



# RADIO TEST REPORT

**Test Report No. : 33AE0098-HO-01-A**

**Applicant** : Panasonic Corporation of North America  
**Type of Equipment** : Wireless LAN Module  
**Model No.** : DWM-W092  
**FCC ID** : ACJ-HXWA30M  
**Test regulation** : FCC Part 15 Subpart C: 2012  
**Test Result** : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

**Date of test:** September 19 to 22, 2012

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NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.  
\*As for the range of Accreditation in NVLAP, you may refer to the WEB address,  
<http://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap>

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13-EM-F0429

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## **SECTION 1: Customer information**

Company Name : Panasonic Corporation of North America  
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Contact Person : Richard Mullen

## **SECTION 2: Equipment under test (E.U.T.)**

### **2.1 Identification of E.U.T.**

Type of Equipment : Wireless LAN Module  
Model No. : DWM-W092  
Serial No. : Refer to Section 4, Clause 4.2  
Rating : DC 3.3V  
Receipt Date of Sample : September 17, 2012  
Country of Mass-production : Philippines  
Condition of EUT : Production prototype  
(Not for Sale: This sample is equivalent to mass-produced items.)  
Modification of EUT : No Modification by the test lab

### **2.2 Product Description**

#### **General Specification**

Clock frequency(ies) in the system : 26MHz

#### **Radio Specification of WLAN (IEEE802.11b/g/n)**

Radio Type : Transceiver  
Frequency of Operation : 2412-2462MHz  
Modulation : DSSS and OFDM  
Power Supply (radio part input) : DC3.3V (Digital part), DC1.6V (RF Core), DC1.2V (Digital part)  
Antenna type : 2.4GHz Pattern Antenna  
Antenna Gain : 0.41dBi

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## SECTION 3: Test specification, procedures & results

### 3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2012, final revised on August 13, 2012 and effective September 12, 2012

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.207 Conducted limits  
Section 15.247 Operation within the bands 902-928MHz,  
2400-2483.5MHz, and 5725-5850MHz

### 3.2 Procedures and results

| Item                                    | Test Procedure                                                                                                             | Specification                                                       | Worst margin                                                             | Results  | Remarks                |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------------|----------|------------------------|
| Conducted Emission                      | FCC: ANSI C63.4:2003<br>7. AC powerline Conducted Emission measurements<br>-----<br>IC: RSS-Gen 7.2.4                      | FCC: Section 15.207<br>-----<br>IC: RSS-Gen 7.2.4                   | <b>QP</b><br>29.6dB, 0.15000MHz, L<br><b>AV</b><br>31.7dB, 0.15000MHz, N | Complied | -                      |
| 6dB Bandwidth                           | FCC: "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247"<br>-----<br>IC: RSS-Gen 4.6.2 | FCC: Section 15.247(a)(2)<br>-----<br>IC: RSS-210 A8.2(a)           | See data.                                                                | Complied | Conducted              |
| Maximum Peak Output Power               | FCC: "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247"<br>-----<br>IC: RSS-Gen 4.8   | FCC: Section 15.247(b)(3)<br>-----<br>IC: RSS-210 A8.4(4)           |                                                                          | Complied | Conducted              |
| Power Density                           | FCC: "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247"<br>-----<br>IC: -             | FCC: Section 15.247 (e)<br>-----<br>IC: RSS-210 A8.2(b)             |                                                                          | Complied | Conducted              |
| Spurious Emission Restricted Band Edges | FCC: "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247"<br>-----<br>IC: RSS-Gen 4.9   | FCC: Section15.247(d)<br>-----<br>IC: RSS-210 A8.5<br>RSS-Gen 7.2.3 | 0.5dB<br>2483.500MHz,<br>Horizontal, AV                                  | Complied | Conducted/<br>Radiated |

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.

\* In case any questions arise about test procedure, ANSI C63.4: 2003 is also referred.

#### FCC 15.31 (e)

This EUT provides stable voltage (DC3.3V, DC1.6V, DC1.2V) constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

#### FCC Part 15.203/212Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203/212.

### 3.3 Addition to standard

| Item                   | Test Procedure    | Specification     | Worst margin | Results | Remarks   |
|------------------------|-------------------|-------------------|--------------|---------|-----------|
| 99% Occupied Bandwidth | IC: RSS-Gen 4.6.1 | IC: RSS-Gen 4.6.1 | N/A          | -       | Conducted |

Other than above, no addition, exclusion nor deviation has been made from the standard.

### 3.4 Uncertainty

#### EMI

The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor k=2.

| Test room<br>(semi-anechoic chamber) | Conducted emission<br>(+dB) |
|--------------------------------------|-----------------------------|
|                                      | 150kHz-30MHz                |
| No.1                                 | 3.5dB                       |
| No.2                                 | 3.6dB                       |
| No.3                                 | 3.6dB                       |
| No.4                                 | 3.6dB                       |

| Test room<br>(semi-anechoic chamber) | Radiated emission |                  |                 |                |                 |                   |                   |
|--------------------------------------|-------------------|------------------|-----------------|----------------|-----------------|-------------------|-------------------|
|                                      | (3m*)(+dB)        |                  |                 |                | (1m*)(+dB)      |                   | (0.5m*)(+dB)      |
|                                      | 9kHz<br>-30MHz    | 30MHz<br>-300MHz | 300MHz<br>-1GHz | 1GHz<br>-10GHz | 10GHz<br>-18GHz | 18GHz<br>-26.5GHz | 26.5GHz<br>-40GHz |
| No.1                                 | 4.3dB             | 5.0dB            | 5.1dB           | 4.9dB          | 5.8dB           | 4.4dB             | 4.3dB             |
| No.2                                 | 4.3dB             | 5.2dB            | 5.1dB           | 5.0dB          | 5.7dB           | 4.3dB             | 4.2dB             |
| No.3                                 | 4.6dB             | 5.0dB            | 5.1dB           | 5.0dB          | 5.7dB           | 4.5dB             | 4.2dB             |
| No.4                                 | 4.8dB             | 5.2dB            | 5.0dB           | 5.0dB          | 5.7dB           | 5.2dB             | 4.2dB             |

\*3m/1m/0.5m = Measurement distance

| Power meter (+dB) |            |
|-------------------|------------|
| Below 1GHz        | Above 1GHz |
| 1.0dB             | 1.0dB      |

| Antenna terminal conducted emission<br>and Power density (+dB) |           |            | Antenna terminal conducted emission<br>(+dB) |               | Channel power<br>(±dB) |
|----------------------------------------------------------------|-----------|------------|----------------------------------------------|---------------|------------------------|
| Below 1GHz                                                     | 1GHz-3GHz | 3GHz-18GHz | 18GHz-26.5GHz                                | 26.5GHz-40GHz |                        |
| 1.0dB                                                          | 1.1dB     | 2.7dB      | 3.2dB                                        | 3.3dB         | 1.5dB                  |

#### Conducted Emission test

The data listed in this test report has enough margin, more than the site margin.

#### Radiated emission test (3m)

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

### 3.5 Test Location

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|                               | FCC<br>Registration<br>Number | IC Registration<br>Number | Width x Depth x<br>Height (m) | Size of<br>reference ground plane (m) /<br>horizontal conducting plane | Other<br>rooms              |
|-------------------------------|-------------------------------|---------------------------|-------------------------------|------------------------------------------------------------------------|-----------------------------|
| No.1 semi-anechoic<br>chamber | 313583                        | 2973C-1                   | 19.2 x 11.2 x 7.7m            | 7.0 x 6.0m                                                             | No.1 Power<br>source room   |
| No.2 semi-anechoic<br>chamber | 655103                        | 2973C-2                   | 7.5 x 5.8 x 5.2m              | 4.0 x 4.0m                                                             | -                           |
| No.3 semi-anechoic<br>chamber | 148738                        | 2973C-3                   | 12.0 x 8.5 x 5.9m             | 6.8 x 5.75m                                                            | No.3<br>Preparation<br>room |
| No.3 shielded room            | -                             | -                         | 4.0 x 6.0 x 2.7m              | N/A                                                                    | -                           |
| No.4 semi-anechoic<br>chamber | 134570                        | 2973C-4                   | 12.0 x 8.5 x 5.9m             | 6.8 x 5.75m                                                            | No.4<br>Preparation<br>room |
| No.4 shielded room            | -                             | -                         | 4.0 x 6.0 x 2.7m              | N/A                                                                    | -                           |
| No.5 semi-anechoic<br>chamber | -                             | -                         | 6.0 x 6.0 x 3.9m              | 6.0 x 6.0m                                                             | -                           |
| No.6 shielded<br>room         | -                             | -                         | 4.0 x 4.5 x 2.7m              | 4.75 x 5.4 m                                                           | -                           |
| No.6 measurement<br>room      | -                             | -                         | 4.75 x 5.4 x 3.0m             | 4.75 x 4.15 m                                                          | -                           |
| No.7 shielded room            | -                             | -                         | 4.7 x 7.5 x 2.7m              | 4.7 x 7.5m                                                             | -                           |
| No.8 measurement<br>room      | -                             | -                         | 3.1 x 5.0 x 2.7m              | N/A                                                                    | -                           |
| No.9 measurement<br>room      | -                             | -                         | 8.0 x 4.5 x 2.8m              | 2.0 x 2.0m                                                             | -                           |
| No.10 measurement<br>room     | -                             | -                         | 2.6 x 2.8 x 2.5m              | 2.4 x 2.4m                                                             | -                           |
| No.11 measurement<br>room     | -                             | -                         | 3.1 x 3.4 x 3.0m              | 2.4 x 3.4m                                                             | -                           |

\* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

### 3.6 Data of EMI, Test instruments, and Test set up

Refer to APPENDIX.

## **SECTION 4: Operation of E.U.T. during testing**

### **4.1 Operating Mode(s)**

Test operating mode was determined as follows according to “Section 1 of 6 802.11 a/b/g/n testing- Managing Complex Regulatory Approvals - ” of TCB Council Workshop October 2009.

| <b>Mode</b>                                                                                                                                                                                                                                                                                                                                                                        | <b>Remarks*</b>       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| IEEE 802.11b (11b)                                                                                                                                                                                                                                                                                                                                                                 | 2Mbps, PN9            |
| IEEE 802.11g (11g)                                                                                                                                                                                                                                                                                                                                                                 | 36Mbps, PN9           |
| IEEE 802.11n MIMO 20MHz BW (11n-20)                                                                                                                                                                                                                                                                                                                                                | MCS 6 (Short GI), PN9 |
| *The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)                                                                                                                                                                                                                                                                            |                       |
| *Power of the EUT was set by the software as follows;<br>Power settings: 11b/g: 14.5, 11n: 12.5<br>Software: Wi-Fi_GUI_TOOL (Release X86) Version: 1.0.0.0<br>*This setting of software is the worst case.<br>Any conditions under the normal use do not exceed the condition of setting.<br>In addition, end users cannot change the settings of the output power of the product. |                       |

\*The details of Operating mode(s)

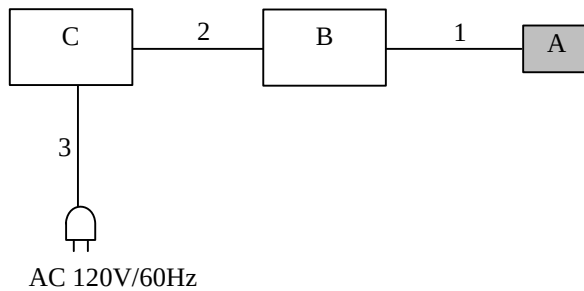
| <b>Test Item</b>                                                                                                         | <b>Operating Mode</b>         | <b>Tested frequency</b>       |
|--------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------|
| Conducted Emission                                                                                                       | 11n Tx                        | 2412MHz *1)                   |
| 6dB Bandwidth,<br>Maximum Peak Output Power,<br>Conducted Spurious Emission,<br>Power Density,<br>99% Occupied Bandwidth | 11b Tx<br>11g Tx<br>11n-20 Tx | 2412MHz<br>2437MHz<br>2462MHz |
| Radiated Spurious Emission (Below 1GHz)                                                                                  | 11n-20 Tx                     | 2412MHz *1)                   |
| Radiated Spurious Emission (Above 1GHz)                                                                                  | 11b Tx<br>11n-20 Tx<br>*2)    | 2412MHz<br>2437MHz<br>2462MHz |

\*1) The mode was tested as a representative, because it had the highest power at antenna terminal test.

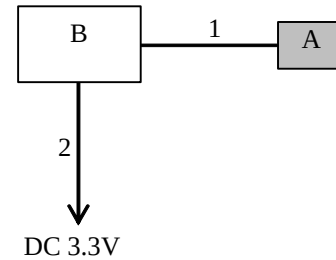
\*2) Since 11g and 11n-20 have the same modulation method and no differences in transmitting specification, test was performed on the representative mode that had the highest peak output power.

## 4.2 Configuration and peripherals

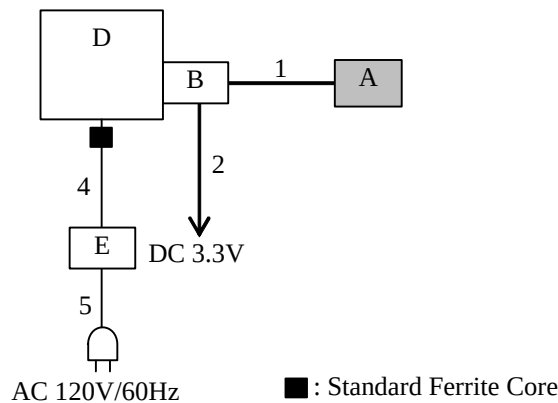
<Conducted emission test>



<Radiated emission test>



<Antenna conducted terminal test>



\* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.

### Description of EUT and Support equipment

| No. | Item                | Model number   | Serial number                | Manufacturer | Remarks |
|-----|---------------------|----------------|------------------------------|--------------|---------|
| A   | Wireless LAN Module | DWM-W092       | 66                           | Panasonic    | EUT     |
| B   | Jig                 | -              | -                            | -            | -       |
| C   | DC Power Supply     | PW8-3ATP       | 09067054                     | KENWOOD TMI  | -       |
| D   | Laptop PC           | LATITUDEEE6510 | CFGYZ A00                    | DELL         | -       |
| E   | AC Adapter          | LA90PE0-01     | CN-03T6XF-71615-07J-0DEB-A01 | DELL         | -       |

### List of cables used

| No. | Name         | Length (m)                                               | Shield     |            | Remarks |
|-----|--------------|----------------------------------------------------------|------------|------------|---------|
|     |              |                                                          | Cable      | Connector  |         |
| 1   | Signal Cable | 0.07 <sup>*1)</sup> for RE* only<br>0.04 for other tests | Unshielded | Unshielded | -       |
| 2   | DC Cable     | 2.6                                                      | Unshielded | Unshielded | -       |
| 3   | AC Cable     | 2.2                                                      | Unshielded | Unshielded | -       |
| 4   | DC Cable     | 1.8                                                      | Unshielded | Unshielded | -       |
| 5   | AC Cable     | 1.0                                                      | Unshielded | Unshielded | -       |

\*1) For practical use, the test was performed with conceivable maximum cable length.

\*RE: Radiated Spurious Emission test

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## **SECTION 5: Conducted Emission**

### **Test Procedure and conditions**

EUT was placed on a urethane platform of nominal size, 1.0m by 1.5m, raised 0.8m above the conducting ground plane. The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

#### For the tests on EUT with other peripherals (as a whole system)

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane. All unused 50ohm connectors of the LISN(AMN) were resistivity terminated in 50ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber.

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

|                          |                     |
|--------------------------|---------------------|
| <b>Detector</b>          | <b>: QP and AV</b>  |
| <b>Measurement range</b> | <b>: 0.15-30MHz</b> |
| <b>Test data</b>         | <b>: APPENDIX</b>   |
| <b>Test result</b>       | <b>: Pass</b>       |

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## **SECTION 6: Radiated Spurious Emission**

### **Test Procedure**

It was measured based on "2. Radiated emission test" of "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247 (issued on March 23, 2005)".

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 0.8m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

The height of the measuring antenna varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.

The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

### **Test Antennas are used as below;**

|              |             |                 |                |            |
|--------------|-------------|-----------------|----------------|------------|
| Frequency    | Below 30MHz | 30MHz to 300MHz | 300MHz to 1GHz | Above 1GHz |
| Antenna Type | Loop        | Biconical       | Logperiodic    | Horn       |

In any 100kHz bandwidth outside the restricted band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

**20dBc was applied to the frequency over the limit of FCC 15.209 / Table 5 of RSS-Gen 7.2.5(IC) and outside the restricted band of FCC15.205 / Table 3 of RSS-Gen 7.2.2 (IC).**

|                 |                |                                          |                                                  |                                  |
|-----------------|----------------|------------------------------------------|--------------------------------------------------|----------------------------------|
| Frequency       | Below 1GHz     | Above 1GHz                               |                                                  | 20dBc                            |
| Instrument used | Test Receiver  | Spectrum Analyzer                        |                                                  | Spectrum Analyzer                |
| Detector        | QP             | PK                                       | AV                                               | PK                               |
| IF Bandwidth    | BW 120kHz(T/R) | RBW: 1MHz<br>VBW: 3MHz                   | RBW: 1MHz<br>VBW: 240Hz(11b)/<br>6.2kHz(11n) *1) | RBW: 100kHz<br>VBW: 300kHz (S/A) |
| Test Distance   | 3m             | 3m (below 10GHz),<br>1m*2) (above 10GHz) |                                                  | 3m                               |

\*1) Used for the band edge of the carrier and the harmonics that can be measured. The VBW is based on the inverse of the duty cycle (see Appendix).

\*2) Distance Factor:  $20 \times \log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

|                   |               |
|-------------------|---------------|
| Measurement range | : 30M-26.5GHz |
| Test data         | : APPENDIX    |
| Test result       | : Pass        |

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## **SECTION 7: Antenna Terminal Conducted Tests**

### **Test Procedure**

The tests were made with below setting connected to the antenna port.

| Test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Span                                      | RBW             | VBW                | Sweep time     | Detector             | Trace    | Instrument used                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-----------------|--------------------|----------------|----------------------|----------|-----------------------------------|
| 6dB Bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 18MHz, 20MHz                              | 100kHz          | 300kHz             | Auto           | Peak                 | Max Hold | Spectrum Analyzer                 |
| 99% Occupied Bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Enough width to display 20dB Bandwidth    | 1 to 3% of Span | Three times of RBW | Auto           | Peak                 | Max Hold | Spectrum Analyzer                 |
| Maximum Peak Output Power                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | -                                         | -               | -                  | Auto           | Peak/<br>Average *4) | -        | Power Meter<br>(Sensor: 50MHz BW) |
| Peak Power Density                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 18MHz, 20MHz                              | 30kHz           | 100kHz             | 600sec, 667sec | Peak                 | Max Hold | Spectrum Analyzer<br>*1) *2)      |
| Conducted Spurious Emission *3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 9kHz to 150kHz                            | 200Hz           | 620Hz              | Auto           | Peak                 | Max Hold | Spectrum Analyzer                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 150kHz to 30MHz                           | 9.1kHz          | 27kHz              |                |                      |          |                                   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 30MHz to 25GHz<br>(Less or equal to 5GHz) | 100kHz          | 300kHz             |                |                      |          |                                   |
| <p>*1) PSD Option 1 of "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247 (issued on March 23, 2005)".</p> <p>*2) The test was not performed at RBW:3kHz however the measurement is to be performed with RBW:3kHz in the regulation, because, the measurement value with RBW:3kHz is less than the value of RBW:30kHz and the test data met the limit with RBW:30kHz.</p> <p>*3) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.<br/>Then, wide-band noise near the limit was checked separately, however the noise was low enough as shown in the chart.(9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=9.1kHz). Since the margin is more than about 50dB, the EUT complies with the limit of FCC15.209 if the measurement is performed with RBW=100kHz.</p> <p>*4) Testing using an average detector was performed in order to confirm that the output power of the EUT met the exclusion limits stated in FCC Part 2 Section 2.1093 and FCC radio frequency (RF) Exposure Guidelines in Supplement C to OET 65 and the EUT was exempt from RF exposure SAR evaluation.</p> |                                           |                 |                    |                |                      |          |                                   |

The test results and limit are rounded off to two decimals place, so some differences might be observed.

**Test data** : APPENDIX  
**Test result** : Pass

APPENDIX 1: Data of EMI test

Conducted Emission

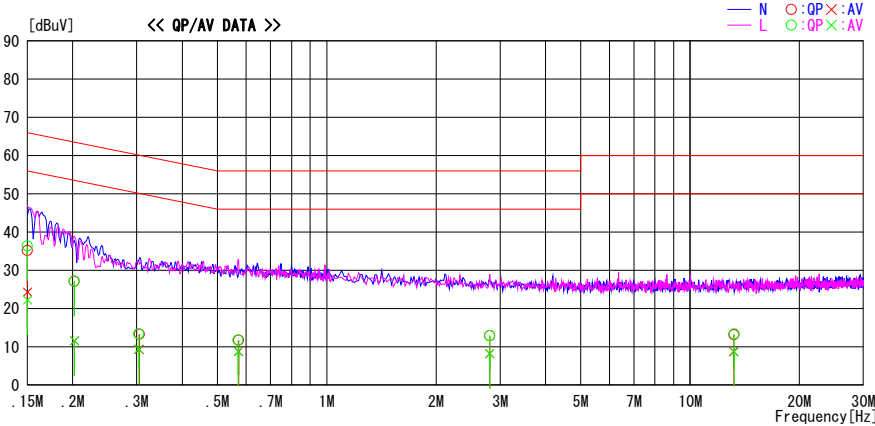
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic Chamber  
Date : 2012/09/22

Report No. : 33AE0098-HO-01  
Power : AC 120V / 60Hz  
Temp./Humi. : 23deg. C / 52% RH  
Engineer : Kazuya Yoshioka

Mode / Remarks : Tx 11n 2412MHz MCS6

LIMIT : FCC15.207 QP  
FCC15.207 AV



| Frequency | Reading Level |        | Corr. Factor | Results |        | Limit  |        | Margin |      | Phase | Comment |
|-----------|---------------|--------|--------------|---------|--------|--------|--------|--------|------|-------|---------|
|           | QP            | AV     |              | QP      | AV     | QP     | AV     | QP     | AV   |       |         |
| [MHz]     | [dBuV]        | [dBuV] | [dB]         | [dBuV]  | [dBuV] | [dBuV] | [dBuV] | [dB]   | [dB] |       |         |
| 0.15000   | 21.9          | 11.0   | 13.3         | 35.2    | 24.3   | 66.0   | 56.0   | 30.8   | 31.7 | N     |         |
| 0.20220   | 13.8          | -1.7   | 13.3         | 27.1    | 11.6   | 63.5   | 53.5   | 36.4   | 41.9 | N     |         |
| 0.30515   | -0.1          | -4.1   | 13.4         | 13.3    | 9.3    | 60.1   | 50.1   | 46.8   | 40.8 | N     |         |
| 0.57195   | -1.7          | -4.6   | 13.4         | 11.7    | 8.8    | 56.0   | 46.0   | 44.3   | 37.2 | N     |         |
| 2.80912   | -0.7          | -5.4   | 13.6         | 12.9    | 8.2    | 56.0   | 46.0   | 43.1   | 37.8 | N     |         |
| 13.19142  | -1.2          | -5.6   | 14.4         | 13.2    | 8.8    | 60.0   | 50.0   | 46.8   | 41.2 | N     |         |
| 0.15000   | 23.1          | 8.9    | 13.3         | 36.4    | 22.2   | 66.0   | 56.0   | 29.6   | 33.8 | L     |         |
| 0.20220   | 13.9          | -1.7   | 13.3         | 27.2    | 11.6   | 63.5   | 53.5   | 36.3   | 41.9 | L     |         |
| 0.30370   | 0.0           | -4.0   | 13.4         | 13.4    | 9.4    | 60.1   | 50.1   | 46.7   | 40.7 | L     |         |
| 0.57050   | -1.7          | -4.6   | 13.4         | 11.7    | 8.8    | 56.0   | 46.0   | 44.3   | 37.2 | L     |         |
| 2.80912   | -0.7          | -5.4   | 13.6         | 12.9    | 8.2    | 56.0   | 46.0   | 43.1   | 37.8 | L     |         |
| 13.22484  | -1.0          | -5.7   | 14.4         | 13.4    | 8.7    | 60.0   | 50.0   | 46.6   | 41.3 | L     |         |

CHART: WITH FACTOR, Peak hold data. CALCULATION: RESULT=READING+C.F (LISN LOSS+ATT LOSS +CABLE LOSS)  
Except for the above table : adequate margin data below the limits.

### **6dB Bandwidth**

|                       |                                         |                   |
|-----------------------|-----------------------------------------|-------------------|
| Test place            | Head Office EMC Lab. No.7 Shielded Room |                   |
| Report No.            | 33AE0098-HO-01                          |                   |
| Date                  | 09/19/2012                              | 09/20/2012        |
| Temperature/ Humidity | 20 deg.C / 48% RH                       | 21 deg.C / 46% RH |
| Engineer              | Tomohisa Nakagawa                       | Tomohisa Nakagawa |
| Mode                  | Tx                                      |                   |

11b

| Frequency<br>[MHz] | 6dB Bandwidth<br>[MHz] | Limit<br>[kHz] |
|--------------------|------------------------|----------------|
| 2412               | 8.250                  | >500           |
| 2437               | 9.590                  | >500           |
| 2462               | 9.387                  | >500           |

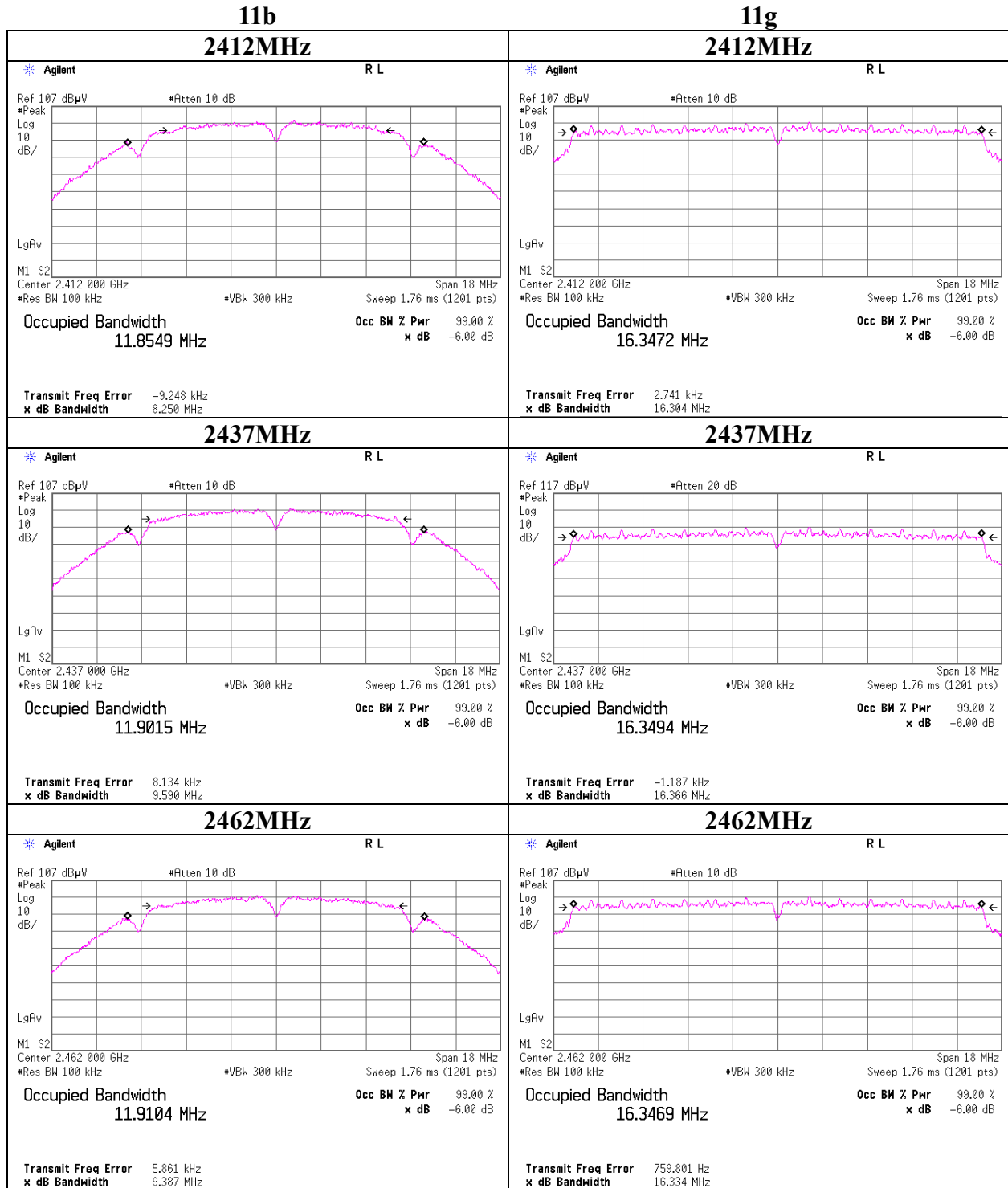
11g

| Frequency<br>[MHz] | 6dB Bandwidth<br>[MHz] | Limit<br>[kHz] |
|--------------------|------------------------|----------------|
| 2412               | 16.304                 | >500           |
| 2437               | 16.366                 | >500           |
| 2462               | 16.334                 | >500           |

11n-20

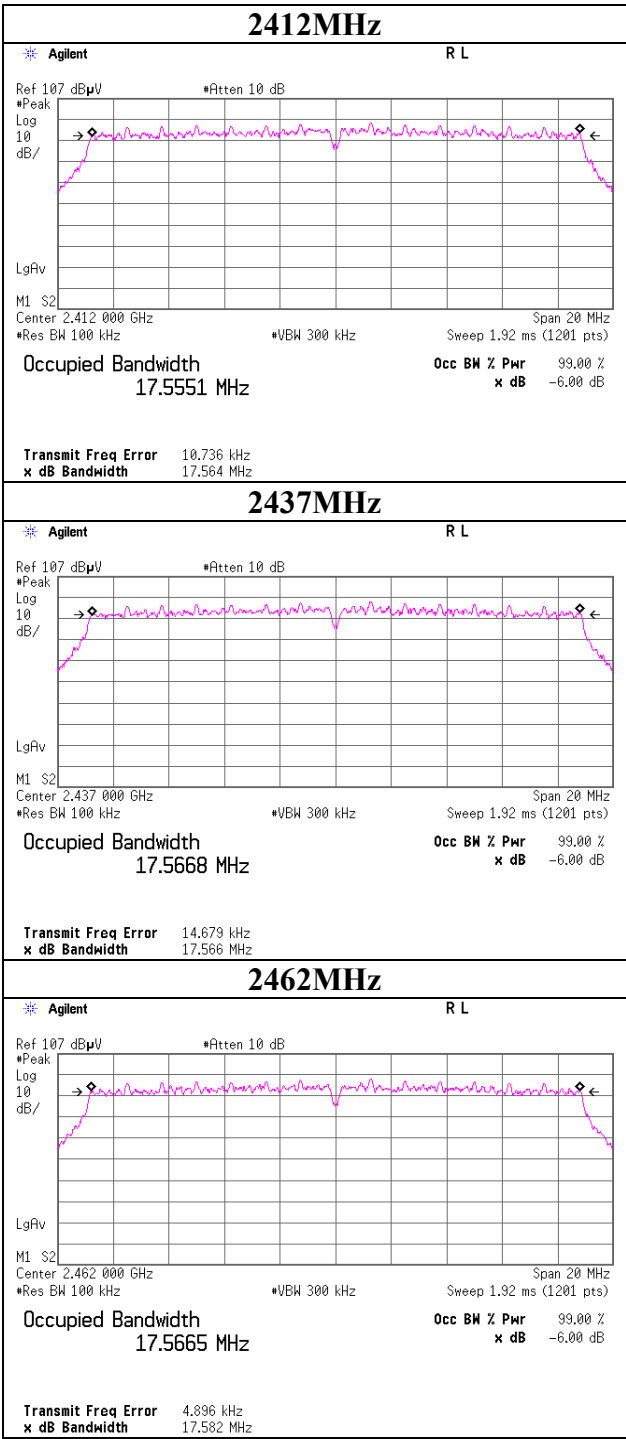
| Frequency<br>[MHz] | 6dB Bandwidth<br>[MHz] | Limit<br>[kHz] |
|--------------------|------------------------|----------------|
| 2412               | 17.564                 | >500           |
| 2437               | 17.566                 | >500           |
| 2462               | 17.582                 | >500           |

## 6dB Bandwidth



6dB Bandwidth

11n-20 Antenna



## Maximum Peak Output Power

|                       |                                         |
|-----------------------|-----------------------------------------|
| Test place            | Head Office EMC Lab. No.7 Shielded Room |
| Report No.            | 33AE0097-HO-02                          |
| Date                  | 09/19/2012                              |
| Temperature/ Humidity | 20 deg.C / 48% RH                       |
| Engineer              | Tomohisa Nakagawa                       |
| Mode                  | 11b Tx                                  |

| Freq.<br>[MHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>[dB] | Result |       | Limit |      | Margin<br>[dB] |
|----------------|------------------|-----------------------|----------------|--------|-------|-------|------|----------------|
|                |                  |                       |                | [dBm]  | [mW]  | [dBm] | [mW] |                |
| 2412           | 1.72             | 0.88                  | 10.00          | 12.60  | 18.20 | 30.00 | 1000 | 17.40          |
| 2437           | 1.43             | 0.89                  | 10.00          | 12.32  | 17.06 | 30.00 | 1000 | 17.68          |
| 2462           | 1.30             | 0.89                  | 10.00          | 12.19  | 16.56 | 30.00 | 1000 | 17.81          |

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

Antenna, 2437MHz

| Rate<br>[Mbps] | Reading<br>[dBm] | Remark |
|----------------|------------------|--------|
| 1              | 1.40             |        |
| 2              | 1.43             | *      |
| 5.5            | 1.22             |        |
| 11             | 1.23             |        |

\*: Worst Rate

All comparizon were carried out on same frequency and measurement factors.



## Maximum Peak Output Power

|                       |                                         |
|-----------------------|-----------------------------------------|
| Test place            | Head Office EMC Lab. No.7 Shielded Room |
| Report No.            | 33AE0097-HO-02                          |
| Date                  | 09/19/2012                              |
| Temperature/ Humidity | 20 deg.C / 48% RH                       |
| Engineer              | Tomohisa Nakagawa                       |
| Mode                  | 11g Tx                                  |

| Freq.<br>[MHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>[dB] | Result |       | Limit |      | Margin<br>[dB] |
|----------------|------------------|-----------------------|----------------|--------|-------|-------|------|----------------|
|                |                  |                       |                | [dBm]  | [mW]  | [dBm] | [mW] |                |
| 2412           | 8.01             | 0.88                  | 10.00          | 18.89  | 77.45 | 30.00 | 1000 | 11.11          |
| 2437           | 7.69             | 0.89                  | 10.00          | 18.58  | 72.11 | 30.00 | 1000 | 11.42          |
| 2462           | 7.34             | 0.89                  | 10.00          | 18.23  | 66.53 | 30.00 | 1000 | 11.77          |

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

Antenna, 2437MHz

| Rate<br>[Mbps] | Reading<br>Long GI<br>[dBm] |
|----------------|-----------------------------|
| 6              | 7.51                        |
| 9              | 7.52                        |
| 12             | 7.58                        |
| 18             | 7.58                        |
| 24             | 7.66                        |
| 36             | 7.69*                       |
| 48             | 7.60                        |
| 54             | 7.62                        |

\*: Worst Rate

All comparison were carried out on same frequency and measurement factors.

### Maximum Peak Output Power

Test place Head Office EMC Lab. No.7 Shielded Room  
Report No. 33AE0097-HO-02  
Date 09/19/2012  
Temperature/ Humidity 20 deg.C / 48% RH  
Engineer Tomohisa Nakagawa  
Mode 11n Tx

| Freq.<br>[MHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>[dB] | Result |       | Limit |      | Margin<br>[dB] |
|----------------|------------------|-----------------------|----------------|--------|-------|-------|------|----------------|
|                |                  |                       |                | [dBm]  | [mW]  | [dBm] | [mW] |                |
| 2412           | 8.71             | 0.88                  | 10.00          | 19.59  | 90.99 | 30.00 | 1000 | 10.41          |
| 2437           | 8.05             | 0.89                  | 10.00          | 18.94  | 78.34 | 30.00 | 1000 | 11.06          |
| 2462           | 7.56             | 0.89                  | 10.00          | 18.45  | 69.98 | 30.00 | 1000 | 11.55          |

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

Antenna, 2437MHz

| MCS | Reading<br>Short GI<br>[dBm] | Reading<br>Long GI<br>[dBm] |
|-----|------------------------------|-----------------------------|
| 0   | 7.86                         |                             |
| 1   | 7.90                         |                             |
| 2   | 7.92                         |                             |
| 3   | 7.97                         |                             |
| 4   | 8.01                         |                             |
| 5   | 8.01                         | 7.70                        |
| 6   | 8.05*                        |                             |
| 7   | 8.00                         |                             |

\*: Worst Rate

All comparison were carried out on same frequency and measurement factors.

## Average Output Power

|                       |                                         |
|-----------------------|-----------------------------------------|
| Test place            | Head Office EMC Lab. No.7 Shielded Room |
| Report No.            | 33AE0098-HO-01                          |
| Date                  | 09/19/2012                              |
| Temperature/ Humidity | 20 deg.C / 48% RH                       |
| Engineer              | Tomohisa Nakagawa                       |
| Mode                  | 11b/g/n-20 Tx                           |

[AV]

11b     **2Mbps**

| Freq.<br>[MHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>[dB] | AntGain<br>[dBi] | Result |       | Limit |      | Margin<br>[dB] |
|----------------|------------------|-----------------------|----------------|------------------|--------|-------|-------|------|----------------|
|                |                  |                       |                |                  | [dBm]  | [mW]  | [dBm] | [mW] |                |
| 2412           | 0.14             | 0.88                  | 10.00          | 0.41             | 11.43  | 13.90 | 30.00 | 1000 | 18.57          |
| 2437           | -0.16            | 0.89                  | 10.00          | 0.41             | 11.14  | 13.00 | 30.00 | 1000 | 18.86          |
| 2462           | -0.14            | 0.89                  | 10.00          | 0.41             | 11.16  | 13.06 | 30.00 | 1000 | 18.84          |

11g     **36Mbps**

| Freq.<br>[MHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>[dB] | AntGain<br>[dBi] | Result |       | Limit |      | Margin<br>[dB] |
|----------------|------------------|-----------------------|----------------|------------------|--------|-------|-------|------|----------------|
|                |                  |                       |                |                  | [dBm]  | [mW]  | [dBm] | [mW] |                |
| 2412           | -1.18            | 0.88                  | 10.00          | 0.41             | 10.11  | 10.26 | 30.00 | 1000 | 19.89          |
| 2437           | -1.38            | 0.89                  | 10.00          | 0.41             | 9.92   | 9.82  | 30.00 | 1000 | 20.08          |
| 2462           | -1.36            | 0.89                  | 10.00          | 0.41             | 9.94   | 9.86  | 30.00 | 1000 | 20.06          |

11n-20     **MCS6**

| Freq.<br>[MHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>[dB] | AntGain<br>[dBi] | Result |      | Limit |      | Margin<br>[dB] |
|----------------|------------------|-----------------------|----------------|------------------|--------|------|-------|------|----------------|
|                |                  |                       |                |                  | [dBm]  | [mW] | [dBm] | [mW] |                |
| 2412           | -3.05            | 0.88                  | 10.00          | 0.41             | 8.24   | 6.67 | 30.00 | 1000 | 21.76          |
| 2437           | -3.51            | 0.89                  | 10.00          | 0.41             | 7.79   | 6.01 | 30.00 | 1000 | 22.21          |
| 2462           | -3.41            | 0.89                  | 10.00          | 0.41             | 7.89   | 6.15 | 30.00 | 1000 | 22.11          |

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

## Radiated Spurious Emission

Test place Head Office EMC Lab. No.4 Semi Anechoic Chamber  
Report No. 33AE0098-HO-01  
Date 09/20/2012 09/21/2012  
Temperature/ Humidity 23 deg.C / 52% RH 23 deg.C / 52% RH  
Engineer Kazuya Yoshioka Kazuya Yoshioka  
(1-10GHz) (10-26.5GHz)  
Mode 11b Tx 2412MHz

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|--------|
| Hori     | 2390.000           | PK       | 49.2              | 27.5               | 2.4          | 32.3         | 46.8               | 73.9              | 27.1           |        |
| Hori     | 4824.000           | PK       | 43.0              | 31.4               | 4.3          | 31.5         | 47.2               | 73.9              | 26.7           |        |
| Hori     | 7236.000           | PK       | 42.0              | 35.8               | 5.0          | 32.5         | 50.3               | 73.9              | 23.6           | NS     |
| Hori     | 9648.000           | PK       | 44.4              | 38.3               | 5.8          | 32.9         | 55.6               | 73.9              | 18.3           | NS     |
| Hori     | 24120.000          | PK       | 46.3              | 38.5               | -1.1         | 32.1         | 51.6               | 73.9              | 22.3           | NS     |
| Hori     | 2390.000           | AV       | 39.8              | 27.5               | 2.4          | 32.3         | 37.4               | 53.9              | 16.5           |        |
| Hori     | 4824.000           | AV       | 35.9              | 31.4               | 4.3          | 31.5         | 40.1               | 53.9              | 13.8           |        |
| Hori     | 7236.000           | AV       | 30.7              | 35.8               | 5.0          | 32.5         | 39.0               | 53.9              | 14.9           | NS     |
| Hori     | 9648.000           | AV       | 32.5              | 38.3               | 5.8          | 32.9         | 43.7               | 53.9              | 10.2           | NS     |
| Hori     | 24120.000          | AV       | 34.4              | 38.5               | -1.1         | 32.1         | 39.7               | 53.9              | 14.2           | NS     |
| Vert     | 2390.000           | PK       | 48.9              | 27.5               | 2.4          | 32.3         | 46.5               | 73.9              | 27.4           |        |
| Vert     | 4824.000           | PK       | 43.1              | 31.4               | 4.3          | 31.5         | 47.3               | 73.9              | 26.6           |        |
| Vert     | 7236.000           | PK       | 41.7              | 35.8               | 5.0          | 32.5         | 50.0               | 73.9              | 23.9           | NS     |
| Vert     | 9648.000           | PK       | 44.6              | 38.3               | 5.8          | 32.9         | 55.8               | 73.9              | 18.1           | NS     |
| Vert     | 24120.000          | PK       | 46.2              | 38.5               | -1.1         | 32.1         | 51.5               | 73.9              | 22.4           | NS     |
| Vert     | 2390.000           | AV       | 39.6              | 27.5               | 2.4          | 32.3         | 37.2               | 53.9              | 16.7           |        |
| Vert     | 4824.000           | AV       | 32.8              | 31.4               | 4.3          | 31.5         | 37.0               | 53.9              | 16.9           |        |
| Vert     | 7236.000           | AV       | 30.7              | 35.8               | 5.0          | 32.5         | 39.0               | 53.9              | 14.9           | NS     |
| Vert     | 9648.000           | AV       | 32.5              | 38.3               | 5.8          | 32.9         | 43.7               | 53.9              | 10.2           | NS     |
| Vert     | 24120.000          | AV       | 34.4              | 38.5               | -1.1         | 32.1         | 39.7               | 53.9              | 14.2           | NS     |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

\*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

NS:Non Signal

Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB  
26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

### 20dBc Data Sheet

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark  |
|----------|--------------------|----------|-------------------|-------------------------|--------------|--------------|--------------------|-------------------|----------------|---------|
| Hori     | 2412.000           | PK       | 100.2             | 27.5                    | 2.4          | 32.3         | 97.8               | -                 | -              | Carrier |
| Hori     | 2399.920           | PK       | 46.7              | 27.5                    | 2.4          | 32.3         | 44.3               | 77.8              | 33.5           |         |
| Hori     | 2400.000           | PK       | 47.8              | 27.5                    | 2.4          | 32.3         | 45.4               | 77.8              | 32.4           |         |
| Vert     | 2412.000           | PK       | 101.6             | 27.5                    | 2.4          | 32.3         | 99.2               | -                 | -              | Carrier |
| Vert     | 2399.920           | PK       | 47.1              | 27.5                    | 2.4          | 32.3         | 44.7               | 79.2              | 34.5           |         |
| Vert     | 2400.000           | PK       | 47.3              | 27.5                    | 2.4          | 32.3         | 44.9               | 79.2              | 34.3           |         |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

## Radiated Spurious Emission

Test place Head Office EMC Lab. No.4 Semi Anechoic Chamber  
Report No. 33AE0098-HO-01  
Date 09/20/2012 09/21/2012  
Temperature/ Humidity 23 deg.C / 52% RH 23 deg.C / 52% RH  
Engineer Kazuya Yoshioka Kazuya Yoshioka  
(1-10GHz) (10-26.5GHz)  
Mode 11b Tx 2437MHz

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|--------|
| Hori     | 4874.000           | PK       | 43.2              | 31.5               | 4.3          | 31.5         | 47.5               | 73.9              | 26.4           |        |
| Hori     | 7311.000           | PK       | 42.0              | 35.8               | 5.0          | 32.5         | 50.3               | 73.9              | 23.6           | NS     |
| Hori     | 9748.000           | PK       | 44.0              | 38.4               | 5.9          | 32.9         | 55.4               | 73.9              | 18.5           | NS     |
| Hori     | 24370.000          | PK       | 45.8              | 38.6               | -1.1         | 32.1         | 51.2               | 73.9              | 22.7           | NS     |
| Hori     | 4874.000           | AV       | 34.4              | 31.5               | 4.3          | 31.5         | 38.7               | 53.9              | 15.2           |        |
| Hori     | 7311.000           | AV       | 30.4              | 35.8               | 5.0          | 32.5         | 38.7               | 53.9              | 15.2           | NS     |
| Hori     | 9748.000           | AV       | 31.8              | 38.4               | 5.9          | 32.9         | 43.2               | 53.9              | 10.7           | NS     |
| Hori     | 24370.000          | AV       | 34.9              | 38.6               | -1.1         | 32.1         | 40.3               | 53.9              | 13.6           | NS     |
| Vert     | 4874.000           | PK       | 41.9              | 31.5               | 4.3          | 31.5         | 46.2               | 73.9              | 27.7           |        |
| Vert     | 7311.000           | PK       | 42.2              | 35.8               | 5.0          | 32.5         | 50.5               | 73.9              | 23.4           | NS     |
| Vert     | 9748.000           | PK       | 44.2              | 38.4               | 5.9          | 32.9         | 55.6               | 73.9              | 18.3           | NS     |
| Vert     | 24370.000          | PK       | 46.1              | 38.6               | -1.1         | 32.1         | 51.5               | 73.9              | 22.4           | NS     |
| Vert     | 4874.000           | AV       | 32.3              | 31.5               | 4.3          | 31.5         | 36.6               | 53.9              | 17.3           |        |
| Vert     | 7311.000           | AV       | 30.4              | 35.8               | 5.0          | 32.5         | 38.7               | 53.9              | 15.2           | NS     |
| Vert     | 9748.000           | AV       | 31.8              | 38.4               | 5.9          | 32.9         | 43.2               | 53.9              | 10.7           | NS     |
| Vert     | 24370.000          | AV       | 34.9              | 38.6               | -1.1         | 32.1         | 40.3               | 53.9              | 13.6           | NS     |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

\*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

NS:Non Signal

Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB  
26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

## Radiated Spurious Emission

|                       |                                                 |                                 |
|-----------------------|-------------------------------------------------|---------------------------------|
| Test place            | Head Office EMC Lab. No.4 Semi Anechoic Chamber |                                 |
| Report No.            | 33AE0098-HO-01                                  |                                 |
| Date                  | 09/20/2012                                      | 09/21/2012                      |
| Temperature/ Humidity | 23 deg.C / 52% RH                               | 23 deg.C / 52% RH               |
| Engineer              | Kazuya Yoshioka<br>(1-10GHz)                    | Kazuya Yoshioka<br>(10-26.5GHz) |
| Mode                  | 11b Tx 2462MHz                                  |                                 |

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|--------|
| Hori     | 2483.500           | PK       | 55.8              | 27.5               | 2.4          | 32.2         | 53.5               | 73.9              | 20.4           |        |
| Hori     | 4924.000           | PK       | 44.1              | 31.7               | 4.3          | 31.5         | 48.6               | 73.9              | 25.3           |        |
| Hori     | 7386.000           | PK       | 41.9              | 35.9               | 5.1          | 32.6         | 50.3               | 73.9              | 23.6           | NS     |
| Hori     | 9848.000           | PK       | 43.0              | 38.5               | 5.9          | 33.0         | 54.4               | 73.9              | 19.5           | NS     |
| Hori     | 24620.000          | PK       | 46.0              | 38.7               | -1.0         | 32.2         | 51.5               | 73.9              | 22.4           | NS     |
| Hori     | 2483.500           | AV       | 48.9              | 27.5               | 2.4          | 32.2         | 46.6               | 53.9              | 7.3            |        |
| Hori     | 4924.000           | AV       | 34.2              | 31.7               | 4.3          | 31.5         | 38.7               | 53.9              | 15.2           |        |
| Hori     | 7386.000           | AV       | 29.9              | 35.9               | 5.1          | 32.6         | 38.3               | 53.9              | 15.6           | NS     |
| Hori     | 9848.000           | AV       | 32.0              | 38.5               | 5.9          | 33.0         | 43.4               | 53.9              | 10.5           | NS     |
| Hori     | 24620.000          | AV       | 34.4              | 38.7               | -1.0         | 32.2         | 39.9               | 53.9              | 14.0           | NS     |
| Vert     | 2483.500           | PK       | 52.9              | 27.5               | 2.4          | 32.2         | 50.6               | 73.9              | 23.3           |        |
| Vert     | 4924.000           | PK       | 43.3              | 31.7               | 4.3          | 31.5         | 47.8               | 73.9              | 26.1           |        |
| Vert     | 7386.000           | PK       | 41.5              | 35.9               | 5.1          | 32.6         | 49.9               | 73.9              | 24.0           | NS     |
| Vert     | 9848.000           | PK       | 43.0              | 38.5               | 5.9          | 33.0         | 54.4               | 73.9              | 19.5           | NS     |
| Vert     | 24620.000          | PK       | 45.9              | 38.7               | -1.0         | 32.2         | 51.4               | 73.9              | 22.5           | NS     |
| Vert     | 2483.500           | AV       | 46.2              | 27.5               | 2.4          | 32.2         | 43.9               | 53.9              | 10.0           |        |
| Vert     | 4924.000           | AV       | 33.0              | 31.7               | 4.3          | 31.5         | 37.5               | 53.9              | 16.4           |        |
| Vert     | 7386.000           | AV       | 29.9              | 35.9               | 5.1          | 32.6         | 38.3               | 53.9              | 15.6           | NS     |
| Vert     | 9848.000           | AV       | 32.0              | 38.5               | 5.9          | 33.0         | 43.4               | 53.9              | 10.5           | NS     |
| Vert     | 24620.000          | AV       | 34.4              | 38.7               | -1.0         | 32.2         | 39.9               | 53.9              | 14.0           | NS     |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

\*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

NS:Non Signal

Distance factor:      10GHz-26.5GHz      20log(3.0m/1.0m)= 9.5dB  
                                 26.5GHz-40GHz      20log(3.0m/0.5m)=15.6dB

## Radiated Spurious Emission

Test place Head Office EMC Lab. No.4 Semi Anechoic Chamber  
Report No. 33AE0098-HO-01  
Date 09/20/2012 09/21/2012  
Temperature/ Humidity 23 deg.C / 52% RH 23 deg.C/ 52% RH  
Engineer Kazuya Yoshioka Kazuya Yoshioka  
(1-10GHz) (10-26.5GHz)/(Below 1GHz)  
Mode 11n Tx 2412MHz

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|--------|
| Hori     | 39.900             | QP       | 22.7              | 14.9               | 7.2          | 32.0         | 12.8               | 40.0              | 27.2           | NS     |
| Hori     | 96.150             | QP       | 22.4              | 9.5                | 8.0          | 32.1         | 7.8                | 43.5              | 35.7           | NS     |
| Hori     | 145.650            | QP       | 22.0              | 14.8               | 8.5          | 32.0         | 13.3               | 43.5              | 30.2           | NS     |
| Hori     | 200.999            | QP       | 22.2              | 16.7               | 8.8          | 31.9         | 15.8               | 43.5              | 27.7           | NS     |
| Hori     | 421.332            | QP       | 21.8              | 17.9               | 10.4         | 32.0         | 18.1               | 46.0              | 27.9           | NS     |
| Hori     | 603.333            | QP       | 22.1              | 20.6               | 11.4         | 32.1         | 22.0               | 46.0              | 24.0           | NS     |
| Hori     | 2390.000           | PK       | 67.5              | 27.5               | 2.4          | 32.3         | 65.1               | 73.9              | 8.8            |        |
| Hori     | 4824.000           | PK       | 42.9              | 31.4               | 4.3          | 31.5         | 47.1               | 73.9              | 26.8           |        |
| Hori     | 7236.000           | PK       | 42.2              | 35.8               | 5.0          | 32.5         | 50.5               | 73.9              | 23.4           | NS     |
| Hori     | 9648.000           | PK       | 44.2              | 38.3               | 5.8          | 32.9         | 55.4               | 73.9              | 18.5           | NS     |
| Hori     | 24120.000          | PK       | 46.0              | 38.5               | -1.1         | 32.1         | 51.3               | 73.9              | 22.6           | NS     |
| Hori     | 2390.000           | AV       | 50.1              | 27.5               | 2.4          | 32.3         | 47.7               | 53.9              | 6.2            |        |
| Hori     | 4824.000           | AV       | 37.2              | 31.4               | 4.3          | 31.5         | 41.4               | 53.9              | 12.5           |        |
| Hori     | 7236.000           | AV       | 30.7              | 35.8               | 5.0          | 32.5         | 39.0               | 53.9              | 14.9           | NS     |
| Hori     | 9648.000           | AV       | 32.5              | 38.3               | 5.8          | 32.9         | 43.7               | 53.9              | 10.2           | NS     |
| Hori     | 24120.000          | AV       | 34.4              | 38.5               | -1.1         | 32.1         | 39.7               | 53.9              | 14.2           | NS     |
| Vert     | 41.250             | QP       | 22.8              | 14.3               | 7.3          | 32.0         | 12.4               | 40.0              | 27.6           | NS     |
| Vert     | 96.600             | QP       | 22.4              | 9.6                | 8.1          | 32.1         | 8.0                | 43.5              | 35.5           | NS     |
| Vert     | 146.100            | QP       | 22.0              | 14.9               | 8.5          | 32.0         | 13.4               | 43.5              | 30.1           | NS     |
| Vert     | 200.549            | QP       | 22.2              | 16.7               | 8.8          | 31.9         | 15.8               | 43.5              | 27.7           | NS     |
| Vert     | 420.166            | QP       | 21.8              | 17.9               | 10.4         | 32.0         | 18.1               | 46.0              | 27.9           | NS     |
| Vert     | 608.000            | QP       | 22.2              | 20.7               | 11.4         | 32.1         | 22.2               | 46.0              | 23.8           | NS     |
| Vert     | 2390.000           | PK       | 66.2              | 27.5               | 2.4          | 32.3         | 63.8               | 73.9              | 10.1           |        |
| Vert     | 4824.000           | PK       | 42.1              | 31.4               | 4.3          | 31.5         | 46.3               | 73.9              | 27.6           |        |
| Vert     | 7236.000           | PK       | 41.6              | 35.8               | 5.0          | 32.5         | 49.9               | 73.9              | 24.0           | NS     |
| Vert     | 9648.000           | PK       | 44.3              | 38.3               | 5.8          | 32.9         | 55.5               | 73.9              | 18.4           | NS     |
| Vert     | 24120.000          | PK       | 46.4              | 38.5               | -1.1         | 32.1         | 51.7               | 73.9              | 22.2           | NS     |
| Vert     | 2390.000           | AV       | 47.2              | 27.5               | 2.4          | 32.3         | 44.8               | 53.9              | 9.1            |        |
| Vert     | 4824.000           | AV       | 35.4              | 31.4               | 4.3          | 31.5         | 39.6               | 53.9              | 14.3           |        |
| Vert     | 7236.000           | AV       | 30.7              | 35.8               | 5.0          | 32.5         | 39.0               | 53.9              | 14.9           | NS     |
| Vert     | 9648.000           | AV       | 32.5              | 38.3               | 5.8          | 32.9         | 43.7               | 53.9              | 10.2           | NS     |
| Vert     | 24120.000          | AV       | 34.4              | 38.5               | -1.1         | 32.1         | 39.7               | 53.9              | 14.2           | NS     |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

\*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

NS:Non Signal

Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB  
26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

### 20dBc Data Sheet

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark  |
|----------|--------------------|----------|-------------------|-------------------------|--------------|--------------|--------------------|-------------------|----------------|---------|
| Hori     | 2412.000           | PK       | 98.0              | 27.5                    | 2.4          | 32.3         | 95.6               | -                 | -              | Carrier |
| Hori     | 2398.250           | PK       | 59.4              | 27.5                    | 2.4          | 32.3         | 57.0               | 75.6              | 18.6           |         |
| Hori     | 2400.000           | PK       | 55.7              | 27.5                    | 2.4          | 32.3         | 53.3               | 75.6              | 22.3           |         |
| Vert     | 2412.000           | PK       | 98.3              | 27.5                    | 2.4          | 32.3         | 95.9               | -                 | -              | Carrier |
| Vert     | 2398.567           | PK       | 58.1              | 27.5                    | 2.4          | 32.3         | 55.7               | 75.9              | 20.2           |         |
| Vert     | 2400.000           | PK       | 55.8              | 27.5                    | 2.4          | 32.3         | 53.4               | 75.9              | 22.5           |         |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

## Radiated Spurious Emission

Test place Head Office EMC Lab. No.4 Semi Anechoic Chamber  
Report No. 33AE0098-HO-01  
Date 09/20/2012 09/21/2012  
Temperature/ Humidity 23 deg.C / 52% RH 23 deg.C / 52% RH  
Engineer Kazuya Yoshioka Kazuya Yoshioka  
(1-10GHz) (10-26.5GHz)  
Mode 11n Tx 2437MHz

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|--------|
| Hori     | 4874.000           | PK       | 42.7              | 31.5               | 4.3          | 31.5         | 47.0               | 73.9              | 26.9           |        |
| Hori     | 7311.000           | PK       | 41.9              | 35.8               | 5.0          | 32.5         | 50.2               | 73.9              | 23.7           | NS     |
| Hori     | 9748.000           | PK       | 43.8              | 38.4               | 5.9          | 32.9         | 55.2               | 73.9              | 18.7           | NS     |
| Hori     | 24370.000          | PK       | 46.2              | 38.6               | -1.1         | 32.1         | 51.6               | 73.9              | 22.3           | NS     |
| Hori     | 4874.000           | AV       | 36.9              | 31.5               | 4.3          | 31.5         | 41.2               | 53.9              | 12.7           |        |
| Hori     | 7311.000           | AV       | 30.4              | 35.8               | 5.0          | 32.5         | 38.7               | 53.9              | 15.2           | NS     |
| Hori     | 9748.000           | AV       | 31.8              | 38.4               | 5.9          | 32.9         | 43.2               | 53.9              | 10.7           | NS     |
| Hori     | 24370.000          | AV       | 34.9              | 38.6               | -1.1         | 32.1         | 40.3               | 53.9              | 13.6           | NS     |
| Vert     | 4874.000           | PK       | 42.3              | 31.5               | 4.3          | 31.5         | 46.6               | 73.9              | 27.3           |        |
| Vert     | 7311.000           | PK       | 42.4              | 35.8               | 5.0          | 32.5         | 50.7               | 73.9              | 23.2           | NS     |
| Vert     | 9748.000           | PK       | 44.0              | 38.4               | 5.9          | 32.9         | 55.4               | 73.9              | 18.5           | NS     |
| Vert     | 24370.000          | PK       | 46.0              | 38.6               | -1.1         | 32.1         | 51.4               | 73.9              | 22.5           | NS     |
| Vert     | 4874.000           | AV       | 34.8              | 31.5               | 4.3          | 31.5         | 39.1               | 53.9              | 14.8           |        |
| Vert     | 7311.000           | AV       | 30.4              | 35.8               | 5.0          | 32.5         | 38.7               | 53.9              | 15.2           | NS     |
| Vert     | 9748.000           | AV       | 31.8              | 38.4               | 5.9          | 32.9         | 43.2               | 53.9              | 10.7           | NS     |
| Vert     | 24370.000          | AV       | 34.9              | 38.6               | -1.1         | 32.1         | 40.3               | 53.9              | 13.6           | NS     |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

\*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

NS:Non Signal

Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB  
26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB



## Radiated Spurious Emission

Test place Head Office EMC Lab. No.4 Semi Anechoic Chamber  
Report No. 33AE0098-HO-01  
Date 09/20/2012 09/21/2012  
Temperature/ Humidity 23 deg.C / 52% RH 23 deg.C / 52% RH  
Engineer Kazuya Yoshioka Kazuya Yoshioka  
(1-10GHz) (10-26.5GHz)  
Mode 11n Tx 2462MHz

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|--------|
| Hori     | 2483.500           | PK       | 71.2              | 27.5               | 2.4          | 32.2         | 68.9               | 73.9              | 5.0            |        |
| Hori     | 2488.586           | PK       | 69.6              | 27.5               | 2.4          | 32.2         | 67.3               | 73.9              | 6.6            |        |
| Hori     | 4924.000           | PK       | 43.2              | 31.7               | 4.3          | 31.5         | 47.7               | 73.9              | 26.2           |        |
| Hori     | 7386.000           | PK       | 41.6              | 35.9               | 5.1          | 32.6         | 50.0               | 73.9              | 23.9           | NS     |
| Hori     | 9848.000           | PK       | 43.3              | 38.5               | 5.9          | 33.0         | 54.7               | 73.9              | 19.2           | NS     |
| Hori     | 24620.000          | PK       | 46.1              | 38.7               | -1.0         | 32.2         | 51.6               | 73.9              | 22.3           | NS     |
| Hori     | 2483.500           | AV       | 55.7              | 27.5               | 2.4          | 32.2         | 53.4               | 53.9              | 0.5            |        |
| Hori     | 2488.586           | AV       | 52.8              | 27.5               | 2.4          | 32.2         | 50.5               | 53.9              | 3.4            |        |
| Hori     | 4924.000           | AV       | 36.0              | 31.7               | 4.3          | 31.5         | 40.5               | 53.9              | 13.4           |        |
| Hori     | 7386.000           | AV       | 29.9              | 35.9               | 5.1          | 32.6         | 38.3               | 53.9              | 15.6           | NS     |
| Hori     | 9848.000           | AV       | 32.0              | 38.5               | 5.9          | 33.0         | 43.4               | 53.9              | 10.5           | NS     |
| Hori     | 24620.000          | AV       | 34.4              | 38.7               | -1.0         | 32.2         | 39.9               | 53.9              | 14.0           | NS     |
| Vert     | 2483.500           | PK       | 68.3              | 27.5               | 2.4          | 32.2         | 66.0               | 73.9              | 7.9            |        |
| Vert     | 2488.586           | PK       | 66.8              | 27.5               | 2.4          | 32.2         | 64.5               | 73.9              | 9.4            |        |
| Vert     | 4924.000           | PK       | 41.4              | 31.7               | 4.3          | 31.5         | 45.9               | 73.9              | 28.0           |        |
| Vert     | 7386.000           | PK       | 41.4              | 35.9               | 5.1          | 32.6         | 49.8               | 73.9              | 24.1           | NS     |
| Vert     | 9848.000           | PK       | 43.4              | 38.5               | 5.9          | 33.0         | 54.8               | 73.9              | 19.1           | NS     |
| Vert     | 24620.000          | PK       | 46.3              | 38.7               | -1.0         | 32.2         | 51.8               | 73.9              | 22.1           | NS     |
| Vert     | 2483.500           | AV       | 52.9              | 27.5               | 2.4          | 32.2         | 50.6               | 53.9              | 3.3            |        |
| Vert     | 2488.586           | AV       | 50.0              | 27.5               | 2.4          | 32.2         | 47.7               | 53.9              | 6.2            |        |
| Vert     | 4924.000           | AV       | 34.0              | 31.7               | 4.3          | 31.5         | 38.5               | 53.9              | 15.4           |        |
| Vert     | 7386.000           | AV       | 29.9              | 35.9               | 5.1          | 32.6         | 38.3               | 53.9              | 15.6           | NS     |
| Vert     | 9848.000           | AV       | 32.0              | 38.5               | 5.9          | 33.0         | 43.4               | 53.9              | 10.5           | NS     |
| Vert     | 24620.000          | AV       | 34.4              | 38.7               | -1.0         | 32.2         | 39.9               | 53.9              | 14.0           | NS     |

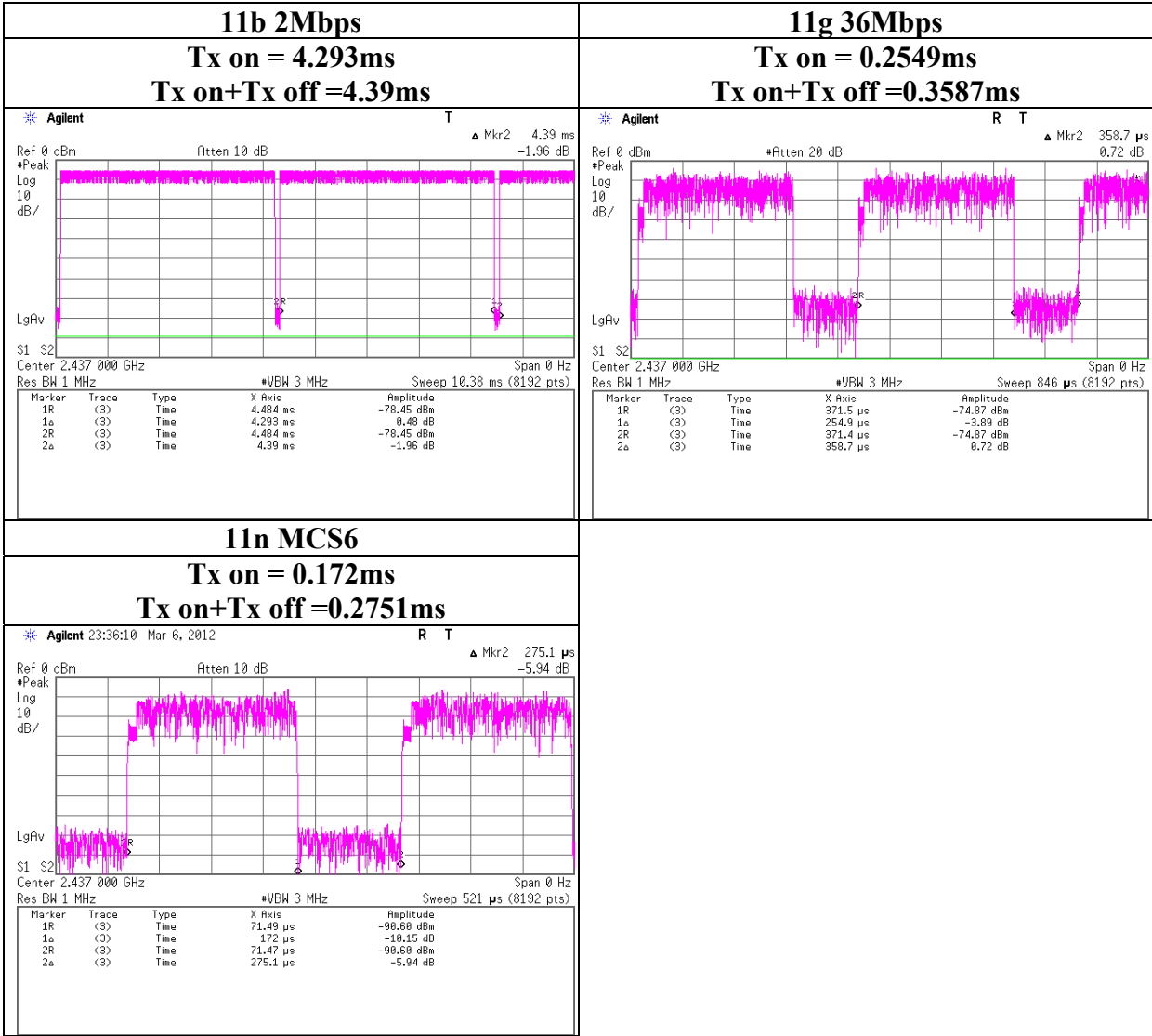
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

\*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

NS:Non Signal

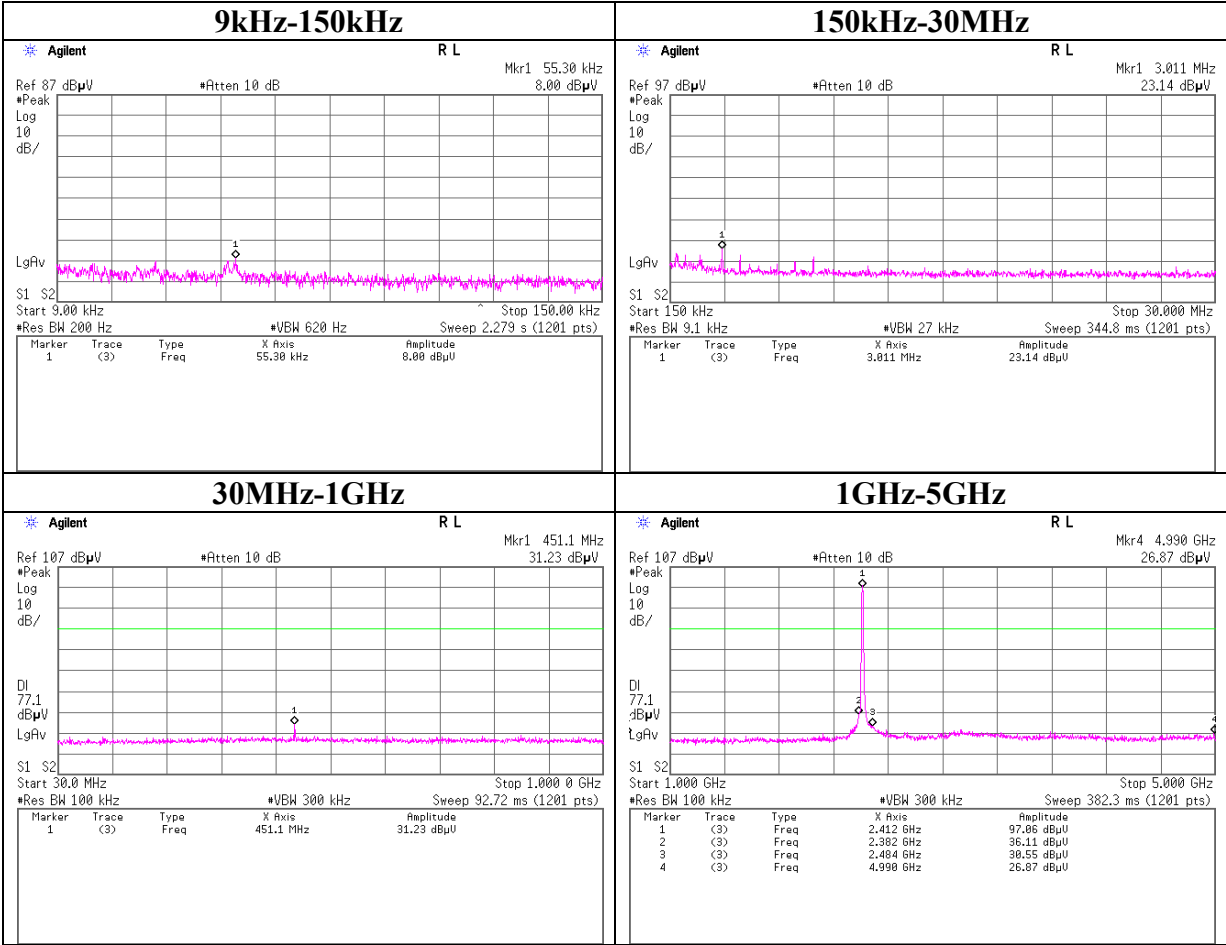
Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB  
26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

Burst rate confirmation



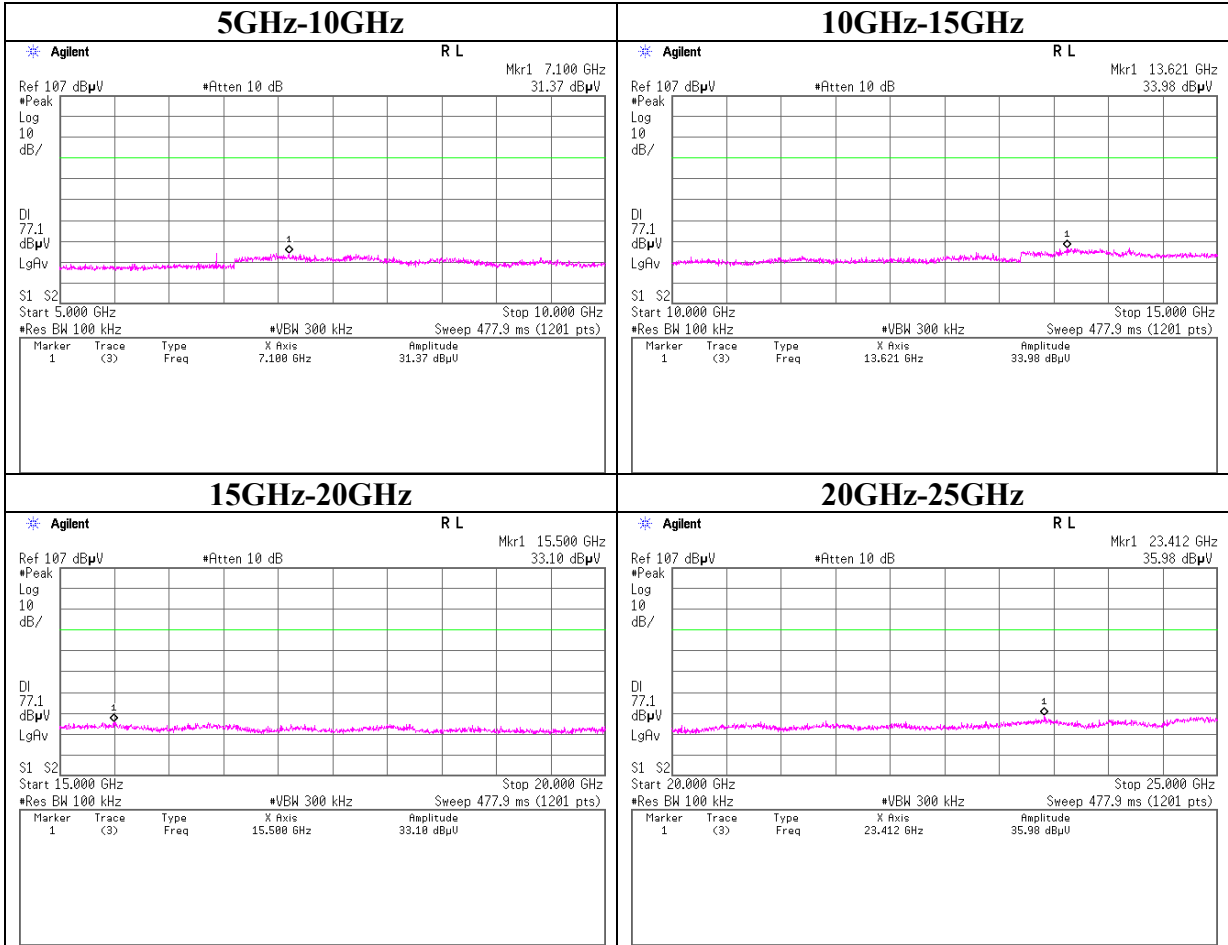
Conducted Spurious Emission

11b Tx 2412MHz



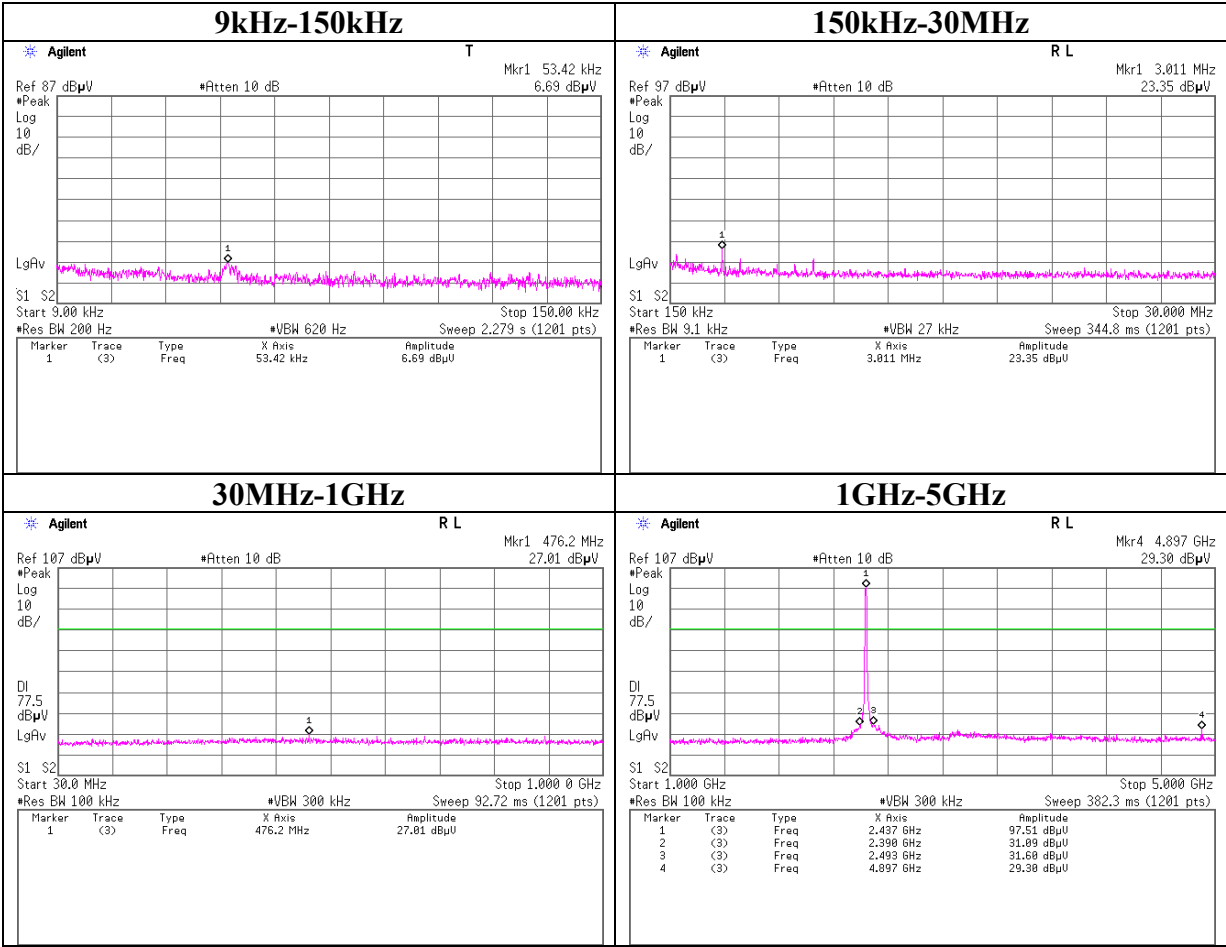
Conducted Spurious Emission

11b Tx 2412MHz



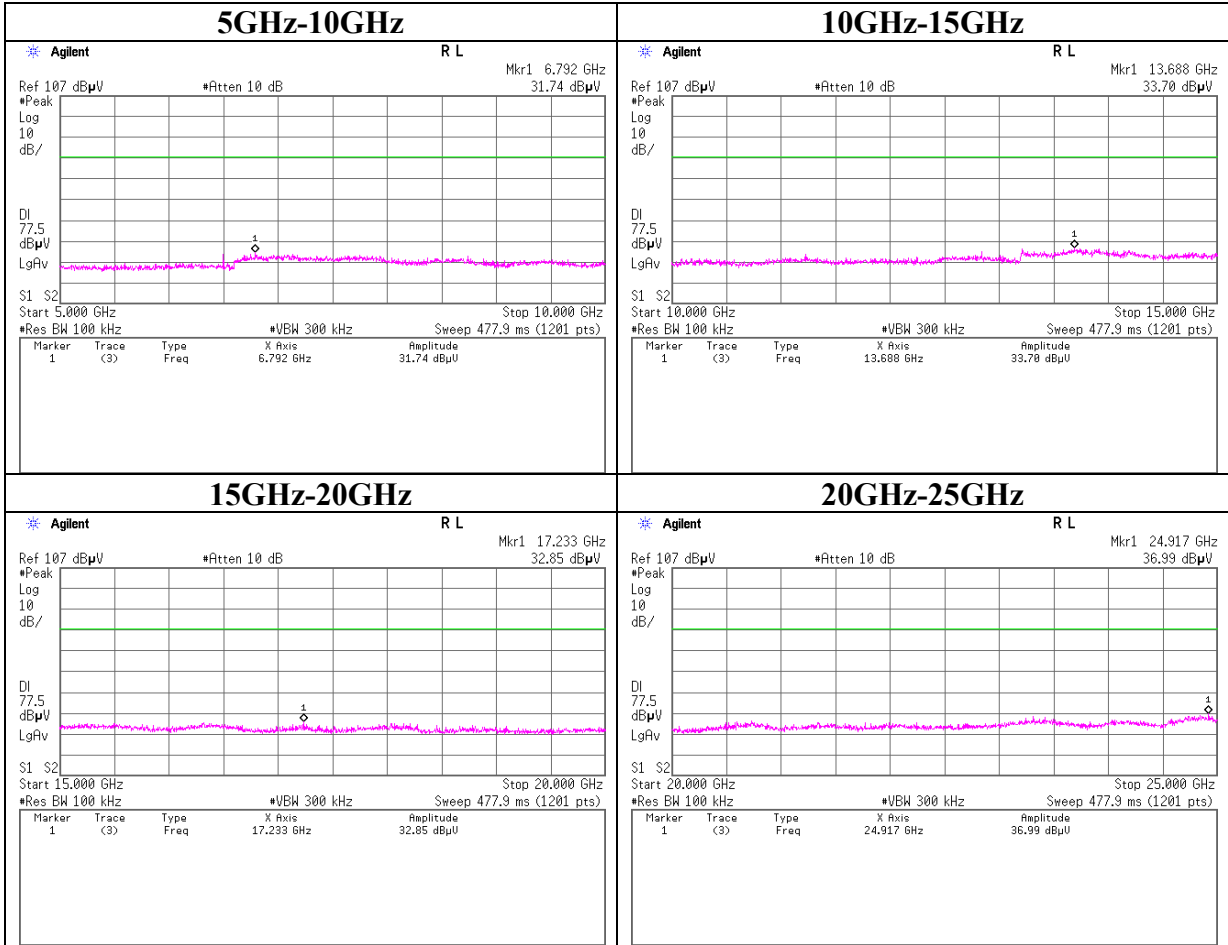
Conducted Spurious Emission

11b Tx 2437MHz



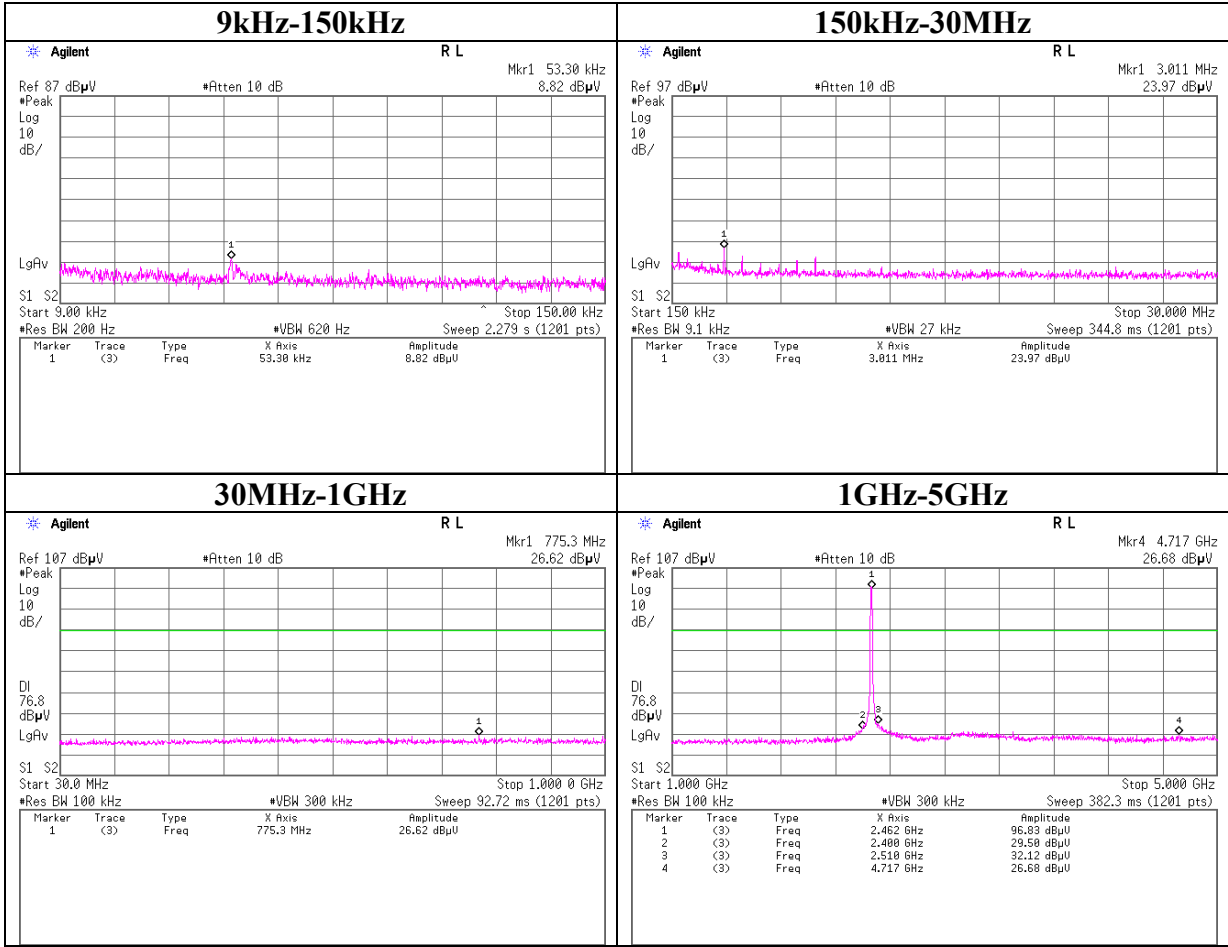
Conducted Spurious Emission

11b Tx 2437MHz



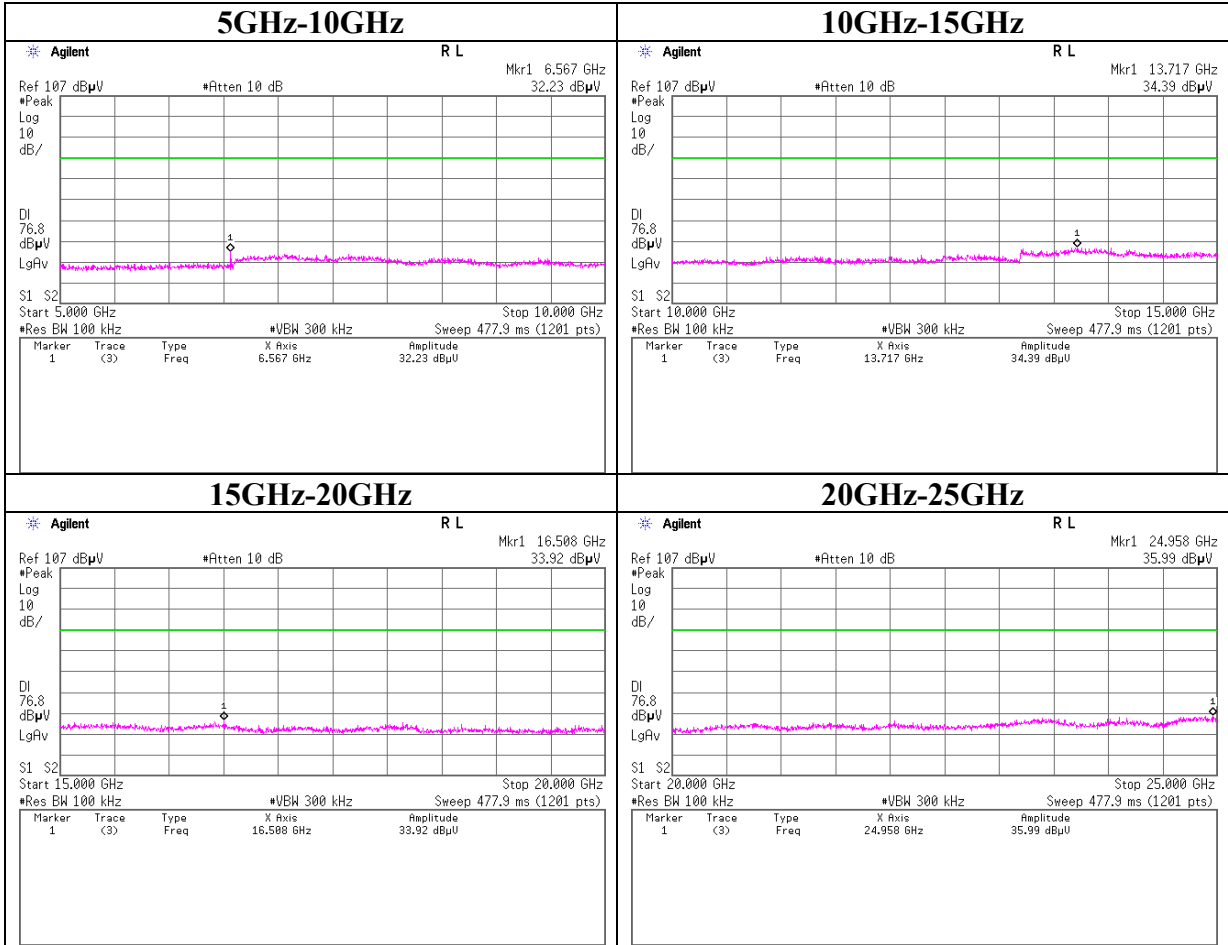
Conducted Spurious Emission

11b Tx 2462MHz



Conducted Spurious Emission

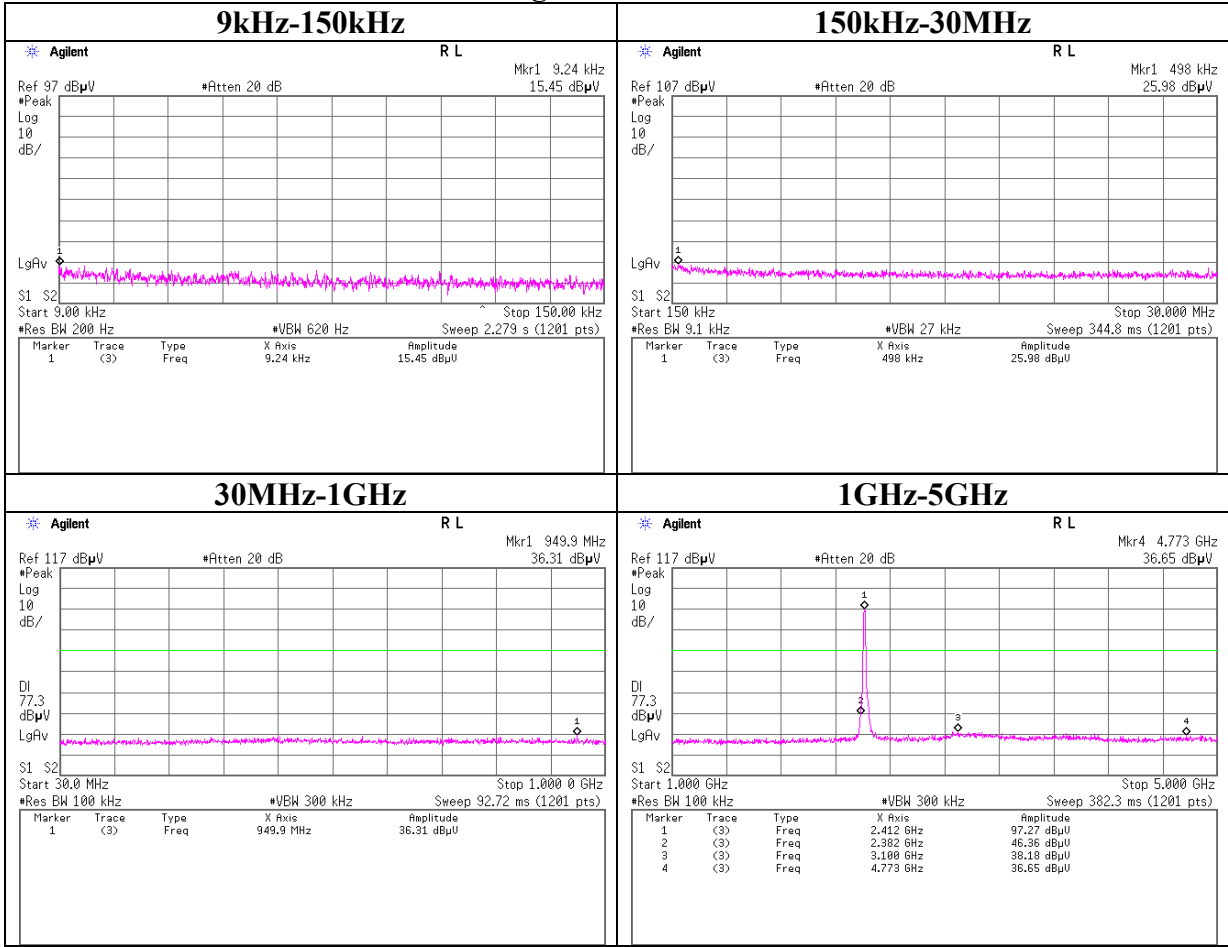
11b Tx 2462MHz





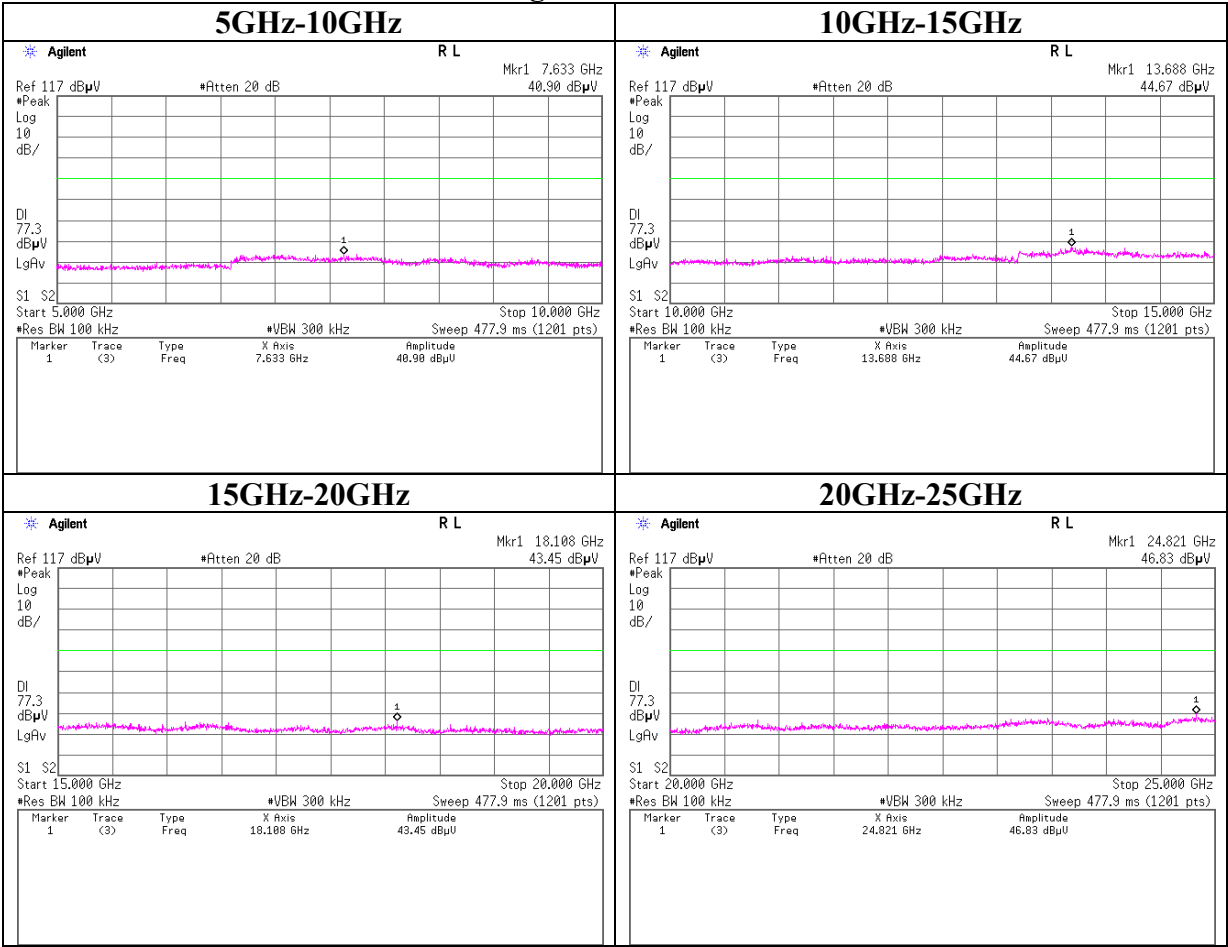
Conducted Spurious Emission

11g Tx 2412MHz



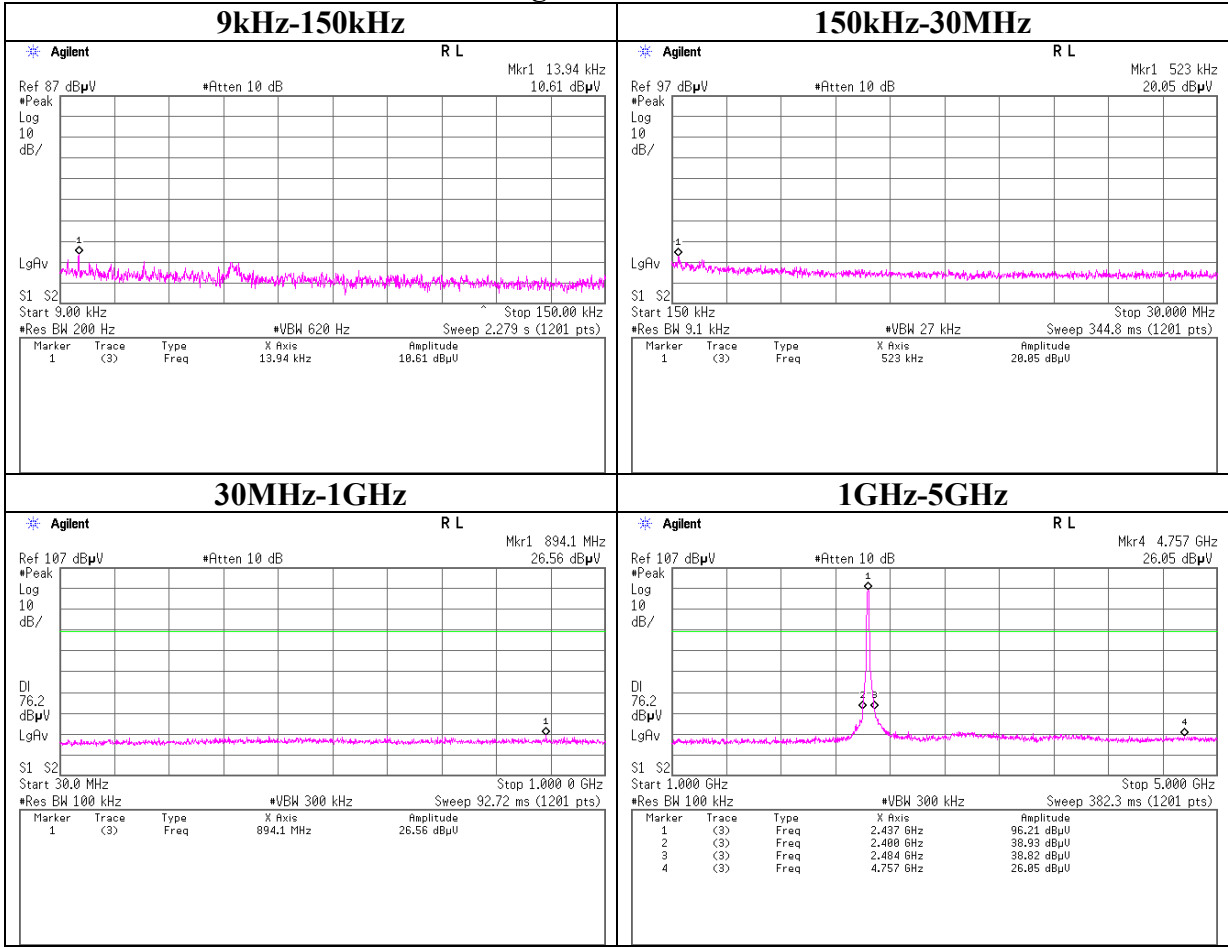
Conducted Spurious Emission

11g Tx 2412MHz



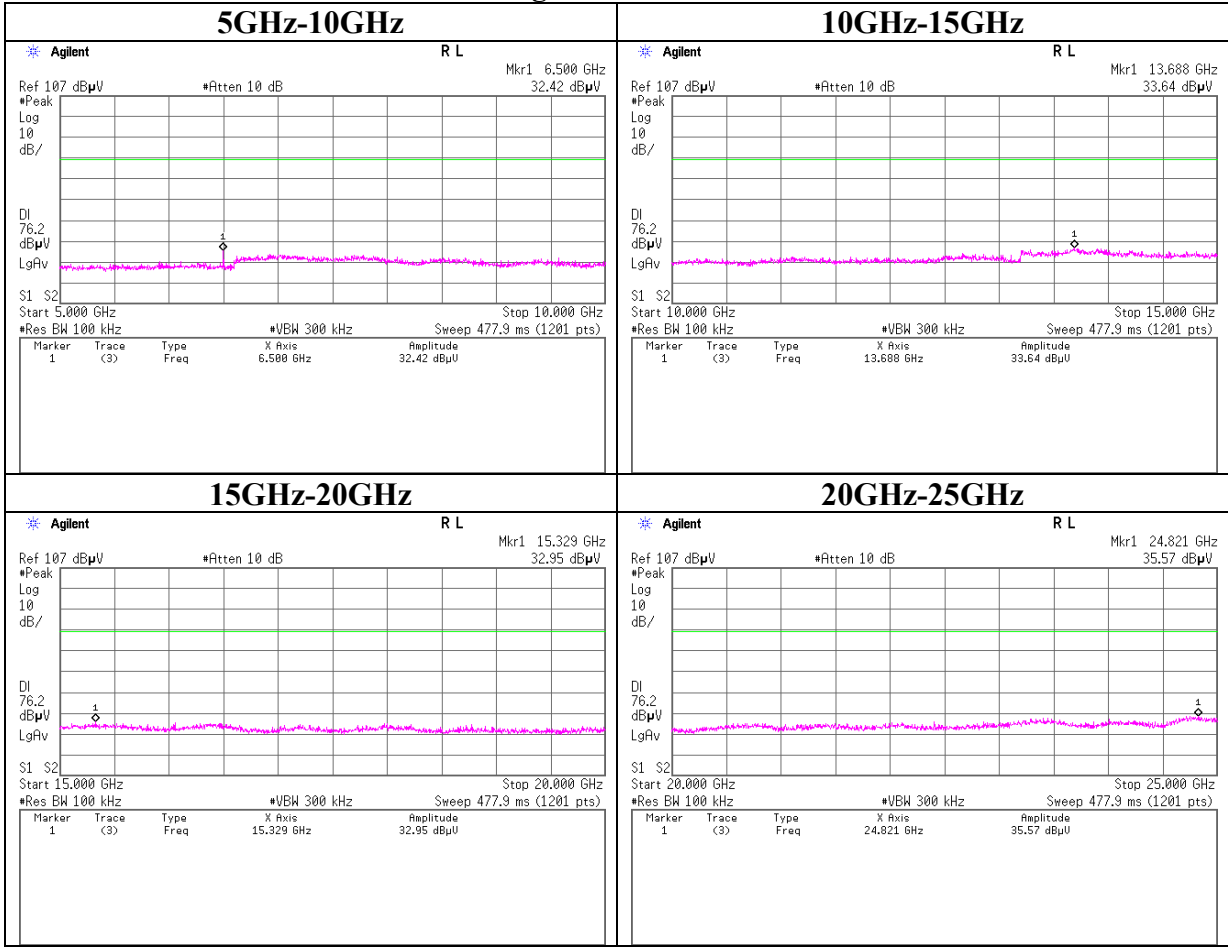
Conducted Spurious Emission

11g Tx 2437MHz



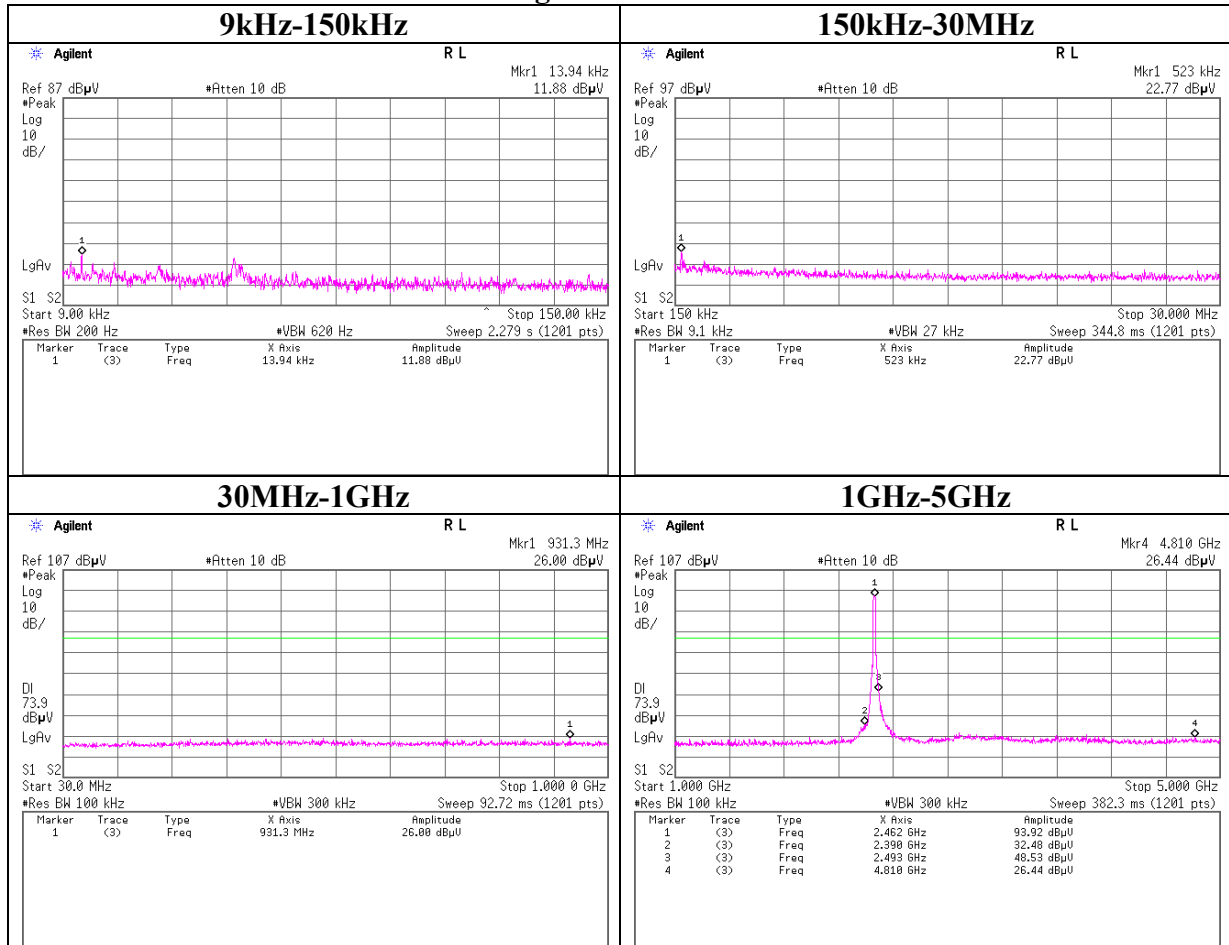
Conducted Spurious Emission

11g Tx 2437MHz



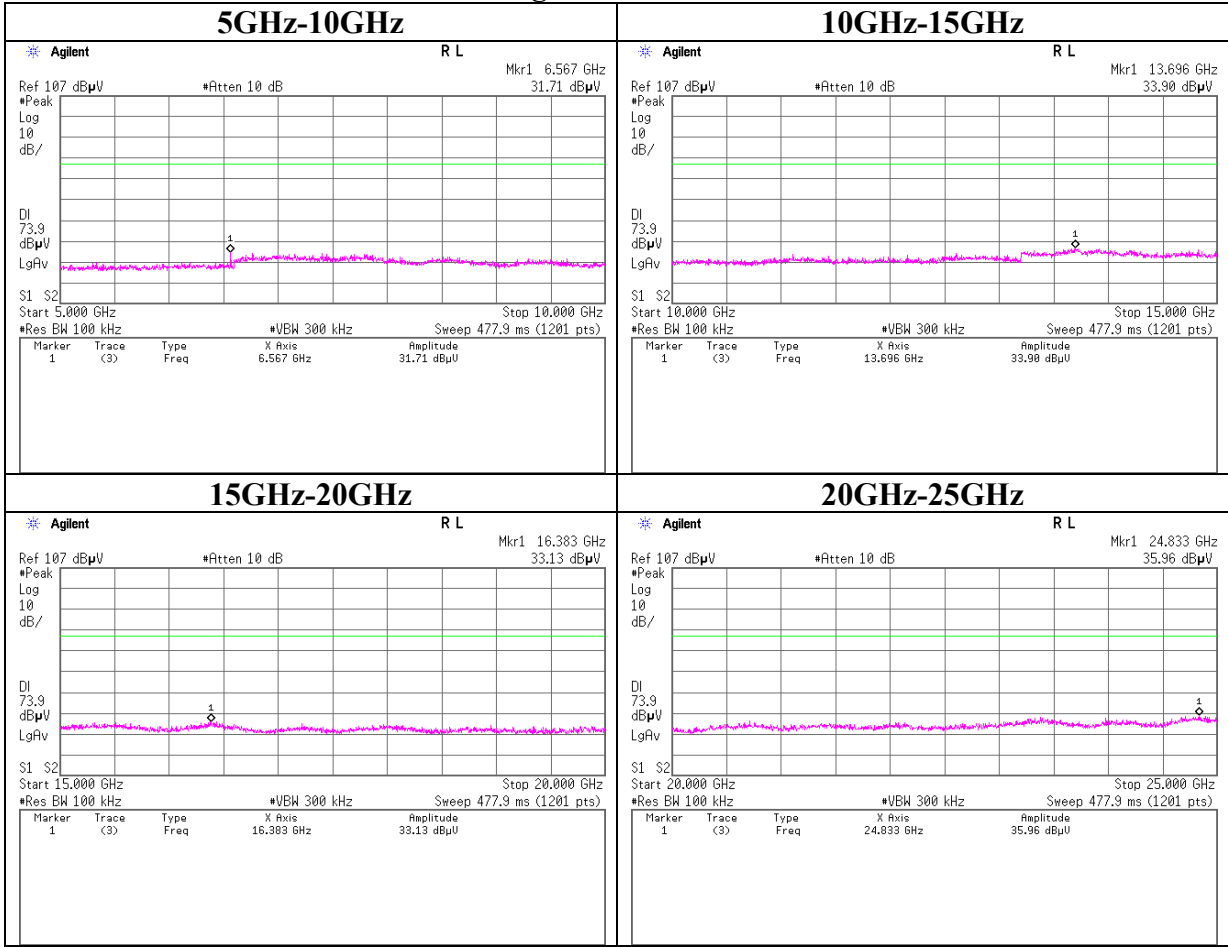
## Conducted Spurious Emission

11g Tx 2462MHz



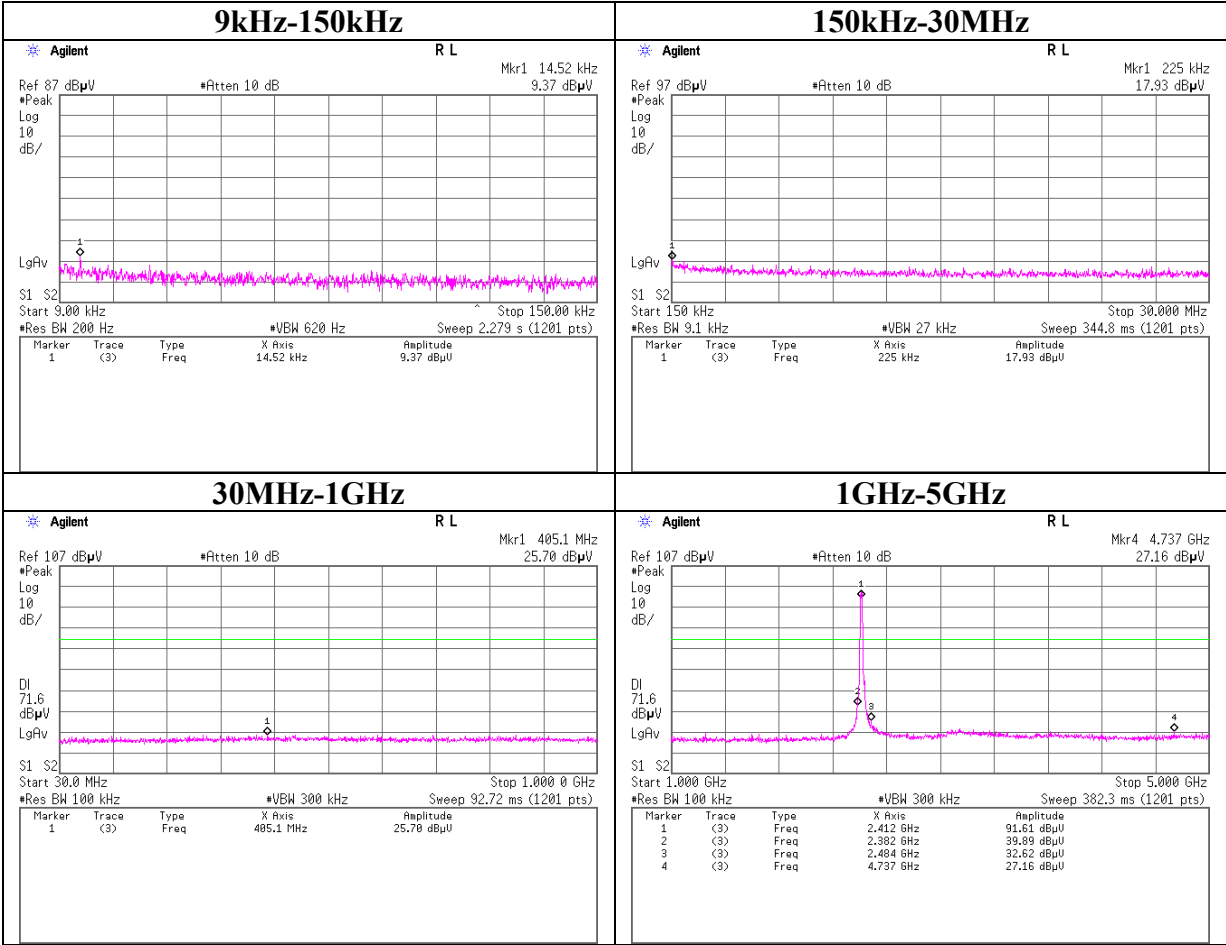
Conducted Spurious Emission

11g Tx 2462MHz



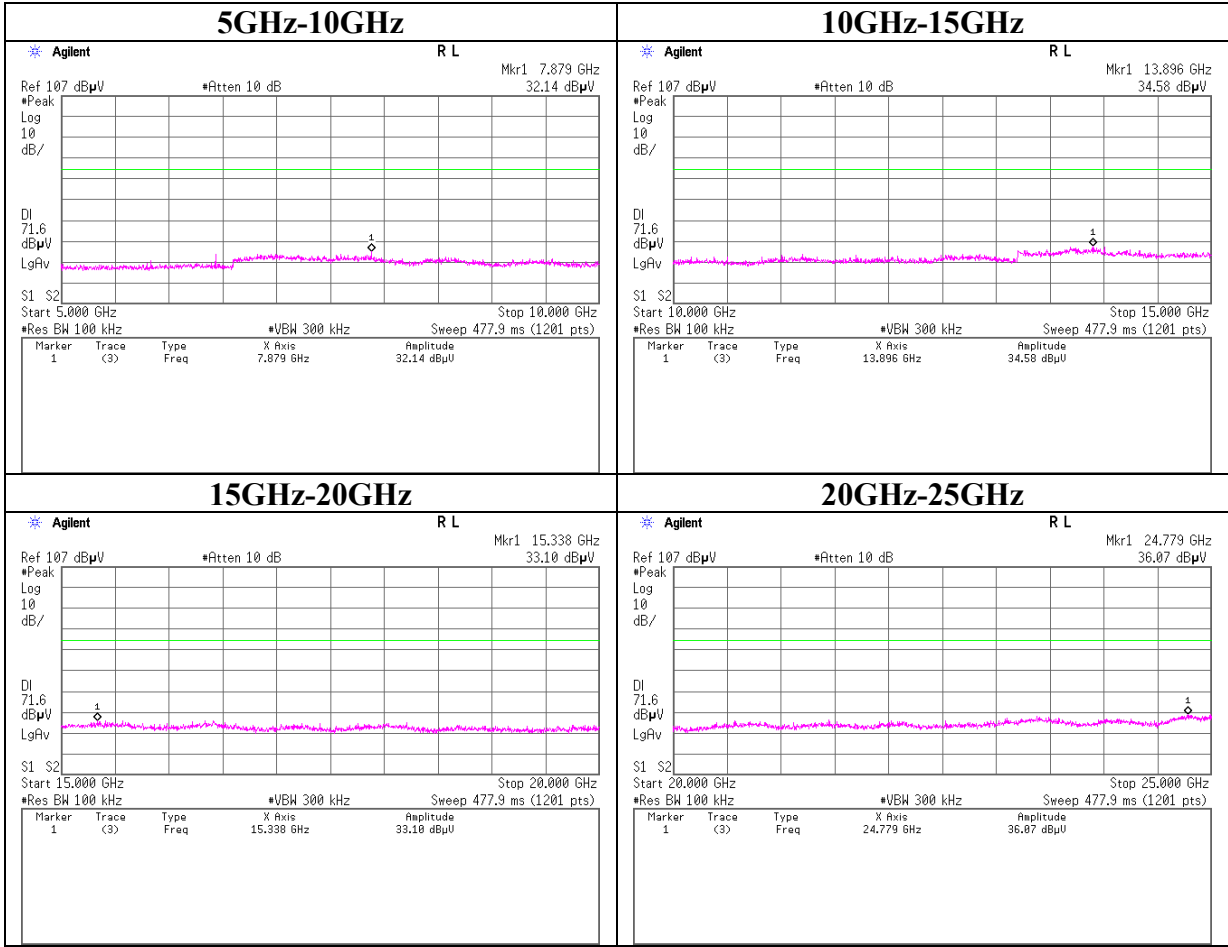
Conducted Spurious Emission

11n-20 Tx 2412MHz



Conducted Spurious Emission

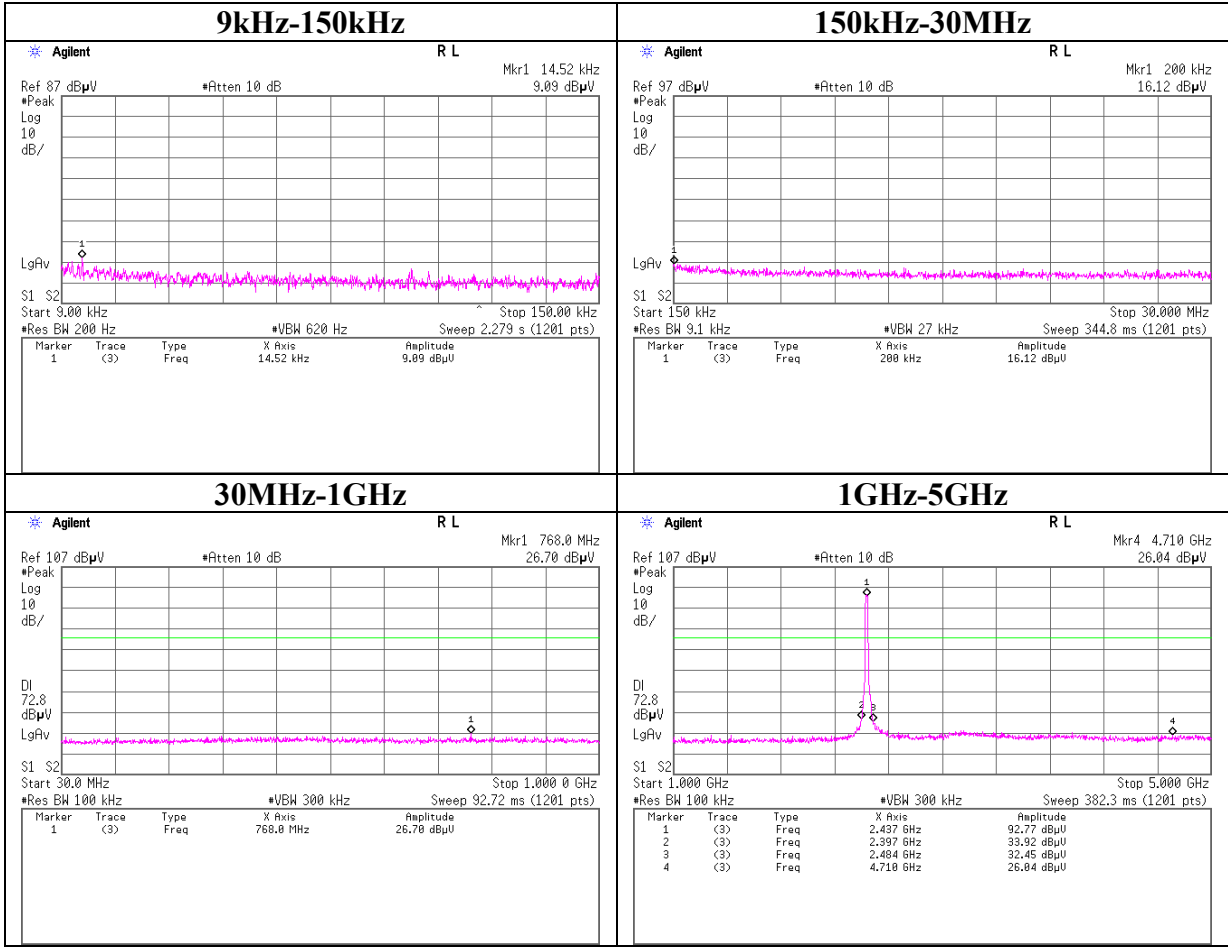
11n-20 Tx 2412MHz





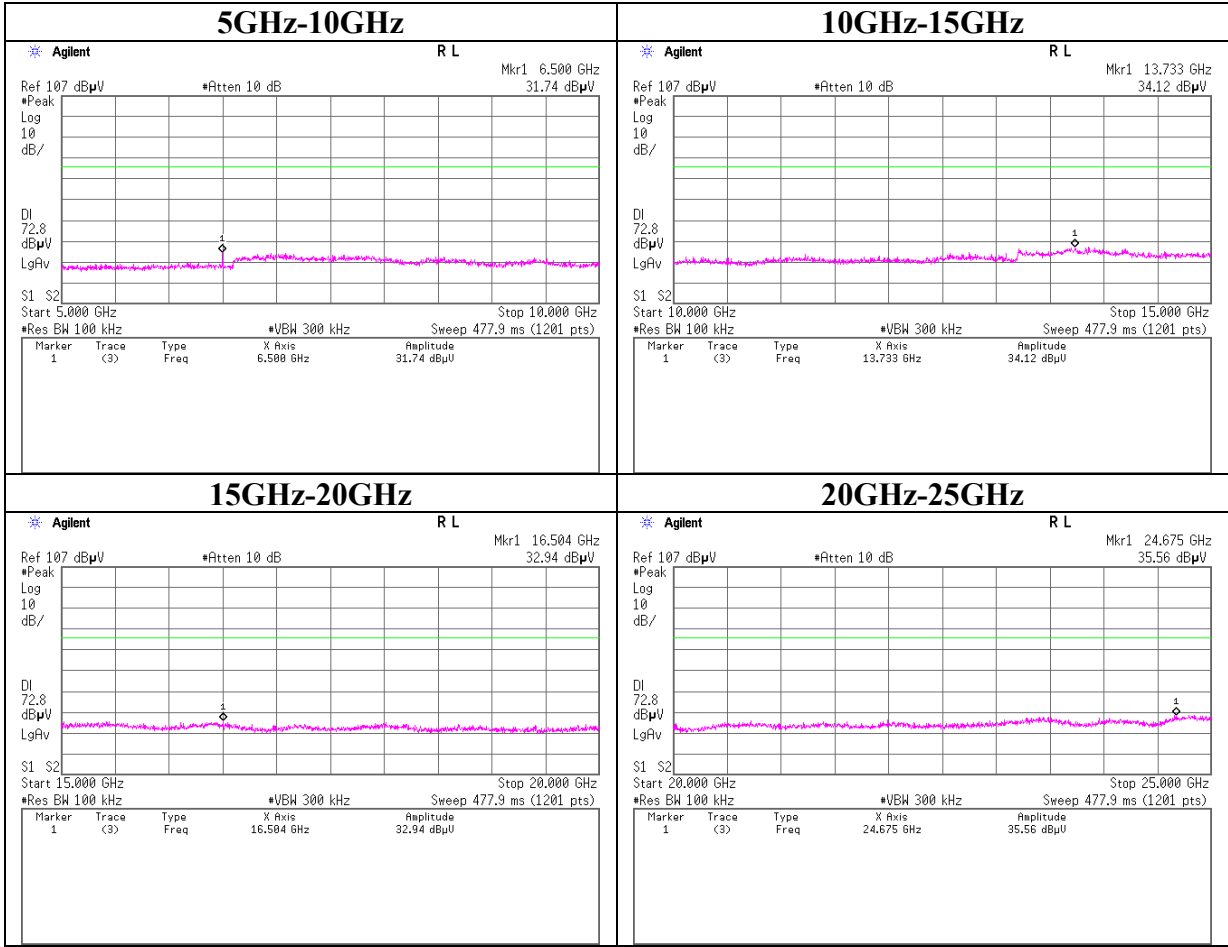
Conducted Spurious Emission

11n-20 Tx 2437MHz



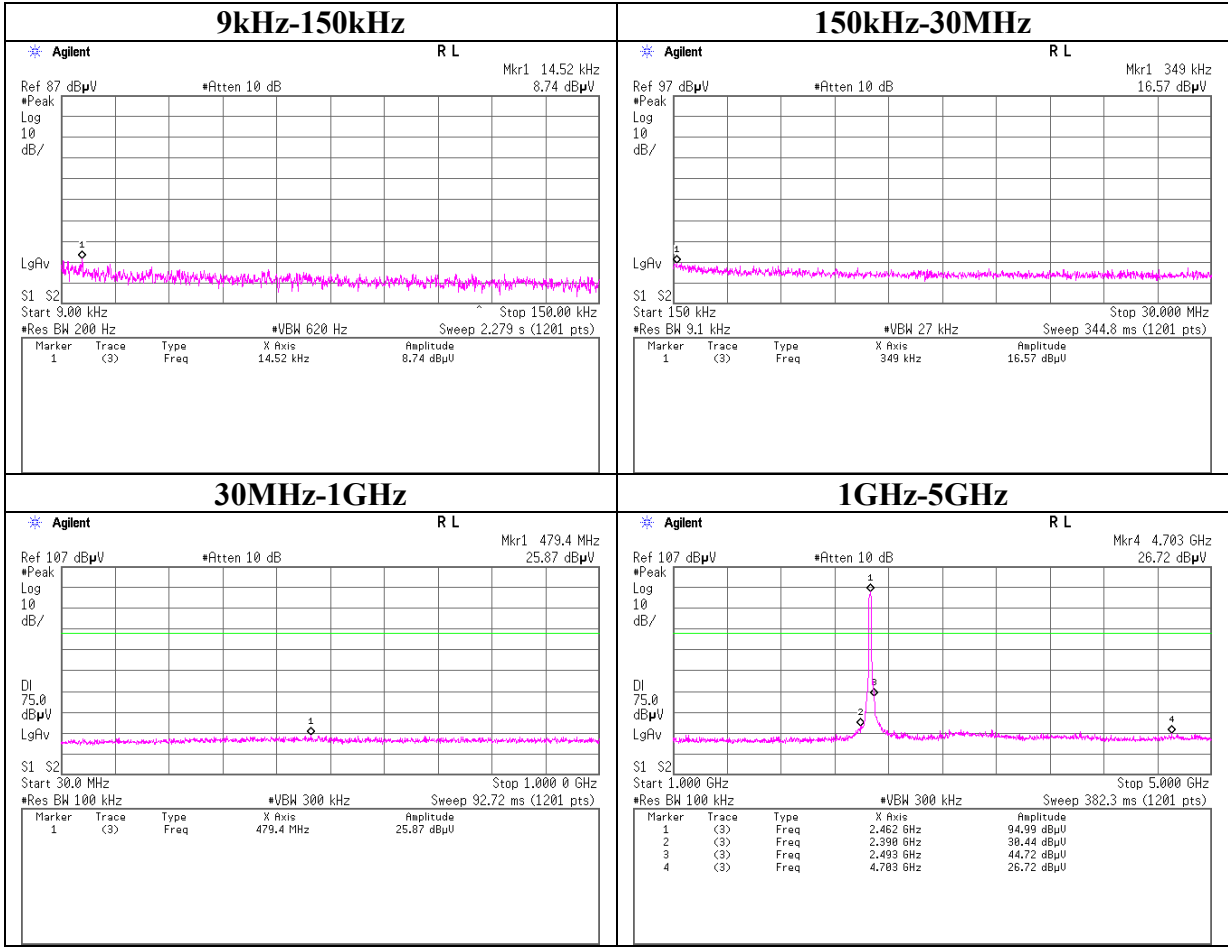
Conducted Spurious Emission

11n-20 Tx 2437MHz



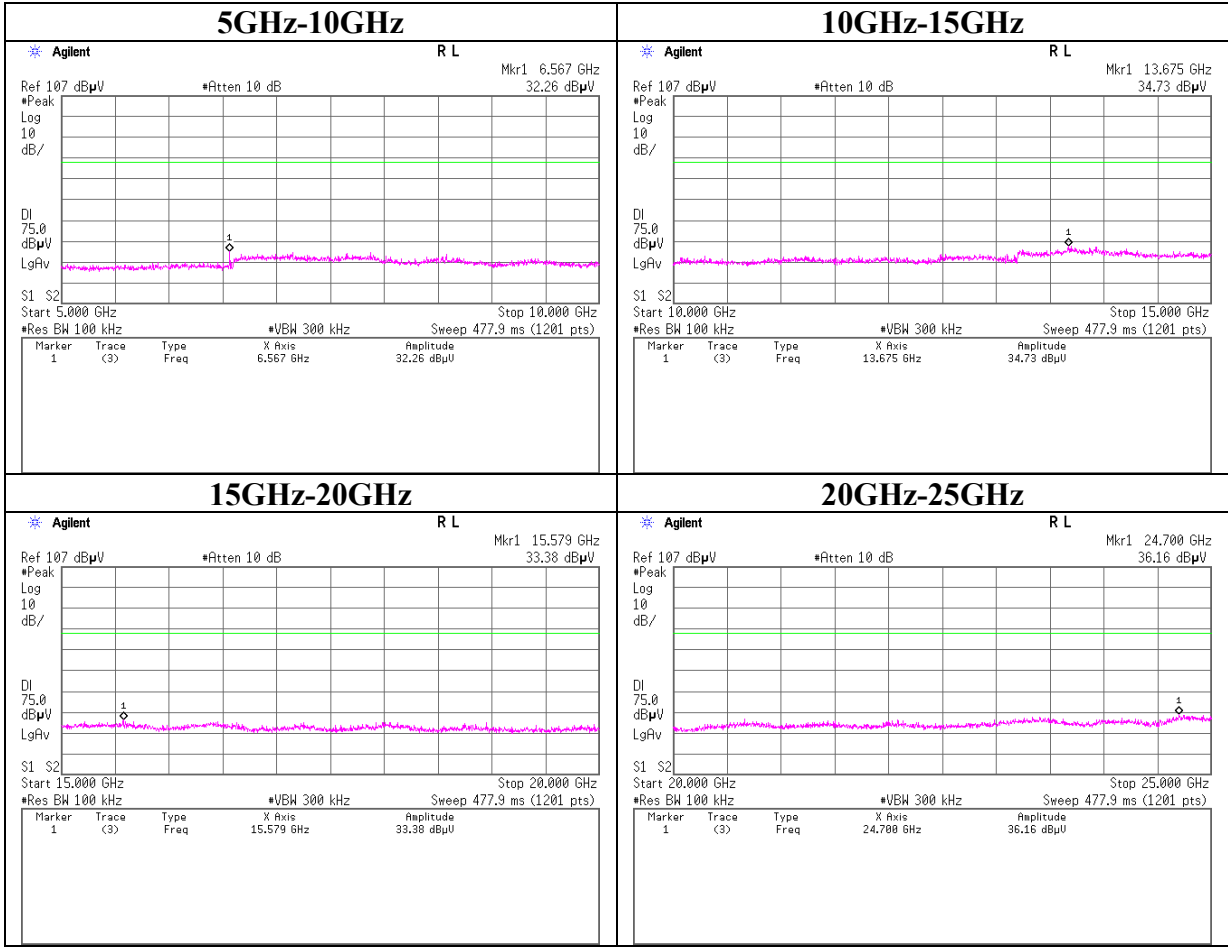
Conducted Spurious Emission

11n-20 Tx 2462MHz



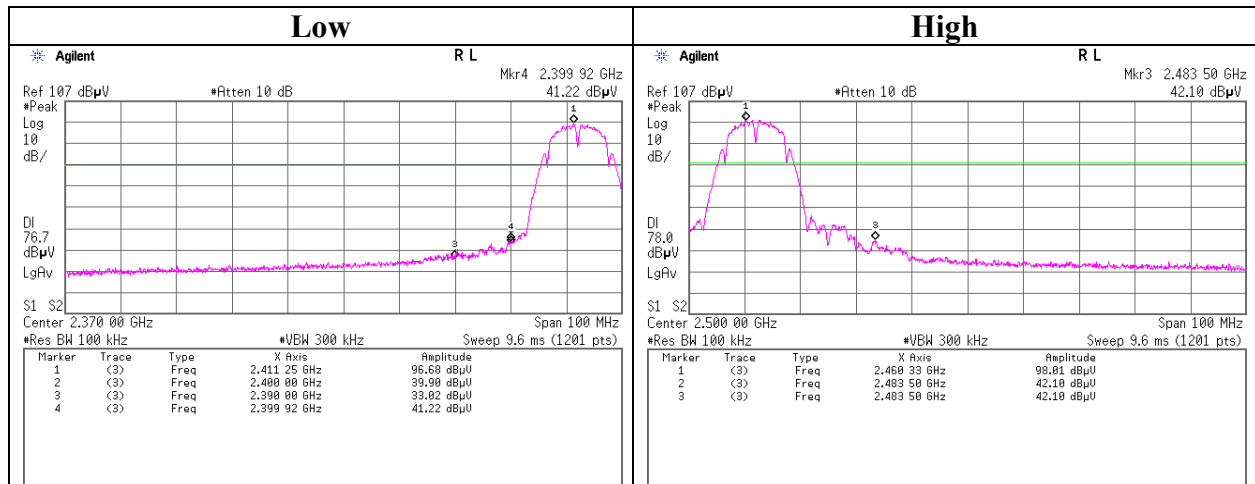
Conducted Spurious Emission

11n-20 Tx 2462MHz

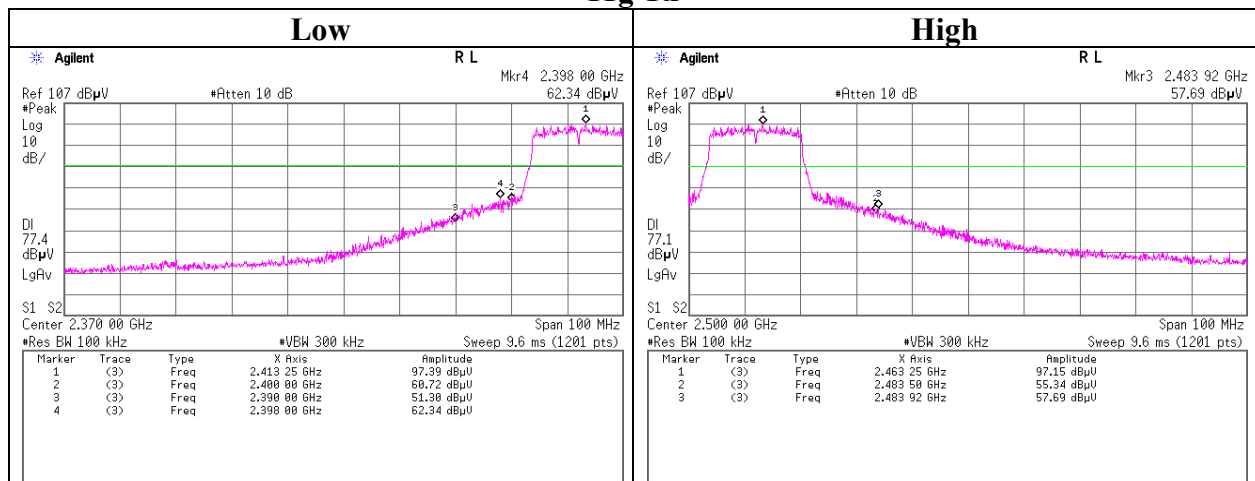


## Conducted Emission Band Edge compliance

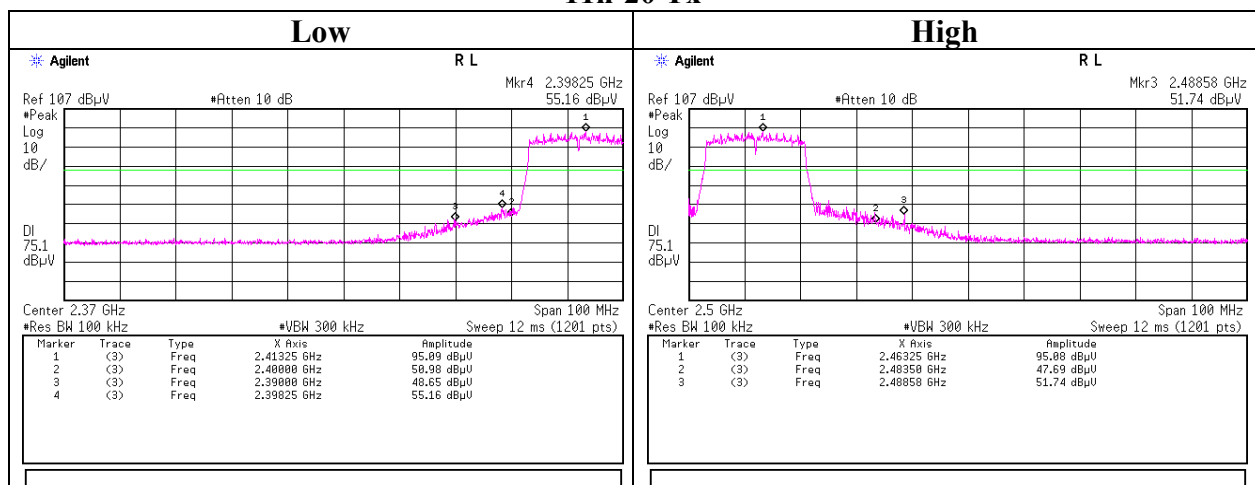
### 11b Tx



### 11g Tx



### 11n-20 Tx



### **Power Density**

Test place                      Head Office EMC Lab. No.7 Shielded Room  
Report No.                     33AE0098-HO-01  
Date                             09/19/2012  
Temperature/ Humidity      20 deg.C / 48% RH  
Engineer                      Tomohisa Nakagawa  
Mode                            11b Tx, 11g Tx

11b      Antenna

| Freq.   | Reading | Cable<br>Loss | Atten. | Result | Limit | Margin |
|---------|---------|---------------|--------|--------|-------|--------|
| [MHz]   | [dBm]   | [dB]          | [dB]   | [dBm]  | [dBm] | [dB]   |
| 2412.00 | -13.86  | 0.88          | 10.00  | -2.98  | 8.00  | 10.98  |
| 2437.00 | -12.05  | 0.89          | 10.00  | -1.16  | 8.00  | 9.16   |
| 2462.00 | -12.04  | 0.89          | 10.00  | -1.15  | 8.00  | 9.15   |

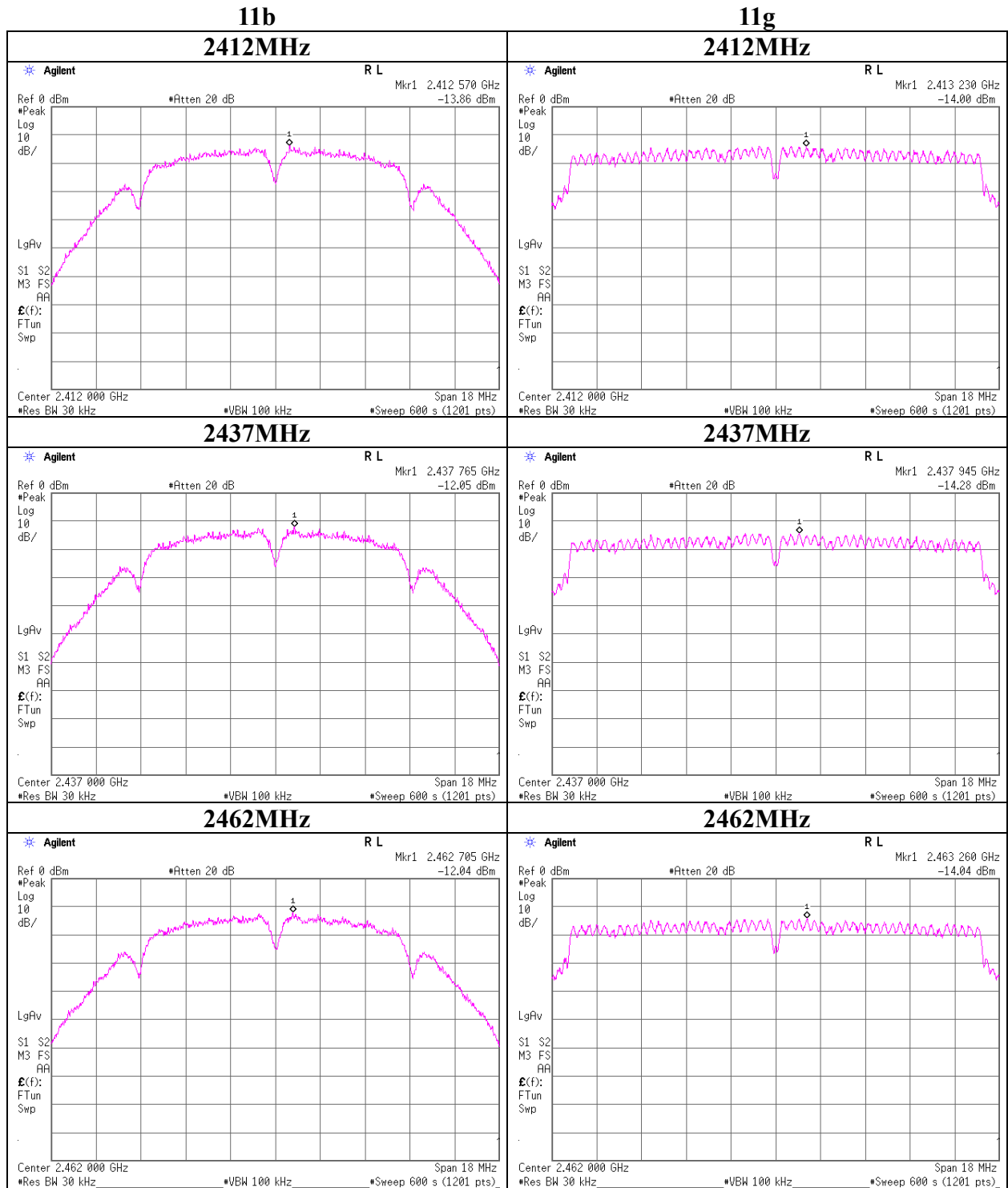
11g      Antenna

| Freq.   | Reading | Cable<br>Loss | Atten. | Result | Limit | Margin |
|---------|---------|---------------|--------|--------|-------|--------|
| [MHz]   | [dBm]   | [dB]          | [dB]   | [dBm]  | [dBm] | [dB]   |
| 2412.00 | -14.00  | 0.88          | 10.00  | -3.12  | 8.00  | 11.12  |
| 2437.00 | -14.28  | 0.89          | 10.00  | -3.39  | 8.00  | 11.39  |
| 2462.00 | -14.04  | 0.89          | 10.00  | -3.15  | 8.00  | 11.15  |

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

## Power Density



### **Power Density**

Test place                      Head Office EMC Lab. No.7 Shielded Room  
Report No.                     33AE0098-HO-01  
Date                            09/19/2012  
Temperature/ Humidity      21 deg.C / 46% RH  
Engineer                      Tomohisa Nakagawa  
Mode                            11n-20 Tx

#### Antenna

| Freq.<br>[MHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>[dB] | Result |      | Limit<br>[dBm] | Margin<br>[dB] |
|----------------|------------------|-----------------------|----------------|--------|------|----------------|----------------|
|                |                  |                       |                | [dBm]  | [mW] |                |                |
| 2412.00        | -15.91           | 0.88                  | 10.00          | -5.03  | 0.31 | 8.00           | 13.03          |
| 2437.00        | -16.08           | 0.89                  | 10.00          | -5.19  | 0.30 | 8.00           | 13.19          |
| 2462.00        | -16.19           | 0.89                  | 10.00          | -5.30  | 0.30 | 8.00           | 13.30          |

Sample Calculation:

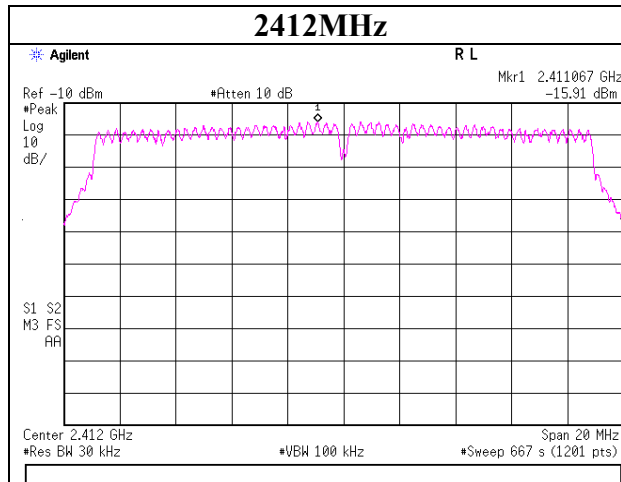
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator



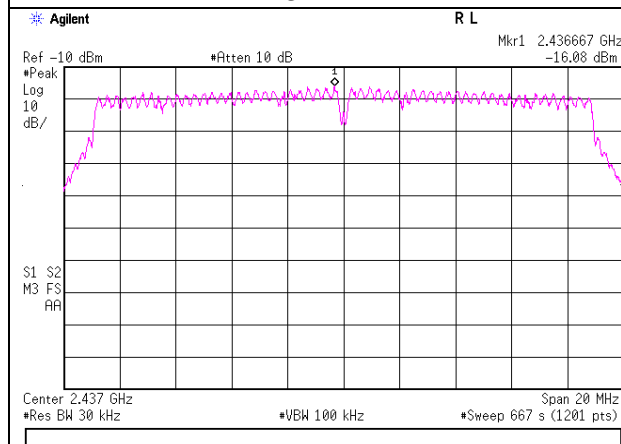
## Power Density

### 11n-20 Antenna

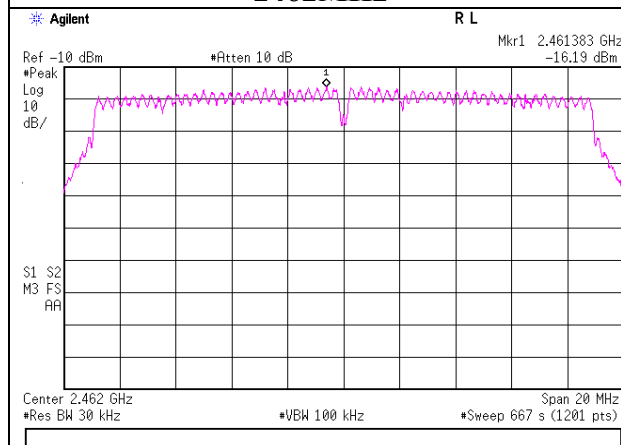
#### 2412MHz



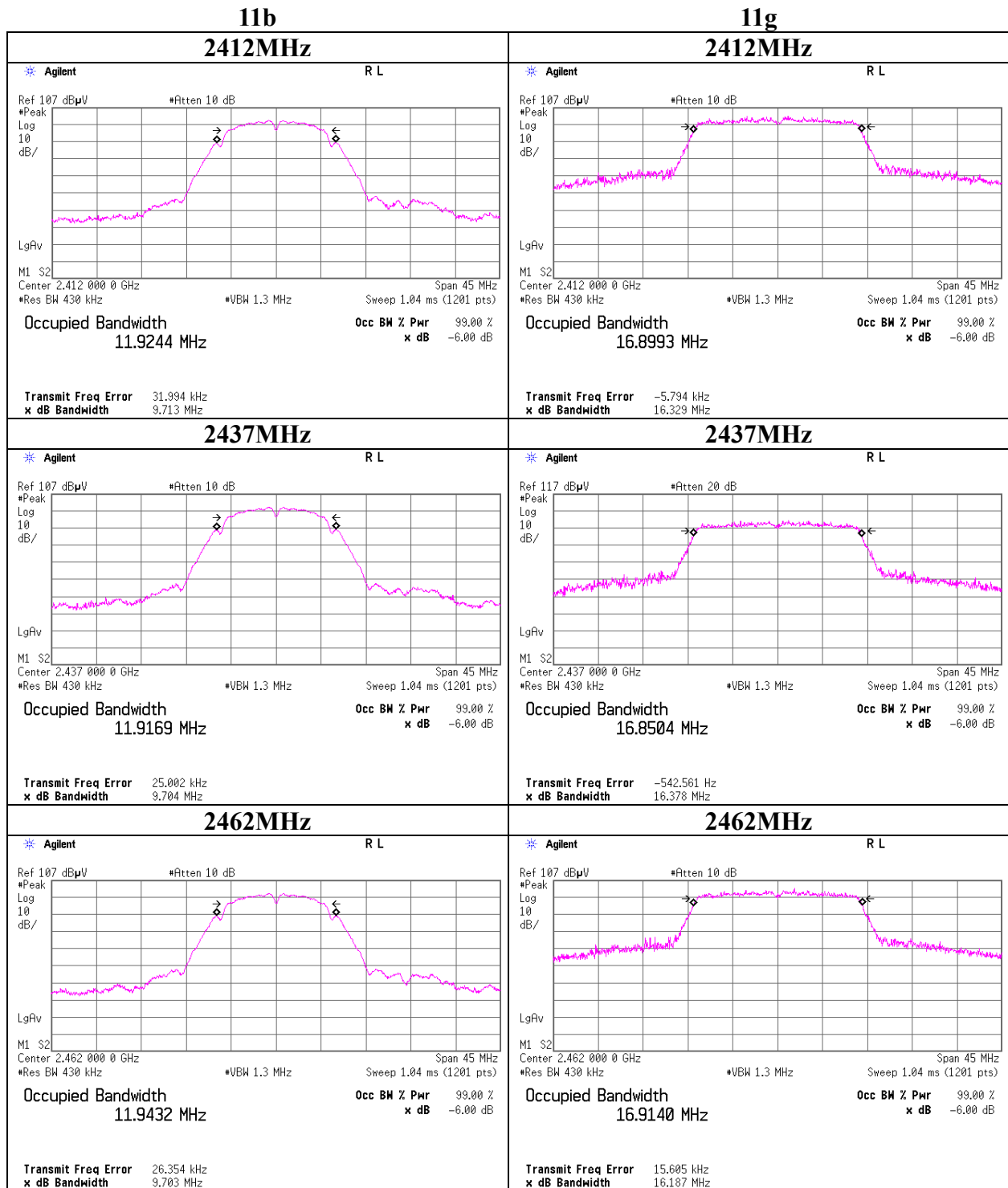
#### 2437MHz



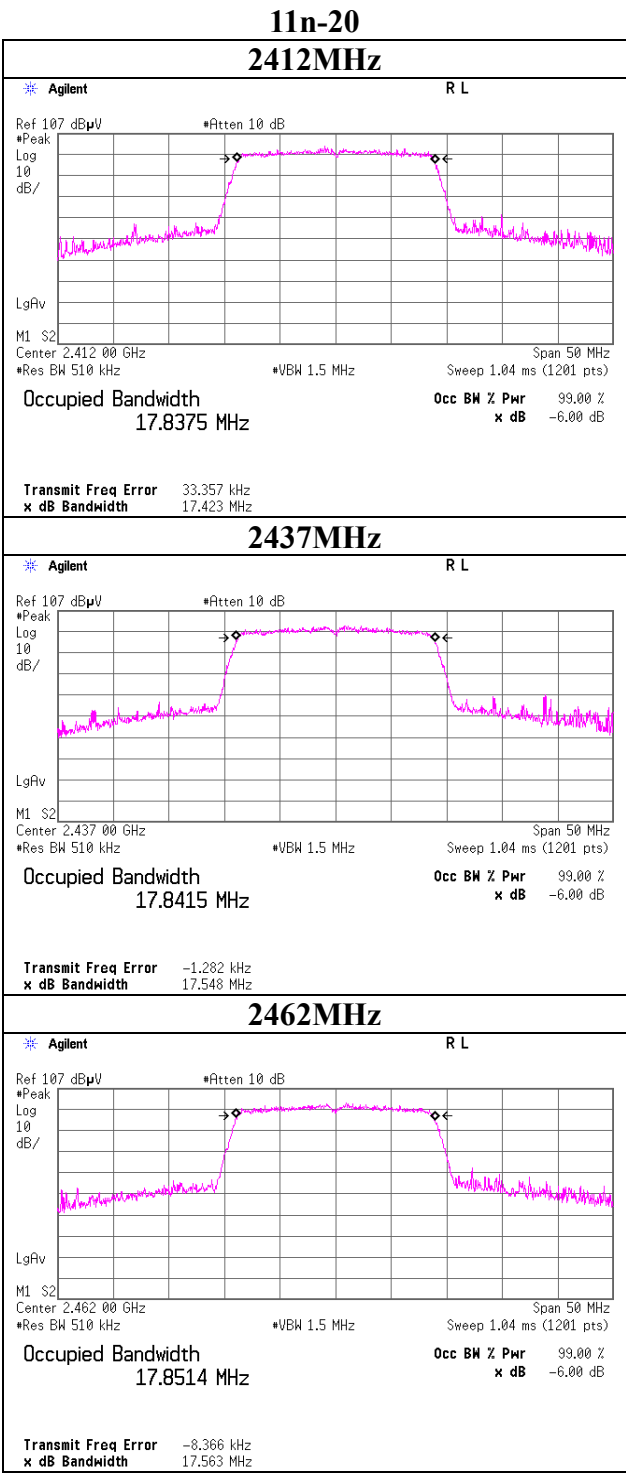
#### 2462MHz



### 99%Occupied Bandwidth



99% Occupied Bandwidth



## APPENDIX 2: Test instruments

### EMI test equipment

| Control No. | Instrument                 | Manufacturer         | Model No                                                                | Serial No                   | Test Item | Calibration Date *<br>Interval(month) |
|-------------|----------------------------|----------------------|-------------------------------------------------------------------------|-----------------------------|-----------|---------------------------------------|
| MOS-04      | Digital Humidity Indicator | N.T                  | NT-1800                                                                 | MOS04                       | AT        | 2012/02/06 * 12                       |
| MSA-10      | Spectrum Analyzer          | Agilent              | E4448A                                                                  | MY46180655                  | AT        | 2012/02/03 * 12                       |
| MPM-12      | Power Meter                | Anritsu              | ML2495A                                                                 | 0825002                     | AT        | 2012/06/01 * 12                       |
| MPSE-17     | Power sensor               | Anritsu              | MA2411B                                                                 | 0738285                     | AT        | 2012/06/01 * 12                       |
| MCC-144     | Microwave Cable            | Junkosha             | MWX221                                                                  | 1207S407                    | AT        | 2012/08/03 * 12                       |
| MAT-22      | Attenuator(10dB) 1-18GHz   | Orient Microwave     | BX10-0476-00                                                            | -                           | AT        | 2012/03/27 * 12                       |
| MCC-96      | Microwave Cable 1G-40GHz   | Schner               | SUCOFLEX102                                                             | 30817/2                     | AT        | 2012/05/09 * 12                       |
| MSA-06      | Spectrum Analyzer          | Agilent              | E4407B                                                                  | MY45107638                  | AT        | 2012/04/04 * 12                       |
| MAEC-04     | Semi Anechoic Chamber(NSA) | TDK                  | Semi Anechoic Chamber 3m                                                | DA-10005                    | RE/CE     | 2012/02/29 * 12                       |
| MOS-15      | Thermo-Hygrometer          | Custom               | CTH-180                                                                 | -                           | RE/CE     | 2012/02/06 * 12                       |
| MJM-07      | Measure                    | PROMART              | SEN1955                                                                 | -                           | RE/CE     | -                                     |
| COTS-MEMI   | EMI measurement program    | TSJ                  | TEPTO-DV                                                                | -                           | RE/CE     | -                                     |
| MSA-04      | Spectrum Analyzer          | Agilent              | E4448A                                                                  | US44300523                  | RE/CE     | 2012/04/06 * 12                       |
| MHA-21      | Horn Antenna 1-18GHz       | Schwarzbeck          | BBHA9120D                                                               | 9120D-557                   | RE        | 2012/08/17 * 12                       |
| MCC-141     | Microwave Cable            | Junkosha             | MWX221                                                                  | 1203S212(1m) / 1204S062(5m) | RE        | 2012/04/23 * 12                       |
| MPA-12      | MicroWave System Amplifier | Agilent              | 83017A                                                                  | MY39500780                  | RE        | 2012/03/28 * 12                       |
| MHF-06      | High Pass Filter 3.5-24GHz | TOKIMEC              | TF323DCA                                                                | 601                         | RE        | 2012/05/30 * 12                       |
| MTR-07      | Test Receiver              | Rohde & Schwarz      | ESCI                                                                    | 100635                      | RE/CE     | 2012/04/05 * 12                       |
| MBA-05      | Biconical Antenna          | Schwarzbeck          | BBA9106                                                                 | 1302                        | RE        | 2011/11/16 * 12                       |
| MLA-08      | Logperiodic Antenna        | Schwarzbeck          | UKLP9140-A                                                              | N/A                         | RE        | 2011/11/16 * 12                       |
| MCC-50      | Coaxial Cable              | UL Japan             | -                                                                       | -                           | RE        | 2012/06/01 * 12                       |
| AT-38       | Attenuator                 | Anritsu              | MP721B                                                                  | 6200961025                  | RE        | 2011/12/08 * 12                       |
| MPA-14      | Pre Amplifier              | SONOMA INSTRUMENT    | 310                                                                     | 260833                      | RE        | 2012/03/05 * 12                       |
| MHA-17      | Horn Antenna 15-40GHz      | Schwarzbeck          | BBHA9170                                                                | BBHA9170307                 | RE        | 2012/06/27 * 12                       |
| MSA-05      | Spectrum Analyzer          | Advantest            | R3273                                                                   | 160400285                   | CE        | 2011/11/23 * 12                       |
| MLS-06      | LISN(AMN)                  | Schwarzbeck          | NSLK8127                                                                | 8127363                     | CE(EUT)   | 2012/02/06 * 12                       |
| MAT-67      | Attenuator(13dB)           | JFW Industries, Inc. | 50FP-013H2 N                                                            | -                           | CE        | 2012/01/28 * 12                       |
| MCC-113     | Coaxial cable              | Fujikura/Suhner/TSJ  | 5D-2W(10m)/SFM141(5m)/421-010(1m)/sucoform141-PE(1m)/RFM-E121(Switcher) | -/04178                     | CE        | 2012/07/12 * 12                       |

The expiration date of the calibration is the end of the expired month.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

Test Item: CE: Conducted Emission

RE: Radiated Emission

AT: Antenna Terminal Conducted test

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