



# **RADIO TEST REPORT**

**Test Report No.: 10622710S-C**

**Applicant** : Murata Manufacturing Co., Ltd.  
**Type of Equipment** : Communication Module  
**Model No.** : Type1DR  
**FCC ID** : VPYLB1DR  
**Test regulation** : FCC Part15 Subpart C: 2015  
**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 limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
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6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.

**Date of test:** December 22, 2014 to February 11, 2015

**Representative test engineer:**

*T. Arai*

Tatsuya Arai  
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**Approved by :**

*T. Imamura*

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- ☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.  
☒ There is no testing item of "Non-accreditation".

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13-EM-F0429

## REVISION HISTORY

**Original Test Report No.: 10622710S-C**

[illegible]

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## **SECTION 1: Customer information**

Company Name : Murata Manufacturing Co., Ltd.  
Address : 10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555 Japan  
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Contact Person : Noriko Ueno

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

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

Type of equipment : Communication Module  
Model No. : Type1DR  
Serial No. : Refer to 4.2 in this report.  
Rating : 3.2(VBAT), 1.8(VDDXO), 1.8 or 3.3(VIO)  
Country of Mass-production : China, Japan  
Condition of EUT : Engineering prototype  
(Not for Sale: This sample is equivalent to mass-produced items.)  
Modification of EUT : No modification by the test lab.  
Receipt Date of Sample : December 22, 2014

### **2.2 Product description**

Model: Type1DR (referred to as the EUT in this report) is Communication Module.

Clock frequency(ies) in the system : 37.4MHz

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## **Radio Specification**

|                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Equipment type                                                                                                               | : Transceiver                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Frequency of operation                                                                                                       | : 2.4GHz: 2402-2480MHz (Bluetooth BDR/EDR/Low Energy (LE))<br>2412-2462MHz (IEEE 802.11b, 11g, 11n (HT20))<br>W52: 5180-5240MHz (IEEE 802.11a, 11n (HT20), 11ac (VHT20))<br>5190-5230MHz (IEEE 802.11n (HT40), 11ac (VHT40))<br>5210MHz (IEEE 802.11ac (VHT80))<br>W53: 5260-5320MHz (IEEE 802.11a, 11n (HT20), 11ac (VHT20))<br>5270-5310MHz (IEEE 802.11n (HT40), 11ac (VHT40))<br>5290MHz (IEEE 802.11ac (VHT80))<br>W56: 5500-5700MHz (IEEE 802.11a, 11n (HT20), 11ac (VHT20))<br>5510-5670MHz (IEEE 802.11n (HT40), 11ac (VHT40))<br>5530-5610MHz (IEEE 802.11ac (VHT80))<br>W58: 5745-5825MHz (IEEE 802.11a, 11n (HT20), 11ac (VHT20))<br>5755-5795MHz (IEEE 802.11n (HT40), 11ac (VHT40))<br>5775MHz(IEEE 802.11ac (VHT80)) |
| Bandwidth                                                                                                                    | : 20MHz (IEEE 802.11a/b/g/n/ac), 40MHz (IEEE 802.11n/ac),<br>80MHz(IEEE 802.11ac) , 79MHz (Bluetooth BDR/EDR), 1MHz (Bluetooth LE)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Channel spacing                                                                                                              | : 5MHz (Wi-Fi 2.4GHz), 20MHz/40MHz/80MHz (Wi-Fi 5GHz),<br>1MHz (Bluetooth BDR/EDR), 2MHz (Bluetooth LE)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Type of modulation                                                                                                           | : DSSS (IEEE 802.11b), OFDM (IEEE 802.11a/g/n/ac),<br>FHSS (Bluetooth BDR/EDR), GFSK (Bluetooth LE)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Antenna type                                                                                                                 | : [2.4GHz] Monopole antenna/Dipole antenna/Dual monopole antenna<br>[5GHz] Monopole antenna/ Dual monopole antenna                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Antenna connector type                                                                                                       | : spring                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Antenna gain                                                                                                                 | : [2.4GHz] Monopole antenna:+0.91dBi<br>[2.4GHz] Dipole antenna:-0.15dBi<br>[2.4GHz] Dual monopole antenna:-1.1dBi<br>[5GHz] Monopole antenna:+1.0dBi<br>[5GHz] Dual monopole antenna:+0.28dBi                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| TU code                                                                                                                      | : F1D, G1D (Bluetooth BDR/EDR), F1D (Bluetooth LE)<br>D1D, G1D (IEEE802.11b/g/n/a/ac)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Operation temperature range                                                                                                  | : -20 to +85 deg.C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| * For Bluetooth BDR/EDR part, refer to the test report: 10622710S-A. For FCC 15.407, refer to the test reports: 10622710S-E. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

FCC 15.31 (e) / 212

The RF Module has its own regulator.

The RF Module is constantly provided voltage (DC 1.2, 1.35, 2.5 and 3.0V) through the regulator regardless of input voltage. Therefore, this EUT complies with the requirement of 15.212.

FCC 15.203 / 212

It is impossible for end users to replace the antenna, because it is soldered on the circuit board.

Therefore the equipment complies with the requirement of 15.203/212.

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## 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  
 Section 15.207 Conducted limits  
 Section 15.209 Radiated emission limits, general requirements  
 Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz,  
 and 5725-5850MHz

\* The revision on January 21, 2015 does not affect the test specification applied to the EUT.

### 3.2 Procedures & Results

| Item                                         | Test Procedure *1) | Specification                   | Remarks              | Deviation | Worst Margin                                                                                                                                                   | Results  |
|----------------------------------------------|--------------------|---------------------------------|----------------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Conducted emission                           | ANSI C63.10:2009   | FCC 15.207                      | -                    | N/A       | 21.2dB<br>Detection: Average<br>Phase: L1<br>Mode: LE, Tx, 2480MHz<br><br>Freq.: 24.89773MHz<br>(2.4GHz monopole)<br><br>Freq.: 24.89778MHz<br>(2.4GHz Dipole) | Complied |
| 6dB bandwidth                                | ANSI C63.10:2009   | FCC 15.247 (a)(2)               | Conducted            | N/A       | * See data                                                                                                                                                     | Complied |
| Maximum peak output power                    | ANSI C63.10:2009   | FCC 15.247 (b)(3)               | Conducted            | N/A       |                                                                                                                                                                | Complied |
| Out of band emission & Restricted band edges | ANSI C63.10:2009   | FCC 15.109, 15.247 (d) & 15.209 | Conducted / Radiated | N/A       | 0.4 dB<br>Freq.: 2483.500MHz<br>Polarization: Horizontal<br>Detection: Average<br>Mode: Tx, IEEE802.11n HT20, 2457 MHz<br>Dipole Antenna                       | Complied |
| Power density                                | ANSI C63.10:2009   | FCC 15.247 (e)                  | Conducted            | N/A       | * See data                                                                                                                                                     | Complied |

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

\*1) These tests were also referred to KDB 558074 v03 r02 (FCC), "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

### 3.3 Addition to standard

| Item                     | Test Procedure                | Specification | Remarks   | Worst Margin | Results |
|--------------------------|-------------------------------|---------------|-----------|--------------|---------|
| Occupied Bandwidth (99%) | ANSI C63.10:2009, RSS-Gen 6.6 | -             | Conducted | -            | -       |

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

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

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### 3.4 Uncertainty

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

| Item                                            | Frequency range | No.1 SAC <sup>*1</sup> /SR <sup>*2</sup><br>(±) | No.2 SAC/SR<br>(±) | No.3 SAC/SR<br>(±) |
|-------------------------------------------------|-----------------|-------------------------------------------------|--------------------|--------------------|
| Conducted emission<br>(AC Mains) LISN           | 150kHz-30MHz    | 3.6 dB                                          | 3.4 dB             | 3.4 dB             |
| Radiated emission<br>(Measurement distance: 3m) | 9kHz-30MHz      | 3.7 dB                                          | 3.5 dB             | 3.5 dB             |
|                                                 | 30MHz-300MHz    | 4.9 dB                                          | 4.9 dB             | 4.7 dB             |
|                                                 | 300MHz-1GHz     | 5.0 dB                                          | 5.0 dB             | 4.8 dB             |
|                                                 | 1GHz-15GHz      | 4.9 dB                                          | 4.9 dB             | 4.9 dB             |
| Radiated emission<br>(Measurement distance: 1m) | 15GHz-18GHz     | 5.7 dB                                          | 5.7 dB             | 5.7 dB             |
|                                                 | 18GHz-40GHz     | 4.5 dB                                          | 4.3 dB             | 4.3 dB             |

\*1: SAC=Semi-Anechoic Chamber

\*2: SR= Shielded Room is applied besides radiated emission

#### Conducted emission test

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

#### Radiated emission test

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

#### Antenna port conducted test

Power measurement uncertainty above 1GHz for this test was: (±) 0.68dB

Spurious emission (Conducted) measurement (below 1GHz) uncertainty for this test was: (±) 1.5dB

Spurious emission (Conducted) measurement (1G-3GHz) uncertainty for this test was: (±) 1.7dB

Spurious emission (Conducted) measurement (3G-18GHz) uncertainty for this test was: (±) 2.4dB

Spurious emission (Conducted) measurement (18G-26.5GHz) uncertainty for this test was: (±) 2.5dB

Bandwidth Measurement uncertainty for this test was: (±) 0.66%

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### 3.5 Test location

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JAB Accreditation No. : RTL02610

|                                                                | IC<br>Registration<br>No. | Width x Depth x<br>Height (m) | Size of reference<br>ground plane (m) /<br>horizontal<br>conducting plane | Maximum<br>measurement<br>distance |
|----------------------------------------------------------------|---------------------------|-------------------------------|---------------------------------------------------------------------------|------------------------------------|
| <input type="checkbox"/> No.1 Semi-anechoic chamber            | 2973D-1                   | 20.6 x 11.3 x 7.65            | 20.6 x 11.3                                                               | 10m                                |
| <input type="checkbox"/> No.2 Semi-anechoic chamber            | 2973D-2                   | 20.6 x 11.3 x 7.65            | 20.6 x 11.3                                                               | 10m                                |
| <input checked="" type="checkbox"/> No.3 Semi-anechoic chamber | 2973D-3                   | 12.7 x 7.7 x 5.35             | 12.7 x 7.7                                                                | 5m                                 |
| <input type="checkbox"/> No.4 Semi-anechoic chamber            | -                         | 8.1 x 5.1 x 3.55              | 8.1 x 5.1                                                                 | -                                  |
| <input type="checkbox"/> No.1 Shielded room                    | -                         | 6.8 x 4.1 x 2.7               | 6.8 x 4.1                                                                 | -                                  |
| <input type="checkbox"/> No.2 Shielded room                    | -                         | 6.8 x 4.1 x 2.7               | 6.8 x 4.1                                                                 | -                                  |
| <input checked="" type="checkbox"/> No.3 Shielded room         | -                         | 6.3 x 4.7 x 2.7               | 6.3 x 4.7                                                                 | -                                  |
| <input type="checkbox"/> No.4 Shielded room                    | -                         | 4.4 x 4.7 x 2.7               | 4.4 x 4.7                                                                 | -                                  |
| <input checked="" type="checkbox"/> No.5 Shielded room         | -                         | 7.8 x 6.4 x 2.7               | 7.8 x 6.4                                                                 | -                                  |
| <input type="checkbox"/> No.6 Shielded room                    | -                         | 7.8 x 6.4 x 2.7               | 7.8 x 6.4                                                                 | -                                  |
| <input type="checkbox"/> No.7 Shielded room                    | -                         | 2.76 x 3.76 x 2.4             | 2.76 x 3.76                                                               | -                                  |
| <input type="checkbox"/> No.8 Shielded room                    | -                         | 3.45 x 5.5 x 2.4              | 3.45 x 5.5                                                                | -                                  |
| <input checked="" type="checkbox"/> No.1 Measurement room      | -                         | 2.55 x 4.1 x 2.5              | 2.55 x 4.1                                                                | -                                  |

### 3.6 Test setup, Test data & Test instruments

Refer to APPENDIX 1 to 3.

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**SECTION 4: Operation of E.U.T. during testing****4.1 Operating mode**

| Test item                                          | Mode                                                            | Tested frequency          | Power setting [dBm] *3) | Worst data mode *1) | Antenna *5)                       |
|----------------------------------------------------|-----------------------------------------------------------------|---------------------------|-------------------------|---------------------|-----------------------------------|
| Conducted emission, Radiated emission (below 1GHz) | Transmitting(Tx) IEEE 802.11n (HT20) *2)                        | 2437MHz *2)               | 17                      | MCS0                | Monopole, Dipole                  |
|                                                    | Transmitting(Tx) Hopping OFF Low Energy(LE), Payload: PRBS9     | 2402MHz, 2440MHz, 2480MHz | 7                       | -                   | Monopole, Dipole                  |
| Radaited emission (Spurious emission) (Above 1GHz) | Transmitting(Tx) IEEE 802.11b                                   | 2412MHz, 2437MHz, 2462MHz | 17                      | 11Mbps              | Monopole, Dipole<br>Dual monopole |
|                                                    | Transmitting(Tx) IEEE 802.11g *4)                               | 2412MHz, 2462MHz          | 13.5                    | 6Mbps               | Monopole, Dipole<br>Dual monopole |
|                                                    |                                                                 | 2417MHz, 2457MHz          | 17                      |                     |                                   |
|                                                    | Transmitting(Tx) IEEE 802.11n (HT20) *5)                        | 2412MHz, 2462MHz          | 13.5                    | MCS0                | Monopole, Dipole<br>Dual monopole |
|                                                    |                                                                 | 2417MHz, 2437MHz, 2457MHz | 17                      |                     |                                   |
|                                                    | Transmitting(Tx) Hopping OFF Low Energy(LE), Payload: PRBS9 *5) | 2402MHz, 2440MHz, 2480MHz | 7                       | -                   | Monopole, Dipole<br>Dual monopole |
|                                                    | Transmitting(Tx) IEEE 802.11b                                   | 2412MHz, 2437MHz, 2462MHz | High: 17<br>Low: 7      | 11Mbps              | -                                 |
|                                                    |                                                                 | 2412MHz, 2462MHz          | High: 13.5<br>Low: 7    | 6Mbps               | -                                 |
| Other items                                        | Transmitting(Tx) IEEE 802.11g                                   | 2437MHz,                  | High: 17<br>Low: 7      | 6Mbps               | -                                 |
|                                                    |                                                                 | 2412MHz, 2462MHz          | High: 13.5<br>Low: 7    |                     |                                   |
|                                                    | Transmitting(Tx) IEEE 802.11n (HT20)                            | 2437MHz,                  | High: 17<br>Low: 7      | MCS0                | -                                 |
|                                                    |                                                                 | 2402MHz, 2440MHz, 2480MHz | 7                       |                     |                                   |

\*1) The worst condition was determined based on the test result of Maximum Peak Output Power.

\*2) 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.

\*3) Lowest power setting mode was performed only worst mode (maximum peak conducted output power mode).

\*4) These were carried out only in Band edge.

\*5) Monopole antenna and Dipole antenna were used in Bandwidth 1-25GHz. Dual monopole antenna was used only in Band edge.

(Wireless LAN mode)

Software : Tera Term ver. 4.69

(Bluetooth Low energy mode)

Software : Broadcom BlueTool ver. 1.8.7.3

Justification: The system was configured in typical fashion (as customer would normally use it) for testing.

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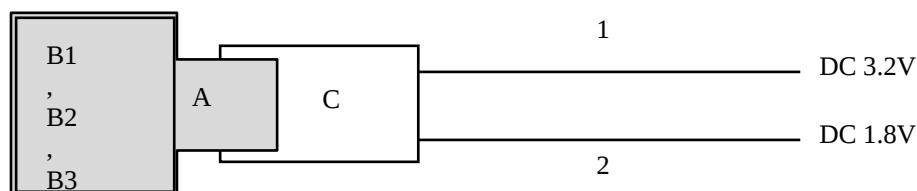
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## 4.2 Configuration and peripherals



\* Test data was taken under worse case conditions.

### Description of EUT and support equipment

| No. | Item                  | Model number | Serial number | Manufacturer                   | FCC ID (Remarks) |
|-----|-----------------------|--------------|---------------|--------------------------------|------------------|
| A   | Module                | Type1DR      | *1)           | Murata Manufacturing Co., Ltd. | EUT              |
| B1  | Monopole antenna      | 2.4-Mono     | -             | Murata Manufacturing Co., Ltd. | EUT              |
| B2  | Dipole antenna        | 2.4-D1-1     | -             | Murata Manufacturing Co., Ltd. | EUT              |
| B3  | Dual monopole antenna | Dual-8       | -             | Murata Manufacturing Co., Ltd. | EUT              |
| C   | Jig                   | -            | -             | Murata Manufacturing Co., Ltd. | -                |

\*1) 11: used for Radiated emission tests (WLAN, monopole antenna) and Antenna terminal tests.

47: used for Radiated emission tests (WLAN, Dipole antenna)

BT\_11: used for Radiated emission tests (Bluetooth LE, monopole antenna) and Antenna terminal tests.

BT\_28: used for Radiated emission tests (Bluetooth LE, Dipole antenna)

48: used for Radiated emission tests (Dual monopole antenna)

### List of cables used

| No. | Cable Name | Length (m) | Shield     |            | Remark |
|-----|------------|------------|------------|------------|--------|
|     |            |            | Cable      | Connector  |        |
| 1   | DC cable   | 1.4        | Unshielded | Unshielded | -      |
| 2   | DC cable   | 1.1        | Unshielded | Unshielded | -      |

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## **SECTION 5: Conducted emission**

### **5.1 Operating environment**

Test place : See test data (APPENDIX 1)  
Temperature : See test data (APPENDIX 1)  
Humidity : See test data (APPENDIX 1)

### **5.2 Test configuration**

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 0.8m above the conducting ground plane.

The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity.

The rear of tabletop was located 40cm to the vertical conducting plane. The rear of peripheral was aligned and was 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 LISN.

Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN to the input power source. All unused 50ohm connectors of the LISN were resistively terminated in 50ohm when not connected to the measuring equipment.

Photographs of the set up are shown in APPENDIX 3.

### **5.3 Test conditions**

Frequency range : 0.15 - 30MHz  
EUT position : Table top

### **5.4 Test procedure**

The AC Mains Terminal Continuous disturbance Voltage had been measured with the EUT via DC power supply within a Shielded room. The EUT via DC power supply was connected to a Line Impedance Stabilization Network (LISN).

An overview sweep with peak detection has been performed.

The measurements had been performed with a quasi-peak detector and if required, a CISPR average detector.

The conducted emission measurements were made with the following detection of the test receiver.

Detection Type : Quasi-Peak/ CISPR Average  
IF Bandwidth : 9kHz

### **5.5 Results**

Summary of the test results : Pass  
Refer to APPENDIX 1

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**SECTION 6: 6dB bandwidth & Occupied bandwidth (99%)****Test procedure**

The bandwidth was measured with a spectrum analyzer connected to the antenna port.

The test was measured based on Method 8.2 Option 2 of KDB 558074 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

Summary of the test results: Pass

Refer to APPENDIX 1

**SECTION 7: Maximum peak output power****Test procedure**

The Maximum Output Power was measured with a power meter connected to the antenna port.

The test was measured based on Method 9.1.2 PKPM1 of KDB 558074 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

Detection type: Peak / Average \*1)

Summary of the test results: Pass

Refer to APPENDIX 1

\*1) Average detector was used only for Reference data.

**SECTION 8: Out of band emissions (Antenna port conducted)****Test procedure**

The Out of Band Emissions was measured with a spectrum analyzer connected to the antenna port.

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.

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=10kHz)

Summary of the test results: Pass

Refer to APPENDIX 1

**SECTION 9: Peak power density****Test procedure**

The peak power density was measured with a spectrum analyzer connected to the antenna port.

Instrument used : Spectrum Analyzer

RBW / VBW : 3kHz / 9.1kHz

The test was measured based on Method 10.2 PKPSD of KDB 558074 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

Summary of the test results: Pass

Refer to APPENDIX 1

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Facsimile : +81 463 50 6401

## SECTION 10: Radiated emission

### 10.1 Operating environment

Test place : See test data (APPENDIX 1)  
 Temperature : See test data (APPENDIX 1)  
 Humidity : See test data (APPENDIX 1)

### 10.2 Test configuration

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 0.8m (Below 1GHz) and a polystyrene platform of nominal size, 0.5m by 0.5m, raised 0.8m (Above 1GHz) above the conducting ground plane. Photographs of the set up are shown in APPENDIX 3.

### 10.3 Test conditions

Frequency range : 30MHz to 25GHz  
 EUT position : Table top

### 10.4 Test procedure

The Radiated Electric Field Strength intensity has been measured on a semi-anechoic chamber with a ground plane and at a distance of 3m (below 15GHz) / 1m (above 15GHz) (Refer to Figure 1). Measurements were performed with quasi-peak, peak and average detector. The measuring antenna height was varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity. The measurements were performed for both vertical and horizontal antenna polarization.

The radiated emission measurements were made with the following detection.

| Frequency      | 30-1000MHz | 1-25GHz                |                                                              | 20dBc                      |
|----------------|------------|------------------------|--------------------------------------------------------------|----------------------------|
| Detection type | Quasi-Peak | Peak                   | Average *1)                                                  | Peak                       |
| IF Bandwidth   | 120kHz     | RBW: 1MHz<br>VBW: 3MHz | RBW: 1MHz<br>VBW: 3MHz<br>Detector: Linear Voltage Averaging | RBW: 100kHz<br>VBW: 300kHz |

\*1) Average Power Measurement was measured based on 13.3.2 of KDB 558074 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

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

#### [Monopole antenna (2.4GHz WLAN)]

| Antenna polarization | Spurious (30-1000MHz) | Carrier | Spurious (1-2.8GHz) | Spurious (2.8-15GHz) | Spurious (15-18GHz) | Spurious (18-26.5GHz) |
|----------------------|-----------------------|---------|---------------------|----------------------|---------------------|-----------------------|
| Horizontal           | X                     | X       | X                   | X                    | X                   | X                     |
| Vertical             | X                     | Z       | Z                   | Z                    | X                   | X                     |

#### [Dipole antenna (2.4GHz WLAN)]

| Antenna polarization | Spurious (30-1000MHz) | Carrier | Spurious (1-2.8GHz) | Spurious (2.8-15GHz) | Spurious (15-18GHz) | Spurious (18-26.5GHz) |
|----------------------|-----------------------|---------|---------------------|----------------------|---------------------|-----------------------|
| Horizontal           | X                     | Y       | Y                   | Y                    | X                   | X                     |
| Vertical             | X                     | Y       | Y                   | Y                    | X                   | X                     |

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[Dual monopole antenna (2.4GHz WLAN)]

| Antenna polarization | Carrier |
|----------------------|---------|
| Horizontal           | X       |
| Vertical             | Y       |

[Monopole antenna (2.4GHz Bluetooth Low Energy)]

| Antenna polarization | Spurious (30-1000MHz) | Carrier | Spurious (1-2.8GHz) | Spurious (2.8-15GHz) | Spurious (15-18GHz) | Spurious (18-26.5GHz) |
|----------------------|-----------------------|---------|---------------------|----------------------|---------------------|-----------------------|
| Horizontal           | X                     | X       | X                   | X                    | X                   | X                     |
| Vertical             | X                     | X       | X                   | Z                    | X                   | X                     |

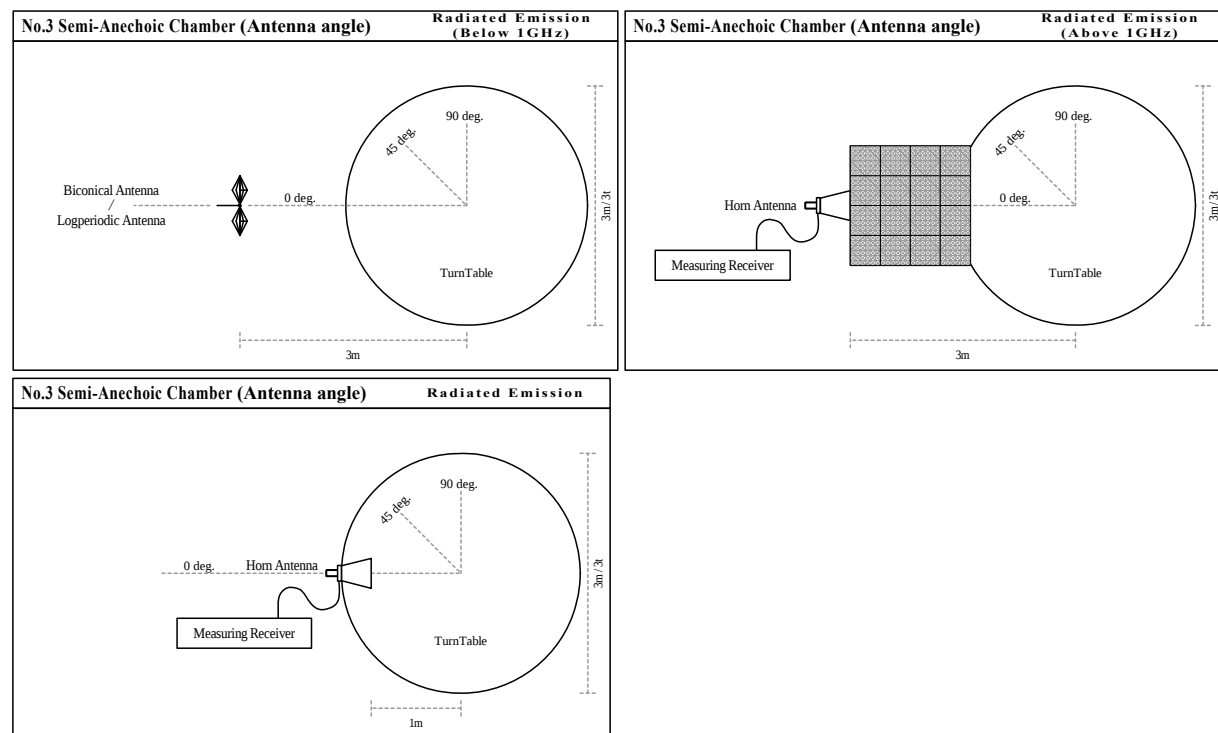
[Dipole antenna (2.4GHz Bluetooth Low Energy)]

| Antenna polarization | Spurious (30-1000MHz) | Carrier | Spurious (1-2.8GHz) | Spurious (2.8-15GHz) | Spurious (15-18GHz) | Spurious (18-26.5GHz) |
|----------------------|-----------------------|---------|---------------------|----------------------|---------------------|-----------------------|
| Horizontal           | X                     | Y       | Y                   | Y                    | X                   | X                     |
| Vertical             | X                     | X       | X                   | Y                    | X                   | X                     |

[Dual monopole antenna (2.4GHz Bluetooth Low Energy)]

| Antenna polarization | Carrier |
|----------------------|---------|
| Horizontal           | Y       |
| Vertical             | Y       |

Figure 1. Antenna angle



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### 10.5 Band edge

Band edge level at 2390MHz and 2483.5MHz is below the limits of FCC 15.209 and band edge level at 2400MHz is below the 20dBc. Refer to the data.

### 10.6 Results

Summary of the test results : Pass

\* No noise was detected above the 5th order harmonics.

Refer to APPENDIX 1

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## **Contents of APPENDIXES**

### **APPENDIX 1: Data of Radio tests**

Conducted emission  
6dB bandwidth  
Maximum peak output power  
Radiated emission  
Spurious emission (Antenna port conducted)  
Peak power density  
Occupied bandwidth

### **APPENDIX 2: Test instruments**

Test instruments

### **APPENDIX 3: Photographs of test setup**

Conducted emission  
Radiated emission  
Pre-check of the worst position

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**UL Japan, Inc.**

**Shonan EMC Lab.**

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Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

**APPENDIX 1: Data of Radio tests****DATA OF CONDUCTED EMISSION TEST**

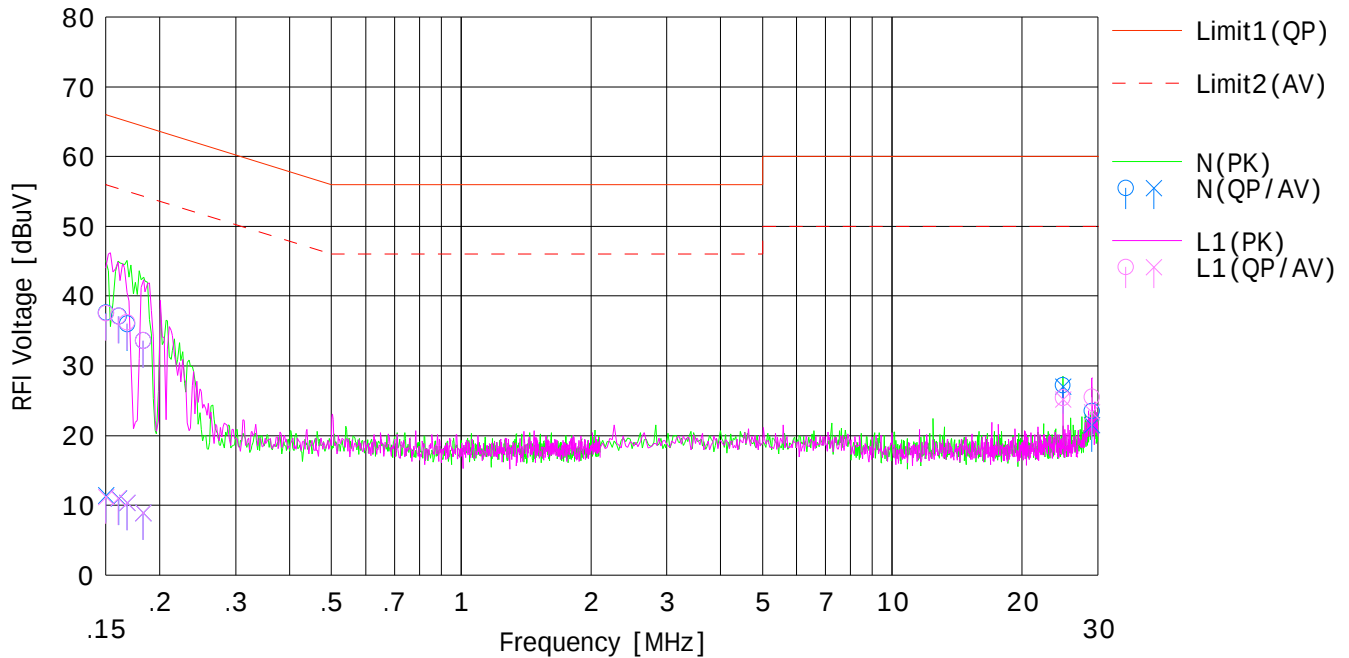
UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room  
Date : 2015/01/17

Company : Murata Manufacturing Co., Ltd.  
Kind of EUT : Communication Module  
Model No. : Type1DR  
Serial No. : 11 (2.4GHz monopole)  
Remarks : -

Mode : IEEE802.11n(HT20), Tx, 2437MHz  
Order No. : 10622710S  
Power : DC 3.2V / 1.8V  
Temp./Humi. : 22deg.C / 32%RH

Limit1 : FCC 15C(15.207) QP  
Limit2 : FCC 15C(15.207) AV

Engineer : Shinichi Takano



| No. | Freq.<br>[MHz] | Reading        |                | C.Fac | Results        |                | Limit          |                | Margin       |              | Phase | Comment |
|-----|----------------|----------------|----------------|-------|----------------|----------------|----------------|----------------|--------------|--------------|-------|---------|
|     |                | <QP><br>[dBuV] | <AV><br>[dBuV] |       | <QP><br>[dBuV] | <AV><br>[dBuV] | <QP><br>[dBuV] | <AV><br>[dBuV] | <QP><br>[dB] | <AV><br>[dB] |       |         |
| 1   | 0.15000        | 25.1           | -1.1           | 12.5  | 37.6           | 11.4           | 65.9           | 55.9           | 28.3         | 44.5         | N     |         |
| 2   | 0.16080        | 24.6           | -1.5           | 12.5  | 37.1           | 11.0           | 65.4           | 55.4           | 28.3         | 44.4         | N     |         |
| 3   | 0.16806        | 23.5           | -2.2           | 12.5  | 36.0           | 10.3           | 65.0           | 55.0           | 29.0         | 44.7         | N     |         |
| 4   | 0.18309        | 21.1           | -3.6           | 12.5  | 33.6           | 8.9            | 64.3           | 54.3           | 30.7         | 45.4         | N     |         |
| 5   | 24.89834       | 13.7           | 13.5           | 13.5  | 27.2           | 27.0           | 60.0           | 50.0           | 32.8         | 23.0         | N     |         |
| 6   | 29.04764       | 9.8            | 7.8            | 13.7  | 23.5           | 21.5           | 60.0           | 50.0           | 36.5         | 28.5         | N     |         |
| 7   | 0.15000        | 25.0           | -1.3           | 12.5  | 37.5           | 11.2           | 65.9           | 55.9           | 28.4         | 44.7         | L1    |         |
| 8   | 0.16024        | 24.6           | -1.5           | 12.5  | 37.1           | 11.0           | 65.4           | 55.4           | 28.3         | 44.4         | L1    |         |
| 9   | 0.16793        | 23.7           | -2.2           | 12.5  | 36.2           | 10.3           | 65.0           | 55.0           | 28.8         | 44.7         | L1    |         |
| 10  | 0.18292        | 21.1           | -3.6           | 12.5  | 33.6           | 8.9            | 64.3           | 54.3           | 30.7         | 45.4         | L1    |         |
| 11  | 24.89906       | 11.9           | 11.7           | 13.5  | 25.4           | 25.2           | 60.0           | 50.0           | 34.6         | 24.8         | L1    |         |
| 12  | 29.04810       | 11.8           | 9.6            | 13.7  | 25.5           | 23.3           | 60.0           | 50.0           | 34.5         | 26.7         | L1    |         |

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN + Cable + ATT) [dB]  
LISN: SLS-05

# DATA OF CONDUCTED EMISSION TEST

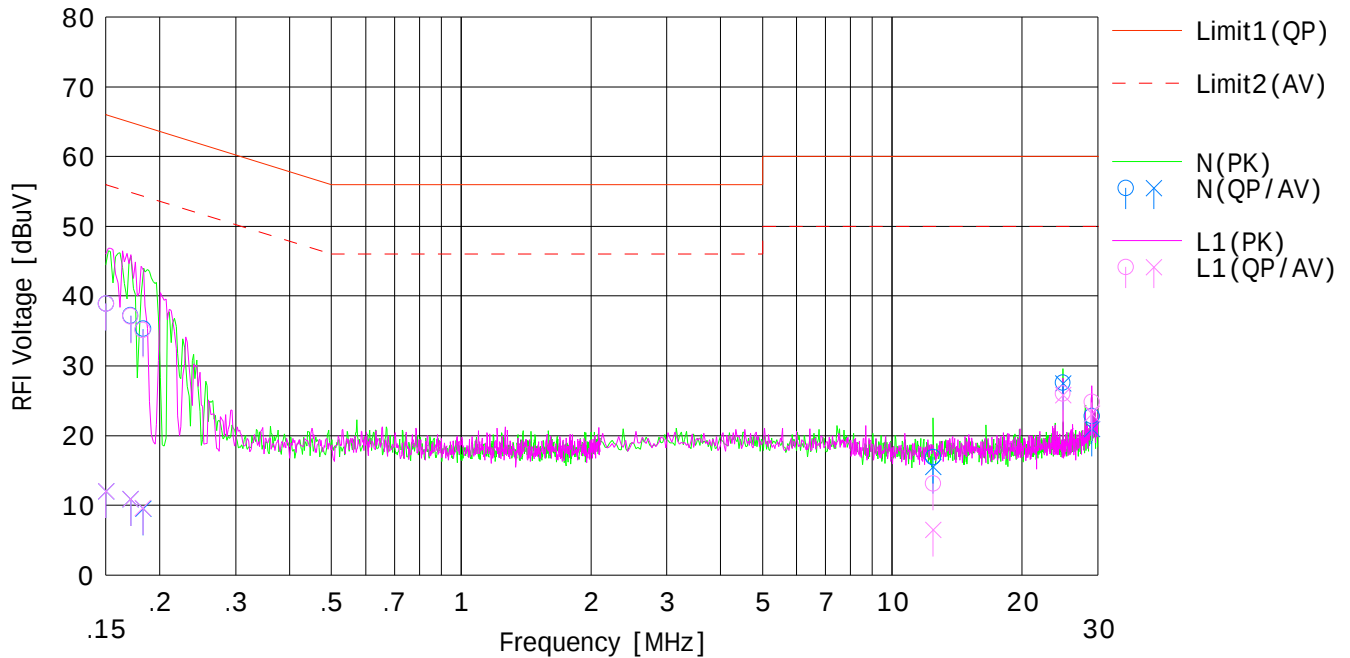
UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room  
Date : 2015/01/17

Company : Murata Manufacturing Co., Ltd.  
Kind of EUT : Communication Module  
Model No. : Type1DR  
Serial No. : 47 (2.4GHz Dipole)  
Remarks : -

Mode : IEEE802.11n(HT20), Tx, 2437MHz  
Order No. : 10622710S  
Power : DC 3.2V / 1.8V  
Temp./Humi. : 22deg.C / 32%RH

Limit1 : FCC 15C(15.207) QP  
Limit2 : FCC 15C(15.207) AV

Engineer : Shinichi Takano



| No. | Freq.<br>[MHz] | Reading        |                | C.Fac | Results        |                | Limit          |                | Margin       |              | Phase | Comment |
|-----|----------------|----------------|----------------|-------|----------------|----------------|----------------|----------------|--------------|--------------|-------|---------|
|     |                | <QP><br>[dBuV] | <AV><br>[dBuV] |       | <QP><br>[dBuV] | <AV><br>[dBuV] | <QP><br>[dBuV] | <AV><br>[dBuV] | <QP><br>[dB] | <AV><br>[dB] |       |         |
| 1   | 0.15000        | 26.4           | -0.5           | 12.5  | 38.9           | 12.0           | 65.9           | 55.9           | 27.0         | 43.9         | N     |         |
| 2   | 0.17112        | 24.7           | -1.6           | 12.5  | 37.2           | 10.9           | 64.9           | 54.9           | 27.7         | 44.0         | N     |         |
| 3   | 0.18309        | 22.8           | -3.0           | 12.5  | 35.3           | 9.5            | 64.3           | 54.3           | 29.0         | 44.8         | N     |         |
| 4   | 12.45020       | 3.9            | 2.5            | 13.0  | 16.9           | 15.5           | 60.0           | 50.0           | 43.1         | 34.5         | N     |         |
| 5   | 24.89994       | 14.1           | 14.0           | 13.5  | 27.6           | 27.5           | 60.0           | 50.0           | 32.4         | 22.5         | N     |         |
| 6   | 29.04910       | 9.1            | 7.2            | 13.7  | 22.8           | 20.9           | 60.0           | 50.0           | 37.2         | 29.1         | N     |         |
| 7   | 0.15000        | 26.4           | -0.5           | 12.5  | 38.9           | 12.0           | 65.9           | 55.9           | 27.0         | 43.9         | L1    |         |
| 8   | 0.17110        | 24.6           | -1.6           | 12.5  | 37.1           | 10.9           | 64.9           | 54.9           | 27.8         | 44.0         | L1    |         |
| 9   | 0.18288        | 22.6           | -2.9           | 12.5  | 35.1           | 9.6            | 64.3           | 54.3           | 29.2         | 44.7         | L1    |         |
| 10  | 12.45010       | 0.1            | -6.5           | 13.0  | 13.1           | 6.5            | 60.0           | 50.0           | 46.9         | 43.5         | L1    |         |
| 11  | 24.90006       | 12.5           | 12.3           | 13.5  | 26.0           | 25.8           | 60.0           | 50.0           | 34.0         | 24.2         | L1    |         |
| 12  | 29.04990       | 11.1           | 9.4            | 13.7  | 24.8           | 23.1           | 60.0           | 50.0           | 35.2         | 26.9         | L1    |         |

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN + Cable + ATT) [dB]  
LISN: SLS-05

# DATA OF CONDUCTED EMISSION TEST

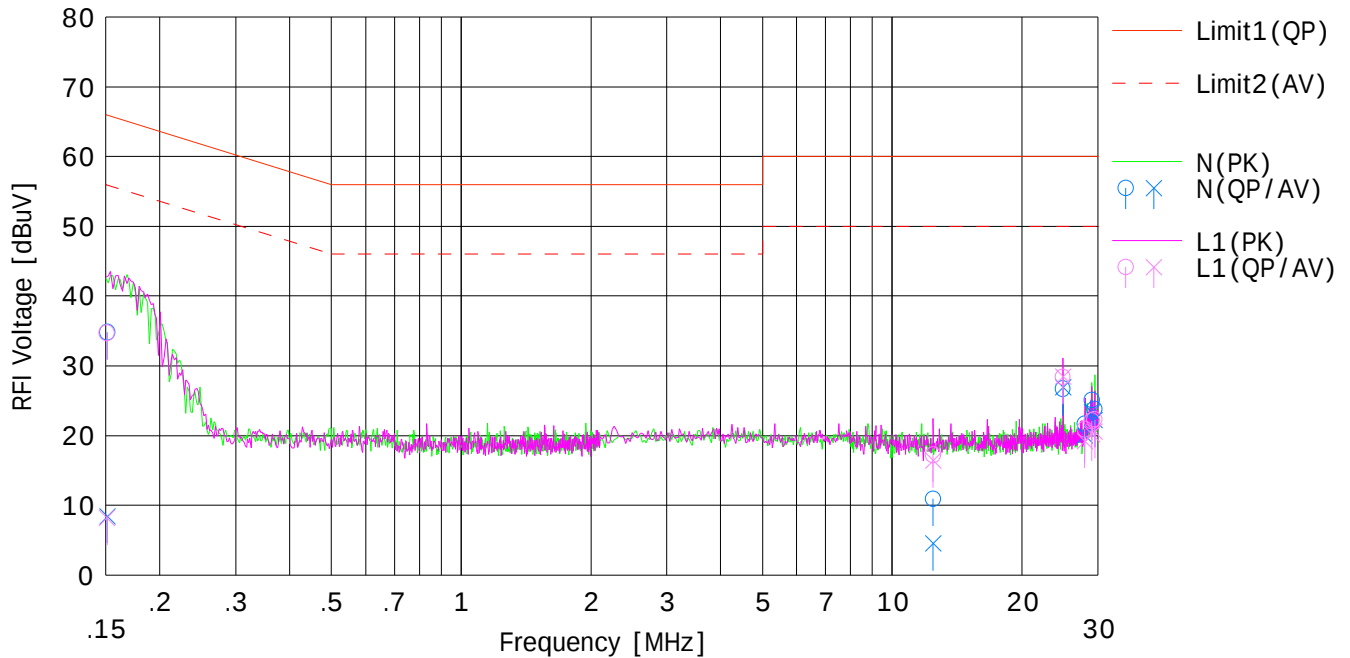
UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room  
Date : 2015/02/11

Company : Murata Manufacturing Co., Ltd.  
Kind of EUT : Communication Module  
Model No. : Type1DR  
Serial No. : BT\_11  
Remarks : -

Mode : LE, Tx, 2402MHz  
Order No. : 10622710S  
Power : DC 3.2V / 1.8V  
Temp. / Humi. : 22deg.C / 25%RH

Limit1 : FCC 15C(15.207) QP  
Limit2 : FCC 15C(15.207) AV

Engineer : Yosuke Ishikawa



| No. | Freq.<br>[MHz] | Reading        |                | C.Fac | Results        |                | Limit          |                | Margin       |              | Phase | Comment |
|-----|----------------|----------------|----------------|-------|----------------|----------------|----------------|----------------|--------------|--------------|-------|---------|
|     |                | <QP><br>[dBuV] | <AV><br>[dBuV] |       | <QP><br>[dBuV] | <AV><br>[dBuV] | <QP><br>[dBuV] | <AV><br>[dBuV] | <QP><br>[dB] | <AV><br>[dB] |       |         |
| 1   | 0.15117        | 22.3           | -4.1           | 12.5  | 34.8           | 8.4            | 65.9           | 55.9           | 31.1         | 47.5         | N     |         |
| 2   | 12.44682       | -2.1           | -8.5           | 13.0  | 10.9           | 4.5            | 60.0           | 50.0           | 49.1         | 45.5         | N     |         |
| 3   | 24.89770       | 13.2           | 13.4           | 13.5  | 26.7           | 26.9           | 60.0           | 50.0           | 33.3         | 23.1         | N     |         |
| 4   | 28.01113       | 8.1            | 6.4            | 13.6  | 21.7           | 20.0           | 60.0           | 50.0           | 38.3         | 30.0         | N     |         |
| 5   | 29.04885       | 11.4           | 9.6            | 13.7  | 25.1           | 23.3           | 60.0           | 50.0           | 34.9         | 26.7         | N     |         |
| 6   | 29.49666       | 10.1           | 8.5            | 13.7  | 23.8           | 22.2           | 60.0           | 50.0           | 36.2         | 27.8         | N     |         |
| 7   | 0.15085        | 22.2           | -4.3           | 12.5  | 34.7           | 8.2            | 65.9           | 55.9           | 31.2         | 47.7         | L1    |         |
| 8   | 12.44865       | 4.2            | 3.4            | 13.0  | 17.2           | 16.4           | 60.0           | 50.0           | 42.8         | 33.6         | L1    |         |
| 9   | 24.89901       | 14.9           | 15.0           | 13.5  | 28.4           | 28.5           | 60.0           | 50.0           | 31.6         | 21.5         | L1    |         |
| 10  | 28.00862       | 7.3            | 5.6            | 13.6  | 20.9           | 19.2           | 60.0           | 50.0           | 39.1         | 30.8         | L1    |         |
| 11  | 29.04548       | 8.4            | 6.5            | 13.7  | 22.1           | 20.2           | 60.0           | 50.0           | 37.9         | 29.8         | L1    |         |
| 12  | 29.49648       | 8.6            | 6.9            | 13.7  | 22.3           | 20.6           | 60.0           | 50.0           | 37.7         | 29.4         | L1    |         |

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN + Cable + ATT) [dB]  
LISN: SLS-05

# DATA OF CONDUCTED EMISSION TEST

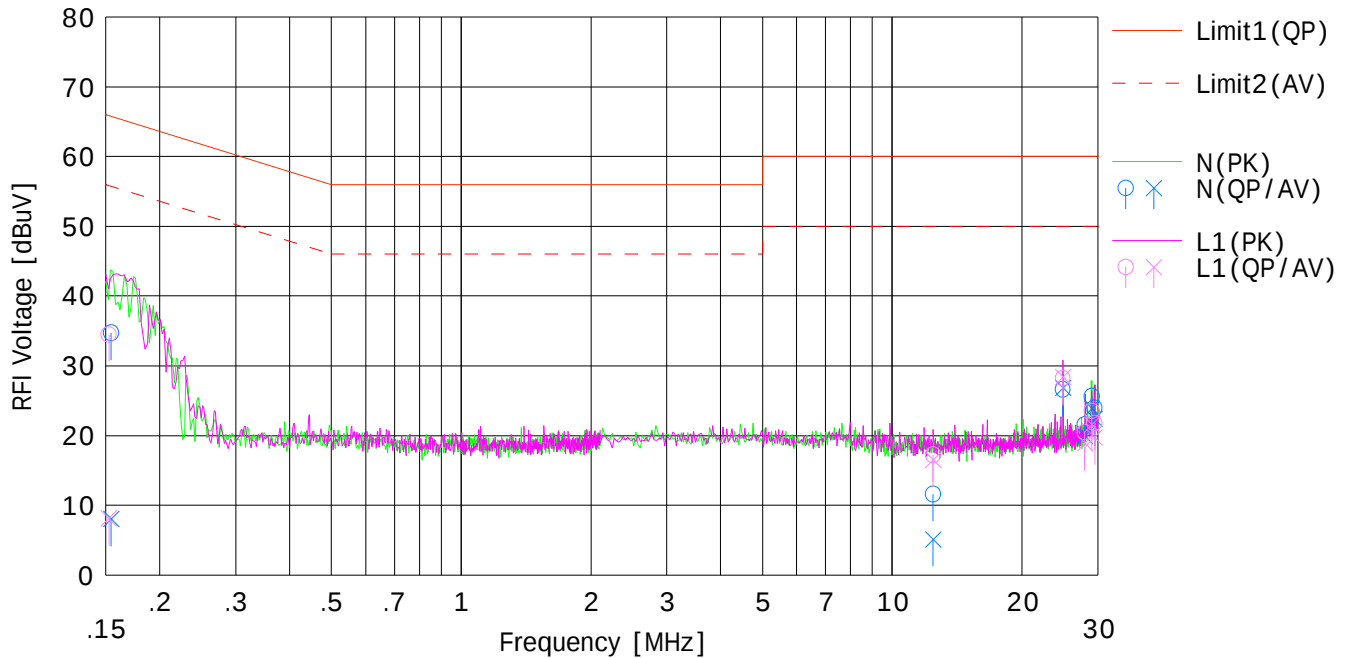
UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room  
Date : 2015/02/11

Company : Murata Manufacturing Co., Ltd.  
Kind of EUT : Communication Module  
Model No. : Type1DR  
Serial No. : BT\_11  
Remarks : -

Mode : LE, Tx, 2440MHz  
Order No. : 10622710S  
Power : DC 3.2V / 1.8V  
Temp./Humi. : 22deg.C / 25%RH

Limit1 : FCC 15C(15.207) QP  
Limit2 : FCC 15C(15.207) AV

Engineer : Yosuke Ishikawa



| No. | Freq.<br>[MHz] | Reading        |                | C.Fac<br>[dB] | Results        |                | Limit          |                | Margin       |              | Phase | Comment |
|-----|----------------|----------------|----------------|---------------|----------------|----------------|----------------|----------------|--------------|--------------|-------|---------|
|     |                | <QP><br>[dBuV] | <AV><br>[dBuV] |               | <QP><br>[dBuV] | <AV><br>[dBuV] | <QP><br>[dBuV] | <AV><br>[dBuV] | <QP><br>[dB] | <AV><br>[dB] |       |         |
| 1   | 0.15431        | 22.2           | -4.5           | 12.5          | 34.7           | 8.0            | 65.7           | 55.7           | 31.0         | 47.7         | N     |         |
| 2   | 12.44749       | -1.4           | -7.9           | 13.0          | 11.6           | 5.1            | 60.0           | 50.0           | 48.4         | 44.9         | N     |         |
| 3   | 24.89841       | 13.1           | 13.3           | 13.5          | 26.6           | 26.8           | 60.0           | 50.0           | 33.4         | 23.2         | N     |         |
| 4   | 28.00908       | 8.0            | 6.3            | 13.6          | 21.6           | 19.9           | 60.0           | 50.0           | 38.4         | 30.1         | N     |         |
| 5   | 29.04756       | 11.9           | 10.2           | 13.7          | 25.6           | 23.9           | 60.0           | 50.0           | 34.4         | 26.1         | N     |         |
| 6   | 29.49669       | 10.3           | 8.7            | 13.7          | 24.0           | 22.4           | 60.0           | 50.0           | 36.0         | 27.6         | N     |         |
| 7   | 0.15241        | 22.0           | -4.4           | 12.5          | 34.5           | 8.1            | 65.8           | 55.8           | 31.3         | 47.7         | L1    |         |
| 8   | 12.44874       | 4.2            | 3.5            | 13.0          | 17.2           | 16.5           | 60.0           | 50.0           | 42.8         | 33.5         | L1    |         |
| 9   | 24.89688       | 14.7           | 14.9           | 13.5          | 28.2           | 28.4           | 60.0           | 50.0           | 31.8         | 21.6         | L1    |         |
| 10  | 28.01204       | 6.9            | 5.3            | 13.6          | 20.5           | 18.9           | 60.0           | 50.0           | 39.5         | 31.1         | L1    |         |
| 11  | 29.04774       | 9.8            | 7.9            | 13.7          | 23.5           | 21.6           | 60.0           | 50.0           | 36.5         | 28.4         | L1    |         |
| 12  | 29.49498       | 8.1            | 6.0            | 13.7          | 21.8           | 19.7           | 60.0           | 50.0           | 38.2         | 30.3         | L1    |         |

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]  
LISN: SLS-05

# DATA OF CONDUCTED EMISSION TEST

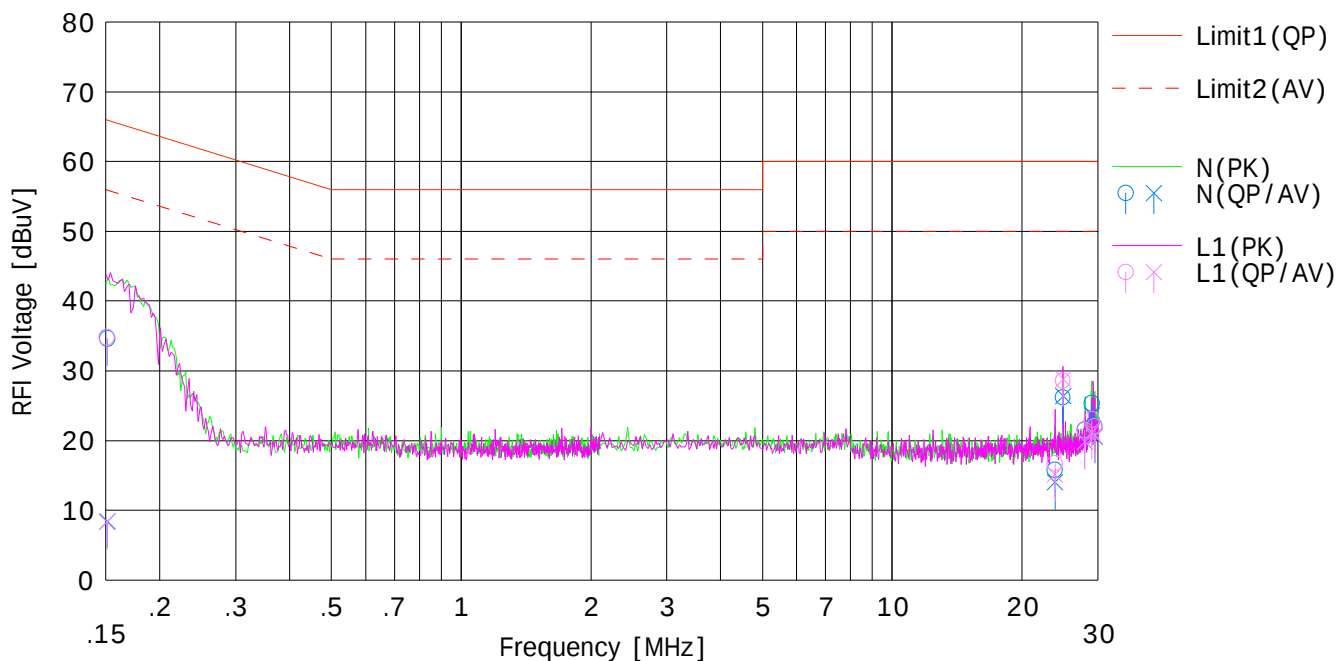
UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room  
Date : 2015/02/11

Company : Murata Manufacturing Co., Ltd.  
Kind of EUT : Communication Module  
Model No. : Type1DR  
Serial No. : BT\_11  
Remarks : -

Mode : LE, Tx, 2480MHz  
Order No. : 10622710S  
Power : DC 3.2V / 1.8V  
Temp. / Humi. : 22deg.C / 25%RH

Limit1 : FCC 15C(15.207) QP  
Limit2 : FCC 15C(15.207) AV

Engineer : Yosuke Ishikawa



| No. | Freq.<br>[MHz] | Reading        |                | C.Fac | Results        |                | Limit          |                | Margin       |              | Phase | Comment |
|-----|----------------|----------------|----------------|-------|----------------|----------------|----------------|----------------|--------------|--------------|-------|---------|
|     |                | <QP><br>[dBuV] | <AV><br>[dBuV] |       | <QP><br>[dBuV] | <AV><br>[dBuV] | <QP><br>[dBuV] | <AV><br>[dBuV] | <QP><br>[dB] | <AV><br>[dB] |       |         |
| 1   | 0.15118        | 22.1           | -4.1           | 12.5  | 34.6           | 8.4            | 65.9           | 55.9           | 31.3         | 47.5         | N     |         |
| 2   | 23.85958       | 2.3            | 0.5            | 13.5  | 15.8           | 14.0           | 60.0           | 50.0           | 44.2         | 36.0         | N     |         |
| 3   | 24.89906       | 12.7           | 12.9           | 13.5  | 26.2           | 26.4           | 60.0           | 50.0           | 33.8         | 23.6         | N     |         |
| 4   | 28.00898       | 8.0            | 6.2            | 13.6  | 21.6           | 19.8           | 60.0           | 50.0           | 38.4         | 30.2         | N     |         |
| 5   | 29.04847       | 11.6           | 9.9            | 13.7  | 25.3           | 23.6           | 60.0           | 50.0           | 34.7         | 26.4         | N     |         |
| 6   | 29.49927       | 8.4            | 6.9            | 13.7  | 22.1           | 20.6           | 60.0           | 50.0           | 37.9         | 29.4         | N     |         |
| 7   | 0.15090        | 22.3           | -4.2           | 12.5  | 34.8           | 8.3            | 65.9           | 55.9           | 31.1         | 47.6         | L1    |         |
| 8   | 23.86208       | 3.2            | 1.6            | 13.5  | 16.7           | 15.1           | 60.0           | 50.0           | 43.3         | 34.9         | L1    |         |
| 9   | 24.89773       | 15.1           | 15.3           | 13.5  | 28.6           | 28.6           | 60.0           | 50.0           | 31.4         | 21.2         | L1    |         |
| 10  | 28.01035       | 7.9            | 6.2            | 13.6  | 21.5           | 19.8           | 60.0           | 50.0           | 38.5         | 30.2         | L1    |         |
| 11  | 29.04871       | 9.3            | 7.5            | 13.7  | 23.0           | 21.2           | 60.0           | 50.0           | 37.0         | 28.8         | L1    |         |
| 12  | 29.49759       | 8.3            | 7.0            | 13.7  | 22.0           | 20.7           | 60.0           | 50.0           | 38.0         | 29.3         | L1    |         |

# DATA OF CONDUCTED EMISSION TEST

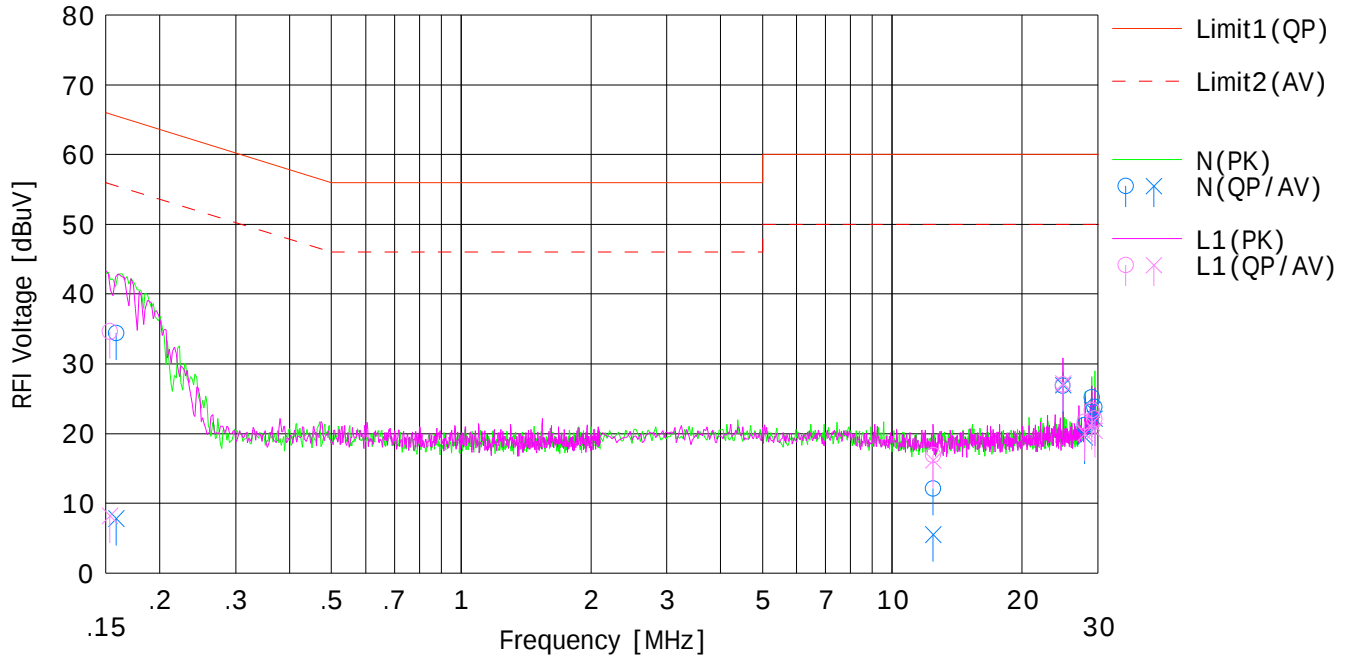
UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room  
Date : 2015/02/11

Company : Murata Manufacturing Co., Ltd.  
Kind of EUT : Communication Module  
Model No. : Type1DR  
Serial No. : BT\_28  
Remarks : -

Mode : LE, Tx, 2402MHz  
Order No. : 10622710S  
Power : DC 3.2V / 1.8V  
Temp./Humi. : 22deg.C / 25%RH

Limit1 : FCC 15C(15.207) QP  
Limit2 : FCC 15C(15.207) AV

Engineer : Yosuke Ishikawa



| No. | Freq.<br>[MHz] | Reading        |                | C.Fac<br>[dB] | Results        |                | Limit          |                | Margin       |              | Phase | Comment |
|-----|----------------|----------------|----------------|---------------|----------------|----------------|----------------|----------------|--------------|--------------|-------|---------|
|     |                | <QP><br>[dBuV] | <AV><br>[dBuV] |               | <QP><br>[dBuV] | <AV><br>[dBuV] | <QP><br>[dBuV] | <AV><br>[dBuV] | <QP><br>[dB] | <AV><br>[dB] |       |         |
| 1   | 0.15861        | 21.9           | -4.7           | 12.5          | 34.4           | 7.8            | 65.5           | 55.5           | 31.1         | 47.7         | N     |         |
| 2   | 12.44866       | -0.9           | -7.5           | 13.0          | 12.1           | 5.5            | 60.0           | 50.0           | 47.9         | 44.5         | N     |         |
| 3   | 24.89830       | 13.3           | 13.4           | 13.5          | 26.8           | 26.9           | 60.0           | 50.0           | 33.2         | 23.1         | N     |         |
| 4   | 28.01228       | 7.6            | 5.9            | 13.6          | 21.2           | 19.5           | 60.0           | 50.0           | 38.8         | 30.5         | N     |         |
| 5   | 29.04695       | 11.5           | 9.7            | 13.7          | 25.2           | 23.4           | 60.0           | 50.0           | 34.8         | 26.6         | N     |         |
| 6   | 29.49656       | 10.1           | 8.4            | 13.7          | 23.8           | 22.1           | 60.0           | 50.0           | 36.2         | 27.9         | N     |         |
| 7   | 0.15330        | 22.1           | -4.3           | 12.5          | 34.6           | 8.2            | 65.8           | 55.8           | 31.2         | 47.6         | L1    |         |
| 8   | 12.44808       | 3.9            | 3.1            | 13.0          | 16.9           | 16.1           | 60.0           | 50.0           | 43.1         | 33.9         | L1    |         |
| 9   | 24.89607       | 13.5           | 13.7           | 13.5          | 27.0           | 27.2           | 60.0           | 50.0           | 33.0         | 22.8         | L1    |         |
| 10  | 28.01045       | 8.1            | 6.4            | 13.6          | 21.7           | 20.0           | 60.0           | 50.0           | 38.3         | 30.0         | L1    |         |
| 11  | 29.04863       | 9.6            | 7.8            | 13.7          | 23.3           | 21.5           | 60.0           | 50.0           | 36.7         | 28.5         | L1    |         |
| 12  | 29.49568       | 8.4            | 6.7            | 13.7          | 22.1           | 20.4           | 60.0           | 50.0           | 37.9         | 29.6         | L1    |         |

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]  
LISN: SLS-05

# DATA OF CONDUCTED EMISSION TEST

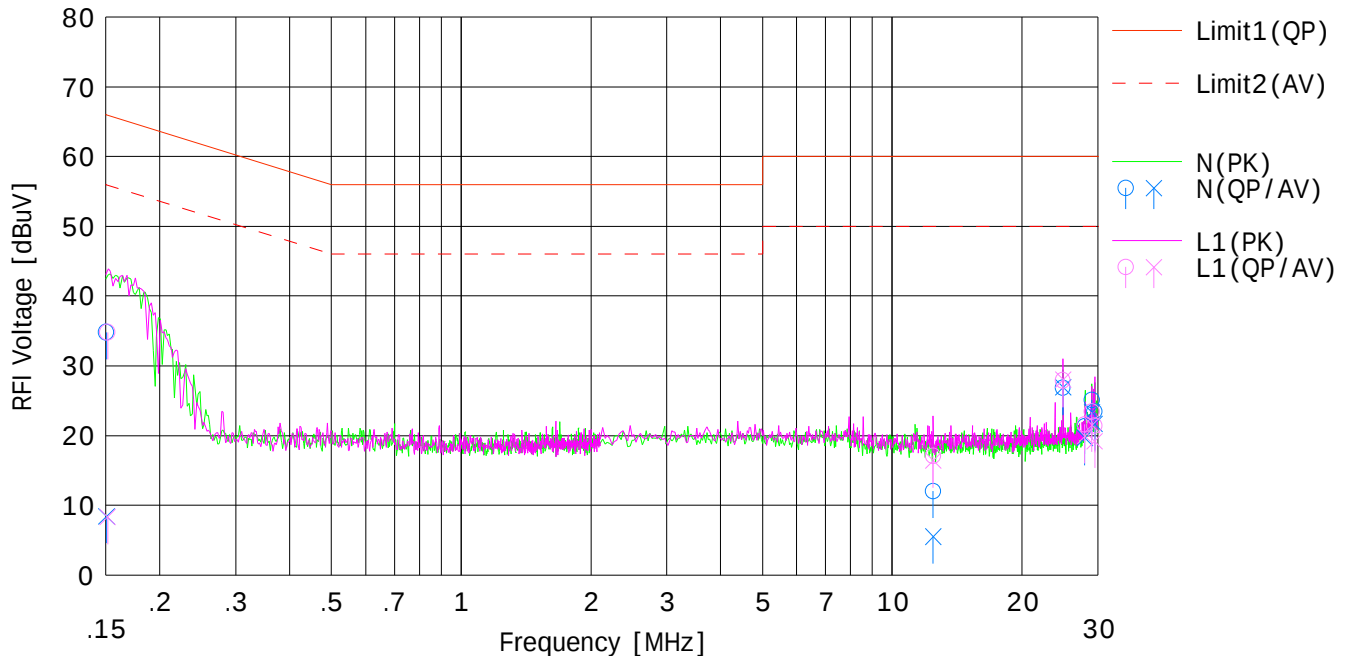
UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room  
Date : 2015/02/11

Company : Murata Manufacturing Co., Ltd.  
Kind of EUT : Communication Module  
Model No. : Type1DR  
Serial No. : BT\_28  
Remarks : -

Mode : LE, Tx, 2440MHz  
Order No. : 10622710S  
Power : DC 3.2V / 1.8V  
Temp./Humi. : 22deg.C / 25%RH

Limit1 : FCC 15C(15.207) QP  
Limit2 : FCC 15C(15.207) AV

Engineer : Yosuke Ishikawa



| No. | Freq.<br>[MHz] | Reading        |                | C.Fac | Results        |                | Limit          |                | Margin       |              | Phase | Comment |
|-----|----------------|----------------|----------------|-------|----------------|----------------|----------------|----------------|--------------|--------------|-------|---------|
|     |                | <QP><br>[dBuV] | <AV><br>[dBuV] |       | <QP><br>[dBuV] | <AV><br>[dBuV] | <QP><br>[dBuV] | <AV><br>[dBuV] | <QP><br>[dB] | <AV><br>[dB] |       |         |
| 1   | 0.15045        | 22.3           | -4.1           | 12.5  | 34.8           | 8.4            | 65.9           | 55.9           | 31.1         | 47.5         | N     |         |
| 2   | 12.44966       | -1.0           | -7.5           | 13.0  | 12.0           | 5.5            | 60.0           | 50.0           | 48.0         | 44.5         | N     |         |
| 3   | 24.89823       | 13.3           | 13.4           | 13.5  | 26.8           | 26.9           | 60.0           | 50.0           | 33.2         | 23.1         | N     |         |
| 4   | 28.00893       | 7.7            | 6.0            | 13.6  | 21.3           | 19.6           | 60.0           | 50.0           | 38.7         | 30.4         | N     |         |
| 5   | 29.04669       | 11.4           | 9.6            | 13.7  | 25.1           | 23.3           | 60.0           | 50.0           | 34.9         | 26.7         | N     |         |
| 6   | 29.49539       | 9.7            | 8.0            | 13.7  | 23.4           | 21.7           | 60.0           | 50.0           | 36.6         | 28.3         | N     |         |
| 7   | 0.15140        | 22.3           | -4.2           | 12.5  | 34.8           | 8.3            | 65.9           | 55.9           | 31.1         | 47.6         | L1    |         |
| 8   | 12.44967       | 4.1            | 3.4            | 13.0  | 17.1           | 16.4           | 60.0           | 50.0           | 42.9         | 33.6         | L1    |         |
| 9   | 24.89668       | 14.4           | 14.5           | 13.5  | 27.9           | 28.0           | 60.0           | 50.0           | 32.1         | 22.0         | L1    |         |
| 10  | 28.01109       | 8.0            | 6.3            | 13.6  | 21.6           | 19.9           | 60.0           | 50.0           | 38.4         | 30.1         | L1    |         |
| 11  | 29.04778       | 9.7            | 7.8            | 13.7  | 23.4           | 21.5           | 60.0           | 50.0           | 36.6         | 28.5         | L1    |         |
| 12  | 29.49466       | 7.7            | 5.5            | 13.7  | 21.4           | 19.2           | 60.0           | 50.0           | 38.6         | 30.8         | L1    |         |

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]  
LISN: SLS-05

# DATA OF CONDUCTED EMISSION TEST

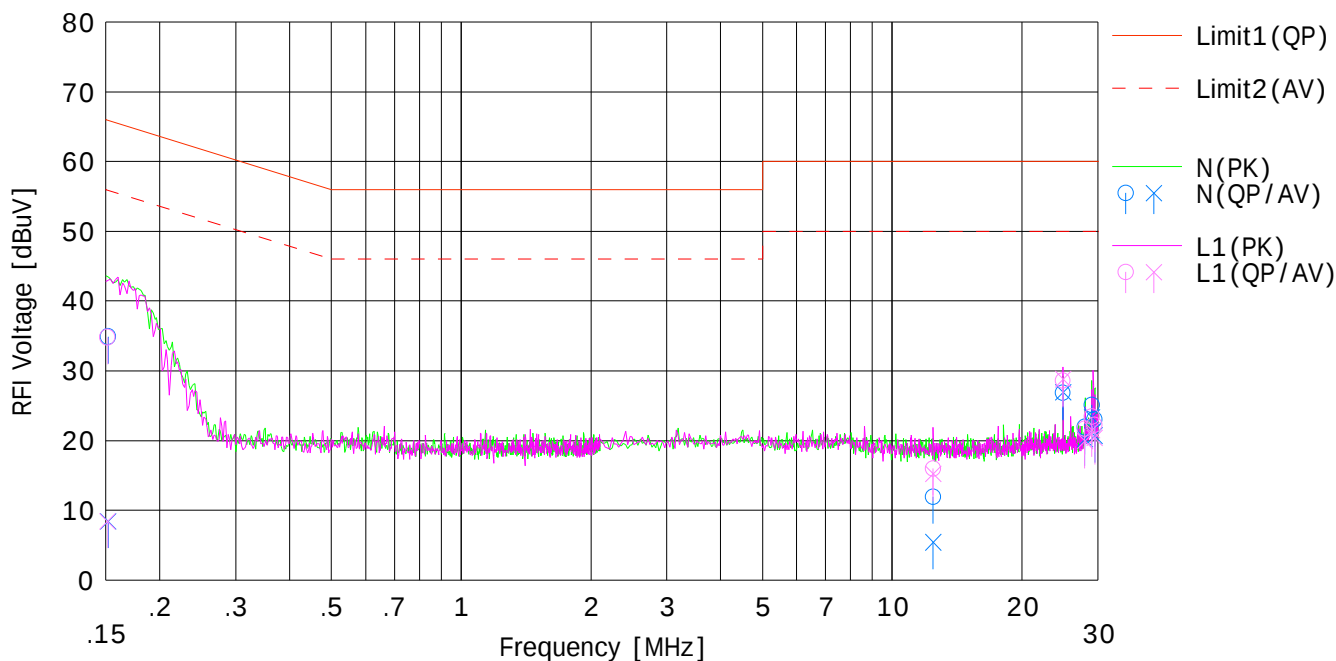
UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room  
Date : 2015/02/11

Company : Murata Manufacturing Co., Ltd.  
Kind of EUT : Communication Module  
Model No. : Type1DR  
Serial No. : BT\_28  
Remarks : -

Mode : LE, Tx, 2480MHz  
Order No. : 10622710S  
Power : DC 3.2V / 1.8V  
Temp. / Humi. : 22deg.C / 25%RH

Limit1 : FCC 15C(15.207) QP  
Limit2 : FCC 15C(15.207) AV

Engineer : Yosuke Ishikawa



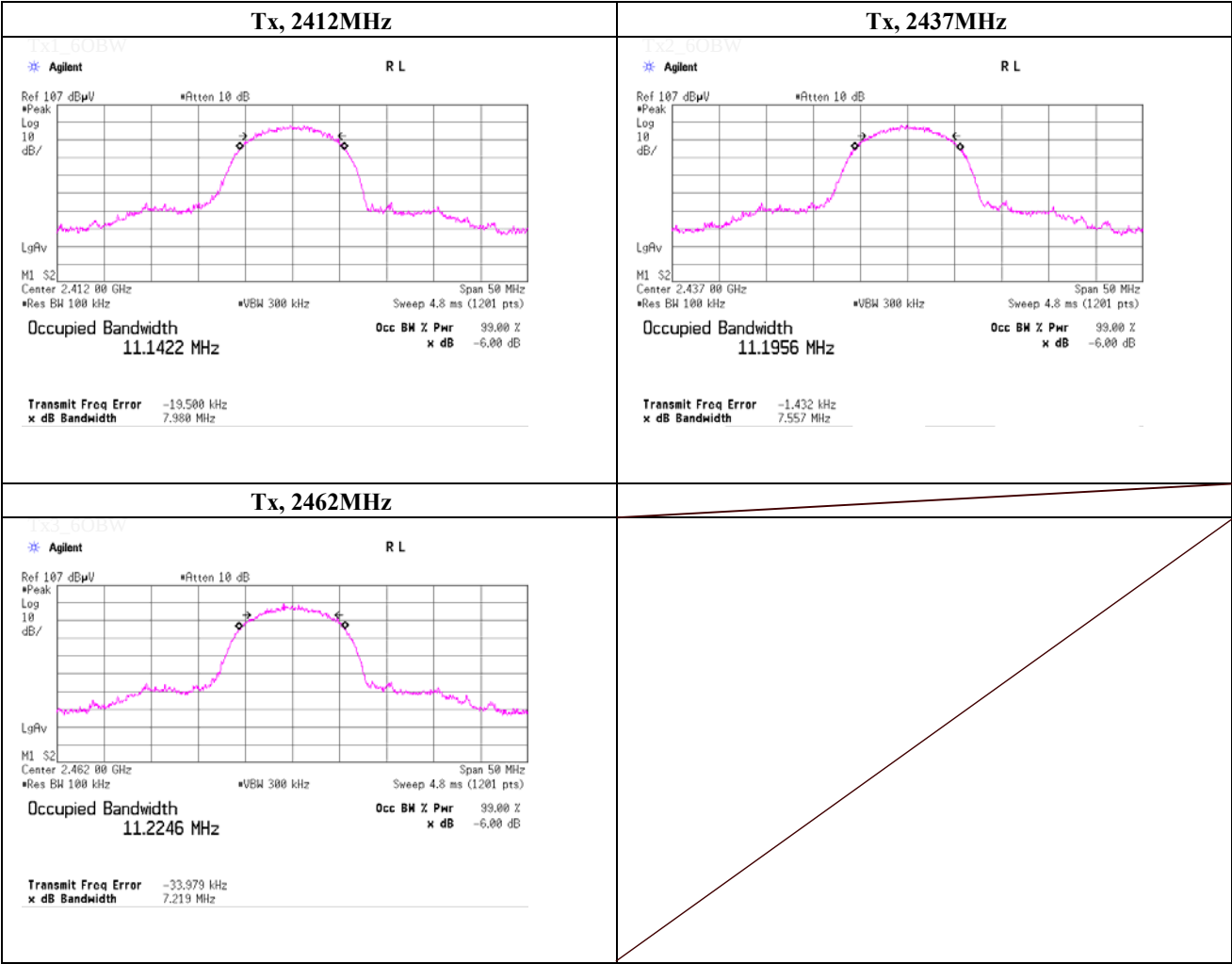
| No. | Freq.<br>[MHz] | Reading        |                | C.Fac<br>[dB] | Results        |                | Limit          |                | Margin       |              | Phase | Comment |
|-----|----------------|----------------|----------------|---------------|----------------|----------------|----------------|----------------|--------------|--------------|-------|---------|
|     |                | <QP><br>[dBuV] | <AV><br>[dBuV] |               | <QP><br>[dBuV] | <AV><br>[dBuV] | <QP><br>[dBuV] | <AV><br>[dBuV] | <QP><br>[dB] | <AV><br>[dB] |       |         |
| 1   | 0.15183        | 22.4           | -4.1           | 12.5          | 34.9           | 8.4            | 65.8           | 55.8           | 30.9         | 47.4         | N     |         |
| 2   | 12.44801       | -1.1           | -7.6           | 13.0          | 11.9           | 5.4            | 60.0           | 50.0           | 48.1         | 44.6         | N     |         |
| 3   | 24.89790       | 13.3           | 13.4           | 13.5          | 26.8           | 26.9           | 60.0           | 50.0           | 33.2         | 23.1         | N     |         |
| 4   | 28.00985       | 8.3            | 6.6            | 13.6          | 21.9           | 20.2           | 60.0           | 50.0           | 38.1         | 29.8         | N     |         |
| 5   | 29.04665       | 11.4           | 9.6            | 13.7          | 25.1           | 23.3           | 60.0           | 50.0           | 34.9         | 26.7         | N     |         |
| 6   | 29.49462       | 9.3            | 7.0            | 13.7          | 23.0           | 20.7           | 60.0           | 50.0           | 37.0         | 29.3         | N     |         |
| 7   | 0.15136        | 22.3           | -4.1           | 12.5          | 34.8           | 8.4            | 65.9           | 55.9           | 31.1         | 47.5         | L1    |         |
| 8   | 12.44697       | 3.0            | 2.2            | 13.0          | 16.0           | 15.2           | 60.0           | 50.0           | 44.0         | 34.8         | L1    |         |
| 9   | 24.89778       | 15.1           | 15.3           | 13.5          | 28.6           | 28.6           | 60.0           | 50.0           | 31.4         | 21.2         | L1    |         |
| 10  | 28.01042       | 8.1            | 6.3            | 13.6          | 21.7           | 19.9           | 60.0           | 50.0           | 38.3         | 30.1         | L1    |         |
| 11  | 29.04799       | 9.7            | 7.8            | 13.7          | 23.4           | 21.5           | 60.0           | 50.0           | 36.6         | 28.5         | L1    |         |
| 12  | 29.49599       | 8.5            | 6.7            | 13.7          | 22.2           | 20.4           | 60.0           | 50.0           | 37.8         | 29.6         | L1    |         |

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN + Cable + ATT) [dB]  
LISN: SLS-05

**-6dB Bandwidth**

|                        |                                              |                    |
|------------------------|----------------------------------------------|--------------------|
| Test place             | UL Japan, Inc. Shonan EMC Lab.               | No.5 Shielded Room |
| Date                   | January 5, 2015                              |                    |
| Temperature / Humidity | 26deg.C , 30%RH                              |                    |
| Engineer               | Yosuke Ishikawa                              |                    |
| Mode                   | Tx, IEEE802.11b, PN9, worst data mode 11Mbps |                    |

| Freq.<br>[MHz] | -6dB Bandwidth<br>[MHz] | Limit<br>[MHz] |
|----------------|-------------------------|----------------|
| 2412.0000      | 7.980                   | > 0.500        |
| 2437.0000      | 7.557                   | > 0.500        |
| 2462.0000      | 7.219                   | > 0.500        |

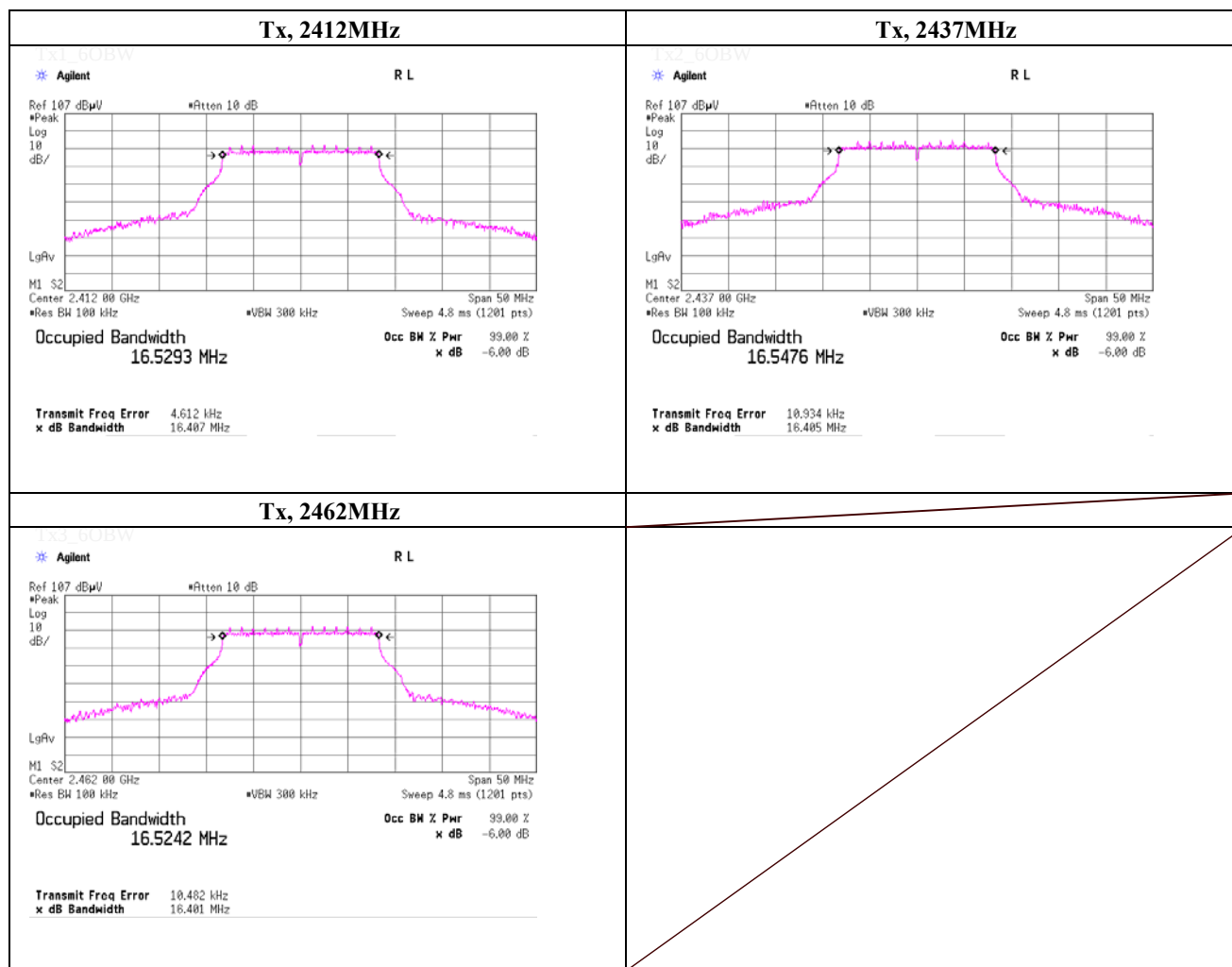


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### -6dB Bandwidth

|                        |                                             |                    |
|------------------------|---------------------------------------------|--------------------|
| Test place             | UL Japan, Inc. Shonan EMC Lab.              | No.5 Shielded Room |
| Date                   | January 5, 2015                             |                    |
| Temperature / Humidity | 26deg.C , 30%RH                             |                    |
| Engineer               | Yosuke Ishikawa                             |                    |
| Mode                   | Tx, IEEE802.11g, PN9, worst data mode 6Mbps |                    |

| Freq.<br>[MHz] | -6dB Bandwidth<br>[MHz] | Limit<br>[MHz] |
|----------------|-------------------------|----------------|
| 2412.0000      | 16.407                  | > 0.500        |
| 2437.0000      | 16.405                  | > 0.500        |
| 2462.0000      | 16.401                  | > 0.500        |

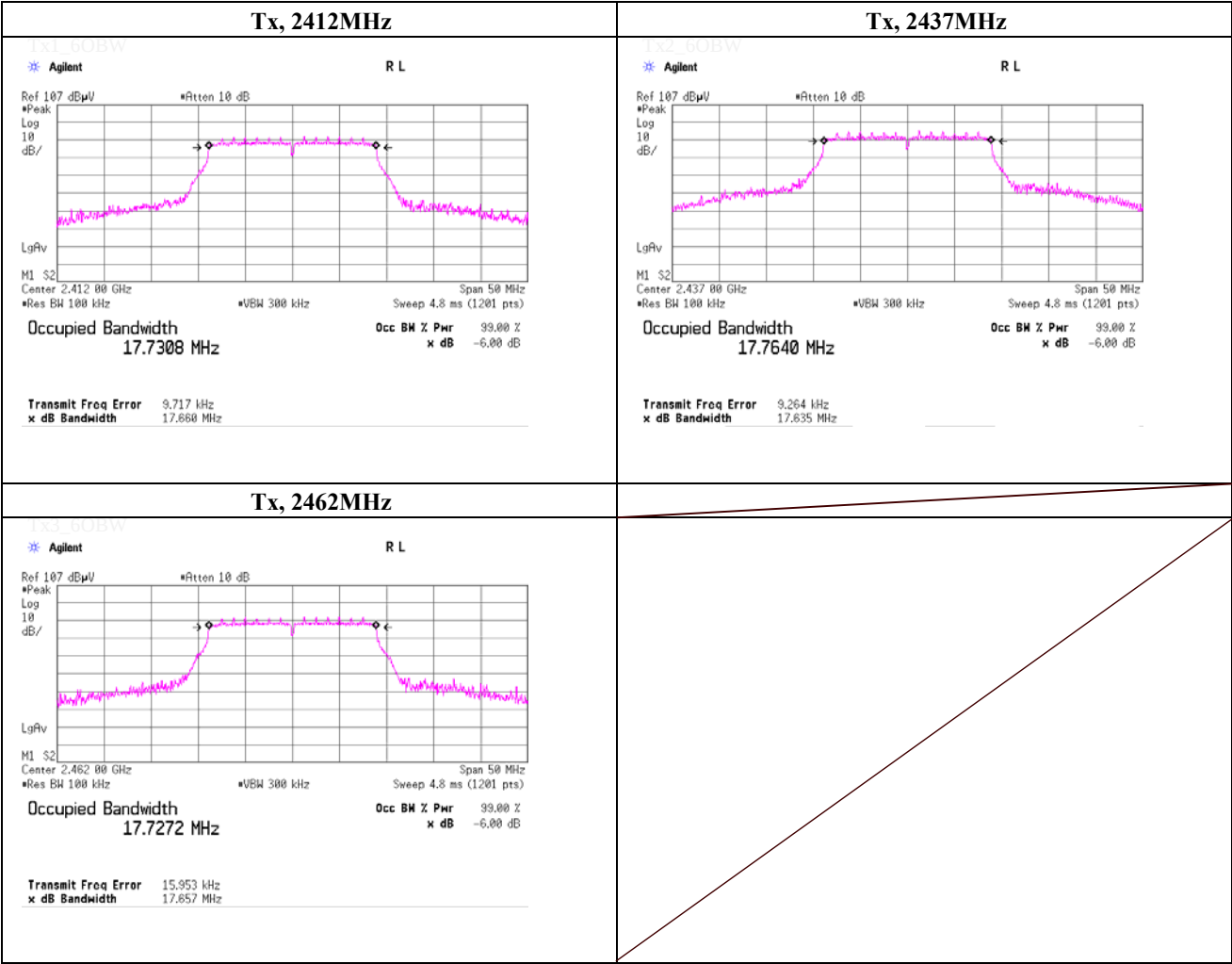


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-6dB Bandwidth

|                        |                                                    |                    |
|------------------------|----------------------------------------------------|--------------------|
| Test place             | UL Japan, Inc. Shonan EMC Lab.                     | No.5 Shielded Room |
| Date                   | January 5, 2015                                    |                    |
| Temperature / Humidity | 26deg.C , 30%RH                                    |                    |
| Engineer               | Yosuke Ishikawa                                    |                    |
| Mode                   | Tx, IEEE802.11n(HT20), PN9, worst data mode 0(MCS) |                    |

| Freq.<br>[MHz] | -6dB Bandwidth<br>[MHz] | Limit<br>[MHz] |
|----------------|-------------------------|----------------|
| 2412.0000      | 17.660                  | > 0.500        |
| 2437.0000      | 17.635                  | > 0.500        |
| 2462.0000      | 17.657                  | > 0.500        |

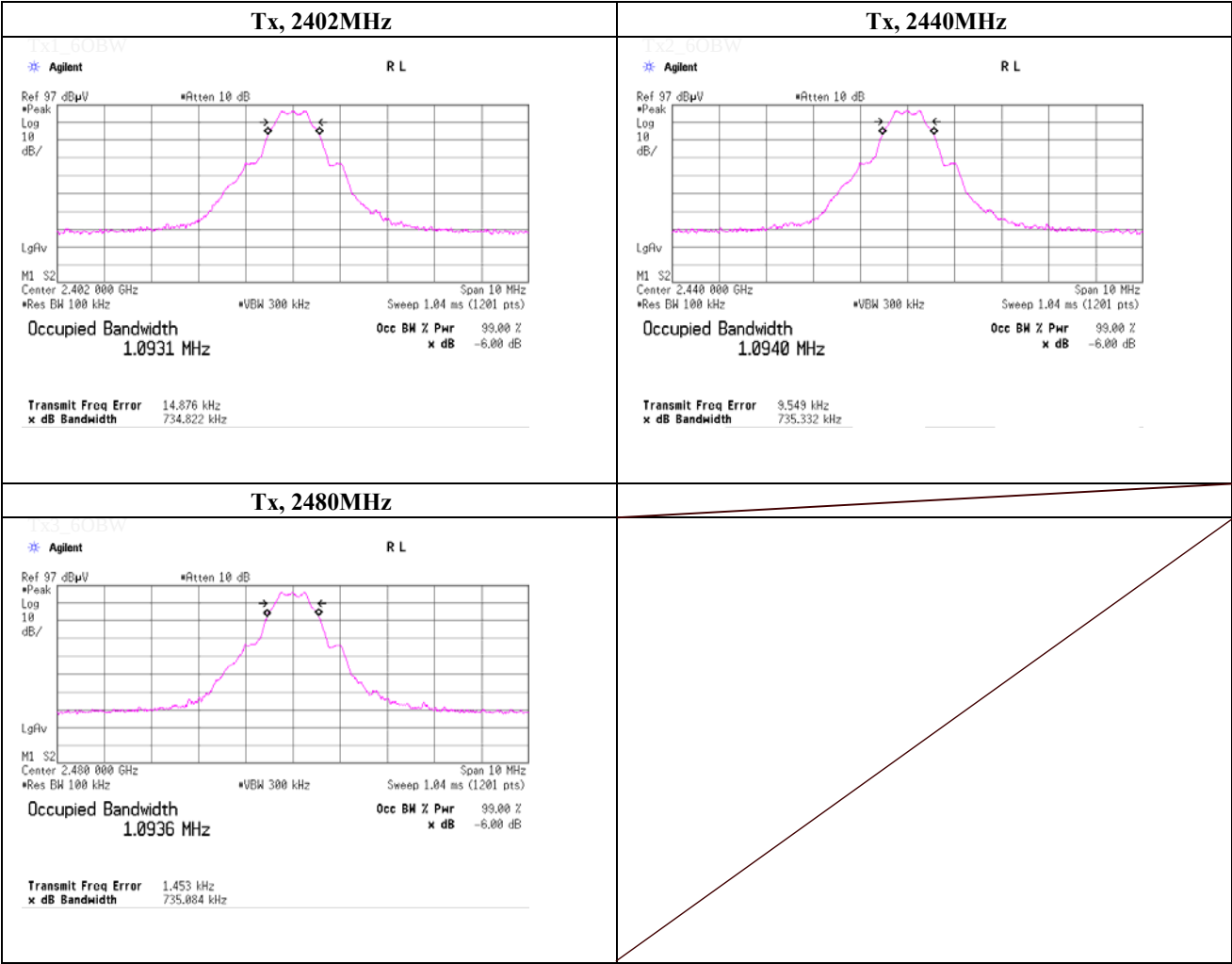


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-6dB Bandwidth

|                        |                                |                    |
|------------------------|--------------------------------|--------------------|
| Test place             | UL Japan, Inc. Shonan EMC Lab. | No.5 Shielded Room |
| Date                   | February 9, 2015               |                    |
| Temperature / Humidity | 24 deg.C , 43 %RH              |                    |
| Engineer               | Tatsuya Arai                   |                    |
| Mode                   | Tx, Bluetooth, Low Energy, PN9 |                    |

| Freq.<br>[MHz] | -6dB Bandwidth<br>[MHz] | Limit<br>[MHz] |
|----------------|-------------------------|----------------|
| 2402.0000      | 0.735                   | > 0.500        |
| 2440.0000      | 0.735                   | > 0.500        |
| 2480.0000      | 0.735                   | > 0.500        |



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### Maximum Peak Conducted Output Power

(PKPM1)

|                        |                                          |                                            |
|------------------------|------------------------------------------|--------------------------------------------|
| Test place             | UL Japan, Inc. Shonan EMC Lab.           | No.1 Measurement Room & No.5 Shielded Room |
| Date                   | December 23, 2014                        | January 5, 2015                            |
| Temperature / Humidity | 23deg.C , 32%RH                          | 26deg.C , 30%RH                            |
| Engineer               | Tatsuya Arai                             | Yosuke Ishikawa                            |
| Mode                   | Tx, IEEE802.11b, PN9, High power setting | worst data mode : 11 Mbps                  |

(\* P/M: Power Meter with power sensor)

| Ch   | Freq.  | P/M (Peak<br>Reading | Cable<br>Loss | Atten.<br>Loss | Result |        | Limit |      | Margin |
|------|--------|----------------------|---------------|----------------|--------|--------|-------|------|--------|
|      | [MHz]  | [dBm]                | [dB]          | [dB]           | [dBm]  | [mW]   | [dBm] | [mW] |        |
| Low  | 2412.0 | 0.38                 | 1.10          | 20.24          | 21.72  | 148.59 | 30.00 | 1000 | 8.28   |
| Mid  | 2437.0 | 0.36                 | 1.10          | 20.24          | 21.70  | 147.91 | 30.00 | 1000 | 8.30   |
| High | 2462.0 | 0.36                 | 1.10          | 20.24          | 21.70  | 147.91 | 30.00 | 1000 | 8.30   |

**Sample Calculation:**

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

**[Pre check]**

|  | Data rate | Freq.  | P/M (Peak)<br>Reading | Cable<br>Loss | Atten.<br>Loss | Result       |        | Limit |      | Margin      |
|--|-----------|--------|-----------------------|---------------|----------------|--------------|--------|-------|------|-------------|
|  | [Mbps]    | [MHz]  | [dBm]                 | [dB]          | [dB]           | [dBm]        | [mW]   | [dBm] | [mW] | [dB]        |
|  | 1         | 2412.0 | -0.24                 | 1.10          | 20.24          | 21.10        | 128.82 | 30.00 | 1000 | 8.90        |
|  | 2         | 2412.0 | -0.13                 | 1.10          | 20.24          | 21.21        | 132.13 | 30.00 | 1000 | 8.79        |
|  | 5.5       | 2412.0 | 0.11                  | 1.10          | 20.24          | 21.45        | 139.64 | 30.00 | 1000 | 8.55        |
|  | 11        | 2412.0 | 0.38                  | 1.10          | 20.24          | <b>21.72</b> | 148.59 | 30.00 | 1000 | <b>8.28</b> |

**Worst**

Sample Calculation:

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

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**Maximum Conducted Output Power (Reference data)**  
(AVGPM)

Test place                      UL Japan, Inc. Shonan EMC Lab.                      No.1 Measurement Room & No.5 Shielded Room  
Date                              December 23, 2014                      January 5, 2015  
Temperature / Humidity        23deg.C                      , 32%RH                      26deg.C                      , 30%RH  
Engineer                        Tatsuya Arai                      Yosuke Ishikawa  
Mode                              Tx, IEEE802.11b, PN9, High power setting                      worst data mode :                      11 Mbps

(\* P/M: Power Meter with power sensor, AV: Average)

| Ch   | Freq.<br>[MHz] | P/M (AV)<br>Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>Loss<br>[dB] | Duty<br>Factor<br>[dB] | Result |       |
|------|----------------|------------------------------|-----------------------|------------------------|------------------------|--------|-------|
|      |                |                              |                       |                        |                        | [dBm]  | [mW]  |
| Low  | 2412.0         | -3.50                        | 1.10                  | 20.24                  | 0.08                   | 17.92  | 61.94 |
| Mid  | 2437.0         | -3.56                        | 1.10                  | 20.24                  | 0.08                   | 17.86  | 61.09 |
| High | 2462.0         | -3.23                        | 1.10                  | 20.24                  | 0.08                   | 18.19  | 65.92 |

Sample Calculation:  
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

[Pre check]

|  | Data rate | Freq.<br>[MHz] | P/M (AV)<br>Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>Loss<br>[dB] | Duty<br>Factor<br>[dB] | Result       |       |
|--|-----------|----------------|------------------------------|-----------------------|------------------------|------------------------|--------------|-------|
|  | [Mbps]    |                |                              |                       |                        |                        | [dBm]        | [mW]  |
|  | 1         | 2412.0         | -3.48                        | 1.10                  | 20.24                  | 0.01                   | 17.87        | 61.24 |
|  | 2         | 2412.0         | -3.50                        | 1.10                  | 20.24                  | 0.02                   | 17.86        | 61.09 |
|  | 5.5       | 2412.0         | -3.48                        | 1.10                  | 20.24                  | 0.04                   | 17.90        | 61.66 |
|  | 11        | 2412.0         | -3.50                        | 1.10                  | 20.24                  | 0.08                   | <b>17.92</b> | 61.94 |

Sample Calculation:  
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

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**Maximum Peak Conducted Output Power**  
(PKPM1)

Test place                   UL Japan, Inc. Shonan EMC Lab.       No.5 Shielded Room  
Date                        January 15, 2015  
Temperature / Humidity    21deg.C       , 55%RH  
Engineer                  Yosuke Ishikawa  
Mode                       Tx, IEEE802.11b, PN9, Low power setting                   worst data mode :       11 Mbps

(\* P/M: Power Meter with power sensor)

| Ch   | Freq.<br>[MHz] | P/M (Peak<br>Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>Loss<br>[dB] | Result |       | Limit |      | Margin |
|------|----------------|-------------------------------|-----------------------|------------------------|--------|-------|-------|------|--------|
|      |                |                               |                       |                        | [dBm]  | [mW]  | [dBm] | [mW] | [dB]   |
| Low  | 2412.0         | -9.71                         | 1.10                  | 20.24                  | 11.63  | 14.55 | 30.00 | 1000 | 18.37  |
| Mid  | 2437.0         | -9.96                         | 1.10                  | 20.24                  | 11.38  | 13.74 | 30.00 | 1000 | 18.62  |
| High | 2462.0         | -9.94                         | 1.10                  | 20.24                  | 11.40  | 13.80 | 30.00 | 1000 | 18.60  |

Sample Calculation:  
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss

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## (AVGPM)

worst data mode : 11 Mbps

| Ch   | Freq.  | P/M (AV)<br>Reading | Cable<br>Loss | Atten.<br>Loss | Duty<br>Factor | Result |      |
|------|--------|---------------------|---------------|----------------|----------------|--------|------|
|      | [MHz]  | [dBm]               | [dB]          | [dB]           | [dB]           | [dBm]  | [mW] |
| Low  | 2412.0 | -13.43              | 1.10          | 20.24          | 0.08           | 7.99   | 6.30 |
| Mid  | 2437.0 | -13.63              | 1.10          | 20.24          | 0.08           | 7.79   | 6.01 |
| High | 2462.0 | -13.58              | 1.10          | 20.24          | 0.08           | 7.84   | 6.08 |

$$\text{Result} = \text{Reading} + \text{Cable Loss (including the cable(s) customer supplied)} + \text{Atten. Loss} + \text{Duty Factor}$$

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Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room  
 Date December 22, 2014  
 Temperature / Humidity 24deg.C , 32%RH  
 Engineer Tatsuya Arai

## Duty Factor Calculation chart for Maximum Conducted Output Power



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## Maximum Peak Conducted Output Power

(PKPM1)

|                        |                                          |                          |
|------------------------|------------------------------------------|--------------------------|
| Test place             | UL Japan, Inc. Shonan EMC Lab.           | No.5 Shielded Room       |
| Date                   | January 5, 2015                          | January 21, 2015         |
| Temperature / Humidity | 26deg.C , 30%RH                          | 23deg.C , 41%RH          |
| Engineer               | Yosuke Ishikawa                          | Shinichi Takano          |
| Mode                   | Tx, IEEE802.11g, PN9, High power setting | worst data mode : 6 Mbps |

(\* P/M: Power Meter with power sensor)

| Ch   | Freq.<br>[MHz] | P/M (Peak)<br>Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>Loss<br>[dB] | Result |        | Limit |      | Margin |
|------|----------------|--------------------------------|-----------------------|------------------------|--------|--------|-------|------|--------|
|      |                |                                |                       |                        | [dBm]  | [mW]   | [dBm] | [mW] | [dB]   |
| Low  | 2412.0         | 3.26                           | 1.10                  | 20.24                  | 24.60  | 288.40 | 30.00 | 1000 | 5.40   |
| Mid  | 2437.0         | 4.05                           | 1.10                  | 20.24                  | 25.39  | 345.94 | 30.00 | 1000 | 4.61   |
| High | 2462.0         | 3.11                           | 1.10                  | 20.24                  | 24.45  | 278.61 | 30.00 | 1000 | 5.55   |

Sample Calculation:

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

### [Pre check]

|  | Data rate<br>[Mbps] | Freq.<br>[MHz] | P/M (Peak)<br>Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>Loss<br>[dB] | Result       |        | Limit |      | Margin      |
|--|---------------------|----------------|--------------------------------|-----------------------|------------------------|--------------|--------|-------|------|-------------|
|  |                     |                |                                |                       |                        | [dBm]        | [mW]   | [dBm] | [mW] | [dB]        |
|  | 6                   | 2412.0         | 3.26                           | 1.10                  | 20.24                  | <b>24.60</b> | 288.40 | 30.00 | 1000 | <b>5.40</b> |
|  | 9                   | 2412.0         | 3.17                           | 1.10                  | 20.24                  | 24.51        | 282.49 | 30.00 | 1000 | 5.49        |
|  | 12                  | 2412.0         | 3.23                           | 1.10                  | 20.24                  | 24.57        | 286.42 | 30.00 | 1000 | 5.43        |
|  | 18                  | 2412.0         | 3.18                           | 1.10                  | 20.24                  | 24.52        | 283.14 | 30.00 | 1000 | 5.48        |
|  | 24                  | 2412.0         | 3.19                           | 1.10                  | 20.24                  | 24.53        | 283.79 | 30.00 | 1000 | 5.47        |
|  | 36                  | 2412.0         | 2.97                           | 1.10                  | 20.24                  | 24.31        | 269.77 | 30.00 | 1000 | 5.69        |
|  | 48                  | 2412.0         | 3.21                           | 1.10                  | 20.24                  | 24.55        | 285.10 | 30.00 | 1000 | 5.45        |
|  | 54                  | 2412.0         | 2.42                           | 1.10                  | 20.24                  | 23.76        | 237.68 | 30.00 | 1000 | 6.24        |

**Worst**

Sample Calculation:

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

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## Maximum Conducted Output Power (Reference data)

(AVGPM)

|                        |                                          |                          |
|------------------------|------------------------------------------|--------------------------|
| Test place             | UL Japan, Inc. Shonan EMC Lab.           | No.5 Shielded Room       |
| Date                   | January 5, 2015                          | January 21, 2015         |
| Temperature / Humidity | 26deg.C , 30%RH                          | 23deg.C , 41%RH          |
| Engineer               | Yosuke Ishikawa                          | Shinichi Takano          |
| Mode                   | Tx, IEEE802.11g, PN9, High power setting | worst data mode : 6 Mbps |

(\* P/M: Power Meter with power sensor, AV: Average)

| Ch   | Freq.<br>[MHz] | P/M (AV)<br>Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>Loss<br>[dB] | Duty<br>Factor<br>[dB] | Result |       |
|------|----------------|------------------------------|-----------------------|------------------------|------------------------|--------|-------|
|      |                |                              |                       |                        |                        | [dBm]  | [mW]  |
| Low  | 2412.0         | -6.71                        | 1.10                  | 20.24                  | 0.07                   | 14.70  | 29.51 |
| Mid  | 2437.0         | -3.83                        | 1.10                  | 20.24                  | 0.07                   | 17.58  | 57.28 |
| High | 2462.0         | -6.75                        | 1.10                  | 20.24                  | 0.07                   | 14.66  | 29.24 |

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

### [Pre check]

|  | Data rate<br>[Mbps] | Freq.<br>[MHz] | P/M (AV)<br>Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>Loss<br>[dB] | Duty<br>Factor<br>[dB] | Result       |       |
|--|---------------------|----------------|------------------------------|-----------------------|------------------------|------------------------|--------------|-------|
|  |                     |                |                              |                       |                        |                        | [dBm]        | [mW]  |
|  | 6                   | 2412.0         | -6.71                        | 1.10                  | 20.24                  | 0.07                   | <b>14.70</b> | 29.51 |
|  | 9                   | 2412.0         | -6.84                        | 1.10                  | 20.24                  | 0.10                   | 14.60        | 28.84 |
|  | 12                  | 2412.0         | -7.01                        | 1.10                  | 20.24                  | 0.13                   | 14.46        | 27.93 |
|  | 18                  | 2412.0         | -6.87                        | 1.10                  | 20.24                  | 0.19                   | 14.66        | 29.24 |
|  | 24                  | 2412.0         | -6.98                        | 1.10                  | 20.24                  | 0.25                   | 14.61        | 28.91 |
|  | 36                  | 2412.0         | -7.21                        | 1.10                  | 20.24                  | 0.36                   | 14.49        | 28.12 |
|  | 48                  | 2412.0         | -7.25                        | 1.10                  | 20.24                  | 0.47                   | 14.56        | 28.58 |
|  | 54                  | 2412.0         | -7.23                        | 1.10                  | 20.24                  | 0.51                   | 14.62        | 28.97 |

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

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(PKPM1)

(\* P/M: Power Meter with power sensor)

Sample Calculation:

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

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**Maximum Conducted Output Power (Reference data)**  
(AVGPM)

Test place                   UL Japan, Inc. Shonan EMC Lab.           No.5 Shielded Room  
Date                        January 15, 2015  
Temperature / Humidity    21deg.C       , 55%RH  
Engineer                  Yosuke Ishikawa  
Mode                       Tx, IEEE802.11g, PN9, Low power setting                   worst data mode :           6 Mbps

(\* P/M: Power Meter with power sensor, AV: Average)

| Ch   | Freq.  | P/M (AV)<br>Reading | Cable<br>Loss | Atten.<br>Loss | Duty<br>Factor | Result |      |
|------|--------|---------------------|---------------|----------------|----------------|--------|------|
|      | [MHz]  | [dBm]               | [dB]          | [dB]           | [dB]           | [dBm]  | [mW] |
| Low  | 2412.0 | -13.45              | 1.10          | 20.24          | 0.07           | 7.96   | 6.25 |
| Mid  | 2437.0 | -13.63              | 1.10          | 20.24          | 0.07           | 7.78   | 6.00 |
| High | 2462.0 | -13.61              | 1.10          | 20.24          | 0.07           | 7.80   | 6.03 |

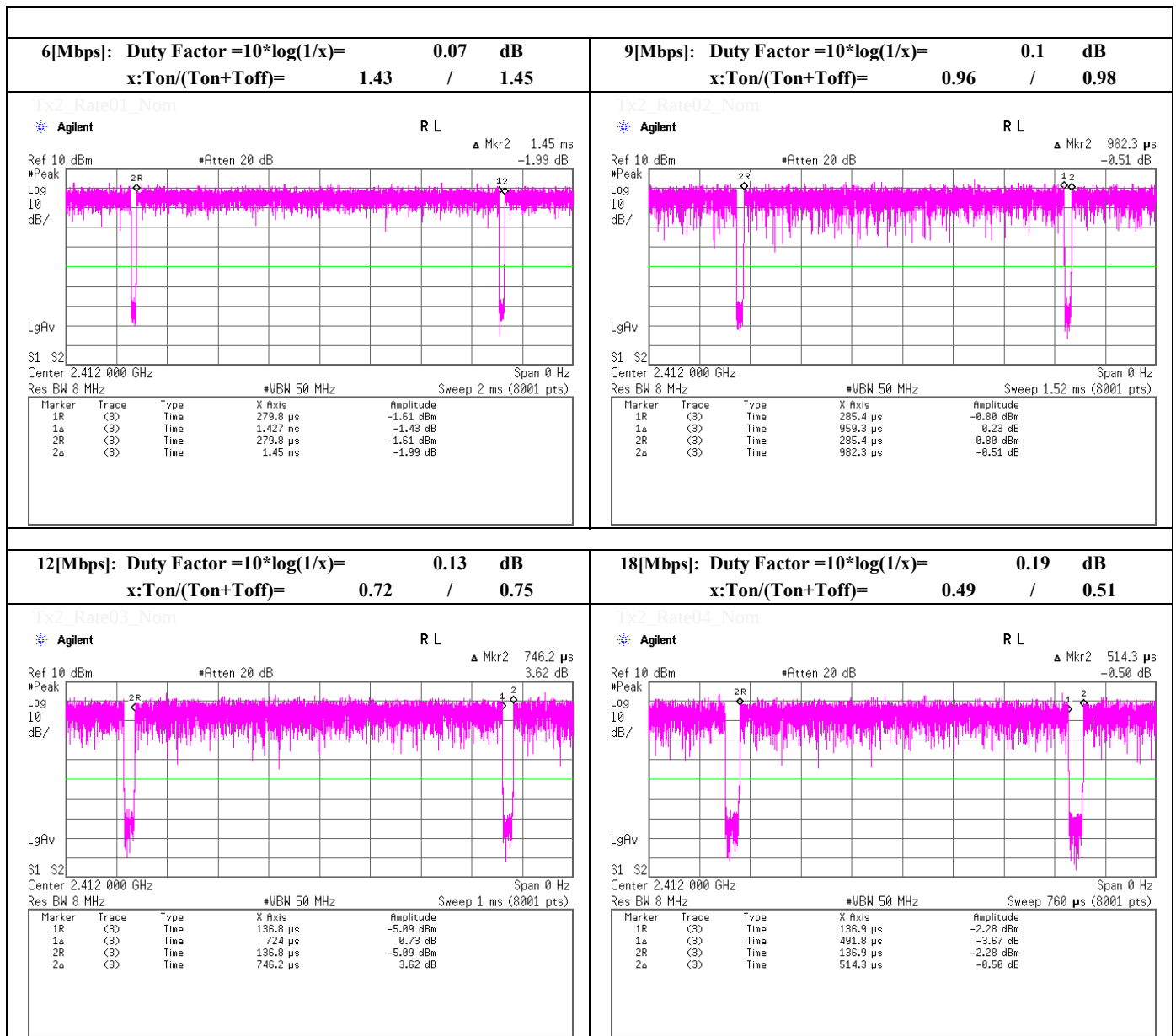
Sample Calculation:  
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

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Test place UL Japan, Inc. Shonan EMC Lab. No.1 Measurement Room  
 Date December 22, 2014  
 Temperature / Humidity 24deg.C , 32%RH  
 Engineer Tatsuya Arai

## Duty Factor Calculation chart for Maximum Conducted Output Power



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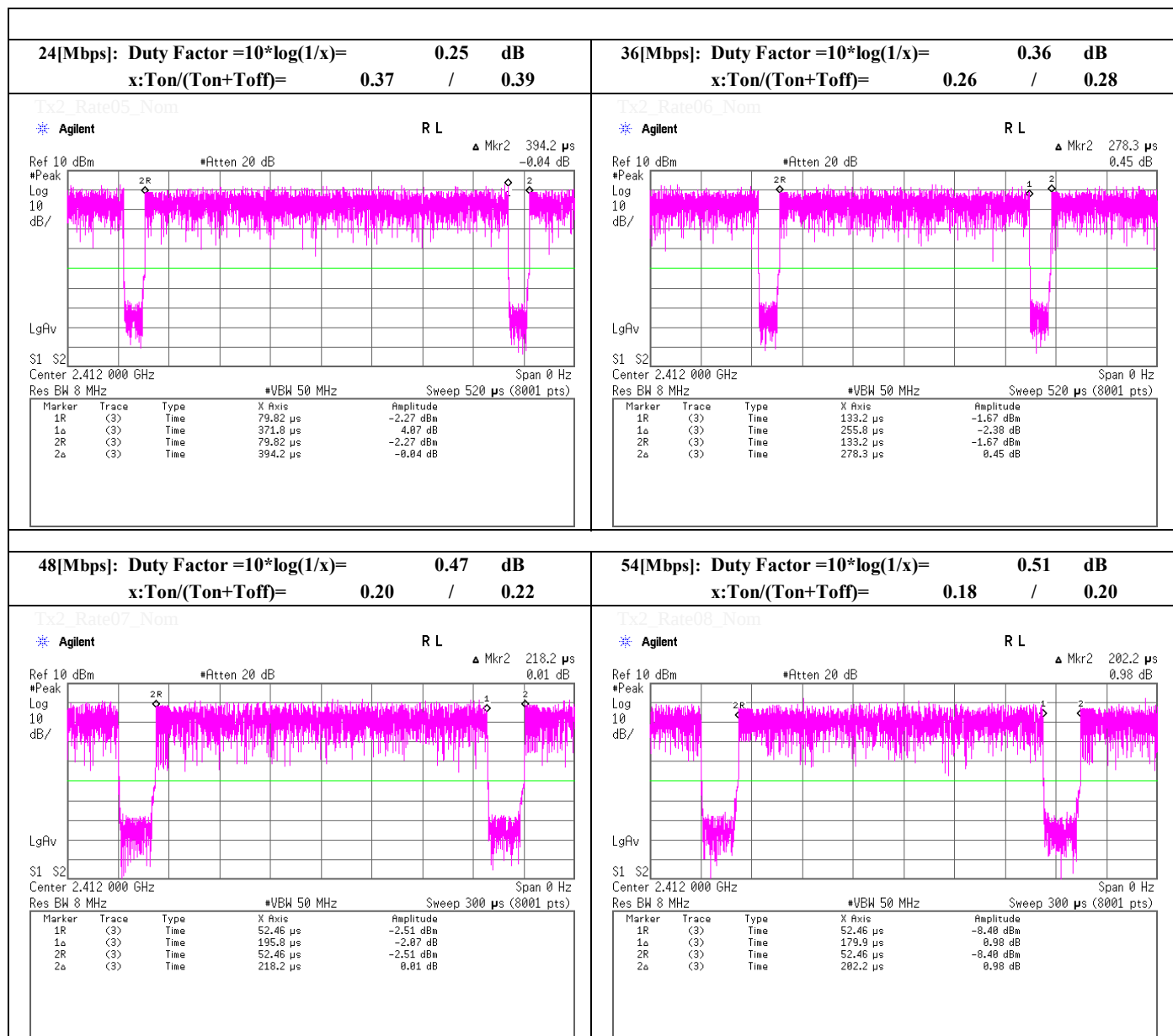
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Test place UL Japan, Inc. Shonan EMC Lab. No.1 Measurement Room  
 Date December 22, 2014  
 Temperature / Humidity 24deg.C , 32%RH  
 Engineer Tatsuya Arai

## Duty Factor Calculation chart for Maximum Conducted Output Power



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## Maximum Conducted Output Power (Reference data)

(AVGPM)

Test place                      UL Japan, Inc. Shonan EMC Lab.              No.5 Shielded Room  
 Date                              January 5, 2015  
 Temperature / Humidity      26deg.C              , 30%RH  
 Engineer                        Yosuke Ishikawa  
 Mode                              Tx, IEEE802.11n(HT20), PN9, High power setting              worst data mode :              0 (MCS)

(\* P/M: Power Meter with power sensor, AV: Average)

| Ch   | Freq.<br>[MHz] | P/M (AV)<br>Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>Loss<br>[dB] | Duty<br>Factor<br>[dB] | Result |       |
|------|----------------|------------------------------|-----------------------|------------------------|------------------------|--------|-------|
|      |                |                              |                       |                        |                        | [dBm]  | [mW]  |
| Low  | 2412.0         | -7.05                        | 1.10                  | 20.24                  | 0.07                   | 14.36  | 27.29 |
| Mid  | 2437.0         | -4.02                        | 1.10                  | 20.24                  | 0.07                   | 17.39  | 54.83 |
| High | 2462.0         | -6.95                        | 1.10                  | 20.24                  | 0.07                   | 14.46  | 27.93 |

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

### [Pre check]

|  | Mode<br>(MCS) | Freq.<br>[MHz] | P/M (AV)<br>Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>Loss<br>[dB] | Duty<br>Factor<br>[dB] | Result       |       |
|--|---------------|----------------|------------------------------|-----------------------|------------------------|------------------------|--------------|-------|
|  |               |                |                              |                       |                        |                        | [dBm]        | [mW]  |
|  | 0             | 2412.0         | -7.05                        | 1.10                  | 20.24                  | 0.07                   | <b>14.36</b> | 27.29 |
|  | 1             | 2412.0         | -7.13                        | 1.10                  | 20.24                  | 0.14                   | 14.35        | 27.23 |
|  | 2             | 2412.0         | -7.26                        | 1.10                  | 20.24                  | 0.20                   | 14.28        | 26.79 |
|  | 3             | 2412.0         | -7.27                        | 1.10                  | 20.24                  | 0.26                   | 14.33        | 27.10 |
|  | 4             | 2412.0         | -7.37                        | 1.10                  | 20.24                  | 0.36                   | 14.33        | 27.10 |
|  | 5             | 2412.0         | -7.51                        | 1.10                  | 20.24                  | 0.46                   | 14.29        | 26.85 |
|  | 6             | 2412.0         | -7.50                        | 1.10                  | 20.24                  | 0.50                   | 14.34        | 27.16 |
|  | 7             | 2412.0         | -7.75                        | 1.10                  | 20.24                  | 0.54                   | 14.13        | 25.88 |

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

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(PKPM1)

(\* P/M: Power Meter with power sensor)

Sample Calculation:

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**Maximum Conducted Output Power (Reference data)**  
(AVGPM)

Test place                   UL Japan, Inc. Shonan EMC Lab.           No.5 Shielded Room  
Date                        January 15, 2015  
Temperature / Humidity    21deg.C       , 55%RH  
Engineer                  Yosuke Ishikawa  
Mode                       Tx, IEEE802.11n(HT20), PN9, Low power setting                   worst data mode :           0 (MCS)

(\* P/M: Power Meter with power sensor, AV: Average)

| Ch   | Freq.  | P/M (AV)<br>Reading | Cable<br>Loss | Atten.<br>Loss | Duty<br>Factor | Result |      |
|------|--------|---------------------|---------------|----------------|----------------|--------|------|
|      | [MHz]  | [dBm]               | [dB]          | [dB]           | [dB]           | [dBm]  | [mW] |
| Low  | 2412.0 | -13.59              | 1.10          | 20.24          | 0.07           | 7.82   | 6.05 |
| Mid  | 2437.0 | -13.62              | 1.10          | 20.24          | 0.07           | 7.79   | 6.01 |
| High | 2462.0 | -13.63              | 1.10          | 20.24          | 0.07           | 7.78   | 6.00 |

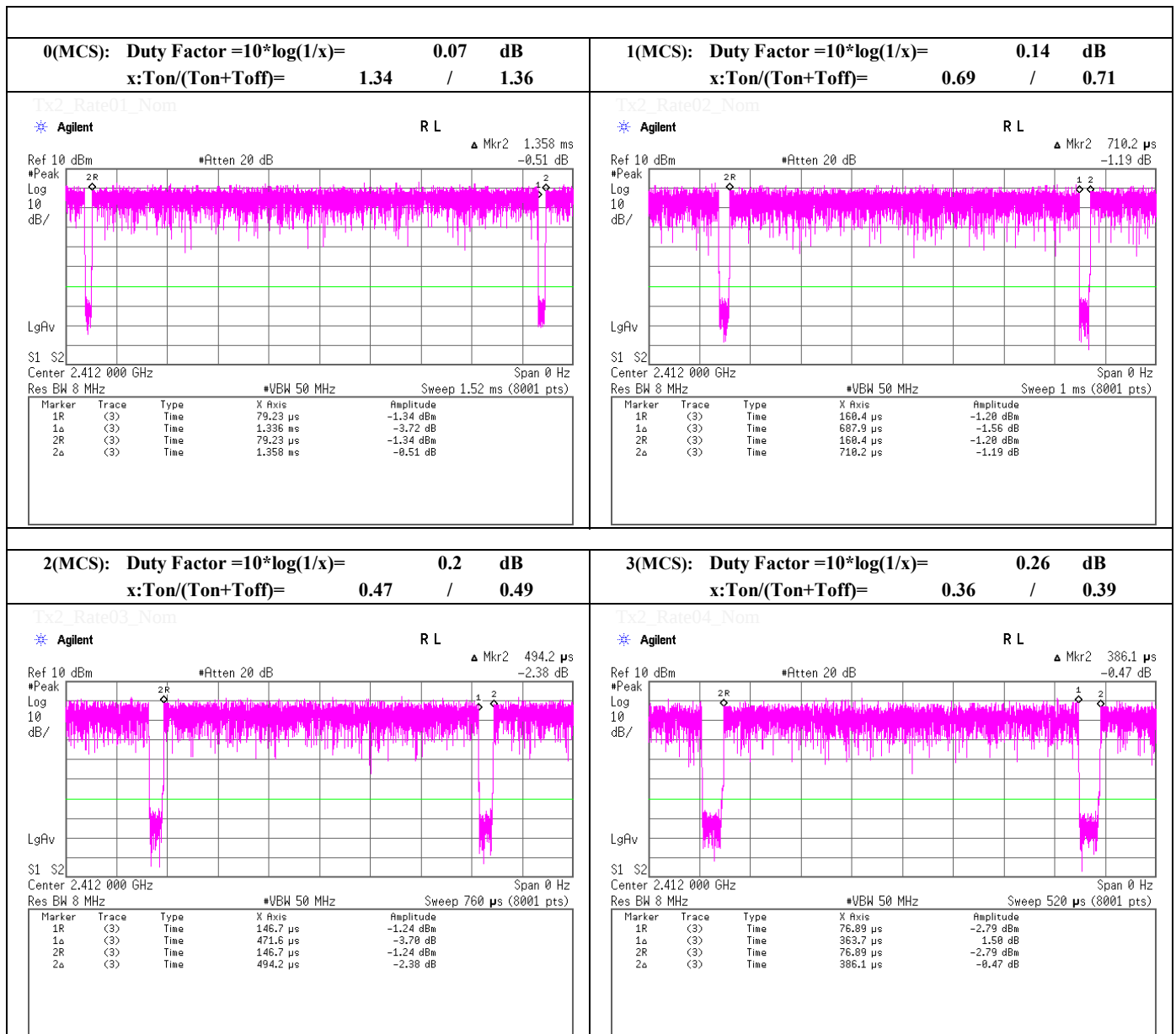
Sample Calculation:  
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

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Test place UL Japan, Inc. Shonan EMC Lab. No.1 Measurement Room  
 Date December 22, 2014  
 Temperature / Humidity 24deg.C , 32%RH  
 Engineer Tatsuya Arai

## Duty Factor Calculation chart for Maximum Conducted Output Power



**UL Japan, Inc.**

**Shonan EMC Lab.**

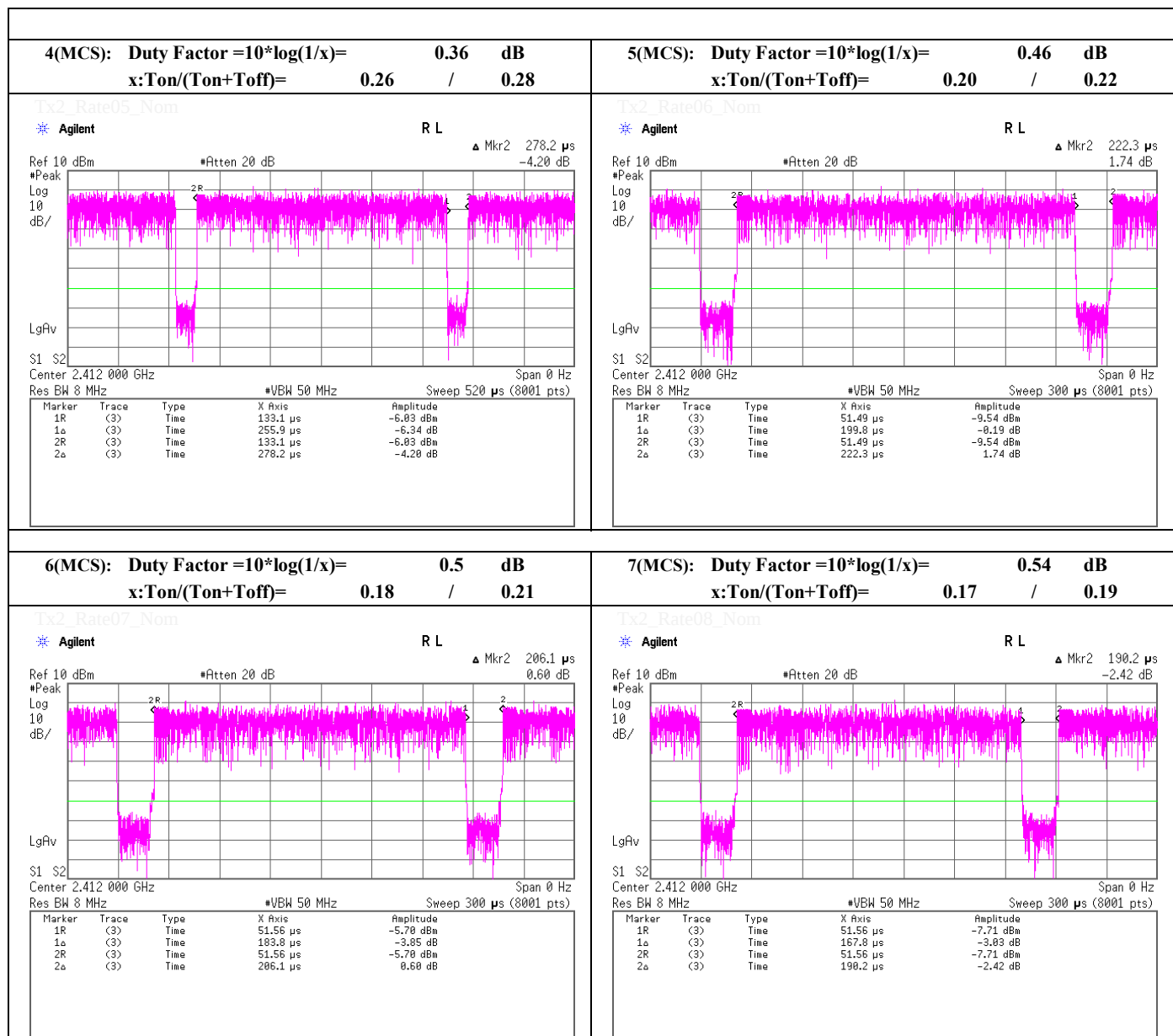
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Test place UL Japan, Inc. Shonan EMC Lab. No.1 Measurement Room  
 Date December 22, 2014  
 Temperature / Humidity 24deg.C , 32%RH  
 Engineer Tatsuya Arai

## Duty Factor Calculation chart for Maximum Conducted Output Power



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**Maximum Peak Conducted Output Power**  
(PKPM1)

Test place                   UL Japan, Inc. Shonan EMC Lab.           No.5 Shielded Room  
Date                        February 4, 2015  
Temperature / Humidity    25deg.C       , 48%RH  
Engineer                  Shinichi Takano  
Mode                       Tx, Bluetooth, Low Energy, PN9,

(\* P/M: Power Meter with power sensor)

| Ch   | Freq.  | P/M (Peak<br>Reading | Cable<br>Loss | Atten.<br>Loss | Result |      | Limit |      | Margin |
|------|--------|----------------------|---------------|----------------|--------|------|-------|------|--------|
|      | [MHz]  | [dBm]                | [dB]          | [dB]           | [dBm]  | [mW] | [dBm] | [mW] | [dB]   |
| Low  | 2402.0 | -12.54               | 1.09          | 20.24          | 8.79   | 7.57 | 30.00 | 1000 | 21.21  |
| Mid  | 2440.0 | -12.41               | 1.10          | 20.24          | 8.93   | 7.82 | 30.00 | 1000 | 21.07  |
| High | 2480.0 | -13.03               | 1.11          | 20.24          | 8.32   | 6.79 | 30.00 | 1000 | 21.68  |

Sample Calculation:  
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss

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**Maximum Conducted Output Power**  
(AVGPM)

Test place                   UL Japan, Inc. Shonan EMC Lab.           No.5 Shielded Room  
Date                        February 4, 2015  
Temperature / Humidity    25deg.C       , 48%RH  
Engineer                  Shinichi Takano  
Mode                       Tx, Bluetooth, Low Energy, PN9,

(\* P/M: Power Meter with power sensor, AV: Average)

| Ch   | Freq.  | P/M (AV)<br>Reading | Cable<br>Loss | Atten.<br>Loss | Duty<br>Factor | Result |      |
|------|--------|---------------------|---------------|----------------|----------------|--------|------|
|      | [MHz]  | [dBm]               | [dB]          | [dB]           | [dB]           | [dBm]  | [mW] |
| Low  | 2402.0 | -15.27              | 1.09          | 20.24          | 2.06           | 8.12   | 6.49 |
| Mid  | 2440.0 | -15.10              | 1.10          | 20.24          | 2.06           | 8.30   | 6.76 |
| High | 2480.0 | -15.78              | 1.11          | 20.24          | 2.06           | 7.63   | 5.79 |

Sample Calculation:  
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

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Test place

UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room

Date

February 4, 2015

Temperature / Humidity

25deg.C , 48%RH

Engineer

Shinichi Takano

Duty Factor Caliculation chart for Maximum Conducted Output Power

| <div>Duty Factor =10*log(1/x)=2.06 dB</div> <div>x:Ton/(Ton+Toff)=0.39 / 0.63</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                           |       |          |            |           |    |     |      |        |            |    |     |      |          |          |    |     |      |        |            |    |     |      |          |         |                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------|----------|------------|-----------|----|-----|------|--------|------------|----|-----|------|----------|----------|----|-----|------|--------|------------|----|-----|------|----------|---------|---------------------------|
| <div><div>Tx2_Rate01_Nom</div><div><div>Agilent</div><div>R L</div><div>Ref 0 dBm</div><div>Peak</div><div>Log 10 dB/</div><div>LgAv</div><div>S1 S2</div><div>Center 2.440 000 GHz</div><div>Res BW 1 MHz</div><div>Atten 10 dB</div><div>Mkr 2 625.2 μs 0.50 dB</div><div>Span 0 Hz</div><div>Sweep 760 μs (8001 pts)</div><div><table><tr><th>Marker</th><th>Trace</th><th>Type</th><th>X Axis</th><th>Amplitude</th></tr><tr><td>1R</td><td>(3)</td><td>Time</td><td>101 μs</td><td>-15.51 dBm</td></tr><tr><td>1a</td><td>(3)</td><td>Time</td><td>388.9 μs</td><td>-0.14 dB</td></tr><tr><td>2R</td><td>(3)</td><td>Time</td><td>101 μs</td><td>-15.51 dBm</td></tr><tr><td>2a</td><td>(3)</td><td>Time</td><td>625.2 μs</td><td>0.50 dB</td></tr></table></div></div></div> | Marker                    | Trace | Type     | X Axis     | Amplitude | 1R | (3) | Time | 101 μs | -15.51 dBm | 1a | (3) | Time | 388.9 μs | -0.14 dB | 2R | (3) | Time | 101 μs | -15.51 dBm | 2a | (3) | Time | 625.2 μs | 0.50 dB | <div>Tx2_Rate02_Nom</div> |
| Marker                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Trace                     | Type  | X Axis   | Amplitude  |           |    |     |      |        |            |    |     |      |          |          |    |     |      |        |            |    |     |      |          |         |                           |
| 1R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | (3)                       | Time  | 101 μs   | -15.51 dBm |           |    |     |      |        |            |    |     |      |          |          |    |     |      |        |            |    |     |      |          |         |                           |
| 1a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | (3)                       | Time  | 388.9 μs | -0.14 dB   |           |    |     |      |        |            |    |     |      |          |          |    |     |      |        |            |    |     |      |          |         |                           |
| 2R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | (3)                       | Time  | 101 μs   | -15.51 dBm |           |    |     |      |        |            |    |     |      |          |          |    |     |      |        |            |    |     |      |          |         |                           |
| 2a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | (3)                       | Time  | 625.2 μs | 0.50 dB    |           |    |     |      |        |            |    |     |      |          |          |    |     |      |        |            |    |     |      |          |         |                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                           |       |          |            |           |    |     |      |        |            |    |     |      |          |          |    |     |      |        |            |    |     |      |          |         |                           |
| <div>Tx2_Rate03_Nom</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <div>Tx2_Rate04_Nom</div> |       |          |            |           |    |     |      |        |            |    |     |      |          |          |    |     |      |        |            |    |     |      |          |         |                           |

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## Radiated Emission

Test place                      No.3 Semi Anechoic Chamber  
 Date                            December 25, 2014                      January 14, 2015                      January 15, 2015  
 Temperature / Humidity    23 deg.C, 33 %RH                      22 deg.C, 34 %RH                      22 deg.C, 34 %RH  
 Engineer                      Makoto Hosaka                            Tatsuya Arai                            Tatsuya Arai  
 Mode                            Tx,                            2412 MHz  
                                      Tx, IEEE802.11b, Monopole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2390.000           | PK       | 50.7              | 26.4               | 23.8         | 41.1         | 59.8               | 73.9              | 14.1           | 100            | 137            |        |
| Hori.    | 4824.000           | PK       | 50.9              | 30.7               | 5.5          | 39.8         | 47.3               | 73.9              | 26.6           | 100            | 273            |        |
| Hori.    | 7236.000           | PK       | 49.0              | 36.7               | 6.9          | 40.2         | 52.4               | 73.9              | 21.5           | 100            | 73             |        |
| Hori.    | 12060.000          | PK       | 47.3              | 39.5               | 8.9          | 39.6         | 56.1               | 73.9              | 17.8           | 100            | 36             |        |
| Hori.    | 2390.000           | AV       | 41.5              | 26.4               | 23.8         | 41.1         | 50.6               | 53.9              | 3.3            | 100            | 137            |        |
| Hori.    | 4824.000           | AV       | 42.5              | 30.7               | 5.5          | 39.8         | 38.9               | 53.9              | 15.0           | 100            | 273            |        |
| Hori.    | 7236.000           | AV       | 37.3              | 36.7               | 6.9          | 40.2         | 40.7               | 53.9              | 13.2           | 100            | 73             |        |
| Hori.    | 12060.000          | AV       | 37.2              | 39.5               | 8.9          | 39.6         | 46.0               | 53.9              | 7.9            | 100            | 36             |        |
| Vert.    | 2390.000           | PK       | 47.7              | 26.4               | 23.8         | 41.1         | 56.8               | 73.9              | 17.1           | 100            | 177            |        |
| Vert.    | 4824.000           | PK       | 50.3              | 30.7               | 5.5          | 39.8         | 46.7               | 73.9              | 27.2           | 100            | 306            |        |
| Vert.    | 7236.000           | PK       | 48.4              | 36.7               | 6.9          | 40.2         | 51.8               | 73.9              | 22.1           | 100            | 0              |        |
| Vert.    | 12060.000          | PK       | 46.7              | 39.5               | 8.9          | 39.6         | 55.5               | 73.9              | 18.4           | 100            | 0              |        |
| Vert.    | 2390.000           | AV       | 38.0              | 26.4               | 23.8         | 41.1         | 47.1               | 53.9              | 6.8            | 100            | 177            |        |
| Vert.    | 4824.000           | AV       | 42.0              | 30.7               | 5.5          | 39.8         | 38.4               | 53.9              | 15.5           | 100            | 306            |        |
| Vert.    | 7236.000           | AV       | 36.5              | 36.7               | 6.9          | 40.2         | 39.9               | 53.9              | 14.0           | 100            | 0              |        |
| Vert.    | 12060.000          | AV       | 35.0              | 39.5               | 8.9          | 39.6         | 43.8               | 53.9              | 10.1           | 100            | 0              |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**20dBc Data Sheet (RBW 100kHz, VBW 300kHz)**

| 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.    | 2412.000           | PK       | 96.8              | 26.4               | 23.8         | 41.1         | 105.9              | -                 | -              | Carrier |
| Hori.    | 2396.459           | PK       | 54.3              | 26.4               | 23.8         | 41.1         | 63.4               | 85.9              | 22.5           |         |
| Hori.    | 2400.000           | PK       | 51.4              | 26.4               | 23.8         | 41.1         | 60.5               | 85.9              | 25.4           |         |
| Hori.    | 9648.000           | PK       | 50.8              | 38.5               | 8.0          | 40.1         | 57.2               | 85.9              | 28.7           |         |
| Vert.    | 2412.000           | PK       | 90.6              | 26.4               | 23.8         | 41.1         | 99.7               | -                 | -              | Carrier |
| Vert.    | 2396.459           | PK       | 48.3              | 26.4               | 23.8         | 41.1         | 57.4               | 79.7              | 22.3           |         |
| Vert.    | 2400.000           | PK       | 44.3              | 26.4               | 23.8         | 41.1         | 53.4               | 79.7              | 26.3           |         |
| Vert.    | 9648.000           | PK       | 50.1              | 38.5               | 8.0          | 40.1         | 56.5               | 79.7              | 23.2           |         |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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# Radiated Emission

Test place                    No.3 Semi Anechoic Chamber  
Date                            January 14, 2015                    January 15, 2015  
Temperature / Humidity    22 deg.C, 34 %RH                22 deg.C, 34 %RH  
Engineer                    Tatsuya Arai                        Tatsuya Arai  
Mode                         Tx,                        2437 MHz  
                                 Tx, IEEE802.11b, Monopole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 4874.000           | PK       | 51.3              | 30.9               | 5.5          | 39.7         | 48.0               | 73.9              | 25.9           | 100            | 294            |        |
| Hori.    | 7311.000           | PK       | 48.6              | 36.8               | 6.8          | 40.3         | 51.9               | 73.9              | 22.0           | 100            | 19             |        |
| Hori.    | 12185.000          | PK       | 45.4              | 39.4               | 9.0          | 39.8         | 54.0               | 73.9              | 19.9           | 100            | 0              |        |
| Hori.    | 4874.000           | AV       | 42.5              | 30.9               | 5.5          | 39.7         | 39.2               | 53.9              | 14.7           | 100            | 294            |        |
| Hori.    | 7311.000           | AV       | 39.6              | 36.8               | 6.8          | 40.3         | 42.9               | 53.9              | 11.0           | 100            | 19             |        |
| Hori.    | 12185.000          | AV       | 35.0              | 39.4               | 9.0          | 39.8         | 43.6               | 53.9              | <b>10.3</b>    | 100            | 0              |        |
| Vert.    | 4874.000           | PK       | 50.6              | 30.9               | 5.5          | 39.7         | 47.3               | 73.9              | 26.6           | 114            | 281            |        |
| Vert.    | 7311.000           | PK       | 47.7              | 36.8               | 6.8          | 40.3         | 51.0               | 73.9              | 22.9           | 100            | 0              |        |
| Vert.    | 12185.000          | PK       | 46.1              | 39.4               | 9.0          | 39.8         | 54.7               | 73.9              | 19.2           | 100            | 0              |        |
| Vert.    | 4874.000           | AV       | 42.0              | 30.9               | 5.5          | 39.7         | 38.7               | 53.9              | 15.2           | 114            | 281            |        |
| Vert.    | 7311.000           | AV       | 38.0              | 36.8               | 6.8          | 40.3         | 41.3               | 53.9              | 12.6           | 100            | 0              |        |
| Vert.    | 12185.000          | AV       | 35.0              | 39.4               | 9.0          | 39.8         | 43.6               | 53.9              | <b>10.3</b>    | 100            | 0              |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**20dBc Data Sheet                    (RBW 100kHz, VBW 300kHz)**

| 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.    | 2437.000           | PK       | 95.5              | 26.5               | 23.8         | 41.1         | 104.7              | -                 | -              | Carrier |
| Hori.    | 9748.000           | PK       | 51.7              | 38.6               | 8.0          | 40.0         | 58.3               | 84.7              | 26.4           |         |
| Vert.    | 2437.000           | PK       | 88.9              | 26.5               | 23.8         | 41.1         | 98.1               | -                 | -              | Carrier |
| Vert.    | 9748.000           | PK       | 50.9              | 38.6               | 8.0          | 40.0         | 57.5               | 78.1              | 20.6           |         |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

## Radiated Emission

Test place                      No.3 Semi Anechoic Chamber  
 Date                            December 25, 2014                      January 14, 2015                      January 15, 2015  
 Temperature / Humidity    23 deg.C, 33 %RH                      22 deg.C, 34 %RH                      22 deg.C, 34 %RH  
 Engineer                      Makoto Hosaka                      Tatsuya Arai                      Tatsuya Arai  
 Mode                            Tx,                      2462 MHz  
                                      Tx, IEEE802.11b, Monopole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2483.500           | PK       | 50.2              | 26.6               | 23.8         | 41.1         | 59.5               | 73.9              | 14.4           | 100            | 136            |        |
| Hori.    | 4924.000           | PK       | 51.2              | 31.1               | 5.5          | 39.6         | 48.2               | 73.9              | 25.7           | 100            | 289            |        |
| Hori.    | 7386.000           | PK       | 45.5              | 36.9               | 6.8          | 40.4         | 48.8               | 73.9              | 25.1           | 100            | 0              |        |
| Hori.    | 12310.000          | PK       | 44.7              | 39.3               | 9.0          | 39.9         | 53.1               | 73.9              | 20.8           | 100            | 0              |        |
| Hori.    | 2483.500           | AV       | 41.4              | 26.6               | 23.8         | 41.1         | 50.7               | 53.9              | 3.2            | 100            | 136            |        |
| Hori.    | 4924.000           | AV       | 41.2              | 31.1               | 5.5          | 39.6         | 38.2               | 53.9              | 15.7           | 100            | 289            |        |
| Hori.    | 7386.000           | AV       | 35.2              | 36.9               | 6.8          | 40.4         | 38.5               | 53.9              | 15.4           | 100            | 0              |        |
| Hori.    | 12310.000          | AV       | 35.4              | 39.3               | 9.0          | 39.9         | 43.8               | 53.9              | 10.1           | 100            | 0              |        |
| Vert.    | 2483.500           | PK       | 47.8              | 26.6               | 23.8         | 41.1         | 57.1               | 73.9              | 16.8           | 100            | 175            |        |
| Vert.    | 4924.000           | PK       | 50.0              | 31.1               | 5.5          | 39.6         | 47.0               | 73.9              | 26.9           | 100            | 272            |        |
| Vert.    | 7386.000           | PK       | 42.5              | 36.9               | 6.8          | 40.4         | 45.8               | 73.9              | 28.1           | 100            | 0              |        |
| Vert.    | 12310.000          | PK       | 44.4              | 39.3               | 9.0          | 39.9         | 52.8               | 73.9              | 21.1           | 100            | 0              |        |
| Vert.    | 2483.500           | AV       | 38.7              | 26.6               | 23.8         | 41.1         | 48.0               | 53.9              | 5.9            | 100            | 175            |        |
| Vert.    | 4924.000           | AV       | 41.2              | 31.1               | 5.5          | 39.6         | 38.2               | 53.9              | 15.7           | 100            | 272            |        |
| Vert.    | 7386.000           | AV       | 37.9              | 36.9               | 6.8          | 40.4         | 41.2               | 53.9              | 12.7           | 100            | 0              |        |
| Vert.    | 12310.000          | AV       | 35.2              | 39.3               | 9.0          | 39.9         | 43.6               | 53.9              | 10.3           | 100            | 0              |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**20dBc Data Sheet (RBW 100kHz, VBW 300kHz)**

| 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.    | 2462.000           | PK       | 97.3              | 26.5               | 23.8         | 41.1         | 106.5              | -                 | -              | Carrier |
| Hori.    | 9848.000           | PK       | 51.1              | 38.6               | 8.0          | 39.9         | 57.8               | 86.5              | 28.7           |         |
| Vert.    | 2462.000           | PK       | 90.8              | 26.5               | 23.8         | 41.1         | 100.0              | -                 | -              | Carrier |
| Vert.    | 9848.000           | PK       | 51.2              | 38.6               | 8.0          | 39.9         | 57.9               | 80.0              | 22.1           |         |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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**Radiated Emission**

Test place                    No.3 Semi Anechoic Chamber  
Date                            December 25, 2014  
Temperature / Humidity    23 deg.C, 33 %RH  
Engineer                     Makoto Hosaka  
Mode                          Tx,                    2412 MHz  
                                     Tx, IEEE802.11g, Monopole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2261.119           | PK       | 49.5              | 26.2               | 13.5         | 41.2         | 48.0               | 73.9              | 25.9           | 100            | 221            |        |
| Hori.    | 2390.000           | PK       | 69.1              | 26.4               | 13.6         | 41.1         | 68.0               | 73.9              | 5.9            | 100            | 133            |        |
| Hori.    | 2713.531           | PK       | 49.3              | 27.0               | 13.8         | 40.9         | 49.2               | 73.9              | 24.7           | 100            | 143            |        |
| Hori.    | 2261.119           | AV       | 41.5              | 26.2               | 13.5         | 41.2         | 40.0               | 53.9              | 13.9           | 100            | 221            |        |
| Hori.    | 2390.000           | AV       | 52.4              | 26.4               | 13.6         | 41.1         | 51.3               | 53.9              | 2.6            | 100            | 133            |        |
| Hori.    | 2713.531           | AV       | 42.5              | 27.0               | 13.8         | 40.9         | 42.4               | 53.9              | 11.5           | 100            | 143            |        |
| Vert.    | 2261.119           | PK       | 47.4              | 26.2               | 13.5         | 41.2         | 45.9               | 73.9              | 28.0           | 100            | 40             |        |
| Vert.    | 2390.000           | PK       | 62.1              | 26.4               | 13.6         | 41.1         | 61.0               | 73.9              | 12.9           | 100            | 18             |        |
| Vert.    | 2713.531           | PK       | 48.9              | 27.0               | 13.8         | 40.9         | 48.8               | 73.9              | 25.1           | 100            | 38             |        |
| Vert.    | 2261.119           | AV       | 38.2              | 26.2               | 13.5         | 41.2         | 36.7               | 53.9              | 17.2           | 100            | 40             |        |
| Vert.    | 2390.000           | AV       | 45.2              | 26.4               | 13.6         | 41.1         | 44.1               | 53.9              | 9.8            | 100            | 18             |        |
| Vert.    | 2713.531           | AV       | 40.2              | 27.0               | 13.8         | 40.9         | 40.1               | 53.9              | 13.8           | 100            | 38             |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**20dBc Data Sheet                    (RBW 100kHz, VBW 300kHz)**

| 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.    | 2412.000           | PK       | 99.1              | 26.4               | 13.6         | 41.1         | 98.0               | -                 | -              | Carrier |
| Hori.    | 2400.000           | PK       | 63.9              | 26.4               | 13.6         | 41.1         | 62.8               | 78.0              | 15.2           |         |
| Vert.    | 2412.000           | PK       | 93.4              | 26.4               | 13.6         | 41.1         | 92.3               | -                 | -              | Carrier |
| Vert.    | 2400.000           | PK       | 57.9              | 26.4               | 13.6         | 41.1         | 56.8               | 72.3              | 15.5           |         |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**Radiated Emission**

Test place                    No.3 Semi Anechoic Chamber  
Date                         January 7, 2015  
Temperature / Humidity    23 deg.C, 33 %RH  
Engineer                    Tatsuya Arai  
Mode                        Tx,                    2417 MHz  
                                 Tx, IEEE802.11g, Monopole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2390.000           | PK       | 70.2              | 26.4               | 13.6         | 41.1         | 69.1               | 73.9              | 4.8            | 100            | 134            |        |
| Hori.    | 2390.000           | AV       | 53.4              | 26.4               | 13.6         | 41.1         | 52.3               | 53.9              | <b>1.6</b>     | 100            | 134            |        |
| Vert.    | 2390.000           | PK       | 64.5              | 26.4               | 13.6         | 41.1         | 63.4               | 73.9              | 10.5           | 120            | 148            |        |
| Vert.    | 2390.000           | AV       | 48.1              | 26.4               | 13.6         | 41.1         | 47.0               | 53.9              | 6.9            | 120            | 148            |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**20dBc Data Sheet                    (RBW 100kHz, VBW 300kHz)**

| 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.    | 2417.000           | PK       | 102.7             | 26.4               | 13.6         | 41.1         | 101.6              | -                 | -              | Carrier |
| Hori.    | 2400.000           | PK       | 66.8              | 26.4               | 13.6         | 41.1         | 65.7               | 81.6              | 15.9           |         |
| Vert.    | 2417.000           | PK       | 97.4              | 26.4               | 13.6         | 41.1         | 96.3               | -                 | -              | Carrier |
| Vert.    | 2400.000           | PK       | 60.3              | 26.4               | 13.6         | 41.1         | 59.2               | 76.3              | 17.1           |         |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**Radiated Emission**

Test place            No.3 Semi Anechoic Chamber  
Date                    January 7, 2015  
Temperature / Humidity    23 deg.C, 33 %RH  
Engineer                Tatsuya Arai  
Mode                    Tx,                    2457 MHz  
                              Tx, IEEE802.11g, Monopole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2483.500           | PK       | 68.3              | 26.6               | 13.6         | 41.1         | 67.4               | 73.9              | 6.5            | 100            | 137            |        |
| Hori.    | 2483.500           | AV       | 52.7              | 26.6               | 13.6         | 41.1         | 51.8               | 53.9              | <b>2.1</b>     | 100            | 137            |        |
| Vert.    | 2483.500           | PK       | 65.0              | 26.6               | 13.6         | 41.1         | 64.1               | 73.9              | 9.8            | 107            | 153            |        |
| Vert.    | 2483.500           | AV       | 49.3              | 26.6               | 13.6         | 41.1         | 48.4               | 53.9              | 5.5            | 107            | 153            |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**Radiated Emission**

Test place                No.3 Semi Anechoic Chamber  
Date                      December 25, 2014  
Temperature / Humidity   23 deg.C, 33 %RH  
Engineer                Makoto Hosaka  
Mode                    Tx,                2462 MHz  
                             Tx, IEEE802.11g, Monopole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2308.162           | PK       | 48.9              | 26.2               | 13.5         | 41.2         | 47.4               | 73.9              | 26.5           | 100            | 224            |        |
| Hori.    | 2483.500           | PK       | 68.6              | 26.6               | 13.6         | 41.1         | 67.7               | 73.9              | 6.2            | 100            | 140            |        |
| Hori.    | 2769.638           | PK       | 49.5              | 27.1               | 13.8         | 40.9         | 49.5               | 73.9              | 24.4           | 100            | 143            |        |
| Hori.    | 2308.162           | AV       | 41.0              | 26.2               | 13.5         | 41.2         | 39.5               | 53.9              | 14.4           | 100            | 224            |        |
| Hori.    | 2483.500           | AV       | 50.1              | 26.6               | 13.6         | 41.1         | 49.2               | 53.9              | 4.7            | 100            | 140            |        |
| Hori.    | 2769.638           | AV       | 42.6              | 27.1               | 13.8         | 40.9         | 42.6               | 53.9              | 11.3           | 100            | 143            |        |
| Vert.    | 2483.500           | PK       | 65.6              | 26.6               | 13.6         | 41.1         | 64.7               | 73.9              | 9.2            | 113            | 151            |        |
| Vert.    | 2769.638           | PK       | 48.6              | 27.1               | 13.8         | 40.9         | 48.6               | 73.9              | 25.3           | 100            | 0              |        |
| Vert.    | 2483.500           | AV       | 46.0              | 26.6               | 13.6         | 41.1         | 45.1               | 53.9              | 8.8            | 113            | 151            |        |
| Vert.    | 2769.638           | AV       | 40.2              | 27.1               | 13.8         | 40.9         | 40.2               | 53.9              | 13.7           | 100            | 0              |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

## Radiated Emission

Test place                    No.3 Semi Anechoic Chamber  
 Date                        December 24, 2014                    January 14, 2015                    January 15, 2015  
 Temperature / Humidity   24 deg.C, 56 %RH                    22 deg.C, 34 %RH                    22 deg.C, 34 %RH  
 Engineer                    Tatsuya Arai                    Tatsuya Arai                    Tatsuya Arai  
 Mode                        Tx,                    2412 MHz  
                                  Tx, IEEE802.11n (HT20), Monopole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2261.269           | PK       | 49.0              | 26.2               | 13.5         | 41.2         | 47.5               | 73.9              | 26.4           | 100            | 223            |        |
| Hori.    | 2390.000           | PK       | 71.7              | 26.4               | 13.6         | 41.1         | 70.6               | 73.9              | 3.3            | 100            | 219            |        |
| Hori.    | 2713.530           | PK       | 49.7              | 27.0               | 13.8         | 40.9         | 49.6               | 73.9              | 24.3           | 100            | 142            |        |
| Hori.    | 4824.000           | PK       | 46.5              | 30.7               | 5.5          | 39.8         | 42.9               | 73.9              | 31.0           | 100            | 267            |        |
| Hori.    | 7236.000           | PK       | 46.4              | 36.7               | 6.9          | 40.2         | 49.8               | 73.9              | 24.1           | 100            | 0              |        |
| Hori.    | 9648.000           | PK       | 47.5              | 38.5               | 8.0          | 40.1         | 53.9               | 73.9              | 20.0           | 100            | 77             |        |
| Hori.    | 12060.000          | PK       | 47.2              | 39.5               | 8.9          | 39.6         | 56.0               | 73.9              | 17.9           | 100            | 0              |        |
| Hori.    | 2261.269           | AV       | 41.5              | 26.2               | 13.5         | 41.2         | 40.0               | 53.9              | 13.9           | 100            | 223            |        |
| Hori.    | 2390.000           | AV       | 52.3              | 26.4               | 13.6         | 41.1         | 51.2               | 53.9              | 2.7            | 100            | 219            |        |
| Hori.    | 2713.530           | AV       | 42.3              | 27.0               | 13.8         | 40.9         | 42.2               | 53.9              | 11.7           | 100            | 142            |        |
| Hori.    | 4824.000           | AV       | 35.9              | 30.7               | 5.5          | 39.8         | 32.3               | 53.9              | 21.6           | 100            | 267            |        |
| Hori.    | 7236.000           | AV       | 35.5              | 36.7               | 6.9          | 40.2         | 38.9               | 53.9              | 15.0           | 100            | 0              |        |
| Hori.    | 9648.000           | AV       | 35.8              | 38.5               | 8.0          | 40.1         | 42.2               | 53.9              | 11.7           | 100            | 77             |        |
| Hori.    | 12060.000          | AV       | 36.5              | 39.5               | 8.9          | 39.6         | 45.3               | 53.9              | 8.6            | 100            | 0              |        |
| Vert.    | 2390.000           | PK       | 65.9              | 26.4               | 13.6         | 41.1         | 64.8               | 73.9              | 9.1            | 118            | 168            |        |
| Vert.    | 2713.530           | PK       | 48.2              | 27.0               | 13.8         | 40.9         | 48.1               | 73.9              | 25.8           | 100            | 38             |        |
| Vert.    | 4824.000           | PK       | 46.6              | 30.7               | 5.5          | 39.8         | 43.0               | 73.9              | 30.9           | 100            | 67             |        |
| Vert.    | 7236.000           | PK       | 46.2              | 36.7               | 6.9          | 40.2         | 49.6               | 73.9              | 24.3           | 100            | 0              |        |
| Vert.    | 9648.000           | PK       | 46.7              | 38.5               | 8.0          | 40.1         | 53.1               | 73.9              | 20.8           | 100            | 124            |        |
| Vert.    | 12060.000          | PK       | 47.3              | 39.5               | 8.9          | 39.6         | 56.1               | 73.9              | 17.8           | 100            | 0              |        |
| Vert.    | 2390.000           | AV       | 46.4              | 26.4               | 13.6         | 41.1         | 45.3               | 53.9              | 8.6            | 118            | 168            |        |
| Vert.    | 2713.530           | AV       | 39.6              | 27.0               | 13.8         | 40.9         | 39.5               | 53.9              | 14.4           | 100            | 38             |        |
| Vert.    | 4824.000           | AV       | 36.2              | 30.7               | 5.5          | 39.8         | 32.6               | 53.9              | 21.3           | 100            | 67             |        |
| Vert.    | 7236.000           | AV       | 36.5              | 36.7               | 6.9          | 40.2         | 39.9               | 53.9              | 14.0           | 100            | 0              |        |
| Vert.    | 9648.000           | AV       | 36.0              | 38.5               | 8.0          | 40.1         | 42.4               | 53.9              | 11.5           | 100            | 124            |        |
| Vert.    | 12060.000          | AV       | 36.8              | 39.5               | 8.9          | 39.6         | 45.6               | 53.9              | 8.3            | 100            | 0              |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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**Radiated Emission**

Test place                    No.3 Semi Anechoic Chamber  
Date                         December 24, 2014  
Temperature / Humidity    24 deg.C, 56 %RH  
Engineer                    Tatsuya Arai  
Mode                        Tx,                    2417 MHz  
                                 Tx, IEEE802.11n (HT20), Monopole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2390.000           | PK       | 72.0              | 26.4               | 13.6         | 41.1         | 70.9               | 73.9              | <b>3.0</b>     | 100            | 221            |        |
| Hori.    | 2390.000           | AV       | 51.2              | 26.4               | 13.6         | 41.1         | 50.1               | 53.9              | 3.8            | 100            | 221            |        |
| Vert.    | 2390.000           | PK       | 66.8              | 26.4               | 13.6         | 41.1         | 65.7               | 73.9              | 8.2            | 121            | 164            |        |
| Vert.    | 2390.000           | AV       | 47.8              | 26.4               | 13.6         | 41.1         | 46.7               | 53.9              | 7.2            | 121            | 164            |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**20dBc Data Sheet                    (RBW 100kHz, VBW 300kHz)**

| 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.    | 2417.000           | PK       | 102.4             | 26.4               | 13.6         | 41.1         | 101.3              | -                 | -              | Carrier |
| Hori.    | 2400.000           | PK       | 69.8              | 26.4               | 13.6         | 41.1         | 68.7               | 81.3              | 12.6           |         |
| Vert.    | 2417.000           | PK       | 97.3              | 26.4               | 13.6         | 41.1         | 96.2               | -                 | -              | Carrier |
| Vert.    | 2400.000           | PK       | 62.6              | 26.4               | 13.6         | 41.1         | 61.5               | 76.2              | 14.7           |         |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**Radiated Emission**

Test place                    No.3 Semi Anechoic Chamber  
Date                         January 14, 2015                    January 15, 2015                    January 17, 2015  
Temperature / Humidity    22 deg.C, 34 %RH                    22 deg.C, 34 %RH                    22 deg.C, 32 %RH  
Engineer                    Tatsuya Arai                         Tatsuya Arai                         Shinichi Takano  
Mode                         Tx,                         2437 MHz  
                                 Tx, IEEE802.11n (HT20), Monopole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 37.414             | QP       | 22.5              | 15.2               | 6.5          | 32.2         | 12.0               | 40.0              | 28.0           | 294            | 59             |        |
| Hori.    | 548.595            | QP       | 22.1              | 18.5               | 9.4          | 32.1         | 17.9               | 46.0              | 28.1           | 100            | 302            |        |
| Hori.    | 2741.469           | PK       | 49.1              | 27.0               | 13.8         | 40.9         | 49.0               | 73.9              | 24.9           | 100            | 140            |        |
| Hori.    | 4874.000           | PK       | 47.4              | 30.9               | 5.5          | 39.7         | 44.1               | 73.9              | 29.8           | 100            | 63             |        |
| Hori.    | 7311.000           | PK       | 46.1              | 36.8               | 6.8          | 40.3         | 49.4               | 73.9              | 24.5           | 100            | 0              |        |
| Hori.    | 9748.000           | PK       | 50.6              | 38.6               | 8.0          | 40.0         | 57.2               | 73.9              | 16.7           | 100            | 278            |        |
| Hori.    | 12185.000          | PK       | 45.2              | 39.4               | 9.0          | 39.8         | 53.8               | 73.9              | 20.1           | 100            | 0              |        |
| Hori.    | 2741.469           | AV       | 43.9              | 27.0               | 13.8         | 40.9         | 43.8               | 53.9              | 10.1           | 100            | 140            |        |
| Hori.    | 4874.000           | AV       | 38.0              | 30.9               | 5.5          | 39.7         | 34.7               | 53.9              | 19.2           | 100            | 63             |        |
| Hori.    | 7311.000           | AV       | 35.6              | 36.8               | 6.8          | 40.3         | 38.9               | 53.9              | 15.0           | 100            | 0              |        |
| Hori.    | 9748.000           | AV       | 38.3              | 38.6               | 8.0          | 40.0         | 44.9               | 53.9              | 9.0            | 100            | 278            |        |
| Hori.    | 12185.000          | AV       | 35.6              | 39.4               | 9.0          | 39.8         | 44.2               | 53.9              | 9.7            | 100            | 0              |        |
| Vert.    | 37.514             | QP       | 22.4              | 15.1               | 6.5          | 32.2         | 11.8               | 40.0              | 28.2           | 100            | 326            |        |
| Vert.    | 548.323            | QP       | 22.0              | 18.5               | 9.4          | 32.1         | 17.8               | 46.0              | 28.2           | 100            | 247            |        |
| Vert.    | 2741.469           | PK       | 48.0              | 27.0               | 13.8         | 40.9         | 47.9               | 73.9              | 26.0           | 100            | 45             |        |
| Vert.    | 4874.000           | PK       | 47.6              | 30.9               | 5.5          | 39.7         | 44.3               | 73.9              | 29.6           | 100            | 272            |        |
| Vert.    | 7311.000           | PK       | 47.1              | 36.8               | 6.8          | 40.3         | 50.4               | 73.9              | 23.5           | 100            | 0              |        |
| Vert.    | 9748.000           | PK       | 47.8              | 38.6               | 8.0          | 40.0         | 54.4               | 73.9              | 19.5           | 100            | 265            |        |
| Vert.    | 12185.000          | PK       | 45.4              | 39.4               | 9.0          | 39.8         | 54.0               | 73.9              | 19.9           | 100            | 0              |        |
| Vert.    | 2741.469           | AV       | 42.2              | 27.0               | 13.8         | 40.9         | 42.1               | 53.9              | 11.8           | 100            | 45             |        |
| Vert.    | 4874.000           | AV       | 37.1              | 30.9               | 5.5          | 39.7         | 33.8               | 53.9              | 20.1           | 100            | 272            |        |
| Vert.    | 7311.000           | AV       | 37.1              | 36.8               | 6.8          | 40.3         | 40.4               | 53.9              | 13.5           | 100            | 0              |        |
| Vert.    | 9748.000           | AV       | 36.9              | 38.6               | 8.0          | 40.0         | 43.5               | 53.9              | 10.4           | 100            | 265            |        |
| Vert.    | 12185.000          | AV       | 35.6              | 39.4               | 9.0          | 39.8         | 44.2               | 53.9              | 9.7            | 100            | 0              |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**Radiated Emission**

Test place                No.3 Semi Anechoic Chamber  
Date                        December 24, 2014  
Temperature / Humidity   24 deg.C, 56 %RH  
Engineer                 Tatsuya Arai  
Mode                        Tx,                        2457 MHz  
                                 Tx, IEEE802.11n (HT20), Monopole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2483.500           | PK       | 70.9              | 26.6               | 13.6         | 41.1         | 70.0               | 73.9              | 3.9            | 100            | 140            |        |
| Hori.    | 2483.500           | AV       | 52.6              | 26.6               | 13.6         | 41.1         | 51.7               | 53.9              | <b>2.2</b>     | 100            | 140            |        |
| Vert.    | 2483.500           | PK       | 67.5              | 26.6               | 13.6         | 41.1         | 66.6               | 73.9              | 7.3            | 112            | 150            |        |
| Vert.    | 2483.500           | AV       | 50.3              | 26.6               | 13.6         | 41.1         | 49.4               | 53.9              | 4.5            | 112            | 150            |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Ampriifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**Radiated Emission**

Test place                    No.3 Semi Anechoic Chamber  
Date                         December 24, 2014                    January 14, 2015                    January 15, 2015  
Temperature / Humidity    24 deg.C, 56 %RH                    22 deg.C, 34 %RH                    22 deg.C, 34 %RH  
Engineer                    Tatsuya Arai                    Tatsuya Arai                    Tatsuya Arai  
Mode                        Tx,                    2462 MHz  
                                 Tx, IEEE802.11n (HT20), Monopole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2483.500           | PK       | 74.1              | 26.6               | 13.6         | 41.1         | 73.2               | 73.9              | <b>0.7</b>     | 100            | 142            |        |
| Hori.    | 2769.776           | PK       | 49.7              | 27.1               | 13.8         | 40.9         | 49.7               | 73.9              | 24.2           | 123            | 146            |        |
| Hori.    | 4924.000           | PK       | 45.9              | 31.1               | 5.5          | 39.6         | 42.9               | 73.9              | 31.0           | 100            | 267            |        |
| Hori.    | 7386.000           | PK       | 46.6              | 36.9               | 6.8          | 40.4         | 49.9               | 73.9              | 24.0           | 102            | 0              |        |
| Hori.    | 9848.000           | PK       | 44.7              | 38.6               | 8.0          | 39.9         | 51.4               | 73.9              | 22.5           | 100            | 0              |        |
| Hori.    | 12310.000          | PK       | 46.1              | 39.3               | 9.0          | 39.9         | 54.5               | 73.9              | 19.4           | 100            | 5              |        |
| Hori.    | 2483.500           | AV       | 48.0              | 26.6               | 13.6         | 41.1         | 47.1               | 53.9              | 6.8            | 100            | 142            |        |
| Hori.    | 2769.776           | AV       | 42.5              | 27.1               | 13.8         | 40.9         | 42.5               | 53.9              | 11.4           | 123            | 146            |        |
| Hori.    | 4924.000           | AV       | 34.8              | 31.1               | 5.5          | 39.6         | 31.8               | 53.9              | 22.1           | 100            | 267            |        |
| Hori.    | 7386.000           | AV       | 35.9              | 36.9               | 6.8          | 40.4         | 39.2               | 53.9              | 14.7           | 102            | 0              |        |
| Hori.    | 9848.000           | AV       | 34.8              | 38.6               | 8.0          | 39.9         | 41.5               | 53.9              | 12.4           | 100            | 0              |        |
| Hori.    | 12310.000          | AV       | 35.2              | 39.3               | 9.0          | 39.9         | 43.6               | 53.9              | 10.3           | 100            | 5              |        |
| Vert.    | 2483.500           | PK       | 71.6              | 26.6               | 13.6         | 41.1         | 70.7               | 73.9              | 3.2            | 113            | 98             |        |
| Vert.    | 2769.776           | PK       | 48.5              | 27.1               | 13.8         | 40.9         | 48.5               | 73.9              | 25.4           | 100            | 79             |        |
| Vert.    | 4924.000           | PK       | 45.6              | 31.1               | 5.5          | 39.6         | 42.6               | 73.9              | 31.3           | 100            | 279            |        |
| Vert.    | 7386.000           | PK       | 45.5              | 36.9               | 6.8          | 40.4         | 48.8               | 73.9              | 25.1           | 100            | 0              |        |
| Vert.    | 9848.000           | PK       | 45.0              | 38.6               | 8.0          | 39.9         | 51.7               | 73.9              | 22.2           | 100            | 0              |        |
| Vert.    | 12310.000          | PK       | 45.5              | 39.3               | 9.0          | 39.9         | 53.9               | 73.9              | 20.0           | 100            | 23             |        |
| Vert.    | 2483.500           | AV       | 46.6              | 26.6               | 13.6         | 41.1         | 45.7               | 53.9              | 8.2            | 113            | 98             |        |
| Vert.    | 2769.776           | AV       | 39.8              | 27.1               | 13.8         | 40.9         | 39.8               | 53.9              | 14.1           | 100            | 79             |        |
| Vert.    | 4924.000           | AV       | 35.5              | 31.1               | 5.5          | 39.6         | 32.5               | 53.9              | 21.4           | 100            | 279            |        |
| Vert.    | 7386.000           | AV       | 36.3              | 36.9               | 6.8          | 40.4         | 39.6               | 53.9              | 14.3           | 100            | 0              |        |
| Vert.    | 9848.000           | AV       | 36.5              | 38.6               | 8.0          | 39.9         | 43.2               | 53.9              | 10.7           | 100            | 0              |        |
| Vert.    | 12310.000          | AV       | 34.8              | 39.3               | 9.0          | 39.9         | 43.2               | 53.9              | 10.7           | 100            | 23             |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Ampriifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

## Radiated Emission

Test place                    No.3 Semi Anechoic Chamber  
 Date                         February 5, 2015                    February 8, 2015  
 Temperature / Humidity   24 deg.C, 32 %RH                24 deg.C, 30 %RH  
 Engineer                    Yasumasa Owaki                    Yosuke Ishikawa  
 Mode                        Tx,                    2402 MHz  
                                  Tx, Bluetooth Low Energy, Monopole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 37.314             | QP       | 22.1              | 15.2               | 6.8          | 32.2         | 11.9               | 40.0              | 28.1           | 100            | 0              |        |
| Hori.    | 506.661            | QP       | 20.9              | 17.9               | 9.5          | 32.1         | 16.2               | 46.0              | 29.8           | 100            | 0              |        |
| Hori.    | 2390.000           | PK       | 46.9              | 26.4               | 13.6         | 41.1         | 45.8               | 73.9              | 28.1           | 100            | 248            |        |
| Hori.    | 3202.718           | PK       | 53.5              | 27.8               | 5.2          | 40.8         | 45.7               | 73.9              | 28.2           | 109            | 148            |        |
| Hori.    | 4804.000           | PK       | 52.8              | 30.6               | 5.6          | 39.8         | 49.2               | 73.9              | 24.7           | 100            | 64             |        |
| Hori.    | 7206.000           | PK       | 44.3              | 36.6               | 7.1          | 40.2         | 47.8               | 73.9              | 26.1           | 100            | 0              |        |
| Hori.    | 12010.000          | PK       | 45.0              | 39.5               | 9.2          | 39.6         | 54.1               | 73.9              | 19.8           | 100            | 0              |        |
| Hori.    | 3202.718           | AV       | 48.8              | 27.8               | 5.2          | 40.8         | 41.0               | 53.9              | <b>12.9</b>    | 109            | 148            |        |
| Vert.    | 37.128             | QP       | 22.0              | 15.2               | 6.8          | 32.2         | 11.8               | 40.0              | 28.2           | 100            | 0              |        |
| Vert.    | 506.450            | QP       | 20.9              | 17.9               | 9.5          | 32.1         | 16.2               | 46.0              | 29.8           | 100            | 0              |        |
| Vert.    | 2390.000           | PK       | 45.7              | 26.4               | 13.6         | 41.1         | 44.6               | 73.9              | 29.3           | 100            | 233            |        |
| Vert.    | 3202.689           | PK       | 52.8              | 27.8               | 5.2          | 40.8         | 45.0               | 73.9              | 28.9           | 107            | 194            |        |
| Vert.    | 4804.000           | PK       | 51.9              | 30.6               | 5.6          | 39.8         | 48.3               | 73.9              | 25.6           | 100            | 76             |        |
| Vert.    | 7206.000           | PK       | 44.2              | 36.6               | 7.1          | 40.2         | 47.7               | 73.9              | 26.2           | 100            | 0              |        |
| Vert.    | 12010.000          | PK       | 44.4              | 39.5               | 9.2          | 39.6         | 53.5               | 73.9              | 20.4           | 100            | 0              |        |
| Vert.    | 3202.689           | AV       | 47.2              | 27.8               | 5.2          | 40.8         | 39.4               | 53.9              | 14.5           | 107            | 194            |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**Average measurement value with duty factor**

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|--------|
| Hori.    | 2390.000           | AV       | 36.9              | 26.4               | 13.6         | 41.1         | 4.1                    | 39.9               | 53.9              | 14.0           | *1)    |
| Hori.    | 4804.000           | AV       | 45.6              | 30.6               | 5.6          | 39.8         | 4.1                    | 46.1               | 53.9              | 7.8            |        |
| Hori.    | 7206.000           | AV       | 34.9              | 36.6               | 7.1          | 40.2         | 4.1                    | 42.5               | 53.9              | 11.4           |        |
| Hori.    | 12010.000          | AV       | 35.8              | 39.5               | 9.2          | 39.6         | 4.1                    | 49.0               | 53.9              | 4.9            |        |
| Vert.    | 2390.000           | AV       | 36.9              | 26.4               | 13.6         | 41.1         | 4.1                    | 39.9               | 53.9              | 14.0           | *1)    |
| Vert.    | 4804.000           | AV       | 44.5              | 30.6               | 5.6          | 39.8         | 4.1                    | 45.0               | 53.9              | 8.9            |        |
| Vert.    | 7206.000           | AV       | 35.1              | 36.6               | 7.1          | 40.2         | 4.1                    | 42.7               | 53.9              | 11.2           |        |
| Vert.    | 12010.000          | AV       | 35.9              | 39.5               | 9.2          | 39.6         | 4.1                    | 49.1               | 53.9              | <b>4.8</b>     |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier) + Duty factor

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

\*1) Not out of Band emission (Leakage Power)

**20dBc Data Sheet (RBW 100kHz, VBW 300kHz)**

| 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.    | 2402.000           | PK       | 102.8             | 26.4               | 13.6         | 41.1         | 101.7              | -                 | -              | Carrier |
| Hori.    | 2400.000           | PK       | 42.3              | 26.4               | 13.6         | 41.1         | 41.2               | 81.7              | 40.5           |         |
| Hori.    | 9608.001           | PK       | 44.0              | 38.5               | 8.1          | 40.1         | 50.5               | 81.7              | 31.2           |         |
| Vert.    | 2402.000           | PK       | 96.9              | 26.4               | 13.6         | 41.1         | 95.8               | -                 | -              | Carrier |
| Vert.    | 2400.000           | PK       | 39.2              | 26.4               | 13.6         | 41.1         | 38.1               | 75.8              | 37.7           |         |
| Vert.    | 9608.001           | PK       | 44.6              | 38.5               | 8.1          | 40.1         | 51.1               | 75.8              | 24.7           |         |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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## Radiated Emission

Test place                      No.3 Semi Anechoic Chamber  
 Date                              February 5, 2015                      February 8, 2015  
 Temperature / Humidity      24 deg.C, 32 %RH                      24 deg.C, 30 %RH  
 Engineer                        Yasumasa Owaki                      Yosuke Ishikawa  
 Mode                              Tx,                      2440 MHz  
                                          Tx, Bluetooth Low Energy, Monopole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 36.496             | QP       | 21.9              | 15.4               | 6.8          | 32.2         | 11.9               | 40.0              | 28.1           | 100            | 0              |        |
| Hori.    | 500.890            | QP       | 20.7              | 17.8               | 9.4          | 32.1         | 15.8               | 46.0              | 30.2           | 100            | 0              |        |
| Hori.    | 3253.357           | PK       | 52.3              | 27.9               | 5.2          | 40.9         | 44.5               | 73.9              | 29.4           | 100            | 146            |        |
| Hori.    | 4880.000           | PK       | 50.8              | 30.9               | 5.6          | 39.7         | 47.6               | 73.9              | 26.3           | 100            | 301            |        |
| Hori.    | 7320.000           | PK       | 45.6              | 36.8               | 7.0          | 40.3         | 49.1               | 73.9              | 24.8           | 100            | 0              |        |
| Hori.    | 12200.000          | PK       | 43.8              | 39.4               | 9.3          | 39.8         | 52.7               | 73.9              | 21.2           | 100            | 0              |        |
| Hori.    | 3253.357           | AV       | 47.1              | 27.9               | 5.2          | 40.9         | 39.3               | 53.9              | 14.6           | 100            | 146            |        |
| Vert.    | 36.599             | QP       | 22.0              | 15.4               | 6.8          | 32.2         | 12.0               | 40.0              | 28.0           | 100            | 0              |        |
| Vert.    | 500.766            | QP       | 20.7              | 17.8               | 9.4          | 32.1         | 15.8               | 46.0              | 30.2           | 100            | 0              |        |
| Vert.    | 3253.362           | PK       | 53.4              | 27.9               | 5.2          | 40.9         | 45.6               | 73.9              | 28.3           | 105            | 259            |        |
| Vert.    | 4880.000           | PK       | 50.1              | 30.9               | 5.6          | 39.7         | 46.9               | 73.9              | 27.0           | 106            | 82             |        |
| Vert.    | 7320.000           | PK       | 44.3              | 36.8               | 7.0          | 40.3         | 47.8               | 73.9              | 26.1           | 100            | 0              |        |
| Vert.    | 12200.000          | PK       | 44.5              | 39.4               | 9.3          | 39.8         | 53.4               | 73.9              | 20.5           | 100            | 0              |        |
| Vert.    | 3253.362           | AV       | 48.2              | 27.9               | 5.2          | 40.9         | 40.4               | 53.9              | 13.5           | 105            | 259            |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

## Average measurement value with duty factor

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|--------|
| Hori.    | 4880.000           | AV       | 43.2              | 30.9               | 5.6          | 39.7         | 4.1                    | 44.1               | 53.9              | 9.8            |        |
| Hori.    | 7320.000           | AV       | 35.1              | 36.8               | 7.0          | 40.3         | 4.1                    | 42.7               | 53.9              | 11.2           |        |
| Hori.    | 12200.000          | AV       | 35.2              | 39.4               | 9.3          | 39.8         | 4.1                    | 48.2               | 53.9              | 5.7            |        |
| Vert.    | 4880.000           | AV       | 43.0              | 30.9               | 5.6          | 39.7         | 4.1                    | 43.9               | 53.9              | 10.0           |        |
| Vert.    | 7320.000           | AV       | 35.1              | 36.8               | 7.0          | 40.3         | 4.1                    | 42.7               | 53.9              | 11.2           |        |
| Vert.    | 12200.000          | AV       | 35.2              | 39.4               | 9.3          | 39.8         | 4.1                    | 48.2               | 53.9              | 5.7            |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier) + Duty factor

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

## 20dBc Data Sheet (RBW 100kHz, VBW 300kHz)

| 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.    | 2440.000           | PK       | 102.5             | 26.5               | 13.6         | 41.1         | 101.5              | -                 | -              | Carrier |
| Hori.    | 9760.001           | PK       | 41.3              | 38.6               | 8.1          | 40.0         | 48.0               | 81.5              | 33.5           |         |
| Vert.    | 2440.000           | PK       | 95.8              | 26.5               | 13.6         | 41.1         | 94.8               | -                 | -              | Carrier |
| Vert.    | 9760.001           | PK       | 41.7              | 38.6               | 8.1          | 40.0         | 48.4               | 74.8              | 26.4           |         |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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## Radiated Emission

Test place                    No.3 Semi Anechoic Chamber  
 Date                         February 5, 2015                    February 8, 2015  
 Temperature / Humidity   24 deg.C, 32 %RH                24 deg.C, 30 %RH  
 Engineer                    Yasumasa Owaki                    Yosuke Ishikawa  
 Mode                        Tx,                    2480 MHz  
                                  Tx, Bluetooth Low Energy, Monopole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 36.529             | QP       | 21.9              | 15.4               | 6.8          | 32.2         | 11.9               | 40.0              | 28.1           | 100            | 0              |        |
| Hori.    | 500.957            | QP       | 20.7              | 17.8               | 9.4          | 32.1         | 15.8               | 46.0              | 30.2           | 100            | 0              |        |
| Hori.    | 2483.500           | PK       | 48.1              | 26.6               | 13.6         | 41.1         | 47.2               | 73.9              | 26.7           | 149            | 239            |        |
| Hori.    | 3306.678           | PK       | 52.7              | 27.9               | 5.2          | 40.9         | 44.9               | 73.9              | 29.0           | 100            | 148            |        |
| Hori.    | 4960.000           | PK       | 49.1              | 31.2               | 5.7          | 39.6         | 46.4               | 73.9              | 27.5           | 100            | 304            |        |
| Hori.    | 7440.000           | PK       | 44.8              | 37.0               | 7.0          | 40.4         | 48.4               | 73.9              | 25.5           | 100            | 0              |        |
| Hori.    | 12400.000          | PK       | 44.9              | 39.3               | 9.4          | 40.0         | 53.6               | 73.9              | 20.3           | 100            | 0              |        |
| Hori.    | 3306.678           | AV       | 47.2              | 27.9               | 5.2          | 40.9         | 39.4               | 53.9              | <b>14.5</b>    | 100            | 148            |        |
| Vert.    | 36.712             | QP       | 22.0              | 15.4               | 6.8          | 32.2         | 12.0               | 40.0              | 28.0           | 100            | 0              |        |
| Vert.    | 500.748            | QP       | 20.6              | 17.8               | 9.4          | 32.1         | 15.7               | 46.0              | 30.3           | 100            | 0              |        |
| Vert.    | 2483.500           | PK       | 46.2              | 26.6               | 13.6         | 41.1         | 45.3               | 73.9              | 28.6           | 100            | 140            |        |
| Vert.    | 3306.712           | PK       | 51.4              | 27.9               | 5.2          | 40.9         | 43.6               | 73.9              | 30.3           | 100            | 31             |        |
| Vert.    | 4960.000           | PK       | 49.2              | 31.2               | 5.7          | 39.6         | 46.5               | 73.9              | 27.4           | 110            | 281            |        |
| Vert.    | 7440.000           | PK       | 45.0              | 37.0               | 7.0          | 40.4         | 48.6               | 73.9              | 25.3           | 100            | 0              |        |
| Vert.    | 12400.000          | PK       | 44.9              | 39.3               | 9.4          | 40.0         | 53.6               | 73.9              | 20.3           | 100            | 0              |        |
| Vert.    | 3306.712           | AV       | 45.4              | 27.9               | 5.2          | 40.9         | 37.6               | 53.9              | 16.3           | 100            | 31             |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

## Average measurement value with duty factor

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|--------|
| Hori.    | 2483.500           | AV       | 37.7              | 26.6               | 13.6         | 41.1         | 4.1                    | 40.9               | 53.9              | 13.0           | *1)    |
| Hori.    | 4960.000           | AV       | 41.4              | 31.2               | 5.7          | 39.6         | 4.1                    | 42.8               | 53.9              | 11.1           |        |
| Hori.    | 7440.000           | AV       | 35.6              | 37.0               | 7.0          | 40.4         | 4.1                    | 43.3               | 53.9              | 10.6           |        |
| Hori.    | 12400.000          | AV       | 35.7              | 39.3               | 9.4          | 40.0         | 4.1                    | 48.5               | 53.9              | <b>5.4</b>     |        |
| Vert.    | 2483.500           | AV       | 36.6              | 26.6               | 13.6         | 41.1         | 4.1                    | 39.8               | 53.9              | 14.1           | *1)    |
| Vert.    | 4960.000           | AV       | 40.9              | 31.2               | 5.7          | 39.6         | 4.1                    | 42.3               | 53.9              | 11.6           |        |
| Vert.    | 7440.000           | AV       | 35.7              | 37.0               | 7.0          | 40.4         | 4.1                    | 43.4               | 53.9              | 10.5           |        |
| Vert.    | 12400.000          | AV       | 35.6              | 39.3               | 9.4          | 40.0         | 4.1                    | 48.4               | 53.9              | 5.5            |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier) + Duty factor

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

\*1) Not out of Band emission (Leakage Power)

## 20dBc Data Sheet (RBW 100kHz, VBW 300kHz)

| 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.    | 2480.000           | PK       | 101.7             | 26.6               | 13.6         | 41.1         | 100.8              | -                 | -              | Carrier |
| Hori.    | 9920.001           | PK       | 36.6              | 38.6               | 8.0          | 39.9         | 43.3               | 80.8              | 37.5           |         |
| Vert.    | 2480.000           | PK       | 94.1              | 26.6               | 13.6         | 41.1         | 93.2               | -                 | -              | Carrier |
| Vert.    | 9920.001           | PK       | 39.0              | 38.6               | 8.0          | 39.9         | 45.7               | 73.2              | 27.5           |         |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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## Radiated Emission

Test place                      No.3 Semi Anechoic Chamber  
 Date                            January 7, 2015                      January 9, 2015                      January 10, 2015  
 Temperature / Humidity    24 deg.C, 56 %RH                      23 deg.C, 33 %RH                      22 deg.C, 34 %RH  
 Engineer                      Tatsuya Arai                            Tatsuya Arai                            Hikaru Shirasawa  
 Mode                            Tx,                            2412 MHz  
                                      Tx, IEEE802.11b, Dipole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2390.000           | PK       | 50.0              | 26.4               | 23.8         | 41.1         | 59.1               | 73.9              | 14.8           | 100            | 127            |        |
| Hori.    | 4824.000           | PK       | 53.1              | 30.7               | 5.5          | 39.8         | 49.5               | 73.9              | 24.4           | 100            | 5              |        |
| Hori.    | 7236.000           | PK       | 49.1              | 36.7               | 6.9          | 40.2         | 52.5               | 73.9              | 21.4           | 100            | 328            |        |
| Hori.    | 12060.000          | PK       | 46.0              | 39.5               | 8.9          | 39.6         | 54.8               | 73.9              | 19.1           | 160            | 343            |        |
| Hori.    | 2390.000           | AV       | 40.6              | 26.4               | 23.8         | 41.1         | 49.7               | 53.9              | 4.2            | 100            | 127            |        |
| Hori.    | 4824.000           | AV       | 45.7              | 30.7               | 5.5          | 39.8         | 42.1               | 53.9              | 11.8           | 100            | 5              |        |
| Hori.    | 7236.000           | AV       | 40.4              | 36.7               | 6.9          | 40.2         | 43.8               | 53.9              | 10.1           | 100            | 328            |        |
| Hori.    | 12060.000          | AV       | 37.6              | 39.5               | 8.9          | 39.6         | 46.4               | 53.9              | 7.5            | 160            | 343            |        |
| Vert.    | 2390.000           | PK       | 48.0              | 26.4               | 23.8         | 41.1         | 57.1               | 73.9              | 16.8           | 100            | 207            |        |
| Vert.    | 4824.000           | PK       | 53.5              | 30.7               | 5.5          | 39.8         | 49.9               | 73.9              | 24.0           | 107            | 359            |        |
| Vert.    | 7236.000           | PK       | 47.9              | 36.7               | 6.9          | 40.2         | 51.3               | 73.9              | 22.6           | 100            | 0              |        |
| Vert.    | 12060.000          | PK       | 44.8              | 39.5               | 8.9          | 39.6         | 53.6               | 73.9              | 20.3           | 144            | 359            |        |
| Vert.    | 2390.000           | AV       | 38.1              | 26.4               | 23.8         | 41.1         | 47.2               | 53.9              | 6.7            | 100            | 207            |        |
| Vert.    | 4824.000           | AV       | 45.1              | 30.7               | 5.5          | 39.8         | 41.5               | 53.9              | 12.4           | 107            | 359            |        |
| Vert.    | 7236.000           | AV       | 38.8              | 36.7               | 6.9          | 40.2         | 42.2               | 53.9              | 11.7           | 100            | 0              |        |
| Vert.    | 12060.000          | AV       | 36.4              | 39.5               | 8.9          | 39.6         | 45.2               | 53.9              | 8.7            | 144            | 359            |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz :  $20\log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$ **20dBc Data Sheet (RBW 100kHz, VBW 300kHz)**

| 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.    | 2412.000           | PK       | 95.8              | 26.4               | 23.8         | 41.1         | 104.9              | -                 | -              | Carrier |
| Hori.    | 2396.487           | PK       | 54.4              | 26.4               | 23.8         | 41.1         | 63.5               | 84.9              | 21.4           |         |
| Hori.    | 2400.000           | PK       | 51.3              | 26.4               | 23.8         | 41.1         | 60.4               | 84.9              | 24.5           |         |
| Hori.    | 9648.000           | PK       | 51.5              | 38.5               | 8.0          | 40.1         | 57.9               | 84.9              | 27             |         |
| Vert.    | 2412.000           | PK       | 91.0              | 26.4               | 23.8         | 41.1         | 100.1              | -                 | -              | Carrier |
| Vert.    | 2396.487           | PK       | 48.5              | 26.4               | 23.8         | 41.1         | 57.6               | 80.1              | 22.5           |         |
| Vert.    | 2400.000           | PK       | 45.4              | 26.4               | 23.8         | 41.1         | 54.5               | 80.1              | 25.6           |         |
| Vert.    | 9648.000           | PK       | 45.6              | 38.5               | 8.0          | 40.1         | 52.0               | 80.1              | 28.1           |         |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz :  $20\log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$ **UL Japan, Inc.****Shonan EMC Lab.**

1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

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Facsimile : +81 463 50 6401

**Radiated Emission**

Test place                    No.3 Semi Anechoic Chamber  
Date                         January 9, 2015                    January 10, 2015  
Temperature / Humidity    23 deg.C, 33 %RH                22 deg.C, 34 %RH  
Engineer                    Tatsuya Arai                        Hikaru Shirasawa  
Mode                        Tx,                    2437 MHz  
                                 Tx, IEEE802.11b, Dipole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 4874.000           | PK       | 50.6              | 30.9               | 5.5          | 39.7         | 47.3               | 73.9              | 26.6           | 100            | 17             |        |
| Hori.    | 7311.000           | PK       | 49.2              | 36.8               | 6.8          | 40.3         | 52.5               | 73.9              | 21.4           | 100            | 332            |        |
| Hori.    | 12185.000          | PK       | 46.2              | 39.4               | 9.0          | 39.8         | 54.8               | 73.9              | 19.1           | 100            | 342            |        |
| Hori.    | 4874.000           | AV       | 42.8              | 30.9               | 5.5          | 39.7         | 39.5               | 53.9              | 14.4           | 100            | 17             |        |
| Hori.    | 7311.000           | AV       | 39.7              | 36.8               | 6.8          | 40.3         | 43.0               | 53.9              | 10.9           | 100            | 332            |        |
| Hori.    | 12185.000          | AV       | 37.1              | 39.4               | 9.0          | 39.8         | 45.7               | 53.9              | 8.2            | 100            | 342            |        |
| Vert.    | 4874.000           | PK       | 51.2              | 30.9               | 5.5          | 39.7         | 47.9               | 73.9              | 26.0           | 126            | 0              |        |
| Vert.    | 7311.000           | PK       | 47.4              | 36.8               | 6.8          | 40.3         | 50.7               | 73.9              | 23.2           | 100            | 358            |        |
| Vert.    | 12185.000          | PK       | 44.9              | 39.4               | 9.0          | 39.8         | 53.5               | 73.9              | 20.4           | 131            | 1              |        |
| Vert.    | 4874.000           | AV       | 43.0              | 30.9               | 5.5          | 39.7         | 39.7               | 53.9              | 14.2           | 126            | 0              |        |
| Vert.    | 7311.000           | AV       | 38.5              | 36.8               | 6.8          | 40.3         | 41.8               | 53.9              | 12.1           | 100            | 358            |        |
| Vert.    | 12185.000          | AV       | 36.5              | 39.4               | 9.0          | 39.8         | 45.1               | 53.9              | 8.8            | 131            | 1              |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**20dBc Data Sheet                    (RBW 100kHz, VBW 300kHz)**

| 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.    | 2437.000           | PK       | 96.5              | 26.5               | 23.8         | 41.1         | 105.7              | -                 | -              | Carrier |
| Hori.    | 9748.000           | PK       | 51.3              | 38.6               | 8.0          | 40.0         | 57.9               | 85.7              | 27.8           |         |
| Vert.    | 2437.000           | PK       | 89.9              | 26.5               | 23.8         | 41.1         | 99.1               | -                 | -              | Carrier |
| Vert.    | 9748.000           | PK       | 47.5              | 38.6               | 8.0          | 40.0         | 54.1               | 79.1              | 25.0           |         |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

## Radiated Emission

Test place                      No.3 Semi Anechoic Chamber  
 Date                            January 7, 2015                      January 9, 2015                      January 10, 2015  
 Temperature / Humidity    24 deg.C, 56 %RH                      23 deg.C, 33 %RH                      22 deg.C, 34 %RH  
 Engineer                      Tatsuya Arai                            Tatsuya Arai                            Hikaru Shirasawa  
 Mode                            Tx,                            2462 MHz  
                                      Tx, IEEE802.11b, Dipole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2483.500           | PK       | 50.8              | 26.6               | 23.8         | 41.1         | 60.1               | 73.9              | 13.8           | 100            | 134            |        |
| Hori.    | 4924.000           | PK       | 50.3              | 31.1               | 5.5          | 39.6         | 47.3               | 73.9              | 26.6           | 100            | 22             |        |
| Hori.    | 7386.000           | PK       | 47.0              | 36.9               | 6.8          | 40.4         | 50.3               | 73.9              | 23.6           | 100            | 330            |        |
| Hori.    | 12310.000          | PK       | 45.1              | 39.3               | 9.0          | 39.9         | 53.5               | 73.9              | 20.4           | 100            | 339            |        |
| Hori.    | 2483.500           | AV       | 41.0              | 26.6               | 23.8         | 41.1         | 50.3               | 53.9              | 3.6            | 100            | 134            |        |
| Hori.    | 4924.000           | AV       | 42.1              | 31.1               | 5.5          | 39.6         | 39.1               | 53.9              | 14.8           | 100            | 22             |        |
| Hori.    | 7386.000           | AV       | 38.1              | 36.9               | 6.8          | 40.4         | 41.4               | 53.9              | 12.5           | 100            | 330            |        |
| Hori.    | 12310.000          | AV       | 36.9              | 39.3               | 9.0          | 39.9         | 45.3               | 53.9              | 8.6            | 100            | 339            |        |
| Vert.    | 2483.500           | PK       | 47.5              | 26.6               | 23.8         | 41.1         | 56.8               | 73.9              | 17.1           | 125            | 71             |        |
| Vert.    | 4924.000           | PK       | 50.1              | 31.1               | 5.5          | 39.6         | 47.1               | 73.9              | 26.8           | 159            | 1              |        |
| Vert.    | 7386.000           | PK       | 46.6              | 36.9               | 6.8          | 40.4         | 49.9               | 73.9              | 24.0           | 148            | 359            |        |
| Vert.    | 12310.000          | PK       | 45.1              | 39.3               | 9.0          | 39.9         | 53.5               | 73.9              | 20.4           | 120            | 5              |        |
| Vert.    | 2483.500           | AV       | 38.1              | 26.6               | 23.8         | 41.1         | 47.4               | 53.9              | 6.5            | 125            | 71             |        |
| Vert.    | 4924.000           | AV       | 41.8              | 31.1               | 5.5          | 39.6         | 38.8               | 53.9              | 15.1           | 159            | 1              |        |
| Vert.    | 7386.000           | AV       | 37.8              | 36.9               | 6.8          | 40.4         | 41.1               | 53.9              | 12.8           | 148            | 359            |        |
| Vert.    | 12310.000          | AV       | 36.3              | 39.3               | 9.0          | 39.9         | 44.7               | 53.9              | 9.2            | 120            | 5              |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**20dBc Data Sheet (RBW 100kHz, VBW 300kHz)**

| 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.    | 2462.000           | PK       | 95.6              | 26.5               | 23.8         | 41.1         | 104.8              | -                 | -              | Carrier |
| Hori.    | 9848.000           | PK       | 52.8              | 38.6               | 8.0          | 39.9         | 59.5               | 84.8              | 25.3           |         |
| Vert.    | 2462.000           | PK       | 90.2              | 26.5               | 23.8         | 41.1         | 99.4               | -                 | -              | Carrier |
| Vert.    | 9848.000           | PK       | 46.7              | 38.6               | 8.0          | 39.9         | 53.4               | 79.4              | 26.0           |         |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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## Radiated Emission

Test place            No.3 Semi Anechoic Chamber  
 Date                 December 25, 2014  
 Temperature / Humidity    23 deg.C, 33 %RH  
 Engineer             Tatsuya Arai  
 Mode                 Tx,                 2412 MHz  
                          Tx, IEEE802.11g, Dipole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2390.000           | PK       | 66.8              | 26.4               | 13.6         | 41.1         | 65.7               | 73.9              | 8.2            | 100            | 124            |        |
| Hori.    | 2713.596           | PK       | 48.1              | 27.0               | 13.8         | 40.9         | 48.0               | 73.9              | 25.9           | 128            | 202            |        |
| Hori.    | 2390.000           | AV       | 51.2              | 26.4               | 13.6         | 41.1         | 50.1               | 53.9              | <b>3.8</b>     | 100            | 124            |        |
| Hori.    | 2713.596           | AV       | 40.8              | 27.0               | 13.8         | 40.9         | 40.7               | 53.9              | 13.2           | 128            | 202            |        |
| Vert.    | 2390.000           | PK       | 61.7              | 26.4               | 13.6         | 41.1         | 60.6               | 73.9              | 13.3           | 100            | 275            |        |
| Vert.    | 2713.596           | PK       | 48.5              | 27.0               | 13.8         | 40.9         | 48.4               | 73.9              | 25.5           | 100            | 24             |        |
| Vert.    | 2390.000           | AV       | 45.5              | 26.4               | 13.6         | 41.1         | 44.4               | 53.9              | 9.5            | 100            | 275            |        |
| Vert.    | 2713.596           | AV       | 40.9              | 27.0               | 13.8         | 40.9         | 40.8               | 53.9              | 13.1           | 100            | 24             |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz :  $20\log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$ 

### 20dBc Data Sheet (RBW 100kHz, VBW 300kHz)

| 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.    | 2412.000           | PK       | 99.3              | 26.4               | 13.6         | 41.1         | 98.2               | -                 | -              | Carrier |
| Hori.    | 2400.000           | PK       | 62.2              | 26.4               | 13.6         | 41.1         | 61.1               | 78.2              | 17.1           |         |
| Vert.    | 2412.000           | PK       | 93.7              | 26.4               | 13.6         | 41.1         | 92.6               | -                 | -              | Carrier |
| Vert.    | 2400.000           | PK       | 56.2              | 26.4               | 13.6         | 41.1         | 55.1               | 72.6              | 17.5           |         |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz :  $20\log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$ 

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**Radiated Emission**

Test place                    No.3 Semi Anechoic Chamber  
Date                         January 6, 2015  
Temperature / Humidity    23 deg.C, 33 %RH  
Engineer                    Tatsuya Arai  
Mode                        Tx,                    2417 MHz  
                                 Tx, IEEE802.11g, Dipole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2390.000           | PK       | 67.1              | 26.4               | 13.6         | 41.1         | 66.0               | 73.9              | 7.9            | 128            | 126            |        |
| Hori.    | 2390.000           | AV       | 51.4              | 26.4               | 13.6         | 41.1         | 50.3               | 53.9              | <b>3.6</b>     | 128            | 126            |        |
| Vert.    | 2390.000           | PK       | 63.4              | 26.4               | 13.6         | 41.1         | 62.3               | 73.9              | 11.6           | 100            | 73             |        |
| Vert.    | 2390.000           | AV       | 48.0              | 26.4               | 13.6         | 41.1         | 46.9               | 53.9              | 7.0            | 100            | 73             |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**20dBc Data Sheet                    (RBW 100kHz, VBW 300kHz)**

| 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.    | 2417.000           | PK       | 101.9             | 26.4               | 13.6         | 41.1         | 100.8              | -                 | -              | Carrier |
| Hori.    | 2400.000           | PK       | 63.2              | 26.4               | 13.6         | 41.1         | 62.1               | 80.8              | 18.7           |         |
| Vert.    | 2417.000           | PK       | 96.9              | 26.4               | 13.6         | 41.1         | 95.8               | -                 | -              | Carrier |
| Vert.    | 2400.000           | PK       | 59.6              | 26.4               | 13.6         | 41.1         | 58.5               | 75.8              | 17.3           |         |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**Radiated Emission**

Test place            No.3 Semi Anechoic Chamber  
Date                    December 25, 2014  
Temperature / Humidity   23 deg.C, 33 %RH  
Engineer                Tatsuya Arai  
Mode                    Tx,                    2457 MHz  
                             Tx, IEEE802.11g, Dipole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2483.500           | PK       | 67.8              | 26.6               | 13.6         | 41.1         | 66.9               | 73.9              | 7.0            | 100            | 133            |        |
| Hori.    | 2483.500           | AV       | 53.7              | 26.6               | 13.6         | 41.1         | 52.8               | 53.9              | <b>1.1</b>     | 100            | 133            |        |
| Vert.    | 2483.500           | PK       | 63.0              | 26.6               | 13.6         | 41.1         | 62.1               | 73.9              | 11.8           | 100            | 275            |        |
| Vert.    | 2483.500           | AV       | 48.5              | 26.6               | 13.6         | 41.1         | 47.6               | 53.9              | 6.3            | 100            | 275            |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**Radiated Emission**

Test place                No.3 Semi Anechoic Chamber  
Date                        December 25, 2014  
Temperature / Humidity   23 deg.C, 33 %RH  
Engineer                  Tatsuya Arai  
Mode                        Tx,                        2462    MHz  
                                 Tx, IEEE802.11g, Dipole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2483.500           | PK       | 69.1              | 26.6               | 13.6         | 41.1         | 68.2               | 73.9              | 5.7            | 100            | 223            |        |
| Hori.    | 2769.858           | PK       | 48.3              | 27.1               | 13.8         | 40.9         | 48.3               | 73.9              | 25.6           | 113            | 210            |        |
| Hori.    | 2483.500           | AV       | 50.6              | 26.6               | 13.6         | 41.1         | 49.7               | 53.9              | <b>4.2</b>     | 100            | 223            |        |
| Hori.    | 2769.858           | AV       | 41.0              | 27.1               | 13.8         | 40.9         | 41.0               | 53.9              | 12.9           | 113            | 210            |        |
| Vert.    | 2483.500           | PK       | 62.4              | 26.6               | 13.6         | 41.1         | 61.5               | 73.9              | 12.4           | 100            | 271            |        |
| Vert.    | 2769.858           | PK       | 48.8              | 27.1               | 13.8         | 40.9         | 48.8               | 73.9              | 25.1           | 119            | 18             |        |
| Vert.    | 2483.500           | AV       | 44.0              | 26.6               | 13.6         | 41.1         | 43.1               | 53.9              | 10.8           | 100            | 271            |        |
| Vert.    | 2769.858           | AV       | 40.7              | 27.1               | 13.8         | 40.9         | 40.7               | 53.9              | 13.2           | 119            | 18             |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**Radiated Emission**

Test place                    No.3 Semi Anechoic Chamber  
Date                         December 25, 2014                    January 9, 2015                    January 10, 2015  
Temperature / Humidity    23 deg.C, 33 %RH                    23 deg.C, 33 %RH                    22 deg.C, 34 %RH  
Engineer                    Tatsuya Arai                    Tatsuya Arai                    Hikaru Shirasawa  
Mode                         Tx,                    2412 MHz  
                                 Tx, IEEE802.11n (HT20), Dipole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2390.000           | PK       | 70.7              | 26.4               | 13.6         | 41.1         | 69.6               | 73.9              | 4.3            | 100            | 129            |        |
| Hori.    | 2713.616           | PK       | 48.5              | 27.0               | 13.8         | 40.9         | 48.4               | 73.9              | 25.5           | 120            | 214            |        |
| Hori.    | 4824.000           | PK       | 49.1              | 30.7               | 5.5          | 39.8         | 45.5               | 73.9              | 28.4           | 100            | 17             |        |
| Hori.    | 7236.000           | PK       | 45.8              | 36.7               | 6.9          | 40.2         | 49.2               | 73.9              | 24.7           | 100            | 331            |        |
| Hori.    | 9648.000           | PK       | 46.3              | 38.5               | 8.0          | 40.1         | 52.7               | 73.9              | 21.2           | 100            | 337            |        |
| Hori.    | 12060.000          | PK       | 43.0              | 39.5               | 8.9          | 39.6         | 51.8               | 73.9              | 22.1           | 100            | 0              |        |
| Hori.    | 2390.000           | AV       | 53.1              | 26.4               | 13.6         | 41.1         | 52.0               | 53.9              | 1.9            | 100            | 129            |        |
| Hori.    | 2713.616           | AV       | 41.1              | 27.0               | 13.8         | 40.9         | 41.0               | 53.9              | 12.9           | 120            | 214            |        |
| Hori.    | 4824.000           | AV       | 39.5              | 30.7               | 5.5          | 39.8         | 35.9               | 53.9              | 18.0           | 100            | 17             |        |
| Hori.    | 7236.000           | AV       | 36.9              | 36.7               | 6.9          | 40.2         | 40.3               | 53.9              | 13.6           | 100            | 331            |        |
| Hori.    | 9648.000           | AV       | 37.6              | 38.5               | 8.0          | 40.1         | 44.0               | 53.9              | 9.9            | 100            | 337            |        |
| Hori.    | 12060.000          | AV       | 35.1              | 39.5               | 8.9          | 39.6         | 43.9               | 53.9              | 10.0           | 100            | 0              |        |
| Vert.    | 2390.000           | PK       | 64.8              | 26.4               | 13.6         | 41.1         | 63.7               | 73.9              | 10.2           | 100            | 279            |        |
| Vert.    | 2713.616           | PK       | 48.9              | 27.0               | 13.8         | 40.9         | 48.8               | 73.9              | 25.1           | 100            | 34             |        |
| Vert.    | 4824.000           | PK       | 47.9              | 30.7               | 5.5          | 39.8         | 44.3               | 73.9              | 29.6           | 100            | 1              |        |
| Vert.    | 7236.000           | PK       | 45.4              | 36.7               | 6.9          | 40.2         | 48.8               | 73.9              | 25.1           | 100            | 358            |        |
| Vert.    | 9648.000           | PK       | 45.2              | 38.5               | 8.0          | 40.1         | 51.6               | 73.9              | 22.3           | 166            | 8              |        |
| Vert.    | 12060.000          | PK       | 44.5              | 39.5               | 8.9          | 39.6         | 53.3               | 73.9              | 20.6           | 100            | 0              |        |
| Vert.    | 2390.000           | AV       | 46.0              | 26.4               | 13.6         | 41.1         | 44.9               | 53.9              | 9.0            | 100            | 279            |        |
| Vert.    | 2713.616           | AV       | 40.9              | 27.0               | 13.8         | 40.9         | 40.8               | 53.9              | 13.1           | 100            | 34             |        |
| Vert.    | 4824.000           | AV       | 38.1              | 30.7               | 5.5          | 39.8         | 34.5               | 53.9              | 19.4           | 100            | 1              |        |
| Vert.    | 7236.000           | AV       | 36.5              | 36.7               | 6.9          | 40.2         | 39.9               | 53.9              | 14.0           | 100            | 358            |        |
| Vert.    | 9648.000           | AV       | 36.4              | 38.5               | 8.0          | 40.1         | 42.8               | 53.9              | 11.1           | 166            | 8              |        |
| Vert.    | 12060.000          | AV       | 35.2              | 39.5               | 8.9          | 39.6         | 44.0               | 53.9              | 9.9            | 100            | 0              |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Ampriifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**20dBc Data Sheet (RBW 100kHz, VBW 300kHz)**

| 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.    | 2412.000           | PK       | 98.7              | 26.4               | 13.6         | 41.1         | 97.6               | -                 | -              | Carrier |
| Hori.    | 2400.000           | PK       | 65.9              | 26.4               | 13.6         | 41.1         | 64.8               | 77.6              | 12.8           |         |
| Vert.    | 2412.000           | PK       | 92.8              | 26.4               | 13.6         | 41.1         | 91.7               | -                 | -              | Carrier |
| Vert.    | 2400.000           | PK       | 60.2              | 26.4               | 13.6         | 41.1         | 59.1               | 71.7              | 12.6           |         |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Ampriifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**Radiated Emission**

Test place                    No.3 Semi Anechoic Chamber  
Date                         December 25, 2014  
Temperature / Humidity    23 deg.C, 33 %RH  
Engineer                    Tatsuya Arai  
Mode                        Tx,                    2417 MHz  
                                 Tx, IEEE802.11n (HT20), Dipole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2390.000           | PK       | 67.9              | 26.4               | 13.6         | 41.1         | 66.8               | 73.9              | 7.1            | 100            | 122            |        |
| Hori.    | 2390.000           | AV       | 52.1              | 26.4               | 13.6         | 41.1         | 51.0               | 53.9              | <b>2.9</b>     | 100            | 122            |        |
| Vert.    | 2390.000           | PK       | 62.5              | 26.4               | 13.6         | 41.1         | 61.4               | 73.9              | 12.5           | 100            | 276            |        |
| Vert.    | 2390.000           | AV       | 47.1              | 26.4               | 13.6         | 41.1         | 46.0               | 53.9              | 7.9            | 100            | 276            |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**20dBc Data Sheet                    (RBW 100kHz, VBW 300kHz)**

| 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.    | 2417.000           | PK       | 101.9             | 26.4               | 13.6         | 41.1         | 100.8              | -                 | -              | Carrier |
| Hori.    | 2400.000           | PK       | 67.8              | 26.4               | 13.6         | 41.1         | 66.7               | 80.8              | 14.1           |         |
| Vert.    | 2417.000           | PK       | 96.8              | 26.4               | 13.6         | 41.1         | 95.7               | -                 | -              | Carrier |
| Vert.    | 2400.000           | PK       | 62.9              | 26.4               | 13.6         | 41.1         | 61.8               | 75.7              | 13.9           |         |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**Radiated Emission**

Test place                    No.3 Semi Anechoic Chamber  
Date                         January 9, 2015                    January 10, 2015                    January 17, 2015  
Temperature / Humidity    23 deg.C, 33 %RH                22 deg.C, 34 %RH                22 deg.C, 32 %RH  
Engineer                    Tatsuya Arai                        Hikaru Shirasawa                 Shinichi Takano  
Mode                        Tx,                        2437 MHz  
                                 Tx, IEEE802.11n (HT20), Dipole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 37.891             | QP       | 22.4              | 15.0               | 6.5          | 32.2         | 11.7               | 40.0              | 28.3           | 284            | 296            |        |
| Hori.    | 491.656            | QP       | 22.1              | 17.7               | 9.2          | 32.1         | 16.9               | 46.0              | 29.1           | 154            | 126            |        |
| Hori.    | 2741.644           | PK       | 49.3              | 27.0               | 13.8         | 40.9         | 49.2               | 73.9              | 24.7           | 119            | 215            |        |
| Hori.    | 4874.000           | PK       | 49.7              | 30.9               | 5.5          | 39.7         | 46.4               | 73.9              | 27.5           | 100            | 14             |        |
| Hori.    | 7311.000           | PK       | 48.9              | 36.8               | 6.8          | 40.3         | 52.2               | 73.9              | 21.7           | 104            | 327            |        |
| Hori.    | 9748.000           | PK       | 53.2              | 38.6               | 8.0          | 40.0         | 59.8               | 73.9              | 14.1           | 100            | 342            |        |
| Hori.    | 12185.000          | PK       | 45.7              | 39.4               | 9.0          | 39.8         | 54.3               | 73.9              | 19.6           | 140            | 343            |        |
| Hori.    | 2741.644           | AV       | 42.7              | 27.0               | 13.8         | 40.9         | 42.6               | 53.9              | 11.3           | 119            | 215            |        |
| Hori.    | 4874.000           | AV       | 40.8              | 30.9               | 5.5          | 39.7         | 37.5               | 53.9              | 16.4           | 100            | 14             |        |
| Hori.    | 7311.000           | AV       | 39.1              | 36.8               | 6.8          | 40.3         | 42.4               | 53.9              | 11.5           | 104            | 327            |        |
| Hori.    | 9748.000           | AV       | 40.5              | 38.6               | 8.0          | 40.0         | 47.1               | 53.9              | <b>6.8</b>     | 100            | 342            |        |
| Hori.    | 12185.000          | AV       | 36.5              | 39.4               | 9.0          | 39.8         | 45.1               | 53.9              | 8.8            | 140            | 343            |        |
| Vert.    | 37.645             | QP       | 22.4              | 15.1               | 6.5          | 32.2         | 11.8               | 40.0              | 28.2           | 100            | 218            |        |
| Vert.    | 487.921            | QP       | 22.8              | 17.6               | 9.2          | 32.1         | 17.5               | 46.0              | 28.5           | 100            | 72             |        |
| Vert.    | 2741.644           | PK       | 50.5              | 27.0               | 13.8         | 40.9         | 50.4               | 73.9              | 23.5           | 109            | 35             |        |
| Vert.    | 4874.000           | PK       | 49.4              | 30.9               | 5.5          | 39.7         | 46.1               | 73.9              | 27.8           | 110            | 358            |        |
| Vert.    | 7311.000           | PK       | 47.7              | 36.8               | 6.8          | 40.3         | 51.0               | 73.9              | 22.9           | 100            | 0              |        |
| Vert.    | 9748.000           | PK       | 47.8              | 38.6               | 8.0          | 40.0         | 54.4               | 73.9              | 19.5           | 147            | 217            |        |
| Vert.    | 12185.000          | PK       | 44.7              | 39.4               | 9.0          | 39.8         | 53.3               | 73.9              | 20.6           | 100            | 1              |        |
| Vert.    | 2741.644           | AV       | 42.6              | 27.0               | 13.8         | 40.9         | 42.5               | 53.9              | 11.4           | 109            | 35             |        |
| Vert.    | 4874.000           | AV       | 40.2              | 30.9               | 5.5          | 39.7         | 36.9               | 53.9              | 17.0           | 110            | 358            |        |
| Vert.    | 7311.000           | AV       | 37.9              | 36.8               | 6.8          | 40.3         | 41.2               | 53.9              | 12.7           | 100            | 0              |        |
| Vert.    | 9748.000           | AV       | 37.1              | 38.6               | 8.0          | 40.0         | 43.7               | 53.9              | 10.2           | 147            | 217            |        |
| Vert.    | 12185.000          | AV       | 35.7              | 39.4               | 9.0          | 39.8         | 44.3               | 53.9              | 9.6            | 100            | 1              |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amprifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**Radiated Emission**

Test place                No.3 Semi Anechoic Chamber  
Date                        December 25, 2014  
Temperature / Humidity   23 deg.C, 33 %RH  
Engineer                  Tatsuya Arai  
Mode                        Tx,                        2457 MHz  
                                 Tx, IEEE802.11n (HT20), Dipole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2483.500           | PK       | 68.5              | 26.6               | 13.6         | 41.1         | 67.6               | 73.9              | 6.3            | 100            | 133            |        |
| Hori.    | 2483.500           | AV       | 54.4              | 26.6               | 13.6         | 41.1         | 53.5               | 53.9              | <b>0.4</b>     | 100            | 133            |        |
| Vert.    | 2483.500           | PK       | 63.6              | 26.6               | 13.6         | 41.1         | 62.7               | 73.9              | 11.2           | 100            | 217            |        |
| Vert.    | 2483.500           | AV       | 49.4              | 26.6               | 13.6         | 41.1         | 48.5               | 53.9              | 5.4            | 100            | 217            |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**Radiated Emission**

Test place                    No.3 Semi Anechoic Chamber  
Date                         December 25, 2014                    January 9, 2015                    January 10, 2015  
Temperature / Humidity    23 deg.C, 33 %RH                    23 deg.C, 33 %RH                    22 deg.C, 34 %RH  
Engineer                    Tatsuya Arai                    Tatsuya Arai                    Hikaru Shirasawa  
Mode                         Tx,                    2462 MHz  
                                 Tx, IEEE802.11n (HT20), Dipole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2483.500           | PK       | 74.0              | 26.6               | 13.6         | 41.1         | 73.1               | 73.9              | <b>0.8</b>     | 100            | 126            |        |
| Hori.    | 2769.848           | PK       | 48.6              | 27.1               | 13.8         | 40.9         | 48.6               | 73.9              | 25.3           | 110            | 210            |        |
| Hori.    | 4924.000           | PK       | 46.7              | 31.1               | 5.5          | 39.6         | 43.7               | 73.9              | 30.2           | 100            | 18             |        |
| Hori.    | 7386.000           | PK       | 46.7              | 36.9               | 6.8          | 40.4         | 50.0               | 73.9              | 23.9           | 100            | 336            |        |
| Hori.    | 9848.000           | PK       | 47.4              | 38.6               | 8.0          | 39.9         | 54.1               | 73.9              | 19.8           | 100            | 340            |        |
| Hori.    | 12310.000          | PK       | 44.7              | 39.3               | 9.0          | 39.9         | 53.1               | 73.9              | 20.8           | 100            | 340            |        |
| Hori.    | 2483.500           | AV       | 49.2              | 26.6               | 13.6         | 41.1         | 48.3               | 53.9              | 5.6            | 100            | 126            |        |
| Hori.    | 2769.848           | AV       | 40.8              | 27.1               | 13.8         | 40.9         | 40.8               | 53.9              | 13.1           | 110            | 210            |        |
| Hori.    | 4924.000           | AV       | 38.0              | 31.1               | 5.5          | 39.6         | 35.0               | 53.9              | 18.9           | 100            | 18             |        |
| Hori.    | 7386.000           | AV       | 36.7              | 36.9               | 6.8          | 40.4         | 40.0               | 53.9              | 13.9           | 100            | 336            |        |
| Hori.    | 9848.000           | AV       | 38.2              | 38.6               | 8.0          | 39.9         | 44.9               | 53.9              | 9.0            | 100            | 340            |        |
| Hori.    | 12310.000          | AV       | 35.5              | 39.3               | 9.0          | 39.9         | 43.9               | 53.9              | 10.0           | 100            | 340            |        |
| Vert.    | 2483.500           | PK       | 67.7              | 26.6               | 13.6         | 41.1         | 66.8               | 73.9              | 7.1            | 100            | 271            |        |
| Vert.    | 2769.848           | PK       | 48.7              | 27.1               | 13.8         | 40.9         | 48.7               | 73.9              | 25.2           | 120            | 39             |        |
| Vert.    | 4924.000           | PK       | 46.3              | 31.1               | 5.5          | 39.6         | 43.3               | 73.9              | 30.6           | 100            | 359            |        |
| Vert.    | 7386.000           | PK       | 46.2              | 36.9               | 6.8          | 40.4         | 49.5               | 73.9              | 24.4           | 100            | 0              |        |
| Vert.    | 9848.000           | PK       | 45.9              | 38.6               | 8.0          | 39.9         | 52.6               | 73.9              | 21.3           | 144            | 169            |        |
| Vert.    | 12310.000          | PK       | 45.2              | 39.3               | 9.0          | 39.9         | 53.6               | 73.9              | 20.3           | 100            | 0              |        |
| Vert.    | 2483.500           | AV       | 43.3              | 26.6               | 13.6         | 41.1         | 42.4               | 53.9              | 11.5           | 100            | 271            |        |
| Vert.    | 2769.848           | AV       | 40.5              | 27.1               | 13.8         | 40.9         | 40.5               | 53.9              | 13.4           | 120            | 39             |        |
| Vert.    | 4924.000           | AV       | 37.1              | 31.1               | 5.5          | 39.6         | 34.1               | 53.9              | 19.8           | 100            | 359            |        |
| Vert.    | 7386.000           | AV       | 36.7              | 36.9               | 6.8          | 40.4         | 40.0               | 53.9              | 13.9           | 100            | 0              |        |
| Vert.    | 9848.000           | AV       | 36.2              | 38.6               | 8.0          | 39.9         | 42.9               | 53.9              | 11.0           | 144            | 169            |        |
| Vert.    | 12310.000          | AV       | 35.0              | 39.3               | 9.0          | 39.9         | 43.4               | 53.9              | 10.5           | 100            | 0              |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Ampriifier)  
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

## Radiated Emission

Test place                      No.3 Semi Anechoic Chamber  
 Date                              February 5, 2015                      February 8, 2015  
 Temperature / Humidity      24 deg.C, 32 %RH                      24 deg.C, 30 %RH  
 Engineer                        Yasumasa Owaki                      Yosuke Ishikawa  
 Mode                              Tx,                      2402 MHz  
                                       Tx, Bluetooth Low Energy, Dipole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 36.596             | QP       | 22.1              | 15.4               | 6.8          | 32.2         | 12.1               | 40.0              | 27.9           | 100            | 0              |        |
| Hori.    | 499.599            | QP       | 20.7              | 17.8               | 9.4          | 32.1         | 15.8               | 46.0              | 30.2           | 100            | 0              |        |
| Hori.    | 2390.000           | PK       | 45.6              | 26.4               | 13.6         | 41.1         | 44.5               | 73.9              | 29.4           | 100            | 134            |        |
| Hori.    | 3202.712           | PK       | 52.7              | 27.8               | 5.2          | 40.8         | 44.9               | 73.9              | 29.0           | 112            | 232            |        |
| Hori.    | 4804.000           | PK       | 55.1              | 30.6               | 5.6          | 39.8         | 51.5               | 73.9              | 22.4           | 100            | 1              |        |
| Hori.    | 7206.000           | PK       | 43.5              | 36.6               | 7.1          | 40.2         | 47.0               | 73.9              | 26.9           | 100            | 0              |        |
| Hori.    | 12010.000          | PK       | 45.0              | 39.5               | 9.2          | 39.6         | 54.1               | 73.9              | 19.8           | 100            | 0              |        |
| Hori.    | 3202.712           | AV       | 47.0              | 27.8               | 5.2          | 40.8         | 39.2               | 53.9              | 14.7           | 112            | 232            |        |
| Vert.    | 36.729             | QP       | 22.1              | 15.4               | 6.8          | 32.2         | 12.1               | 40.0              | 27.9           | 100            | 0              |        |
| Vert.    | 501.354            | QP       | 20.8              | 17.8               | 9.4          | 32.1         | 15.9               | 46.0              | 30.1           | 100            | 0              |        |
| Vert.    | 2390.000           | PK       | 46.6              | 26.4               | 13.6         | 41.1         | 45.5               | 73.9              | 28.4           | 100            | 351            |        |
| Vert.    | 3202.689           | PK       | 49.6              | 27.8               | 5.2          | 40.8         | 41.8               | 73.9              | 32.1           | 110            | 56             |        |
| Vert.    | 4804.000           | PK       | 53.8              | 30.6               | 5.6          | 39.8         | 50.2               | 73.9              | 23.7           | 100            | 1              |        |
| Vert.    | 7206.000           | PK       | 44.4              | 36.6               | 7.1          | 40.2         | 47.9               | 73.9              | 26.0           | 100            | 0              |        |
| Vert.    | 12010.000          | PK       | 45.3              | 39.5               | 9.2          | 39.6         | 54.4               | 73.9              | 19.5           | 100            | 0              |        |
| Vert.    | 3202.689           | AV       | 42.7              | 27.8               | 5.2          | 40.8         | 34.9               | 53.9              | 19.0           | 110            | 56             |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

## Average measurement value with duty factor

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|--------|
| Hori.    | 2390.000           | AV       | 36.8              | 26.4               | 13.6         | 41.1         | 4.1                    | 39.8               | 53.9              | 14.1           | *1)    |
| Hori.    | 4804.000           | AV       | 49.4              | 30.6               | 5.6          | 39.8         | 4.1                    | 49.9               | 53.9              | 4.0            |        |
| Hori.    | 7206.000           | AV       | 34.8              | 36.6               | 7.1          | 40.2         | 4.1                    | 42.4               | 53.9              | 11.5           |        |
| Hori.    | 12010.000          | AV       | 36.1              | 39.5               | 9.2          | 39.6         | 4.1                    | 49.3               | 53.9              | 4.6            |        |
| Vert.    | 2390.000           | AV       | 37.1              | 26.4               | 13.6         | 41.1         | 4.1                    | 40.1               | 53.9              | 13.8           | *1)    |
| Vert.    | 4804.000           | AV       | 48.3              | 30.6               | 5.6          | 39.8         | 4.1                    | 48.8               | 53.9              | 5.1            |        |
| Vert.    | 7206.000           | AV       | 34.8              | 36.6               | 7.1          | 40.2         | 4.1                    | 42.4               | 53.9              | 11.5           |        |
| Vert.    | 12010.000          | AV       | 35.9              | 39.5               | 9.2          | 39.6         | 4.1                    | 49.1               | 53.9              | 4.8            |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier) + Duty factor

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

\*1) Not out of Band emission (Leakage Power)

## 20dBc Data Sheet (RBW 100kHz, VBW 300kHz)

| 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.    | 2402.000           | PK       | 102.9             | 26.4               | 13.6         | 41.1         | 101.8              | -                 | -              | Carrier |
| Hori.    | 2400.000           | PK       | 41.7              | 26.4               | 13.6         | 41.1         | 40.6               | 81.8              | 41.2           |         |
| Hori.    | 9608.001           | PK       | 45.1              | 38.5               | 8.1          | 40.1         | 51.6               | 81.8              | 30.2           |         |
| Vert.    | 2402.000           | PK       | 98.9              | 26.4               | 13.6         | 41.1         | 97.8               | -                 | -              | Carrier |
| Vert.    | 2400.000           | PK       | 38.8              | 26.4               | 13.6         | 41.1         | 37.7               | 77.8              | 40.1           |         |
| Vert.    | 9608.001           | PK       | 42.3              | 38.5               | 8.1          | 40.1         | 48.8               | 77.8              | 29.0           |         |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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## Radiated Emission

Test place                    No.3 Semi Anechoic Chamber  
 Date                         February 5, 2015                    February 8, 2015  
 Temperature / Humidity   24 deg.C, 32 %RH                24 deg.C, 30 %RH  
 Engineer                    Yasumasa Owaki                    Yosuke Ishikawa  
 Mode                        Tx,                    2440 MHz  
                                  Tx, Bluetooth Low Energy, Dipole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 35.734             | QP       | 21.7              | 15.7               | 6.8          | 32.2         | 12.0               | 40.0              | 28.0           | 100            | 0              |        |
| Hori.    | 499.967            | QP       | 20.8              | 17.8               | 9.4          | 32.1         | 15.9               | 46.0              | 30.1           | 100            | 0              |        |
| Hori.    | 3253.362           | PK       | 52.6              | 27.9               | 5.2          | 40.9         | 44.8               | 73.9              | 29.1           | 106            | 229            |        |
| Hori.    | 4880.000           | PK       | 52.9              | 30.9               | 5.6          | 39.7         | 49.7               | 73.9              | 24.2           | 100            | 359            |        |
| Hori.    | 7320.000           | PK       | 43.6              | 36.8               | 7.0          | 40.3         | 47.1               | 73.9              | 26.8           | 100            | 0              |        |
| Hori.    | 12200.000          | PK       | 44.4              | 39.4               | 9.3          | 39.8         | 53.3               | 73.9              | 20.6           | 100            | 0              |        |
| Hori.    | 3253.362           | AV       | 47.5              | 27.9               | 5.2          | 40.9         | 39.7               | 53.9              | <b>14.2</b>    | 106            | 229            |        |
| Vert.    | 35.715             | QP       | 21.7              | 15.7               | 6.8          | 32.2         | 12.0               | 40.0              | 28.0           | 100            | 0              |        |
| Vert.    | 499.600            | QP       | 20.8              | 17.8               | 9.4          | 32.1         | 15.9               | 46.0              | 30.1           | 100            | 0              |        |
| Vert.    | 3253.378           | PK       | 48.8              | 27.9               | 5.2          | 40.9         | 41.0               | 73.9              | 32.9           | 102            | 260            |        |
| Vert.    | 4880.000           | PK       | 52.3              | 30.9               | 5.6          | 39.7         | 49.1               | 73.9              | 24.8           | 100            | 1              |        |
| Vert.    | 7320.000           | PK       | 43.6              | 36.8               | 7.0          | 40.3         | 47.1               | 73.9              | 26.8           | 100            | 0              |        |
| Vert.    | 12200.000          | PK       | 44.3              | 39.4               | 9.3          | 39.8         | 53.2               | 73.9              | 20.7           | 100            | 0              |        |
| Vert.    | 3253.378           | AV       | 41.2              | 27.9               | 5.2          | 40.9         | 33.4               | 53.9              | 20.5           | 102            | 260            |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**Average measurement value with duty factor**

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|--------|
| Hori.    | 4880.000           | AV       | 46.3              | 30.9               | 5.6          | 39.7         | 4.1                    | 47.2               | 53.9              | 6.7            |        |
| Hori.    | 7320.000           | AV       | 35.0              | 36.8               | 7.0          | 40.3         | 4.1                    | 42.6               | 53.9              | 11.3           |        |
| Hori.    | 12200.000          | AV       | 35.5              | 39.4               | 9.3          | 39.8         | 4.1                    | 48.5               | 53.9              | <b>5.4</b>     |        |
| Vert.    | 4880.000           | AV       | 46.2              | 30.9               | 5.6          | 39.7         | 4.1                    | 47.1               | 53.9              | 6.8            |        |
| Vert.    | 7320.000           | AV       | 35.1              | 36.8               | 7.0          | 40.3         | 4.1                    | 42.7               | 53.9              | 11.2           |        |
| Vert.    | 12200.000          | AV       | 35.3              | 39.4               | 9.3          | 39.8         | 4.1                    | 48.3               | 53.9              | 5.6            |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier) + Duty factor

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**20dBc Data Sheet (RBW 100kHz, VBW 300kHz)**

| 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.    | 2440.000           | PK       | 103.1             | 26.5               | 13.6         | 41.1         | 102.1              | -                 | -              | Carrier |
| Hori.    | 9760.001           | PK       | 44.6              | 38.6               | 8.1          | 40.0         | 51.3               | 82.1              | 30.8           |         |
| Vert.    | 2440.000           | PK       | 99.3              | 26.5               | 13.6         | 41.1         | 98.3               | -                 | -              | Carrier |
| Vert.    | 9760.001           | PK       | 41.1              | 38.6               | 8.1          | 40.0         | 47.8               | 78.3              | 30.5           |         |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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## Radiated Emission

Test place                      No.3 Semi Anechoic Chamber  
 Date                              February 5, 2015                      February 8, 2015  
 Temperature / Humidity      24 deg.C, 32 %RH                      24 deg.C, 30 %RH  
 Engineer                        Yasumasa Owaki                      Yosuke Ishikawa  
 Mode                              Tx,                      2480 MHz  
                                          Tx, Bluetooth Low Energy, Dipole Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 36.605             | QP       | 22.0              | 15.4               | 6.8          | 32.2         | 12.0               | 40.0              | 28.0           | 100            | 0              |        |
| Hori.    | 500.306            | QP       | 20.7              | 17.8               | 9.4          | 32.1         | 15.8               | 46.0              | 30.2           | 100            | 0              |        |
| Hori.    | 2483.500           | PK       | 49.0              | 26.6               | 13.6         | 41.1         | 48.1               | 73.9              | 25.8           | 100            | 127            |        |
| Hori.    | 3306.674           | PK       | 53.1              | 27.9               | 5.2          | 40.9         | 45.3               | 73.9              | 28.6           | 112            | 224            |        |
| Hori.    | 4960.000           | PK       | 51.5              | 31.2               | 5.7          | 39.6         | 48.8               | 73.9              | 25.1           | 100            | 349            |        |
| Hori.    | 7440.000           | PK       | 44.9              | 37.0               | 7.0          | 40.4         | 48.5               | 73.9              | 25.4           | 100            | 0              |        |
| Hori.    | 12400.000          | PK       | 44.8              | 39.3               | 9.4          | 40.0         | 53.5               | 73.9              | 20.4           | 100            | 0              |        |
| Hori.    | 3306.674           | AV       | 47.7              | 27.9               | 5.2          | 40.9         | 39.9               | 53.9              | <b>14.0</b>    | 112            | 224            |        |
| Vert.    | 36.729             | QP       | 22.0              | 15.4               | 6.8          | 32.2         | 12.0               | 40.0              | 28.0           | 100            | 0              |        |
| Vert.    | 500.429            | QP       | 20.7              | 17.8               | 9.4          | 32.1         | 15.8               | 46.0              | 30.2           | 100            | 0              |        |
| Vert.    | 2483.500           | PK       | 48.0              | 26.6               | 13.6         | 41.1         | 47.1               | 73.9              | 26.8           | 100            | 1              |        |
| Vert.    | 3306.671           | PK       | 49.9              | 27.9               | 5.2          | 40.9         | 42.1               | 73.9              | 31.8           | 120            | 58             |        |
| Vert.    | 4960.000           | PK       | 52.0              | 31.2               | 5.7          | 39.6         | 49.3               | 73.9              | 24.6           | 100            | 359            |        |
| Vert.    | 7440.000           | PK       | 43.8              | 37.0               | 7.0          | 40.4         | 47.4               | 73.9              | 26.5           | 100            | 0              |        |
| Vert.    | 12400.000          | PK       | 44.8              | 39.3               | 9.4          | 40.0         | 53.5               | 73.9              | 20.4           | 100            | 0              |        |
| Vert.    | 3306.671           | AV       | 42.5              | 27.9               | 5.2          | 40.9         | 34.7               | 53.9              | 19.2           | 120            | 58             |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**Average measurement value with duty factor**

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|--------|
| Hori.    | 2483.500           | AV       | 38.3              | 26.6               | 13.6         | 41.1         | 4.1                    | 41.5               | 53.9              | 12.4           | *1)    |
| Hori.    | 4960.000           | AV       | 44.9              | 31.2               | 5.7          | 39.6         | 4.1                    | 46.3               | 53.9              | 7.6            |        |
| Hori.    | 7440.000           | AV       | 35.6              | 37.0               | 7.0          | 40.4         | 4.1                    | 43.3               | 53.9              | 10.6           |        |
| Hori.    | 12400.000          | AV       | 35.6              | 39.3               | 9.4          | 40.0         | 4.1                    | 48.4               | 53.9              | <b>5.5</b>     |        |
| Vert.    | 2483.500           | AV       | 37.5              | 26.6               | 13.6         | 41.1         | 4.1                    | 40.7               | 53.9              | 13.2           | *1)    |
| Vert.    | 4960.000           | AV       | 44.1              | 31.2               | 5.7          | 39.6         | 4.1                    | 45.5               | 53.9              | 8.4            |        |
| Vert.    | 7440.000           | AV       | 35.4              | 37.0               | 7.0          | 40.4         | 4.1                    | 43.1               | 53.9              | 10.8           |        |
| Vert.    | 12400.000          | AV       | 35.6              | 39.3               | 9.4          | 40.0         | 4.1                    | 48.4               | 53.9              | <b>5.5</b>     |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier) + Duty factor

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

\*1) Not out of Band emission (Leakage Power)

**20dBc Data Sheet (RBW 100kHz, VBW 300kHz)**

| 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.    | 2480.000           | PK       | 103.4             | 26.6               | 13.6         | 41.1         | 102.5              | -                 | -              | Carrier |
| Hori.    | 9920.001           | PK       | 43.5              | 38.6               | 8.0          | 39.9         | 50.2               | 82.5              | 32.3           |         |
| Vert.    | 2480.000           | PK       | 98.9              | 26.6               | 13.6         | 41.1         | 98.0               | -                 | -              | Carrier |
| Vert.    | 9920.001           | PK       | 39.6              | 38.6               | 8.0          | 39.9         | 46.3               | 78                | 31.7           |         |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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## Radiated Emission

Test place            No.3 Semi Anechoic Chamber  
 Date                 February 9, 2015  
 Temperature / Humidity    27 deg.C, 31 %RH  
 Engineer            Yosuke Ishikawa  
 Mode                Tx,                2402 MHz  
                          Tx, Bluetooth Low Energy, Dual Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2390.000           | PK       | 46.7              | 26.4               | 13.6         | 41.1         | 45.6               | 73.9              | 28.3           | 100            | 131            |        |
| Vert.    | 2390.000           | PK       | 46.5              | 26.4               | 13.6         | 41.1         | 45.4               | 73.9              | 28.5           | 100            | 314            |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz :  $20\log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$ **Average measurement value with duty factor**

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|--------|
| Hori.    | 2390.000           | AV       | 36.7              | 26.4               | 13.6         | 41.1         | 4.1                    | 39.7               | 53.9              | 14.2           | *1)    |
| Vert.    | 2390.000           | AV       | 36.8              | 26.4               | 13.6         | 41.1         | 4.1                    | 39.8               | 53.9              | <b>14.1</b>    | *1)    |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier) + Duty factor

Distance factor : 15GHz -40GHz :  $20\log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$ 

\*1) Not out of Band emission (Leakage Power)

**20dBc Data Sheet (RBW 100kHz, VBW 300kHz)**

| 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.    | 2402.000           | PK       | 103.0             | 26.4               | 13.6         | 41.1         | 101.9              | -                 | -              | Carrier |
| Hori.    | 2400.000           | PK       | 44.4              | 26.4               | 13.6         | 41.1         | 43.3               | 81.9              | 38.6           |         |
| Vert.    | 2402.000           | PK       | 95.8              | 26.4               | 13.6         | 41.1         | 94.7               | -                 | -              | Carrier |
| Vert.    | 2400.000           | PK       | 38.9              | 26.4               | 13.6         | 41.1         | 37.8               | 74.7              | 36.9           |         |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Amplifier)

Distance factor : 15GHz -40GHz :  $20\log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$

**Radiated Emission**

Test place                    No.3 Semi Anechoic Chamber  
Date                         February 9, 2015  
Temperature / Humidity    27 deg.C, 31 %RH  
Engineer                    Yosuke Ishikawa  
Mode                        Tx,                    2480 MHz  
                                 Tx, Bluetooth Low Energy, Dual Antenna

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| 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] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 2483.500           | PK       | 48.8              | 26.6               | 13.6         | 41.1         | 47.9               | 73.9              | 26.0           | 100            | 126            |        |
| Vert.    | 2483.500           | PK       | 46.5              | 26.6               | 13.6         | 41.1         | 45.6               | 73.9              | 28.3           | 100            | 295            |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Ampriifier)

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

**Average measurement value with duty factor**

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|--------|
| Hori.    | 2483.500           | AV       | 38.8              | 26.6               | 13.6         | 41.1         | 4.1                    | 42.0               | 53.9              | <b>11.9</b>    | *1)    |
| Vert.    | 2483.500           | AV       | 37.3              | 26.6               | 13.6         | 41.1         | 4.1                    | 40.5               | 53.9              | 13.4           | *1)    |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18GHz)-Distance factor(above 15GHz)) - Gain(Ampriifier) + Duty factor

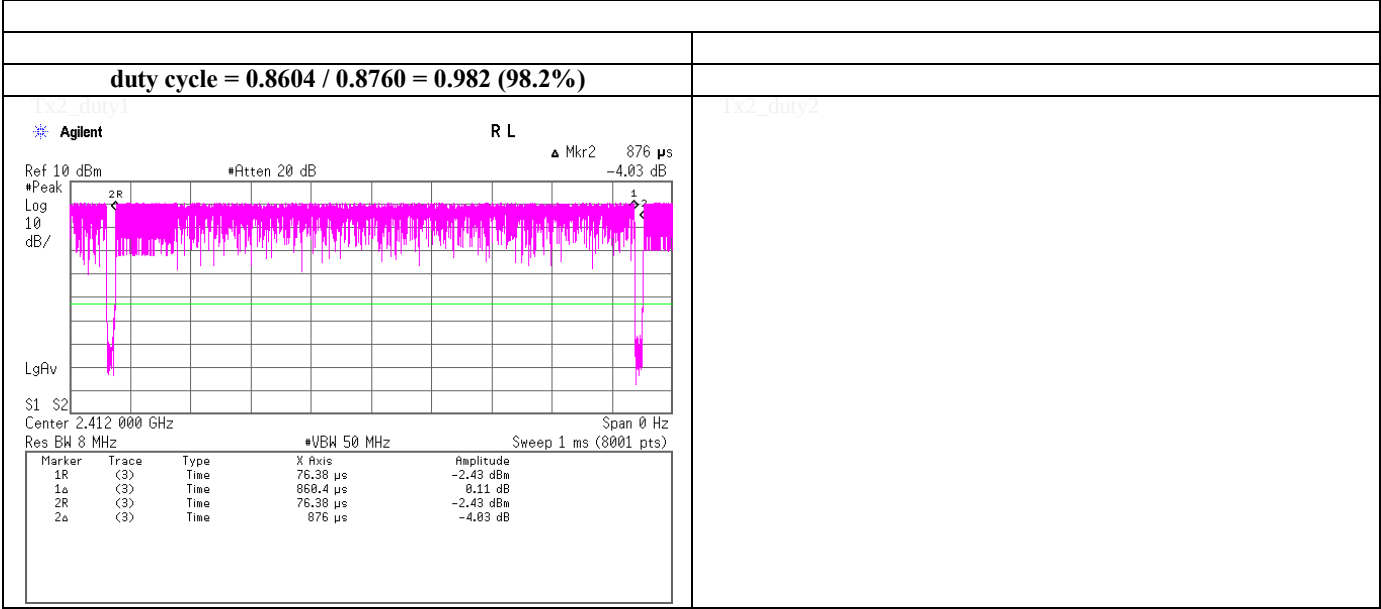
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

\*1) Not out of Band emission (Leakage Power)

Test place                   UL Japan, Inc. Shonan EMC Lab.       No.5 Shielded Room  
Date                        January 5, 2015  
Temperature / Humidity   26deg.C       , 30%RH  
Engineer                  Yosuke Ishikawa

**Burst rate confirmation**

**Tx, IEEE802.11b, PN9, worst data mode 11Mbps**

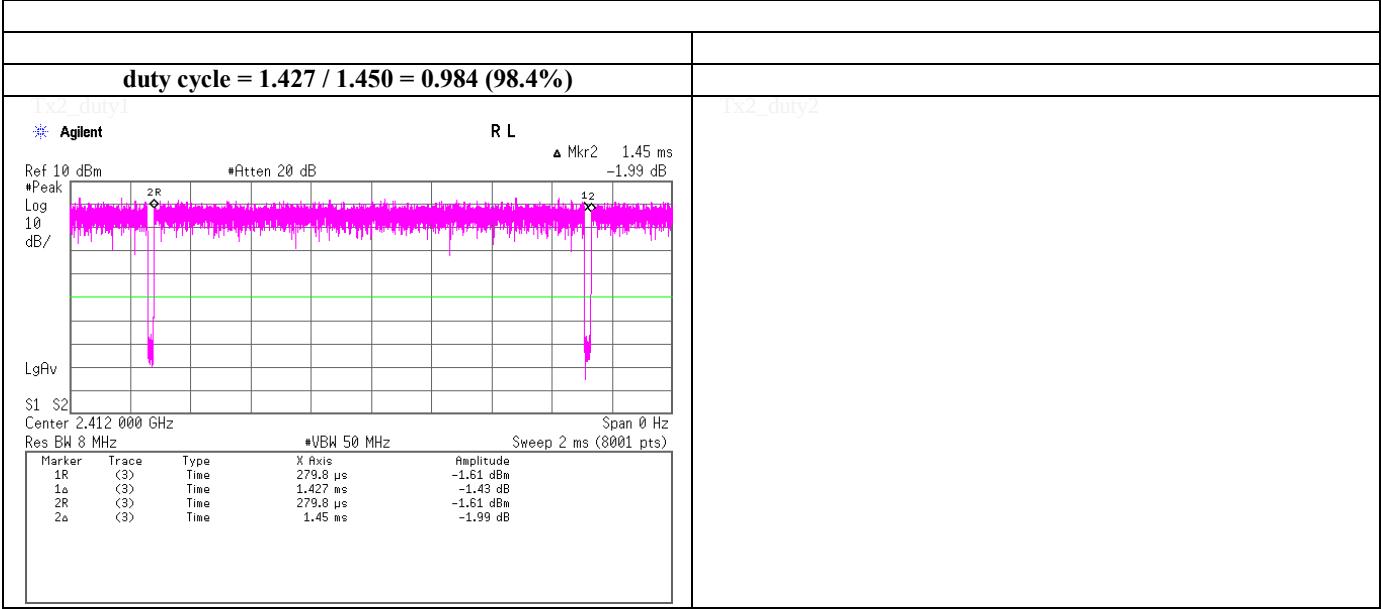


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Facsimile       : +81 463 50 6401

Test place                   UL Japan, Inc. Shonan EMC Lab.       No.5 Shielded Room  
Date                         January 5, 2015  
Temperature / Humidity   26deg.C       , 30%RH  
Engineer                  Yosuke Ishikawa

**Burst rate confirmation**

**Tx, IEEE802.11g, PN9, worst data mode 6Mbps**

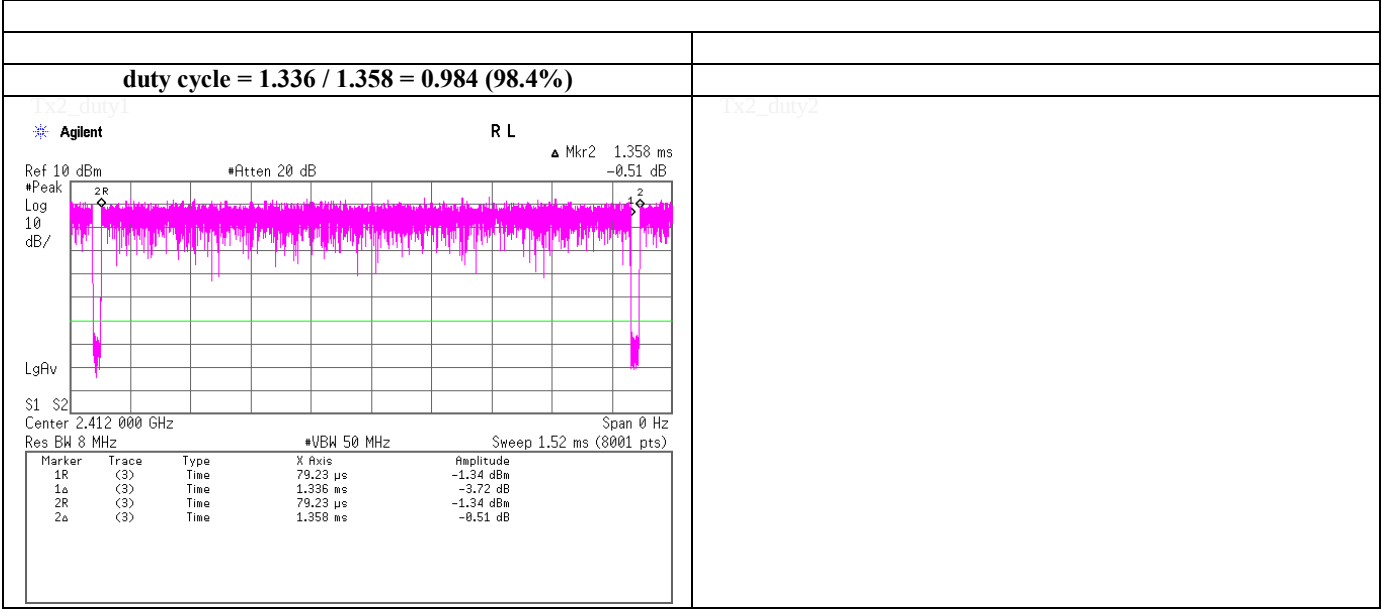


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Test place                   UL Japan, Inc. Shonan EMC Lab.       No.5 Shielded Room  
Date                        January 5, 2015  
Temperature / Humidity   26deg.C       , 30%RH  
Engineer                  Yosuke Ishikawa

**Burst rate confirmation**

**Tx, IEEE802.11n(HT20), PN9, worst data mode 0(MCS)**

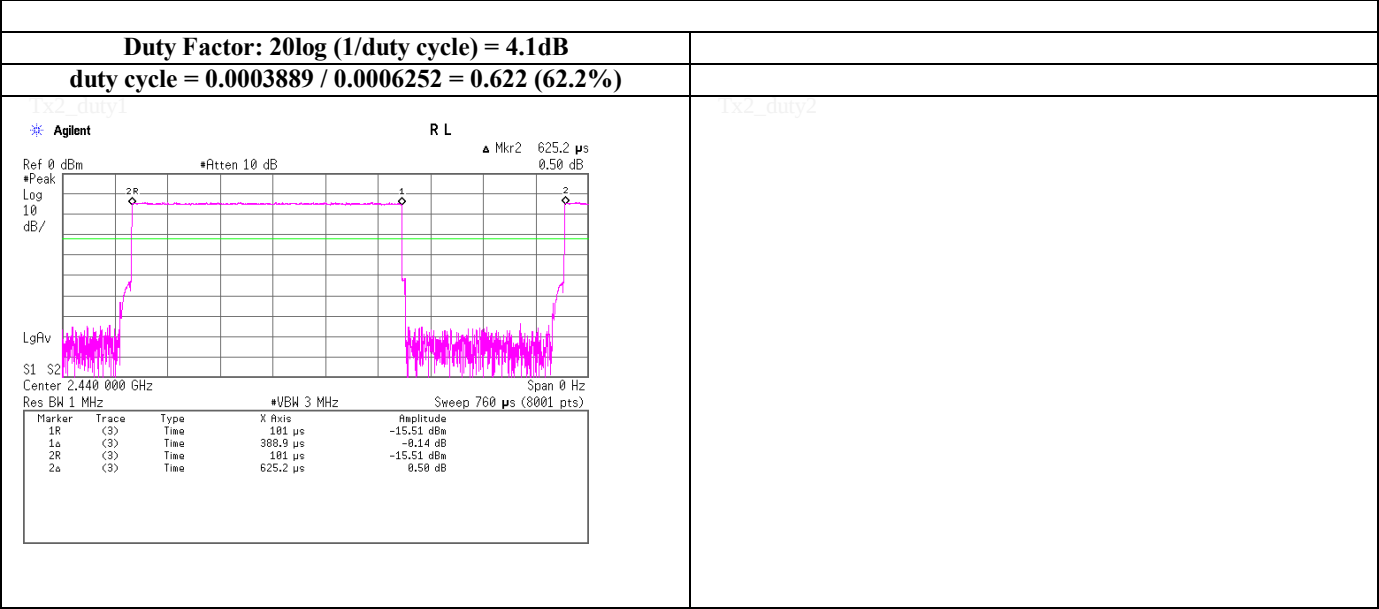


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Test place                   UL Japan, Inc. Shonan EMC Lab.       No.5 Shielded Room  
Date                        February 4, 2015  
Temperature / Humidity   25deg.C       , 48%RH  
Engineer                  Shinichi Takano

**Duty Factor Calculation chart**

**Tx, Bluetooth, Low Energy, PN9**



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Test place

UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room

Date

January 5, 2015

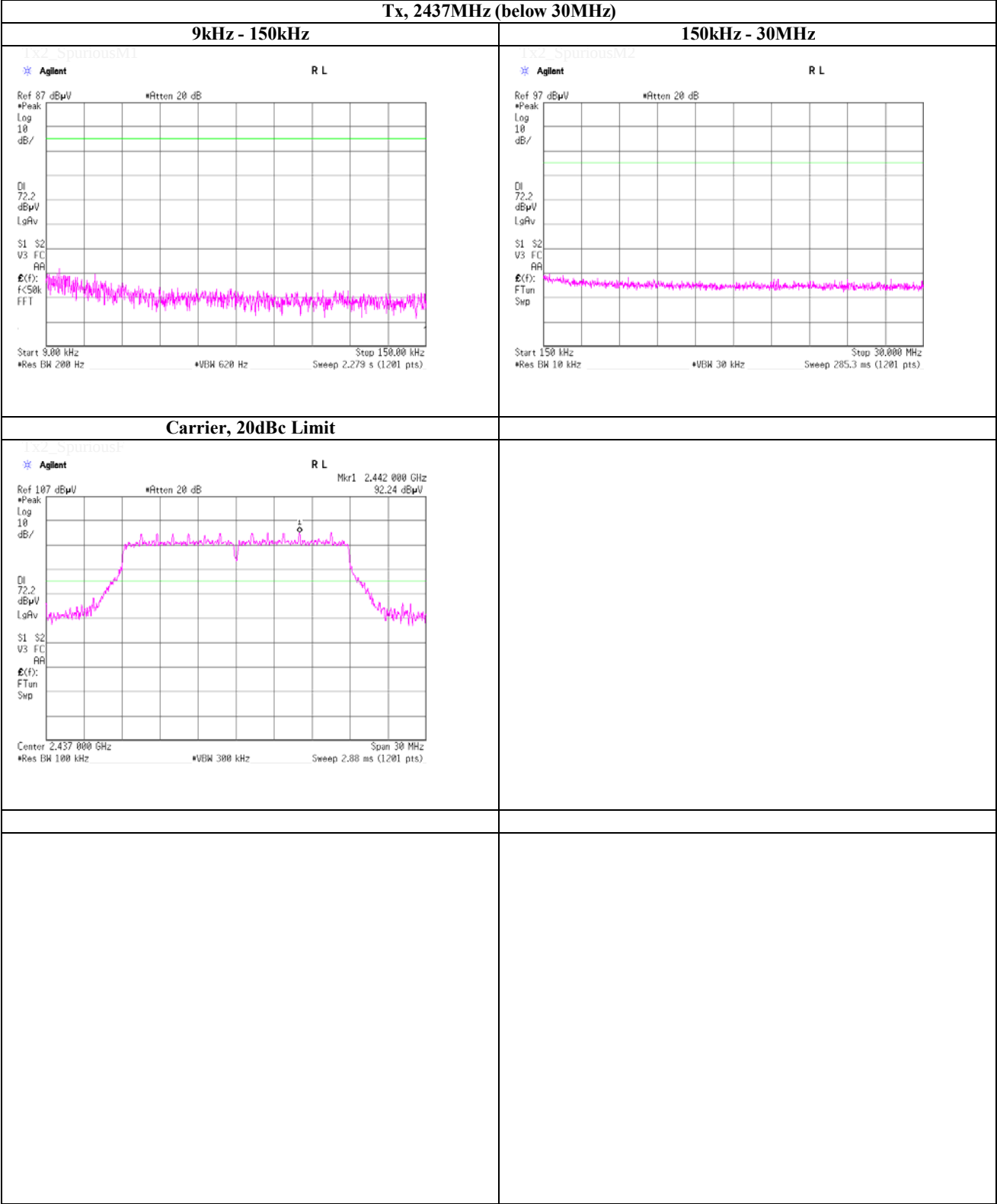
Temperature / Humidity

26deg.C , 30%RH

Engineer

Yosuke Ishikawa

**Spurious emission (Conducted)**  
**Tx, IEEE802.11n(HT20), PN9, worst data mode 0(MCS)**



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Test place

UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room

Date

February 9, 2015

Temperature / Humidity

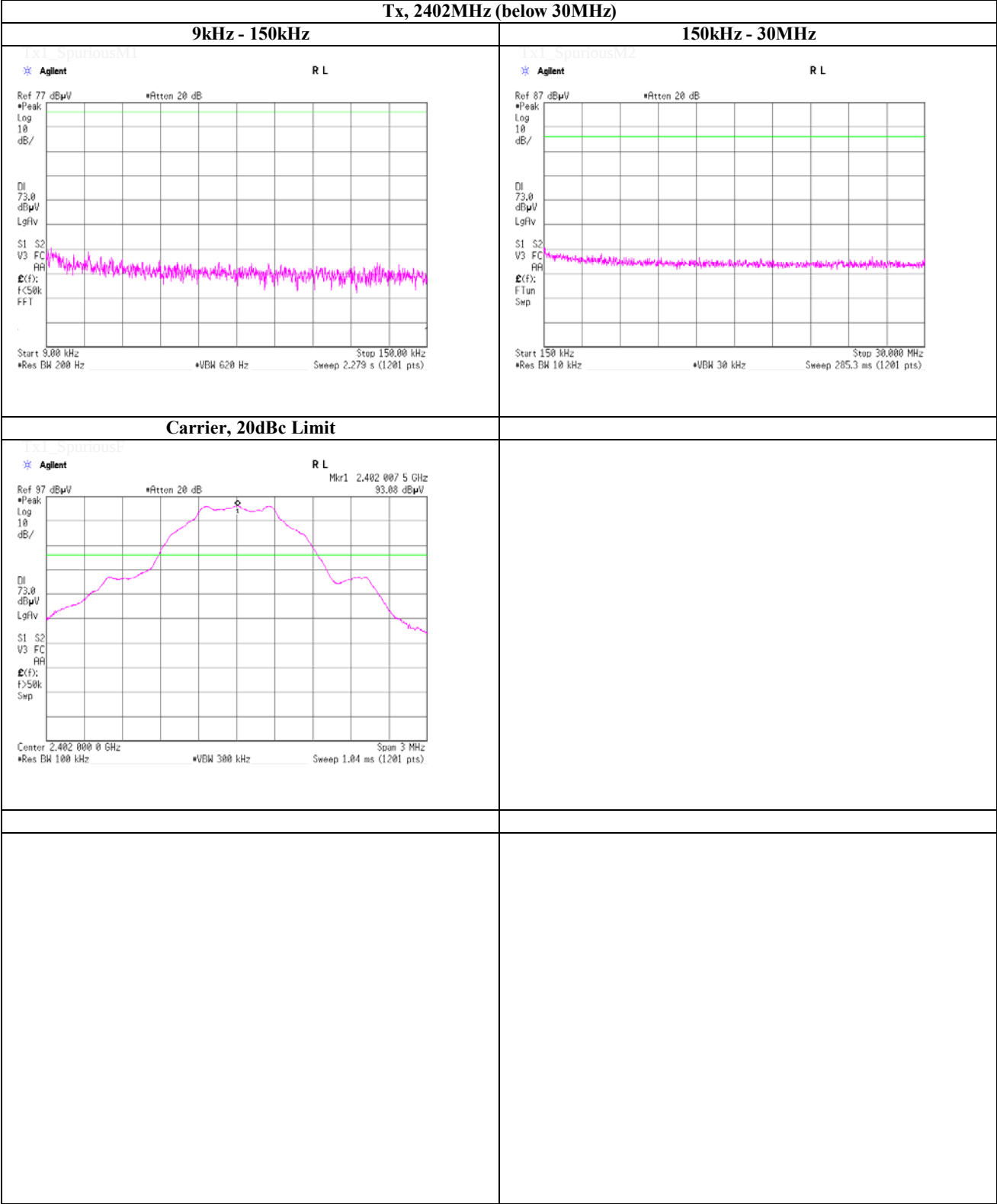
24 deg.C , 43 %RH

Engineer

Tatsuya Arai

Spurious emission (Conducted)

Tx, Bluetooth, Low Energy, PN9  
Tx, 2402MHz (below 30MHz)



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Test place

UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room

Date

February 9, 2015

Temperature / Humidity

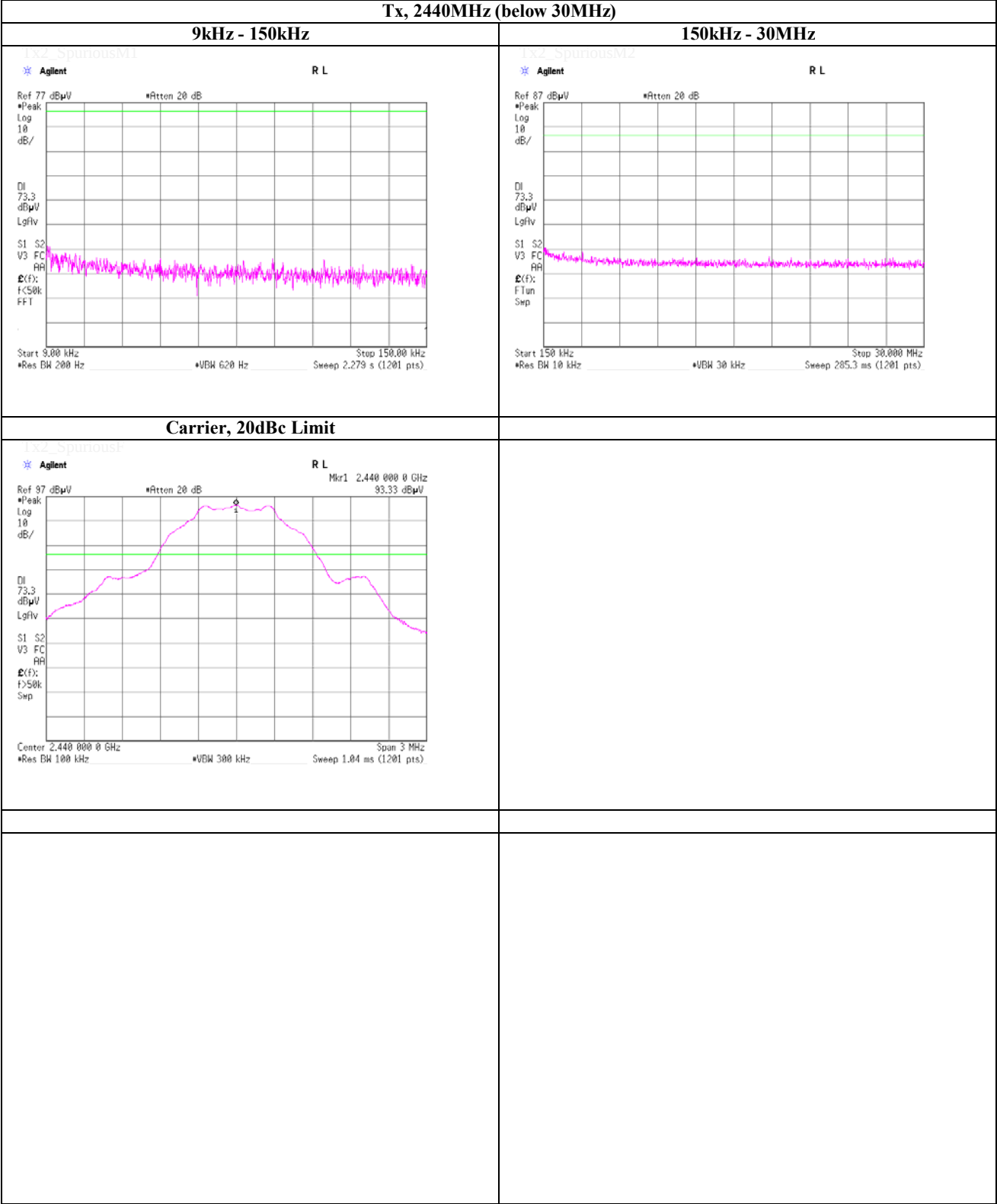
24 deg.C , 43 %RH

Engineer

Tatsuya Arai

Spurious emission (Conducted)

Tx, Bluetooth, Low Energy, PN9  
Tx, 2440MHz (below 30MHz)



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Test place

UL Japan, Inc. Shonan EMC Lab.

No.5 Shielded Room

Date

February 9, 2015

Temperature / Humidity

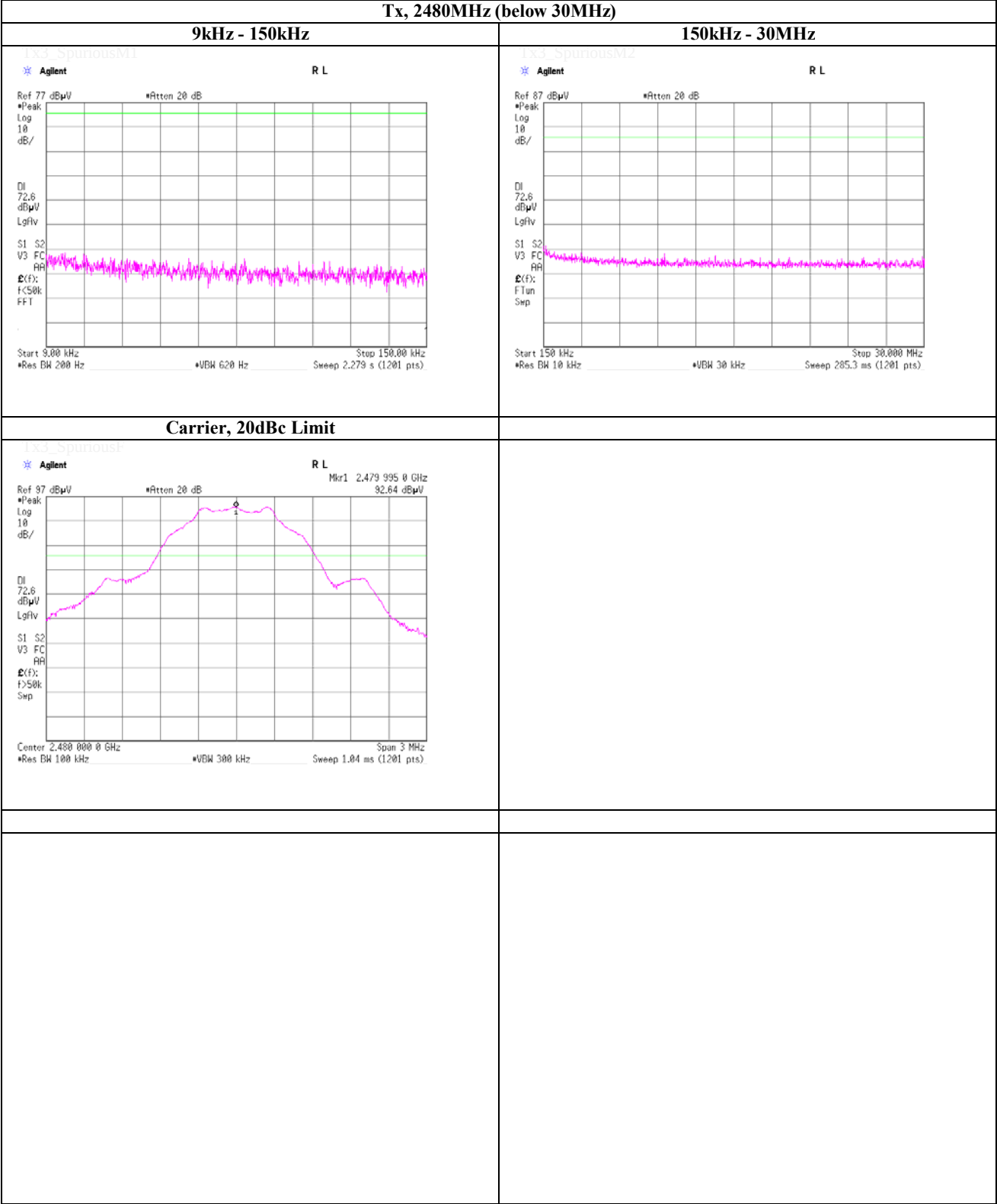
24 deg.C , 43 %RH

Engineer

Tatsuya Arai

Spurious emission (Conducted)

Tx, Bluetooth, Low Energy, PN9  
Tx, 2480MHz (below 30MHz)



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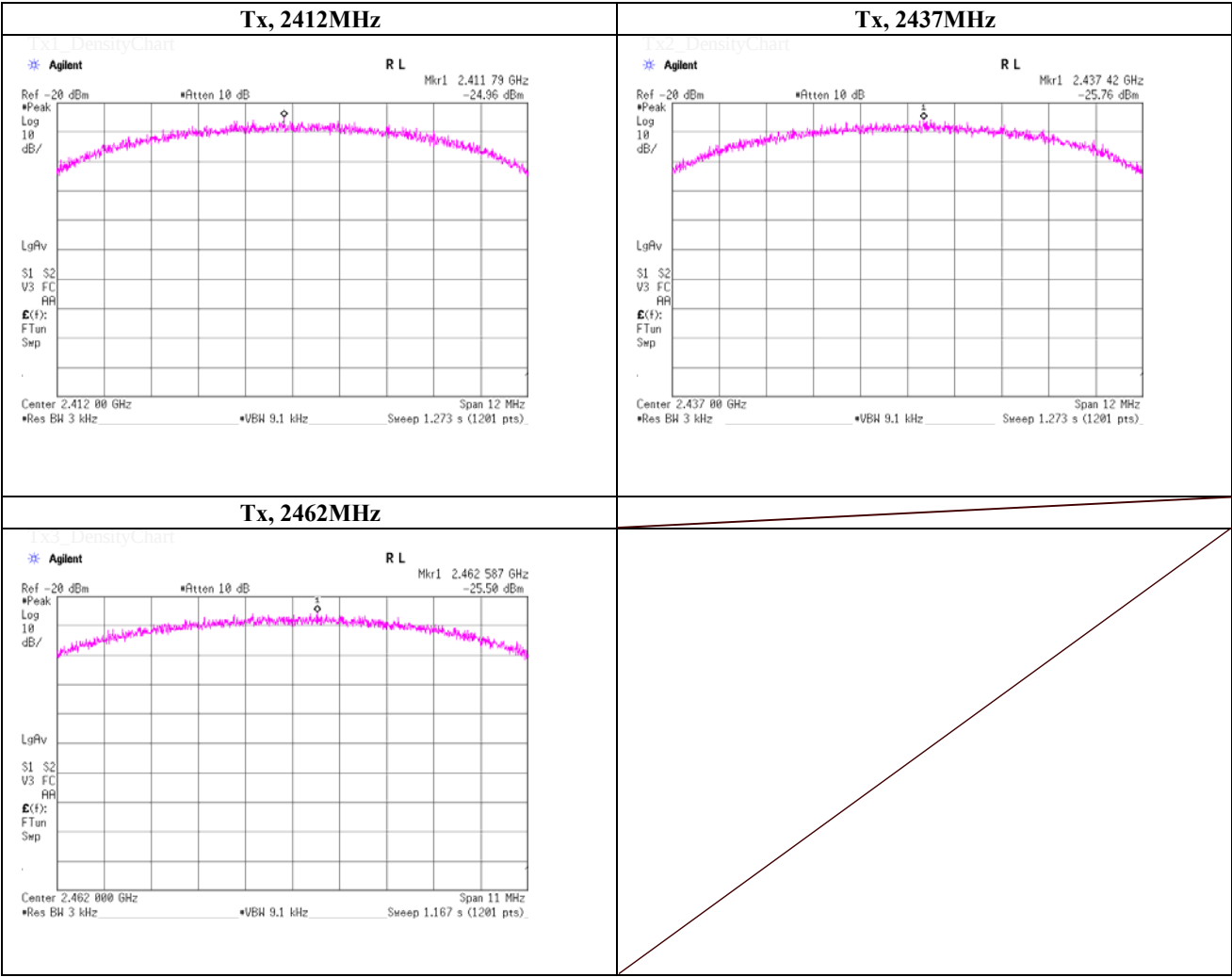
Facsimile : +81 463 50 6401

**Maximum Power Spectral Density**  
(PKPSD)

|                        |                                              |                    |
|------------------------|----------------------------------------------|--------------------|
| Test place             | UL Japan, Inc. Shonan EMC Lab.               | No.5 Shielded Room |
| Date                   | January 5, 2015                              |                    |
| Temperature / Humidity | 26deg.C , 30%RH                              |                    |
| Engineer               | Yosuke Ishikawa                              |                    |
| Mode                   | Tx, IEEE802.11b, PN9, worst data mode 11Mbps |                    |

| Ch. Freq.<br>[MHz] | Freq.<br>Reading<br>[MHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>[dB] | Result<br>[dBm] | Limit<br>[dBm] | Margin<br>[dB] |
|--------------------|---------------------------|------------------|-----------------------|----------------|-----------------|----------------|----------------|
| 2412.0000          | 2411.79                   | -24.96           | 1.10                  | 20.24          | -3.62           | 8.00           | 11.62          |
| 2437.0000          | 2437.42                   | -25.76           | 1.10                  | 20.24          | -4.42           | 8.00           | 12.42          |
| 2462.0000          | 2462.59                   | -25.50           | 1.10                  | 20.24          | -4.16           | 8.00           | 12.16          |

Sample Calculation:  
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss



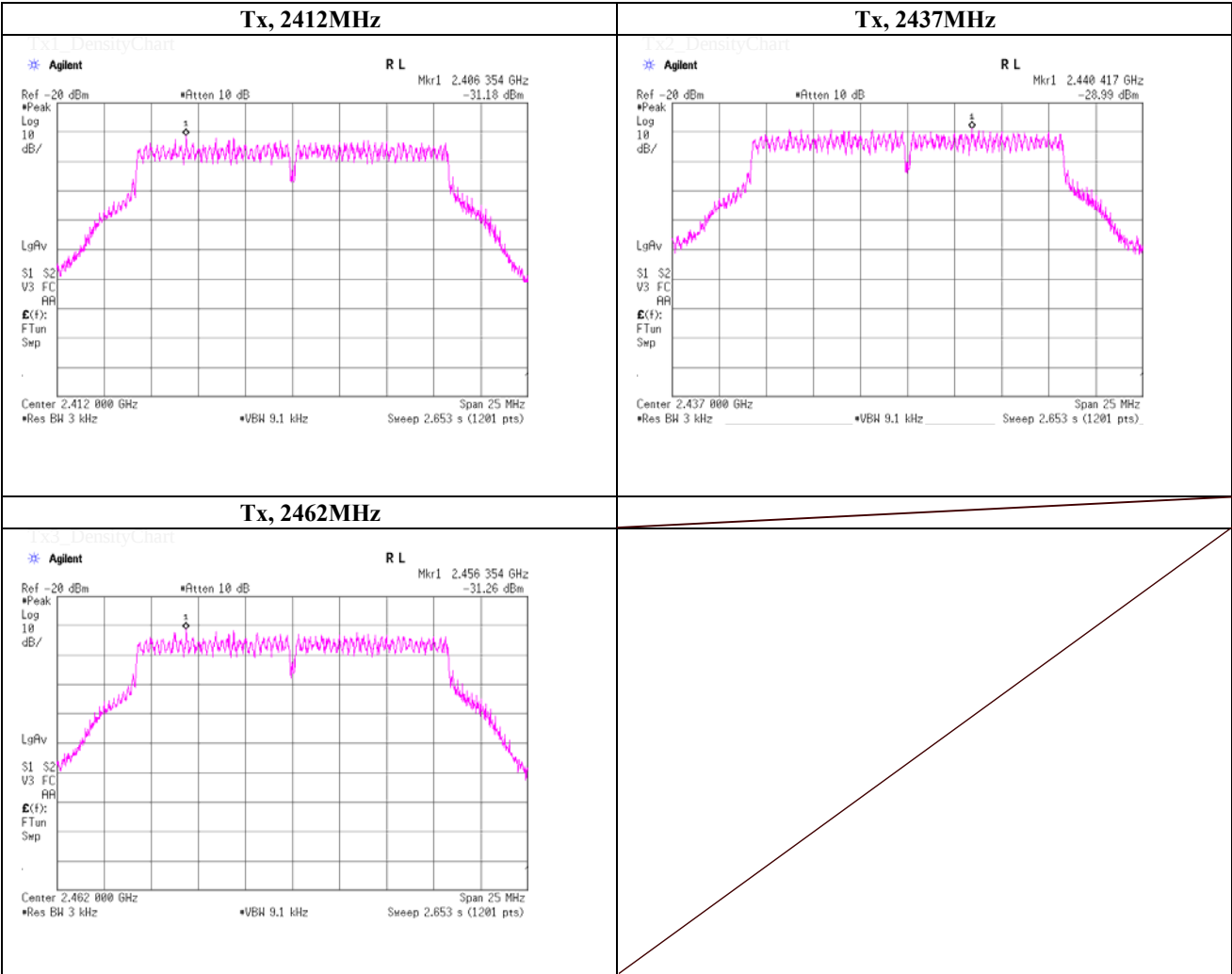
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Facsimile : +81 463 50 6401

**Maximum Power Spectral Density**  
(PKPSD)

|                        |                                             |                    |
|------------------------|---------------------------------------------|--------------------|
| Test place             | UL Japan, Inc. Shonan EMC Lab.              | No.5 Shielded Room |
| Date                   | January 5, 2015                             | January 21, 2015   |
| Temperature / Humidity | 26deg.C , 30%RH                             | 23deg.C , 41%RH    |
| Engineer               | Yosuke Ishikawa                             | Shinichi Takano    |
| Mode                   | Tx, IEEE802.11g, PN9, worst data mode 6Mbps |                    |

| Ch. Freq.<br>[MHz] | Freq.<br>Reading<br>[MHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>[dB] | Result<br>[dBm] | Limit<br>[dBm] | Margin<br>[dB] |
|--------------------|---------------------------|------------------|-----------------------|----------------|-----------------|----------------|----------------|
| 2412.0000          | 2406.35                   | -31.18           | 1.10                  | 20.24          | -9.84           | 8.00           | 17.84          |
| 2437.0000          | 2440.42                   | -28.99           | 1.10                  | 20.24          | -7.65           | 8.00           | 15.65          |
| 2462.0000          | 2456.35                   | -31.26           | 1.10                  | 20.24          | -9.92           | 8.00           | 17.92          |

Sample Calculation:  
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss

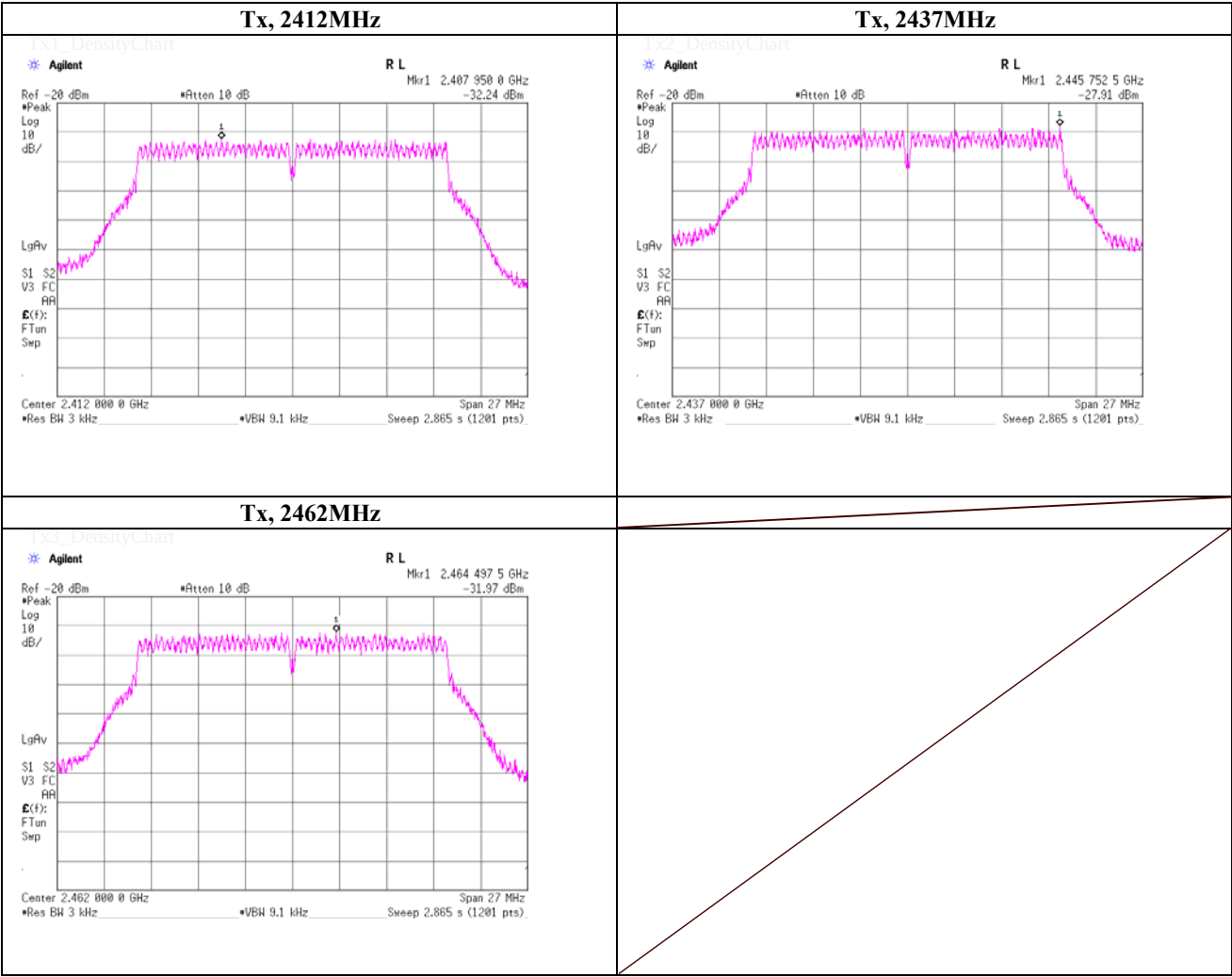


**Maximum Power Spectral Density**  
(PKPSD)

|                        |                                                    |                    |
|------------------------|----------------------------------------------------|--------------------|
| Test place             | UL Japan, Inc. Shonan EMC Lab.                     | No.5 Shielded Room |
| Date                   | January 5, 2015                                    |                    |
| Temperature / Humidity | 26deg.C , 30%RH                                    |                    |
| Engineer               | Yosuke Ishikawa                                    |                    |
| Mode                   | Tx, IEEE802.11n(HT20), PN9, worst data mode 0(MCS) |                    |

| Ch. Freq. | Freq. Reading | Reading | Cable Loss | Atten. | Result | Limit | Margin |
|-----------|---------------|---------|------------|--------|--------|-------|--------|
| [MHz]     | [MHz]         | [dBm]   | [dB]       | [dB]   | [dBm]  | [dBm] | [dB]   |
| 2412.0000 | 2407.95       | -32.24  | 1.10       | 20.24  | -10.90 | 8.00  | 18.90  |
| 2437.0000 | 2445.75       | -27.91  | 1.10       | 20.24  | -6.57  | 8.00  | 14.57  |
| 2462.0000 | 2464.50       | -31.97  | 1.10       | 20.24  | -10.63 | 8.00  | 18.63  |

Sample Calculation:  
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss



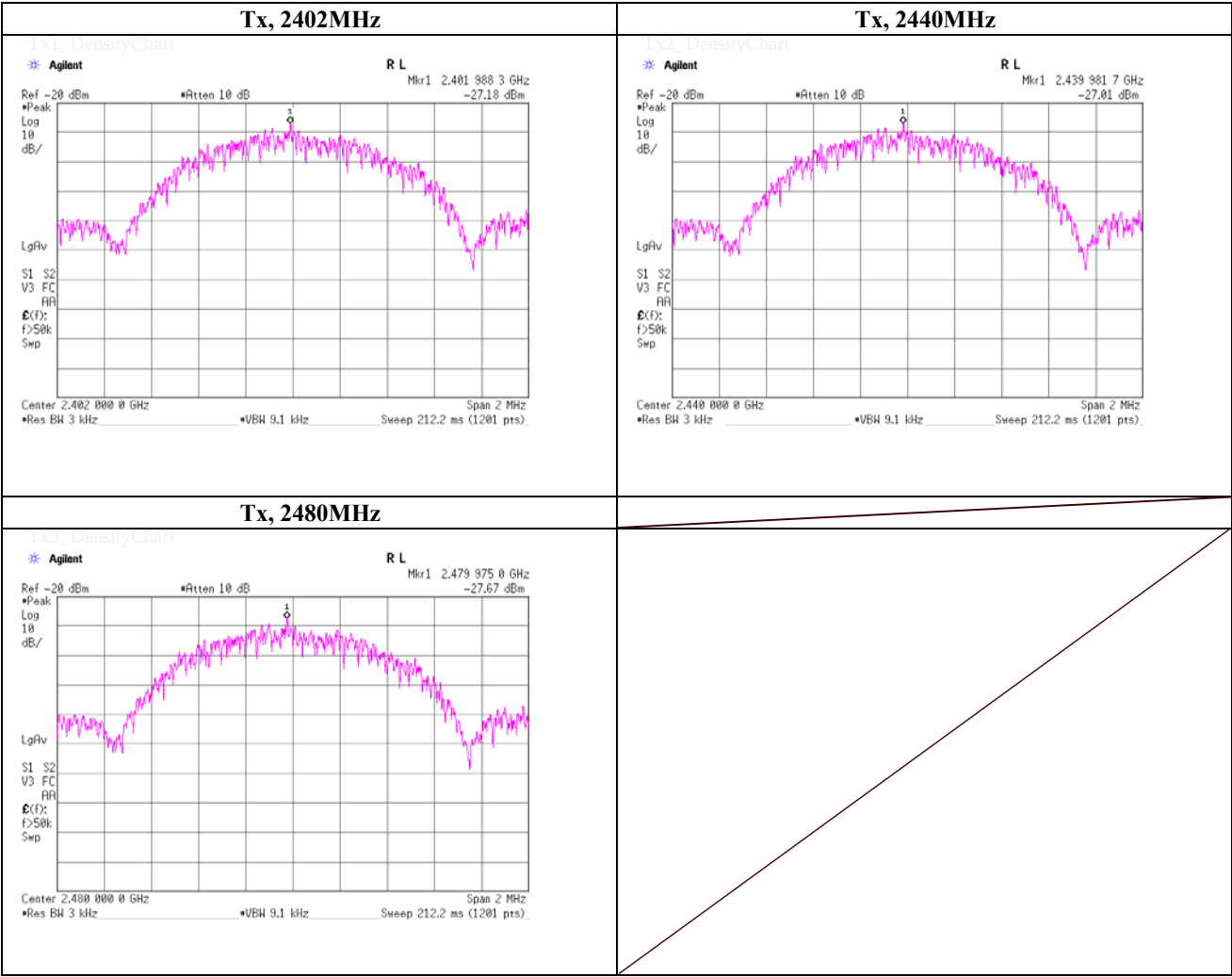
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**Maximum Power Spectral Density**  
(PKPSD)

|                        |                                |                    |
|------------------------|--------------------------------|--------------------|
| Test place             | UL Japan, Inc. Shonan EMC Lab. | No.5 Shielded Room |
| Date                   | February 9, 2015               |                    |
| Temperature / Humidity | 24 deg.C , 43 %RH              |                    |
| Engineer               | Tatsuya Arai                   |                    |
| Mode                   | Tx, Bluetooth, Low Energy, PN9 |                    |

| Ch. Freq. | Freq. Reading | Reading | Cable Loss | Atten. | Result | Limit | Margin |
|-----------|---------------|---------|------------|--------|--------|-------|--------|
| [MHz]     | [MHz]         | [dBm]   | [dB]       | [dB]   | [dBm]  | [dBm] | [dB]   |
| 2402.0000 | 2401.99       | -27.18  | 1.09       | 20.24  | -5.85  | 8.00  | 13.85  |
| 2440.0000 | 2439.98       | -27.01  | 1.10       | 20.24  | -5.67  | 8.00  | 13.67  |
| 2480.0000 | 2479.98       | -27.67  | 1.11       | 20.24  | -6.32  | 8.00  | 14.32  |

Sample Calculation:  
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss



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Test place

UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room

Date

January 5, 2015

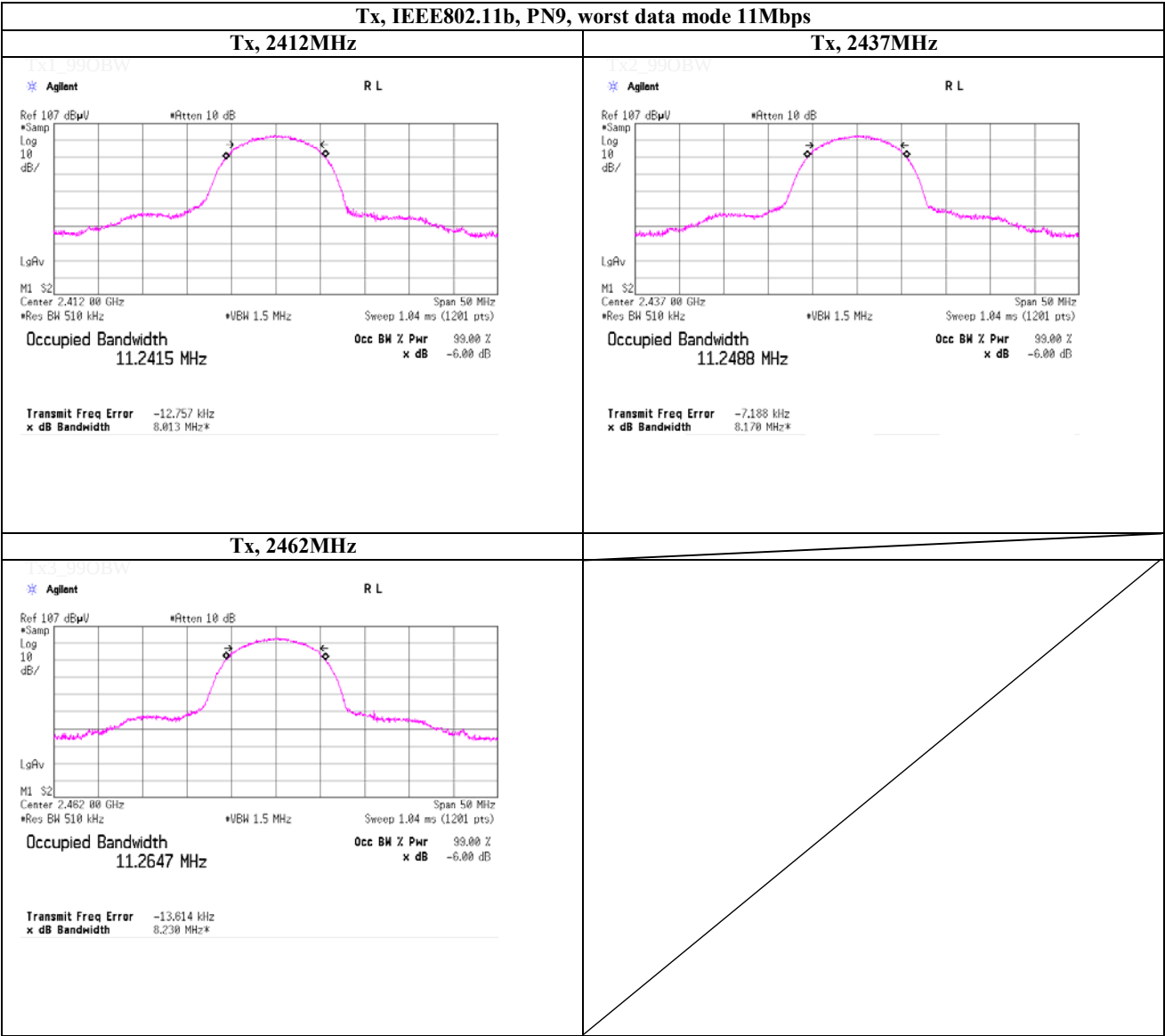
Temperature / Humidity

26deg.C , 30%RH

Engineer

Yosuke Ishikawa

99% Occupied Bandwidth



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Test place

UL Japan, Inc. Shonan EMC Lab.

No.5 Shielded Room

Date

January 5, 2015

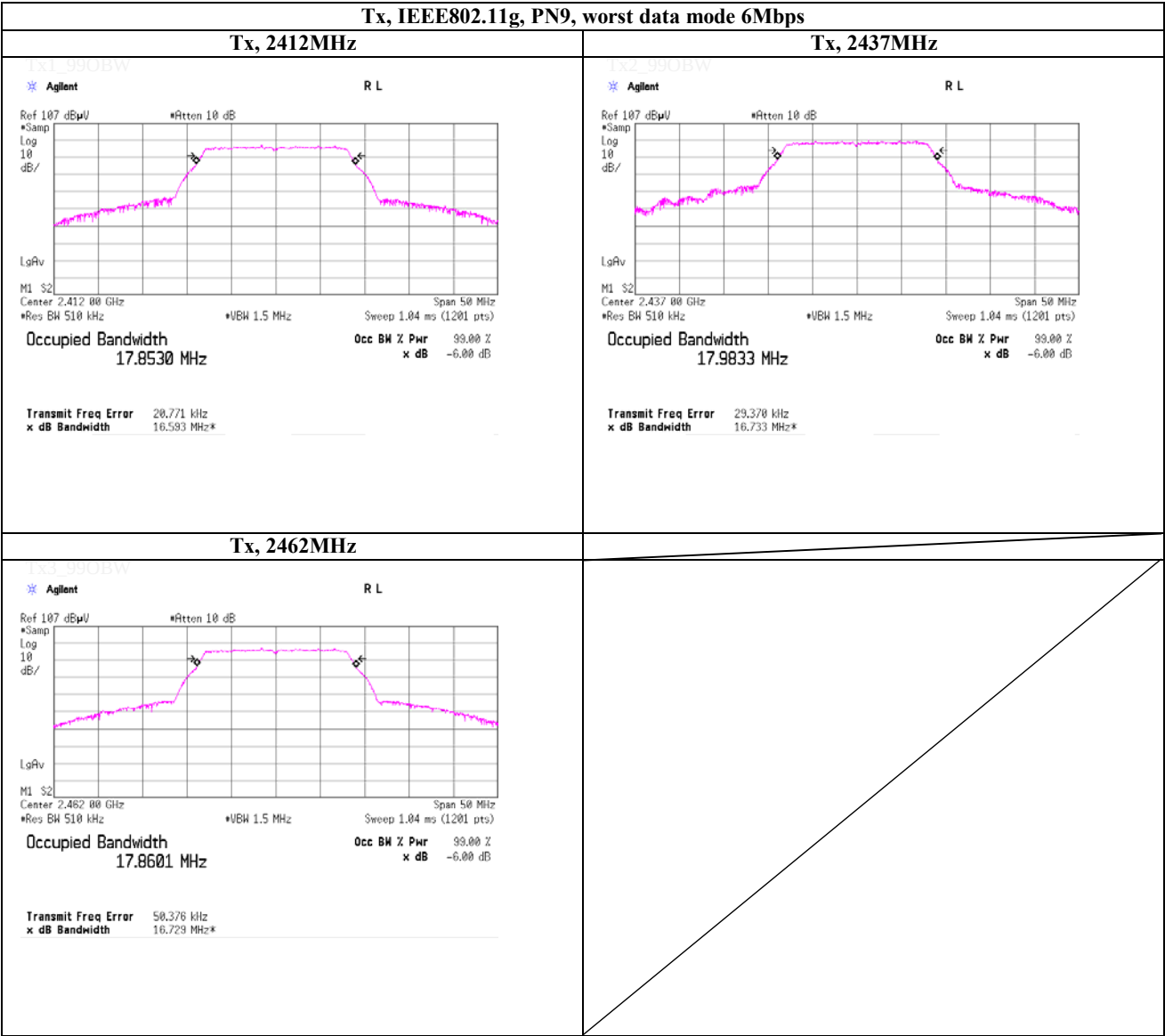
Temperature / Humidity

26deg.C , 30%RH

Engineer

Yosuke Ishikawa

99% Occupied Bandwidth



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Test place

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Date

January 5, 2015

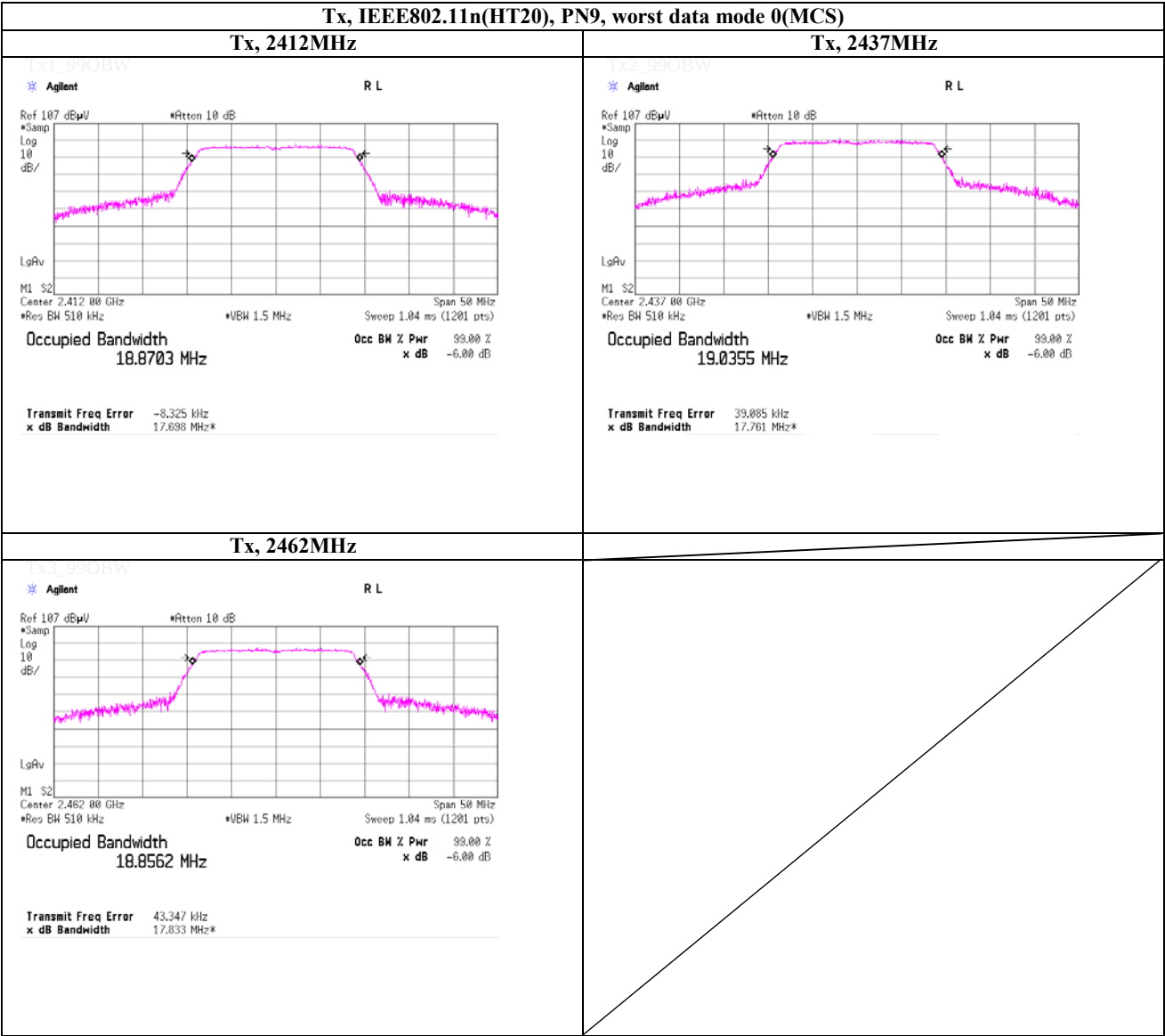
Temperature / Humidity

26deg.C , 30%RH

Engineer

Yosuke Ishikawa

99% Occupied Bandwidth



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Date

February 9, 2015

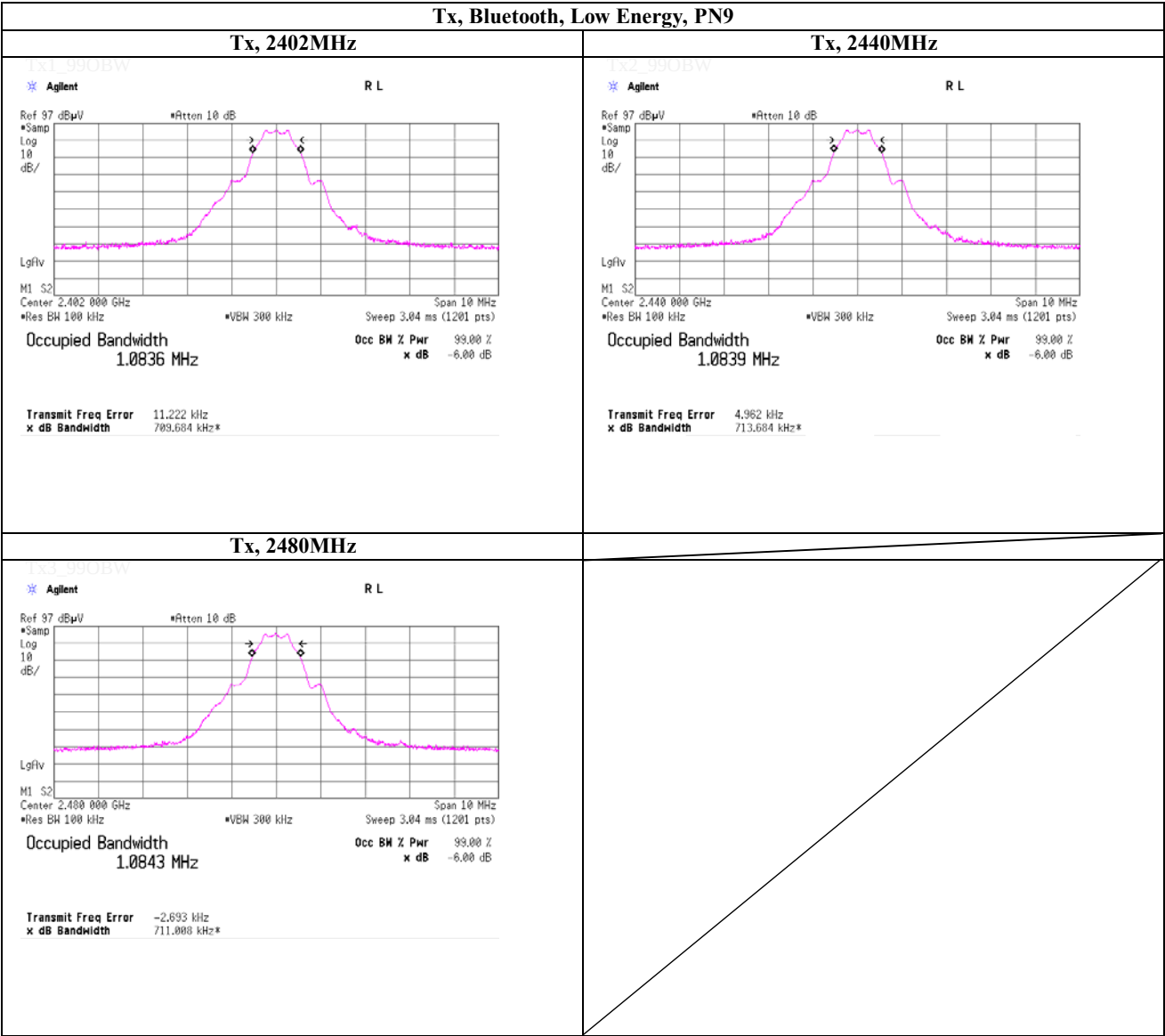
Temperature / Humidity

24 deg.C , 43 %RH

Engineer

Tatsuya Arai

99% Occupied Bandwidth



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## APPENDIX 2

### Test Instruments

#### EMI test equipment

| Control No.                            | Instrument                   | Manufacturer                                               | Model No                                           | Serial No                  | Test Item | Calibration Date<br>* Interval(month) |
|----------------------------------------|------------------------------|------------------------------------------------------------|----------------------------------------------------|----------------------------|-----------|---------------------------------------|
| SPM-07                                 | Power Meter                  | Agilent                                                    | 8990B                                              | MY5100272                  | AT        | 2014/04/04 * 12                       |
| SPSS-04                                | Power sensor                 | Agilent                                                    | N1923A                                             | MY5326009                  | AT        | 2014/04/04 * 12                       |
| SAT20-07                               | Attenuator                   | Weinschel Corp.                                            | 54A-20                                             | 31484                      | AT        | 2014/04/22 * 12                       |
| SCC-G12                                | Coaxial Cable                | Suhner                                                     | SUCOFLEX 102                                       | 30790/2                    | AT        | 2014/03/13 * 12                       |
| SOS-09                                 | Humidity Indicator           | A&D                                                        | AD-5681                                            | 4061484                    | AT        | 2014/12/24 * 12                       |
| SSA-03                                 | Spectrum Analyzer            | Agilent                                                    | E4448A                                             | MY48250152                 | AT        | 2014/02/03 * 12                       |
| SAEC-03(NSA)                           | Semi-Anechoic Chamber        | TDK                                                        | SAEC-03(NSA)                                       | 3                          | RE        | 2014/07/14 * 12                       |
| SAF-06                                 | Pre Amplifier                | TOYO Corporation                                           | TPA0118-36                                         | 1440491                    | RE        | 2014/05/23 * 12                       |
| SCC-G04                                | Coaxial Cable                | Junkosha                                                   | J12J102207-00                                      | JUN-12-14-018              | RE        | 2014/06/24 * 12                       |
| SCC-G23                                | Coaxial Cable                | Suhner                                                     | SUCOFLEX 104                                       | 297342/4                   | RE        | 2014/05/15 * 12                       |
| SHA-03                                 | Horn Antenna                 | Schwarzbeck                                                | BBHA9120D                                          | 9120D-739                  | RE        | 2014/08/12 * 12                       |
| SOS-05                                 | Humidity Indicator           | A&D                                                        | AD-5681                                            | 4062518                    | RE        | 2014/10/30 * 12                       |
| SSA-02                                 | Spectrum Analyzer            | Agilent                                                    | E4448A                                             | MY48250106                 | RE        | 2014/03/17 * 12                       |
| SJM-15                                 | Measure                      | ASKUL                                                      | -                                                  | -                          | RE,CE     | -                                     |
| COTS-SEMI-1                            | EMI Software                 | TSJ                                                        | TEPTO-DV(RE,CE,<br>RFI,MF)                         | -                          | RE,CE     | -                                     |
| SAT10-05                               | Attenuator(above1GHz)        | Agilent                                                    | 8493C-010                                          | 74864                      | RE        | 2014/11/21 * 12                       |
| SFL-02                                 | Highpass Filter              | MICRO-TRONICS                                              | HPM50111                                           | 051                        | RE        | 2014/11/21 * 12                       |
| SFL-18                                 | Highpass Filter              | MICRO-TRONICS                                              | HPM50111                                           | 119                        | RE        | 2014/04/22 * 12                       |
| SHA-05                                 | Horn Antenna                 | ETS LINDGREN                                               | 3160-09                                            | LM4210                     | RE        | 2014/03/15 * 12                       |
| SAF-09                                 | Pre Amplifier                | TOYO Corporation                                           | HAP18-26W                                          | 00000018                   | RE        | 2014/05/15 * 12                       |
| SCC-G18                                | Coaxial Cable                | Suhner                                                     | SUCOFLEX 104A                                      | 46292/4A                   | RE        | 2014/03/14 * 12                       |
| SBA-03                                 | Biconical Antenna            | Schwarzbeck                                                | BBA9106                                            | 91032666                   | RE        | 2014/10/18 * 12                       |
| SLA-03                                 | Logperiodic Antenna          | Schwarzbeck                                                | UHALP9108A                                         | UHALP 9108-A<br>0901       | RE        | 2014/10/18 * 12                       |
| SAT6-08                                | Attenuator                   | HIROSE ELECTRIC<br>CO.,LTD.                                | AT-406(40)                                         | -                          | RE        | 2014/08/27 * 12                       |
| SCC-C1/C2/C<br>3/C4/C5/C10/<br>SRSE-03 | Coaxial Cable&RF<br>Selector | Fujikura/Fujikura/Suhne<br>r/Suhner/Suhner/Suhn<br>er/TOYO | 8D2W/12DSFA/14<br>1PE/141PE/141PE<br>/141PE/NS4906 | -/0901-271(RF<br>Selector) | RE        | 2014/04/25 * 12                       |
| SAF-03                                 | Pre Amplifier                | SONOMA                                                     | 310N                                               | 290213                     | RE        | 2014/02/14 * 12                       |
| STR-06                                 | Test Receiver                | Rohde & Schwarz                                            | ESCI                                               | 101259                     | RE,CE     | 2014/03/04 * 12                       |
| SHA-04                                 | Horn Antenna                 | ETS LINDGREN                                               | 3160-09                                            | LM3640                     | RE        | 2014/03/15 * 12                       |
| SCC-G15                                | Coaxial Cable                | Suhner                                                     | SUCOFLEX 102                                       | 32703/2                    | RE        | 2014/03/13 * 12                       |
| SCC-C9/C10/S<br>RSE-03                 | Coaxial Cable&RF<br>Selector | Suhner/Suhner/TOYO                                         | RG223U/141PE/N<br>S4906                            | -/0901-271(RF<br>Selector) | CE        | 2014/04/25 * 12                       |
| SLS-05                                 | LISN                         | Rohde & Schwarz                                            | ENV216                                             | 100516                     | CE        | 2014/02/26 * 12                       |
| SAT3-06                                | Attenuator                   | JFW                                                        | 50HF-003N                                          | -                          | CE        | 2014/02/17 * 12                       |
| SOS-06                                 | Humidity Indicator           | A&D                                                        | AD-5681                                            | 4062118                    | CE        | 2014/12/24 * 12                       |
| STM-05                                 | Terminator                   | TME                                                        | CT-01 BP                                           | -                          | CE        | 2014/12/19 * 12                       |
|                                        |                              |                                                            |                                                    |                            |           |                                       |
|                                        |                              |                                                            |                                                    |                            |           |                                       |

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

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

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

Test Item :

CE: Conducted emission,

RE: Radiated emission,

AT: Antenna terminal disturbance voltage