# RADIO TEST REPORT

## Test Report No. : 11873611H-B

| | | |
|---|---|---|
| **Applicant** | : | **VAIO Corporation** |
| **Type of Equipment** | : | **Bluetooth Speaker** |
| **Model No.** | : | **P01** |
| **FCC ID** | : | **2AL4MP01** |
| **Test regulation** | : | **FCC Part 15 Subpart C: 2017** |
| **Test Result** | : | **Complied** |

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

**Date of test:** July 31 to August 3, 2017

**Representative test engineer:**
Shuichi Ohyama
Engineer
Consumer Technology Division

**Approved by:**
Satofumi Matsuyama
Engineer
Consumer Technology Division

NVLAP TESTING
NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
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# REVISION HISTORY

## Original Test Report No.: 11873611H-B

| Revision | Test report No. | Date | Page revised | Contents |
|---|---|---|---|---|
| - (Original) | 11873611H-B | August 31, 2017 | - | - |
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**UL Japan, Inc.**
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**CONTENTS** **PAGE**

# SECTION 1: Customer information

| | | |
|---|---|---|
| Company Name | : | VAIO Corporation |
| Address | : | 5432 Toyoshina, Azumino-shi, Nagano, 399-8282 Japan |
| Telephone Number | : | +81-263-50-7391 |
| Facsimile Number | : | +81-263-50-7015 |
| Contact Person | : | Masami Ogawa |

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

## 2.1 Identification of E.U.T.

| | | |
|---|---|---|
| Type of Equipment | : | Bluetooth Speaker |
| Model No. | : | P01 |
| Serial No. | : | Refer to Section 4, Clause 4.2 |
| Rating | : | DC 5.0 V (USB), DC 3.7 V (Battery) |
| Receipt Date of Sample | : | July 31, 2017 |
| Country of Mass-production | : | Japan |
| Condition of EUT | : | Production model |
| Modification of EUT | : | No Modification by the test lab |

## 2.2 Product Description

Model: P01 (referred to as the EUT in this report) is a Bluetooth Speaker.

**General Specification**

| | | |
|---|---|---|
| Clock frequency(ies) in the system | : | 80 MHz, 26 MHz |

**Radio Specification**

**[Bluetooth (Ver. 3.0)]**

| | | |
|---|---|---|
| Radio Type | : | Transceiver |
| Frequency of Operation | : | 2402 MHz - 2480 MHz |
| Modulation | : | FHSS |
| Power Supply (radio part input) | : | DC 1.8 V, DC 1.35 V |
| Antenna type | : | λ/4 monopole Antenna (Pattern Antenna) |
| Antenna Gain | : | 2.15dBi |

# SECTION 3: Test specification, procedures & results

## 3.1 Test Specification

| | | |
|---|---|---|
| Test Specification | : | FCC Part 15 Subpart C<br>FCC Part 15 final revised on June 14, 2017 and effective July 14, 2017 |
| Title | : | FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators<br>Section 15.207 Conducted limits<br>Section 15.247 Operation within the bands 902-928MHz,<br>2400-2483.5MHz, and 5725-5850MHz |

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

## 3.2 Procedures and results

| Item | Test Procedure | Specification | Worst Margin | Results | Remarks |
|---|---|---|---|---|---|
| Conducted Emission | ANSI C63.10-2013<br>6. Standard test methods | Section 15.207 | **QP**<br>23.6 dB<br>0.74580 MHz, L<br>**AV**<br>27.1 dB,<br>0.74090 MHz, L, Tx DH5 2480 MHz /<br>0.74580 MHz, L, Tx 3DH5 2480 MHz | Complied | - |
| Carrier Frequency Separation | FCC Public Notice<br>DA 00-705 | Section15.247(a)(1) | See data. | Complied | Conducted |
| 20dB Bandwidth | FCC Public Notice<br>DA 00-705 | Section15.247(a)(1) | | Complied | Conducted |
| Number of Hopping Frequency | FCC Public Notice<br>DA 00-705 | Section15.247(a)(1)(iii) | | Complied | Conducted |
| Dwell time | FCC Public Notice<br>DA 00-705 | Section15.247(a)(1)(iii) | | Complied | Conducted |
| Maximum Peak Output Power | FCC Public Notice<br>DA 00-705 | Section15.247(a)(b)(1) | | Complied | Conducted |
| Spurious Emission & Band Edge Compliance | FCC Public Notice<br>DA 00-705 | Section15.247(d) | 3.8 dB<br>2557.975 MHz, Horizontal, AV | Complied | Conducted/ Radiated (above 30 MHz) *1) |
| Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.<br>*1) Radiated test was selected over 30 MHz based on section 15.247(d). | | | | | |

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

**FCC Part 15.31 (e)**

This EUT provides stable voltage (DC 1.8 V, DC 1.35 V) constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

**FCC Part 15.203 Antenna requirement**

The antenna is not removable from 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 | **IC:** RSS-Gen 6.6 | **IC:** - | N/A | - | Conducted |

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

## 3.4 Uncertainty

**EMI**

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

Ise EMC Lab.

| Antenna terminal test | Uncertainty (+/-) |
|---|---|
| RF output power | 1.2 dB |
| Antenna terminal conducted emission / Power density / Burst power | 3.1 dB |
| Adjacent channel power / Channel power | |
| Below 3 GHz | 1.8 dB |
| 3 GHz to 6 GHz | 2.7 dB |

| Frequency range | Conducted emission using AMN(LISN) (+/-) |
|---|---|
| 0.009 MHz - 0.15 MHz | 3.1 dB |
| 0.15 MHz - 30 MHz | 2.5 dB |

| Test distance | Radiated emission (+/-) 9 kHz - 30 MHz |
|---|---|
| 3 m | 3.8 dB |
| 10 m | 3.6 dB |

| Polarity | Radiated emission (Below 1 GHz) | | | |
|---|---|---|---|---|
| | (3 m*) (+/-) | | (10 m*) (+/-) | |
| | 30 MHz - 200 MHz | 200 MHz - 1000 MHz | 30 MHz - 200 MHz | 200 MHz - 1000 MHz |
| Horizontal | 5.0 dB | 5.3 dB | 5.0 dB | 5.0 dB |
| Vertical | 5.2 dB | 6.3 dB | 5.0 dB | 5.0 dB |

| Radiated emission (Above 1 GHz) | | | | |
|---|---|---|---|---|
| (3 m*) (+/-) | | (1 m*) (+/-) | | (10 m*) (+/-) |
| 1 GHz - 6 GHz | 6 GHz - 18 GHz | 10 GHz - 26.5 GHz | 26.5 GHz - 40 GHz | 1 GHz - 18 GHz |
| 5.2 dB | 5.5 dB | 5.5 dB | 5.4 dB | 5.5 dB |

*Measurement distance

Conducted Emission test
The data listed in this test report has enough margin, more than the site margin.

Radiated emission test
The data listed in this report meets the limits unless the uncertainty is taken into consideration.

## 3.5 Test Location

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

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

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

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

Refer to APPENDIX.

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

## 4.1 Operating Mode(s)

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

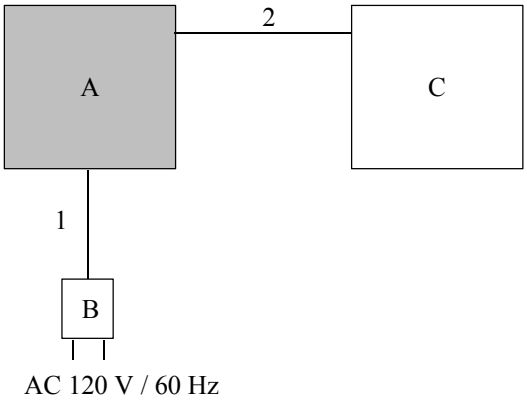
Details of Operating Mode(s)

| Test Item | Mode | Tested frequency |
|---|---|---|
| Conducted Emission | Tx (Hopping Off) DH5, 3DH5 | 2480 MHz |
| Spurious Emission (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 |
| 20dB 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 (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 |

*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)
*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.
* It is considered that the non-tested packet type (e.g. inquiry) can be omitted as it is complied with above all test items based on Bluetooth Core specification.

*EUT has the power settings by the software as follows;
Power settings: BDR: Ext.=23, Int.=39
EDR: Ext.=23, Int.=39
Software: Bluetest3 1612260
*This setting of software is the worst case.
Any conditions under the normal use do not exceed the condition of setting.
In addition, end users cannot change the settings of the output power of the product.

## 4.2 Configuration and peripherals




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

**Description of EUT and Support equipment**

| No. | Item | Model number | Serial number | Manufacturer | Remarks |
|---|---|---|---|---|---|
| A | Bluetooth Speaker | P01 | Pechat-FCC1 *1)<br>Pechat-FCC2 *2) | VAIO Corporation | EUT |
| B | AC Adaptor | CP-AD2 | 5241927 | SONY | - |
| C | Jig | - | - | - | - |

*1) Used for Conducted emission and Radiated emission
*2) Used for Antenna terminal conducted tests

**List of cables used**

| No. | Name | Length (m) | Shield | | Remarks |
|---|---|---|---|---|---|
| | | | Cable | Connector | |
| 1 | USB Cable | 2.0 | Shielded | Shielded | - |
| 2 | Signal Cable | 0.3 | Unshielded | Unshielded | - |

## SECTION 5: Conducted Emission

**Test Procedure and conditions**

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.
The 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 in a Semi Anechoic Chamber.
The EUT was connected to a LISN (AMN).
An overview sweep with peak detection has been performed.

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

| | |
|---|---|
| **Detector** | **: QP and CISPR AV** |
| **Measurement range** | **: 0.15 MHz - 30 MHz** |
| **Test data** | **: APPENDIX** |
| **Test result** | **: Pass** |

## SECTION 6: Radiated Spurious Emission

**Test Procedure**

[For below 1 GHz]
EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]
EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.
The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The height of the measuring antenna varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.
The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.
The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).
The test was made with the detector (RBW/VBW) in the following table.
When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

**Test Antennas are used as below;**

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

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

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

| Frequency | Below 1 GHz | Above 1 GHz | | 20 dBc |
|---|---|---|---|---|
| Instrument used | Test Receiver | Spectrum Analyzer | | Spectrum Analyzer |
| Detector | QP | PK | AV | PK |
| IF Bandwidth | BW 120 kHz | RBW: 1 MHz<br>VBW: 3 MHz | RBW: 1 MHz<br>VBW: 10 Hz *1) | RBW: 100 kHz<br>VBW: 300 kHz |
| Test Distance | 3 m | 3 m*2) (1 GHz to 10 GHz),<br>1 m*3) (10 GHz to 26.5 GHz) | | 3 m*2) (1 GHz to 10 GHz),<br>1 m*3) (10 GHz to 26.5 GHz) |

*1) Although DA 00-705 accepts VBW = 10 Hz for AV measurements, it was confirmed that superfluous smoothing was not performed.
*2) Distance Factor: 20 x log (4.5 m/3.0 m) = 3.53 dB
*3) Distance Factor: 20 x log (1.0 m/3.0 m) = -9.5 dB

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

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

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

# SECTION 7: Antenna Terminal Conducted Tests

**Test Procedure**

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

| Test | Span | RBW | VBW | Sweep time | Detector | Trace | Instrument used |
|---|---|---|---|---|---|---|---|
| 20dB 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 | Spectrum Analyzer |
| Maximum Peak Output Power | - | - | - | Auto | Peak Average *2) | - | Power Meter (Sensor: 50MHz BW) |
| Carrier Frequency Separation | 3 MHz | 30 kHz | 100 kHz | Auto | Peak | Max Hold | Spectrum Analyzer |
| Number of Hopping Frequency | 30 MHz | 300 kHz | 1 MHz | 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 | 9.1 kHz | 27 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 30MHz, RBW was narrowed to separate the noise contents.
Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.

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

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

# APPENDIX 1: Test data

## Conducted Emission

DATA OF CONDUCTED EMISSION TEST

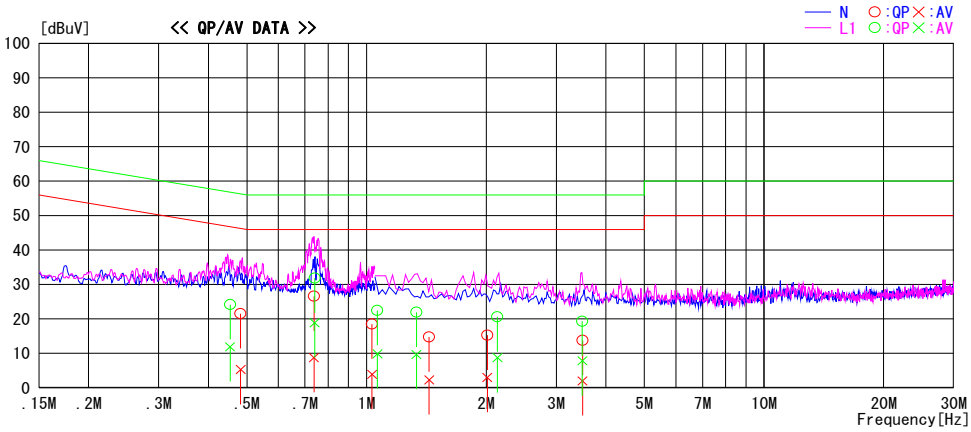
UL Japan, Inc. Ise EMC Lab. No.3 Semi Anechoic Chamber
Date : 2017/08/01

Report No. : 11873611H

Temp./Humi. : 24 deg. C / 58 % RH
Engineer : Ryota Yamanaka

Mode / Remarks : Tx DH5 2480MHz

LIMIT : FCC15.207 QP
FCC15.207 AV



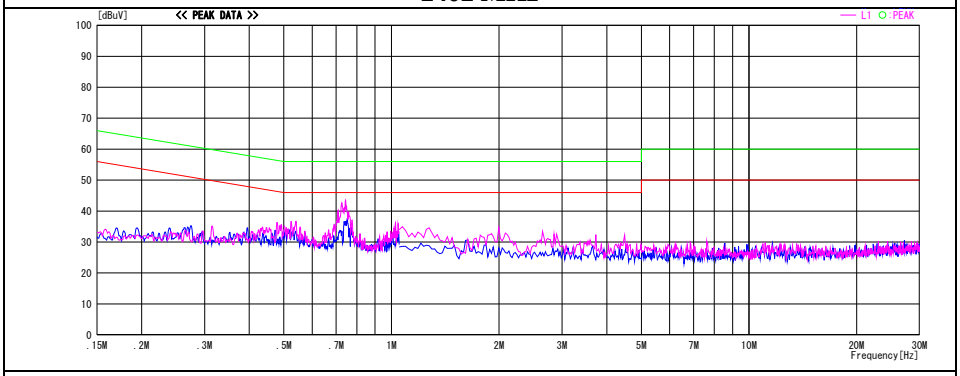

| Frequency | Reading Level | | Corr. | Results | | Limit | | Margin | | Phase | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | QP | AV | Factor | QP | AV | QP | AV | QP | AV | | |
| [MHz] | [dBuV] | [dBuV] | [dB] | [dBuV] | [dBuV] | [dBuV] | [dBuV] | [dB] | [dB] | | |
| 0.48220 | 8.1 | -8.1 | 13.4 | 21.5 | 5.3 | 56.3 | 46.3 | 34.8 | 41.0 | N | |
| 0.73760 | 13.2 | -4.6 | 13.4 | 26.6 | 8.8 | 56.0 | 46.0 | 29.4 | 37.2 | N | |
| 1.03210 | 5.1 | -9.5 | 13.4 | 18.5 | 3.9 | 56.0 | 46.0 | 37.5 | 42.1 | N | |
| 1.43680 | 1.4 | -11.1 | 13.4 | 14.8 | 2.3 | 56.0 | 46.0 | 41.2 | 43.7 | N | |
| 2.01300 | 1.7 | -10.6 | 13.6 | 15.3 | 3.0 | 56.0 | 46.0 | 40.7 | 43.0 | N | |
| 3.49560 | 0.0 | -11.7 | 13.7 | 13.7 | 2.0 | 56.0 | 46.0 | 42.3 | 44.0 | N | |
| 0.45380 | 10.8 | -1.5 | 13.4 | 24.2 | 11.9 | 56.8 | 46.8 | 32.6 | 34.9 | L | |
| 0.74090 | 18.4 | 5.5 | 13.4 | 31.8 | 18.9 | 56.0 | 46.0 | 24.2 | 27.1 | L | |
| 1.06530 | 9.0 | -3.5 | 13.4 | 22.4 | 9.9 | 56.0 | 46.0 | 33.6 | 36.1 | L | |
| 1.33450 | 8.5 | -3.7 | 13.4 | 21.9 | 9.7 | 56.0 | 46.0 | 34.1 | 36.3 | L | |
| 2.13377 | 7.0 | -4.9 | 13.6 | 20.6 | 8.7 | 56.0 | 46.0 | 35.4 | 37.3 | L | |
| 3.48960 | 5.6 | -5.9 | 13.7 | 19.3 | 7.8 | 56.0 | 46.0 | 36.7 | 38.2 | L | |

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

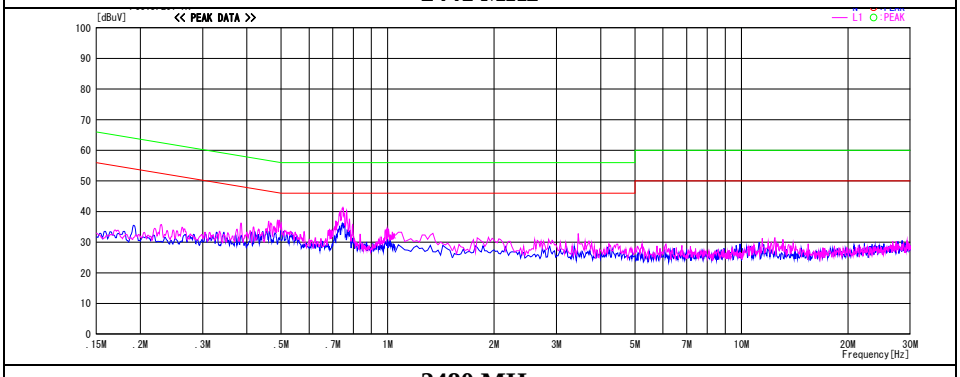
# Conducted Emission

| | |
|---|---|
| Test place | Ise EMC Lab. No.3 Semi Anechoic Chamber |
| Report No. | 11873611H |
| Date | August 1, 2017 |
| Temperature / Humidity | 24 deg. C / 58 % RH |
| Engineer | Ryota Yamanaka |
| Mode | Tx, Hopping Off, DH5 |

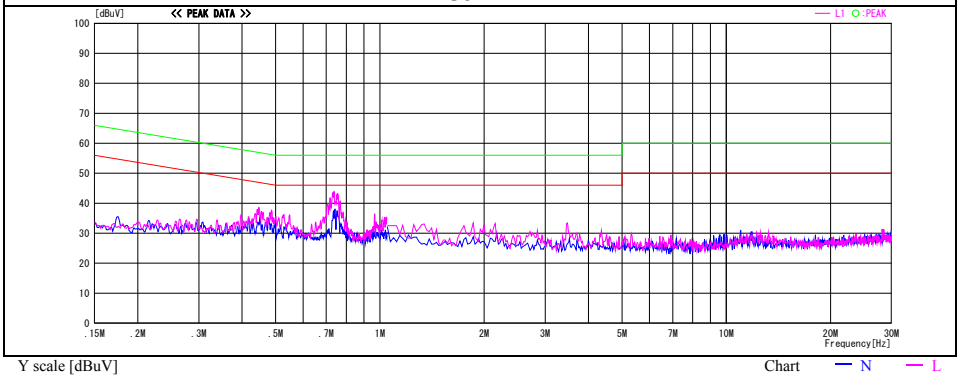
**2402 MHz**




**2441 MHz**




**2480 MHz**




Y scale [dBuV] Chart — N — L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# Conducted Emission

## DATA OF CONDUCTED EMISSION TEST

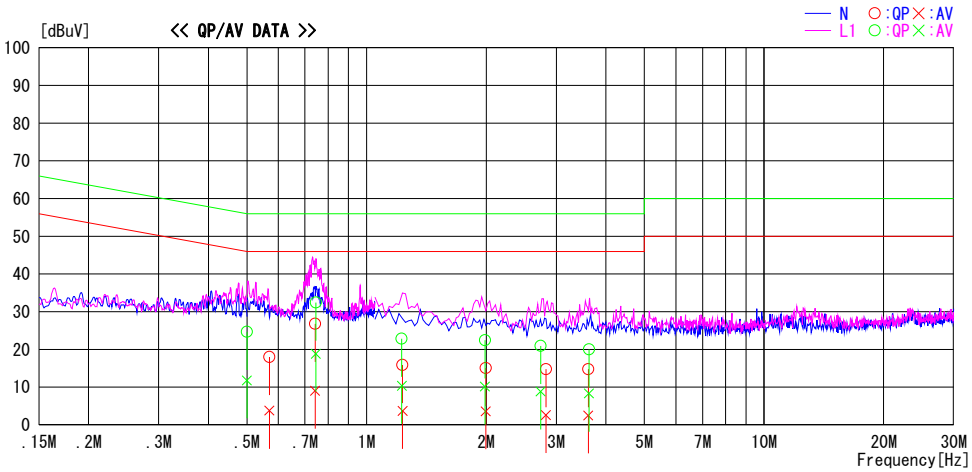
UL Japan, Inc. Ise EMC Lab. No.3 Semi Anechoic Chamber
Date : 2017/08/01

Report No. : 11873611H

Temp./Humi. : 24 deg. C / 58 % RH
Engineer : Ryota Yamanaka

Mode / Remarks : Tx 3DH5 2480MHz

LIMIT : FCC15.207 QP
FCC15.207 AV



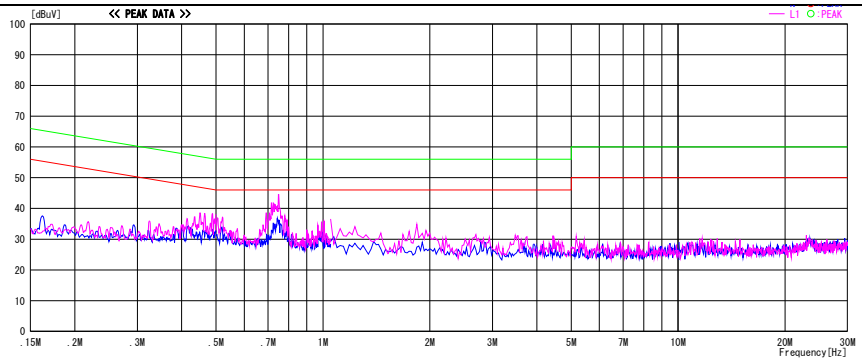

| Frequency | Reading Level | | Corr. | Results | | Limit | | Margin | | Phase | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | QP | AV | Factor | QP | AV | QP | AV | QP | AV | | |
| [MHz] | [dBuV] | [dBuV] | [dB] | [dBuV] | [dBuV] | [dBuV] | [dBuV] | [dB] | [dB] | | |
| 0.56940 | 4.6 | -9.6 | 13.4 | 18.0 | 3.8 | 56.0 | 46.0 | 38.0 | 42.2 | N | |
| 0.74200 | 13.4 | -4.3 | 13.4 | 26.8 | 9.1 | 56.0 | 46.0 | 29.2 | 36.9 | N | |
| 1.23140 | 2.5 | -9.7 | 13.4 | 15.9 | 3.7 | 56.0 | 46.0 | 40.1 | 42.3 | N | |
| 1.99380 | 1.5 | -10.0 | 13.6 | 15.1 | 3.6 | 56.0 | 46.0 | 40.9 | 42.4 | N | |
| 2.82820 | 1.2 | -11.0 | 13.6 | 14.8 | 2.6 | 56.0 | 46.0 | 41.2 | 43.4 | N | |
| 3.60980 | 1.0 | -11.3 | 13.8 | 14.8 | 2.5 | 56.0 | 46.0 | 41.2 | 43.5 | N | |
| 0.50008 | 11.3 | -1.6 | 13.4 | 24.7 | 11.8 | 56.0 | 46.0 | 31.3 | 34.2 | L | |
| 0.74580 | 19.0 | 5.5 | 13.4 | 32.4 | 18.9 | 56.0 | 46.0 | 23.6 | 27.1 | L | |
| 1.22620 | 9.4 | -3.0 | 13.4 | 22.8 | 10.4 | 56.0 | 46.0 | 33.2 | 35.6 | L | |
| 1.98520 | 8.8 | -3.4 | 13.6 | 22.4 | 10.2 | 56.0 | 46.0 | 33.6 | 35.8 | L | |
| 2.73980 | 7.3 | -4.7 | 13.6 | 20.9 | 8.9 | 56.0 | 46.0 | 35.1 | 37.1 | L | |
| 3.62880 | 6.2 | -5.5 | 13.8 | 20.0 | 8.3 | 56.0 | 46.0 | 36.0 | 37.7 | L | |

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

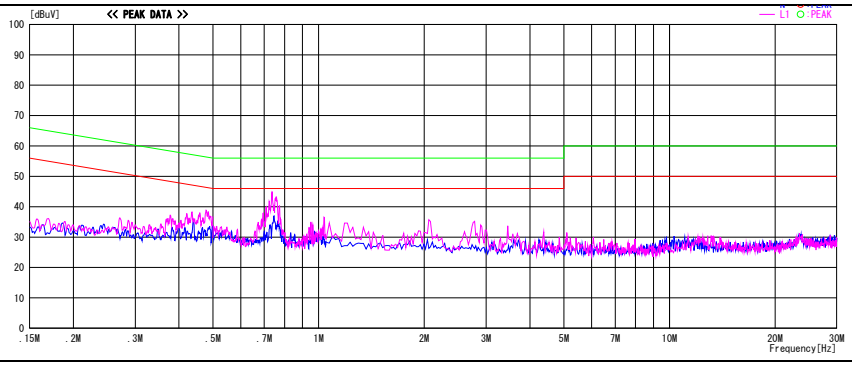
# Conducted Emission

| | |
|---|---|
| Test place | Ise EMC Lab. No.3 Semi Anechoic Chamber |
| Report No. | 11873611H |
| Date | August 1, 2017 |
| Temperature / Humidity | 24 deg. C / 58 % RH |
| Engineer | Ryota Yamanaka |
| Mode | Tx, Hopping Off, 3DH5 |

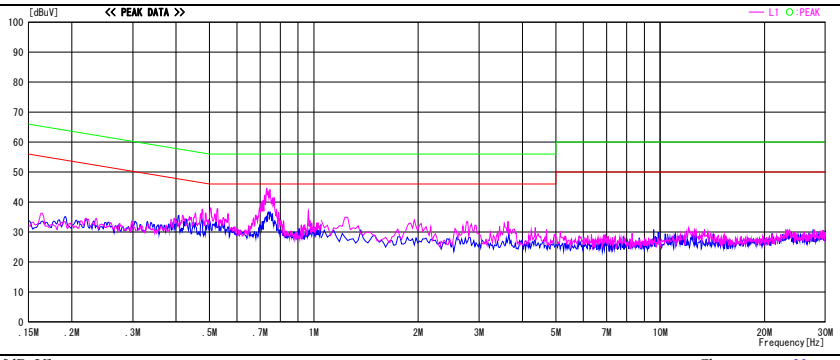
**2402 MHz**




**2441 MHz**




**2480 MHz**




Y scale [dBuV]  Chart — N — L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# 20dB Bandwidth and Carrier Frequency Separation

| | |
|---|---|
| Test place | Ise EMC Lab. No.11 Measurement Room |
| Report No. | 11873611H |
| Date | August 3, 2017 |
| Temperature / Humidity | 24 deg. C / 52 % RH |
| Engineer | Yuta Moriya |
| Mode | Tx, Hopping On |

| Mode | Freq. [MHz] | 20dB Bandwidth [MHz] | Carrier Frequency Separation [MHz] | Limit for Carrier Frequency separation [MHz] |
|---|---|---|---|---|
| DH5 | 2402.0 | 0.950 | 1.000 | >= 0.633 |
| DH5 | 2441.0 | 0.950 | 1.000 | >= 0.633 |
| DH5 | 2480.0 | 0.950 | 1.000 | >= 0.633 |
| 3DH5 | 2402.0 | 1.258 | 1.000 | >= 0.839 |
| 3DH5 | 2441.0 | 1.274 | 1.000 | >= 0.849 |
| 3DH5 | 2480.0 | 1.259 | 1.000 | >= 0.839 |

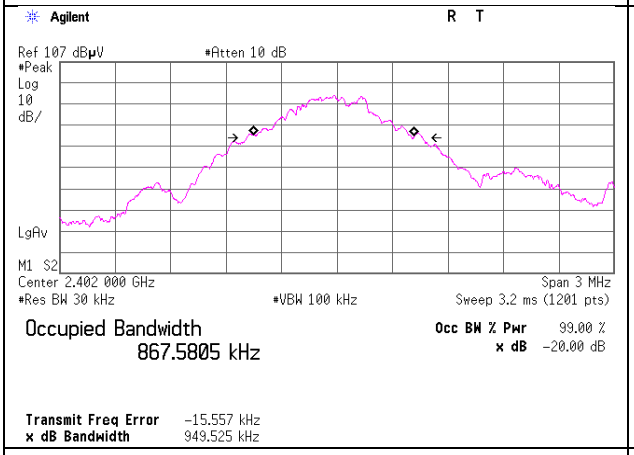
Limit: Two-thirds of 20dB Bandwidth or 25kHz (whichever is greater).
No limit applies to 20dB Bandwidth.

# 20dB Bandwidth and Carrier Frequency Separation

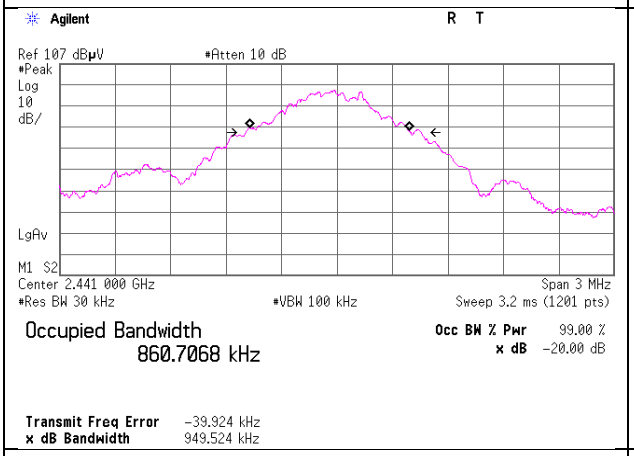
## DH5

### 20 dB Bandwidth

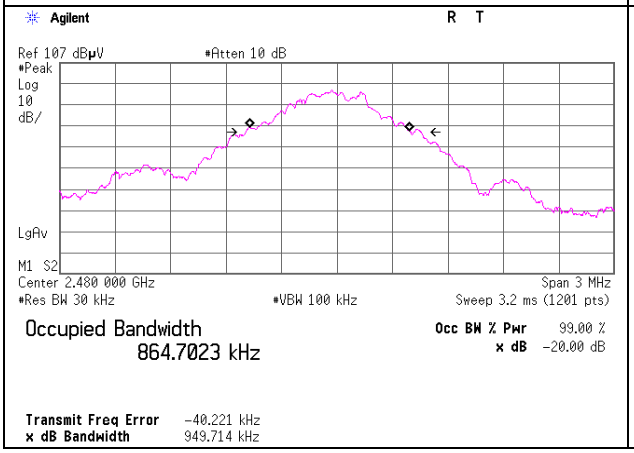
#### 2402 MHz




#### 2441 MHz

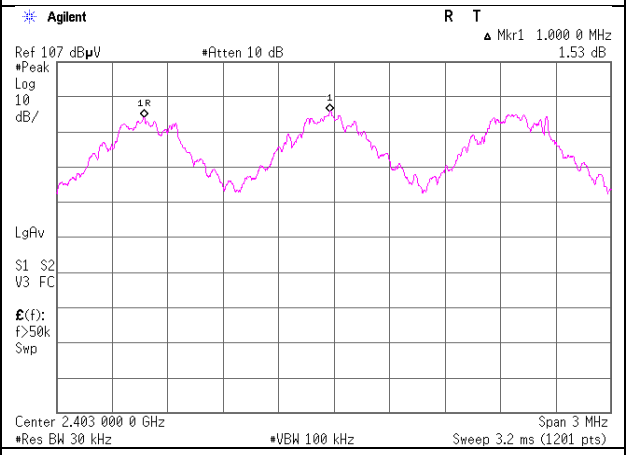



#### 2480 MHz

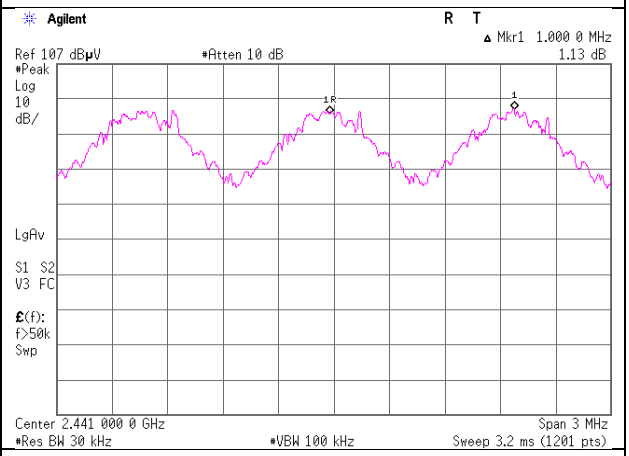



### Carrier Frequency Separation

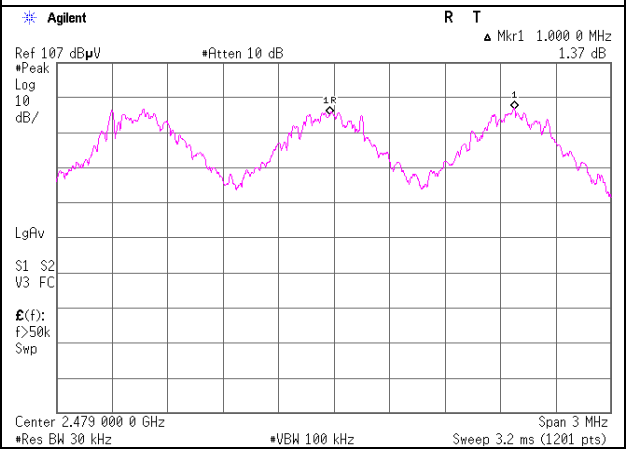
#### 2402 MHz




#### 2441 MHz




#### 2480 MHz

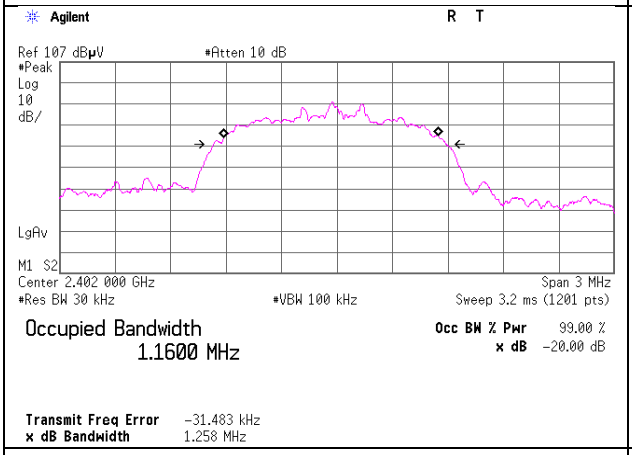


# 20dB Bandwidth and Carrier Frequency Separation

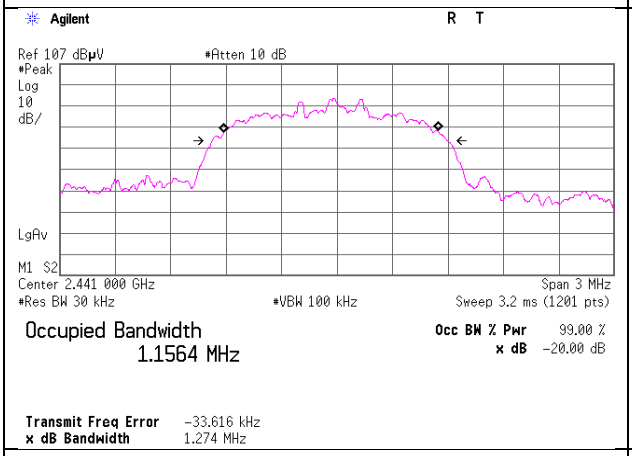
## 3DH5

### 20 dB Bandwidth

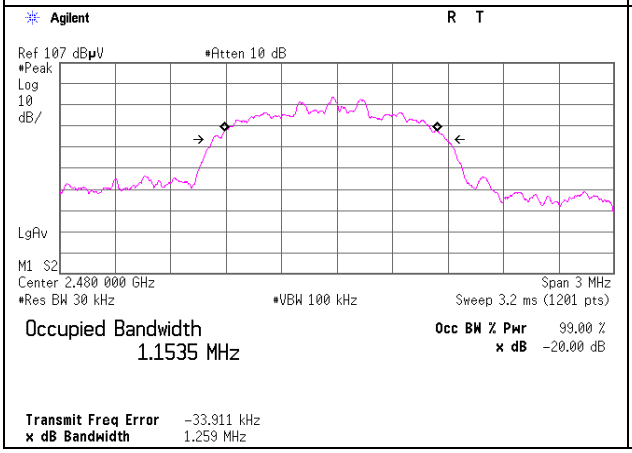
#### 2402 MHz




#### 2441MHz

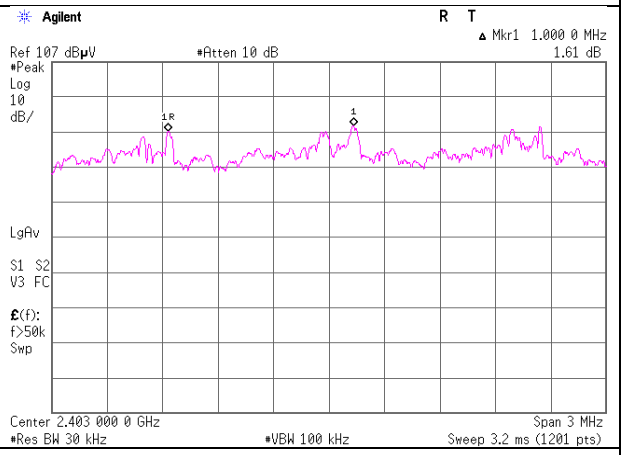



#### 2480MHz

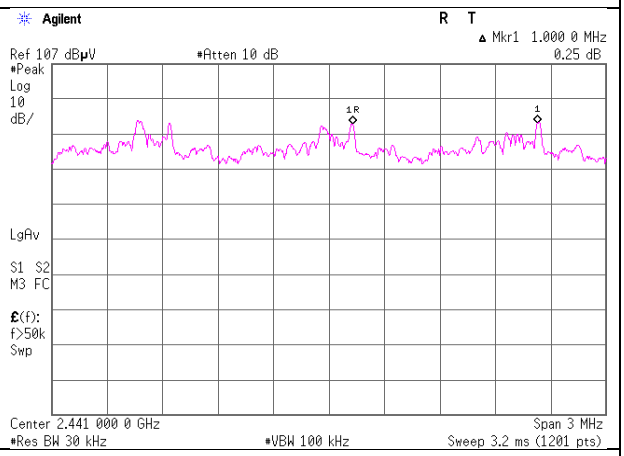



### Carrier Frequency Separation

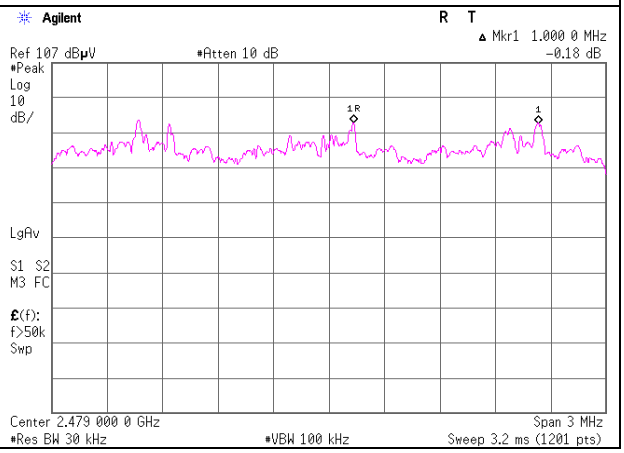
#### 2402 MHz




#### 2441 MHz




#### 2480 MHz



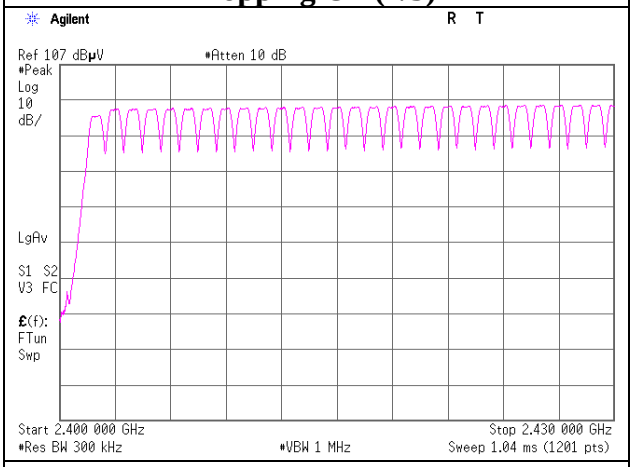
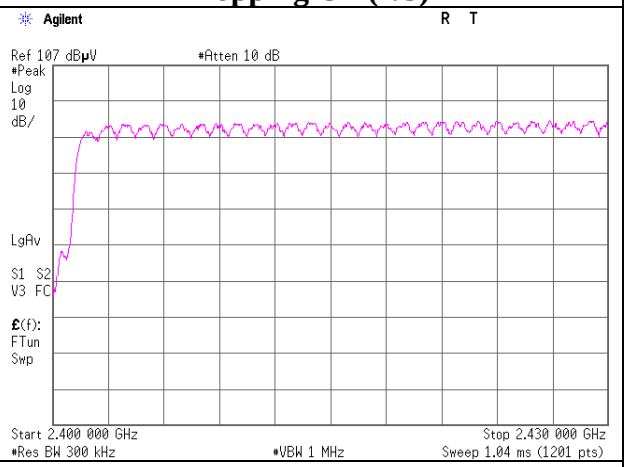
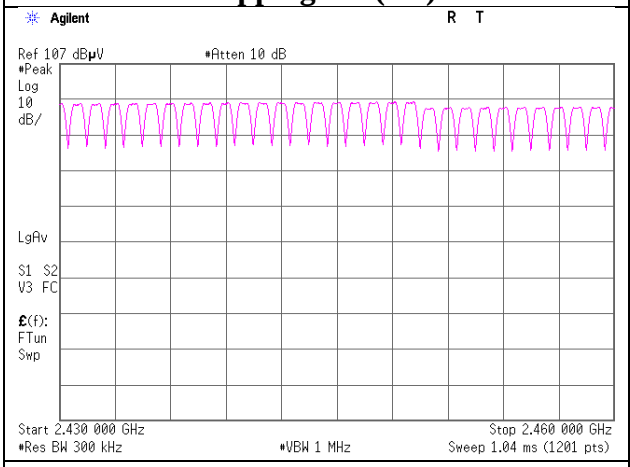
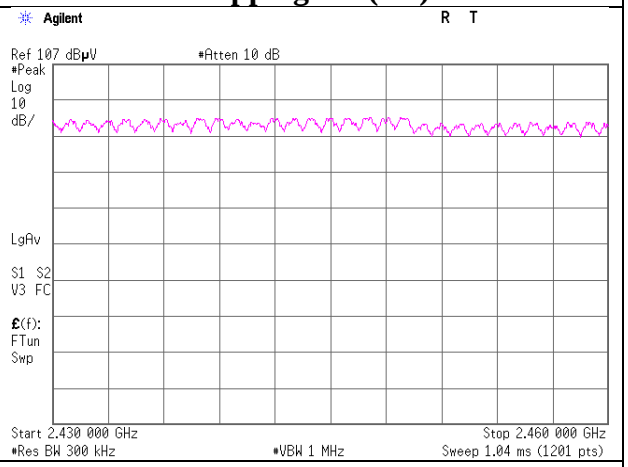
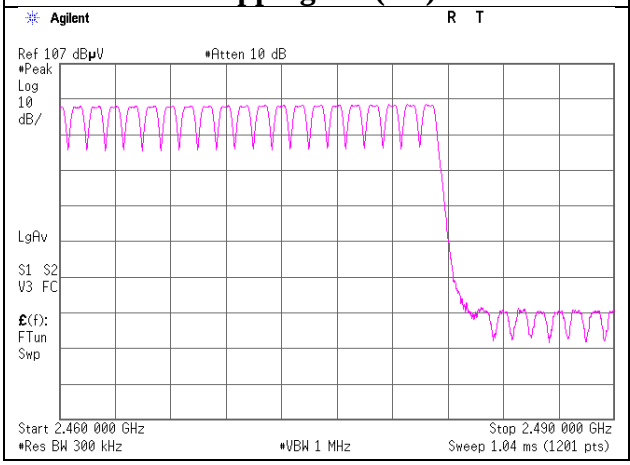
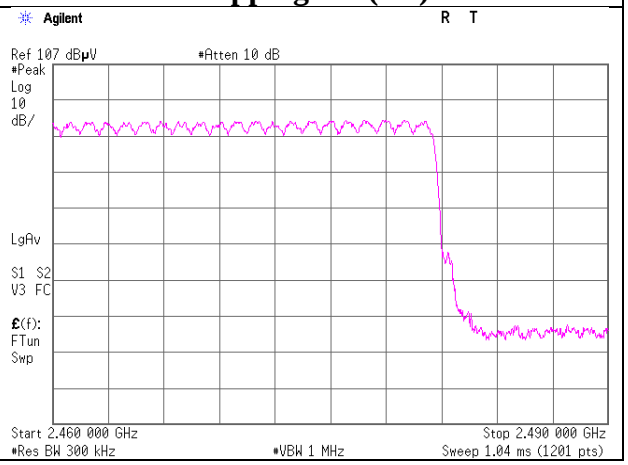
# Number of Hopping Frequency

| | |
|---|---|
| Test place | Ise EMC Lab. No.11 Measurement Room |
| Report No. | 11873611H |
| Date | August 3, 2017 |
| Temperature / Humidity | 24 deg. C / 52 % RH |
| Engineer | Yuta Moriya |
| Mode | Tx, Hopping On |

| Mode | Number of channel [channels] | Limit [channels] |
|---|---|---|
| DH5 | 79 | >= 15 |
| 3DH5 | 79 | >= 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

| DH5 | 3DH5 |
|---|---|
| **Hopping On (1/3)** | **Hopping On (1/3)** |
|  |  |
| **Hopping On (2/3)** | **Hopping On (2/3)** |
|  |  |
| **Hopping On (3/3)** | **Hopping On (3/3)** |
|  |  |

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# Dwell time

| | |
|---|---|
| Test place | Ise EMC Lab. No.11 Measurement Room |
| Report No. | 11873611H |
| Date | August 3, 2017 |
| Temperature / Humidity | 24 deg. C / 52 % RH |
| Engineer | Yuta Moriya |
| Mode | Tx, Hopping On |

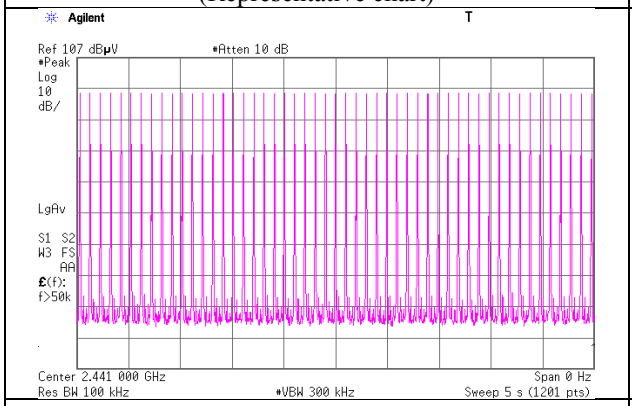
| Mode | Number of transmission in a 31.6(79 Hopping x 0.4) / 12.8 (32 Hopping x 0.4) second period | Length of transmission [msec] | Result [msec] | Limit [msec] |
|---|---|---|---|---|
| DH1 | 51.0 times / 5 sec. x 31.6 sec. = 323 times | 0.428 | 138 | 400 |
| DH3 | 26.0 times / 5 sec. x 31.6 sec. = 165 times | 1.690 | 279 | 400 |
| DH5 | 17.0 times / 5 sec. x 31.6 sec. = 108 times | 2.948 | 318 | 400 |
| 3DH1 | 51.0 times / 5 sec. x 31.6 sec. = 323 times | 0.440 | 142 | 400 |
| 3DH3 | 26.0 times / 5 sec. x 31.6 sec. = 165 times | 1.700 | 281 | 400 |
| 3DH5 | 17.0 times / 5 sec. x 31.6 sec. = 108 times | 2.948 | 318 | 400 |

Sample Calculation
Result = Number of transmission x Length of transmission

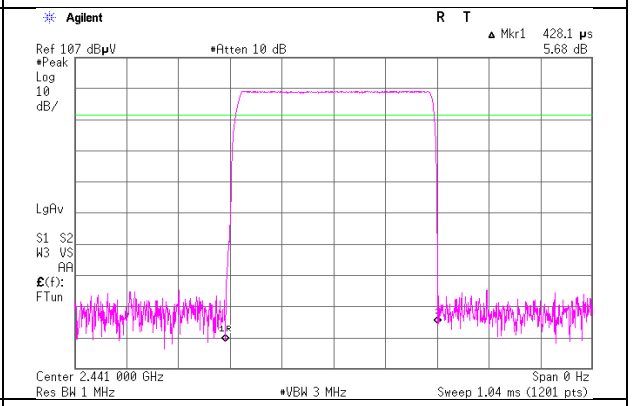
This device complies with the Bluetooth protocol for FHSS operation, employing a pseudo random channel selection and hopping rate to ensure that the occupancy time in N x 0.4s, where N is the number of channels being used in the hopping sequence ($20 \leq N \leq 79$), is always less than 0.4s regardless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

# Dwell time

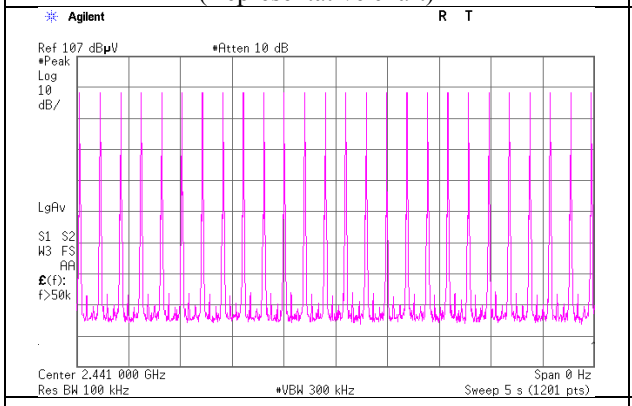
## DH1 (1/2)
(Representative chart)



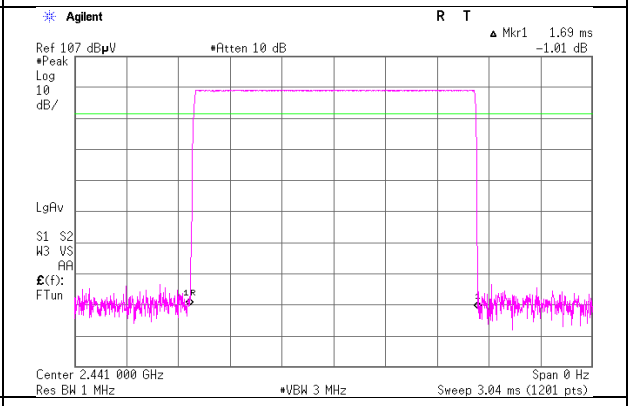

## DH1 (2/2)



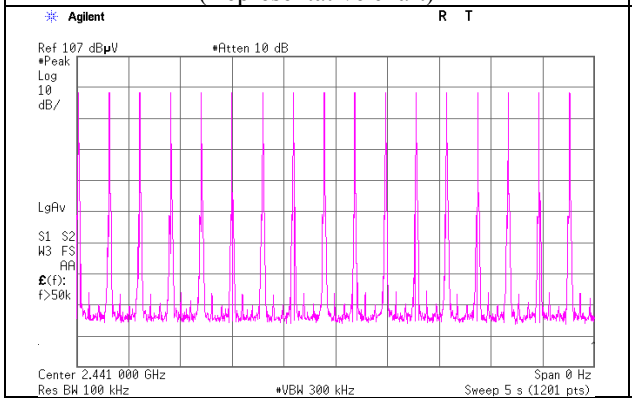

## DH3 (1/2)
(Representative chart)



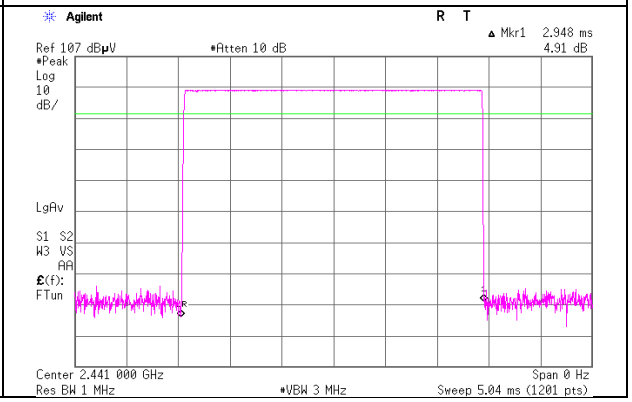

## DH3 (2/2)




## DH5 (1/2)
(Representative chart)

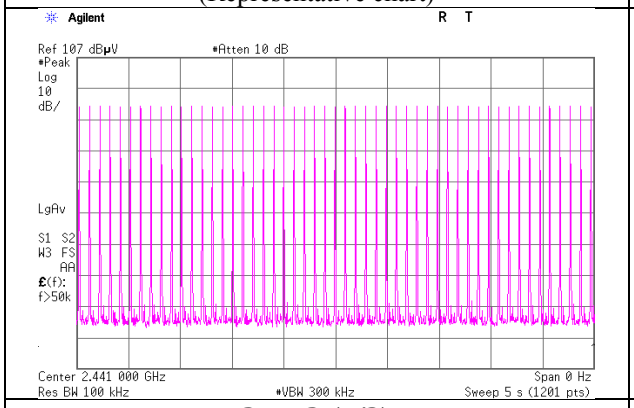



## DH5 (2/2)

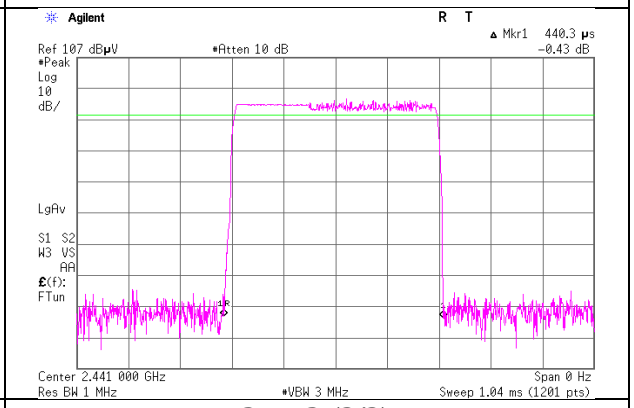


# Dwell time

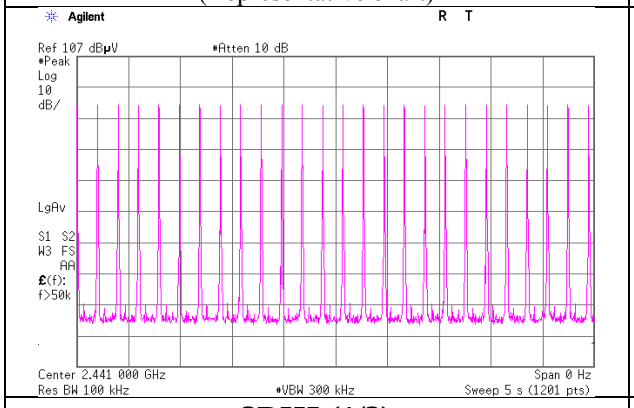
## 3DH1 (1/2)
(Representative chart)



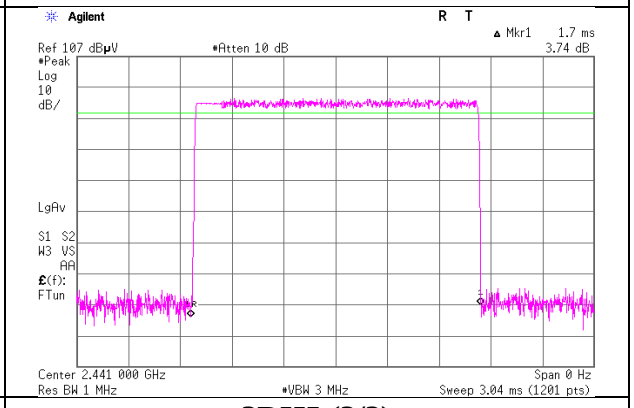

## 3DH1 (2/2)



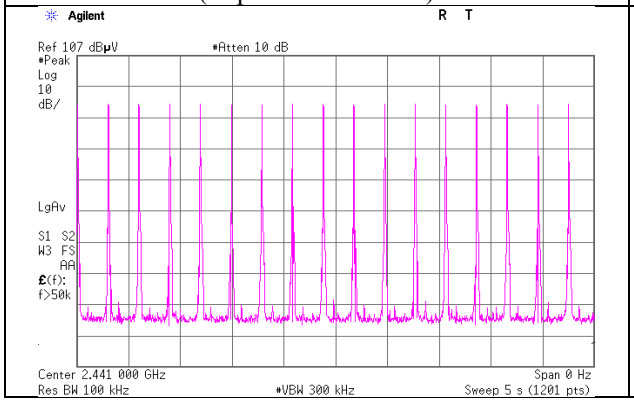

## 3DH3 (1/2)
(Representative chart)



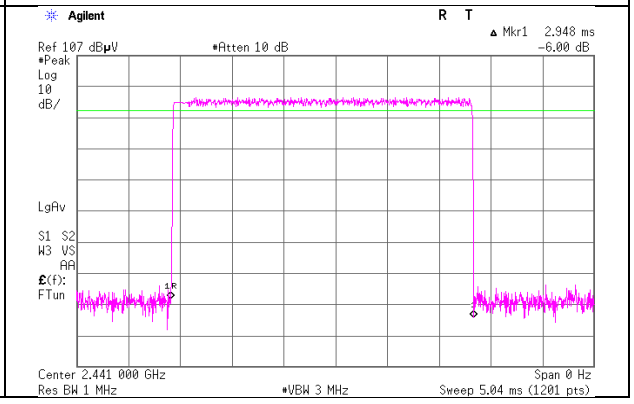

## 3DH3 (2/2)




## 3DH5 (1/2)
(Representative chart)




## 3DH5 (2/2)



# Maximum Peak Output Power

| | |
|---|---|
| Test place | Ise EMC Lab. No.11 Measurement Room |
| Report No. | 11873611H |
| Date | August 3, 2017 |
| Temperature / Humidity | 24 deg. C / 52 % RH |
| Engineer | Yuta Moriya |
| Mode | Tx, Hopping Off |

| Mode | Freq. | Reading | Cable Loss | Atten. Loss | Result | | Limit | | Margin |
|---|---|---|---|---|---|---|---|---|---|
| | [MHz] | [dBm] | [dB] | [dB] | [dBm] | [mW] | [dBm] | [mW] | [dB] |
| DH5 | 2402.0 | -13.59 | 0.80 | 10.06 | -2.73 | 0.53 | 20.96 | 125 | 23.69 |
| DH5 | 2441.0 | -10.34 | 0.80 | 10.06 | 0.52 | 1.13 | 20.96 | 125 | 20.44 |
| DH5 | 2480.0 | -10.91 | 0.80 | 10.06 | -0.05 | 0.99 | 20.96 | 125 | 21.01 |
| 2DH5 | 2402.0 | -16.07 | 0.80 | 10.06 | -5.21 | 0.30 | 20.96 | 125 | 26.17 |
| 2DH5 | 2441.0 | -12.98 | 0.80 | 10.06 | -2.12 | 0.61 | 20.96 | 125 | 23.08 |
| 2DH5 | 2480.0 | -13.47 | 0.80 | 10.06 | -2.61 | 0.55 | 20.96 | 125 | 23.57 |
| 3DH5 | 2402.0 | -15.29 | 0.80 | 10.06 | -4.43 | 0.36 | 20.96 | 125 | 25.39 |
| 3DH5 | 2441.0 | -12.41 | 0.80 | 10.06 | -1.55 | 0.70 | 20.96 | 125 | 22.51 |
| 3DH5 | 2480.0 | -12.92 | 0.80 | 10.06 | -2.06 | 0.62 | 20.96 | 125 | 23.02 |

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

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

Test was not performed at AFH mode, because the decrease of number of channel (min: 20ch) 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 20dB BW without 2/3 relaxation, 125mW power limit was applied to it.

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

| | |
|---|---|
| Test place | Ise EMC Lab. No.11 Measurement Room |
| Report No. | 11873611H |
| Date | August 3, 2017 |
| Temperature / Humidity | 24 deg. C / 52 % RH |
| Engineer | Yuta Moriya |
| Mode | Tx, Hopping Off |

| Mode | Freq. | Reading | Cable Loss | Atten. Loss | Result (Time average) | | Duty factor | Result (Burst power average) | |
|---|---|---|---|---|---|---|---|---|---|
| | [MHz] | [dBm] | [dB] | [dB] | [dBm] | [mW] | [dB] | [dBm] | [mW] |
| DH5 | 2402.0 | -15.34 | 0.80 | 10.06 | -4.48 | 0.36 | 1.04 | -3.44 | 0.45 |
| DH5 | 2441.0 | -11.95 | 0.80 | 10.06 | -1.09 | 0.78 | 1.04 | -0.05 | 0.99 |
| DH5 | 2480.0 | -12.49 | 0.80 | 10.06 | -1.63 | 0.69 | 1.04 | -0.59 | 0.87 |
| 2DH5 | 2402.0 | -20.28 | 0.80 | 10.06 | -9.42 | 0.11 | 1.01 | -8.41 | 0.14 |
| 2DH5 | 2441.0 | -17.06 | 0.80 | 10.06 | -6.20 | 0.24 | 1.01 | -5.19 | 0.30 |
| 2DH5 | 2480.0 | -17.58 | 0.80 | 10.06 | -6.72 | 0.21 | 1.01 | -5.71 | 0.27 |
| 3DH5 | 2402.0 | -20.27 | 0.80 | 10.06 | -9.41 | 0.11 | 1.02 | -8.39 | 0.14 |
| 3DH5 | 2441.0 | -17.05 | 0.80 | 10.06 | -6.19 | 0.24 | 1.02 | -5.17 | 0.30 |
| 3DH5 | 2480.0 | -17.57 | 0.80 | 10.06 | -6.71 | 0.21 | 1.02 | -5.69 | 0.27 |

Sample Calculation:
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
Result (Burst power average) = Time average + Duty factor

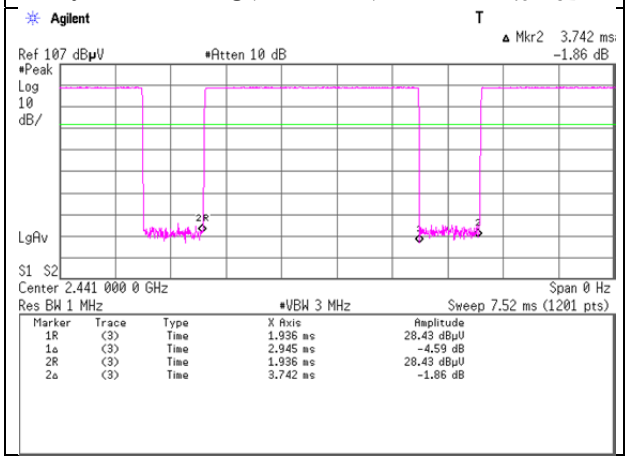
*The equipment and cables were not used for factor 0 dB of the data sheets.

# Burst Rate Confirmation

| | |
|---|---|
| Test place | Ise EMC Lab. No.11 Measurement Room |
| Report No. | 11873611H |
| Date | August 3, 2017 |
| Temperature / Humidity | 24 deg. C / 52 % RH |
| Engineer | Yuta Moriya |
| Mode | Tx, Hopping Off |

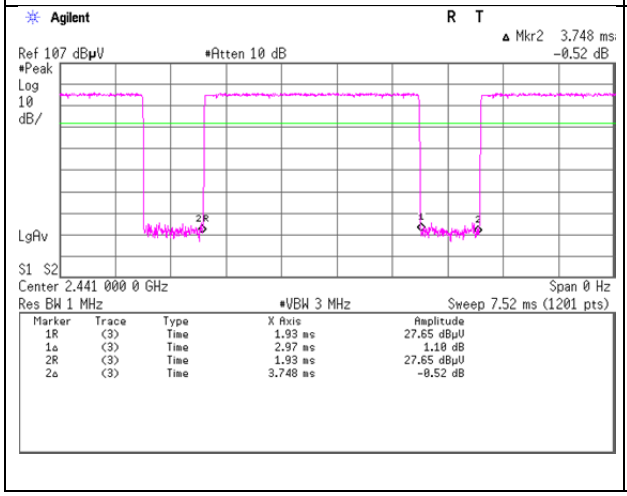
## DH5

| | |
|---|---|
| **Tx on / (Tx on + Tx off) =** | **0.787** |
| **Tx on / (Tx on + Tx off) * 100 =** | **78.7 %** |
| **Duty factor = 10 * log (3.742 / 2.945) =** | **1.04 dB** |



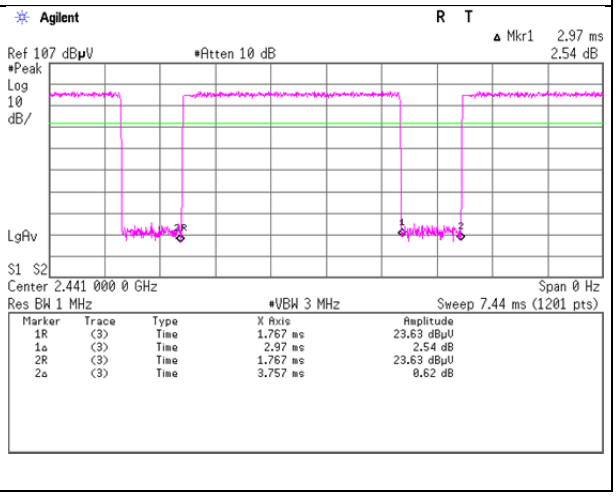

## 2DH5

| | |
|---|---|
| **Tx on / (Tx on + Tx off) =** | **0.792** |
| **Tx on / (Tx on + Tx off) * 100 =** | **79.2 %** |
| **Duty factor = 10 * log (3.748 / 2.97) =** | **1.01 dB** |




## 3DH5

| | |
|---|---|
| **Tx on / (Tx on + Tx off) =** | **0.791** |
| **Tx on / (Tx on + Tx off) * 100 =** | **79.1 %** |
| **Duty factor = 10 * log (3.757 / 2.97) =** | **1.02 dB** |



# Radiated Spurious Emission

| | | |
|---|---|---|
| Report No. | 11873611H | |
| Test place | Ise EMC Lab. | |
| Semi Anechoic Chamber | No.3 | No.3 |
| Date | July 31, 2017 Day | July 31, 2017 Night |
| Temperature / Humidity | 24 deg. C / 63 % RH | 22 deg. C / 58 % RH |
| Engineer | Tomoki Matsui | Shuichi Ohyama |
| | (1 GHz -10 GHz) | (Below 1 GHz and 10 GHz - 26.5 GHz) |
| Mode | Tx, Hopping Off, DH5 2402 MHz | |

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 46.820 | QP | 22.0 | 11.9 | 7.4 | 32.2 | 9.1 | 40.0 | 30.9 | |
| Hori | 74.200 | QP | 22.2 | 6.4 | 7.8 | 32.2 | 4.2 | 40.0 | 35.8 | |
| Hori | 150.000 | QP | 21.5 | 15.1 | 8.7 | 32.1 | 13.2 | 43.5 | 30.3 | |
| Hori | 328.000 | QP | 34.9 | 14.1 | 10.2 | 32.0 | 27.2 | 46.0 | 18.8 | |
| Hori | 336.000 | QP | 35.3 | 14.3 | 10.3 | 32.0 | 27.9 | 46.0 | 18.1 | |
| Hori | 910.660 | QP | 20.2 | 22.1 | 13.5 | 30.9 | 24.9 | 46.0 | 21.1 | |
| Hori | 2390.000 | PK | 42.5 | 27.7 | 6.8 | 32.4 | 44.6 | 73.9 | 29.3 | |
| Hori | 2557.975 | PK | 52.1 | 28.0 | 6.9 | 32.4 | 54.6 | 73.9 | 19.3 | |
| Hori | 4804.000 | PK | 45.2 | 31.6 | 9.0 | 31.4 | 54.4 | 73.9 | 19.5 | |
| Hori | 7206.000 | PK | 41.6 | 36.0 | 10.4 | 32.1 | 55.9 | 73.9 | 18.0 | Floor noise |
| Hori | 9608.000 | PK | 42.6 | 38.5 | 11.0 | 32.9 | 59.2 | 73.9 | 14.7 | Floor noise |
| Hori | 2390.000 | AV | 29.8 | 27.7 | 6.8 | 32.4 | 31.9 | 53.9 | 22.0 | |
| Hori | 2557.975 | AV | 47.6 | 28.0 | 6.9 | 32.4 | 50.1 | 53.9 | 3.8 | |
| Hori | 4804.000 | AV | 37.7 | 31.6 | 9.0 | 31.4 | 46.9 | 53.9 | 7.0 | |
| Hori | 7206.000 | AV | 29.3 | 36.0 | 10.4 | 32.1 | 43.6 | 53.9 | 10.3 | Floor noise |
| Hori | 9608.000 | AV | 30.2 | 38.5 | 11.0 | 32.9 | 46.8 | 53.9 | 7.1 | Floor noise |
| Vert | 47.907 | QP | 29.8 | 11.5 | 7.4 | 32.2 | 16.5 | 40.0 | 23.5 | |
| Vert | 74.483 | QP | 28.6 | 6.4 | 7.8 | 32.2 | 10.6 | 40.0 | 29.4 | |
| Vert | 150.000 | QP | 21.5 | 15.1 | 8.7 | 32.1 | 13.2 | 43.5 | 30.3 | |
| Vert | 328.000 | QP | 36.6 | 14.1 | 10.2 | 32.0 | 28.9 | 46.0 | 17.1 | |
| Vert | 336.000 | QP | 36.8 | 14.3 | 10.3 | 32.0 | 29.4 | 46.0 | 16.6 | |
| Vert | 911.460 | QP | 20.3 | 22.1 | 13.5 | 30.9 | 25.0 | 46.0 | 21.0 | |
| Vert | 2390.000 | PK | 42.5 | 27.7 | 6.8 | 32.4 | 44.6 | 73.9 | 29.3 | |
| Vert | 2557.975 | PK | 51.3 | 28.0 | 6.9 | 32.4 | 53.8 | 73.9 | 20.1 | |
| Vert | 4804.000 | PK | 44.6 | 31.6 | 9.0 | 31.4 | 53.8 | 73.9 | 20.1 | |
| Vert | 7206.000 | PK | 41.6 | 36.0 | 10.4 | 32.1 | 55.9 | 73.9 | 18.0 | Floor noise |
| Vert | 9608.000 | PK | 42.6 | 38.5 | 11.0 | 32.9 | 59.2 | 73.9 | 14.7 | Floor noise |
| Vert | 2390.000 | AV | 29.9 | 27.7 | 6.8 | 32.4 | 32.0 | 53.9 | 21.9 | |
| Vert | 2557.975 | AV | 46.7 | 28.0 | 6.9 | 32.4 | 49.2 | 53.9 | 4.7 | |
| Vert | 4804.000 | AV | 35.1 | 31.6 | 9.0 | 31.4 | 44.3 | 53.9 | 9.6 | |
| Vert | 7206.000 | AV | 29.3 | 36.0 | 10.4 | 32.1 | 43.6 | 53.9 | 10.3 | Floor noise |
| Vert | 9608.000 | AV | 30.2 | 38.5 | 11.0 | 32.9 | 46.8 | 53.9 | 7.1 | Floor noise |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (4.5 m / 3.0 m) = 3.53 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

***These results have sufficient margin without taking account Dwell time factor.**

**20dBc Data Sheet**

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 2402.000 | PK | 93.5 | 27.7 | 6.9 | 32.4 | 95.7 | - | - | Carrier |
| Hori | 2400.000 | PK | 40.2 | 27.7 | 6.9 | 32.4 | 42.4 | 75.7 | 33.3 | |
| Vert | 2402.000 | PK | 92.6 | 27.7 | 6.9 | 32.4 | 94.8 | - | - | Carrier |
| Vert | 2400.000 | PK | 39.9 | 27.7 | 6.9 | 32.4 | 42.1 | 74.8 | 32.7 | |

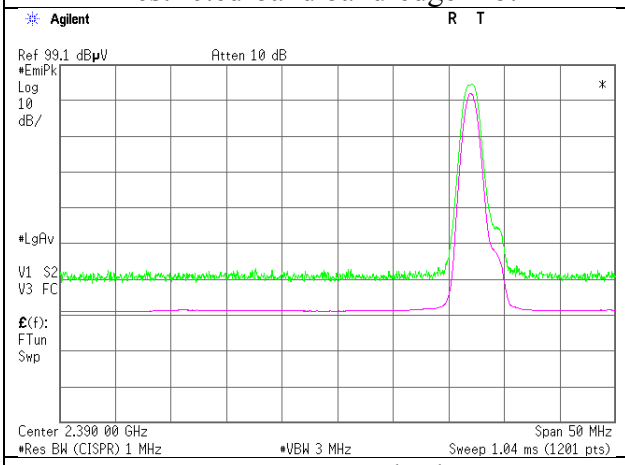
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amprifier)

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

| | |
|---|---|
| Report No. | 11873611H |
| Test place | Ise EMC Lab. |
| Semi Anechoic Chamber | No.3 |
| Date | July 31, 2017 Day |
| Temperature / Humidity | 24 deg. C / 63 % RH |
| Engineer | Tomoki Matsui<br>(1 GHz -10 GHz) |
| Mode | Tx, Hopping Off, DH5 2402 MHz |

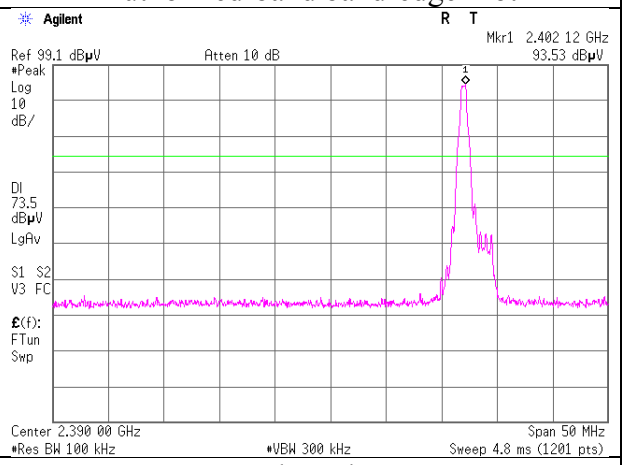
### Horizontal

**Restricted-band band-edge Plot**




Trace Green : Peak Plot
Trace Purple : Average Plot

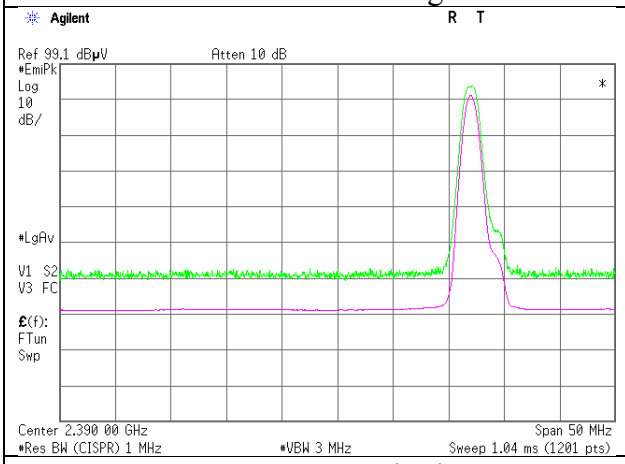
**Authorized-band band-edge Plot**




20dBc Plot

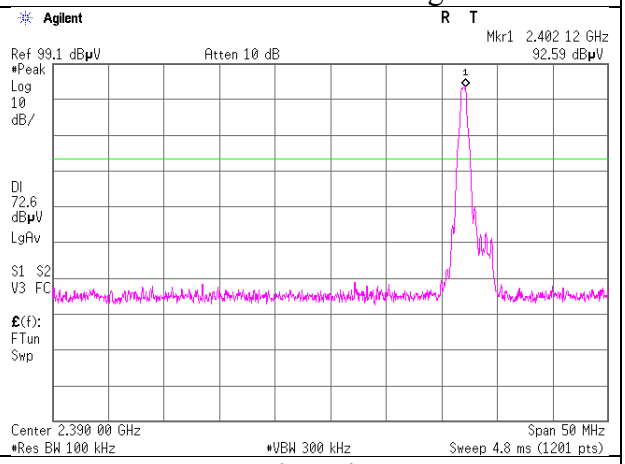
### Vertical

**Restricted-band band-edge Plot**




Trace Green : Peak Plot
Trace Purple : Average Plot

**Authorized-band band-edge Plot**




20dBc Plot

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

# Radiated Spurious Emission

| | | |
|---|---|---|
| Report No. | 11873611H | |
| Test place | Ise EMC Lab. | |
| Semi Anechoic Chamber | No.3 | No.3 |
| Date | July 31, 2017 Day | July 31, 2017 Night |
| Temperature / Humidity | 24 deg. C / 63 % RH | 22 deg. C / 58 % RH |
| Engineer | Tomoki Matsui | Shuichi Ohyama |
| | (1 GHz -10 GHz) | (Below 1 GHz and 10 GHz - 26.5 GHz) |
| Mode | Tx, Hopping Off, DH5 2441 MHz | |

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 46.150 | QP | 22.3 | 12.2 | 7.4 | 32.2 | 9.7 | 40.0 | 30.3 | |
| Hori | 71.650 | QP | 22.4 | 6.3 | 7.8 | 32.2 | 4.3 | 40.0 | 35.7 | |
| Hori | 150.000 | QP | 21.6 | 15.1 | 8.7 | 32.1 | 13.3 | 43.5 | 30.2 | |
| Hori | 328.000 | QP | 33.1 | 14.1 | 10.2 | 32.0 | 25.4 | 46.0 | 20.6 | |
| Hori | 336.000 | QP | 34.5 | 14.3 | 10.3 | 32.0 | 27.1 | 46.0 | 18.9 | |
| Hori | 942.662 | QP | 20.3 | 22.2 | 13.7 | 30.8 | 25.4 | 46.0 | 20.6 | |
| Hori | 2596.973 | PK | 50.3 | 28.1 | 7.0 | 32.3 | 53.1 | 73.9 | 20.8 | |
| Hori | 4882.000 | PK | 45.5 | 31.9 | 9.0 | 31.4 | 55.0 | 73.9 | 18.9 | |
| Hori | 7323.000 | PK | 40.6 | 36.2 | 10.3 | 32.2 | 54.9 | 73.9 | 19.0 | Floor noise |
| Hori | 9764.000 | PK | 40.3 | 38.7 | 11.1 | 33.0 | 57.1 | 73.9 | 16.8 | Floor noise |
| Hori | 2596.973 | AV | 45.5 | 28.1 | 7.0 | 32.3 | 48.3 | 53.9 | 5.6 | |
| Hori | 4882.000 | AV | 38.0 | 31.9 | 9.0 | 31.4 | 47.5 | 53.9 | 6.4 | |
| Hori | 7323.000 | AV | 28.5 | 36.2 | 10.3 | 32.2 | 42.8 | 53.9 | 11.1 | Floor noise |
| Hori | 9764.000 | AV | 28.6 | 38.7 | 11.1 | 33.0 | 45.4 | 53.9 | 8.5 | Floor noise |
| Vert | 48.417 | QP | 29.9 | 11.4 | 7.4 | 32.2 | 16.5 | 40.0 | 23.5 | |
| Vert | 73.917 | QP | 28.7 | 6.4 | 7.8 | 32.2 | 10.7 | 40.0 | 29.3 | |
| Vert | 150.000 | QP | 21.5 | 15.1 | 8.7 | 32.1 | 13.2 | 43.5 | 30.3 | |
| Vert | 328.000 | QP | 34.3 | 14.1 | 10.2 | 32.0 | 26.6 | 46.0 | 19.4 | |
| Vert | 336.000 | QP | 36.6 | 14.3 | 10.3 | 32.0 | 29.2 | 46.0 | 16.8 | |
| Vert | 933.329 | QP | 20.3 | 22.2 | 13.7 | 30.8 | 25.4 | 46.0 | 20.6 | |
| Vert | 2596.973 | PK | 48.6 | 28.1 | 7.0 | 32.3 | 51.4 | 73.9 | 22.5 | |
| Vert | 4882.000 | PK | 44.3 | 31.9 | 9.0 | 31.4 | 53.8 | 73.9 | 20.1 | |
| Vert | 7323.000 | PK | 40.6 | 36.2 | 10.3 | 32.2 | 54.9 | 73.9 | 19.0 | Floor noise |
| Vert | 9764.000 | PK | 40.3 | 38.7 | 11.1 | 33.0 | 57.1 | 73.9 | 16.8 | Floor noise |
| Vert | 2596.973 | AV | 42.6 | 28.1 | 7.0 | 32.3 | 45.4 | 53.9 | 8.5 | |
| Vert | 4882.000 | AV | 36.8 | 31.9 | 9.0 | 31.4 | 46.3 | 53.9 | 7.6 | |
| Vert | 7323.000 | AV | 28.5 | 36.2 | 10.3 | 32.2 | 42.8 | 53.9 | 11.1 | Floor noise |
| Vert | 9764.000 | AV | 28.6 | 38.7 | 11.1 | 33.0 | 45.4 | 53.9 | 8.5 | Floor noise |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (4.5 m / 3.0 m) = 3.53 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

# Radiated Spurious Emission

| | | |
|---|---|---|
| Report No. | 11873611H | |
| Test place | Ise EMC Lab. | |
| Semi Anechoic Chamber | No.3 | No.3 |
| Date | July 31, 2017 Day | July 31, 2017 Night |
| Temperature / Humidity | 24 deg. C / 63 % RH | 22 deg. C / 58 % RH |
| Engineer | Tomoki Matsui | Shuichi Ohyama |
| | (1 GHz -10 GHz) | (Below 1 GHz and 10 GHz - 26.5 GHz) |
| Mode | Tx, Hopping Off, DH5 2480 MHz | |

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 45.583 | QP | 22.5 | 12.4 | 7.4 | 32.2 | 10.1 | 40.0 | 29.9 | |
| Hori | 75.617 | QP | 22.3 | 6.5 | 7.9 | 32.2 | 4.5 | 40.0 | 35.5 | |
| Hori | 150.000 | QP | 21.5 | 15.1 | 8.7 | 32.1 | 13.2 | 43.5 | 30.3 | |
| Hori | 328.000 | QP | 32.2 | 14.1 | 10.2 | 32.0 | 24.5 | 46.0 | 21.5 | |
| Hori | 336.000 | QP | 34.3 | 14.3 | 10.3 | 32.0 | 26.9 | 46.0 | 19.1 | |
| Hori | 927.995 | QP | 20.3 | 22.2 | 13.6 | 30.8 | 25.3 | 46.0 | 20.7 | |
| Hori | 2483.500 | PK | 44.4 | 27.8 | 6.9 | 32.4 | 46.7 | 73.9 | 27.2 | |
| Hori | 2636.000 | PK | 46.9 | 28.2 | 7.0 | 32.3 | 49.8 | 73.9 | 24.1 | |
| Hori | 4960.000 | PK | 42.6 | 32.1 | 9.1 | 31.3 | 52.5 | 73.9 | 21.4 | |
| Hori | 7440.000 | PK | 41.1 | 36.4 | 10.3 | 32.2 | 55.6 | 73.9 | 18.3 | Floor noise |
| Hori | 9920.000 | PK | 41.4 | 38.9 | 11.1 | 33.1 | 58.3 | 73.9 | 15.6 | Floor noise |
| Hori | 2483.500 | AV | 31.1 | 27.8 | 6.9 | 32.4 | 33.4 | 53.9 | 20.5 | |
| Hori | 2636.000 | AV | 40.6 | 28.2 | 7.0 | 32.3 | 43.5 | 53.9 | 10.4 | |
| Hori | 4960.000 | AV | 33.5 | 32.1 | 9.1 | 31.3 | 43.4 | 53.9 | 10.5 | |
| Hori | 7440.000 | AV | 28.6 | 36.4 | 10.3 | 32.2 | 43.1 | 53.9 | 10.8 | Floor noise |
| Hori | 9920.000 | AV | 28.5 | 38.9 | 11.1 | 33.1 | 45.4 | 53.9 | 8.5 | Floor noise |
| Vert | 48.983 | QP | 29.2 | 11.2 | 7.5 | 32.2 | 15.7 | 40.0 | 24.3 | |
| Vert | 74.200 | QP | 28.5 | 6.4 | 7.8 | 32.2 | 10.5 | 40.0 | 29.5 | |
| Vert | 150.000 | QP | 21.6 | 15.1 | 8.7 | 32.1 | 13.3 | 43.5 | 30.2 | |
| Vert | 328.000 | QP | 34.1 | 14.1 | 10.2 | 32.0 | 26.4 | 46.0 | 19.6 | |
| Vert | 336.000 | QP | 36.0 | 14.3 | 10.3 | 32.0 | 28.6 | 46.0 | 17.4 | |
| Vert | 938.662 | QP | 20.3 | 22.2 | 13.7 | 30.8 | 25.4 | 46.0 | 20.6 | |
| Vert | 2483.500 | PK | 43.6 | 27.8 | 6.9 | 32.4 | 45.9 | 73.9 | 28.0 | |
| Vert | 2636.000 | PK | 47.5 | 28.2 | 7.0 | 32.3 | 50.4 | 73.9 | 23.5 | |
| Vert | 4960.000 | PK | 43.3 | 32.1 | 9.1 | 31.3 | 53.2 | 73.9 | 20.7 | |
| Vert | 7440.000 | PK | 41.1 | 36.4 | 10.3 | 32.2 | 55.6 | 73.9 | 18.3 | Floor noise |
| Vert | 9920.000 | PK | 41.4 | 38.9 | 11.1 | 33.1 | 58.3 | 73.9 | 15.6 | Floor noise |
| Vert | 2483.500 | AV | 31.1 | 27.8 | 6.9 | 32.4 | 33.4 | 53.9 | 20.5 | |
| Vert | 2636.000 | AV | 41.6 | 28.2 | 7.0 | 32.3 | 44.5 | 53.9 | 9.4 | |
| Vert | 4960.000 | AV | 34.5 | 32.1 | 9.1 | 31.3 | 44.4 | 53.9 | 9.5 | |
| Vert | 7440.000 | AV | 28.6 | 36.4 | 10.3 | 32.2 | 43.1 | 53.9 | 10.8 | Floor noise |
| Vert | 9920.000 | AV | 28.5 | 38.9 | 11.1 | 33.1 | 45.4 | 53.9 | 8.5 | Floor noise |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

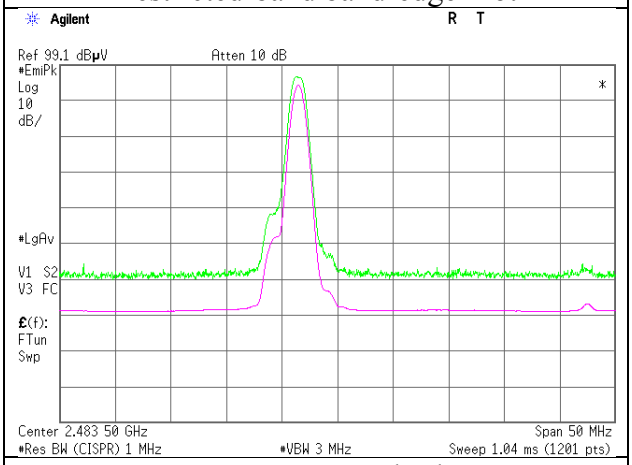
Distance factor: 1 GHz - 10 GHz 20log (4.5 m / 3.0 m) = 3.53 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

| | |
|---|---|
| Report No. | 11873611H |
| Test place | Ise EMC Lab. |
| Semi Anechoic Chamber | No.3 |
| Date | July 31, 2017 Day |
| Temperature / Humidity | 24 deg. C / 63 % RH |
| Engineer | Tomoki Matsui<br>(1 GHz -10 GHz) |
| Mode | Tx, Hopping Off, DH5 2480 MHz |

Horizontal

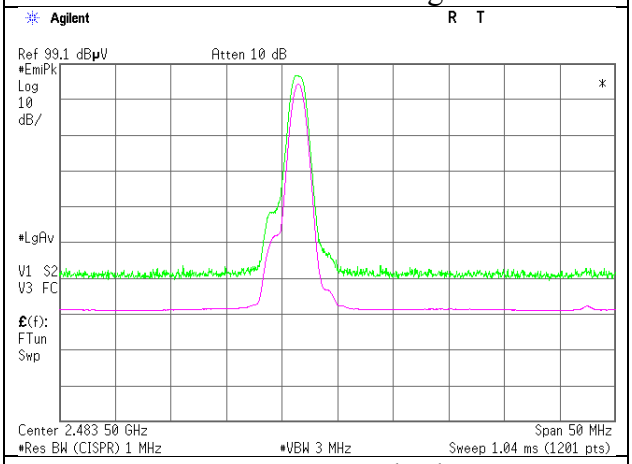
Restricted-band band-edge Plot




Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot




Trace Green : Peak Plot
Trace Purple : Average Plot

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

# Radiated Spurious Emission

| | | |
|---|---|---|
| Report No. | 11873611H | |
| Test place | Ise EMC Lab. | |
| Semi Anechoic Chamber | No.3 | No.3 |
| Date | July 31, 2017 Day | July 31, 2017 Night |
| Temperature / Humidity | 24 deg. C / 63 % RH | 22 deg. C / 58 % RH |
| Engineer | Tomoki Matsui | Shuichi Ohyama |
| | (1 GHz -10 GHz) | (Below 1 GHz and 10 GHz - 26.5 GHz) |
| Mode | Tx, Hopping Off, 3DH5 2402 MHz | |

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 49.267 | QP | 21.9 | 11.1 | 7.5 | 32.2 | 8.3 | 40.0 | 31.7 | |
| Hori | 76.750 | QP | 22.2 | 6.6 | 7.9 | 32.2 | 4.5 | 40.0 | 35.5 | |
| Hori | 150.000 | QP | 21.5 | 15.1 | 8.7 | 32.1 | 13.2 | 43.5 | 30.3 | |
| Hori | 328.000 | QP | 34.8 | 14.1 | 10.2 | 32.0 | 27.1 | 46.0 | 18.9 | |
| Hori | 336.000 | QP | 34.3 | 14.3 | 10.3 | 32.0 | 26.9 | 46.0 | 19.1 | |
| Hori | 922.662 | QP | 20.3 | 22.2 | 13.6 | 30.9 | 25.2 | 46.0 | 20.8 | |
| Hori | 2390.000 | PK | 42.6 | 27.7 | 6.8 | 32.4 | 44.7 | 73.9 | 29.2 | |
| Hori | 2557.975 | PK | 50.2 | 28.0 | 6.9 | 32.4 | 52.7 | 73.9 | 21.2 | |
| Hori | 4804.000 | PK | 40.9 | 31.6 | 9.0 | 31.4 | 50.1 | 73.9 | 23.8 | Floor noise |
| Hori | 7206.000 | PK | 41.6 | 36.0 | 10.4 | 32.1 | 55.9 | 73.9 | 18.0 | Floor noise |
| Hori | 9608.000 | PK | 42.6 | 38.5 | 11.0 | 32.9 | 59.2 | 73.9 | 14.7 | Floor noise |
| Hori | 2390.000 | AV | 29.9 | 27.7 | 6.8 | 32.4 | 32.0 | 53.9 | 21.9 | |
| Hori | 2557.975 | AV | 42.9 | 28.0 | 6.9 | 32.4 | 45.4 | 53.9 | 8.5 | |
| Hori | 4804.000 | AV | 29.8 | 31.6 | 9.0 | 31.4 | 39.0 | 53.9 | 14.9 | Floor noise |
| Hori | 7206.000 | AV | 29.3 | 36.0 | 10.4 | 32.1 | 43.6 | 53.9 | 10.3 | Floor noise |
| Hori | 9608.000 | AV | 30.2 | 38.5 | 11.0 | 32.9 | 46.8 | 53.9 | 7.1 | Floor noise |
| Vert | 48.983 | QP | 29.1 | 11.2 | 7.5 | 32.2 | 15.6 | 40.0 | 24.4 | |
| Vert | 74.483 | QP | 27.8 | 6.4 | 7.8 | 32.2 | 9.8 | 40.0 | 30.2 | |
| Vert | 150.000 | QP | 21.5 | 15.1 | 8.7 | 32.1 | 13.2 | 43.5 | 30.3 | |
| Vert | 328.000 | QP | 36.0 | 14.1 | 10.2 | 32.0 | 28.3 | 46.0 | 17.7 | |
| Vert | 336.000 | QP | 36.4 | 14.3 | 10.3 | 32.0 | 29.0 | 46.0 | 17.0 | |
| Vert | 917.329 | QP | 20.3 | 22.2 | 13.6 | 30.9 | 25.2 | 46.0 | 20.8 | |
| Vert | 2390.000 | PK | 42.5 | 27.7 | 6.8 | 32.4 | 44.6 | 73.9 | 29.3 | |
| Vert | 2557.975 | PK | 48.7 | 28.0 | 6.9 | 32.4 | 51.2 | 73.9 | 22.7 | |
| Vert | 4804.000 | PK | 40.9 | 31.6 | 9.0 | 31.4 | 50.1 | 73.9 | 23.8 | Floor noise |
| Vert | 7206.000 | PK | 41.6 | 36.0 | 10.4 | 32.1 | 55.9 | 73.9 | 18.0 | Floor noise |
| Vert | 9608.000 | PK | 42.6 | 38.5 | 11.0 | 32.9 | 59.2 | 73.9 | 14.7 | Floor noise |
| Vert | 2390.000 | AV | 29.8 | 27.7 | 6.8 | 32.4 | 31.9 | 53.9 | 22.0 | |
| Vert | 2557.975 | AV | 41.4 | 28.0 | 6.9 | 32.4 | 43.9 | 53.9 | 10.0 | |
| Vert | 4804.000 | AV | 28.7 | 31.6 | 9.0 | 31.4 | 37.9 | 53.9 | 16.0 | Floor noise |
| Vert | 7206.000 | AV | 29.3 | 36.0 | 10.4 | 32.1 | 43.6 | 53.9 | 10.3 | Floor noise |
| Vert | 9608.000 | AV | 30.2 | 38.5 | 11.0 | 32.9 | 46.8 | 53.9 | 7.1 | Floor noise |

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

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

Distance factor: 1 GHz - 10 GHz 20log (4.5 m / 3.0 m) = 3.53 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

**20dBc Data Sheet**

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 2402.000 | PK | 89.1 | 27.7 | 6.9 | 32.4 | 91.3 | - | - | Carrier |
| Hori | 2400.000 | PK | 45.9 | 27.7 | 6.9 | 32.4 | 48.1 | 71.3 | 23.2 | |
| Vert | 2402.000 | PK | 88.3 | 27.7 | 6.9 | 32.4 | 90.5 | - | - | Carrier |
| Vert | 2400.000 | PK | 45.3 | 27.7 | 6.9 | 32.4 | 47.5 | 70.5 | 23.0 | |

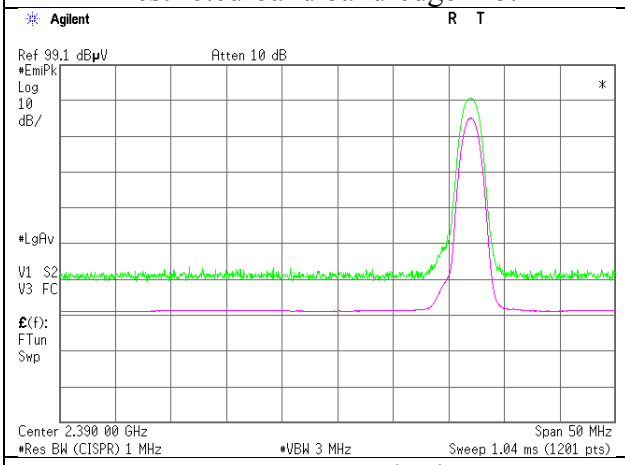
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amprifier)

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

| | |
|---|---|
| Report No. | 11873611H |
| Test place | Ise EMC Lab. |
| Semi Anechoic Chamber | No.3 |
| Date | July 31, 2017 Day |
| Temperature / Humidity | 24 deg. C / 63 % RH |
| Engineer | Tomoki Matsui<br>(1 GHz -10 GHz) |
| Mode | Tx, Hopping Off, 3DH5 2402 MHz |

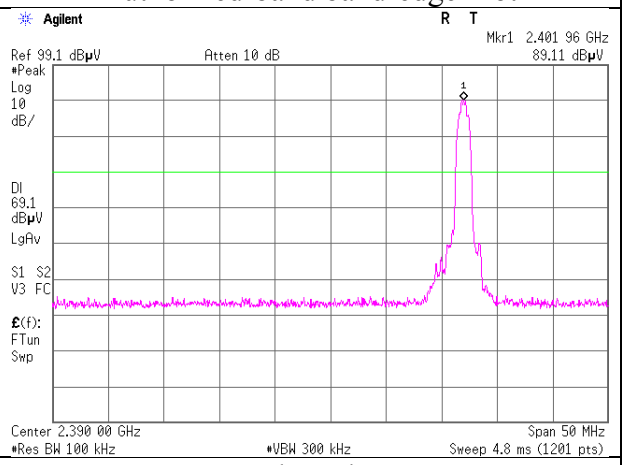
### Horizontal

**Restricted-band band-edge Plot**




Trace Green : Peak Plot
Trace Purple : Average Plot

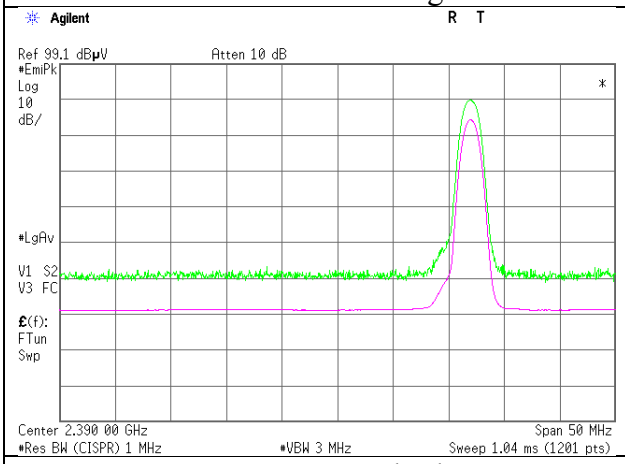
**Authorized-band band-edge Plot**




20dBc Plot

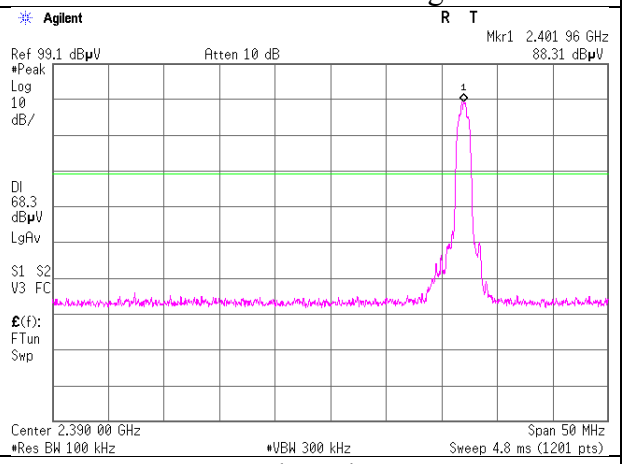
### Vertical

**Restricted-band band-edge Plot**




Trace Green : Peak Plot
Trace Purple : Average Plot

**Authorized-band band-edge Plot**




20dBc Plot

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

# Radiated Spurious Emission

| | | |
|---|---|---|
| Report No. | 11873611H | |
| Test place | Ise EMC Lab. | |
| Semi Anechoic Chamber | No.3 | No.3 |
| Date | July 31, 2017 Day | July 31, 2017 Night |
| Temperature / Humidity | 24 deg. C / 63 % RH | 22 deg. C / 58 % RH |
| Engineer | Tomoki Matsui | Shuichi Ohyama |
| | (1 GHz -10 GHz) | (Below 1 GHz and 10 GHz - 26.5 GHz) |
| Mode | Tx, Hopping Off, 3DH5 2441 MHz | |

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 49.267 | QP | 22.2 | 11.1 | 7.5 | 32.2 | 8.6 | 40.0 | 31.4 | |
| Hori | 76.467 | QP | 22.4 | 6.6 | 7.9 | 32.2 | 4.7 | 40.0 | 35.3 | |
| Hori | 150.000 | QP | 21.6 | 15.1 | 8.7 | 32.1 | 13.3 | 43.5 | 30.2 | |
| Hori | 328.000 | QP | 34.8 | 14.1 | 10.2 | 32.0 | 27.1 | 46.0 | 18.9 | |
| Hori | 336.000 | QP | 34.9 | 14.3 | 10.3 | 32.0 | 27.5 | 46.0 | 18.5 | |
| Hori | 947.995 | QP | 20.5 | 22.2 | 13.7 | 30.7 | 25.7 | 46.0 | 20.3 | |
| Hori | 2596.973 | PK | 47.6 | 28.1 | 7.0 | 32.3 | 50.4 | 73.9 | 23.5 | |
| Hori | 4882.000 | PK | 39.7 | 31.9 | 9.0 | 31.4 | 49.2 | 73.9 | 24.7 | Floor noise |
| Hori | 7323.000 | PK | 40.6 | 36.2 | 10.3 | 32.2 | 54.9 | 73.9 | 19.0 | Floor noise |
| Hori | 9764.000 | PK | 40.3 | 38.7 | 11.1 | 33.0 | 57.1 | 73.9 | 16.8 | Floor noise |
| Hori | 2596.973 | AV | 40.1 | 28.1 | 7.0 | 32.3 | 42.9 | 53.9 | 11.0 | |
| Hori | 4882.000 | AV | 27.7 | 31.9 | 9.0 | 31.4 | 37.2 | 53.9 | 16.7 | Floor noise |
| Hori | 7323.000 | AV | 28.5 | 36.2 | 10.3 | 32.2 | 42.8 | 53.9 | 11.1 | Floor noise |
| Hori | 9764.000 | AV | 28.6 | 38.7 | 11.1 | 33.0 | 45.4 | 53.9 | 8.5 | Floor noise |
| Vert | 47.283 | QP | 29.3 | 11.8 | 7.4 | 32.2 | 16.3 | 40.0 | 23.7 | |
| Vert | 71.933 | QP | 27.2 | 6.3 | 7.8 | 32.2 | 9.1 | 40.0 | 30.9 | |
| Vert | 150.000 | QP | 21.6 | 15.1 | 8.7 | 32.1 | 13.3 | 43.5 | 30.2 | |
| Vert | 328.000 | QP | 36.0 | 14.1 | 10.2 | 32.0 | 28.3 | 46.0 | 17.7 | |
| Vert | 336.000 | QP | 37.1 | 14.3 | 10.3 | 32.0 | 29.7 | 46.0 | 16.3 | |
| Vert | 937.329 | QP | 20.3 | 22.2 | 13.7 | 30.8 | 25.4 | 46.0 | 20.6 | |
| Vert | 2596.973 | PK | 47.4 | 28.1 | 7.0 | 32.3 | 50.2 | 73.9 | 23.7 | |
| Vert | 4882.000 | PK | 39.7 | 31.9 | 9.0 | 31.4 | 49.2 | 73.9 | 24.7 | Floor noise |
| Vert | 7323.000 | PK | 40.6 | 36.2 | 10.3 | 32.2 | 54.9 | 73.9 | 19.0 | Floor noise |
| Vert | 9764.000 | PK | 40.3 | 38.7 | 11.1 | 33.0 | 57.1 | 73.9 | 16.8 | Floor noise |
| Vert | 2596.973 | AV | 39.8 | 28.1 | 7.0 | 32.3 | 42.6 | 53.9 | 11.3 | |
| Vert | 4882.000 | AV | 27.7 | 31.9 | 9.0 | 31.4 | 37.2 | 53.9 | 16.7 | Floor noise |
| Vert | 7323.000 | AV | 28.5 | 36.2 | 10.3 | 32.2 | 42.8 | 53.9 | 11.1 | Floor noise |
| Vert | 9764.000 | AV | 28.6 | 38.7 | 11.1 | 33.0 | 45.4 | 53.9 | 8.5 | Floor noise |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (4.5 m / 3.0 m) = 3.53 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

# Radiated Spurious Emission

| | | |
|---|---|---|
| Report No. | 11873611H | |
| Test place | Ise EMC Lab. | |
| Semi Anechoic Chamber | No.3 | No.3 |
| Date | July 31, 2017 Day | July 31, 2017 Night |
| Temperature / Humidity | 24 deg. C / 63 % RH | 22 deg. C / 58 % RH |
| Engineer | Tomoki Matsui | Shuichi Ohyama |
| | (1 GHz -10 GHz) | (Below 1 GHz and 10 GHz - 26.5 GHz) |
| Mode | Tx, Hopping Off, 3DH5 2480 MHz | |

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 46.717 | QP | 22.1 | 12.0 | 7.4 | 32.2 | 9.3 | 40.0 | 30.7 | |
| Hori | 73.350 | QP | 22.4 | 6.4 | 7.8 | 32.2 | 4.4 | 40.0 | 35.6 | |
| Hori | 150.000 | QP | 21.5 | 15.1 | 8.7 | 32.1 | 13.2 | 43.5 | 30.3 | |
| Hori | 328.000 | QP | 34.3 | 14.1 | 10.2 | 32.0 | 26.6 | 46.0 | 19.4 | |
| Hori | 336.000 | QP | 35.0 | 14.3 | 10.3 | 32.0 | 27.6 | 46.0 | 18.4 | |
| Hori | 939.995 | QP | 20.4 | 22.2 | 13.7 | 30.8 | 25.5 | 46.0 | 20.5 | |
| Hori | 2483.500 | PK | 43.0 | 27.8 | 6.9 | 32.4 | 45.3 | 73.9 | 28.6 | |
| Hori | 2636.000 | PK | 45.7 | 28.2 | 7.0 | 32.3 | 48.6 | 73.9 | 25.3 | |
| Hori | 4960.000 | PK | 39.6 | 32.1 | 9.1 | 31.3 | 49.5 | 73.9 | 24.4 | Floor noise |
| Hori | 7440.000 | PK | 41.1 | 36.4 | 10.3 | 32.2 | 55.6 | 73.9 | 18.3 | Floor noise |
| Hori | 9920.000 | PK | 41.4 | 38.9 | 11.1 | 33.1 | 58.3 | 73.9 | 15.6 | Floor noise |
| Hori | 2483.500 | AV | 30.7 | 27.8 | 6.9 | 32.4 | 33.0 | 53.9 | 20.9 | |
| Hori | 2636.000 | AV | 37.2 | 28.2 | 7.0 | 32.3 | 40.1 | 53.9 | 13.8 | |
| Hori | 4960.000 | AV | 27.9 | 32.1 | 9.1 | 31.3 | 37.8 | 53.9 | 16.1 | Floor noise |
| Hori | 7440.000 | AV | 28.6 | 36.4 | 10.3 | 32.2 | 43.1 | 53.9 | 10.8 | Floor noise |
| Hori | 9920.000 | AV | 28.5 | 38.9 | 11.1 | 33.1 | 45.4 | 53.9 | 8.5 | Floor noise |
| Vert | 46.717 | QP | 29.5 | 12.0 | 7.4 | 32.2 | 16.7 | 40.0 | 23.3 | |
| Vert | 73.633 | QP | 28.6 | 6.4 | 7.8 | 32.2 | 10.6 | 40.0 | 29.4 | |
| Vert | 150.000 | QP | 21.6 | 15.1 | 8.7 | 32.1 | 13.3 | 43.5 | 30.2 | |
| Vert | 328.000 | QP | 36.0 | 14.1 | 10.2 | 32.0 | 28.3 | 46.0 | 17.7 | |
| Vert | 336.000 | QP | 36.8 | 14.3 | 10.3 | 32.0 | 29.4 | 46.0 | 16.6 | |
| Vert | 918.662 | QP | 20.5 | 22.2 | 13.6 | 30.9 | 25.4 | 46.0 | 20.6 | |
| Vert | 2483.500 | PK | 42.7 | 27.8 | 6.9 | 32.4 | 45.0 | 73.9 | 28.9 | |
| Vert | 2636.000 | PK | 45.5 | 28.2 | 7.0 | 32.3 | 48.4 | 73.9 | 25.5 | |
| Vert | 4960.000 | PK | 39.6 | 32.1 | 9.1 | 31.3 | 49.5 | 73.9 | 24.4 | Floor noise |
| Vert | 7440.000 | PK | 41.1 | 36.4 | 10.3 | 32.2 | 55.6 | 73.9 | 18.3 | Floor noise |
| Vert | 9920.000 | PK | 41.4 | 38.9 | 11.1 | 33.1 | 58.3 | 73.9 | 15.6 | Floor noise |
| Vert | 2483.500 | AV | 30.6 | 27.8 | 6.9 | 32.4 | 32.9 | 53.9 | 21.0 | |
| Vert | 2636.000 | AV | 36.7 | 28.2 | 7.0 | 32.3 | 39.6 | 53.9 | 14.3 | |
| Vert | 4960.000 | AV | 27.9 | 32.1 | 9.1 | 31.3 | 37.8 | 53.9 | 16.1 | Floor noise |
| Vert | 7440.000 | AV | 28.6 | 36.4 | 10.3 | 32.2 | 43.1 | 53.9 | 10.8 | Floor noise |
| Vert | 9920.000 | AV | 28.5 | 38.9 | 11.1 | 33.1 | 45.4 | 53.9 | 8.5 | Floor noise |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

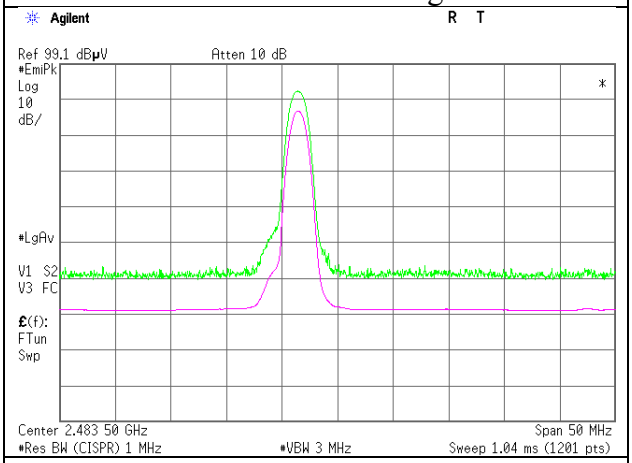
Distance factor: 1 GHz - 10 GHz 20log (4.5 m / 3.0 m) = 3.53 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

| | |
|---|---|
| Report No. | 11873611H |
| Test place | Ise EMC Lab. |
| Semi Anechoic Chamber | No.3 |
| Date | July 31, 2017 Day |
| Temperature / Humidity | 24 deg. C / 63 % RH |
| Engineer | Tomoki Matsui<br>(1 GHz -10 GHz) |
| Mode | Tx, Hopping Off, 3DH5 2480 MHz |

Horizontal

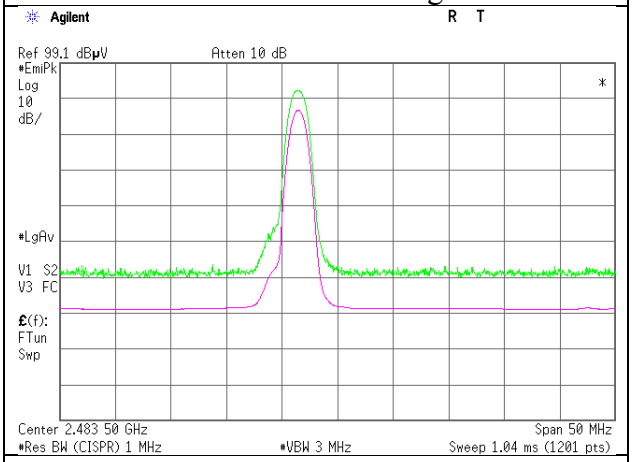
Restricted-band band-edge Plot




Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot

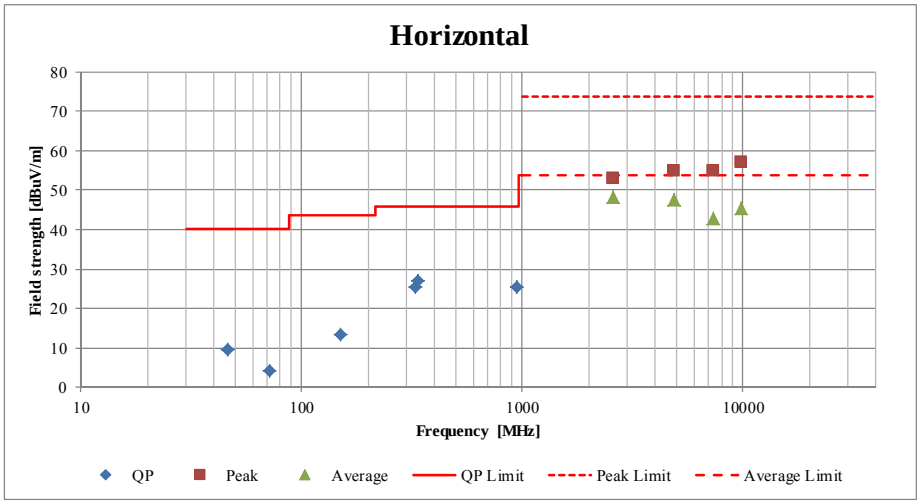


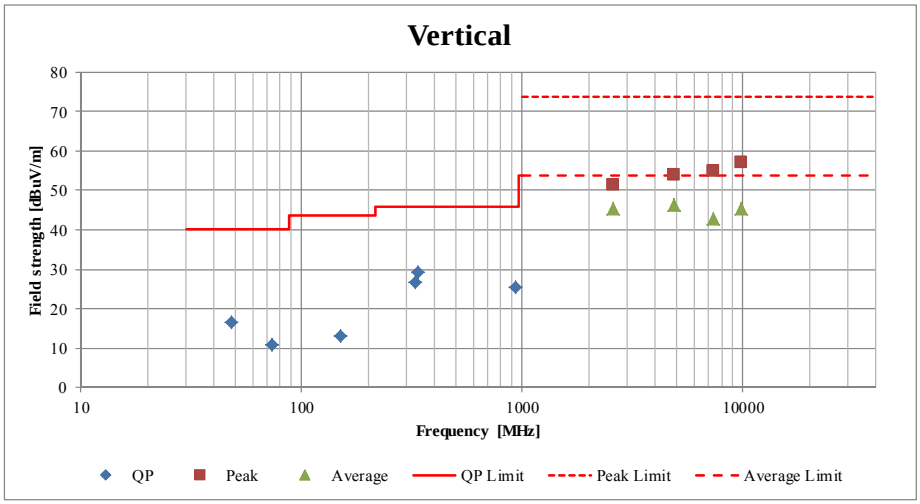

Trace Green : Peak Plot
Trace Purple : Average Plot

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

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

| | | |
|---|---|---|
| Report No. | 11873611H | |
| Test place | Ise EMC Lab. | |
| Semi Anechoic Chamber | No.3 | No.3 |
| Date | July 31, 2017 Day | July 31, 2017 Night |
| Temperature / Humidity | 24 deg. C / 63 % RH | 22 deg. C / 58 % RH |
| Engineer | Tomoki Matsui | Shuichi Ohyama |
| | (1 GHz -10 GHz) | (Below 1 GHz and 10 GHz - 26.5 GHz) |
| Mode | Tx, Hopping Off, DH5 2441 MHz | |



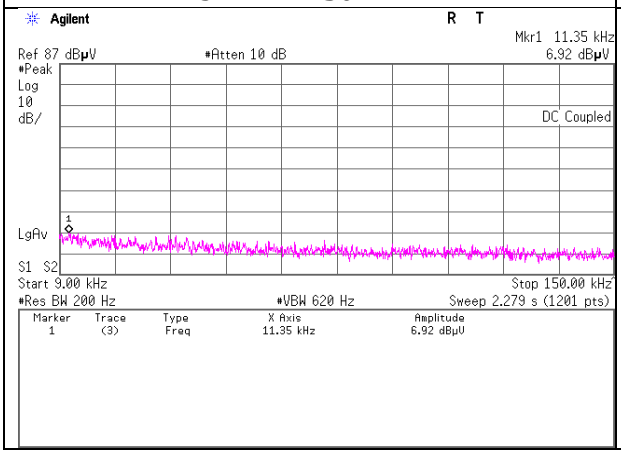

*These plots data contains sufficient number to show the trend of characteristic features for EUT.

# Conducted Spurious Emission

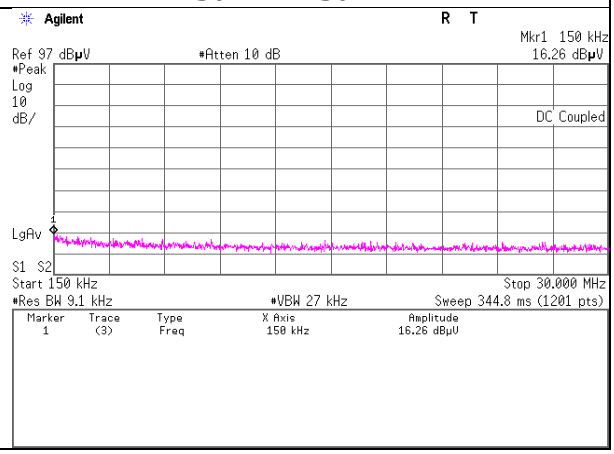
| | |
|---|---|
| Test place | Ise EMC Lab. No.11 Measurement Room |
| Report No. | 11873611H |
| Date | August 3, 2017 |
| Temperature / Humidity | 24 deg. C / 52 % RH |
| Engineer | Yuta Moriya |
| Mode | Tx, Hopping Off, DH5 |

## 2402 MHz

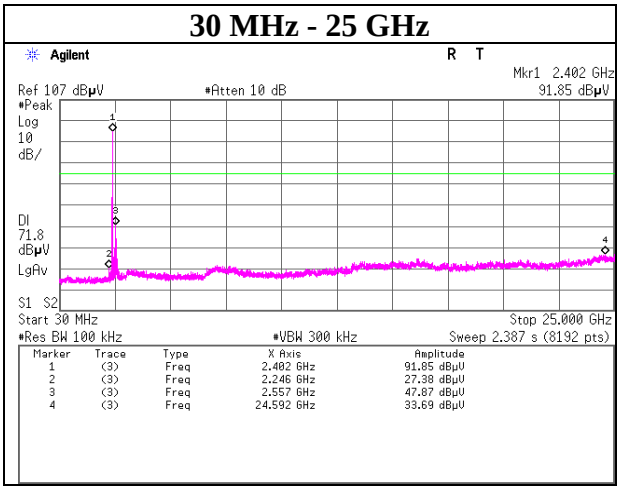
### 9 kHz - 150 kHz




### 150 kHz - 30 MHz




### 30 MHz - 25 GHz

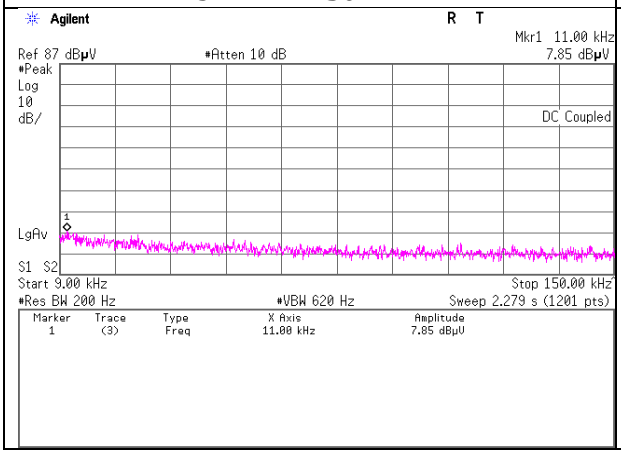


# Conducted Spurious Emission

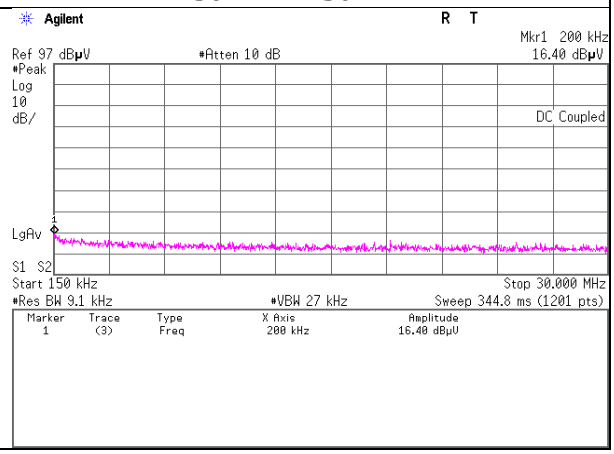
| | |
|---|---|
| Test place | Ise EMC Lab. No.11 Measurement Room |
| Report No. | 11873611H |
| Date | August 3, 2017 |
| Temperature / Humidity | 24 deg. C / 52 % RH |
| Engineer | Yuta Moriya |
| Mode | Tx, Hopping Off, DH5 |

## 2441 MHz

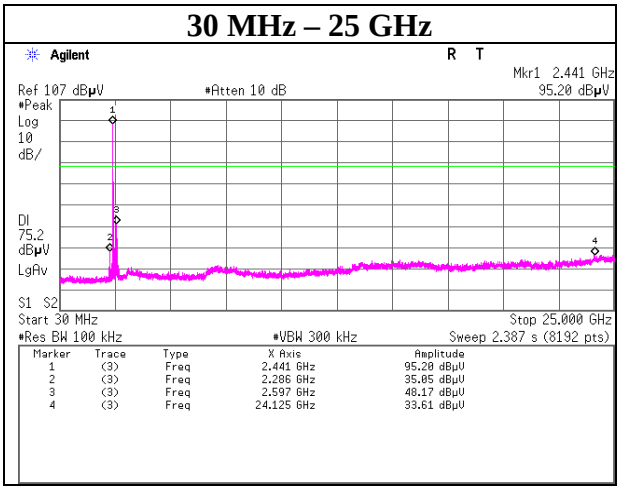
### 9 kHz – 150 kHz




### 150 kHz – 30 MHz




### 30 MHz – 25 GHz

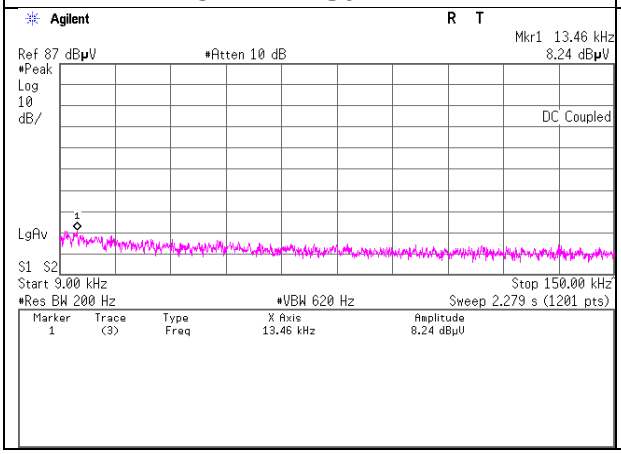


# Conducted Spurious Emission

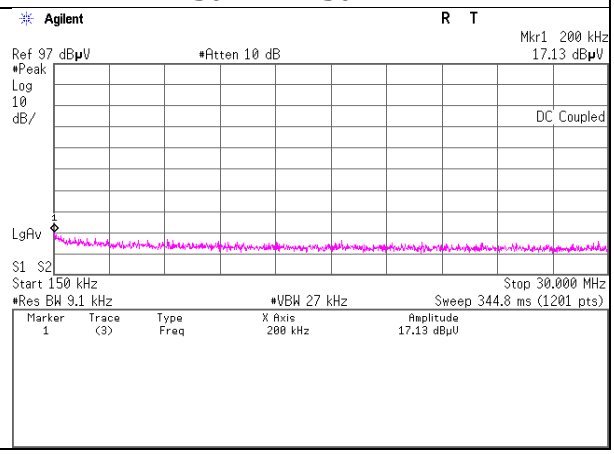
| | |
|---|---|
| Test place | Ise EMC Lab. No.11 Measurement Room |
| Report No. | 11873611H |
| Date | August 3, 2017 |
| Temperature / Humidity | 24 deg. C / 52 % RH |
| Engineer | Yuta Moriya |
| Mode | Tx, Hopping Off, DH5 |

## 2480 MHz

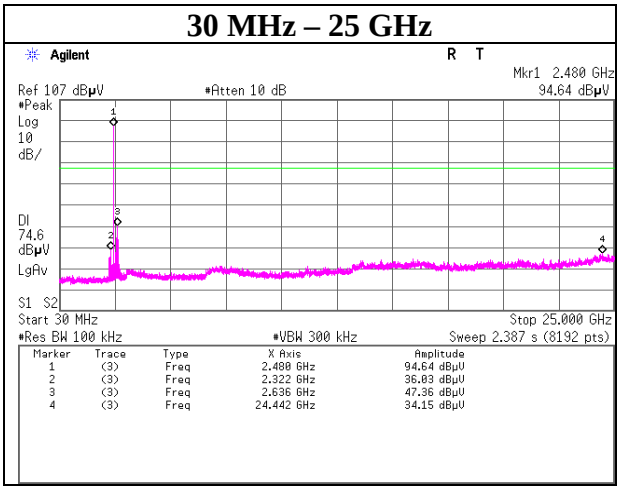
### 9 kHz – 150 kHz




### 150 kHz – 30 MHz




### 30 MHz – 25 GHz

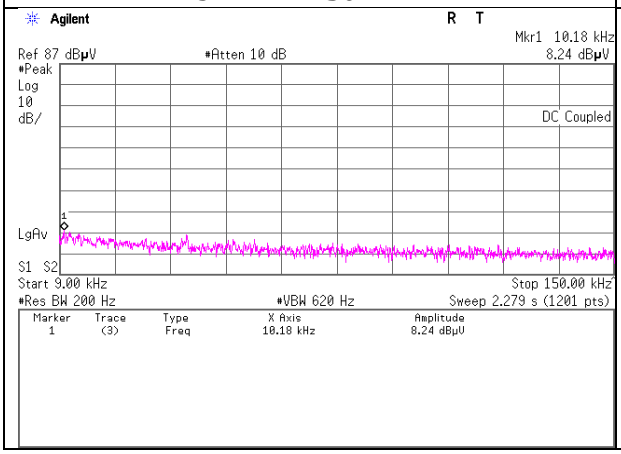


# Conducted Spurious Emission

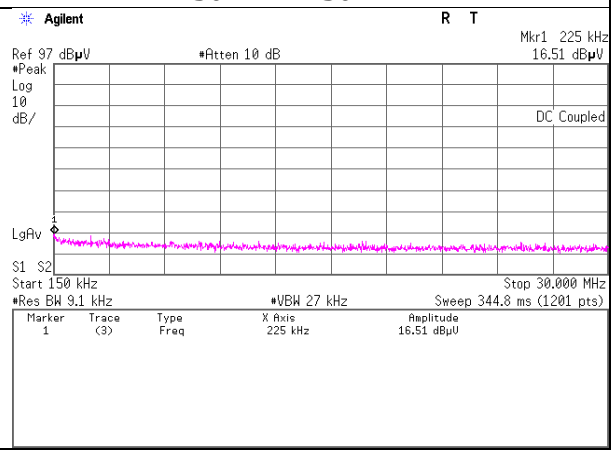
| | |
|---|---|
| Test place | Ise EMC Lab. No.11 Measurement Room |
| Report No. | 11873611H |
| Date | August 3, 2017 |
| Temperature / Humidity | 24 deg. C / 52 % RH |
| Engineer | Yuta Moriya |
| Mode | Tx, Hopping Off, 3DH5 |

## 2402 MHz

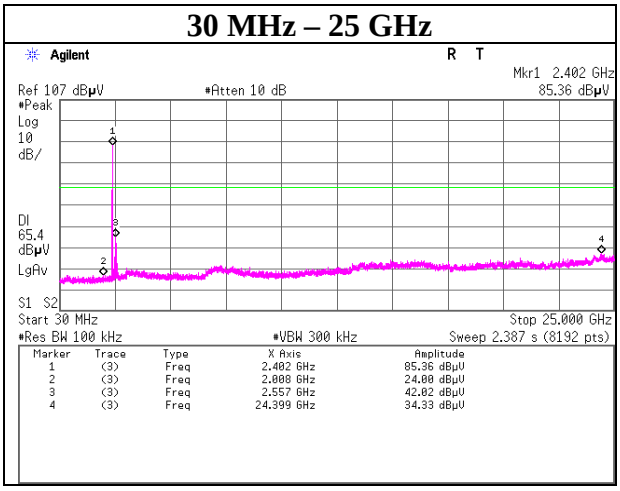
### 9 kHz – 150 kHz




### 150 kHz – 30 MHz




### 30 MHz – 25 GHz

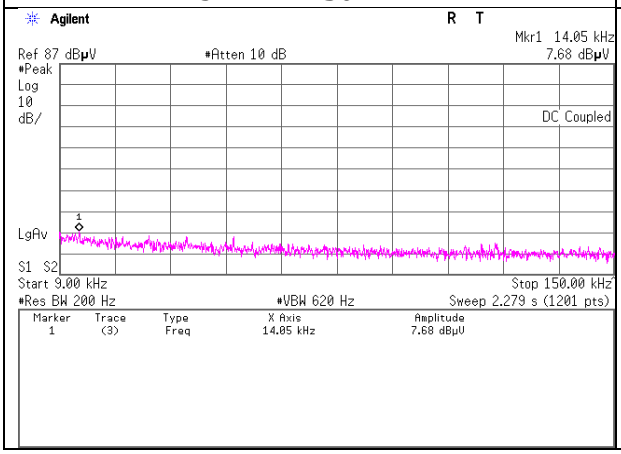


# Conducted Spurious Emission

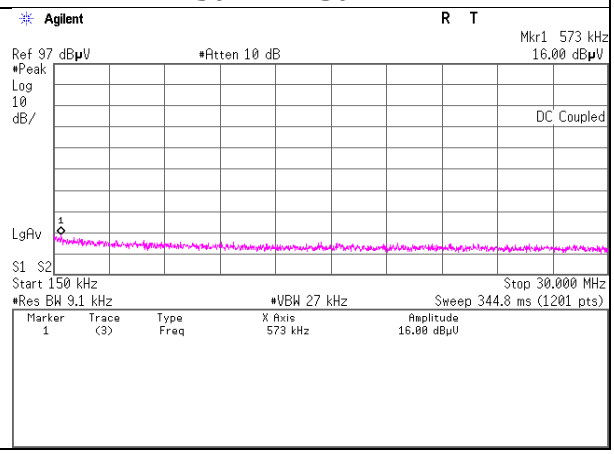
| | |
|---|---|
| Test place | Ise EMC Lab. No.11 Measurement Room |
| Report No. | 11873611H |
| Date | August 3, 2017 |
| Temperature / Humidity | 24 deg. C / 52 % RH |
| Engineer | Yuta Moriya |
| Mode | Tx, Hopping Off, 3DH5 |

## 2441 MHz

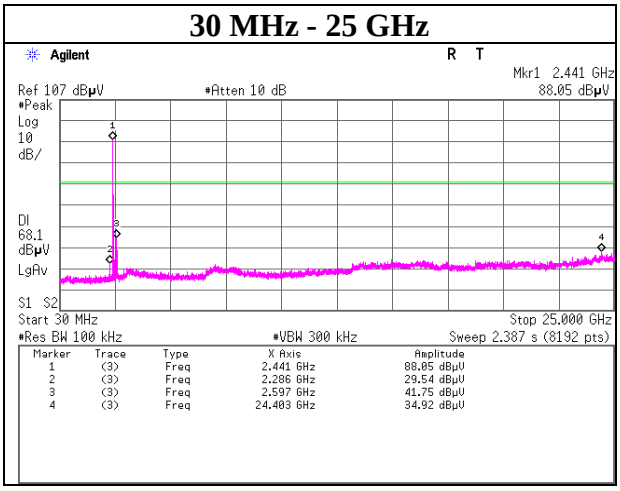
### 9 kHz - 150 kHz




### 150 kHz - 30 MHz




### 30 MHz - 25 GHz

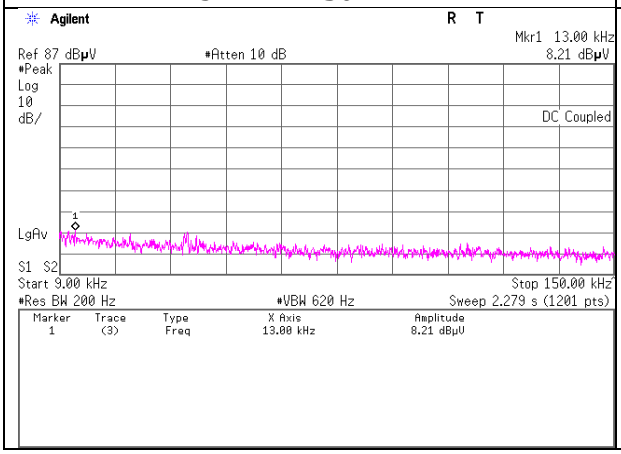


# Conducted Spurious Emission

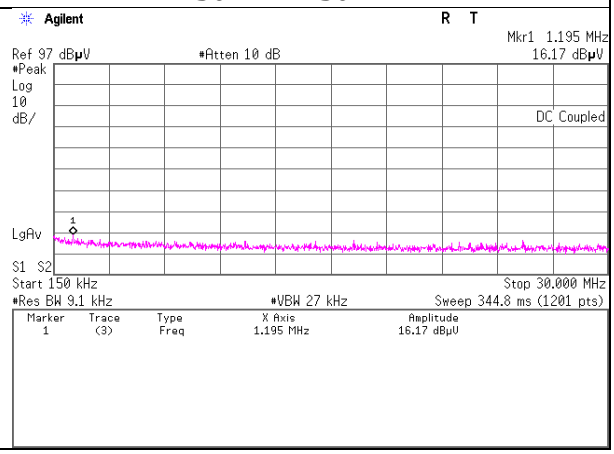
| | |
|---|---|
| Test place | Ise EMC Lab. No.11 Measurement Room |
| Report No. | 11873611H |
| Date | August 3, 2017 |
| Temperature / Humidity | 24 deg. C / 52 % RH |
| Engineer | Yuta Moriya |
| Mode | Tx, Hopping Off, 3DH5 |

## 2480 MHz

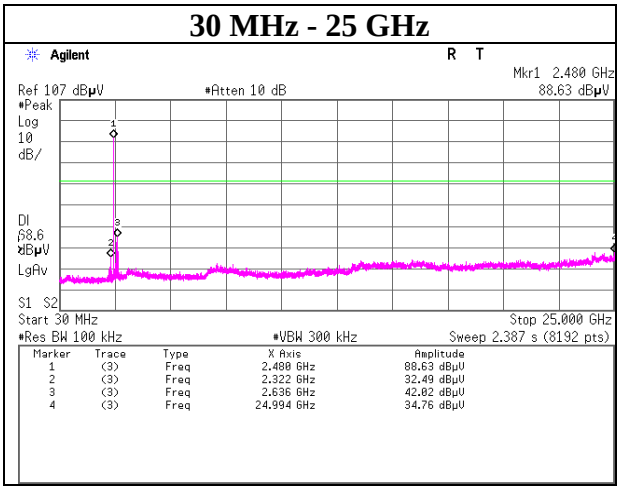
### 9 kHz - 150 kHz




### 150 kHz - 30 MHz




### 30 MHz - 25 GHz

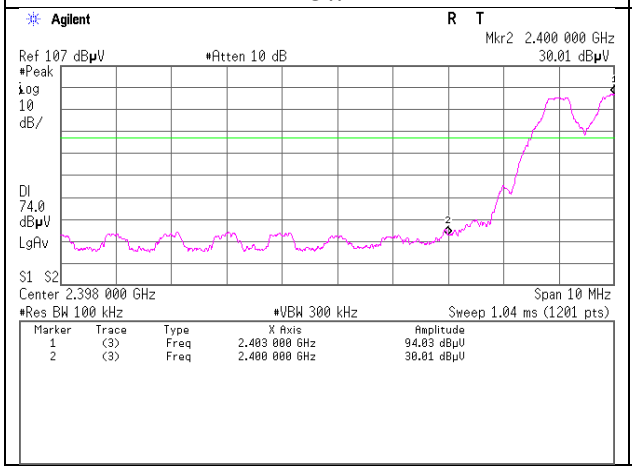


# Conducted Emission Band Edge compliance

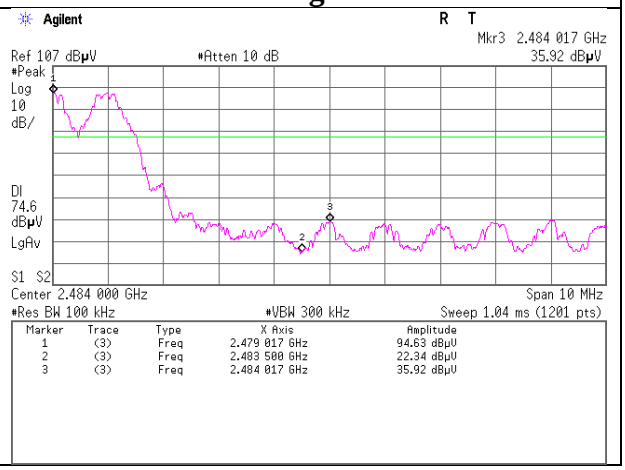
| | |
|---|---|
| Test place | Ise EMC Lab. No.11 Measurement Room |
| Report No. | 11873611H |
| Date | August 3, 2017 |
| Temperature / Humidity | 24 deg. C / 52 % RH |
| Engineer | Yuta Moriya |
| Mode | Tx DH5 |

## Hopping On

### Low

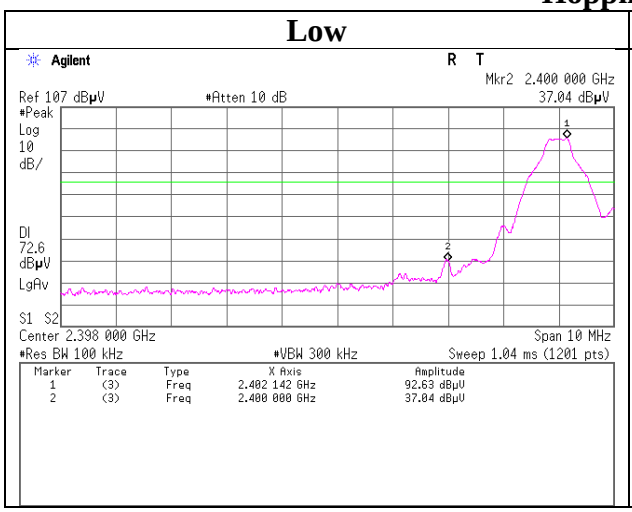



### High

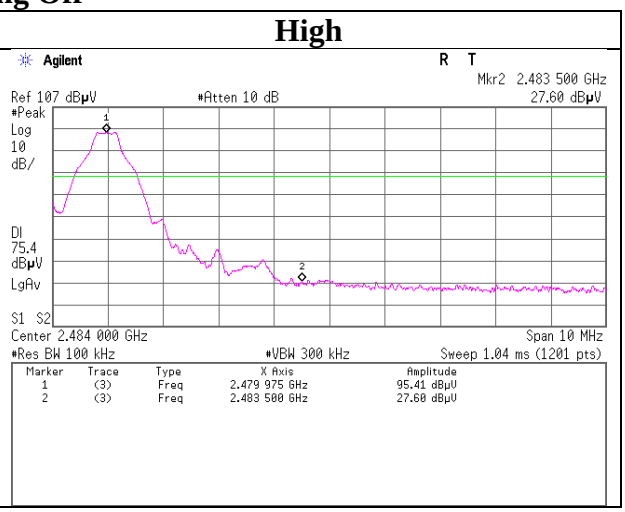



## Hopping Off

### Low




### High

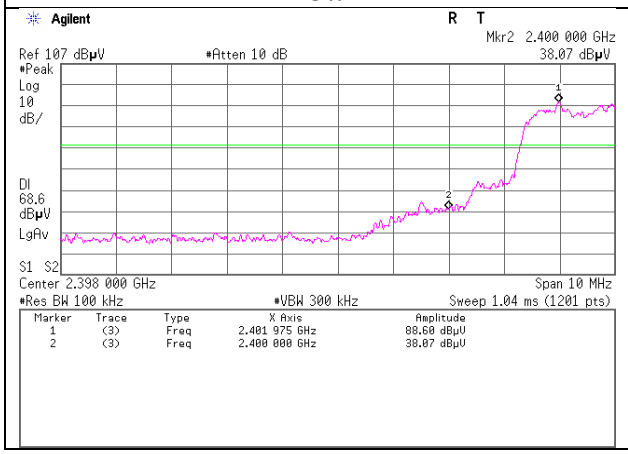


# Conducted Emission Band Edge compliance

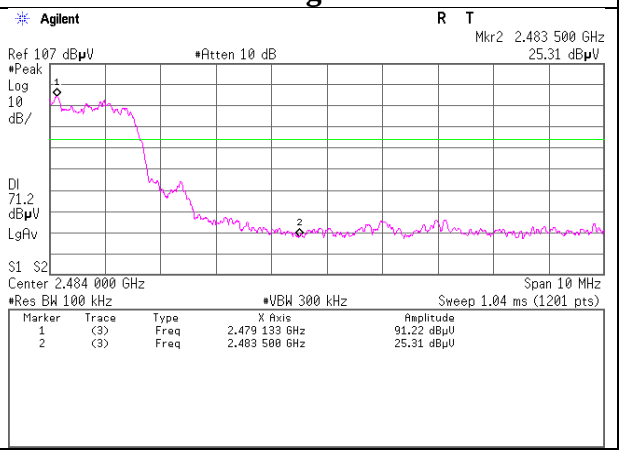
| | |
|---|---|
| Test place | Ise EMC Lab. No.11 Measurement Room |
| Report No. | 11873611H |
| Date | August 3, 2017 |
| Temperature / Humidity | 24 deg. C / 52 % RH |
| Engineer | Yuta Moriya |
| Mode | Tx 3DH5 |

## Hopping On

### Low

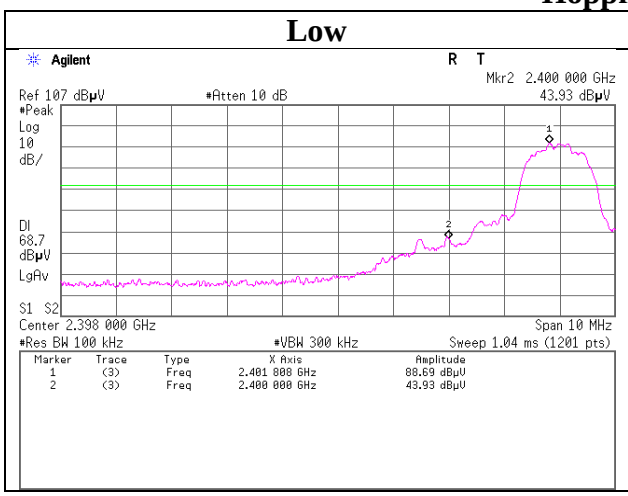



### High

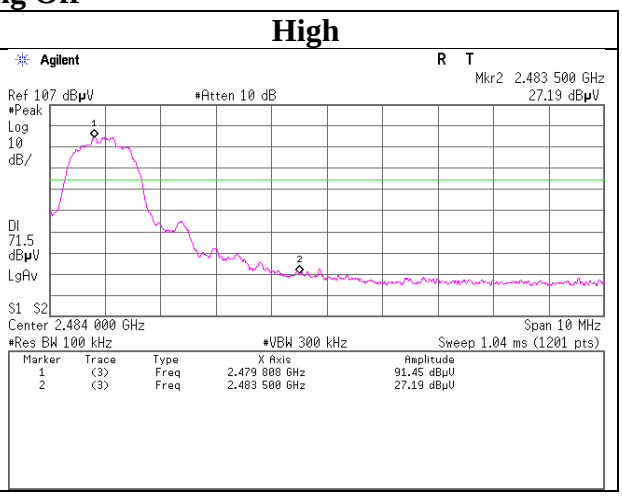



## Hopping Off

### Low




### High

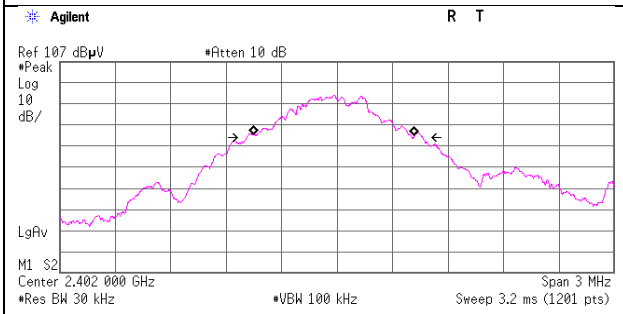


# 99%Occupied Bandwidth

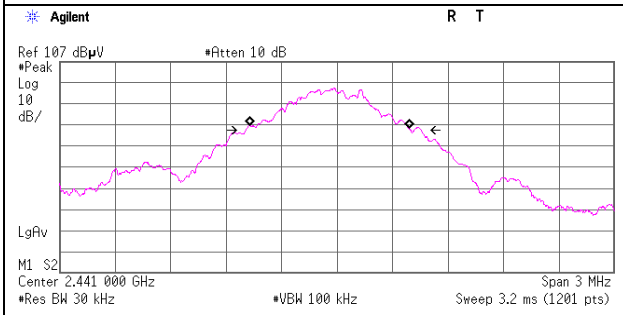
| | |
|---|---|
| Test place | Ise EMC Lab. No.11 Measurement Room |
| Report No. | 11873611H |
| Date | August 3, 2017 |
| Temperature / Humidity | 24 deg. C / 52 % RH |
| Engineer | Yuta Moriya |
| Mode | Tx Hopping Off |

## Hopping Off, DH5

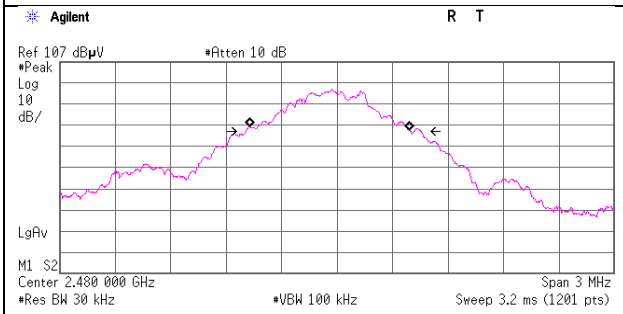
### 2402 MHz




### 2441 MHz

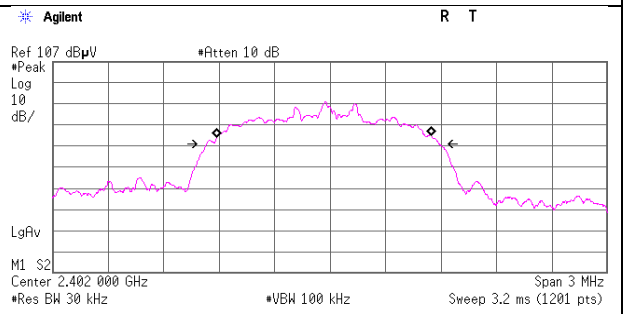



### 2480 MHz

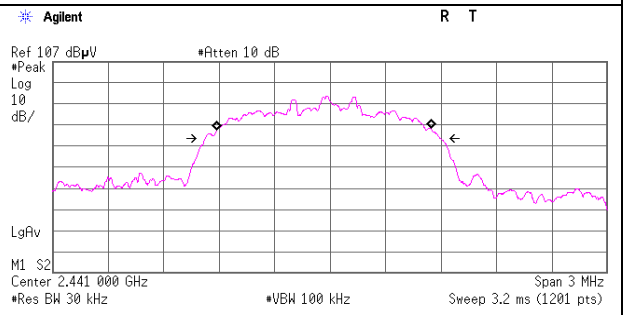



## Hopping Off, 3DH5

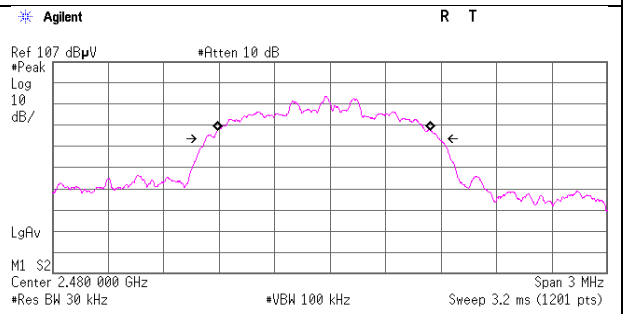
### 2402 MHz




### 2441 MHz



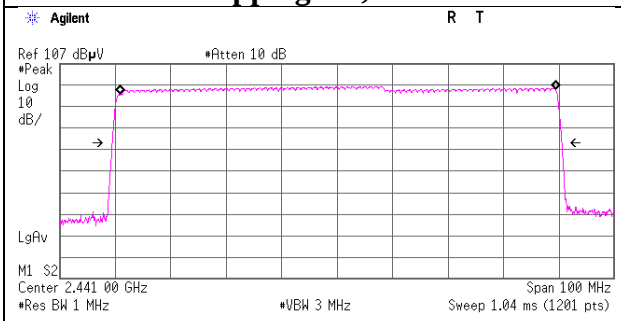

### 2480 MHz



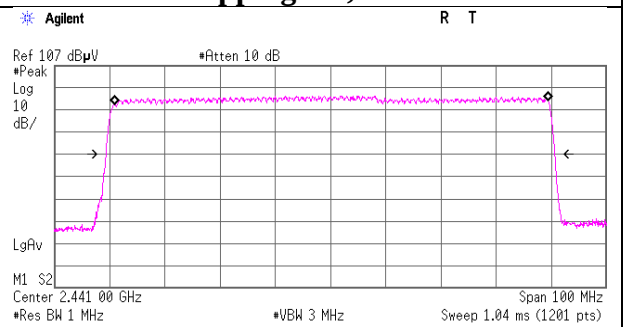
# 99% Occupied Bandwidth

| | |
|---|---|
| Test place | Ise EMC Lab. No.11 Measurement Room |
| Report No. | 11873611H |
| Date | August 3, 2017 |
| Temperature / Humidity | 24 deg. C / 52 % RH |
| Engineer | Yuta Moriya |
| Mode | Tx Hopping On |

## Hopping On, DH5




## Hopping On, 3DH5



# APPENDIX 2: Test instruments

**Test equipment**

| Control No. | Instrument | Manufacturer | Model No | Serial No | Test Item | Calibration Date * Interval(month) |
|---|---|---|---|---|---|---|
| MAEC-03 | Semi Anechoic Chamber(NSA) | TDK | Semi Anechoic Chamber 3m | DA-10005 | RE/CE | 2016/10/20 * 12 |
| MOS-13 | Thermo-Hygrometer | Custom | CTH-180 | 1301 | RE/CE | 2017/01/20 * 12 |
| MJM-16 | Measure | KOMELON | KMC-36 | - | RE/CE | - |
| COTS-MEMI | EMI measurement program | TSJ | TEPTO-DV | - | RE/CE | - |
| MSA-03 | Spectrum Analyzer | Agilent | E4448A | MY44020357 | RE/CE | 2017/05/29 * 12 |
| MHA-20 | Horn Antenna 1-18GHz | Schwarzbeck | BBHA9120D | 258 | RE | 2017/05/22 * 12 |
| MCC-167 | Microwave Cable | Junkosha | MWX221 | 1404S374(1m) / 1405S074(5m) | RE | 2017/05/29 * 12 |
| MPA-11 | MicroWave System Amplifier | Agilent | 83017A | MY39500779 | RE | 2017/03/21 * 12 |
| MHA-16 | Horn Antenna 15-40GHz | Schwarzbeck | BBHA9170 | BBHA9170306 | RE | 2017/05/14 * 12 |
| MMM-08 | DIGITAL HiTESTER | Hioki | 3805 | 051201197 | RE/CE | 2017/01/19 * 12 |
| MHF-25 | High Pass Filter 3.5-18.0GHz | UL Japan | HPF SELECTOR | 001 | RE | 2016/09/21 * 12 |
| MTR-08 | Test Receiver | Rohde & Schwarz | ESCI | 100767 | RE/CE | 2016/09/15 * 12 |
| MBA-03 | Biconical Antenna | Schwarzbeck | BBA9106 | 1915 | RE | 2016/10/15 * 12 |
| MLA-22 | Logperiodic Antenna(200-1000MHz) | Schwarzbeck | VUSLP9111B | 911B-191 | RE | 2017/01/26 * 12 |
| MCC-51 | Coaxial cable | UL Japan | - | - | RE | 2017/07/12 * 12 |
| MAT-98 | Attenuator | KEYSIGHT | 8491A | MY52462349 | RE | 2016/12/05 * 12 |
| MPA-13 | Pre Amplifier | SONOMA INSTRUMENT | 310 | 260834 | RE | 2017/03/27 * 12 |
| MLS-23 | LISN(AMN) | Schwarzbeck | NSLK8127 | 8127-729 | CE(EUT) | 2017/07/24 * 12 |
| MCC-112 | Coaxial cable | Fujikura/Suhner/TSJ | 5D-2W(10m)/ SFM141(3m)/ sucoform141-PE(1m)/ 421-010(1.5m)/ RFM-E321(Switcher) | -/00640 | CE | 2017/07/12 * 12 |
| MAT-66 | Attenuator(13dB) | JFW Industries, Inc. | 50FP-013H2 N | - | CE | 2016/12/24 * 12 |
| MOS-19 | Thermo-Hygrometer | Custom | CTH-201 | 0001 | AT | 2016/12/13 * 12 |
| MPM-12 | Power Meter | Anritsu | ML2495A | 0825002 | AT | 2017/06/20 * 12 |
| MSA-16 | Spectrum Analyzer | Agilent | E4440A | MY46186390 | AT | 2017/02/21 * 12 |
| MAT-58 | Attenuator(10dB) | Suhner | 6810.19.A | - | AT | 2016/12/15 * 12 |
| MPSE-17 | Power sensor | Anritsu | MA2411B | 0738285 | AT | 2017/06/20 * 12 |
| MMM-17 | DIGIITAL HiTESTER | Hioki | 3805 | 070900530 | AT | 2017/01/19 * 12 |

**The expiration date of the calibration is the end of the expired month.**
**All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.**

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

**Test Item:** **CE: Conducted Emission test**
**RE: Radiated Emission test**
**AT: Antenna Terminal Conducted test**