



# **RADIO TEST REPORT**

**Test Report No. : 12547242H-A-R1**

**Applicant** : Roland Corporation  
**Type of Equipment** : Wireless Transmitter  
**Model No.** : WL-60T  
**FCC ID** : SOP421721A  
**Test regulation** : FCC Part 15 Subpart C: 2018  
**Test Result** : Complied (Refer to SECTION 3.2)

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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 covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
6. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
7. 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.
8. The information provided from the customer for this report is identified in SECTION 1.
9. This report is a revised version of 12547242H-A. 12547242H-A is replaced with this report.

**Date of test:** February 26 to 28, 2019

**Representative test engineer:**

  
Akihiko Maeda  
Engineer  
Consumer Technology Division

**Approved by:**

  
Tsubasa Takayama  
Leader  
Consumer Technology Division



NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.  
\*As for the range of Accreditation in NVLAP, you may refer to the WEB address,  
[http://japan.ul.com/resources/emc\\_accredited/](http://japan.ul.com/resources/emc_accredited/)

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

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## REVISION HISTORY

**Original Test Report No.: 12547242H-A**

[illegible]

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## **SECTION 1: Customer information**

|                  |   |                                                                  |
|------------------|---|------------------------------------------------------------------|
| Company Name     | : | Roland Corporation                                               |
| Address          | : | 1-5-3 Shinmiyakoda, Kita-ku, Hamamatsu, Shizuoka 431-2103, JAPAN |
| Telephone Number | : | +81-53-428-5101                                                  |
| Facsimile Number | : | +81-53-428-5109                                                  |
| Contact Person   | : | Hiroshi Yamate                                                   |

The information provided from the customer is as follows;

- Applicant, Type of Equipment, Model No., FCC ID on the cover and other relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (E.U.T.)
- SECTION 4: Operation of E.U.T. during testing

\* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

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

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

|                              |   |                                                                   |
|------------------------------|---|-------------------------------------------------------------------|
| Type of Equipment            | : | Wireless Transmitter                                              |
| Model No.                    | : | WL-60T                                                            |
| Serial No.                   | : | Refer to SECTION 4.2                                              |
| Rating                       | : | DC 3.0 V                                                          |
| Receipt Date of Sample       | : | February 25, 2019 (for Radiated Emission test )                   |
| (Information from test lab.) | : | February 27, 2019 (For Antenna Terminal Conducted test)           |
| Country of Mass-production   | : | Malaysia                                                          |
| Condition of EUT             | : | Engineering prototype                                             |
|                              | : | (Not for Sale: This sample is equivalent to mass-produced items.) |
| Modification of EUT          | : | No Modification by the test lab                                   |

### **2.2 Product Description**

Model: WL-60T (referred to as the EUT in this report) is a Wireless Transmitter.

### **Radio Specification**

|                           |   |                     |
|---------------------------|---|---------------------|
| Radio Type                | : | Transmitter         |
| Frequency of Operation    | : | 2402 MHz - 2478 MHz |
| Modulation                | : | GFSK                |
| Antenna type              | : | Pattern Antenna     |
| Antenna Gain              | : | -0.19 dBi           |
| Clock frequency (Maximum) | : | 32 MHz              |

## SECTION 3: Test specification, procedures & results

### 3.1 Test Specification

Test Specification : FCC Part 15 Subpart C

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

### 3.2 Procedures and results

| Item                                       | Test Procedure                                     | Specification                                  | Worst margin                      | Results          | Remarks                                                     |
|--------------------------------------------|----------------------------------------------------|------------------------------------------------|-----------------------------------|------------------|-------------------------------------------------------------|
| Conducted Emission                         | FCC: ANSI C63.10-2013<br>6. Standard test methods  | FCC: Section 15.207                            | N/A                               | N/A              | *1)                                                         |
|                                            | IC: RSS-Gen 8.8                                    | IC: RSS-Gen 8.8                                |                                   |                  |                                                             |
| 6dB Bandwidth                              | FCC: KDB 558074 D01 15.247<br>Meas Guidance v05r01 | FCC: Section 15.247(a)(2)                      | See data.                         | Complied a)      | Conducted                                                   |
|                                            | IC: -                                              | IC: RSS-247 5.2(a)                             |                                   | Complied b)      | Conducted                                                   |
| Maximum Peak Output Power                  | FCC: KDB 558074 D01 15.247<br>Meas Guidance v05r01 | FCC: Section 15.247(b)(3)                      |                                   |                  |                                                             |
|                                            | IC: RSS-Gen 6.12                                   | IC: RSS-247 5.4(d)                             |                                   | N/A c)           | Conducted                                                   |
| Power Density                              | FCC: KDB 558074 D01 15.247<br>Meas Guidance v05r01 | FCC: Section 15.247(e)                         |                                   | Complied# d), e) | Conducted (below 30 MHz)/<br>Radiated (above 30 MHz)<br>*2) |
|                                            | IC: -                                              | IC: RSS-247 5.2(b)                             |                                   |                  |                                                             |
| Spurious Emission<br>Restricted Band Edges | FCC: KDB 558074 D01 15.247<br>Meas Guidance v05r01 | FCC: Section 15.247(d)                         | 2.1 dB<br>4956.000 MHz, AV, Vert. | Complied# d), e) | Conducted (below 30 MHz)/<br>Radiated (above 30 MHz)<br>*2) |
|                                            | IC: RSS-Gen 6.13                                   | IC: RSS-247 5.5<br>RSS-Gen 8.9<br>RSS-Gen 8.10 |                                   |                  |                                                             |

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

\*1) The test is not applicable since the EUT is a battery operated device.

\*2) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 15.247 Meas Guidance v05r01 8.5 and 8.6.

a) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)

b) Refer to APPENDIX 1 (data of Maximum Peak Output Power)

c) Refer to APPENDIX 1 (data of Power Density)

d) Refer to APPENDIX 1 (data of Conducted Spurious Emission)

e) Refer to APPENDIX 1 (data of Radiated Spurious Emission)

Symbols:

Complied The data of this test item has enough margin, more than the measurement uncertainty.

Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

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

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**FCC Part 15.31 (e)**

The test was performed with the New Battery and the stable voltage was supplied to the EUT during the tests.  
Therefore, the EUT complies with the requirement.

**FCC Part 15.203 Antenna requirement**

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

**3.3 Addition to standard**

| Item                   | Test Procedure | Specification | Worst margin | Results | Remarks   |
|------------------------|----------------|---------------|--------------|---------|-----------|
| 99% Occupied Bandwidth | RSS-Gen 6.7    | IC: -         | N/A          | -<br>a) | Conducted |

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

a) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)

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

### 3.4 Uncertainty

#### EMI

There is no applicable rule of uncertainty in this applied standard. Therefore, the following results are derived depending on whether or not laboratory uncertainty is applied.

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 (+/-) |
|--------------------------------------------------|-------------------|
| 20 dB Bandwidth / 99 % Occupied Bandwidth        | 0.96 %            |
| Maximum Peak Output Power / Average Output Power | 1.3 dB            |
| Carrier Frequency Separation                     | 0.42 %            |
| Dwell time / Burst rate                          | 0.10 %            |
| Conducted Spurious Emission                      | 2.7 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            |

### 3.5 Test Location

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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            | 3.1 x 5.0                                                        | -                      | -                            |
| 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.

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

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

| <b>Mode</b>                                                                                                                                                                                                                                                                                                                                       | <b>Remarks*</b> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| Tx GFSK                                                                                                                                                                                                                                                                                                                                           | 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: 0 dBm<br>Software: V061R0016_20190130-1255_wl60t<br>*This setting of software is the worst case.<br>Any conditions under the normal use do not exceed the condition of setting.<br>In addition, end users cannot change the settings of the output power of the product. |                 |

\*The details of Operating mode(s)

| <b>Test Item</b>                                                                                                                  | <b>Operating Mode</b> | <b>Tested frequency</b>          |
|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------------------------|
| 6 dB Bandwidth<br>99% Occupied Bandwidth<br>Maximum Peak Output Power<br>Power Density<br>Spurious Emission (Conducted/ Radiated) | Tx GFSK               | 2402 MHz<br>2442 MHz<br>2478 MHz |

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## 4.2 Configuration and peripherals



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

### Description of EUT and Support equipment

| No. | Item                 | Model number | Serial number  | Manufacturer       | Remarks |
|-----|----------------------|--------------|----------------|--------------------|---------|
| A   | Wireless Transmitter | WL-60T       | 1 *1)<br>2 *2) | Roland Corporation | EUT     |
| B   | iPod touch           | MKJ22J/A     | CCQV734HGGNM   | Apple              | -       |

\*1) Used for Radiated Emission test

\*2) Used for Antenna Terminal conducted test

### List of cables used

| No. | Name        | Length (m) | Shield   |           | Remarks |
|-----|-------------|------------|----------|-----------|---------|
|     |             |            | Cable    | Connector |         |
| 1   | Audio Cable | 0.8        | Shielded | Shielded  | -       |

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## **SECTION 5: Radiated Spurious Emission**

### **Test Procedure**

It was measured based on "8.5 and 8.6 of KDB 558074 D01 15.247 Meas Guidance v05r01".

[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.

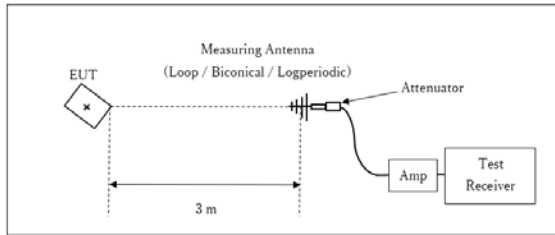
**20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).**

| 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 | <u>11.12.2.5.1</u><br>RBW: 1 MHz<br>VBW: 3 MHz<br>Detector:<br>Power Averaging (RMS)<br>Trace: 100 traces<br><u>11.12.2.5.2</u><br>The duty cycle was less than 98% for detected noise, a duty factor was added to the 11.12.2.5.1 results. | RBW: 100 kHz<br>VBW: 300kHz |

\*1) Average Power Measurement was performed based on ANSI C63.10-2013.

## Radiated emission

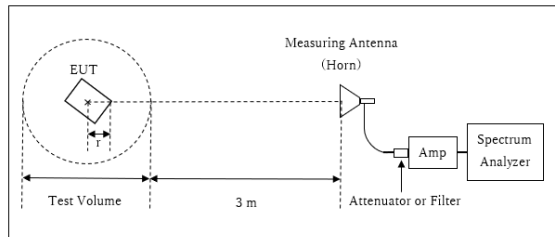
### Below 1 GHz



x : Center of turn table

Test Distance: 3 m

### 1 GHz - 10 GHz



r : Radius of an outer periphery of EUT

x : Center of turn table

Distance Factor:  $20 \times \log (3.95 \text{ m} / 3.0 \text{ m}) = 2.39 \text{ dB}$

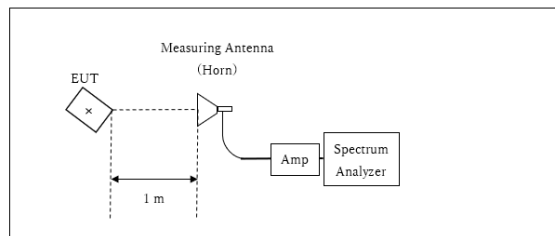
\* Test Distance:  $(3 + \text{Test Volume} / 2) - r = 3.95 \text{ m}$

Test Volume : 2.0 m

(Test Volume has been calibrated based on CISPR 16-1-4.)

$r = 0.05 \text{ m}$

### 10 GHz - 26.5 GHz



x : Center of turn table

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

\*Test Distance: 1 m

- 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              |

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## SECTION 6: Antenna Terminal Conducted Tests

### Test Procedure

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

| Test                                                                                                                                                                                                                                                                                                                                                                                                                                         | Span                                    | RBW             | VBW                | Sweep time | Detector             | Trace    | Instrument used                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------------|--------------------|------------|----------------------|----------|---------------------------------|
| 6dB Bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                | 3 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 (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 11.10.2 Method PKPSD (peak PSD) of "ANSI C63.10-2013".<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

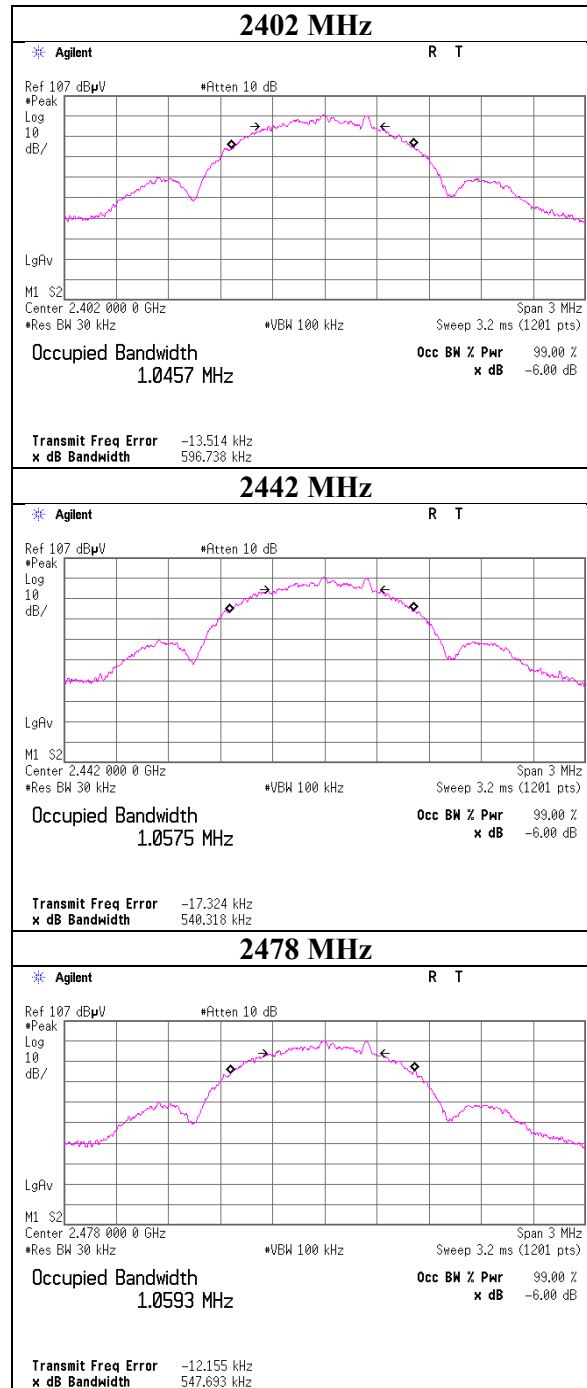
## **APPENDIX 1: Test data**

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

Report No. 12547242H  
Test place Ise EMC Lab. No.8 Measurement Room  
Date February 27, 2019  
Temperature / Humidity 24 deg. C / 38 % RH  
Engineer Junki Nagatomi  
Mode Tx

| Frequency<br>[MHz] | 6dB Bandwidth<br>[MHz] | 99% Occupied<br>Bandwidth<br>[kHz] | Limit for<br>6dB Bandwidth<br>[kHz] |
|--------------------|------------------------|------------------------------------|-------------------------------------|
| 2402               | 0.696                  | 1045.7                             | > 500                               |
| 2442               | 0.711                  | 1057.5                             | > 500                               |
| 2478               | 0.699                  | 1059.3                             | > 500                               |

## 99 % Occupied Bandwidth



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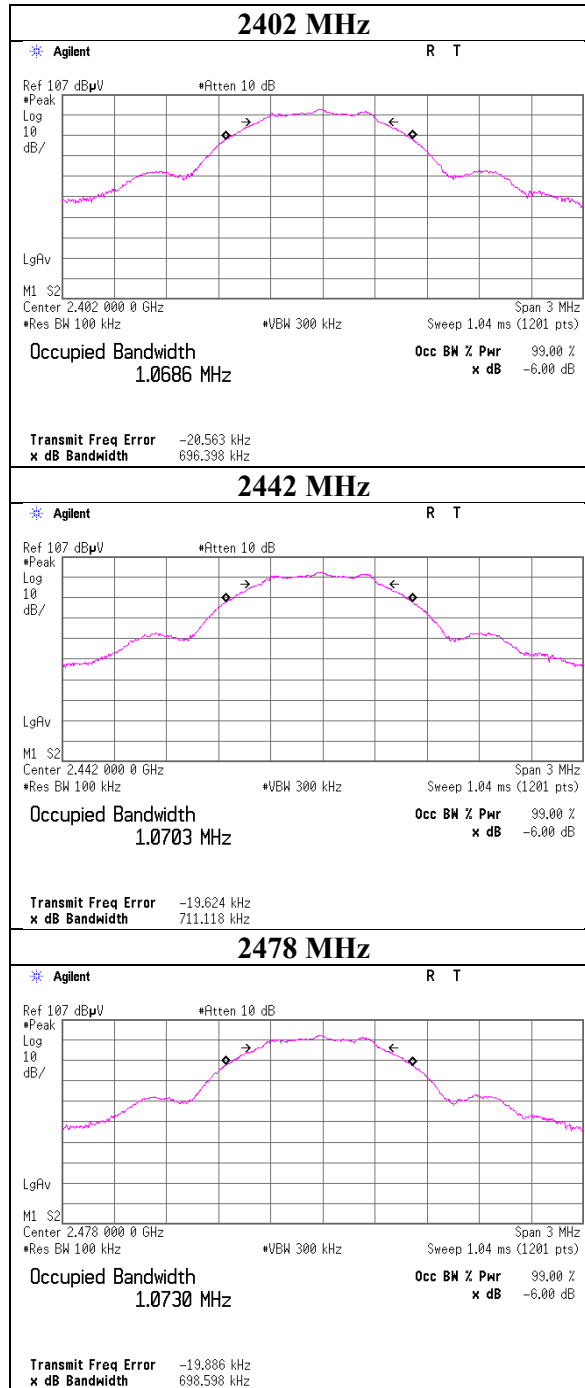
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## 6 dB Bandwidth



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## Maximum Peak Output Power

Report No. 12547242H  
Test place Ise EMC Lab. No.8 Measurement Room  
Date February 27, 2019  
Temperature / Humidity 24 deg. C / 38 % RH  
Engineer Junki Nagatomi  
Mode Tx

| Freq. | Reading | Cable<br>Loss | Atten.<br>Loss | Conducted Power |      |       |      |        | Antenna<br>Gain | e.i.r.p. for RSS-247 |       |       |       |        |
|-------|---------|---------------|----------------|-----------------|------|-------|------|--------|-----------------|----------------------|-------|-------|-------|--------|
|       |         |               |                | Result          |      | Limit |      | Margin |                 | Result               |       | Limit |       | Margin |
|       |         |               |                | [dBm]           | [mW] | [dBm] | [mW] |        |                 | [dB]                 | [dBm] | [mW]  | [dBm] |        |
| [MHz] | [dBm]   | [dB]          | [dB]           |                 |      |       |      |        | [dBi]           |                      |       |       |       |        |
| 2402  | -7.25   | 0.40          | 10.09          | 3.24            | 2.11 | 30.00 | 1000 | 26.77  | -0.19           | 3.05                 | 2.02  | 36.02 | 4000  | 32.98  |
| 2442  | -7.50   | 0.42          | 10.09          | 3.01            | 2.00 | 30.00 | 1000 | 26.99  | -0.19           | 2.82                 | 1.91  | 36.02 | 4000  | 33.20  |
| 2478  | -7.74   | 0.43          | 10.09          | 2.78            | 1.90 | 30.00 | 1000 | 27.22  | -0.19           | 2.59                 | 1.82  | 36.02 | 4000  | 33.43  |

Sample Calculation:

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

e.i.r.p. Result = Conducted Power Result + Antenna Gain

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**Ise EMC Lab.**

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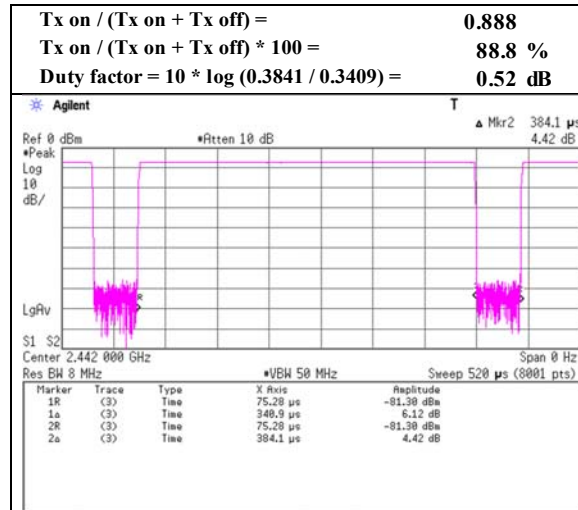
**Average Output Power**  
**(Reference data for RF Exposure / SAR testing)**

Report No. 12547242H  
Test place Ise EMC Lab. No.8 Measurement Room  
Date February 27, 2019  
Temperature / Humidity 24 deg. C / 38 % RH  
Engineer Junki Nagatomi  
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] |
| 2402           | -7.91            | 0.40                  | 10.09                  | 2.58                     | 1.81 | 0.52                   | 3.10                            | 2.04 |
| 2442           | -8.17            | 0.42                  | 10.09                  | 2.34                     | 1.71 | 0.52                   | 2.86                            | 1.93 |
| 2478           | -8.42            | 0.43                  | 10.09                  | 2.10                     | 1.62 | 0.52                   | 2.62                            | 1.83 |

### Burst rate confirmation

Report No. 12547242H  
Test place Ise EMC Lab. No.8 Measurement Room  
Date February 27, 2019  
Temperature / Humidity 24 deg. C / 38 % RH  
Engineer Junki Nagatomi  
Mode Tx 2442MHz



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

## Radiated Spurious Emission

Report No. 12547242H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.4  
Date February 26, 2019 No.4  
Temperature / Humidity 20 deg. C / 37 % RH February 28, 2019  
Engineer Akihiko Maeda 22 deg. C / 33 % RH  
(Above 1 GHz) Akihiko Maeda  
(Below 1 GHz)  
Mode Tx GFSK, 2402MHz

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Duty Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark      |
|----------|-----------------|----------|----------------|-----------------|-----------|-----------|------------------|-----------------|----------------|-------------|-------------|
| Hori     | 32.000          | QP       | 23.2           | 17.6            | 7.3       | 32.2      | -                | 15.9            | 40.0           | 24.1        |             |
| Hori     | 64.000          | QP       | 23.1           | 6.8             | 7.8       | 32.1      | -                | 5.6             | 40.0           | 34.4        |             |
| Hori     | 110.983         | QP       | 37.4           | 11.8            | 8.3       | 32.1      | -                | 25.4            | 43.5           | 18.1        |             |
| Hori     | 336.273         | QP       | 22.4           | 14.7            | 10.2      | 31.9      | -                | 15.4            | 46.0           | 30.6        |             |
| Hori     | 544.690         | QP       | 22.4           | 18.0            | 11.5      | 32.0      | -                | 19.9            | 46.0           | 26.1        |             |
| Hori     | 852.507         | QP       | 22.5           | 21.7            | 13.0      | 31.3      | -                | 25.9            | 46.0           | 20.1        |             |
| Hori     | 2338.147        | PK       | 46.1           | 27.8            | 5.6       | 31.4      | -                | 48.1            | 73.9           | 25.8        |             |
| Hori     | 2390.000        | PK       | 42.3           | 27.6            | 5.8       | 31.3      | -                | 44.4            | 73.9           | 29.5        |             |
| Hori     | 4804.000        | PK       | 47.1           | 31.4            | 8.0       | 30.6      | -                | 55.9            | 73.9           | 18.0        |             |
| Hori     | 7206.000        | PK       | 42.2           | 36.2            | 9.0       | 31.8      | -                | 55.6            | 73.9           | 18.3        | Floor noise |
| Hori     | 9608.000        | PK       | 40.8           | 37.9            | 10.2      | 32.1      | -                | 56.8            | 73.9           | 17.1        | Floor noise |
| Hori     | 2338.147        | AV       | 39.5           | 27.8            | 5.6       | 31.4      | 0.5              | 42.0            | 53.9           | 11.9        | *1)         |
| Hori     | 2390.000        | AV       | 33.0           | 27.6            | 5.8       | 31.3      | 0.5              | 35.6            | 53.9           | 18.3        | *1)         |
| Hori     | 4804.000        | AV       | 41.8           | 31.4            | 8.0       | 30.6      | 0.5              | 51.1            | 53.9           | 2.8         |             |
| Hori     | 7206.000        | AV       | 33.8           | 36.2            | 9.0       | 31.8      | -                | 47.2            | 53.9           | 6.7         | Floor noise |
| Hori     | 9608.000        | AV       | 31.8           | 37.9            | 10.2      | 32.1      | -                | 47.8            | 53.9           | 6.1         | Floor noise |
| Vert     | 32.000          | QP       | 23.1           | 17.6            | 7.3       | 32.2      | -                | 15.8            | 40.0           | 24.2        |             |
| Vert     | 64.000          | QP       | 23.1           | 6.8             | 7.8       | 32.1      | -                | 5.6             | 40.0           | 34.4        |             |
| Vert     | 110.983         | QP       | 32.4           | 11.8            | 8.3       | 32.1      | -                | 20.4            | 43.5           | 23.1        |             |
| Vert     | 336.273         | QP       | 22.4           | 14.7            | 10.2      | 31.9      | -                | 15.4            | 46.0           | 30.6        |             |
| Vert     | 544.690         | QP       | 22.6           | 18.0            | 11.5      | 32.0      | -                | 20.1            | 46.0           | 25.9        |             |
| Vert     | 852.507         | QP       | 22.5           | 21.7            | 13.0      | 31.3      | -                | 25.9            | 46.0           | 20.1        |             |
| Vert     | 2338.147        | PK       | 47.6           | 27.8            | 5.6       | 31.4      | -                | 49.6            | 73.9           | 24.3        |             |
| Vert     | 2390.000        | PK       | 42.5           | 27.6            | 5.8       | 31.3      | -                | 44.6            | 73.9           | 29.3        |             |
| Vert     | 4804.000        | PK       | 47.4           | 31.4            | 8.0       | 30.6      | -                | 56.2            | 73.9           | 17.7        |             |
| Vert     | 7206.000        | PK       | 42.2           | 36.2            | 9.0       | 31.8      | -                | 55.6            | 73.9           | 18.3        | Floor noise |
| Vert     | 9608.000        | PK       | 40.8           | 37.9            | 10.2      | 32.1      | -                | 56.8            | 73.9           | 17.1        | Floor noise |
| Vert     | 2338.147        | AV       | 41.3           | 27.8            | 5.6       | 31.4      | 0.5              | 43.8            | 53.9           | 10.1        | *1)         |
| Vert     | 2390.000        | AV       | 33.7           | 27.6            | 5.8       | 31.3      | 0.5              | 36.3            | 53.9           | 17.6        | *1)         |
| Vert     | 4804.000        | AV       | 42.3           | 31.4            | 8.0       | 30.6      | 0.5              | 51.6            | 53.9           | 2.3         |             |
| Vert     | 7206.000        | AV       | 33.8           | 36.2            | 9.0       | 31.8      | -                | 47.2            | 53.9           | 6.7         | Floor noise |
| Vert     | 9608.000        | AV       | 31.8           | 37.9            | 10.2      | 32.1      | -                | 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 (3.95 m / 3.0 m) = 2.39 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 [MHz] | Detector | Reading [dBuV] | Ant Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark  |
|----------|-----------------|----------|----------------|-------------------|-----------|-----------|-----------------|----------------|-------------|---------|
| Hori     | 2402.000        | PK       | 94.8           | 27.6              | 5.8       | 31.3      | 96.9            | -              | -           | Carrier |
| Hori     | 2400.000        | PK       | 47.1           | 27.6              | 5.8       | 31.3      | 49.2            | 76.9           | 27.7        |         |
| Vert     | 2402.000        | PK       | 96.4           | 27.6              | 5.8       | 31.3      | 98.5            | -              | -           | Carrier |
| Vert     | 2400.000        | PK       | 49.4           | 27.6              | 5.8       | 31.3      | 51.5            | 78.5           | 27.0        |         |

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

Distance factor: 1 GHz - 10 GHz 20log (3.95 m / 3.0 m) = 2.39 dB  
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5dB

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**Ise EMC Lab.**

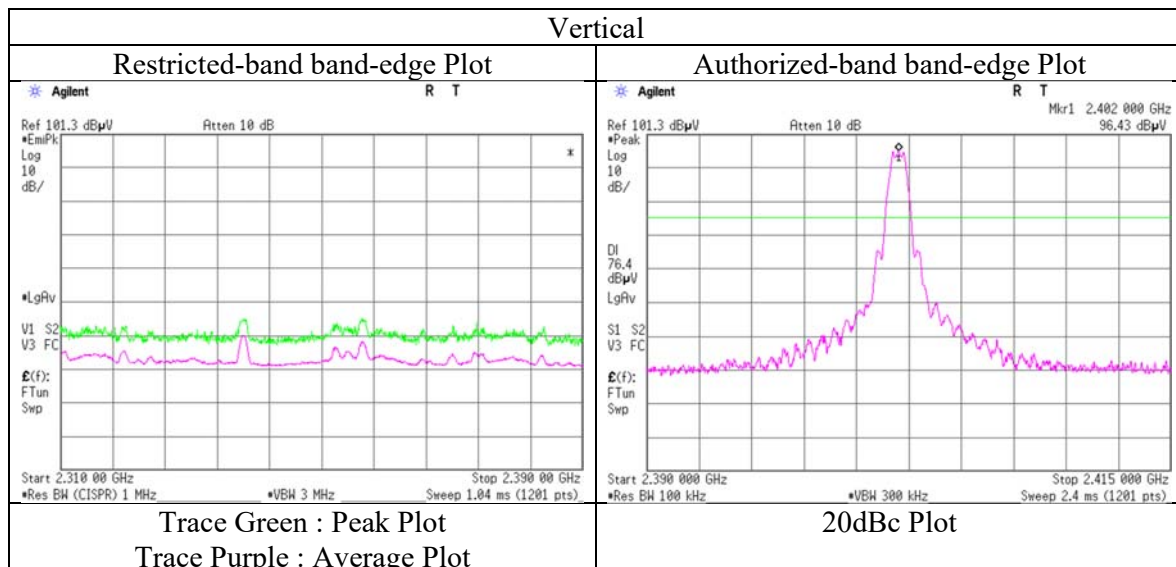
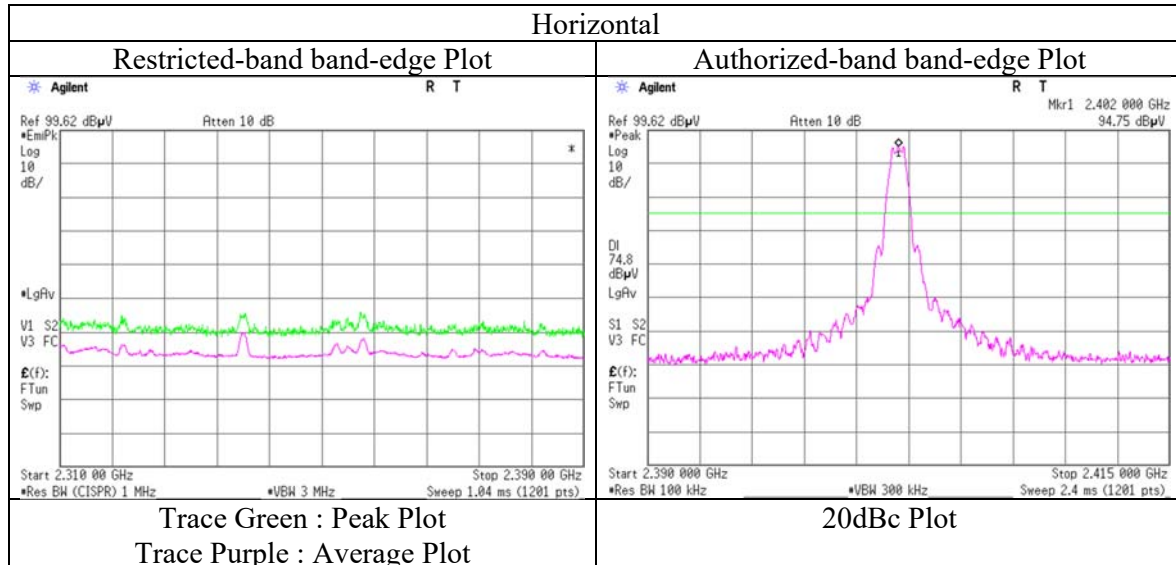
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## Radiated Spurious Emission (Reference Plot for band-edge)

|                        |                                |
|------------------------|--------------------------------|
| Report No.             | 12547242H                      |
| Test place             | Ise EMC Lab.                   |
| Semi Anechoic Chamber  | No.4                           |
| Date                   | February 26, 2019              |
| Temperature / Humidity | 20 deg. C / 37 % RH            |
| Engineer               | Akihiko Maeda<br>(Above 1 GHz) |
| Mode                   | Tx GFSK, 2402MHz               |



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

## Radiated Spurious Emission

|                        |                                |                                |
|------------------------|--------------------------------|--------------------------------|
| Report No.             | 12547242H                      |                                |
| Test place             | Ise EMC Lab.                   |                                |
| Semi Anechoic Chamber  | No.4                           | No.4                           |
| Date                   | February 26, 2019              | February 28, 2019              |
| Temperature / Humidity | 20 deg. C / 37 % RH            | 22 deg. C / 33 % RH            |
| Engineer               | Akihiko Maeda<br>(Above 1 GHz) | Akihiko Maeda<br>(Below 1 GHz) |
| Mode                   | Tx GFSK, 2442MHz               |                                |

| 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     | 32.000             | QP       | 23.1              | 17.6               | 7.3          | 32.2         | -                   | 15.8               | 40.0              | 24.2           |             |
| Hori     | 64.000             | QP       | 23.2              | 6.8                | 7.8          | 32.1         | -                   | 5.7                | 40.0              | 34.3           |             |
| Hori     | 110.985            | QP       | 37.6              | 11.8               | 8.3          | 32.1         | -                   | 25.6               | 43.5              | 17.9           |             |
| Hori     | 336.643            | QP       | 22.3              | 14.7               | 10.2         | 31.9         | -                   | 15.3               | 46.0              | 30.7           |             |
| Hori     | 544.973            | QP       | 22.5              | 18.0               | 11.5         | 32.0         | -                   | 20.0               | 46.0              | 26.0           |             |
| Hori     | 852.457            | QP       | 22.5              | 21.7               | 13.0         | 31.3         | -                   | 25.9               | 46.0              | 20.1           |             |
| Hori     | 2314.112           | PK       | 49.8              | 27.9               | 5.6          | 31.4         | -                   | 51.9               | 73.9              | 22.0           |             |
| Hori     | 4884.000           | PK       | 46.1              | 31.5               | 8.0          | 30.6         | -                   | 55.0               | 73.9              | 18.9           |             |
| Hori     | 7326.000           | PK       | 41.2              | 36.3               | 9.0          | 31.9         | -                   | 54.6               | 73.9              | 19.3           | Floor noise |
| Hori     | 9768.000           | PK       | 40.6              | 38.3               | 10.3         | 32.1         | -                   | 57.1               | 73.9              | 16.8           | Floor noise |
| Hori     | 2314.112           | AV       | 44.7              | 27.9               | 5.6          | 31.4         | 0.5                 | 47.3               | 53.9              | 6.6            | *1)         |
| Hori     | 4884.000           | AV       | 40.8              | 31.5               | 8.0          | 30.6         | 0.5                 | 50.2               | 53.9              | 3.7            |             |
| Hori     | 7326.000           | AV       | 33.9              | 36.3               | 9.0          | 31.9         | -                   | 47.3               | 53.9              | 6.6            | Floor noise |
| Hori     | 9768.000           | AV       | 31.4              | 38.3               | 10.3         | 32.1         | -                   | 47.9               | 53.9              | 6.0            | Floor noise |
| Vert     | 32.000             | QP       | 23.1              | 17.6               | 7.3          | 32.2         | -                   | 15.8               | 40.0              | 24.2           |             |
| Vert     | 64.000             | QP       | 23.1              | 6.8                | 7.8          | 32.1         | -                   | 5.6                | 40.0              | 34.4           |             |
| Vert     | 110.985            | QP       | 33.1              | 11.8               | 8.3          | 32.1         | -                   | 21.1               | 43.5              | 22.4           |             |
| Vert     | 336.643            | QP       | 22.4              | 14.7               | 10.2         | 31.9         | -                   | 15.4               | 46.0              | 30.6           |             |
| Vert     | 544.973            | QP       | 22.4              | 18.0               | 11.5         | 32.0         | -                   | 19.9               | 46.0              | 26.1           |             |
| Vert     | 852.457            | QP       | 22.5              | 21.7               | 13.0         | 31.3         | -                   | 25.9               | 46.0              | 20.1           |             |
| Vert     | 2314.112           | PK       | 49.7              | 27.9               | 5.6          | 31.4         | -                   | 51.8               | 73.9              | 22.1           |             |
| Vert     | 4884.000           | PK       | 47.0              | 31.5               | 8.0          | 30.6         | -                   | 55.9               | 73.9              | 18.0           |             |
| Vert     | 7326.000           | PK       | 41.2              | 36.3               | 9.0          | 31.9         | -                   | 54.6               | 73.9              | 19.3           | Floor noise |
| Vert     | 9768.000           | PK       | 40.6              | 38.3               | 10.3         | 32.1         | -                   | 57.1               | 73.9              | 16.8           | Floor noise |
| Vert     | 2314.112           | AV       | 44.8              | 27.9               | 5.6          | 31.4         | 0.5                 | 47.4               | 53.9              | 6.5            | *1)         |
| Vert     | 4884.000           | AV       | 41.9              | 31.5               | 8.0          | 30.6         | 0.5                 | 51.3               | 53.9              | 2.6            |             |
| Vert     | 7326.000           | AV       | 33.9              | 36.3               | 9.0          | 31.9         | -                   | 47.3               | 53.9              | 6.6            | Floor noise |
| Vert     | 9768.000           | AV       | 31.4              | 38.3               | 10.3         | 32.1         | -                   | 47.9               | 53.9              | 6.0            | 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  $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$   
10 GHz - 26.5 GHz  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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

## Radiated Spurious Emission

|                        |                                |                                |
|------------------------|--------------------------------|--------------------------------|
| Report No.             | 12547242H                      |                                |
| Test place             | Ise EMC Lab.                   |                                |
| Semi Anechoic Chamber  | No.4                           | No.4                           |
| Date                   | February 26, 2019              | February 28, 2019              |
| Temperature / Humidity | 20 deg. C / 37 % RH            | 22 deg. C / 33 % RH            |
| Engineer               | Akihiko Maeda<br>(Above 1 GHz) | Akihiko Maeda<br>(Below 1 GHz) |
| Mode                   | Tx GFSK, 2478MHz               |                                |

| 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     | 32.000             | QP       | 23.2              | 17.6               | 7.3          | 32.2         | -                   | 15.9               | 40.0              | 24.1           |             |
| Hori     | 64.000             | QP       | 23.1              | 6.8                | 7.8          | 32.1         | -                   | 5.6                | 40.0              | 34.4           |             |
| Hori     | 110.944            | QP       | 37.3              | 11.8               | 8.3          | 32.1         | -                   | 25.3               | 43.5              | 18.2           |             |
| Hori     | 340.117            | QP       | 22.4              | 14.9               | 10.2         | 31.9         | -                   | 15.6               | 46.0              | 30.4           |             |
| Hori     | 549.708            | QP       | 22.4              | 18.1               | 11.5         | 32.0         | -                   | 20.0               | 46.0              | 26.0           |             |
| Hori     | 854.442            | QP       | 22.5              | 21.7               | 13.0         | 31.3         | -                   | 25.9               | 46.0              | 20.1           |             |
| Hori     | 2350.000           | PK       | 49.8              | 27.7               | 5.6          | 31.3         | -                   | 51.8               | 73.9              | 22.1           |             |
| Hori     | 2483.500           | PK       | 50.6              | 27.5               | 5.8          | 31.3         | -                   | 52.6               | 73.9              | 21.3           |             |
| Hori     | 2606.000           | PK       | 49.0              | 28.2               | 5.9          | 31.2         | -                   | 51.9               | 73.9              | 22.0           |             |
| Hori     | 4956.000           | PK       | 46.6              | 31.7               | 8.0          | 30.6         | -                   | 55.7               | 73.9              | 18.2           |             |
| Hori     | 7434.000           | PK       | 43.1              | 36.3               | 9.0          | 31.9         | -                   | 56.5               | 73.9              | 17.4           | Floor noise |
| Hori     | 9912.000           | PK       | 40.7              | 38.4               | 10.4         | 32.2         | -                   | 57.3               | 73.9              | 16.6           | Floor noise |
| Hori     | 2350.000           | AV       | 44.7              | 27.7               | 5.6          | 31.3         | 0.5                 | 47.2               | 53.9              | 6.7            | *1)         |
| Hori     | 2483.500           | AV       | 37.0              | 27.5               | 5.8          | 31.3         | 0.5                 | 39.5               | 53.9              | 14.4           | *1)         |
| Hori     | 2606.000           | AV       | 43.6              | 28.2               | 5.9          | 31.2         | 0.5                 | 47.0               | 53.9              | 6.9            | *1)         |
| Hori     | 4956.000           | AV       | 40.8              | 31.7               | 8.0          | 30.6         | 0.5                 | 50.4               | 53.9              | 3.5            |             |
| Hori     | 7434.000           | AV       | 33.9              | 36.3               | 9.0          | 31.9         | -                   | 47.3               | 53.9              | 6.6            | Floor noise |
| Hori     | 9912.000           | AV       | 31.0              | 38.4               | 10.4         | 32.2         | -                   | 47.6               | 53.9              | 6.3            | Floor noise |
| Vert     | 32.000             | QP       | 23.2              | 17.6               | 7.3          | 32.2         | -                   | 15.9               | 40.0              | 24.1           |             |
| Vert     | 64.000             | QP       | 23.2              | 6.8                | 7.8          | 32.1         | -                   | 5.7                | 40.0              | 34.3           |             |
| Vert     | 110.944            | QP       | 31.9              | 11.8               | 8.3          | 32.1         | -                   | 19.9               | 43.5              | 23.6           |             |
| Vert     | 340.117            | QP       | 22.4              | 14.9               | 10.2         | 31.9         | -                   | 15.6               | 46.0              | 30.4           |             |
| Vert     | 549.708            | QP       | 22.6              | 18.1               | 11.5         | 32.0         | -                   | 20.2               | 46.0              | 25.8           |             |
| Vert     | 854.442            | QP       | 22.5              | 21.7               | 13.0         | 31.3         | -                   | 25.9               | 46.0              | 20.1           |             |
| Vert     | 2350.000           | PK       | 49.8              | 27.7               | 5.6          | 31.3         | -                   | 51.8               | 73.9              | 22.1           |             |
| Vert     | 2483.500           | PK       | 51.4              | 27.5               | 5.8          | 31.3         | -                   | 53.4               | 73.9              | 20.5           |             |
| Vert     | 2606.000           | PK       | 49.5              | 28.2               | 5.9          | 31.2         | -                   | 52.4               | 73.9              | 21.5           |             |
| Vert     | 4956.000           | PK       | 47.0              | 31.7               | 8.0          | 30.6         | -                   | 56.1               | 73.9              | 17.8           |             |
| Vert     | 7434.000           | PK       | 43.1              | 36.3               | 9.0          | 31.9         | -                   | 56.5               | 73.9              | 17.4           | Floor noise |
| Vert     | 9912.000           | PK       | 40.7              | 38.4               | 10.4         | 32.2         | -                   | 57.3               | 73.9              | 16.6           | Floor noise |
| Vert     | 2350.000           | AV       | 45.3              | 27.7               | 5.6          | 31.3         | 0.5                 | 47.8               | 53.9              | 6.1            | *1)         |
| Vert     | 2483.500           | AV       | 38.4              | 27.5               | 5.8          | 31.3         | 0.5                 | 40.9               | 53.9              | 13.0           | *1)         |
| Vert     | 2606.000           | AV       | 44.4              | 28.2               | 5.9          | 31.2         | 0.5                 | 47.8               | 53.9              | 6.1            | *1)         |
| Vert     | 4956.000           | AV       | 42.2              | 31.7               | 8.0          | 30.6         | 0.5                 | 51.8               | 53.9              | 2.1            |             |
| Vert     | 7434.000           | AV       | 33.9              | 36.3               | 9.0          | 31.9         | -                   | 47.3               | 53.9              | 6.6            | Floor noise |
| Vert     | 9912.000           | AV       | 31.0              | 38.4               | 10.4         | 32.2         | -                   | 47.6               | 53.9              | 6.3            | Floor noise |

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

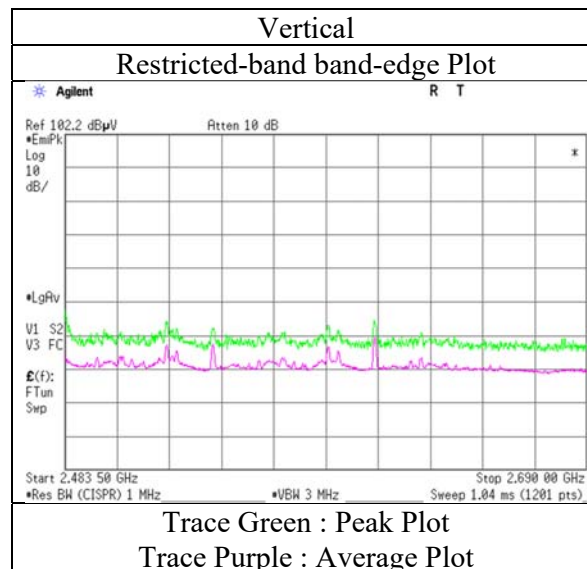
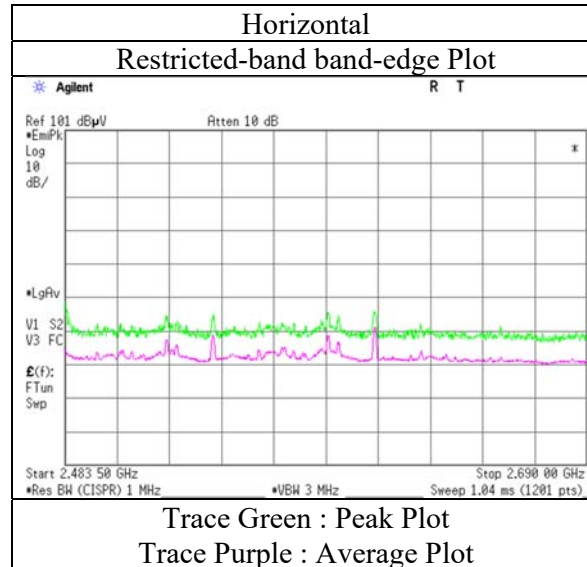
\*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (3.95 m / 3.0 m) = 2.39 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)

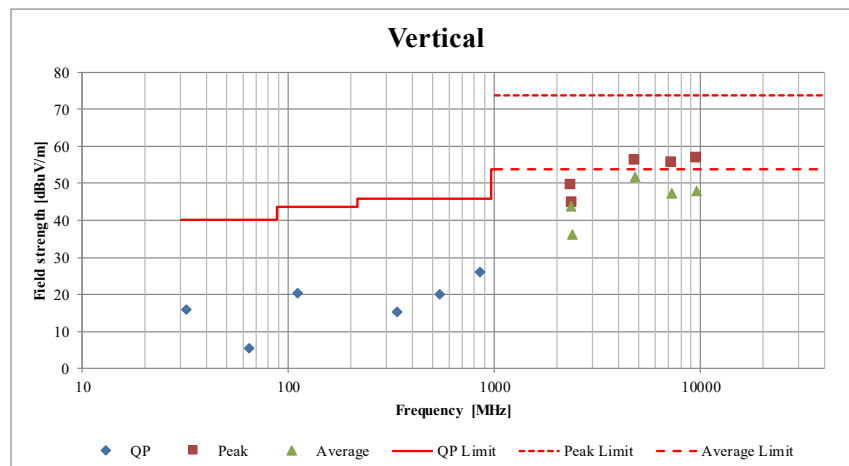
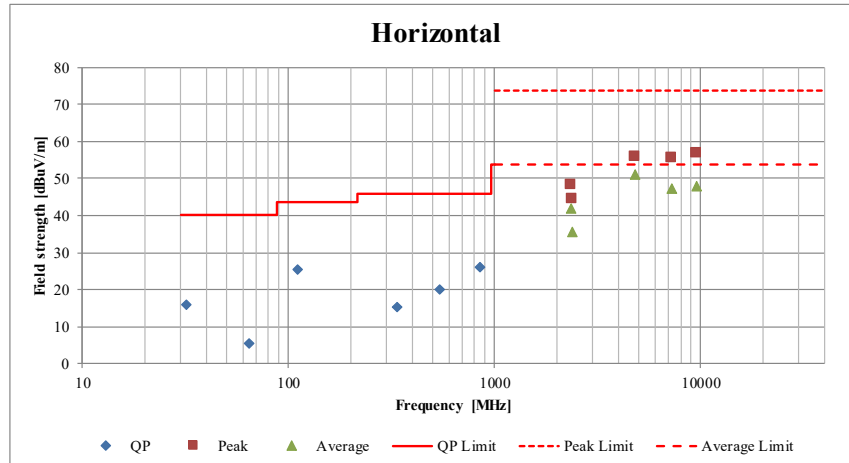
|                        |                                |
|------------------------|--------------------------------|
| Report No.             | 12547242H                      |
| Test place             | Ise EMC Lab.                   |
| Semi Anechoic Chamber  | No.4                           |
| Date                   | February 26, 2019              |
| Temperature / Humidity | 20 deg. C / 37 % RH            |
| Engineer               | Akihiko Maeda<br>(Above 1 GHz) |
| Mode                   | Tx GFSK, 2478MHz               |



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

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

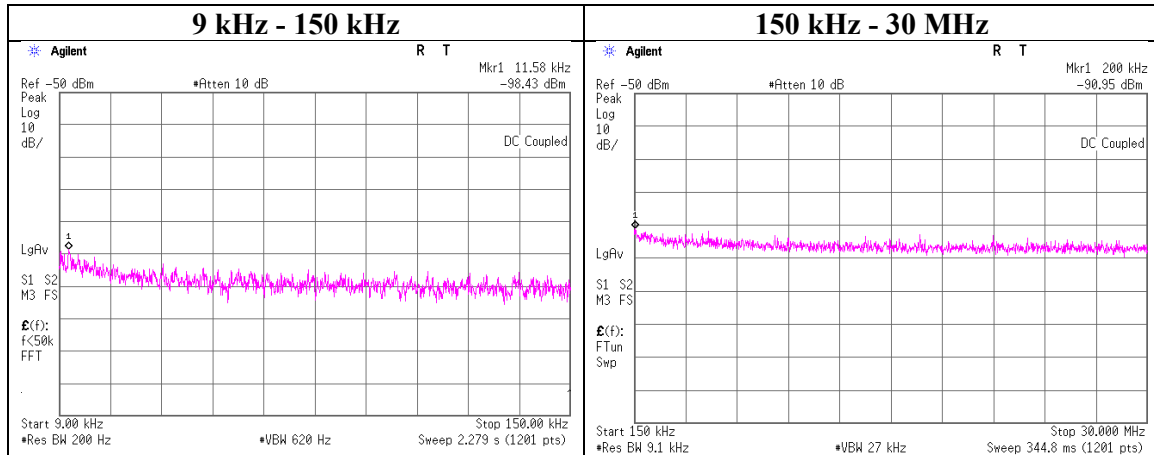
|                        |                                |                                |
|------------------------|--------------------------------|--------------------------------|
| Report No.             | 12547242H                      |                                |
| Test place             | Ise EMC Lab.                   |                                |
| Semi Anechoic Chamber  | No.4                           | No.4                           |
| Date                   | February 26, 2019              | February 28, 2019              |
| Temperature / Humidity | 20 deg. C / 37 % RH            | 22 deg. C / 33 % RH            |
| Engineer               | Akihiko Maeda<br>(Above 1 GHz) | Akihiko Maeda<br>(Below 1 GHz) |
| Mode                   | Tx GFSK, 2402MHz               |                                |



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

## Conducted Spurious Emission

|                        |                                    |
|------------------------|------------------------------------|
| Report No.             | 12547242H                          |
| Test place             | Ise EMC Lab. No.8 Measurement Room |
| Date                   | February 27, 2019                  |
| Temperature / Humidity | 24 deg. C / 38 % RH                |
| Engineer               | Junki Nagatomi                     |
| Mode                   | Tx 2402 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 |
|--------------------|------------------|-----------------------|----------------------------|----------------------------|----------------------------|---------------|-----------------|--------------------------|-----------------------------------|-------------------|----------------|--------|
| 11.58              | -98.4            | 0.40                  | 9.8                        | 2.0                        | 1                          | -86.2         | 300             | 6.0                      | -24.9                             | 46.3              | 71.2           |        |
| 200.00             | -91.0            | 0.40                  | 9.8                        | 2.0                        | 1                          | -78.7         | 300             | 6.0                      | -17.5                             | 21.5              | 39.0           |        |

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

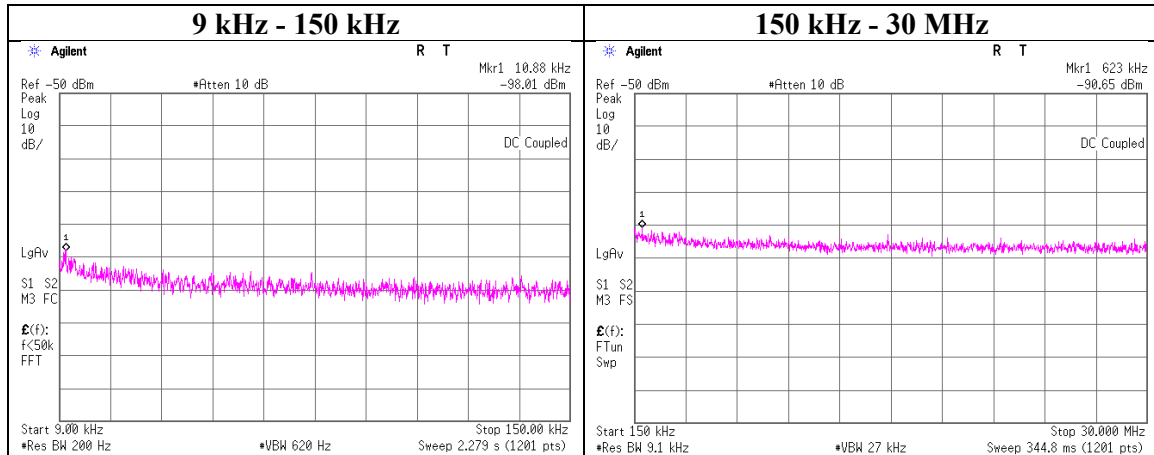
$EIRP[dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB] + Antenna\ gain [dBi] + 10 * \log (N)$

N: Number of output

\*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

## Conducted Spurious Emission

Report No. 12547242H  
Test place Ise EMC Lab. No.8 Measurement Room  
Date February 27, 2019  
Temperature / Humidity 24 deg. C / 38 % RH  
Engineer Junki Nagatomi  
Mode Tx 2442 MHz



| Frequency | Reading | Cable Loss | Attenuator Loss | Antenna Gain * | N (Number of Output) | EIRP  | Distance | Ground bounce | E (field strength) | Limit    | Margin | Remark |
|-----------|---------|------------|-----------------|----------------|----------------------|-------|----------|---------------|--------------------|----------|--------|--------|
| [kHz]     | [dBm]   | [dB]       | [dB]            | [dBi]          |                      | [dBm] | [m]      | [dB]          | [dBuV/m]           | [dBuV/m] | [dB]   |        |
| 10.88     | -98.0   | 0.40       | 9.8             | 2.0            | 1                    | -85.8 | 300      | 6.0           | -24.5              | 46.8     | 71.3   |        |
| 623.00    | -90.7   | 0.40       | 9.8             | 2.0            | 1                    | -78.4 | 30       | 6.0           | 2.8                | 31.7     | 28.9   |        |

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

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

N: Number of output

\*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

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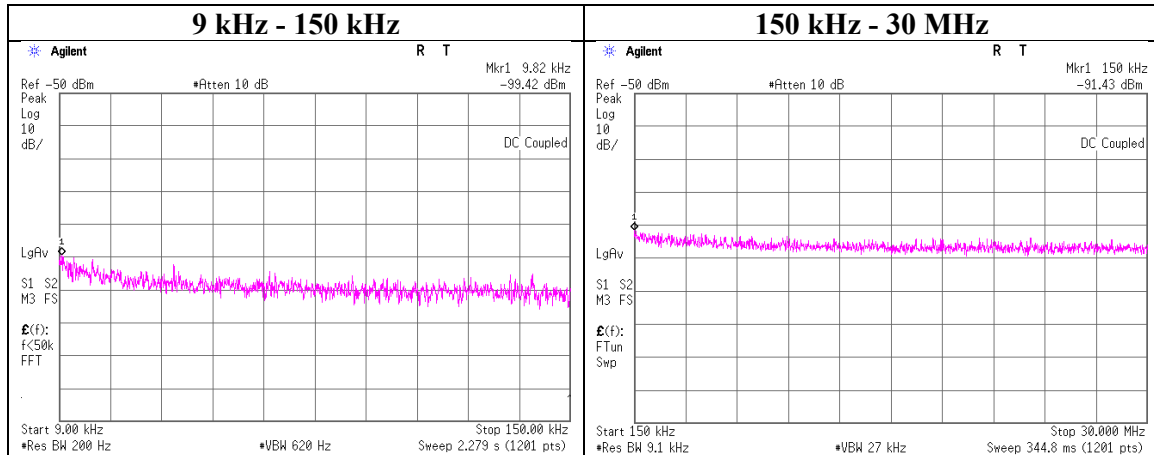
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Conducted Spurious Emission

Report No. 12547242H  
Test place Ise EMC Lab. No.8 Measurement Room  
Date February 27, 2019  
Temperature / Humidity 24 deg. C / 38 % RH  
Engineer Junki Nagatomi  
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 |
|--------------------|------------------|-----------------------|----------------------------|----------------------------|----------------------------|---------------|-----------------|--------------------------|-----------------------------------|-------------------|----------------|--------|
| 9.82               | -99.4            | 0.40                  | 9.8                        | 2.0                        | 1                          | -87.2         | 300             | 6.0                      | -25.9                             | 47.7              | 73.6           |        |
| 150.00             | -91.4            | 0.40                  | 9.8                        | 2.0                        | 1                          | -79.2         | 300             | 6.0                      | -18.0                             | 24.0              | 42.0           |        |

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

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

N: Number of output

\*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

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### **Power Density**

Report No. 12547242H  
Test place Ise EMC Lab. No.8 Measurement Room  
Date February 27, 2019  
Temperature / Humidity 24 deg. C / 38 % RH  
Engineer Junki Nagatomi  
Mode Tx

| Freq.<br>[MHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>Loss<br>[dB] | Result<br>[dBm] | Limit<br>[dBm] | Margin<br>[dB] |
|----------------|------------------|-----------------------|------------------------|-----------------|----------------|----------------|
| 2402.00        | -19.02           | 0.40                  | 10.09                  | -8.54           | 8.00           | 16.54          |
| 2442.00        | -19.69           | 0.42                  | 10.09                  | -9.18           | 8.00           | 17.18          |
| 2478.00        | -19.17           | 0.43                  | 10.09                  | -8.65           | 8.00           | 16.65          |

Sample Calculation:

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

\*The equipment and cables were not used for factor 0 dB of the data sheets.

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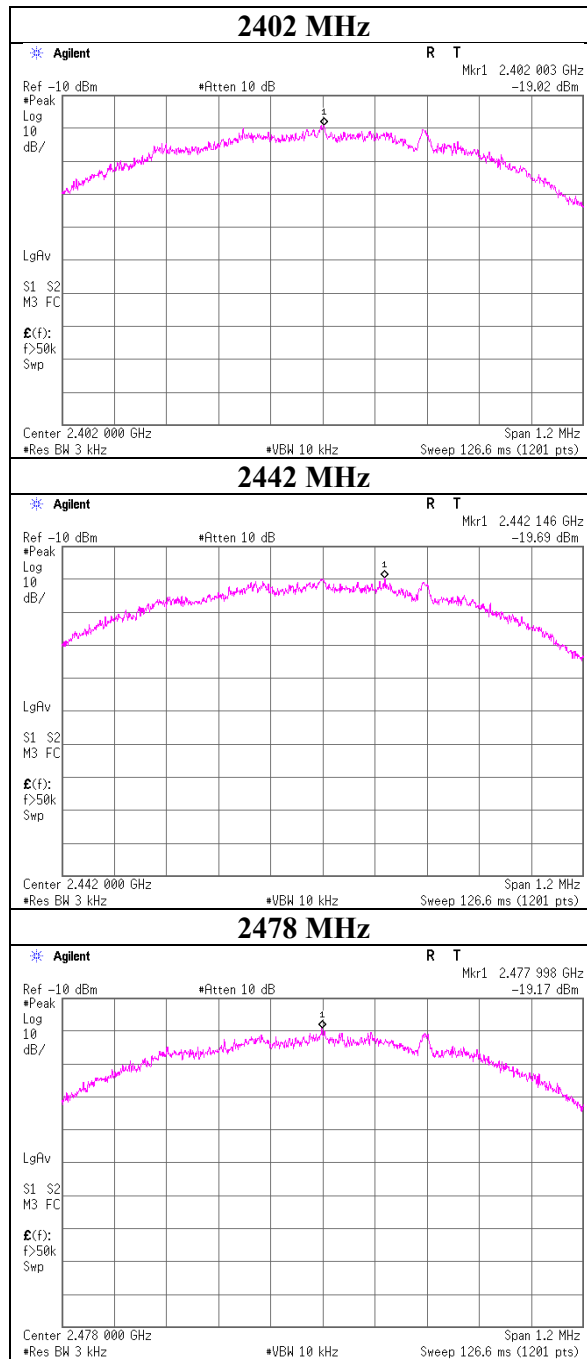
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## Power Density



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## APPENDIX 2: Test instruments

### Test Instruments

| Test Item | LIMS ID | Description                       | Manufacturer             | Model                    | Serial                       | Last Calibration Date | Calibration Due Date | Cal Int |
|-----------|---------|-----------------------------------|--------------------------|--------------------------|------------------------------|-----------------------|----------------------|---------|
| RE        | 141562  | Thermo-Hygrometer                 | CUSTOM                   | CTH-201                  | 0010                         | 1/11/2019             | 01/31/2020           | 12      |
| RE        | 141506  | Horn Antenna 15-40GHz             | Schwarzbeck              | BBHA9170                 | BBHA9170307                  | 6/8/2018              | 06/30/2019           | 12      |
| RE        | 141412  | Microwave Cable                   | Junkosha                 | MWX221                   | 1305S002R(1m) / 1405S146(5m) | 6/14/2018             | 06/30/2019           | 12      |
| RE        | 141508  | Horn Antenna 1-18GHz              | Schwarzbeck              | BBHA9120D                | 9120D-557                    | 6/8/2018              | 06/30/2019           | 12      |
| RE        | 141296  | High Pass Filter 3.5-18.0GHz      | UL Japan                 | HPF SELECTOR             | 002                          | 9/19/2018             | 09/30/2019           | 12      |
| RE        | 141581  | MicroWave System Amplifier        | AGILENT                  | 83017A                   | 650                          | 10/4/2018             | 10/31/2019           | 12      |
| RE        | 141899  | Spectrum Analyzer                 | AGILENT                  | E4448A                   | MY46180655                   | 8/10/2018             | 08/31/2019           | 12      |
| RE        | 141152  | EMI measurement program           | TSJ                      | TEPTO-DV                 | -                            | -                     | -                    | -       |
| RE        | 142017  | AC4 Semi Anechoic Chamber(SVSWR)  | TDK                      | Semi Anechoic Chamber 3m | DA-10005                     | 4/7/2018              | 04/30/2019           | 12      |
| RE        | 142228  | Measure                           | KOMELON                  | KMC-36                   | -                            | -                     | -                    | -       |
| RE        | 141545  | DIGITAL HiTESTER                  | HIOKI                    | 3805                     | 51201148                     | 1/29/2019             | 01/31/2020           | 12      |
| AT        | 141567  | Thermo-Hygrometer                 | CUSTOM                   | CTH-201                  | 0008                         | 1/11/2019             | 01/31/2020           | 12      |
| AT        | 141156  | Attenuator(10dB)                  | Weinschel Corp           | 2                        | BL1173                       | 11/2/2018             | 11/30/2019           | 12      |
| AT        | 141173  | Attenuator(10dB) (above1GHz)      | HIROSE ELECTRIC CO.,LTD. | AT-110                   | -                            | 12/17/2018            | 12/31/2019           | 12      |
| AT        | 141841  | Power sensor                      | ANRITSU                  | MA2411B                  | 11598                        | 10/31/2018            | 10/31/2019           | 12      |
| AT        | 141806  | Power Meter                       | ANRITSU                  | ML2495A                  | 6K00003348                   | 10/31/2018            | 10/31/2019           | 12      |
| AT        | 141855  | Spectrum Analyzer                 | AGILENT                  | E4440A                   | MY46187750                   | 11/9/2018             | 11/30/2019           | 12      |
| RE        | 141397  | Coaxial Cable                     | UL Japan                 | -                        | -                            | 6/13/2018             | 06/30/2019           | 12      |
| RE        | 148898  | Attenuator                        | KEYSIGHT                 | 8491A                    | MY52462282                   | 10/3/2018             | 10/31/2019           | 12      |
| RE        | 141267  | Logperiodic Antenna (200-1000MHz) | Schwarzbeck              | VUSLP9111B               | 911B-192                     | 6/1/2018              | 06/30/2019           | 12      |
| RE        | 141425  | Biconical Antenna                 | Schwarzbeck              | BBA9106                  | 1302                         | 6/1/2018              | 06/30/2019           | 12      |
| RE        | 141950  | EMI Test Receiver                 | Rohde & Schwarz          | ESU26                    | 100412                       | 6/15/2018             | 06/30/2019           | 12      |
| RE        | 141583  | Pre Amplifier                     | SONOMA INSTRUMENT        | 310                      | 260833                       | 2/8/2019              | 02/29/2020           | 12      |

\*Hyphens for Last Calibration Date, Calibration Due Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.

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

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

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

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

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