# RADIO TEST REPORT

## Test Report No. : 10607274H-A-R1

| | | |
|---|---|---|
| **Applicant** | : | **MITSUBISHI ELECTRIC CORPORATION SANDA WORKS** |
| **Type of Equipment** | : | **HEADUNIT A-HIGH** |
| **Model No.** | : | **NR-213** |
| **FCC ID** | : | **UJHNR213** |
| **Test regulation** | : | **FCC Part 15 Subpart C: 2015 (WLAN Part)** |
| **Test Result** | : | **Complied** |

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4. The test results in this report are traceable to the national or international standards.
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6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. This report is a revised version of 10607274H-A. 10607274H-A is replaced with this report.

**Date of test:** February 27 to June 24, 2015

**Representative test engineer:**

Tsubasa Takayama
Engineer
Consumer Technology Division

**Approved by:**

Takahiro Hatakeda
Leader
Consumer Technology Division

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# REVISION HISTORY

## Original Test Report No.: 10607274H-A

| Revision | Test report No. | Date | Page revised | Contents |
|---|---|---|---|---|
| - (Original) | 10607274H-A | June 26, 2015 | - | - |
| 1 | 10607274H-A-R1 | July 7, 2015 | P9 | Addition of explanatory note for Radiated Spurious Emission (Co location transmitting) of Operating Mode table |

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## SECTION 1: Customer information

| | | |
|---|---|---|
| Company Name | : | MITSUBISHI ELECTRIC CORPORATION SANDA WORKS |
| Address | : | 2-3-33, Miwa, Sanda-city, Hyogo, 669-1513, Japan |
| Telephone Number | : | +81-79-559-3607 |
| Facsimile Number | : | +81-79-559-3875 |
| Contact Person | : | Yuji Funaba |

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

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

| | | |
|---|---|---|
| Type of Equipment | : | HEADUNIT A-HIGH |
| Model No. | : | NR-213 |
| Serial No. | : | Refer to Clause 4.2 |
| Rating | : | DC 12 V |
| Receipt Date of Sample | : | February 26, 2015 |
| Country of Mass-production | : | Japan |
| Condition of EUT | : | Production prototype<br>(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 : 1.4 GHz,
40 MHz (Radio part)

**Radio Specification**

| | IEEE802.11b | IEEE802.11g/n (20 M band) | IEEE802.11a/n (20 M band) | IEEE802.11n (40 M band) | Bluetooth Ver.3.0 with EDR function |
|---|---|---|---|---|---|
| Frequency of operation | 2412-2462MHz *1) | 2412-2462MHz *1) | 5180-5240MHz<br>5260-5320MHz<br>5500-5700MHz<br>5745-5825MHz | 5190-5230MHz<br>5270-5310MHz<br>5510-5670MHz<br>5755-5795MHz | 2402-2480MHz |
| Type of modulation | DSSS (CCK, DQPSK, DBPSK) | OFDM-CCK (64QAM, 16QAM, QPSK, BPSK) | OFDM (64QAM, 16QAM, QPSK, BPSK) | | FHSS (GFSK, π/4-DQPSK, 8-DPSK) |
| Channel spacing | 5MHz | | 20MHz | 40MHz | 1MHz |
| Antenna type | Printed patch Antenna | | | | Dipole Pattern Antenna |
| Antenna Gain | 3.3dBi | | 6.5dBi | | 2.32dBi |
| Antenna Connector type | FAKRA | | | | PSE-LP2 |

*1) This test report applies for WLAN (IEEE802.11b/g/n-20 [2412-2462MHz]).

| | GPS/GLONASS |
|---|---|
| Frequency of operation | GPS: 1575.42MHz<br>GLONASS: 1597.55-1605.89MHz |
| Type of modulation | GPS: BPSK<br>GLONASS: BPSK |
| Channel spacing | GLONASS: 0.5625MHz |
| Antenna type | Active antenna |
| Antenna Connector type | FAKRA |
| Antenna Gain | 25dBi |

# SECTION 3: Test specification, procedures & results

## 3.1 Test Specification

| | | |
|---|---|---|
| Test Specification | : | FCC Part 15 Subpart C: 2015, final revised on January 21, 2015 |
| Title | : | FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators<br>Section 15.207 Conducted limits<br>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 C63.4-2009<br>7. AC powerline Conducted Emission measurements<br>**IC:** RSS-Gen 8.8 | **FCC:** Section 15.207<br>**IC:** RSS-Gen 8.8 | N/A | N/A<br>*1) | - |
| 6dB Bandwidth | **FCC:** KDB 558074 D01 DTS Meas Guidance v03r03<br>**IC:** - | **FCC:** Section 15.247(a)(2)<br>**IC:** RSS-247 5.2(1) | See data. | Complied | Conducted |
| Maximum Peak Output Power | **FCC:** KDB 558074 D01 DTS Meas Guidance v03r03<br>**IC:** RSS-Gen 6.12 | **FCC:** Section 15.247(b)(3)<br>**IC:** RSS-247 5.4(4) | | Complied | Conducted |
| Power Density | **FCC:** KDB 558074 D01 DTS Meas Guidance v03r03<br>**IC:** - | **FCC:** Section 15.247(e)<br>**IC:** RSS-247 5.2(2) | | Complied | Conducted |
| Spurious Emission Restricted Band Edges | **FCC:** KDB 558074 D01 DTS Meas Guidance v03r03<br>**IC:** RSS-Gen 6.13 | **FCC:** Section15.247(d)<br>**IC:** RSS-247 5.5<br>RSS-Gen 8.9<br>RSS-Gen 8.10 | 1.6dB<br>1838.017MHz, AV, Vertical<br>1837.880MHz, AV, Vertical | Complied | Conducted (below 30 MHz)/ Radiated (above 30 MHz)<br>*2) |

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.
*1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.
*2) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v03r03 12.2.7.

* In case any questions arise about test procedure, ANSI C63.4: 2009 is also referred.

**FCC 15.31 (e)**
The EUT provides stable voltage (DC 3.3 V) constantly to the wireless transmitter regardless of input voltage.
Instead of a new battery, DC power supply was used for the test.
That does not affect the test result, therefore the EUT complies with the requirement.

**FCC Part 15.203 Antenna requirement**
It is impossible for end users to replace the antenna, because the antenna is mounted inside of the vehicle. Therefore, the equipment complies with the antenna requirement of Section 15.203.

## 3.3 Addition to standard

| Item | Test Procedure | Specification | Worst margin | Results | Remarks |
|---|---|---|---|---|---|
| 99% Occupied Bandwidth | **IC:** RSS-Gen 6.6 | **IC:** - | N/A | - | Conducted |
| Co-location & Co-operation (Confirmation testing for Radiated Spurious Emission at simultaneous transmission) | **FCC:** KDB 558074 D01 DTS Meas Guidance v03r03 | **FCC:** Section15.247(d) | 6.5 dB 1844.828 MHz, Vertical, AV | Complied | Radiated |
| | **IC:** RSS-Gen 6.13 | **IC:** RSS-247 5.5 | | | |

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** (semi-anechoic chamber) | **Radiated emission** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **(3m*)(±dB)** | | | | **(1m*)(±dB)** | | **(0.5m*)(±dB)** |
| | 9kHz -30MHz | 30MHz -300MHz | 300MHz -1GHz | 1GHz -10GHz | 10GHz -18GHz | 18GHz -26.5GHz | 26.5GHz -40GHz |
| No.1 | 4.3dB | 5.5dB | 6.3dB | 5.5dB | 5.8dB | 5.8dB | 4.3dB |
| No.2 | 4.2dB | 5.4dB | 6.3dB | 5.4dB | 5.7dB | 5.9dB | 5.6dB |
| No.3 | 4.4dB | 5.4dB | 6.4dB | 5.2dB | 5.5dB | 5.8dB | 5.5dB |
| No.4 | 4.7dB | 5.6dB | 6.4dB | 5.3dB | 5.7dB | 5.9dB | 5.5dB |

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

| **Power meter (±dB)** | |
|---|---|
| Below 1GHz | Above 1GHz |
| 0.7dB | 1.5dB |

| **Antenna terminal conducted emission and Power density (±dB)** | | | **Antenna terminal conducted emission (±dB)** | | **Channel power (±dB)** |
|---|---|---|---|---|---|
| Below 1GHz | 1GHz-3GHz | 3GHz-18GHz | 18GHz-26.5GHz | 26.5GHz-40GHz | |
| 1.5dB | 1.7dB | 2.8dB | 2.8dB | 2.9dB | 2.6dB |

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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| | IC Registration Number | Width x Depth x Height (m) | Size of reference ground plane (m) / horizontal conducting plane | Other rooms |
|---|---|---|---|---|
| No.1 semi-anechoic chamber | 2973C-1 | 19.2 x 11.2 x 7.7m | 7.0 x 6.0m | No.1 Power source room |
| No.2 semi-anechoic chamber | 2973C-2 | 7.5 x 5.8 x 5.2m | 4.0 x 4.0m | - |
| No.3 semi-anechoic chamber | 2973C-3 | 12.0 x 8.5 x 5.9m | 6.8 x 5.75m | No.3 Preparation room |
| No.3 shielded room | - | 4.0 x 6.0 x 2.7m | N/A | - |
| No.4 semi-anechoic chamber | 2973C-4 | 12.0 x 8.5 x 5.9m | 6.8 x 5.75m | No.4 Preparation room |
| No.4 shielded room | - | 4.0 x 6.0 x 2.7m | N/A | - |
| No.5 semi-anechoic chamber | - | 6.0 x 6.0 x 3.9m | 6.0 x 6.0m | - |
| No.6 shielded room | - | 4.0 x 4.5 x 2.7m | 4.0 x 4.5 m | - |
| No.6 measurement 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 room | - | 3.1 x 5.0 x 2.7m | N/A | - |
| No.9 measurement room | - | 8.0 x 4.6 x 2.8m | 2.4 x 2.4m | - |
| No.11 measurement room | - | 6.2 x 4.7 x 3.0m | 4.8 x 4.6m | - |

* 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.

| Mode | Remarks* |
|---|---|
| IEEE 802.11b (11b) | 5.5Mbps, PN9 |
| IEEE 802.11g (11g) | 18Mbps, PN9 |
| IEEE 802.11n 20MHz BW (11n-20) | MCS 0, 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 Setting: default<br>- Software: Engineering mode E45.2<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. | |

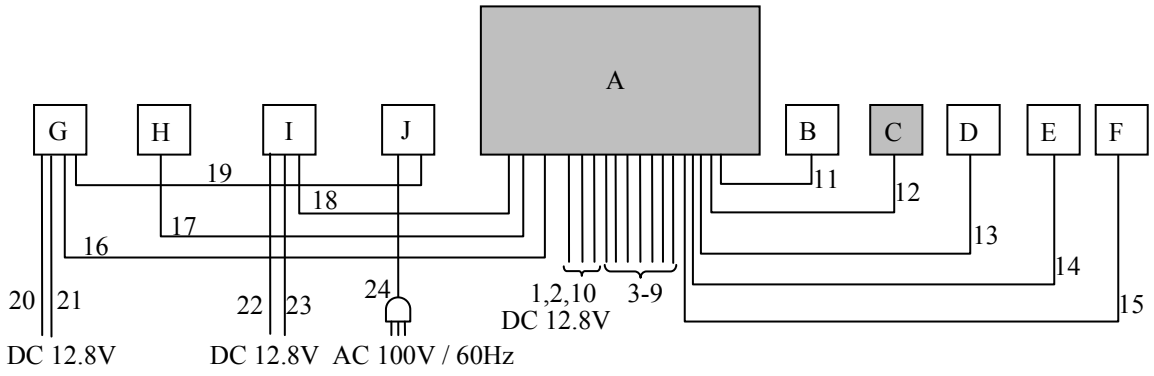
**<2.4GHz band>**
*The details of Operating mode(s)

| Test Item | Operating Mode | Tested frequency |
|---|---|---|
| Radiated Spurious Emission (Below 1GHz) | 11n-20 Tx *1) | 2412 MHz *1) |
| Radiated Spurious Emission (Above 1GHz) | 11b Tx<br>11n-20 Tx *2) | 2412 MHz<br>2437 MHz<br>2462 MHz |
| Conducted Spurious Emission | 11n-20 Tx *1) | 2412 MHz *1) |
| 6dB Bandwidth,<br>Maximum Peak Output Power,<br>Average Output Power,<br>Power Density,<br>99% Occupied Bandwidth | 11b Tx<br>11g Tx<br>11n-20 Tx | 2412 MHz<br>2437 MHz<br>2462 MHz |
| Radiated Spurious Emission (Co location transmitting) *3) | 11n-20 Tx + 11a Tx | 2412 MHz + 5180 MHz<br>2462 MHz + 5180 MHz |

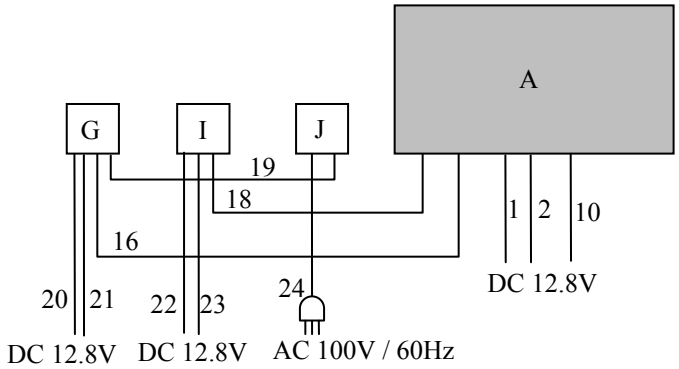
*1) The operating mode and tested frequency were tested as a representative, because it had the highest power at antenna terminal test.
*2) Since 11g and 11n-20 have the same modulation method and no differences in transmitting specification, test was performed on the representative mode that had the highest peak output power.
*3) The combination of 2.4 GHz band maximum power and 5 GHz band maximum power was tested in case using the same antenna. For another combination, refer 5 GHz band test report (10607274H-C-R1).

## 4.2 Configuration and peripherals

**[Radiated Spurious Emission test]**




**[Antenna Terminal Conducted tests]**




* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.
* The testing was performed with DC 12.8 V only.
The voltage which the car battery mounted in the car outputs was selected as a test voltage according to the customer's request.
As the stable voltage (DC 3.3 V) is provided to RF module via the internal regulator, it does not influence on the test result.

**Description of EUT and Support equipment**

| No. | Item | Model number | Serial number | Manufacturer | Remarks |
|---|---|---|---|---|---|
| A | HEADUNIT A-HIGH | NR-213 | No 3-2 for RE*<br>No 3-1 for AT* | MITSUBISHI ELECTRIC CORPORATION SANDA WORKS | EUT |
| B | BT Antenna | 050 978-A | 38113 | WiSi | - |
| C | WLAN Antenna | A2139058402 | 1234 00012 | WiSi | EUT |
| D | GPS Antenna | - | - | MITSUBISHI ELECTRIC CORPORATION SANDA WORKS | - |
| E | USB Memory | RFU-2 | 120301 | BUFFALO | - |
| F | Dummy Load | - | - | MITSUBISHI ELECTRIC CORPORATION SANDA WORKS | - |
| G | HSVL PCB | NTG 5.5 H0H | 489 | MITSUBISHI ELECTRIC CORPORATION SANDA WORKS | - |
| H | HSVL PCB | NTG 5.5 H0H | 487 | MITSUBISHI ELECTRIC CORPORATION SANDA WORKS | - |
| I | Controller | A 166 900 10 10 | 63358850202 | Mercedes-Benz | - |
| J | LCD Monitor | EW2730-B | ETNAB07468SL0 | BenQ | - |

* RE: Radiated Spurious Emission test / AT: Antenna Terminal Conducted tests

**List of cables used**

| No. | Name | Length (m) | Shield | | Remarks |
|---|---|---|---|---|---|
| | | | Cable | Connector | |
| 1 | DC Cable (+) | 2.0 | Unshielded | Unshielded | - |
| 2 | DC Cable (-) | 2.0 | Unshielded | Unshielded | - |
| 3 | Dummy Cable (Aux) | 1.0 | Shielded | Shielded | - |
| 4 | Dummy Cable (RUG) | 1.0 | Shielded | Shielded | - |
| 5 | Dummy Cable (Tune 1) | 1.0 | Shielded | Shielded | - |
| 6 | Dummy Cable (Tune 2) | 1.0 | Shielded | Shielded | - |
| 7 | Dummy Cable (Tune 3) | 1.0 | Shielded | Shielded | - |
| 8 | USB Cable 1 | 1.0 | Shielded | Shielded | - |
| 9 | USB Cable 2 | 1.0 | Shielded | Shielded | - |
| 10 | Main Harness | 1.0 | Unshielded | Unshielded | - |
| 11 | BT Antenna Cable | 0.5 | Shielded | Shielded | - |
| 12 | WLAN Antenna Cable | 1.5 | Shielded | Shielded | - |
| 13 | GPS Antenna Cable | 5.0 | Shielded | Shielded | - |
| 14 | USB Cable 3 | 1.0 | Shielded | Shielded | - |
| 15 | Speaker Cable | 0.5 | Unshielded | Unshielded | - |
| 16 | HSLV Cable | 1.0 | Shielded | Shielded | - |
| 17 | HSLV Cable | 1.0 | Shielded | Shielded | - |
| 18 | Controller Cable | 2.3 | Shielded | Shielded | - |
| 19 | DVI Cable | 3.0 | Shielded | Shielded | - |
| 20 | DC Cable (+) | 2.0 | Shielded | Shielded | - |
| 21 | DC Cable (-) | 2.0 | Unshielded | Unshielded | - |
| 22 | DC Cable (+) | 2.0 | Unshielded | Unshielded | - |
| 23 | DC Cable (-) | 2.0 | Unshielded | Unshielded | - |
| 24 | AC Cable | 2.0 | Unshielded | Unshielded | - |

# SECTION 5: Radiated Spurious Emission

**Test Procedure**

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "558074 D01 DTS Meas Guidance v03r03".

EUT was placed on a urethane platform of nominal size, 1.0m by 2.0m, 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 | 30MHz to 300MHz | 300MHz to 1GHz | Above 1GHz |
|---|---|---|---|
| Antenna Type | 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 4 of RSS-Gen 8.9(IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).**

| Frequency | Below 1GHz | Above 1GHz | | 20dBc |
|---|---|---|---|---|
| Instrument used | Test Receiver | Spectrum Analyzer | | Spectrum Analyzer |
| Detector | QP | PK | AV *1) | PK |
| IF Bandwidth | BW 120kHz | RBW: 1MHz<br>VBW: 3MHz | Average Power Method:<br>12.2.5.1<br>RBW: 1 MHz<br>VBW: 3 MHz<br>Detector:<br>Power Averaging (RMS)<br>Trace: 100 traces | RBW: 100kHz<br>VBW: 300kHz |
| Test Distance | 3m | 3m (below 10GHz),<br>1m *2) (above 10GHz) | | 3m (below 10GHz),<br>1m *2) (above 10GHz) |

*1) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v03r03"
*2) Distance Factor: 20 x log (3.0m/1.0m) = 9.5dB

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

[HEADUNIT A-HIGH]
-The test was made on EUT at the normal use position.

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**

# SECTION 6: 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 | 20MHz | 100kHz | 300kHz | Auto | Peak | Max Hold | Spectrum Analyzer |
| 99% Occupied Bandwidth | Enough width to display emission skirts | 1 to 5% of OBW | Three times of RBW | Auto | Peak | Max Hold*1) | Spectrum Analyzer |
| Maximum Peak Output Power | - | - | - | Auto | Peak/ Average *2) | - | Power Meter (Sensor: 50MHz BW) |
| Peak Power Density | 1.5 times the 6dB Bandwidth | 3kHz | 10kHz | Auto | Peak | Max Hold | Spectrum Analyzer *3) |
| Conducted Spurious Emission *4) | 9kHz to 150kHz | 200Hz | 620Hz | Auto | Peak | Max Hold | Spectrum Analyzer |
| | 150kHz to 30MHz | 9.1kHz | 27kHz | | | | |
| Band Edge confirmation | 40 MHz | 100 kHz | 300 kHz | Auto | Peak | Max Hold | Spectrum Analyzer *2) |

*1) The measurement was performed with Max Hold since the duty cycle was not 100%.
*2) Reference data
*3) Section 10.2 Method PKPSD (peak PSD) of "KDB 558074 D01 DTS Meas Guidance v03r03".
*4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.
Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.(9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=9.1kHz)

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

## 6dB Bandwidth

| | |
|---|---|
| Test place | Ise EMC Lab. No.11 Measurement Room |
| Report No. | 10607274H |
| Date | 03/04/2015 |
| Temperature/ Humidity | 22 deg. C / 32% RH |
| Engineer | Tsubasa Takayama |
| Mode | 11b Tx / 11g Tx / 11n-20 Tx |

11b

| Frequency [MHz] | 6dB Bandwidth [MHz] | Limit [kHz] |
|---|---|---|
| 2412 | 8.193 | >500 |
| 2437 | 8.179 | >500 |
| 2462 | 8.052 | >500 |

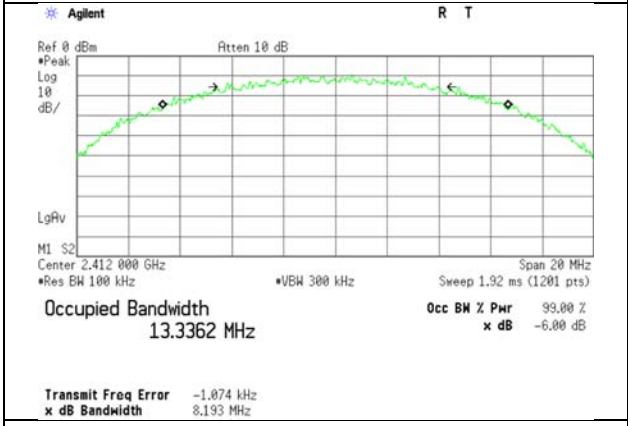
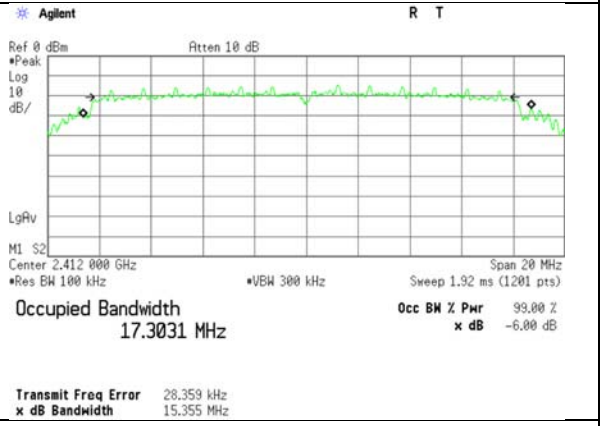
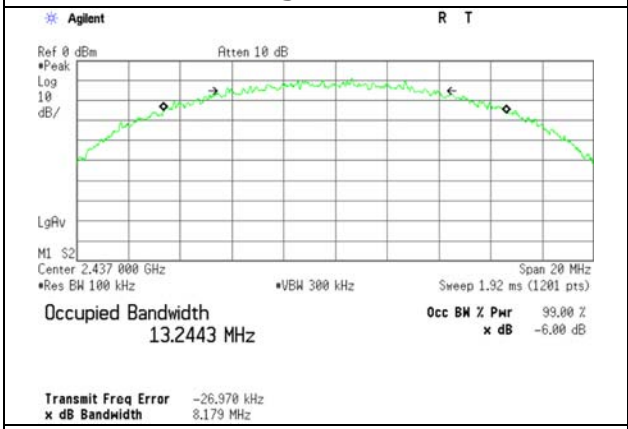
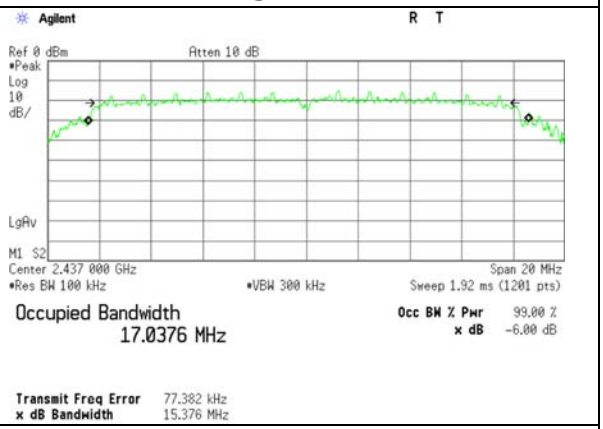
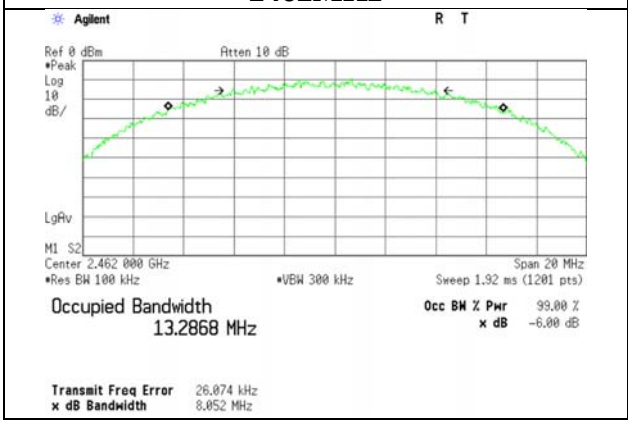
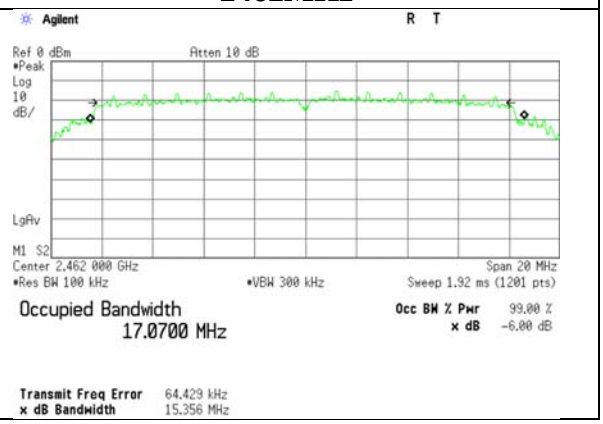
11g

| Frequency [MHz] | 6dB Bandwidth [MHz] | Limit [kHz] |
|---|---|---|
| 2412 | 15.355 | >500 |
| 2437 | 15.376 | >500 |
| 2462 | 15.356 | >500 |

11n-20

| Frequency [MHz] | 6dB Bandwidth [MHz] | Limit [kHz] |
|---|---|---|
| 2412 | 15.151 | >500 |
| 2437 | 15.149 | >500 |
| 2462 | 15.152 | >500 |

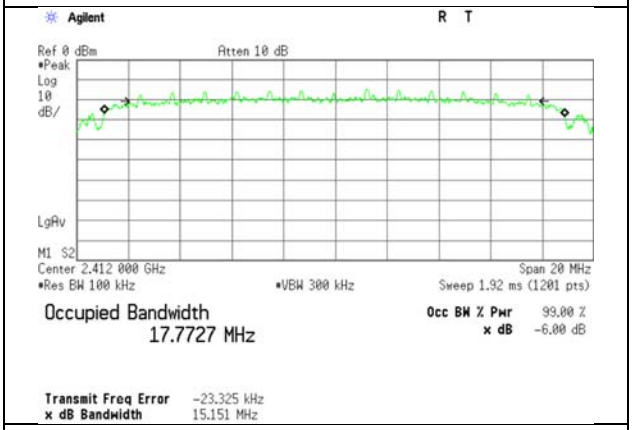
# 6dB Bandwidth

| 11b | 11g |
|---|---|
| **2412MHz** | **2412MHz** |
|   |   |
| **2437MHz** | **2437MHz** |
|   |   |
| **2462MHz** | **2462MHz** |
|   |   |

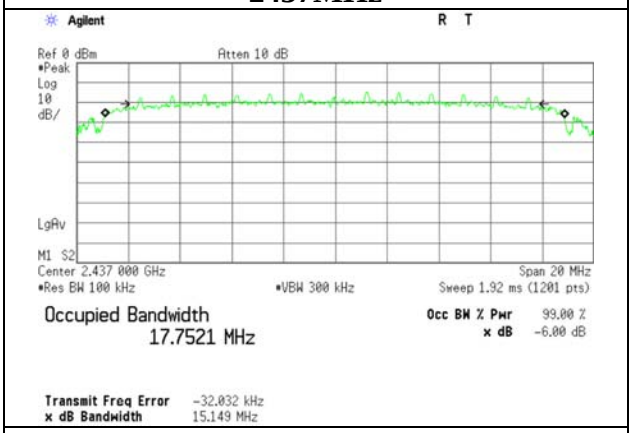
# 6dB Bandwidth

## 11n-20

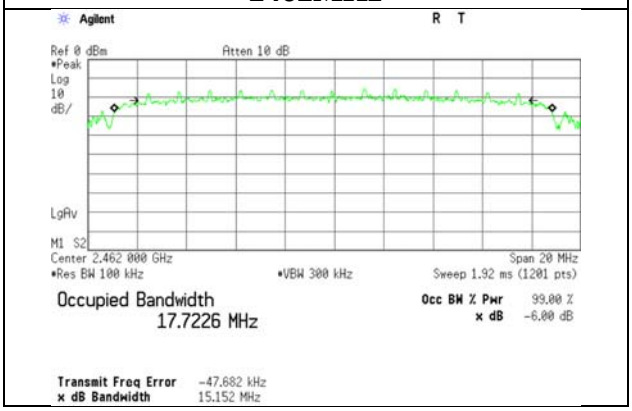
### 2412MHz




### 2437MHz




### 2462MHz



# Maximum Peak Output Power

| | |
|---|---|
| Test place | Ise EMC Lab. No.7 Measurement Room |
| Report No. | 10607274H |
| Date | 02/27/2015 |
| Temperature/ Humidity | 24 deg. C / 32% RH |
| Engineer | Tsubasa Takayama |
| Mode | 11b Tx |

| Freq. [MHz] | Reading [dBm] | Cable Loss [dB] | Atten. [dB] | Result [dBm] | Result [mW] | Limit [dBm] | Limit [mW] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|
| 2412 | 0.32 | 2.32 | 10.08 | 12.72 | 18.71 | 30.00 | 1000 | 17.28 |
| 2437 | 0.52 | 2.32 | 10.08 | 12.92 | 19.59 | 30.00 | 1000 | 17.08 |
| 2462 | 0.50 | 2.32 | 10.08 | 12.90 | 19.50 | 30.00 | 1000 | 17.10 |

Sample Calculation:
Result = Reading + Cable Loss (including Cable(s) Customer Supplied) + Attenuator

2437MHz

| Rate [Mbps] | Reading [dBm] | Remark |
|---|---|---|
| 1 | 0.48 | |
| 2 | 0.50 | |
| 5.5 | 0.52 | * |
| 11 | 0.32 | |

*: Worst Rate
All comparison were carried out on same frequency and measurement factors.

# Maximum Peak Output Power

| | |
|---|---|
| Test place | Ise EMC Lab. No.7 Measurement Room |
| Report No. | 10607274H |
| Date | 02/27/2015 |
| Temperature/ Humidity | 24 deg. C / 32% RH |
| Engineer | Tsubasa Takayama |
| Mode | 11g Tx |

| Freq. [MHz] | Reading [dBm] | Cable Loss [dB] | Atten. [dB] | Result [dBm] | Result [mW] | Limit [dBm] | Limit [mW] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|
| 2412 | 3.43 | 2.32 | 10.08 | 15.83 | 38.28 | 30.00 | 1000 | 14.17 |
| 2437 | 3.50 | 2.32 | 10.08 | 15.90 | 38.90 | 30.00 | 1000 | 14.10 |
| 2462 | 3.04 | 2.32 | 10.08 | 15.44 | 34.99 | 30.00 | 1000 | 14.56 |

Sample Calculation:
Result = Reading + Cable Loss (including Cable(s) Customer Supplied) + Attenuator

2437MHz

| Rate [Mbps] | Reading [dBm] | Remark |
|---|---|---|
| 6 | 2.62 | |
| 9 | 3.06 | |
| 12 | 3.13 | |
| 18 | 3.50 | * |
| 24 | 2.31 | |
| 36 | 2.50 | |
| 48 | 2.55 | |
| 54 | 2.13 | |

*: Worst Rate
All comparison were carried out on same frequency and measurement factors.

# Maximum Peak Output Power

| | |
|---|---|
| Test place | Ise EMC Lab. No.7 Measurement Room |
| Report No. | 10607274H |
| Date | 02/27/2015 |
| Temperature/ Humidity | 24 deg. C / 32% RH |
| Engineer | Tsubasa Takayama |
| Mode | 11n-20 Tx |

| Freq. [MHz] | Reading [dBm] | Cable Loss [dB] | Atten. [dB] | Result [dBm] | Result [mW] | Limit [dBm] | Limit [mW] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|
| 2412 | 3.86 | 2.32 | 10.08 | 16.26 | 42.27 | 30.00 | 1000 | 13.74 |
| 2437 | 3.52 | 2.32 | 10.08 | 15.92 | 39.08 | 30.00 | 1000 | 14.08 |
| 2462 | 3.43 | 2.32 | 10.08 | 15.83 | 38.28 | 30.00 | 1000 | 14.17 |

Sample Calculation:
Result = Reading + Cable Loss (including Cable(s) Customer Supplied) + Attenuator

2437MHz

| Rate [MCS] | Reading [dBm] | Remark |
|---|---|---|
| 0 | 3.52 | * |
| 1 | 3.16 | |
| 2 | 2.57 | |
| 3 | 1.96 | |
| 4 | 1.96 | |
| 5 | 2.65 | |
| 6 | 2.59 | |
| 7 | 2.54 | |

*: Worst Rate
All comparison were carried out on same frequency and measurement factors.

# Average Output Power

| | |
|---|---|
| Test place | Ise EMC Lab. No.7 Measurement Room |
| Report No. | 10607274H |
| Date | 02/27/2015 |
| Temperature/ Humidity | 24 deg. C / 32% RH |
| Engineer | Tsubasa Takayama |
| Mode | 11b Tx / 11g Tx / 11n-20 Tx |

[AV]

11b **5.5Mbps**

| Freq. [MHz] | Reading [dBm] | Cable Loss [dB] | Atten. [dB] | Duty [dB] | Result [dBm] | Result [mW] |
|---|---|---|---|---|---|---|
| 2412 | -12.26 | 2.32 | 10.08 | 9.95 | 10.09 | 10.21 |
| 2437 | -11.84 | 2.32 | 10.08 | 9.95 | 10.51 | 11.25 |
| 2462 | -11.75 | 2.32 | 10.08 | 9.95 | 10.60 | 11.48 |

11g **18Mbps**

| Freq. [MHz] | Reading [dBm] | Cable Loss [dB] | Atten. [dB] | Duty [dB] | Result [dBm] | Result [mW] |
|---|---|---|---|---|---|---|
| 2412 | -14.83 | 2.32 | 10.08 | 9.91 | 7.48 | 5.60 |
| 2437 | -14.75 | 2.32 | 10.08 | 9.91 | 7.56 | 5.70 |
| 2462 | -15.20 | 2.32 | 10.08 | 9.91 | 7.11 | 5.14 |

11n-20 **MCS0**

| Freq. [MHz] | Reading [dBm] | Cable Loss [dB] | Atten. [dB] | Duty [dB] | Result [dBm] | Result [mW] |
|---|---|---|---|---|---|---|
| 2412 | -15.16 | 2.32 | 10.08 | 9.95 | 7.19 | 5.24 |
| 2437 | -15.38 | 2.32 | 10.08 | 9.95 | 6.97 | 4.98 |
| 2462 | -15.42 | 2.32 | 10.08 | 9.95 | 6.93 | 4.93 |

Sample Calculation:
Result = Reading + Cable Loss (including Cable(s) Customer Supplied) + Duty + Attenuator
*Average output power result was calculated at 100% duty cycle using duty factor.

# Radiated Spurious Emission

| | | |
|---|---|---|
| Test place | Ise EMC Lab. No.3 Semi Anechoic Chamber | |
| Report No. | 10607274H | |
| Date | 03/03/2015 | 03/04/2015 |
| Temperature/ Humidity | 23 deg. C / 37% RH | 25deg. C / 39% RH |
| Engineer | Koji Yamamoto (1-10GHz) | Takafumi Noguchi (10-26.5GHz) |
| Mode | 11b Tx 2412MHz | |

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 1249.933 | PK | 59.5 | 24.7 | 2.4 | 34.6 | 52.0 | 73.9 | 21.9 | |
| Hori | 1838.017 | PK | 60.6 | 25.9 | 2.9 | 33.3 | 56.1 | 73.9 | 17.8 | |
| Hori | 2390.000 | PK | 43.1 | 26.8 | 3.2 | 32.7 | 40.4 | 73.9 | 33.5 | |
| Hori | 2499.882 | PK | 56.7 | 26.9 | 3.2 | 32.7 | 54.1 | 73.9 | 19.8 | |
| Hori | 3132.323 | PK | 49.4 | 27.5 | 3.6 | 32.4 | 48.1 | 73.9 | 25.8 | |
| Hori | 4824.000 | PK | 42.1 | 30.6 | 4.4 | 31.8 | 45.3 | 73.9 | 28.6 | Floor Noise |
| Hori | 7236.000 | PK | 42.5 | 35.9 | 5.6 | 32.7 | 51.3 | 73.9 | 22.6 | Floor Noise |
| Hori | 8195.625 | PK | 47.4 | 37.1 | 5.8 | 32.9 | 57.4 | 73.9 | 16.5 | |
| Hori | 9648.000 | PK | 41.6 | 38.5 | 6.4 | 33.4 | 53.1 | 73.9 | 20.8 | Floor Noise |
| Hori | 1249.933 | AV | 58.2 | 24.7 | 2.4 | 34.6 | 50.7 | 53.9 | 3.2 | |
| Hori | 1838.017 | AV | 50.1 | 25.9 | 2.9 | 33.3 | 45.6 | 53.9 | 8.3 | |
| Hori | 2390.000 | AV | 34.2 | 26.8 | 3.2 | 32.7 | 31.5 | 53.9 | 22.4 | |
| Hori | 2499.882 | AV | 54.4 | 26.9 | 3.2 | 32.7 | 51.8 | 53.9 | 2.1 | |
| Hori | 3132.323 | AV | 43.3 | 27.5 | 3.6 | 32.4 | 42.0 | 53.9 | 11.9 | |
| Hori | 4824.000 | AV | 31.9 | 30.6 | 4.4 | 31.8 | 35.1 | 53.9 | 18.8 | Floor Noise |
| Hori | 7236.000 | AV | 33.5 | 35.9 | 5.6 | 32.7 | 42.3 | 53.9 | 11.6 | Floor Noise |
| Hori | 8195.625 | AV | 35.5 | 37.1 | 5.8 | 32.9 | 45.5 | 53.9 | 8.4 | |
| Hori | 9648.000 | AV | 33.1 | 38.5 | 6.4 | 33.4 | 44.6 | 53.9 | 9.3 | Floor Noise |
| Vert | 1249.933 | PK | 54.3 | 24.7 | 2.4 | 34.6 | 46.8 | 73.9 | 27.1 | |
| Vert | 1838.017 | PK | 66.2 | 25.9 | 2.9 | 33.3 | 61.7 | 73.9 | 12.2 | |
| Vert | 2390.000 | PK | 42.2 | 26.8 | 3.2 | 32.7 | 39.5 | 73.9 | 34.4 | |
| Vert | 2499.882 | PK | 53.8 | 26.9 | 3.2 | 32.7 | 51.2 | 73.9 | 22.7 | |
| Vert | 3132.323 | PK | 52.0 | 27.5 | 3.6 | 32.4 | 50.7 | 73.9 | 23.2 | |
| Vert | 4824.000 | PK | 41.6 | 30.6 | 4.4 | 31.8 | 44.8 | 73.9 | 29.1 | Floor Noise |
| Vert | 7236.000 | PK | 42.6 | 35.9 | 5.6 | 32.7 | 51.4 | 73.9 | 22.5 | Floor Noise |
| Vert | 8195.625 | PK | 46.6 | 37.1 | 5.8 | 32.9 | 56.6 | 73.9 | 17.3 | |
| Vert | 9648.000 | PK | 42.7 | 38.5 | 6.4 | 33.4 | 54.2 | 73.9 | 19.7 | Floor Noise |
| Vert | 1249.933 | AV | 52.8 | 24.7 | 2.4 | 34.6 | 45.3 | 53.9 | 8.6 | |
| Vert | 1838.017 | AV | 56.3 | 25.9 | 2.9 | 33.3 | 51.8 | 53.9 | 2.1 | |
| Vert | 2390.000 | AV | 33.5 | 26.8 | 3.2 | 32.7 | 40.8 | 53.9 | 13.2 | |
| Vert | 2499.882 | AV | 51.2 | 26.9 | 3.2 | 32.7 | 48.6 | 53.9 | 5.3 | |
| Vert | 3132.323 | AV | 48.1 | 27.5 | 3.6 | 32.4 | 46.8 | 53.9 | 7.1 | |
| Vert | 4824.000 | AV | 32.2 | 30.6 | 4.4 | 31.8 | 35.4 | 53.9 | 18.5 | Floor Noise |
| Vert | 7236.000 | AV | 33.1 | 35.9 | 5.6 | 32.7 | 41.9 | 53.9 | 12.0 | Floor Noise |
| Vert | 8195.625 | AV | 36.0 | 37.1 | 5.8 | 32.9 | 46.0 | 53.9 | 7.9 | |
| Vert | 9648.000 | AV | 32.9 | 38.5 | 6.4 | 33.4 | 44.4 | 53.9 | 9.5 | Floor Noise |

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).

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

*Noises that had duty cycle synchronized with the fundamental frequency were not detected at the band-edge and harmonics frequencies.

**20dBc Data Sheet**

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 2412.000 | PK | 89.3 | 26.8 | 3.2 | 32.7 | 86.6 | - | - | Carrier |
| Hori | 2400.000 | PK | 40.5 | 26.8 | 3.2 | 32.7 | 37.8 | 66.6 | 28.8 | |
| Vert | 2412.000 | PK | 88.3 | 26.8 | 3.2 | 32.7 | 85.6 | - | - | Carrier |
| Vert | 2400.000 | PK | 39.5 | 26.8 | 3.2 | 32.7 | 36.8 | 65.6 | 28.8 | |

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

# Radiated Spurious Emission

| | | |
|---|---|---|
| Test place | Ise EMC Lab. No.3 Semi Anechoic Chamber | |
| Report No. | 10607274H | |
| Date | 03/03/2015 | 03/04/2015 |
| Temperature/ Humidity | 23 deg. C / 37% RH | 25deg. C / 39% RH |
| Engineer | Koji Yamamoto (1-10GHz) | Takafumi Noguchi (10-26.5GHz) |
| Mode | 11b Tx 2437MHz | |

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 1249.933 | PK | 60.1 | 24.7 | 2.4 | 34.6 | 52.6 | 73.9 | 21.3 | |
| Hori | 1838.017 | PK | 59.9 | 25.9 | 2.9 | 33.3 | 55.4 | 73.9 | 18.5 | |
| Hori | 2499.882 | PK | 57.2 | 26.9 | 3.2 | 32.7 | 54.6 | 73.9 | 19.3 | |
| Hori | 3132.323 | PK | 48.5 | 27.5 | 3.6 | 32.4 | 47.2 | 73.9 | 26.7 | |
| Hori | 4874.000 | PK | 41.8 | 30.7 | 4.4 | 31.7 | 45.2 | 73.9 | 28.7 | Floor Noise |
| Hori | 7311.000 | PK | 43.1 | 35.9 | 5.6 | 32.7 | 51.9 | 73.9 | 22.0 | Floor Noise |
| Hori | 8195.625 | PK | 46.9 | 37.1 | 5.8 | 32.9 | 56.9 | 73.9 | 17.0 | |
| Hori | 9748.000 | PK | 42.3 | 38.7 | 6.5 | 33.4 | 54.1 | 73.9 | 19.8 | Floor Noise |
| Hori | 1249.933 | AV | 58.1 | 24.7 | 2.4 | 34.6 | 50.6 | 53.9 | 3.3 | |
| Hori | 1838.017 | AV | 50.5 | 25.9 | 2.9 | 33.3 | 46.0 | 53.9 | 7.9 | |
| Hori | 2499.882 | AV | 54.5 | 26.9 | 3.2 | 32.7 | 51.9 | 53.9 | 2.0 | |
| Hori | 3132.323 | AV | 42.6 | 27.5 | 3.6 | 32.4 | 41.3 | 53.9 | 12.6 | |
| Hori | 4874.000 | AV | 32.5 | 30.7 | 4.4 | 31.7 | 35.9 | 53.9 | 18.0 | Floor Noise |
| Hori | 7311.000 | AV | 32.9 | 35.9 | 5.6 | 32.7 | 41.7 | 53.9 | 12.2 | Floor Noise |
| Hori | 8195.625 | AV | 36.3 | 37.1 | 5.8 | 32.9 | 46.3 | 53.9 | 7.6 | |
| Hori | 9748.000 | AV | 32.8 | 38.7 | 6.5 | 33.4 | 44.6 | 53.9 | 9.3 | Floor Noise |
| Vert | 1249.933 | PK | 54.8 | 24.7 | 2.4 | 34.6 | 47.3 | 73.9 | 26.6 | |
| Vert | 1838.017 | PK | 65.6 | 25.9 | 2.9 | 33.3 | 61.1 | 73.9 | 12.8 | |
| Vert | 2499.882 | PK | 55.2 | 26.9 | 3.2 | 32.7 | 52.6 | 73.9 | 21.3 | |
| Vert | 3132.323 | PK | 50.6 | 27.5 | 3.6 | 32.4 | 49.3 | 73.9 | 24.6 | |
| Vert | 4874.000 | PK | 42.6 | 30.7 | 4.4 | 31.7 | 46.0 | 73.9 | 27.9 | Floor Noise |
| Vert | 7311.000 | PK | 43.3 | 35.9 | 5.6 | 32.7 | 52.1 | 73.9 | 21.8 | Floor Noise |
| Vert | 8195.625 | PK | 47.0 | 37.1 | 5.8 | 32.9 | 57.0 | 73.9 | 16.9 | |
| Vert | 9748.000 | PK | 42.5 | 38.7 | 6.5 | 33.4 | 54.3 | 73.9 | 19.6 | Floor Noise |
| Vert | 1249.933 | AV | 53.0 | 24.7 | 2.4 | 34.6 | 45.5 | 53.9 | 8.4 | |
| Vert | 1838.017 | AV | 56.8 | 25.9 | 2.9 | 33.3 | 52.3 | 53.9 | 1.6 | |
| Vert | 2499.882 | AV | 51.3 | 26.9 | 3.2 | 32.7 | 48.7 | 53.9 | 5.2 | |
| Vert | 3132.323 | AV | 47.2 | 27.5 | 3.6 | 32.4 | 45.9 | 53.9 | 8.0 | |
| Vert | 4874.000 | AV | 32.7 | 30.7 | 4.4 | 31.7 | 36.1 | 53.9 | 17.8 | Floor Noise |
| Vert | 7311.000 | AV | 32.9 | 35.9 | 5.6 | 32.7 | 41.7 | 53.9 | 12.2 | Floor Noise |
| Vert | 8195.625 | AV | 38.1 | 37.1 | 5.8 | 32.9 | 48.1 | 53.9 | 5.8 | |
| Vert | 9748.000 | AV | 33.0 | 38.7 | 6.5 | 33.4 | 44.8 | 53.9 | 9.1 | Floor Noise |

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).

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

*Noises that had duty cycle synchronized with the fundamental frequency were not detected at the band-edge and harmonics frequencies.

# Radiated Spurious Emission

| | | |
|---|---|---|
| Test place | Ise EMC Lab. No.3 Semi Anechoic Chamber | |
| Report No. | 10607274H | |
| Date | 03/03/2015 | 03/04/2015 |
| Temperature/ Humidity | 23 deg. C / 37% RH | 25deg. C / 39% RH |
| Engineer | Koji Yamamoto (1-10GHz) | Takafumi Noguchi (10-26.5GHz) |
| Mode | 11b Tx 2462MHz | |

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 1249.933 | PK | 57.9 | 24.7 | 2.4 | 34.6 | 50.4 | 73.9 | 23.5 | |
| Hori | 1838.017 | PK | 57.3 | 25.9 | 2.9 | 33.3 | 52.8 | 73.9 | 21.1 | |
| Hori | 2483.500 | PK | 43.8 | 26.9 | 3.2 | 32.7 | 41.2 | 73.9 | 32.7 | |
| Hori | 2499.882 | PK | 53.5 | 26.9 | 3.2 | 32.7 | 50.9 | 73.9 | 23.0 | |
| Hori | 3132.323 | PK | 48.6 | 27.5 | 3.6 | 32.4 | 47.3 | 73.9 | 26.6 | |
| Hori | 4924.000 | PK | 42.7 | 30.8 | 4.4 | 31.7 | 46.2 | 73.9 | 27.7 | Floor Noise |
| Hori | 7386.000 | PK | 42.8 | 35.9 | 5.6 | 32.7 | 51.6 | 73.9 | 22.3 | Floor Noise |
| Hori | 8195.625 | PK | 46.9 | 37.1 | 5.8 | 32.9 | 56.9 | 73.9 | 17.0 | |
| Hori | 9848.000 | PK | 43.1 | 38.8 | 6.5 | 33.5 | 54.9 | 73.9 | 19.0 | Floor Noise |
| Hori | 1249.933 | AV | 53.8 | 24.7 | 2.4 | 34.6 | 46.3 | 53.9 | 7.6 | |
| Hori | 1838.017 | AV | 46.6 | 25.9 | 2.9 | 33.3 | 42.1 | 53.9 | 11.8 | |
| Hori | 2483.500 | AV | 33.3 | 26.9 | 3.2 | 32.7 | 30.7 | 53.9 | 23.2 | |
| Hori | 2499.882 | AV | 50.8 | 26.9 | 3.2 | 32.7 | 48.2 | 53.9 | 5.7 | |
| Hori | 3132.323 | AV | 44.1 | 27.5 | 3.6 | 32.4 | 42.8 | 53.9 | 11.1 | |
| Hori | 4924.000 | AV | 32.1 | 30.8 | 4.4 | 31.7 | 35.6 | 53.9 | 18.3 | Floor Noise |
| Hori | 7386.000 | AV | 33.2 | 35.9 | 5.6 | 32.7 | 42.0 | 53.9 | 11.9 | Floor Noise |
| Hori | 8195.625 | AV | 36.3 | 37.1 | 5.8 | 32.9 | 46.3 | 53.9 | 7.6 | |
| Hori | 9848.000 | AV | 33.4 | 38.8 | 6.5 | 33.5 | 45.2 | 53.9 | 8.7 | Floor Noise |
| Vert | 1249.933 | PK | 53.6 | 24.7 | 2.4 | 34.6 | 46.1 | 73.9 | 27.8 | |
| Vert | 1838.017 | PK | 63.3 | 25.9 | 2.9 | 33.3 | 58.8 | 73.9 | 15.1 | |
| Vert | 2483.500 | PK | 45.8 | 26.9 | 3.2 | 32.7 | 43.2 | 73.9 | 30.7 | |
| Vert | 2499.882 | PK | 54.9 | 26.9 | 3.2 | 32.7 | 52.3 | 73.9 | 21.6 | |
| Vert | 3132.323 | PK | 49.8 | 27.5 | 3.6 | 32.4 | 48.5 | 73.9 | 25.4 | |
| Vert | 4924.000 | PK | 42.1 | 30.8 | 4.4 | 31.7 | 45.6 | 73.9 | 28.3 | Floor Noise |
| Vert | 7386.000 | PK | 43.6 | 35.9 | 5.6 | 32.7 | 52.4 | 73.9 | 21.5 | Floor Noise |
| Vert | 8195.625 | PK | 47.0 | 37.1 | 5.8 | 32.9 | 57.0 | 73.9 | 16.9 | |
| Vert | 9848.000 | PK | 42.3 | 38.8 | 6.5 | 33.5 | 54.1 | 73.9 | 19.8 | Floor Noise |
| Vert | 1249.933 | AV | 50.6 | 24.7 | 2.4 | 34.6 | 43.1 | 53.9 | 10.8 | |
| Vert | 1838.017 | AV | 54.5 | 25.9 | 2.9 | 33.3 | 50.0 | 53.9 | 3.9 | |
| Vert | 2483.500 | AV | 33.7 | 26.9 | 3.2 | 32.7 | 31.1 | 53.9 | 22.8 | |
| Vert | 2499.882 | AV | 50.2 | 26.9 | 3.2 | 32.7 | 47.6 | 53.9 | 6.3 | |
| Vert | 3132.323 | AV | 46.7 | 27.5 | 3.6 | 32.4 | 45.4 | 53.9 | 8.5 | |
| Vert | 4924.000 | AV | 32.6 | 30.8 | 4.4 | 31.7 | 36.1 | 53.9 | 17.8 | Floor Noise |
| Vert | 7386.000 | AV | 33.5 | 35.9 | 5.6 | 32.7 | 42.3 | 53.9 | 11.6 | Floor Noise |
| Vert | 8195.625 | AV | 38.1 | 37.1 | 5.8 | 32.9 | 48.1 | 53.9 | 5.8 | |
| Vert | 9848.000 | AV | 33.3 | 38.8 | 6.5 | 33.5 | 45.1 | 53.9 | 8.8 | Floor Noise |

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).

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

*Noises that had duty cycle synchronized with the fundamental frequency were not detected at the band-edge and harmonics frequencies.

# Radiated Spurious Emission

| | | | |
|---|---|---|---|
| Test place | Ise EMC Lab. No.3 Semi Anechoic Chamber | | |
| Report No. | 10607274H | | |
| Date | 03/03/2015 | 03/04/2015 | 03/09/2015 |
| Temperature/ Humidity | 23 deg. C / 37% RH | 25deg. C / 39% RH | 25deg. C / 34% RH |
| Engineer | Koji Yamamoto (1-10GHz) | Takafumi Noguchi (10-26.5GHz) | Tsubasa Takayama (below 1GHz) |
| Mode | 11n-20 Tx 2412MHz | | |

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 78.150 | QP | 35.3 | 6.3 | 7.8 | 32.1 | 17.3 | 40.0 | 22.7 | |
| Hori | 243.749 | QP | 35.8 | 17.1 | 9.4 | 32.0 | 30.3 | 46.0 | 15.7 | |
| Hori | 341.243 | QP | 34.3 | 16.0 | 10.2 | 31.9 | 28.6 | 46.0 | 17.4 | |
| Hori | 374.976 | QP | 33.9 | 16.9 | 10.4 | 31.9 | 29.3 | 46.0 | 16.7 | |
| Hori | 627.167 | QP | 33.7 | 19.7 | 12.0 | 32.0 | 33.4 | 46.0 | 12.6 | |
| Hori | 983.016 | QP | 41.2 | 23.3 | 13.6 | 30.5 | 47.6 | 53.9 | 6.3 | |
| Hori | 1250.000 | PK | 57.8 | 24.7 | 2.4 | 34.6 | 50.3 | 73.9 | 23.6 | |
| Hori | 1837.880 | PK | 59.6 | 25.9 | 2.9 | 33.3 | 55.1 | 73.9 | 18.8 | |
| Hori | 2390.000 | PK | 43.5 | 26.8 | 3.2 | 32.7 | 40.8 | 73.9 | 33.1 | |
| Hori | 2499.882 | PK | 54.5 | 26.9 | 3.2 | 32.7 | 51.9 | 73.9 | 22.0 | |
| Hori | 3132.323 | PK | 47.5 | 27.5 | 3.6 | 32.4 | 46.2 | 73.9 | 27.7 | |
| Hori | 4824.000 | PK | 42.1 | 30.8 | 4.4 | 31.7 | 45.6 | 73.9 | 28.3 | Floor Noise |
| Hori | 7236.000 | PK | 41.5 | 35.9 | 5.6 | 32.7 | 50.3 | 73.9 | 23.6 | Floor Noise |
| Hori | 8195.917 | PK | 48.2 | 37.1 | 5.8 | 32.9 | 58.2 | 73.9 | 15.7 | |
| Hori | 9648.000 | PK | 43.3 | 38.8 | 6.5 | 33.5 | 55.1 | 73.9 | 18.8 | Floor Noise |
| Hori | 1250.000 | AV | 55.9 | 24.7 | 2.4 | 34.6 | 48.4 | 53.9 | 5.5 | |
| Hori | 1837.880 | AV | 52.1 | 25.9 | 2.9 | 33.3 | 47.6 | 53.9 | 6.3 | |
| Hori | 2390.000 | AV | 34.6 | 26.8 | 3.2 | 32.7 | 31.9 | 53.9 | 22.0 | |
| Hori | 2499.882 | AV | 50.0 | 26.9 | 3.2 | 32.7 | 47.4 | 53.9 | 6.5 | |
| Hori | 3132.323 | AV | 42.9 | 27.5 | 3.6 | 32.4 | 41.6 | 53.9 | 12.3 | |
| Hori | 4824.000 | AV | 32.5 | 30.8 | 4.4 | 31.7 | 36.0 | 53.9 | 17.9 | Floor Noise |
| Hori | 7236.000 | AV | 32.7 | 35.9 | 5.6 | 32.7 | 41.5 | 53.9 | 12.4 | Floor Noise |
| Hori | 8195.917 | AV | 37.1 | 37.1 | 5.8 | 32.9 | 47.1 | 53.9 | 6.8 | |
| Hori | 9648.000 | AV | 33.2 | 38.8 | 6.5 | 33.5 | 45.0 | 53.9 | 8.9 | Floor Noise |
| Vert | 78.600 | QP | 39.6 | 6.3 | 7.8 | 32.1 | 21.6 | 40.0 | 18.4 | |
| Vert | 108.000 | QP | 35.6 | 11.3 | 8.1 | 32.1 | 22.9 | 43.5 | 20.6 | |
| Vert | 146.100 | QP | 36.4 | 14.7 | 8.6 | 32.1 | 27.6 | 43.5 | 15.9 | |
| Vert | 243.749 | QP | 36.4 | 17.1 | 9.4 | 32.0 | 30.9 | 46.0 | 15.1 | |
| Vert | 276.000 | QP | 33.0 | 18.6 | 9.8 | 31.9 | 29.5 | 46.0 | 16.5 | |
| Vert | 341.263 | QP | 32.9 | 16.0 | 10.2 | 31.9 | 27.2 | 46.0 | 18.8 | |
| Vert | 375.000 | QP | 31.2 | 16.9 | 10.4 | 31.9 | 26.6 | 46.0 | 19.4 | |
| Vert | 627.177 | QP | 31.0 | 19.7 | 12.0 | 32.0 | 30.7 | 46.0 | 15.3 | |
| Vert | 983.016 | QP | 38.0 | 23.3 | 13.6 | 30.5 | 44.4 | 53.9 | 9.5 | |
| Vert | 1250.000 | PK | 55.9 | 24.7 | 2.4 | 34.6 | 48.4 | 73.9 | 25.5 | |
| Vert | 1837.880 | PK | 65.9 | 25.9 | 2.9 | 33.3 | 61.4 | 73.9 | 12.5 | |
| Vert | 2390.000 | PK | 42.6 | 26.8 | 3.2 | 32.7 | 39.9 | 73.9 | 34.0 | |
| Vert | 2499.882 | PK | 53.5 | 26.9 | 3.2 | 32.7 | 50.9 | 73.9 | 23.0 | |
| Vert | 3132.323 | PK | 50.8 | 27.5 | 3.6 | 32.4 | 49.5 | 73.9 | 24.4 | |
| Vert | 4824.000 | PK | 42.7 | 30.8 | 4.4 | 31.7 | 46.2 | 73.9 | 27.7 | Floor Noise |
| Vert | 7236.000 | PK | 42.8 | 35.9 | 5.6 | 32.7 | 51.6 | 73.9 | 22.3 | Floor Noise |
| Vert | 8195.110 | PK | 48.2 | 37.1 | 5.8 | 32.9 | 58.2 | 73.9 | 15.7 | |
| Vert | 9648.000 | PK | 42.1 | 38.8 | 6.5 | 33.5 | 53.9 | 73.9 | 20.0 | Floor Noise |
| Vert | 1250.000 | AV | 54.0 | 24.7 | 2.4 | 34.6 | 46.5 | 53.9 | 7.4 | |
| Vert | 1837.880 | AV | 56.5 | 25.9 | 2.9 | 33.3 | 52.0 | 53.9 | 1.9 | |
| Vert | 2390.000 | AV | 33.5 | 26.8 | 3.2 | 32.7 | 30.8 | 53.9 | 23.1 | |
| Vert | 2499.882 | AV | 49.7 | 26.9 | 3.2 | 32.7 | 47.1 | 53.9 | 6.8 | |
| Vert | 3132.323 | AV | 45.8 | 27.5 | 3.6 | 32.4 | 44.5 | 53.9 | 9.4 | |
| Vert | 4824.000 | AV | 33.0 | 30.8 | 4.4 | 31.7 | 36.5 | 53.9 | 17.4 | Floor Noise |
| Vert | 7236.000 | AV | 33.1 | 35.9 | 5.6 | 32.7 | 41.9 | 53.9 | 12.0 | Floor Noise |
| Vert | 8195.110 | AV | 39.3 | 37.1 | 5.8 | 32.9 | 49.3 | 53.9 | 4.6 | |
| Vert | 9648.000 | AV | 33.8 | 38.8 | 6.5 | 33.5 | 45.6 | 53.9 | 8.3 | Floor Noise |

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

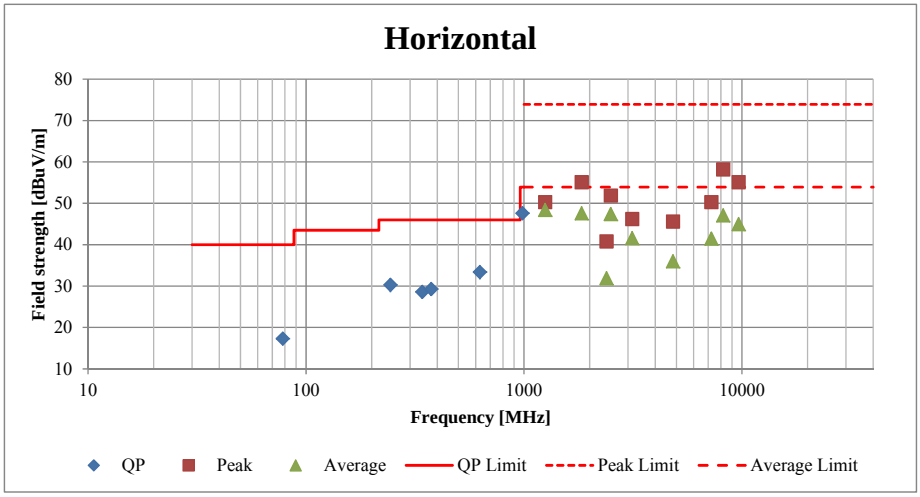
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

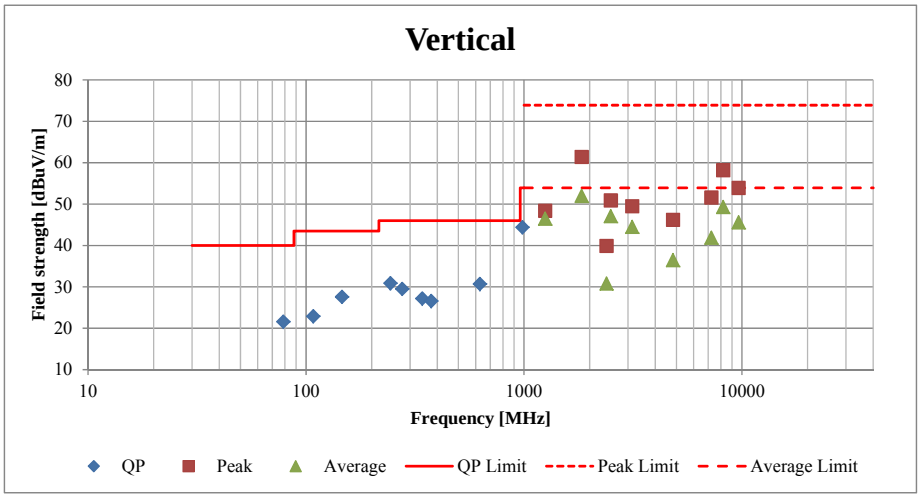
Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB

*Noises that had duty cycle synchronized with the fundamental frequency were not detected at the band-edge and harmonics frequencies.

# Radiated Spurious Emission
## (Plot data, Worst case)

| | | | |
|---|---|---|---|
| Test place | Ise EMC Lab. No.3 Semi Anechoic Chamber | | |
| Report No. | 10607274H | | |
| Date | 03/03/2015 | 03/04/2015 | 03/09/2015 |
| Temperature/ Humidity | 23 deg. C / 37% RH | 25deg. C / 39% RH | 25deg. C / 34% RH |
| Engineer | Koji Yamamoto (1-10GHz) | Takafumi Noguchi (10-26.5GHz) | Tsubasa Takayama (below 1GHz) |
| Mode | 11n-20 Tx 2412MHz | | |



# Radiated Spurious Emission

| | |
|---|---|
| Test place | Ise EMC Lab. No.3 Semi Anechoic Chamber |
| Report No. | 10607274H |
| Date | 03/03/2015 |
| Temperature/ Humidity | 23 deg. C / 37% RH |
| Engineer | Koji Yamamoto<br>(1-10GHz) |
| Mode | 11n-20 Tx 2412MHz |

**20dBc Data Sheet**

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 2412.000 | PK | 88.0 | 26.8 | 3.2 | 32.7 | 85.3 | - | - | Carrier |
| Hori | 2400.000 | PK | 46.8 | 26.8 | 3.2 | 32.7 | 44.1 | 65.3 | 21.2 | |
| Vert | 2412.000 | PK | 86.7 | 26.8 | 3.2 | 32.7 | 84.0 | - | - | Carrier |
| Vert | 2400.000 | PK | 45.6 | 26.8 | 3.2 | 32.7 | 42.9 | 64.0 | 21.1 | |

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

# Radiated Spurious Emission

| | | |
|---|---|---|
| Test place | Ise EMC Lab. No.3 Semi Anechoic Chamber | |
| Report No. | 10607274H | |
| Date | 03/03/2015 | 03/04/2015 |
| Temperature/ Humidity | 23 deg. C / 37% RH | 25deg. C / 39% RH |
| Engineer | Koji Yamamoto (1-10GHz) | Takafumi Noguchi (10-26.5GHz) |
| Mode | 11n-20 Tx 2437MHz | |

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 1250.000 | PK | 56.8 | 24.7 | 2.4 | 34.6 | 49.3 | 73.9 | 24.6 | |
| Hori | 1837.880 | PK | 58.9 | 25.9 | 2.9 | 33.3 | 54.4 | 73.9 | 19.5 | |
| Hori | 2499.882 | PK | 55.2 | 26.9 | 3.2 | 32.7 | 52.6 | 73.9 | 21.3 | |
| Hori | 3132.323 | PK | 48.8 | 27.5 | 3.6 | 32.4 | 47.5 | 73.9 | 26.4 | |
| Hori | 4874.000 | PK | 41.6 | 30.7 | 4.4 | 31.7 | 45.0 | 73.9 | 28.9 | Floor Noise |
| Hori | 7311.000 | PK | 42.5 | 35.9 | 5.6 | 32.7 | 51.3 | 73.9 | 22.6 | Floor Noise |
| Hori | 8195.917 | PK | 47.8 | 37.1 | 5.8 | 32.9 | 57.8 | 73.9 | 16.1 | |
| Hori | 9748.000 | PK | 42.9 | 38.7 | 6.5 | 33.4 | 54.7 | 73.9 | 19.2 | Floor Noise |
| Hori | 1250.000 | AV | 56.1 | 24.7 | 2.4 | 34.6 | 48.6 | 53.9 | 5.3 | |
| Hori | 1837.880 | AV | 52.5 | 25.9 | 2.9 | 33.3 | 48.0 | 53.9 | 5.9 | |
| Hori | 2499.882 | AV | 50.5 | 26.9 | 3.2 | 32.7 | 47.9 | 53.9 | 6.0 | |
| Hori | 3132.323 | AV | 43.8 | 27.5 | 3.6 | 32.4 | 42.5 | 53.9 | 11.4 | |
| Hori | 4874.000 | AV | 32.3 | 30.7 | 4.4 | 31.7 | 35.7 | 53.9 | 18.2 | Floor Noise |
| Hori | 7311.000 | AV | 33.0 | 35.9 | 5.6 | 32.7 | 41.8 | 53.9 | 12.1 | Floor Noise |
| Hori | 8195.917 | AV | 38.2 | 37.1 | 5.8 | 32.9 | 48.2 | 53.9 | 5.7 | |
| Hori | 9748.000 | AV | 33.1 | 38.7 | 6.5 | 33.4 | 44.9 | 53.9 | 9.0 | Floor Noise |
| Vert | 1250.000 | PK | 54.7 | 24.7 | 2.4 | 34.6 | 47.2 | 73.9 | 26.7 | |
| Vert | 1837.880 | PK | 66.1 | 25.9 | 2.9 | 33.3 | 61.6 | 73.9 | 12.3 | |
| Vert | 2499.882 | PK | 53.8 | 26.9 | 3.2 | 32.7 | 51.2 | 73.9 | 22.7 | |
| Vert | 3132.323 | PK | 52.1 | 27.5 | 3.6 | 32.4 | 50.8 | 73.9 | 23.1 | |
| Vert | 4874.000 | PK | 43.3 | 30.7 | 4.4 | 31.7 | 46.7 | 73.9 | 27.2 | Floor Noise |
| Vert | 7311.000 | PK | 42.1 | 35.9 | 5.6 | 32.7 | 50.9 | 73.9 | 23.0 | Floor Noise |
| Vert | 8195.110 | PK | 47.6 | 37.1 | 5.8 | 32.9 | 57.6 | 73.9 | 16.3 | |
| Vert | 9748.000 | PK | 42.3 | 38.7 | 6.5 | 33.4 | 54.1 | 73.9 | 19.8 | Floor Noise |
| Vert | 1250.000 | AV | 53.3 | 24.7 | 2.4 | 34.6 | 45.8 | 53.9 | 8.1 | |
| Vert | 1837.880 | AV | 56.8 | 25.9 | 2.9 | 33.3 | 52.3 | 53.9 | 1.6 | |
| Vert | 2499.882 | AV | 49.6 | 26.9 | 3.2 | 32.7 | 47.0 | 53.9 | 6.9 | |
| Vert | 3132.323 | AV | 46.3 | 27.5 | 3.6 | 32.4 | 45.0 | 53.9 | 8.9 | |
| Vert | 4874.000 | AV | 32.7 | 30.7 | 4.4 | 31.7 | 36.1 | 53.9 | 17.8 | Floor Noise |
| Vert | 7311.000 | AV | 33.1 | 35.9 | 5.6 | 32.7 | 41.9 | 53.9 | 12.0 | Floor Noise |
| Vert | 8195.110 | AV | 38.1 | 37.1 | 5.8 | 32.9 | 48.1 | 53.9 | 5.8 | |
| Vert | 9748.000 | AV | 33.1 | 38.7 | 6.5 | 33.4 | 44.9 | 53.9 | 9.0 | Floor Noise |

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).

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

*Noises that had duty cycle synchronized with the fundamental frequency were not detected at the band-edge and harmonics frequencies.

# Radiated Spurious Emission

| | | |
|---|---|---|
| Test place | Ise EMC Lab. No.3 Semi Anechoic Chamber | |
| Report No. | 10607274H | |
| Date | 03/03/2015 | 03/04/2015 |
| Temperature/ Humidity | 23 deg. C / 37% RH | 25deg. C / 39% RH |
| Engineer | Koji Yamamoto (1-10GHz) | Takafumi Noguchi (10-26.5GHz) |
| Mode | 11n-20 Tx 2462MHz | |

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 1250.000 | PK | 57.0 | 24.7 | 2.4 | 34.6 | 49.5 | 73.9 | 24.4 | |
| Hori | 1837.880 | PK | 59.1 | 25.9 | 2.9 | 33.3 | 54.6 | 73.9 | 19.3 | |
| Hori | 2483.500 | PK | 43.8 | 26.9 | 3.2 | 32.7 | 41.2 | 73.9 | 32.7 | |
| Hori | 2499.882 | PK | 54.1 | 26.9 | 3.2 | 32.7 | 51.5 | 73.9 | 22.4 | |
| Hori | 3132.323 | PK | 48.9 | 27.5 | 3.6 | 32.4 | 47.6 | 73.9 | 26.3 | |
| Hori | 4924.000 | PK | 42.4 | 30.8 | 4.4 | 31.7 | 45.9 | 73.9 | 28.0 | Floor Noise |
| Hori | 7386.000 | PK | 42.9 | 35.9 | 5.6 | 32.7 | 51.7 | 73.9 | 22.2 | Floor Noise |
| Hori | 8195.917 | PK | 48.3 | 37.1 | 5.8 | 32.9 | 58.3 | 73.9 | 15.6 | |
| Hori | 9848.000 | PK | 43.7 | 38.8 | 6.5 | 33.5 | 55.5 | 73.9 | 18.4 | Floor Noise |
| Hori | 1250.000 | AV | 55.3 | 24.7 | 2.4 | 34.6 | 47.8 | 53.9 | 6.1 | |
| Hori | 1837.880 | AV | 51.7 | 25.9 | 2.9 | 33.3 | 47.2 | 53.9 | 6.7 | |
| Hori | 2483.500 | AV | 33.4 | 26.9 | 3.2 | 32.7 | 30.8 | 53.9 | 23.1 | |
| Hori | 2499.882 | AV | 49.3 | 26.9 | 3.2 | 32.7 | 46.7 | 53.9 | 7.2 | |
| Hori | 3132.323 | AV | 42.2 | 27.5 | 3.6 | 32.4 | 40.9 | 53.9 | 13.0 | |
| Hori | 4924.000 | AV | 32.6 | 30.8 | 4.4 | 31.7 | 36.1 | 53.9 | 17.8 | Floor Noise |
| Hori | 7386.000 | AV | 33.0 | 35.9 | 5.6 | 32.7 | 41.8 | 53.9 | 12.1 | Floor Noise |
| Hori | 8195.917 | AV | 36.6 | 37.1 | 5.8 | 32.9 | 46.6 | 53.9 | 7.3 | |
| Hori | 9848.000 | AV | 33.4 | 38.8 | 6.5 | 33.5 | 45.2 | 53.9 | 8.7 | Floor Noise |
| Vert | 1250.000 | PK | 54.5 | 24.7 | 2.4 | 34.6 | 47.0 | 73.9 | 26.9 | |
| Vert | 1837.880 | PK | 64.8 | 25.9 | 2.9 | 33.3 | 60.3 | 73.9 | 13.6 | |
| Vert | 2483.500 | PK | 43.6 | 26.9 | 3.2 | 32.7 | 41.0 | 73.9 | 32.9 | |
| Vert | 2499.882 | PK | 52.1 | 26.9 | 3.2 | 32.7 | 49.5 | 73.9 | 24.4 | |
| Vert | 3132.323 | PK | 51.5 | 27.5 | 3.6 | 32.4 | 50.2 | 73.9 | 23.7 | |
| Vert | 4924.000 | PK | 43.2 | 30.8 | 4.4 | 31.7 | 46.7 | 73.9 | 27.2 | Floor Noise |
| Vert | 7386.000 | PK | 43.3 | 35.9 | 5.6 | 32.7 | 52.1 | 73.9 | 21.8 | Floor Noise |
| Vert | 8195.110 | PK | 47.8 | 37.1 | 5.8 | 32.9 | 57.8 | 73.9 | 16.1 | |
| Vert | 9848.000 | PK | 42.5 | 38.8 | 6.5 | 33.5 | 54.3 | 73.9 | 19.6 | Floor Noise |
| Vert | 1250.000 | AV | 53.7 | 24.7 | 2.4 | 34.6 | 46.2 | 53.9 | 7.7 | |
| Vert | 1837.880 | AV | 56.1 | 25.9 | 2.9 | 33.3 | 51.6 | 53.9 | 2.3 | |
| Vert | 2483.500 | AV | 33.7 | 26.9 | 3.2 | 32.7 | 31.1 | 53.9 | 22.8 | |
| Vert | 2499.882 | AV | 48.1 | 26.9 | 3.2 | 32.7 | 45.5 | 53.9 | 8.4 | |
| Vert | 3132.323 | AV | 45.7 | 27.5 | 3.6 | 32.4 | 44.4 | 53.9 | 9.5 | |
| Vert | 4924.000 | AV | 32.3 | 30.8 | 4.4 | 31.7 | 35.8 | 53.9 | 18.1 | Floor Noise |
| Vert | 7386.000 | AV | 33.0 | 35.9 | 5.6 | 32.7 | 41.8 | 53.9 | 12.1 | Floor Noise |
| Vert | 8195.110 | AV | 36.7 | 37.1 | 5.8 | 32.9 | 46.7 | 53.9 | 7.2 | |
| Vert | 9848.000 | AV | 33.5 | 38.8 | 6.5 | 33.5 | 45.3 | 53.9 | 8.6 | Floor Noise |

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).

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

*Noises that had duty cycle synchronized with the fundamental frequency were not detected at the band-edge and harmonics frequencies.

# Radiated Spurious Emission

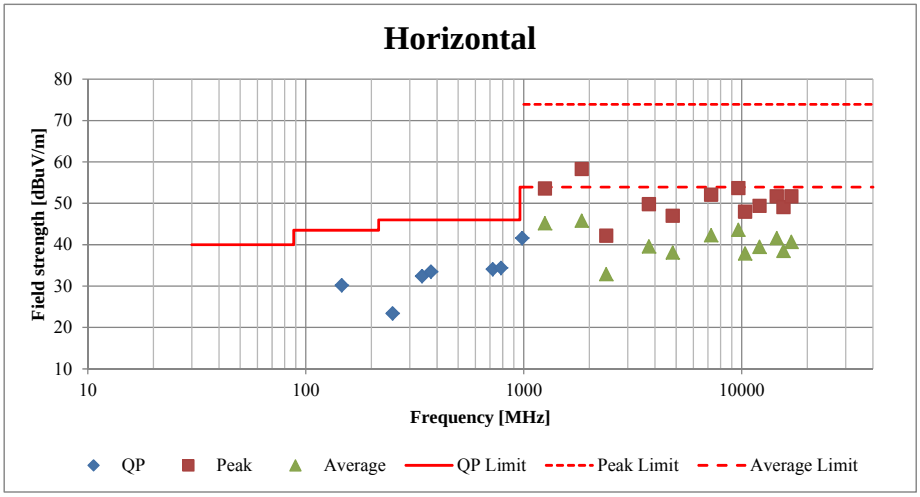
Test place Ise EMC Lab. No. 2 Semi Anechoic Chamber
Report No. 10607274H
Date 06/24/2015
Temperature/ Humidity 25 deg. C / 43% RH
Engineer Tsubasa Takayama
(30MHz-26.5GHz)
Mode 11n-20 Tx 2412MHz + 11a Tx 5180MHz Co location transmitting

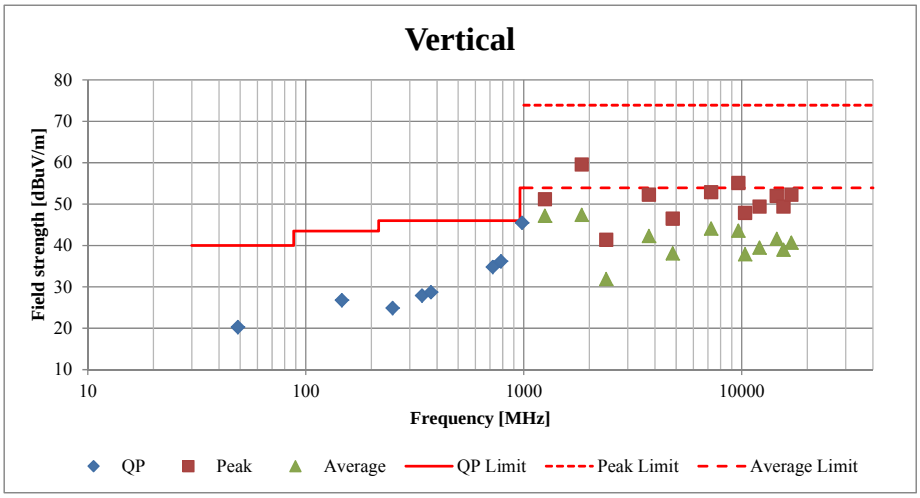
| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 146.100 | QP | 35.8 | 14.7 | 7.8 | 28.1 | 30.2 | 43.5 | 13.3 | |
| Hori | 249.987 | QP | 25.3 | 17.2 | 8.5 | 27.6 | 23.4 | 46.0 | 22.6 | |
| Hori | 341.251 | QP | 35.2 | 15.9 | 9.1 | 27.8 | 32.4 | 46.0 | 13.6 | |
| Hori | 374.949 | QP | 35.4 | 16.9 | 9.3 | 28.1 | 33.5 | 46.0 | 12.5 | |
| Hori | 720.002 | QP | 30.5 | 20.9 | 10.7 | 28.0 | 34.1 | 46.0 | 11.9 | |
| Hori | 786.503 | QP | 29.4 | 21.7 | 11.0 | 27.7 | 34.4 | 46.0 | 11.6 | |
| Hori | 983.006 | QP | 33.7 | 23.4 | 11.6 | 27.1 | 41.6 | 53.9 | 12.3 | |
| Hori | 1249.982 | PK | 61.6 | 25.8 | 2.0 | 35.8 | 53.6 | 73.9 | 20.3 | |
| Hori | 1844.828 | PK | 62.6 | 28.5 | 2.4 | 35.2 | 58.3 | 73.9 | 15.6 | |
| Hori | 2390.000 | PK | 45.1 | 29.3 | 2.8 | 35.0 | 42.2 | 73.9 | 31.7 | |
| Hori | 3750.349 | PK | 49.9 | 30.5 | 3.5 | 34.1 | 49.8 | 73.9 | 24.1 | |
| Hori | 4824.000 | PK | 44.5 | 32.7 | 4.0 | 34.2 | 47.0 | 73.9 | 26.9 | |
| Hori | 7236.000 | PK | 44.3 | 36.8 | 5.1 | 34.1 | 52.1 | 73.9 | 21.8 | |
| Hori | 9648.000 | PK | 43.5 | 38.9 | 6.0 | 34.7 | 53.7 | 73.9 | 20.2 | |
| Hori | 10360.000 | PK | 45.7 | 40.0 | -3.3 | 34.4 | 48.0 | 73.9 | 25.9 | Floor Noise |
| Hori | 12060.000 | PK | 45.3 | 40.3 | -2.7 | 33.5 | 49.4 | 73.9 | 24.5 | Floor Noise |
| Hori | 14472.000 | PK | 45.3 | 41.6 | -2.4 | 32.8 | 51.7 | 73.9 | 22.2 | Floor Noise |
| Hori | 15540.000 | PK | 45.1 | 39.6 | -2.1 | 33.5 | 49.1 | 73.9 | 24.8 | Floor Noise |
| Hori | 16884.000 | PK | 45.0 | 41.3 | -1.8 | 32.8 | 51.7 | 73.9 | 22.2 | Floor Noise |
| Hori | 1249.982 | AV | 53.2 | 25.8 | 2.0 | 35.8 | 45.2 | 53.9 | 8.7 | |
| Hori | 1844.828 | AV | 50.1 | 28.5 | 2.4 | 35.2 | 45.8 | 53.9 | 8.1 | |
| Hori | 2390.000 | AV | 35.8 | 29.3 | 2.8 | 35.0 | 32.9 | 53.9 | 21.0 | |
| Hori | 3750.349 | AV | 39.7 | 30.5 | 3.5 | 34.1 | 39.6 | 53.9 | 14.3 | |
| Hori | 4824.000 | AV | 35.6 | 32.7 | 4.0 | 34.2 | 38.1 | 53.9 | 15.8 | |
| Hori | 7236.000 | AV | 34.5 | 36.8 | 5.1 | 34.1 | 42.3 | 53.9 | 11.6 | |
| Hori | 9648.000 | AV | 33.4 | 38.9 | 6.0 | 34.7 | 43.6 | 53.9 | 10.3 | |
| Hori | 10360.000 | AV | 35.6 | 40.0 | -3.3 | 34.4 | 37.9 | 53.9 | 16.0 | Floor Noise |
| Hori | 12060.000 | AV | 35.4 | 40.3 | -2.7 | 33.5 | 39.5 | 53.9 | 14.4 | Floor Noise |
| Hori | 14472.000 | AV | 35.2 | 41.6 | -2.4 | 32.8 | 41.6 | 53.9 | 12.3 | Floor Noise |
| Hori | 15540.000 | AV | 34.5 | 39.6 | -2.1 | 33.5 | 38.5 | 53.9 | 15.4 | Floor Noise |
| Hori | 16884.000 | AV | 34.0 | 41.3 | -1.8 | 32.8 | 40.7 | 53.9 | 13.2 | Floor Noise |
| Vert | 48.750 | QP | 30.7 | 11.1 | 7.0 | 28.5 | 20.3 | 40.0 | 19.7 | |
| Vert | 146.250 | QP | 32.4 | 14.7 | 7.8 | 28.1 | 26.8 | 43.5 | 16.7 | |
| Vert | 249.987 | QP | 26.8 | 17.2 | 8.5 | 27.6 | 24.9 | 46.0 | 21.1 | |
| Vert | 341.266 | QP | 30.7 | 15.9 | 9.1 | 27.8 | 27.9 | 46.0 | 18.1 | |
| Vert | 374.970 | QP | 30.6 | 16.9 | 9.3 | 28.1 | 28.7 | 46.0 | 17.3 | |
| Vert | 719.960 | QP | 31.2 | 20.9 | 10.7 | 28.0 | 34.8 | 46.0 | 11.2 | |
| Vert | 786.403 | QP | 31.2 | 21.7 | 11.0 | 27.7 | 36.2 | 46.0 | 9.8 | |
| Vert | 982.506 | QP | 37.6 | 23.4 | 11.6 | 27.1 | 45.5 | 53.9 | 8.4 | |
| Vert | 1249.931 | PK | 59.2 | 25.8 | 2.0 | 35.8 | 51.2 | 73.9 | 22.7 | |
| Vert | 1844.828 | PK | 63.9 | 28.5 | 2.4 | 35.2 | 59.6 | 73.9 | 14.3 | |
| Vert | 2390.000 | PK | 44.3 | 29.3 | 2.8 | 35.0 | 41.4 | 73.9 | 32.5 | |
| Vert | 3750.349 | PK | 52.4 | 30.5 | 3.5 | 34.1 | 52.3 | 73.9 | 21.6 | |
| Vert | 4824.000 | PK | 44.0 | 32.7 | 4.0 | 34.2 | 46.5 | 73.9 | 27.4 | |
| Vert | 7236.000 | PK | 45.1 | 36.8 | 5.1 | 34.1 | 52.9 | 73.9 | 21.0 | |
| Vert | 9648.000 | PK | 44.9 | 38.9 | 6.0 | 34.7 | 55.1 | 73.9 | 18.8 | |
| Vert | 10360.000 | PK | 45.6 | 40.0 | -3.3 | 34.4 | 47.9 | 73.9 | 26.0 | Floor Noise |
| Vert | 12060.000 | PK | 45.3 | 40.3 | -2.7 | 33.5 | 49.4 | 73.9 | 24.5 | Floor Noise |
| Vert | 14472.000 | PK | 45.6 | 41.6 | -2.4 | 32.8 | 52.0 | 73.9 | 21.9 | Floor Noise |
| Vert | 15540.000 | PK | 45.4 | 39.6 | -2.1 | 33.5 | 49.4 | 73.9 | 24.5 | Floor Noise |
| Vert | 16884.000 | PK | 45.6 | 41.3 | -1.8 | 32.8 | 52.3 | 73.9 | 21.6 | Floor Noise |
| Vert | 1249.931 | AV | 55.2 | 25.8 | 2.0 | 35.8 | 47.2 | 53.9 | 6.7 | |
| Vert | 1844.828 | AV | 51.7 | 28.5 | 2.4 | 35.2 | 47.4 | 53.9 | 6.5 | |
| Vert | 2390.000 | AV | 34.8 | 29.3 | 2.8 | 35.0 | 31.9 | 53.9 | 22.0 | |
| Vert | 3750.349 | AV | 42.4 | 30.5 | 3.5 | 34.1 | 42.3 | 53.9 | 11.6 | |
| Vert | 4824.000 | AV | 35.6 | 32.7 | 4.0 | 34.2 | 38.1 | 53.9 | 15.8 | |
| Vert | 7236.000 | AV | 36.3 | 36.8 | 5.1 | 34.1 | 44.1 | 53.9 | 9.8 | |
| Vert | 9648.000 | AV | 33.4 | 38.9 | 6.0 | 34.7 | 43.6 | 53.9 | 10.3 | |
| Vert | 10360.000 | AV | 35.6 | 40.0 | -3.3 | 34.4 | 37.9 | 53.9 | 16.0 | Floor Noise |
| Vert | 12060.000 | AV | 35.4 | 40.3 | -2.7 | 33.5 | 39.5 | 53.9 | 14.4 | Floor Noise |
| Vert | 14472.000 | AV | 35.2 | 41.6 | -2.4 | 32.8 | 41.6 | 53.9 | 12.3 | Floor Noise |
| Vert | 15540.000 | AV | 35.0 | 39.6 | -2.1 | 33.5 | 39.0 | 53.9 | 14.9 | Floor Noise |
| Vert | 16884.000 | AV | 34.0 | 41.3 | -1.8 | 32.8 | 40.7 | 53.9 | 13.2 | Floor Noise |

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).
Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB
*Noises that had duty cycle synchronized with the fundamental frequency were not detected at the band-edge and harmonics frequencies.

# Radiated Spurious Emission
## (Plot data, Worst case)

| | |
|---|---|
| Test place | Ise EMC Lab. No. 2 Semi Anechoic Chamber |
| Report No. | 10607274H |
| Date | 06/24/2015 |
| Temperature/ Humidity | 25 deg. C / 43% RH |
| Engineer | Tsubasa Takayama<br>(30MHz-26.5GHz) |
| Mode | 11n-20 Tx 2412MHz + 11a Tx 5180MHz Co location transmitting |



# Radiated Spurious Emission

| | |
|---|---|
| Test place | Ise EMC Lab. No.2 Semi Anechoic Chamber |
| Report No. | 10607274H |
| Date | 06/24/2015 |
| Temperature/ Humidity | 25 deg. C / 43% RH |
| Engineer | Tsubasa Takayama<br>(1-10GHz) |
| Mode | 11n-20 Tx 2412MHz + 11a Tx 5180MHz Co location transmitting |

**20dBc Data Sheet**

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 2412.000 | PK | 89.2 | 29.3 | 2.8 | 35.0 | 86.3 | - | - | Carrier |
| Hori | 2400.000 | PK | 49.3 | 29.3 | 2.8 | 35.0 | 46.4 | 66.3 | 19.9 | |
| Vert | 2412.000 | PK | 89.6 | 29.3 | 2.8 | 35.0 | 86.7 | - | - | Carrier |
| Vert | 2400.000 | PK | 48.3 | 29.3 | 2.8 | 35.0 | 45.4 | 66.7 | 21.3 | |

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

# Radiated Spurious Emission

| | |
|---|---|
| Test place | Ise EMC Lab. No.2 Semi Anechoic Chamber |
| Report No. | 10607274H |
| Date | 06/24/2015 |
| Temperature/ Humidity | 25 deg. C / 43% RH |
| Engineer | Tsubasa Takayama<br>(1-10GHz) |
| Mode | 11n-20 Tx 2462MHz + 11a Tx 5180MHz Co location transmitting |

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 2483.500 | PK | 45.4 | 29.3 | 2.8 | 34.9 | 42.6 | 73.9 | 31.3 | |
| Hori | 2483.500 | AV | 35.5 | 29.3 | 2.8 | 34.9 | 32.7 | 53.9 | 21.2 | |
| Vert | 2483.500 | PK | 45.9 | 29.3 | 2.8 | 34.9 | 43.1 | 73.9 | 30.8 | |
| Vert | 2483.500 | AV | 35.8 | 29.3 | 2.8 | 34.9 | 33.0 | 53.9 | 20.9 | |

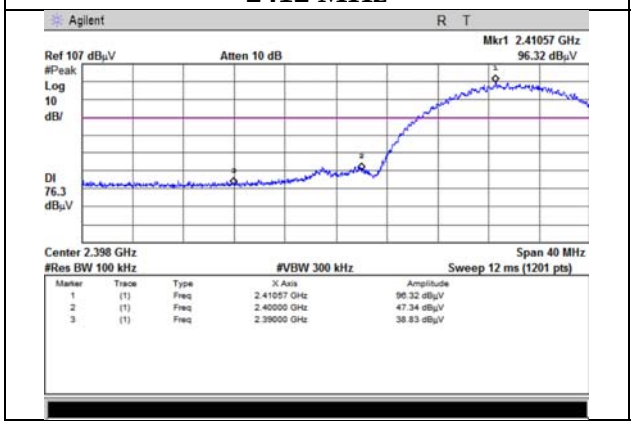
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).
Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB
*Noises that had duty cycle synchronized with the fundamental frequency were not detected at the band-edge and harmonics frequencies.

# Band Edge confirmation

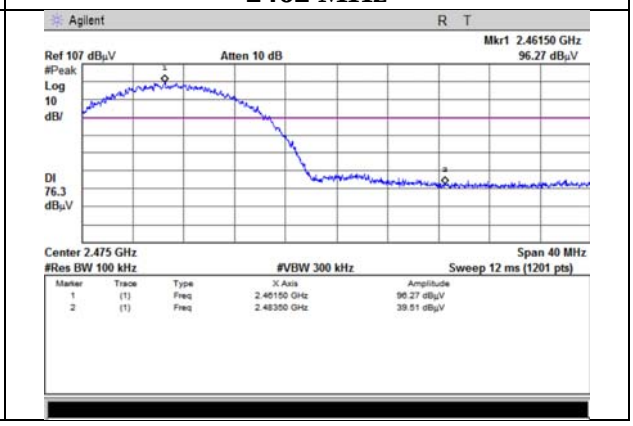
| | |
|---|---|
| Test place | Ise EMC Lab. No.3 Semi Anechoic Chamber |
| Report No. | 10607274H |
| Date | 03/03/2015 |
| Temperature/ Humidity | 23 deg. C / 37% RH |
| Engineer | Koji Yamamoto |
| Mode | 11b/11n-20 Tx |

## 11b

**2412 MHz**

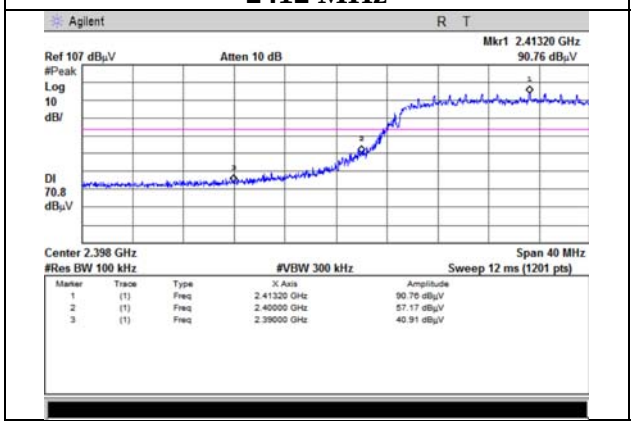



**2462 MHz**

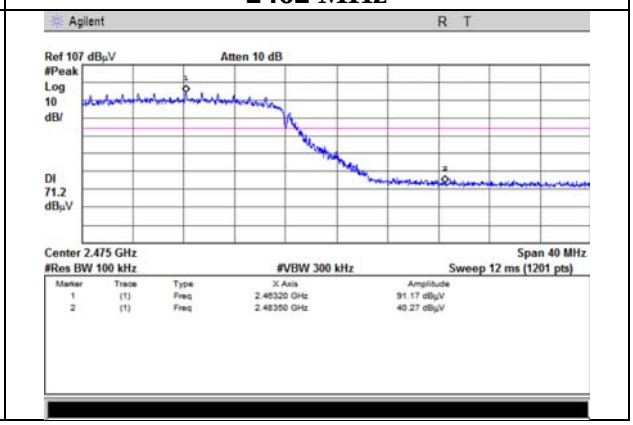



## 11n-20

**2412 MHz**




**2462 MHz**



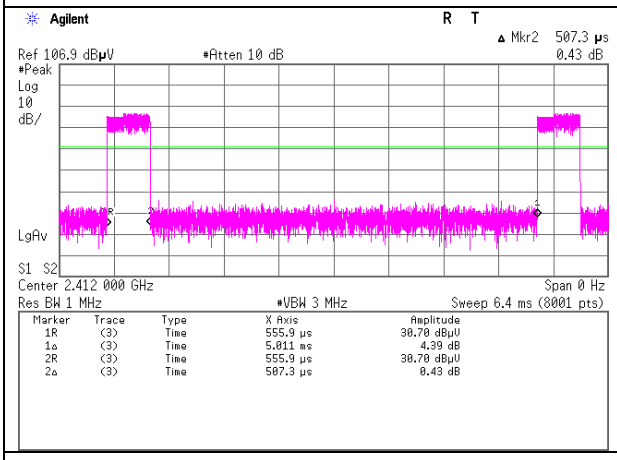

* Final result of band edge was measured as radiated spurious emission. Refer to Radiated Spurious Emission's pages.

# Burst rate confirmation

| | |
|---|---|
| Test place | Ise EMC Lab. No.3 Anechoic Chamber |
| Report No. | 10607274H |
| Date | 03/03/2015 |
| Temperature/ Humidity | 23deg. C / 40% RH |
| Engineer | Takafumi Noguchi |
| Mode | 11b Tx / 11g Tx / 11n-20 Tx |

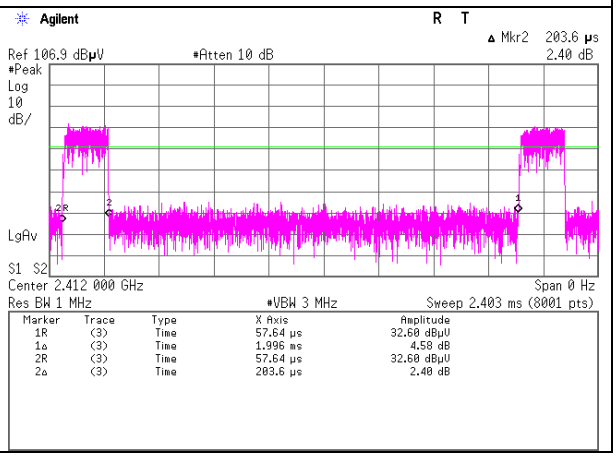
## 11b 5.5Mbps

**Tx on / (Tx on + Tx off) = 0.101**
**Tx on / (Tx on + Tx off) * 100 = 10.1 %**
**Duty factor = 10 * log (5.011 / 0.5073) = 9.95 dB**



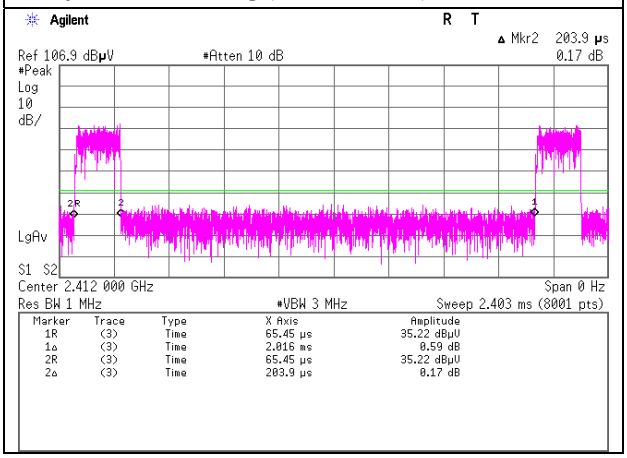

## 11g 18Mbps

**Tx on / (Tx on + Tx off) = 0.102**
**Tx on / (Tx on + Tx off) * 100 = 10.2 %**
**Duty factor = 10 * log (1.996 / 0.2036) = 9.91 dB**




## 11n-20 MCS0

**Tx on / (Tx on + Tx off) = 0.101**
**Tx on / (Tx on + Tx off) * 100 = 10.1 %**
**Duty factor = 10 * log (2.016 / 0.2039) = 9.95 dB**

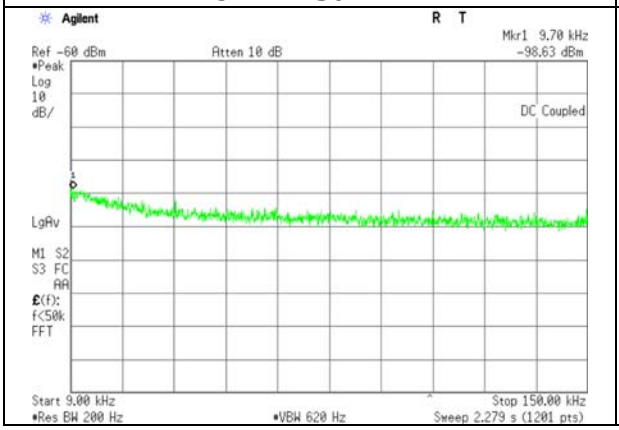


# Conducted Spurious Emission

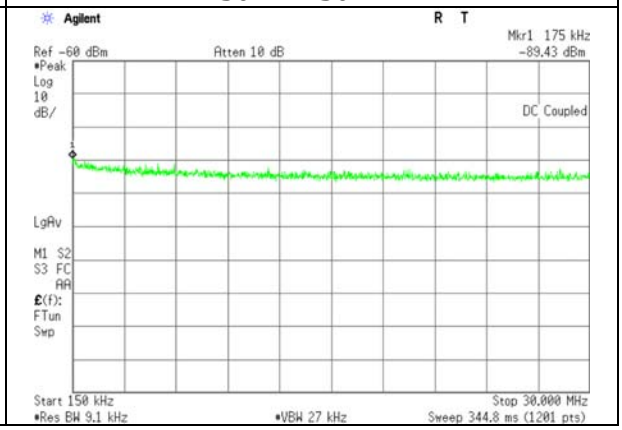
| | |
|---|---|
| Test place | Ise EMC Lab. No.11 Measurement Room |
| Report No. | 10607274H |
| Date | 03/04/2015 |
| Temperature/ Humidity | 22 deg. C / 32% RH |
| Engineer | Tsubasa Takayama |
| Mode | 11n-20 Tx |

## 11n-20 Tx 2412MHz

### 9kHz-150kHz




### 150kHz-30MHz




| Frequency [kHz] | Reading [dBm] | Cable Loss [dB] | Attenator [dB] | Antenna Gain [dBi] | EIRP [dBm] | Distance [m] | Ground bounce [dB] | E (field strength) [dBuV/m] | Limit [dBuV/m] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|---|---|
| 9.70 | -98.6 | 1.00 | 9.8 | 3.3 | -84.5 | 300 | 6.0 | -23.2 | 47.8 | 71.0 |
| 175.00 | -89.4 | 1.00 | 9.8 | 3.3 | -75.3 | 300 | 6.0 | -14.0 | 22.7 | 36.7 |

E=EIRP-20log(D)+Ground bounce +104.8[dBuV/m]

EIRP=Reading+Cable Loss(including customer supply cable)+Attenator+Antenna Gain+10*log(N)

# Power Density

| | |
|---|---|
| Test place | Ise EMC Lab. No.11 Measurement Room |
| Report No. | 10607274H |
| Date | 03/04/2015 |
| Temperature/ Humidity | 22 deg. C / 32% RH |
| Engineer | Tsubasa Takayama |
| Mode | 11b Tx / 11g Tx / 11n-20 Tx |

11b

| Freq. [MHz] | Reading [dBm] | Cable Loss [dB] | Atten. [dB] | Result [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|
| 2412.00 | -12.31 | 2.32 | 10.08 | 0.09 | 8.00 | 7.91 |
| 2437.00 | -22.62 | 2.32 | 10.08 | -10.22 | 8.00 | 18.22 |
| 2462.00 | -23.50 | 2.33 | 10.08 | -11.09 | 8.00 | 19.09 |

11g

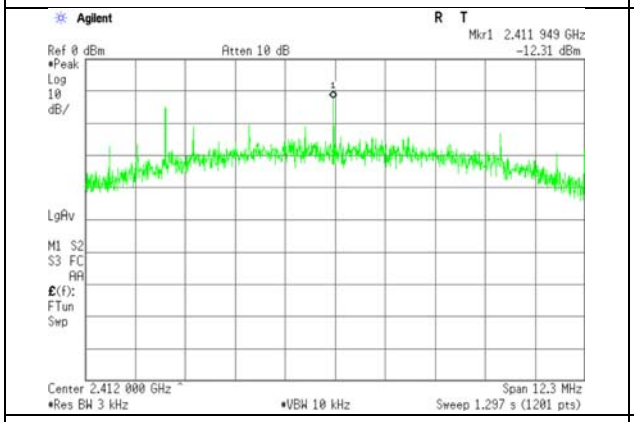
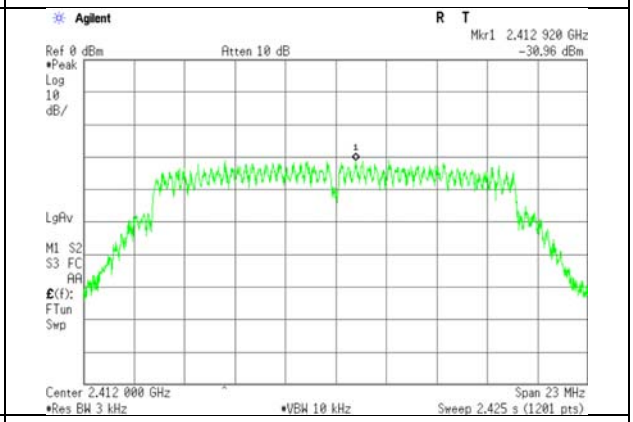
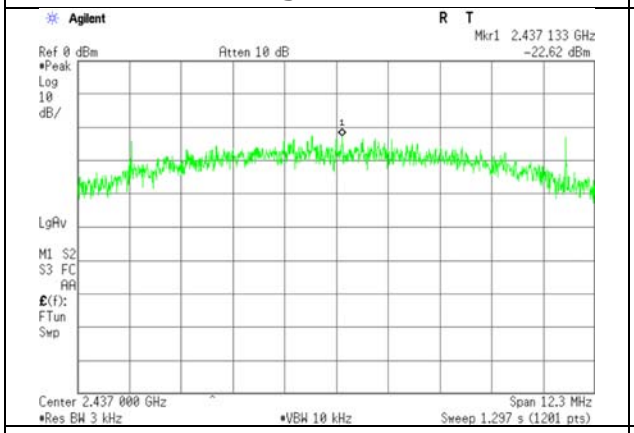
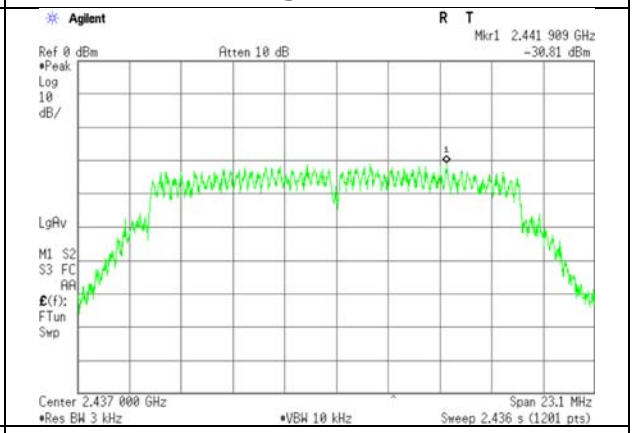
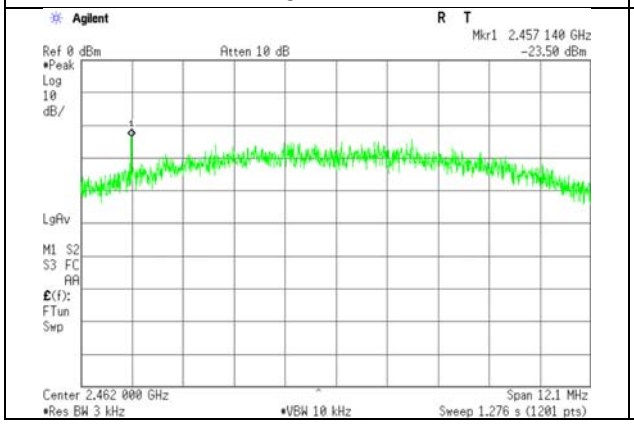
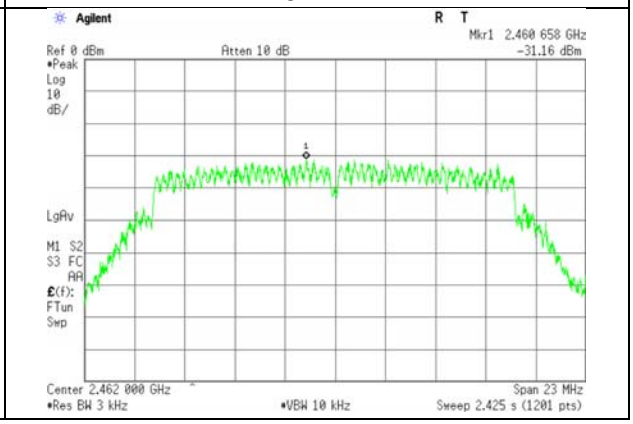
| Freq. [MHz] | Reading [dBm] | Cable Loss [dB] | Atten. [dB] | Result [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|
| 2412.00 | -30.96 | 2.32 | 10.08 | -18.56 | 8.00 | 26.56 |
| 2437.00 | -30.81 | 2.32 | 10.08 | -18.41 | 8.00 | 26.41 |
| 2462.00 | -31.16 | 2.33 | 10.08 | -18.75 | 8.00 | 26.75 |

11n-20

| Freq. [MHz] | Reading [dBm] | Cable Loss [dB] | Atten. [dB] | Result [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|
| 2412.00 | -30.22 | 2.32 | 10.08 | -17.82 | 8.00 | 25.82 |
| 2437.00 | -30.27 | 2.32 | 10.08 | -17.87 | 8.00 | 25.87 |
| 2462.00 | -30.25 | 2.33 | 10.08 | -17.84 | 8.00 | 25.84 |

Sample Calculation:
Result = Reading + Cable Loss (including Cable(s) Customer Supplied) + Attenuator

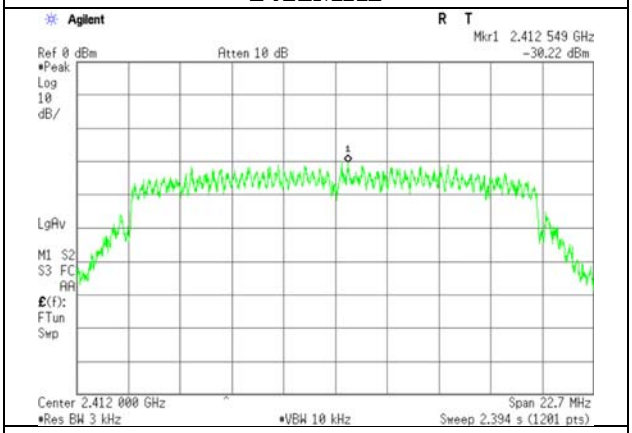
# Power Density

| 11b | 11g |
|---|---|
| **2412MHz** | **2412MHz** |
|  |  |
| **2437MHz** | **2437MHz** |
|  |  |
| **2462MHz** | **2462MHz** |
|  |  |

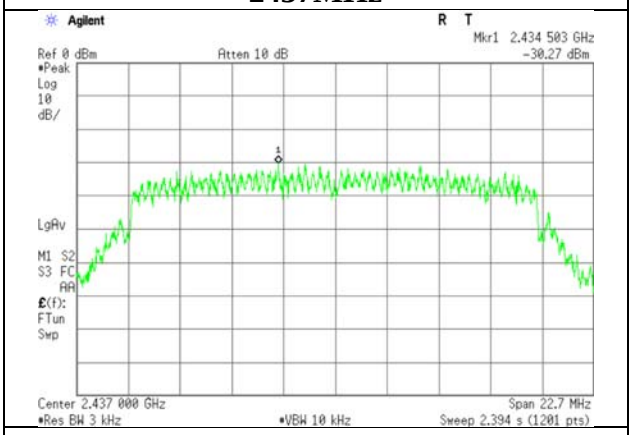
# Power Density

## 11n-20

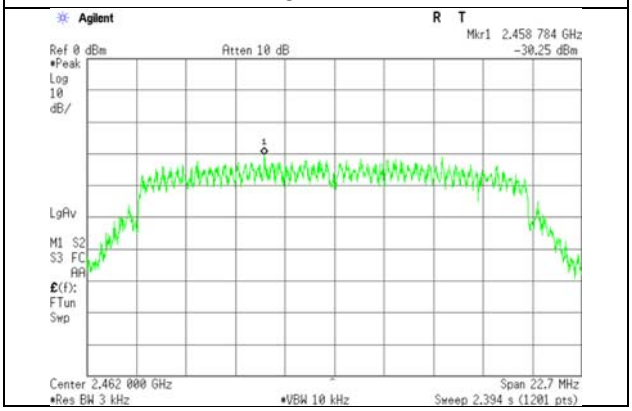
### 2412MHz




### 2437MHz

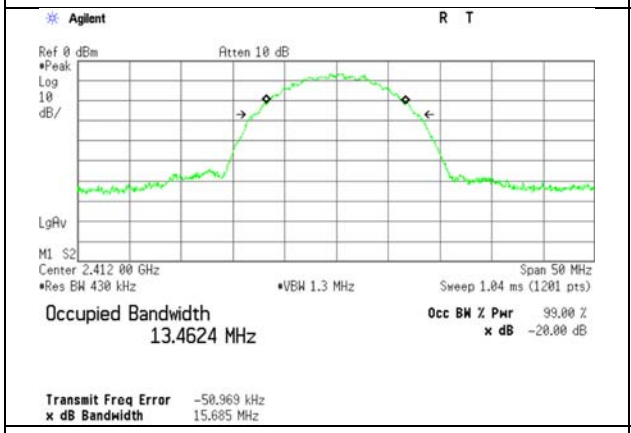
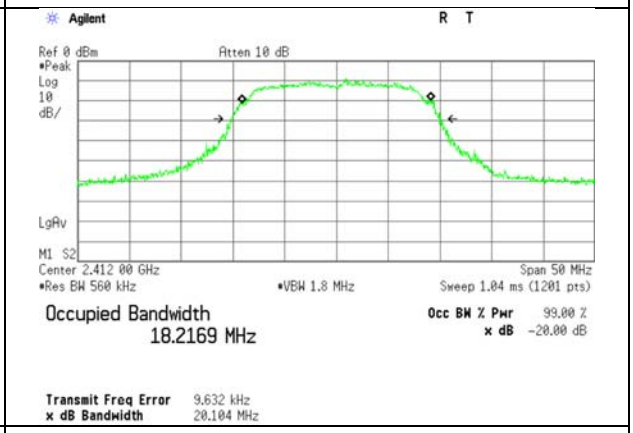
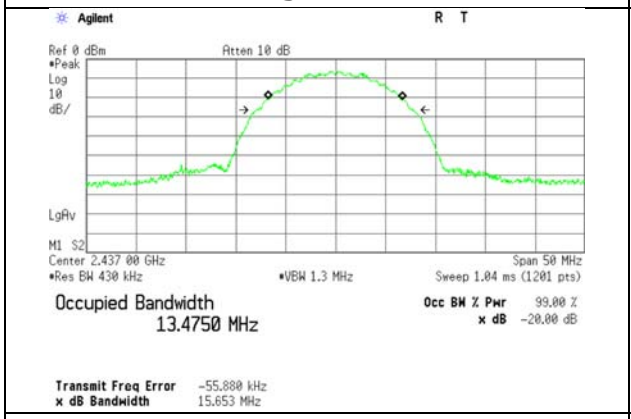
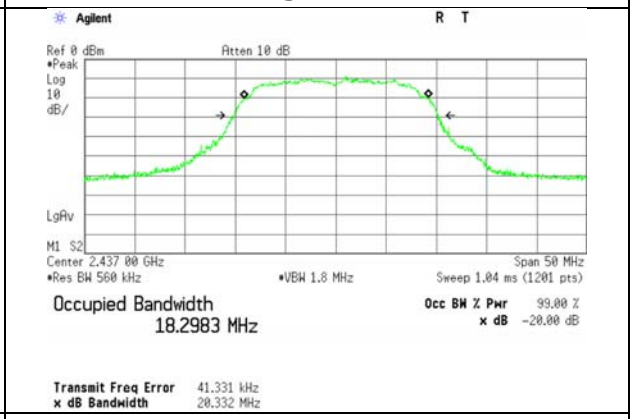
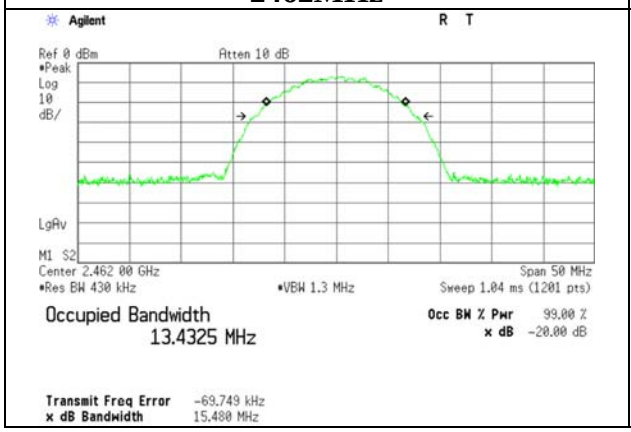
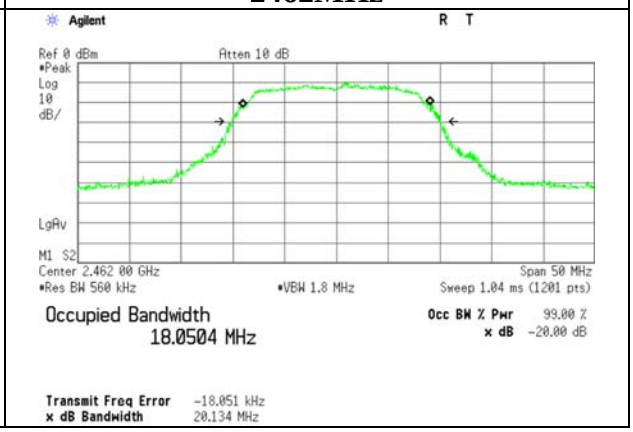



### 2462MHz



# 99%Occupied Bandwidth

| | |
|---|---|
| Test place | Ise EMC Lab. No.11 Measurement Room |
| Report No. | 10607274H |
| Date | 03/04/2015 |
| Temperature/ Humidity | 22 deg. C / 32% RH |
| Engineer | Tsubasa Takayama |
| Mode | 11b Tx / 11g Tx |

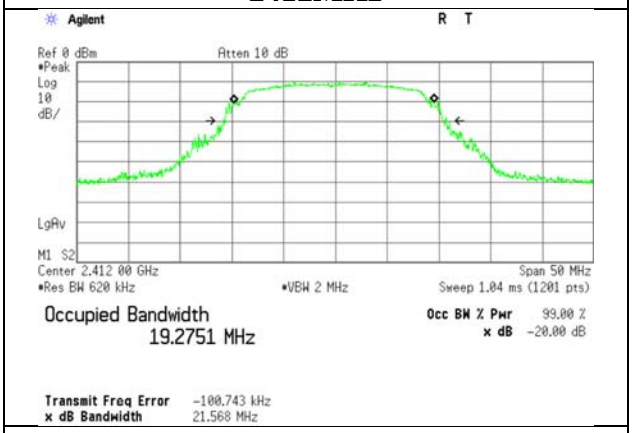
| 11b | 11g |
|---|---|
| **2412MHz** | **2412MHz** |
|  |  |
| **2437MHz** | **2437MHz** |
|  |  |
| **2462MHz** | **2462MHz** |
|  |  |

# 99% Occupied Bandwidth

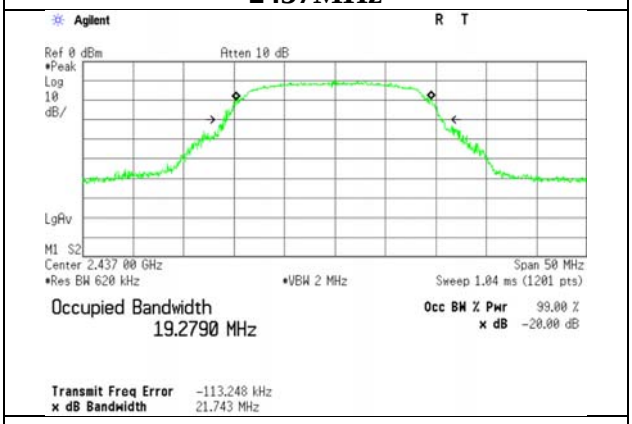
| | |
|---|---|
| Test place | Ise EMC Lab. No.11 Measurement Room |
| Report No. | 10607274H |
| Date | 03/04/2015 |
| Temperature/ Humidity | 22 deg. C / 32% RH |
| Engineer | Tsubasa Takayama |
| Mode | 11n-20 Tx |

## 11n-20

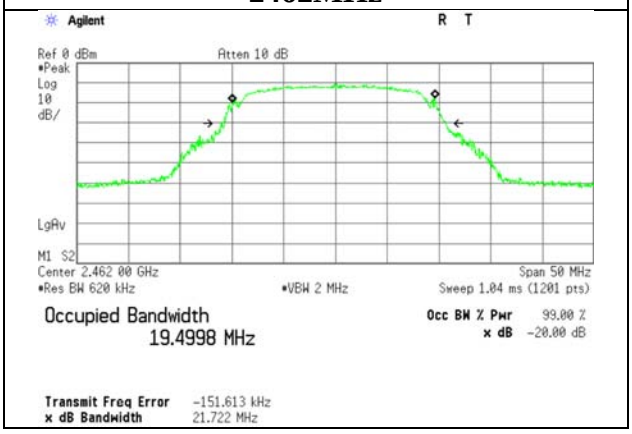
### 2412MHz




### 2437MHz




### 2462MHz



# APPENDIX 2: Test instruments

## EMI test equipment (1/2)

| Control No. | Instrument | Manufacturer | Model No | Serial No | Test Item | Calibration Date * Interval(month) |
|---|---|---|---|---|---|---|
| MRENT-116 | Spectrum Analyzer | Agilent | E4440A | MY46187620 | AT | 2015/03/09 * 12 |
| MPM-12 | Power Meter | Anritsu | ML2495A | 0825002 | AT | 2014/06/16 * 12 |
| MPSE-17 | Power sensor | Anritsu | MA2411B | 0738285 | AT | 2014/06/16 * 12 |
| MPSE-22 | Power sensor | Agilent | N1923A | MY54070003 | AT | 2014/04/04 * 12 *1) |
| MPM-16 | Power Meter | Agilent | 8990B | MY51000271 | AT | 2014/04/04 * 12 *1) |
| MAT-23 | Attenuator(10dB) 1-18GHz | Orient Microwave | BX10-0476-00 | - | AT | 2014/03/13 * 12 *1) |
| MCC-66 | Microwave Cable 1G-40GHz | Suhner | SUCOFLEX102 | 28636/2 | AT | 2014/04/09 * 12 *1) |
| MOS-19 | Thermo-Hygrometer | Custom | CTH-201 | 0001 | AT | 2014/12/22 * 12 |
| MCC-38 | Coaxial Cable | UL Japan | - | - | AT | 2014/12/02 * 12 |
| MAT-10 | Attenuator(10dB) | Weinschel Corp | 2 | BL1173 | AT | 2014/11/19 * 12 |
| MSA-16 | Spectrum Analyzer | Agilent | E4440A | MY46186390 | AT | 2015/02/16 * 12 |
| MAEC-03 | Semi Anechoic Chamber(NSA) | TDK | Semi Anechoic Chamber 3m | DA-10005 | RE | 2015/02/19 * 12 |
| MOS-13 | Thermo-Hygrometer | Custom | CTH-180 | 1301 | RE | 2015/01/13 * 12 |
| MJM-16 | Measure | KOMELON | KMC-36 | - | RE | - |
| COTS-MEMI | EMI measurement program | TSJ | TEPTO-DV | - | RE | - |
| MSA-03 | Spectrum Analyzer | Agilent | E4448A | MY44020357 | RE | 2014/04/08 * 12 *1) |
| MHA-20 | Horn Antenna 1-18GHz | Schwarzbeck | BBHA9120D | 258 | RE | 2014/05/26 * 12 *1) |
| MCC-167 | Microwave Cable | Junkosha | MWX221 | 1404S374(1m) / 1405S074(5m) | RE | 2014/05/26 * 12 *1) |
| MPA-11 | MicroWave System Amplifier | Agilent | 83017A | MY39500779 | RE | 2014/03/24 * 12 *1) |
| MHF-25 | High Pass Filter 3.5-18.0GHz | UL Japan | HPF SELECTOR | 001 | RE | 2014/09/22 * 12 |
| MHA-16 | Horn Antenna 15-40GHz | Schwarzbeck | BBHA9170 | BBHA9170306 | RE | 2014/05/26 * 12 *1) |
| MHF-22 | High Pass Filter 7-20GHz | TOKIMEC | TF37NCCB | 602 | RE | 2015/01/27 * 12 |
| MCC-79 | Microwave Cable 1G-26.5GHz | Suhner | SUCOFLEX104 | 278923/4 | RE | 2014/12/15 * 12 |
| MPA-22 | Pre Amplifier | MITEQ, Inc | AMF-6F-2600400-33-8P / AMF-4F-2600400-33-8P | 1871355 /1871328 | RE | 2014/09/11 * 12 |
| MHA-29 | Horn Antenna 26.5-40GHz | ETS LINDGREN | 3160-10 | 00152399 | RE | 2014/09/02 * 12 |
| MCC-54 | Microwave Cable | Suhner | SUCOFLEX101 | 2873(1m) / 2876(5m) | RE | 2014/03/11 * 12 *1) |
| MTR-08 | Test Receiver | Rohde & Schwarz | ESCI | 100767 | RE | 2014/08/19 * 12 |
| MBA-03 | Biconical Antenna | Schwarzbeck | BBA9106 | 1915 | RE | 2014/10/18 * 12 |
| MLA-03 | Logperiodic Antenna | Schwarzbeck | USLP9143 | 174 | RE | 2014/10/18 * 12 |
| MCC-51 | Coaxial cable | UL Japan | - | - | RE | 2014/07/14 * 12 |
| MAT-70 | Attenuator(6dB) | Agilent | 8491A-006 | MY52460153 | RE | 2014/04/14 * 12 *1) |
| MPA-13 | Pre Amplifier | SONOMA INSTRUMENT | 310 | 260834 | RE | 2015/03/10 * 12 |
| MHA-06 | Horn Antenna 1-18GHz | Schwarzbeck | BBHA9120D | 254 | RE | 2015/02/05 * 12 |
| MPA-03 | Microwave System Power Amplifier | Agilent | 83050A | 3950M00205 | RE | 2015/06/02 * 12 |
| MHA-16 | Horn Antenna 15-40GHz | Schwarzbeck | BBHA9170 | BBHA9170306 | RE | 2015/05/19 * 12 |
| MAEC-02 | Semi Anechoic Chamber(NSA) | TDK | Semi Anechoic Chamber 3m | DA-06902 | RE | 2014/06/25 * 12 |
| MOS-22 | Thermo-Hygrometer | Custom | CTH-201 | 0003 | RE | 2015/01/13 * 12 |
| MJM-14 | Measure | KOMELON | KMC-36 | - | RE | - |

***1) This test equipment was used for the tests before the expiration date of the calibration.**

**EMI test equipment (2/2)**

| Control No. | Instrument | Manufacturer | Model No | Serial No | Test Item | Calibration Date * Interval(month) |
|---|---|---|---|---|---|---|
| MSA-04 | Spectrum Analyzer | Agilent | E4448A | US44300523 | RE | 2014/11/12 * 12 |
| MTR-03 | Test Receiver | Rohde & Schwarz | ESCI | 100300 | RE | 2015/06/08 * 12 |
| MBA-02 | Biconical Antenna | Schwarzbeck | BBA9106 | VHA91032008 | RE | 2014/10/18 * 12 |
| MLA-02 | Logperiodic Antenna | Schwarzbeck | USLP9143 | 201 | RE | 2014/10/18 * 12 |
| MCC-12 | Coaxial Cable | Fujikura/Agilent | - | - | RE | 2015/02/06 * 12 |
| MAT-07 | Attenuator(6dB) | Weinschel Corp | 2 | BK7970 | RE | 2014/11/11 * 12 |
| MPA-09 | Pre Amplifier | Agilent | 8447D | 2944A10845 | RE | 2014/09/26 * 12 |
| MCC-166 | Microwave Cable | Junkosha | MWX221 | 1303S120(1m) / 1311S167(5m) | RE | 2014/09/24 * 12 |
| MPA-10 | Pre Amplifier | Agilent | 8449B | 3008A02142 | RE | 2015/01/28 * 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: RE: Radiated Emission test**
**AT: Antenna Terminal Conducted test**