



# RADIO TEST REPORT

Test Report No. : 12053884S-A

**Applicant** : Alpine Electronics, Inc.  
**Type of Equipment** : CAR AUDIO  
**Model No.** : CDE-175BT  
**FCC ID** : A269ZUA155  
**Test regulation** : FCC Part 15 Subpart C: 2018  
**Test Result** : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
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:** January 9 to 16, 2018

**Representative test engineer:**

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Engineer  
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**Approved by:**

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- 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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13-EM-F0429



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## **SECTION 1: Customer information**

Company Name : Alpine Electronics, Inc.  
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Contact Person : Mitsuru Yoshida

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

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

Type of Equipment : CAR AUDIO  
Model No. : CDE-175BT  
Serial No. : Refer to Section 4, Clause 4.2  
Rating : DC 12 V  
Receipt Date of Sample : December 27, 2017  
Country of Mass-production : Thailand  
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: CDE-175BT (referred to as the EUT in this report) is a CAR AUDIO.

### **General Specification**

Clock frequency(ies) in the system : 26 MHz

### **Radio Specification (Bluetooth)**

Radio Type : Transceiver  
Frequency of Operation : 2402 MHz to 2480 MHz, 1 MHz each  
Modulation : FHSS/ GFSK/  $\pi/4$  DQPSK/ 8DPSK  
Power Supply (radio part input) : DC 3.3 V  
Antenna type : Top-GND-coupled loop  
Antenna Gain : Peak Gain -1.8 dBi, Ave.Gain -5.2 dBi

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

### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C  
FCC Part 15 final revised on January 2, 2018 and effective February 1, 2018

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

\* The revision on January 2, 2018, does not affect the test specification applied to the EUT.

### **3.2 Procedures and results**

| Item                                     | Test Procedure   | Specification   | Worst Margin  | Results  | Remarks   |
|--|--|---|---|----------|---|
| Conducted Emission                       | FCC: ANSI C63.10-2013<br>6. Standard test methods<br>IC: RSS-Gen 8.8 | FCC: Section 15.207<br>IC: RSS-Gen 8.8                                  | N/A   | N/A      | *1)   |
| Carrier Frequency Separation             | FCC: FCC Public Notice<br>DA 00-705<br>IC: -                         | FCC: Section15.247(a)(1)<br>IC: RSS-247 5.1 (b)                         | See data.   | Complied | Conducted                                       |
| 20dB Bandwidth                           | FCC: FCC Public Notice<br>DA 00-705<br>IC: -                         | FCC: Section15.247(a)(1)<br>IC: RSS-247 5.1 (a)                         |   | Complied | Conducted                                       |
| Number of Hopping Frequency              | FCC: FCC Public Notice<br>DA 00-705<br>IC: -                         | FCC: Section15.247(a)(1)(iii)<br>IC: RSS-247 5.1 (d)                    |   | Complied | Conducted                                       |
| Dwell time                               | FCC: FCC Public Notice<br>DA 00-705<br>IC: -                         | FCC: Section15.247(a)(1)(iii)<br>IC: RSS-247 5.1 (d)                    |   | Complied | Conducted                                       |
| Maximum Peak Output Power                | FCC: FCC Public Notice<br>DA 00-705<br>IC: RSS-Gen 6.12              | FCC: Section15.247(a)(b)(1)<br>IC: RSS-247 5.4 (b)                      |   | Complied | Conducted                                       |
| Spurious Emission & Band Edge Compliance | FCC: FCC Public Notice<br>DA 00-705<br>IC: RSS-Gen 6.13              | FCC: Section15.247(d)<br>IC: RSS-247 5.5<br>RSS-Gen 8.9<br>RSS-Gen 8.10 | 7.6 dB<br>48.004 MHz, QP, Vert.<br>Tx, Hopping Off, DH5 2441<br>MHz | Complied | Conducted/<br>Radiated<br>(above 30 MHz)<br>*2) |

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.  
\*1) The test is not applicable since the EUT has no AC mains.  
\*2) 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)**

The equipment provides the wireless transmitter with stable power supply (DC 3.3 V). Instead of a new battery, DC power supply was used for the test. That does not affect the test result, therefore the EUT complies with the requirement.

#### **FCC Part 15.203 Antenna requirement**

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement.

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### 3.3 Addition to standard

| Item                   | Test Procedure  | Specification | Worst margin | Results | Remarks   |
|------------------------|-----------------|---------------|--------------|---------|-----------|
| 99% Occupied Bandwidth | IC: RSS-Gen 6.6 | IC: -         | N/A          | -       | Conducted |

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

### 3.4 Uncertainty

#### EMI

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

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| Item   | Frequency range | Uncertainty (+/-) |                |                |                |              |
|--|-----------------|-------------------|----------------|----------------|----------------|--------------|
|  |                 | No. 1 SAC / SR    | No. 2 SAC / SR | No. 3 SAC / SR | No. 4 SAC / SR | No. 5,6,8 SR |
| Radiated emission<br>(Measurement distance: 3 m) | 30 MHz-200 MHz  | 4.3 dB            | 4.3 dB         | 4.3 dB         | -              | -            |
|  | 200 MHz-1 GHz   | 5.9 dB            | 5.9 dB         | 5.9 dB         | -              | -            |
|  | 1 GHz-6 GHz     | 4.7 dB            | 4.7 dB         | 4.7 dB         | -              | -            |
|  | 6 GHz-18 GHz    | 5.3 dB            | 5.3 dB         | 5.3 dB         | -              | -            |
|  | 18 GHz-40 GHz   | 5.6 dB            | 5.6 dB         | 5.6 dB         | -              | -            |
| Radiated emission<br>(Measurement distance: 1 m) | 1 GHz-18 GHz    | 5.6 dB            | 5.6 dB         | 5.6 dB         | -              | -            |
|  | 18 GHz-40 GHz   | 5.9 dB            | 5.9 dB         | 5.9 dB         | -              | -            |

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

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

#### Radiated emission test

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

### 3.5 Test Location

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

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

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

Refer to APPENDIX.

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

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

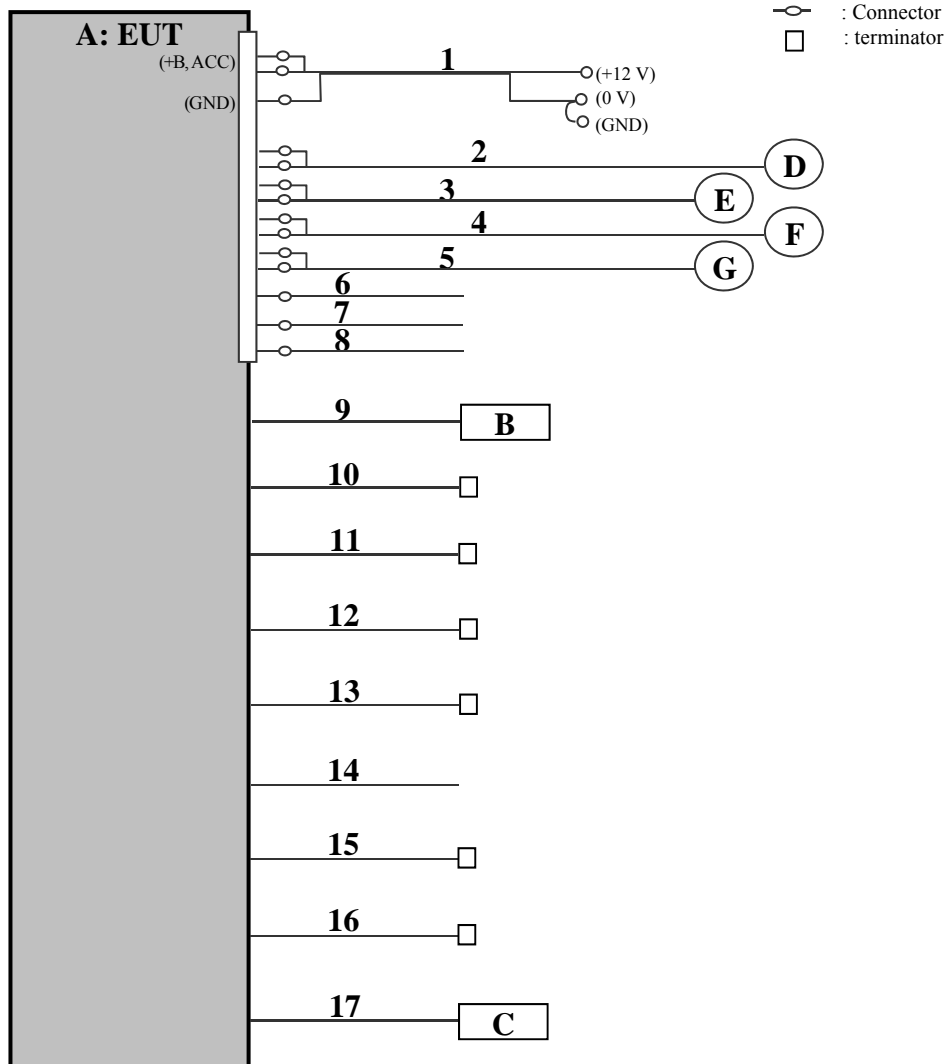
Bluetooth (BT): Transmitting (Tx), Payload: PRBS9

Details of Operating Mode(s)

| <b>Test Item</b>  | <b>Mode</b>   | <b>Tested frequency</b>          |
|---|---|----------------------------------|
| Spurious Emission<br>(Conducted/Radiated)   | Tx (Hopping Off) DH5, 3DH5                              | 2402 MHz<br>2441 MHz<br>2480 MHz |
| Carrier Frequency Separation  | Tx (Hopping On) DH5, 3DH5                               | 2402 MHz<br>2441 MHz<br>2480 MHz |
| 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<br>(Conducted)   | Tx DH5, 3DH5<br>-Hopping On<br>-Hopping Off             | 2402 MHz<br>2480 MHz             |
| 99% Occupied Bandwidth  | Tx DH5, 3DH5<br>-Hopping On<br>-Hopping Off             | 2402 MHz<br>2441 MHz<br>2480 MHz |
| <p>*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload length (except Dwell time test)</p> <p>*2DH mode (2Mb/s EDR: pi/4DQPSK) was excluded for other tests than power measurement by using 3DH mode (3 Mb/s EDR: 8DPSK) as a representative.</p> <p>* It is considered that the non-tested packet type (e.g. inquiry) can be omitted as it is complied with above all test items based on Bluetooth Core specification.</p> <p>*EUT has the power settings by the software as follows;<br/> Power settings: BDR: Ext.=23, Int.=39<br/> EDR: Ext.=73, Int.=48<br/> Software: CSR BlueSuite BlueTest3 Ver. 2.5.8.667<br/> *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



\* 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   | CAR AUDIO  | CDE-175BT    | 019 *1)<br>025 *2) | Alpine Electronics, Inc. | EUT     |
| B   | USB memory | USM4GU       | -                  | Sony                     | -       |
| C   | Mic        | -            | -                  | Alpine Electronics, Inc. | -       |
| D   | Speaker 1  | LV-002       | S11014200773       | L&V                      | -       |
| E   | Speaker 2  | LV-002       | S11014200773       | L&V                      | -       |
| F   | Speaker 3  | LV-002       | S11014200775       | L&V                      | -       |
| G   | Speaker 4  | LV-002       | S11014200775       | L&V                      | -       |

\*1) Used for Antenna Terminal conducted test

\*2) Used for Radiated Emission test

**List of cables used**

| No. | Name                  | Length (m) | Shield     |            | Remarks |
|-----|-----------------------|------------|------------|------------|---------|
|     |                       |            | Cable      | Connector  |         |
| 1   | DC Power              | 0.20 + 2.0 | Unshielded | Unshielded | -       |
| 2   | Speaker (1)           | 0.20 + 3.0 | Unshielded | Unshielded | -       |
| 3   | Speaker (2)           | 0.20 + 3.0 | Unshielded | Unshielded | -       |
| 4   | Speaker (3)           | 0.20 + 3.0 | Unshielded | Unshielded | -       |
| 5   | Speaker (4)           | 0.20 + 3.0 | Unshielded | Unshielded | -       |
| 6   | Illumination          | 0.20 + 1.0 | Unshielded | Unshielded | -       |
| 7   | Remote Turn-On        | 0.20 + 1.0 | Unshielded | Unshielded | -       |
| 8   | Power Antenna         | 0.20 + 1.0 | Unshielded | Unshielded | -       |
| 9   | USB                   | 1.0        | Shielded   | Shielded   | -       |
| 10  | AUX                   | 1.5        | Shielded   | Shielded   | -       |
| 11  | RCA (Front Audio Out) | 1.5        | Shielded   | Shielded   | -       |
| 12  | RCA (Rear Audio Out)  | 1.5        | Shielded   | Shielded   | -       |
| 13  | RCA (Sub Audio Out)   | 1.5        | Shielded   | Shielded   | -       |
| 14  | Remote                | 2.0        | Shielded   | Shielded   | -       |
| 15  | Antenna (FM/AM)       | 1.2        | Shielded   | Shielded   | -       |
| 16  | Antenna (Sirius X)    | 1.2        | Shielded   | Shielded   | -       |
| 17  | Mic                   | 3.5        | Shielded   | Shielded   | -       |

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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, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The table is made of expanded polystyrol and expanded polypropylene and the table top is covered with polycarbonate. That has very low permittivity. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

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

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

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

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           | 3.88 m*2) (1 GHz – 13 GHz),<br>1 m*3) (13 GHz – 26.5 GHz) |                              | 3.88 m*2) (1 GHz – 13 GHz),<br>1 m*3) (13 GHz – 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:  $20 \times \log(3.88 \text{ m}/3.0 \text{ m}) = 2.24 \text{ dB}$

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

The noise levels were confirmed at angle of 0 deg. to 30 deg. based on the product specification to see the position of maximum noise, and the test was made at the position that has the maximum noise.

**Worst case:**

| Antenna polarization | Carrier (Band edge) | Spurious    |                 |                  |                   |
|----------------------|---------------------|-------------|-----------------|------------------|-------------------|
|                      |                     | Below 1 GHz | Above 1 GHz     |                  |                   |
|                      |                     |             | 1 GHz – 2.8 GHz | 2.8 GHz - 13 GHz | 13 GHz – 26.5 GHz |
| Horizontal           | 0 deg.              | 0 deg.      | 0 deg.          | 0 deg.           | 0 deg.            |
| Vertical             | 0 deg.              | 0 deg.      | 0 deg.          | 0 deg.           | 0 deg.            |

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

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

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

### **Test Procedure**

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

| <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>         |
|--|---|-----------------|--------------------|--|------------------|--------------|--------------------------------|
| 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                                   | 100 kHz         | 300 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                       | 10 kHz          | 30 kHz             |  |                  |              |                                |
|  | 30 MHz to 25 GHz                        | 100 kHz         | 300 kHz            |  |                  |              |                                |
| Conducted Spurious Emission Band Edge compliance   | 10 MHz                                  | 100 kHz         | 300 kHz            | Auto   | Peak             | Max Hold     | Spectrum Analyzer              |
| *1) Peak hold was applied as Worst-case measurement.<br>*2) Reference data<br>*3) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.<br>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**

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

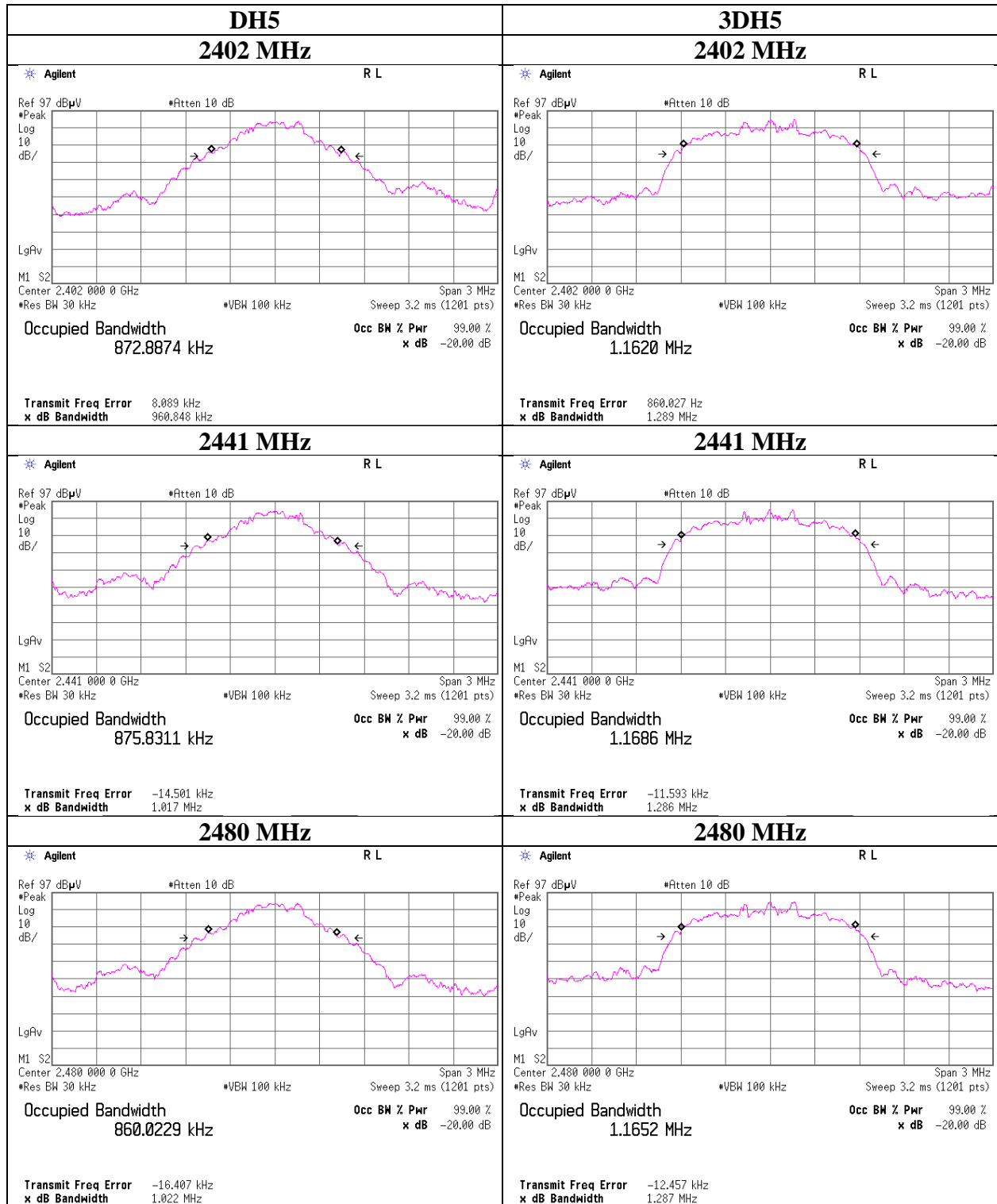
Test place                      Shonan EMC Lab. No.5 Shielded Room  
Report No.                      12053884S-A  
Date                              January 9, 2018  
Temperature / Humidity        23 deg. C / 47 % RH  
Engineer                        Makoto Hosaka  
Mode                              Tx, Hopping Off, Tx, Hopping On

| Mode | Freq.<br>[MHz] | 20dB Bandwidth<br>[MHz] | 99% Occupied<br>Bandwidth<br>[kHz] | Carrier Frequency<br>Separation<br>[MHz] | Limit for Carrier<br>Frequency separation<br>[MHz] |
|------|----------------|-------------------------|------------------------------------|--|--|
| DH5  | 2402.0         | 0.961                   | 872.9                              | 1.000                                    | >= 0.641   |
| DH5  | 2441.0         | 1.017                   | 875.8                              | 1.000                                    | >= 0.678   |
| DH5  | 2480.0         | 1.022                   | 860.0                              | 1.000                                    | >= 0.681   |
| DH5  | Hopping On     | -                       | 78554.5                            | -  | -  |
| 3DH5 | 2402.0         | 1.289                   | 1162.0                             | 1.000                                    | >= 0.860   |
| 3DH5 | 2441.0         | 1.286                   | 1168.6                             | 1.000                                    | >= 0.858   |
| 3DH5 | 2480.0         | 1.287                   | 1165.2                             | 1.000                                    | >= 0.858   |
| 3DH5 | Hopping On     | -                       | 78582.7                            | -  | -  |

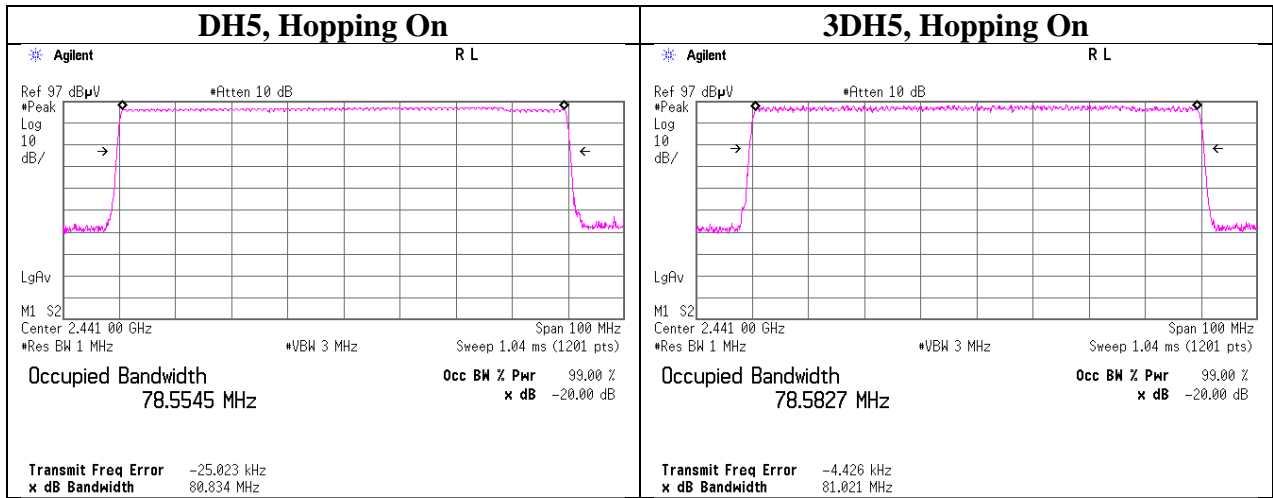
Limit: Two-thirds of 20dB Bandwidth or 25kHz (whichever is greater).

No limit applies to 20dB Bandwidth.

### 20dB Bandwidth and 99% Occupied Bandwidth

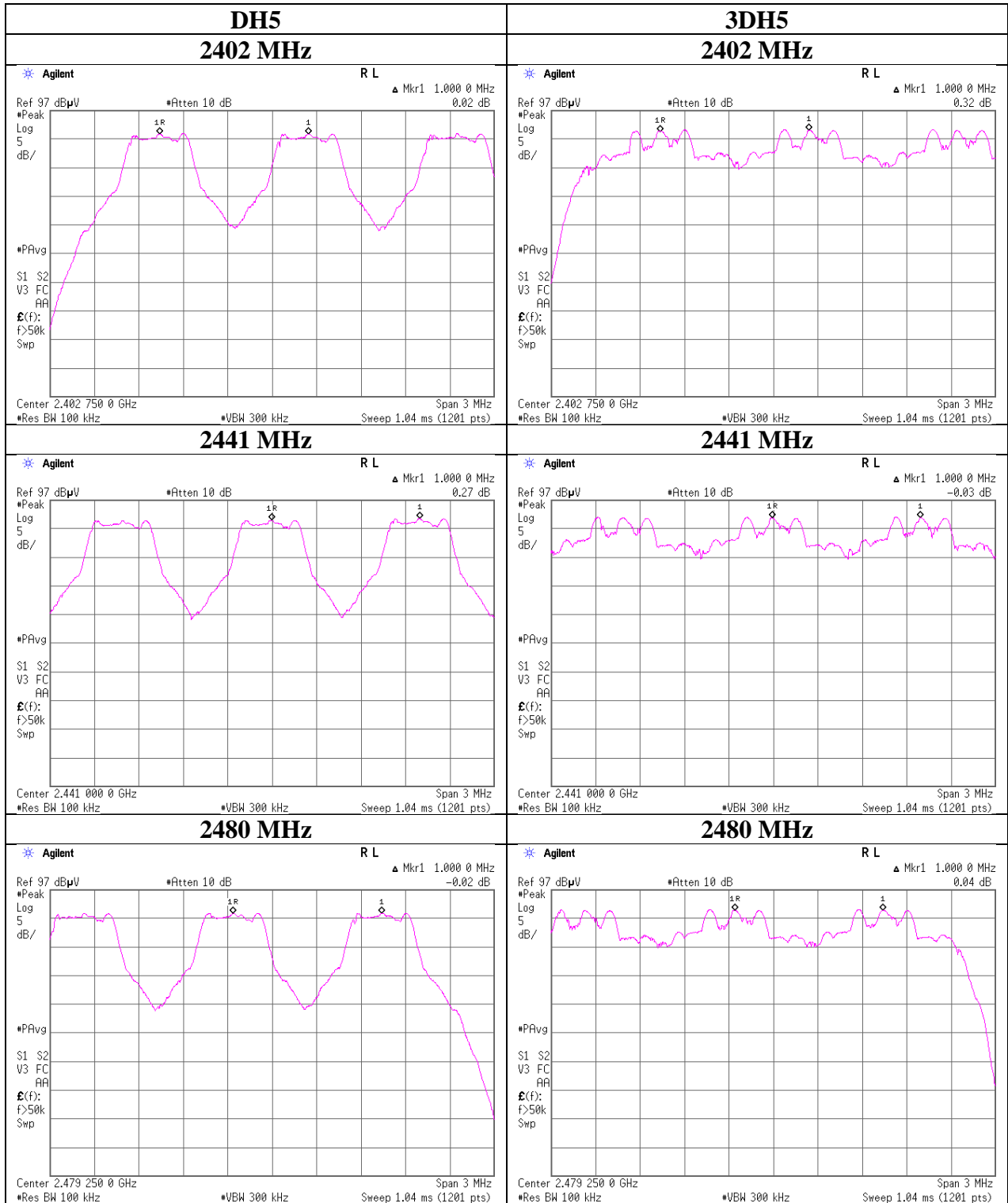


**20dB Bandwidth and 99% Occupied Bandwidth**





### Carrier Frequency Separation



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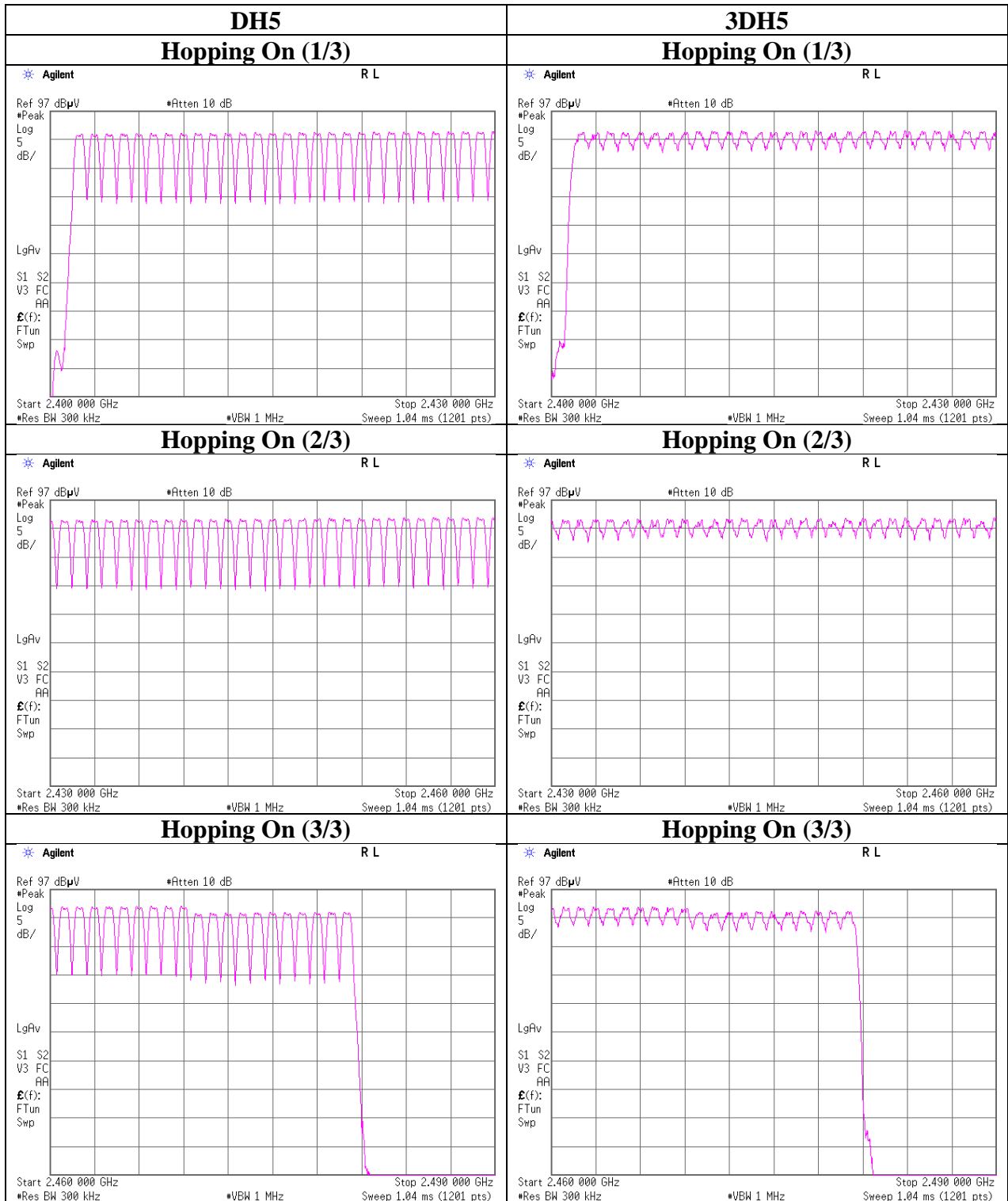
### Number of Hopping Frequency

Test place                   Shonan EMC Lab. No.5 Shielded Room  
Report No.                 12053884S-A  
Date                         January 9, 2018  
Temperature / Humidity   23 deg. C / 47 % RH  
Engineer                  Makoto Hosaka  
Mode                        Tx, Hopping On

| Mode | Number of channel<br>[channels] | Limit<br>[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**



### Dwell time

Test place Shonan EMC Lab. No.5 Shielded Room  
Report No. 12053884S-A  
Date January 9, 2018  
Temperature / Humidity 23 deg. C / 47 % RH  
Engineer Makoto Hosaka  
Mode Tx, Hopping On

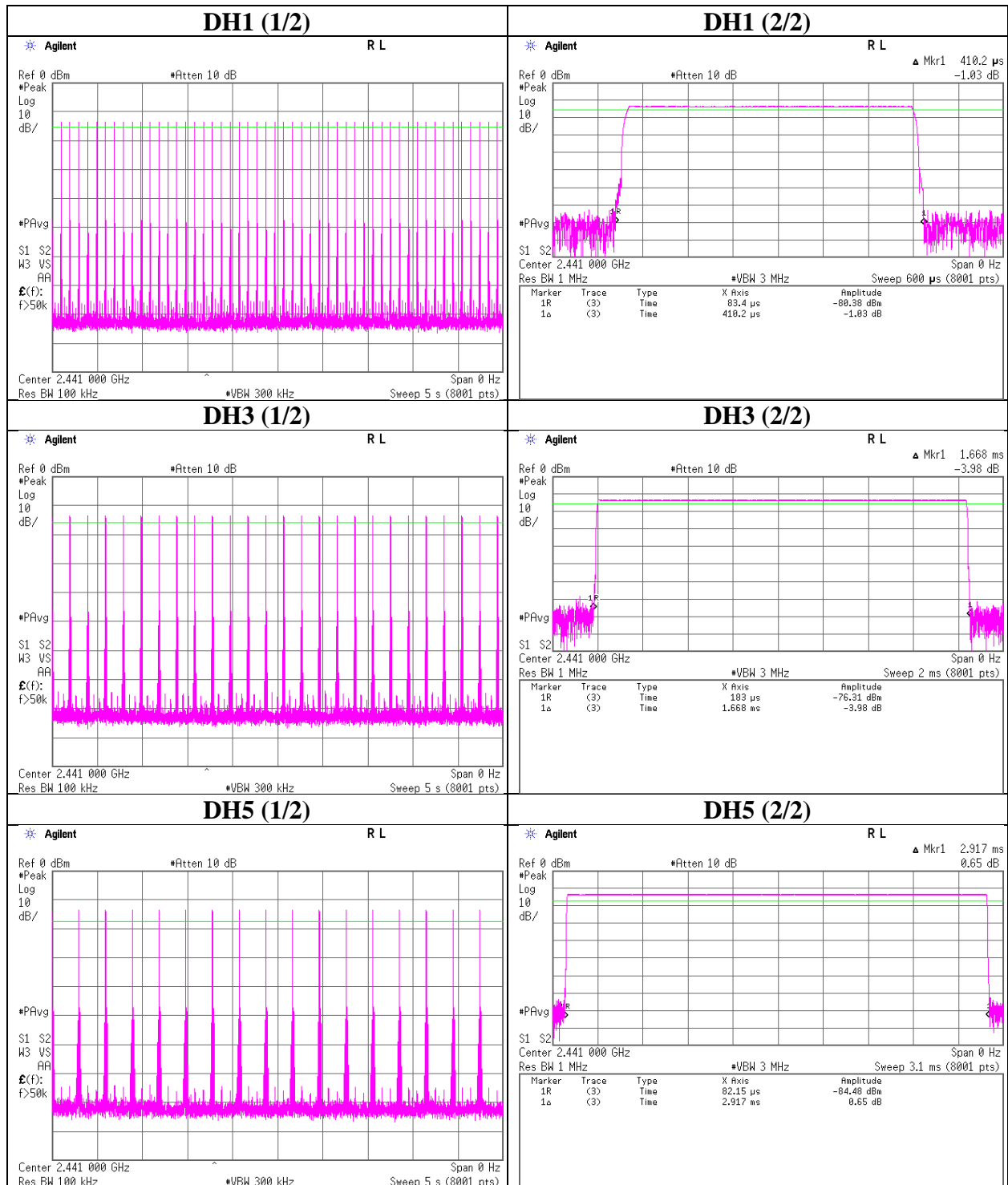
| Mode | Number of transmission<br>in a 31.6(79 Hopping x 0.4)<br>/ 12.8 (32 Hopping x 0.4) second period |             |           |       | Length of<br>transmission<br>[msec] | Result<br>[msec] | Limit<br>[msec] |
|------|--|-------------|-----------|-------|-------------------------------------|------------------|-----------------|
| DH1  | 51.0 times / 5 sec. x  | 31.6 sec. = | 323 times | 0.410 | 132                                 | 400              |                 |
| DH3  | 26.0 times / 5 sec. x  | 31.6 sec. = | 165 times | 1.668 | 275                                 | 400              |                 |
| DH5  | 17.0 times / 5 sec. x  | 31.6 sec. = | 108 times | 2.917 | 315                                 | 400              |                 |
| 3DH1 | 51.0 times / 5 sec. x  | 31.6 sec. = | 323 times | 0.430 | 139                                 | 400              |                 |
| 3DH3 | 26.0 times / 5 sec. x  | 31.6 sec. = | 165 times | 1.680 | 277                                 | 400              |                 |
| 3DH5 | 17.0 times / 5 sec. x  | 31.6 sec. = | 108 times | 2.931 | 317                                 | 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  $N \times 0.4s$ , 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



**UL Japan, Inc.**

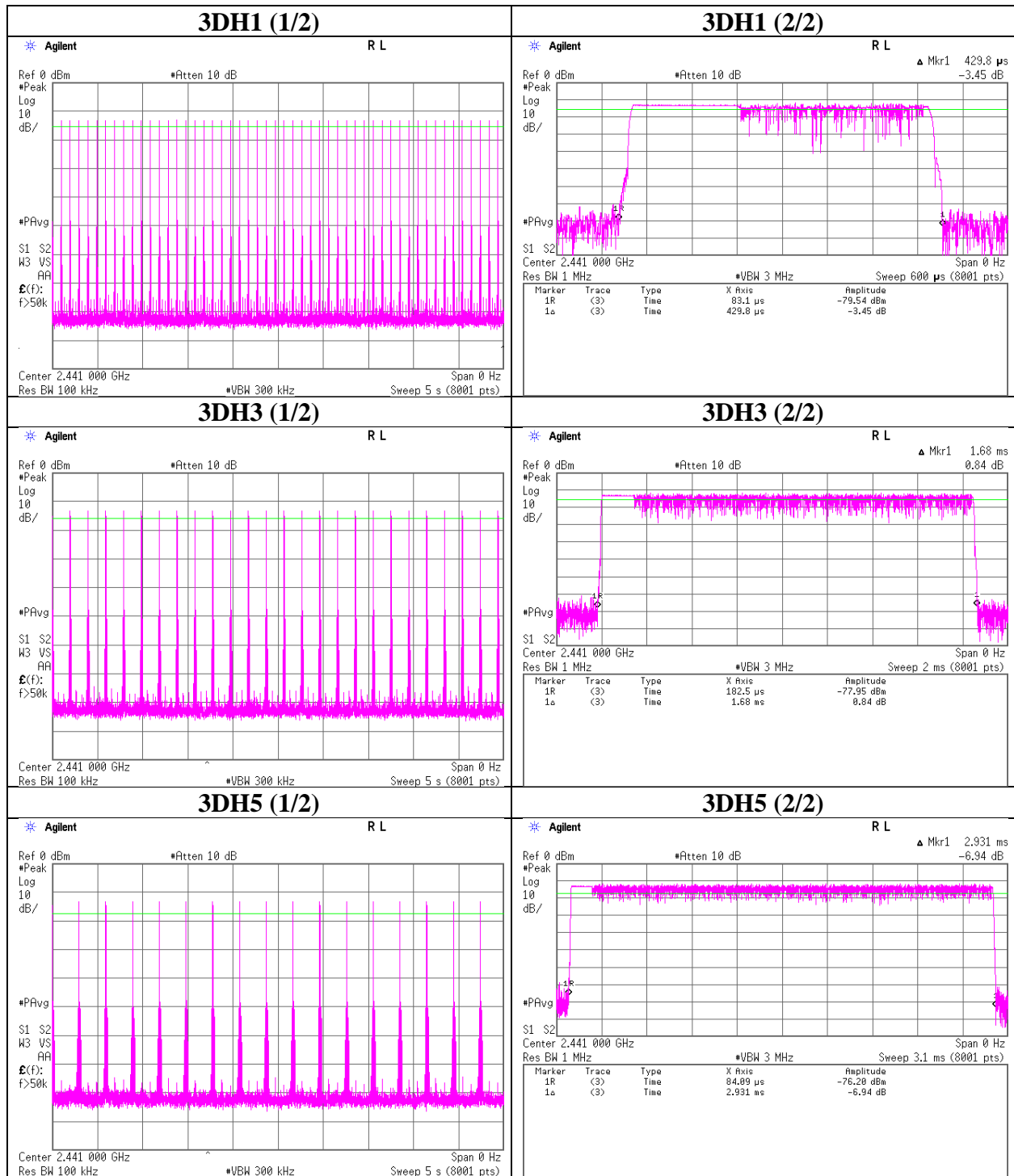
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### Dwell time



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## Maximum Peak Output Power

Test place : Shonan EMC Lab. No.5 Shielded Room  
 Report No. : 12053884S-A  
 Date : January 9, 2018  
 Temperature / Humidity : 23 deg. C / 47 % RH  
 Engineer : Makoto Hosaka  
 Mode : Tx, Hopping Off

| Mode | Freq.<br>[MHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>Loss<br>[dB] | Result |      | Limit |      | Margin<br>[dB] |
|------|----------------|------------------|-----------------------|------------------------|--------|------|-------|------|----------------|
|      |                |                  |                       |                        | [dBm]  | [mW] | [dBm] | [mW] |                |
| DH5  | 2402.0         | -12.75           | 1.92                  | 9.85                   | -0.98  | 0.80 | 20.96 | 125  | 21.94          |
| DH5  | 2441.0         | -12.22           | 1.94                  | 9.84                   | -0.44  | 0.90 | 20.96 | 125  | 21.40          |
| DH5  | 2480.0         | -12.86           | 1.95                  | 9.84                   | -1.07  | 0.78 | 20.96 | 125  | 22.03          |
| 2DH5 | 2402.0         | -11.35           | 1.92                  | 9.85                   | 0.42   | 1.10 | 20.96 | 125  | 20.54          |
| 2DH5 | 2441.0         | -11.10           | 1.94                  | 9.84                   | 0.68   | 1.17 | 20.96 | 125  | 20.28          |
| 2DH5 | 2480.0         | -11.56           | 1.95                  | 9.84                   | 0.23   | 1.05 | 20.96 | 125  | 20.73          |
| 3DH5 | 2402.0         | -11.05           | 1.92                  | 9.85                   | 0.72   | 1.18 | 20.96 | 125  | 20.24          |
| 3DH5 | 2441.0         | -10.78           | 1.94                  | 9.84                   | 1.00   | 1.26 | 20.96 | 125  | 19.96          |
| 3DH5 | 2480.0         | -11.05           | 1.95                  | 9.84                   | 0.74   | 1.19 | 20.96 | 125  | 20.22          |

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                      Shonan EMC Lab. No.5 Shielded Room  
Report No.                     12053884S-A  
Date                             January 9, 2018  
Temperature / Humidity      23 deg. C / 47 % RH  
Engineer                      Makoto Hosaka  
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         | -14.88           | 1.92                  | 9.85                   | -3.11                    | 0.49 | 1.10                   | -2.01                           | 0.63 |
| DH5  | 2441.0         | -14.27           | 1.94                  | 9.84                   | -2.49                    | 0.56 | 1.10                   | -1.39                           | 0.73 |
| DH5  | 2480.0         | -14.87           | 1.95                  | 9.84                   | -3.08                    | 0.49 | 1.10                   | -1.98                           | 0.63 |
| 2DH5 | 2402.0         | -15.65           | 1.92                  | 9.85                   | -3.88                    | 0.41 | 1.08                   | -2.80                           | 0.52 |
| 2DH5 | 2441.0         | -15.31           | 1.94                  | 9.84                   | -3.53                    | 0.44 | 1.08                   | -2.45                           | 0.57 |
| 2DH5 | 2480.0         | -15.79           | 1.95                  | 9.84                   | -4.00                    | 0.40 | 1.08                   | -2.92                           | 0.51 |
| 3DH5 | 2402.0         | -15.67           | 1.92                  | 9.85                   | -3.90                    | 0.41 | 1.07                   | -2.83                           | 0.52 |
| 3DH5 | 2441.0         | -15.30           | 1.94                  | 9.84                   | -3.52                    | 0.44 | 1.07                   | -2.45                           | 0.57 |
| 3DH5 | 2480.0         | -15.79           | 1.95                  | 9.84                   | -4.00                    | 0.40 | 1.07                   | -2.93                           | 0.51 |

Sample Calculation:

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

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

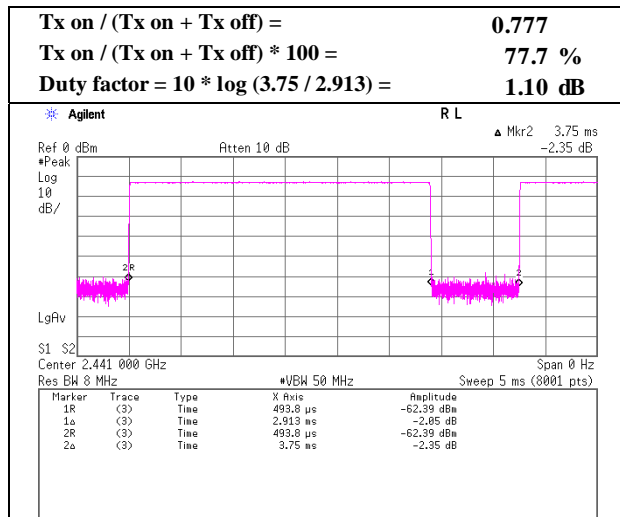
\*The equipment and cables were not used for factor 0 dB of the data sheets.



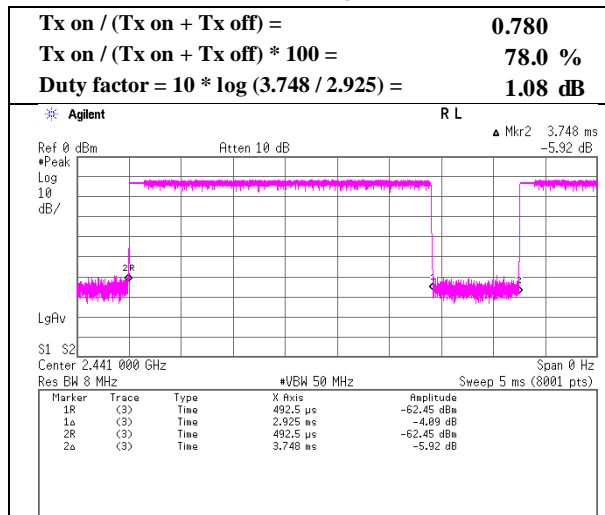
## Burst Rate Confirmation

|                        |                                    |
|------------------------|------------------------------------|
| Test place             | Shonan EMC Lab. No.5 Shielded Room |
| Report No.             | 12053884S-A                        |
| Date                   | January 9, 2018                    |
| Temperature / Humidity | 23 deg. C / 47 % RH                |
| Engineer               | Makoto Hosaka                      |
| Mode                   | Tx, Hopping Off                    |

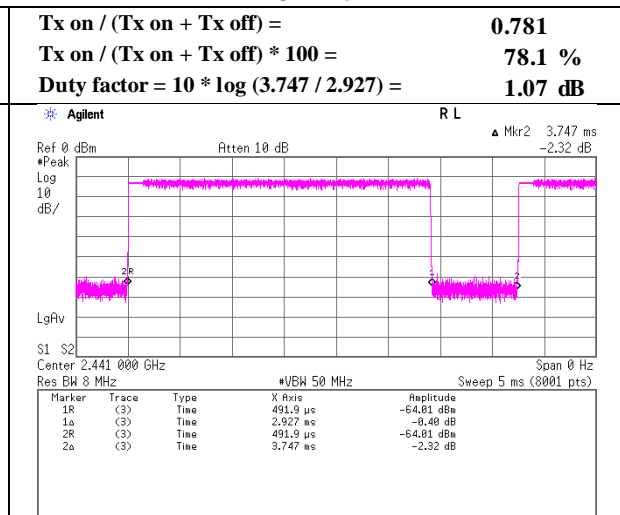
### DH5



### 2DH5



### 3DH5



## Radiated Spurious Emission

Report No. 12053884S-A  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber 2 2  
Date January 16, 2018 January 15, 2018  
Temperature / Humidity 24 deg. C / 36 % RH 22 deg. C / 34 % RH  
Engineer Yosuke Ishikawa Yosuke Ishikawa  
(30 MHz – 1000 MHz) (1 GHz – 18 GHz)  
(18 GHz – 26.5 GHz)  
Mode Tx, Hopping Off, DH5 2402 MHz

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

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Distance Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Height [cm] | Angle [deg] | Remark |
|----------|-----------------|----------|----------------|-----------------|-----------|-----------|----------------------|-----------------|----------------|-------------|-------------|-------------|--------|
| Hori.    | 48.008          | QP       | 37.60          | 11.46           | 7.22      | 31.89     | 0.00                 | 24.39           | 40.00          | 15.6        | 189         | 235         |        |
| Hori.    | 60.016          | QP       | 41.40          | 7.72            | 7.06      | 31.88     | 0.00                 | 24.30           | 40.00          | 15.7        | 368         | 250         |        |
| Hori.    | 78.008          | QP       | 33.00          | 6.20            | 8.01      | 31.87     | 0.00                 | 15.34           | 40.00          | 24.6        | 253         | 211         |        |
| Hori.    | 119.985         | QP       | 23.80          | 12.93           | 8.01      | 31.83     | 0.00                 | 12.91           | 43.50          | 30.5        | 280         | 56          |        |
| Hori.    | 167.996         | QP       | 26.30          | 15.65           | 8.82      | 31.79     | 0.00                 | 18.98           | 43.50          | 24.5        | 182         | 8           |        |
| Hori.    | 192.008         | QP       | 29.30          | 16.26           | 8.84      | 31.77     | 0.00                 | 22.63           | 43.50          | 20.8        | 166         | 182         |        |
| Hori.    | 204.000         | QP       | 37.40          | 11.39           | 5.70      | 31.76     | 0.00                 | 22.73           | 43.50          | 20.7        | 199         | 271         |        |
| Hori.    | 384.008         | QP       | 33.30          | 15.43           | 7.03      | 31.62     | 0.00                 | 24.14           | 46.00          | 21.8        | 100         | 247         |        |
| Hori.    | 2390.000        | PK       | 46.70          | 27.16           | 14.12     | 36.83     | 2.24                 | 53.39           | 73.90          | 20.5        | 147         | 310         |        |
| Hori.    | 4804.000        | PK       | 47.46          | 31.14           | 6.61      | 36.99     | 2.24                 | 50.46           | 73.90          | 23.4        | 262         | 146         |        |
| Hori.    | 7206.000        | PK       | 46.72          | 36.48           | 8.15      | 37.81     | 2.24                 | 55.78           | 73.90          | 18.1        | 150         | 0           |        |
| Hori.    | 9608.000        | PK       | 46.62          | 38.20           | 9.14      | 38.48     | 2.24                 | 57.72           | 73.90          | 16.2        | 150         | 0           |        |
| Hori.    | 2390.000        | AV       | 32.84          | 27.16           | 14.12     | 36.83     | 2.24                 | 39.53           | 53.90          | 14.4        | 147         | 310         |        |
| Hori.    | 4804.000        | AV       | 35.77          | 31.14           | 6.61      | 36.99     | 2.24                 | 38.77           | 53.90          | 15.1        | 262         | 146         |        |
| Hori.    | 7206.000        | AV       | 33.41          | 36.48           | 8.15      | 37.81     | 2.24                 | 42.47           | 53.90          | 11.4        | 150         | 0           |        |
| Hori.    | 9608.000        | AV       | 34.20          | 38.20           | 9.14      | 38.48     | 2.24                 | 45.30           | 53.90          | 8.6         | 150         | 0           |        |
| Vert.    | 46.811          | QP       | 38.80          | 11.89           | 7.21      | 31.89     | 0.00                 | 26.01           | 40.00          | 13.9        | 100         | 4           |        |
| Vert.    | 48.001          | QP       | 45.40          | 11.46           | 7.22      | 31.89     | 0.00                 | 32.19           | 40.00          | 7.8         | 100         | 11          |        |
| Vert.    | 60.021          | QP       | 40.50          | 7.72            | 7.06      | 31.88     | 0.00                 | 23.40           | 40.00          | 16.6        | 100         | 332         |        |
| Vert.    | 65.997          | QP       | 32.90          | 6.82            | 7.07      | 31.88     | 0.00                 | 14.91           | 40.00          | 25.0        | 100         | 246         |        |
| Vert.    | 204.005         | QP       | 30.70          | 11.39           | 5.70      | 31.76     | 0.00                 | 16.03           | 43.50          | 27.4        | 100         | 20          |        |
| Vert.    | 384.010         | QP       | 31.60          | 15.43           | 7.03      | 31.62     | 0.00                 | 22.44           | 46.00          | 23.5        | 100         | 273         |        |
| Vert.    | 2390.000        | PK       | 46.65          | 27.16           | 14.12     | 36.83     | 2.24                 | 53.34           | 73.90          | 20.6        | 127         | 47          |        |
| Vert.    | 4804.000        | PK       | 47.25          | 31.14           | 6.61      | 36.99     | 2.24                 | 50.25           | 73.90          | 23.7        | 160         | 6           |        |
| Vert.    | 7206.000        | PK       | 46.91          | 36.48           | 8.15      | 37.81     | 2.24                 | 55.97           | 73.90          | 17.9        | 154         | 2           |        |
| Vert.    | 9608.000        | PK       | 46.36          | 38.20           | 9.14      | 38.48     | 2.24                 | 57.46           | 73.90          | 16.4        | 150         | 0           |        |
| Vert.    | 2390.000        | AV       | 32.91          | 27.16           | 14.12     | 36.83     | 2.24                 | 39.60           | 53.90          | 14.3        | 127         | 47          |        |
| Vert.    | 4804.000        | AV       | 35.87          | 31.14           | 6.61      | 36.99     | 2.24                 | 38.87           | 53.90          | 15.0        | 160         | 6           |        |
| Vert.    | 7206.000        | AV       | 34.14          | 36.48           | 8.15      | 37.81     | 2.24                 | 43.20           | 53.90          | 10.7        | 154         | 2           |        |
| Vert.    | 9608.000        | AV       | 34.17          | 38.20           | 9.14      | 38.48     | 2.24                 | 45.27           | 53.90          | 8.6         | 150         | 0           |        |

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.24\text{ dB}$

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

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

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

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Distance Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark  |
|----------|-----------------|----------|----------------|-----------------|-----------|-----------|----------------------|-----------------|----------------|-------------|---------|
| Hori.    | 2402.000        | PK       | 78.98          | 27.20           | 14.13     | 36.83     | 2.24                 | 85.72           | -              | -           | Carrier |
| Hori.    | 2400.000        | PK       | 37.83          | 27.20           | 14.12     | 36.83     | 2.24                 | 44.56           | 65.72          | 21.2        |         |
| Vert.    | 2402.000        | PK       | 84.95          | 27.20           | 14.13     | 36.83     | 2.24                 | 91.69           | -              | -           | Carrier |
| Vert.    | 2400.000        | PK       | 38.43          | 27.20           | 14.12     | 36.83     | 2.24                 | 45.16           | 71.69          | 26.5        |         |

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.24\text{ dB}$

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

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**Shonan EMC Lab.**

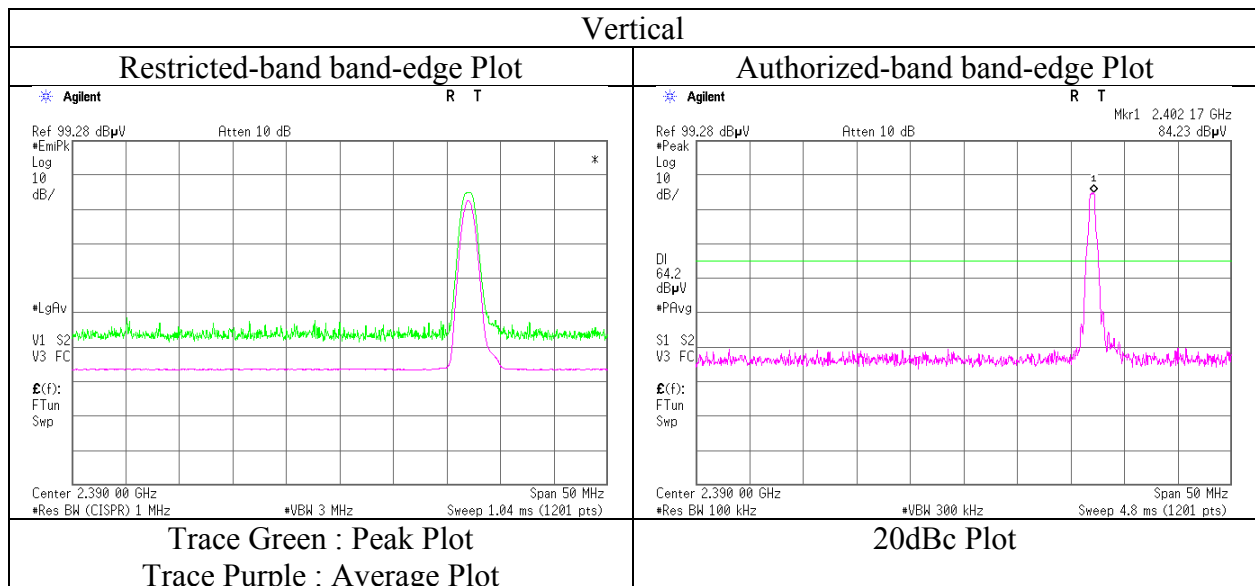
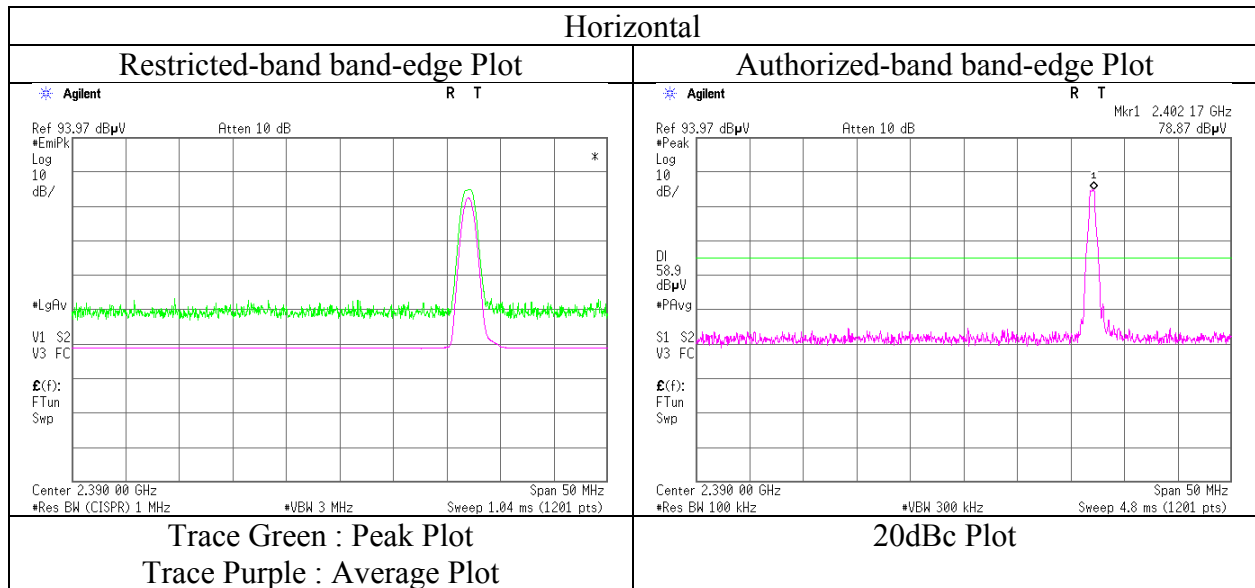
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## Radiated Spurious Emission (Reference Plot for band-edge)

|                        |                                    |
|------------------------|------------------------------------|
| Report No.             | 12053884S-A                        |
| Test place             | Shonan EMC Lab.                    |
| Semi Anechoic Chamber  | 2                                  |
| Date                   | January 15, 2018                   |
| Temperature / Humidity | 22 deg. C / 34 % RH                |
| Engineer               | Yosuke Ishikawa<br>(1 GHz -18 GHz) |
| Mode                   | Tx, Hopping Off, DH5 2402 MHz      |



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

## Radiated Spurious Emission

Report No. 12053884S-A  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber 2 2  
Date January 16, 2018 January 15, 2018  
Temperature / Humidity 24 deg. C / 36 % RH 22 deg. C / 34 % RH  
Engineer Yosuke Ishikawa Yosuke Ishikawa  
(30 MHz – 1000 MHz) (1 GHz – 18 GHz)  
(18 GHz – 26.5 GHz)  
Mode Tx, Hopping Off, DH5 2441 MHz

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

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Distance Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Height [cm] | Angle [deg] | Remark |
|----------|-----------------|----------|----------------|-----------------|-----------|-----------|----------------------|-----------------|----------------|-------------|-------------|-------------|--------|
| Hori.    | 48.010          | QP       | 37.30          | 11.46           | 7.22      | 31.89     | 0.00                 | 24.09           | 40.00          | 15.9        | 202         | 230         |        |
| Hori.    | 60.019          | QP       | 42.20          | 7.72            | 7.06      | 31.88     | 0.00                 | 25.10           | 40.00          | 14.9        | 343         | 249         |        |
| Hori.    | 77.986          | QP       | 33.90          | 6.20            | 8.01      | 31.87     | 0.00                 | 16.24           | 40.00          | 23.7        | 236         | 215         |        |
| Hori.    | 96.004          | QP       | 28.20          | 9.27            | 8.10      | 31.85     | 0.00                 | 13.72           | 43.50          | 29.7        | 319         | 240         |        |
| Hori.    | 107.994         | QP       | 28.10          | 11.20           | 7.97      | 31.84     | 0.00                 | 15.43           | 43.50          | 28.0        | 275         | 59          |        |
| Hori.    | 186.057         | QP       | 26.60          | 16.19           | 8.81      | 31.78     | 0.00                 | 19.82           | 43.50          | 23.6        | 156         | 3           |        |
| Hori.    | 288.017         | QP       | 31.40          | 12.99           | 6.36      | 31.68     | 0.00                 | 19.07           | 46.00          | 26.9        | 100         | 303         |        |
| Hori.    | 348.002         | QP       | 30.60          | 14.56           | 6.80      | 31.61     | 0.00                 | 20.35           | 46.00          | 25.6        | 100         | 227         |        |
| Hori.    | 4882.000        | PK       | 47.61          | 31.31           | 6.64      | 37.03     | 2.24                 | 50.77           | 73.90          | 23.1        | 194         | 151         |        |
| Hori.    | 7323.000        | PK       | 47.84          | 36.65           | 8.18      | 37.88     | 2.24                 | 57.03           | 73.90          | 16.9        | 150         | 0           |        |
| Hori.    | 9764.000        | PK       | 47.20          | 38.51           | 9.19      | 38.67     | 2.24                 | 58.47           | 73.90          | 15.4        | 150         | 0           |        |
| Hori.    | 4882.000        | AV       | 36.74          | 31.31           | 6.64      | 37.03     | 2.24                 | 39.90           | 53.90          | 14.0        | 194         | 151         |        |
| Hori.    | 7323.000        | AV       | 33.61          | 36.65           | 8.18      | 37.88     | 2.24                 | 42.80           | 53.90          | 11.1        | 150         | 0           |        |
| Hori.    | 9764.000        | AV       | 34.56          | 38.51           | 9.19      | 38.67     | 2.24                 | 45.83           | 53.90          | 8.1         | 150         | 0           |        |
| Vert.    | 46.808          | QP       | 39.10          | 11.89           | 7.21      | 31.89     | 0.00                 | 26.31           | 40.00          | 13.6        | 100         | 2           |        |
| Vert.    | 48.004          | QP       | 45.60          | 11.46           | 7.22      | 31.89     | 0.00                 | 32.39           | 40.00          | 7.6         | 100         | 351         |        |
| Vert.    | 62.777          | QP       | 39.90          | 7.30            | 7.03      | 31.88     | 0.00                 | 22.35           | 40.00          | 17.6        | 100         | 69          |        |
| Vert.    | 66.005          | QP       | 32.70          | 6.82            | 7.07      | 31.88     | 0.00                 | 14.71           | 40.00          | 25.2        | 100         | 230         |        |
| Vert.    | 77.995          | QP       | 28.60          | 6.20            | 8.01      | 31.87     | 0.00                 | 10.94           | 40.00          | 29.0        | 100         | 89          |        |
| Vert.    | 384.009         | QP       | 31.60          | 15.43           | 7.03      | 31.62     | 0.00                 | 22.44           | 46.00          | 23.5        | 100         | 273         |        |
| Vert.    | 4882.000        | PK       | 47.19          | 31.31           | 6.64      | 37.03     | 2.24                 | 50.35           | 73.90          | 23.6        | 153         | 4           |        |
| Vert.    | 7323.000        | PK       | 48.06          | 36.65           | 8.18      | 37.88     | 2.24                 | 57.25           | 73.90          | 16.7        | 161         | 3           |        |
| Vert.    | 9764.000        | PK       | 47.22          | 38.51           | 9.19      | 38.67     | 2.24                 | 58.49           | 73.90          | 15.4        | 150         | 0           |        |
| Vert.    | 4882.000        | AV       | 35.55          | 31.31           | 6.64      | 37.03     | 2.24                 | 38.71           | 53.90          | 15.2        | 153         | 4           |        |
| Vert.    | 7323.000        | AV       | 34.38          | 36.65           | 8.18      | 37.88     | 2.24                 | 43.57           | 53.90          | 10.3        | 161         | 3           |        |
| Vert.    | 9764.000        | AV       | 34.51          | 38.51           | 9.19      | 38.67     | 2.24                 | 45.78           | 53.90          | 8.1         | 150         | 0           |        |

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

Distance factor : 1 GHz - 13 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB

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

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

**UL Japan, Inc.**

**Shonan EMC Lab.**

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## Radiated Spurious Emission

Report No. 12053884S-A  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber 2 2  
Date January 16, 2018 January 15, 2018  
Temperature / Humidity 24 deg. C / 36 % RH 22 deg. C / 34 % RH  
Engineer Yosuke Ishikawa Yosuke Ishikawa  
(30 MHz – 1000 MHz) (1 GHz – 18 GHz)  
(18 GHz – 26.5 GHz)  
Mode Tx, Hopping Off, DH5 2480 MHz

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

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Distance Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Height [cm] | Angle [deg] | Remark |
|----------|-----------------|----------|----------------|-----------------|-----------|-----------|----------------------|-----------------|----------------|-------------|-------------|-------------|--------|
| Hori.    | 48.013          | QP       | 37.00          | 11.46           | 7.22      | 31.89     | 0.00                 | 23.79           | 40.00          | 16.2        | 212         | 237         |        |
| Hori.    | 78.006          | QP       | 34.40          | 6.20            | 8.01      | 31.87     | 0.00                 | 16.74           | 40.00          | 23.2        | 246         | 223         |        |
| Hori.    | 84.010          | QP       | 33.40          | 6.96            | 8.20      | 31.86     | 0.00                 | 16.70           | 40.00          | 23.3        | 328         | 36          |        |
| Hori.    | 168.017         | QP       | 26.30          | 15.65           | 8.82      | 31.79     | 0.00                 | 18.98           | 43.50          | 24.5        | 202         | 5           |        |
| Hori.    | 186.021         | QP       | 26.80          | 16.19           | 8.81      | 31.78     | 0.00                 | 20.02           | 43.50          | 23.4        | 195         | 4           |        |
| Hori.    | 215.999         | QP       | 34.30          | 11.48           | 5.80      | 31.74     | 0.00                 | 19.84           | 43.50          | 23.6        | 100         | 265         |        |
| Hori.    | 324.011         | QP       | 33.50          | 13.97           | 6.62      | 31.65     | 0.00                 | 22.44           | 46.00          | 23.5        | 100         | 227         |        |
| Hori.    | 2483.500        | PK       | 46.59          | 27.48           | 14.23     | 36.79     | 2.24                 | 53.75           | 73.90          | 20.2        | 266         | 299         |        |
| Hori.    | 4960.000        | PK       | 46.97          | 31.48           | 6.67      | 37.07     | 2.24                 | 50.29           | 73.90          | 23.6        | 190         | 150         |        |
| Hori.    | 7440.000        | PK       | 46.96          | 36.81           | 8.20      | 37.95     | 2.24                 | 56.26           | 73.90          | 17.6        | 150         | 0           |        |
| Hori.    | 9920.000        | PK       | 47.52          | 38.82           | 9.21      | 38.87     | 2.24                 | 58.92           | 73.90          | 15.0        | 150         | 0           |        |
| Hori.    | 2483.500        | AV       | 32.79          | 27.48           | 14.23     | 36.79     | 2.24                 | 39.95           | 53.90          | 14.0        | 266         | 299         |        |
| Hori.    | 4960.000        | AV       | 35.78          | 31.48           | 6.67      | 37.07     | 2.24                 | 39.10           | 53.90          | 14.8        | 190         | 150         |        |
| Hori.    | 7440.000        | AV       | 33.71          | 36.81           | 8.20      | 37.95     | 2.24                 | 43.01           | 53.90          | 10.9        | 150         | 0           |        |
| Hori.    | 9920.000        | AV       | 34.70          | 38.82           | 9.21      | 38.87     | 2.24                 | 46.10           | 53.90          | 7.8         | 150         | 0           |        |
| Vert.    | 46.806          | QP       | 38.60          | 11.89           | 7.21      | 31.89     | 0.00                 | 25.81           | 40.00          | 14.1        | 100         | 8           |        |
| Vert.    | 48.003          | QP       | 45.20          | 11.46           | 7.22      | 31.89     | 0.00                 | 31.99           | 40.00          | 8.0         | 100         | 4           |        |
| Vert.    | 54.007          | QP       | 27.70          | 9.53            | 7.24      | 31.89     | 0.00                 | 12.58           | 40.00          | 27.4        | 100         | 148         |        |
| Vert.    | 60.026          | QP       | 41.30          | 7.72            | 7.06      | 31.88     | 0.00                 | 24.20           | 40.00          | 15.8        | 100         | 339         |        |
| Vert.    | 63.770          | QP       | 39.60          | 7.15            | 7.02      | 31.88     | 0.00                 | 21.89           | 40.00          | 18.1        | 100         | 81          |        |
| Vert.    | 240.020         | QP       | 32.40          | 11.66           | 5.99      | 31.71     | 0.00                 | 18.34           | 46.00          | 27.6        | 100         | 134         |        |
| Vert.    | 2483.500        | PK       | 46.96          | 27.48           | 14.23     | 36.79     | 2.24                 | 54.12           | 73.90          | 19.8        | 109         | 1           |        |
| Vert.    | 4960.000        | PK       | 47.60          | 31.48           | 6.67      | 37.07     | 2.24                 | 50.92           | 73.90          | 23.0        | 137         | 9           |        |
| Vert.    | 7440.000        | PK       | 47.11          | 36.81           | 8.20      | 37.95     | 2.24                 | 56.41           | 73.90          | 17.5        | 177         | 2           |        |
| Vert.    | 9920.000        | PK       | 47.65          | 38.82           | 9.21      | 38.87     | 2.24                 | 59.05           | 73.90          | 14.9        | 150         | 0           |        |
| Vert.    | 2483.500        | AV       | 32.83          | 27.48           | 14.23     | 36.79     | 2.24                 | 39.99           | 53.90          | 13.9        | 109         | 1           |        |
| Vert.    | 4960.000        | AV       | 37.13          | 31.48           | 6.67      | 37.07     | 2.24                 | 40.45           | 53.90          | 13.5        | 137         | 9           |        |
| Vert.    | 7440.000        | AV       | 34.16          | 36.81           | 8.20      | 37.95     | 2.24                 | 43.46           | 53.90          | 10.4        | 177         | 2           |        |
| Vert.    | 9920.000        | AV       | 34.61          | 38.82           | 9.21      | 38.87     | 2.24                 | 46.01           | 53.90          | 7.9         | 150         | 0           |        |

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.24\text{ dB}$

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

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

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**Shonan EMC Lab.**

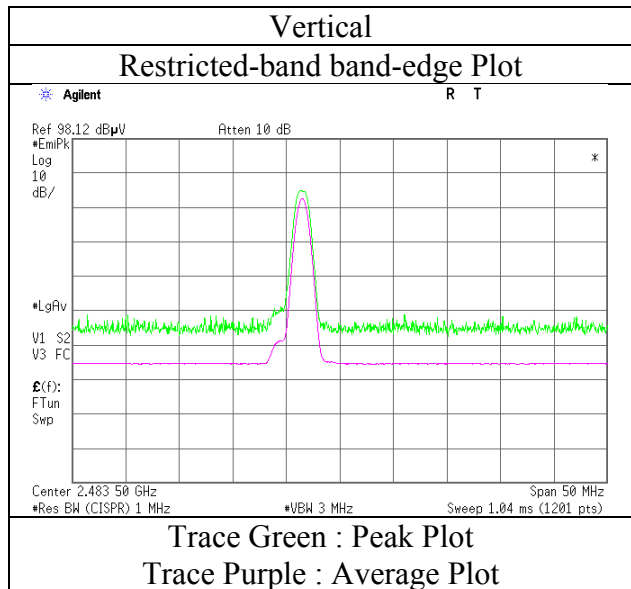
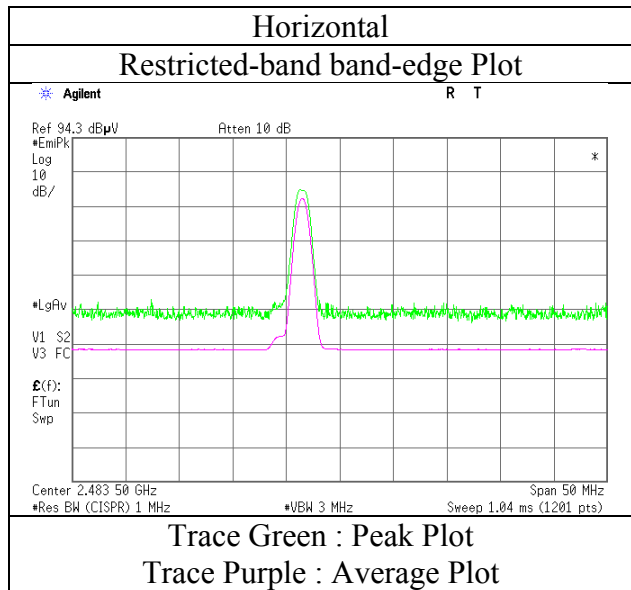
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**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

Report No. 12053884S-A  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber 2  
Date January 15, 2018  
Temperature / Humidity 22 deg. C / 34 % RH  
Engineer Yosuke Ishikawa  
(1 GHz – 18 GHz)  
Mode Tx, Hopping Off, DH5 2480 MHz



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

## Radiated Spurious Emission

Report No. 12053884S-A  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber 2 2  
Date January 16, 2018 January 15, 2018  
Temperature / Humidity 24 deg. C / 36 % RH 22 deg. C / 34 % RH  
Engineer Yosuke Ishikawa Yosuke Ishikawa  
(30 MHz – 1000 MHz) (1 GHz – 18 GHz)  
(18 GHz – 26.5 GHz)  
Mode Tx, Hopping Off, 3DH5 2402 MHz

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

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Distance Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Height [cm] | Angle [deg] | Remark |
|----------|-----------------|----------|----------------|-----------------|-----------|-----------|----------------------|-----------------|----------------|-------------|-------------|-------------|--------|
| Hori.    | 48.017          | QP       | 37.00          | 11.45           | 7.22      | 31.89     | 0.00                 | 23.78           | 40.00          | 16.2        | 236         | 240         |        |
| Hori.    | 60.018          | QP       | 42.70          | 7.72            | 7.06      | 31.88     | 0.00                 | 25.60           | 40.00          | 14.4        | 337         | 248         |        |
| Hori.    | 78.005          | QP       | 34.50          | 6.20            | 8.01      | 31.87     | 0.00                 | 16.84           | 40.00          | 23.1        | 261         | 232         |        |
| Hori.    | 108.010         | QP       | 28.10          | 11.20           | 7.97      | 31.84     | 0.00                 | 15.43           | 43.50          | 28.0        | 281         | 63          |        |
| Hori.    | 132.012         | QP       | 25.30          | 13.78           | 8.23      | 31.82     | 0.00                 | 15.49           | 43.50          | 28.0        | 229         | 246         |        |
| Hori.    | 156.010         | QP       | 29.50          | 15.13           | 8.74      | 31.80     | 0.00                 | 21.57           | 43.50          | 21.9        | 212         | 2           |        |
| Hori.    | 192.018         | QP       | 28.90          | 16.26           | 8.84      | 31.77     | 0.00                 | 22.23           | 43.50          | 21.2        | 191         | 176         |        |
| Hori.    | 258.026         | QP       | 33.60          | 12.00           | 6.13      | 31.69     | 0.00                 | 20.04           | 46.00          | 25.9        | 131         | 161         |        |
| Hori.    | 2390.000        | PK       | 46.65          | 27.16           | 14.12     | 36.83     | 2.24                 | 53.34           | 73.90          | 20.6        | 147         | 309         |        |
| Hori.    | 4804.000        | PK       | 46.93          | 31.14           | 6.61      | 36.99     | 2.24                 | 49.93           | 73.90          | 24.0        | 185         | 142         |        |
| Hori.    | 7206.000        | PK       | 46.82          | 36.48           | 8.15      | 37.81     | 2.24                 | 55.88           | 73.90          | 18.0        | 150         | 0           |        |
| Hori.    | 9608.000        | PK       | 47.11          | 38.20           | 9.14      | 38.48     | 2.24                 | 58.21           | 73.90          | 15.7        | 150         | 0           |        |
| Hori.    | 2390.000        | AV       | 32.88          | 27.16           | 14.12     | 36.83     | 2.24                 | 39.57           | 53.90          | 14.3        | 147         | 309         |        |
| Hori.    | 4804.000        | AV       | 33.49          | 31.14           | 6.61      | 36.99     | 2.24                 | 36.49           | 53.90          | 17.4        | 185         | 142         |        |
| Hori.    | 7206.000        | AV       | 33.41          | 36.48           | 8.15      | 37.81     | 2.24                 | 42.47           | 53.90          | 11.4        | 150         | 0           |        |
| Hori.    | 9608.000        | AV       | 34.11          | 38.20           | 9.14      | 38.48     | 2.24                 | 45.21           | 53.90          | 8.7         | 150         | 0           |        |
| Vert.    | 42.001          | QP       | 24.50          | 13.63           | 7.11      | 31.89     | 0.00                 | 13.35           | 40.00          | 26.6        | 100         | 354         |        |
| Vert.    | 46.813          | QP       | 38.60          | 11.89           | 7.21      | 31.89     | 0.00                 | 25.81           | 40.00          | 14.1        | 100         | 11          |        |
| Vert.    | 48.004          | QP       | 45.00          | 11.46           | 7.22      | 31.89     | 0.00                 | 31.79           | 40.00          | 8.2         | 100         | 2           |        |
| Vert.    | 62.781          | QP       | 40.30          | 7.30            | 7.03      | 31.88     | 0.00                 | 22.75           | 40.00          | 17.2        | 100         | 94          |        |
| Vert.    | 264.026         | QP       | 35.90          | 12.20           | 6.18      | 31.69     | 0.00                 | 22.59           | 46.00          | 23.4        | 100         | 148         |        |
| Vert.    | 2390.000        | PK       | 46.77          | 27.16           | 14.12     | 36.83     | 2.24                 | 53.46           | 73.90          | 20.4        | 130         | 47          |        |
| Vert.    | 4804.000        | PK       | 46.71          | 31.14           | 6.61      | 36.99     | 2.24                 | 49.71           | 73.90          | 24.2        | 156         | 6           |        |
| Vert.    | 7206.000        | PK       | 47.11          | 36.48           | 8.15      | 37.81     | 2.24                 | 56.17           | 73.90          | 17.7        | 163         | 10          |        |
| Vert.    | 9608.000        | PK       | 47.10          | 38.20           | 9.14      | 38.48     | 2.24                 | 58.20           | 73.90          | 15.7        | 150         | 0           |        |
| Vert.    | 2390.000        | AV       | 32.96          | 27.16           | 14.12     | 36.83     | 2.24                 | 39.65           | 53.90          | 14.3        | 130         | 47          |        |
| Vert.    | 4804.000        | AV       | 33.57          | 31.14           | 6.61      | 36.99     | 2.24                 | 36.57           | 53.90          | 17.3        | 156         | 6           |        |
| Vert.    | 7206.000        | AV       | 33.67          | 36.48           | 8.15      | 37.81     | 2.24                 | 42.73           | 53.90          | 11.2        | 163         | 10          |        |
| Vert.    | 9608.000        | AV       | 34.14          | 38.20           | 9.14      | 38.48     | 2.24                 | 45.24           | 53.90          | 8.7         | 150         | 0           |        |

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

Distance factor : 1 GHz - 13 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB

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

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

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

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Distance Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark  |
|----------|-----------------|----------|----------------|-----------------|-----------|-----------|----------------------|-----------------|----------------|-------------|---------|
| Hori.    | 2402.000        | PK       | 79.75          | 27.20           | 14.13     | 36.83     | 2.24                 | 86.49           | -              | -           | Carrier |
| Hori.    | 2400.000        | PK       | 37.76          | 27.20           | 14.12     | 36.83     | 2.24                 | 44.49           | 66.49          | 22.0        | Carrier |
| Vert.    | 2402.000        | PK       | 84.80          | 27.20           | 14.13     | 36.83     | 2.24                 | 91.54           | -              | -           | Carrier |
| Vert.    | 2400.000        | PK       | 38.56          | 27.20           | 14.12     | 36.83     | 2.24                 | 45.29           | 71.54          | 26.3        |         |

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

Distance factor : 1 GHz - 13 GHz : 20log(3.88 m / 3.0 m) = 2.24 dB

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

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**Shonan EMC Lab.**

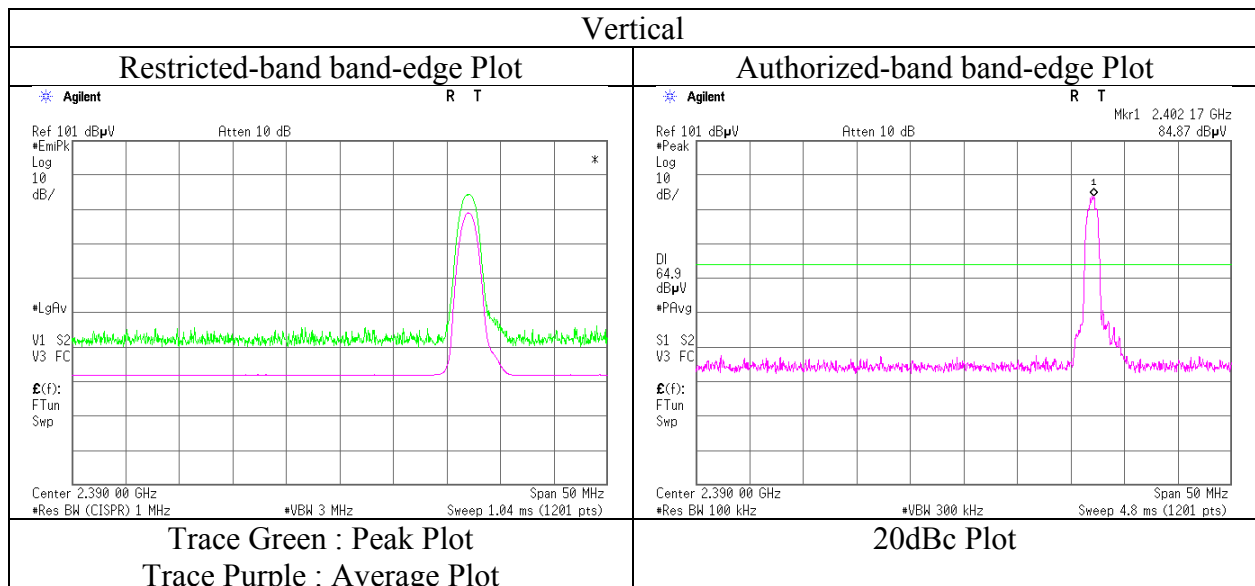
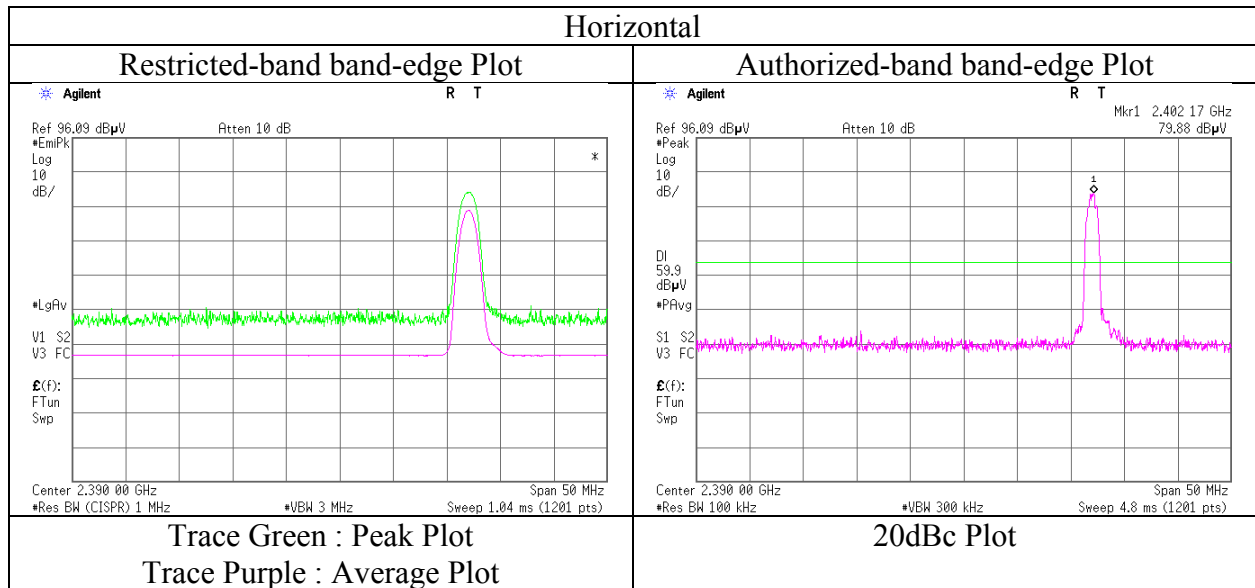
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Facsimile : +81 463 50 6401

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

|                        |                                |
|------------------------|--------------------------------|
| Report No.             | 12053884S-A                    |
| Test place             | Shonan EMC Lab.                |
| Semi Anechoic Chamber  | 2                              |
| Date                   | January 15, 2018               |
| Temperature / Humidity | 22 deg. C / 34 % RH            |
| Engineer               | Yosuke Ishikawa                |
|                        | (1 GHz – 18 GHz)               |
| Mode                   | Tx, Hopping Off, 3DH5 2402 MHz |



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



## Radiated Spurious Emission

Report No. 12053884S-A  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber 2 2  
Date January 16, 2018 January 15, 2018  
Temperature / Humidity 24 deg. C / 36 % RH 22 deg. C / 34 % RH  
Engineer Yosuke Ishikawa Yosuke Ishikawa  
(30 MHz – 1000 MHz) (1 GHz – 18 GHz)  
(18 GHz – 26.5 GHz)  
Mode Tx, Hopping Off, 3DH5 2441 MHz

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

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Distance Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Height [cm] | Angle [deg] | Remark |
|----------|-----------------|----------|----------------|-----------------|-----------|-----------|----------------------|-----------------|----------------|-------------|-------------|-------------|--------|
| Hori.    | 60.029          | QP       | 41.60          | 7.72            | 7.06      | 31.88     | 0.00                 | 24.50           | 40.00          | 15.5        | 353         | 245         |        |
| Hori.    | 78.012          | QP       | 34.50          | 6.20            | 8.01      | 31.87     | 0.00                 | 16.84           | 40.00          | 23.1        | 278         | 229         |        |
| Hori.    | 84.008          | QP       | 33.80          | 6.96            | 8.20      | 31.86     | 0.00                 | 17.10           | 40.00          | 22.9        | 361         | 45          |        |
| Hori.    | 192.006         | QP       | 29.30          | 16.26           | 8.84      | 31.77     | 0.00                 | 22.63           | 43.50          | 20.8        | 217         | 173         |        |
| Hori.    | 198.050         | QP       | 28.30          | 16.32           | 8.88      | 31.77     | 0.00                 | 21.73           | 43.50          | 21.7        | 192         | 177         |        |
| Hori.    | 300.002         | QP       | 31.20          | 13.39           | 6.45      | 31.68     | 0.00                 | 19.36           | 46.00          | 26.6        | 100         | 236         |        |
| Hori.    | 4882.000        | PK       | 46.87          | 31.31           | 6.64      | 37.03     | 2.24                 | 50.03           | 73.90          | 23.9        | 189         | 153         |        |
| Hori.    | 7323.000        | PK       | 47.42          | 36.65           | 8.18      | 37.88     | 2.24                 | 56.61           | 73.90          | 17.3        | 150         | 0           |        |
| Hori.    | 9764.000        | PK       | 47.07          | 38.51           | 9.19      | 38.67     | 2.24                 | 58.34           | 73.90          | 15.6        | 150         | 0           |        |
| Hori.    | 4882.000        | AV       | 34.01          | 31.31           | 6.64      | 37.03     | 2.24                 | 37.17           | 53.90          | 16.7        | 189         | 153         |        |
| Hori.    | 7323.000        | AV       | 33.61          | 36.65           | 8.18      | 37.88     | 2.24                 | 42.80           | 53.90          | 11.1        | 150         | 0           |        |
| Hori.    | 9764.000        | AV       | 34.67          | 38.51           | 9.19      | 38.67     | 2.24                 | 45.94           | 53.90          | <b>8.0</b>  | 150         | 0           |        |
| Vert.    | 46.803          | QP       | 37.90          | 11.89           | 7.21      | 31.89     | 0.00                 | 25.11           | 40.00          | 14.8        | 100         | 3           |        |
| Vert.    | 48.005          | QP       | 44.60          | 11.46           | 7.22      | 31.89     | 0.00                 | 31.39           | 40.00          | 8.6         | 100         | 7           |        |
| Vert.    | 60.021          | QP       | 41.30          | 7.72            | 7.06      | 31.88     | 0.00                 | 24.20           | 40.00          | 15.8        | 100         | 2           |        |
| Vert.    | 63.205          | QP       | 39.40          | 7.24            | 7.02      | 31.88     | 0.00                 | 21.78           | 40.00          | 18.2        | 100         | 99          |        |
| Vert.    | 66.005          | QP       | 32.90          | 6.82            | 7.07      | 31.88     | 0.00                 | 14.91           | 40.00          | 25.0        | 100         | 206         |        |
| Vert.    | 384.007         | QP       | 31.30          | 15.43           | 7.03      | 31.62     | 0.00                 | 22.14           | 46.00          | 23.8        | 100         | 273         |        |
| Vert.    | 4882.000        | PK       | 46.98          | 31.31           | 6.64      | 37.03     | 2.24                 | 50.14           | 73.90          | 23.8        | 137         | 4           |        |
| Vert.    | 7323.000        | PK       | 47.01          | 36.65           | 8.18      | 37.88     | 2.24                 | 56.20           | 73.90          | 17.7        | 144         | 2           |        |
| Vert.    | 9764.000        | PK       | 47.28          | 38.51           | 9.19      | 38.67     | 2.24                 | 58.55           | 73.90          | 15.4        | 150         | 0           |        |
| Vert.    | 4882.000        | AV       | 33.60          | 31.31           | 6.64      | 37.03     | 2.24                 | 36.76           | 53.90          | 17.1        | 137         | 4           |        |
| Vert.    | 7323.000        | AV       | 34.11          | 36.65           | 8.18      | 37.88     | 2.24                 | 43.30           | 53.90          | 10.6        | 144         | 2           |        |
| Vert.    | 9764.000        | AV       | 34.65          | 38.51           | 9.19      | 38.67     | 2.24                 | 45.92           | 53.90          | 8.0         | 150         | 0           |        |

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.24\text{ dB}$

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

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

**UL Japan, Inc.**

**Shonan EMC Lab.**

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Telephone : +81 463 50 6400

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## Radiated Spurious Emission

Report No. 12053884S-A  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber 2 2  
Date January 16, 2018 January 15, 2018  
Temperature / Humidity 24 deg. C / 36 % RH 22 deg. C / 34 % RH  
Engineer Yosuke Ishikawa Yosuke Ishikawa  
(30 MHz – 1000 MHz) (1 GHz – 18 GHz)  
(18 GHz – 26.5 GHz)  
Mode Tx, Hopping Off, 3DH5 2480 MHz

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

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Distance Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Height [cm] | Angle [deg] | Remark |
|----------|-----------------|----------|----------------|-----------------|-----------|-----------|----------------------|-----------------|----------------|-------------|-------------|-------------|--------|
| Hori.    | 60.022          | QP       | 42.00          | 7.72            | 7.06      | 31.88     | 0.00                 | 24.90           | 40.00          | 15.1        | 329         | 244         |        |
| Hori.    | 120.013         | QP       | 24.40          | 12.93           | 8.01      | 31.83     | 0.00                 | 13.51           | 43.50          | 29.9        | 250         | 55          |        |
| Hori.    | 156.006         | QP       | 29.60          | 15.13           | 8.74      | 31.80     | 0.00                 | 21.67           | 43.50          | 21.8        | 198         | 2           |        |
| Hori.    | 192.011         | QP       | 29.40          | 16.26           | 8.84      | 31.77     | 0.00                 | 22.73           | 43.50          | 20.7        | 160         | 185         |        |
| Hori.    | 198.024         | QP       | 28.20          | 16.32           | 8.88      | 31.77     | 0.00                 | 21.63           | 43.50          | 21.8        | 170         | 182         |        |
| Hori.    | 264.030         | QP       | 38.90          | 12.20           | 6.18      | 31.69     | 0.00                 | 25.59           | 46.00          | 20.4        | 127         | 252         |        |
| Hori.    | 2483.500        | PK       | 46.95          | 27.48           | 14.23     | 36.79     | 2.24                 | 54.11           | 73.90          | 19.8        | 269         | 298         |        |
| Hori.    | 4960.000        | PK       | 46.60          | 31.48           | 6.67      | 37.07     | 2.24                 | 49.92           | 73.90          | 24.0        | 161         | 145         |        |
| Hori.    | 7440.000        | PK       | 47.22          | 36.81           | 8.20      | 37.95     | 2.24                 | 56.52           | 73.90          | 17.4        | 150         | 0           |        |
| Hori.    | 9920.000        | PK       | 47.28          | 38.82           | 9.21      | 38.87     | 2.24                 | 58.68           | 73.90          | 15.2        | 150         | 0           |        |
| Hori.    | 2483.500        | AV       | 32.77          | 27.48           | 14.23     | 36.79     | 2.24                 | 39.93           | 53.90          | 14.0        | 269         | 298         |        |
| Hori.    | 4960.000        | AV       | 33.85          | 31.48           | 6.67      | 37.07     | 2.24                 | 37.17           | 53.90          | 16.7        | 161         | 145         |        |
| Hori.    | 7440.000        | AV       | 33.69          | 36.81           | 8.20      | 37.95     | 2.24                 | 42.99           | 53.90          | 10.9        | 150         | 0           |        |
| Hori.    | 9920.000        | AV       | 34.67          | 38.82           | 9.21      | 38.87     | 2.24                 | 46.07           | 53.90          | 7.8         | 150         | 0           |        |
| Vert.    | 46.811          | QP       | 38.30          | 11.89           | 7.21      | 31.89     | 0.00                 | 25.51           | 40.00          | 14.4        | 100         | 7           |        |
| Vert.    | 48.010          | QP       | 44.50          | 11.46           | 7.22      | 31.89     | 0.00                 | 31.29           | 40.00          | 8.7         | 100         | 351         |        |
| Vert.    | 54.009          | QP       | 27.50          | 9.53            | 7.24      | 31.89     | 0.00                 | 12.38           | 40.00          | 27.6        | 100         | 171         |        |
| Vert.    | 60.029          | QP       | 41.20          | 7.72            | 7.06      | 31.88     | 0.00                 | 24.10           | 40.00          | 15.9        | 100         | 340         |        |
| Vert.    | 63.217          | QP       | 39.10          | 7.24            | 7.02      | 31.88     | 0.00                 | 21.48           | 40.00          | 18.5        | 100         | 101         |        |
| Vert.    | 78.017          | QP       | 28.50          | 6.20            | 8.01      | 31.87     | 0.00                 | 10.84           | 40.00          | 29.1        | 100         | 130         |        |
| Vert.    | 215.999         | QP       | 30.90          | 11.48           | 5.80      | 31.74     | 0.00                 | 16.44           | 43.50          | 27.0        | 100         | 105         |        |
| Vert.    | 2483.500        | PK       | 46.86          | 27.48           | 14.23     | 36.79     | 2.24                 | 54.02           | 73.90          | 19.9        | 180         | 2           |        |
| Vert.    | 4960.000        | PK       | 46.88          | 31.48           | 6.67      | 37.07     | 2.24                 | 50.20           | 73.90          | 23.7        | 136         | 8           |        |
| Vert.    | 7440.000        | PK       | 47.11          | 36.81           | 8.20      | 37.95     | 2.24                 | 56.41           | 73.90          | 17.5        | 150         | 0           |        |
| Vert.    | 9920.000        | PK       | 47.31          | 38.82           | 9.21      | 38.87     | 2.24                 | 58.71           | 73.90          | 15.2        | 150         | 0           |        |
| Vert.    | 2483.500        | AV       | 32.87          | 27.48           | 14.23     | 36.79     | 2.24                 | 40.03           | 53.90          | 13.9        | 180         | 2           |        |
| Vert.    | 4960.000        | AV       | 34.50          | 31.48           | 6.67      | 37.07     | 2.24                 | 37.82           | 53.90          | 16.1        | 136         | 8           |        |
| Vert.    | 7440.000        | AV       | 33.70          | 36.81           | 8.20      | 37.95     | 2.24                 | 43.00           | 53.90          | 10.9        | 150         | 0           |        |
| Vert.    | 9920.000        | AV       | 34.69          | 38.82           | 9.21      | 38.87     | 2.24                 | 46.09           | 53.90          | 7.8         | 150         | 0           |        |

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.24\text{ dB}$

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

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

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**Shonan EMC Lab.**

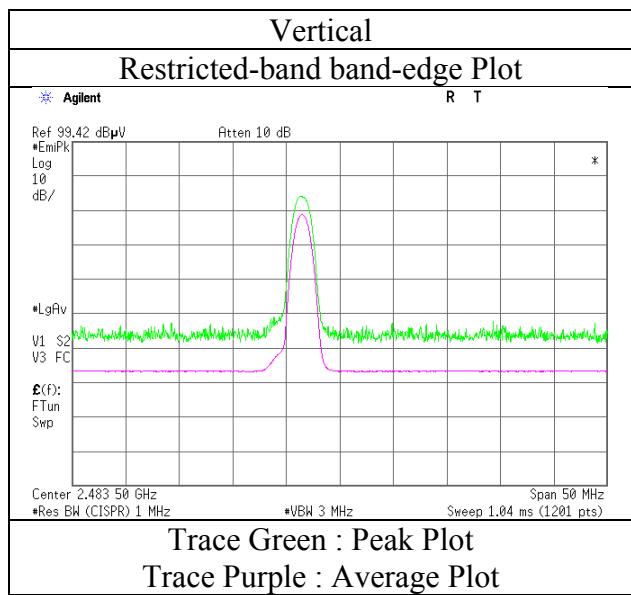
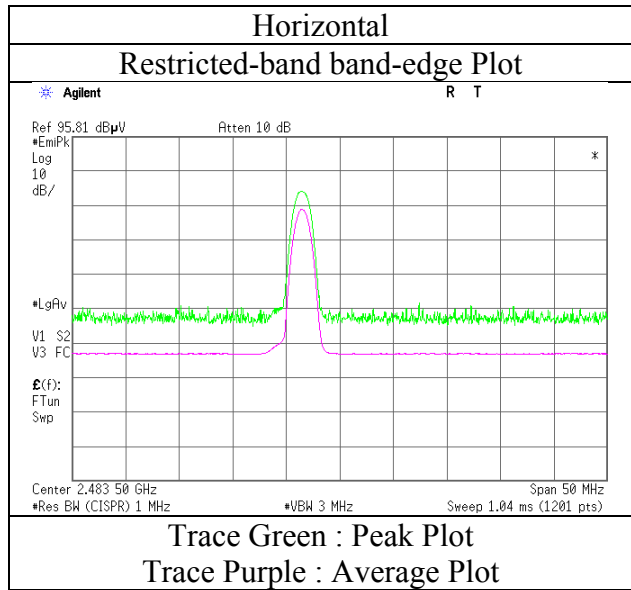
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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

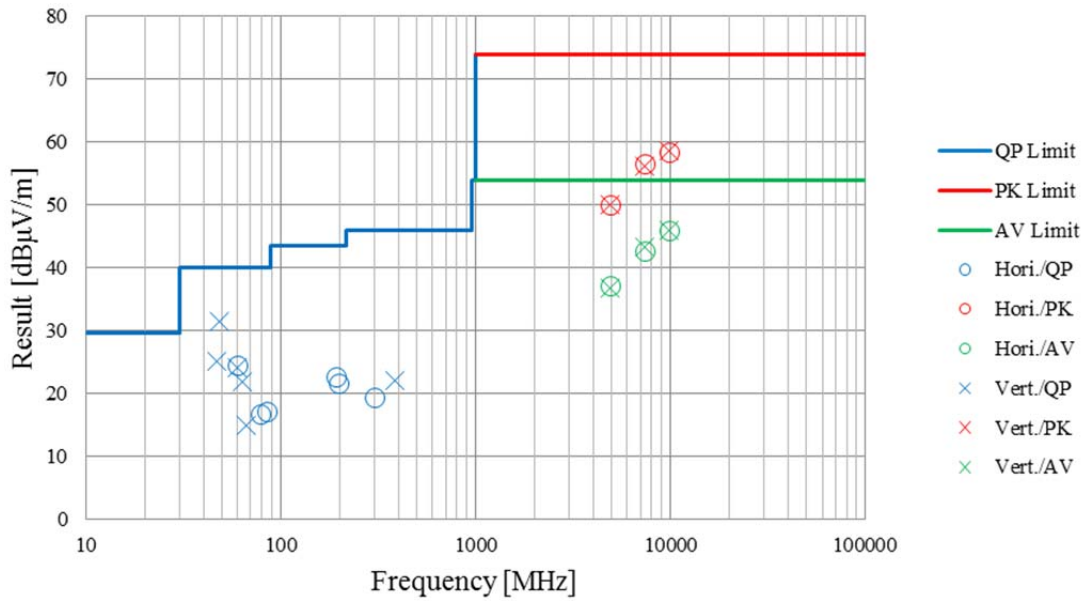
Report No. 12053884S-A  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber 2  
Date January 15, 2018  
Temperature / Humidity 22 deg. C / 34 % RH  
Engineer Yosuke Ishikawa  
(1 GHz – 18 GHz)  
Mode Tx, Hopping Off, 3DH5 2480 MHz



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

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

|                        |                                |                     |
|------------------------|--------------------------------|---------------------|
| Report No.             | 12053884S-A                    |                     |
| Test place             | Shonan EMC Lab.                |                     |
| Semi Anechoic Chamber  | 2                              | 2                   |
| Date                   | January 16, 2018               | January 15, 2018    |
| Temperature / Humidity | 24 deg. C / 36 % RH            | 22 deg. C / 34 % RH |
| Engineer               | Yosuke Ishikawa                | Yosuke Ishikawa     |
|                        | (30 MHz – 1000 MHz)            | (1 GHz – 18 GHz)    |
|                        | (18 GHz – 26.5 GHz)            |                     |
| Mode                   | Tx, Hopping Off, 3DH5 2441 MHz |                     |

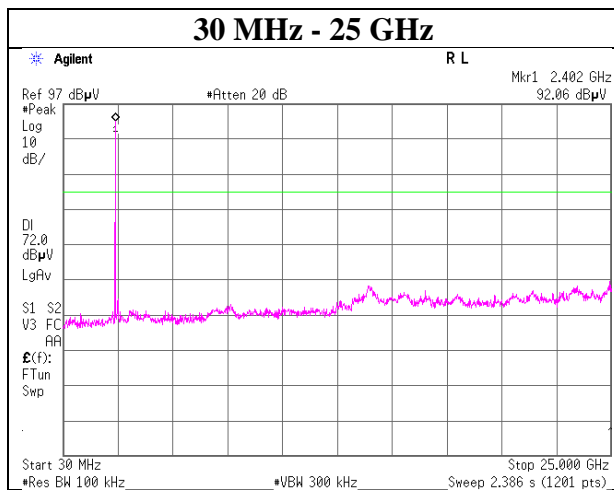
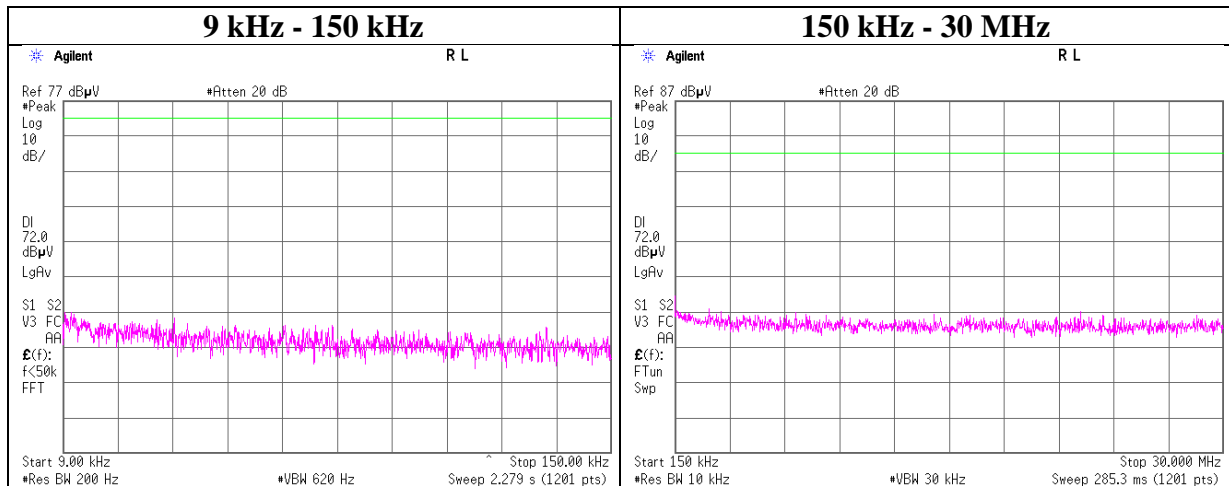


\*These plots data contains sufficient number to show the trend of characteristic features for EUT.

## Conducted Spurious Emission

|                        |                                    |
|------------------------|------------------------------------|
| Test place             | Shonan EMC Lab. No.5 Shielded Room |
| Report No.             | 12053884S-A                        |
| Date                   | January 9, 2018                    |
| Temperature / Humidity | 23 deg. C / 47 % RH                |
| Engineer               | Makoto Hosaka                      |
| Mode                   | Tx, Hopping Off, DH5               |

### 2402 MHz



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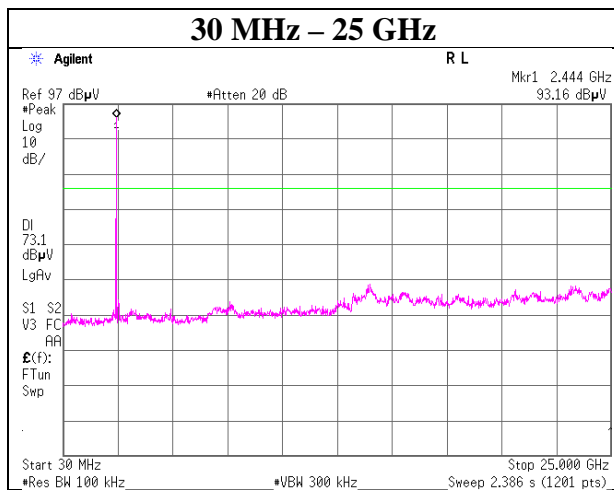
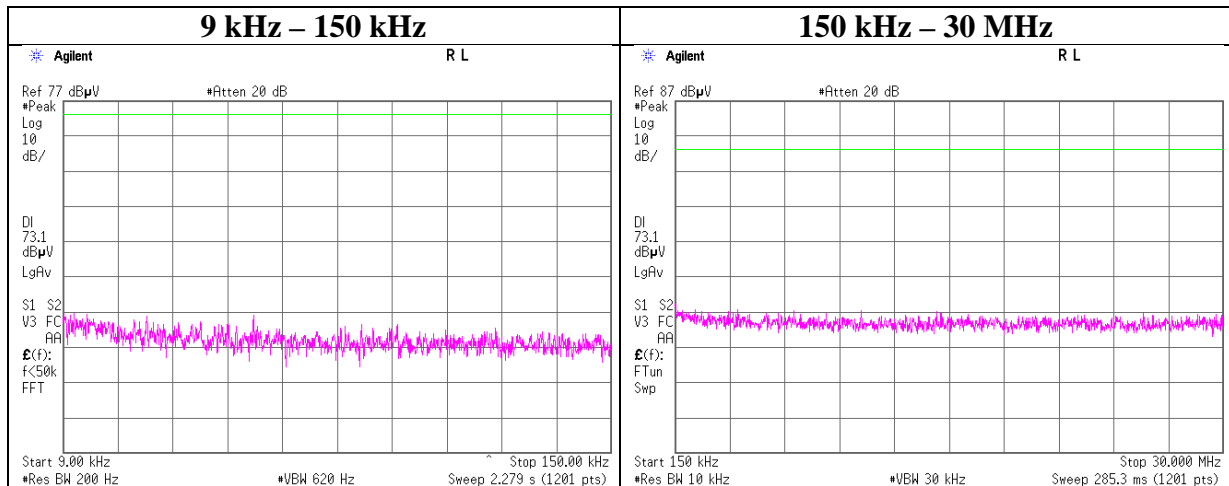
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Conducted Spurious Emission

|                        |                                    |
|------------------------|------------------------------------|
| Test place             | Shonan EMC Lab. No.5 Shielded Room |
| Report No.             | 12053884S-A                        |
| Date                   | January 9, 2018                    |
| Temperature / Humidity | 23 deg. C / 47 % RH                |
| Engineer               | Makoto Hosaka                      |
| Mode                   | Tx, Hopping Off, DH5               |

### 2441 MHz



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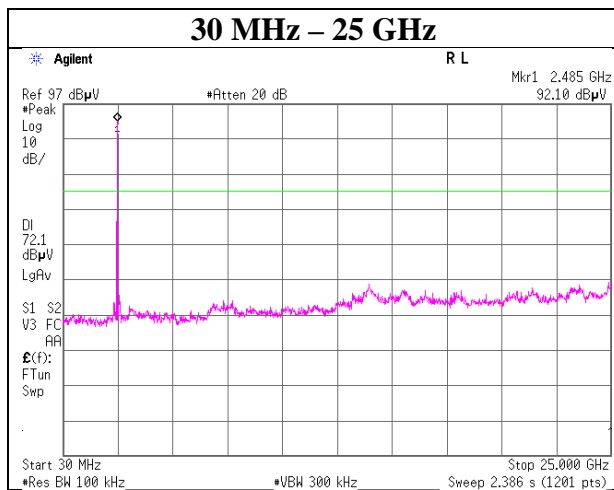
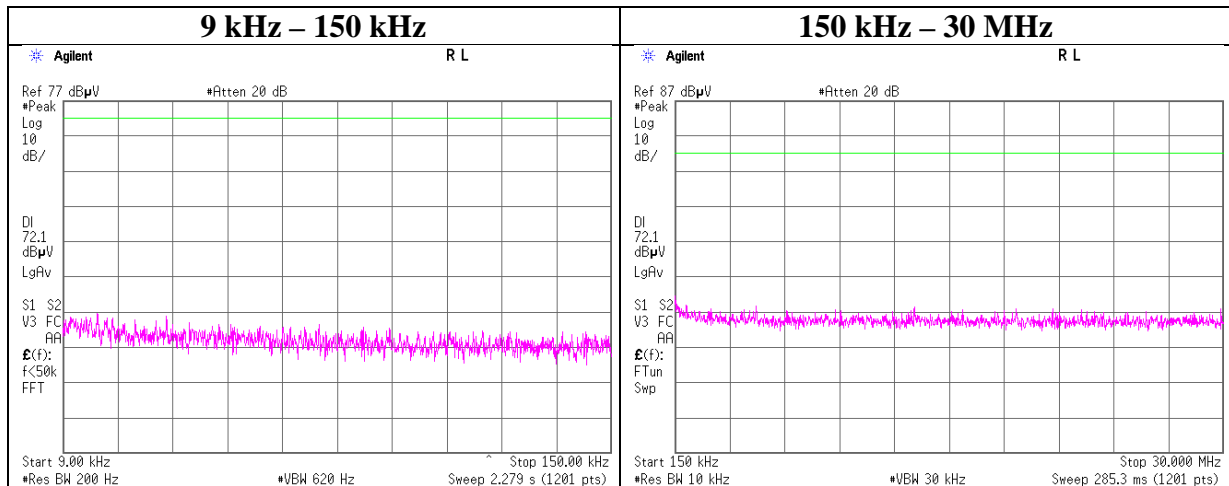
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Conducted Spurious Emission

|                        |                                    |
|------------------------|------------------------------------|
| Test place             | Shonan EMC Lab. No.5 Shielded Room |
| Report No.             | 12053884S-A                        |
| Date                   | January 9, 2018                    |
| Temperature / Humidity | 23 deg. C / 47 % RH                |
| Engineer               | Makoto Hosaka                      |
| Mode                   | Tx, Hopping Off, DH5               |

### 2480 MHz



**UL Japan, Inc.**

**Shonan EMC Lab.**

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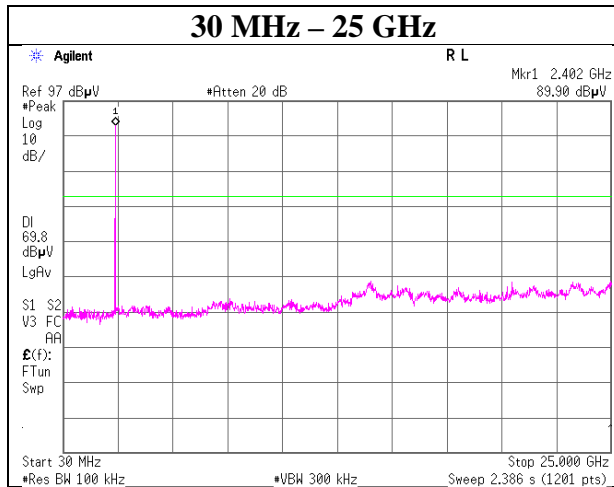
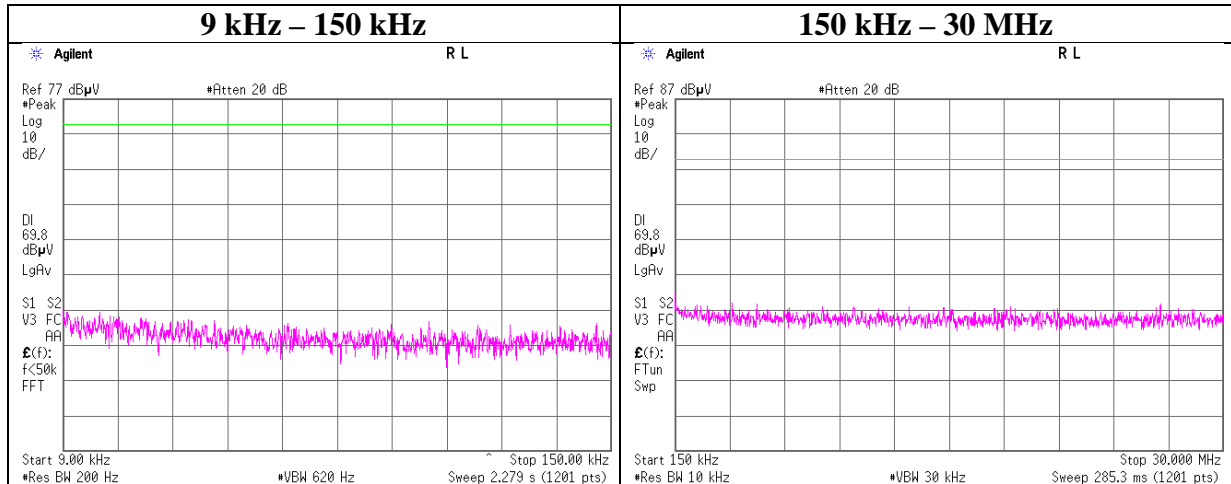
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Conducted Spurious Emission

|                        |                                    |
|------------------------|------------------------------------|
| Test place             | Shonan EMC Lab. No.5 Shielded Room |
| Report No.             | 12053884S-A                        |
| Date                   | January 9, 2018                    |
| Temperature / Humidity | 23 deg. C / 47 % RH                |
| Engineer               | Makoto Hosaka                      |
| Mode                   | Tx, Hopping Off, 3DH5              |

### 2402 MHz



**UL Japan, Inc.**

**Shonan EMC Lab.**

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

Telephone : +81 463 50 6400

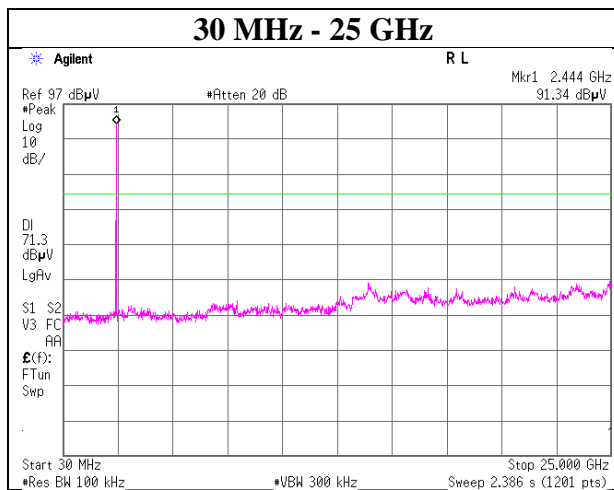
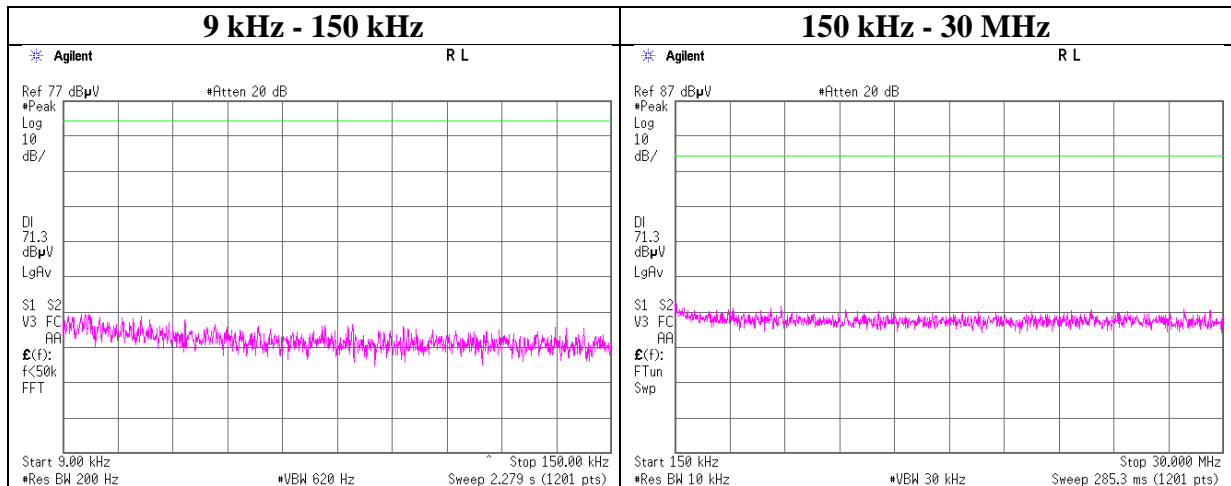
Facsimile : +81 463 50 6401



## Conducted Spurious Emission

|                        |                                    |
|------------------------|------------------------------------|
| Test place             | Shonan EMC Lab. No.5 Shielded Room |
| Report No.             | 12053884S-A                        |
| Date                   | January 9, 2018                    |
| Temperature / Humidity | 23 deg. C / 47 % RH                |
| Engineer               | Makoto Hosaka                      |
| Mode                   | Tx, Hopping Off, 3DH5              |

### 2441 MHz



**UL Japan, Inc.**

**Shonan EMC Lab.**

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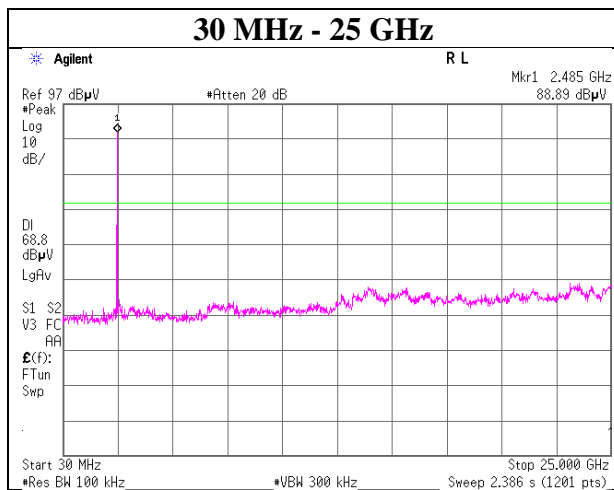
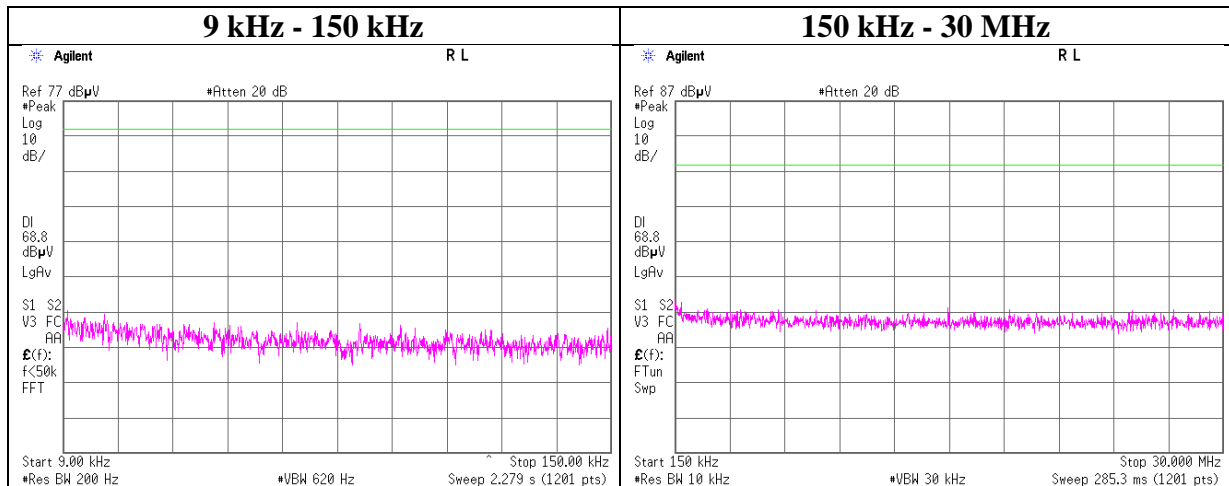
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Conducted Spurious Emission

|                        |                                    |
|------------------------|------------------------------------|
| Test place             | Shonan EMC Lab. No.5 Shielded Room |
| Report No.             | 12053884S-A                        |
| Date                   | January 9, 2018                    |
| Temperature / Humidity | 23 deg. C / 47 % RH                |
| Engineer               | Makoto Hosaka                      |
| Mode                   | Tx, Hopping Off, 3DH5              |

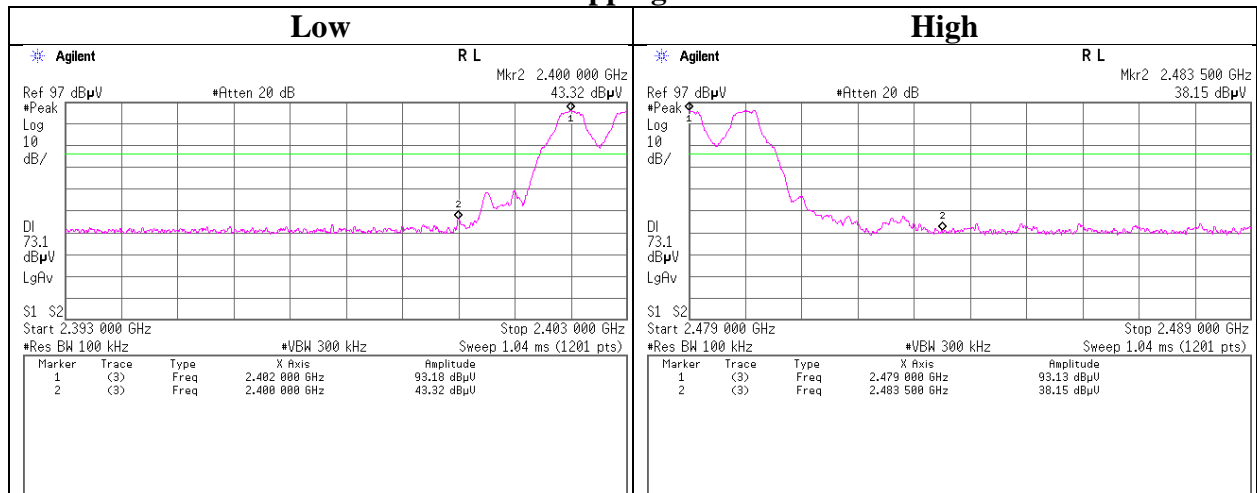
### 2480 MHz



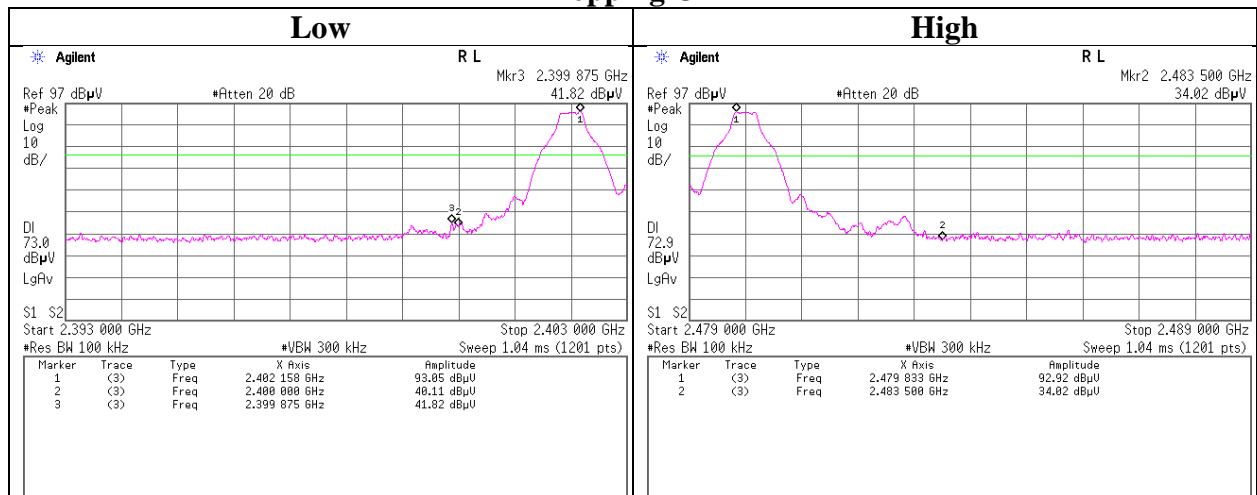
## Conducted Emission Band Edge compliance

|                        |                                    |
|------------------------|------------------------------------|
| Test place             | Shonan EMC Lab. No.5 Shielded Room |
| Report No.             | 12053884S-A                        |
| Date                   | January 9, 2018                    |
| Temperature / Humidity | 23 deg. C / 47 % RH                |
| Engineer               | Makoto Hosaka                      |
| Mode                   | Tx DH5                             |

### Hopping On



### Hopping Off



**UL Japan, Inc.**

**Shonan EMC Lab.**

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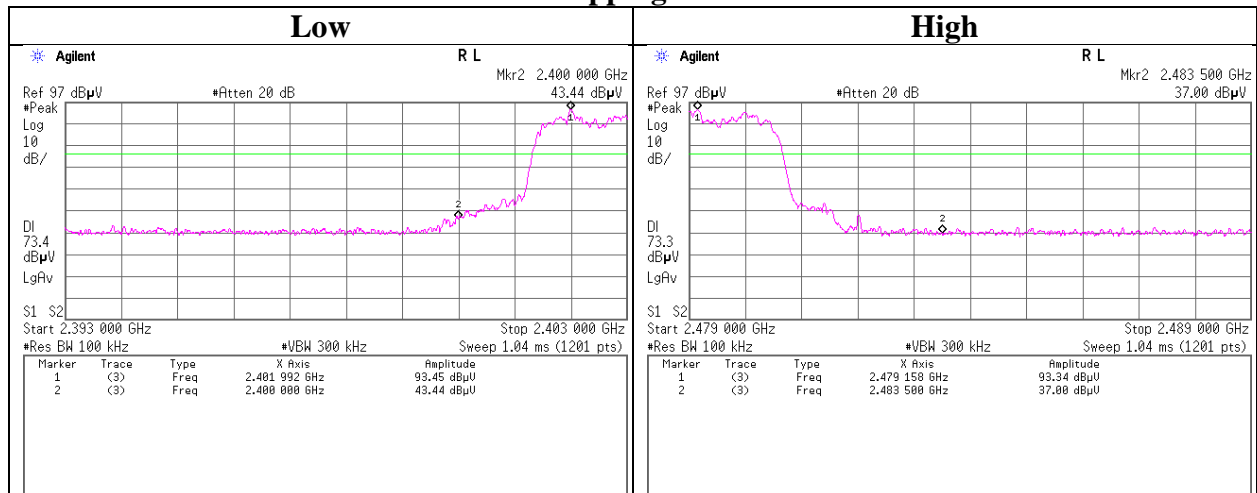
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

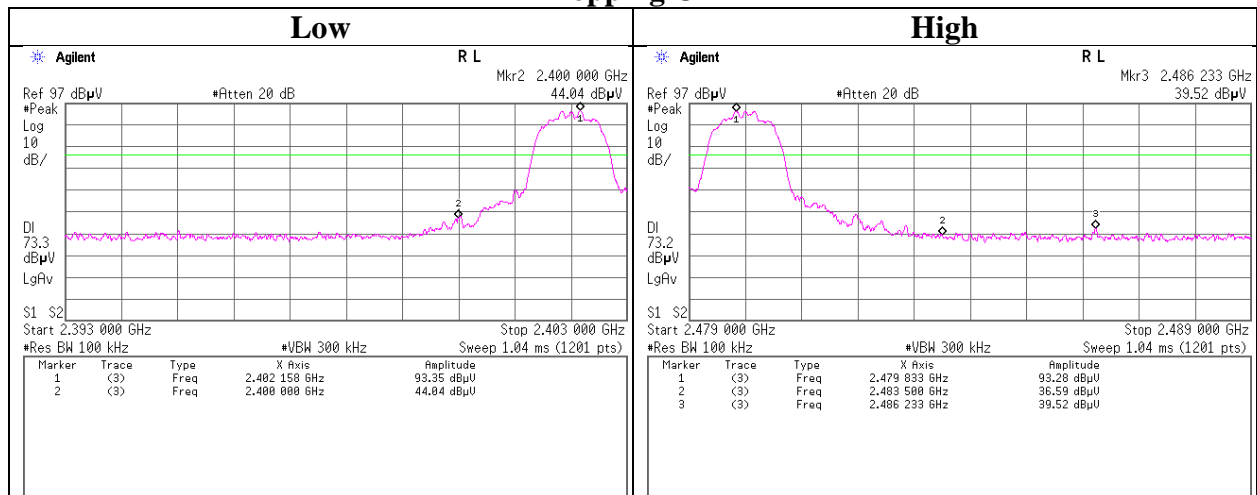
## Conducted Emission Band Edge compliance

|                        |                                    |
|------------------------|------------------------------------|
| Test place             | Shonan EMC Lab. No.5 Shielded Room |
| Report No.             | 12053884S-A                        |
| Date                   | January 9, 2018                    |
| Temperature / Humidity | 23 deg. C / 47 % RH                |
| Engineer               | Makoto Hosaka                      |
| Mode                   | Tx 3DH5                            |

### Hopping On



### Hopping Off



**UL Japan, Inc.**

**Shonan EMC Lab.**

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

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## **APPENDIX 2: Test instruments**

### **Test Instruments**

| Control No.                            | Instrument                   | Manufacturer   | Model No   | Serial No                  | Test Item | Calibration Date *<br>Interval(month) |
|--|------------------------------|--|--|----------------------------|-----------|---------------------------------------|
| SPM-07                                 | Power Meter                  | Agilent  | 8990B  | MY5100272                  | AT        | 2017/05/01 * 12                       |
| SPSS-05                                | Power sensor                 | Agilent  | N1923A   | MY5349008                  | AT        | 2017/05/01 * 12                       |
| SRENT-08                               | Spectrum Analyzer            | Agilent  | E4448A   | MY50180019                 | AT        | 2017/10/12 * 12                       |
| SAT10-12                               | Attenuator                   | Weinschel Corp.  | 54A-10   | 81601                      | AT        | 2017/03/23 * 12                       |
| SCC-G32                                | Coaxial Cable                | Junkosha   | MWX241-02000<br>KMSKMS                             | OCT-09-13-005              | AT        | 2017/11/22 * 12                       |
| SOS-09                                 | Humidity Indicator           | A&D  | AD-5681  | 4061484                    | AT        | 2017/12/21 * 12                       |
| STS-05                                 | Digital Hitester             | Hioki  | 3805-50  | 080997828                  | AT        | 2017/10/16 * 12                       |
| SAF-05                                 | Pre Amplifier                | TOYO Corporation   | TPA0118-36   | 1440490                    | RE        | 2017/02/17 * 12                       |
| SCC-G06                                | Coaxial Cable                | Junkosha   | J12J102207-00                                      | MAY-23-16-091              | RE        | 2017/06/13 * 12                       |
| SCC-G23                                | Coaxial Cable                | Suhner   | SUCOFLEX 104                                       | 297342/4                   | RE        | 2017/05/08 * 12                       |
| SCC-G40                                | Coaxial Cable                | Junkosha   | MWX221-01000<br>NFSNMS/B                           | 1612S005                   | RE        | 2017/01/08 * 12                       |
| SHA-02                                 | Horn Antenna                 | Schwarzbeck  | BBHA9120D  | 9120D-726                  | RE        | 2017/08/14 * 12                       |
| SOS-03                                 | Humidity Indicator           | A&D  | AD-5681  | 4063325                    | RE        | 2017/10/30 * 12                       |
| SRENT-08                               | Spectrum Analyzer            | Agilent  | E4448A   | MY50180019                 | RE        | 2017/10/12 * 12                       |
| SJM-09                                 | Measure                      | PROMART  | SEN1935  | -                          | RE        | -                                     |
| SAEC-02(SVSW R)                        | Semi-Anechoic Chamber        | TDK  | SAEC-02(SVSW R)                                    | 2                          | RE        | 2017/07/18 * 12                       |
| COTS-SEMI-1                            | EMI Software                 | TSJ  | TEPTO-DV(RE,C<br>E,RFI,MF)                         | -                          | RE        | -                                     |
| STS-02                                 | Digital Hitester             | Hioki  | 3805-50  | 080997819                  | RE        | 2017/03/08 * 12                       |
| SAT10-06                               | Attenuator                   | Agilent  | 8493C-010  | 74865                      | RE        | 2017/11/22 * 12                       |
| SFL-18                                 | Highpass Filter              | MICRO-TRONICS  | HPM50111   | 119                        | RE        | 2017/04/20 * 12                       |
| SHA-05                                 | Horn Antenna                 | ETS LINDGREN   | 3160-09  | LM4210                     | RE        | 2017/03/15 * 12                       |
| SAF-09                                 | Pre Amplifier                | TOYO Corporation   | HAP18-26W  | 00000018                   | RE        | 2017/09/22 * 12                       |
| SCC-G19                                | Coaxial Cable                | Suhner   | SUCOFLEX<br>102A                                   | 1188/2A                    | RE        | 2017/03/23 * 12                       |
| SCC-G33                                | Coaxial Cable                | Junkosha   | MWX241-01000<br>KMSKMS                             | -                          | RE        | 2017/04/20 * 12                       |
| SAF-02                                 | Pre Amplifier                | SONOMA   | 310N   | 290212                     | RE        | 2017/02/09 * 12                       |
| SAT6-02                                | Attenuator                   | JFW  | 50HF-006N  | -                          | RE        | 2017/02/09 * 12                       |
| SAT3-11                                | Attenuator                   | JFW  | 50HF-003N  | -                          | RE        | 2017/02/23 * 12                       |
| SBA-02                                 | Biconical Antenna            | Schwarzbeck  | BBA9106  | 91032665                   | RE        | 2017/11/23 * 12                       |
| SCC-B1/B3/B5/B<br>7/B8/B13/SRSE-<br>02 | Coaxial Cable&RF<br>Selector | Fujikura/Fujikura/Suhner/<br>Suhner/Suhner/Suhner/<br>TOYO | 8D2W/12DSFA/1<br>41PE/141PE/141P<br>E/141PE/NS4906 | -/0901-270(RF<br>Selector) | RE        | 2017/04/07 * 12                       |
| SCC-B2/B4/B6/B<br>7/B8/B13/SRSE-<br>02 | Coaxial Cable&RF<br>Selector | Fujikura/Fujikura/Suhner/<br>Suhner/Suhner/Suhner/<br>TOYO | 8D2W/12DSFA/1<br>41PE/141PE/141P<br>E/141PE/NS4906 | -/0901-270(RF<br>Selector) | RE        | 2017/04/07 * 12                       |
| SLA-06                                 | Logperiodic<br>Antenna       | Schwarzbeck  | VUSLP9111B   | 195                        | RE        | 2017/01/05 * 12                       |
| STR-07                                 | Test Receiver                | Rohde & Schwarz  | ESU26  | 100484                     | RE        | 2017/09/26 * 12                       |
| SAEC-02(NSA)                           | Semi-Anechoic<br>Chamber     | TDK  | SAEC-02(NSA)                                       | 2                          | RE        | 2017/06/08 * 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: RE: Radiated Emission test  
AT: Antenna Terminal Conducted test**

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