



# **RADIO TEST REPORT**

**Test Report No. : 12341751S-A-R2**

**Applicant** : Triple W Japan K.K.  
**Type of Equipment** : DFree-U1P  
**Model No.** : DU-BL-B2  
**FCC ID** : 2APWD-DFU01P  
**Test regulation** : FCC Part 15 Subpart C: 2018  
**Test Result** : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
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It does not cover administrative issues such as Manual or non-EMC test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. This report is a revised version of 12341751S-A-R1. 12341751S-A-R1 is replaced with this report.

**Date of test:** June 8 to 9, 2018

**Representative test engineer:**

Makoto Hosaka  
Engineer  
Consumer Technology Division

**Approved by:**

Hikaru Shirasawa  
Engineer  
Consumer Technology Division



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

**UL Japan, Inc.**  
**Shonan EMC Lab.**

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13-EM-F0429

## REVISION HISTORY

**Original Test Report No.: 12341751S-A**

[illegible]

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## **SECTION 1: Customer information**

|                  |   |                                                                                  |
|------------------|---|----------------------------------------------------------------------------------|
| Company Name     | : | Triple W Japan K.K.                                                              |
| Address          | : | Dai-1 Kasuya Building, 2-9, Sakuragaokacho, Shibuya-ku, Tokyo,<br>150-0031 Japan |
| Telephone Number | : | +81-3-5459-1295                                                                  |
| Contact Person   | : | Yuichi Chikui                                                                    |

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

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

|                            |   |                                                                                           |
|----------------------------|---|-------------------------------------------------------------------------------------------|
| Type of Equipment          | : | DFree-U1P                                                                                 |
| Model No.                  | : | DU-BL-B2                                                                                  |
| Serial No.                 | : | Refer to Section 4, Clause 4.2                                                            |
| Rating                     | : | DC 3.7 V (Battery)                                                                        |
| Receipt Date of Sample     | : | June 7, 2018                                                                              |
| Country of Mass-production | : | Japan                                                                                     |
| Condition of EUT           | : | Production prototype<br>(Not for Sale: This sample is equivalent to mass-produced items.) |
| Modification of EUT        | : | No Modification by the test lab                                                           |

### **2.2 Product Description**

Model: DU-BL-B2 (referred to as the EUT in this report) is a DFree-U1P.

## **Radio Specification**

### **Bluetooth Low Energy**

|                           |   |                     |
|---------------------------|---|---------------------|
| Equipment Type            | : | Transceiver         |
| Frequency of Operation    | : | 2402 MHz – 2480 MHz |
| Type of Modulation        | : | GFSK                |
| Antenna Type              | : | Printed antenna     |
| Antenna Gain              | : | 1.48 dBi            |
| Clock frequency (Maximum) | : | 24 MHz              |

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

### **3.1 Test Specification**

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

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

\* 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>IC: RSS-Gen 8.8 | FCC: Section 15.207<br>IC: RSS-Gen 8.8                                   | -                                                      | N/A       | *1)                                                               |
| 6dB Bandwidth                                                                                                                                                                                                                                                                                                                             | FCC: KDB 558074 D01 DTS Meas<br>Guidance v04<br>IC: -                | FCC: Section<br>15.247(a)(2)<br>IC: RSS-247 5.2(a)                       | See data.                                              | Complied  | Conducted                                                         |
| Maximum Peak<br>Output Power                                                                                                                                                                                                                                                                                                              | FCC: KDB 558074 D01 DTS Meas<br>Guidance v04<br>IC: RSS-Gen 6.12     | FCC: Section<br>15.247(b)(3)<br>IC: RSS-247 5.4(d)                       |                                                        | Complied  | Conducted                                                         |
| Power Density                                                                                                                                                                                                                                                                                                                             | FCC: KDB 558074 D01 DTS Meas<br>Guidance v04<br>IC: -                | FCC: Section 15.247(e)<br>IC: RSS-247 5.2(b)                             |                                                        | Complied  | Conducted                                                         |
| Spurious Emission<br>Restricted Band Edges                                                                                                                                                                                                                                                                                                | FCC: KDB 558074 D01 DTS Meas<br>Guidance v04<br>IC: RSS-Gen 6.13     | FCC: Section 15.247(d)<br>IC: RSS-247 5.5<br>RSS-Gen 8.9<br>RSS-Gen 8.10 | 0.6 dB<br>4804.000 MHz, AV, Hori.<br>Tx BT LE 2402 MHz | Complied# | 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's radio operation stops when it connects to AC mains, and turns into charging mode.<br>*2) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v04 12.2.7. |                                                                      |                                                                          |                                                        |           |                                                                   |
| 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 EUT is a battery-operated device and test was performed with the full-charged battery. Therefore, this 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 | IC: RSS-Gen 6.6 | IC: -         | N/A          | -       | Conducted |

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

### 3.4 Uncertainty

#### EMI

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

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| Item                                             | Frequency range | Uncertainty (+/-) |                |                |                |              |
|--------------------------------------------------|-----------------|-------------------|----------------|----------------|----------------|--------------|
|                                                  |                 | No. 1 SAC / SR    | No. 2 SAC / SR | No. 3 SAC / SR | No. 4 SAC / SR | No. 5,6,8 SR |
| Conducted emission (AC Mains) LISN               | 150 kHz-30 MHz  | 2.5 dB            | 2.5 dB         | 2.5 dB         | 2.6 dB         | 2.6 dB       |
| Radiated emission<br>(Measurement distance: 3 m) | 9 kHz-30 MHz    | 3.2 dB            | 3.2 dB         | 3.3 dB         | -              | -            |
|                                                  | 30 MHz-200 MHz  | 4.9 dB            | 4.8 dB         | 4.9 dB         | -              | -            |
|                                                  | 200 MHz-1 GHz   | 6.1 dB            | 6.1 dB         | 6.1 dB         | -              | -            |
|                                                  | 1 GHz-6 GHz     | 4.7 dB            | 4.7 dB         | 4.7 dB         | -              | -            |
|                                                  | 6 GHz-18 GHz    | 5.3 dB            | 5.3 dB         | 5.3 dB         | -              | -            |
|                                                  | 18 GHz-40 GHz   | 5.6 dB            | 5.6 dB         | 5.6 dB         | -              | -            |
| Radiated emission<br>(Measurement distance: 1 m) | 1 GHz-18 GHz    | 5.6 dB            | 5.6 dB         | 5.6 dB         | -              | -            |
|                                                  | 18 GHz-40 GHz   | 5.9 dB            | 5.9 dB         | 5.9 dB         | -              | -            |

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

| Antenna terminal test                                   | Uncertainty (+/-) |
|---------------------------------------------------------|-------------------|
| Power Measurement above 1 GHz (Average Detector)_SPM-06 | 0.48 dB           |
| Power Measurement above 1 GHz (Peak Detector)_SPM-06    | 0.66 dB           |
| Power Measurement above 1 GHz (Average Detector)_SPM-07 | 0.47 dB           |
| Power Measurement above 1 GHz (Peak Detector)_SPM-07    | 0.64 dB           |
| Power Measurement above 1 GHz (Average Detector)_SPM-13 | 0.90 dB           |
| Power Measurement above 1 GHz (Peak Detector)_SPM-13    | 1.04 dB           |
| Spurious emission (Conducted) below 1GHz                | 1.8 dB            |
| Spurious emission (Conducted) 1 GHz-3 GHz               | 1.7 dB            |
| Spurious emission (Conducted) 3 GHz-18 GHz              | 2.5 dB            |
| Spurious emission (Conducted) 18 GHz-26.5 GHz           | 2.5 dB            |
| Spurious emission (Conducted) 26.5 GHz-40 GHz           | 2.7 dB            |
| Bandwidth Measurement                                   | 1.01 %            |
| Duty cycle and Time Measurement                         | 0.012 %           |

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### 3.5 Test Location

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JAB Accreditation No. RTL02610  
FCC Test Firm Registration Number: 839876

| Test site                  | IC Registration Number | Width x Depth x Height (m) | Size of reference ground plane (m) / horizontal conducting plane | Maximum measurement distance |
|----------------------------|------------------------|----------------------------|------------------------------------------------------------------|------------------------------|
| No.1 Semi-anechoic chamber | 2973D-1                | 20.6 x 11.3 x 7.65         | 20.6 x 11.3                                                      | 10 m                         |
| No.2 Semi-anechoic chamber | 2973D-2                | 20.6 x 11.3 x 7.65         | 20.6 x 11.3                                                      | 10 m                         |
| No.3 Semi-anechoic chamber | 2973D-3                | 12.7 x 7.7 x 5.35          | 12.7 x 7.7                                                       | 5 m                          |
| No.4 Semi-anechoic chamber | -                      | 8.1 x 5.1 x 3.55           | 8.1 x 5.1                                                        | -                            |
| No.1 Shielded room         | -                      | 6.8 x 4.1 x 2.7            | 6.8 x 4.1                                                        | -                            |
| No.2 Shielded room         | -                      | 6.8 x 4.1 x 2.7            | 6.8 x 4.1                                                        | -                            |
| No.3 Shielded room         | -                      | 6.3 x 4.7 x 2.7            | 6.3 x 4.7                                                        | -                            |
| No.4 Shielded room         | -                      | 4.4 x 4.7 x 2.7            | 4.4 x 4.7                                                        | -                            |
| No.5 Shielded room         | -                      | 7.8 x 6.4 x 2.7            | 7.8 x 6.4                                                        | -                            |
| No.6 Shielded room         | -                      | 7.8 x 6.4 x 2.7            | 7.8 x 6.4                                                        | -                            |
| No.8 shielded room         | -                      | 3.45 x 5.5 x 2.4           | 3.45 x 5.5                                                       | -                            |
| No.1 Measurement room      | -                      | 2.55 x 4.1 x 2.5           | -                                                                | -                            |

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

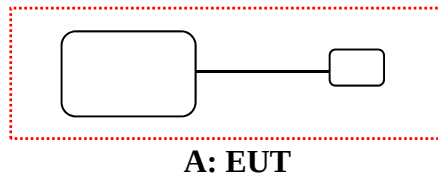
Refer to APPENDIX.

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

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

| Mode                                                                                                                                                                                                                                                                                                                                                                    | Frequency                    | Remarks* |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|----------|
| Bluetooth Low Energy                                                                                                                                                                                                                                                                                                                                                    | 2402 MHz, 2440 MHz, 2480 MHz | PN9      |
| <p>*Power of the EUT was set by the software as follows;</p> <p>- Power Setting: Fixed</p> <p>- Software: Integrated_Test_1.0.1</p> <p>*This setting of software is the worst case.</p> <p>Any conditions under the normal use do not exceed the condition of setting.</p> <p>In addition, end users cannot change the settings of the output power of the product.</p> |                              |          |

### **4.2 Configuration and peripherals**



\*Cabling and setup 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        | Remark |
|-----|-----------|--------------|------------------|---------------------|--------|
| A   | DFree-U1P | DU-BL-B2     | 12 *1)<br>01 *2) | Triple W Japan K.K. | EUT    |

\*1) Used for Radiated Emission test

\*2) Used for Antenna Terminal Conducted Tests

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

### **Test Procedure**

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

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

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

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

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

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

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

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

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

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

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

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

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

|                 |               |                                                             |                                                                                                                                                                                     |                              |
|-----------------|---------------|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| Frequency       | Below 1 GHz   | Above 1 GHz                                                 |                                                                                                                                                                                     | 20 dBc                       |
| Instrument used | Test Receiver | Spectrum Analyzer                                           |                                                                                                                                                                                     | Spectrum Analyzer            |
| Detector        | QP            | PK                                                          | AV *1)                                                                                                                                                                              | PK                           |
| IF Bandwidth    | BW 120 kHz    | RBW: 1 MHz<br>VBW: 3 MHz                                    | Average Power Method:<br><u>12.2.5.2</u><br>RBW: 1 MHz<br>VBW: 3 MHz<br>Detector:<br>Power Averaging (Linear voltage)<br>Trace: 100 traces<br>Duty factor was added to the results. | RBW: 100 kHz<br>VBW: 300 kHz |
| Test Distance   | 3 m           | 3.89 m *2) (1 GHz – 13 GHz),<br>1 m *3) (13 GHz – 26.5 GHz) |                                                                                                                                                                                     | 3.89 m *2) (1 GHz – 13 GHz)  |

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

\*2) Distance factor :  $20 \log (3.89 \text{ m} / 3.0 \text{ m}) = 2.26 \text{ dB}$

\*3) Distance Factor:  $20 \times \log (1.0 \text{ m} / 3.0 \text{ m}) = -9.54 \text{ dB}$

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

Combinations of the worst case

| Antenna<br>polarization \ Frequency | Carrier | Spurious    |                |                 |                   |
|-------------------------------------|---------|-------------|----------------|-----------------|-------------------|
|                                     |         | Below 1 GHz | 1 GHz - 13 GHz | 13 GHz – 18 GHz | 18 GHz – 26.5 GHz |
| Horizontal                          | Y       | X           | X              | X               | X                 |
| Vertical                            | Z       | X           | Y              | X               | X                 |

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                   | 10 MHz                                  | 100 kHz         | 300 kHz            | Auto       | Peak             | Max Hold | Spectrum Analyzer               |
| 99% Occupied Bandwidth *1)      | Enough width to display emission skirts | 1 to 5 % of OBW | Three times of RBW | Auto       | Peak             | Max Hold | Spectrum Analyzer               |
| Maximum Peak Output Power       | -                                       | -               | -                  | Auto       | Peak/Average *2) | -        | Power Meter (Sensor: 50 MHz BW) |
| Peak Power Density              | 1.5 times the 6dB Bandwidth             | 3 kHz           | 9.1 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                         | 10 kHz          | 30 kHz             |            |                  |          |                                 |

\*1) Peak hold was applied as Worst-case measurement.  
 \*2) Reference data  
 \*3) Section 10.2 Method PKPSD (peak PSD) of "KDB 558074 D01 DTS Meas Guidance v04".  
 \*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.

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

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

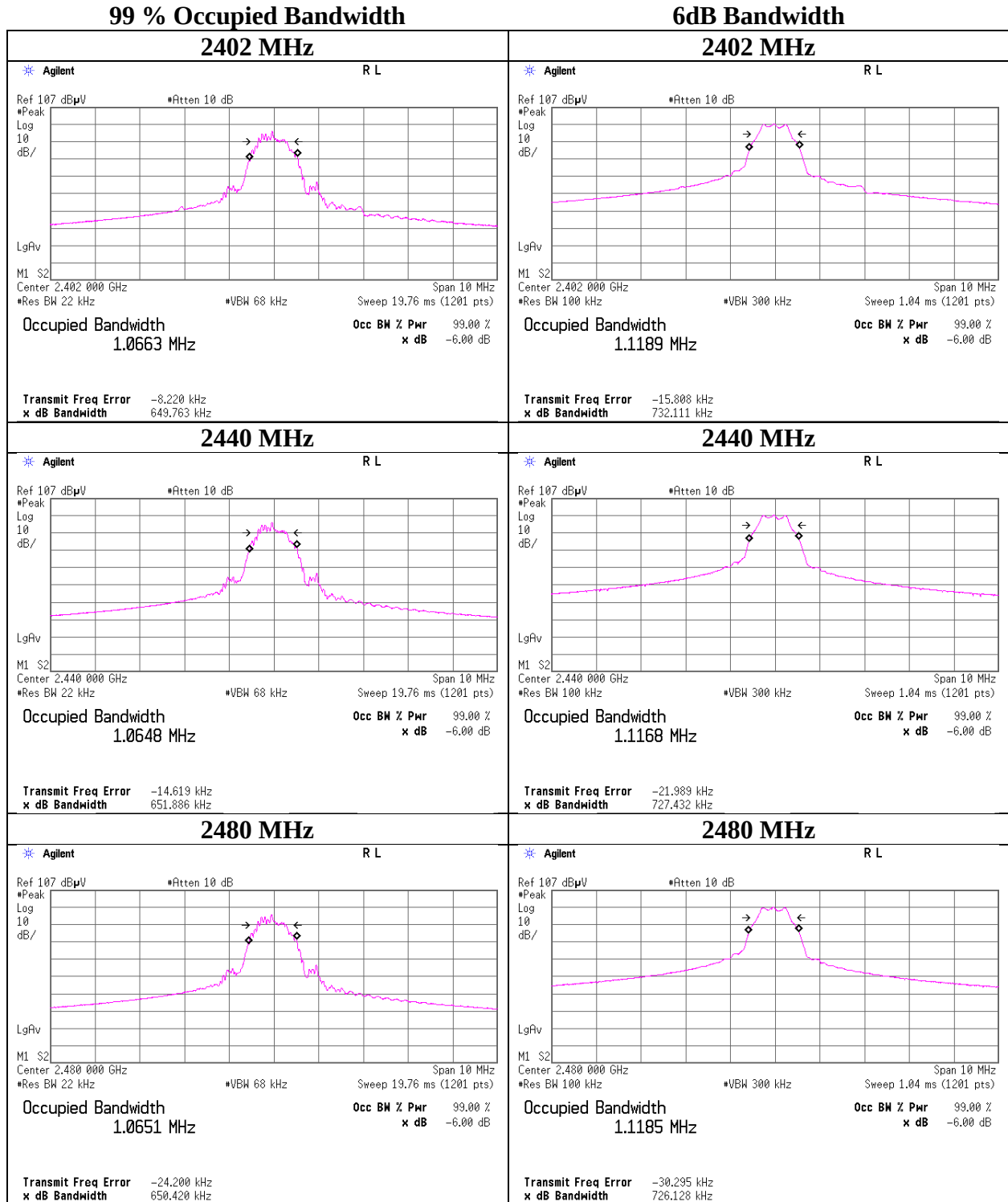
## **APPENDIX 1: Test data**

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

Report No. 12341751S-A-R2  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date June 8, 2018  
Temperature / Humidity 26 deg. C / 53 % RH  
Engineer Kazuya Noda  
Mode Tx

| Mode  | Frequency<br>[MHz] | 99% Occupied<br>Bandwidth<br>[kHz] | 6dB Bandwidth<br>[MHz] | Limit for<br>6dB Bandwidth<br>[MHz] |
|-------|--------------------|------------------------------------|------------------------|-------------------------------------|
| BT LE | 2402               | 1066.3                             | 0.73211                | > 0.5000                            |
|       | 2440               | 1064.8                             | 0.72743                | > 0.5000                            |
|       | 2480               | 1065.1                             | 0.72613                | > 0.5000                            |

## 6dB Bandwidth and 99 % Occupied Bandwidth



## Maximum Peak Output Power

Report No. 12341751S-A-R2  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date June 8, 2018  
Temperature / Humidity 26 deg. C / 53 % RH  
Engineer Kazuya Noda  
Mode Tx BT LE

| BT LE          |                  |                       |                        | Conducted Power |      |       |      |                | e.i.r.p. for RSS-247     |        |      |       |      |                |
|----------------|------------------|-----------------------|------------------------|-----------------|------|-------|------|----------------|--------------------------|--------|------|-------|------|----------------|
| Freq.<br>[MHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>Loss<br>[dB] | Result          |      | Limit |      | Margin<br>[dB] | Antenna<br>Gain<br>[dBi] | Result |      | Limit |      | Margin<br>[dB] |
|                |                  |                       |                        | [dBm]           | [mW] | [dBm] | [mW] |                |                          | [dBm]  | [mW] | [dBm] | [mW] |                |
| 2402           | -8.70            | 1.38                  | 9.86                   | 2.54            | 1.79 | 30.00 | 1000 | 27.46          | 1.48                     | 4.02   | 2.52 | 36.02 | 4000 | 32.00          |
| 2440           | -8.94            | 1.39                  | 9.86                   | 2.31            | 1.70 | 30.00 | 1000 | 27.69          | 1.48                     | 3.79   | 2.39 | 36.02 | 4000 | 32.23          |
| 2480           | -9.11            | 1.40                  | 9.85                   | 2.14            | 1.64 | 30.00 | 1000 | 27.86          | 1.48                     | 3.62   | 2.30 | 36.02 | 4000 | 32.40          |

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.

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

Report No. 12341751S-A-R2  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date June 8, 2018  
Temperature / Humidity 26 deg. C / 53% RH  
Engineer Kazuya Noda  
Mode Tx

BT LE

| 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           | -11.17           | 1.38                  | 9.86                   | 0.07                     | 1.02 | 1.78                   | 1.85                            | 1.53 |
| 2440           | -11.40           | 1.39                  | 9.86                   | -0.15                    | 0.97 | 1.78                   | 1.63                            | 1.46 |
| 2480           | -11.59           | 1.40                  | 9.85                   | -0.34                    | 0.92 | 1.78                   | 1.44                            | 1.39 |

Sample Calculation:

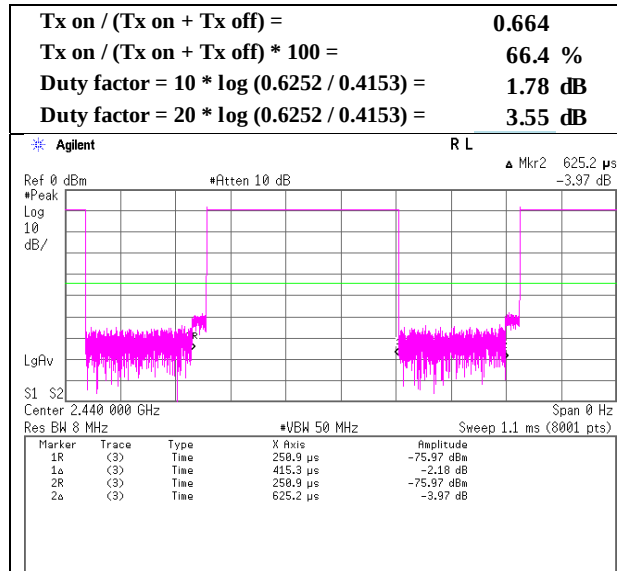
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

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

### Burst rate confirmation

Report No. 12341751S-A-R2  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date June 8, 2018  
Temperature / Humidity 26 deg. C / 53 % RH  
Engineer Kazuya Noda  
Mode Tx



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

## Radiated Spurious Emission

Report No. 12341751S-A-R2  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No.1  
Date June 9, 2018 June 8, 2018  
Temperature / Humidity 24 deg. C / 60 % RH 20 deg. C / 58 % RH  
Engineer Kazuya Noda Makoto Hosaka  
(30 MHz – 1 GHz) (1 GHz – 18 GHz)  
(18 GHz – 26.5 GHz)  
Mode Tx BT LE 2402 MHz

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

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Distance Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Height [cm] | Angle [deg] | Remark |
|----------|-----------------|----------|----------------|-----------------|-----------|-----------|----------------------|-----------------|----------------|-------------|-------------|-------------|--------|
| Hori.    | 57.452          | QP       | 21.82          | 8.68            | 7.58      | 31.82     | 0.00                 | 6.26            | 40.00          | 33.7        | 100         | 1           |        |
| Hori.    | 62.768          | QP       | 21.89          | 7.40            | 7.65      | 31.82     | 0.00                 | 5.12            | 40.00          | 34.8        | 100         | 1           |        |
| Hori.    | 91.667          | QP       | 21.81          | 8.46            | 8.05      | 31.81     | 0.00                 | 6.51            | 43.50          | 36.9        | 100         | 1           |        |
| Hori.    | 176.670         | QP       | 21.35          | 15.86           | 8.97      | 31.77     | 0.00                 | 14.41           | 43.50          | 29.0        | 100         | 1           |        |
| Hori.    | 288.551         | QP       | 30.67          | 13.06           | 6.79      | 31.77     | 0.00                 | 18.75           | 46.00          | 27.2        | 100         | 327         |        |
| Hori.    | 781.793         | QP       | 21.57          | 20.55           | 9.13      | 31.91     | 0.00                 | 19.34           | 46.00          | 26.6        | 100         | 1           |        |
| Hori.    | 2390.000        | PK       | 60.88          | 27.14           | 14.53     | 44.13     | 2.26                 | 60.68           | 73.90          | 13.2        | 170         | 0           |        |
| Hori.    | 4804.000        | PK       | 60.18          | 31.13           | 7.21      | 44.45     | 2.26                 | 56.33           | 73.90          | 17.5        | 111         | 341         |        |
| Hori.    | 7206.000        | PK       | 50.30          | 36.35           | 8.95      | 43.99     | 2.26                 | 53.87           | 73.90          | 20.0        | 213         | 60          |        |
| Vert.    | 125.633         | QP       | 21.55          | 13.53           | 8.44      | 31.79     | 0.00                 | 11.73           | 43.50          | 31.7        | 100         | 1           |        |
| Vert.    | 288.543         | QP       | 23.79          | 13.06           | 6.79      | 31.77     | 0.00                 | 11.87           | 46.00          | 34.1        | 145         | 73          |        |
| Vert.    | 902.188         | QP       | 20.80          | 22.01           | 9.68      | 31.34     | 0.00                 | 21.15           | 46.00          | 24.8        | 100         | 1           |        |
| Vert.    | 2390.000        | PK       | 60.89          | 27.14           | 14.53     | 44.13     | 2.26                 | 60.69           | 73.90          | 13.2        | 228         | 264         |        |
| Vert.    | 4804.000        | PK       | 59.49          | 31.13           | 7.21      | 44.45     | 2.26                 | 55.64           | 73.90          | 18.2        | 212         | 133         |        |
| Vert.    | 7206.000        | PK       | 49.95          | 36.35           | 8.95      | 43.99     | 2.26                 | 53.52           | 73.90          | 20.3        | 268         | 139         |        |

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.89\text{ m} / 3.0\text{ m}) = 2.26\text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

### Average measurement value with duty factor

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Duty Factor [dB] | Distance Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|----------|-----------------|----------|----------------|-----------------|-----------|-----------|------------------|----------------------|-----------------|----------------|-------------|--------|
| Hori.    | 2390.000        | AV       | 39.80          | 27.14           | 14.53     | 44.13     | 3.55             | 2.26                 | 43.15           | 53.90          | 10.8        | *1)    |
| Hori.    | 4804.000        | AV       | 53.55          | 31.13           | 7.21      | 44.45     | 3.55             | 2.26                 | 53.25           | 53.90          | 0.6         |        |
| Hori.    | 7206.000        | AV       | 40.59          | 36.35           | 8.95      | 43.99     | 3.55             | 2.26                 | 47.71           | 53.90          | 6.2         |        |
| Vert.    | 2390.000        | AV       | 39.48          | 27.14           | 14.53     | 44.13     | 3.55             | 2.26                 | 42.83           | 53.90          | 11.1        | *1)    |
| Vert.    | 4804.000        | AV       | 52.38          | 31.13           | 7.21      | 44.45     | 3.55             | 2.26                 | 52.08           | 53.90          | 1.8         |        |
| Vert.    | 7206.000        | AV       | 40.82          | 36.35           | 8.95      | 43.99     | 3.55             | 2.26                 | 47.94           | 53.90          | 6.0         |        |

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.89\text{ m} / 3.0\text{ m}) = 2.26\text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

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

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

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Distance Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark  |
|----------|-----------------|----------|----------------|-----------------|-----------|-----------|----------------------|-----------------|----------------|-------------|---------|
| Hori.    | 2402.000        | PK       | 96.57          | 27.18           | 14.54     | 44.14     | 2.26                 | 96.41           | -              | -           | Carrier |
| Hori.    | 2400.000        | PK       | 59.92          | 27.17           | 14.54     | 44.14     | 2.26                 | 59.75           | 76.41          | 16.7        |         |
| Vert.    | 2402.000        | PK       | 96.48          | 27.18           | 14.54     | 44.14     | 2.26                 | 96.32           | -              | -           | Carrier |
| Vert.    | 2400.000        | PK       | 59.97          | 27.17           | 14.54     | 44.14     | 2.26                 | 59.80           | 76.32          | 16.5        |         |

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.89\text{ m} / 3.0\text{ m}) = 2.26\text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

**UL Japan, Inc.**

**Shonan EMC Lab.**

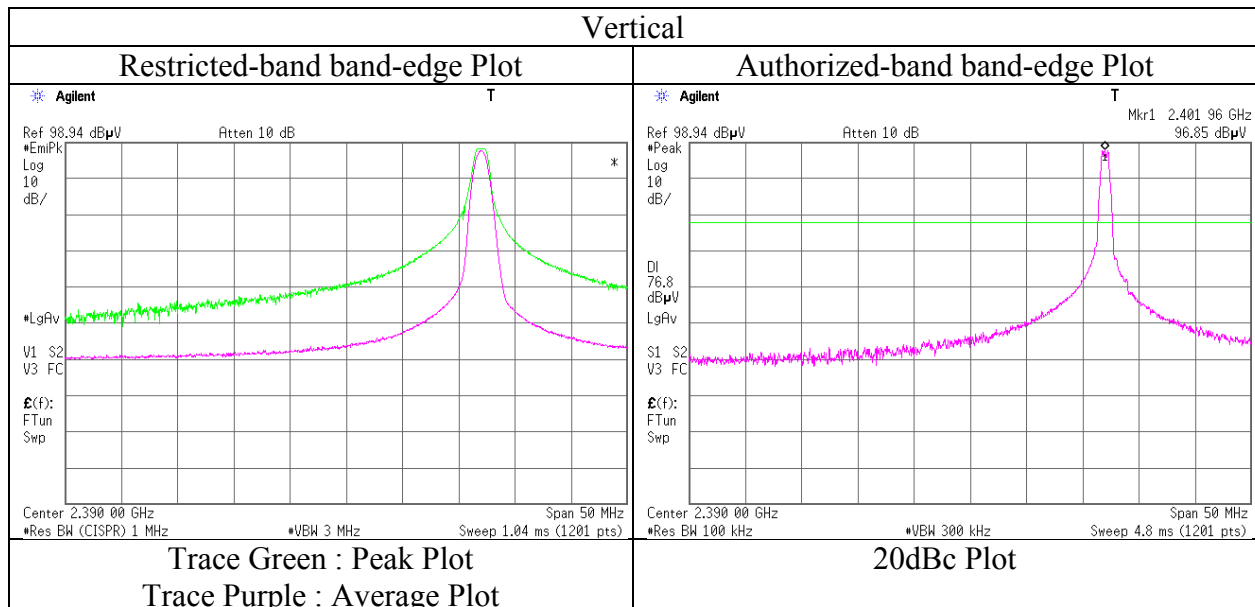
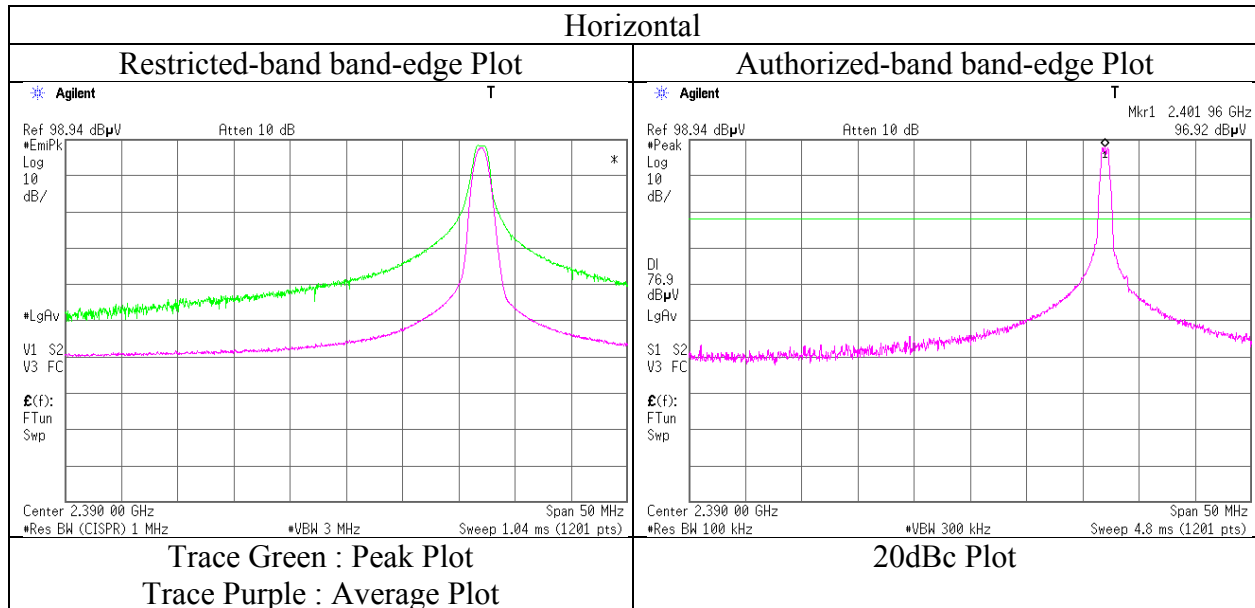
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

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

|                        |                     |
|------------------------|---------------------|
| Report No.             | 12341751S-A-R2      |
| Test place             | Shonan EMC Lab.     |
| Semi Anechoic Chamber  | No.1                |
| Date                   | June 8, 2018        |
| Temperature / Humidity | 20 deg. C / 58 % RH |
| Engineer               | Makoto Hosaka       |
|                        | (1 GHz – 13 GHz)    |
| Mode                   | Tx BT LE 2402 MHz   |



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

## Radiated Spurious Emission

Report No. 12341751S-A-R2  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No.1  
Date June 9, 2018 June 8, 2018  
Temperature / Humidity 24 deg. C / 60 % RH 20 deg. C / 58 % RH  
Engineer Kazuya Noda Makoto Hosaka  
(30 MHz – 1 GHz) (1 GHz – 18 GHz)  
(18 GHz – 26.5 GHz)  
Mode Tx BT LE 2440 MHz

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

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Distance<br>Factor [dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|-------------------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 57.452             | QP       | 21.78             | 8.68               | 7.58         | 31.82        | 0.00                    | 6.22               | 40.00             | 33.7           | 100            | 1              |        |
| Hori.    | 62.768             | QP       | 21.88             | 7.40               | 7.65         | 31.82        | 0.00                    | 5.11               | 40.00             | 34.8           | 100            | 1              |        |
| Hori.    | 91.667             | QP       | 21.74             | 8.46               | 8.05         | 31.81        | 0.00                    | 6.44               | 43.50             | 37.0           | 100            | 1              |        |
| Hori.    | 176.670            | QP       | 21.37             | 15.86              | 8.97         | 31.77        | 0.00                    | 14.43              | 43.50             | 29.0           | 100            | 1              |        |
| Hori.    | 288.525            | QP       | 30.09             | 13.06              | 6.79         | 31.77        | 0.00                    | 18.17              | 46.00             | 27.8           | 100            | 326            |        |
| Hori.    | 781.793            | QP       | 21.52             | 20.55              | 9.13         | 31.91        | 0.00                    | 19.29              | 46.00             | 26.7           | 100            | 1              |        |
| Hori.    | 4880.000           | PK       | 59.63             | 31.30              | 7.30         | 44.48        | 2.26                    | 56.01              | 73.90             | 17.8           | 100            | 322            |        |
| Hori.    | 7320.000           | PK       | 50.05             | 36.51              | 9.10         | 44.03        | 2.26                    | 53.89              | 73.90             | 20.0           | 247            | 54             |        |
| Vert.    | 125.633            | QP       | 21.66             | 13.53              | 8.44         | 31.79        | 0.00                    | 11.84              | 43.50             | 31.6           | 100            | 1              |        |
| Vert.    | 289.467            | QP       | 22.95             | 13.09              | 6.80         | 31.77        | 0.00                    | 11.07              | 46.00             | 34.9           | 143            | 86             |        |
| Vert.    | 902.188            | QP       | 20.87             | 22.01              | 9.68         | 31.34        | 0.00                    | 21.22              | 46.00             | 24.7           | 100            | 1              |        |
| Vert.    | 4880.000           | PK       | 58.44             | 31.30              | 7.30         | 44.48        | 2.26                    | 54.82              | 73.90             | 19.0           | 356            | 132            |        |
| Vert.    | 7320.000           | PK       | 49.73             | 36.51              | 9.10         | 44.03        | 2.26                    | 53.57              | 73.90             | 20.3           | 102            | 271            |        |

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.89\text{ m} / 3.0\text{ m}) = 2.26\text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

### Average measurement value with duty factor

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Distance<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|------------------------|----------------------------|--------------------|-------------------|----------------|--------|
| Hori.    | 4880.000           | AV       | 52.97             | 31.30              | 7.30         | 44.48        | 3.55                   | 2.26                       | 52.90              | 53.90             | 1.0            |        |
| Hori.    | 7320.000           | AV       | 40.57             | 36.51              | 9.10         | 44.03        | 3.55                   | 2.26                       | 47.96              | 53.90             | 5.9            |        |
| Vert.    | 4880.000           | AV       | 52.43             | 31.30              | 7.30         | 44.48        | 3.55                   | 2.26                       | 52.36              | 53.90             | 1.5            |        |
| Vert.    | 7320.000           | AV       | 39.56             | 36.51              | 9.10         | 44.03        | 3.55                   | 2.26                       | 46.95              | 53.90             | 7.0            |        |

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.89\text{ m} / 3.0\text{ m}) = 2.26\text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

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

## Radiated Spurious Emission

Report No. 12341751S-A-R2  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No.1  
Date June 9, 2018 June 8, 2018  
Temperature / Humidity 24 deg. C / 60 % RH 20 deg. C / 58 % RH  
Engineer Kazuya Noda Makoto Hosaka  
(30 MHz – 1 GHz) (1 GHz – 18 GHz)  
(18 GHz – 26.5 GHz)  
Mode Tx BT LE 2480 MHz

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

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Distance<br>Factor [dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|-------------------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 57.452             | QP       | 21.83             | 8.68               | 7.58         | 31.82        | 0.00                    | 6.27               | 40.00             | 33.7           | 100            | 1              |        |
| Hori.    | 62.768             | QP       | 21.92             | 7.40               | 7.65         | 31.82        | 0.00                    | 5.15               | 40.00             | 34.8           | 100            | 1              |        |
| Hori.    | 91.667             | QP       | 21.87             | 8.46               | 8.05         | 31.81        | 0.00                    | 6.57               | 43.50             | 36.9           | 100            | 1              |        |
| Hori.    | 176.670            | QP       | 21.37             | 15.86              | 8.97         | 31.77        | 0.00                    | 14.43              | 43.50             | 29.0           | 100            | 1              |        |
| Hori.    | 288.556            | QP       | 30.34             | 13.06              | 6.79         | 31.77        | 0.00                    | 18.42              | 46.00             | 27.5           | 100            | 325            |        |
| Hori.    | 781.793            | QP       | 21.61             | 20.55              | 9.13         | 31.91        | 0.00                    | 19.38              | 46.00             | 26.6           | 100            | 1              |        |
| Hori.    | 2483.500           | PK       | 71.05             | 27.45              | 14.63        | 44.16        | 2.26                    | 71.23              | 73.90             | 2.6            | 110            | 0              |        |
| Hori.    | 4960.000           | PK       | 59.52             | 31.48              | 7.38         | 44.51        | 2.26                    | 56.13              | 73.90             | 17.7           | 100            | 41             |        |
| Hori.    | 7440.000           | PK       | 51.12             | 36.68              | 9.28         | 44.08        | 2.26                    | 55.26              | 73.90             | 18.6           | 226            | 80             |        |
| Vert.    | 125.633            | QP       | 21.68             | 13.53              | 8.44         | 31.79        | 0.00                    | 11.86              | 43.50             | 31.6           | 100            | 1              |        |
| Vert.    | 288.547            | QP       | 23.39             | 13.06              | 6.79         | 31.77        | 0.00                    | 11.47              | 46.00             | 34.5           | 143            | 75             |        |
| Vert.    | 902.188            | QP       | 20.89             | 22.01              | 9.68         | 31.34        | 0.00                    | 21.24              | 46.00             | 24.7           | 100            | 1              |        |
| Vert.    | 2483.500           | PK       | 70.32             | 27.45              | 14.63        | 44.16        | 2.26                    | 70.50              | 73.90             | 3.4            | 208            | 252            |        |
| Vert.    | 4960.000           | PK       | 58.09             | 31.48              | 7.38         | 44.51        | 2.26                    | 54.70              | 73.90             | 19.2           | 351            | 122            |        |
| Vert.    | 7440.000           | PK       | 50.35             | 36.68              | 9.28         | 44.08        | 2.26                    | 54.49              | 73.90             | 19.4           | 100            | 271            |        |

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.89\text{ m} / 3.0\text{ m}) = 2.26\text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

### Average measurement value with duty factor

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Distance<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|------------------------|----------------------------|--------------------|-------------------|----------------|--------|
| Hori.    | 2483.500           | AV       | 42.26             | 27.45              | 14.63        | 44.16        | 3.55                   | 2.26                       | 45.99              | 53.90             | 7.9            | *1)    |
| Hori.    | 4960.000           | AV       | 52.81             | 31.48              | 7.38         | 44.51        | 3.55                   | 2.26                       | 52.97              | 53.90             | 0.9            |        |
| Hori.    | 7440.000           | AV       | 41.72             | 36.68              | 9.28         | 44.08        | 3.55                   | 2.26                       | 49.41              | 53.90             | 4.5            |        |
| Vert.    | 2483.500           | AV       | 42.15             | 27.45              | 14.63        | 44.16        | 3.55                   | 2.26                       | 45.88              | 53.90             | 8.0            | *1)    |
| Vert.    | 4960.000           | AV       | 50.97             | 31.48              | 7.38         | 44.51        | 3.55                   | 2.26                       | 51.13              | 53.90             | 2.8            |        |
| Vert.    | 7440.000           | AV       | 40.52             | 36.68              | 9.28         | 44.08        | 3.55                   | 2.26                       | 48.21              | 53.90             | 5.7            |        |

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.89\text{ m} / 3.0\text{ m}) = 2.26\text{ dB}$

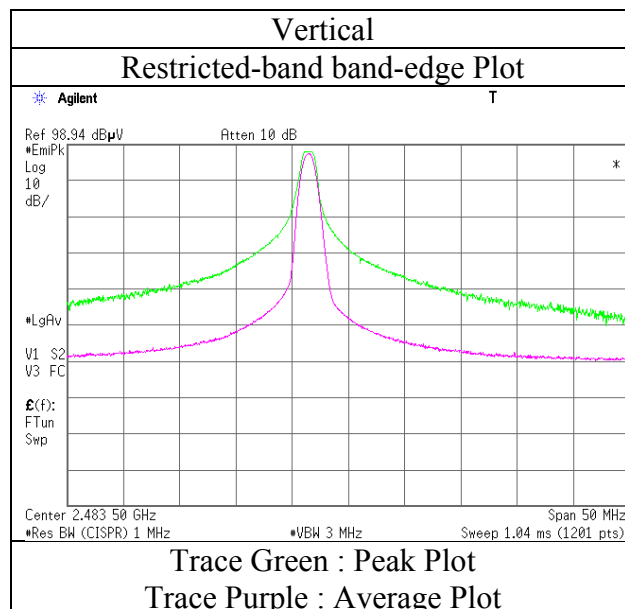
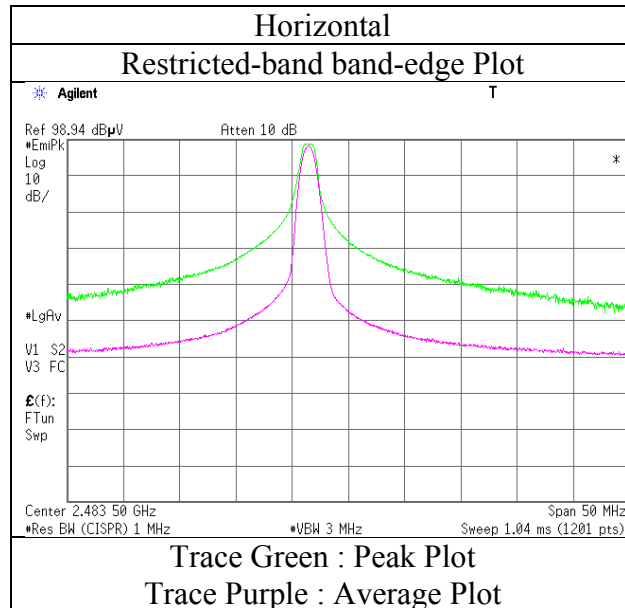
13 GHz - 40 GHz :  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

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

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

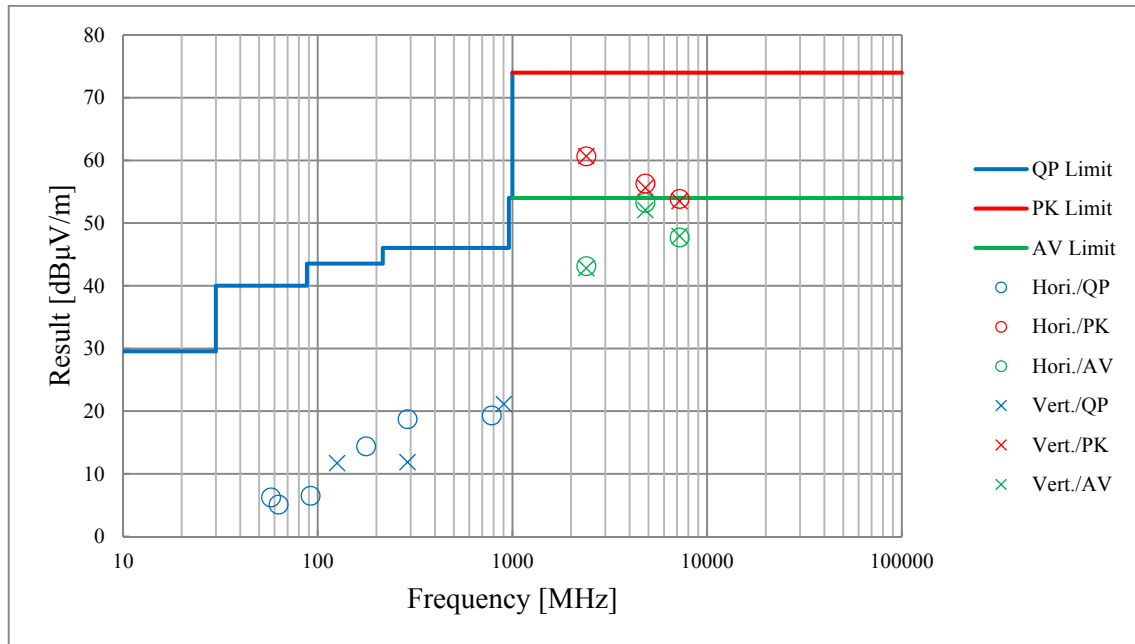
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|------------------------|---------------------|
| Report No.             | 12341751S-A-R2      |
| Test place             | Shonan EMC Lab.     |
| Semi Anechoic Chamber  | No.1                |
| Date                   | June 8, 2018        |
| Temperature / Humidity | 20 deg. C / 58 % RH |
| Engineer               | Makoto Hosaka       |
|                        | (1 GHz – 13 GHz)    |
| Mode                   | Tx BT LE 2480 MHz   |



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

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

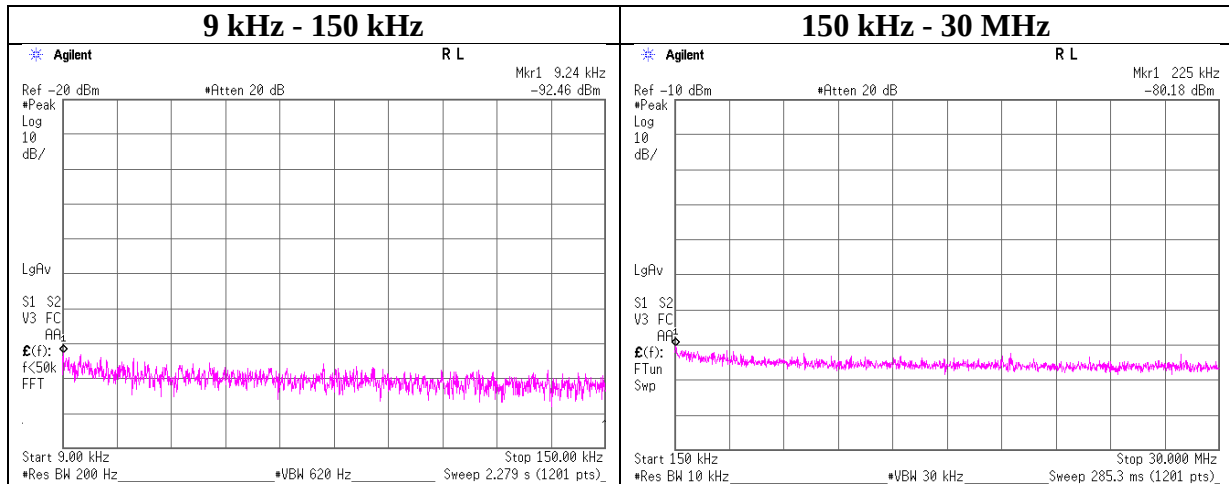
|                        |                     |                     |
|------------------------|---------------------|---------------------|
| Report No.             | 12341751S-A-R2      |                     |
| Test place             | Shonan EMC Lab.     |                     |
| Semi Anechoic Chamber  | No.1                |                     |
| Date                   | June 9, 2018        | June 8, 2018        |
| Temperature / Humidity | 24 deg. C / 60 % RH | 20 deg. C / 58 % RH |
| Engineer               | Kazuya Noda         | Makoto Hosaka       |
|                        | (30 MHz – 1 GHz)    | (1 GHz – 18 GHz)    |
|                        | (18 GHz – 26.5 GHz) |                     |
| Mode                   | Tx BT LE 2402 MHz   |                     |



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

## Conducted Spurious Emission

|                        |                                    |
|------------------------|------------------------------------|
| Report No.             | 12341751S-A-R2                     |
| Test place             | Shonan EMC Lab. No.5 Shielded Room |
| Date                   | June 8, 2018                       |
| Temperature / Humidity | 26 deg. C / 53 % RH                |
| Engineer               | Kazuya Noda                        |
| Mode                   | Tx BT LE 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 |
|--------------------|------------------|-----------------------|----------------------------|---------------------------|----------------------------|---------------|-----------------|--------------------------|-----------------------------------|-------------------|----------------|--------|
| 9.24               | -92.5            | 0.01                  | 9.83                       | 2.0                       | 1                          | -80.6         | 300             | 6.0                      | -19.4                             | 48.2              | 67.6           |        |
| 225.00             | -80.2            | 0.01                  | 9.83                       | 2.0                       | 1                          | -68.3         | 300             | 6.0                      | -7.1                              | 20.5              | 27.6           |        |

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

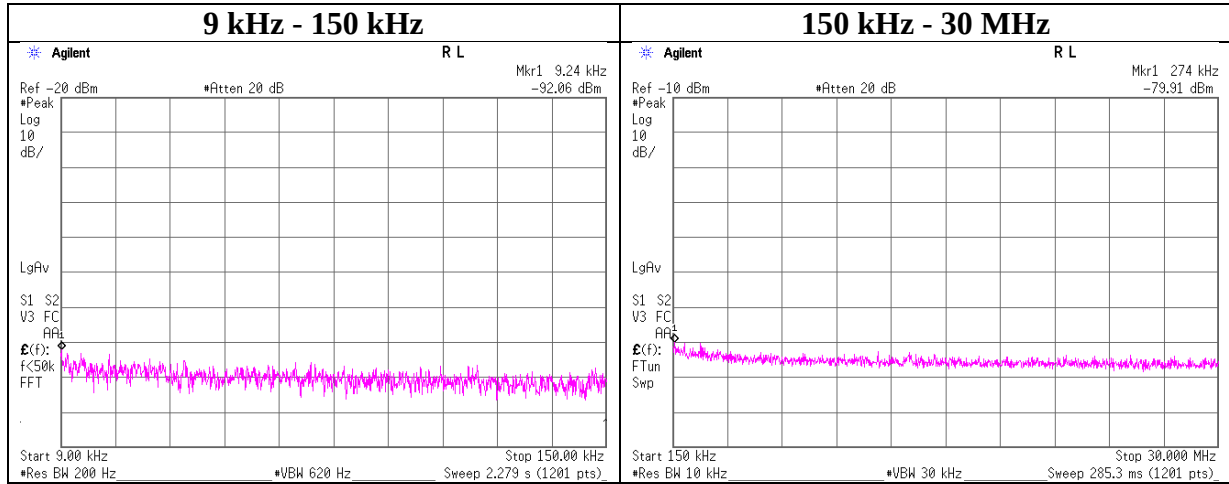
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

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.

## Conducted Spurious Emission

|                        |                                    |
|------------------------|------------------------------------|
| Report No.             | 12341751S-A-R2                     |
| Test place             | Shonan EMC Lab. No.5 Shielded Room |
| Date                   | June 8, 2018                       |
| Temperature / Humidity | 26 deg. C / 53 % RH                |
| Engineer               | Kazuya Noda                        |
| Mode                   | Tx BT LE 2440 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 |
|--------------------|------------------|-----------------------|----------------------------|---------------------------|----------------------------|---------------|-----------------|--------------------------|-----------------------------------|-------------------|----------------|--------|
| 9.24               | -92.1            | 0.01                  | 9.83                       | 2.0                       | 1                          | -80.2         | 300             | 6.0                      | -19.0                             | 48.2              | 67.2           |        |
| 274.00             | -79.9            | 0.01                  | 9.83                       | 2.0                       | 1                          | -68.1         | 300             | 6.0                      | -6.8                              | 18.8              | 25.6           |        |

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

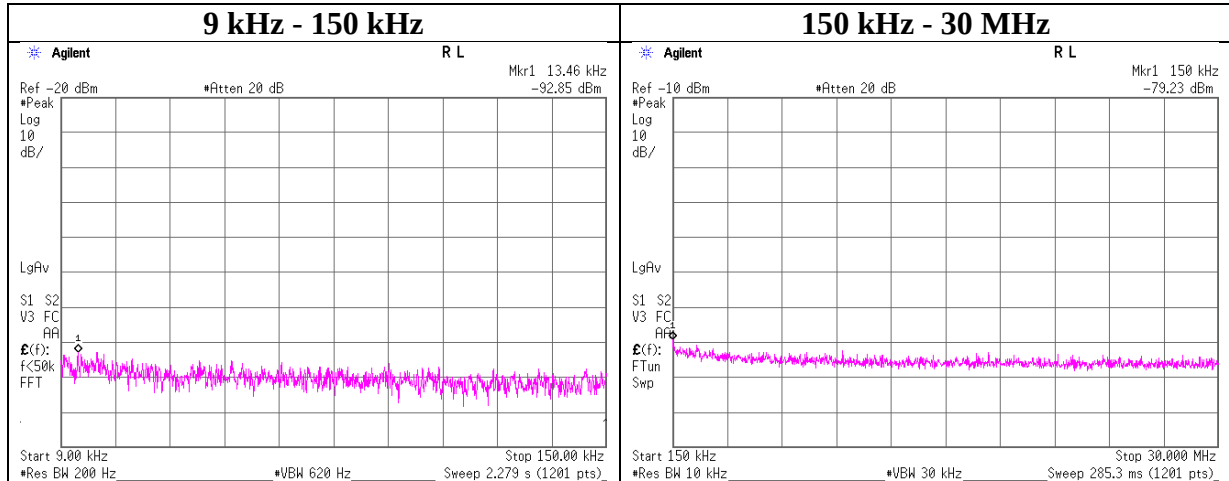
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

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.

## Conducted Spurious Emission

|                        |                                    |
|------------------------|------------------------------------|
| Report No.             | 12341751S-A-R2                     |
| Test place             | Shonan EMC Lab. No.5 Shielded Room |
| Date                   | June 8, 2018                       |
| Temperature / Humidity | 26 deg. C / 53 % RH                |
| Engineer               | Kazuya Noda                        |
| Mode                   | Tx BT LE 2480 MHz                  |



| Frequency<br>[kHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Attenuator<br>Loss<br>[dB] | Antenna<br>Gain*<br>[dBi] | N<br>(Number<br>of Output) | EIRP<br>[dBm] | Distance<br>[m] | Ground<br>bounce<br>[dB] | E<br>(field strength)<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|--------------------|------------------|-----------------------|----------------------------|---------------------------|----------------------------|---------------|-----------------|--------------------------|-----------------------------------|-------------------|----------------|--------|
| 13.46              | -92.9            | 0.01                  | 9.86                       | 2.0                       | 1                          | -81.0         | 300             | 6.0                      | -19.7                             | 45.0              | 64.7           |        |
| 150.00             | -79.2            | 0.01                  | 9.86                       | 2.0                       | 1                          | -67.4         | 300             | 6.0                      | -6.1                              | 24.0              | 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

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

### **Power Density**

Report No. 12341751S-A-R2  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date June 8, 2018  
Temperature / Humidity 26 deg. C / 53 % RH  
Engineer Kazuya Noda  
Mode Tx

#### Bluetooth Low Energy

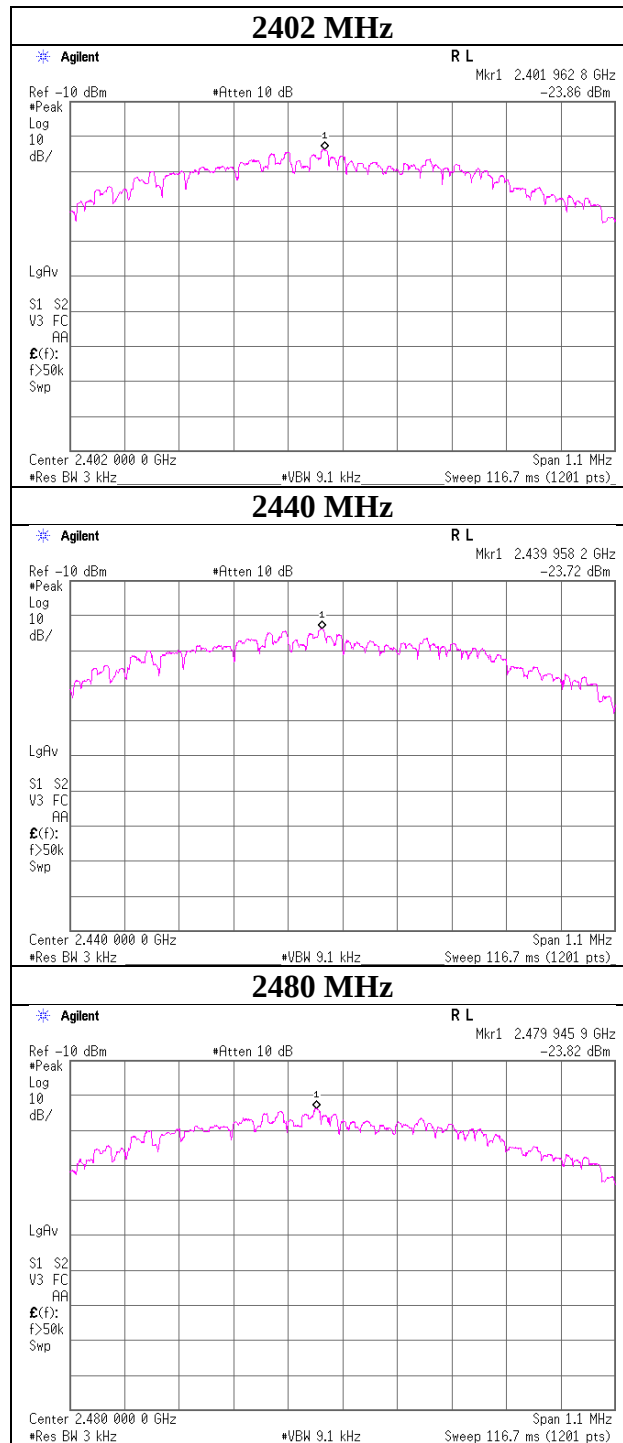
| Freq.<br>[MHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>Loss<br>[dB] | Result<br>[dBm] | Limit<br>[dBm] | Margin<br>[dB] |
|----------------|------------------|-----------------------|------------------------|-----------------|----------------|----------------|
| 2402.00        | -23.86           | 1.38                  | 9.86                   | -12.62          | 8.00           | 20.62          |
| 2440.00        | -23.72           | 1.39                  | 9.86                   | -12.47          | 8.00           | 20.47          |
| 2480.00        | -23.82           | 1.40                  | 9.85                   | -12.57          | 8.00           | 20.57          |

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



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## APPENDIX 2: Test instruments

### Test Instruments

| Control No.                        | Instrument                   | Manufacturer                                               | Model No                                           | Serial No                  | Test Item | Calibration Date *<br>Interval(month) |
|------------------------------------|------------------------------|------------------------------------------------------------|----------------------------------------------------|----------------------------|-----------|---------------------------------------|
| SSA-02                             | Spectrum Analyzer            | Agilent                                                    | E4448A                                             | MY48250106                 | AT        | 2018/03/05 * 12                       |
| SAT10-12                           | Attenuator                   | Weinschel Corp.                                            | 54A-10                                             | 81601                      | AT        | 2018/03/22 * 12                       |
| SCC-G13                            | Coaxial Cable                | Suhner                                                     | SUCOFLEX 102                                       | 31599/2                    | AT        | 2018/03/19 * 12                       |
| SPM-13                             | Power Meter                  | KEYSIGHT                                                   | 8990B                                              | MY51000448                 | AT        | 2018/05/18 * 12                       |
| SPSS-06                            | Power sensor                 | KEYSIGHT                                                   | N1923A                                             | MY57270004                 | AT        | 2018/05/18 * 12                       |
| KTS-07                             | Digital Tester               | SANWA                                                      | PC500                                              | 7019232                    | AT        | 2017/10/11 * 12                       |
| SOS-09                             | Humidity Indicator           | A&D                                                        | AD-5681                                            | 4061484                    | AT        | 2017/12/21 * 12                       |
| SAEC-01(SVSWR)                     | Semi-Anechoic Chamber        | TDK                                                        | SAEC-01(SVSWR)                                     | 1                          | RE        | 2017/07/20 * 12                       |
| SAF-06                             | Pre Amplifier                | TOYO Corporation                                           | TPA0118-36                                         | 2046104                    | RE        | 2017/09/22 * 12                       |
| SCC-G05                            | Coaxial Cable                | Junkosha                                                   | J12J102207-00                                      | APR-30-15-037              | RE        | 2018/01/29 * 12                       |
| SCC-G22                            | Coaxial Cable                | Suhner                                                     | SUCOFLEX 104                                       | 296199/4                   | RE        | 2018/05/11 * 12                       |
| SCC-G41                            | Coaxial Cable                | Junkosha                                                   | MWX221-01000N<br>FSNMS/B                           | 1612S006                   | RE        | 2018/01/29 * 12                       |
| SHA-01                             | Horn Antenna                 | Schwarzbeck                                                | BBHA9120D                                          | 9120D-725                  | RE        | 2017/08/14 * 12                       |
| SAT10-05                           | Attenuator(above1GHz)        | Agilent                                                    | 8493C-010                                          | 74864                      | RE        | 2017/11/22 * 12                       |
| SFL-02                             | Highpass Filter              | MICRO-TRONICS                                              | HPM50111                                           | 051                        | RE        | 2017/11/16 * 12                       |
| SOS-01                             | Humidity Indicator           | A&D                                                        | AD-5681                                            | 4062555                    | RE        | 2017/10/30 * 12                       |
| KSA-08                             | Spectrum Analyzer            | Agilent                                                    | E4446A                                             | MY46180525                 | RE        | 2017/10/10 * 12                       |
| KJM-09                             | Measure                      | KOMELON                                                    | KMC-36                                             | -                          | RE        | -                                     |
| COTS-SEMI-1                        | EMI Software                 | TSJ                                                        | TEPTO-DV(RE,C<br>E,RFL,MF)                         | -                          | RE        | -                                     |
| SCC-G45                            | Coaxial Cable                | HUBER+SUHNER                                               | SUCOFLEX 102 E                                     | 800137/2EA                 | RE        | 2018/03/28 * 12                       |
| SCC-G33                            | Coaxial Cable                | Junkosha                                                   | MWX241-01000K<br>MSKMS                             | -                          | RE        | 2018/04/20 * 12                       |
| SAF-08                             | Pre Amplifier                | TOYO Corporation                                           | HAP18-26W                                          | 00000019                   | RE        | 2018/03/27 * 12                       |
| SHA-04                             | Horn Antenna                 | ETS LINDGREN                                               | 3160-09                                            | LM9861                     | RE        | 2017/07/11 * 12                       |
| SAF-01                             | Pre Amplifier                | SONOMA                                                     | 310N                                               | 290211                     | RE        | 2018/02/16 * 12                       |
| KAT6-04                            | Attenuator                   | INMET                                                      | 18N-6dB                                            | -                          | RE        | 2017/12/14 * 12                       |
| SAT3-09                            | Attenuator                   | JFW                                                        | 50HF-003N                                          | -                          | RE        | 2017/08/24 * 12                       |
| SBA-01                             | Biconical Antenna            | Schwarzbeck                                                | BBA9106                                            | 91032664                   | RE        | 2017/10/21 * 12                       |
| SCC-A1/A3/A5/A7/<br>A8/A13/SRSE-01 | Coaxial Cable&RF<br>Selector | Fujikura/Fujikura/Suhne<br>r/Suhner/Suhner/Suhner/<br>TOYO | 8D2W/12DSFA/14<br>1PE/141PE/141PE/<br>141PE/NS4906 | -/0901-269(RF<br>Selector) | RE        | 2018/04/12 * 12                       |
| SCC-A2/A4/A6/A7/<br>A8/A13/SRSE-01 | Coaxial Cable&RF<br>Selector | Fujikura/Fujikura/Suhne<br>r/Suhner/Suhner/Suhner/<br>TOYO | 8D2W/12DSFA/14<br>1PE/141PE/141PE/<br>141PE/NS4906 | -/0901-269(RF<br>Selector) | RE        | 2018/04/12 * 12                       |
| SLA-05                             | Logperiodic Antenna          | Schwarzbeck                                                | VUSLP9111B                                         | 193                        | RE        | 2017/12/10 * 12                       |
| STR-01                             | Test Receiver                | Rohde & Schwarz                                            | ESU40                                              | 100093                     | RE        | 2018/04/13 * 12                       |
| SAEC-01(NSA)                       | Semi-Anechoic Chamber        | TDK                                                        | SAEC-01(NSA)                                       | 1                          | RE        | 2018/05/29 * 12                       |
| STS-01                             | Digital Hitester             | Hioki                                                      | 3805-50                                            | 080997812                  | RE        | 2017/10/16 * 12                       |

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

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

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