |
| Above 960       | 3                 | 54.0                    | 500                   |

### TEST RESULTS

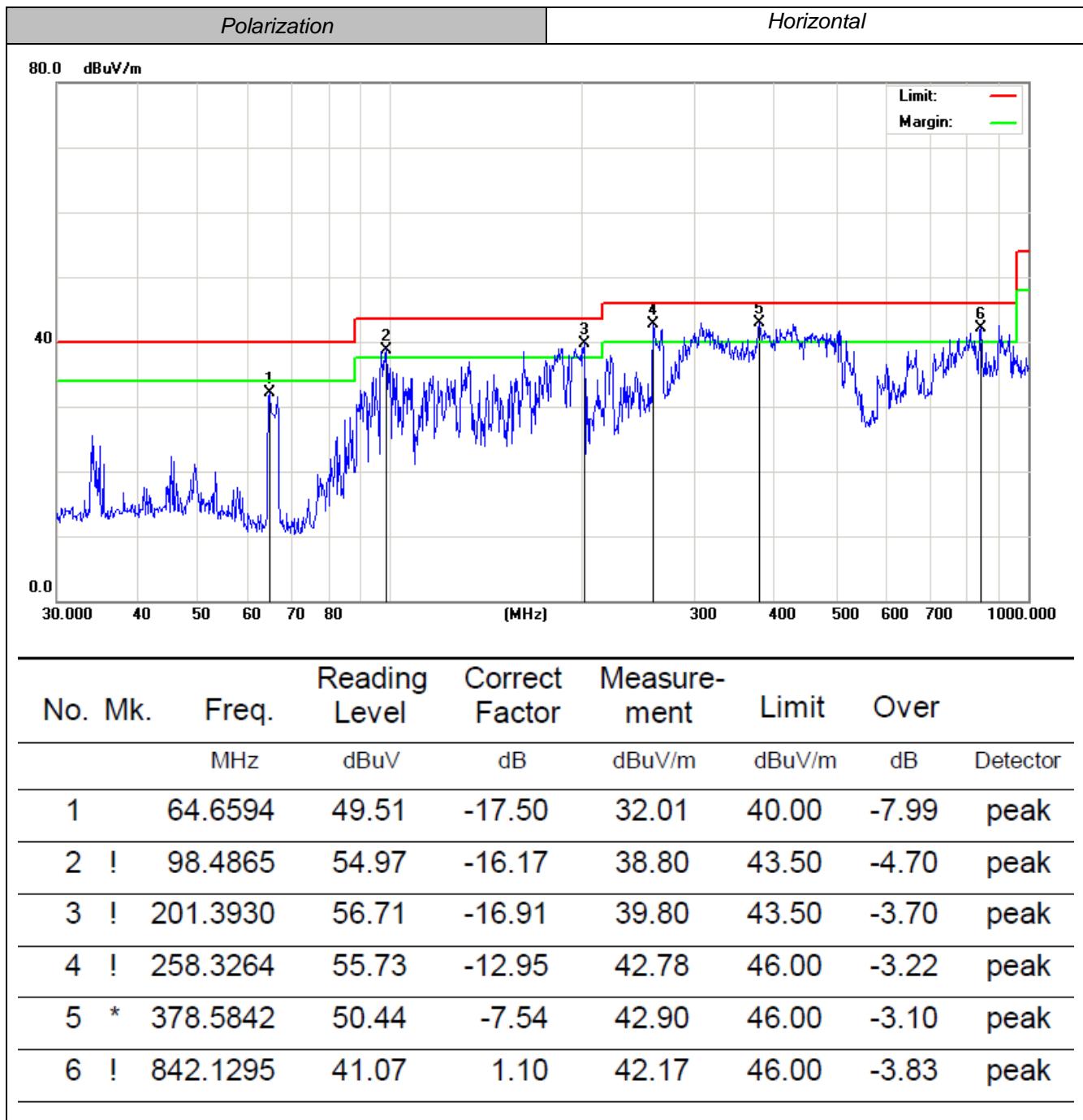
Remark:

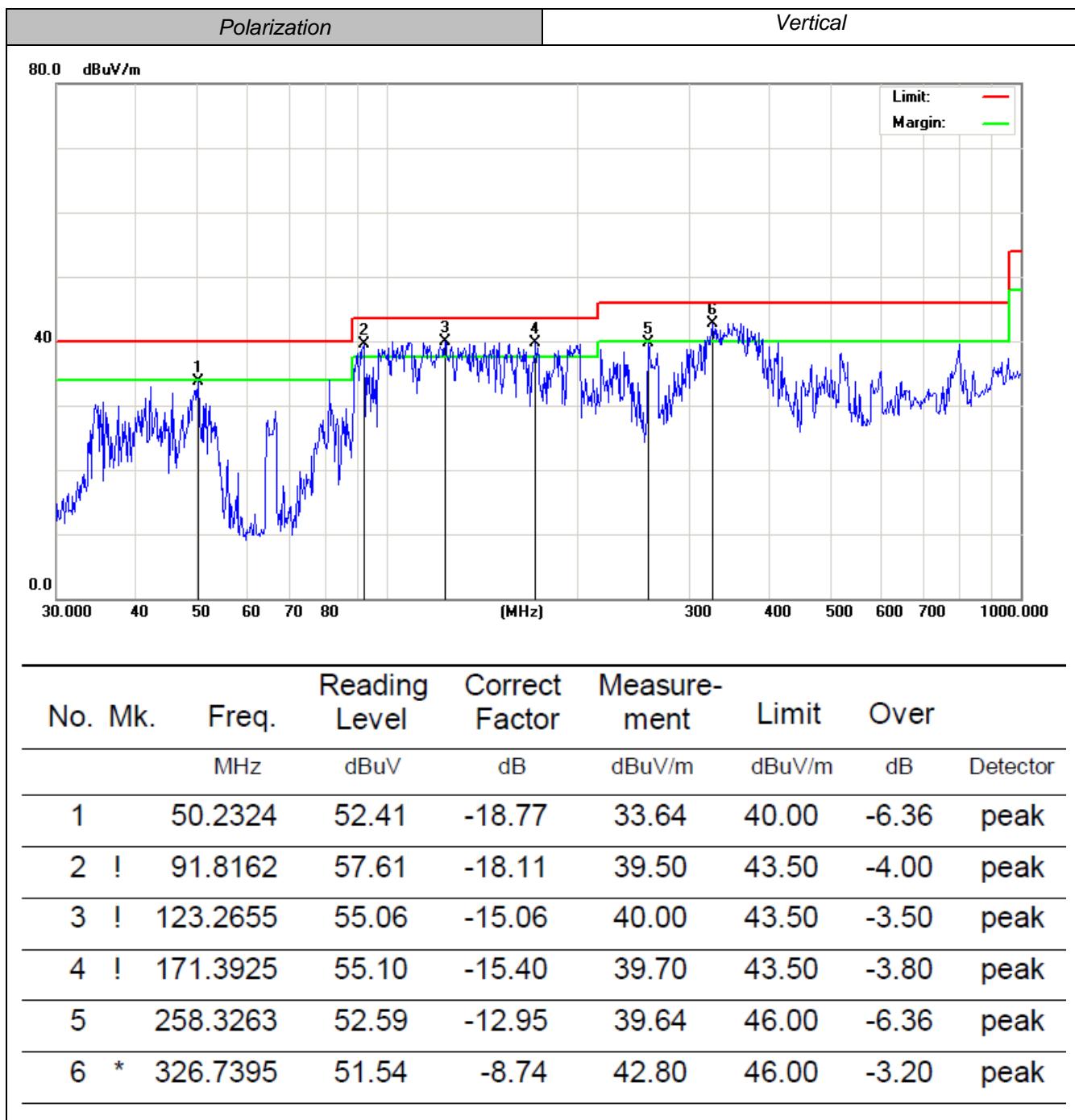
1. The radiated measurement are performed the each test mode (b/g/n) and channel (low/mid/high), the datum recorded below (802.11b mode, the middle channel) is the worst case for all the test mode and channel.
2. ULTRA-BROADBAND ANTENNA for the radiation emission test below 1G.
3. HORN ANTENNA for the radiation emission test above 1G.
4. We tested both battery powered and powered by adapter charging mode at three orientate ons, recorded worst case at powered by adapter charging mode.
5. “--” means not recorded as emission levels lower than limit.
6. Margin= Limit - Level

#### For 9KHz to 30MHz

| Frequency (MHz) | Corrected Reading (dB $\mu$ V/m)@3m | FCC Limit (dB $\mu$ V/m) @3m | Margin (dB) | Detector | Result |
|-----------------|-------------------------------------|------------------------------|-------------|----------|--------|
| 15.85           | 48.85                               | 69.54                        | -20.69      | QP       | PASS   |
| 25.79           | 46.76                               | 69.54                        | -22.78      | QP       | PASS   |

For 30MHz to 1000MHz





**For 1GHz to 25GHz**

Note: We tested 802.11b, 802.11g, 802.11n HT20 and recorded the worst case at the 802.11b Mode.

**802.11b Mode (above 1GHz)**

| Frequency(MHz): |                 |                         | 2412           |             | Polarity:        |                       |                   | HORIZONTAL         |                          |
|-----------------|-----------------|-------------------------|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| No.             | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 1               | 4824.00         | 50.19 PK                | 74             | 23.81       | 45.64            | 33.52                 | 6.92              | 35.89              | 4.55                     |
| 1               | 4824.00         | 42.88 AV                | 54             | 11.12       | 38.33            | 33.52                 | 6.92              | 35.89              | 4.55                     |
| 2               | 5215.50         | 52.78 PK                | 74             | 21.22       | 45.38            | 34.56                 | 7.15              | 34.31              | 7.40                     |
| 2               | 5215.50         | -- AV                   | 54             | --          | --               | --                    | --                | --                 | --                       |
| 3               | 7236.00         | 50.11 PK                | 74             | 23.89       | 38.84            | 37.10                 | 9.19              | 35.02              | 11.27                    |
| 3               | 7236.00         | -- AV                   | 54             | --          | --               | --                    | --                | --                 | --                       |

| Frequency(MHz): |                 |                         | 2412           |             | Polarity:        |                       |                   | VERTICAL           |                          |
|-----------------|-----------------|-------------------------|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| No.             | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 1               | 4824.00         | 50.32 PK                | 74             | 23.68       | 45.77            | 33.52                 | 6.92              | 35.89              | 4.55                     |
| 1               | 4824.00         | 41.17 AV                | 54             | 12.83       | 36.62            | 33.52                 | 6.92              | 35.89              | 4.55                     |
| 2               | 5365.75         | 52.66 PK                | 74             | 21.34       | 45.08            | 34.71                 | 7.24              | 34.36              | 7.58                     |
| 2               | 5365.75         | -- AV                   | 54             | --          | --               | --                    | --                | --                 | --                       |
| 3               | 7236.00         | 49.19 PK                | 74             | 24.81       | 37.92            | 37.10                 | 9.19              | 35.02              | 11.27                    |
| 3               | 7236.00         | -- AV                   | 54             | --          | --               | --                    | --                | --                 | --                       |

**REMARKS:**

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor
3. Margin value = Limit value - Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.
6. RBW=1MHz VBW=3MHz Peak detector is for PK value; RBW =1MHz VBW=10Hz Peak detector is for AV value.

| Frequency(MHz): |                 |                         | 2437           |             | Polarity:        |                       |                   | HORIZONTAL         |                          |
|-----------------|-----------------|-------------------------|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| No.             | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 1               | 4874.00         | 48.05 PK                | 74             | 25.95       | 41.81            | 33.59                 | 6.95              | 34.30              | 6.24                     |
| 1               | 4874.00         | 39.71 AV                | 54             | 14.29       | 33.47            | 33.59                 | 6.95              | 34.30              | 6.24                     |
| 2               | 5375.75         | 45.81 PK                | 74             | 28.19       | 37.86            | 34.72                 | 7.25              | 34.02              | 7.95                     |
| 2               | 5375.75         | -- AV                   | 54             | --          | --               | --                    | --                | --                 | --                       |
| 3               | 7311.00         | 53.11 PK                | 74             | 20.89       | 41.45            | 37.44                 | 9.22              | 35.00              | 11.66                    |
| 3               | 7311.00         | -- AV                   | 54             | --          | --               | --                    | --                | --                 | --                       |

| Frequency(MHz): |                 |                         | 2437           |             | Polarity:        |                       |                   | VERTICAL           |                          |
|-----------------|-----------------|-------------------------|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| No.             | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 1               | 4874.00         | 50.87 PK                | 74             | 23.13       | 44.63            | 33.59                 | 6.95              | 34.30              | 6.24                     |
| 1               | 4874.00         | 41.06 AV                | 54             | 12.94       | 34.82            | 33.59                 | 6.95              | 34.30              | 6.24                     |
| 2               | 5215.75         | 46.09 PK                | 74             | 27.91       | 38.49            | 34.56                 | 7.15              | 34.11              | 7.60                     |
| 2               | 5215.75         | -- AV                   | 54             | --          | --               | --                    | --                | --                 | --                       |
| 3               | 7311.00         | 54.06 PK                | 74             | 19.94       | 42.40            | 37.44                 | 9.22              | 35.00              | 11.66                    |
| 3               | 7311.00         | -- AV                   | 54             | --          | --               | --                    | --                | --                 | --                       |

## REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.
6. RBW=1MHz VBW=3MHz Peak detector is for PK value; RBW =1MHz VBW=10Hz Peak detector is for AV value.

| Frequency(MHz): |                 |                         | 2462           |             | Polarity:        |                       |                   | HORIZONTAL         |                          |
|-----------------|-----------------|-------------------------|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| No.             | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 1               | 4924.00         | 50.29 PK                | 74             | 23.71       | 45.51            | 33.71                 | 6.98              | 35.91              | 4.78                     |
| 1               | 4924.00         | 42.74 AV                | 54             | 11.26       | 37.96            | 33.71                 | 6.98              | 35.91              | 4.78                     |
| 2               | 5175.75         | 51.25 PK                | 74             | 22.75       | 43.93            | 34.49                 | 7.13              | 34.29              | 7.32                     |
| 2               | 5175.75         | -- AV                   | 54             | --          | --               | --                    | --                | --                 | --                       |
| 3               | 7386.00         | 51.35 PK                | 74             | 22.65       | 39.47            | 37.61                 | 9.25              | 34.98              | 11.88                    |
| 3               | 7386.00         | -- AV                   | 54             | --          | --               | --                    | --                | --                 | --                       |

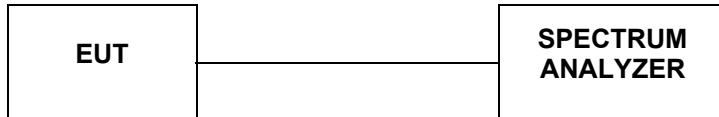
| Frequency(MHz): |                 |                         | 2462           |             | Polarity:        |                       |                   | VERTICAL           |                          |
|-----------------|-----------------|-------------------------|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| No.             | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 1               | 4924.00         | 49.95 PK                | 74             | 24.05       | 45.17            | 33.71                 | 6.98              | 35.91              | 4.78                     |
| 1               | 4924.00         | 41.66 AV                | 54             | 12.34       | 36.88            | 33.71                 | 6.98              | 35.91              | 4.78                     |
| 2               | 5211.50         | 49.05 PK                | 74             | 24.95       | 41.66            | 34.55                 | 7.15              | 34.31              | 7.39                     |
| 2               | 5211.50         | -- AV                   | 54             | --          | --               | --                    | --                | --                 | --                       |
| 3               | 7386.00         | 51.14 PK                | 74             | 22.86       | 39.26            | 37.61                 | 9.25              | 34.98              | 11.88                    |
| 3               | 7386.00         | -- AV                   | 54             | --          | --               | --                    | --                | --                 | --                       |

## REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.
6. RBW=1MHz VBW=3MHz Peak detector is for PK value; RBW=1MHz VBW=10Hz Peak detector is for AV value.

### 4.3 Duty Cycle

#### TEST CONFIGURATION



#### LIMIT

The Maximum Peak Output Power Measurement is 30dBm.

Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%).

#### TEST PROCEDURE

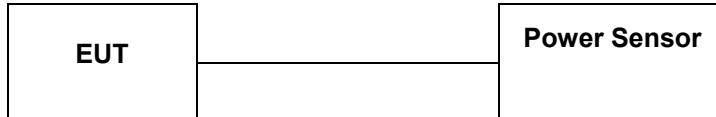
- a. A diode detector and an oscilloscope that together have sufficiently short response time to permit accurate measurements of the on and off times of the transmitted signal.
- b. The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set  $RBW \geq OBW$  if possible; otherwise, set  $RBW$  to the largest available value. Set  $VBW \geq RBW$ . Set detector = peak or average. The zero-span measurement method shall not be used unless both  $RBW$  and  $VBW$  are  $> 50/T$  and the number of sweep points across duration  $T$  exceeds 100. (For example, if  $VBW$  and/or  $RBW$  are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if  $T \leq 16.7$  microseconds.)

#### TEST RESULTS

The Manufacturer provide engineer mode \*#3646633#\* to setup 100% continuous transmit for WLAN;

## 4.4 Maximum Output Power

### TEST CONFIGURATION



### TEST PROCEDURE

According to KDB558074 D01 DTS Meas Guidance v03:

PKPM1 Peak power meter method: The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

Maximum conducted (average) output power: As an alternative to spectrum analyzer or EMI receiver measurements, measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.

1. The EUT is configured to transmit continuously, or to transmit with a constant duty factor.
2. At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.
3. The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

If the transmitter does not transmit continuously, measure the duty cycle (x) of the transmitter output signal as described in Section 6.0.

Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.

Adjust the measurement in dBm by adding  $10\log(1/x)$ , where x is the duty cycle to the measurement result.

### LIMIT

The Maximum Peak Output Power Measurement is 30dBm.

### TEST RESULTS

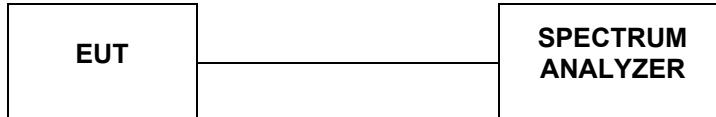
| Test Mode          | Channel | Frequency (MHz) | Measured Output Peak Power (dBm) | Limits (dBm) | Verdict |
|--------------------|---------|-----------------|----------------------------------|--------------|---------|
| IEEE 802.11 b      | 1       | 2412            | 19.38                            | 30           | PASS    |
|                    | 6       | 2437            | 19.77                            |              |         |
|                    | 11      | 2462            | 19.87                            |              |         |
| IEEE 802.11 g      | 1       | 2412            | 20.78                            | 30           | PASS    |
|                    | 6       | 2437            | 20.85                            |              |         |
|                    | 11      | 2462            | 20.91                            |              |         |
| IEEE 802.11 n HT20 | 1       | 2412            | 19.24                            | 30           | PASS    |
|                    | 6       | 2437            | 19.62                            |              |         |
|                    | 11      | 2462            | 19.83                            |              |         |

Remark:

1. Measured output power at difference data rate for each mode and recorded worst case for each mode.
2. Test results including cable loss;
3. Worst case data at 1Mbps at IEEE 802.11 b; 6Mbps at IEEE 802.11 g; 6.5Mbps at IEEE 802.11 n HT20;

## 4.5 Power Spectral Density

### TEST CONFIGURATION



### TEST PROCEDURE

According to KDB 558074 D01 V03 Method PKPSD (peak PSD) this procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
4. Set the VBW  $\geq 3 \text{ RBW}$ .
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

### LIMIT

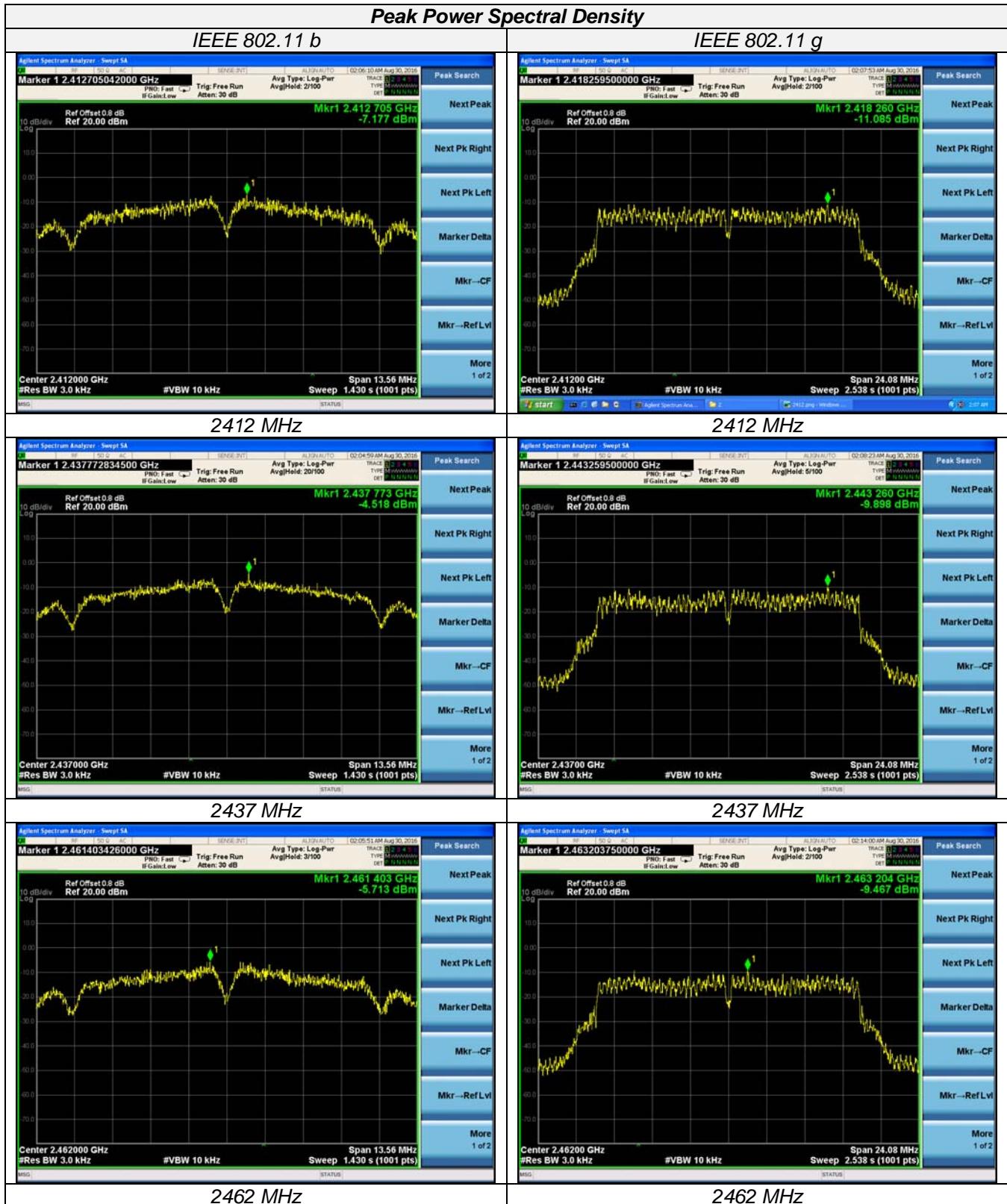
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

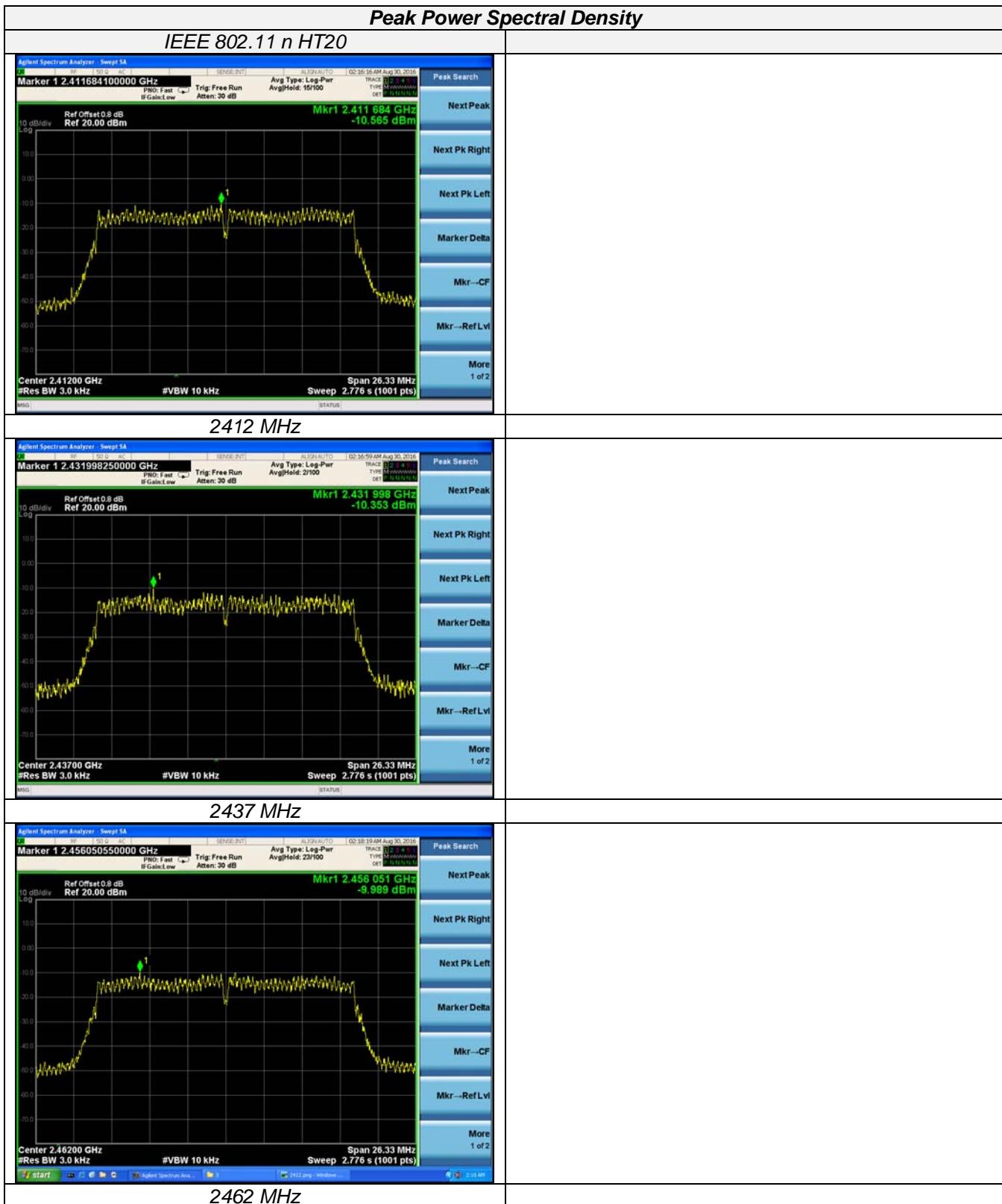
### TEST RESULTS

| Test Mode          | Channel | Frequency (MHz) | Measured Peak Power Spectral Density (dBm/3KHz) | Limits (dBm/3KHz) | Verdict |
|--------------------|---------|-----------------|---|-------------------|---------|
| IEEE 802.11 b      | 1       | 2412            | -7.177  | 8                 | PASS    |
|                    | 6       | 2437            | -4.518  |                   |         |
|                    | 11      | 2462            | -5.713  |                   |         |
| IEEE 802.11 g      | 1       | 2412            | -11.085   | 8                 | PASS    |
|                    | 6       | 2437            | -9.898  |                   |         |
|                    | 11      | 2462            | -9.467  |                   |         |
| IEEE 802.11 n HT20 | 1       | 2412            | -10.565   | 8                 | PASS    |
|                    | 6       | 2437            | -10.353   |                   |         |
|                    | 11      | 2462            | -9.989  |                   |         |

#### Remark:

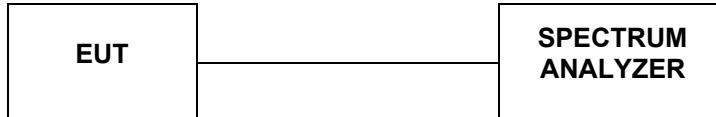
1. Measured output power at difference data rate for each mode and recorded worst case for each mode.
2. Test results including cable loss;
3. Worst case data at 1Mbps at IEEE 802.11 b; 6Mbps at IEEE 802.11 g; 6.5Mbps at IEEE 802.11 n HT20;;
4. please refer to following plots;





## 4.6 Spurious RF Conducted Emission

### TEST CONFIGURATION



### TEST PROCEDURE

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=100 kHz and VBW= 300 KHz to measure the peak field strength, and measure frequency range from 9 KHz to 25GHz.

### LIMIT

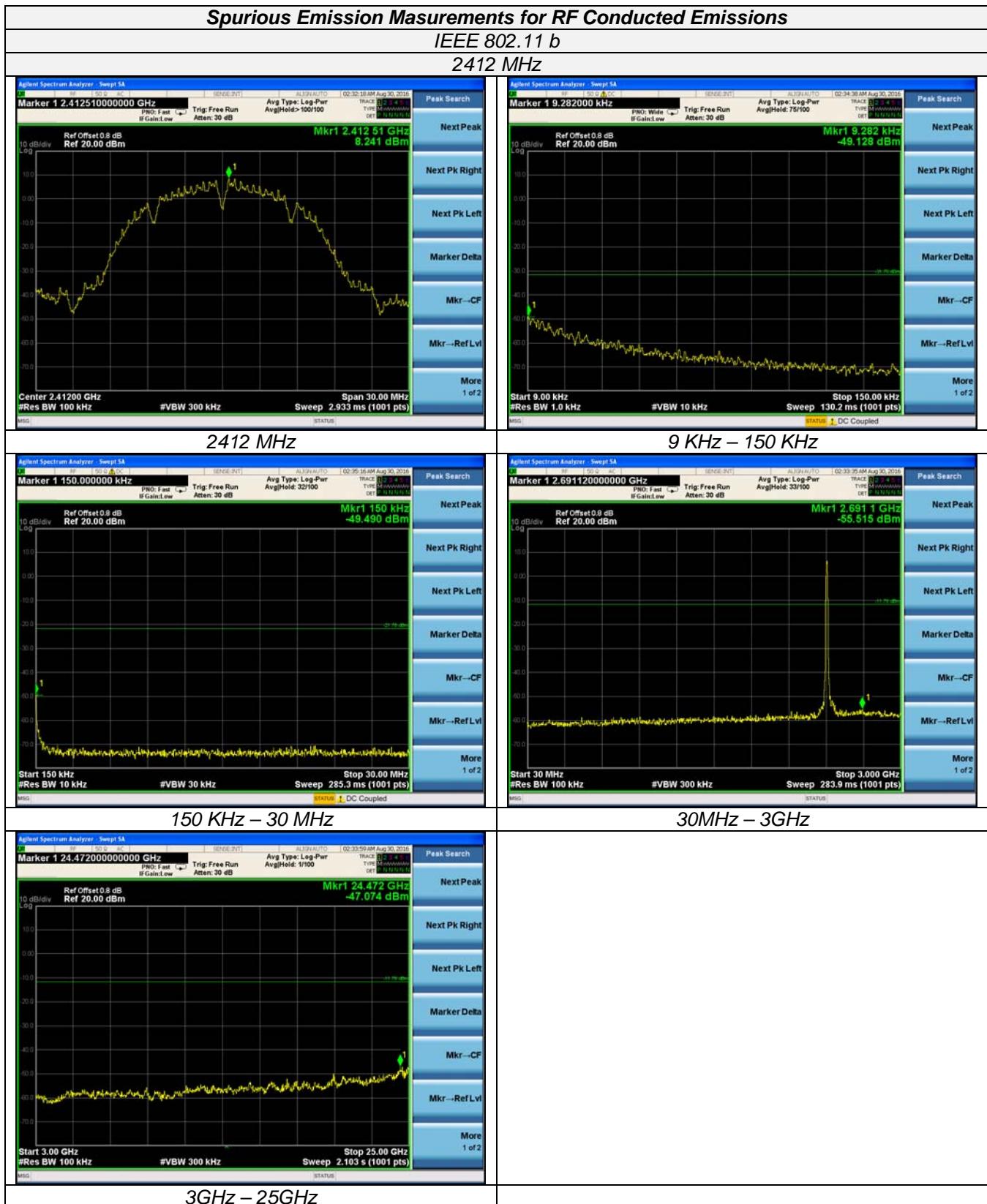
1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

### TEST RESULTS

| Test Mode          | Channel | Frequency (MHz) | Spurious RF Conducted Emission (dBc) | Limits (dBc) | Verdict |
|--------------------|---------|-----------------|--------------------------------------|--------------|---------|
| IEEE 802.11 b      | 1       | 2412            | <-20dBc                              | -20          | PASS    |
|                    | 6       | 2437            | <-20dBc                              | -20          |         |
|                    | 11      | 2462            | <-20dBc                              | -20          |         |
| IEEE 802.11 g      | 1       | 2412            | <-20dBc                              | -20          | PASS    |
|                    | 6       | 2437            | <-20dBc                              | -20          |         |
|                    | 11      | 2462            | <-20dBc                              | -20          |         |
| IEEE 802.11 n HT20 | 1       | 2412            | <-20dBc                              | -20          | PASS    |
|                    | 6       | 2437            | <-20dBc                              | -20          |         |
|                    | 11      | 2462            | <-20dBc                              | -20          |         |

#### Remark:

1. Measured output power at difference data rate for each mode and recorded worst case for each mode.
2. Test results including cable loss;
3. Worst case data at 1Mbps at IEEE 802.11 b; 6Mbps at IEEE 802.11 g; 6.5Mbps at IEEE 802.11 n HT20;
4. “---” means that the fundamental frequency not for 15.209 limits requirement.
5. please refer to following plots;



## **Spurious Emission Measurements for RF Conducted Emissions**

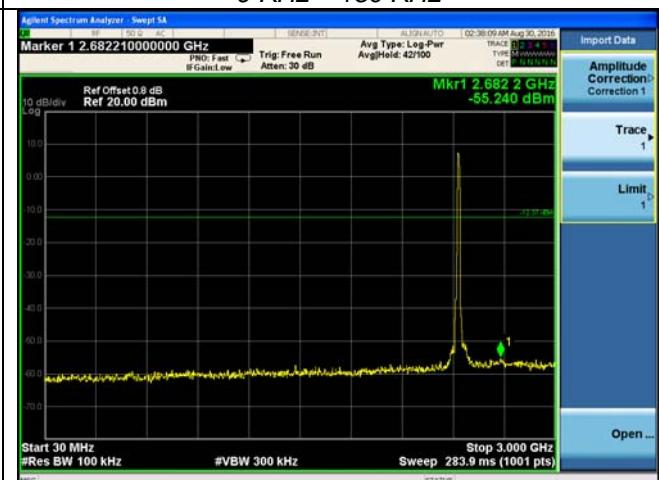
IEEE 802.11 b

2437 MHz



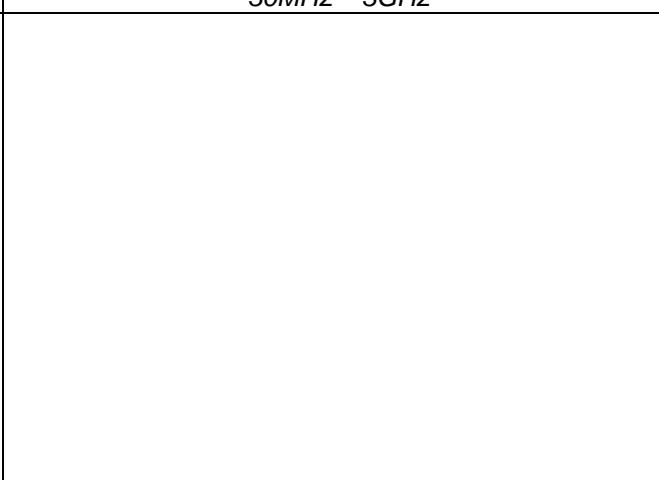
2437 MHz

9 KHz – 150 KHz

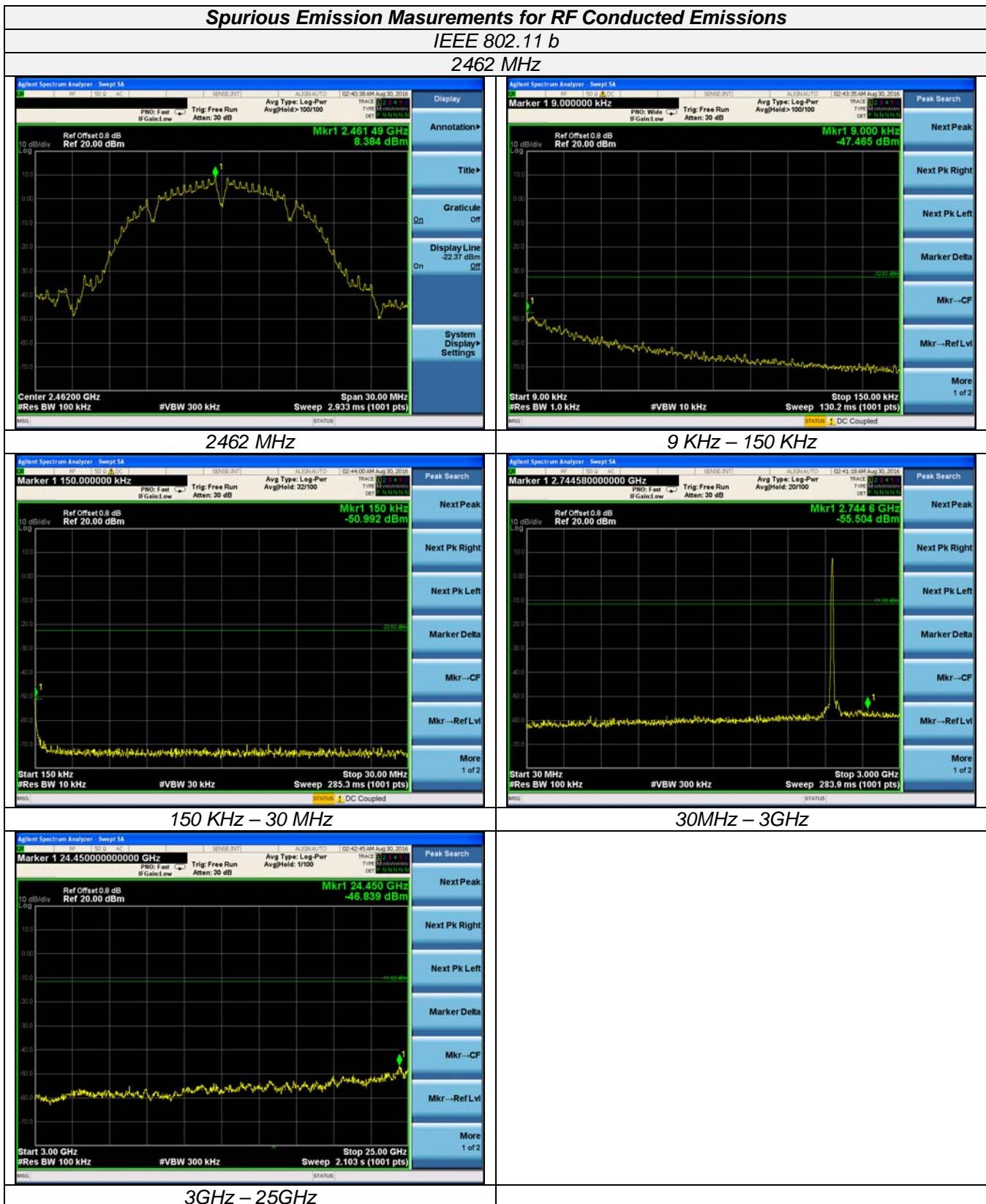


30.1.5.1.0.0

30MHz - 3GHz



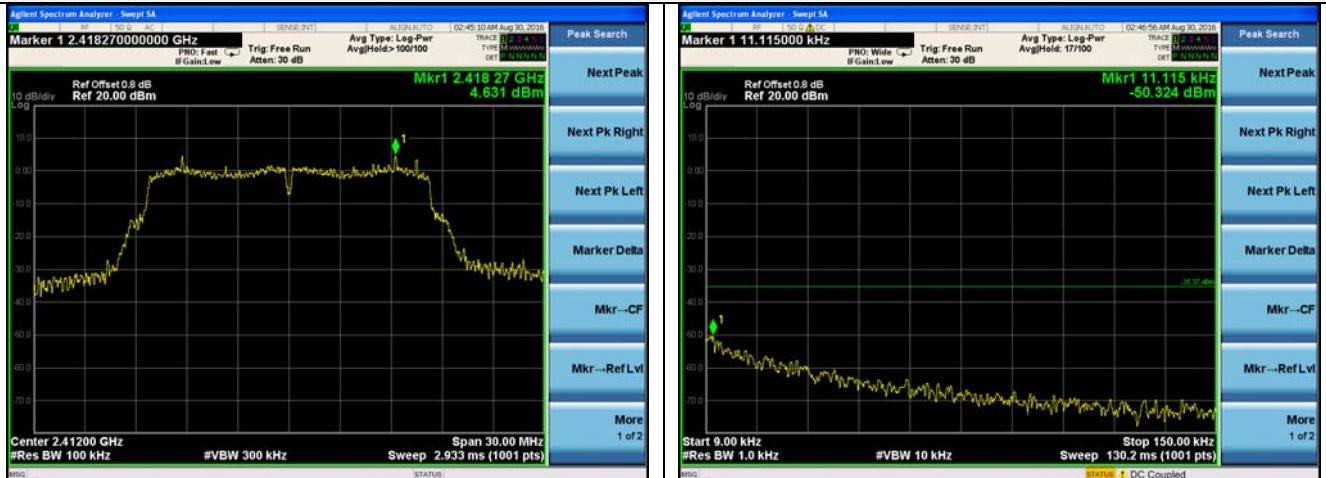
3GHz 35GHz



## **Spurious Emission Measurements for RF Conducted Emissions**

IEEE 802.11 g

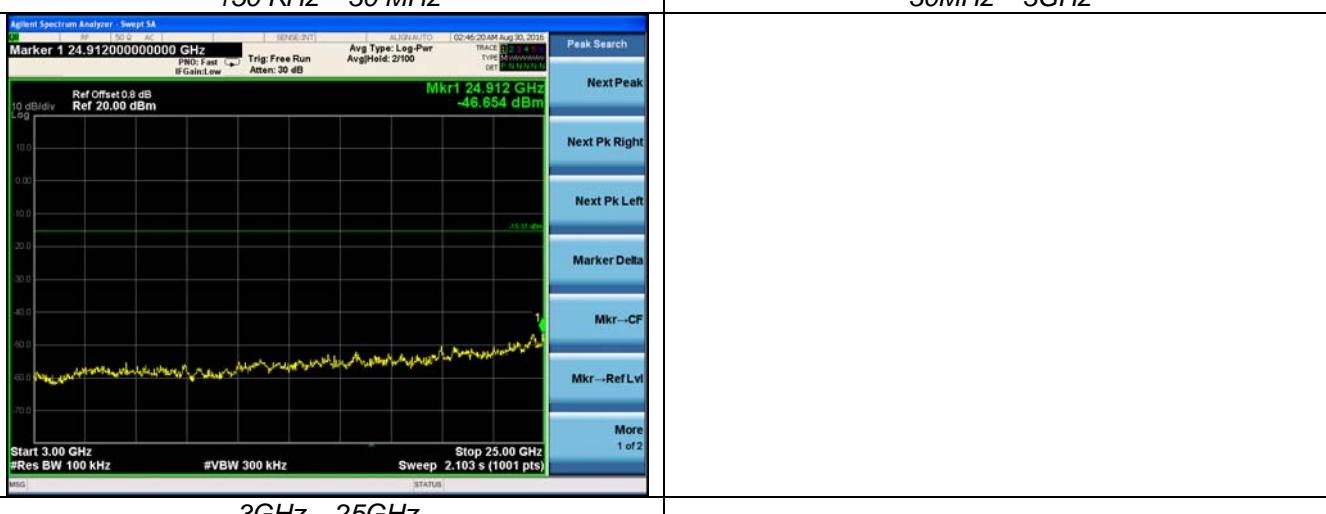
2412 MHz

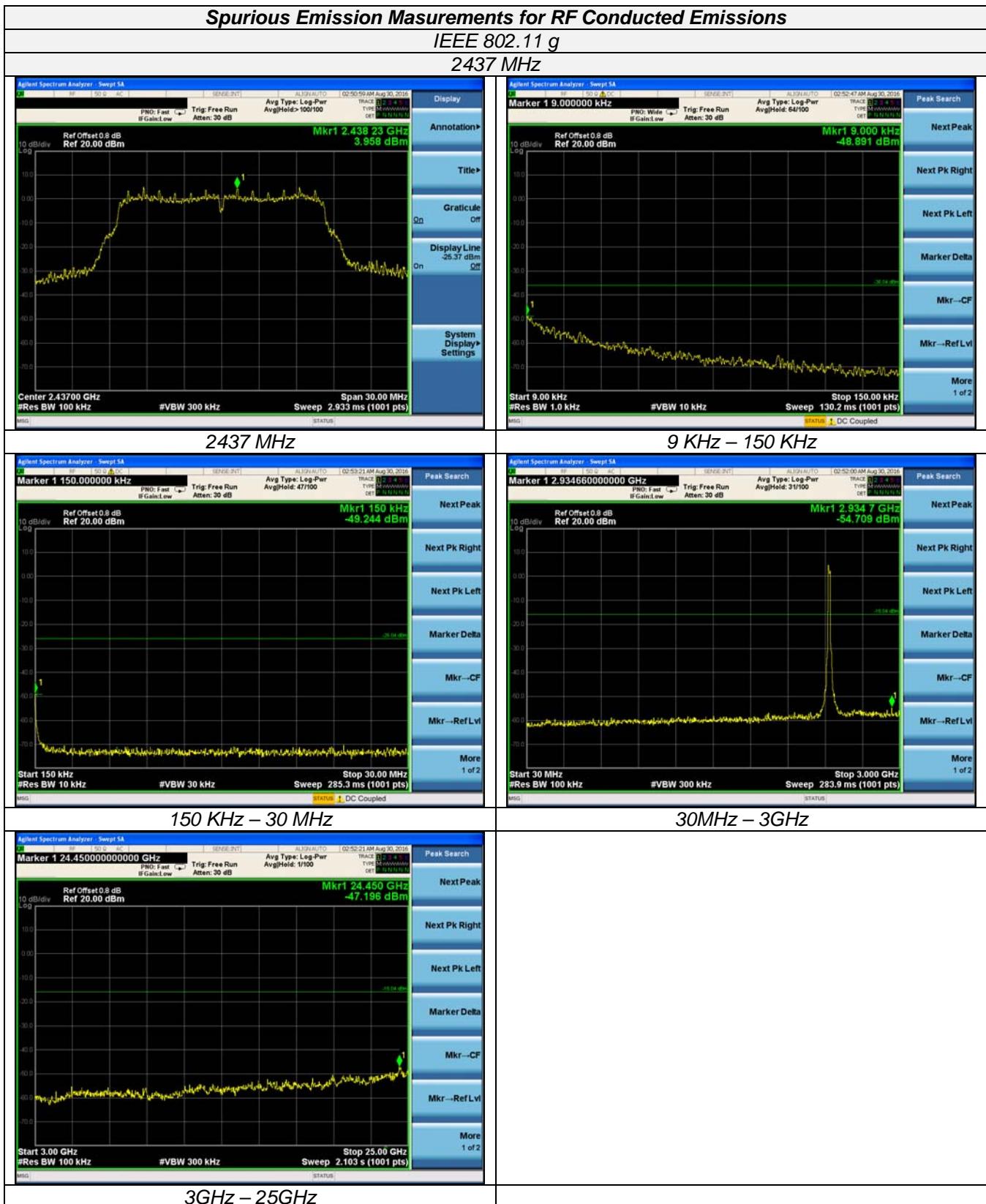


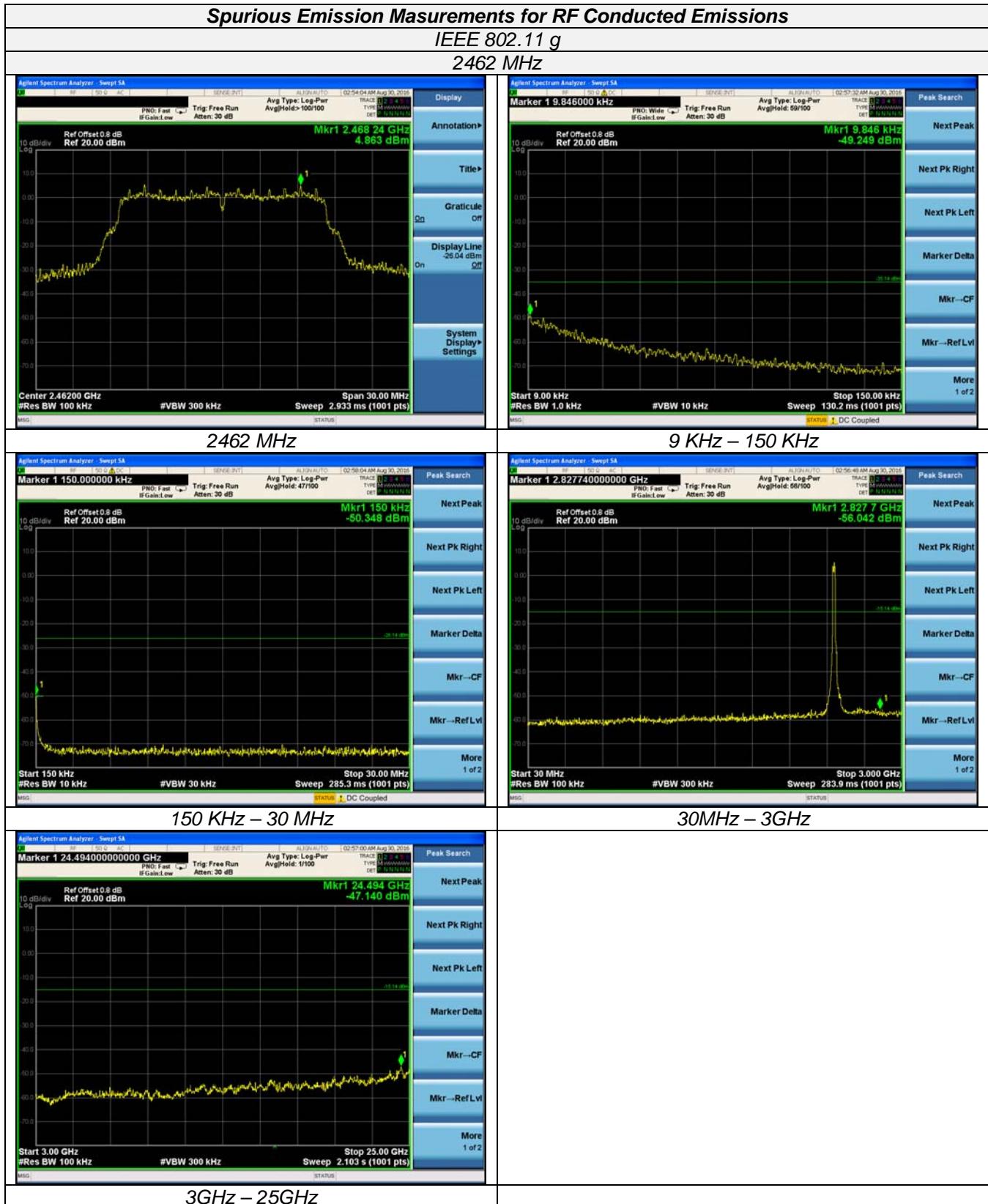
2412 MHz



30.1.5.1.0.0



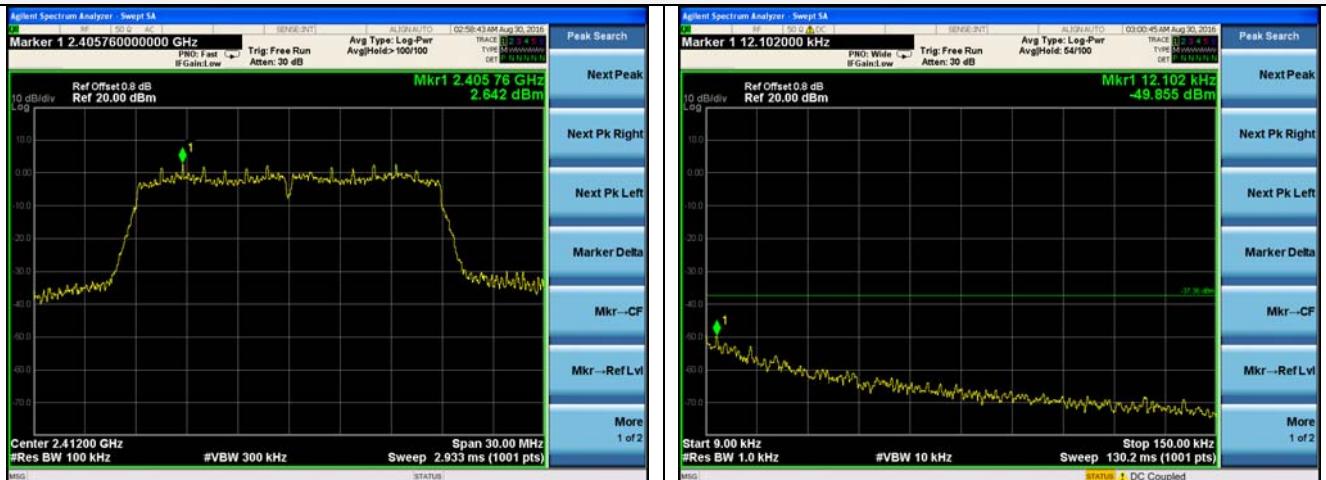




## **Spurious Emission Measurements for RF Conducted Emissions**

IEEE 802.11 n HT20

2412 MHz



2412 MHz



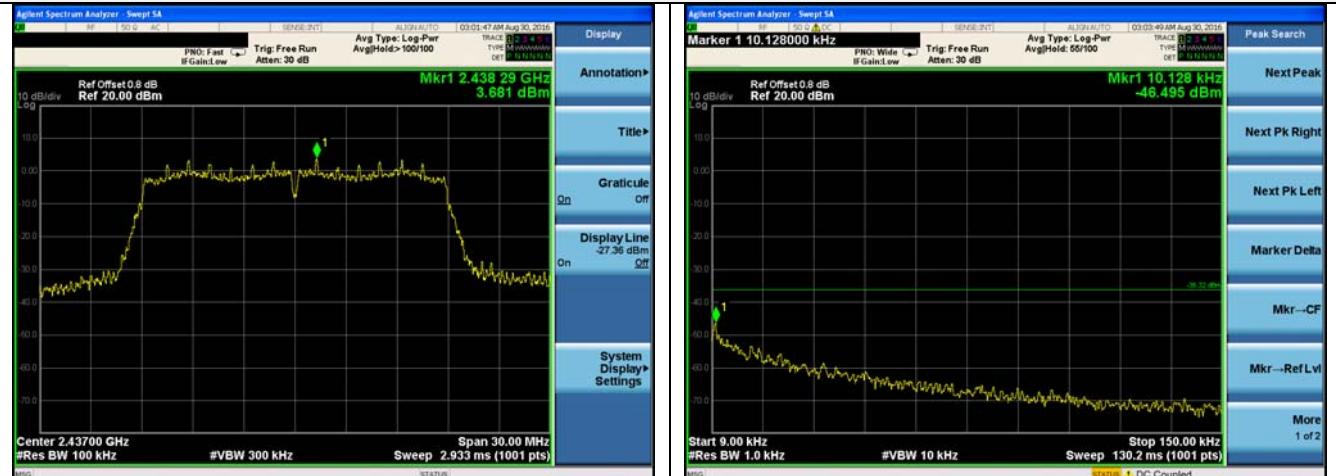
30MHz - 3GHz



## **Spurious Emission Measurements for RF Conducted Emissions**

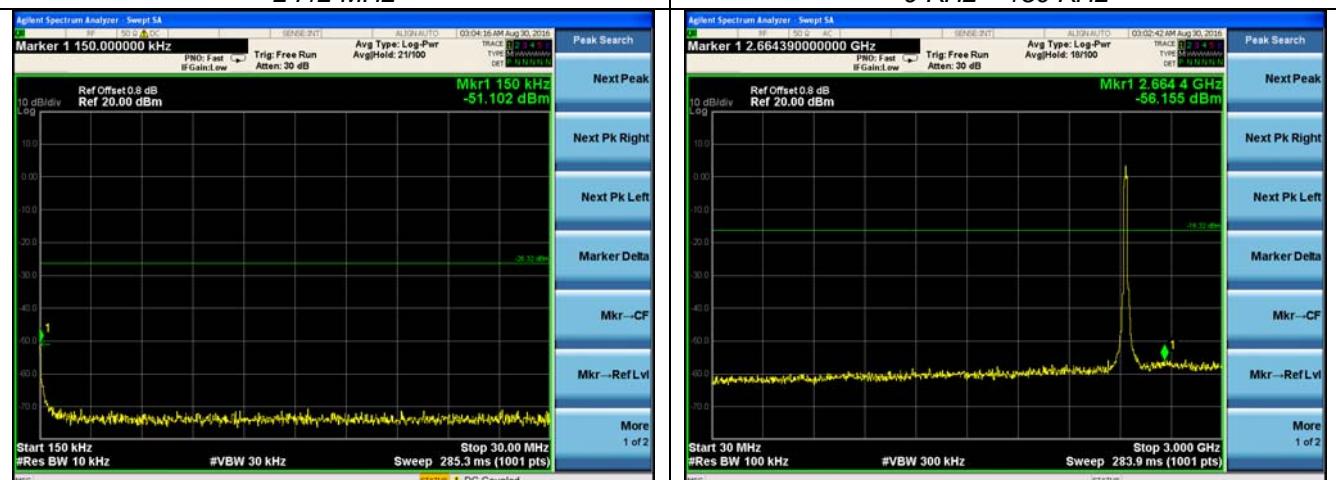
IEEE 802.11 n HT20

2437 MHz



2412 MHz

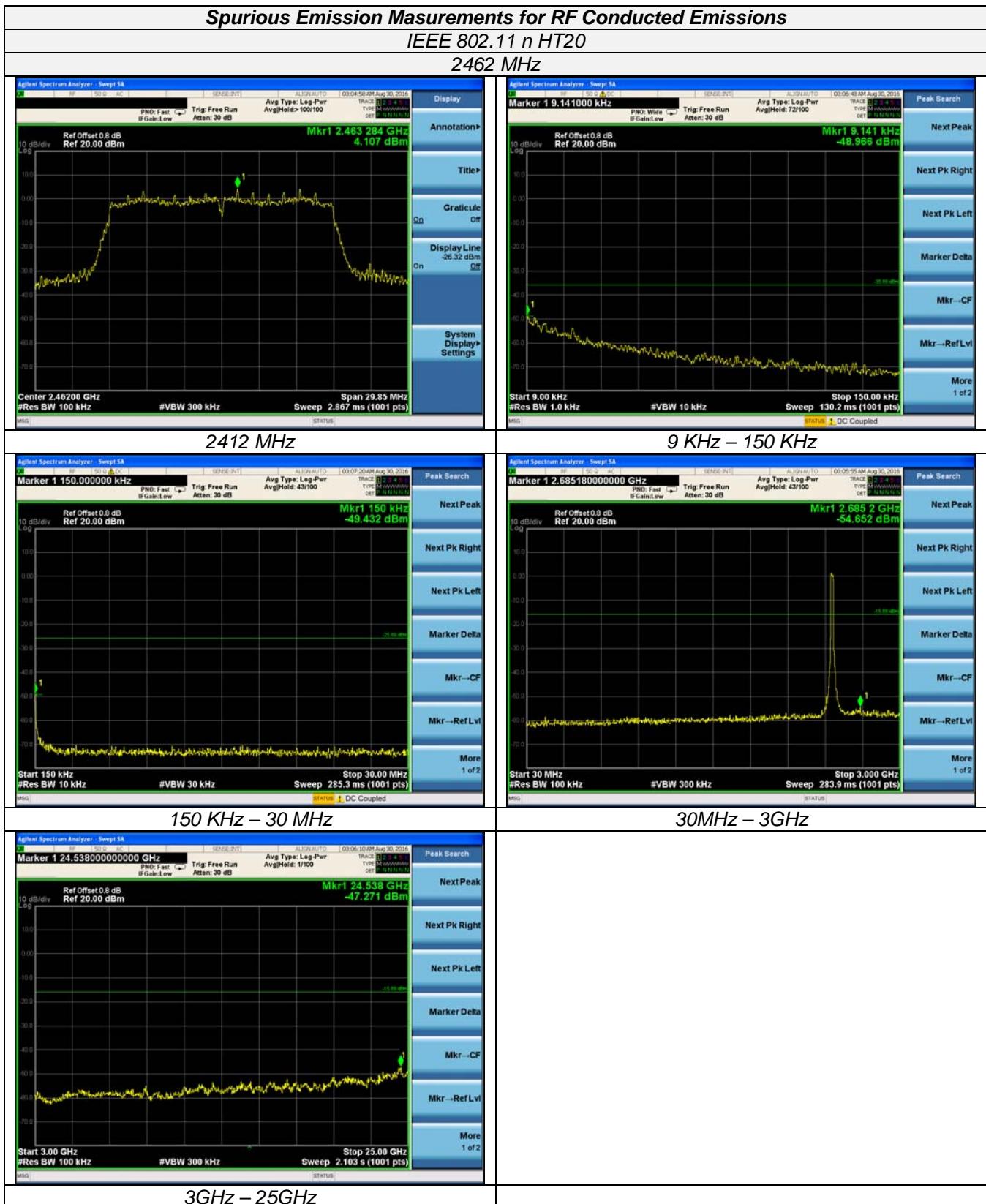
9 KHz – 150 KHz



30.1.5.1.0.0

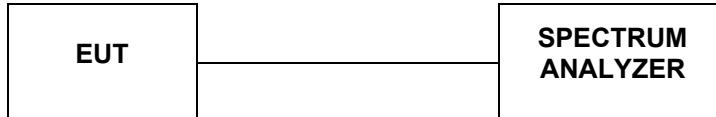
30MHz – 3GHz





## 4.7 6dB Bandwidth

### TEST CONFIGURATION



### TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=100 KHz and VBW=300KHz. The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB. According to KDB558074 D01 V03 for one of the following procedures may be used to determine the modulated DTS device signal bandwidth.

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW)  $\geq$  3 RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### LIMIT

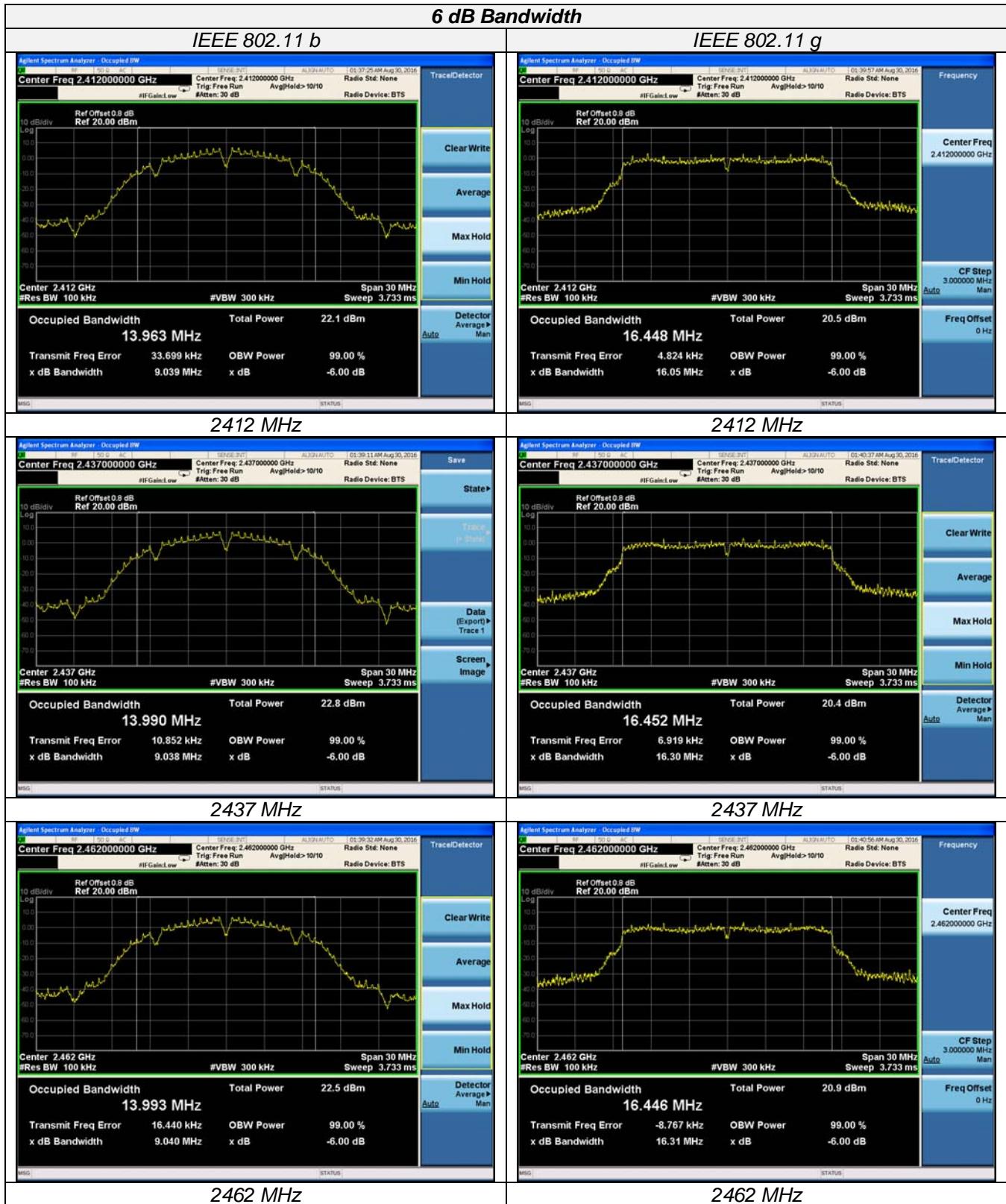
For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

### TEST RESULTS

| Test Mode          | Channel | Frequency (MHz) | Measured 6 dB Bandwidth (MHz) | Limits (MHz)  | Verdict |
|--------------------|---------|-----------------|-------------------------------|---------------|---------|
| IEEE 802.11 b      | 1       | 2412            | 9.039                         | $\geq 0.5000$ | PASS    |
|                    | 6       | 2437            | 9.038                         |               |         |
|                    | 11      | 2462            | 9.040                         |               |         |
| IEEE 802.11 g      | 1       | 2412            | 16.05                         | $\geq 0.5000$ | PASS    |
|                    | 6       | 2437            | 16.30                         |               |         |
|                    | 11      | 2462            | 16.31                         |               |         |
| IEEE 802.11 n HT20 | 1       | 2412            | 17.55                         | $\geq 0.5000$ | PASS    |
|                    | 6       | 2437            | 17.57                         |               |         |
|                    | 11      | 2462            | 17.54                         |               |         |

#### Remark:

1. Measured output power at difference data rate for each mode and recorded worst case for each mode.
2. Test results including cable loss;
3. Worst case data at 1Mbps at IEEE 802.11 b; 6Mbps at IEEE 802.11 g; 6.5Mbps at IEEE 802.11 n HT20;
4. please refer to following plots;



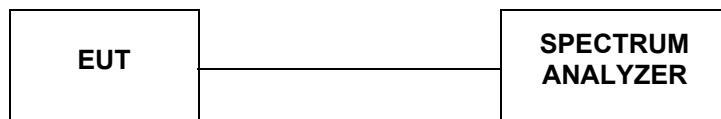


## 4.8 Band-edge Measurements for Radiated Emissions

### TEST REQUIREMENT

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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### TEST CONFIGURATION



### TEST PROCEDURE

According to KDB 558074 D01 V03 for Antenna-port conducted measurement. Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz for peak detector and RBW=1MHz, VBW=10Hz for Peak detector.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.
6. Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency (see 12.2.2, 12.2.3, and 12.2.4 for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).
7. Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)
8. Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies  $\leq$  30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies  $>$  1000 MHz).
9. For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).
10. Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:  

$$E = EIRP - 20\log D + 104.8$$

where:

$E$  = electric field strength in  $\text{dB}\mu\text{V/m}$ ,

$EIRP$  = equivalent isotropic radiated power in  $\text{dBm}$

$D$  = specified measurement distance in meters.

11. Since the out-of-band characteristics of the EUT transmit antenna will often be unknown, the use of a conservative antenna gain value is necessary. Thus, when determining the EIRP based on the measured conducted power, the upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater. However, for devices that operate in multiple frequency bands while using the same transmit antenna, the highest gain of the antenna within the operating band nearest in frequency to the restricted band emission being measured may be used in lieu of the overall highest gain when the emission is at a frequency that is within 20 percent of the nearest band edge frequency, but in no case shall a value less than 2 dBi be used.
12. Compare the resultant electric field strength level to the applicable regulatory limit.
13. Perform radiated spurious emission test dures until all measured frequencies were complete.

LIMIT

Below -20dB of the highest emission level in operating band.

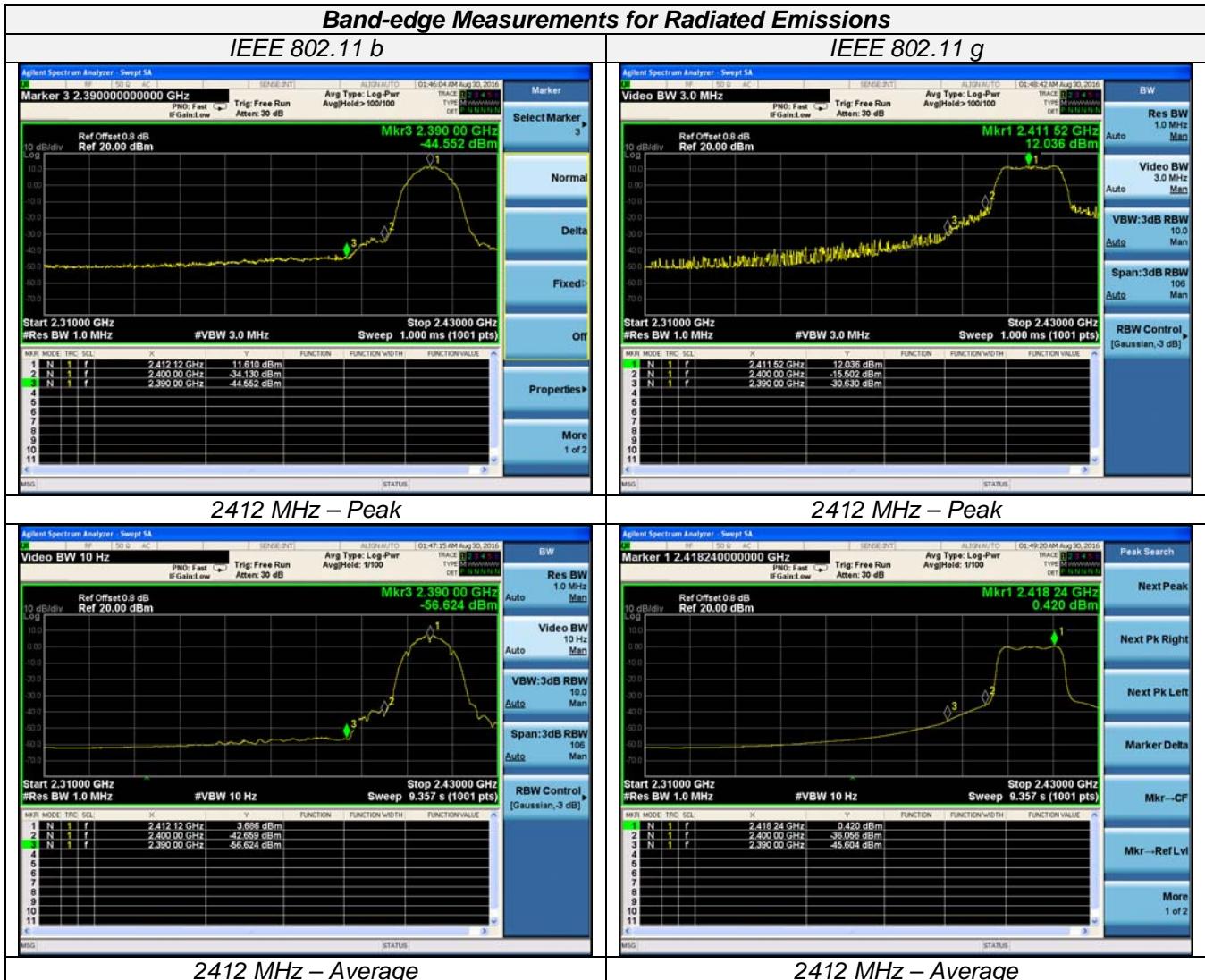
Radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)

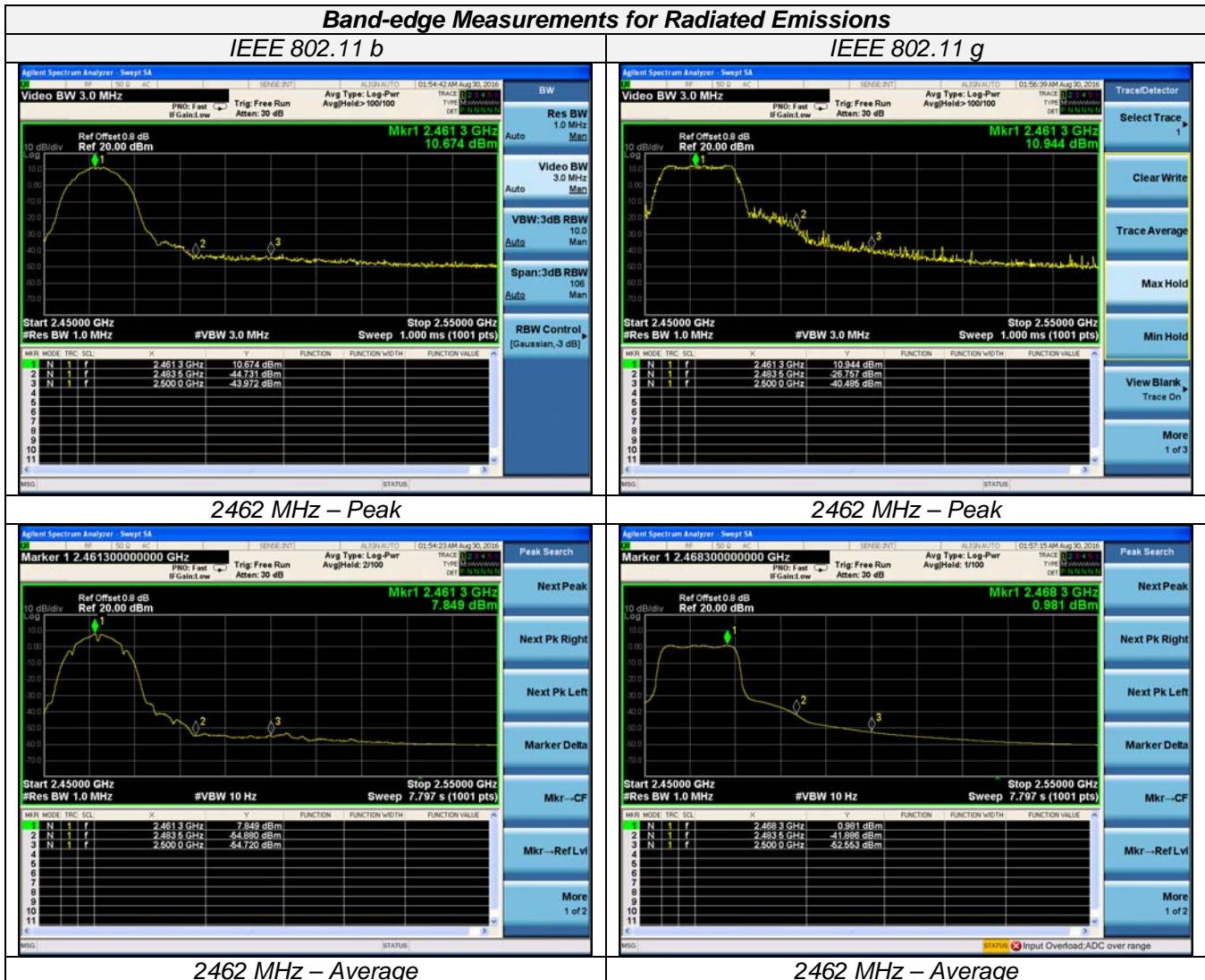
TEST RESULTS

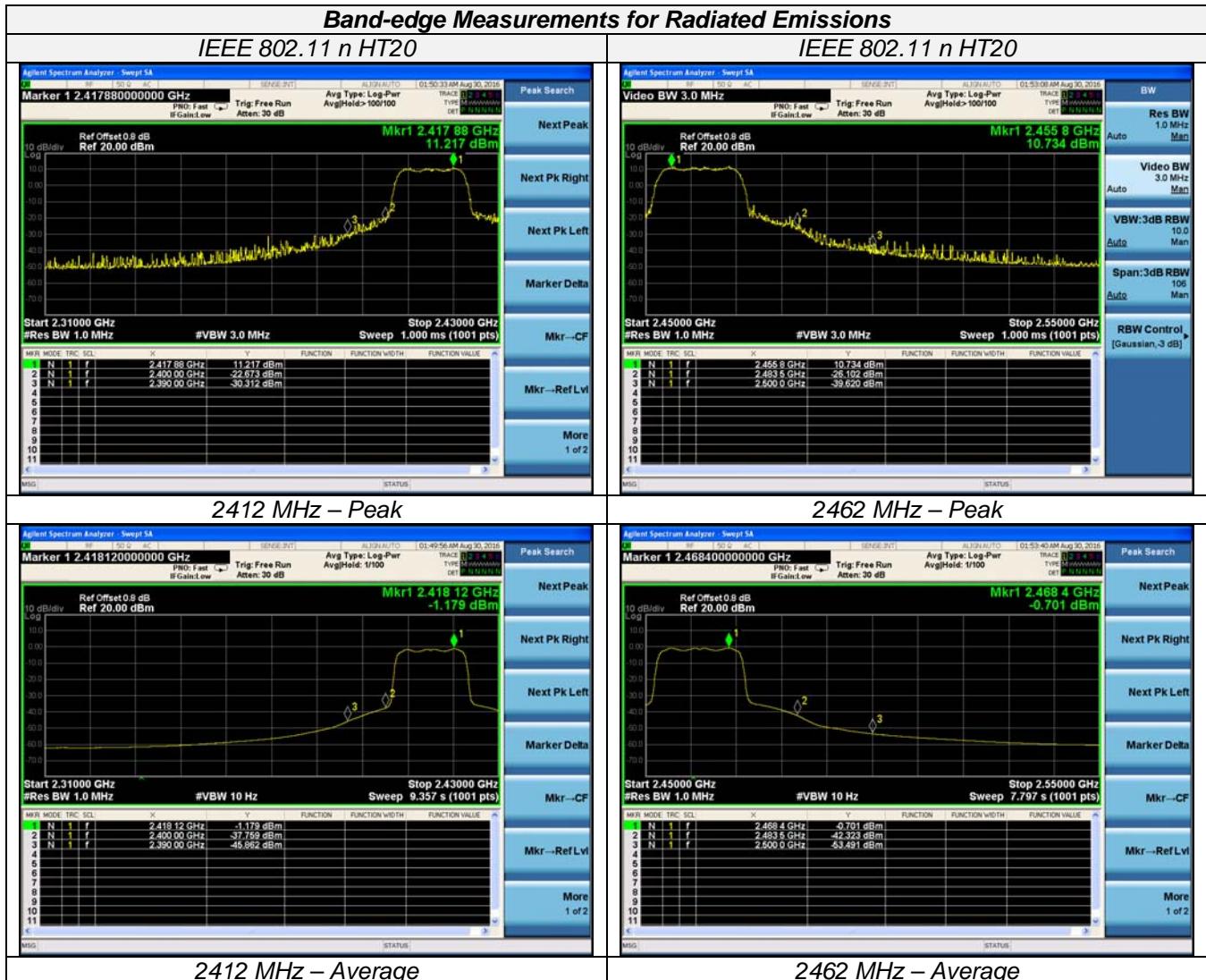
| <b>IEEE 802.11 b</b>      |                       |                    |                               |  |          |                |         |
|---------------------------|-----------------------|--------------------|-------------------------------|--|----------|----------------|---------|
| Frequency (MHz)           | Conducted Power (dBm) | Antenna Gain (dBi) | Ground Reflection Factor (dB) | Covert Radiated E Level At 3m (dBuV/m) | Detector | Limit (dBuV/m) | Verdict |
| 2390.000                  | -44.552               | 3.00               | 0.00                          | 53.708                                 | Peak     | 74.00          | PASS    |
| 2390.000                  | -56.624               | 3.00               | 0.00                          | 41.636                                 | AV       | 54.00          | PASS    |
| 2483.500                  | -44.731               | 3.00               | 0.00                          | 53.529                                 | Peak     | 74.00          | PASS    |
| 2483.500                  | -54.880               | 3.00               | 0.00                          | 43.380                                 | AV       | 54.00          | PASS    |
| <b>IEEE 802.11 g</b>      |                       |                    |                               |  |          |                |         |
| Frequency (MHz)           | Conducted Power (dBm) | Antenna Gain (dBi) | Ground Reflection Factor (dB) | Covert Radiated E Level At 3m (dBuV/m) | Detector | Limit (dBuV/m) | Verdict |
| 2390.000                  | -30.630               | 3.00               | 0.00                          | 67.630                                 | Peak     | 74.00          | PASS    |
| 2390.000                  | -45.604               | 3.00               | 0.00                          | 52.656                                 | AV       | 54.00          | PASS    |
| 2483.500                  | -26.757               | 3.00               | 0.00                          | 71.503                                 | Peak     | 74.00          | PASS    |
| 2483.500                  | -41.886               | 3.00               | 0.00                          | 56.374                                 | AV       | 54.00          | PASS    |
| <b>IEEE 802.11 n HT20</b> |                       |                    |                               |  |          |                |         |
| Frequency (MHz)           | Conducted Power (dBm) | Antenna Gain (dBi) | Ground Reflection Factor (dB) | Covert Radiated E Level At 3m (dBuV/m) | Detector | Limit (dBuV/m) | Verdict |
| 2390.000                  | -30.312               | 3.00               | 0.00                          | 67.948                                 | Peak     | 74.00          | PASS    |
| 2390.000                  | -45.862               | 3.00               | 0.00                          | 52.398                                 | AV       | 54.00          | PASS    |
| 2483.500                  | -26.102               | 3.00               | 0.00                          | 72.158                                 | Peak     | 74.00          | PASS    |
| 2483.500                  | -42.323               | 3.00               | 0.00                          | 55.937                                 | AV       | 54.00          | PASS    |

## Remark:

1. Measured output power at difference data rate for each mode and recorded worst case for each mode.
2. Test results including cable loss;
3. Worst case data at 1Mbps at IEEE 802.11 b; 6Mbps at IEEE 802.11 g; 6.5Mbps at IEEE 802.11 n HT20;
4. “---” means that the fundamental frequency not for 15.209 limits requirement.
5. please refer to following plots;





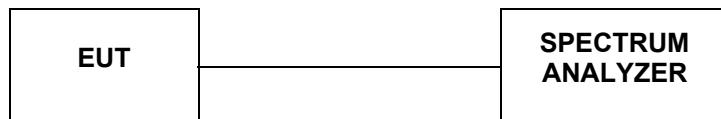


## 4.9 Band-edge Measurements for RF Conducted Emissions

### LIMIT

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

### TEST CONFIGURATION



### TEST PROCEDURE

According to KDB 558074 D01 V03 for Antenna-port conducted measurement.

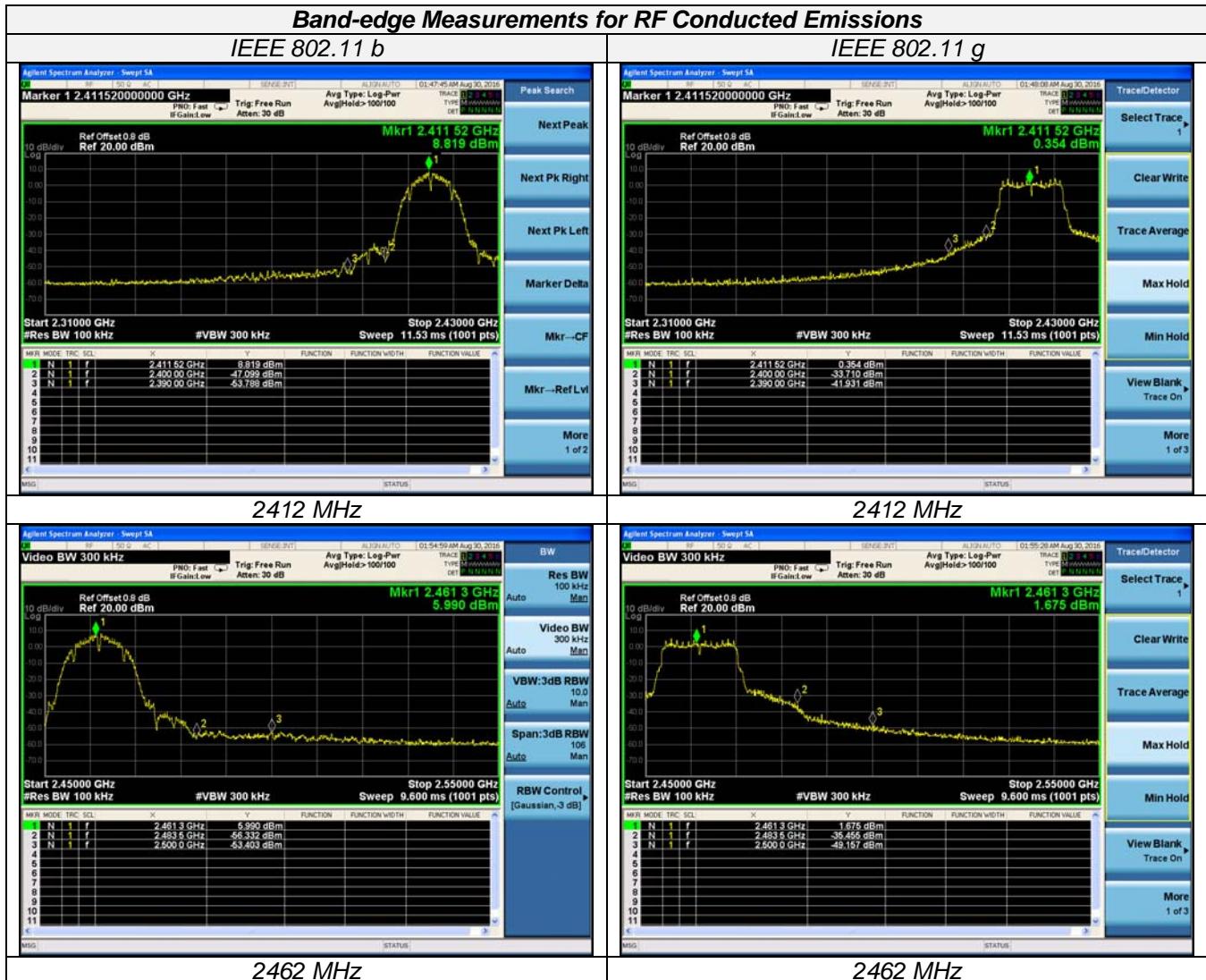
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge,
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.
6. Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency (see 12.2.2, 12.2.3, and 12.2.4 for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).

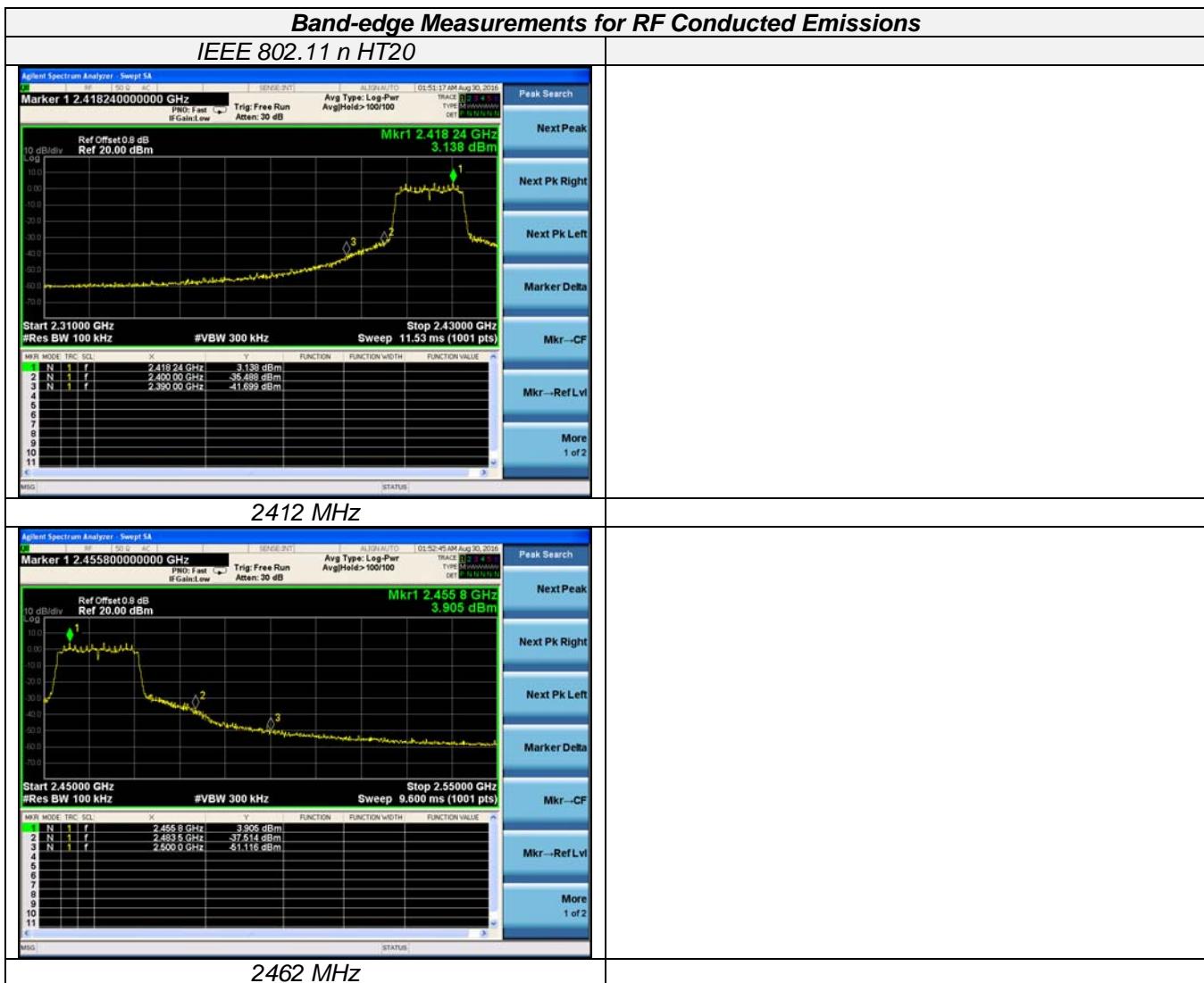
### TEST RESULTS

| Test Mode          | Channel | Frequency (MHz) | Conducted Band-edge Emission (dBc) | Limits (dBc) | Verdict |
|--------------------|---------|-----------------|------------------------------------|--------------|---------|
| IEEE 802.11 b      | 1       | 2412            | <-20dBc                            | -20          | PASS    |
|                    | 11      | 2462            | <-20dBc                            | -20          |         |
| IEEE 802.11 g      | 1       | 2412            | <-20dBc                            | -20          | PASS    |
|                    | 11      | 2462            | <-20dBc                            | -20          |         |
| IEEE 802.11 n HT20 | 1       | 2412            | <-20dBc                            | -20          | PASS    |
|                    | 11      | 2462            | <-20dBc                            | -20          |         |

Remark:

1. Measured output power at difference data rate for each mode and recorded worst case for each mode.
2. Test results including cable loss;
3. Worst case data at 1Mbps at IEEE 802.11 b; 6Mbps at IEEE 802.11 g; 6.5Mbps at IEEE 802.11 n HT20;
4. “---” means that the fundamental frequency not for 15.209 limits requirement.
5. please refer to following plots;





## 4.10 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.

### Measurement

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module. For normal WLAN devices, the DSSS mode is used.

Conducted power refer ANSI C63.10 :2009 Section 11.9 Output power test procedure for DTS devices  
Radiated power refer to ANSI C63.10 :2009 Section 6.6.4 Radiated emissions tests.

### Measurement parameters

| Measurement parameter |          |
|-----------------------|----------|
| Detector:             | Peak     |
| Sweep time:           | Auto     |
| Resolution bandwidth: | 1MHz     |
| Video bandwidth:      | 3MHz     |
| Trace-Mode:           | Max hold |

### Limits

| FCC          | IC |
|--------------|----|
| Antenna Gain |    |
| 6 dBi        |    |

### Results

| T <sub>nom</sub>                                       | V <sub>nom</sub>                    | Lowest Channel<br>2412 MHz | Middle Channel<br>2437 MHz | Highest Channel<br>2462 MHz |
|--|-------------------------------------|----------------------------|----------------------------|-----------------------------|
| Conducted power [dBm]<br>Measured with DSSS modulation |                                     | 10.129                     | 10.643                     | 10.691                      |
| Radiated power [dBm]<br>Measured with DSSS modulation  |                                     | 12.170                     | 13.238                     | 12.684                      |
| Gain [dBi]<br>Calculated                               |                                     | 2.041                      | 2.595                      | 1.993                       |
| Measurement uncertainty                                | ± 0.6 dB (cond.) / ± 2.56 dB (rad.) |                            |                            |                             |

## **5 Test Setup Photos of the EUT**

Please refer to separated files for Test Setup Photos of the EUT.

## **6 External Photos of the EUT**

Please refer to separated files for External Photos of the EUT.

## **7 Internal Photos of the EUT**

Please refer to separated files for Internal Photos of the EUT.

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