



# **RADIO TEST REPORT**

**Test Report No. : 13280770H-A**

**Applicant** : OMRON HEALTHCARE Co., Ltd.  
**Type of EUT** : WheezeScan  
**Model Number of EUT** : RE-W100  
**FCC ID** : Q6ZHWZ1000T  
**Test regulation** : FCC Part 15 Subpart C: 2019  
**Test Result** : Complied (Refer to SECTION 3.2)

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
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 U.S. Government.
8. The information provided from the customer for this report is identified in SECTION 1.

**Date of test:** March 23 and April 2, 2020

**Representative test engineer:**

Hiroyuki Furutaka  
Engineer

Consumer Technology Division

**Approved by:**

Takayuki Shimada  
Leader

Consumer Technology Division



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/)

- ☐ This report contains data that are not covered by the NVLAP accreditation.  
☒ There is no testing item of "Non-accreditation".

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## **REVISION HISTORY**

**Original Test Report No.: 13280770H-A**

| Revision        | Test report No. | Date           | Page revised | Contents |
|-----------------|-----------------|----------------|--------------|----------|
| -<br>(Original) | 13280770H-A     | April 22, 2020 | -            | -        |

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## Reference: Abbreviations (Including words undescribed in this report)

|                |                                                                 |         |                                                     |
|----------------|-----------------------------------------------------------------|---------|-----------------------------------------------------|
| A2LA           | The American Association for Laboratory Accreditation           | MCS     | Modulation and Coding Scheme                        |
| AC             | Alternating Current                                             | MRA     | Mutual Recognition Arrangement                      |
| AFH            | Adaptive Frequency Hopping                                      | N/A     | Not Applicable                                      |
| AM             | Amplitude Modulation                                            | NIST    | National Institute of Standards and Technology      |
| Amp, AMP       | Amplifier                                                       | NS      | No signal detect.                                   |
| ANSI           | American National Standards Institute                           | NSA     | Normalized Site Attenuation                         |
| Ant, ANT       | Antenna                                                         | NVLAP   | National Voluntary Laboratory Accreditation Program |
| AP             | Access Point                                                    | OBW     | Occupied Band Width                                 |
| ASK            | Amplitude Shift Keying                                          | OFDM    | Orthogonal Frequency Division Multiplexing          |
| Atten., ATT    | Attenuator                                                      | P/M     | Power meter                                         |
| AV             | Average                                                         | PCB     | Printed Circuit Board                               |
| BPSK           | Binary Phase-Shift Keying                                       | PER     | Packet Error Rate                                   |
| BR             | Bluetooth Basic Rate                                            | PHY     | Physical Layer                                      |
| BT             | Bluetooth                                                       | PK      | Peak                                                |
| BT LE          | Bluetooth Low Energy                                            | PN      | Pseudo random Noise                                 |
| BW             | BandWidth                                                       | PRBS    | Pseudo-Random Bit Sequence                          |
| Cal Int        | Calibration Interval                                            | PSD     | Power Spectral Density                              |
| CCK            | Complementary Code Keying                                       | QAM     | Quadrature Amplitude Modulation                     |
| Ch., CH        | Channel                                                         | QP      | Quasi-Peak                                          |
| CISPR          | Comite International Special des Perturbations Radioelectriques | QPSK    | Quadri-Phase Shift Keying                           |
| CW             | Continuous Wave                                                 | RBW     | Resolution Band Width                               |
| DBPSK          | Differential BPSK                                               | RDS     | Radio Data System                                   |
| DC             | Direct Current                                                  | RE      | Radio Equipment                                     |
| D-factor       | Distance factor                                                 | RF      | Radio Frequency                                     |
| DFS            | Dynamic Frequency Selection                                     | RMS     | Root Mean Square                                    |
| DQPSK          | Differential QPSK                                               | RSS     | Radio Standards Specifications                      |
| DSSS           | Direct Sequence Spread Spectrum                                 | Rx      | Receiving                                           |
| EDR            | Enhanced Data Rate                                              | SA, S/A | Spectrum Analyzer                                   |
| EIRP, e.i.r.p. | Equivalent Isotropically Radiated Power                         | SG      | Signal Generator                                    |
| EMC            | ElectroMagnetic Compatibility                                   | SVSWR   | Site-Voltage Standing Wave Ratio                    |
| EMI            | ElectroMagnetic Interference                                    | TR      | Test Receiver                                       |
| EN             | European Norm                                                   | Tx      | Transmitting                                        |
| ERP, e.r.p.    | Effective Radiated Power                                        | VBW     | Video BandWidth                                     |
| EU             | European Union                                                  | Vert.   | Vertical                                            |
| EUT            | Equipment Under Test                                            | WLAN    | Wireless LAN                                        |
| Fac.           | Factor                                                          |         |                                                     |
| FCC            | Federal Communications Commission                               |         |                                                     |
| FHSS           | Frequency Hopping Spread Spectrum                               |         |                                                     |
| FM             | Frequency Modulation                                            |         |                                                     |
| Freq.          | Frequency                                                       |         |                                                     |
| FSK            | Frequency Shift Keying                                          |         |                                                     |
| GFSK           | Gaussian Frequency-Shift Keying                                 |         |                                                     |
| GNSS           | Global Navigation Satellite System                              |         |                                                     |
| GPS            | Global Positioning System                                       |         |                                                     |
| Hori.          | Horizontal                                                      |         |                                                     |
| ICES           | Interference-Causing Equipment Standard                         |         |                                                     |
| IEC            | International Electrotechnical Commission                       |         |                                                     |
| IEEE           | Institute of Electrical and Electronics Engineers               |         |                                                     |
| IF             | Intermediate Frequency                                          |         |                                                     |
| ILAC           | International Laboratory Accreditation Conference               |         |                                                     |
| ISED           | Innovation, Science and Economic Development Canada             |         |                                                     |
| ISO            | International Organization for Standardization                  |         |                                                     |
| JAB            | Japan Accreditation Board                                       |         |                                                     |
| LAN            | Local Area Network                                              |         |                                                     |
| LIMS           | Laboratory Information Management System                        |         |                                                     |

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## **SECTION 1: Customer information**

|                  |   |                                                        |
|------------------|---|--------------------------------------------------------|
| Company Name     | : | OMRON HEALTHCARE Co., Ltd.                             |
| Address          | : | 53, Kunotsubo, Terado-cho, Muko, KYOTO, 617-0002 Japan |
| Telephone Number | : | +81-75-925-2045                                        |
| Facsimile Number | : | +81-75-925-2046                                        |
| Contact Person   | : | Yoshinori Tsurumi                                      |

The information provided from the customer is as follows;

- Applicant, Type of EUT, Model Number of EUT, FCC ID on the cover and other relevant pages
- Operating/Test Mode(s) (Mode(s)) on all the relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (EUT) other than the Receipt Date
- SECTION 4: Operation of EUT 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 (EUT)**

### **2.1 Identification of EUT**

|                            |   |                                                                                           |
|----------------------------|---|-------------------------------------------------------------------------------------------|
| Type                       | : | WheezeScan                                                                                |
| Model Number               | : | RE-W100                                                                                   |
| Serial Number              | : | Refer to SECTION 4.2                                                                      |
| Rating                     | : | DC 3.0 V                                                                                  |
| Receipt Date               | : | March 23, 2020                                                                            |
| Country of Mass-production | : | China                                                                                     |
| Condition                  | : | 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: RE-W100 (referred to as the EUT in this report) is a WheezeScan.

### **Radio Specification**

|                           |   |                     |
|---------------------------|---|---------------------|
| Radio Type                | : | Transceiver         |
| Frequency of Operation    | : | 2402 MHz - 2480 MHz |
| Modulation                | : | GFSK                |
| Antenna type              | : | Chip Antenna        |
| Antenna Gain              | : | 5.05 dBi            |
| Clock frequency (Maximum) | : | 26 MHz              |

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

### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C  
FCC Part 15 final revised on July 19, 2019 and effective August 19, 2019 except 15.258

Title : FCC 47 CFR Part 15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.207 Conducted limits  
Section 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz,  
and 5725-5850 MHz

\* Also the EUT complies with FCC Part 15 Subpart B.

### **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>ISED: RSS-Gen 8.8      | FCC: Section 15.207<br>ISED: RSS-Gen 8.8                                   | N/A                                     | N/A                | *1)                                                               |
| 6dB Bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | FCC: KDB 558074 D01<br>15.247<br>Meas Guidance v05r02<br>ISED: -            | FCC: Section<br>15.247(a)(2)<br>ISED: RSS-247 5.2(a)                       | See data.                               | Complied<br>a)     | Conducted                                                         |
| Maximum Peak Output Power                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | FCC: KDB 558074 D01<br>15.247<br>Meas Guidance v05r02<br>ISED: RSS-Gen 6.12 | FCC: Section<br>15.247(b)(3)<br>ISED: RSS-247 5.4(d)                       |                                         | Complied<br>b)     | Conducted                                                         |
| Power Density                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | FCC: KDB 558074 D01<br>15.247<br>Meas Guidance v05r02<br>ISED: -            | FCC: Section 15.247(e)<br>ISED: RSS-247 5.2(b)                             |                                         | Complied<br>c)     | Conducted                                                         |
| Spurious Emission<br>Restricted Band<br>Edges                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | FCC: KDB 558074 D01<br>15.247<br>Meas Guidance v05r02<br>ISED: RSS-Gen 6.13 | FCC: Section 15.247(d)<br>ISED: RSS-247 5.5<br>RSS-Gen 8.9<br>RSS-Gen 8.10 | 5.4 dB<br>4804.000 MHz,<br>Vertical, AV | Complied<br>d), e) | Conducted<br>(below 30 MHz)/<br>Radiated<br>(above 30 MHz)<br>*2) |
| Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.<br>*1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.<br>*2) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 15.247 Meas Guidance v05r02 8.5 and 8.6.<br>a) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)<br>b) Refer to APPENDIX 1 (data of Maximum Peak Output Power)<br>c) Refer to APPENDIX 1 (data of Power Density)<br>d) Refer to APPENDIX 1 (data of Conducted Spurious Emission)<br>e) Refer to APPENDIX 1 (data of Radiated Spurious Emission)<br>Symbols:<br>Complied The data of this test item has enough margin, more than the measurement uncertainty.<br>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.

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

The test was performed with the New Battery and the stable voltage was supplied to the EUT RF module 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.

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### 3.3 Addition to standard

| Item                   | Test Procedure    | Specification | Worst margin | Results | Remarks   |
|------------------------|-------------------|---------------|--------------|---------|-----------|
| 99% Occupied Bandwidth | ISED: RSS-Gen 6.7 | ISED: -       | N/A          | -       | Conducted |

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

### 3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the 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 | 1.4 dB            |
| Carrier Frequency Separation                     | 0.42 %            |
| Dwell time / Burst rate                          | 0.10 %            |
| Conducted Spurious Emission                      | 2.6 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)<br>(Vertical)   | 4.8 dB            |
|                      |                                                | 5.0 dB            |
|                      | 200 MHz to 1000 MHz (Horizontal)<br>(Vertical) | 5.2 dB            |
|                      |                                                | 6.3 dB            |
| 10 m                 | 30 MHz to 200 MHz (Horizontal)<br>(Vertical)   | 4.8 dB            |
|                      |                                                | 4.8 dB            |
|                      | 200 MHz to 1000 MHz (Horizontal)<br>(Vertical) | 5.0 dB            |
|                      |                                                | 5.0 dB            |
| 3 m                  | 1 GHz to 6 GHz                                 | 4.9 dB            |
|                      | 6 GHz to 18 GHz                                | 5.2 dB            |
| 1 m                  | 10 GHz to 26.5 GHz                             | 5.5 dB            |
|                      | 26.5 GHz to 40 GHz                             | 5.5 dB            |
| 10 m                 | 1 GHz to 18 GHz                                | 5.2 dB            |

### 3.5 Test Location

UL Japan, Inc. Ise EMC Lab.

\*NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967 / ISED Lab Company Number: 2973C

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| Test site                  | 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 | 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 | 7.5 x 5.8 x 5.2            | 4.0 x 4.0                                                        | -                      | 3 m                          |
| No.3 semi-anechoic chamber | 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 | 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.5 measurement room      | 6.4 x 6.4 x 3.0            | 6.4 x 6.4                                                        | -                      | -                            |
| 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 x 2.0 m 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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## **SECTION 4: Operation of EUT during testing**

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

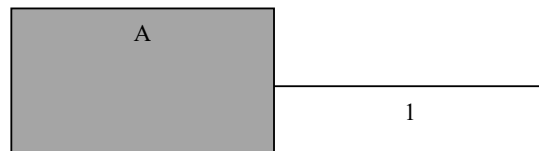
| Mode                                                                                                                                                                                                                 | Remarks*                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Bluetooth Low Energy (BT LE)                                                                                                                                                                                         | Payload: PRBS9<br>Uncoded 1M-PHY |
| *Power of the EUT was set by the software as follows;<br>Power settings: 0dBm<br>Software: Lanmei Ver. F.00.7GA-07<br>(Date: 2019.10.10, Storage location: TC3567C)                                                  |                                  |
| *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 frequency                 |
|------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------|
| 6dB Bandwidth and 99% Occupied Bandwidth<br>Maximum Peak Output Power<br>Spurious Emission (Radiated / Conducted)<br>Power Density | Tx BT LE       | 2402 MHz<br>2440 MHz<br>2480 MHz |

### **4.2 Configuration and peripherals**

[Radiated emission test]



#### **Description of EUT**

| No. | Item       | Model number | Serial number | Manufacturer               | Remarks |
|-----|------------|--------------|---------------|----------------------------|---------|
| A   | WheezeScan | RE-W100      | 286           | OMRON HEALTHCARE Co., Ltd. | EUT     |

#### **List of cables used**

| No. | Name         | Length (m) | Shield     |            | Remarks |
|-----|--------------|------------|------------|------------|---------|
|     |              |            | Cable      | Connector  |         |
| 1   | Signal Cable | 0.05       | Unshielded | Unshielded | -       |

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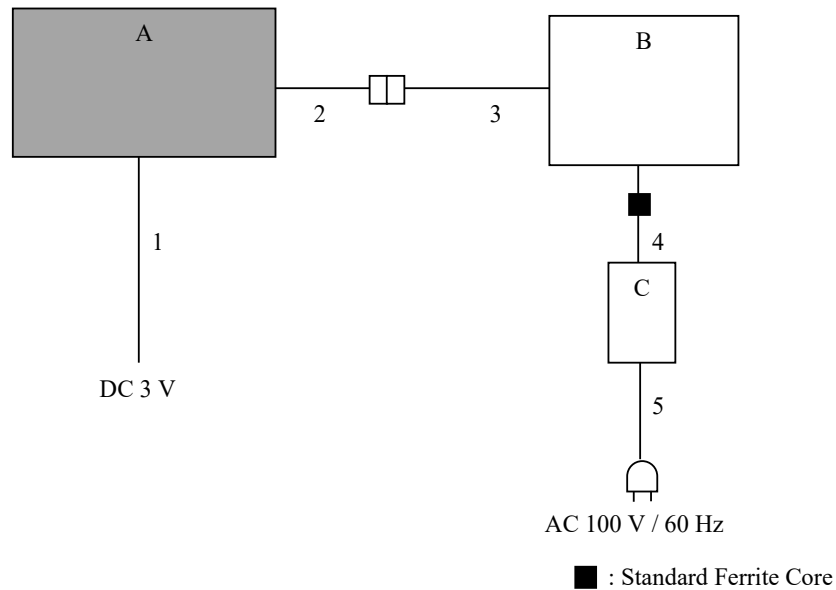
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[Antenna Terminal conducted test]



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

**Description of EUT and Support equipment**

| No. | Item       | Model number | Serial number                | Manufacturer               | Remarks |
|-----|------------|--------------|------------------------------|----------------------------|---------|
| A   | WheezeScan | RE-W100      | 285                          | OMRON HEALTHCARE Co., Ltd. | EUT     |
| B   | Laptop PC  | P24T         | 4S7GLT2                      | DELL                       | -       |
| C   | AC Adaptor | LA45NM140    | CN-0KXTTW-LOC00-967-6828-A09 | DELL                       | -       |

**List of cables used**

| No. | Name         | Length (m) | Shield     |            | Remarks |
|-----|--------------|------------|------------|------------|---------|
|     |              |            | Cable      | Connector  |         |
| 1   | DC Cable     | 1.50       | Unshielded | Unshielded | -       |
| 2   | Signal Cable | 0.07       | Unshielded | Unshielded | -       |
| 3   | USB Cable    | 1.50       | Shielded   | Shielded   | -       |
| 4   | DC Cable     | 1.80       | Unshielded | Unshielded | -       |
| 5   | AC Cable     | 0.30       | Unshielded | Unshielded | -       |

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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 v05r02".

[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 m and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

Test antenna was aimed at the EUT for receiving the maximum signal and always kept within the illumination area of the 3 dB beamwidth of the antenna.

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(ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).**

|                 |               |                          |                                                                                                                                                                                                                               |                              |
|-----------------|---------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 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 | 11.12.2.5.1<br>RBW: 1 MHz<br>VBW: 3 MHz<br>Detector:<br>Power Averaging (RMS)<br>Trace: 100 traces<br>11.12.2.5.2<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: 300 kHz |

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

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**Ise EMC Lab.**

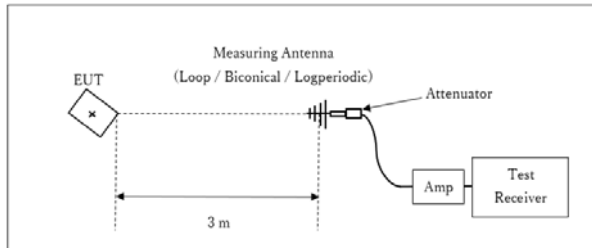
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

**Figure 2: Test Setup**

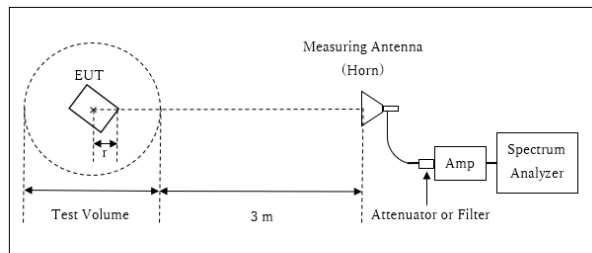
Below 1 GHz



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:  $20 \times \log (3.75 \text{ m} / 3.0 \text{ m}) = 1.94 \text{ dB}$

\* Test Distance:  $(3 + \text{Test Volume} / 2) - r = 3.75 \text{ m}$

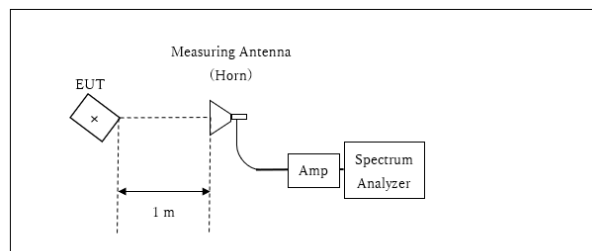
Test Volume : 1.5 m

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

r = 0.0 m

\* The test was performed with r = 0.0 m since EUT is small and it was the rather conservative condition.

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

## **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/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) *5) | 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.  
 \*2) Reference data  
 \*3) Section 11.10.2 Method PKPSD (peak PSD) of "ANSI C63.10-2013".  
 \*4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.  
 Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.  
 (9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 9.1 kHz)  
 \*5) The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohms. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to  $45.5 - 51.5 = -6.0$  dBuA/m, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

The test results and limit are rounded off to two decimals place, so some differences might be observed.  
 The equipment and cables were not used for factor 0 dB of the data sheets.

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

## **APPENDIX 1: Test data**

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

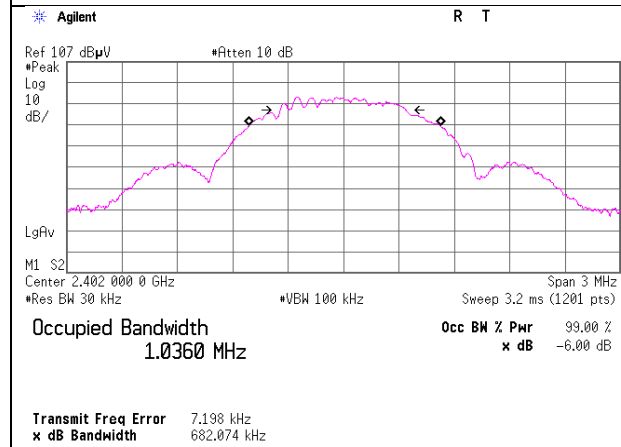
Report No. 13280770H  
Test place Ise EMC Lab. No.6 Measurement Room  
Date March 23, 2020  
Temperature / Humidity 23 deg. C / 41 % RH  
Engineer Hiroyuki Furutaka  
Mode Tx BT LE

| Mode  | Frequency<br>[MHz] | 99% Occupied<br>Bandwidth<br>[kHz] | 6dB Bandwidth<br>[MHz] | Limit for<br>6dB Bandwidth<br>[MHz] |
|-------|--------------------|------------------------------------|------------------------|-------------------------------------|
| BT LE | 2402               | 1036.0                             | 0.713                  | > 0.5000                            |
|       | 2440               | 1034.1                             | 0.705                  | > 0.5000                            |
|       | 2480               | 1033.7                             | 0.707                  | > 0.5000                            |

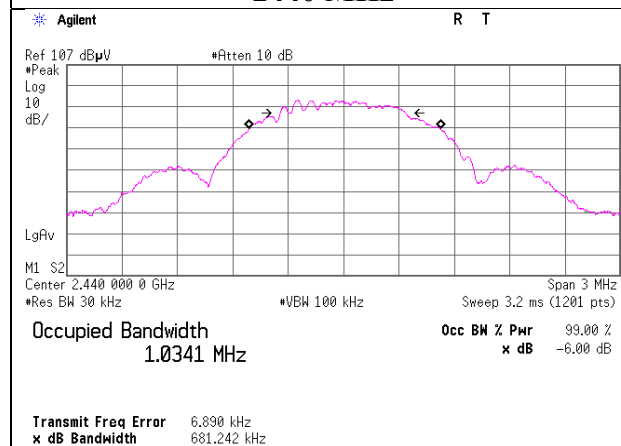
## 99%Occupied Bandwidth

BT LE

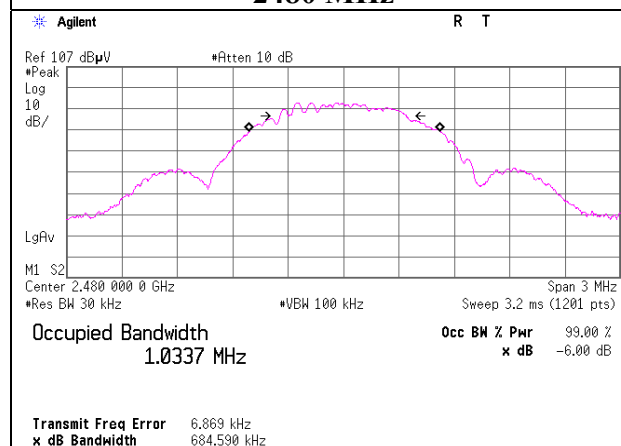
2402 MHz



2440 MHz



2480 MHz



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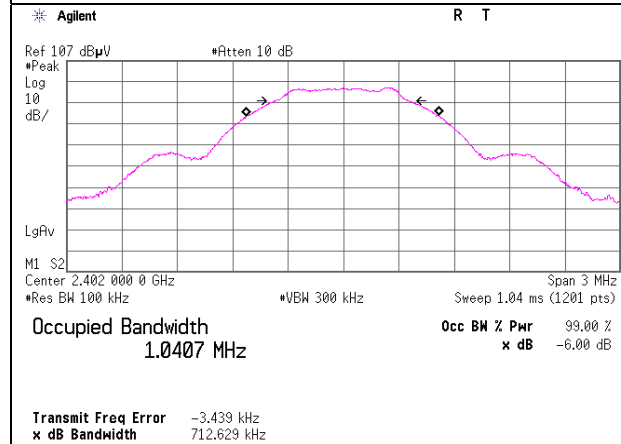
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

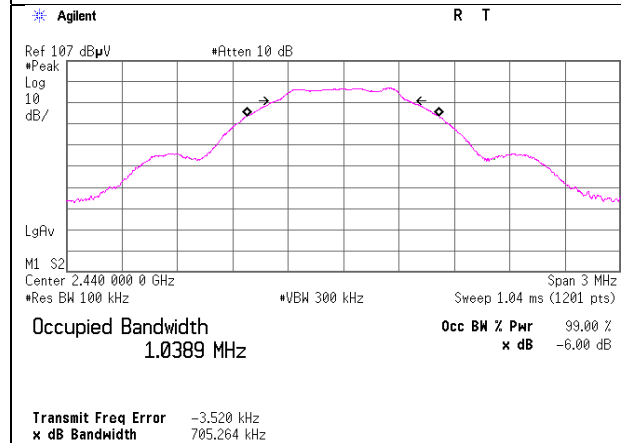
## 6dB Bandwidth

BT LE

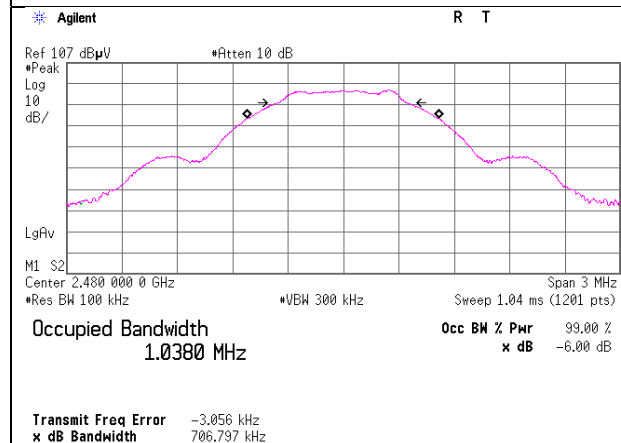
2402 MHz



2440 MHz



2480 MHz



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## Maximum Peak Output Power

Report No. 13280770H  
Test place Ise EMC Lab. No.6 Measurement Room  
Date March 23, 2020  
Temperature / Humidity 23 deg. C / 41 % RH  
Engineer Hiroyuki Furutaka  
Mode Tx BT LE

|       |         |            |             | Conducted Power |      |       |      |        | e.i.r.p. for RSS-247 |        |      |       |      |        |
|-------|---------|------------|-------------|-----------------|------|-------|------|--------|----------------------|--------|------|-------|------|--------|
| Freq. | Reading | Cable Loss | Atten. Loss | Result          |      | Limit |      | Margin | Antenna Gain         | Result |      | Limit |      | Margin |
| [MHz] | [dBm]   | [dB]       | [dB]        | [dBm]           | [mW] | [dBm] | [mW] | [dB]   | [dBi]                | [dBm]  | [mW] | [dBm] | [mW] | [dB]   |
| 2402  | -11.94  | 1.07       | 10.06       | -0.81           | 0.83 | 30.00 | 1000 | 30.81  | 5.05                 | 4.24   | 2.65 | 36.02 | 4000 | 31.78  |
| 2440  | -11.99  | 1.07       | 10.06       | -0.86           | 0.82 | 30.00 | 1000 | 30.86  | 5.05                 | 4.19   | 2.62 | 36.02 | 4000 | 31.83  |
| 2480  | -12.14  | 1.08       | 10.06       | -1.00           | 0.79 | 30.00 | 1000 | 31.00  | 5.05                 | 4.05   | 2.54 | 36.02 | 4000 | 31.97  |

Sample Calculation:

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

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

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

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

Report No. 13280770H  
Test place Ise EMC Lab. No.6 Measurement Room  
Date March 23, 2020  
Temperature / Humidity 23 deg. C / 41 % RH  
Engineer Hiroyuki Furutaka  
Mode Tx BT LE

| Freq.<br>[MHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>Loss<br>[dB] | Result<br>(Burst power average) |      |
|----------------|------------------|-----------------------|------------------------|---------------------------------|------|
|                |                  |                       |                        | [dBm]                           | [mW] |
| 2402           | -12.24           | 1.07                  | 10.06                  | -1.11                           | 0.77 |
| 2440           | -12.31           | 1.07                  | 10.06                  | -1.18                           | 0.76 |
| 2480           | -12.48           | 1.08                  | 10.06                  | -1.34                           | 0.73 |

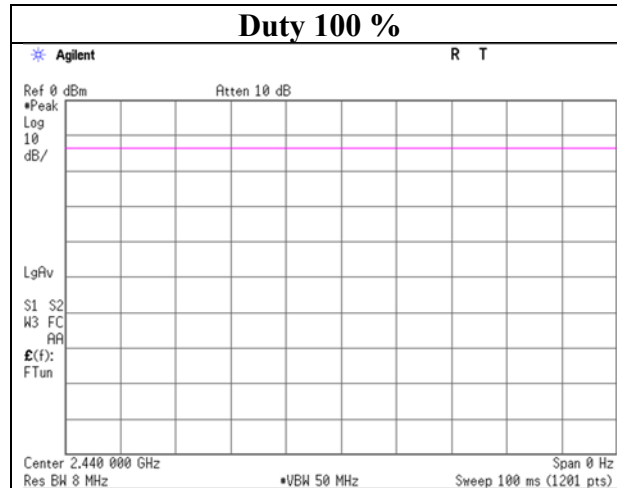
Sample Calculation:

Result (Burst power average) = 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.

### Burst rate confirmation

Report No. 13280770H  
Test place Ise EMC Lab. No.6 Measurement Room  
Date March 23, 2020  
Temperature / Humidity 23 deg. C / 41 % RH  
Engineer Hiroyuki Furutaka  
Mode Tx BT LE



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

## Radiated Spurious Emission

Report No. 13280770H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.2  
Date April 2, 2020  
Temperature / Humidity 26 deg. C / 23 % RH  
Engineer Tomohisa Nakagawa  
Mode Tx BT LE 2402 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.    | 40.000             | QP       | 26.3              | 14.9               | 7.2          | 30.4         | -                   | 17.9               | 40.0              | 22.1           | Floor noise |
| Hori.    | 115.000            | QP       | 26.3              | 12.4               | 8.2          | 30.1         | -                   | 16.7               | 43.5              | 26.8           | Floor noise |
| Hori.    | 135.000            | QP       | 25.0              | 14.1               | 8.4          | 30.0         | -                   | 17.5               | 43.5              | 26.0           | Floor noise |
| Hori.    | 330.000            | QP       | 23.7              | 14.4               | 10.0         | 29.3         | -                   | 18.8               | 46.0              | 27.2           | Floor noise |
| Hori.    | 450.000            | QP       | 23.5              | 16.5               | 10.8         | 29.9         | -                   | 20.9               | 46.0              | 25.1           | Floor noise |
| Hori.    | 750.000            | QP       | 21.5              | 20.0               | 12.3         | 29.1         | -                   | 24.6               | 46.0              | 21.4           | Floor noise |
| Hori.    | 2390.000           | PK       | 43.6              | 27.6               | 4.9          | 35.2         | -                   | 40.9               | 73.9              | 33.0           |             |
| Hori.    | 4804.000           | PK       | 46.5              | 31.6               | 7.1          | 34.4         | -                   | 50.8               | 73.9              | 23.1           |             |
| Hori.    | 7206.000           | PK       | 42.1              | 36.1               | 8.4          | 34.3         | -                   | 52.4               | 73.9              | 21.6           | Floor noise |
| Hori.    | 9608.000           | PK       | 42.0              | 38.6               | 9.0          | 34.9         | -                   | 54.7               | 73.9              | 19.2           | Floor noise |
| Hori.    | 2390.000           | AV       | 35.7              | 27.6               | 4.9          | 35.2         | -                   | 32.9               | 53.9              | 21.0           |             |
| Hori.    | 4804.000           | AV       | 41.4              | 31.6               | 7.1          | 34.4         | -                   | 45.7               | 53.9              | 8.2            |             |
| Hori.    | 7206.000           | AV       | 34.7              | 36.1               | 8.4          | 34.3         | -                   | 44.9               | 53.9              | 9.0            | Floor noise |
| Hori.    | 9608.000           | AV       | 34.6              | 38.6               | 9.0          | 34.9         | -                   | 47.4               | 53.9              | 6.5            | Floor noise |
| Vert.    | 40.000             | QP       | 26.3              | 14.9               | 7.2          | 30.4         | -                   | 17.9               | 40.0              | 22.1           | Floor noise |
| Vert.    | 115.000            | QP       | 26.3              | 12.4               | 8.2          | 30.1         | -                   | 16.7               | 43.5              | 26.8           | Floor noise |
| Vert.    | 135.000            | QP       | 25.0              | 14.1               | 8.4          | 30.0         | -                   | 17.5               | 43.5              | 26.0           | Floor noise |
| Vert.    | 330.000            | QP       | 23.8              | 14.4               | 10.0         | 29.3         | -                   | 18.9               | 46.0              | 27.1           | Floor noise |
| Vert.    | 450.000            | QP       | 23.5              | 16.5               | 10.8         | 29.9         | -                   | 20.9               | 46.0              | 25.1           | Floor noise |
| Vert.    | 750.000            | QP       | 21.5              | 20.0               | 12.3         | 29.1         | -                   | 24.6               | 46.0              | 21.4           | Floor noise |
| Vert.    | 2390.000           | PK       | 44.2              | 27.6               | 4.9          | 35.2         | -                   | 41.5               | 73.9              | 32.4           |             |
| Vert.    | 4804.000           | PK       | 48.8              | 31.6               | 7.1          | 34.4         | -                   | 53.1               | 73.9              | 20.8           |             |
| Vert.    | 7206.000           | PK       | 42.2              | 36.1               | 8.4          | 34.3         | -                   | 52.4               | 73.9              | 21.5           | Floor noise |
| Vert.    | 9608.000           | PK       | 42.2              | 38.6               | 9.0          | 34.9         | -                   | 54.9               | 73.9              | 19.0           | Floor noise |
| Vert.    | 2390.000           | AV       | 35.2              | 27.6               | 4.9          | 35.2         | -                   | 32.5               | 53.9              | 21.4           |             |
| Vert.    | 4804.000           | AV       | 44.2              | 31.6               | 7.1          | 34.4         | -                   | 48.5               | 53.9              | 5.4            |             |
| Vert.    | 7206.000           | AV       | 34.6              | 36.1               | 8.4          | 34.3         | -                   | 44.8               | 53.9              | 9.1            | Floor noise |
| Vert.    | 9608.000           | AV       | 34.4              | 38.6               | 9.0          | 34.9         | -                   | 47.1               | 53.9              | 6.8            | Floor noise |

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

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

Distance factor: 1 GHz - 10 GHz  $20\log(3.75 \text{ m} / 3.0 \text{ m}) = 1.94 \text{ dB}$   
10 GHz - 26.5 GHz  $20\log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

### 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.    | 2402.000           | PK       | 95.9              | 27.6                    | 4.9          | 35.2         | 93.2               | -                 | -              | Carrier |
| Hori.    | 2400.000           | PK       | 40.2              | 27.6                    | 4.9          | 35.2         | 37.5               | 73.2              | 35.7           |         |
| Vert.    | 2402.000           | PK       | 93.6              | 27.6                    | 4.9          | 35.2         | 90.9               | -                 | -              | Carrier |
| Vert.    | 2400.000           | PK       | 39.7              | 27.6                    | 4.9          | 35.2         | 37.0               | 70.9              | 33.9           |         |

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

**UL Japan, Inc.**

**Ise EMC Lab.**

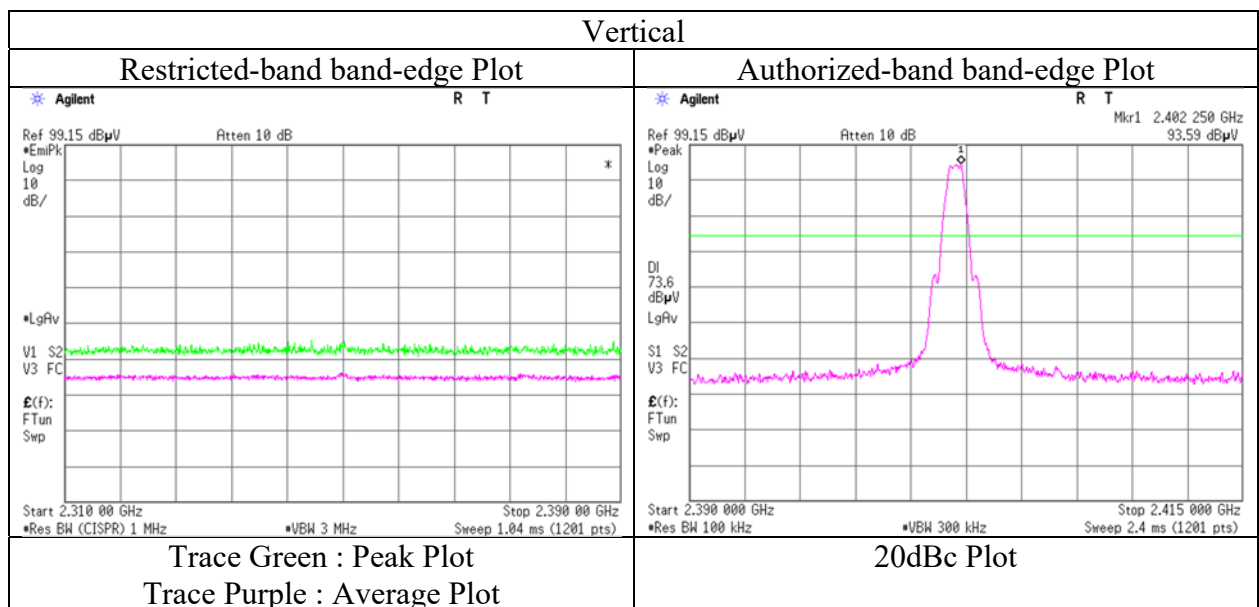
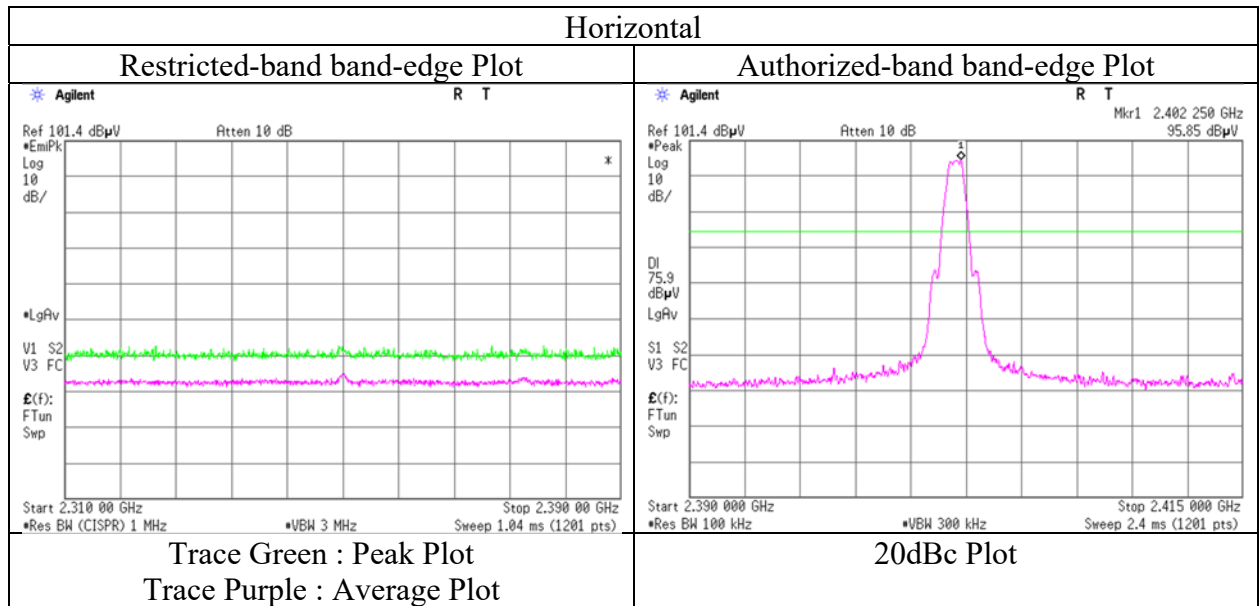
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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

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

|                        |                     |
|------------------------|---------------------|
| Report No.             | 13280770H           |
| Test place             | Ise EMC Lab.        |
| Semi Anechoic Chamber  | No.2                |
| Date                   | April 2, 2020       |
| Temperature / Humidity | 26 deg. C / 23 % RH |
| Engineer               | Tomohisa Nakagawa   |
| Mode                   | Tx BT LE 2402 MHz   |



\* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.  
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

Report No. 13280770H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.2  
Date April 2, 2020  
Temperature / Humidity 26 deg. C / 23 % RH  
Engineer Tomohisa Nakagawa  
Mode Tx BT LE 2440 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.    | 40.000             | QP       | 26.3              | 14.9               | 7.2          | 30.4         | -                   | 17.9               | 40.0              | 22.1           | Floor noise |
| Hori.    | 115.000            | QP       | 26.3              | 12.4               | 8.2          | 30.1         | -                   | 16.7               | 43.5              | 26.8           | Floor noise |
| Hori.    | 135.000            | QP       | 25.0              | 14.1               | 8.4          | 30.0         | -                   | 17.5               | 43.5              | 26.0           | Floor noise |
| Hori.    | 330.000            | QP       | 23.7              | 14.4               | 10.0         | 29.3         | -                   | 18.8               | 46.0              | 27.2           | Floor noise |
| Hori.    | 450.000            | QP       | 23.5              | 16.5               | 10.8         | 29.9         | -                   | 20.9               | 46.0              | 25.1           | Floor noise |
| Hori.    | 750.000            | QP       | 21.6              | 20.0               | 12.3         | 29.1         | -                   | 24.7               | 46.0              | 21.3           | Floor noise |
| Hori.    | 4880.000           | PK       | 45.0              | 31.6               | 7.1          | 34.4         | -                   | 49.2               | 73.9              | 24.7           |             |
| Hori.    | 7320.000           | PK       | 42.7              | 36.1               | 8.4          | 34.4         | -                   | 52.8               | 73.9              | 21.1           | Floor noise |
| Hori.    | 9760.000           | PK       | 43.0              | 39.2               | 9.1          | 34.9         | -                   | 56.4               | 73.9              | 17.5           | Floor noise |
| Hori.    | 4880.000           | AV       | 38.4              | 31.6               | 7.1          | 34.4         | -                   | 42.6               | 53.9              | 11.3           |             |
| Hori.    | 7320.000           | AV       | 35.3              | 36.1               | 8.4          | 34.4         | -                   | 45.5               | 53.9              | 8.4            | Floor noise |
| Hori.    | 9760.000           | AV       | 34.7              | 39.2               | 9.1          | 34.9         | -                   | 48.1               | 53.9              | 5.8            | Floor noise |
| Vert.    | 40.000             | QP       | 26.3              | 14.9               | 7.2          | 30.4         | -                   | 17.9               | 40.0              | 22.1           | Floor noise |
| Vert.    | 115.000            | QP       | 26.3              | 12.4               | 8.2          | 30.1         | -                   | 16.7               | 43.5              | 26.8           | Floor noise |
| Vert.    | 135.000            | QP       | 25.0              | 14.1               | 8.4          | 30.0         | -                   | 17.5               | 43.5              | 26.0           | Floor noise |
| Vert.    | 330.000            | QP       | 23.7              | 14.4               | 10.0         | 29.3         | -                   | 18.8               | 46.0              | 27.2           | Floor noise |
| Vert.    | 450.000            | QP       | 23.5              | 16.5               | 10.8         | 29.9         | -                   | 20.9               | 46.0              | 25.1           | Floor noise |
| Vert.    | 750.000            | QP       | 21.5              | 20.0               | 12.3         | 29.1         | -                   | 24.6               | 46.0              | 21.4           | Floor noise |
| Vert.    | 4880.000           | PK       | 44.4              | 31.6               | 7.1          | 34.4         | -                   | 48.6               | 73.9              | 25.3           |             |
| Vert.    | 7320.000           | PK       | 42.9              | 36.1               | 8.4          | 34.4         | -                   | 53.0               | 73.9              | 20.9           | Floor noise |
| Vert.    | 9760.000           | PK       | 42.5              | 39.2               | 9.1          | 34.9         | -                   | 55.9               | 73.9              | 18.1           | Floor noise |
| Vert.    | 4880.000           | AV       | 37.8              | 31.6               | 7.1          | 34.4         | -                   | 42.0               | 53.9              | 11.9           |             |
| Vert.    | 7320.000           | AV       | 34.9              | 36.1               | 8.4          | 34.4         | -                   | 45.0               | 53.9              | 8.9            | Floor noise |
| Vert.    | 9760.000           | AV       | 34.7              | 39.2               | 9.1          | 34.9         | -                   | 48.1               | 53.9              | 5.8            | Floor noise |

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

\*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 (3.75 m / 3.0 m) = 1.94 dB  
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

## Radiated Spurious Emission

Report No. 13280770H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.2  
Date April 2, 2020  
Temperature / Humidity 26 deg. C / 23 % RH  
Engineer Tomohisa Nakagawa  
Mode Tx BT LE 2480 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.    | 40.000             | QP       | 26.3              | 14.9               | 7.2          | 30.4         | -                   | 17.9               | 40.0              | 22.1           | Floor noise |
| Hori.    | 115.000            | QP       | 26.3              | 12.4               | 8.2          | 30.1         | -                   | 16.7               | 43.5              | 26.8           | Floor noise |
| Hori.    | 135.000            | QP       | 25.0              | 14.1               | 8.4          | 30.0         | -                   | 17.5               | 43.5              | 26.0           | Floor noise |
| Hori.    | 330.000            | QP       | 23.7              | 14.4               | 10.0         | 29.3         | -                   | 18.8               | 46.0              | 27.2           | Floor noise |
| Hori.    | 450.000            | QP       | 23.5              | 16.5               | 10.8         | 29.9         | -                   | 20.9               | 46.0              | 25.1           | Floor noise |
| Hori.    | 750.000            | QP       | 21.5              | 20.0               | 12.3         | 29.1         | -                   | 24.6               | 46.0              | 21.4           | Floor noise |
| Hori.    | 2483.500           | PK       | 44.9              | 27.5               | 5.0          | 35.2         | -                   | 42.1               | 73.9              | 31.8           |             |
| Hori.    | 4960.000           | PK       | 41.9              | 31.6               | 7.1          | 34.5         | -                   | 46.1               | 73.9              | 27.8           |             |
| Hori.    | 7440.000           | PK       | 42.8              | 36.3               | 8.4          | 34.4         | -                   | 53.0               | 73.9              | 20.9           | Floor noise |
| Hori.    | 9920.000           | PK       | 42.6              | 38.9               | 9.1          | 34.9         | -                   | 55.8               | 73.9              | 18.1           | Floor noise |
| Hori.    | 2483.500           | AV       | 36.8              | 27.5               | 5.0          | 35.2         | -                   | 34.0               | 53.9              | 19.9           |             |
| Hori.    | 4960.000           | AV       | 32.2              | 31.6               | 7.1          | 34.5         | -                   | 36.4               | 53.9              | 17.5           |             |
| Hori.    | 7440.000           | AV       | 32.5              | 36.3               | 8.4          | 34.4         | -                   | 42.7               | 53.9              | 11.2           | Floor noise |
| Hori.    | 9920.000           | AV       | 33.2              | 38.9               | 9.1          | 34.9         | -                   | 46.4               | 53.9              | 7.5            | Floor noise |
| Vert.    | 40.000             | QP       | 26.3              | 14.9               | 7.2          | 30.4         | -                   | 17.9               | 40.0              | 22.1           | Floor noise |
| Vert.    | 115.000            | QP       | 26.3              | 12.4               | 8.2          | 30.1         | -                   | 16.7               | 43.5              | 26.8           | Floor noise |
| Vert.    | 135.000            | QP       | 25.0              | 14.1               | 8.4          | 30.0         | -                   | 17.5               | 43.5              | 26.0           | Floor noise |
| Vert.    | 330.000            | QP       | 23.7              | 14.4               | 10.0         | 29.3         | -                   | 18.8               | 46.0              | 27.2           | Floor noise |
| Vert.    | 450.000            | QP       | 23.5              | 16.5               | 10.8         | 29.9         | -                   | 20.9               | 46.0              | 25.1           | Floor noise |
| Vert.    | 750.000            | QP       | 21.5              | 20.0               | 12.3         | 29.1         | -                   | 24.6               | 46.0              | 21.4           | Floor noise |
| Vert.    | 2483.500           | PK       | 44.3              | 27.5               | 5.0          | 35.2         | -                   | 41.6               | 73.9              | 32.3           |             |
| Vert.    | 4960.000           | PK       | 42.9              | 31.6               | 7.1          | 34.5         | -                   | 47.1               | 73.9              | 26.8           |             |
| Vert.    | 7440.000           | PK       | 42.7              | 36.3               | 8.4          | 34.4         | -                   | 52.9               | 73.9              | 21.0           | Floor noise |
| Vert.    | 9920.000           | PK       | 42.8              | 38.9               | 9.1          | 34.9         | -                   | 55.9               | 73.9              | 18.0           | Floor noise |
| Vert.    | 2483.500           | AV       | 36.4              | 27.5               | 5.0          | 35.2         | -                   | 33.7               | 53.9              | 20.2           |             |
| Vert.    | 4960.000           | AV       | 32.2              | 31.6               | 7.1          | 34.5         | -                   | 36.5               | 53.9              | 17.5           |             |
| Vert.    | 7440.000           | AV       | 33.2              | 36.3               | 8.4          | 34.4         | -                   | 43.5               | 53.9              | 10.5           | Floor noise |
| Vert.    | 9920.000           | AV       | 32.6              | 38.9               | 9.1          | 34.9         | -                   | 45.8               | 53.9              | 8.1            | Floor noise |

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

\*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 (3.75 m / 3.0 m) = 1.94 dB  
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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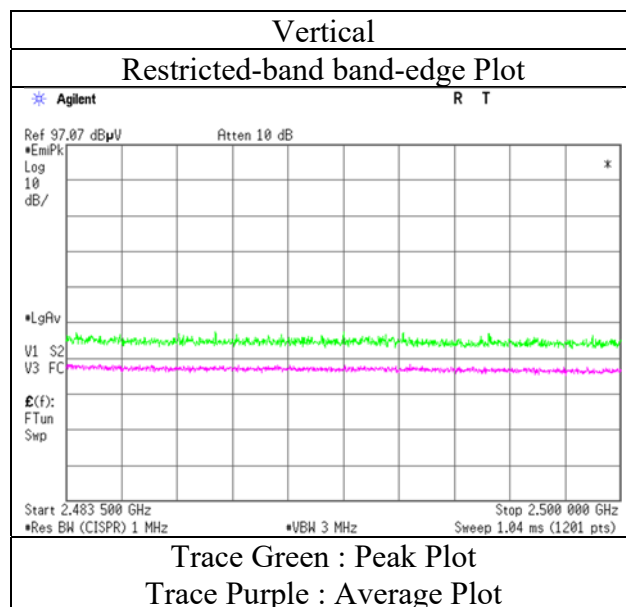
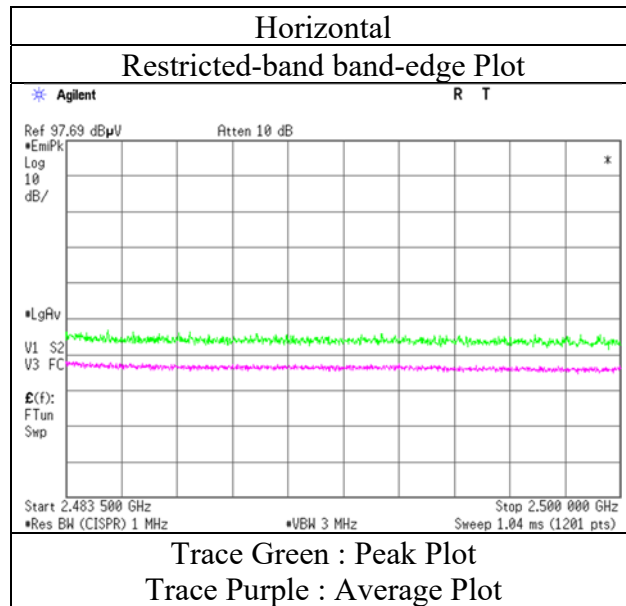
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## Radiated Spurious Emission (Reference Plot for band-edge)

|                        |                     |
|------------------------|---------------------|
| Report No.             | 13280770H           |
| Test place             | Ise EMC Lab.        |
| Semi Anechoic Chamber  | No.2                |
| Date                   | April 2, 2020       |
| Temperature / Humidity | 26 deg. C / 23 % RH |
| Engineer               | Tomohisa Nakagawa   |
| Mode                   | Tx BT LE 2480 MHz   |



\* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.  
Final result of restricted band edge was shown in tabular data.

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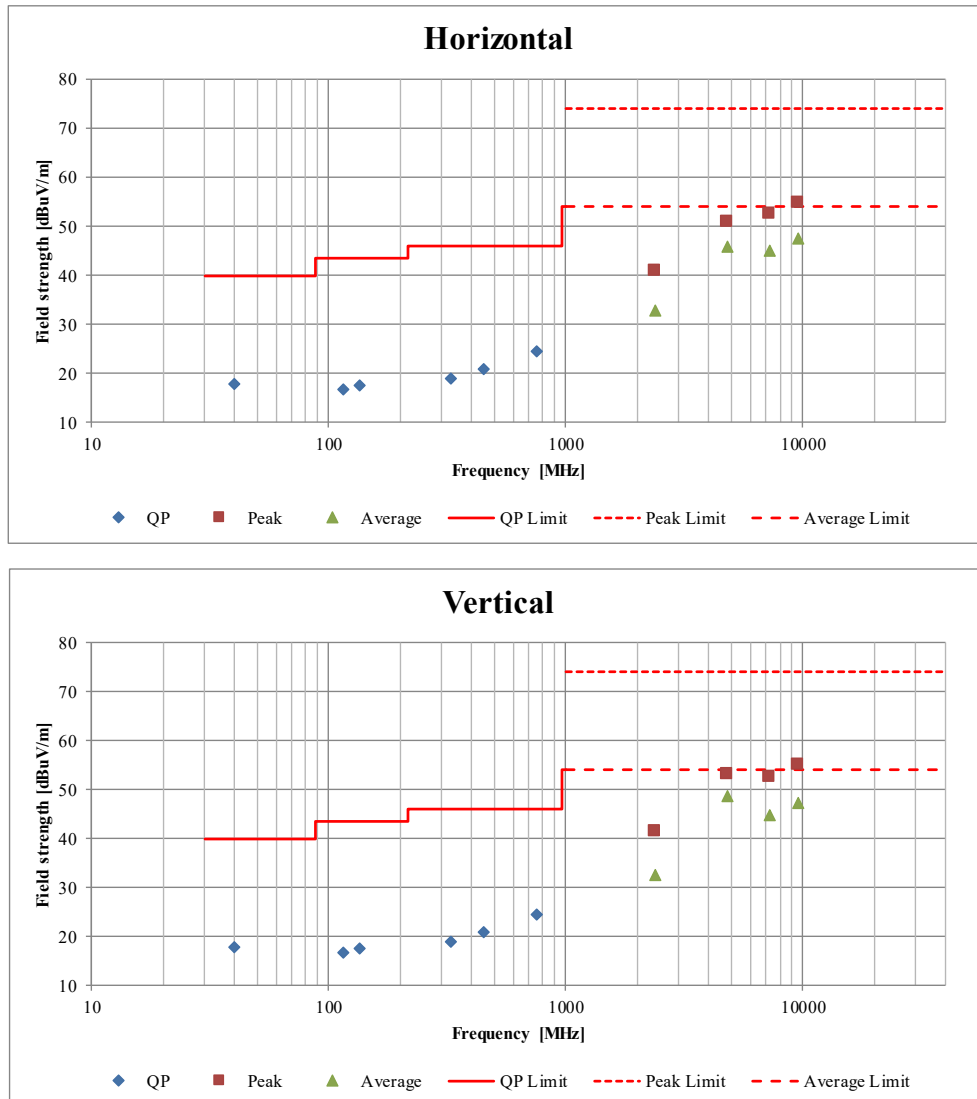
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## Radiated Spurious Emission (Plot data, Worst case)

Report No. 13280770H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.2  
Date April 2, 2020  
Temperature / Humidity 26 deg. C / 23 % RH  
Engineer Tomohisa Nakagawa  
Mode Tx BT LE 2402 MHz



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

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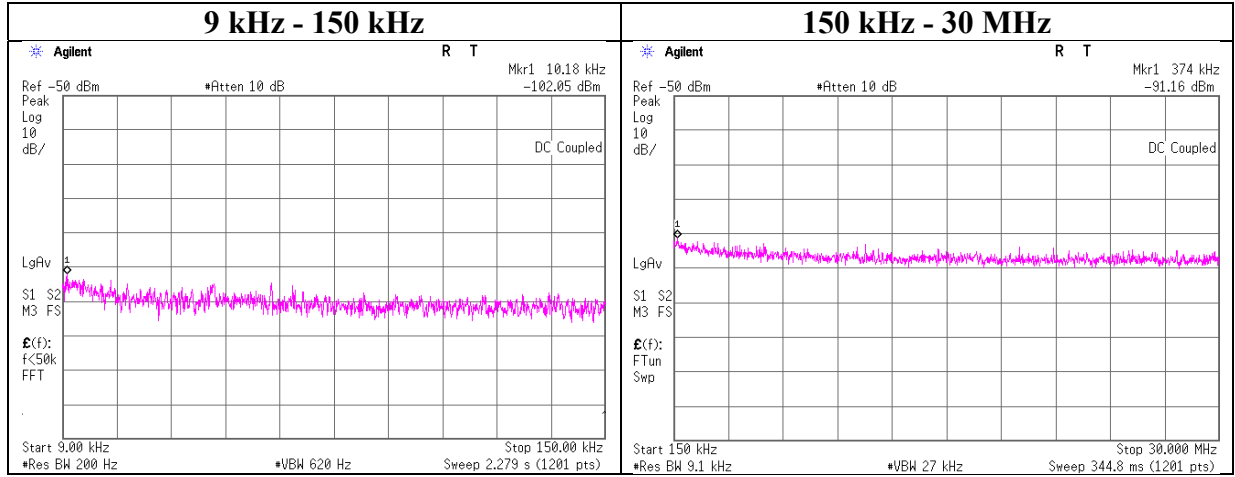
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## Conducted Spurious Emission

Report No. 13280770H  
Test place Ise EMC Lab. No.6 Measurement Room  
Date March 23, 2020  
Temperature / Humidity 23 deg. C / 41 % RH  
Engineer Hiroyuki Furutaka  
Mode Tx BT LE 2402MHz



| 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 |
|--------------------|------------------|-----------------------|----------------------------|--------------------------|----------------------------|---------------|-----------------|--------------------------|-----------------------------------|-------------------|----------------|--------|
| 10.18              | -102.1           | 0.10                  | 9.9                        | 5.05                     | 1                          | -87.0         | 300             | 6.0                      | -25.8                             | 47.4              | 73.2           |        |
| 374.00             | -91.2            | 0.10                  | 9.9                        | 5.05                     | 1                          | -76.2         | 300             | 6.0                      | -14.9                             | 16.1              | 31.0           |        |

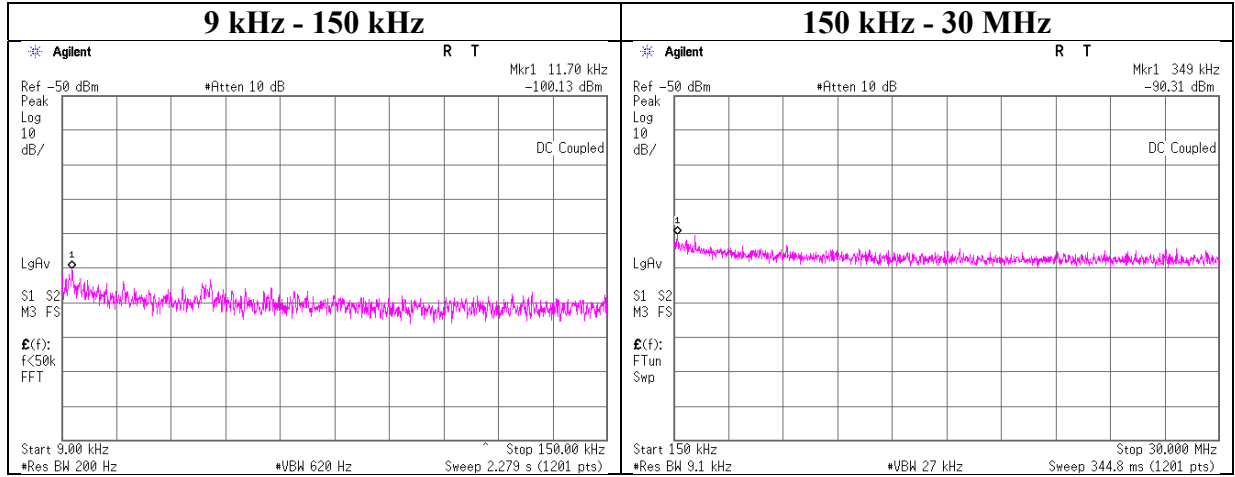
$E [dBuV/m] = EIRP [dBm] - 20 \log (Distance [m]) + Ground\ bounce [dB] + 104.8 [dBuV/m]$

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

N: Number of output

## Conducted Spurious Emission

Report No. 13280770H  
Test place Ise EMC Lab. No.6 Measurement Room  
Date March 23, 2020  
Temperature / Humidity 23 deg. C / 41 % RH  
Engineer Hiroyuki Furutaka  
Mode Tx BT LE 2440MHz



| 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              | -100.1           | 0.10                  | 9.9                        | 5.05                     | 1                          | -85.1         | 300             | 6.0                      | -23.9                             | 46.2              | 70.1           |        |
| 349.00             | -90.3            | 0.10                  | 9.9                        | 5.05                     | 1                          | -75.3         | 300             | 6.0                      | -14.1                             | 16.7              | 30.8           |        |

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

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

N: Number of output

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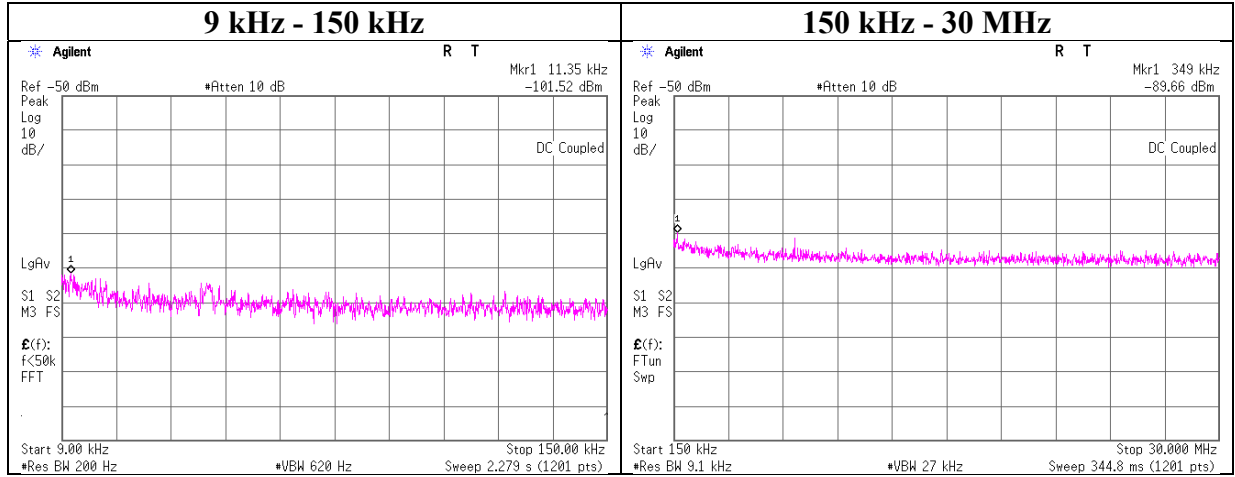
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## Conducted Spurious Emission

Report No. 13280770H  
Test place Ise EMC Lab. No.6 Measurement Room  
Date March 23, 2020  
Temperature / Humidity 23 deg. C / 41 % RH  
Engineer Hiroyuki Furutaka  
Mode Tx BT LE 2480MHz



| 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              | -101.5           | 0.10                  | 9.9                        | 5.05                     | 1                          | -86.5         | 300             | 6.0                      | -25.2                             | 46.5              | 71.7           |        |
| 349.00             | -89.7            | 0.10                  | 9.9                        | 5.05                     | 1                          | -74.7         | 300             | 6.0                      | -13.4                             | 16.7              | 30.1           |        |

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

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

N: Number of output

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### **Power Density**

Report No. 13280770H  
Test place Ise EMC Lab. No.6 Measurement Room  
Date March 23, 2020  
Temperature / Humidity 23 deg. C / 41 % RH  
Engineer Hiroyuki Furutaka  
Mode Tx BT LE

| Freq. | Reading | Cable<br>Loss | Atten.<br>Loss | Result | Limit | Margin |
|-------|---------|---------------|----------------|--------|-------|--------|
| [MHz] | [dBm]   | [dB]          | [dB]           | [dBm]  | [dBm] | [dB]   |
| 2402  | -28.32  | 1.07          | 10.06          | -17.19 | 8.00  | 25.19  |
| 2440  | -28.32  | 1.07          | 10.06          | -17.19 | 8.00  | 25.19  |
| 2480  | -28.44  | 1.08          | 10.06          | -17.30 | 8.00  | 25.30  |

Sample Calculation:

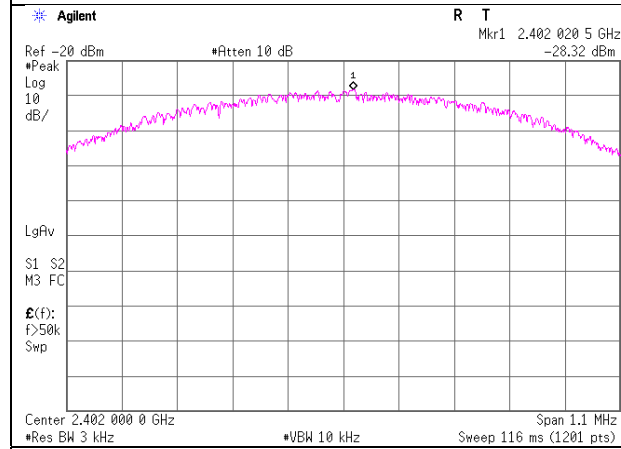
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

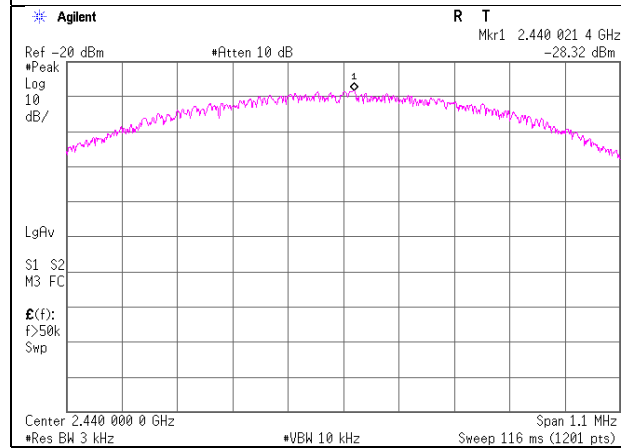
## Power Density

### BT LE

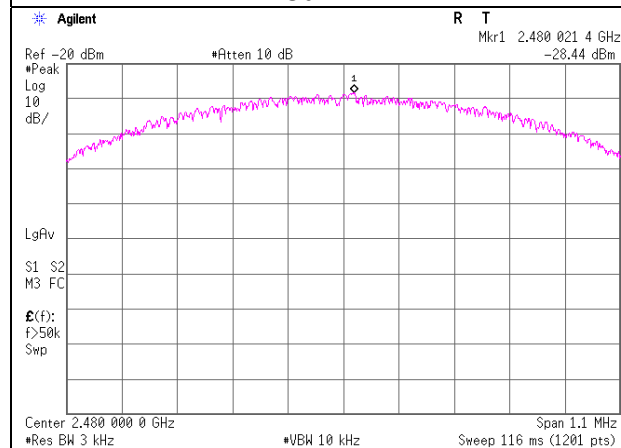
#### 2402 MHz



#### 2440 MHz



#### 2480 MHz



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## APPENDIX 2: Test instruments

### Test equipment

| Test Item | Local ID      | LIMS ID | Description                       | Manufacturer                  | Model                    | Serial                           | Last Calibration Date | Cal Int |
|-----------|---------------|---------|-----------------------------------|-------------------------------|--------------------------|----------------------------------|-----------------------|---------|
| RE        | MAT-07        | 141203  | Attenuator(6dB)                   | Weinschel Corp                | 2                        | BK7970                           | 11/07/2019            | 12      |
| RE        | MBA-08        | 141427  | Biconical Antenna                 | Schwarzbeck Mess - Elektronik | VHA9103B+ BBA9106        | 8031                             | 08/23/2019            | 12      |
| RE        | MCC-12        | 141317  | Coaxial Cable                     | Fujikura/Agilent              | -                        | -                                | 09/03/2019            | 12      |
| RE        | MLA-21        | 141265  | Logperiodic Antenna (200-1000MHz) | Schwarzbeck Mess - Elektronik | VUSLP9111B               | 9111B-190                        | 08/23/2019            | 12      |
| RE        | MPA-09        | 141578  | Pre Amplifier                     | Keysight Technologies Inc     | 8447D                    | 2944A10845                       | 09/06/2019            | 12      |
| RE        | MTR-03        | 141942  | Test Receiver                     | Rohde & Schwarz               | ESCI                     | 100300                           | 08/08/2019            | 12      |
| RE        | MAEC-02       | 142004  | AC2_Semi Anechoic Chamber(NSA)    | TDK                           | Semi Anechoic Chamber 3m | DA-06902                         | 06/29/2018            | 24      |
| RE        | MOS-41        | 192300  | Thermo-Hygrometer                 | CUSTOM                        | CTH-201                  | 0013                             | 12/19/2019            | 12      |
| RE        | MMM-01        | 141542  | Digital Tester                    | Fluke Corporation             | FLUKE 26-3               | 78030611                         | 08/20/2019            | 12      |
| RE        | MJM-27        | 142228  | Measure                           | KOMELON                       | KMC-36                   | -                                | -                     | -       |
| RE        | COTS-MEMI-02  | 178648  | EMI measurement program           | TSJ                           | TEPTO-DV                 | -                                | -                     | -       |
| RE        | MAEC-02-SVSWR | 142006  | AC2_Semi Anechoic Chamber(SVSWR)  | TDK                           | Semi Anechoic Chamber 3m | DA-06902                         | 04/01/2019            | 24      |
| RE        | MHA-06        | 141512  | Horn Antenna 1-18GHz              | Schwarzbeck Mess - Elektronik | BBHA9120D                | 254                              | 09/03/2019            | 12      |
| RE        | MCC-216       | 141392  | Microwave Cable                   | Junkosha                      | MWX221                   | 1604S253(1 m) / 537073/126E(5 m) | 02/18/2020            | 12      |
| RE        | MPA-10        | 141579  | Pre Amplifier                     | Keysight Technologies Inc     | 8449B                    | 3008A02142                       | 01/07/2020            | 12      |
| RE        | MHA-02        | 141503  | Horn Antenna 18-26.5GHz           | EMCO                          | 3160-09                  | 1265                             | 10/08/2019            | 12      |
| AT        | MOS-14        | 141561  | Thermo-Hygrometer                 | CUSTOM                        | CTH-201                  | 1401                             | 01/07/2020            | 12      |
| AT        | MMM-12        | 141547  | DIGITAL HiTESTER                  | Hioki                         | 3805                     | 60500120                         | 02/03/2020            | 12      |
| AT        | MSA-14        | 141901  | Spectrum Analyzer                 | Keysight Technologies Inc     | E4440A                   | MY48250080                       | 10/06/2019            | 12      |
| AT        | MPM-08        | 141805  | Power Meter                       | ANRITSU                       | ML2495A                  | 6K00003338                       | 10/03/2019            | 12      |
| AT        | MPSE-11       | 141840  | Power sensor                      | ANRITSU                       | MA2411B                  | 11737                            | 10/03/2019            | 12      |
| AT        | MAT-10        | 141156  | Attenuator(10dB)                  | Weinschel Corp                | 2                        | BL1173                           | 11/07/2019            | 12      |
| AT        | MCC-38        | 141395  | Coaxial Cable                     | UL Japan                      | -                        | -                                | 11/12/2019            | 12      |
| AT        | MCC-170       | 141321  | Microwave Cable                   | Junkosha                      | MWX221                   | 1409S493                         | -                     | -       |
| AT        | MAT-58        | 141334  | Attenuator(10dB)                  | Suhner                        | 6810.19.A                | -                                | 12/09/2019            | 12      |

\*Hyphens for Last Calibration 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.

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

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

Test item:

RE: Radiated Emission test

AT: Antenna Terminal Conducted test

**UL Japan, Inc.**

**Ise EMC Lab.**

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