




# RADIO TEST REPORT

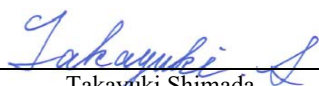
**Test Report No. : 12905370H-A**

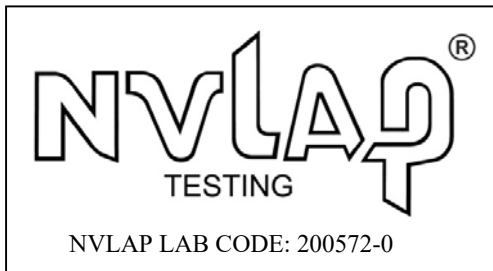
**Applicant** : Panasonic Avionics Corporation  
**Type of Equipment** : Bluetooth v5 Dual-Mode USB Module  
**Model No.** : R8U4FJ5168Z  
**FCC ID** : U6YBT850  
**Test regulation** : FCC Part 15 Subpart C: 2019  
**For Permissive Change**  
\* Bluetooth part  
(Maximum Peak Output Power and Radiated Spurious Emission tests only)  
**Test Result** : Complied (Refer to SECTION 3.2)

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
6. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
7. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
8. The information provided from the customer for this report is identified in SECTION 1.

**Date of test:** May 28 to June 13, 2019

**Representative test engineer:**   
Takumi Shimada  
Engineer  
Consumer Technology Division

**Approved by:**   
Takayuki Shimada  
Leader  
Consumer Technology Division



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

- 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 : Panasonic Avionics Corporation  
Address : 26200 Enterprise Way Lake Forest, CA 92630 USA  
Telephone Number : +1-949-672-2000  
Facsimile Number : +1-949-462-7100  
Contact Person : David O'Reilly

The information provided from the customer is as follows;

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

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

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

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

Type of Equipment : Bluetooth v5 Dual-Mode USB Module  
Model No. : R8U4FJ5168Z  
Serial No. : Refer to SECTION 4.2  
Rating : DC 3.3 V  
Receipt Date of Sample : May 28, 2019  
(Information from test lab.)  
Country of Mass-production : Japan  
Condition of EUT : Production prototype  
(Not for Sale: This sample is equivalent to mass-produced items.)  
Modification of EUT : No Modification by the test lab.

### **2.2 Product Description**

Model: R8U4FJ5168Z (referred to as the EUT in this report) is a Bluetooth v5 Dual-Mode USB Module.

### **Radio Specification**

#### **[Bluetooth (Classic Bluetooth and BLE)]**

Radio Type : Transceiver  
Frequency of Operation : 2402 MHz - 2480 MHz  
Modulation : BT: FHSS (GFSK,  $\pi/4$ DQPSK, 8DPSK)  
LE: GFSK  
Channel spacing : BT: 1 MHz  
LE: 2 MHz  
Antenna type : Microstrip Antenna  
Antenna Gain : -3.4 dBi  
Clock frequency (Maximum) : 40 MHz

\* This test report applies to Bluetooth with EDR function (2402 MHz - 2480 MHz) except for Bluetooth Low Energy.

<Contents of the change from original model>

Antenna of the EUT is new type.

The maximum output level of Bluetooth module is changed from +8dBm to +2dBm.

The radio specification except above is identical to the original.

Therefore only Radiated Spurious Emission test were performed in this report.

Additionally, only the information of modified antenna is described in this report.

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### **Ise EMC Lab.**

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## **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.

### **3.2 Procedures and results**

| Item  | Test Procedure   | Specification  | Worst Margin                     | Results        | Remarks                           |
|---|--|--|----------------------------------|----------------|-----------------------------------|
| Maximum Peak Output Power   | FCC: KDB 558074 D01<br>15.247 Meas Guidance v05r02<br>IC: RSS-Gen 6.12 | FCC: Section15.247(a)(b)(1)<br>-----<br>IC: RSS-247 5.4 (b)                      | -                                | Complied<br>a) | Conducted                         |
| Spurious Emission & Band Edge Compliance  | FCC: KDB 558074 D01<br>15.247 Meas Guidance v05r02<br>IC: RSS-Gen 6.13 | FCC: Section15.247(d)<br>-----<br>IC: RSS-247 5.5<br>RSS-Gen 8.9<br>RSS-Gen 8.10 | 16.3 dB<br>48.695 MHz, QP, Vert. | Complied<br>b) | Radiated<br>(above 30 MHz)<br>*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). |  |  |                                  |                |                                   |
| a) Refer to APPENDIX 1 (data of Maximum Peak Output Power)<br>b) 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.

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

This EUT provides stable voltage 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

No addition, exclusion nor deviation has been made from the standard.

### 3.4 Uncertainty

#### EMI

There is no applicable rule of uncertainty in this applied standard. Therefore, the 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  $k=2$ .  
Ise EMC Lab.

#### Antenna Terminal test

| Test Item  | Uncertainty (+/-) |
|--|-------------------|
| Maximum Peak Output Power / Average Output Power | 1.3 dB            |

#### Radiated emission

| Measurement distance | Frequency range                                | Uncertainty (+/-) |
|----------------------|--|-------------------|
| 3 m                  | 9 kHz to 30 MHz                                | 3.3 dB            |
| 10 m                 |  | 3.2 dB            |
| 3 m                  | 30 MHz to 200 MHz (Horizontal)<br>(Vertical)   | 4.8 dB            |
|                      |  | 5.0 dB            |
|                      | 200 MHz to 1000 MHz (Horizontal)<br>(Vertical) | 5.2 dB            |
|                      |  | 6.3 dB            |
| 10 m                 | 30 MHz to 200 MHz (Horizontal)<br>(Vertical)   | 4.8 dB            |
|                      |  | 4.9 dB            |
|                      | 200 MHz to 1000 MHz (Horizontal)<br>(Vertical) | 5.0 dB            |
|                      |  | 5.0 dB            |
| 3 m                  | 1 GHz to 6 GHz                                 | 5.0 dB            |
|                      | 6 GHz to 18 GHz                                | 5.3 dB            |
| 1 m                  | 10 GHz to 26.5 GHz                             | 5.8 dB            |
|                      | 26.5 GHz to 40 GHz                             | 5.8 dB            |
| 10 m                 | 1 GHz to 18 GHz                                | 5.2 dB            |

### 3.5 Test Location

UL Japan, Inc. Ise EMC Lab.

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

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| Test site                  | Width x Depth x Height (m) | Size of reference ground plane (m) / horizontal conducting plane | Other rooms            | Maximum measurement distance |
|----------------------------|----------------------------|--|------------------------|------------------------------|
| No.1 semi-anechoic chamber | 19.2 x 11.2 x 7.7          | 7.0 x 6.0  | No.1 Power source room | 10 m                         |
| No.2 semi-anechoic chamber | 7.5 x 5.8 x 5.2            | 4.0 x 4.0  | -                      | 3 m                          |
| No.3 semi-anechoic chamber | 12.0 x 8.5 x 5.9           | 6.8 x 5.75   | No.3 Preparation room  | 3 m                          |
| No.3 shielded room         | 4.0 x 6.0 x 2.7            | N/A  | -                      | -                            |
| No.4 semi-anechoic chamber | 12.0 x 8.5 x 5.9           | 6.8 x 5.75   | No.4 Preparation room  | 3 m                          |
| No.4 shielded room         | 4.0 x 6.0 x 2.7            | N/A  | -                      | -                            |
| No.5 semi-anechoic chamber | 6.0 x 6.0 x 3.9            | 6.0 x 6.0  | -                      | -                            |
| No.5 measurement room      | 6.4 x 6.4 x 3.0            | 6.4 x 6.4  | -                      | -                            |
| No.6 shielded room         | 4.0 x 4.5 x 2.7            | 4.0 x 4.5  | -                      | -                            |
| No.6 measurement room      | 4.75 x 5.4 x 3.0           | 4.75 x 4.15  | -                      | -                            |
| No.7 shielded room         | 4.7 x 7.5 x 2.7            | 4.7 x 7.5  | -                      | -                            |
| No.8 measurement room      | 3.1 x 5.0 x 2.7            | 3.1 x 5.0  | -                      | -                            |
| No.9 measurement room      | 8.8 x 4.6 x 2.8            | 2.4 x 2.4  | -                      | -                            |
| No.11 measurement room     | 6.2 x 4.7 x 3.0            | 4.8 x 4.6  | -                      | -                            |

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

Refer to APPENDIX.

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

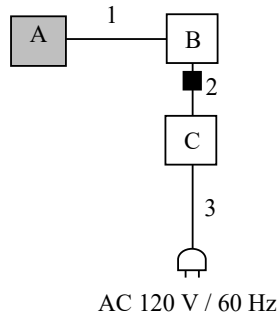
### **4.1 Operating Mode(s)**

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

| <b>Test Item</b>  | <b>Mode</b>                      | <b>Tested frequency</b>          |
|---|----------------------------------|----------------------------------|
| Radiated Spurious Emission  | Tx (Hopping Off) DH5, 3DH5       | 2402 MHz<br>2441 MHz<br>2480 MHz |
| Maximum Peak Output Power   | Tx (Hopping Off) DH5, 2DH5, 3DH5 | 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)<br/>*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.<br/>* 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.<br/>*EUT has the power settings by the software as follows;<br/>Power settings:    BDR:    2 dBm<br/>                      EDR:    2 dBm<br/>Software:           cybluetool ver Version 0.1.55.1</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   | Bluetooth v5<br>Dual-Mode USB<br>Module | R8U4FJ5168Z   | 4A1A03 *1)<br>4A1C20 *2) | Panasonic Corporation | EUT     |
| B   | Laptop PC                               | CF-SZ5ADCVS   | 6JKSA17867               | Panasonic Corporation | -       |
| C   | AC adaptor                              | CF-AA64L2C M1 | 64L2CM116904226A         | Panasonic Corporation | -       |

\*1) Used for Maximum Peak Output Power test

\*2) Used for Radiated Emission test

### List of cables used

| No. | Name      | Length (m) | Shield     |            | Remarks |
|-----|-----------|------------|------------|------------|---------|
|     |           |            | Cable      | Connector  |         |
| 1   | USB Cable | 0.90       | Shielded   | Shielded   | -       |
| 2   | DC Cable  | 0.90       | Unshielded | Unshielded | -       |
| 3   | AC Cable  | 0.70       | Unshielded | Unshielded | -       |

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## **SECTION 5: 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.

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.

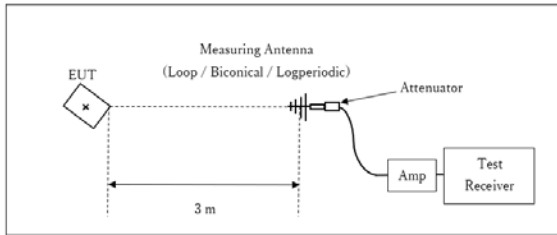
#### **20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9 (IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).**

|                 |               |                          |  |                              |
|-----------------|---------------|--------------------------|--|------------------------------|
| 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: 3 MHz<br>Detector:<br>Power Averaging (RMS)<br>Trace: 100 traces<br>Duty factor was added to the results. | RBW: 100 kHz<br>VBW: 300 kHz |

\*1) Average Power Measurement was performed based on KDB 558074 D01 15.247 Meas Guidance v05r02.

**Figure 2: Test Setup**

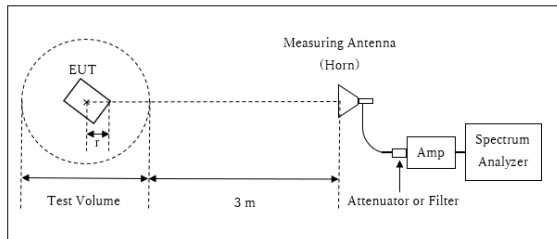
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz



r : Radius of an outer periphery of EUT

× : Center of turn table

Distance Factor:  $20 \times \log(3.7 \text{ m} / 3.0 \text{ m}) = 1.83 \text{ dB}$

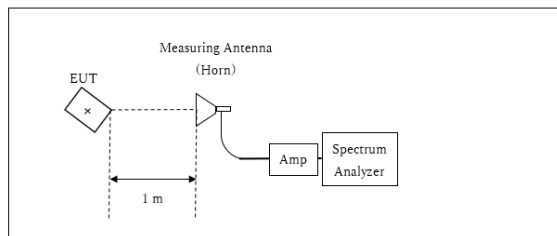
\* Test Distance:  $(3 + \text{Test Volume} / 2) - r = 3.9 \text{ m}$

Test Volume : 2.0 m

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

r = 0.1 m

10 GHz - 26.5 GHz



× : Center of turn table

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

\*Test Distance: 1 m

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

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

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

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## **SECTION 6: Antenna Terminal Conducted Tests**

### **Test Procedure**

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

| <b>Test</b>               | <b>Span</b> | <b>RBW</b> | <b>VBW</b> | <b>Sweep time</b> | <b>Detector</b>     | <b>Trace</b> | <b>Instrument used</b>            |
|---------------------------|-------------|------------|------------|-------------------|---------------------|--------------|-----------------------------------|
| Maximum Peak Output Power | -           | -          | -          | Auto              | Peak Average<br>*1) | -            | Power Meter<br>(Sensor: 50MHz BW) |
| *1) Reference data        |             |            |            |                   |                     |              |                                   |

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

### Maximum Peak Output Power

Report No. 12905370H  
 Test place Ise EMC Lab. No.6 Measurement Room  
 Date June 13, 2019  
 Temperature / Humidity 23 deg. C / 64 % RH  
 Engineer Takumi Shimada  
 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<br>[dB] | Antenna<br>Gain<br>[dBi] | Result |      | Limit |      | Margin<br>[dB] |
|      |                |                  |                       |                        | [dBm]           | [mW] | [dBm] | [mW] |                |                          | [dBm]  | [mW] | [dBm] | [mW] |                |
| DH5  | 2402.0         | -9.10            | 0.03                  | 10.09                  | 1.02            | 1.26 | 20.96 | 125  | 19.94          | -3.40                    | -2.38  | 0.58 | 36.02 | 4000 | 38.40          |
| DH5  | 2441.0         | -8.57            | 0.03                  | 10.09                  | 1.55            | 1.43 | 20.96 | 125  | 19.41          | -3.40                    | -1.85  | 0.65 | 36.02 | 4000 | 37.87          |
| DH5  | 2480.0         | -8.75            | 0.03                  | 10.09                  | 1.37            | 1.37 | 20.96 | 125  | 19.59          | -3.40                    | -2.03  | 0.63 | 36.02 | 4000 | 38.05          |
| 2DH5 | 2402.0         | -6.10            | 0.03                  | 10.09                  | 4.02            | 2.52 | 20.96 | 125  | 16.94          | -3.40                    | 0.62   | 1.15 | 36.02 | 4000 | 35.40          |
| 2DH5 | 2441.0         | -5.69            | 0.03                  | 10.09                  | 4.43            | 2.77 | 20.96 | 125  | 16.53          | -3.40                    | 1.03   | 1.27 | 36.02 | 4000 | 34.99          |
| 2DH5 | 2480.0         | -5.99            | 0.03                  | 10.09                  | 4.13            | 2.59 | 20.96 | 125  | 16.83          | -3.40                    | 0.73   | 1.18 | 36.02 | 4000 | 35.29          |
| 3DH5 | 2402.0         | -5.92            | 0.03                  | 10.09                  | 4.20            | 2.63 | 20.96 | 125  | 16.76          | -3.40                    | 0.80   | 1.20 | 36.02 | 4000 | 35.22          |
| 3DH5 | 2441.0         | -5.45            | 0.03                  | 10.09                  | 4.67            | 2.93 | 20.96 | 125  | 16.29          | -3.40                    | 1.27   | 1.34 | 36.02 | 4000 | 34.75          |
| 3DH5 | 2480.0         | -5.76            | 0.03                  | 10.09                  | 4.36            | 2.73 | 20.96 | 125  | 16.60          | -3.40                    | 0.96   | 1.25 | 36.02 | 4000 | 35.06          |

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: 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.

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

Report No. 12905370H  
Test place Ise EMC Lab. No.6 Measurement Room  
Date June 13, 2019  
Temperature / Humidity 23 deg. C / 64 % RH  
Engineer Takumi Shimada  
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         | -10.41           | 0.03                  | 10.09                  | -0.29                    | 0.94 | 1.11                   | 0.82                            | 1.21 |
| DH5  | 2441.0         | -9.92            | 0.03                  | 10.09                  | 0.20                     | 1.05 | 1.11                   | 1.31                            | 1.35 |
| DH5  | 2480.0         | -10.06           | 0.03                  | 10.09                  | 0.06                     | 1.01 | 1.11                   | 1.17                            | 1.31 |
| 2DH5 | 2402.0         | -9.97            | 0.03                  | 10.09                  | 0.15                     | 1.04 | 1.11                   | 1.26                            | 1.34 |
| 2DH5 | 2441.0         | -9.41            | 0.03                  | 10.09                  | 0.71                     | 1.18 | 1.11                   | 1.82                            | 1.52 |
| 2DH5 | 2480.0         | -9.77            | 0.03                  | 10.09                  | 0.35                     | 1.08 | 1.11                   | 1.46                            | 1.40 |
| 3DH5 | 2402.0         | -9.87            | 0.03                  | 10.09                  | 0.25                     | 1.06 | 1.11                   | 1.36                            | 1.37 |
| 3DH5 | 2441.0         | -9.38            | 0.03                  | 10.09                  | 0.74                     | 1.19 | 1.11                   | 1.85                            | 1.53 |
| 3DH5 | 2480.0         | -9.99            | 0.03                  | 10.09                  | 0.13                     | 1.03 | 1.11                   | 1.24                            | 1.33 |

Sample Calculation:

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

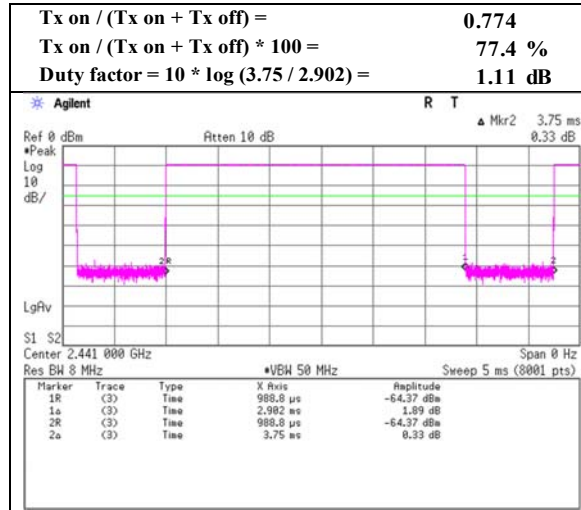
Result (Burst power average) = Time average + Duty factor

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

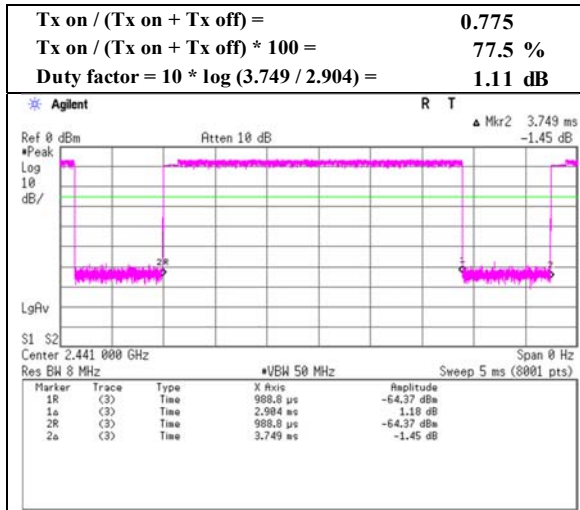
### Burst Rate Confirmation

Report No. 12905370H  
 Test place Ise EMC Lab. No.6 Measurement Room  
 Date June 13, 2019  
 Temperature / Humidity 23 deg. C / 64 % RH  
 Engineer Takumi Shimada  
 Mode Tx, Hopping Off

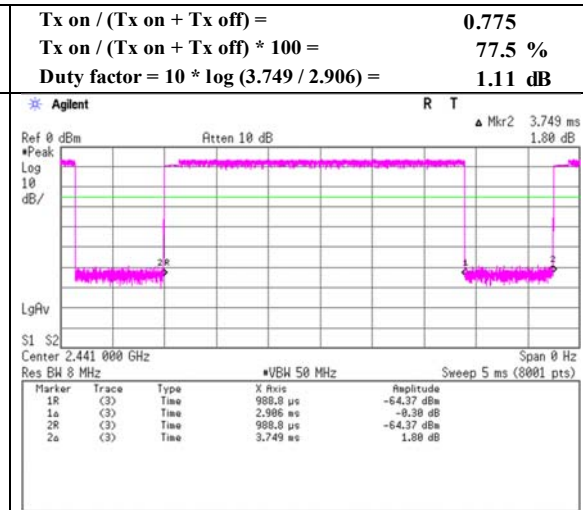
#### DH5



#### 2DH5



#### 3DH5



## Radiated Spurious Emission

|                        |                               |                                   |                                   |
|------------------------|-------------------------------|-----------------------------------|-----------------------------------|
| Report No.             | 12905370H                     |                                   |                                   |
| Test place             | Ise EMC Lab.                  |                                   |                                   |
| Semi Anechoic Chamber  | No.2                          | No.2                              | No.4                              |
| Date                   | May 28, 2019                  | May 28, 2019                      | June 12, 2019                     |
| Temperature / Humidity | 24 deg. C / 56 % RH           | 24 deg. C / 56 % RH               | 22 deg. C / 70 % RH               |
| Engineer               | Yuta Moriya<br>(1 - 10 GHz)   | Takumi Shimada<br>(10 - 26.5 GHz) | Takafumi Noguchi<br>(Below 1 GHz) |
| Mode                   | Tx, Hopping Off, DH5 2402 MHz |                                   |                                   |

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Duty Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark      |
|----------|-----------------|----------|----------------|-----------------|-----------|-----------|------------------|-----------------|----------------|-------------|-------------|
| Hori.    | 31.664          | QP       | 22.5           | 17.6            | 7.2       | 32.2      | -                | 15.1            | 40.0           | 24.9        |             |
| Hori.    | 50.080          | QP       | 22.8           | 11.0            | 7.5       | 32.2      | -                | 9.1             | 40.0           | 30.9        |             |
| Hori.    | 85.180          | QP       | 29.2           | 7.2             | 8.0       | 32.1      | -                | 12.3            | 40.0           | 27.7        |             |
| Hori.    | 182.338         | QP       | 27.8           | 16.3            | 9.0       | 32.0      | -                | 21.1            | 43.5           | 22.4        |             |
| Hori.    | 225.280         | QP       | 26.8           | 11.1            | 9.4       | 32.0      | -                | 15.3            | 46.0           | 30.7        |             |
| Hori.    | 454.560         | QP       | 23.9           | 16.5            | 11.0      | 32.0      | -                | 19.4            | 46.0           | 26.6        |             |
| Hori.    | 2390.000        | PK       | 43.0           | 27.3            | 5.1       | 34.3      | -                | 41.1            | 73.9           | 32.8        |             |
| Hori.    | 4804.000        | PK       | 42.4           | 31.6            | 7.2       | 33.5      | -                | 47.7            | 73.9           | 26.2        | Floor noise |
| Hori.    | 7206.000        | PK       | 42.8           | 36.4            | 8.3       | 33.4      | -                | 54.1            | 73.9           | 19.9        | Floor noise |
| Hori.    | 9608.000        | PK       | 42.0           | 38.5            | 9.4       | 33.8      | -                | 56.1            | 73.9           | 17.8        | Floor noise |
| Hori.    | 2390.000        | AV       | 35.3           | 27.3            | 5.1       | 34.3      | 1.1              | 34.5            | 53.9           | 19.4        | *1)         |
| Hori.    | 4804.000        | AV       | 31.6           | 31.6            | 7.2       | 33.5      | -                | 36.9            | 53.9           | 17.0        | Floor noise |
| Hori.    | 7206.000        | AV       | 32.9           | 36.4            | 8.3       | 33.4      | -                | 44.2            | 53.9           | 9.8         | Floor noise |
| Hori.    | 9608.000        | AV       | 32.5           | 38.5            | 9.4       | 33.8      | -                | 46.6            | 53.9           | 7.3         | Floor noise |
| Vert.    | 32.220          | QP       | 28.1           | 17.4            | 7.2       | 32.2      | -                | 20.5            | 40.0           | 19.5        |             |
| Vert.    | 49.984          | QP       | 34.6           | 11.0            | 7.5       | 32.2      | -                | 21.0            | 40.0           | 19.0        |             |
| Vert.    | 84.230          | QP       | 31.5           | 6.9             | 8.0       | 32.1      | -                | 14.2            | 40.0           | 25.8        |             |
| Vert.    | 181.680         | QP       | 30.2           | 16.3            | 9.0       | 32.0      | -                | 23.5            | 43.5           | 20.0        |             |
| Vert.    | 226.240         | QP       | 27.2           | 11.1            | 9.4       | 32.0      | -                | 15.8            | 46.0           | 30.2        |             |
| Vert.    | 454.500         | QP       | 30.7           | 16.5            | 11.0      | 32.0      | -                | 26.2            | 46.0           | 19.8        |             |
| Vert.    | 2390.000        | PK       | 43.5           | 27.3            | 5.1       | 34.3      | -                | 41.6            | 73.9           | 32.3        |             |
| Vert.    | 4804.000        | PK       | 42.2           | 31.6            | 7.2       | 33.5      | -                | 47.5            | 73.9           | 26.4        | Floor noise |
| Vert.    | 7206.000        | PK       | 42.7           | 36.4            | 8.3       | 33.4      | -                | 54.0            | 73.9           | 20.0        | Floor noise |
| Vert.    | 9608.000        | PK       | 42.3           | 38.5            | 9.4       | 33.8      | -                | 56.4            | 73.9           | 17.5        | Floor noise |
| Vert.    | 2390.000        | AV       | 35.7           | 27.3            | 5.1       | 34.3      | 1.1              | 34.9            | 53.9           | 19.0        | *1)         |
| Vert.    | 4804.000        | AV       | 31.8           | 31.6            | 7.2       | 33.5      | -                | 37.1            | 53.9           | 16.8        | Floor noise |
| Vert.    | 7206.000        | AV       | 33.0           | 36.4            | 8.3       | 33.4      | -                | 44.3            | 53.9           | 9.7         | Floor noise |
| Vert.    | 9608.000        | AV       | 32.5           | 38.5            | 9.4       | 33.8      | -                | 46.6            | 53.9           | 7.3         | Floor noise |

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

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

Distance factor: 1 GHz - 10 GHz 20log(3.7 m / 3.0 m) = 1.83 dB

10 GHz - 26.5 GHz 20log(1.0 m / 3.0 m) = -9.5 dB

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

### 20dBc Data Sheet

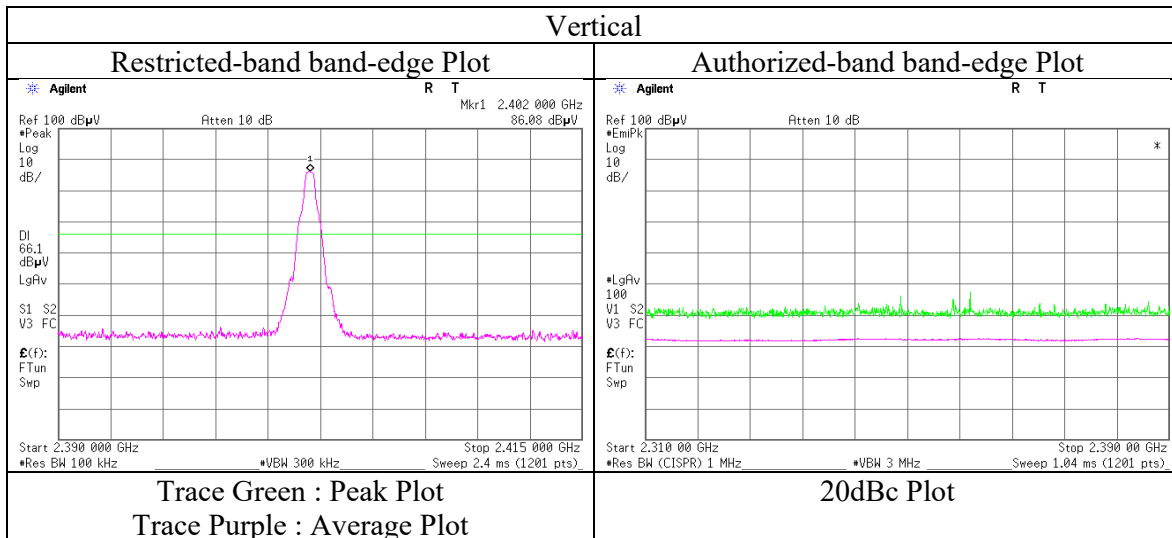
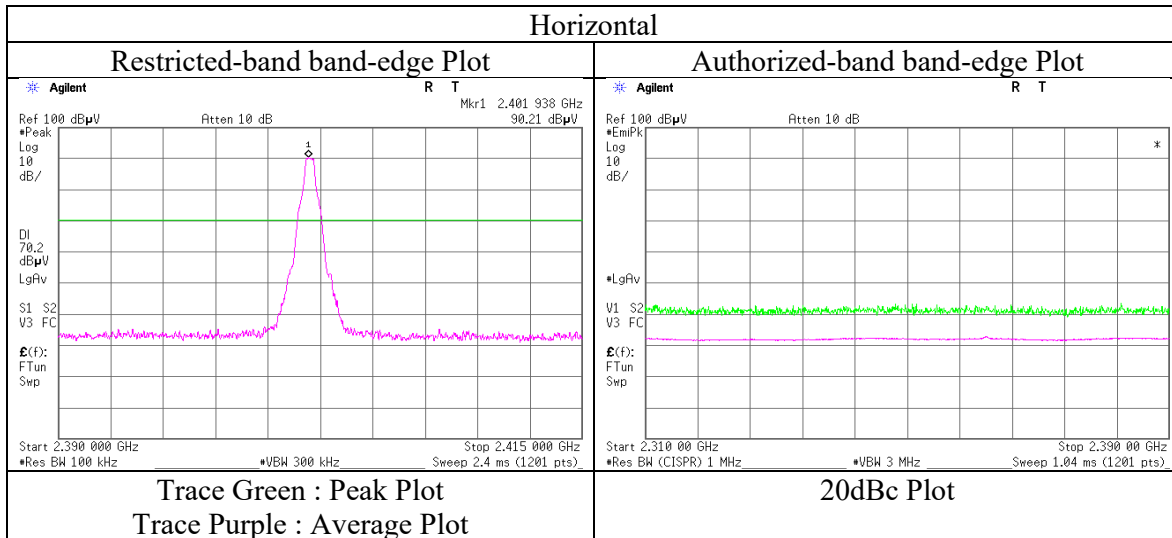
| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark  |
|----------|-----------------|----------|----------------|-------------------|-----------|-----------|-----------------|----------------|-------------|---------|
| Hori.    | 2402.000        | PK       | 90.2           | 27.0              | 5.1       | 34.3      | 88.1            | -              | -           | Carrier |
| Hori.    | 2400.000        | PK       | 36.5           | 27.0              | 5.1       | 34.3      | 34.3            | 68.1           | 33.7        |         |
| Vert.    | 2402.000        | PK       | 86.1           | 27.0              | 5.1       | 34.3      | 84.0            | -              | -           | Carrier |
| Vert.    | 2400.000        | PK       | 34.9           | 27.0              | 5.1       | 34.3      | 32.7            | 64.0           | 31.2        |         |

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



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

|                        |                               |
|------------------------|-------------------------------|
| Report No.             | 12905370H                     |
| Test place             | Ise EMC Lab.                  |
| Semi Anechoic Chamber  | No.2                          |
| Date                   | May 28, 2019                  |
| Temperature / Humidity | 24 deg. C / 56 % RH           |
| Engineer               | Yuta Moriya                   |
|                        | (1 - 10 GHz)                  |
| Mode                   | Tx, Hopping Off, DH5 2402 MHz |



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

## Radiated Spurious Emission

|                        |                               |                     |                     |
|------------------------|-------------------------------|---------------------|---------------------|
| Report No.             | 12905370H                     |                     |                     |
| Test place             | Ise EMC Lab.                  |                     |                     |
| Semi Anechoic Chamber  | No.2                          | No.2                | No.2                |
| Date                   | May 28, 2019                  | May 28, 2019        | May 28, 2019        |
| Temperature / Humidity | 24 deg. C / 56 % RH           | 24 deg. C / 56 % RH | 24 deg. C / 56 % RH |
| Engineer               | Yuta Moriya                   | Takumi Shimada      | Takumi Shimada      |
|                        | (1 - 10 GHz)                  | (10 - 26.5 GHz)     | (below 1GHz)        |
| Mode                   | Tx, Hopping Off, DH5 2441 MHz |                     |                     |

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Duty Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark      |
|----------|-----------------|----------|----------------|-----------------|-----------|-----------|------------------|-----------------|----------------|-------------|-------------|
| Hori.    | 31.023          | QP       | 25.3           | 17.7            | 6.7       | 30.5      | -                | 19.2            | 40.0           | 20.8        |             |
| Hori.    | 48.523          | QP       | 25.4           | 11.5            | 6.9       | 30.5      | -                | 13.3            | 40.0           | 26.7        |             |
| Hori.    | 89.758          | QP       | 30.9           | 8.3             | 7.4       | 30.3      | -                | 16.3            | 43.5           | 27.2        |             |
| Hori.    | 172.173         | QP       | 26.6           | 15.6            | 8.0       | 29.8      | -                | 20.3            | 43.5           | 23.2        |             |
| Hori.    | 226.408         | QP       | 24.0           | 11.2            | 8.4       | 29.5      | -                | 14.1            | 46.0           | 31.9        |             |
| Hori.    | 466.152         | QP       | 24.0           | 16.7            | 9.7       | 29.9      | -                | 20.5            | 46.0           | 25.5        |             |
| Hori.    | 4882.000        | PK       | 41.7           | 31.7            | 7.2       | 33.5      | -                | 47.2            | 73.9           | 26.7        | Floor noise |
| Hori.    | 7323.000        | PK       | 43.1           | 36.0            | 8.3       | 33.5      | -                | 54.0            | 73.9           | 19.9        | Floor noise |
| Hori.    | 9764.000        | PK       | 42.4           | 38.8            | 9.4       | 33.8      | -                | 56.8            | 73.9           | 17.1        | Floor noise |
| Hori.    | 4882.000        | AV       | 34.0           | 31.7            | 7.2       | 33.5      | -                | 39.5            | 53.9           | 14.4        | Floor noise |
| Hori.    | 7323.000        | AV       | 34.5           | 36.0            | 8.3       | 33.5      | -                | 45.4            | 53.9           | 8.5         | Floor noise |
| Hori.    | 9764.000        | AV       | 32.3           | 38.8            | 9.4       | 33.8      | -                | 46.7            | 53.9           | 7.2         | Floor noise |
| Vert.    | 31.023          | QP       | 27.8           | 17.7            | 6.7       | 30.5      | -                | 21.7            | 40.0           | 18.3        |             |
| Vert.    | 48.523          | QP       | 36.1           | 11.5            | 6.9       | 30.5      | -                | 24.0            | 40.0           | 16.0        |             |
| Vert.    | 89.120          | QP       | 30.6           | 8.1             | 7.4       | 30.3      | -                | 15.8            | 43.5           | 27.7        |             |
| Vert.    | 172.173         | QP       | 31.3           | 15.6            | 8.0       | 29.8      | -                | 25.0            | 43.5           | 18.5        |             |
| Vert.    | 226.408         | QP       | 26.4           | 11.2            | 8.4       | 29.5      | -                | 16.5            | 46.0           | 29.5        |             |
| Vert.    | 466.152         | QP       | 24.3           | 16.7            | 9.7       | 29.9      | -                | 20.8            | 46.0           | 25.2        |             |
| Vert.    | 4882.000        | PK       | 42.1           | 31.7            | 7.2       | 33.5      | -                | 47.6            | 73.9           | 26.3        | Floor noise |
| Vert.    | 7323.000        | PK       | 42.8           | 36.0            | 8.3       | 33.5      | -                | 53.7            | 73.9           | 20.2        | Floor noise |
| Vert.    | 9764.000        | PK       | 42.2           | 38.8            | 9.4       | 33.8      | -                | 56.6            | 73.9           | 17.3        | Floor noise |
| Vert.    | 4882.000        | AV       | 34.3           | 31.7            | 7.2       | 33.5      | -                | 39.8            | 53.9           | 14.1        | Floor noise |
| Vert.    | 7323.000        | AV       | 34.5           | 36.0            | 8.3       | 33.5      | -                | 45.4            | 53.9           | 8.5         | Floor noise |
| Vert.    | 9764.000        | AV       | 32.5           | 38.8            | 9.4       | 33.8      | -                | 46.9            | 53.9           | 7.0         | Floor noise |

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

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

Distance factor:    1 GHz - 10 GHz    20log(3.7 m / 3.0 m) = 1.83 dB  
                          10 GHz - 26.5 GHz    20log(1.0 m / 3.0 m) = -9.5 dB

### Radiated Spurious Emission

|                        |                               |                     |                     |
|------------------------|-------------------------------|---------------------|---------------------|
| Report No.             | 12905370H                     |                     |                     |
| Test place             | Ise EMC Lab.                  |                     |                     |
| Semi Anechoic Chamber  | No.2                          | No.2                | No.4                |
| Date                   | May 28, 2019                  | May 28, 2019        | June 12, 2019       |
| Temperature / Humidity | 24 deg. C / 56 % RH           | 24 deg. C / 56 % RH | 22 deg. C / 70 % RH |
| Engineer               | Yuta Moriya                   | Takumi Shimada      | Takafumi Noguchi    |
|                        | (1 - 10 GHz)                  | (10 - 26.5 GHz)     | (Below 1 GHz)       |
| Mode                   | Tx, Hopping Off, DH5 2480 MHz |                     |                     |

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Duty Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark      |
|----------|-----------------|----------|----------------|-----------------|-----------|-----------|------------------|-----------------|----------------|-------------|-------------|
| Hori.    | 32.026          | QP       | 22.5           | 17.4            | 7.2       | 32.2      | -                | 15.0            | 40.0           | 25.0        |             |
| Hori.    | 50.414          | QP       | 22.8           | 10.8            | 7.6       | 32.2      | -                | 9.0             | 40.0           | 31.0        |             |
| Hori.    | 85.100          | QP       | 29.9           | 7.2             | 8.0       | 32.1      | -                | 13.0            | 40.0           | 27.1        |             |
| Hori.    | 185.680         | QP       | 28.8           | 16.4            | 9.1       | 32.0      | -                | 22.3            | 43.5           | 21.2        |             |
| Hori.    | 245.965         | QP       | 31.6           | 11.7            | 9.5       | 32.0      | -                | 20.9            | 46.0           | 25.1        |             |
| Hori.    | 454.640         | QP       | 27.2           | 16.5            | 11.0      | 32.0      | -                | 22.7            | 46.0           | 23.3        |             |
| Hori.    | 2483.500        | PK       | 45.8           | 28.1            | 5.1       | 34.2      | -                | 44.8            | 73.9           | 29.1        |             |
| Hori.    | 4960.000        | PK       | 40.6           | 31.9            | 7.3       | 33.5      | -                | 46.3            | 73.9           | 27.6        | Floor noise |
| Hori.    | 7440.000        | PK       | 42.4           | 36.3            | 8.4       | 33.5      | -                | 53.6            | 73.9           | 20.3        | Floor noise |
| Hori.    | 9920.000        | PK       | 42.3           | 38.7            | 9.5       | 33.8      | -                | 56.7            | 73.9           | 17.2        | Floor noise |
| Hori.    | 2483.500        | AV       | 35.6           | 28.1            | 5.1       | 34.2      | 1.1              | 35.7            | 53.9           | 18.2        | *1)         |
| Hori.    | 4960.000        | AV       | 33.2           | 31.9            | 7.3       | 33.5      | -                | 38.9            | 53.9           | 15.0        | Floor noise |
| Hori.    | 7440.000        | AV       | 33.9           | 36.3            | 8.4       | 33.5      | -                | 45.1            | 53.9           | 8.8         | Floor noise |
| Hori.    | 9920.000        | AV       | 32.0           | 38.7            | 9.5       | 33.8      | -                | 46.4            | 53.9           | 7.5         | Floor noise |
| Vert.    | 31.962          | QP       | 28.5           | 17.5            | 7.2       | 32.2      | -                | 21.0            | 40.0           | 19.0        |             |
| Vert.    | 49.840          | QP       | 35.0           | 11.1            | 7.5       | 32.2      | -                | 21.4            | 40.0           | 18.6        |             |
| Vert.    | 84.451          | QP       | 31.3           | 6.9             | 8.0       | 32.1      | -                | 14.1            | 40.0           | 25.9        |             |
| Vert.    | 181.520         | QP       | 31.0           | 16.3            | 9.0       | 32.0      | -                | 24.3            | 43.5           | 19.2        |             |
| Vert.    | 226.220         | QP       | 27.1           | 11.1            | 9.4       | 32.0      | -                | 15.7            | 46.0           | 30.3        |             |
| Vert.    | 454.520         | QP       | 31.2           | 16.5            | 11.0      | 32.0      | -                | 26.7            | 46.0           | 19.3        |             |
| Vert.    | 2483.500        | PK       | 43.6           | 28.1            | 5.1       | 34.2      | -                | 42.6            | 73.9           | 31.3        |             |
| Vert.    | 4960.000        | PK       | 40.6           | 31.9            | 7.3       | 33.5      | -                | 46.3            | 73.9           | 27.6        | Floor noise |
| Vert.    | 7440.000        | PK       | 41.4           | 36.3            | 8.4       | 33.5      | -                | 52.6            | 73.9           | 21.3        | Floor noise |
| Vert.    | 9920.000        | PK       | 41.7           | 38.7            | 9.5       | 33.8      | -                | 56.1            | 73.9           | 17.8        | Floor noise |
| Vert.    | 2483.500        | AV       | 32.9           | 28.1            | 5.1       | 34.2      | 1.1              | 33.0            | 53.9           | 20.9        | *1)         |
| Vert.    | 4960.000        | AV       | 31.8           | 31.9            | 7.3       | 33.5      | -                | 37.5            | 53.9           | 16.4        | Floor noise |
| Vert.    | 7440.000        | AV       | 31.8           | 36.3            | 8.4       | 33.5      | -                | 43.0            | 53.9           | 10.9        | Floor noise |
| Vert.    | 9920.000        | AV       | 32.2           | 38.7            | 9.5       | 33.8      | -                | 46.6            | 53.9           | 7.3         | Floor noise |

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

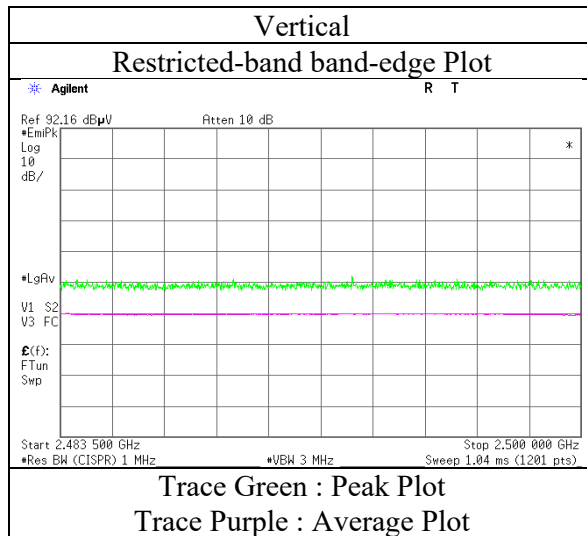
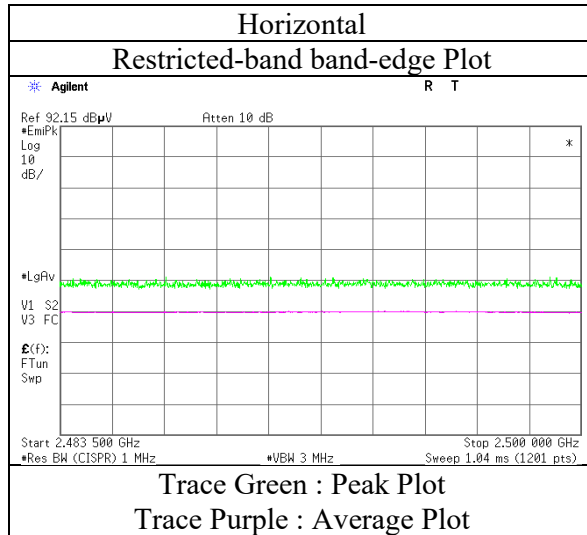
\*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log(3.7 m / 3.0 m) = 1.83 dB  
10 GHz - 26.5 GHz 20log(1.0 m / 3.0 m) = -9.5 dB

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

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

Report No. 12905370H  
 Test place Ise EMC Lab.  
 Semi Anechoic Chamber No.2  
 Date May 28, 2019  
 Temperature / Humidity 24 deg. C / 56 % RH  
 Engineer Yuta Moriya  
 (1 - 10 GHz)  
 Mode Tx, Hopping Off, DH5 2480 MHz



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

### Radiated Spurious Emission

Report No. 12905370H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.2 No.2 No.4  
Date May 28, 2019 May 28, 2019 June 12, 2019  
Temperature / Humidity 24 deg. C / 56 % RH 24 deg. C / 56 % RH 22 deg. C / 70 % RH  
Engineer Yuta Moriya Takumi Shimada Takafumi Noguchi  
(1 - 10 GHz) (10 - 26.5 GHz) (Below 1 GHz)  
Mode Tx, Hopping Off, 3DHS 2402 MHz

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Duty Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark      |
|----------|-----------------|----------|----------------|-----------------|-----------|-----------|------------------|-----------------|----------------|-------------|-------------|
| Hori.    | 33.036          | QP       | 22.5           | 17.1            | 7.3       | 32.2      | -                | 14.7            | 40.0           | 25.4        |             |
| Hori.    | 50.133          | QP       | 22.7           | 10.9            | 7.5       | 32.2      | -                | 9.0             | 40.0           | 31.0        |             |
| Hori.    | 83.513          | QP       | 30.0           | 6.7             | 8.0       | 32.1      | -                | 12.6            | 40.0           | 27.4        |             |
| Hori.    | 186.421         | QP       | 28.9           | 16.5            | 9.1       | 32.0      | -                | 22.4            | 43.5           | 21.1        |             |
| Hori.    | 247.636         | QP       | 31.6           | 11.7            | 9.6       | 32.0      | -                | 20.9            | 46.0           | 25.1        |             |
| Hori.    | 454.340         | QP       | 27.2           | 16.5            | 11.0      | 32.0      | -                | 22.7            | 46.0           | 23.3        |             |
| Hori.    | 2390.000        | PK       | 43.4           | 27.3            | 5.1       | 34.3      | -                | 41.5            | 73.9           | 32.4        |             |
| Hori.    | 4804.000        | PK       | 41.9           | 31.6            | 7.2       | 33.5      | -                | 47.2            | 73.9           | 26.7        | Floor noise |
| Hori.    | 7206.000        | PK       | 43.0           | 36.4            | 8.3       | 33.4      | -                | 54.3            | 73.9           | 19.7        | Floor noise |
| Hori.    | 9608.000        | PK       | 42.2           | 38.5            | 9.4       | 33.8      | -                | 56.3            | 73.9           | 17.6        | Floor noise |
| Hori.    | 2390.000        | AV       | 35.1           | 27.3            | 5.1       | 34.3      | 1.1              | 34.2            | 53.9           | 19.7        | *1)         |
| Hori.    | 4804.000        | AV       | 31.8           | 31.6            | 7.2       | 33.5      | -                | 37.1            | 53.9           | 16.8        | Floor noise |
| Hori.    | 7206.000        | AV       | 33.1           | 36.4            | 8.3       | 33.4      | -                | 44.4            | 53.9           | 9.5         | Floor noise |
| Hori.    | 9608.000        | AV       | 32.3           | 38.5            | 9.4       | 33.8      | -                | 46.4            | 53.9           | 7.5         | Floor noise |
| Vert.    | 34.188          | QP       | 29.5           | 16.5            | 7.3       | 32.2      | -                | 21.1            | 40.0           | 18.9        |             |
| Vert.    | 49.574          | QP       | 34.5           | 11.2            | 7.5       | 32.2      | -                | 21.0            | 40.0           | 19.0        |             |
| Vert.    | 83.302          | QP       | 31.3           | 6.7             | 8.0       | 32.1      | -                | 13.9            | 40.0           | 26.1        |             |
| Vert.    | 186.426         | QP       | 30.6           | 16.5            | 9.1       | 32.0      | -                | 24.1            | 43.5           | 19.4        |             |
| Vert.    | 237.261         | QP       | 27.1           | 11.4            | 9.5       | 32.0      | -                | 16.0            | 46.0           | 30.0        |             |
| Vert.    | 454.500         | QP       | 31.2           | 16.5            | 11.0      | 32.0      | -                | 26.7            | 46.0           | 19.3        |             |
| Vert.    | 2390.000        | PK       | 44.3           | 27.3            | 5.1       | 34.3      | -                | 42.4            | 73.9           | 31.5        |             |
| Vert.    | 4804.000        | PK       | 42.4           | 31.6            | 7.2       | 33.5      | -                | 47.7            | 73.9           | 26.2        | Floor noise |
| Vert.    | 7206.000        | PK       | 42.9           | 36.4            | 8.3       | 33.4      | -                | 54.2            | 73.9           | 19.8        | Floor noise |
| Vert.    | 9608.000        | PK       | 42.7           | 38.5            | 9.4       | 33.8      | -                | 56.8            | 73.9           | 17.1        | Floor noise |
| Vert.    | 2390.000        | AV       | 35.0           | 27.3            | 5.1       | 34.3      | 1.1              | 34.1            | 53.9           | 19.8        | *1)         |
| Vert.    | 4804.000        | AV       | 31.9           | 31.6            | 7.2       | 33.5      | -                | 37.2            | 53.9           | 16.7        | Floor noise |
| Vert.    | 7206.000        | AV       | 32.6           | 36.4            | 8.3       | 33.4      | -                | 43.9            | 53.9           | 10.1        | Floor noise |
| Vert.    | 9608.000        | AV       | 32.3           | 38.5            | 9.4       | 33.8      | -                | 46.4            | 53.9           | 7.5         | Floor noise |

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

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

Distance factor: 1 GHz - 10 GHz  $20\log(3.7\text{ m} / 3.0\text{ m}) = 1.83\text{ dB}$

10 GHz - 26.5 GHz  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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

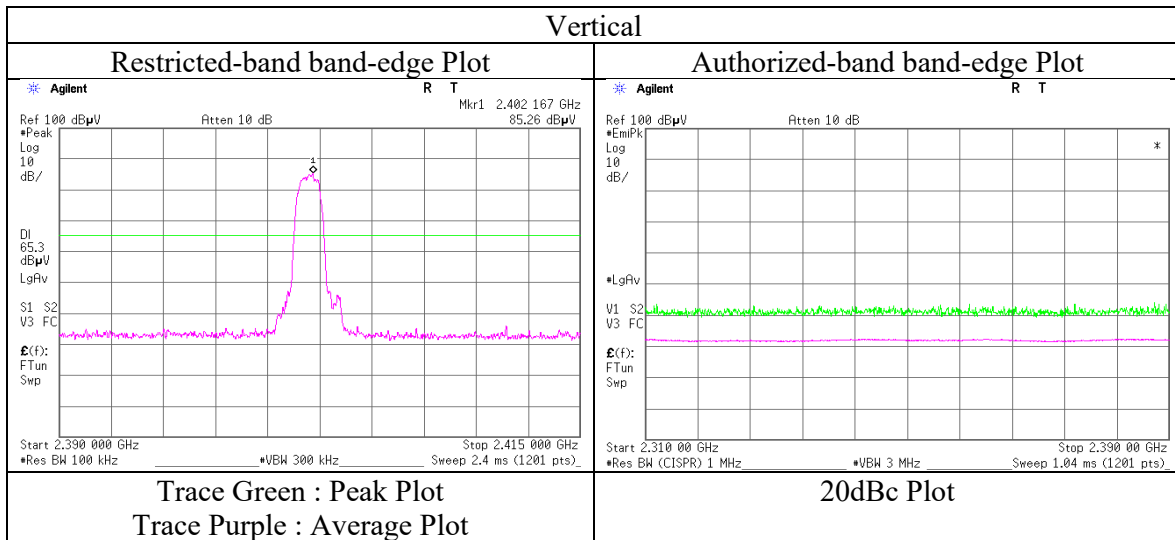
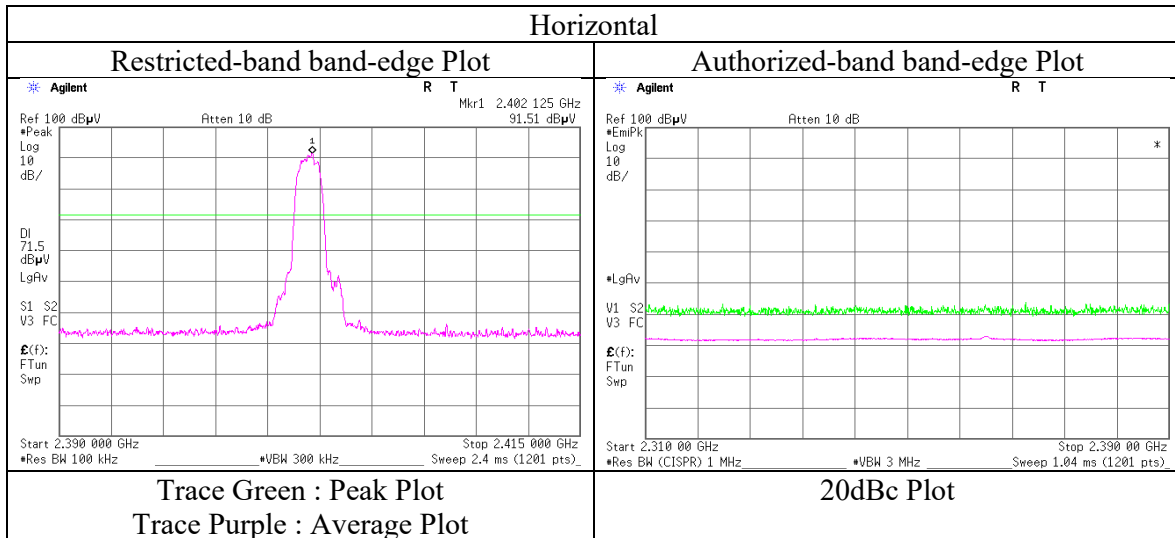
**20dBc Data Sheet**

| 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       | 91.5           | 27.0              | 5.1       | 34.3      | 89.4            | -              | -           | Carrier |
| Hori.    | 2400.000        | PK       | 36.6           | 27.0              | 5.1       | 34.3      | 34.4            | 69.4           | 34.9        |         |
| Vert.    | 2402.000        | PK       | 85.3           | 27.0              | 5.1       | 34.3      | 83.2            | -              | -           | Carrier |
| Vert.    | 2400.000        | PK       | 35.2           | 27.0              | 5.1       | 34.3      | 33.0            | 63.2           | 30.1        |         |

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

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

Report No. 12905370H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.2  
Date May 28, 2019  
Temperature / Humidity 24 deg. C / 56 % RH  
Engineer Yuta Moriya  
(1 - 10 GHz)  
Mode Tx, Hopping Off, 3DH5 2402 MHz



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

## Radiated Spurious Emission

|                        |                                |                                   |                                 |
|------------------------|--------------------------------|-----------------------------------|---------------------------------|
| Report No.             | 12905370H                      |                                   |                                 |
| Test place             | Ise EMC Lab.                   |                                   |                                 |
| Semi Anechoic Chamber  | No.2                           | No.2                              | No.2                            |
| Date                   | May 28, 2019                   | May 28, 2019                      | May 28, 2019                    |
| Temperature / Humidity | 24 deg. C / 56 % RH            | 24 deg. C / 56 % RH               | 24 deg. C / 56 % RH             |
| Engineer               | Yuta Moriya<br>(1 - 10 GHz)    | Takumi Shimada<br>(10 - 26.5 GHz) | Takumi Shimada<br>(below 1 GHz) |
| Mode                   | Tx, Hopping Off, 3DH5 2441 MHz |                                   |                                 |

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Duty Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark      |
|----------|-----------------|----------|----------------|-----------------|-----------|-----------|------------------|-----------------|----------------|-------------|-------------|
| Hori.    | 32.154          | QP       | 25.5           | 17.1            | 6.7       | 30.5      | -                | 18.9            | 40.0           | 21.2        |             |
| Hori.    | 48.695          | QP       | 25.6           | 11.4            | 7.0       | 30.5      | -                | 13.5            | 40.0           | 26.5        |             |
| Hori.    | 89.499          | QP       | 30.8           | 8.2             | 7.4       | 30.3      | -                | 16.1            | 43.5           | 27.4        |             |
| Hori.    | 171.815         | QP       | 25.7           | 15.5            | 8.0       | 29.8      | -                | 19.4            | 43.5           | 24.1        |             |
| Hori.    | 292.825         | QP       | 26.0           | 13.4            | 8.8       | 29.2      | -                | 19.0            | 46.0           | 27.0        |             |
| Hori.    | 522.736         | QP       | 23.9           | 17.6            | 9.9       | 29.9      | -                | 21.4            | 46.0           | 24.6        |             |
| Hori.    | 4882.000        | PK       | 41.7           | 31.7            | 7.2       | 33.5      | -                | 47.2            | 73.9           | 26.7        | Floor noise |
| Hori.    | 7323.000        | PK       | 42.2           | 36.0            | 8.3       | 33.5      | -                | 53.1            | 73.9           | 20.8        | Floor noise |
| Hori.    | 9764.000        | PK       | 41.8           | 38.8            | 9.4       | 33.8      | -                | 56.2            | 73.9           | 17.7        | Floor noise |
| Hori.    | 4882.000        | AV       | 33.8           | 31.7            | 7.2       | 33.5      | -                | 39.3            | 53.9           | 14.6        | Floor noise |
| Hori.    | 7323.000        | AV       | 34.4           | 36.0            | 8.3       | 33.5      | -                | 45.3            | 53.9           | 8.6         | Floor noise |
| Hori.    | 9764.000        | AV       | 32.4           | 38.8            | 9.4       | 33.8      | -                | 46.8            | 53.9           | 7.1         | Floor noise |
| Vert.    | 32.154          | QP       | 28.1           | 17.1            | 6.7       | 30.5      | -                | 21.5            | 40.0           | 18.6        |             |
| Vert.    | 48.695          | QP       | 35.8           | 11.4            | 7.0       | 30.5      | -                | 23.7            | 40.0           | 16.3        |             |
| Vert.    | 89.499          | QP       | 31.1           | 8.2             | 7.4       | 30.3      | -                | 16.4            | 43.5           | 27.1        |             |
| Vert.    | 171.815         | QP       | 31.3           | 15.5            | 8.0       | 29.8      | -                | 25.0            | 43.5           | 18.5        |             |
| Vert.    | 292.825         | QP       | 26.0           | 13.4            | 8.8       | 29.2      | -                | 19.0            | 46.0           | 27.0        |             |
| Vert.    | 522.736         | QP       | 23.9           | 17.6            | 9.9       | 29.9      | -                | 21.4            | 46.0           | 24.6        |             |
| Vert.    | 4882.000        | PK       | 40.9           | 31.7            | 7.2       | 33.5      | -                | 46.4            | 73.9           | 27.5        | Floor noise |
| Vert.    | 7323.000        | PK       | 42.0           | 36.0            | 8.3       | 33.5      | -                | 52.9            | 73.9           | 21.0        | Floor noise |
| Vert.    | 9764.000        | PK       | 41.0           | 38.8            | 9.4       | 33.8      | -                | 55.4            | 73.9           | 18.5        | Floor noise |
| Vert.    | 4882.000        | AV       | 33.8           | 31.7            | 7.2       | 33.5      | -                | 39.3            | 53.9           | 14.6        | Floor noise |
| Vert.    | 7323.000        | AV       | 34.4           | 36.0            | 8.3       | 33.5      | -                | 45.3            | 53.9           | 8.6         | Floor noise |
| Vert.    | 9764.000        | AV       | 32.3           | 38.8            | 9.4       | 33.8      | -                | 46.7            | 53.9           | 7.2         | Floor noise |

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

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

Distance factor: 1 GHz - 10 GHz 20log (3.7 m / 3.0 m) = 1.83 dB  
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

### Radiated Spurious Emission

|                        |                                |                                   |                                   |
|------------------------|--------------------------------|-----------------------------------|-----------------------------------|
| Report No.             | 12905370H                      |                                   |                                   |
| Test place             | Ise EMC Lab.                   |                                   |                                   |
| Semi Anechoic Chamber  | No.2                           | No.2                              | No.4                              |
| Date                   | May 28, 2019                   | May 28, 2019                      | June 12, 2019                     |
| Temperature / Humidity | 24 deg. C / 56 % RH            | 24 deg. C / 56 % RH               | 22 deg. C / 70 % RH               |
| Engineer               | Yuta Moriya<br>(1 - 10 GHz)    | Takumi Shimada<br>(10 - 26.5 GHz) | Takafumi Noguchi<br>(Below 1 GHz) |
| Mode                   | Tx, Hopping Off, 3DH5 2480 MHz |                                   |                                   |

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Duty Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark      |
|----------|-----------------|----------|----------------|-----------------|-----------|-----------|------------------|-----------------|----------------|-------------|-------------|
| Hori.    | 31.988          | QP       | 22.5           | 17.4            | 7.2       | 32.2      | -                | 15.0            | 40.0           | 25.0        |             |
| Hori.    | 49.721          | QP       | 22.7           | 11.1            | 7.5       | 32.2      | -                | 9.2             | 40.0           | 30.8        |             |
| Hori.    | 83.423          | QP       | 29.8           | 6.7             | 8.0       | 32.1      | -                | 12.4            | 40.0           | 27.6        |             |
| Hori.    | 182.897         | QP       | 28.7           | 16.2            | 9.0       | 32.0      | -                | 21.9            | 43.5           | 21.6        |             |
| Hori.    | 225.962         | QP       | 31.7           | 11.1            | 9.4       | 32.0      | -                | 20.3            | 46.0           | 25.7        |             |
| Hori.    | 457.018         | QP       | 28.0           | 16.5            | 11.0      | 32.0      | -                | 23.5            | 46.0           | 22.5        |             |
| Hori.    | 2483.500        | PK       | 46.4           | 28.1            | 5.1       | 34.2      | -                | 45.4            | 73.9           | 28.5        |             |
| Hori.    | 4960.000        | PK       | 41.9           | 31.9            | 7.3       | 33.5      | -                | 47.6            | 73.9           | 26.3        | Floor noise |
| Hori.    | 7440.000        | PK       | 42.0           | 36.3            | 8.4       | 33.5      | -                | 53.2            | 73.9           | 20.7        | Floor noise |
| Hori.    | 9920.000        | PK       | 42.4           | 38.7            | 9.5       | 33.8      | -                | 56.8            | 73.9           | 17.1        | Floor noise |
| Hori.    | 2483.500        | AV       | 34.2           | 28.1            | 5.1       | 34.2      | 1.1              | 34.3            | 53.9           | 19.6        | *1)         |
| Hori.    | 4960.000        | AV       | 31.2           | 31.9            | 7.3       | 33.5      | -                | 36.9            | 53.9           | 17.0        | Floor noise |
| Hori.    | 7440.000        | AV       | 31.8           | 36.3            | 8.4       | 33.5      | -                | 43.0            | 53.9           | 10.9        | Floor noise |
| Hori.    | 9920.000        | AV       | 32.4           | 38.7            | 9.5       | 33.8      | -                | 46.8            | 53.9           | 7.1         | Floor noise |
| Vert.    | 32.281          | QP       | 29.4           | 17.4            | 7.2       | 32.2      | -                | 21.8            | 40.0           | 18.2        |             |
| Vert.    | 49.805          | QP       | 35.2           | 11.1            | 7.5       | 32.2      | -                | 21.6            | 40.0           | 18.4        |             |
| Vert.    | 83.533          | QP       | 31.3           | 6.7             | 8.0       | 32.1      | -                | 13.9            | 40.0           | 26.1        |             |
| Vert.    | 183.139         | QP       | 30.7           | 16.2            | 9.0       | 32.0      | -                | 23.9            | 43.5           | 19.6        |             |
| Vert.    | 224.842         | QP       | 27.1           | 11.1            | 9.4       | 32.0      | -                | 15.6            | 46.0           | 30.4        |             |
| Vert.    | 454.455         | QP       | 31.3           | 16.5            | 11.0      | 32.0      | -                | 26.8            | 46.0           | 19.2        |             |
| Vert.    | 2483.500        | PK       | 43.8           | 28.1            | 5.1       | 34.2      | -                | 42.8            | 73.9           | 31.1        |             |
| Vert.    | 4960.000        | PK       | 41.0           | 31.9            | 7.3       | 33.5      | -                | 46.7            | 73.9           | 27.2        | Floor noise |
| Vert.    | 7440.000        | PK       | 41.6           | 36.3            | 8.4       | 33.5      | -                | 52.8            | 73.9           | 21.1        | Floor noise |
| Vert.    | 9920.000        | PK       | 41.8           | 38.7            | 9.5       | 33.8      | -                | 56.2            | 73.9           | 17.7        | Floor noise |
| Vert.    | 2483.500        | AV       | 35.7           | 28.1            | 5.1       | 34.2      | 1.1              | 35.8            | 53.9           | 18.1        | *1)         |
| Vert.    | 4960.000        | AV       | 31.4           | 31.9            | 7.3       | 33.5      | -                | 37.1            | 53.9           | 16.8        | Floor noise |
| Vert.    | 7440.000        | AV       | 31.7           | 36.3            | 8.4       | 33.5      | -                | 42.9            | 53.9           | 11.0        | Floor noise |
| Vert.    | 9920.000        | AV       | 32.2           | 38.7            | 9.5       | 33.8      | -                | 46.6            | 53.9           | 7.3         | Floor noise |

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

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

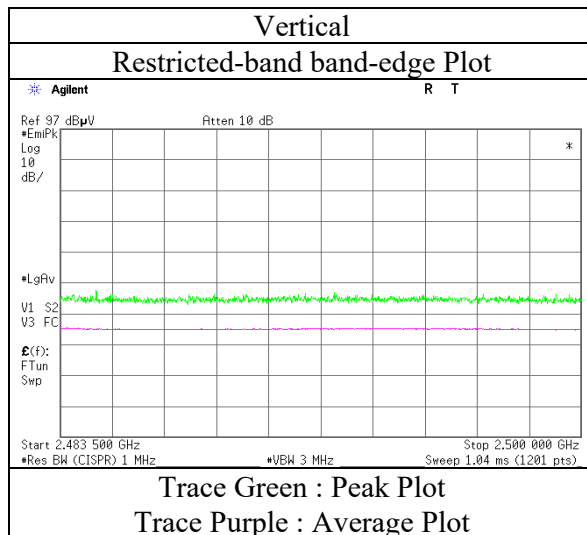
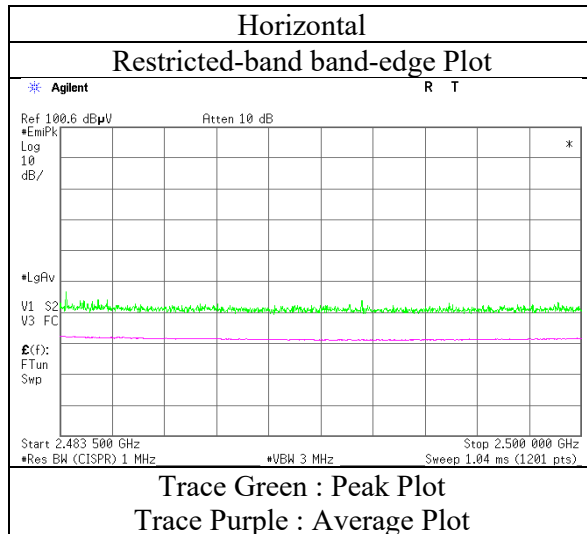
Distance factor: 1 GHz - 10 GHz 20log(3.7 m / 3.0 m) = 1.83 dB  
10 GHz - 26.5 GHz 20log(1.0 m / 3.0 m) = -9.5 dB

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



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

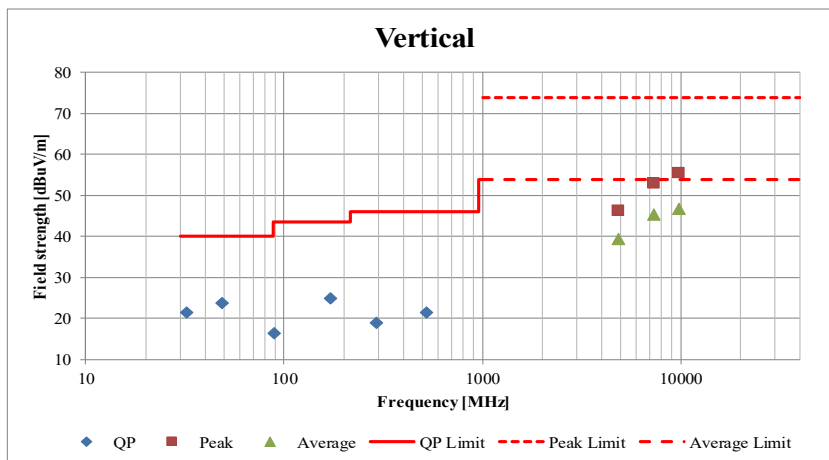
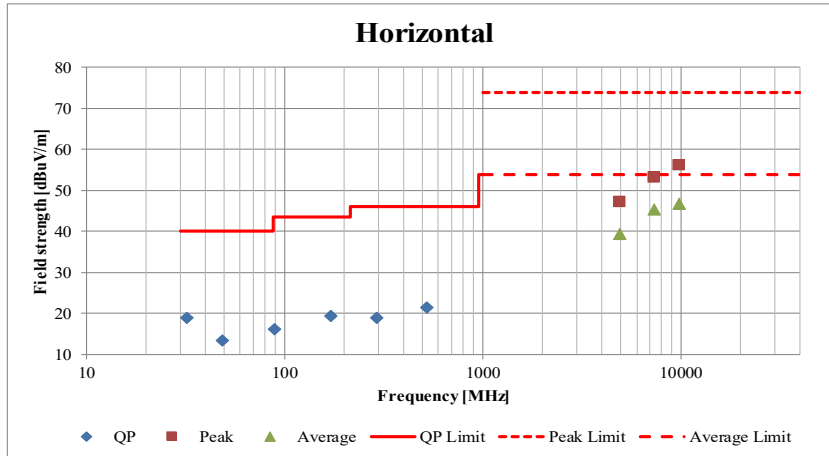
Report No. 12905370H  
 Test place Ise EMC Lab.  
 Semi Anechoic Chamber No.2  
 Date May 28, 2019  
 Temperature / Humidity 24 deg. C / 56 % RH  
 Engineer Yuta Moriya  
 (1 - 10 GHz)  
 Mode Tx, Hopping Off, 3DH5 2480 MHz



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

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

|                        |                                |                     |                     |
|------------------------|--------------------------------|---------------------|---------------------|
| Report No.             | 12905370H                      |                     |                     |
| Test place             | Ise EMC Lab.                   |                     |                     |
| Semi Anechoic Chamber  | No.2                           | No.2                | No.2                |
| Date                   | May 28, 2019                   | May 28, 2019        | May 28, 2019        |
| Temperature / Humidity | 24 deg. C / 56 % RH            | 24 deg. C / 56 % RH | 24 deg. C / 56 % RH |
| Engineer               | Yuta Moriya                    | Takumi Shimada      | Takumi Shimada      |
|                        | (1 - 10 GHz)                   | (10 - 26.5 GHz)     | (below 1 GHz)       |
| Mode                   | Tx, Hopping Off, 3DH5 2441 MHz |                     |                     |



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

## APPENDIX 2: Test instruments

### Test Instruments

| Test Item | LIMS ID | Description                         | Manufacturer                | Model                       | Serial                           | Last Calibration Date | Calibration Due Date | Cal Int |
|-----------|---------|-------------------------------------|-----------------------------|-----------------------------|----------------------------------|-----------------------|----------------------|---------|
| RE        | 142229  | Measure                             | KOMELON                     | KMC-36                      | -                                | -                     | -                    | -       |
| RE        | 141542  | Digital Tester                      | Fluke Corporation           | FLUKE 26-3                  | 78030611                         | 08/21/2018            | 08/31/2019           | 12      |
| RE        | 141556  | Thermo-Hygrometer                   | CUSTOM                      | CTH-201                     | 0003                             | 12/05/2018            | 12/31/2019           | 12      |
| RE        | 141579  | Pre Amplifier                       | AGILENT                     | 8449B                       | 3008A02142                       | 01/21/2019            | 01/31/2020           | 12      |
| RE        | 141392  | Microwave Cable                     | Junkosha                    | MWX221                      | 1604S253(1 m) /<br>1608S087(5 m) | 08/08/2018            | 08/31/2019           | 12      |
| RE        | 141512  | Horn Antenna 1-18GHz                | Schwarzbeck                 | BBHA9120D                   | 254                              | 05/09/2019            | 05/31/2020           | 12      |
| RE        | 141296  | High Pass Filter<br>3.5-18.0GHz     | UL Japan                    | HPF SELECTOR                | 002                              | 09/19/2018            | 09/30/2019           | 12      |
| RE        | 142004  | AC2_Semi Anechoic<br>Chamber(NSA)   | TDK                         | Semi Anechoic<br>Chamber 3m | DA-06902                         | 06/29/2018            | 06/30/2020           | 24      |
| RE        | 141855  | Spectrum Analyzer                   | AGILENT                     | E4440A                      | MY46187750                       | 11/09/2018            | 11/30/2019           | 12      |
| RE        | 142006  | AC2_Semi Anechoic<br>Chamber(SVSWR) | TDK                         | Semi Anechoic<br>Chamber 3m | DA-06902                         | 04/01/2019            | 04/30/2020           | 12      |
| RE        | 141942  | Test Receiver                       | Rohde & Schwarz             | ESCI                        | 100300                           | 08/08/2018            | 08/31/2019           | 12      |
| RE        | 141203  | Attenuator(6dB)                     | Weinschel Corp              | 2                           | BK7970                           | 11/05/2018            | 11/30/2019           | 12      |
| RE        | 141427  | Biconical Antenna                   | Schwarzbeck                 | VHA9103B                    | 8031                             | 04/12/2019            | 04/30/2020           | 12      |
| RE        | 141265  | Logperiodic<br>Antenna(200-1000MHz) | Schwarzbeck                 | VUSLP9111B                  | 911B-190                         | 03/25/2019            | 03/31/2020           | 12      |
| RE        | 141578  | Pre Amplifier                       | AGILENT                     | 8447D                       | 2944A10845                       | 09/19/2018            | 09/30/2019           | 12      |
| RE        | 141513  | Horn Antenna 15-40GHz               | Schwarzbeck                 | BBHA9170                    | BBHA9170306                      | 05/10/2019            | 05/31/2020           | 12      |
| RE        | 141317  | Coaxial Cable                       | Fujikura/Agilent            | -                           | -                                | 02/25/2019            | 02/29/2020           | 12      |
| AT        | 141805  | Power Meter                         | ANRITSU                     | ML2495A                     | 6K00003338                       | 10/16/2018            | 10/31/2019           | 12      |
| AT        | 141840  | Power sensor                        | ANRITSU                     | MA2411B                     | 11737                            | 10/16/2018            | 10/31/2019           | 12      |
| AT        | 141902  | Spectrum Analyzer                   | AGILENT                     | E4440A                      | MY46187105                       | 10/04/2018            | 10/31/2019           | 12      |
| RE        | 142011  | AC4_Semi Anechoic<br>Chamber(NSA)   | TDK                         | Semi Anechoic<br>Chamber 3m | DA-10005                         | 06/28/2018            | 06/30/2020           | 24      |
| RE        | 142227  | Measure                             | KOMELON                     | KMC-36                      | -                                | -                     | -                    | -       |
| AT        | 141173  | Attenuator(10dB)(above 1<br>GHz)    | HIROSE ELECTRIC<br>CO.,LTD. | AT-110                      | -                                | 12/17/2018            | 12/31/2019           | 12      |
| RE        | 141562  | Thermo-Hygrometer                   | CUSTOM                      | CTH-201                     | 0010                             | 01/11/2019            | 01/31/2020           | 12      |
| RE        | 141583  | Pre Amplifier                       | SONOMA<br>INSTRUMENT        | 310                         | 260833                           | 02/08/2019            | 02/29/2020           | 12      |
| RE        | 141267  | Logperiodic<br>Antenna(200-1000MHz) | Schwarzbeck                 | VUSLP9111B                  | 911B-192                         | 03/21/2019            | 03/31/2020           | 12      |
| RE        | 141152  | EMI measurement<br>program          | TSJ                         | TEPTO-DV                    | -                                | -                     | -                    | -       |
| RE        | 141545  | DIGITAL HiTESTER                    | HIOKI                       | 3805                        | 51201148                         | 01/29/2019            | 01/31/2020           | 12      |
| RE        | 141397  | Coaxial Cable                       | UL Japan                    | -                           | -                                | 06/13/2018            | 06/30/2019           | 12      |
| RE        | 148898  | Attenuator                          | KEYSIGHT                    | 8491A                       | MY52462282                       | 10/03/2018            | 10/31/2019           | 12      |
| RE        | 141425  | Biconical Antenna                   | Schwarzbeck                 | BBA9106                     | 1302                             | 05/24/2019            | 05/31/2020           | 12      |

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

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

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

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

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

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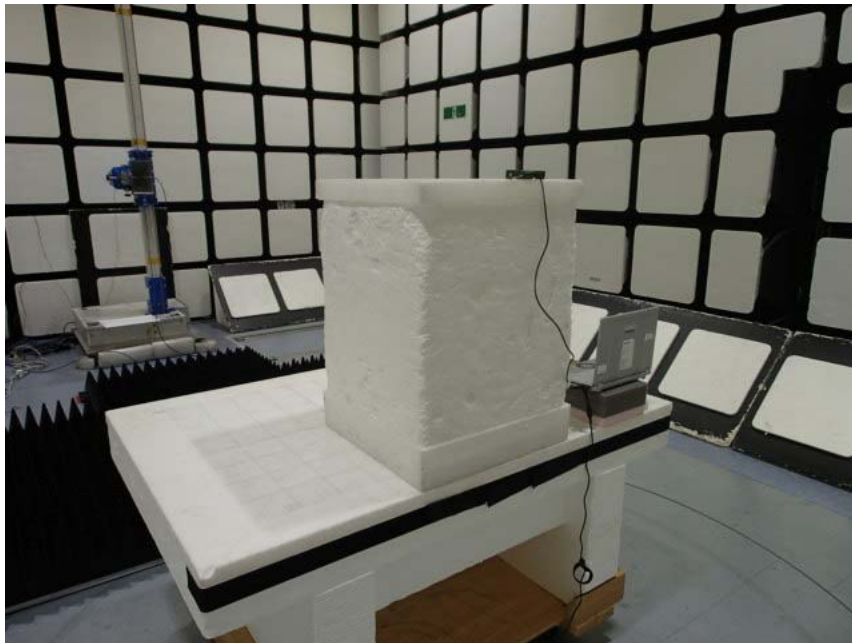
Facsimile : +81 596 24 8124

**APPENDIX 3: Photographs of test setup**

**Radiated Spurious Emission**



**Photo 1**

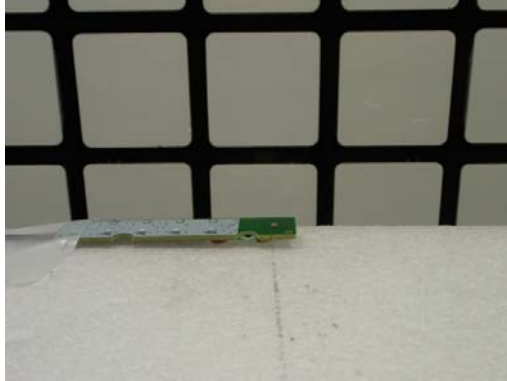


**Photo 2**

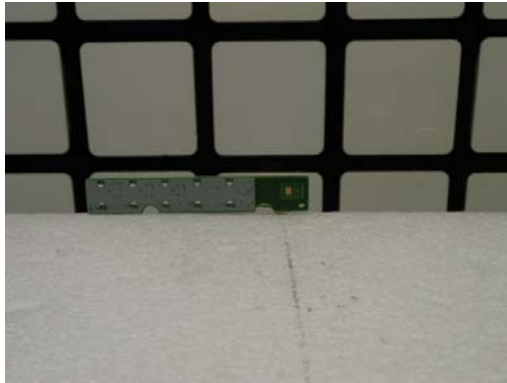
**Worst Case Position**

**Below 1 GHz (Horizontal: X-axis/ Vertical:X-axis)  
Above 1 GHz (Horizontal: Y-axis/ Vertical:Z-axis)**

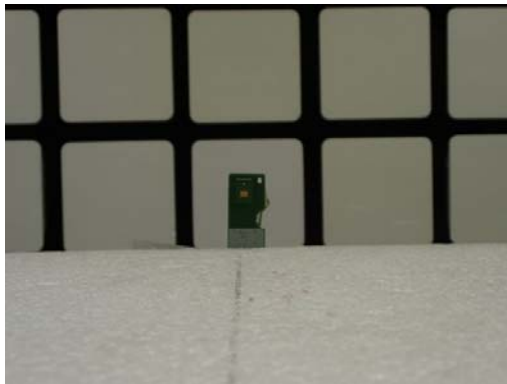
**X-axis**



**Y-axis**



**Z-axis**



**End of Report**