



# **RADIO TEST REPORT**

**Test Report No. : 12656071S-H**

**Applicant** : Nintendo Co., Ltd.  
**Type of Equipment** : Game Console  
**Model No.** : HDH-001  
**FCC ID** : BKEHDH001  
**Test regulation** : FCC Part 15 Subpart C: 2019  
\* Bluetooth BDR/EDR part  
**Test Result** : Complied (Refer to SECTION 3.2)

Based on the manufacturer's declaration, Model HDH-001 can be regarded as equivalent to Model HDH-002 for the radio characteristics related to this application.  
(Refer Theory of Operation-Differences)

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2. The results in this report apply only to the sample tested.
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6. This test report covers Radio technical requirements.  
It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. 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. The information provided from the customer for this report is identified in SECTION 1.

**Date of test:** January 7 to March 12, 2019

**Representative test engineer:**

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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".

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## **SECTION 1: Customer information**

|                  |   |                                                               |
|------------------|---|---------------------------------------------------------------|
| Company Name     | : | Nintendo Co., Ltd.                                            |
| Address          | : | 11-1 Hokotate-cho, Kamitoba, Minami-ku, Kyoto 601-8501, Japan |
| Telephone Number | : | +81-75-662-9600                                               |
| Facsimile Number | : | +81-75-662-9624                                               |
| Contact Person   | : | Kazuya Kuramoto                                               |

The information provided from the customer is as follows;

- Applicant, Type of Equipment, Model No., 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 (E.U.T.)
  - SECTION 4: Operation of E.U.T. during testing
- \* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

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

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

|                                                        |   |                                                                                                                              |
|--------------------------------------------------------|---|------------------------------------------------------------------------------------------------------------------------------|
| Type of Equipment                                      | : | Game Console                                                                                                                 |
| Model No.                                              | : | HDH-001                                                                                                                      |
| Serial No.                                             | : | Refer to Section 4.2                                                                                                         |
| Rating                                                 | : | DC 3.8 V (battery),<br>AC Adapter input: AC 100 V - 240 V, 50 Hz / 60 Hz, 1 A,<br>AC Adapter output: DC 5 V - DC 15 V, 2.6 A |
| Receipt Date of Sample<br>(Information from test lab.) | : | December 27, 2018                                                                                                            |
| Country of Mass-production                             | : | China                                                                                                                        |
| Condition of EUT                                       | : | Engineering 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: HDH-001 (referred to as the EUT in this report) is a Game Console.

### Radio Specification

Wireless LAN, Bluetooth part:

|                                 |                                                                                                                                                                                                                                                          |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Equipment type                  | : Transmitter                                                                                                                                                                                                                                            |
| Frequency of operation          | : Wireless LAN part: (2.4 GHz): 2412 MHz - 2472 MHz,<br>(U-NII-1): 5180 MHz - 5240 MHz,<br>(U-NII-2A): 5260 MHz - 5320 MHz,<br>(U-NII-2C): 5500 MHz - 5700 MHz,<br>(U-NII-3): 5745 MHz - 5825 MHz,<br>Bluetooth (BDR/EDR/BTLE) part: 2402 MHz - 2480 MHz |
| Radio part clock frequency      | : 37.4 MHz                                                                                                                                                                                                                                               |
| Channel spacing                 | : Wireless LAN part: (2.4 GHz): 5 MHz, (5 GHz): 20 MHz,<br>Bluetooth part: (BDR/EDR): 1 MHz, (BT LE): 2 MHz                                                                                                                                              |
| Type of modulation              | : Wireless LAN part:<br>2.4 GHz bands: DBPSK, DQPSK, CCK, OFDM,<br>5 GHz bands: OFDM<br>Bluetooth (BT) part:<br>BDR (Basic Data Rate): GFSK,<br>EDR (Enhanced Data Rate): $\pi/4$ -DQPSK, 8DPSK,<br>BT LE (Low Energy mode): GFSK                        |
| Antenna type                    | : Sheet metal antenna                                                                                                                                                                                                                                    |
| Antenna connector type          | : (Ant: 0): MHF2, (Ant: 1): MHF2                                                                                                                                                                                                                         |
| Antenna gain                    | : 2.4 GHz bands: (Ant: 0): -0.904 dBi, (Ant: 1): -0.730 dBi<br>5 GHz bands: (Ant: 0): 2.949 dBi, (Ant: 1): 1.994 dBi                                                                                                                                     |
| Power Supply (radio part input) | : DC 1.8 V, DC 3.3 V                                                                                                                                                                                                                                     |
| Operation temperature range     | : +5 deg.C to +35 deg.C                                                                                                                                                                                                                                  |

Remarks: This wireless module consists of 1 chip each of 5 GHz bands and 2.4 GHz bands.

NFC part:

|                                 |                         |
|---------------------------------|-------------------------|
| Equipment type                  | : Transmitter           |
| Frequency of operation          | : 13.56 MHz             |
| Radio part clock frequency      | : 27.12 MHz             |
| Type of modulation              | : ASK                   |
| Power Supply (radio part input) | : DC 1.8 V, DC 5.0 V    |
| Antenna type                    | : Ferrite Chip Antenna  |
| Operation temperature range     | : +5 deg.C to +35 deg.C |

## SECTION 3: Test specification, procedures & results

### 3.1 Test Specification

Test Specification : FCC Part 15 Subpart C  
 FCC Part 15 final revised on June 4, 2019 and effective July 5, 2019 except 15.258

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

\* The revision on June 4, 2019, does not affect the test specification applied to the EUT.

\* 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                                  | 12.8 dB<br>0.16051 MHz, QP, N,<br>Mode: Tx DH5 2480 MHz<br>0.16052 MHz, QP, N,<br>Mode: Tx 3DH5 2480 MHz | Complied<br>a)       | -                                               |
| Carrier Frequency Separation             | FCC: KDB 558074 D01<br>15.247 Meas Guidance v05r01<br>IC: -            | FCC: Section15.247(a)(1)<br>IC: RSS-247 5.1 (b)                         | See data.                                                                                                | Complied<br>b)       | Conducted                                       |
| 20 dB Bandwidth                          | FCC: KDB 558074 D01<br>15.247 Meas Guidance v05r01<br>IC: -            | FCC: Section15.247(a)(1)<br>IC: RSS-247 5.1 (a)                         |                                                                                                          | Complied<br>b)       | Conducted                                       |
| Number of Hopping Frequency              | FCC: KDB 558074 D01<br>15.247 Meas Guidance v05r01<br>IC: -            | FCC: Section15.247(a)(1)(iii)<br>IC: RSS-247 5.1 (d)                    |                                                                                                          | Complied<br>c)       | Conducted                                       |
| Dwell time                               | FCC: KDB 558074 D01<br>15.247 Meas Guidance v05r01<br>IC: -            | FCC: Section15.247(a)(1)(iii)<br>IC: RSS-247 5.1 (d)                    |                                                                                                          | Complied<br>d)       | Conducted                                       |
| Maximum Peak Output Power                | FCC: KDB 558074 D01<br>15.247 Meas Guidance v05r01<br>IC: RSS-Gen 6.12 | FCC: Section15.247(a)(b)(1)<br>IC: RSS-247 5.4 (b)                      |                                                                                                          | Complied<br>e)       | Conducted                                       |
| Spurious Emission & Band Edge Compliance | FCC: KDB 558074 D01<br>15.247 Meas Guidance v05r01<br>IC: RSS-Gen 6.13 | FCC: Section15.247(d)<br>IC: RSS-247 5.5<br>RSS-Gen 8.9<br>RSS-Gen 8.10 | 1.5 dB<br>4804.00 MHz, Average,<br>Horizontal,<br>Mode: Tx 2402 MHz, EDR                                 | Complied#<br>f) / g) | Conducted/<br>Radiated<br>(above 30 MHz)<br>*1) |

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

- \*1) Radiated test was selected over 30 MHz based on section 15.247(d). (Measurement was performed before issue of KDB 558074 v05r02.)
- a) Refer to APPENDIX 1 (data of Conducted Emission)
- b) Refer to APPENDIX 1 (data of 20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation)
- c) Refer to APPENDIX 1 (data of Number of Hopping Frequency)
- d) Refer to APPENDIX 1 (data of Dwell time)
- e) Refer to APPENDIX 1 (data of Maximum Peak Output Power)
- f) Refer to APPENDIX 1 (data of Conducted Spurious Emission)
- g) Refer to APPENDIX 1 (data of Radiated Spurious Emission)

Symbols:

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

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

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

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

This EUT provides the stable voltage constantly to RF Module regardless of input voltage. 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.

### **3.3 Addition to standard**

| Item                                                                                                       | Test Procedure | Specification | Worst margin | Results | Remarks   |
|------------------------------------------------------------------------------------------------------------|----------------|---------------|--------------|---------|-----------|
| 99 % Occupied Bandwidth                                                                                    | RSS-Gen 6.7    | IC: -         | N/A          | -<br>b) | Conducted |
| b) Refer to APPENDIX 1 (data of 20 dB Bandwidth, 99 % Occupied Bandwidth and Carrier Frequency Separation) |                |               |              |         |           |

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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| 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  | 2.9 dB            | 2.8 dB         | 2.9 dB         | 2.9 dB         | 2.9 dB       |
| Radiated emission<br>(Measurement distance: 3 m) | 9 kHz-30 MHz    | 3.0 dB            | 3.0 dB         | 3.1 dB         | -              | -            |
|                                                  | 30 MHz-200 MHz  | 4.6 dB            | 4.6 dB         | 4.7 dB         | -              | -            |
|                                                  | 200 MHz-1 GHz   | 6.0 dB            | 6.0 dB         | 6.1 dB         | -              | -            |
|                                                  | 1 GHz-6 GHz     | 4.8 dB            | 4.8 dB         | 4.8 dB         | -              | -            |
|                                                  | 6 GHz-18 GHz    | 5.4 dB            | 5.4 dB         | 5.4 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    | 5.7 dB            | 5.7 dB         | 5.7 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 | 0.81 dB           |
| Power Measurement above 1 GHz (Peak Detector)_SPM-06    | 1.53 dB           |
| Power Measurement above 1 GHz (Average Detector)_SPM-07 | 0.95 dB           |
| Power Measurement above 1 GHz (Peak Detector)_SPM-07    | 1.21 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              | 2.3 dB            |
| Spurious emission (Conducted) 18 GHz-26.5 GHz           | 2.4 dB            |
| Spurious emission (Conducted) 26.5 GHz-40 GHz           | 2.4 dB            |
| Bandwidth Measurement                                   | 0.61 %            |
| 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, ISED Lab Company Number: 2973D)

| Test site                  | Width x Depth x Height (m) | Size of reference ground plane (m) / horizontal conducting plane | Maximum measurement distance |
|----------------------------|----------------------------|------------------------------------------------------------------|------------------------------|
| No.1 Semi-anechoic chamber | 20.6 x 11.3 x 7.65         | 20.6 x 11.3                                                      | 10 m                         |
| No.2 Semi-anechoic chamber | 20.6 x 11.3 x 7.65         | 20.6 x 11.3                                                      | 10 m                         |
| No.3 Semi-anechoic chamber | 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.

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

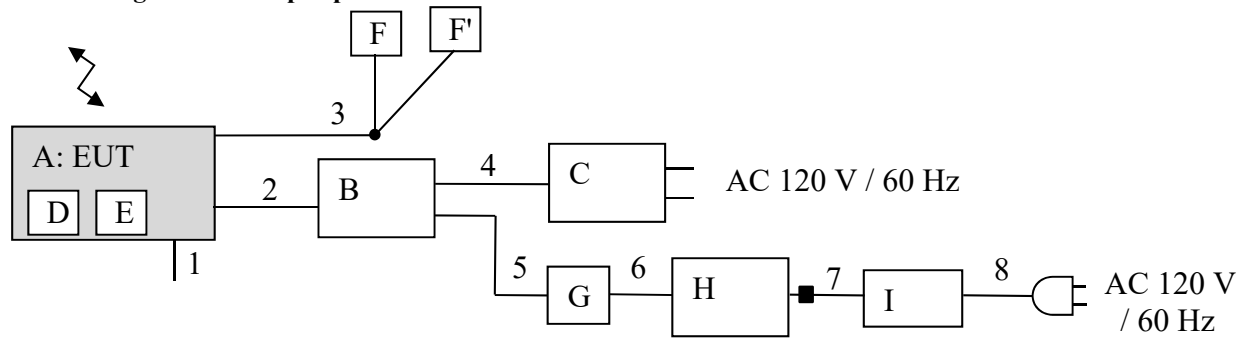
### **4.1 Operating Mode(s)**

Bluetooth (BT): Transmitting (Tx), Payload: PRBS9

Details of Operating Mode(s)

| Test Item                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Mode                                                    | Tested frequency                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|----------------------------------|
| Conducted Emission,<br>Spurious Emission<br>(Conducted/Radiated)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Tx (Hopping Off) DH5, 3DH5                              | 2402 MHz<br>2441 MHz<br>2480 MHz |
| Carrier Frequency Separation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Tx (Hopping On) DH5, 3DH5                               | 2402 MHz<br>2441 MHz<br>2480 MHz |
| 20 dB Bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Tx (Hopping Off) DH5, 3DH5                              | 2402 MHz<br>2441 MHz<br>2480 MHz |
| Number of Hopping Frequency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Tx (Hopping On) DH5, 3DH5                               | -                                |
| Dwell time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Tx (Hopping On),<br>-DH1, DH3, DH5<br>-3DH1, 3DH3, 3DH5 | -                                |
| Maximum Peak Output Power                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Tx (Hopping Off) DH5, 2DH5, 3DH5                        | 2402 MHz<br>2441 MHz<br>2480 MHz |
| Band Edge Compliance<br>(Conducted)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Tx DH5, 3DH5<br>-Hopping On<br>-Hopping Off             | 2402 MHz<br>2480 MHz             |
| 99 % Occupied Bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Tx DH5, 3DH5<br>-Hopping On<br>-Hopping Off             | 2402 MHz<br>2441 MHz<br>2480 MHz |
| <p>*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload length (except Dwell time test)</p> <p>*2DH mode (2Mb/s EDR: pi/4DQPSK) was excluded for other tests than power measurement by using 3DH mode (3 Mb/s EDR: 8DPSK) as a representative.</p> <p>* It is considered that the non-tested packet type (e.g. inquiry) can be omitted as it is complied with above all the test items based on Bluetooth Core specification.</p> <p>*EUT has the power settings by the software as follows;<br/>Power settings: Fixed<br/>Software: cmd.exe version 6.1.7601.23403<br/>BlueTool.exe ver.1.9.2.4</p> <p>*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.</p> |                                                         |                                  |

#### 4.2 Configuration and peripherals



■: Standard Ferrite Core

\* 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     | Game Console          | HDH-001       | XJW01000021026 *1)<br>XJW01000021040 *2) | Nintendo Co., Ltd. | EUT     |
| B     | SDEV Cradle           | HAT-003       | XZL0100007151                            | Nintendo Co., Ltd. | -       |
| C     | AC Adapter            | HAC-002       |                                          | Nintendo Co., Ltd. | -       |
| D     | Game Card             | HAC-008       | DFCAA22L000                              | Nintendo Co., Ltd. | -       |
| E     | Micro SD Card         | -             | -                                        | Transcend          | -       |
| F, F' | Headphone             | -             | -                                        | Nintendo Co., Ltd. | -       |
| G     | GIGA Ethernet Adapter | LAN-GTJU3     | 3495DB2BF5CA                             | Logitech           | -       |
| H     | Laptop PC             | CF-S10AWNDS   | 2BKSA58270                               | Panasonic          | -       |
| I     | AC Adapter            | CF-AA6402A M1 | 6402AM111Z03016A                         | Panasonic          | -       |

\*1) Used for Antenna Terminal conducted test

\*2) Used for Conducted Emission test and Radiated Emission test

#### List of cables used

| No. | Cable Name | Length (m) | Shield     |            | Remarks |
|-----|------------|------------|------------|------------|---------|
|     |            |            | Cable      | Connector  |         |
| 1   | Signal     | 0.1        | Unshielded | Unshielded | *3)     |
| 2   | USB        | 0.4        | Shielded   | Shielded   | -       |
| 3   | Headphone  | 0.5 + 0.3  | Unshielded | Unshielded | -       |
| 4   | USB        | 1.8        | Shielded   | Shielded   | -       |
| 5   | USB        | 0.15       | Shielded   | Shielded   | -       |
| 6   | LAN        | 0.5        | Unshielded | Unshielded | -       |
| 7   | DC         | 1.8        | Unshielded | Unshielded | -       |
| 8   | AC         | 1.0        | Unshielded | Unshielded | -       |

\*3) This signal cable is used only for the settings of the bluetooth test mode, not used for the product.

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## **SECTION 5: Conducted Emission**

### **Test Procedure and conditions**

EUT was placed on a platform of nominal size, 1.0 m by 2.0 m, raised 0.8 m above the conducting ground plane. The table is made of expanded polystyrol and expanded polypropylene and the table top is covered with polycarbonate. That has very low permittivity.

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

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

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT via AC Adapter in a Shielded room.

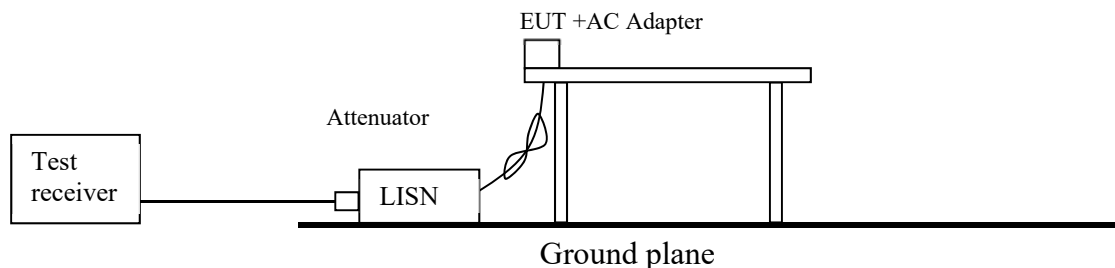
The EUT via AC Adapter was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

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

**Figure 1: Test Setup**



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

### **Test Procedure**

[For below 1 GHz]

EUT was placed on a platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The table is made of expanded polystyrol and expanded polypropylene and the table top is covered with polycarbonate. That has very low permittivity. 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.

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.

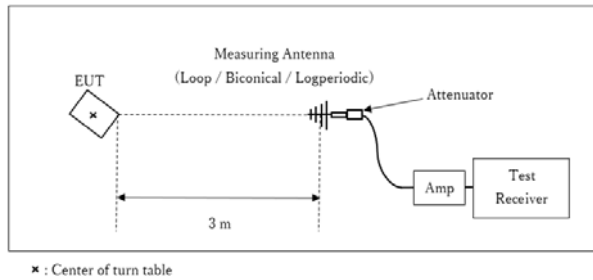
**20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9 (IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).**

|                 |               |                          |                                                                                                       |                              |
|-----------------|---------------|--------------------------|-------------------------------------------------------------------------------------------------------|------------------------------|
| 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 | RBW: 1 MHz<br>VBW: 1/T<br>(T: burst length, refer to Burst rate confirmation sheet)<br>Detector: Peak | RBW: 100 kHz<br>VBW: 300 kHz |

\*1) Average Power Measurement was performed based on KDB 558074 D01 15.247 Meas Guidance v05r01.

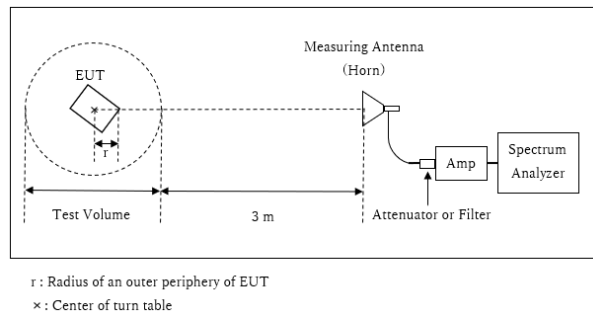
**Figure 2: Test Setup**

Below 1 GHz



Test Distance: 3 m

1 GHz - 13 GHz



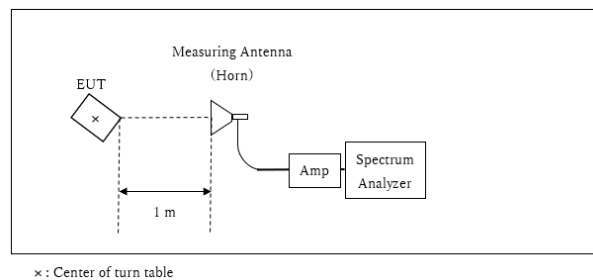
Distance Factor:  $20 \times \log (3.89 \text{ m} / 3.0 \text{ m}) = 2.26 \text{ dB}$

\* Test Distance:  $(3 + \text{Test Volume} / 2) - r = 3.89 \text{ m}$

Test Volume : 2.0 m

(Test Volume has been calibrated based on CISPR 16-1-4.)  
r = 0.11 m

13 GHz - 26.5 GHz



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

\*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.

| Antenna polarization | Spurious Below 1 GHz | Spurious 1 GHz - 2.8 GHz | Spurious 2.8 GHz - 13 GHz | Spurious 13 GHz - 26.5 GHz |
|----------------------|----------------------|--------------------------|---------------------------|----------------------------|
| Horizontal           | X                    | X                        | X                         | X                          |
| Vertical             | X                    | Z                        | 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

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

### **Test Procedure**

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

| Test                                             | Span                                    | RBW             | VBW                | Sweep time                                                     | Detector         | Trace        | Instrument used                  |
|--------------------------------------------------|-----------------------------------------|-----------------|--------------------|----------------------------------------------------------------|------------------|--------------|----------------------------------|
| 20 dB Bandwidth                                  | 3 MHz                                   | 30 kHz          | 100 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 *1) | Spectrum Analyzer                |
| Maximum Peak Output Power                        | -                                       | -               | -                  | Auto                                                           | Peak Average *2) | -            | Power Meter (Sensor: 160 MHz BW) |
| Carrier Frequency Separation                     | 3 MHz                                   | 100 kHz         | 300 kHz            | Auto                                                           | Peak             | Max Hold     | Spectrum Analyzer                |
| Number of Hopping Frequency                      | 30 MHz                                  | 300 kHz         | 1000 kHz           | Auto                                                           | Peak             | Max Hold     | Spectrum Analyzer                |
| Dwell Time                                       | Zero Span                               | 100 kHz, 1 MHz  | 300 kHz, 3 MHz     | As necessary capture the entire dwell time per hopping channel | Peak             | Clear Write  | Spectrum Analyzer                |
| Conducted Spurious Emission *3)                  | 9 kHz to 150 kHz                        | 200 Hz          | 620 Hz             | Auto                                                           | Peak             | Max Hold     | Spectrum Analyzer                |
|                                                  | 150 kHz to 30 MHz                       | 10 kHz          | 30 kHz             |                                                                |                  |              |                                  |
|                                                  | 30 MHz to 25 GHz                        | 100 kHz         | 300 kHz            |                                                                |                  |              |                                  |
| Conducted Spurious Emission Band Edge compliance | 10 MHz                                  | 100 kHz         | 300 kHz            | Auto                                                           | Peak             | Max Hold     | Spectrum Analyzer                |

\*1) Peak hold was applied as Worst-case measurement.  
 \*2) Reference data  
 \*3) In the frequency range below 30 MHz, 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.  
 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

### Conducted Emission

#### DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room  
Date : 2019/03/11

Mode : Tx DH5 2480 MHz

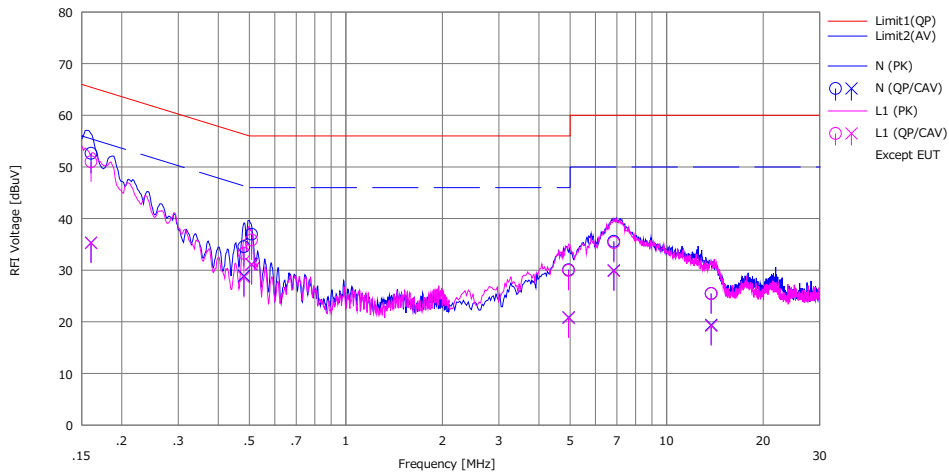
Power : AC 120 V / 60 Hz(AC adapter input)

Temp./Humi. : 25 deg.C / 36 %RH

Remarks : -

Limit : FCC\_Part 15 Subpart C(15.207)

Engineer : Kenichi Adachi



| No. | Freq.<br>[MHz] | Reading        |                 | LISN<br>[dB] | LOSS<br>[dB] | Results        |                 | Limit          |                | Margin       |              | Phase | Comment |
|-----|----------------|----------------|-----------------|--------------|--------------|----------------|-----------------|----------------|----------------|--------------|--------------|-------|---------|
|     |                | (QP)<br>[dBuV] | (CAV)<br>[dBuV] |              |              | (QP)<br>[dBuV] | (CAV)<br>[dBuV] | (QP)<br>[dBuV] | (AV)<br>[dBuV] | (QP)<br>[dB] | (AV)<br>[dB] |       |         |
| 1   | 0.16051        | 40.08          | 22.75           | 9.69         | 2.87         | 52.64          | 35.31           | 65.44          | 55.44          | 12.8         | 20.1         | N     |         |
| 2   | 0.48105        | 21.97          | 16.34           | 9.68         | 2.90         | 34.55          | 28.92           | 56.32          | 46.32          | 21.7         | 17.4         | N     |         |
| 3   | 0.50784        | 24.39          | 18.54           | 9.68         | 2.90         | 36.97          | 31.12           | 56.00          | 46.00          | 19.0         | 14.8         | N     |         |
| 4   | 4.94748        | 16.98          | 7.74            | 10.01        | 3.09         | 30.08          | 20.84           | 56.00          | 46.00          | 25.9         | 25.1         | N     |         |
| 5   | 6.84154        | 22.23          | 16.59           | 10.23        | 3.13         | 35.59          | 29.95           | 60.00          | 50.00          | 24.4         | 20.0         | N     |         |
| 6   | 13.77349       | 11.21          | 5.14            | 10.99        | 3.28         | 25.48          | 19.41           | 60.00          | 50.00          | 34.5         | 30.5         | N     |         |
| 7   | 0.16051        | 38.43          | 22.71           | 9.69         | 2.87         | 50.99          | 35.27           | 65.44          | 55.44          | 14.4         | 20.1         | L1    |         |
| 8   | 0.48105        | 20.68          | 16.03           | 9.68         | 2.90         | 33.26          | 28.61           | 56.32          | 46.32          | 23.0         | 17.7         | L1    |         |
| 9   | 0.50784        | 23.27          | 18.52           | 9.68         | 2.90         | 35.85          | 31.10           | 56.00          | 46.00          | 20.1         | 14.9         | L1    |         |
| 10  | 4.94748        | 16.84          | 7.67            | 10.01        | 3.09         | 29.94          | 20.77           | 56.00          | 46.00          | 26.0         | 25.2         | L1    |         |
| 11  | 6.84154        | 21.98          | 16.48           | 10.23        | 3.13         | 35.34          | 29.84           | 60.00          | 50.00          | 24.6         | 20.1         | L1    |         |
| 12  | 13.77349       | 11.19          | 4.95            | 10.99        | 3.28         | 25.46          | 19.22           | 60.00          | 50.00          | 34.5         | 30.7         | L1    |         |

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN+Cable+ATT)[dB]  
LISN: SLS-02 with Extension cable

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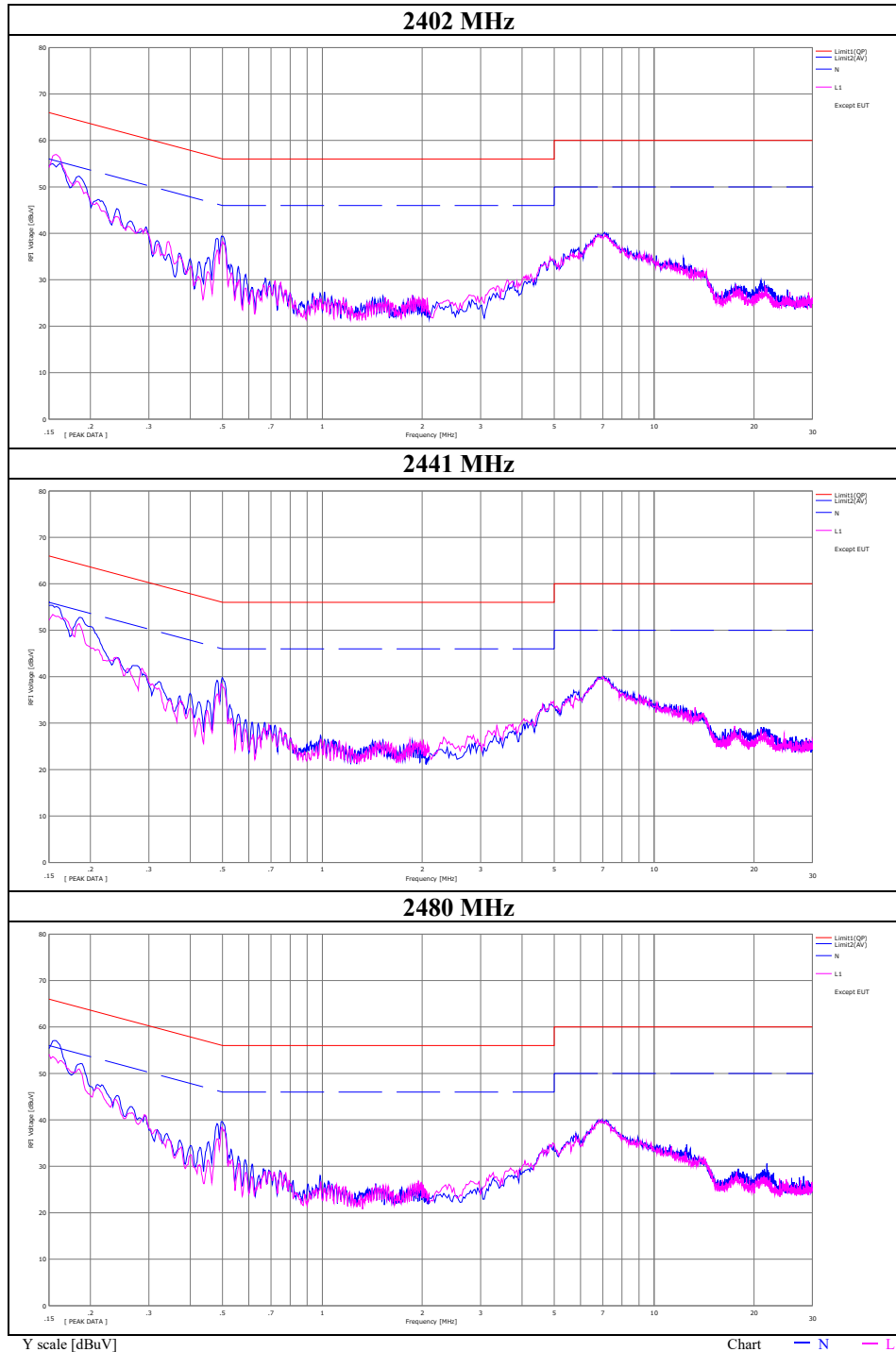
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Facsimile : +81 463 50 6401

## Conducted Emission

Report No. 12656071S-H  
Test place Shonan EMC Lab. No.3 Shielded room  
Date March 11, 2019  
Temperature / Humidity 25 deg. C / 36 % RH  
Engineer Kenichi Adachi  
Mode Tx, Hopping Off, DH5



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## Conducted Emission

### DATA OF CONDUCTED EMISSION TEST

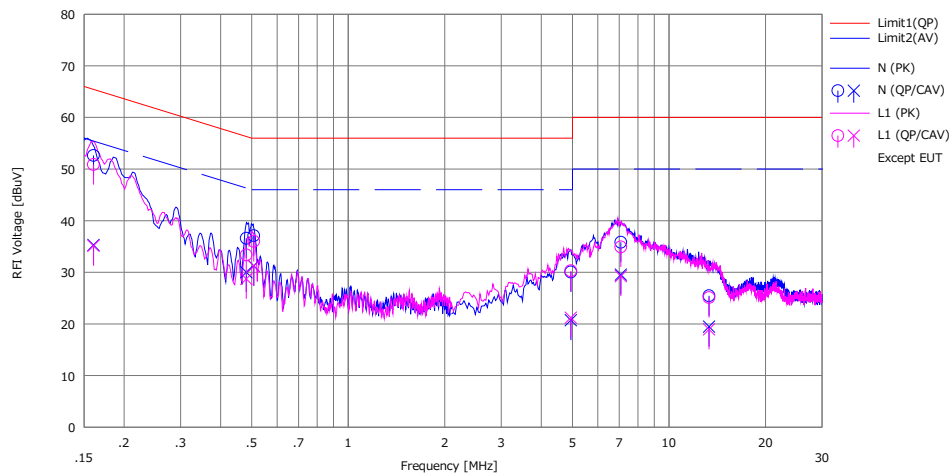
UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room  
Date : 2019/03/11

Mode : Tx 3DH5 2480 MHz  
Power : AC 120 V / 60 Hz (AC adapter input)  
Temp./Humi. : 25 deg.C / 36 %RH

Remarks : -

Limit : FCC\_Part 15 Subpart C(15.207)

Engineer : Kenichi Adachi



| No. | Freq.<br>[MHz] | Reading        |                 | LISN<br>[dB] | LOSS<br>[dB] | Results        |                 | Limit          |                | Margin       |              | Phase | Comment |
|-----|----------------|----------------|-----------------|--------------|--------------|----------------|-----------------|----------------|----------------|--------------|--------------|-------|---------|
|     |                | <QP><br>[dBuV] | <CAV><br>[dBuV] |              |              | <QP><br>[dBuV] | <CAV><br>[dBuV] | <QP><br>[dBuV] | <AV><br>[dBuV] | <QP><br>[dB] | <AV><br>[dB] |       |         |
| 1   | 0.16052        | 40.08          | 22.74           | 9.69         | 2.87         | 52.64          | 35.30           | 65.44          | 55.44          | 12.8         | 20.1         | N     |         |
| 2   | 0.48108        | 24.01          | 17.44           | 9.68         | 2.90         | 36.59          | 30.02           | 56.32          | 46.32          | 19.7         | 16.3         | N     |         |
| 3   | 0.50775        | 24.51          | 18.68           | 9.68         | 2.90         | 37.09          | 31.26           | 56.00          | 46.00          | 18.9         | 14.7         | N     |         |
| 4   | 4.94534        | 16.96          | 7.64            | 10.01        | 3.09         | 30.06          | 20.74           | 56.00          | 46.00          | 25.9         | 25.2         | N     |         |
| 5   | 7.07535        | 22.42          | 16.16           | 10.26        | 3.14         | 35.82          | 29.56           | 60.00          | 50.00          | 24.1         | 20.4         | N     |         |
| 6   | 13.32874       | 11.24          | 5.25            | 10.95        | 3.27         | 25.46          | 19.47           | 60.00          | 50.00          | 34.5         | 30.5         | N     |         |
| 7   | 0.16052        | 38.32          | 22.58           | 9.69         | 2.87         | 50.88          | 35.14           | 65.44          | 55.44          | 14.5         | 20.3         | L1    |         |
| 8   | 0.48108        | 20.79          | 16.14           | 9.68         | 2.90         | 33.37          | 28.72           | 56.32          | 46.32          | 22.9         | 17.6         | L1    |         |
| 9   | 0.50775        | 23.42          | 18.64           | 9.68         | 2.90         | 36.00          | 31.22           | 56.00          | 46.00          | 20.0         | 14.7         | L1    |         |
| 10  | 4.94534        | 17.19          | 8.12            | 10.01        | 3.09         | 30.29          | 21.22           | 56.00          | 46.00          | 25.7         | 24.7         | L1    |         |
| 11  | 7.07535        | 21.51          | 15.84           | 10.26        | 3.14         | 34.91          | 29.24           | 60.00          | 50.00          | 25.0         | 20.7         | L1    |         |
| 12  | 13.32874       | 10.89          | 4.74            | 10.95        | 3.27         | 25.11          | 18.96           | 60.00          | 50.00          | 34.8         | 31.0         | L1    |         |

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN+Cable+ATT)[dB]  
LISN: SLS-02 with Extention cable

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Shonan EMC Lab.

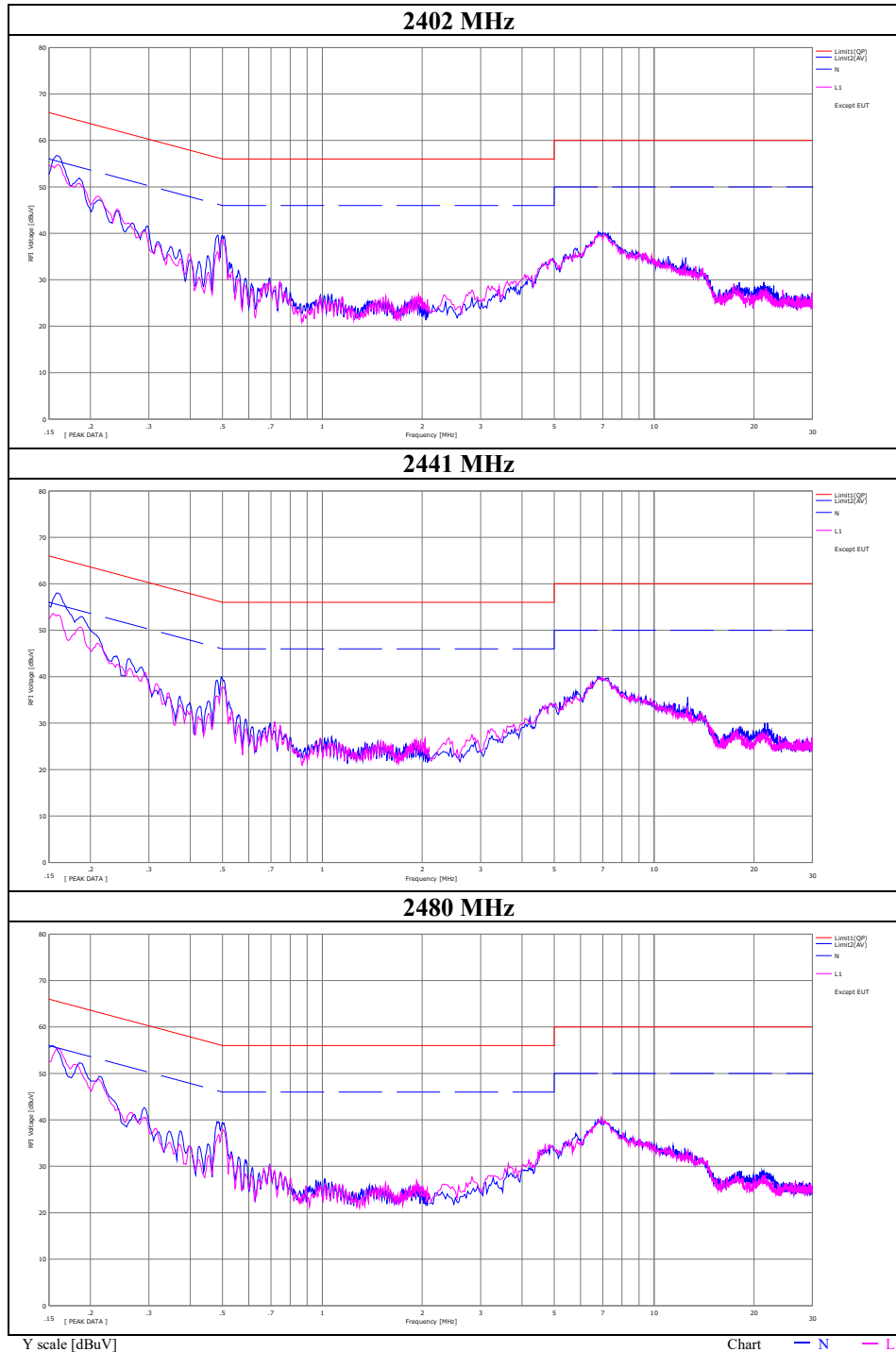
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## Conducted Emission

Report No. 12656071S-H  
Test place Shonan EMC Lab. No.3 Shielded room  
Date March 11, 2019  
Temperature / Humidity 25 deg. C / 36 % RH  
Engineer Kenichi Adachi  
Mode Tx, Hopping Off, 3DH5



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## **20 dB Bandwidth, 99 % Occupied Bandwidth and Carrier Frequency Separation**

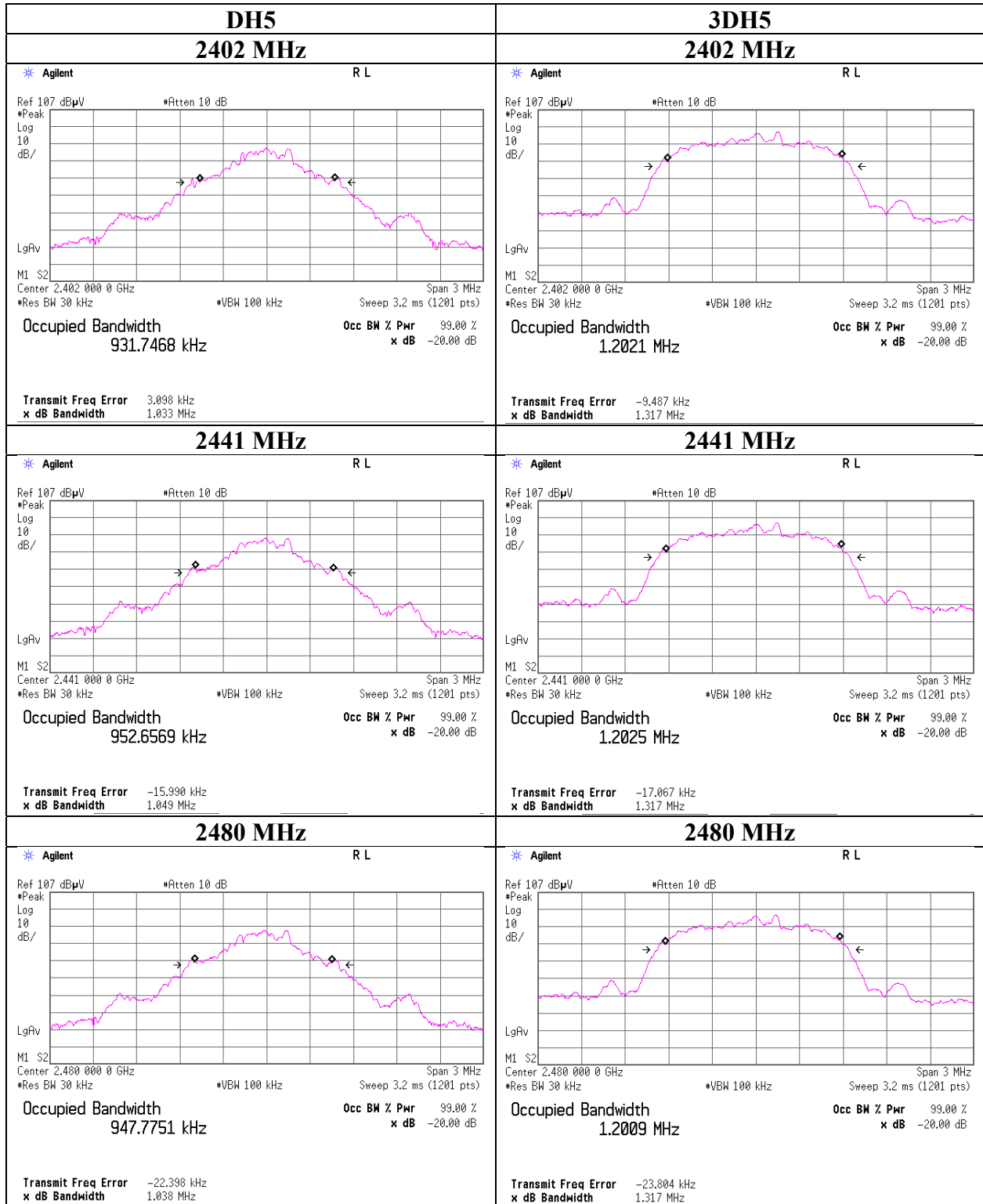
Report No. 12656071S-H  
Test place Shonan EMC Lab. No.1 Measurement Room  
Date March 12, 2019  
Temperature / Humidity 23 deg. C / 59 % RH  
Engineer Kenichi Adachi  
Mode Tx, Hopping Off, Tx, Hopping On

| Mode | Freq.<br>[MHz] | 20 dB Bandwidth<br>[MHz] | 99 % Occupied<br>Bandwidth<br>[kHz] | Carrier Frequency<br>Separation<br>[MHz] | Limit for Carrier<br>Frequency separation<br>[MHz] |
|------|----------------|--------------------------|-------------------------------------|------------------------------------------|----------------------------------------------------|
| DH5  | 2402.0         | 1.033                    | 931.7                               | 1.000                                    | $\geq 0.689$                                       |
| DH5  | 2441.0         | 1.049                    | 952.7                               | 1.000                                    | $\geq 0.700$                                       |
| DH5  | 2480.0         | 1.038                    | 947.8                               | 1.000                                    | $\geq 0.692$                                       |
| DH5  | Hopping On     | -                        | 78650.1                             | -                                        | -                                                  |
| 3DH5 | 2402.0         | 1.317                    | 1202.1                              | 1.000                                    | $\geq 0.878$                                       |
| 3DH5 | 2441.0         | 1.317                    | 1202.5                              | 1.000                                    | $\geq 0.878$                                       |
| 3DH5 | 2480.0         | 1.317                    | 1200.9                              | 1.000                                    | $\geq 0.878$                                       |
| 3DH5 | Hopping On     | -                        | 78729.6                             | -                                        | -                                                  |

Limit: Two-thirds of 20 dB Bandwidth or 25 kHz (whichever is greater).

No limit applies to 20 dB Bandwidth.

## 20 dB Bandwidth and 99 % Occupied Bandwidth



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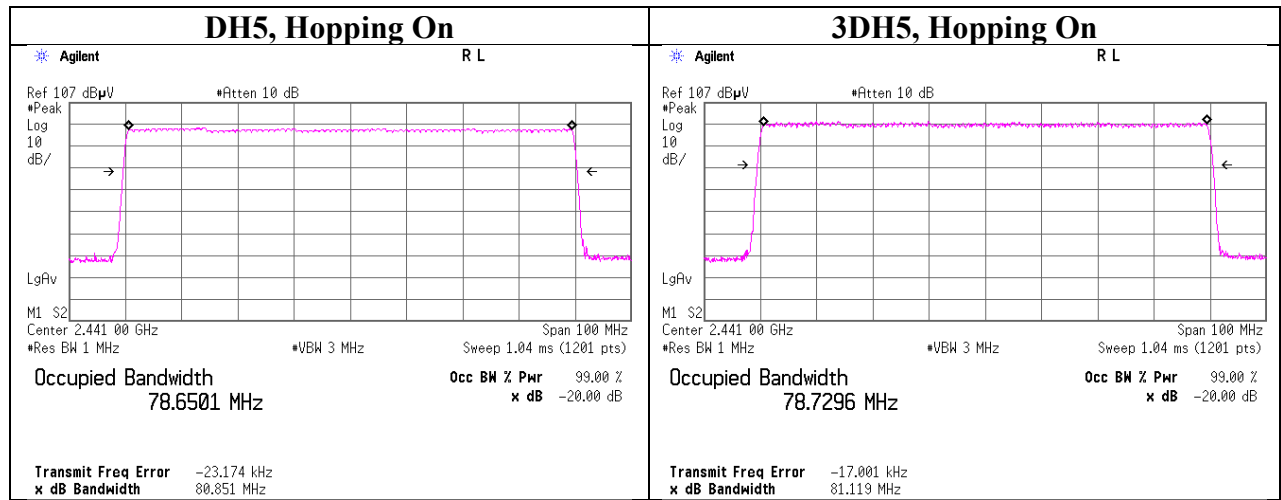
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### 20 dB Bandwidth and 99 % Occupied Bandwidth



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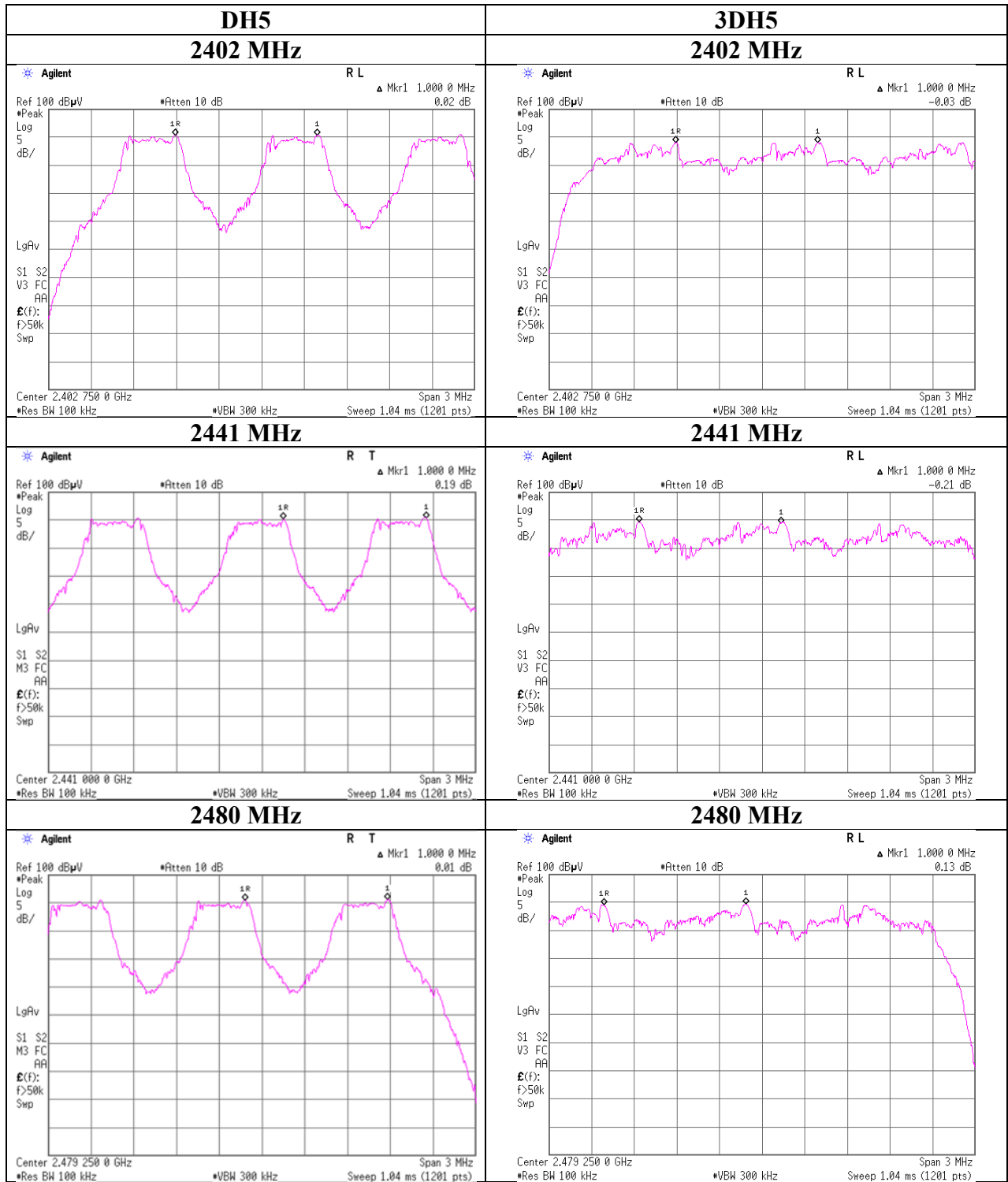
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## Carrier Frequency Separation



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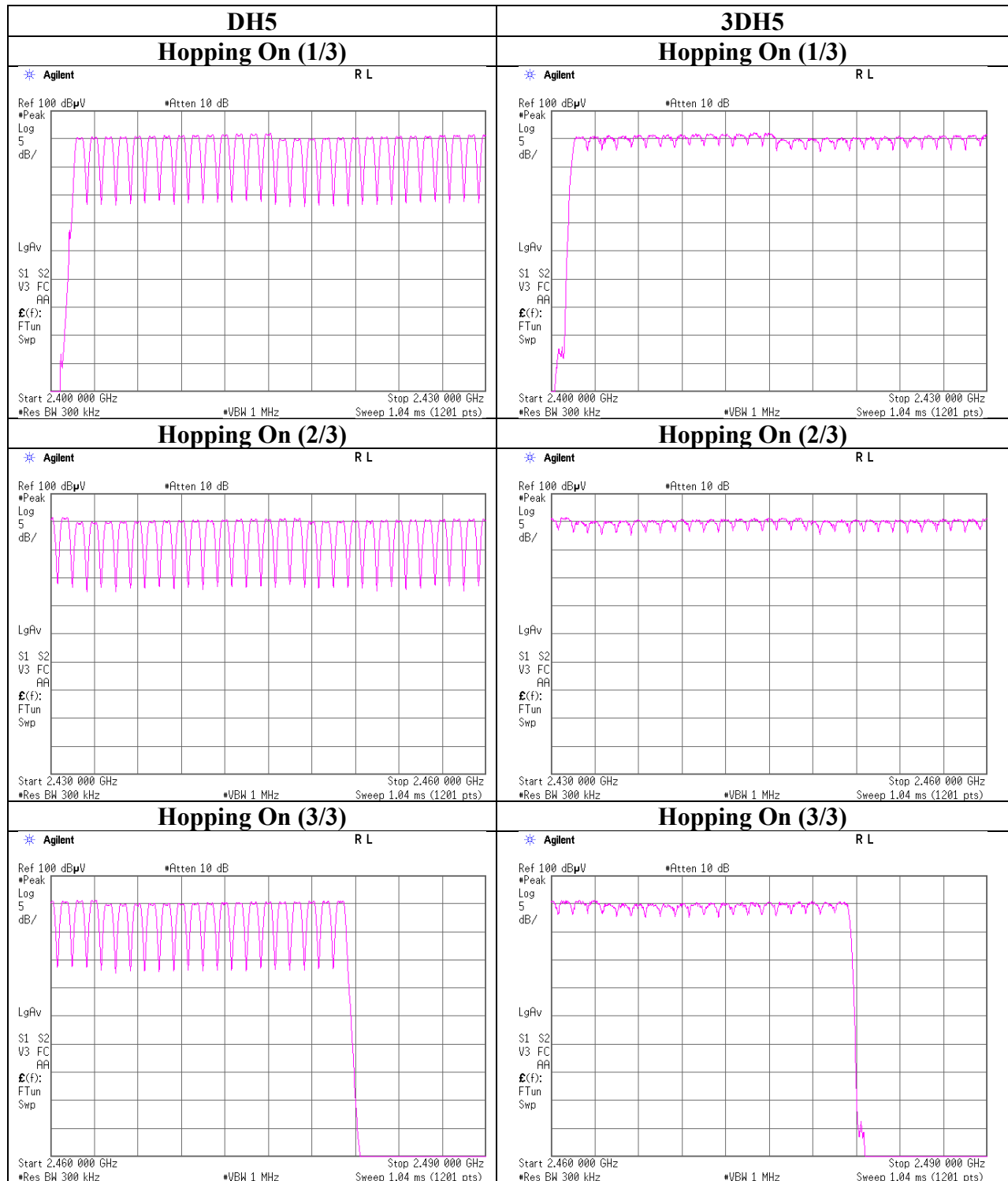
### **Number of Hopping Frequency**

Report No. 12656071S-H  
Test place Shonan EMC Lab. No.1 Measurement Room  
Date March 12, 2019  
Temperature / Humidity 23 deg. C / 59 % RH  
Engineer Kenichi Adachi  
Mode Tx, Hopping On

| Mode | Number of channel<br>[channels] | Limit<br>[channels] |
|------|---------------------------------|---------------------|
| DH5  | 79                              | $\geq 15$           |
| 3DH5 | 79                              | $\geq 15$           |

Test was not performed at AFH mode whose number of hopping channel is 20 channels because this Bluetooth radio is in compliance of Bluetooth Specification.

## Number of Hopping Frequency



## Dwell time

Report No. 12656071S-H  
Test place Shonan EMC Lab. No.1 Measurement Room  
Date March 12, 2019  
Temperature / Humidity 23 deg. C / 59 % RH  
Engineer Kenichi Adachi  
Mode Tx, Hopping On

| Mode | Number of transmission<br>in a 31.6 (79 Hopping x 0.4) second period |       |          |           | Length of<br>transmission<br>[ms] | Result<br>[ms] | Limit<br>[ms] |
|------|----------------------------------------------------------------------|-------|----------|-----------|-----------------------------------|----------------|---------------|
| DH1  | 50.4 times /                                                         | 5 s x | 31.6 s = | 319 times | 0.422                             | 135            | 400           |
| DH3  | 27.8 times /                                                         | 5 s x | 31.6 s = | 176 times | 1.683                             | 296            | 400           |
| DH5  | 18.2 times /                                                         | 5 s x | 31.6 s = | 116 times | 2.946                             | 342            | 400           |
| 3DH1 | 49.8 times /                                                         | 5 s x | 31.6 s = | 315 times | 0.428                             | 135            | 400           |
| 3DH3 | 29.6 times /                                                         | 5 s x | 31.6 s = | 188 times | 1.679                             | 316            | 400           |
| 3DH5 | 20.2 times /                                                         | 5 s x | 31.6 s = | 128 times | 2.935                             | 376            | 400           |

Sample Calculation

Result = Number of transmission x Length of transmission

\*Average data of 5 tests.(except Inquiry)

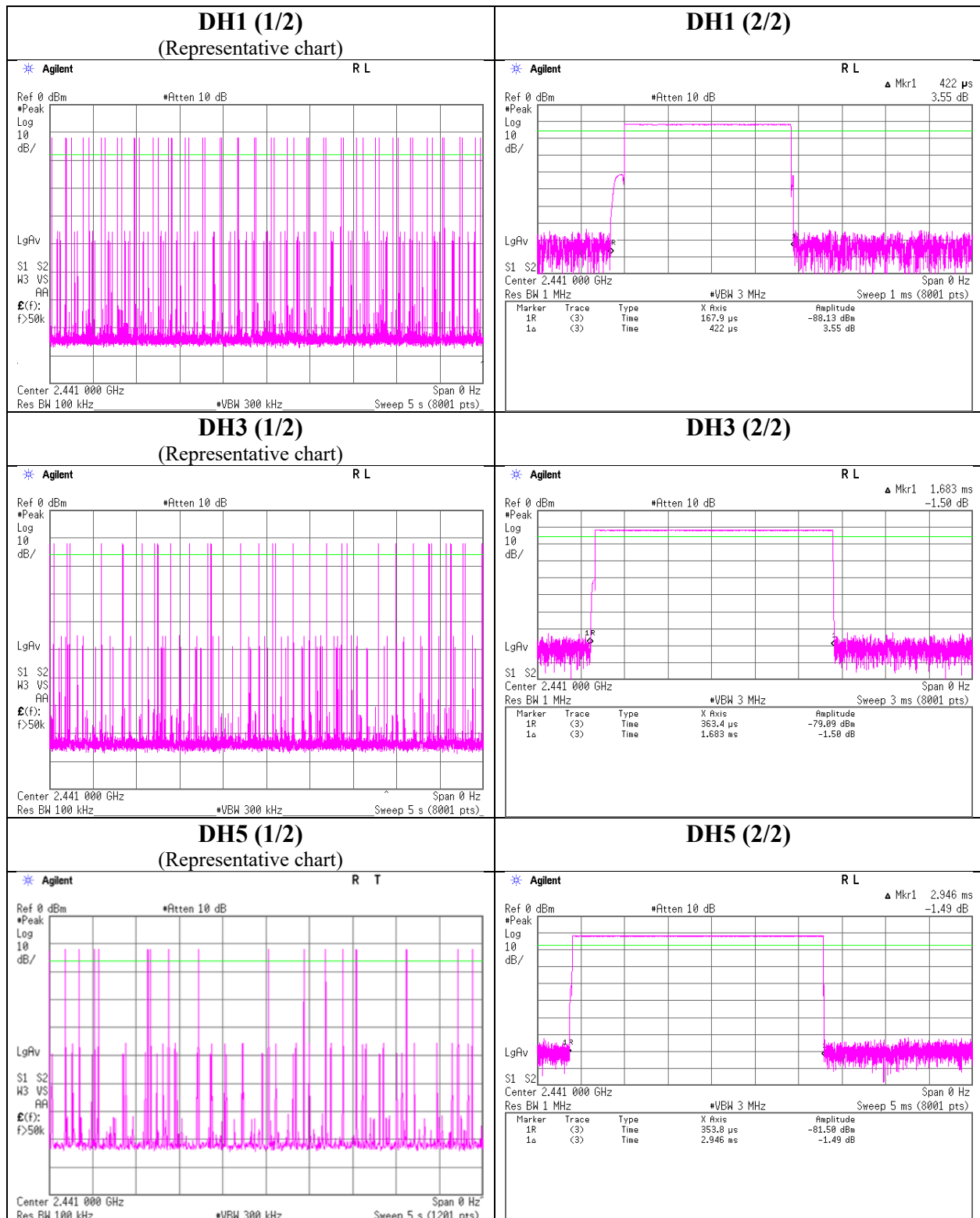
| Mode | Sampling [times] |    |    |    |    | Average<br>[times] |
|------|------------------|----|----|----|----|--------------------|
|      | 1                | 2  | 3  | 4  | 5  |                    |
| DH1  | 50               | 51 | 50 | 51 | 50 | 50.4               |
| DH3  | 32               | 26 | 27 | 26 | 28 | 27.8               |
| DH5  | 17               | 17 | 20 | 18 | 19 | 18.2               |
| 3DH1 | 50               | 50 | 49 | 50 | 50 | 49.8               |
| 3DH3 | 32               | 30 | 30 | 28 | 28 | 29.6               |
| 3DH5 | 20               | 19 | 20 | 21 | 21 | 20.2               |

Sample Calculation

Average = Summation (Sampling 1 to 5) / 5

This device complies with the Bluetooth protocol for FHSS operation, employing a pseudo random channel selection and hopping rate to ensure that the occupancy time in  $N \times 0.4$  s, where N is the number of channels being used in the hopping sequence ( $20 \leq N \leq 79$ ), is always less than 0.4 s regardless of packet size. This is confirmed in the test report for  $N = 79$ .

## Dwell time



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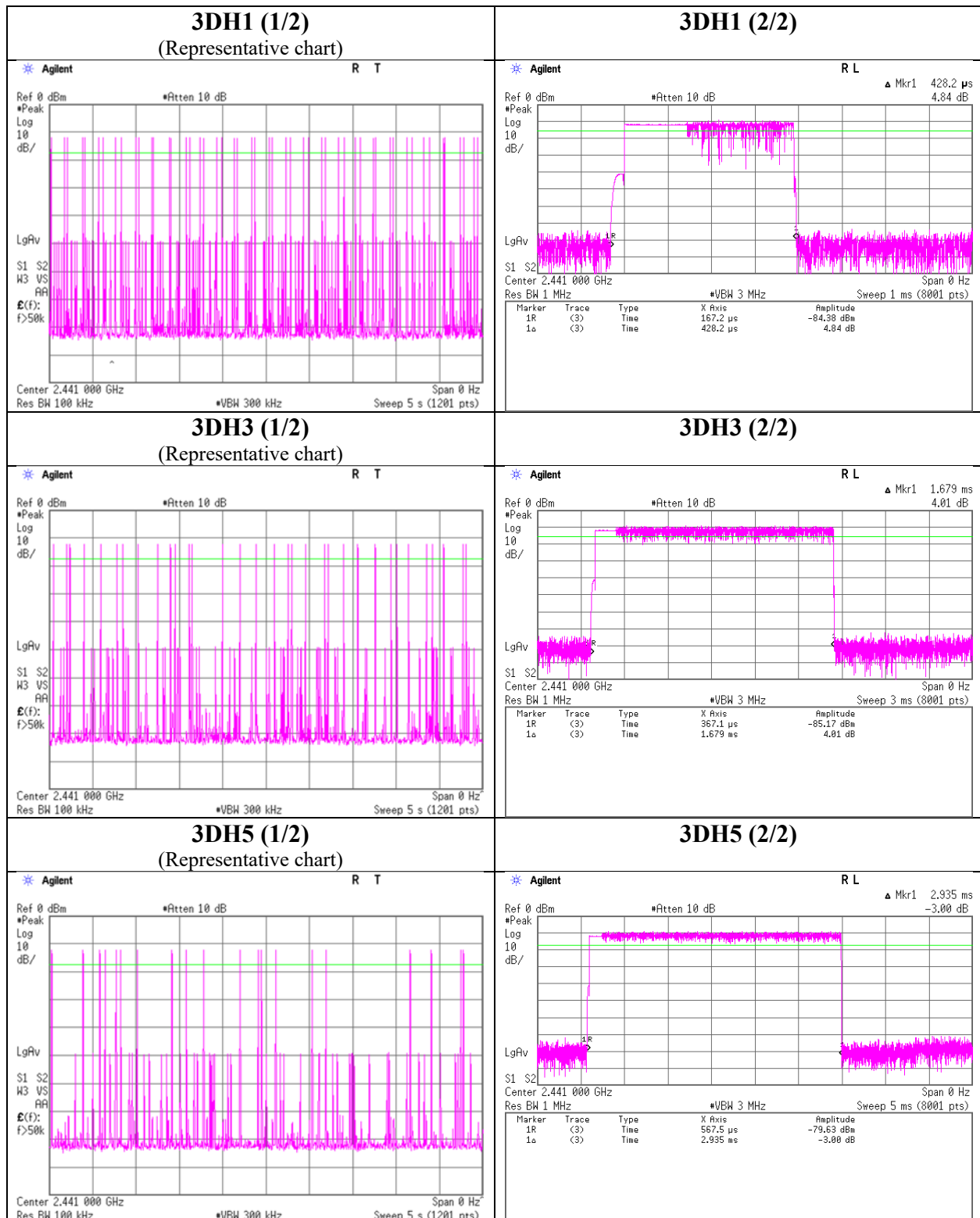
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## Dwell time



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## Maximum Peak Output Power

Report No. 12656071S-H  
Test place Shonan EMC Lab. No.1 Measurement Room  
Date January 7, 2019  
Temperature / Humidity 23 deg. C / 24 % RH  
Engineer Yosuke Ishikawa  
Mode Tx, Hopping Off

| Mode | Freq.<br>[MHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>Loss<br>[dB] | Conducted Power |      |       |      |        | e.i.r.p. for RSS-247     |        |      |       |      |        |
|------|----------------|------------------|-----------------------|------------------------|-----------------|------|-------|------|--------|--------------------------|--------|------|-------|------|--------|
|      |                |                  |                       |                        | Result          |      | Limit |      | Margin | Antenna<br>Gain<br>[dBi] | Result |      | Limit |      | Margin |
|      |                |                  |                       |                        | [dBm]           | [mW] | [dBm] | [mW] |        |                          | [dBm]  | [mW] | [dBm] | [mW] |        |
| DH5  | 2402.0         | -11.26           | 2.40                  | 10.18                  | 1.32            | 1.36 | 20.96 | 125  | 19.64  | -0.90                    | 0.42   | 1.10 | 36.02 | 4000 | 35.60  |
| DH5  | 2441.0         | -11.15           | 2.41                  | 10.18                  | 1.44            | 1.39 | 20.96 | 125  | 19.52  | -0.90                    | 0.54   | 1.13 | 36.02 | 4000 | 35.48  |
| DH5  | 2480.0         | -10.97           | 2.42                  | 10.18                  | 1.63            | 1.46 | 20.96 | 125  | 19.33  | -0.90                    | 0.73   | 1.18 | 36.02 | 4000 | 35.29  |
| 2DH5 | 2402.0         | -8.72            | 2.40                  | 10.18                  | 3.86            | 2.43 | 20.96 | 125  | 17.10  | -0.90                    | 2.96   | 1.98 | 36.02 | 4000 | 33.06  |
| 2DH5 | 2441.0         | -8.69            | 2.41                  | 10.18                  | 3.90            | 2.45 | 20.96 | 125  | 17.06  | -0.90                    | 3.00   | 2.00 | 36.02 | 4000 | 33.02  |
| 2DH5 | 2480.0         | -8.67            | 2.42                  | 10.18                  | 3.93            | 2.47 | 20.96 | 125  | 17.03  | -0.90                    | 3.03   | 2.01 | 36.02 | 4000 | 32.99  |
| 3DH5 | 2402.0         | -8.41            | 2.40                  | 10.18                  | 4.17            | 2.61 | 20.96 | 125  | 16.79  | -0.90                    | 3.27   | 2.12 | 36.02 | 4000 | 32.75  |
| 3DH5 | 2441.0         | -8.45            | 2.41                  | 10.18                  | 4.14            | 2.59 | 20.96 | 125  | 16.82  | -0.90                    | 3.24   | 2.11 | 36.02 | 4000 | 32.78  |
| 3DH5 | 2480.0         | -8.35            | 2.42                  | 10.18                  | 4.25            | 2.66 | 20.96 | 125  | 16.71  | -0.90                    | 3.35   | 2.16 | 36.02 | 4000 | 32.67  |

Sample Calculation:

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

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

Test was not performed at AFH mode, because the decrease of number of channel (min: 20 ch) at AFH mode does not influence on the output power and bandwidth of the EUT.

As this device had AFH mode and frequency separation could not meet the requirement of over 20 dB BW without 2/3 relaxation, 125 mW power limit was applied to it.

**Average Output Power**  
**(Reference data for SAR testing)**

Report No. 12656071S-H  
Test place Shonan EMC Lab. No.1 Measurement Room  
Date January 7, 2019  
Temperature / Humidity 23 deg. C / 24 % RH  
Engineer Yosuke Ishikawa  
Mode Tx, Hopping Off

| Mode | 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] |
| DH5  | 2402.0         | -12.91           | 2.40                  | 10.18                  | -0.33                    | 0.93 | 1.08                   | 0.75                            | 1.19 |
| DH5  | 2441.0         | -12.79           | 2.41                  | 10.18                  | -0.20                    | 0.95 | 1.08                   | 0.88                            | 1.22 |
| DH5  | 2480.0         | -12.64           | 2.42                  | 10.18                  | -0.04                    | 0.99 | 1.08                   | 1.04                            | 1.27 |
| 2DH5 | 2402.0         | -12.72           | 2.40                  | 10.18                  | -0.14                    | 0.97 | 1.07                   | 0.93                            | 1.24 |
| 2DH5 | 2441.0         | -12.71           | 2.41                  | 10.18                  | -0.12                    | 0.97 | 1.07                   | 0.95                            | 1.24 |
| 2DH5 | 2480.0         | -12.70           | 2.42                  | 10.18                  | -0.10                    | 0.98 | 1.07                   | 0.97                            | 1.25 |
| 3DH5 | 2402.0         | -12.72           | 2.40                  | 10.18                  | -0.14                    | 0.97 | 1.07                   | 0.93                            | 1.24 |
| 3DH5 | 2441.0         | -12.71           | 2.41                  | 10.18                  | -0.12                    | 0.97 | 1.07                   | 0.95                            | 1.24 |
| 3DH5 | 2480.0         | -12.70           | 2.42                  | 10.18                  | -0.10                    | 0.98 | 1.07                   | 0.97                            | 1.25 |

Sample Calculation:

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

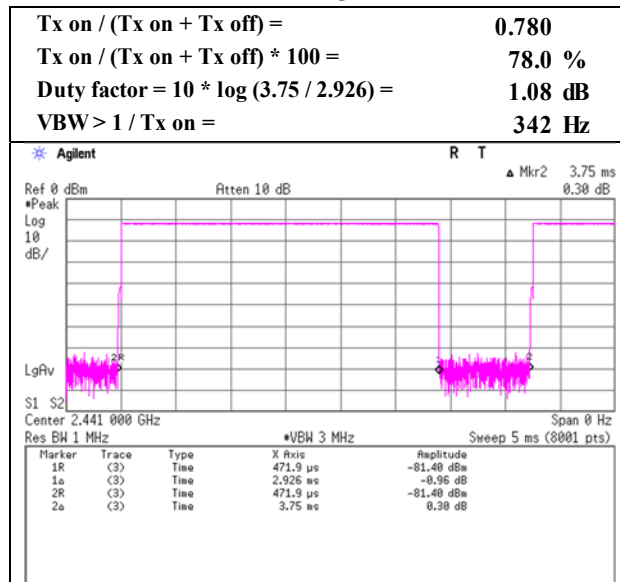
Result (Burst power average) = Time average + Duty factor

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

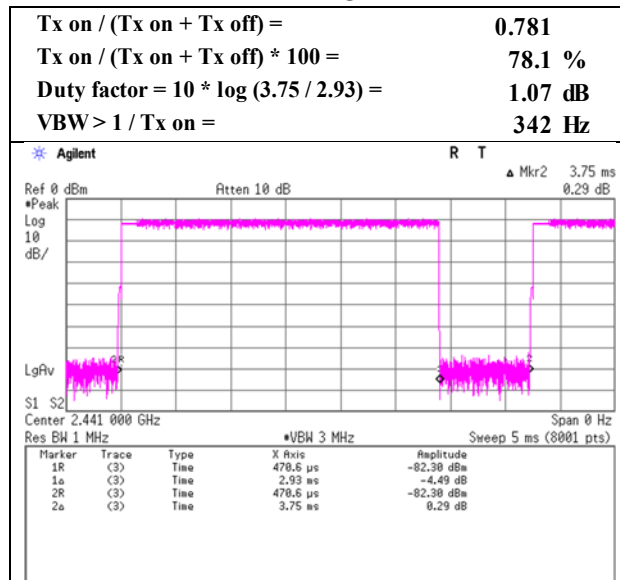
## Burst Rate Confirmation

|                        |                                       |
|------------------------|---------------------------------------|
| Report No.             | 12656071S-H                           |
| Test place             | Shonan EMC Lab. No.1 Measurement Room |
| Date                   | January 7, 2019                       |
| Temperature / Humidity | 23 deg. C / 24 % RH                   |
| Engineer               | Yosuke Ishikawa                       |
| Mode                   | Tx, Hopping Off                       |

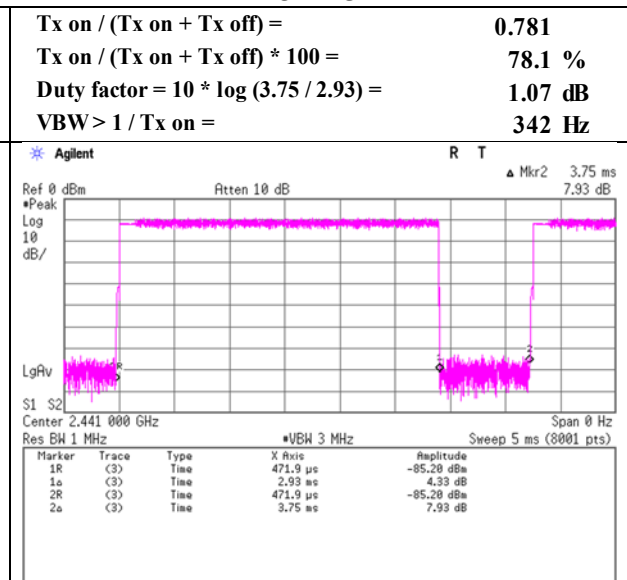
### DH5



### 2DH5



### 3DH5



## Radiated Spurious Emission

Test place Shonan EMC Lab.  
Semi Anechoic Chamber No.3 No.3 No.3  
Date January 7, 2019 February 27, 2019 March 11, 2019  
Temperature / Humidity 22 deg.C / 30 %RH 24 deg.C / 39 %RH 23 deg.C / 33 %RH  
Engineer Kazutaka Takeyama Kenichi Adachi Kenichi Adachi  
(30 MHz - 1000 MHz) (1 GHz - 13 GHz) (13 GHz - 26.5 GHz)  
Mode Tx, 2402 MHz  
Tx, Bluetooth, DH5, PRBS9,

(\* 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.    | 115.857         | QP       | 36.70          | 12.70           | 7.23      | 32.15     | 0.00                 | 24.48           | 43.50          | 19.0        | 300         | 124         |             |
| Hori.    | 380.925         | QP       | 42.80          | 15.21           | 9.16      | 31.97     | 0.00                 | 35.20           | 46.00          | 10.8        | 100         | 96          |             |
| Hori.    | 405.500         | QP       | 42.30          | 15.97           | 9.27      | 31.98     | 0.00                 | 35.56           | 46.00          | 10.4        | 100         | 115         |             |
| Hori.    | 430.080         | QP       | 40.40          | 16.33           | 9.37      | 31.97     | 0.00                 | 34.13           | 46.00          | 11.8        | 100         | 103         |             |
| Hori.    | 442.368         | QP       | 34.30          | 16.62           | 9.42      | 31.97     | 0.00                 | 28.37           | 46.00          | 17.6        | 100         | 328         |             |
| Hori.    | 454.656         | QP       | 38.30          | 16.81           | 9.47      | 31.97     | 0.00                 | 32.61           | 46.00          | 13.3        | 100         | 333         |             |
| Hori.    | 2390.000        | PK       | 45.18          | 27.86           | 14.79     | 41.59     | 2.26                 | 48.50           | 73.90          | 25.4        | 168         | 258         |             |
| Hori.    | 3202.654        | PK       | 49.63          | 28.83           | 6.49      | 41.94     | 2.26                 | 45.27           | 73.90          | 28.6        | 154         | 315         |             |
| Hori.    | 4804.000        | PK       | 56.54          | 31.43           | 7.36      | 42.88     | 2.26                 | 54.71           | 73.90          | 19.1        | 167         | 88          |             |
| Hori.    | 7206.000        | PK       | 47.78          | 36.79           | 9.34      | 42.92     | 2.26                 | 53.25           | 73.90          | 20.6        | 150         | 0           |             |
| Hori.    | 9608.000        | PK       | 48.63          | 38.51           | 10.73     | 43.17     | 2.26                 | 56.96           | 73.90          | 16.9        | 121         | 6           |             |
| Hori.    | 12010.000       | PK       | 47.35          | 39.24           | 11.82     | 42.29     | 2.26                 | 58.38           | 73.90          | 15.5        | 150         | 0           |             |
| Hori.    | 2390.000        | AV       | 35.45          | 27.86           | 14.79     | 41.59     | 2.26                 | 38.77           | 53.90          | 15.1        | 168         | 258         | VBW: 360 Hz |
| Hori.    | 3202.654        | AV       | 40.87          | 28.83           | 6.49      | 41.94     | 2.26                 | 36.51           | 53.90          | 17.3        | 154         | 315         | VBW: 360 Hz |
| Hori.    | 4804.000        | AV       | 51.90          | 31.43           | 7.36      | 42.88     | 2.26                 | 50.07           | 53.90          | 3.8         | 167         | 88          | VBW: 360 Hz |
| Hori.    | 7206.000        | AV       | 36.32          | 36.79           | 9.34      | 42.92     | 2.26                 | 41.79           | 53.90          | 12.1        | 150         | 0           | VBW: 360 Hz |
| Hori.    | 9608.000        | AV       | 37.97          | 38.51           | 10.73     | 43.17     | 2.26                 | 46.30           | 53.90          | 7.6         | 121         | 6           | VBW: 360 Hz |
| Hori.    | 12010.000       | AV       | 36.38          | 39.24           | 11.82     | 42.29     | 2.26                 | 47.41           | 53.90          | 6.4         | 150         | 0           | VBW: 360 Hz |
| Vert.    | 36.971          | QP       | 37.60          | 16.01           | 6.58      | 32.20     | 0.00                 | 27.99           | 40.00          | 12.0        | 100         | 173         |             |
| Vert.    | 345.014         | QP       | 40.30          | 15.05           | 9.00      | 31.95     | 0.00                 | 32.40           | 46.00          | 13.6        | 100         | 180         |             |
| Vert.    | 921.601         | QP       | 35.10          | 22.02           | 11.14     | 30.90     | 0.00                 | 37.36           | 46.00          | 8.6         | 100         | 358         |             |
| Vert.    | 2390.000        | PK       | 45.12          | 27.86           | 14.79     | 41.59     | 2.26                 | 48.44           | 73.90          | 25.4        | 202         | 86          |             |
| Vert.    | 3202.654        | PK       | 50.76          | 28.83           | 6.49      | 41.94     | 2.26                 | 46.40           | 73.90          | 27.5        | 256         | 312         |             |
| Vert.    | 4804.000        | PK       | 57.43          | 31.43           | 7.36      | 42.88     | 2.26                 | 55.60           | 73.90          | 18.3        | 162         | 44          |             |
| Vert.    | 7206.000        | PK       | 47.84          | 36.79           | 9.34      | 42.92     | 2.26                 | 53.31           | 73.90          | 20.5        | 150         | 0           |             |
| Vert.    | 9608.000        | PK       | 48.87          | 38.51           | 10.73     | 43.17     | 2.26                 | 57.20           | 73.90          | 16.7        | 100         | 63          |             |
| Vert.    | 12010.000       | PK       | 47.33          | 39.24           | 11.82     | 42.29     | 2.26                 | 58.36           | 73.90          | 15.5        | 150         | 0           |             |
| Vert.    | 2390.000        | AV       | 35.41          | 27.86           | 14.79     | 41.59     | 2.26                 | 38.73           | 53.90          | 15.1        | 202         | 86          | VBW: 360 Hz |
| Vert.    | 3202.654        | AV       | 43.44          | 28.83           | 6.49      | 41.94     | 2.26                 | 39.08           | 53.90          | 14.8        | 256         | 312         | VBW: 360 Hz |
| Vert.    | 4804.000        | AV       | 53.11          | 31.43           | 7.36      | 42.88     | 2.26                 | 51.28           | 53.90          | 2.6         | 162         | 44          | VBW: 360 Hz |
| Vert.    | 7206.000        | AV       | 36.36          | 36.79           | 9.34      | 42.92     | 2.26                 | 41.83           | 53.90          | 12.0        | 150         | 0           | VBW: 360 Hz |
| Vert.    | 9608.000        | AV       | 38.01          | 38.51           | 10.73     | 43.17     | 2.26                 | 46.34           | 53.90          | 7.5         | 100         | 63          | VBW: 360 Hz |
| Vert.    | 12010.000       | AV       | 36.34          | 39.24           | 11.82     | 42.29     | 2.26                 | 47.37           | 53.90          | 6.5         | 150         | 0           | VBW: 360 Hz |

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

Distance factor : 1 GHz - 13 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

\* These results have sufficient margin without taking account Duty cycle correction factor.

### 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       | 92.78          | 27.86           | 14.80     | 41.60     | 2.26                 | 96.10           | -              | -           | Carrier |
| Hori.    | 2400.000        | PK       | 38.64          | 27.86           | 14.80     | 41.60     | 2.26                 | 41.96           | 76.10          | 34.1        |         |
| Vert.    | 2402.000        | PK       | 92.75          | 27.86           | 14.80     | 41.60     | 2.26                 | 96.07           | -              | -           | Carrier |
| Vert.    | 2400.000        | PK       | 38.60          | 27.86           | 14.80     | 41.60     | 2.26                 | 41.92           | 76.07          | 34.1        |         |

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

Distance factor : 1 GHz - 13 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

**UL Japan, Inc.**

**Shonan EMC Lab.**

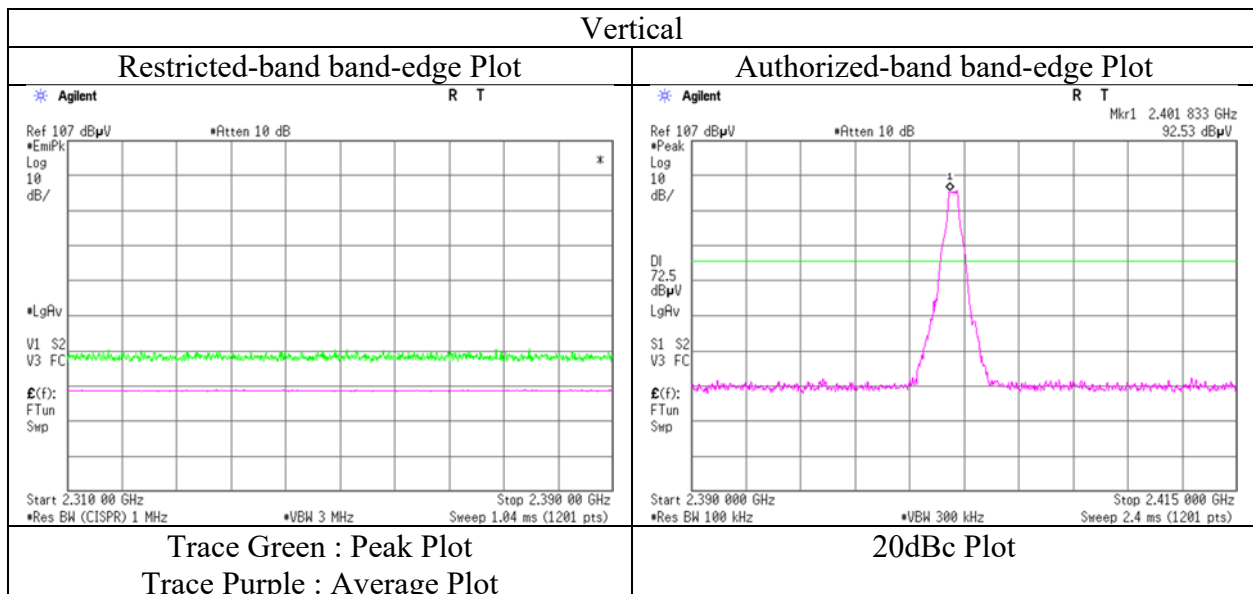
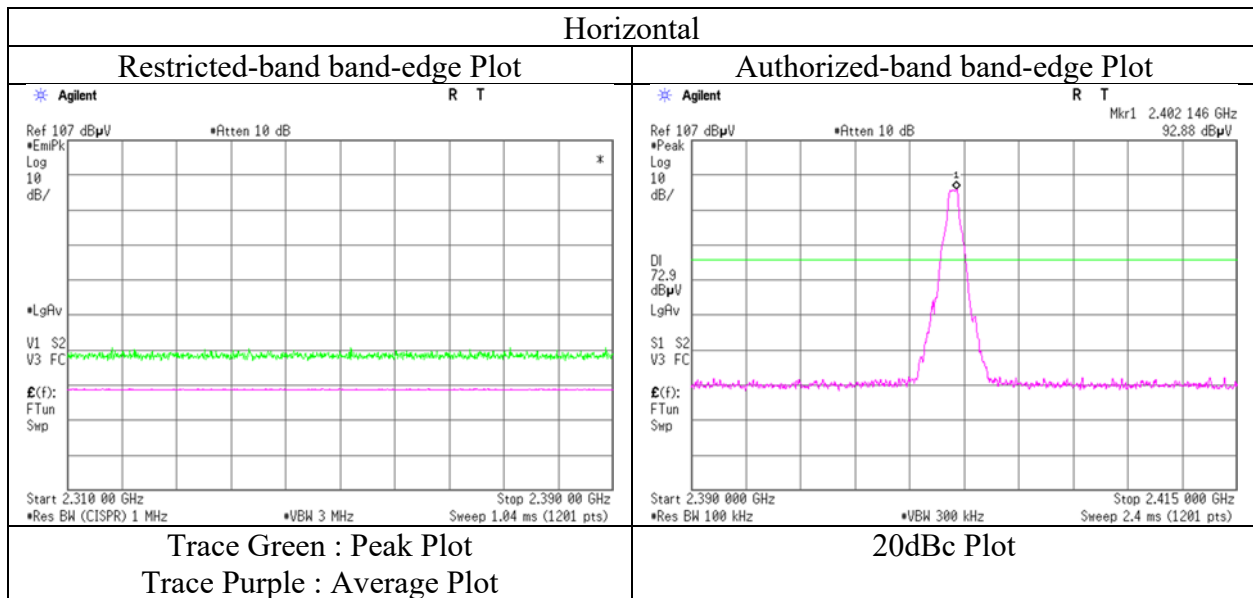
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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

|                        |                               |
|------------------------|-------------------------------|
| Report No.             | 12656071S-H                   |
| Test place             | Shonan EMC Lab.               |
| Semi Anechoic Chamber  | No.3                          |
| Date                   | February 27, 2019             |
| Temperature / Humidity | 24 deg. C / 39 % RH           |
| Engineer               | Kenichi Adachi                |
|                        | (1 GHz -13 GHz)               |
| Mode                   | Tx, Hopping Off, DH5 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.

## Radiated Spurious Emission

Test place Shonan EMC Lab.  
Semi Anechoic Chamber No.3 No.3 No.3  
Date January 7, 2019 February 27, 2019 March 11, 2019  
Temperature / Humidity 22 deg.C / 30 %RH 24 deg.C / 39 %RH 23 deg.C / 33 %RH  
Engineer Kazutaka Takeyama Kenichi Adachi Kenichi Adachi  
(30 MHz - 1000 MHz) (1 GHz - 13 GHz) (13 GHz - 26.5 GHz)  
Mode Tx, 2441 MHz  
Tx, Bluetooth, DH5, PRBS9,

(\* 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.    | 115.842         | QP       | 38.30          | 12.69           | 7.23      | 32.15     | 0.00                 | 26.07           | 43.50          | 17.4        | 300         | 125         |             |
| Hori.    | 380.841         | QP       | 41.40          | 15.21           | 9.16      | 31.97     | 0.00                 | 33.80           | 46.00          | 12.2        | 100         | 77          |             |
| Hori.    | 405.503         | QP       | 40.50          | 15.97           | 9.27      | 31.98     | 0.00                 | 33.76           | 46.00          | 12.2        | 100         | 75          |             |
| Hori.    | 430.079         | QP       | 40.60          | 16.33           | 9.37      | 31.97     | 0.00                 | 34.33           | 46.00          | 11.6        | 100         | 66          |             |
| Hori.    | 3254.645        | PK       | 47.98          | 28.43           | 6.52      | 41.97     | 2.26                 | 43.22           | 73.90          | 30.6        | 154         | 317         |             |
| Hori.    | 4882.000        | PK       | 49.54          | 31.37           | 7.41      | 42.89     | 2.26                 | 47.69           | 73.90          | 26.2        | 168         | 86          |             |
| Hori.    | 7323.000        | PK       | 47.11          | 37.01           | 9.36      | 43.15     | 2.26                 | 52.59           | 73.90          | 21.3        | 150         | 0           |             |
| Hori.    | 9764.000        | PK       | 48.78          | 38.92           | 10.62     | 43.01     | 2.26                 | 57.57           | 73.90          | 16.3        | 122         | 8           |             |
| Hori.    | 12205.000       | PK       | 47.51          | 39.22           | 11.92     | 42.19     | 2.26                 | 58.72           | 73.90          | 15.1        | 150         | 0           |             |
| Hori.    | 3254.645        | AV       | 35.98          | 28.43           | 6.52      | 41.97     | 2.26                 | 31.22           | 53.90          | 22.6        | 154         | 317         | VBW: 360 Hz |
| Hori.    | 4882.000        | AV       | 45.98          | 31.37           | 7.41      | 42.89     | 2.26                 | 44.13           | 53.90          | 9.7         | 168         | 86          | VBW: 360 Hz |
| Hori.    | 7323.000        | AV       | 36.48          | 37.01           | 9.36      | 43.15     | 2.26                 | 41.96           | 53.90          | 11.9        | 150         | 0           | VBW: 360 Hz |
| Hori.    | 9764.000        | AV       | 36.84          | 38.92           | 10.62     | 43.01     | 2.26                 | 45.63           | 53.90          | 8.2         | 122         | 8           | VBW: 360 Hz |
| Hori.    | 12205.000       | AV       | 35.91          | 39.22           | 11.92     | 42.19     | 2.26                 | 47.12           | 53.90          | 6.7         | 150         | 0           | VBW: 360 Hz |
| Vert.    | 38.442          | QP       | 37.20          | 15.42           | 6.61      | 32.20     | 0.00                 | 27.03           | 40.00          | 12.9        | 100         | 180         |             |
| Vert.    | 345.013         | QP       | 41.60          | 15.05           | 9.00      | 31.95     | 0.00                 | 33.70           | 46.00          | 12.3        | 100         | 183         |             |
| Vert.    | 897.600         | QP       | 33.30          | 22.11           | 11.06     | 31.11     | 0.00                 | 35.36           | 46.00          | 10.6        | 100         | 7           |             |
| Vert.    | 921.589         | QP       | 36.00          | 22.02           | 11.14     | 30.90     | 0.00                 | 38.26           | 46.00          | 7.7         | 100         | 358         |             |
| Vert.    | 3254.645        | PK       | 48.94          | 28.43           | 6.52      | 41.97     | 2.26                 | 44.18           | 73.90          | 29.7        | 178         | 315         |             |
| Vert.    | 4882.000        | PK       | 51.96          | 31.37           | 7.41      | 42.89     | 2.26                 | 50.11           | 73.90          | 23.7        | 164         | 42          |             |
| Vert.    | 7323.000        | PK       | 47.04          | 37.01           | 9.36      | 43.15     | 2.26                 | 52.52           | 73.90          | 21.3        | 150         | 0           |             |
| Vert.    | 9764.000        | PK       | 48.85          | 38.92           | 10.62     | 43.01     | 2.26                 | 57.64           | 73.90          | 16.2        | 100         | 65          |             |
| Vert.    | 12205.000       | PK       | 47.43          | 39.22           | 11.92     | 42.19     | 2.26                 | 58.64           | 73.90          | 15.2        | 150         | 0           |             |
| Vert.    | 3254.645        | AV       | 38.43          | 28.43           | 6.52      | 41.97     | 2.26                 | 33.67           | 53.90          | 20.2        | 178         | 315         | VBW: 360 Hz |
| Vert.    | 4882.000        | AV       | 47.67          | 31.37           | 7.41      | 42.89     | 2.26                 | 45.82           | 53.90          | 8.0         | 164         | 42          | VBW: 360 Hz |
| Vert.    | 7323.000        | AV       | 36.44          | 37.01           | 9.36      | 43.15     | 2.26                 | 41.92           | 53.90          | 11.9        | 150         | 0           | VBW: 360 Hz |
| Vert.    | 9764.000        | AV       | 36.96          | 38.92           | 10.62     | 43.01     | 2.26                 | 45.75           | 53.90          | 8.1         | 100         | 65          | VBW: 360 Hz |
| Vert.    | 12205.000       | AV       | 35.82          | 39.22           | 11.92     | 42.19     | 2.26                 | 47.03           | 53.90          | 6.8         | 150         | 0           | VBW: 360 Hz |

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

\* These results have sufficient margin without taking account Duty cycle correction factor.

## Radiated Spurious Emission

|                        |                                            |                                    |                                       |
|------------------------|--------------------------------------------|------------------------------------|---------------------------------------|
| Test place             | Shonan EMC Lab.                            |                                    |                                       |
| Semi Anechoic Chamber  | No.3                                       | No.3                               | No.3                                  |
| Date                   | January 7, 2019                            | February 27, 2019                  | March 11, 2019                        |
| Temperature / Humidity | 22 deg.C / 30 %RH                          | 24 deg.C / 39 %RH                  | 23 deg.C / 33 %RH                     |
| Engineer               | Kazutaka Takeyama<br>(30 MHz - 1000 MHz)   | Kenichi Adachi<br>(1 GHz - 13 GHz) | Kenichi Adachi<br>(13 GHz - 26.5 GHz) |
| Mode                   | Tx, 2480 MHz<br>Tx, Bluetooth, DH5, PRBS9, |                                    |                                       |

(\* 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.    | 115.840         | QP       | 38.50          | 12.69            | 7.23      | 32.15     | 0.00                 | 26.27           | 43.50          | 17.2        | 300         | 126         |             |
| Hori.    | 380.845         | QP       | 41.10          | 15.21            | 9.16      | 31.97     | 0.00                 | 33.50           | 46.00          | 12.5        | 100         | 280         |             |
| Hori.    | 405.500         | QP       | 40.30          | 15.97            | 9.27      | 31.98     | 0.00                 | 33.56           | 46.00          | 12.4        | 100         | 287         |             |
| Hori.    | 430.800         | QP       | 40.90          | 16.34            | 9.37      | 31.97     | 0.00                 | 34.64           | 46.00          | 11.3        | 100         | 287         |             |
| Hori.    | 2483.500        | PK       | 47.02          | 27.65            | 14.88     | 41.62     | 2.26                 | 50.19           | 73.90          | 23.7        | 173         | 249         |             |
| Hori.    | 3306.637        | PK       | 48.64          | 28.12            | 6.53      | 42.00     | 2.26                 | 43.55           | 73.90          | 30.3        | 152         | 312         |             |
| Hori.    | 4960.000        | PK       | 50.63          | 31.54            | 7.46      | 42.91     | 2.26                 | 48.98           | 73.90          | 24.9        | 175         | 94          |             |
| Hori.    | 7440.000        | PK       | 46.49          | 37.10            | 9.38      | 43.38     | 2.26                 | 51.85           | 73.90          | 22.0        | 150         | 0           |             |
| Hori.    | 9920.000        | PK       | 46.49          | 38.97            | 10.51     | 42.84     | 2.26                 | 55.39           | 73.90          | 18.5        | 119         | 4           |             |
| Hori.    | 12400.000       | PK       | 45.24          | 38.65            | 11.99     | 42.08     | 2.26                 | 56.06           | 73.90          | 17.8        | 150         | 0           |             |
| Hori.    | 2483.500        | AV       | 35.91          | 27.65            | 14.88     | 41.62     | 2.26                 | 39.08           | 53.90          | 14.8        | 173         | 249         | VBW: 360 Hz |
| Hori.    | 3306.637        | AV       | 40.04          | 28.12            | 6.53      | 42.00     | 2.26                 | 34.95           | 53.90          | 18.9        | 152         | 312         | VBW: 360 Hz |
| Hori.    | 4960.000        | AV       | 43.54          | 31.54            | 7.46      | 42.91     | 2.26                 | 41.89           | 53.90          | 12.0        | 175         | 94          | VBW: 360 Hz |
| Hori.    | 7440.000        | AV       | 37.05          | 37.10            | 9.38      | 43.38     | 2.26                 | 42.41           | 53.90          | 11.4        | 150         | 0           | VBW: 360 Hz |
| Hori.    | 9920.000        | AV       | 36.06          | 38.97            | 10.51     | 42.84     | 2.26                 | 44.96           | 53.90          | 8.9         | 119         | 4           | VBW: 360 Hz |
| Hori.    | 12400.000       | AV       | 33.42          | 38.65            | 11.99     | 42.08     | 2.26                 | 44.24           | 53.90          | 9.6         | 150         | 0           | VBW: 360 Hz |
| Vert.    | 38.440          | QP       | 37.10          | 15.44            | 6.61      | 32.20     | 0.00                 | 26.95           | 40.00          | 13.0        | 100         | 4           |             |
| Vert.    | 345.011         | QP       | 41.50          | 15.05            | 9.00      | 31.95     | 0.00                 | 33.60           | 46.00          | 12.4        | 100         | 22          |             |
| Vert.    | 897.014         | QP       | 35.50          | 22.10            | 11.06     | 31.11     | 0.00                 | 37.55           | 46.00          | 8.4         | 100         | 3           |             |
| Vert.    | 909.303         | QP       | 34.80          | 22.06            | 11.10     | 31.01     | 0.00                 | 36.95           | 46.00          | 9.0         | 100         | 358         |             |
| Vert.    | 2483.500        | PK       | 47.29          | 27.65            | 14.88     | 41.62     | 2.26                 | 50.46           | 73.90          | 23.4        | 200         | 85          |             |
| Vert.    | 3306.637        | PK       | 48.94          | 28.12            | 6.53      | 42.00     | 2.26                 | 43.85           | 73.90          | 30.0        | 252         | 309         |             |
| Vert.    | 4960.000        | PK       | 50.54          | 31.54            | 7.46      | 42.91     | 2.26                 | 48.89           | 73.90          | 25.0        | 163         | 45          |             |
| Vert.    | 7440.000        | PK       | 46.44          | 37.10            | 9.38      | 43.38     | 2.26                 | 51.80           | 73.90          | 22.1        | 150         | 0           |             |
| Vert.    | 9920.000        | PK       | 46.52          | 38.97            | 10.51     | 42.84     | 2.26                 | 55.42           | 73.90          | 18.4        | 100         | 66          |             |
| Vert.    | 12400.000       | PK       | 45.12          | 38.65            | 11.99     | 42.08     | 2.26                 | 55.94           | 73.90          | 17.9        | 150         | 0           |             |
| Vert.    | 2483.500        | AV       | 35.98          | 27.65            | 14.88     | 41.62     | 2.26                 | 39.15           | 53.90          | 14.7        | 200         | 85          | VBW: 360 Hz |
| Vert.    | 3306.637        | AV       | 40.16          | 28.12            | 6.53      | 42.00     | 2.26                 | 35.07           | 53.90          | 18.8        | 252         | 309         | VBW: 360 Hz |
| Vert.    | 4960.000        | AV       | 43.22          | 31.54            | 7.46      | 42.91     | 2.26                 | 41.57           | 53.90          | 12.3        | 163         | 45          | VBW: 360 Hz |
| Vert.    | 7440.000        | AV       | 37.00          | 37.10            | 9.38      | 43.38     | 2.26                 | 42.36           | 53.90          | 11.5        | 150         | 0           | VBW: 360 Hz |
| Vert.    | 9920.000        | AV       | 36.14          | 38.97            | 10.51     | 42.84     | 2.26                 | 45.04           | 53.90          | 8.8         | 100         | 66          | VBW: 360 Hz |
| Vert.    | 12400.000       | AV       | 33.38          | 38.65            | 11.99     | 42.08     | 2.26                 | 44.20           | 53.90          | 9.7         | 150         | 0           | VBW: 360 Hz |

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

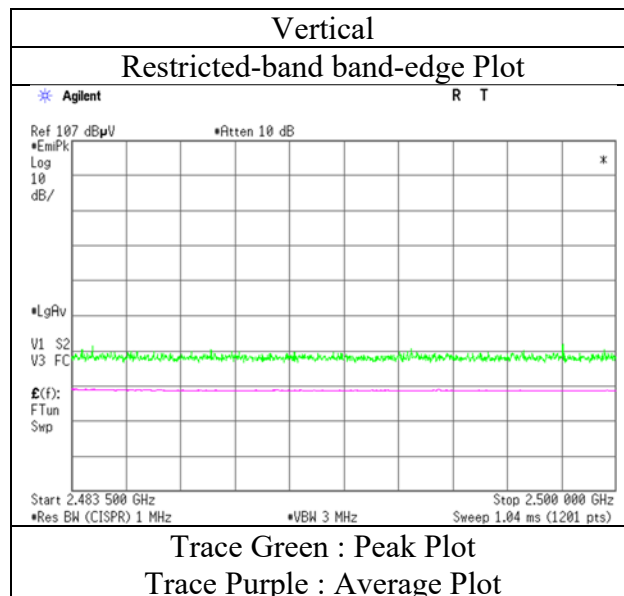
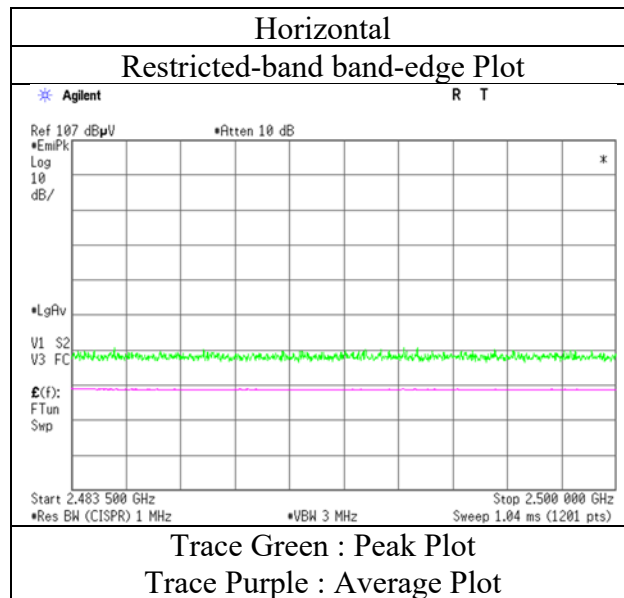
Distance factor : 1 GHz - 13 GHz :  $20\log(3.89\text{ m} / 3.0\text{ m}) = 2.26\text{ dB}$

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

\* These results have sufficient margin without taking account Duty cycle correction factor.

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

|                        |                                   |
|------------------------|-----------------------------------|
| Report No.             | 12656071S-H                       |
| Test place             | Shonan EMC Lab.                   |
| Semi Anechoic Chamber  | No.3                              |
| Date                   | February 27, 2019                 |
| Temperature / Humidity | 24 deg. C / 39 % RH               |
| Engineer               | Kenichi Adachi<br>(1 GHz -13 GHz) |
| Mode                   | Tx, Hopping Off, DH5 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.

## Radiated Spurious Emission

|                        |                                             |                   |                     |
|------------------------|---------------------------------------------|-------------------|---------------------|
| Test place             | Shonan EMC Lab.                             |                   |                     |
| Semi Anechoic Chamber  | No.3                                        | No.3              | No.3                |
| Date                   | January 7, 2019                             | February 27, 2019 | March 11, 2019      |
| Temperature / Humidity | 22 deg.C / 30 %RH                           | 24 deg.C / 39 %RH | 23 deg.C / 33 %RH   |
| Engineer               | Kazutaka Takeyama                           | Kenichi Adachi    | Kenichi Adachi      |
|                        | (30 MHz - 1000 MHz)                         | (1 GHz - 13 GHz)  | (13 GHz - 26.5 GHz) |
| Mode                   | Tx, 2402 MHz<br>Tx, Bluetooth, 3DH5, PRBS9, |                   |                     |

(\* 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.    | 115.850         | QP       | 38.30          | 12.70           | 7.23      | 32.15     | 0.00                 | 26.08           | 43.50          | 17.4        | 300         | 127         |             |
| Hori.    | 380.850         | QP       | 41.50          | 15.21           | 9.16      | 31.97     | 0.00                 | 33.90           | 46.00          | 12.1        | 100         | 286         |             |
| Hori.    | 405.505         | QP       | 40.80          | 15.97           | 9.27      | 31.98     | 0.00                 | 34.06           | 46.00          | 11.9        | 100         | 282         |             |
| Hori.    | 430.800         | QP       | 41.50          | 16.34           | 9.37      | 31.97     | 0.00                 | 35.24           | 46.00          | 10.7        | 100         | 289         |             |
| Hori.    | 2390.000        | PK       | 46.00          | 27.86           | 14.79     | 41.59     | 2.26                 | 49.32           | 73.90          | 24.5        | 200         | 241         |             |
| Hori.    | 4804.000        | PK       | 60.00          | 31.43           | 7.36      | 42.88     | 2.26                 | 58.17           | 73.90          | 15.7        | 100         | 332         |             |
| Hori.    | 7206.000        | PK       | 48.50          | 36.79           | 9.34      | 42.92     | 2.26                 | 53.97           | 73.90          | 19.9        | 100         | 0           |             |
| Hori.    | 9608.000        | PK       | 48.40          | 38.51           | 10.73     | 43.17     | 2.26                 | 56.73           | 73.90          | 17.1        | 100         | 0           |             |
| Hori.    | 2390.000        | AV       | 35.20          | 27.86           | 14.79     | 41.59     | 2.26                 | 38.52           | 53.90          | 15.3        | 200         | 241         | VBW: 360 Hz |
| Hori.    | 4804.000        | AV       | 54.20          | 31.43           | 7.36      | 42.88     | 2.26                 | 52.37           | 53.90          | 1.5         | 100         | 332         | VBW: 360 Hz |
| Hori.    | 7206.000        | AV       | 36.20          | 36.79           | 9.34      | 42.92     | 2.26                 | 41.67           | 53.90          | 12.2        | 100         | 0           | VBW: 360 Hz |
| Hori.    | 9608.000        | AV       | 37.90          | 38.51           | 10.73     | 43.17     | 2.26                 | 46.23           | 53.90          | 7.6         | 100         | 0           | VBW: 360 Hz |
| Vert.    | 38.444          | QP       | 38.30          | 15.44           | 6.61      | 32.20     | 0.00                 | 28.15           | 40.00          | 11.8        | 100         | 1           |             |
| Vert.    | 345.010         | QP       | 42.20          | 15.05           | 9.00      | 31.95     | 0.00                 | 34.30           | 46.00          | 11.7        | 100         | 22          |             |
| Vert.    | 897.011         | QP       | 35.90          | 22.10           | 11.06     | 31.11     | 0.00                 | 37.95           | 46.00          | 8.0         | 100         | 3           |             |
| Vert.    | 909.300         | QP       | 35.50          | 22.06           | 11.10     | 31.01     | 0.00                 | 37.65           | 46.00          | 8.3         | 100         | 356         |             |
| Vert.    | 2390.000        | PK       | 46.30          | 27.86           | 14.79     | 41.59     | 2.26                 | 49.62           | 73.90          | 24.2        | 100         | 270         |             |
| Vert.    | 4804.000        | PK       | 58.10          | 31.43           | 7.36      | 42.88     | 2.26                 | 56.27           | 73.90          | 17.6        | 150         | 41          |             |
| Vert.    | 7206.000        | PK       | 47.30          | 36.79           | 9.34      | 42.92     | 2.26                 | 52.77           | 73.90          | 21.1        | 100         | 0           |             |
| Vert.    | 9608.000        | PK       | 49.00          | 38.51           | 10.73     | 43.17     | 2.26                 | 57.33           | 73.90          | 16.5        | 100         | 0           |             |
| Vert.    | 2390.000        | AV       | 35.10          | 27.86           | 14.79     | 41.59     | 2.26                 | 38.42           | 53.90          | 15.4        | 100         | 270         | VBW: 360 Hz |
| Vert.    | 4804.000        | AV       | 51.30          | 31.43           | 7.36      | 42.88     | 2.26                 | 49.47           | 53.90          | 4.4         | 150         | 41          | VBW: 360 Hz |
| Vert.    | 7206.000        | AV       | 36.00          | 36.79           | 9.34      | 42.92     | 2.26                 | 41.47           | 53.90          | 12.4        | 100         | 0           | VBW: 360 Hz |
| Vert.    | 9608.000        | AV       | 37.30          | 38.51           | 10.73     | 43.17     | 2.26                 | 45.63           | 53.90          | 8.2         | 100         | 0           | VBW: 360 Hz |

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

\* These results have sufficient margin without taking account Duty cycle correction factor.

### 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       | 94.00          | 27.86           | 14.80     | 41.60     | 2.26                 | 97.32           | -              | -           | Carrier |
| Hori.    | 2400.000        | PK       | 39.40          | 27.86           | 14.80     | 41.60     | 2.26                 | 42.72           | 77.32          | 34.6        |         |
| Vert.    | 2402.000        | PK       | 92.20          | 27.86           | 14.80     | 41.60     | 2.26                 | 95.52           | -              | -           | Carrier |
| Vert.    | 2400.000        | PK       | 39.20          | 27.86           | 14.80     | 41.60     | 2.26                 | 42.52           | 75.52          | 33.0        |         |

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.**

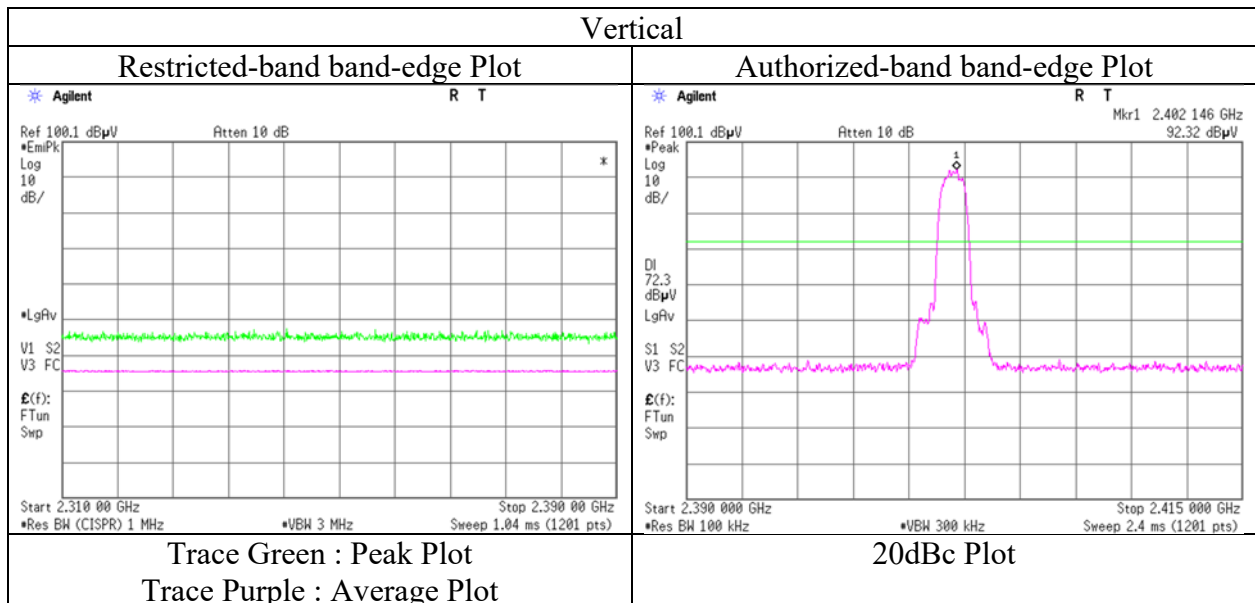
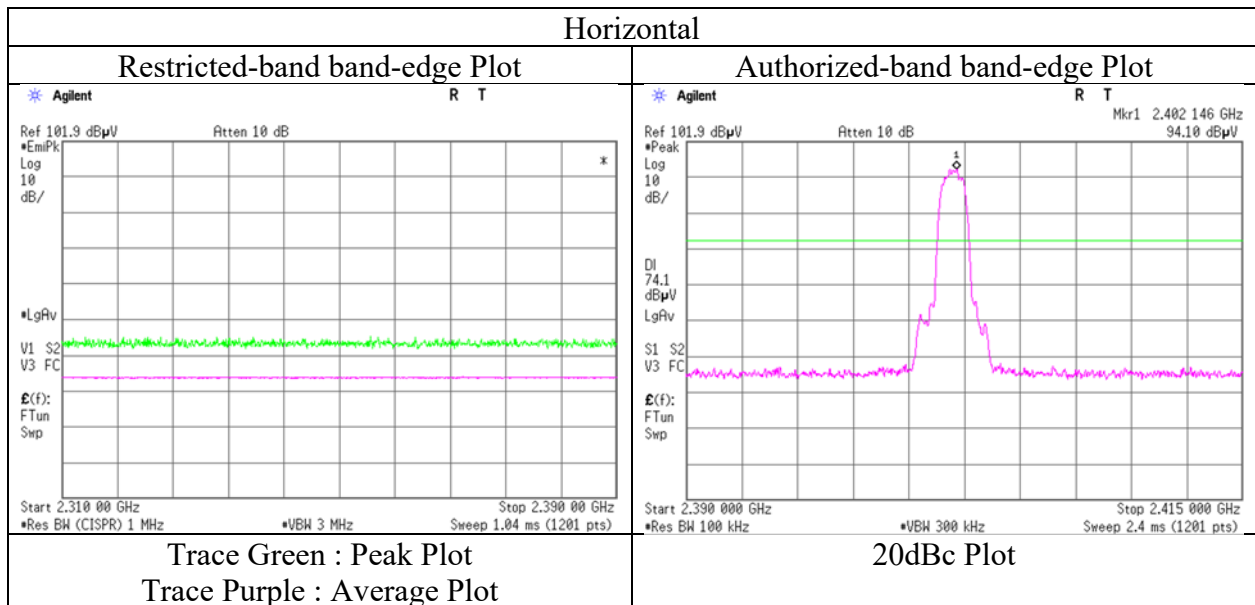
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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

|                        |                                |
|------------------------|--------------------------------|
| Report No.             | 12656071S-H                    |
| Test place             | Shonan EMC Lab.                |
| Semi Anechoic Chamber  | No.3                           |
| Date                   | February 27, 2019              |
| Temperature / Humidity | 24 deg. C / 39 % RH            |
| Engineer               | Kenichi Adachi                 |
|                        | (1 GHz -13 GHz)                |
| Mode                   | Tx, Hopping Off, 3DH5 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.

## Radiated Spurious Emission

|                        |                                             |                                    |                                       |
|------------------------|---------------------------------------------|------------------------------------|---------------------------------------|
| Test place             | Shonan EMC Lab.                             |                                    |                                       |
| Semi Anechoic Chamber  | No.3                                        | No.3                               | No.3                                  |
| Date                   | January 7, 2019                             | February 27, 2019                  | March 11, 2019                        |
| Temperature / Humidity | 22 deg.C / 30 %RH                           | 24 deg.C / 39 %RH                  | 23 deg.C / 33 %RH                     |
| Engineer               | Kazutaka Takeyama<br>(30 MHz - 1000 MHz)    | Kenichi Adachi<br>(1 GHz - 13 GHz) | Kenichi Adachi<br>(13 GHz - 26.5 GHz) |
| Mode                   | Tx, 2441 MHz<br>Tx, Bluetooth, 3DH5, PRBS9, |                                    |                                       |

(\* 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.    | 115.840         | QP       | 38.20          | 12.69            | 7.23      | 32.15     | 0.00                 | 25.97           | 43.50          | 17.5        | 300         | 125         |             |
| Hori.    | 380.844         | QP       | 41.00          | 15.21            | 9.16      | 31.97     | 0.00                 | 33.40           | 46.00          | 12.6        | 100         | 282         |             |
| Hori.    | 405.503         | QP       | 40.40          | 15.97            | 9.27      | 31.98     | 0.00                 | 33.66           | 46.00          | 12.3        | 100         | 290         |             |
| Hori.    | 430.804         | QP       | 41.40          | 16.34            | 9.37      | 31.97     | 0.00                 | 35.14           | 46.00          | 10.8        | 100         | 288         |             |
| Hori.    | 4882.000        | PK       | 54.80          | 31.37            | 7.41      | 42.89     | 2.26                 | 52.95           | 73.90          | 20.9        | 100         | 336         |             |
| Hori.    | 7323.000        | PK       | 47.90          | 37.01            | 9.36      | 43.15     | 2.26                 | 53.38           | 73.90          | 20.5        | 100         | 0           |             |
| Hori.    | 9764.000        | PK       | 48.60          | 38.92            | 10.62     | 43.01     | 2.26                 | 57.39           | 73.90          | 16.5        | 100         | 0           |             |
| Hori.    | 4882.000        | AV       | 49.00          | 31.37            | 7.41      | 42.89     | 2.26                 | 47.15           | 53.90          | 6.7         | 100         | 336         | VBW: 360 Hz |
| Hori.    | 7323.000        | AV       | 36.00          | 37.01            | 9.36      | 43.15     | 2.26                 | 41.48           | 53.90          | 12.4        | 100         | 0           | VBW: 360 Hz |
| Hori.    | 9764.000        | AV       | 36.50          | 38.92            | 10.62     | 43.01     | 2.26                 | 45.29           | 53.90          | 8.6         | 100         | 0           | VBW: 360 Hz |
| Vert.    | 38.442          | QP       | 38.00          | 15.44            | 6.61      | 32.20     | 0.00                 | 27.85           | 40.00          | 12.1        | 100         | 359         |             |
| Vert.    | 345.010         | QP       | 41.80          | 15.05            | 9.00      | 31.95     | 0.00                 | 33.90           | 46.00          | 12.1        | 100         | 21          |             |
| Vert.    | 897.014         | QP       | 35.70          | 22.10            | 11.06     | 31.11     | 0.00                 | 37.75           | 46.00          | 8.2         | 100         | 3           |             |
| Vert.    | 909.301         | QP       | 35.00          | 22.06            | 11.10     | 31.01     | 0.00                 | 37.15           | 46.00          | 8.8         | 100         | 357         |             |
| Vert.    | 4882.000        | PK       | 56.30          | 31.37            | 7.41      | 42.89     | 2.26                 | 54.45           | 73.90          | 19.4        | 100         | 41          |             |
| Vert.    | 7323.000        | PK       | 48.60          | 37.01            | 9.36      | 43.15     | 2.26                 | 54.08           | 73.90          | 19.8        | 100         | 0           |             |
| Vert.    | 9764.000        | PK       | 49.00          | 38.92            | 10.62     | 43.01     | 2.26                 | 57.79           | 73.90          | 16.1        | 100         | 0           |             |
| Vert.    | 4882.000        | AV       | 48.80          | 31.37            | 7.41      | 42.89     | 2.26                 | 46.95           | 53.90          | 6.9         | 100         | 41          | VBW: 360 Hz |
| Vert.    | 7323.000        | AV       | 36.60          | 37.01            | 9.36      | 43.15     | 2.26                 | 42.08           | 53.90          | 11.8        | 100         | 0           | VBW: 360 Hz |
| Vert.    | 9764.000        | AV       | 36.50          | 38.92            | 10.62     | 43.01     | 2.26                 | 45.29           | 53.90          | 8.6         | 100         | 0           | VBW: 360 Hz |

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

\* These results have sufficient margin without taking account Duty cycle correction factor.

## Radiated Spurious Emission

|                        |                                             |                   |                     |
|------------------------|---------------------------------------------|-------------------|---------------------|
| Test place             | Shonan EMC Lab.                             |                   |                     |
| Semi Anechoic Chamber  | No.3                                        | No.3              | No.3                |
| Date                   | January 7, 2019                             | February 27, 2019 | March 11, 2019      |
| Temperature / Humidity | 22 deg.C / 30 %RH                           | 24 deg.C / 39 %RH | 23 deg.C / 33 %RH   |
| Engineer               | Kazutaka Takeyama                           | Kenichi Adachi    | Kenichi Adachi      |
|                        | (30 MHz - 1000 MHz)                         | (1 GHz - 13 GHz)  | (13 GHz - 26.5 GHz) |
| Mode                   | Tx, 2480 MHz<br>Tx, Bluetooth, 3DH5, PRBS9, |                   |                     |

(\* 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.    | 115.850         | QP       | 38.30          | 12.70            | 7.23      | 32.15     | 0.00                 | 26.08           | 43.50          | 17.4        | 300         | 124         |             |
| Hori.    | 380.845         | QP       | 41.00          | 15.21            | 9.16      | 31.97     | 0.00                 | 33.40           | 46.00          | 12.6        | 100         | 282         |             |
| Hori.    | 405.510         | QP       | 40.40          | 15.97            | 9.27      | 31.98     | 0.00                 | 33.66           | 46.00          | 12.3        | 100         | 283         |             |
| Hori.    | 430.801         | QP       | 41.20          | 16.34            | 9.37      | 31.97     | 0.00                 | 34.94           | 46.00          | 11.0        | 101         | 284         |             |
| Hori.    | 2483.500        | PK       | 46.80          | 27.65            | 14.88     | 41.62     | 2.26                 | 49.97           | 73.90          | 23.9        | 111         | 255         |             |
| Hori.    | 4960.000        | PK       | 55.90          | 31.54            | 7.46      | 42.91     | 2.26                 | 54.25           | 73.90          | 19.6        | 109         | 338         |             |
| Hori.    | 7440.000        | PK       | 48.40          | 37.10            | 9.38      | 43.38     | 2.26                 | 53.76           | 73.90          | 20.1        | 100         | 0           |             |
| Hori.    | 9920.000        | PK       | 47.10          | 38.97            | 10.51     | 42.84     | 2.26                 | 56.00           | 73.90          | 17.9        | 100         | 0           |             |
| Hori.    | 2483.500        | AV       | 35.70          | 27.65            | 14.88     | 41.62     | 2.26                 | 38.87           | 53.90          | 15.0        | 111         | 255         | VBW: 360 Hz |
| Hori.    | 4960.000        | AV       | 48.40          | 31.54            | 7.46      | 42.91     | 2.26                 | 46.75           | 53.90          | 7.1         | 109         | 338         | VBW: 360 Hz |
| Hori.    | 7440.000        | AV       | 36.70          | 37.10            | 9.38      | 43.38     | 2.26                 | 42.06           | 53.90          | 11.8        | 100         | 0           | VBW: 360 Hz |
| Hori.    | 9920.000        | AV       | 36.00          | 38.97            | 10.51     | 42.84     | 2.26                 | 44.90           | 53.90          | 9.0         | 100         | 0           | VBW: 360 Hz |
| Vert.    | 38.440          | QP       | 37.00          | 15.44            | 6.61      | 32.20     | 0.00                 | 26.85           | 40.00          | 13.1        | 100         | 4           |             |
| Vert.    | 345.011         | QP       | 41.60          | 15.05            | 9.00      | 31.95     | 0.00                 | 33.70           | 46.00          | 12.3        | 100         | 22          |             |
| Vert.    | 897.013         | QP       | 35.30          | 22.10            | 11.06     | 31.11     | 0.00                 | 37.35           | 46.00          | 8.6         | 100         | 1           |             |
| Vert.    | 909.302         | QP       | 34.80          | 22.06            | 11.10     | 31.01     | 0.00                 | 36.95           | 46.00          | 9.0         | 100         | 356         |             |
| Vert.    | 2483.500        | PK       | 47.40          | 27.65            | 14.88     | 41.62     | 2.26                 | 50.57           | 73.90          | 23.3        | 100         | 289         |             |
| Vert.    | 4960.000        | PK       | 54.60          | 31.54            | 7.46      | 42.91     | 2.26                 | 52.95           | 73.90          | 20.9        | 111         | 44          |             |
| Vert.    | 7440.000        | PK       | 48.00          | 37.10            | 9.38      | 43.38     | 2.26                 | 53.36           | 73.90          | 20.5        | 100         | 0           |             |
| Vert.    | 9920.000        | PK       | 47.70          | 38.97            | 10.51     | 42.84     | 2.26                 | 56.60           | 73.90          | 17.3        | 100         | 0           |             |
| Vert.    | 2483.500        | AV       | 35.60          | 27.65            | 14.88     | 41.62     | 2.26                 | 38.77           | 53.90          | 15.1        | 100         | 289         | VBW: 360 Hz |
| Vert.    | 4960.000        | AV       | 46.50          | 31.54            | 7.46      | 42.91     | 2.26                 | 44.85           | 53.90          | 9.0         | 111         | 44          | VBW: 360 Hz |
| Vert.    | 7440.000        | AV       | 36.50          | 37.10            | 9.38      | 43.38     | 2.26                 | 41.86           | 53.90          | 12.0        | 100         | 0           | VBW: 360 Hz |
| Vert.    | 9920.000        | AV       | 36.20          | 38.97            | 10.51     | 42.84     | 2.26                 | 45.10           | 53.90          | 8.8         | 100         | 0           | VBW: 360 Hz |

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

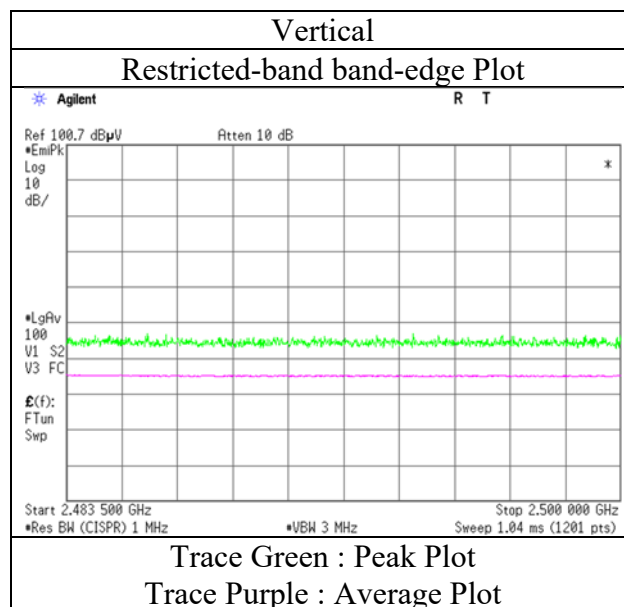
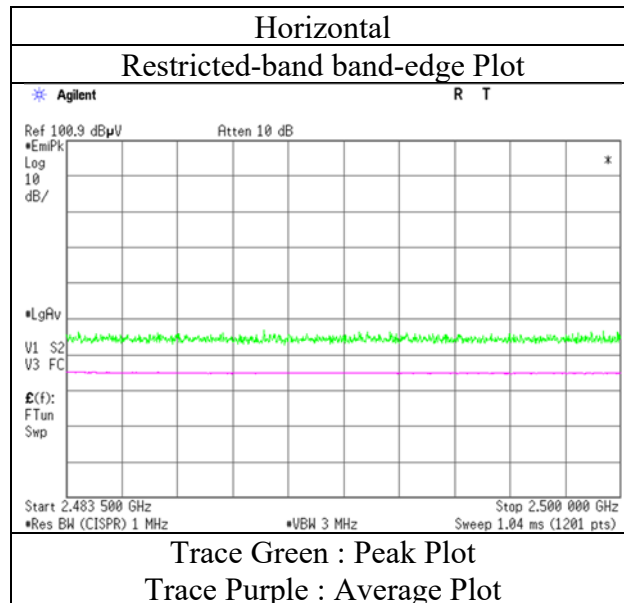
Distance factor : 1 GHz - 13 GHz :  $20\log(3.89\text{ m} / 3.0\text{ m}) = 2.26\text{ dB}$

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

\* These results have sufficient margin without taking account Duty cycle correction factor.

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

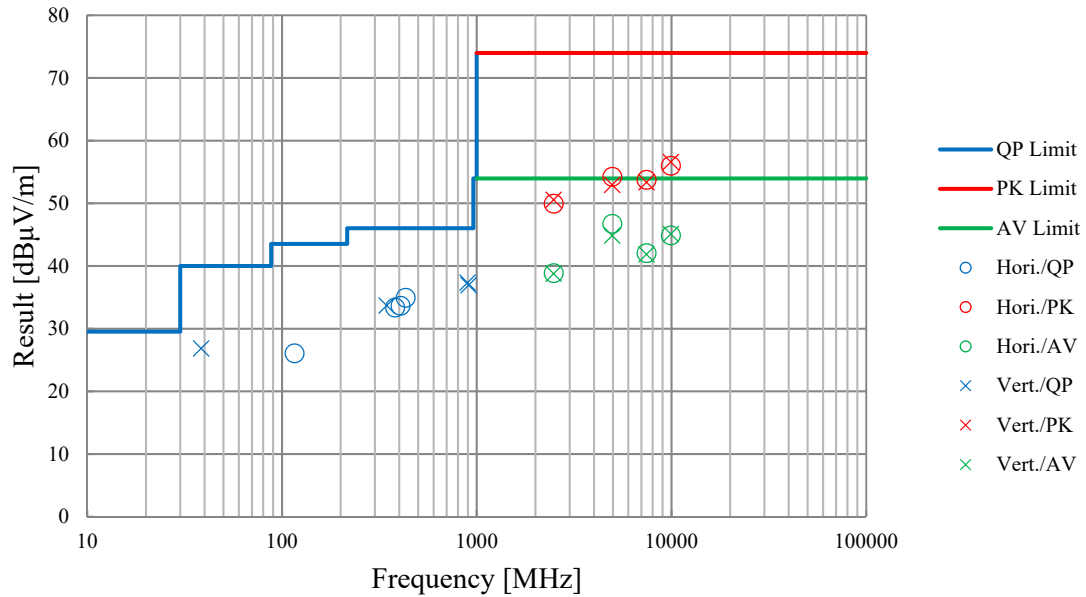
|                        |                                |
|------------------------|--------------------------------|
| Report No.             | 12656071S-H                    |
| Test place             | Shonan EMC Lab.                |
| Semi Anechoic Chamber  | No.3                           |
| Date                   | February 27, 2019              |
| Temperature / Humidity | 24 deg. C / 39 % RH            |
| Engineer               | Kenichi Adachi                 |
|                        | (1 GHz -13 GHz)                |
| Mode                   | Tx, Hopping Off, 3DH5 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.

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

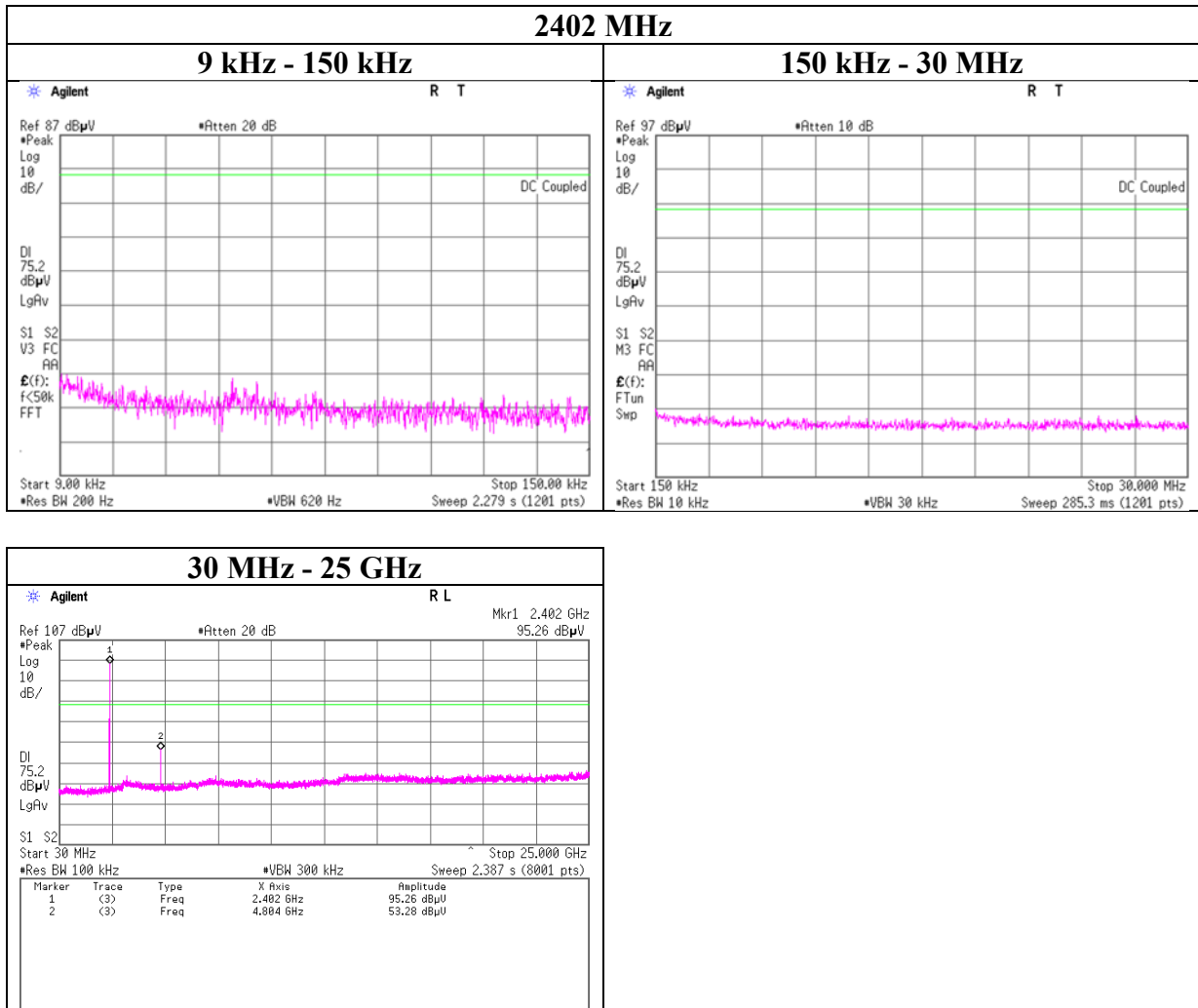
Report No. 12656071S-H  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber Refer to previous sheet  
Date Refer to previous sheet  
Temperature / Humidity Refer to previous sheet  
Engineer Refer to previous sheet  
Mode Tx, Hopping Off, 3DH5 2480 MHz



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

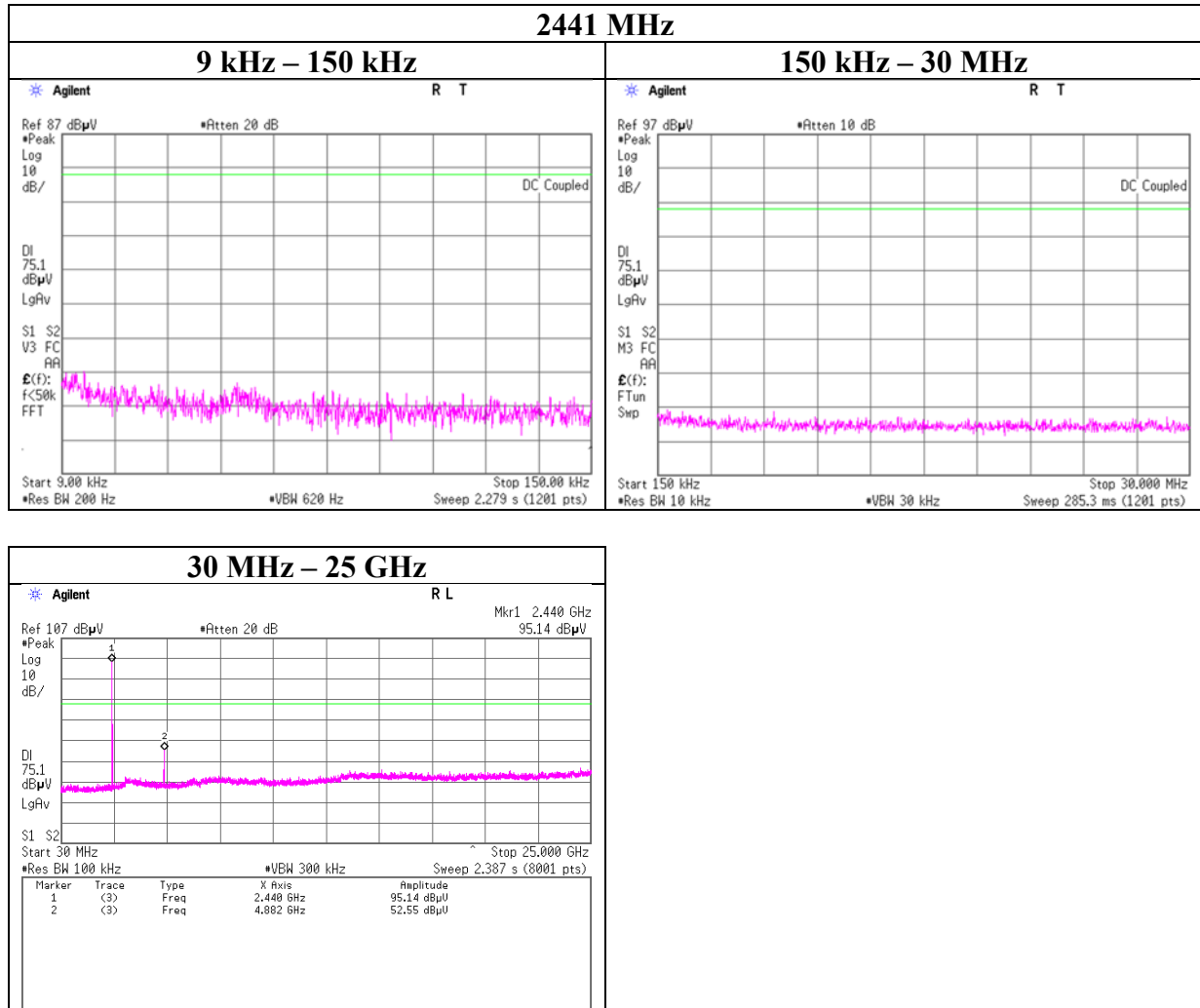
## Conducted Spurious Emission

|                        |                                       |
|------------------------|---------------------------------------|
| Report No.             | 12656071S-H                           |
| Test place             | Shonan EMC Lab. No.1 Measurement Room |
| Date                   | March 12, 2019                        |
| Temperature / Humidity | 23 deg. C / 59 % RH                   |
| Engineer               | Kenichi Adachi                        |
| Mode                   | Tx, Hopping Off, DH5                  |



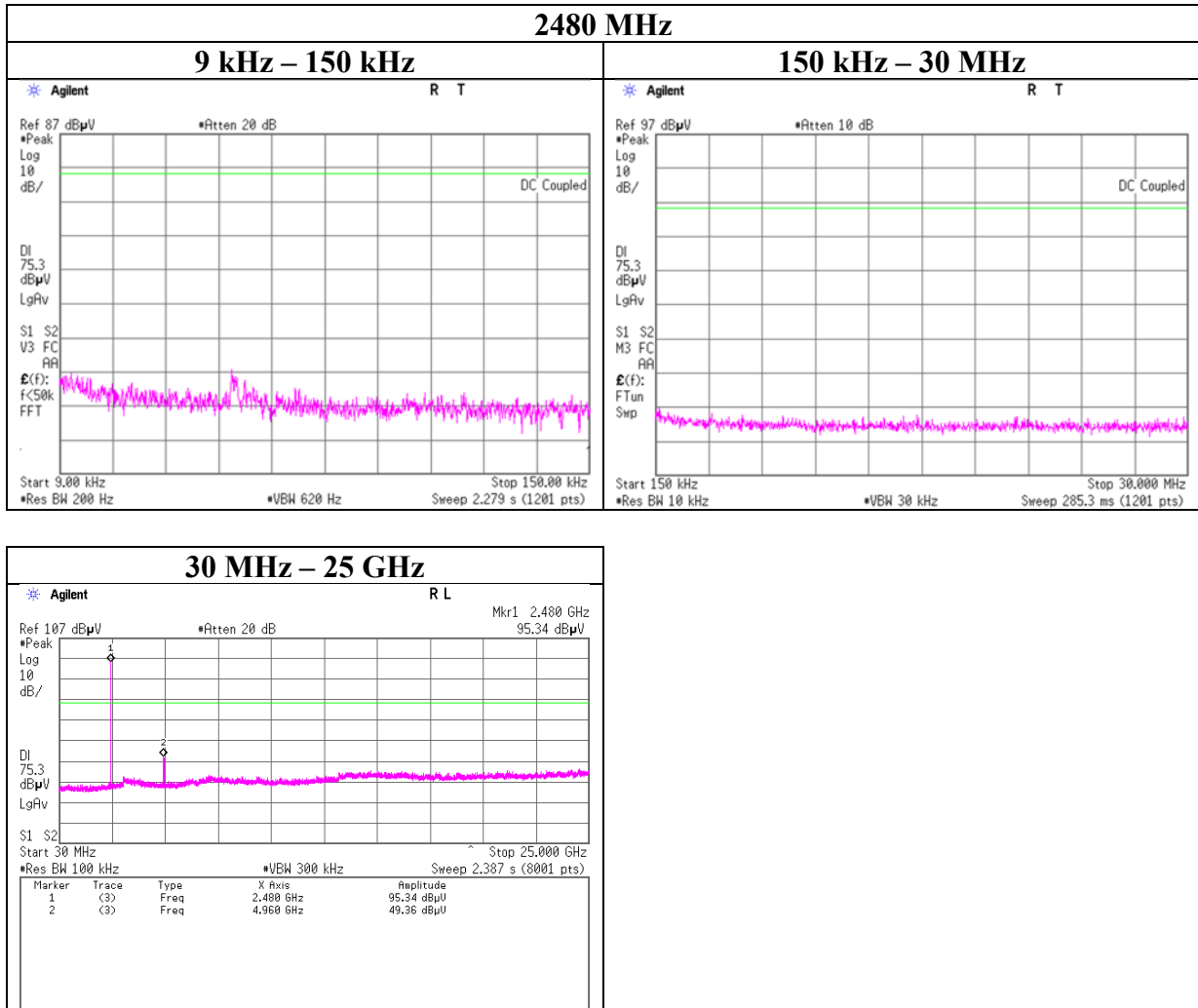
## Conducted Spurious Emission

|                        |                                       |
|------------------------|---------------------------------------|
| Report No.             | 12656071S-H                           |
| Test place             | Shonan EMC Lab. No.1 Measurement Room |
| Date                   | March 12, 2019                        |
| Temperature / Humidity | 23 deg. C / 59 % RH                   |
| Engineer               | Kenichi Adachi                        |
| Mode                   | Tx, Hopping Off, DH5                  |



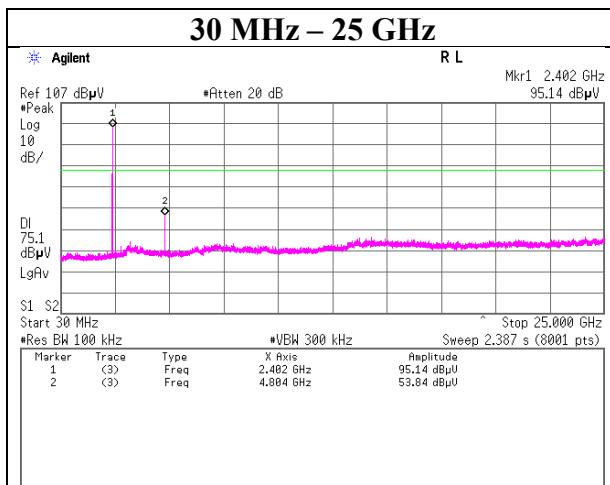
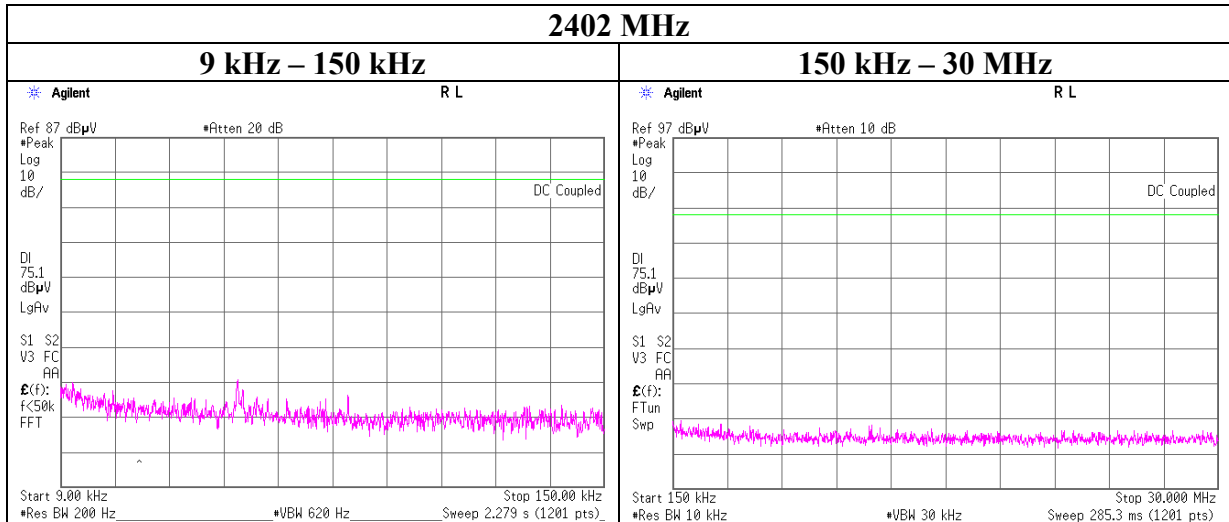
## Conducted Spurious Emission

Report No. 12656071S-H  
Test place Shonan EMC Lab. No.1 Measurement Room  
Date March 12, 2019  
Temperature / Humidity 23 deg. C / 59 % RH  
Engineer Kenichi Adachi  
Mode Tx, Hopping Off, DH5



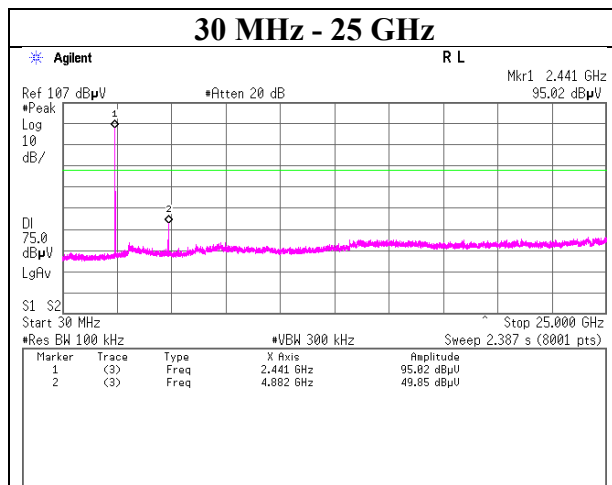
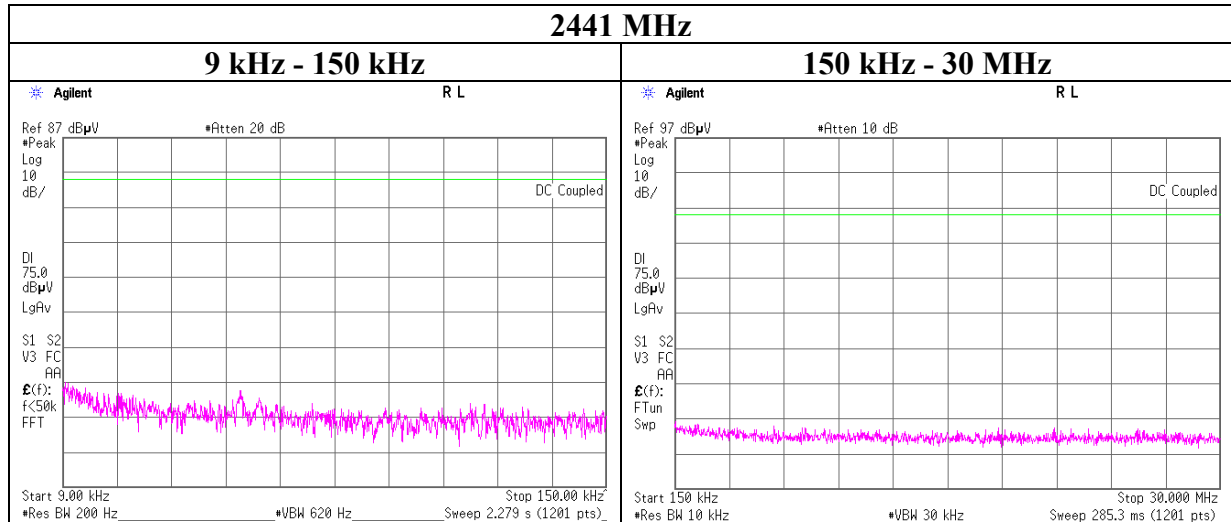
## Conducted Spurious Emission

|                        |                                       |
|------------------------|---------------------------------------|
| Report No.             | 12656071S-H                           |
| Test place             | Shonan EMC Lab. No.1 Measurement Room |
| Date                   | March 12, 2019                        |
| Temperature / Humidity | 23 deg. C / 59 % RH                   |
| Engineer               | Kenichi Adachi                        |
| Mode                   | Tx, Hopping Off, 3DH5                 |



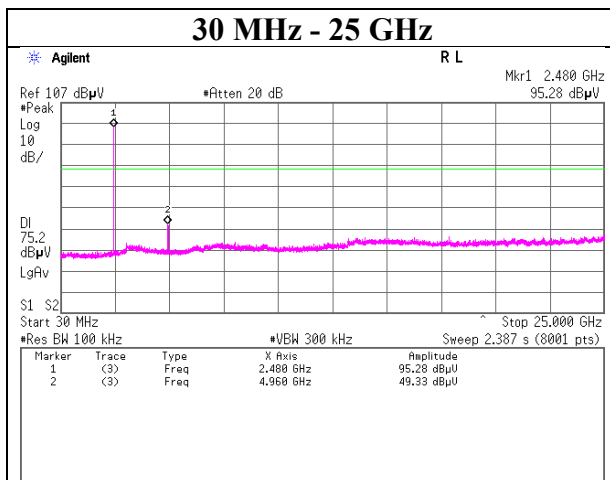
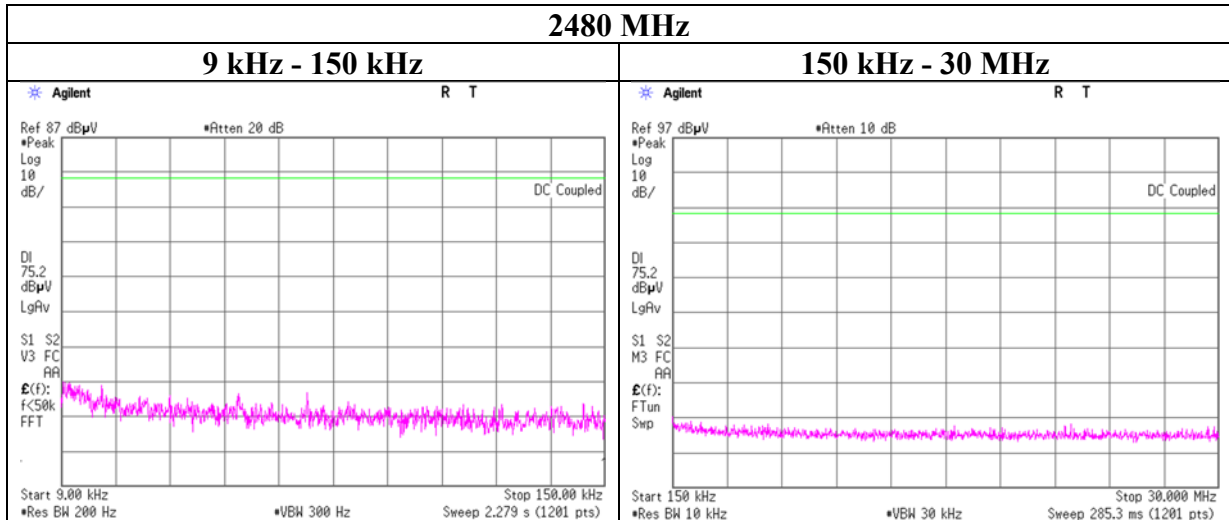
## Conducted Spurious Emission

|                        |                                       |
|------------------------|---------------------------------------|
| Report No.             | 12656071S-H                           |
| Test place             | Shonan EMC Lab. No.1 Measurement Room |
| Date                   | March 12, 2019                        |
| Temperature / Humidity | 23 deg. C / 59 % RH                   |
| Engineer               | Kenichi Adachi                        |
| Mode                   | Tx, Hopping Off, 3DH5                 |



## Conducted Spurious Emission

Report No. 12656071S-H  
Test place Shonan EMC Lab. No.1 Measurement Room  
Date March 12, 2019  
Temperature / Humidity 23 deg. C / 59 % RH  
Engineer Kenichi Adachi  
Mode Tx, Hopping Off, 3DH5



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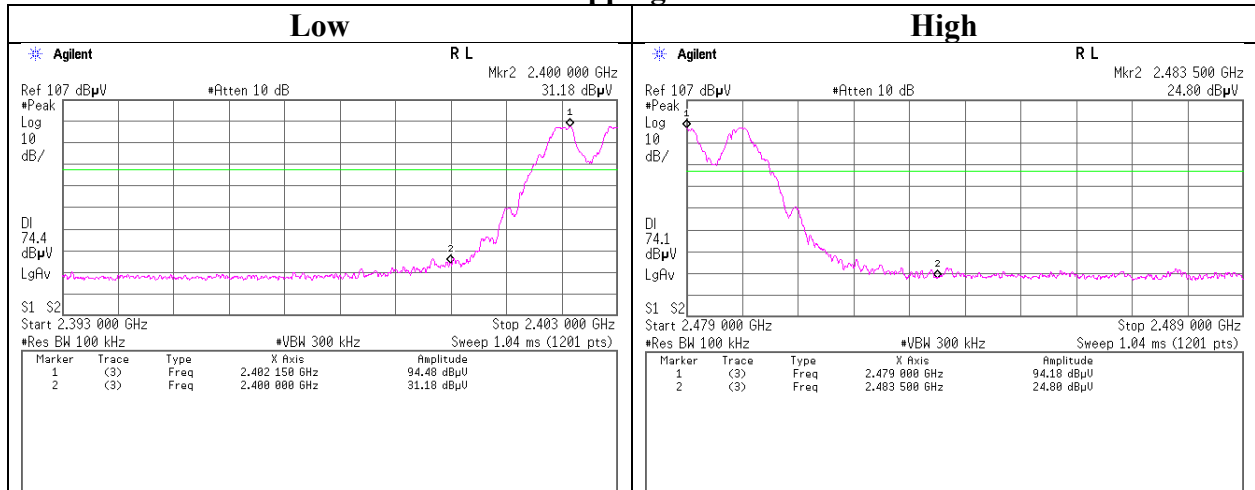
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

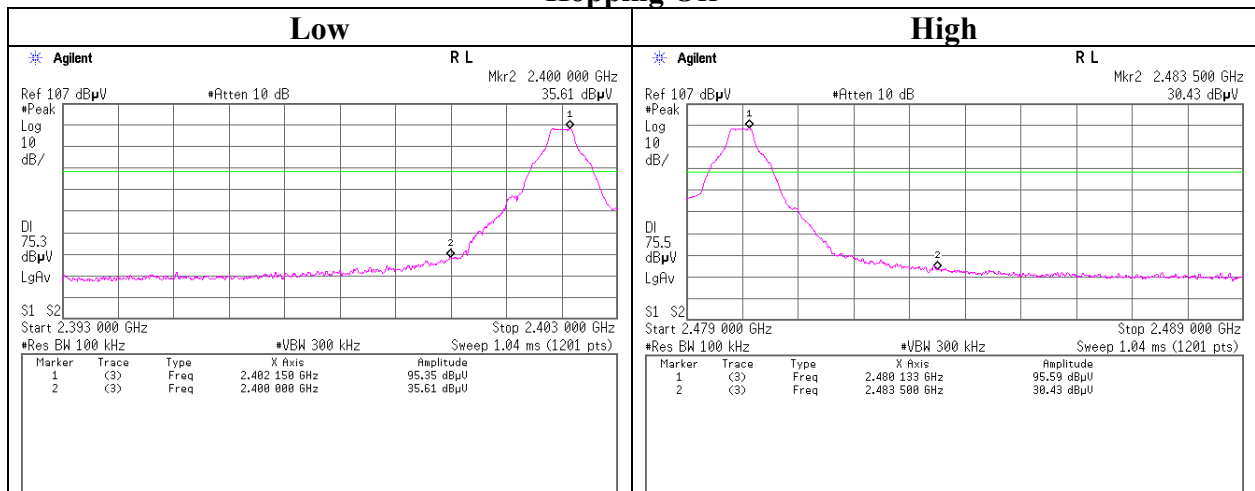
## Conducted Emission Band Edge compliance

|                        |                                       |
|------------------------|---------------------------------------|
| Report No.             | 12656071S-H                           |
| Test place             | Shonan EMC Lab. No.1 Measurement Room |
| Date                   | March 12, 2019                        |
| Temperature / Humidity | 23 deg. C / 59 % RH                   |
| Engineer               | Kenichi Adachi                        |
| Mode                   | Tx DH5                                |

### Hopping On



### Hopping Off



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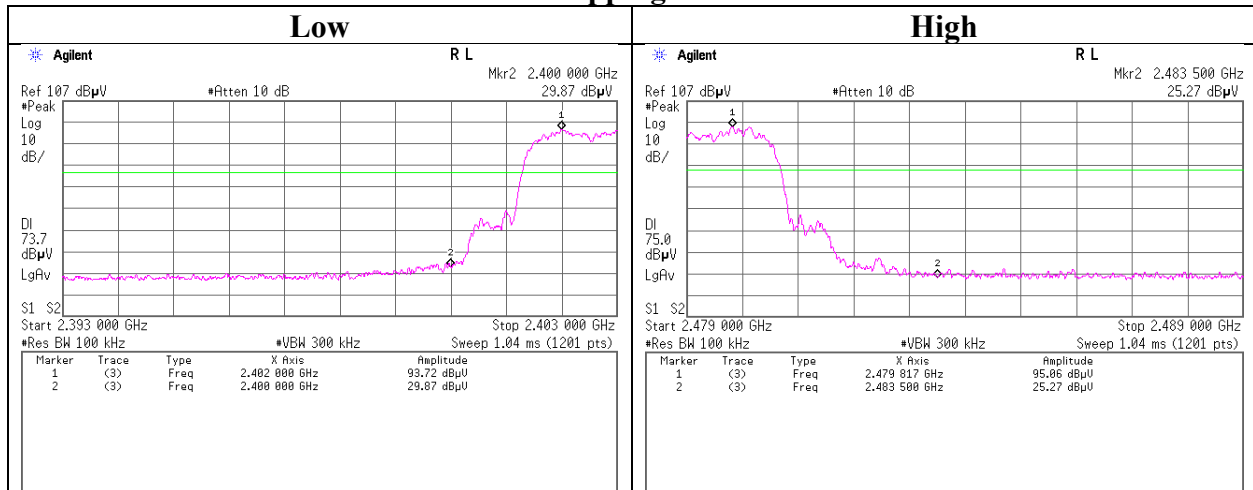
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

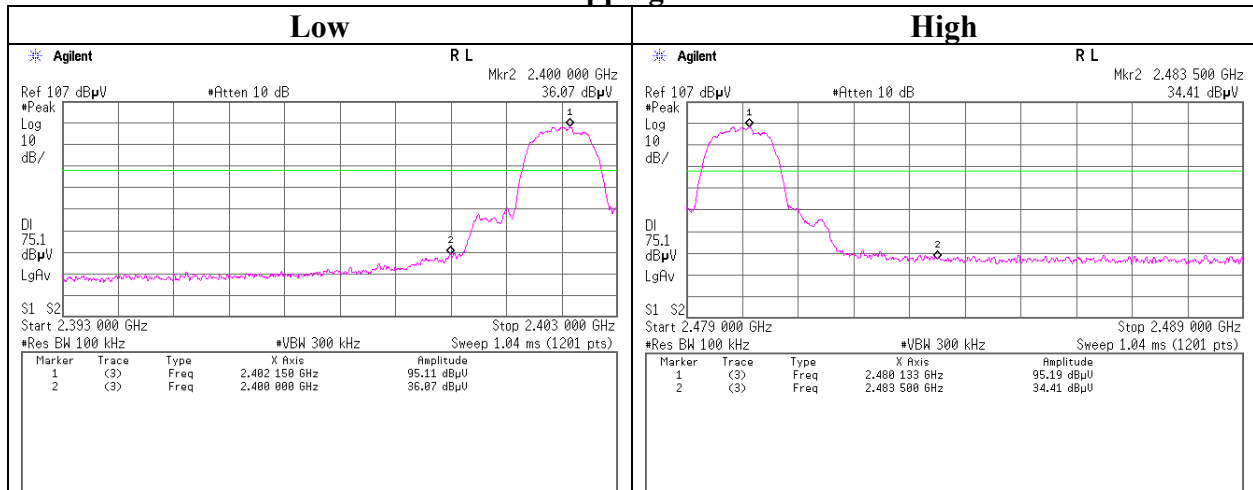
## Conducted Emission Band Edge compliance

|                        |                                       |
|------------------------|---------------------------------------|
| Report No.             | 12656071S-H                           |
| Test place             | Shonan EMC Lab. No.1 Measurement Room |
| Date                   | March 12, 2019                        |
| Temperature / Humidity | 23 deg. C / 59 % RH                   |
| Engineer               | Kenichi Adachi                        |
| Mode                   | Tx 3DH5                               |

### Hopping On



### Hopping Off



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## APPENDIX 2: Test instruments

### Test Instruments

| Local ID                       | Test Name | LIMS ID | Description               | Manufacturer                                | Model                              | Serial                 | Last Calibration Date | Calibration Due Date | Calibration Interval (Month) |
|--------------------------------|-----------|---------|---------------------------|---------------------------------------------|------------------------------------|------------------------|-----------------------|----------------------|------------------------------|
| SAT10-15                       | AT        | 160493  | Attenuator                | Weinschel Corp.                             | 54A-10                             | 83406                  | 2018/12/6             | 2019/12/30           | 12                           |
| SCC-G13                        | AT        | 145166  | Coaxial Cable             | Suhner                                      | SUCOFLEX 102                       | 31599/2                | 2018/12/25            | 2019/12/31           | 12                           |
| SOS-13                         | AT        | 146321  | Humidity Indicator        | CUSTOM                                      | CTH-202                            | Q.C.17                 | 2018/12/5             | 2019/12/31           | 12                           |
| SPM-07                         | AT        | 146247  | Power Meter               | AGILENT                                     | 8990B                              | MY5100272              | 2018/7/13             | 2019/7/31            | 12                           |
| SPSS-04                        | AT        | 146310  | Power sensor              | AGILENT                                     | N1923A                             | MY5326009              | 2018/7/13             | 2019/7/31            | 12                           |
| SSA-03                         | AT        | 145801  | Spectrum Analyzer         | AGILENT                                     | E4448A                             | MY48250152             | 2018/8/30             | 2019/8/31            | 12                           |
| STM-G7                         | AT        | 171614  | Terminator                | WEINSCHTEL                                  | M1459A                             | 88995                  | 2018/7/10             | 2019/7/31            | 12                           |
| SCC-C9/C10/SRSE-03             | CE        | 145036  | Coaxial Cable&RF Selector | Suhner/Suhner/TOYO                          | RG223U/141PE/NS4906                | ~0901-271(RF Selector) | 2018/4/9              | 2019/4/30            | 12                           |
| SOS-06                         | CE        | 146294  | Humidity Indicator        | A&D                                         | AD-5681                            | 4062118                | 2018/12/5             | 2019/12/31           | 12                           |
| SLS-05                         | CE (AE)   | 145542  | LISN                      | Rohde & Schwarz                             | ENV216                             | 100516                 | 2019/2/19             | 2020/2/29            | 12                           |
| STM-08                         | CE (AE)   | 146190  | Terminator                | TME                                         | CT-01 BP                           | -                      | 2018/12/25            | 2019/12/31           | 12                           |
| SAT3-13                        | CE (EUT)  | 150923  | Attenuator                | JFW                                         | 50HF-003N                          | -                      | 2019/1/25             | 2020/1/31            | 12                           |
| SLS-02                         | CE (EUT)  | 145539  | LISN                      | Rohde & Schwarz                             | ENV216                             | 100512                 | 2019/2/20             | 2020/2/29            | 12                           |
| SAEC-03(NSA)                   | RE        | 145565  | Semi-Anechoic Chamber     | TDK                                         | SAEC-03(NSA)                       | 3                      | 2018/6/2              | 2019/6/30            | 12                           |
| SAEC-03(SVSWR)                 | RE        | 145566  | Semi-Anechoic Chamber     | TDK                                         | SAEC-03(SVSWR)                     | 3                      | 2018/7/17             | 2019/7/31            | 12                           |
| SAF-03                         | RE        | 145126  | Pre Amplifier             | SONOMA                                      | 310N                               | 290213                 | 2019/2/5              | 2020/2/29            | 12                           |
| SAF-06                         | RE        | 145005  | Pre Amplifier             | Toyo Corporation                            | TPA0118-36                         | 1440491                | 2019/2/8              | 2020/2/29            | 12                           |
| SAJ-02                         | RE        | 146104  | Antenna Tilt Jig          | Intelligent System Engineering Co., Ltd     | Antenna Tilt Jig                   | T-S002                 | -                     | -                    | -                            |
| SAJ-03                         | RE        | 146105  | Antenna Tilt Jig          | Intelligent System Engineering Co., Ltd     | Antenna Tilt Jig                   | T-S003                 | -                     | -                    | -                            |
| SAT10-05                       | RE        | 145136  | Attenuator(above1G Hz)    | AGILENT                                     | 8493C-010                          | 74864                  | 2018/11/25            | 2019/11/30           | 12                           |
| SAT6-13                        | RE        | 167094  | Attenuator                | JFW                                         | 50HF-006N                          | -                      | 2019/2/5              | 2020/2/29            | 12                           |
| SBA-03                         | RE        | 145023  | Biconical Antenna         | Schwarzbeck                                 | BBA9106                            | 91032666               | 2018/6/17             | 2019/6/30            | 12                           |
| SCC-C1/C2/C3/C4/C5/C10/SRSE-03 | RE        | 145171  | Coaxial Cable&RF Selector | Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO | 8D2W/12DSFA/141PE/141PE/141PE/141P | ~0901-271(RF Selector) | 2018/4/9              | 2019/4/30            | 12                           |
| SCC-G05                        | RE        | 145039  | Coaxial Cable             | Junkosha                                    | J12J102207-00                      | APR-30-15-037          | 2019/1/25             | 2020/1/31            | 12                           |
| SCC-G15                        | RE        | 145176  | Coaxial Cable             | Suhner                                      | SUCOFLEX 102                       | 32703/2                | 2018/3/19             | 2019/3/31            | 12                           |
| SCC-G22                        | RE        | 145180  | Coaxial Cable             | Suhner                                      | SUCOFLEX 104                       | 296199/4               | 2018/5/11             | 2019/5/31            | 12                           |
| SCC-G33                        | RE        | 145184  | Coaxial Cable             | Junkosha                                    | MWX241-01000KMSKMS                 | -                      | 2018/4/20             | 2019/4/30            | 12                           |
| SCC-G41                        | RE        | 151617  | Coaxial Cable             | Junkosha                                    | MWX221-01000NFSNMS/B               | 1612S006               | 2019/1/25             | 2020/1/31            | 12                           |
| SFL-02                         | RE        | 145301  | Highpass Filter           | MICRO-TRONICS                               | HPM50111                           | 51                     | 2018/11/16            | 2019/11/30           | 12                           |
| SHA-03                         | RE        | 145501  | Horn Antenna              | Schwarzbeck                                 | BBHA9120D                          | 9120D-739              | 2018/7/23             | 2019/7/31            | 12                           |
| SHA-04                         | RE        | 145512  | Horn Antenna              | ETS LINDGREN                                | Sep-60                             | LM3640                 | 2018/7/23             | 2019/7/31            | 12                           |
| SLA-07                         | RE        | 145529  | Logperiodic Antenna       | Schwarzbeck                                 | VUSLP9111B                         | 196                    | 2018/6/17             | 2019/6/30            | 12                           |
| SOS-05                         | RE        | 146293  | Humidity Indicator        | A&D                                         | AD-5681                            | 4062518                | 2018/10/25            | 2019/10/31           | 12                           |
| STR-08                         | RE, CE    | 150463  | Test Receiver             | Rohde & Schwarz                             | ESW44                              | 101581                 | 2018/11/28            | 2019/11/30           | 12                           |
| COTS-SEMI-5                    | RE, CE    | 170932  | EMI Software              | TSJ                                         | TEPTO-DV3(RE, CE, ME, PE)          | -                      | -                     | -                    | -                            |
| KJM-02                         | RE, CE    | 146432  | Measure                   | TAJIMA                                      | GL19-55                            | -                      | -                     | -                    | -                            |
| STS-03                         | RE, CE    | 146210  | Digital Hitester          | HIOKI                                       | 3805-50                            | 80997823               | 2018/10/16            | 2019/10/31           | 12                           |

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

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

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

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

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

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