



# **RADIO TEST REPORT**

**Test Report No. : 12206316H-A-R1**

**Applicant** : **HERUTU ELECTRONICS CORPORATION**  
**Type of Equipment** : **2.4GHz Wireless Module**  
**Model No.** : **HRF-2402**  
**FCC ID** : **T82-HRF2402**  
**Test regulation** : **FCC Part 15 Subpart C: 2018**  
**Test Result** : **Complied**

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. This report is a revised version of 12206316H-A. 12206316H-A is replaced with this report.

**Date of test:** March 16 to 23, 2018

**Representative test engineer:**

K. Yamamoto

Koji Yamamoto  
Engineer

Consumer Technology Division

**Approved by:**

S. Miyazono

Shinichi Miyazono  
Engineer

Consumer Technology Division



NVLAP LAB CODE: 200572-0

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**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

13-EM-F0429

## REVISION HISTORY

# Original Test Report No.: 12206316H-A

[illegible]

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## **SECTION 1: Customer information**

|                  |   |                                                               |
|------------------|---|---------------------------------------------------------------|
| Company Name     | : | HERUTU ELECTRONICS CORPORATION                                |
| Address          | : | 62-1 TOYOOKA-CHO KITA-KU, HAMAMATSU-SHI<br>SHIZUOKA-KEN JAPAN |
| Telephone Number | : | +81-53-438-3511                                               |
| Facsimile Number | : | +81-53-438-3411                                               |
| Contact Person   | : | YOSHIYASU UEDA                                                |

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

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

|                            |   |                                                                                           |
|----------------------------|---|-------------------------------------------------------------------------------------------|
| Type of Equipment          | : | 2.4GHz Wireless Module                                                                    |
| Model No.                  | : | HRF-2402                                                                                  |
| Serial No.                 | : | Refer to Section 4, Clause 4.2                                                            |
| Rating                     | : | DC 3.0 V                                                                                  |
| Receipt Date of Sample     | : | March 15, 2018                                                                            |
| Country of Mass-production | : | Japan                                                                                     |
| Condition of EUT           | : | Production prototype<br>(Not for Sale: This sample is equivalent to mass-produced items.) |
| Modification of EUT        | : | No Modification by the test lab                                                           |

### **2.2 Product Description**

Model: HRF-2402 (referred to as the EUT in this report) is a 2.4GHz Wireless Module.

### **Radio Specification**

|                           |   |                                                                                                                                                                      |
|---------------------------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Radio Type                | : | Transceiver                                                                                                                                                          |
| Frequency of Operation    | : | 2403 MHz - 2478 MHz                                                                                                                                                  |
| Modulation                | : | GFSK                                                                                                                                                                 |
| Antenna type              | : | 1) 1/4λ Dipole antenna (chip antenna)<br>2) 1/2λ Dipole antenna (SMB Male connector)<br>3) 1/2λ Dipole antenna (SMB Male connector)<br>Magnet Base Cable :RG174-1.5m |
| Antenna Gain              | : | 3.0 dBi (max)                                                                                                                                                        |
| Clock frequency (Maximum) | : | 16 MHz (crystal)                                                                                                                                                     |

## **SECTION 3: Test specification, procedures & results**

### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C  
FCC Part 15 final revised on March 12, 2018 and effective April 11, 2018

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

\* The revision on March 12, 2018, does not affect the test specification applied to the EUT.

### **3.2 Procedures and results**

| Item                                       | Test Procedure                                                       | Specification                                                           | Worst margin                                                                           | Results  | Remarks                                                           |
|--------------------------------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------|
| Conducted Emission                         | FCC: ANSI C63.10-2013<br>6. Standard test methods<br>IC: RSS-Gen 8.8 | FCC: Section 15.207<br>IC: RSS-Gen 8.8                                  | QP<br>30.5 dB,<br>0.15000 MHz, L<br>AV<br>31.3 dB,<br>0.51653 MHz, N<br>1.62507 MHz, N | Complied | -                                                                 |
| 6dB Bandwidth                              | FCC: KDB 558074 D01 DTS Meas<br>Guidance v04<br>IC: -                | FCC: Section<br>15.247(a)(2)<br>IC: RSS-247 5.2(a)                      | See data.                                                                              | Complied | Conducted                                                         |
| Maximum Peak<br>Output Power               | FCC: KDB 558074 D01 DTS Meas<br>Guidance v04<br>IC: RSS-Gen 6.12     | FCC: Section<br>15.247(b)(3)<br>IC: RSS-247 5.4(d)                      |                                                                                        | Complied | Conducted                                                         |
| Power Density                              | FCC: KDB 558074 D01 DTS Meas<br>Guidance v04<br>IC: -                | FCC: Section 15.247(e)<br>IC: RSS-247 5.2(b)                            |                                                                                        | Complied | Conducted                                                         |
| Spurious Emission<br>Restricted Band Edges | FCC: KDB 558074 D01 DTS Meas<br>Guidance v04<br>IC: RSS-Gen 6.13     | FCC: Section15.247(d)<br>IC: RSS-247 5.5<br>RSS-Gen 8.9<br>RSS-Gen 8.10 | 4.1 dB<br>4806.000 MHz, AV,<br>Horizontal                                              | Complied | Conducted<br>(below 30 MHz)/<br>Radiated<br>(above 30 MHz)<br>*1) |

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

\*1) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v04 12.2.7.

\* In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred.

#### **FCC Part 15.31 (e)**

The RF Module has its own regulator.

The RF Module is constantly provided voltage through the regulator regardless of input voltage. Therefore, this EUT complies with the requirement.

#### **FCC Part 15.203 Antenna requirement**

[1/4λ Dipole antenna]

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.

[1/2λ Dipole antenna]

The EUT has a unique coupling/antenna connector (SMB Male connector). Therefore the equipment complies with the requirement of 15.203.

## **UL Japan, Inc.**

### **Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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Facsimile : +81 596 24 8124

### 3.3 Addition to standard

| Item                   | Test Procedure  | Specification | Worst margin | Results | Remarks   |
|------------------------|-----------------|---------------|--------------|---------|-----------|
| 99% Occupied Bandwidth | IC: RSS-Gen 6.6 | IC: -         | N/A          | -       | Conducted |

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

### 3.4 Uncertainty

#### EMI

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

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#### Antenna Terminal test

| Test Item                                             | Uncertainty (+/-) |
|-------------------------------------------------------|-------------------|
| RF output power                                       | 1.3 dB            |
| Antenna terminal conducted emission / Power density / | 2.7 dB            |
| Adjacent channel power / Channel power                |                   |
| Below 3GHz                                            | 1.9 dB            |
| 3 GHz or 6 GHz                                        | 2.1 dB            |

#### Conducted emission

| using Item | Frequency range       | Uncertainty (+/-) |
|------------|-----------------------|-------------------|
| AMN (LISN) | 0.009 MHz to 0.15 MHz | 3.8 dB            |
|            | 0.15 MHz to 30 MHz    | 3.4 dB            |

#### Radiated emission

| Measurement distance | Frequency range                  | Uncertainty (+/-) |
|----------------------|----------------------------------|-------------------|
| 3 m                  | 9 kHz to 30 MHz                  | 3.3 dB            |
| 10 m                 |                                  | 3.2 dB            |
| 3 m                  | 30 MHz to 200 MHz (Horizontal)   | 4.8 dB            |
|                      | (Vertical)                       | 5.0 dB            |
|                      | 200 MHz to 1000 MHz (Horizontal) | 5.2 dB            |
|                      | (Vertical)                       | 6.3 dB            |
| 10 m                 | 30 MHz to 200 MHz (Horizontal)   | 4.8 dB            |
|                      | (Vertical)                       | 4.9 dB            |
|                      | 200 MHz to 1000 MHz (Horizontal) | 5.0 dB            |
|                      | (Vertical)                       | 5.0 dB            |
| 3 m                  | 1 GHz to 6 GHz                   | 5.0 dB            |
|                      | 6 GHz to 18 GHz                  | 5.3 dB            |
| 1 m                  | 10 GHz to 26.5 GHz               | 5.8 dB            |
|                      | 26.5 GHz to 40 GHz               | 5.8 dB            |
| 10 m                 | 1 GHz to 18 GHz                  | 5.2 dB            |

#### 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.

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

### 3.5 Test Location

UL Japan, Inc. Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124

NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967

| Test site                  | IC Registration Number | Width x Depth x Height (m) | Size of reference ground plane (m) / horizontal conducting plane | Other rooms            | Maximum measurement distance |
|----------------------------|------------------------|----------------------------|------------------------------------------------------------------|------------------------|------------------------------|
| No.1 semi-anechoic chamber | 2973C-1                | 19.2 x 11.2 x 7.7          | 7.0 x 6.0                                                        | No.1 Power source room | 10 m                         |
| No.2 semi-anechoic chamber | 2973C-2                | 7.5 x 5.8 x 5.2            | 4.0 x 4.0                                                        | -                      | 3 m                          |
| No.3 semi-anechoic chamber | 2973C-3                | 12.0 x 8.5 x 5.9           | 6.8 x 5.75                                                       | No.3 Preparation room  | 3 m                          |
| No.3 shielded room         | -                      | 4.0 x 6.0 x 2.7            | N/A                                                              | -                      | -                            |
| No.4 semi-anechoic chamber | 2973C-4                | 12.0 x 8.5 x 5.9           | 6.8 x 5.75                                                       | No.4 Preparation room  | 3 m                          |
| No.4 shielded room         | -                      | 4.0 x 6.0 x 2.7            | N/A                                                              | -                      | -                            |
| No.5 semi-anechoic chamber | -                      | 6.0 x 6.0 x 3.9            | 6.0 x 6.0                                                        | -                      | -                            |
| No.6 shielded room         | -                      | 4.0 x 4.5 x 2.7            | 4.0 x 4.5                                                        | -                      | -                            |
| No.6 measurement room      | -                      | 4.75 x 5.4 x 3.0           | 4.75 x 4.15                                                      | -                      | -                            |
| No.7 shielded room         | -                      | 4.7 x 7.5 x 2.7            | 4.7 x 7.5                                                        | -                      | -                            |
| No.8 measurement room      | -                      | 3.1 x 5.0 x 2.7            | N/A                                                              | -                      | -                            |
| No.9 measurement room      | -                      | 8.8 x 4.6 x 2.8            | 2.4 x 2.4                                                        | -                      | -                            |
| No.11 measurement room     | -                      | 6.2 x 4.7 x 3.0            | 4.8 x 4.6                                                        | -                      | -                            |

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

### 3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

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

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

| Mode                                                                                                                                                                                                                                                                                                                                                                     | Remarks* |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Tx                                                                                                                                                                                                                                                                                                                                                                       | PN9      |
| *The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)                                                                                                                                                                                                                                                                  |          |
| *Power of the EUT was set by the software as follows;<br>Power settings: 1.5 mW (The same power as the product)<br>Software: hrf_2402_test V1.01<br>*This setting of software is the worst case.<br>Any conditions under the normal use do not exceed the condition of setting.<br>In addition, end users cannot change the settings of the output power of the product. |          |

\*The details of Operating mode(s)

| Test Item                                                                             | Operating Mode | Tested Antenna                                                                       | Tested frequency                 |
|---------------------------------------------------------------------------------------|----------------|--------------------------------------------------------------------------------------|----------------------------------|
| Conducted Emission                                                                    | Tx             | 1/4λ Dipole antenna<br>1/2λ Dipole Antenna<br>1/2λ Dipole Antenna with Magnetic Base | 2403 MHz<br>2441 MHz<br>2478 MHz |
| Spurious Emission                                                                     | Tx             | 1/4λ Dipole antenna<br>1/2λ Dipole Antenna<br>1/2λ Dipole Antenna with Magnetic Base | 2403 MHz<br>2441 MHz<br>2478 MHz |
| 6dB Bandwidth<br>Maximum Peak Output Power<br>Power Density<br>99% Occupied Bandwidth | Tx             | -                                                                                    | 2403 MHz<br>2441 MHz<br>2478 MHz |

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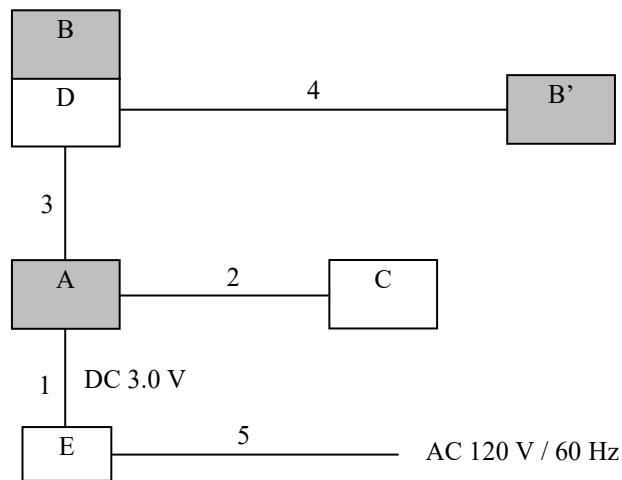
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## 4.2 Configuration and peripherals

[Conducted emission and Radiated emission tests]



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

### Description of EUT and Support equipment

| No. | Item                                   | Model number | Serial number | Manufacturer                   | Remarks  |
|-----|----------------------------------------|--------------|---------------|--------------------------------|----------|
| A   | 2.4 GHz Wireless Module                | HRF-2402     | A900001       | Herutu Electronics Corporation | EUT      |
| B   | 1/2λ Dipole Antenna                    | GRF1696      | 001           | VSO Electronics Co., Ltd.      | EUT *1)  |
| B'  | 1/2λ Dipole Antenna with Magnetic Base | MB-13F-2     | 001           | Tekfun Co., Ltd.               | EUT *2)  |
| C   | Jig                                    | -            | -             | -                              | -        |
| D   | Antenna Connector                      | -            | -             | -                              | *1) *2)  |
| E   | DC Power Supply                        | PMC35-2A     | 13090501      | Kikusui Electronics Corp.      | *CE only |

\*1) Used for 1/2λ Dipole Antenna

\*2) Used for Dipole Antenna with Magnetic Base

### List of cables used

| No. | Name                | Length (m)                 | Shield     |            | Remarks  |
|-----|---------------------|----------------------------|------------|------------|----------|
|     |                     |                            | Cable      | Connector  |          |
| 1   | DC Cable            | 2.00 for RE<br>0.20 for CE | Unshielded | Unshielded | -        |
| 2   | Signal Cable        | 0.15                       | Unshielded | Unshielded | -        |
| 3   | Antenna Cable       | 0.10                       | Shielded   | Shielded   | *1) *2)  |
| 4   | RG174 Coaxial Cable | 1.50                       | Shielded   | Shielded   | *2)      |
| 5   | AC Cable            | 1.50                       | Unshielded | Unshielded | *CE only |

\*1) Used for 1/2λ Dipole Antenna

\*2) Used for Dipole Antenna with Magnetic Base

\* CE: Conducted emission test  
RE: Radiated emission test

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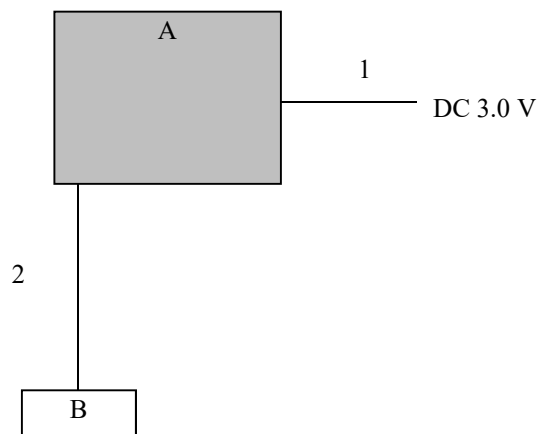
**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

[Antenna Terminal Conducted Tests]



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

**Description of EUT and Support equipment**

| No. | Item   | Model number | Serial number | Manufacturer                   | Remarks |
|-----|--------|--------------|---------------|--------------------------------|---------|
| A   | Module | HRF-2402     | A900001       | HERUTU ELECTRONICS CORPORATION | EUT     |
| B   | Jig    | -            | -             | -                              | -       |

**List of cables used**

| No. | Name         | Length (m) | Shield     |            | Remarks |
|-----|--------------|------------|------------|------------|---------|
|     |              |            | Cable      | Connector  |         |
| 1   | DC cable     | 1.0        | Unshielded | Unshielded | -       |
| 2   | Signal Cable | 0.2        | Unshielded | Unshielded | -       |

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**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## **SECTION 5: Conducted Emission**

### **Test Procedure and conditions**

EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 0.8 m above the conducting ground plane.

The rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

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

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

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

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

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

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

### **Test Procedure**

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "KDB 558074 D01 DTS Meas Guidance v04".

[For below 1 GHz]

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

[For above 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.

The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

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

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

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

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

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

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

|              |                   |                  |             |
|--------------|-------------------|------------------|-------------|
| Frequency    | 30 MHz to 200 MHz | 200 MHz to 1 GHz | Above 1 GHz |
| Antenna Type | Biconical         | Logperiodic      | Horn        |

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

**20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).**

|                 |               |                                                          |                                                                                                                                                                                          |                                                          |
|-----------------|---------------|----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| Frequency       | Below 1 GHz   | Above 1 GHz                                              |                                                                                                                                                                                          | 20 dBc                                                   |
| Instrument used | Test Receiver | Spectrum Analyzer                                        |                                                                                                                                                                                          | Spectrum Analyzer                                        |
| Detector        | QP            | PK                                                       | AV *1)                                                                                                                                                                                   | PK                                                       |
| IF Bandwidth    | BW 120 kHz    | RBW: 1 MHz<br>VBW: 3 MHz                                 | Average Power Method:<br>RBW: 1 MHz<br>VBW: 3 MHz<br>Detector:<br>Power Averaging (RMS)<br>Trace: 100 traces<br>If duty cycle was less than 98%, a duty factor was added to the results. | RBW: 100 kHz<br>VBW: 300kHz                              |
| Test Distance   | 3 m           | 4 m *2) (1 GHz – 10 GHz),<br>1 m *3) (10 GHz – 26.5 GHz) |                                                                                                                                                                                          | 4 m *2) (1 GHz – 10 GHz),<br>1 m *3) (10 GHz – 26.5 GHz) |

\*1) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v04".

\*2) Distance Factor:  $20 \times \log(4.0 \text{ m} / 3.0 \text{ m}) = 2.5 \text{ dB}$

\*3) Distance Factor:  $20 \times \log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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

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

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

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

### **Test Procedure**

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

| Test                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Span                                    | RBW             | VBW                | Sweep time | Detector             | Trace    | Instrument used                    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------------|--------------------|------------|----------------------|----------|------------------------------------|
| 6dB Bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                               | 10 MHz                                  | 100 kHz         | 300 kHz            | Auto       | Peak                 | Max Hold | Spectrum Analyzer                  |
| 99% Occupied Bandwidth *1)                                                                                                                                                                                                                                                                                                                                                                                                                                  | Enough width to display emission skirts | 1 to 5 % of OBW | Three times of RBW | Auto       | Peak                 | Max Hold | Spectrum Analyzer                  |
| Maximum Peak Output Power                                                                                                                                                                                                                                                                                                                                                                                                                                   | -                                       | -               | -                  | Auto       | Peak/<br>Average *2) | -        | Power Meter<br>(Sensor: 50 MHz BW) |
| Peak Power Density                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1.5 times the 6dB Bandwidth             | 3 kHz           | 10 kHz             | Auto       | Peak                 | Max Hold | Spectrum Analyzer *3)              |
| Conducted Spurious Emission *4)                                                                                                                                                                                                                                                                                                                                                                                                                             | 9kHz to 150kHz                          | 200 Hz          | 620 Hz             | Auto       | Peak                 | Max Hold | Spectrum Analyzer                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 150kHz to 30MHz                         | 9.1 kHz         | 27 kHz             |            |                      |          |                                    |
| *1) Peak hold was applied as Worst-case measurement.<br>*2) Reference data<br>*3) Section 10.2 Method PKPSD (peak PSD) of "KDB 558074 D01 DTS Meas Guidance v04".<br>*4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.<br>Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.<br>(9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 9.1 kHz) |                                         |                 |                    |            |                      |          |                                    |

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

Test data : APPENDIX  
 Test result : Pass

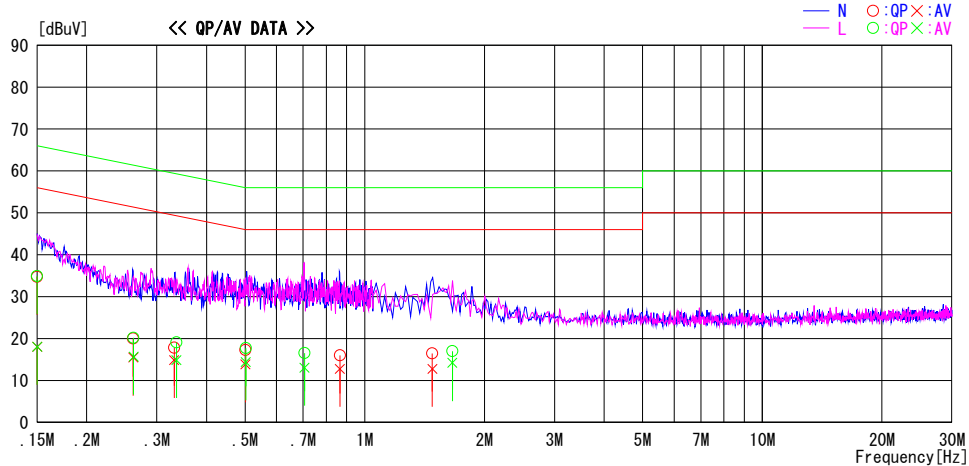
## APPENDIX 1: Test data

### Conducted Emission

1/4λ Dipole antenna

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber  
Report No. : 12206316H  
Date : March 23, 2018  
Temperature / Humidity : 23 deg. C / 33 % RH  
Engineer : Koji Yamamoto  
Mode : Tx 2441 MHz

LIMIT : FCC15.107(a) QP ClassB  
FCC15.107(a) AV ClassB



| Frequency<br>[MHz] | Reading Level |              | Corr.<br>Factor | 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] |       |         |
| 0.15000            | 21.5          | 4.9          | 13.2            | 34.7         | 18.1         | 66.0         | 56.0         | 31.3       | 37.9       | N     |         |
| 0.26175            | 6.8           | 2.3          | 13.2            | 20.0         | 15.5         | 61.4         | 51.4         | 41.4       | 35.9       | N     |         |
| 0.33167            | 4.6           | 1.7          | 13.2            | 17.8         | 14.9         | 59.4         | 49.4         | 41.6       | 34.5       | N     |         |
| 0.50132            | 4.1           | 0.7          | 13.2            | 17.3         | 13.9         | 56.0         | 46.0         | 38.7       | 32.1       | N     |         |
| 0.86586            | 2.7           | -0.5         | 13.3            | 16.0         | 12.8         | 56.0         | 46.0         | 40.0       | 33.2       | N     |         |
| 1.47869            | 3.1           | -0.6         | 13.4            | 16.5         | 12.8         | 56.0         | 46.0         | 39.5       | 33.2       | N     |         |
| 0.15000            | 21.7          | 4.9          | 13.2            | 34.9         | 18.1         | 66.0         | 56.0         | 31.1       | 37.9       | L     |         |
| 0.26232            | 7.0           | 2.5          | 13.2            | 20.2         | 15.7         | 61.4         | 51.4         | 41.2       | 35.7       | L     |         |
| 0.33620            | 5.9           | 1.7          | 13.2            | 19.1         | 14.9         | 59.3         | 49.3         | 40.2       | 34.4       | L     |         |
| 0.50215            | 4.5           | 1.2          | 13.2            | 17.7         | 14.4         | 56.0         | 46.0         | 38.3       | 31.6       | L     |         |
| 0.70523            | 3.3           | -0.2         | 13.3            | 16.6         | 13.1         | 56.0         | 46.0         | 39.4       | 32.9       | L     |         |
| 1.66163            | 3.6           | 0.8          | 13.4            | 17.0         | 14.2         | 56.0         | 46.0         | 39.0       | 31.8       | L     |         |

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

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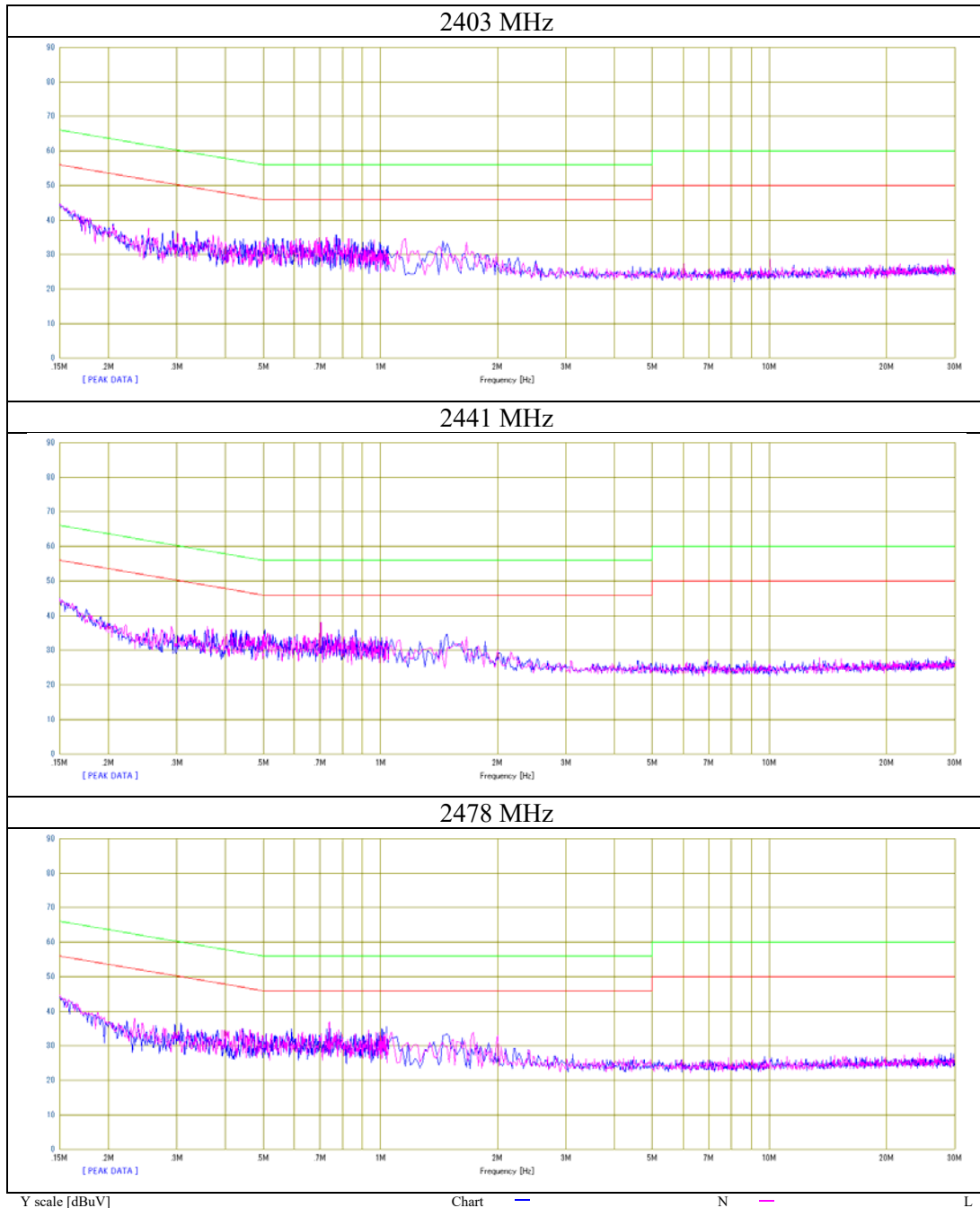
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Conducted Emission

1/4 $\lambda$  Dipole antenna

|                        |                                         |
|------------------------|-----------------------------------------|
| Test place             | Ise EMC Lab. No.2 Semi Anechoic Chamber |
| Report No.             | 12206316H                               |
| Date                   | March 23, 2018                          |
| Temperature / Humidity | 23 deg. C / 33 % RH                     |
| Engineer               | Koji Yamamoto                           |
| Mode                   | Tx                                      |



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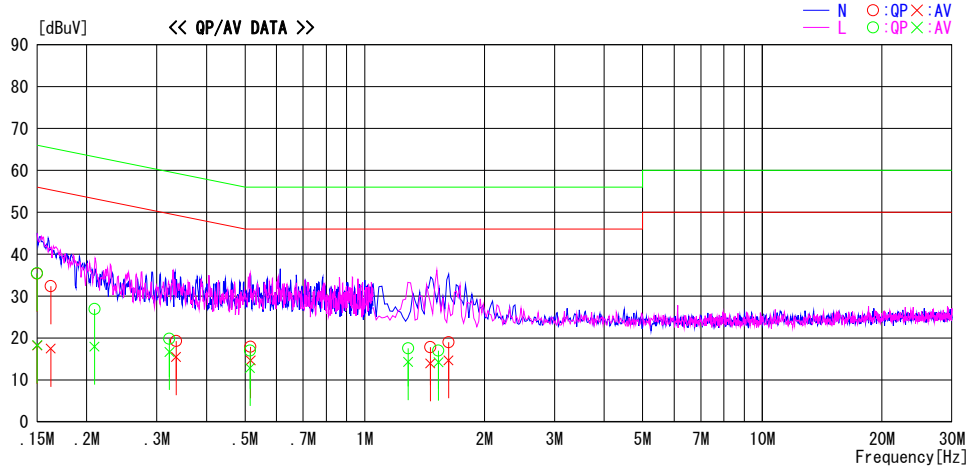
Facsimile : +81 596 24 8124

## Conducted Emission

### 1/2λ Dipole Antenna

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber  
Report No. : 12206316H  
Date : March 23, 2018  
Temperature / Humidity : 23 deg. C / 33 % RH  
Engineer : Koji Yamamoto  
Mode : Tx 2441 MHz

LIMIT : FCC15.107(a) QP ClassB  
FCC15.107(a) AV ClassB



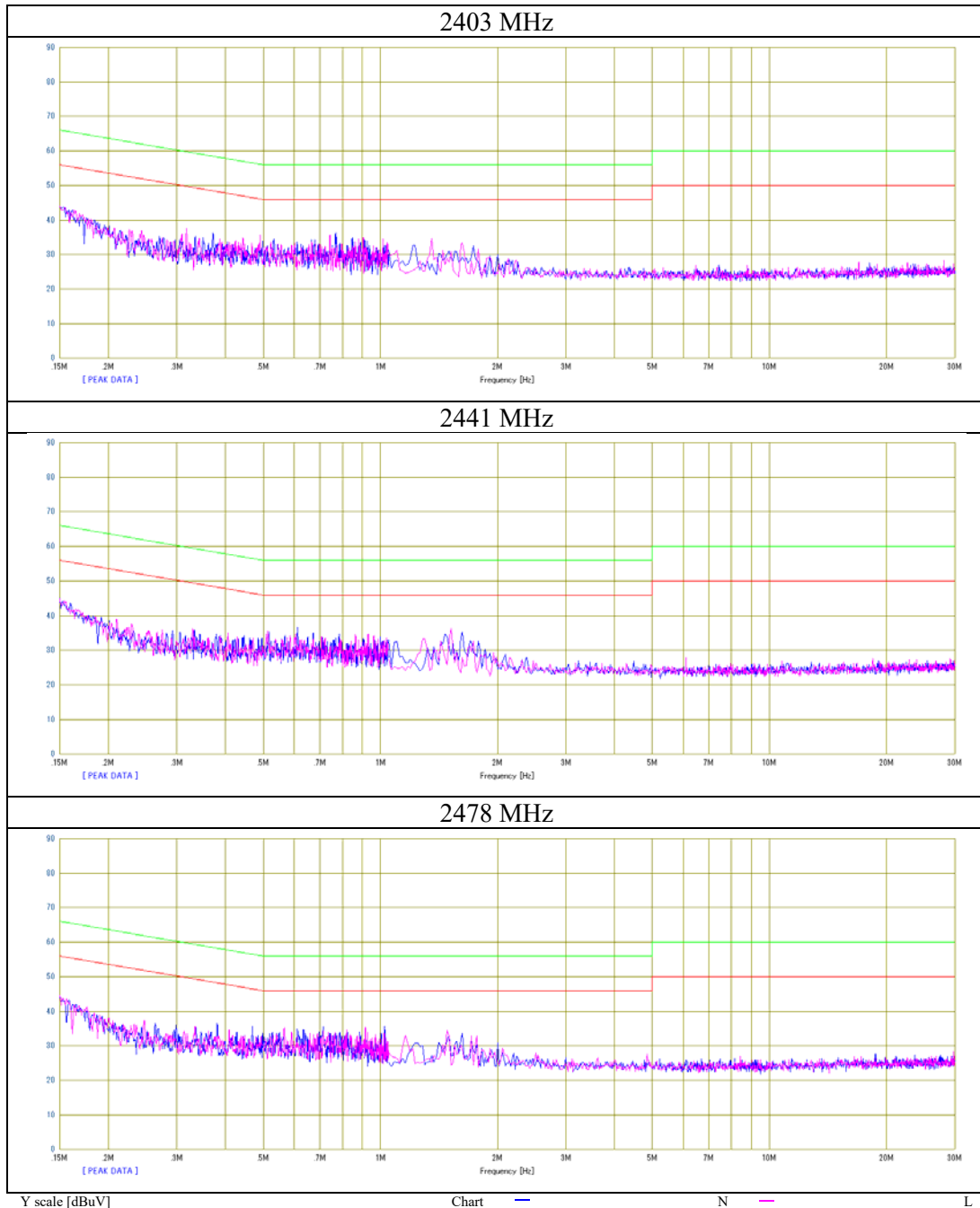
| Frequency<br>[MHz] | Reading Level |              | Corr.<br>Factor<br>[dB] | Results      |              | Limit        |              | Margin     |            | Phase | Comment |
|--------------------|---------------|--------------|-------------------------|--------------|--------------|--------------|--------------|------------|------------|-------|---------|
|                    | QP<br>[dBuV]  | AV<br>[dBuV] |                         | QP<br>[dBuV] | AV<br>[dBuV] | QP<br>[dBuV] | AV<br>[dBuV] | QP<br>[dB] | AV<br>[dB] |       |         |
| 0.15000            | 22.2          | 5.0          | 13.2                    | 35.4         | 18.2         | 66.0         | 56.0         | 30.6       | 37.8       | N     |         |
| 0.16235            | 19.2          | 4.3          | 13.2                    | 32.4         | 17.5         | 65.3         | 55.3         | 32.9       | 37.8       | N     |         |
| 0.33526            | 6.1           | 2.3          | 13.2                    | 19.3         | 15.5         | 59.3         | 49.3         | 40.0       | 33.8       | N     |         |
| 0.51653            | 4.7           | 1.5          | 13.2                    | 17.9         | 14.7         | 56.0         | 46.0         | 38.1       | 31.3       | N     |         |
| 1.46179            | 4.4           | 0.6          | 13.4                    | 17.8         | 14.0         | 56.0         | 46.0         | 38.2       | 32.0       | N     |         |
| 1.62507            | 5.6           | 1.3          | 13.4                    | 19.0         | 14.7         | 56.0         | 46.0         | 37.0       | 31.3       | N     |         |
| 0.15000            | 22.3          | 5.1          | 13.2                    | 35.5         | 18.3         | 66.0         | 56.0         | 30.5       | 37.7       | L     |         |
| 0.20912            | 13.7          | 4.8          | 13.2                    | 26.9         | 18.0         | 63.2         | 53.2         | 36.3       | 35.2       | L     |         |
| 0.32261            | 6.6           | 3.5          | 13.2                    | 19.8         | 16.7         | 59.6         | 49.6         | 39.8       | 32.9       | L     |         |
| 0.51433            | 3.8           | -0.3         | 13.2                    | 17.0         | 12.9         | 56.0         | 46.0         | 39.0       | 33.1       | L     |         |
| 1.28518            | 4.2           | 0.9          | 13.4                    | 17.6         | 14.3         | 56.0         | 46.0         | 38.4       | 31.7       | L     |         |
| 1.53186            | 3.6           | 0.8          | 13.4                    | 17.0         | 14.2         | 56.0         | 46.0         | 39.0       | 31.8       | L     |         |

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

## Conducted Emission

### 1/2λ Dipole Antenna

|                        |                                         |
|------------------------|-----------------------------------------|
| Test place             | Ise EMC Lab. No.2 Semi Anechoic Chamber |
| Report No.             | 12206316H                               |
| Date                   | March 23, 2018                          |
| Temperature / Humidity | 23 deg. C / 33 % RH                     |
| Engineer               | Koji Yamamoto                           |
| Mode                   | Tx                                      |



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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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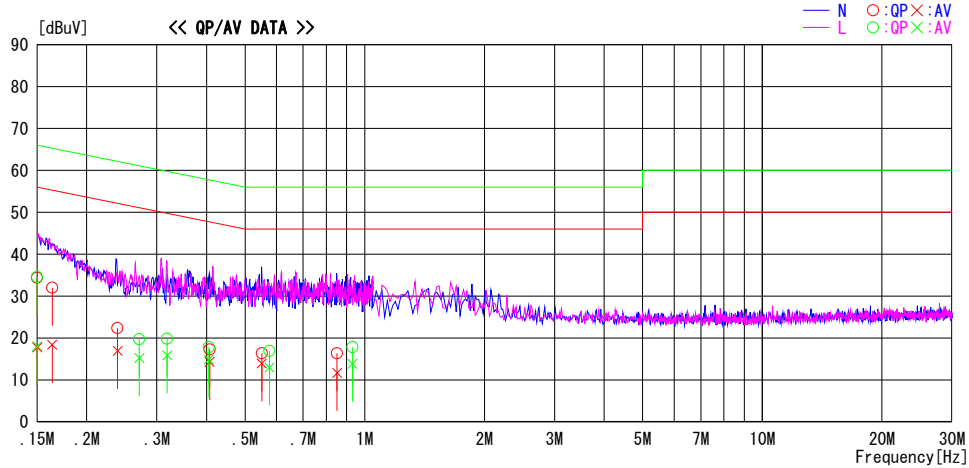
Facsimile : +81 596 24 8124

## Conducted Emission

### 1/2λ Dipole Antenna with Magnetic Base

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber  
Report No. : 12206316H  
Date : March 23, 2018  
Temperature / Humidity : 23 deg. C / 33 % RH  
Engineer : Koji Yamamoto  
Mode : Tx 2441 MHz

LIMIT : FCC15.107(a) QP ClassB  
FCC15.107(a) AV ClassB



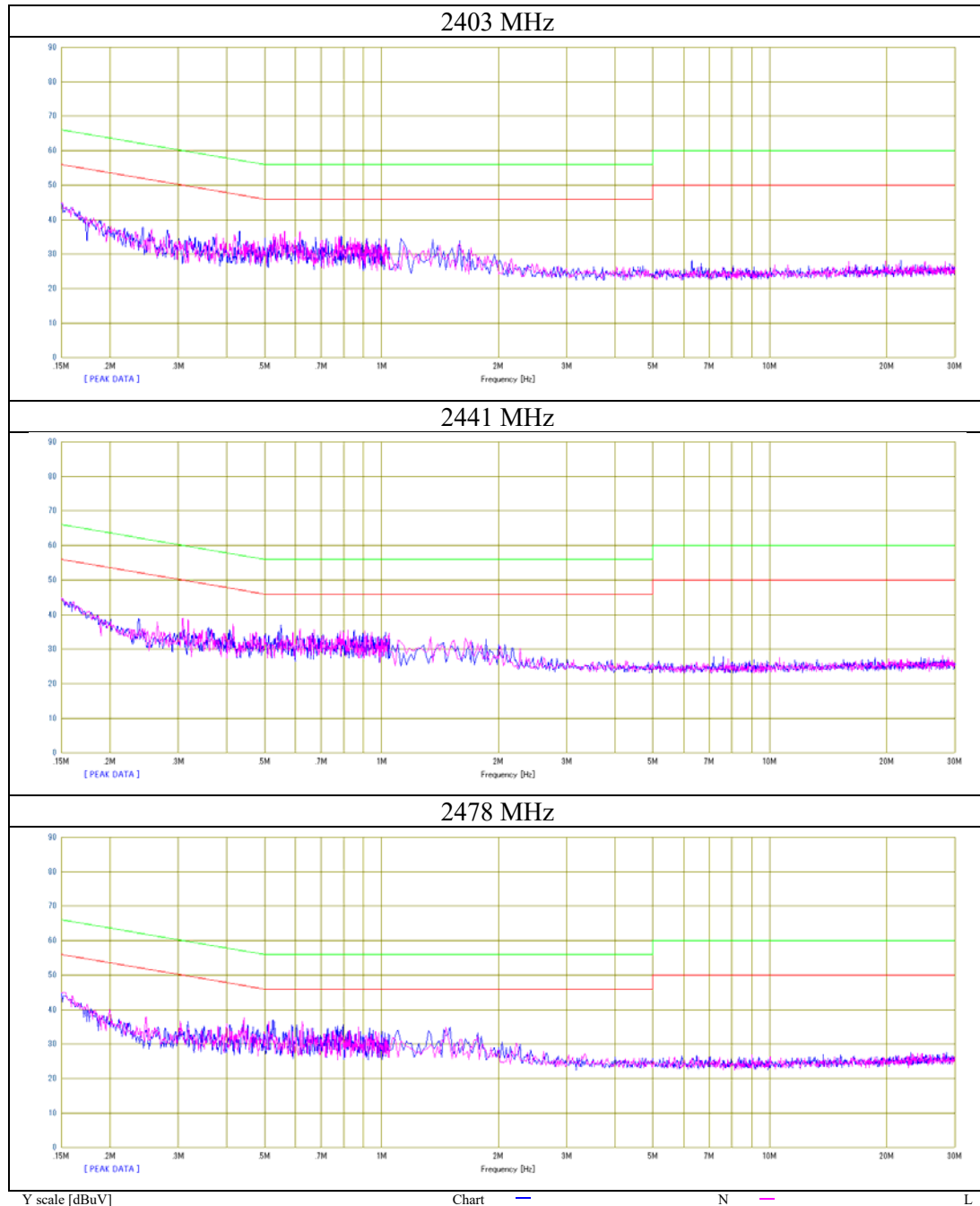
| Frequency<br>[MHz] | Reading Level |              | Corr.<br>Factor<br>[dB] | Results      |              | Limit        |              | Margin     |            | Phase | Comment |
|--------------------|---------------|--------------|-------------------------|--------------|--------------|--------------|--------------|------------|------------|-------|---------|
|                    | QP<br>[dBuV]  | AV<br>[dBuV] |                         | QP<br>[dBuV] | AV<br>[dBuV] | QP<br>[dBuV] | AV<br>[dBuV] | QP<br>[dB] | AV<br>[dB] |       |         |
| 0.15000            | 21.2          | 4.6          | 13.2                    | 34.4         | 17.8         | 66.0         | 56.0         | 31.6       | 38.2       | N     |         |
| 0.16375            | 18.8          | 5.2          | 13.2                    | 32.0         | 18.4         | 65.3         | 55.3         | 33.3       | 36.9       | N     |         |
| 0.23912            | 9.2           | 3.8          | 13.2                    | 22.4         | 17.0         | 62.1         | 52.1         | 39.7       | 35.1       | N     |         |
| 0.40726            | 4.1           | 1.1          | 13.2                    | 17.3         | 14.3         | 57.7         | 47.7         | 40.4       | 33.4       | N     |         |
| 0.55077            | 3.2           | 0.8          | 13.2                    | 16.4         | 14.0         | 56.0         | 46.0         | 39.6       | 32.0       | N     |         |
| 0.85217            | 3.1           | -1.6         | 13.3                    | 16.4         | 11.7         | 56.0         | 46.0         | 39.6       | 34.3       | N     |         |
| 0.15000            | 21.4          | 4.9          | 13.2                    | 34.6         | 18.1         | 66.0         | 56.0         | 31.4       | 37.9       | L     |         |
| 0.27096            | 6.5           | 2.0          | 13.2                    | 19.7         | 15.2         | 61.1         | 51.1         | 41.4       | 35.9       | L     |         |
| 0.31832            | 6.6           | 2.7          | 13.2                    | 19.8         | 15.9         | 59.8         | 49.8         | 40.0       | 33.9       | L     |         |
| 0.40557            | 4.6           | 1.7          | 13.2                    | 17.8         | 14.9         | 57.7         | 47.7         | 39.9       | 32.8       | L     |         |
| 0.57612            | 3.7           | -0.2         | 13.2                    | 16.9         | 13.0         | 56.0         | 46.0         | 39.1       | 33.0       | L     |         |
| 0.93162            | 4.5           | 0.6          | 13.3                    | 17.8         | 13.9         | 56.0         | 46.0         | 38.2       | 32.1       | L     |         |

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

## Conducted Emission

### 1/2λ Dipole Antenna with Magnetic Base

|                        |                                         |
|------------------------|-----------------------------------------|
| Test place             | Ise EMC Lab. No.2 Semi Anechoic Chamber |
| Report No.             | 12206316H                               |
| Date                   | March 23, 2018                          |
| Temperature / Humidity | 23 deg. C / 33 % RH                     |
| Engineer               | Koji Yamamoto                           |
| Mode                   | Tx                                      |



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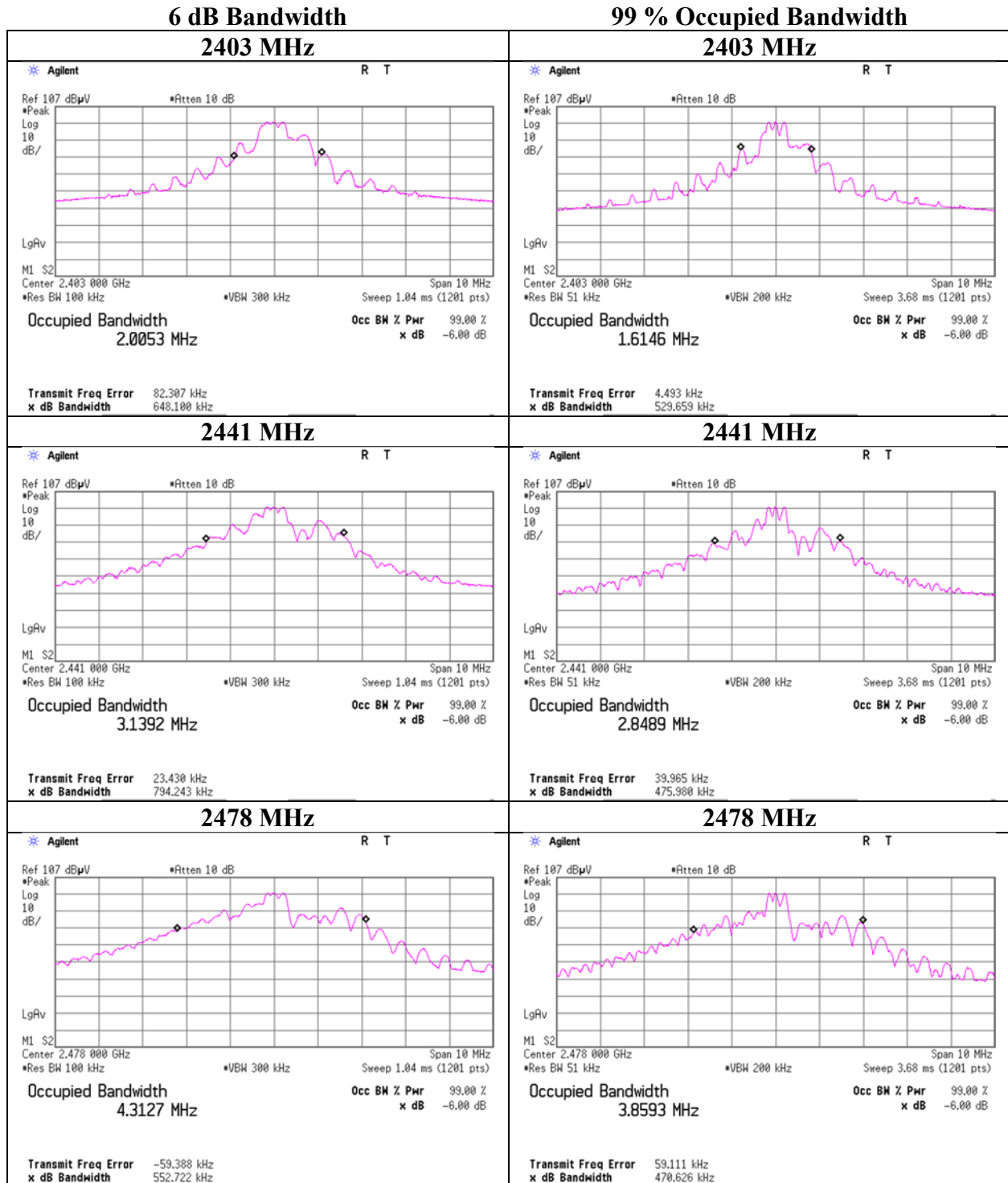
Facsimile : +81 596 24 8124

### **6 dB Bandwidth and 99 % Occupied Bandwidth**

Test place                      Ise EMC Lab. No.6 Measurement Room  
Report No.                    12206316H  
Date                            March 16, 2018  
Temperature / Humidity    22 deg. C / 51 % RH  
Engineer                      Masafumi Niwa  
Mode                            Tx

| Frequency<br>[MHz] | 99% Occupied<br>Bandwidth<br>[kHz] | 6dB Bandwidth<br>[MHz] | Limit for<br>6dB Bandwidth<br>[MHz] |
|--------------------|------------------------------------|------------------------|-------------------------------------|
| 2403               | 1614.6                             | 0.6481                 | > 0.5000                            |
| 2441               | 2848.9                             | 0.7942                 | > 0.5000                            |
| 2478               | 3859.3                             | 0.5527                 | > 0.5000                            |

## 6 dB Bandwidth and 99 % Occupied Bandwidth



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### **Maximum Peak Output Power**

Test place                      Ise EMC Lab. No.6 Measurement Room  
Report No.                    12206316H  
Date                            March 16, 2018  
Temperature / Humidity    22 deg. C / 51 % RH  
Engineer                     Masafumi Niwa  
Mode                          Tx

| Freq.<br>[MHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>Loss<br>[dB] | Result |      | Limit |      | Margin<br>[dB] |
|----------------|------------------|-----------------------|------------------------|--------|------|-------|------|----------------|
|                |                  |                       |                        | [dBm]  | [mW] | [dBm] | [mW] |                |
| 2403           | -9.61            | 1.20                  | 10.04                  | 1.63   | 1.46 | 30.00 | 1000 | 28.37          |
| 2441           | -9.57            | 1.20                  | 10.04                  | 1.67   | 1.47 | 30.00 | 1000 | 28.33          |
| 2478           | -9.69            | 1.20                  | 10.04                  | 1.55   | 1.43 | 30.00 | 1000 | 28.45          |

Sample Calculation:

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

**Average Output Power**  
**(Reference data for RF Exposure)**

|                        |                                    |
|------------------------|------------------------------------|
| Test place             | Ise EMC Lab. No.6 Measurement Room |
| Report No.             | 12206316H                          |
| Date                   | March 16, 2018                     |
| Temperature / Humidity | 22 deg. C / 51 % RH                |
| Engineer               | Masafumi Niwa                      |
| Mode                   | Tx                                 |

| Freq.<br>[MHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>Loss<br>[dB] | Result<br>(Time average) |      | Duty<br>factor<br>[dB] | Result<br>(Burst power average) |      |
|----------------|------------------|-----------------------|------------------------|--------------------------|------|------------------------|---------------------------------|------|
|                |                  |                       |                        | [dBm]                    | [mW] |                        | [dBm]                           | [mW] |
| 2403           | -10.12           | 1.20                  | 10.04                  | 1.12                     | 1.29 | 0.13                   | 1.25                            | 1.33 |
| 2441           | -10.06           | 1.20                  | 10.04                  | 1.18                     | 1.31 | 0.13                   | 1.31                            | 1.35 |
| 2478           | -10.20           | 1.20                  | 10.04                  | 1.04                     | 1.27 | 0.13                   | 1.17                            | 1.31 |

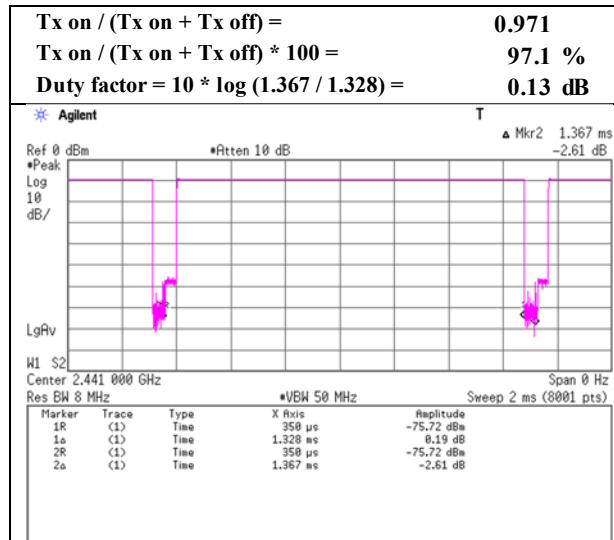
Sample Calculation:

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

Result (Burst power average) = Time average + Duty factor

### Burst rate confirmation

Test place Ise EMC Lab. No.6 Measurement Room  
Report No. 12206316H  
Date March 16, 2018  
Temperature / Humidity 22 deg. C / 51 % RH  
Engineer Masafumi Niwa  
Mode Tx 2441 MHz



\* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

## Radiated Spurious Emission

### 1/4λ Dipole antenna

|                        |                                   |                                 |                                |
|------------------------|-----------------------------------|---------------------------------|--------------------------------|
| Report No.             | 12206316H                         |                                 |                                |
| Test place             | Ise EMC Lab.                      |                                 |                                |
| Semi Anechoic Chamber  | No.4                              | No.4                            | No.2                           |
| Date                   | March 21, 2018                    | March 22, 2018                  | March 23, 2018                 |
| Temperature / Humidity | 21 deg. C / 38 % RH               | 20 deg. C / 40 % RH             | 22 deg. C / 35 % RH            |
| Engineer               | Koji Yamamoto<br>(1 GHz - 10 GHz) | Tomoki Matsui<br>(Above 10 GHz) | Koji Yamamoto<br>(Below 1 GHz) |
| Mode                   | Tx 2403 MHz                       |                                 |                                |

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|-------------|
| Hori     | 96.000             | QP       | 26.2              | 9.5                | 7.4          | 30.3         | -                   | 12.8               | 43.5              | 30.7           |             |
| Hori     | 128.000            | QP       | 28.2              | 13.4               | 7.7          | 30.1         | -                   | 19.2               | 43.5              | 24.3           |             |
| Hori     | 160.000            | QP       | 34.5              | 15.4               | 7.9          | 29.9         | -                   | 27.9               | 43.5              | 15.6           |             |
| Hori     | 208.008            | QP       | 29.6              | 11.5               | 8.2          | 29.6         | -                   | 19.7               | 43.5              | 23.8           |             |
| Hori     | 256.005            | QP       | 32.6              | 11.9               | 8.5          | 29.3         | -                   | 23.7               | 46.0              | 22.3           |             |
| Hori     | 304.005            | QP       | 31.0              | 13.5               | 8.9          | 29.2         | -                   | 24.2               | 46.0              | 21.8           |             |
| Hori     | 2390.000           | PK       | 49.8              | 27.4               | 5.9          | 32.1         | -                   | 51.0               | 73.9              | 22.9           |             |
| Hori     | 4806.000           | PK       | 44.1              | 31.7               | 8.1          | 31.3         | -                   | 52.6               | 73.9              | 21.3           |             |
| Hori     | 7209.000           | PK       | 42.6              | 36.5               | 9.5          | 32.4         | -                   | 56.2               | 73.9              | 17.7           | Floor noise |
| Hori     | 9612.000           | PK       | 42.5              | 38.0               | 10.2         | 32.6         | -                   | 58.1               | 73.9              | 15.8           | Floor noise |
| Hori     | 2390.000           | AV       | 33.2              | 27.4               | 5.9          | 32.1         | 0.1                 | 34.5               | 53.9              | 19.4           | *1)         |
| Hori     | 4806.000           | AV       | 37.8              | 31.7               | 8.1          | 31.3         | 0.1                 | 46.4               | 53.9              | 7.5            |             |
| Hori     | 7209.000           | AV       | 33.6              | 36.5               | 9.5          | 32.4         | -                   | 47.2               | 53.9              | 6.7            | Floor noise |
| Hori     | 9612.000           | AV       | 32.2              | 38.0               | 10.2         | 32.6         | -                   | 47.8               | 53.9              | 6.1            | Floor noise |
| Vert     | 96.000             | QP       | 27.5              | 9.5                | 7.4          | 30.3         | -                   | 14.1               | 43.5              | 29.4           |             |
| Vert     | 128.000            | QP       | 29.9              | 13.4               | 7.7          | 30.1         | -                   | 20.9               | 43.5              | 22.6           |             |
| Vert     | 160.000            | QP       | 28.3              | 15.4               | 7.9          | 29.9         | -                   | 21.7               | 43.5              | 21.8           |             |
| Vert     | 208.008            | QP       | 31.1              | 11.5               | 8.2          | 29.6         | -                   | 21.2               | 43.5              | 22.3           |             |
| Vert     | 256.005            | QP       | 30.6              | 11.9               | 8.5          | 29.3         | -                   | 21.7               | 46.0              | 24.3           |             |
| Vert     | 304.005            | QP       | 35.5              | 13.5               | 8.9          | 29.2         | -                   | 28.7               | 46.0              | 17.3           |             |
| Vert     | 2390.000           | PK       | 50.0              | 27.4               | 5.9          | 32.1         | -                   | 51.2               | 73.9              | 22.7           |             |
| Vert     | 4806.000           | PK       | 45.2              | 31.7               | 8.1          | 31.3         | -                   | 53.7               | 73.9              | 20.2           |             |
| Vert     | 7209.000           | PK       | 42.6              | 36.5               | 9.5          | 32.4         | -                   | 56.2               | 73.9              | 17.7           | Floor noise |
| Vert     | 9612.000           | PK       | 42.5              | 38.0               | 10.2         | 32.6         | -                   | 58.1               | 73.9              | 15.8           | Floor noise |
| Vert     | 2390.000           | AV       | 33.2              | 27.4               | 5.9          | 32.1         | 0.1                 | 34.5               | 53.9              | 19.4           | *1)         |
| Vert     | 4806.000           | AV       | 40.0              | 31.7               | 8.1          | 31.3         | 0.1                 | 48.6               | 53.9              | 5.3            |             |
| Vert     | 7209.000           | AV       | 33.6              | 36.5               | 9.5          | 32.4         | -                   | 47.2               | 53.9              | 6.7            | Floor noise |
| Vert     | 9612.000           | AV       | 32.2              | 38.0               | 10.2         | 32.6         | -                   | 47.8               | 53.9              | 6.1            | Floor noise |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

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

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.5 dB  
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

#### 20dBc Data Sheet

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark  |
|----------|--------------------|----------|-------------------|-------------------------|--------------|--------------|--------------------|-------------------|----------------|---------|
| Hori     | 2403.000           | PK       | 88.2              | 27.4                    | 5.9          | 32.1         | 89.4               | -                 | -              | Carrier |
| Hori     | 2400.000           | PK       | 53.4              | 27.4                    | 5.9          | 32.1         | 54.6               | 69.4              | 14.8           |         |
| Vert     | 2403.000           | PK       | 86.8              | 27.4                    | 5.9          | 32.1         | 88.0               | -                 | -              | Carrier |
| Vert     | 2400.000           | PK       | 52.3              | 27.4                    | 5.9          | 32.1         | 53.5               | 68.0              | 14.5           |         |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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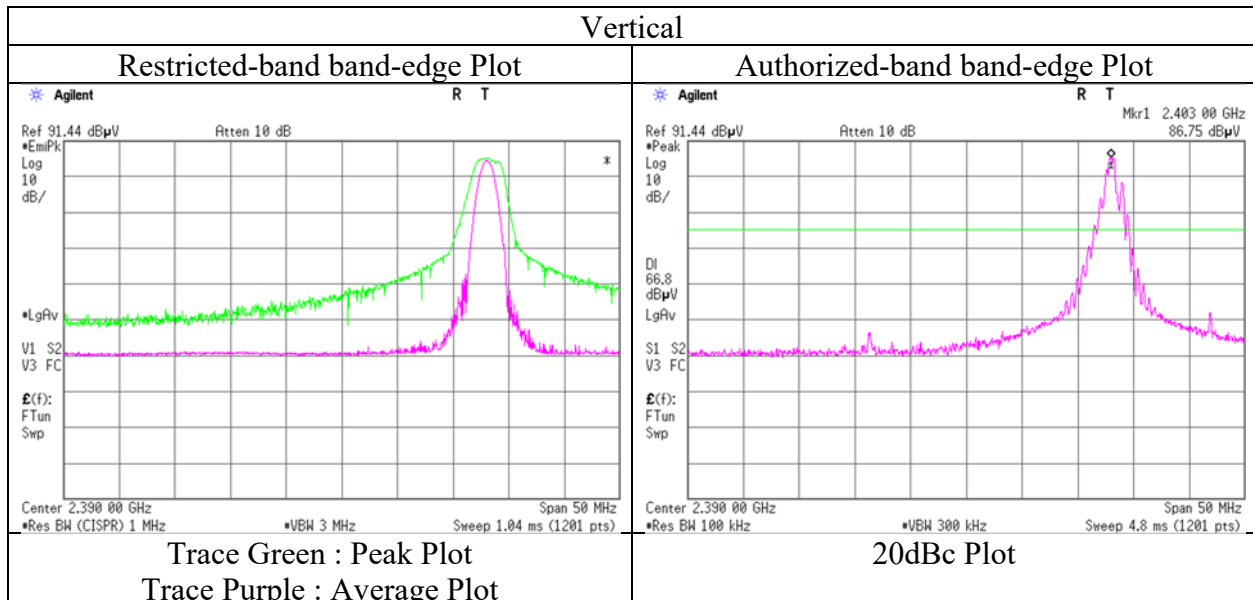
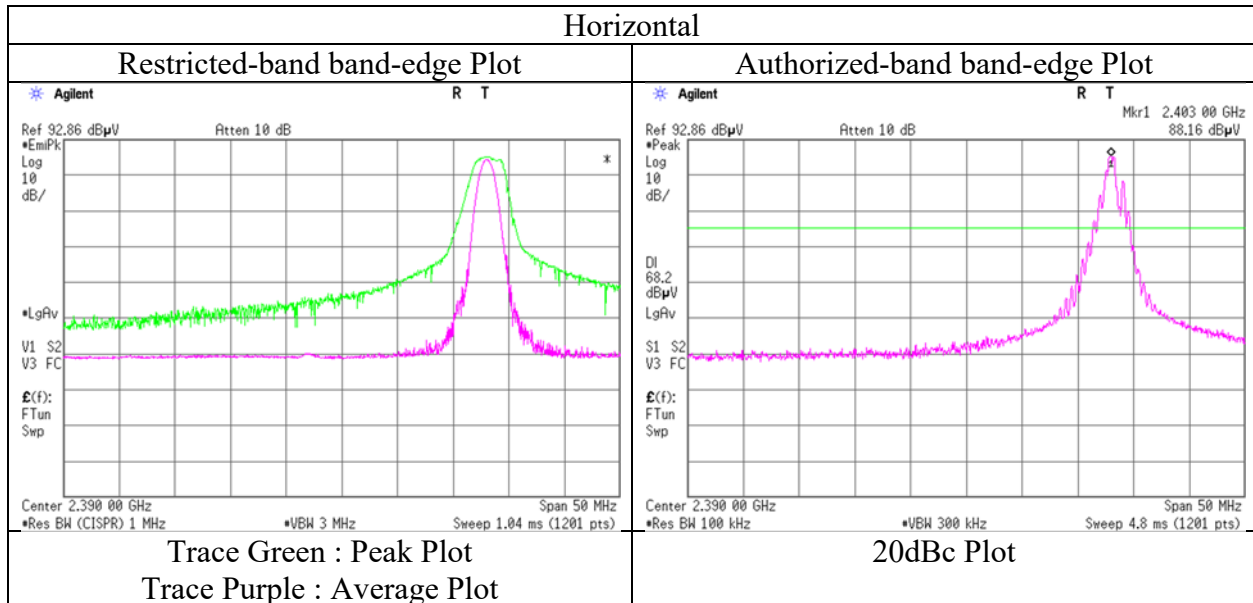
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**  
1/4λ Dipole antenna

|                        |                     |
|------------------------|---------------------|
| Report No.             | 12206316H           |
| Test place             | Ise EMC Lab.        |
| Semi Anechoic Chamber  | No.4                |
| Date                   | March 21, 2018      |
| Temperature / Humidity | 21 deg. C / 38 % RH |
| Engineer               | Koji Yamamoto       |
|                        | (1 GHz - 10 GHz)    |
| Mode                   | Tx 2403 MHz         |



\* Final result of restricted band edge was shown in tabular data.

## Radiated Spurious Emission

1/4λ Dipole antenna

|                        |                                   |                                 |                                |
|------------------------|-----------------------------------|---------------------------------|--------------------------------|
| Report No.             | 12206316H                         |                                 |                                |
| Test place             | Ise EMC Lab.                      |                                 |                                |
| Semi Anechoic Chamber  | No.4                              | No.4                            | No.2                           |
| Date                   | March 21, 2018                    | March 22, 2018                  | March 23, 2018                 |
| Temperature / Humidity | 21 deg. C / 38 % RH               | 20 deg. C / 40 % RH             | 22 deg. C / 35 % RH            |
| Engineer               | Koji Yamamoto<br>(1 GHz - 10 GHz) | Tomoki Matsui<br>(Above 10 GHz) | Koji Yamamoto<br>(Below 1 GHz) |
| Mode                   | Tx 2441 MHz                       |                                 |                                |

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|-------------|
| Hori     | 96.000             | QP       | 26.8              | 9.5                | 7.4          | 30.3         | -                   | 13.4               | 43.5              | 30.1           |             |
| Hori     | 128.000            | QP       | 28.5              | 13.4               | 7.7          | 30.1         | -                   | 19.5               | 43.5              | 24.0           |             |
| Hori     | 160.000            | QP       | 34.2              | 15.4               | 7.9          | 29.9         | -                   | 27.6               | 43.5              | 15.9           |             |
| Hori     | 208.008            | QP       | 32.2              | 11.5               | 8.2          | 29.6         | -                   | 22.3               | 43.5              | 21.2           |             |
| Hori     | 256.005            | QP       | 31.8              | 11.9               | 8.5          | 29.3         | -                   | 22.9               | 46.0              | 23.1           |             |
| Hori     | 304.005            | QP       | 31.5              | 13.5               | 8.9          | 29.2         | -                   | 24.7               | 46.0              | 21.3           |             |
| Hori     | 4882.000           | PK       | 42.5              | 31.9               | 8.2          | 31.2         | -                   | 51.4               | 73.9              | 22.5           |             |
| Hori     | 7323.000           | PK       | 42.3              | 36.6               | 9.5          | 32.4         | -                   | 56.0               | 73.9              | 17.9           | Floor noise |
| Hori     | 9764.000           | PK       | 42.2              | 38.1               | 10.2         | 32.7         | -                   | 57.8               | 73.9              | 16.1           | Floor noise |
| Hori     | 4882.000           | AV       | 35.3              | 31.9               | 8.2          | 31.2         | 0.1                 | 44.3               | 53.9              | 9.6            |             |
| Hori     | 7323.000           | AV       | 33.0              | 36.6               | 9.5          | 32.4         | -                   | 46.7               | 53.9              | 7.2            | Floor noise |
| Hori     | 9764.000           | AV       | 32.2              | 38.1               | 10.2         | 32.7         | -                   | 47.8               | 53.9              | 6.1            | Floor noise |
| Vert     | 96.000             | QP       | 27.8              | 9.5                | 7.4          | 30.3         | -                   | 14.4               | 43.5              | 29.1           |             |
| Vert     | 128.000            | QP       | 30.9              | 13.4               | 7.7          | 30.1         | -                   | 21.9               | 43.5              | 21.6           |             |
| Vert     | 160.000            | QP       | 28.6              | 15.4               | 7.9          | 29.9         | -                   | 22.0               | 43.5              | 21.5           |             |
| Vert     | 208.008            | QP       | 30.9              | 11.5               | 8.2          | 29.6         | -                   | 21.0               | 43.5              | 22.5           |             |
| Vert     | 256.005            | QP       | 31.2              | 11.9               | 8.5          | 29.3         | -                   | 22.3               | 46.0              | 23.7           |             |
| Vert     | 304.005            | QP       | 34.6              | 13.5               | 8.9          | 29.2         | -                   | 27.8               | 46.0              | 18.2           |             |
| Vert     | 4882.000           | PK       | 43.7              | 31.9               | 8.2          | 31.2         | -                   | 52.6               | 73.9              | 21.3           |             |
| Vert     | 7323.000           | PK       | 42.3              | 36.6               | 9.5          | 32.4         | -                   | 56.0               | 73.9              | 17.9           | Floor noise |
| Vert     | 9764.000           | PK       | 42.2              | 38.1               | 10.2         | 32.7         | -                   | 57.8               | 73.9              | 16.1           | Floor noise |
| Vert     | 4882.000           | AV       | 38.2              | 31.9               | 8.2          | 31.2         | 0.1                 | 47.2               | 53.9              | 6.7            |             |
| Vert     | 7323.000           | AV       | 33.0              | 36.6               | 9.5          | 32.4         | -                   | 46.7               | 53.9              | 7.2            | Floor noise |
| Vert     | 9764.000           | AV       | 32.2              | 38.1               | 10.2         | 32.7         | -                   | 47.8               | 53.9              | 6.1            | Floor noise |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

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

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.5 dB  
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Radiated Spurious Emission

1/4λ Dipole antenna

|                        |                                   |                                 |                                |
|------------------------|-----------------------------------|---------------------------------|--------------------------------|
| Report No.             | 12206316H                         |                                 |                                |
| Test place             | Ise EMC Lab.                      |                                 |                                |
| Semi Anechoic Chamber  | No.4                              | No.4                            | No.2                           |
| Date                   | March 21, 2018                    | March 22, 2018                  | March 23, 2018                 |
| Temperature / Humidity | 21 deg. C / 38 % RH               | 20 deg. C / 40 % RH             | 22 deg. C / 35 % RH            |
| Engineer               | Koji Yamamoto<br>(1 GHz - 10 GHz) | Tomoki Matsui<br>(Above 10 GHz) | Koji Yamamoto<br>(Below 1 GHz) |
| Mode                   | Tx 2478 MHz                       |                                 |                                |

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|-------------|
| Hori     | 96.000             | QP       | 26.5              | 9.5                | 7.4          | 30.3         | -                   | 13.1               | 43.5              | 30.4           |             |
| Hori     | 128.000            | QP       | 27.9              | 13.4               | 7.7          | 30.1         | -                   | 18.9               | 43.5              | 24.6           |             |
| Hori     | 160.000            | QP       | 33.6              | 15.4               | 7.9          | 29.9         | -                   | 27.0               | 43.5              | 16.5           |             |
| Hori     | 208.008            | QP       | 29.5              | 11.5               | 8.2          | 29.6         | -                   | 19.6               | 43.5              | 23.9           |             |
| Hori     | 256.005            | QP       | 30.0              | 11.9               | 8.5          | 29.3         | -                   | 21.1               | 46.0              | 24.9           |             |
| Hori     | 304.005            | QP       | 31.3              | 13.5               | 8.9          | 29.2         | -                   | 24.5               | 46.0              | 21.5           |             |
| Hori     | 2483.500           | PK       | 61.5              | 27.5               | 5.9          | 32.0         | -                   | 62.9               | 73.9              | 11.0           |             |
| Hori     | 4956.000           | PK       | 42.6              | 32.2               | 8.2          | 31.2         | -                   | 51.8               | 73.9              | 22.1           |             |
| Hori     | 7434.000           | PK       | 41.6              | 36.7               | 9.5          | 32.5         | -                   | 55.3               | 73.9              | 18.6           | Floor noise |
| Hori     | 9912.000           | PK       | 42.1              | 38.1               | 10.2         | 32.8         | -                   | 57.6               | 73.9              | 16.3           | Floor noise |
| Hori     | 2483.500           | AV       | 42.1              | 27.5               | 5.9          | 32.0         | 0.1                 | 43.6               | 53.9              | 10.3           | *1)         |
| Hori     | 4956.000           | AV       | 36.2              | 32.2               | 8.2          | 31.2         | 0.1                 | 45.5               | 53.9              | 8.4            |             |
| Hori     | 7434.000           | AV       | 32.5              | 36.7               | 9.5          | 32.5         | -                   | 46.2               | 53.9              | 7.7            | Floor noise |
| Hori     | 9912.000           | AV       | 32.3              | 38.1               | 10.2         | 32.8         | -                   | 47.8               | 53.9              | 6.1            | Floor noise |
| Vert     | 96.000             | QP       | 27.9              | 9.5                | 7.4          | 30.3         | -                   | 14.5               | 43.5              | 29.0           |             |
| Vert     | 128.000            | QP       | 30.3              | 13.4               | 7.7          | 30.1         | -                   | 21.3               | 43.5              | 22.2           |             |
| Vert     | 160.000            | QP       | 28.8              | 15.4               | 7.9          | 29.9         | -                   | 22.2               | 43.5              | 21.3           |             |
| Vert     | 208.008            | QP       | 31.2              | 11.5               | 8.2          | 29.6         | -                   | 21.3               | 43.5              | 22.2           |             |
| Vert     | 256.005            | QP       | 30.6              | 11.9               | 8.5          | 29.3         | -                   | 21.7               | 46.0              | 24.3           |             |
| Vert     | 304.005            | QP       | 35.5              | 13.5               | 8.9          | 29.2         | -                   | 28.7               | 46.0              | 17.3           |             |
| Vert     | 2483.500           | PK       | 60.7              | 27.5               | 5.9          | 32.0         | -                   | 62.1               | 73.9              | 11.8           |             |
| Vert     | 4956.000           | PK       | 42.8              | 32.2               | 8.2          | 31.2         | -                   | 52.0               | 73.9              | 21.9           |             |
| Vert     | 7434.000           | PK       | 41.6              | 36.7               | 9.5          | 32.5         | -                   | 55.3               | 73.9              | 18.6           | Floor noise |
| Vert     | 9912.000           | PK       | 42.1              | 38.1               | 10.2         | 32.8         | -                   | 57.6               | 73.9              | 16.3           | Floor noise |
| Vert     | 2483.500           | AV       | 39.8              | 27.5               | 5.9          | 32.0         | 0.1                 | 41.3               | 53.9              | 12.6           | *1)         |
| Vert     | 4956.000           | AV       | 37.3              | 32.2               | 8.2          | 31.2         | 0.1                 | 46.6               | 53.9              | 7.3            |             |
| Vert     | 7434.000           | AV       | 32.5              | 36.7               | 9.5          | 32.5         | -                   | 46.2               | 53.9              | 7.7            | Floor noise |
| Vert     | 9912.000           | AV       | 32.3              | 38.1               | 10.2         | 32.8         | -                   | 47.8               | 53.9              | 6.1            | Floor noise |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

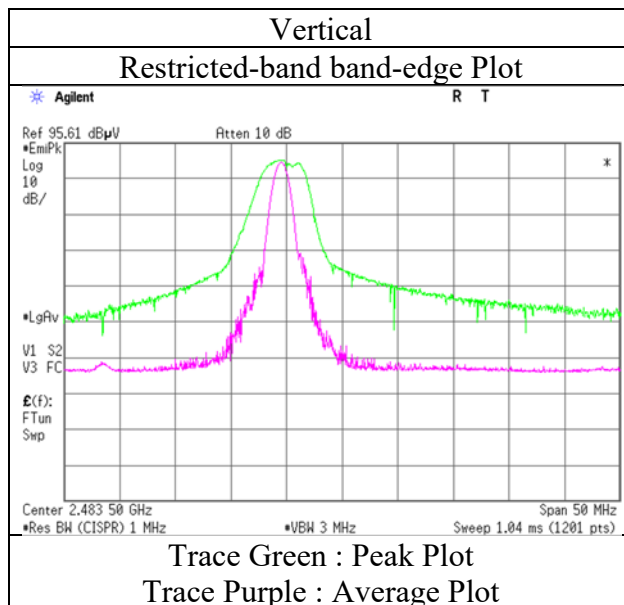
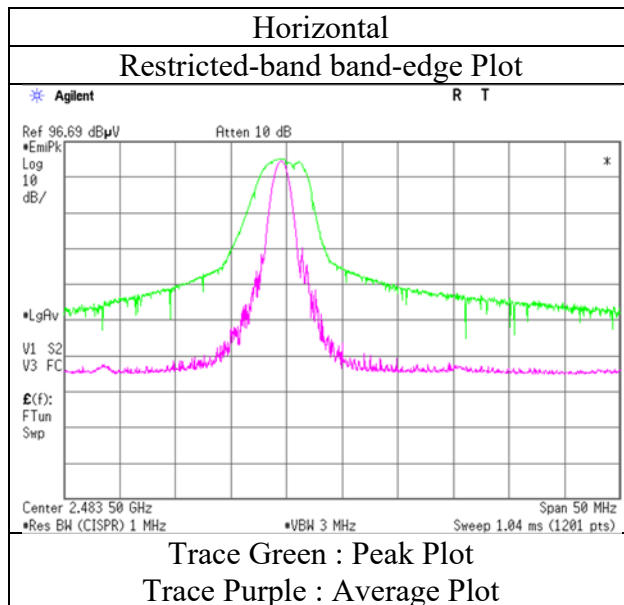
\*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.5 dB  
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**  
1/4λ Dipole antenna

|                        |                                   |
|------------------------|-----------------------------------|
| Report No.             | 12206316H                         |
| Test place             | Ise EMC Lab.                      |
| Semi Anechoic Chamber  | No.4                              |
| Date                   | March 21, 2018                    |
| Temperature / Humidity | 21 deg. C / 38 % RH               |
| Engineer               | Koji Yamamoto<br>(1 GHz - 10 GHz) |
| Mode                   | Tx 2478 MHz                       |



\* Final result of restricted band edge was shown in tabular data.

## Radiated Spurious Emission

### 1/2λ Dipole Antenna

|                        |                                |                                |
|------------------------|--------------------------------|--------------------------------|
| Report No.             | 12206316H                      |                                |
| Test place             | Ise EMC Lab.                   |                                |
| Semi Anechoic Chamber  | No.4                           | No.2                           |
| Date                   | March 22, 2018                 | March 23, 2018                 |
| Temperature / Humidity | 20 deg. C / 40 % RH            | 22 deg. C / 35 % RH            |
| Engineer               | Tomoki Matsui<br>(Above 1 GHz) | Koji Yamamoto<br>(Below 1 GHz) |
| Mode                   | Tx 2403 MHz                    |                                |

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|-------------|
| Hori     | 96.000             | QP       | 29.3              | 9.5                | 7.4          | 30.3         | -                   | 15.9               | 43.5              | 27.6           |             |
| Hori     | 128.000            | QP       | 28.6              | 13.4               | 7.7          | 30.1         | -                   | 19.6               | 43.5              | 23.9           |             |
| Hori     | 160.000            | QP       | 33.9              | 15.4               | 7.9          | 29.9         | -                   | 27.3               | 43.5              | 16.2           |             |
| Hori     | 208.008            | QP       | 30.2              | 11.5               | 8.2          | 29.6         | -                   | 20.3               | 43.5              | 23.2           |             |
| Hori     | 256.005            | QP       | 32.0              | 11.9               | 8.5          | 29.3         | -                   | 23.1               | 46.0              | 22.9           |             |
| Hori     | 304.005            | QP       | 31.0              | 13.5               | 8.9          | 29.2         | -                   | 24.2               | 46.0              | 21.8           |             |
| Hori     | 1201.537           | PK       | 48.6              | 25.0               | 4.9          | 34.2         | -                   | 44.3               | 73.9              | 29.6           |             |
| Hori     | 2390.000           | PK       | 61.1              | 27.4               | 5.9          | 32.1         | -                   | 62.3               | 73.9              | 11.6           |             |
| Hori     | 4806.000           | PK       | 43.8              | 31.7               | 8.1          | 31.3         | -                   | 52.3               | 73.9              | 21.6           |             |
| Hori     | 7209.000           | PK       | 41.9              | 36.5               | 9.5          | 32.4         | -                   | 55.5               | 73.9              | 18.4           | Floor noise |
| Hori     | 1201.537           | AV       | 44.0              | 25.0               | 4.9          | 34.2         | 0.1                 | 39.8               | 53.9              | 14.1           |             |
| Hori     | 2390.000           | AV       | 39.3              | 27.4               | 5.9          | 32.1         | 0.1                 | 40.6               | 53.9              | 13.3           | *1)         |
| Hori     | 4806.000           | AV       | 37.9              | 31.7               | 8.1          | 31.3         | 0.1                 | 46.5               | 53.9              | 7.4            |             |
| Hori     | 7209.000           | AV       | 32.1              | 36.5               | 9.5          | 32.4         | -                   | 45.7               | 53.9              | 8.2            | Floor noise |
| Vert     | 96.000             | QP       | 30.1              | 9.5                | 7.4          | 30.3         | -                   | 16.7               | 43.5              | 26.8           |             |
| Vert     | 128.000            | QP       | 28.8              | 13.4               | 7.7          | 30.1         | -                   | 19.8               | 43.5              | 23.7           |             |
| Vert     | 160.000            | QP       | 32.1              | 15.4               | 7.9          | 29.9         | -                   | 25.5               | 43.5              | 18.0           |             |
| Vert     | 208.008            | QP       | 31.5              | 11.5               | 8.2          | 29.6         | -                   | 21.6               | 43.5              | 21.9           |             |
| Vert     | 256.005            | QP       | 29.7              | 11.9               | 8.5          | 29.3         | -                   | 20.8               | 46.0              | 25.2           |             |
| Vert     | 304.005            | QP       | 34.1              | 13.5               | 8.9          | 29.2         | -                   | 27.3               | 46.0              | 18.7           |             |
| Vert     | 1201.537           | PK       | 49.2              | 25.0               | 4.9          | 34.2         | -                   | 44.9               | 73.9              | 29.0           |             |
| Vert     | 2390.000           | PK       | 57.7              | 27.4               | 5.9          | 32.1         | -                   | 58.9               | 73.9              | 15.0           |             |
| Vert     | 4806.000           | PK       | 44.0              | 31.7               | 8.1          | 31.3         | -                   | 52.5               | 73.9              | 21.4           |             |
| Vert     | 7209.000           | PK       | 41.9              | 36.5               | 9.5          | 32.4         | -                   | 55.5               | 73.9              | 18.4           | Floor noise |
| Vert     | 1201.537           | AV       | 44.8              | 25.0               | 4.9          | 34.2         | 0.1                 | 40.6               | 53.9              | 13.3           |             |
| Vert     | 2390.000           | AV       | 37.0              | 27.4               | 5.9          | 32.1         | 0.1                 | 38.3               | 53.9              | 15.6           | *1)         |
| Vert     | 4806.000           | AV       | 37.2              | 31.7               | 8.1          | 31.3         | 0.1                 | 45.8               | 53.9              | 8.1            |             |
| Vert     | 7209.000           | AV       | 32.1              | 36.5               | 9.5          | 32.4         | -                   | 45.7               | 53.9              | 8.2            | Floor noise |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

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

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.5 dB  
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

#### 20dBc Data Sheet

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark  |
|----------|--------------------|----------|-------------------|-------------------------|--------------|--------------|--------------------|-------------------|----------------|---------|
| Hori     | 2403.000           | PK       | 97.8              | 27.4                    | 5.9          | 32.1         | 99.0               | -                 | -              | Carrier |
| Hori     | 2400.000           | PK       | 57.6              | 27.4                    | 5.9          | 32.1         | 58.8               | 79.0              | 20.2           |         |
| Hori     | 9612.000           | PK       | 36.0              | 38.0                    | 10.2         | 32.6         | 51.6               | 79.0              | 27.4           |         |
| Vert     | 2403.000           | PK       | 98.2              | 27.4                    | 5.9          | 32.1         | 99.4               | -                 | -              | Carrier |
| Vert     | 2400.000           | PK       | 56.3              | 27.4                    | 5.9          | 32.1         | 57.5               | 79.4              | 21.9           |         |
| Vert     | 9612.000           | PK       | 37.0              | 38.0                    | 9.5          | 32.6         | 51.9               | 79.4              | 27.5           |         |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

**UL Japan, Inc.**

**Ise EMC Lab.**

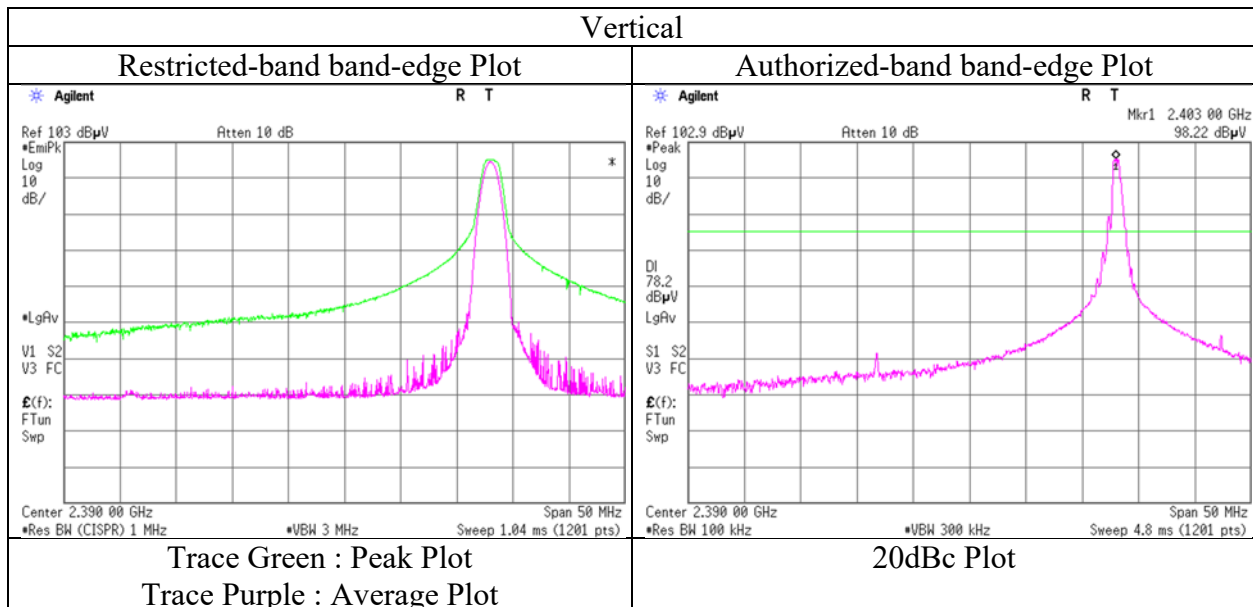
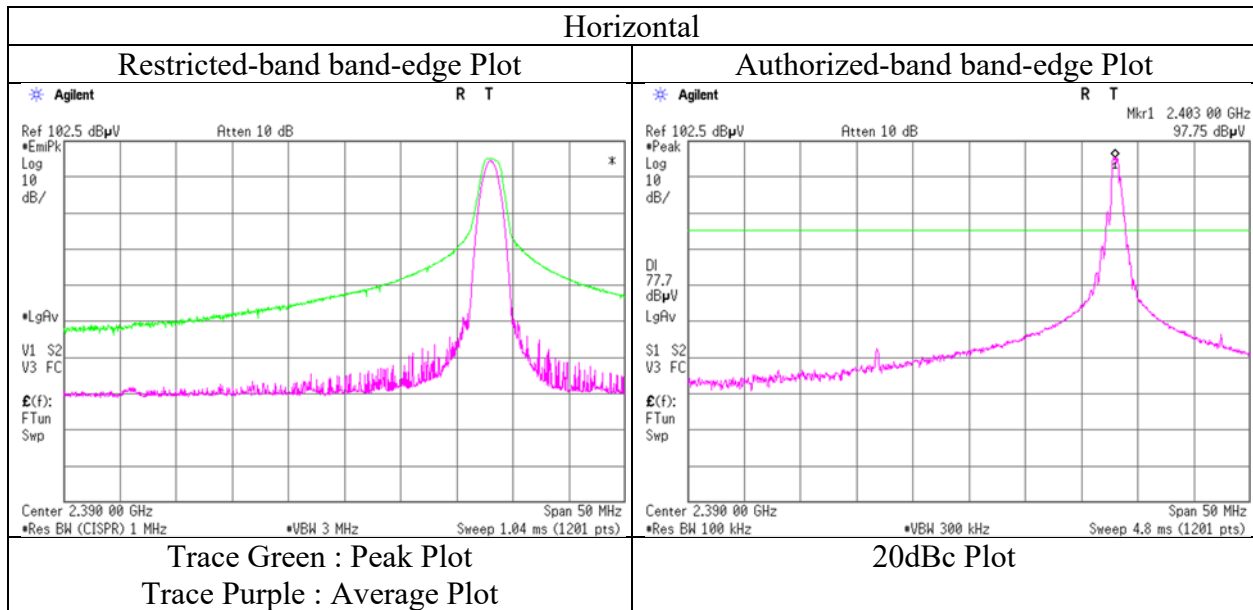
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Radiated Spurious Emission (Reference Plot for band-edge) 1/2λ Dipole Antenna

|                        |                                |
|------------------------|--------------------------------|
| Report No.             | 12206316H                      |
| Test place             | Ise EMC Lab.                   |
| Semi Anechoic Chamber  | No.4                           |
| Date                   | March 22, 2018                 |
| Temperature / Humidity | 20 deg. C / 40 % RH            |
| Engineer               | Tomoki Matsui<br>(Above 1 GHz) |
| Mode                   | Tx 2403 MHz                    |



\* Final result of restricted band edge was shown in tabular data.

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

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## Radiated Spurious Emission

### 1/2λ Dipole Antenna

|                        |                                |                                |
|------------------------|--------------------------------|--------------------------------|
| Report No.             | 12206316H                      |                                |
| Test place             | Ise EMC Lab.                   |                                |
| Semi Anechoic Chamber  | No.4                           | No.2                           |
| Date                   | March 21, 2018                 | March 23, 2018                 |
| Temperature / Humidity | 20 deg. C / 40 % RH            | 23 deg. C / 32 % RH            |
| Engineer               | Tomoki Matsui<br>(Above 1 GHz) | Koji Yamamoto<br>(Below 1 GHz) |
| Mode                   | Tx 2441 MHz                    |                                |

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|-------------|
| Hori     | 96.000             | QP       | 29.0              | 9.5                | 7.4          | 30.3         | -                   | 15.6               | 43.5              | 27.9           |             |
| Hori     | 128.000            | QP       | 29.3              | 13.4               | 7.7          | 30.1         | -                   | 20.3               | 43.5              | 23.2           |             |
| Hori     | 160.000            | QP       | 34.5              | 15.4               | 7.9          | 29.9         | -                   | 27.9               | 43.5              | 15.6           |             |
| Hori     | 208.008            | QP       | 32.1              | 11.5               | 8.2          | 29.6         | -                   | 22.2               | 43.5              | 21.3           |             |
| Hori     | 256.005            | QP       | 31.8              | 11.9               | 8.5          | 29.3         | -                   | 22.9               | 46.0              | 23.1           |             |
| Hori     | 304.005            | QP       | 32.6              | 13.5               | 8.9          | 29.2         | -                   | 25.8               | 46.0              | 20.2           |             |
| Hori     | 1220.510           | PK       | 48.2              | 25.0               | 4.9          | 34.1         | -                   | 44.0               | 73.9              | 29.9           |             |
| Hori     | 4882.000           | PK       | 42.1              | 31.9               | 7.4          | 31.2         | -                   | 50.2               | 73.9              | 23.7           |             |
| Hori     | 7323.000           | PK       | 42.2              | 36.6               | 9.5          | 32.4         | -                   | 55.9               | 73.9              | 18.0           | Floor noise |
| Hori     | 1220.510           | AV       | 43.6              | 25.0               | 4.9          | 34.1         | 0.1                 | 39.5               | 53.9              | 14.4           |             |
| Hori     | 4882.000           | AV       | 35.0              | 31.9               | 7.4          | 31.2         | 0.1                 | 43.2               | 53.9              | 10.7           |             |
| Hori     | 7323.000           | AV       | 32.3              | 36.6               | 9.5          | 32.4         | -                   | 46.0               | 53.9              | 7.9            | Floor noise |
| Vert     | 96.000             | QP       | 29.6              | 9.5                | 7.4          | 30.3         | -                   | 16.2               | 43.5              | 27.3           |             |
| Vert     | 128.000            | QP       | 28.7              | 13.4               | 7.7          | 30.1         | -                   | 19.7               | 43.5              | 23.8           |             |
| Vert     | 160.000            | QP       | 30.6              | 15.4               | 7.9          | 29.9         | -                   | 24.0               | 43.5              | 19.5           |             |
| Vert     | 208.008            | QP       | 30.3              | 11.5               | 8.2          | 29.6         | -                   | 20.4               | 43.5              | 23.1           |             |
| Vert     | 256.005            | QP       | 31.1              | 11.9               | 8.5          | 29.3         | -                   | 22.2               | 46.0              | 23.8           |             |
| Vert     | 304.005            | QP       | 33.8              | 13.5               | 8.9          | 29.2         | -                   | 27.0               | 46.0              | 19.0           |             |
| Vert     | 1220.510           | PK       | 47.9              | 25.0               | 4.9          | 34.1         | -                   | 43.7               | 73.9              | 30.2           |             |
| Vert     | 4882.000           | PK       | 41.7              | 31.9               | 7.4          | 31.2         | -                   | 49.8               | 73.9              | 24.1           |             |
| Vert     | 7323.000           | PK       | 42.2              | 36.6               | 9.5          | 32.4         | -                   | 55.9               | 73.9              | 18.0           | Floor noise |
| Vert     | 1220.510           | AV       | 43.3              | 25.0               | 4.9          | 34.1         | 0.1                 | 39.2               | 53.9              | 14.7           |             |
| Vert     | 4882.000           | AV       | 34.3              | 31.9               | 7.4          | 31.2         | 0.1                 | 42.5               | 53.9              | 11.4           |             |
| Vert     | 7323.000           | AV       | 32.3              | 36.6               | 9.5          | 32.4         | -                   | 46.0               | 53.9              | 7.9            | Floor noise |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

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

Distance factor:      1 GHz - 10 GHz      20log (4.0 m / 3.0 m) = 2.5 dB  
                                 10 GHz - 26.5 GHz      20log (1.0 m / 3.0 m) = -9.5 dB

#### 20dBc Data Sheet

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark  |
|----------|--------------------|----------|-------------------|-------------------------|--------------|--------------|--------------------|-------------------|----------------|---------|
| Hori     | 2441.000           | PK       | 98.7              | 27.4                    | 5.9          | 32.1         | 99.9               | -                 | -              | Carrier |
| Hori     | 9764.000           | PK       | 36.6              | 38.1                    | 10.2         | 32.7         | 52.2               | 79.9              | 27.7           |         |
| Vert     | 2441.000           | PK       | 97.1              | 27.4                    | 5.9          | 32.1         | 98.3               | -                 | -              | Carrier |
| Vert     | 9764.000           | PK       | 37.6              | 38.1                    | 10.2         | 32.7         | 53.2               | 78.3              | 25.1           |         |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Radiated Spurious Emission

### 1/2λ Dipole Antenna

|                        |                                |                                |
|------------------------|--------------------------------|--------------------------------|
| Report No.             | 12206316H                      |                                |
| Test place             | Ise EMC Lab.                   |                                |
| Semi Anechoic Chamber  | No.4                           | No.2                           |
| Date                   | March 22, 2018                 | March 23, 2018                 |
| Temperature / Humidity | 20 deg. C / 40 % RH            | 22 deg. C / 35 % RH            |
| Engineer               | Tomoki Matsui<br>(Above 1 GHz) | Koji Yamamoto<br>(Below 1 GHz) |
| Mode                   | Tx 2478 MHz                    |                                |

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|--------|
| Hori     | 96.000             | QP       | 28.8              | 9.5                | 7.4          | 30.3         | -                   | 15.4               | 43.5              | 28.1           |        |
| Hori     | 128.000            | QP       | 28.9              | 13.4               | 7.7          | 30.1         | -                   | 19.9               | 43.5              | 23.6           |        |
| Hori     | 160.000            | QP       | 33.8              | 15.4               | 7.9          | 29.9         | -                   | 27.2               | 43.5              | 16.3           |        |
| Hori     | 208.008            | QP       | 30.3              | 11.5               | 8.2          | 29.6         | -                   | 20.4               | 43.5              | 23.1           |        |
| Hori     | 256.005            | QP       | 31.3              | 11.9               | 8.5          | 29.3         | -                   | 22.4               | 46.0              | 23.6           |        |
| Hori     | 304.005            | QP       | 31.6              | 13.5               | 8.9          | 29.2         | -                   | 24.8               | 46.0              | 21.2           |        |
| Hori     | 1239.980           | PK       | 50.0              | 25.0               | 4.9          | 34.1         | -                   | 45.8               | 73.9              | 28.1           |        |
| Hori     | 2483.500           | PK       | 63.2              | 27.5               | 5.9          | 32.0         | -                   | 64.6               | 73.9              | 9.3            |        |
| Hori     | 4956.000           | PK       | 42.6              | 32.2               | 8.2          | 31.2         | -                   | 51.8               | 73.9              | 22.1           |        |
| Hori     | 7434.000           | PK       | 42.6              | 36.7               | 9.5          | 32.5         | -                   | 56.3               | 73.9              | 17.6           |        |
| Hori     | 1239.980           | AV       | 46.6              | 25.0               | 4.9          | 34.1         | 0.1                 | 42.5               | 53.9              | 11.4           |        |
| Hori     | 2483.500           | AV       | 41.3              | 27.5               | 5.9          | 32.0         | 0.1                 | 42.8               | 53.9              | 11.1           | *1)    |
| Hori     | 4956.000           | AV       | 33.8              | 32.2               | 8.2          | 31.2         | 0.1                 | 43.1               | 53.9              | 10.8           |        |
| Hori     | 7434.000           | AV       | 32.7              | 36.7               | 9.5          | 32.5         | 0.1                 | 46.5               | 53.9              | 7.4            |        |
| Vert     | 96.000             | QP       | 30.2              | 9.5                | 7.4          | 30.3         | -                   | 16.8               | 43.5              | 26.7           |        |
| Vert     | 128.000            | QP       | 31.0              | 13.4               | 7.7          | 30.1         | -                   | 22.0               | 43.5              | 21.5           |        |
| Vert     | 160.000            | QP       | 29.7              | 15.4               | 7.9          | 29.9         | -                   | 23.1               | 43.5              | 20.4           |        |
| Vert     | 208.008            | QP       | 29.6              | 11.5               | 8.2          | 29.6         | -                   | 19.7               | 43.5              | 23.8           |        |
| Vert     | 256.005            | QP       | 30.8              | 11.9               | 8.5          | 29.3         | -                   | 21.9               | 46.0              | 24.1           |        |
| Vert     | 304.005            | QP       | 34.7              | 13.5               | 8.9          | 29.2         | -                   | 27.9               | 46.0              | 18.1           |        |
| Vert     | 1239.980           | PK       | 48.4              | 25.0               | 4.9          | 34.1         | -                   | 44.2               | 73.9              | 29.7           |        |
| Vert     | 2483.500           | PK       | 65.3              | 27.5               | 5.9          | 32.0         | -                   | 66.7               | 73.9              | 7.2            |        |
| Vert     | 4956.000           | PK       | 43.6              | 32.2               | 8.2          | 31.2         | -                   | 52.8               | 73.9              | 21.1           |        |
| Vert     | 7434.000           | PK       | 41.9              | 36.7               | 9.5          | 32.5         | -                   | 55.6               | 73.9              | 18.3           |        |
| Vert     | 1239.980           | AV       | 42.4              | 25.0               | 4.9          | 34.1         | 0.1                 | 38.3               | 53.9              | 15.6           |        |
| Vert     | 2483.500           | AV       | 33.4              | 27.5               | 5.9          | 32.0         | 0.1                 | 34.9               | 53.9              | 19.0           | *1)    |
| Vert     | 4956.000           | AV       | 35.8              | 32.2               | 8.2          | 31.2         | 0.1                 | 45.1               | 53.9              | 8.8            |        |
| Vert     | 7434.000           | AV       | 31.9              | 36.7               | 9.5          | 32.5         | 0.1                 | 45.7               | 53.9              | 8.2            |        |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

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

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.5 dB  
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

#### 20dBc Data Sheet

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark  |
|----------|--------------------|----------|-------------------|-------------------------|--------------|--------------|--------------------|-------------------|----------------|---------|
| Hori     | 2478.000           | PK       | 96.2              | 27.5                    | 5.9          | 32.0         | 97.6               | -                 | -              | Carrier |
| Hori     | 9912.000           | PK       | 35.3              | 38.1                    | 10.2         | 32.8         | 50.8               | 77.6              | 26.8           |         |
| Vert     | 2478.000           | PK       | 96.1              | 27.5                    | 5.9          | 32.0         | 97.5               | -                 | -              | Carrier |
| Vert     | 9912.000           | PK       | 34.5              | 38.1                    | 10.2         | 32.8         | 50.0               | 77.5              | 27.5           |         |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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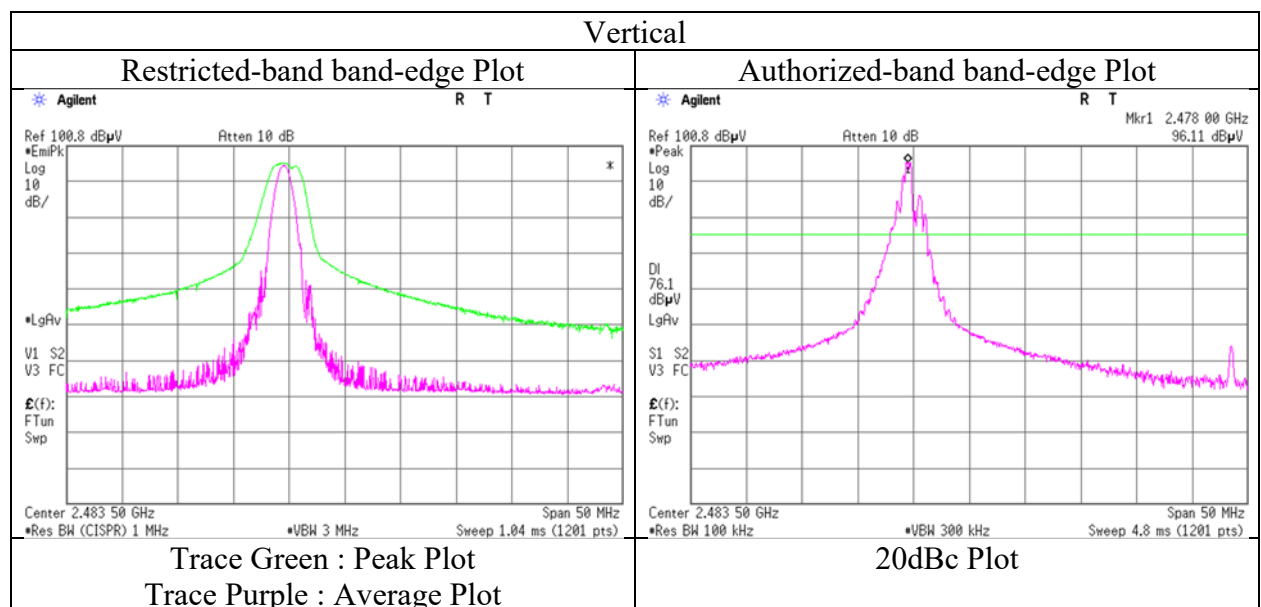
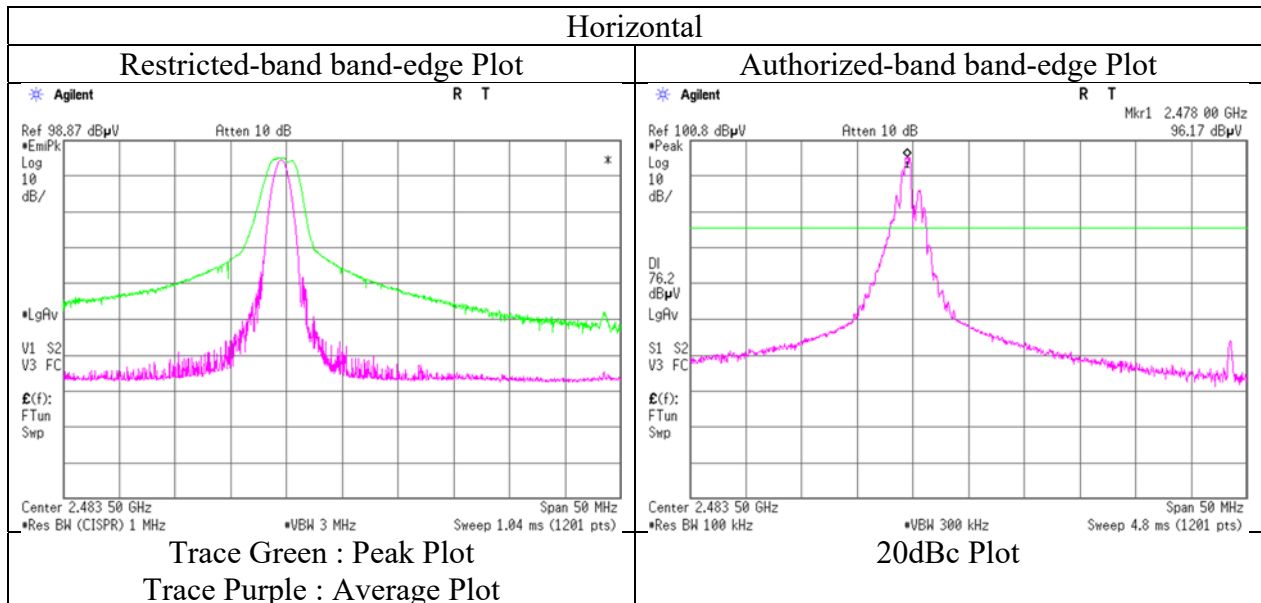
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**  
1/2λ Dipole Antenna

|                        |                     |
|------------------------|---------------------|
| Report No.             | 12206316H           |
| Test place             | Ise EMC Lab.        |
| Semi Anechoic Chamber  | No.4                |
| Date                   | March 22, 2018      |
| Temperature / Humidity | 20 deg. C / 40 % RH |
| Engineer               | Tomoki Matsui       |
|                        | (1 GHz - 10 GHz)    |
| Mode                   | Tx 2478 MHz         |



\* Final result of restricted band edge was shown in tabular data.

## Radiated Spurious Emission

### 1/2λ Dipole Antenna with Magnetic Base

|                        |                                   |                                 |                                |
|------------------------|-----------------------------------|---------------------------------|--------------------------------|
| Report No.             | 12206316H                         |                                 |                                |
| Test place             | Ise EMC Lab.                      |                                 |                                |
| Semi Anechoic Chamber  | No.4                              | No.4                            | No.2                           |
| Date                   | March 21, 2018                    | March 22, 2018                  | March 23, 2018                 |
| Temperature / Humidity | 21 deg. C / 37 % RH               | 20 deg. C / 40 % RH             | 22 deg. C / 35 % RH            |
| Engineer               | Koji Yamamoto<br>(1 GHz - 10 GHz) | Tomoki Matsui<br>(Above 10 GHz) | Koji Yamamoto<br>(Below 1 GHz) |
| Mode                   | Tx 2403 MHz                       |                                 |                                |

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|-------------|
| Hori     | 79.998             | QP       | 28.6              | 6.7                | 7.3          | 30.4         | -                   | 12.2               | 40.0              | 27.8           |             |
| Hori     | 208.008            | QP       | 29.2              | 11.5               | 8.2          | 29.6         | -                   | 19.3               | 43.5              | 24.2           |             |
| Hori     | 256.005            | QP       | 30.9              | 11.9               | 8.5          | 29.3         | -                   | 22.0               | 46.0              | 24.0           |             |
| Hori     | 304.005            | QP       | 30.6              | 13.5               | 8.9          | 29.2         | -                   | 23.8               | 46.0              | 22.2           |             |
| Hori     | 528.006            | QP       | 31.5              | 18.1               | 9.9          | 29.9         | -                   | 29.6               | 46.0              | 16.4           |             |
| Hori     | 600.004            | QP       | 26.3              | 19.1               | 10.2         | 29.7         | -                   | 25.9               | 46.0              | 20.1           |             |
| Hori     | 1201.493           | PK       | 54.1              | 25.0               | 4.9          | 34.2         | -                   | 49.8               | 73.9              | 24.1           |             |
| Hori     | 2390.000           | PK       | 56.4              | 27.4               | 5.9          | 32.1         | -                   | 57.6               | 73.9              | 16.3           |             |
| Hori     | 4806.000           | PK       | 46.1              | 31.7               | 8.1          | 31.3         | -                   | 54.6               | 73.9              | 19.3           |             |
| Hori     | 7209.000           | PK       | 42.6              | 36.5               | 9.5          | 32.4         | -                   | 56.2               | 73.9              | 17.7           | Floor noise |
| Hori     | 9612.000           | PK       | 42.5              | 38.0               | 10.2         | 32.6         | -                   | 58.1               | 73.9              | 15.8           | Floor noise |
| Hori     | 1201.493           | AV       | 51.4              | 25.0               | 4.9          | 34.2         | 0.1                 | 47.2               | 53.9              | 6.7            |             |
| Hori     | 2390.000           | AV       | 36.7              | 27.4               | 5.9          | 32.1         | 0.1                 | 38.0               | 53.9              | 15.9           | *1)         |
| Hori     | 4806.000           | AV       | 41.2              | 31.7               | 8.1          | 31.3         | 0.1                 | 49.8               | 53.9              | 4.1            |             |
| Hori     | 7209.000           | AV       | 32.7              | 36.5               | 9.5          | 32.4         | -                   | 46.3               | 53.9              | 7.6            | Floor noise |
| Hori     | 9612.000           | AV       | 32.1              | 38.0               | 10.2         | 32.6         | -                   | 47.7               | 53.9              | 6.2            | Floor noise |
| Vert     | 79.998             | QP       | 31.0              | 6.7                | 7.3          | 30.4         | -                   | 14.6               | 40.0              | 25.4           |             |
| Vert     | 208.008            | QP       | 29.8              | 11.5               | 8.2          | 29.6         | -                   | 19.9               | 43.5              | 23.6           |             |
| Vert     | 256.005            | QP       | 31.3              | 11.9               | 8.5          | 29.3         | -                   | 22.4               | 46.0              | 23.6           |             |
| Vert     | 304.005            | QP       | 32.5              | 13.5               | 8.9          | 29.2         | -                   | 25.7               | 46.0              | 20.3           |             |
| Vert     | 528.006            | QP       | 29.2              | 18.1               | 9.9          | 29.9         | -                   | 27.3               | 46.0              | 18.7           |             |
| Vert     | 600.004            | QP       | 29.8              | 19.1               | 10.2         | 29.7         | -                   | 29.4               | 46.0              | 16.6           |             |
| Vert     | 1201.493           | PK       | 49.9              | 25.0               | 4.9          | 34.2         | -                   | 45.6               | 73.9              | 28.3           |             |
| Vert     | 2390.000           | PK       | 59.4              | 27.4               | 5.9          | 32.1         | -                   | 60.6               | 73.9              | 13.3           |             |
| Vert     | 4806.000           | PK       | 44.5              | 31.7               | 8.1          | 31.3         | -                   | 53.0               | 73.9              | 20.9           |             |
| Vert     | 7209.000           | PK       | 42.6              | 36.5               | 9.5          | 32.4         | -                   | 56.2               | 73.9              | 17.7           | Floor noise |
| Vert     | 9612.000           | PK       | 42.5              | 38.0               | 10.2         | 32.6         | -                   | 58.1               | 73.9              | 15.8           | Floor noise |
| Vert     | 1201.493           | AV       | 45.4              | 25.0               | 4.9          | 34.2         | 0.1                 | 41.2               | 53.9              | 12.7           |             |
| Vert     | 2390.000           | AV       | 39.3              | 27.4               | 5.9          | 32.1         | 0.1                 | 40.6               | 53.9              | 13.3           | *1)         |
| Vert     | 4806.000           | AV       | 39.2              | 31.7               | 8.1          | 31.3         | 0.1                 | 47.8               | 53.9              | 6.1            |             |
| Vert     | 7209.000           | AV       | 32.7              | 36.5               | 9.5          | 32.4         | -                   | 46.3               | 53.9              | 7.6            | Floor noise |
| Vert     | 9612.000           | AV       | 32.1              | 38.0               | 10.2         | 32.6         | -                   | 47.7               | 53.9              | 6.2            | Floor noise |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

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

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.5 dB  
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

#### 20dBc Data Sheet

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark  |
|----------|--------------------|----------|-------------------|-------------------------|--------------|--------------|--------------------|-------------------|----------------|---------|
| Hori     | 2403.000           | PK       | 95.7              | 27.4                    | 5.9          | 32.1         | 96.9               | -                 | -              | Carrier |
| Hori     | 2400.000           | PK       | 54.2              | 27.4                    | 5.9          | 32.1         | 55.4               | 76.9              | 21.5           |         |
| Vert     | 2403.000           | PK       | 96.2              | 27.4                    | 5.9          | 32.1         | 97.4               | -                 | -              | Carrier |
| Vert     | 2400.000           | PK       | 55.5              | 27.4                    | 5.9          | 32.1         | 56.7               | 77.4              | 20.7           |         |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

**UL Japan, Inc.**

**Ise EMC Lab.**

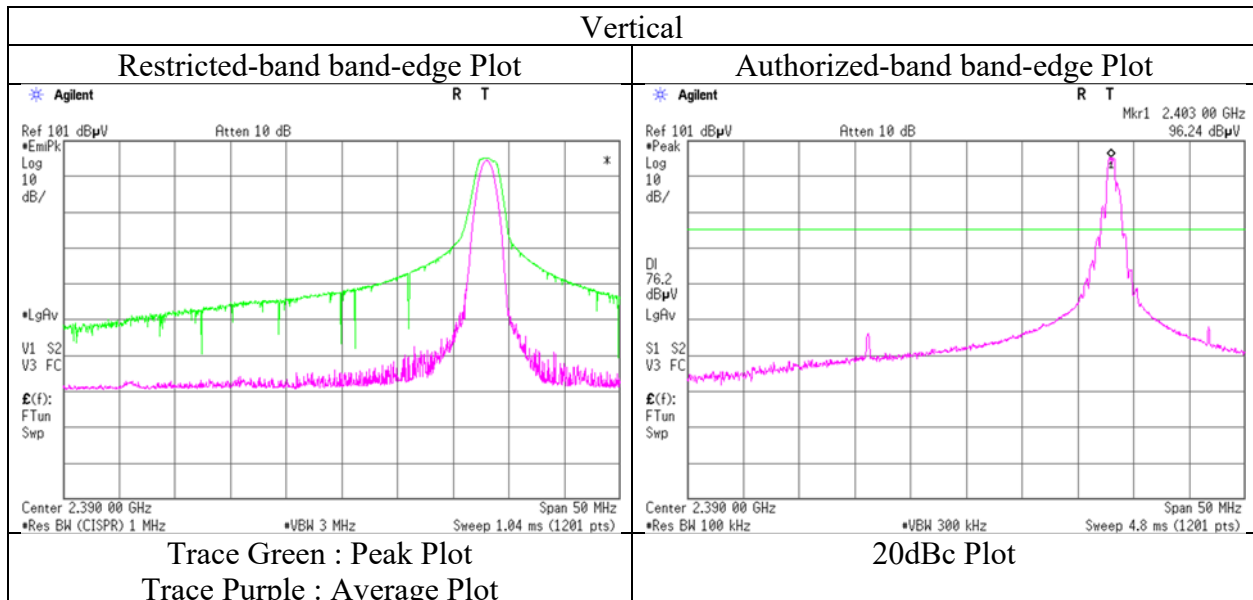
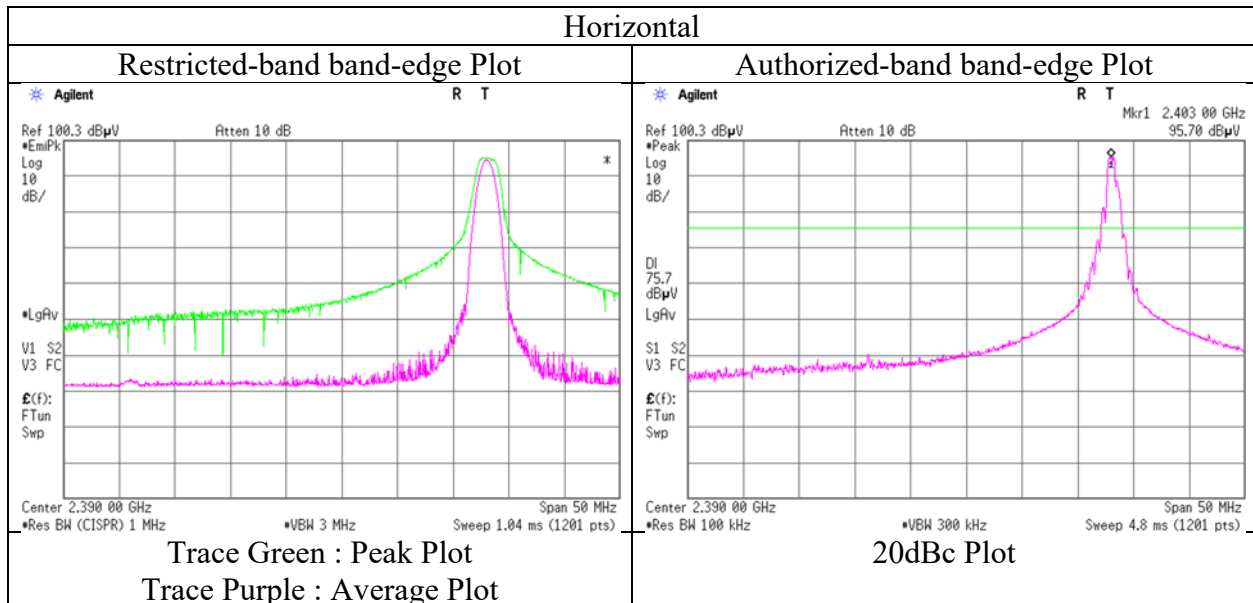
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**  
1/2λ Dipole Antenna with Magnetic Base

|                        |                     |
|------------------------|---------------------|
| Report No.             | 12206316H           |
| Test place             | Ise EMC Lab.        |
| Semi Anechoic Chamber  | No.4                |
| Date                   | March 21, 2018      |
| Temperature / Humidity | 21 deg. C / 37 % RH |
| Engineer               | Koji Yamamoto       |
|                        | (1 GHz - 10 GHz)    |
| Mode                   | Tx 2403 MHz         |



\* Final result of restricted band edge was shown in tabular data.

## Radiated Spurious Emission

### 1/2λ Dipole Antenna with Magnetic Base

|                        |                                   |                                 |                                |
|------------------------|-----------------------------------|---------------------------------|--------------------------------|
| Report No.             | 12206316H                         |                                 |                                |
| Test place             | Ise EMC Lab.                      |                                 |                                |
| Semi Anechoic Chamber  | No.4                              | No.4                            | No.2                           |
| Date                   | March 21, 2018                    | March 22, 2018                  | March 23, 2018                 |
| Temperature / Humidity | 21 deg. C / 37 % RH               | 20 deg. C / 40 % RH             | 22 deg. C / 35 % RH            |
| Engineer               | Koji Yamamoto<br>(1 GHz - 10 GHz) | Tomoki Matsui<br>(Above 10 GHz) | Koji Yamamoto<br>(Below 1 GHz) |
| Mode                   | Tx 2441 MHz                       |                                 |                                |

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|-------------|
| Hori     | 79.998             | QP       | 28.6              | 6.7                | 7.3          | 30.4         | -                   | 12.2               | 40.0              | 27.8           |             |
| Hori     | 160.000            | QP       | 34.6              | 15.4               | 7.9          | 29.9         | -                   | 28.0               | 43.5              | 15.5           |             |
| Hori     | 208.008            | QP       | 29.1              | 11.5               | 8.2          | 29.6         | -                   | 19.2               | 43.5              | 24.3           |             |
| Hori     | 256.005            | QP       | 30.7              | 11.9               | 8.5          | 29.3         | -                   | 21.8               | 46.0              | 24.2           |             |
| Hori     | 304.005            | QP       | 33.2              | 13.5               | 8.9          | 29.2         | -                   | 26.4               | 46.0              | 19.6           |             |
| Hori     | 528.006            | QP       | 29.1              | 18.1               | 9.9          | 29.9         | -                   | 27.2               | 46.0              | 18.8           |             |
| Hori     | 1220.510           | PK       | 50.8              | 25.0               | 4.9          | 34.1         | -                   | 46.6               | 73.9              | 27.3           |             |
| Hori     | 4882.000           | PK       | 43.7              | 31.9               | 8.2          | 31.2         | -                   | 52.6               | 73.9              | 21.3           |             |
| Hori     | 7323.000           | PK       | 41.8              | 36.6               | 9.5          | 32.4         | -                   | 55.5               | 73.9              | 18.4           | Floor noise |
| Hori     | 9764.000           | PK       | 42.0              | 38.1               | 10.2         | 32.7         | -                   | 57.6               | 73.9              | 16.3           | Floor noise |
| Hori     | 1220.510           | AV       | 46.3              | 25.0               | 4.9          | 34.1         | 0.1                 | 42.2               | 53.9              | 11.7           |             |
| Hori     | 4882.000           | AV       | 38.0              | 31.9               | 8.2          | 31.2         | 0.1                 | 47.0               | 53.9              | 6.9            |             |
| Hori     | 7323.000           | AV       | 32.6              | 36.6               | 9.5          | 32.4         | -                   | 46.3               | 53.9              | 7.6            | Floor noise |
| Hori     | 9764.000           | AV       | 32.2              | 38.1               | 10.2         | 32.7         | -                   | 47.8               | 53.9              | 6.1            | Floor noise |
| Vert     | 79.998             | QP       | 33.2              | 6.7                | 7.3          | 30.4         | -                   | 16.8               | 40.0              | 23.2           |             |
| Vert     | 160.000            | QP       | 29.7              | 15.4               | 7.9          | 29.9         | -                   | 23.1               | 43.5              | 20.4           |             |
| Vert     | 208.008            | QP       | 30.7              | 11.5               | 8.2          | 29.6         | -                   | 20.8               | 43.5              | 22.7           |             |
| Vert     | 256.005            | QP       | 31.1              | 11.9               | 8.5          | 29.3         | -                   | 22.2               | 46.0              | 23.8           |             |
| Vert     | 304.005            | QP       | 34.8              | 13.5               | 8.9          | 29.2         | -                   | 28.0               | 46.0              | 18.0           |             |
| Vert     | 528.006            | QP       | 29.2              | 18.1               | 9.9          | 29.9         | -                   | 27.3               | 46.0              | 18.7           |             |
| Vert     | 1220.510           | PK       | 48.2              | 25.0               | 4.9          | 34.1         | -                   | 44.0               | 73.9              | 29.9           |             |
| Vert     | 4882.000           | PK       | 42.3              | 31.9               | 8.2          | 31.2         | -                   | 51.2               | 73.9              | 22.7           |             |
| Vert     | 7323.000           | PK       | 41.8              | 36.6               | 9.5          | 32.4         | -                   | 55.5               | 73.9              | 18.4           | Floor noise |
| Vert     | 9764.000           | PK       | 42.0              | 38.1               | 10.2         | 32.7         | -                   | 57.6               | 73.9              | 16.3           | Floor noise |
| Vert     | 1220.510           | AV       | 42.1              | 25.0               | 4.9          | 34.1         | 0.1                 | 38.0               | 53.9              | 15.9           |             |
| Vert     | 4882.000           | AV       | 35.9              | 31.9               | 8.2          | 31.2         | 0.1                 | 44.9               | 53.9              | 9.0            |             |
| Vert     | 7323.000           | AV       | 32.6              | 36.6               | 9.5          | 32.4         | -                   | 46.3               | 53.9              | 7.6            | Floor noise |
| Vert     | 9764.000           | AV       | 32.2              | 38.1               | 10.2         | 32.7         | -                   | 47.8               | 53.9              | 6.1            | Floor noise |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

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

Distance factor:      1 GHz - 10 GHz      20log (4.0 m / 3.0 m) = 2.5 dB  
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

## Radiated Spurious Emission

### 1/2λ Dipole Antenna with Magnetic Base

|                        |                                   |                                 |                                |
|------------------------|-----------------------------------|---------------------------------|--------------------------------|
| Report No.             | 12206316H                         |                                 |                                |
| Test place             | Ise EMC Lab.                      |                                 |                                |
| Semi Anechoic Chamber  | No.4                              | No.4                            | No.2                           |
| Date                   | March 21, 2018                    | March 22, 2018                  | March 23, 2018                 |
| Temperature / Humidity | 21 deg. C / 37 % RH               | 20 deg. C / 40 % RH             | 22 deg. C / 35 % RH            |
| Engineer               | Koji Yamamoto<br>(1 GHz - 10 GHz) | Tomoki Matsui<br>(Above 10 GHz) | Koji Yamamoto<br>(Below 1 GHz) |
| Mode                   | Tx 2478 MHz                       |                                 |                                |

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|-------------|
| Hori     | 80.000             | QP       | 28.5              | 6.7                | 7.3          | 30.4         | -                   | 12.1               | 40.0              | 27.9           |             |
| Hori     | 160.000            | QP       | 33.8              | 15.4               | 7.9          | 29.9         | -                   | 27.2               | 43.5              | 16.3           |             |
| Hori     | 208.008            | QP       | 29.6              | 11.5               | 8.2          | 29.6         | -                   | 19.7               | 43.5              | 23.8           |             |
| Hori     | 256.005            | QP       | 31.6              | 11.9               | 8.5          | 29.3         | -                   | 22.7               | 46.0              | 23.3           |             |
| Hori     | 304.005            | QP       | 30.8              | 13.5               | 8.9          | 29.2         | -                   | 24.0               | 46.0              | 22.0           |             |
| Hori     | 528.006            | QP       | 29.3              | 18.1               | 9.9          | 29.9         | -                   | 27.4               | 46.0              | 18.6           |             |
| Hori     | 1239.000           | PK       | 55.3              | 25.0               | 4.9          | 34.1         | -                   | 51.1               | 73.9              | 22.8           |             |
| Hori     | 2483.500           | PK       | 59.7              | 27.5               | 5.9          | 32.0         | -                   | 61.1               | 73.9              | 12.8           |             |
| Hori     | 4956.000           | PK       | 42.9              | 32.2               | 8.2          | 31.2         | -                   | 52.1               | 73.9              | 21.8           |             |
| Hori     | 7434.000           | PK       | 41.3              | 36.7               | 9.5          | 32.5         | -                   | 55.0               | 73.9              | 18.9           | Floor noise |
| Hori     | 9912.000           | PK       | 42.2              | 38.1               | 10.2         | 32.8         | -                   | 57.7               | 73.9              | 16.2           | Floor noise |
| Hori     | 1239.000           | AV       | 53.0              | 25.0               | 4.9          | 34.1         | 0.1                 | 48.9               | 53.9              | 5.0            |             |
| Hori     | 2483.500           | AV       | 39.3              | 27.5               | 5.9          | 32.0         | 0.1                 | 40.8               | 53.9              | 13.1           | *1)         |
| Hori     | 4956.000           | AV       | 35.1              | 32.2               | 8.2          | 31.2         | 0.1                 | 44.4               | 53.9              | 9.5            |             |
| Hori     | 7434.000           | AV       | 31.2              | 36.7               | 9.5          | 32.5         | -                   | 44.9               | 53.9              | 9.0            | Floor noise |
| Hori     | 9912.000           | AV       | 31.9              | 38.1               | 10.2         | 32.8         | -                   | 47.4               | 53.9              | 6.5            | Floor noise |
| Vert     | 80.000             | QP       | 33.5              | 6.7                | 7.3          | 30.4         | -                   | 17.1               | 40.0              | 22.9           |             |
| Vert     | 160.000            | QP       | 29.7              | 15.4               | 7.9          | 29.9         | -                   | 23.1               | 43.5              | 20.4           |             |
| Vert     | 208.008            | QP       | 30.5              | 11.5               | 8.2          | 29.6         | -                   | 20.6               | 43.5              | 22.9           |             |
| Vert     | 256.005            | QP       | 33.1              | 11.9               | 8.5          | 29.3         | -                   | 24.2               | 46.0              | 21.8           |             |
| Vert     | 304.005            | QP       | 33.9              | 13.5               | 8.9          | 29.2         | -                   | 27.1               | 46.0              | 18.9           |             |
| Vert     | 528.006            | QP       | 29.3              | 18.1               | 9.9          | 29.9         | -                   | 27.4               | 46.0              | 18.6           |             |
| Vert     | 1239.000           | PK       | 49.2              | 25.0               | 4.9          | 34.1         | -                   | 45.0               | 73.9              | 28.9           |             |
| Vert     | 2483.500           | PK       | 62.0              | 27.5               | 5.9          | 32.0         | -                   | 63.4               | 73.9              | 10.5           |             |
| Vert     | 4956.000           | PK       | 42.5              | 32.2               | 8.2          | 31.2         | -                   | 51.7               | 73.9              | 22.2           |             |
| Vert     | 7434.000           | PK       | 41.3              | 36.7               | 9.5          | 32.5         | -                   | 55.0               | 73.9              | 18.9           | Floor noise |
| Vert     | 9912.000           | PK       | 42.2              | 38.1               | 10.2         | 32.8         | -                   | 57.7               | 73.9              | 16.2           | Floor noise |
| Vert     | 1239.000           | AV       | 45.6              | 25.0               | 4.9          | 34.1         | 0.1                 | 41.5               | 53.9              | 12.4           |             |
| Vert     | 2483.500           | AV       | 41.3              | 27.5               | 5.9          | 32.0         | 0.1                 | 42.8               | 53.9              | 11.1           | *1)         |
| Vert     | 4956.000           | AV       | 33.7              | 32.2               | 8.2          | 31.2         | 0.1                 | 43.0               | 53.9              | 10.9           |             |
| Vert     | 7434.000           | AV       | 31.2              | 36.7               | 9.5          | 32.5         | -                   | 44.9               | 53.9              | 9.0            | Floor noise |
| Vert     | 9912.000           | AV       | 31.9              | 38.1               | 10.2         | 32.8         | -                   | 47.4               | 53.9              | 6.5            | Floor noise |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

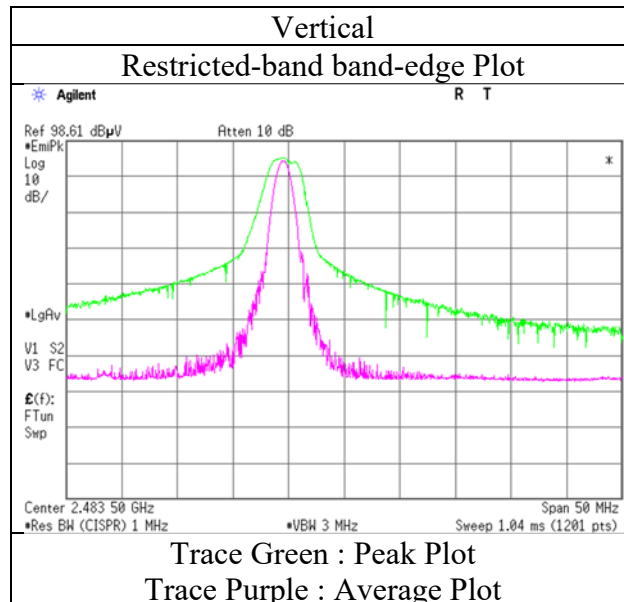
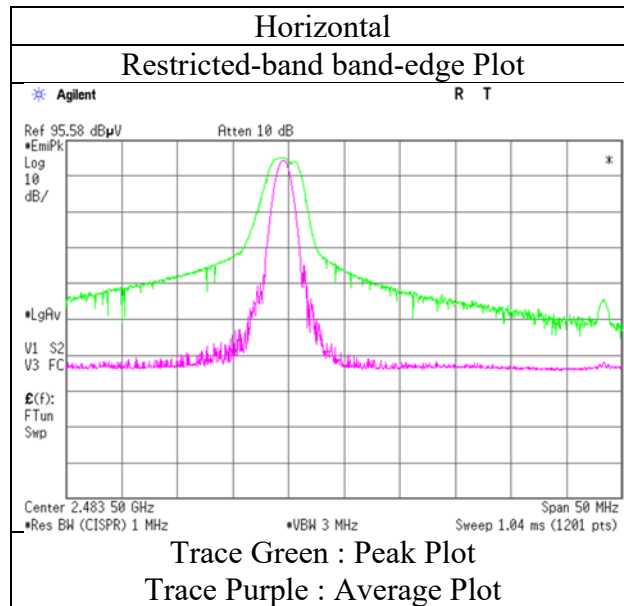
\*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.5 dB  
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**  
1/2λ Dipole Antenna with Magnetic Base

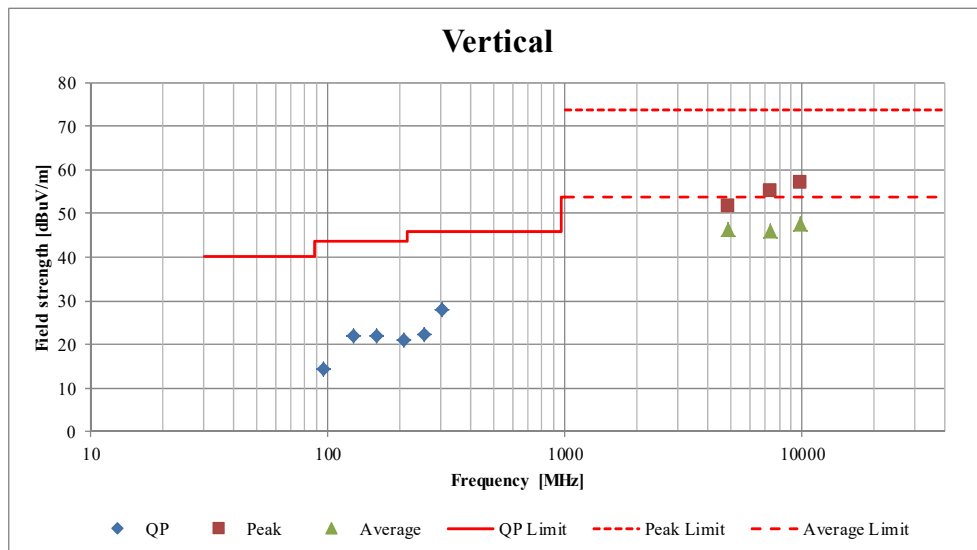
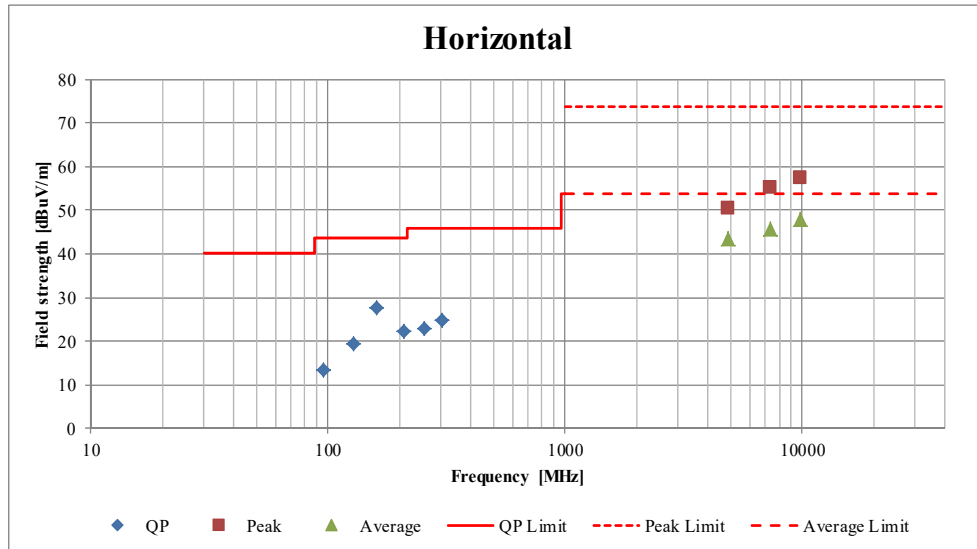
|                        |                                   |
|------------------------|-----------------------------------|
| Report No.             | 12206316H                         |
| Test place             | Ise EMC Lab.                      |
| Semi Anechoic Chamber  | No.4                              |
| Date                   | March 21, 2018                    |
| Temperature / Humidity | 21 deg. C / 37 % RH               |
| Engineer               | Koji Yamamoto<br>(1 GHz - 10 GHz) |
| Mode                   | Tx 2478 MHz                       |



\* Final result of restricted band edge was shown in tabular data.

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

|                        |                                    |                     |                     |
|------------------------|------------------------------------|---------------------|---------------------|
| Report No.             | 12206316H                          |                     |                     |
| Test place             | Ise EMC Lab.                       |                     |                     |
| Semi Anechoic Chamber  | No.4                               | No.4                | No.2                |
| Date                   | March 21, 2018                     | March 22, 2018      | March 23, 2018      |
| Temperature / Humidity | 21 deg. C / 38 % RH                | 20 deg. C / 40 % RH | 22 deg. C / 35 % RH |
| Engineer               | Koji Yamamoto                      | Tomoki Matsui       | Koji Yamamoto       |
|                        | (1 GHz - 10 GHz)                   | (Above 10 GHz)      | (Below 1 GHz)       |
| Mode                   | Tx 2441 MHz (1/4λ Dipole antenna ) |                     |                     |



\*These plots data contains sufficient number to show the trend of characteristic features for EUT.

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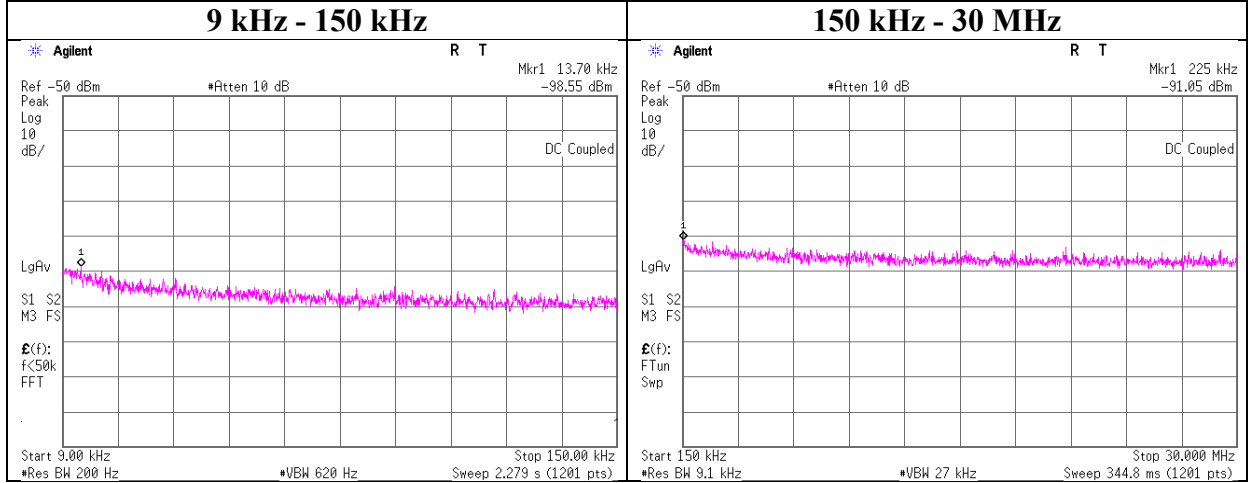
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Conducted Spurious Emission

|                        |                                    |
|------------------------|------------------------------------|
| Test place             | Ise EMC Lab. No.6 Measurement Room |
| Report No.             | 12206316H                          |
| Date                   | March 16, 2018                     |
| Temperature / Humidity | 22 deg. C / 51 % RH                |
| Engineer               | Masafumi Niwa                      |
| Mode                   | Tx 2403 MHz                        |



| Frequency<br>[kHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Attenuator<br>Loss<br>[dB] | Antenna<br>Gain<br>[dBi] | N<br>(Number<br>of Output) | EIRP<br>[dBm] | Distance<br>[m] | Ground<br>bounce<br>[dB] | E<br>(field strength)<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|--------------------|------------------|-----------------------|----------------------------|--------------------------|----------------------------|---------------|-----------------|--------------------------|-----------------------------------|-------------------|----------------|--------|
| 13.70              | -98.6            | 1.20                  | 9.8                        | 3.0                      | 1                          | -84.5         | 300             | 6.0                      | -23.3                             | 44.8              | 68.1           |        |
| 225.00             | -91.1            | 1.20                  | 9.8                        | 3.0                      | 1                          | -77.0         | 300             | 6.0                      | -15.8                             | 20.5              | 36.3           |        |

$E [dBuV/m] = EIRP [dBm] - 20 \log (Distance [m]) + Ground\ bounce [dB] + 104.8 [dBuV/m]$

$EIRP [dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB] + Antenna\ gain [dBi] + 10 * \log (N)$

N: Number of output

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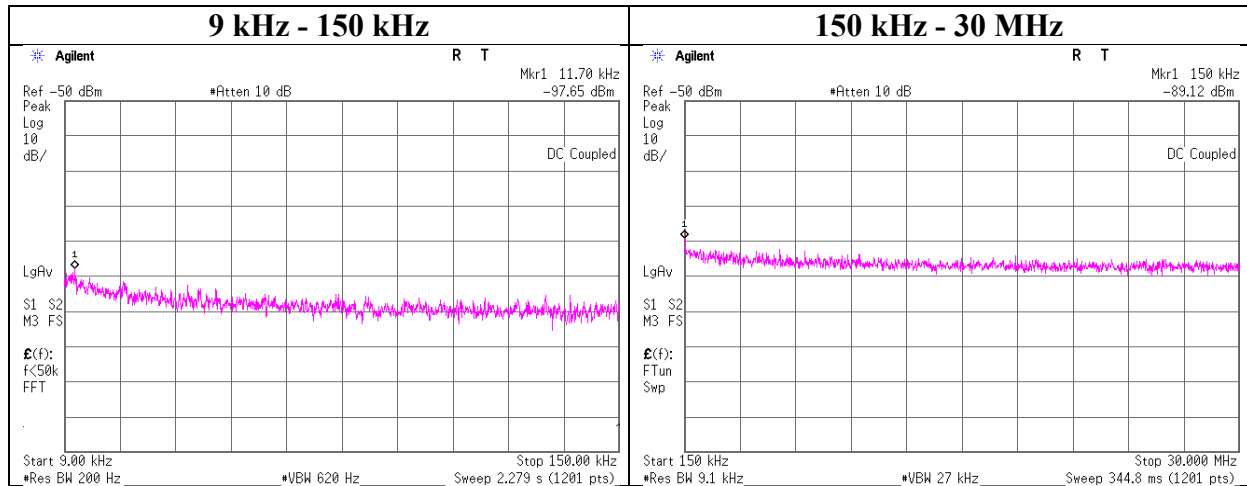
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Facsimile : +81 596 24 8124

## Conducted Spurious Emission

|                        |                                    |
|------------------------|------------------------------------|
| Test place             | Ise EMC Lab. No.6 Measurement Room |
| Report No.             | 12206316H                          |
| Date                   | March 16, 2018                     |
| Temperature / Humidity | 22 deg. C / 51 % RH                |
| Engineer               | Masafumi Niwa                      |
| Mode                   | Tx 2441 MHz                        |



| Frequency<br>[kHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Attenuator<br>Loss<br>[dB] | Antenna<br>Gain<br>[dBi] | N<br>(Number<br>of Output) | EIRP<br>[dBm] | Distance<br>[m] | Ground<br>bounce<br>[dB] | E<br>(field strength)<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|--------------------|------------------|-----------------------|----------------------------|--------------------------|----------------------------|---------------|-----------------|--------------------------|-----------------------------------|-------------------|----------------|--------|
| 11.70              | -97.7            | 1.20                  | 9.8                        | 3.0                      | 1                          | -83.6         | 300             | 6.0                      | -22.4                             | 46.2              | 68.6           |        |
| 150.00             | -89.1            | 1.20                  | 9.8                        | 3.0                      | 1                          | -75.1         | 300             | 6.0                      | -13.8                             | 24.0              | 37.8           |        |

$E [dBuV/m] = EIRP [dBm] - 20 \log (Distance [m]) + Ground\ bounce [dB] + 104.8 [dBuV/m]$

$EIRP[dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB] + Antenna\ gain [dBi] + 10 * \log (N)$

N: Number of output

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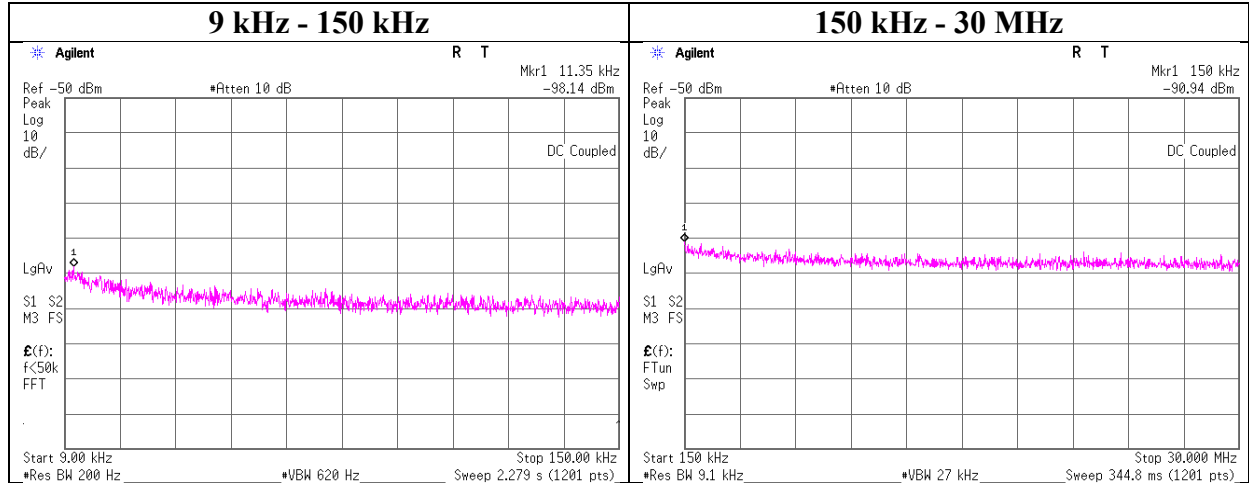
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## Conducted Spurious Emission

|                        |                                    |
|------------------------|------------------------------------|
| Test place             | Ise EMC Lab. No.6 Measurement Room |
| Report No.             | 12206316H                          |
| Date                   | March 16, 2018                     |
| Temperature / Humidity | 22 deg. C / 51 % RH                |
| Engineer               | Masafumi Niwa                      |
| Mode                   | Tx 2478 MHz                        |



| Frequency<br>[kHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Attenuator<br>Loss<br>[dB] | Antenna<br>Gain<br>[dBi] | N<br>(Number<br>of Output) | EIRP<br>[dBm] | Distance<br>[m] | Ground<br>bounce<br>[dB] | E<br>(field strength)<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|--------------------|------------------|-----------------------|----------------------------|--------------------------|----------------------------|---------------|-----------------|--------------------------|-----------------------------------|-------------------|----------------|--------|
| 11.35              | -98.1            | 1.20                  | 9.8                        | 3.0                      | 1                          | -84.1         | 300             | 6.0                      | -22.9                             | 46.5              | 69.4           |        |
| 150.00             | -90.9            | 1.20                  | 9.8                        | 3.0                      | 1                          | -76.9         | 300             | 6.0                      | -15.7                             | 24.0              | 39.7           |        |

$E \text{ [dBuV/m]} = \text{EIRP [dBm]} - 20 \log(\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8 \text{ [dBuV/m]}$

$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$

N: Number of output

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### **Power Density**

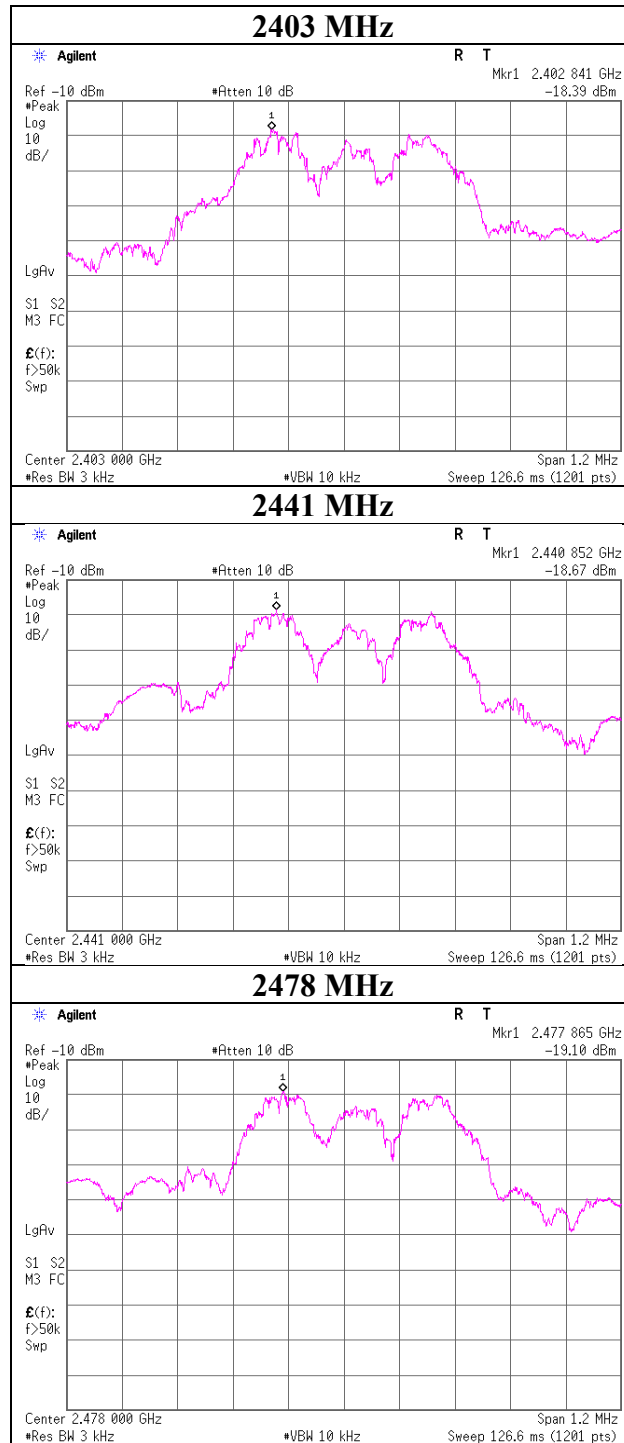
Test place Ise EMC Lab. No.6 Measurement Room  
Report No. 12206316H  
Date March 16, 2018  
Temperature / Humidity 22 deg. C / 51 % RH  
Engineer Masafumi Niwa  
Mode Tx

| Freq.   | Reading | Cable | Atten. | Result | Limit | Margin |
|---------|---------|-------|--------|--------|-------|--------|
| [MHz]   | [dBm]   | Loss  | Loss   | [dBm]  | [dBm] | [dB]   |
|         |         | [dB]  | [dB]   |        |       |        |
| 2403.00 | -18.39  | 1.20  | 10.04  | -7.15  | 8.00  | 15.15  |
| 2441.00 | -18.67  | 1.20  | 10.04  | -7.43  | 8.00  | 15.43  |
| 2478.00 | -19.10  | 1.20  | 10.04  | -7.86  | 8.00  | 15.86  |

Sample Calculation:

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

## Power Density



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## APPENDIX 2: Test instruments

### Test Instruments

| Control No. | Instrument                       | Manufacturer         | Model No                                               | Serial No                       | Test Item | Calibration Date *<br>Interval(month) |
|-------------|----------------------------------|----------------------|--------------------------------------------------------|---------------------------------|-----------|---------------------------------------|
| MAEC-04     | Semi Anechoic Chamber(NSA)       | TDK                  | Semi Anechoic Chamber 3m                               | DA-10005                        | RE        | 2017/10/30 * 12                       |
| MOS-15      | Thermo-Hygrometer                | Custom               | CTH-180                                                | 1501                            | RE        | 2018/01/24 * 12                       |
| MJM-26      | Measure                          | KOMELON              | KMC-36                                                 | -                               | RE        | -                                     |
| COTS-MEMI   | EMI measurement program          | TSJ                  | TEPTO-DV                                               | -                               | RE/CE     | -                                     |
| MRENT-130   | Spectrum Analyzer                | Agilent              | E4440A                                                 | MY46187750                      | RE        | 2017/11/17 * 12                       |
| MHA-21      | Horn Antenna 1-18GHz             | Schwarzbeck          | BBHA9120D                                              | 9120D-557                       | RE        | 2017/09/15 * 12                       |
| MCC-141     | Microwave Cable                  | Junkosha             | MWX221                                                 | 1305S002R(1m) /<br>1405S146(5m) | RE        | 2017/06/23 * 12                       |
| MPA-12      | MicroWave System Amplifier       | Agilent              | 83017A                                                 | 00650                           | RE        | 2017/10/06 * 12                       |
| MHF-26      | High Pass Filter 3.5-18.0GHz     | UL Japan             | HPF SELECTOR                                           | 002                             | RE        | 2017/09/11 * 12                       |
| MMM-10      | DIGITAL HiTESTER                 | Hioki                | 3805                                                   | 051201148                       | RE        | 2018/01/09 * 12                       |
| MHA-17      | Horn Antenna 15-40GHz            | Schwarzbeck          | BBHA9170                                               | BBHA9170307                     | RE        | 2017/06/30 * 12                       |
| MAEC-02     | Semi Anechoic Chamber(NSA)       | TDK                  | Semi Anechoic Chamber 3m                               | DA-06902                        | RE/CE     | 2017/08/31 * 12                       |
| MOS-22      | Thermo-Hygrometer                | Custom               | CTH-201                                                | 0003                            | RE/CE     | 2017/12/21 * 12                       |
| MJM-14      | Measure                          | KOMELON              | KMC-36                                                 | -                               | RE/CE     | -                                     |
| MSA-16      | Spectrum Analyzer                | Agilent              | E4440A                                                 | MY46186390                      | RE/CE     | 2017/09/20 * 12                       |
| MTR-03      | Test Receiver                    | Rohde & Schwarz      | ESCI                                                   | 100300                          | RE/CE     | 2017/08/21 * 12                       |
| MLS-23      | LISN(AMN)                        | Schwarzbeck          | NSLK8127                                               | 8127-729                        | CE(EUT)   | 2017/07/24 * 12                       |
| MCC-13      | Coaxial Cable                    | Fujikura             | 3D-2W(12m)/<br>5D-2W(5m)/<br>5D-2W(0.8m)/<br>5D-2W(1m) | -                               | CE        | 2018/02/23 * 12                       |
| MAT-65      | Attenuator(13dB)                 | JFW Industries, Inc. | 50FP-013H2 N                                           | -                               | CE        | 2017/12/19 * 12                       |
| MMM-01      | Digital Tester                   | Fluke                | FLUKE 26-3                                             | 78030611                        | RE/CE     | 2017/08/07 * 12                       |
| MBA-08      | Biconical Antenna                | Schwarzbeck          | VHA9103B                                               | 08031                           | RE        | 2017/09/13 * 12                       |
| MLA-21      | Logperiodic Antenna(200-1000MHz) | Schwarzbeck          | VUSLP9111B                                             | 911B-190                        | RE        | 2017/12/10 * 12                       |
| MCC-12      | Coaxial Cable                    | Fujikura/Agilent     | -                                                      | -                               | RE        | 2018/02/23 * 12                       |
| MAT-07      | Attenuator(6dB)                  | Weinschel Corp       | 2                                                      | BK7970                          | RE        | 2017/11/14 * 12                       |
| MPA-09      | Pre Amplifier                    | Agilent              | 8447D                                                  | 2944A10845                      | RE        | 2017/09/27 * 12                       |
| MSA-13      | Spectrum Analyzer                | Agilent              | E4440A                                                 | MY46185823                      | AT        | 2017/11/16 * 12                       |
| MPM-13      | Power Meter                      | Anritsu              | ML2495A                                                | 0824014                         | AT        | 2017/11/16 * 12                       |
| MPSE-18     | Power sensor                     | Anritsu              | MA2411B                                                | 0738174                         | AT        | 2017/11/16 * 12                       |
| MAT-22      | Attenuator(10dB) 1-18GHz         | Orient Microwave     | BX10-0476-00                                           | -                               | AT        | 2018/03/12 * 12                       |
| MAT-10      | Attenuator(10dB)                 | Weinschel Corp       | 2                                                      | BL1173                          | AT        | 2017/11/14 * 12                       |
| MMM-12      | DIGITAL HiTESTER                 | Hioki                | 3805                                                   | 060500120                       | AT        | 2018/02/07 * 12                       |
| MOS-14      | Thermo-Hygrometer                | Custom               | CTH-201                                                | 1401                            | AT        | 2018/01/24 * 12                       |

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

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

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

Test item: CE: Conducted Emission test  
RE: Radiated Emission test  
AT: Antenna Terminal Conducted test

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124