



# RADIO TEST REPORT

**Test Report No. : 12541464H-A-R1**

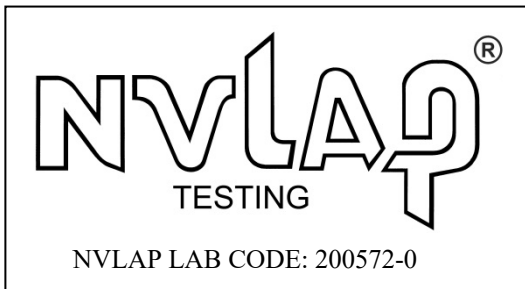
**Applicant** : **Panasonic Corporation of North America**  
**Type of Equipment** : **WAM HI**  
**Model No.** : **IM1135AA**  
**FCC ID** : **ACJ932IM1135AA**  
**Test regulation** : **FCC Part 15 Subpart C: 2018**  
**Test Result** : **Complied (Refer to SECTION 3.2)**

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
6. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
7. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
8. The information provided from the customer for this report is identified in SECTION 1.
9. This report is a revised version of 12541464H-A. 12541464H-A is replaced with this report.

**Date of test:** January 17 to 23, 2019

**Representative test engineer:** K. Yamamoto  
Koji Yamamoto  
Engineer  
Consumer Technology Division

**Approved by:** S. Miyazono  
Shinichi Miyazono  
Engineer  
Consumer Technology Division



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

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

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**Ise EMC Lab.**

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## **REVISION HISTORY**

**Original Test Report No.: 12541464H-A**

| Revision        | Test report No. | Date              | Page revised | Contents   |
|-----------------|-----------------|-------------------|--------------|--|
| -<br>(Original) | 12541464H-A     | February 15, 2019 | -            | -  |
| 1               | 12541464H-A-R1  | March 26, 2019    | P.8. 9       | Correction of Configuration diagram and list of Clause 4.2 |
| 1               | 12541464H-A-R1  | March 26, 2019    | P.31         | replacement of test setup photo                            |
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| <b>CONTENTS</b>   | <b>PAGE</b> |
|---|-------------|
| <b>SECTION 1: Customer information .....</b>                                    | <b>4</b>    |
| <b>SECTION 2: Equipment under test (E.U.T.).....</b>                            | <b>4</b>    |
| <b>SECTION 3: Test specification, procedures &amp; results .....</b>            | <b>5</b>    |
| <b>SECTION 4: Operation of E.U.T. during testing.....</b>                       | <b>8</b>    |
| <b>SECTION 5: Radiated emission (Fundamental and Spurious Emission).....</b>    | <b>10</b>   |
| <b>SECTION 6: -26dB Bandwidth.....</b>  | <b>13</b>   |
| <b>SECTION 7: 99% Occupied Bandwidth.....</b>                                   | <b>13</b>   |
| <b>APPENDIX 1: Test data .....</b>  | <b>14</b>   |
| <b>Radiated Emission below 30 MHz (Fundamental and Spurious Emission) .....</b> | <b>14</b>   |
| <b>Radiated Emission above 30 MHz (Spurious Emission).....</b>                  | <b>20</b>   |
| <b>-26 dB Bandwidth and 99 % Occupied Bandwidth .....</b>                       | <b>25</b>   |
| <b>APPENDIX 2: Test instruments .....</b>                                       | <b>30</b>   |
| <b>APPENDIX 3: Photographs of test setup.....</b>                               | <b>31</b>   |
| <b>Radiated Emission.....</b>   | <b>31</b>   |
| <b>Worst Case Position .....</b>  | <b>32</b>   |

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## **SECTION 1: Customer information**

Company Name : Panasonic Corporation of North America\*1)  
Address : Two Riverfront Plaza, 9th Floor Newark, NJ 07102-5490  
Telephone Number : +1-201-348-7760  
Facsimile Number : +1-201-348-7760  
Contact Person : Ben Botros

\*1) Panasonic Corporation of North America designates Panasonic Automotive Systems Asia Pacific Co.,Ltd as manufacturer of the product (WAM HI).

The information provided from the customer is as follows;

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

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

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

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

Type of Equipment : WAM HI  
Model No. : IM1135AA  
Serial No. : Refer to Section 4, Clause 4.2  
Rating : DC 12.0 V  
Receipt Date of Sample : December 27, 2019  
(Information from test lab.)  
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 No: IM1135AA, (referred to as the EUT in this report), is the WAM HI.

### **Radio Specification**

#### **[Transmitter]**

Radio Type : Transmitter  
Frequency of Operation : 125 kHz  
Modulation : ASK  
Antenna type : Immobilizer: Air core coil inductive antenna  
Other: Ferrite core coil inductive antenna  
Clock frequency (Maximum) : 16 MHz

#### **[Receiver]**

Radio Type : Receiver  
Frequency of Operation : 433.92 MHz

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

### **3.1 Test Specification**

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

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.207 Conducted limits  
Section 15.209 Radiated emission limits; general requirements.

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

### **3.2 Procedures and results**

| Item  | Test Procedure   | Specification   | Remarks  | Deviation | Worst margin   | Results      |
|---|--|---|----------|-----------|--|--------------|
| Conducted Emission                              | <FCC><br>ANSI C63.10:2013<br>6 Standard test methods<br><IC><br>RSS-Gen 8.8            | <FCC><br>Section 15.207<br><IC><br>RSS-Gen 8.8                | -        | N/A       | N/A *1)  | N/A          |
| Electric Field Strength of Fundamental Emission | <FCC><br>ANSI C63.10:2013<br>6 Standard test methods<br><IC><br>RSS-Gen 6.5, 6.12      | <FCC><br>Section 15.209<br><IC><br>RSS-210 4.4<br>RSS-Gen 8.9 | Radiated | N/A       | 2.4 dB<br>125 kHz<br>0 deg.<br>PK with Duty factor<br><Mode 3> | Complied a)# |
| Electric Field Strength of Spurious Emission    | <FCC><br>ANSI C63.10:2013<br>6 Standard test methods<br><IC><br>RSS-Gen 6.5, 6.6, 6.13 | <FCC><br>Section 15.209<br><IC><br>RSS-210 4.4<br>RSS-Gen 8.9 | Radiated | N/A       | 8.3 dB<br>43.001 MHz, QP,<br>Vertical<br><Mode 2>              | Complied a)  |
| -26dB Bandwidth                                 | <FCC><br>ANSI C63.10:2013<br>6 Standard test methods<br><IC><br>-                      | <FCC><br>Reference data<br><IC><br>-                          | Radiated | N/A       | N/A  | Complied b)  |

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 is not the device that is designed to be connected to the public utility (AC) power line.

a) Refer to APPENDIX 1 (data of Radiated emission)  
b) Refer to APPENDIX 1 (data of -26 dB Bandwidth and 99 % Occupied Bandwidth)

Symbols:  
Complied The data of this test item has enough margin, more than the measurement uncertainty.  
Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

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

This EUT provides stable voltage constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

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

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the vehicle. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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### 3.3 Addition to standard

| No. | Item                     | Test Procedure | Specification | Remarks  | Deviation | Worst margin | Results  |
|-----|--------------------------|----------------|---------------|----------|-----------|--------------|----------|
| 1   | 99 % Occupied Band Width | RSS-Gen 6.7    | -             | Radiated | N/A       | N/A          | Complied |

Symbols:  
Complied The data of this test item has enough margin, more than the measurement uncertainty.  
Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

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

### 3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the following results are derived depending on whether or not laboratory uncertainty is applied.

#### EMI

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

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

\*Measurement distance

| Polarity   | Radiated emission (Below 1 GHz) |                     |                   |                     |
|------------|---------------------------------|---------------------|-------------------|---------------------|
|            | (3 m*)(+/-)                     |                     | (10 m*)(+/-)      |                     |
|            | 30 MHz to 200 MHz               | 200 MHz to 1000 MHz | 30 MHz to 200 MHz | 200 MHz to 1000 MHz |
| Horizontal | 4.8 dB                          | 5.2 dB              | 4.8 dB            | 5.0 dB              |
| Vertical   | 5.0 dB                          | 6.3 dB              | 4.9 dB            | 5.0 dB              |

| Radiated emission (Above 1 GHz) |                 |                    |                    |                 |
|---------------------------------|-----------------|--------------------|--------------------|-----------------|
| (3 m*)(+/-)                     |                 | (1 m*)(+/-)        |                    | (10 m*)(+/-)    |
| 1 GHz to 6 GHz                  | 6 GHz to 18 GHz | 10 GHz to 26.5 GHz | 26.5 GHz to 40 GHz | 1 GHz to 18 GHz |
| 5.2 dB                          | 5.5 dB          | 5.9 dB             | 5.9 dB             | 5.5 dB          |

\* Measurement distance

| Bandwidth |
|-----------|
| 0.96 %    |

### 3.5 Test Location

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NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967

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

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

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

Refer to APPENDIX.

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

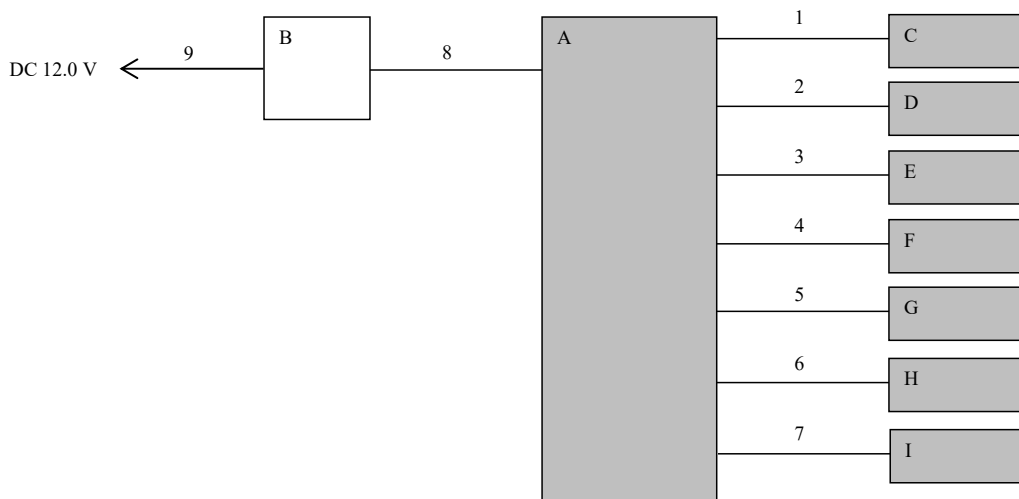
### **4.1 Operating Modes**

| <b>Mode</b> | <b>Remarks*</b>  |
|-------------|--|
| Mode1       | Transmitting mode (Tx) 125 kHz Modulated on (Mod on) CENTER Ant  |
| Mode2       | Transmitting mode (Tx) 125 kHz Modulated on (Mod on) REAR DR Ant |
| Mode3       | Transmitting mode (Tx) 125 kHz Modulated on (Mod on) DOOR DR Ant |
| Mode4       | Transmitting mode (Tx) 125 kHz Modulated on (Mod on) DOOR AS Ant |
| Mode5       | Transmitting mode (Tx) 125 kHz Modulated on (Mod on) START SW    |

\* “REAR DR Ant” and “REAR AS Ant” are completely identical in RF characteristics. Therefore, the test was performed with “REAR DR Ant” as representative. Also, “DOOR AS Ant” and “BUMPER Ant” are completely identical in RF characteristics. Thus, the test was performed with “DOOR AS Ant” as representative.

Justification : The system was configured in typical fashion (as a user would normally use it) for testing.

### **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   | WAM HI                     | IM1135AA     | 500091-0 181031 | Panasonic Automotive Systems Asia Pacific Co.,Ltd | EUT     |
| B   | Antenna Test Box           | -            | -               | -   | -       |
| C   | LF Antenna (CENTER Ant)    | EMU7117401   | 002             | Panasonic Automotive Systems Asia Pacific Co.,Ltd | EUT     |
| D   | LF Antenna (REAR DR Ant)   | EMU7117401   | 001             | Panasonic Automotive Systems Asia Pacific Co.,Ltd | EUT     |
| E   | LF Antenna (DOOR DR Ant)   | EMU7117301   | 001             | Panasonic Automotive Systems Asia Pacific Co.,Ltd | EUT     |
| F   | LF Antenna (DOOR AS Ant)   | EMU7117401   | 005             | Panasonic Automotive Systems Asia Pacific Co.,Ltd | EUT     |
| G   | LF Antenna (BUMPER Ant)    | EMU7117401   | 003             | Panasonic Automotive Systems Asia Pacific Co.,Ltd | EUT     |
| H   | LF Antenna (REAR AS Ant)   | EMU7117401   | 004             | Panasonic Automotive Systems Asia Pacific Co.,Ltd | EUT     |
| I   | Immobilizer (Start Switch) | EMU470602    | 001             | Panasonic Automotive Systems Asia Pacific Co.,Ltd | EUT     |

**List of cables used**

| No. | Name                | Length (m) | Shield     |            | Remarks |
|-----|---------------------|------------|------------|------------|---------|
|     |                     |            | Cable      | Connector  |         |
| 1   | Antenna Cable       | 2.0        | Unshielded | Unshielded | -       |
| 2   | Antenna Cable       | 2.0        | Unshielded | Unshielded | -       |
| 3   | Antenna Cable       | 2.0        | Unshielded | Unshielded | -       |
| 4   | Antenna Cable       | 2.0        | Unshielded | Unshielded | -       |
| 5   | Antenna Cable       | 2.0        | Unshielded | Unshielded | -       |
| 6   | Antenna Cable       | 2.0        | Unshielded | Unshielded | -       |
| 7   | Signal and DC Cable | 0.8        | Unshielded | Unshielded | -       |
| 8   | Signal and DC Cable | 2.0        | Unshielded | Unshielded | -       |
| 9   | DC cable            | 1.2        | Unshielded | Unshielded | -       |

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## **SECTION 5: Radiated emission (Fundamental and Spurious Emission)**

### **Test Procedure**

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.

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

Frequency : From 9 kHz to 30 MHz

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for vertical polarization (antenna angle: 0 deg., 45 deg., 90 deg., and 135 deg.) and horizontal polarization.

\*Refer to Figure 1 about Direction of the Loop Antenna.

Frequency: From 30 MHz to 1 GHz

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

The measurements were performed for both vertical and horizontal antenna polarization.

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    | Below 30 MHz | 30 MHz to 200 MHz | 200 MHz to 1 GHz |
| Antenna Type | Loop         | Biconical         | Logperiodic      |

|                 |  |                        |                         |                        |                      |
|-----------------|--|------------------------|-------------------------|------------------------|----------------------|
| Frequency       | From 9 kHz to 90 kHz<br>and<br>From 110 kHz to 150 kHz | From 90 kHz to 110 kHz | From 150 kHz to 490 kHz | From 490 kHz to 30 MHz | From 30 MHz to 1 GHz |
| Instrument used | Test Receiver  |                        |                         |                        |                      |
| Detector        | PK / AV  | QP                     | PK / AV                 | QP                     | QP                   |
| IF Bandwidth    | 200 Hz   | 200 Hz                 | 9 kHz                   | 9 kHz                  | 120 kHz              |
| Test Distance   | 3 m *1)  | 3 m *1)                | 3 m *1)                 | 3 m *2)                | 3 m                  |

\*1) Distance Factor:  $40 \times \log(3 \text{ m} / 300 \text{ m}) = -80 \text{ dB}$

\*2) Distance Factor:  $40 \times \log(3 \text{ m} / 30 \text{ m}) = -40 \text{ dB}$

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

These tests were performed in semi anechoic chamber. Therefore the measured level of emissions may be higher than if measurements were made without a ground plane.

However test results were confirmed to pass against standard limit.

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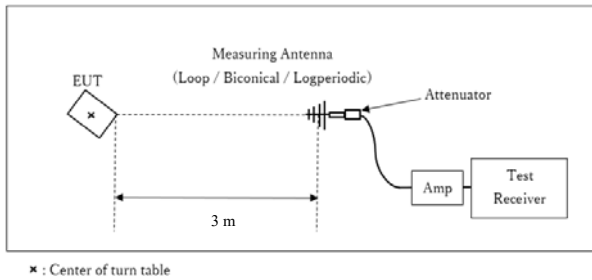
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[Test Setup]  
Below 1 GHz



Test Distance: 3 m

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

As for the START SW, it has two modes which transponder key is inserted or not. The worst case was confirmed with and without transponder key, as a result, the test without transponder key was the worst case. Therefore the test without transponder key was performed only.

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

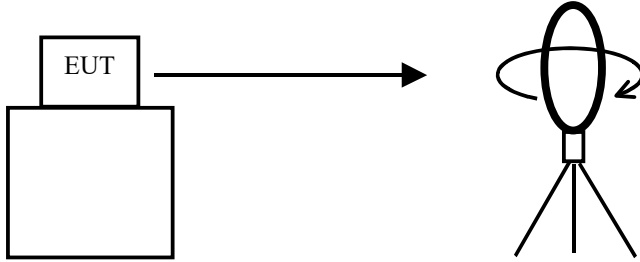
**Measurement range** : 9 kHz - 1 GHz  
**Test data** : APPENDIX 1  
**Test result** : Pass

Date: January 17, 2019  
January 18, 2019  
January 23, 2019

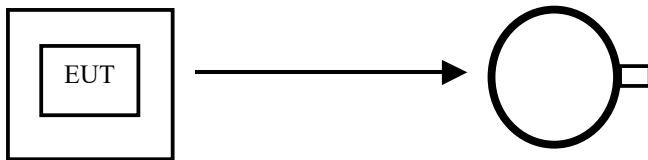
Test engineer: Koji Yamamoto  
Shinya Watanabe  
Koji Yamamoto

**Figure 1: Direction of the Loop Antenna**

*Side View (Vertical)*

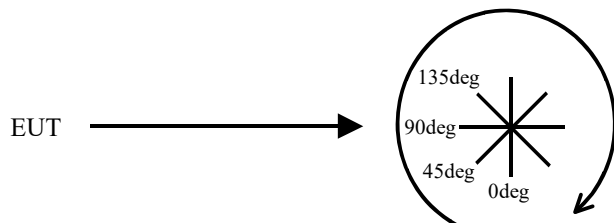


.....  
*Top View (Horizontal)*



.....  
Antenna was not rotated.

.....  
*Top View (Vertical)*



Front side: 0 deg.  
Forward direction: clockwise

## **SECTION 6: -26dB Bandwidth**

### **Test Procedure**

The test was measured with a spectrum analyzer using a test fixture.

| Test             | Span    | RBW   | VBW   | Sweep | Detector | Trace    | Instrument used   |
|------------------|---------|-------|-------|-------|----------|----------|-------------------|
| -26 dB Bandwidth | 100 kHz | 1 kHz | 3 kHz | Auto  | Peak     | Max Hold | Spectrum Analyzer |

Test data : APPENDIX 1  
Test result : Pass

## **SECTION 7: 99% Occupied Bandwidth**

### **Test Procedure**

The test was measured with a spectrum analyzer using a test fixture.

| Test                    | Span                                    | RBW             | VBW                | Sweep | Detector | Trace        | Instrument used   |
|-------------------------|---|-----------------|--------------------|-------|----------|--------------|-------------------|
| 99 % Occupied Bandwidth | Enough width to display emission skirts | 1 to 5 % of OBW | Three times of RBW | Auto  | Peak *1) | Max Hold *1) | Spectrum Analyzer |

\*1) The measurement was performed with Peak detector, Max Hold since the duty cycle was not 100 %.  
Peak hold was applied as Worst-case measurement.

Test data : APPENDIX 1  
Test result : Pass

## APPENDIX 1: Test data

### Radiated Emission below 30 MHz (Fundamental and Spurious Emission) CENTER

Report No. 12541464H  
Test place Ise EMC Lab. No.3 Semi Anechoic Chamber  
Date January 17, 2019  
Temperature/ Humidity 22 deg. C / 35 % RH  
Engineer Koji Yamamoto  
Mode Mode 1

#### PK or QP

| Ant Deg [deg]<br>or<br>Polarity [Hori/Vert] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|---|--------------------|----------|-------------------|-------------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|-------------|
| 45  | 0.12500            | PK       | 102.5             | 19.7                    | -69.7        | 32.3         | -                      | 20.2               | 45.6              | 25.4           | Fundamental |
| 45  | 0.25000            | PK       | 70.7              | 19.7                    | -69.7        | 32.3         | -                      | -11.6              | 39.6              | 51.2           |             |
| 45  | 0.37500            | PK       | 64.1              | 19.6                    | -69.7        | 32.3         | -                      | -18.3              | 36.1              | 54.4           |             |
| 45  | 0.50000            | QP       | 49.3              | 19.6                    | -29.6        | 32.2         | -                      | 7.1                | 33.6              | 26.5           |             |
| 45  | 0.62500            | QP       | 52.7              | 19.6                    | -29.6        | 32.2         | -                      | 10.5               | 31.7              | 21.2           |             |
| 45  | 0.75000            | QP       | 35.6              | 19.6                    | -29.6        | 32.2         | -                      | -6.6               | 30.1              | 36.7           |             |
| 45  | 0.87500            | QP       | 48.2              | 19.6                    | -29.6        | 32.2         | -                      | 6.0                | 28.7              | 22.7           |             |
| 45  | 1.00000            | QP       | 35.5              | 19.6                    | -29.6        | 32.2         | -                      | -6.7               | 27.6              | 34.3           |             |
| 45  | 1.12500            | QP       | 41.2              | 19.6                    | -29.6        | 32.2         | -                      | -1.0               | 26.5              | 27.5           |             |
| 45  | 1.25000            | QP       | 34.2              | 19.6                    | -29.6        | 32.2         | -                      | -8.0               | 25.6              | 33.6           |             |

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier)

#### PK with Duty factor

| Ant Deg [deg] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|---------------|--------------------|----------|-------------------|-------------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|-------------|
| 45            | 0.12500            | AV       | 102.5             | 19.7                    | -69.7        | 32.3         | 0.0                    | 20.2               | 25.6              | 5.4            | Fundamental |
| 45            | 0.25000            | AV       | 70.7              | 19.7                    | -69.7        | 32.3         | 0.0                    | -11.6              | 19.6              | 31.2           |             |
| 45            | 0.37500            | AV       | 64.1              | 19.6                    | -69.7        | 32.3         | 0.0                    | -18.3              | 16.1              | 34.4           |             |

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier) + Duty factor \*

\* Since the peak emission result satisfied the average limit, duty factor was omitted.

#### Result of the fundamental emission at 3m without Distance factor

##### PK or QP

| Ant Deg [deg] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|---------------|--------------------|----------|-------------------|-------------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|-------------|
| 45            | 0.12500            | PK       | 102.5             | 19.7                    | 10.3         | 32.3         | -                      | 100.2              | -                 | -              | Fundamental |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

\* All spurious emissions lower than this result.

\*The test result is rounded off to one or two decimal places, so some differences might be observed.

**Radiated Emission below 30 MHz (Fundamental and Spurious Emission)**  
**REAR DR**

Report No. 12541464H  
Test place Ise EMC Lab. No.3 Semi Anechoic Chamber  
Date January 17, 2019  
Temperature/ Humidity 22 deg. C / 35 % RH  
Engineer Koji Yamamoto  
Mode Mode 2

**PK or QP**

| Ant Deg [deg]<br>or<br>Polarity [Hori/Vert] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|---|--------------------|----------|-------------------|-------------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|-------------|
| 45  | 0.12500            | PK       | 96.7              | 19.7                    | -69.7        | 32.3         | -                      | 14.4               | 45.6              | 31.2           | Fundamental |
| 45  | 0.25000            | PK       | 70.4              | 19.7                    | -69.7        | 32.3         | -                      | -11.9              | 39.6              | 51.5           |             |
| 45  | 0.37500            | PK       | 63.8              | 19.6                    | -69.7        | 32.3         | -                      | -18.6              | 36.1              | 54.7           |             |
| 45  | 0.50000            | QP       | 54.0              | 19.6                    | -29.6        | 32.2         | -                      | 11.8               | 33.6              | 21.8           |             |
| 45  | 0.62500            | QP       | 49.2              | 19.6                    | -29.6        | 32.2         | -                      | 7.0                | 31.7              | 24.7           |             |
| 45  | 0.75000            | QP       | 34.0              | 19.6                    | -29.6        | 32.2         | -                      | -8.2               | 30.1              | 38.3           |             |
| 45  | 0.87500            | QP       | 42.9              | 19.6                    | -29.6        | 32.2         | -                      | 0.7                | 28.7              | 28.0           |             |
| 45  | 1.00000            | QP       | 42.6              | 19.6                    | -29.6        | 32.2         | -                      | 0.4                | 27.6              | 27.2           |             |
| 45  | 1.12500            | QP       | 35.0              | 19.6                    | -29.6        | 32.2         | -                      | -7.2               | 26.5              | 33.7           |             |
| 45  | 1.25000            | QP       | 38.0              | 19.6                    | -29.6        | 32.2         | -                      | -4.2               | 25.6              | 29.8           |             |

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier)

**PK with Duty factor**

| Ant Deg [deg] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|---------------|--------------------|----------|-------------------|-------------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|-------------|
| 45            | 0.12500            | AV       | 96.7              | 19.7                    | -69.7        | 32.3         | 0.0                    | 14.4               | 25.6              | 11.2           | Fundamental |
| 45            | 0.25000            | AV       | 70.4              | 19.7                    | -69.7        | 32.3         | 0.0                    | -11.9              | 19.6              | 31.5           |             |
| 45            | 0.37500            | AV       | 63.8              | 19.6                    | -69.7        | 32.3         | 0.0                    | -18.6              | 16.1              | 34.7           |             |

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier) + Duty factor \*

\* Since the peak emission result satisfied the average limit, duty factor was omitted.

**Result of the fundamental emission at 3m without Distance factor**

**PK or QP**

| Ant Deg [deg] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|---------------|--------------------|----------|-------------------|-------------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|-------------|
| 45            | 0.12500            | PK       | 96.7              | 19.7                    | 10.3         | 32.3         | -                      | 94.4               | -                 | -              | Fundamental |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

\* All spurious emissions lower than this result.

\*The test result is rounded off to one or two decimal places, so some differences might be observed.

**UL Japan, Inc.**

**Ise EMC Lab.**

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**Radiated Emission below 30 MHz (Fundamental and Spurious Emission)**  
**DOOR DR**

Report No. 12541464H  
Test place Ise EMC Lab. No.3 Semi Anechoic Chamber  
Date January 17, 2019  
Temperature/ Humidity 22 deg. C / 35 % RH  
Engineer Koji Yamamoto  
Mode Mode 3

**PK or QP**

| Ant Deg [deg]<br>or<br>Polarity [Hori/Vert] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|---|--------------------|----------|-------------------|-------------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|-------------|
| 0   | 0.12500            | PK       | 105.5             | 19.7                    | -69.7        | 32.3         | -                      | 23.2               | 45.6              | 22.4           | Fundamental |
| 0   | 0.25000            | PK       | 72.0              | 19.7                    | -69.7        | 32.3         | -                      | -10.3              | 39.6              | 49.9           |             |
| 0   | 0.37500            | PK       | 65.4              | 19.6                    | -69.7        | 32.3         | -                      | -17.0              | 36.1              | 53.1           |             |
| 0   | 0.50000            | QP       | 57.7              | 19.6                    | -29.6        | 32.2         | -                      | 15.5               | 33.6              | 18.1           |             |
| 0   | 0.62500            | QP       | 59.7              | 19.6                    | -29.6        | 32.2         | -                      | 17.5               | 31.7              | 14.2           |             |
| 0   | 0.75000            | QP       | 30.9              | 19.6                    | -29.6        | 32.2         | -                      | -11.3              | 30.1              | 41.4           |             |
| 0   | 0.87500            | QP       | 54.4              | 19.6                    | -29.6        | 32.2         | -                      | 12.2               | 28.7              | 16.5           |             |
| 0   | 1.00000            | QP       | 40.0              | 19.6                    | -29.6        | 32.2         | -                      | -2.2               | 27.6              | 29.8           |             |
| 0   | 1.12500            | QP       | 47.7              | 19.6                    | -29.6        | 32.2         | -                      | 5.5                | 26.5              | 21.0           |             |
| 0   | 1.25000            | QP       | 30.7              | 19.6                    | -29.6        | 32.2         | -                      | -11.5              | 25.6              | 37.1           |             |

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier)

**PK with Duty factor**

| Ant Deg [deg] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|---------------|--------------------|----------|-------------------|-------------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|-------------|
| 0             | 0.12500            | AV       | 105.5             | 19.7                    | -69.7        | 32.3         | 0.0                    | 23.2               | 25.6              | 2.4            | Fundamental |
| 0             | 0.25000            | AV       | 72.0              | 19.7                    | -69.7        | 32.3         | 0.0                    | -10.3              | 19.6              | 29.9           |             |
| 0             | 0.37500            | AV       | 65.4              | 19.6                    | -69.7        | 32.3         | 0.0                    | -17.0              | 16.1              | 33.1           |             |

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier) + Duty factor \*

\* Since the peak emission result satisfied the average limit, duty factor was omitted.

**Result of the fundamental emission at 3m without Distance factor**

**PK or QP**

| Ant Deg [deg] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|---------------|--------------------|----------|-------------------|-------------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|-------------|
| 0             | 0.12500            | PK       | 105.5             | 19.7                    | 10.3         | 32.3         | -                      | 103.2              | -                 | -              | Fundamental |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

\* All spurious emissions lower than this result.

\*The test result is rounded off to one or two decimal places, so some differences might be observed.



**Radiated Emission below 30 MHz (Fundamental and Spurious Emission)**  
**DOOR AS**

Report No. 12541464H  
Test place Ise EMC Lab. No.3 Semi Anechoic Chamber  
Date January 17, 2019  
Temperature/ Humidity 22 deg. C / 35 % RH  
Engineer Koji Yamamoto  
Mode Mode 4

**PK or QP**

| Ant Deg [deg]<br>or<br>Polarity [Hori/Vert] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|---|--------------------|----------|-------------------|-------------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|-------------|
| 45  | 0.12500            | PK       | 104.3             | 19.7                    | -69.7        | 32.3         | -                      | 22.0               | 45.6              | 23.6           | Fundamental |
| 45  | 0.25000            | PK       | 70.6              | 19.7                    | -69.7        | 32.3         | -                      | -11.7              | 39.6              | 51.3           |             |
| 45  | 0.37500            | PK       | 64.0              | 19.6                    | -69.7        | 32.3         | -                      | -18.4              | 36.1              | 54.5           |             |
| 45  | 0.50000            | QP       | 49.6              | 19.6                    | -29.6        | 32.2         | -                      | 7.4                | 33.6              | 26.2           |             |
| 45  | 0.62500            | QP       | 56.8              | 19.6                    | -29.6        | 32.2         | -                      | 14.6               | 31.7              | 17.1           |             |
| 45  | 0.75000            | QP       | 37.2              | 19.6                    | -29.6        | 32.2         | -                      | -5.0               | 30.1              | 35.1           |             |
| 45  | 0.87500            | QP       | 51.6              | 19.6                    | -29.6        | 32.2         | -                      | 9.4                | 28.7              | 19.3           |             |
| 45  | 1.00000            | QP       | 36.5              | 19.6                    | -29.6        | 32.2         | -                      | -5.7               | 27.6              | 33.3           |             |
| 45  | 1.12500            | QP       | 45.4              | 19.6                    | -29.6        | 32.2         | -                      | 3.2                | 26.5              | 23.3           |             |
| 45  | 1.25000            | QP       | 33.6              | 19.6                    | -29.6        | 32.2         | -                      | -8.6               | 25.6              | 34.2           |             |

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier)

**PK with Duty factor**

| Ant Deg [deg] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|---------------|--------------------|----------|-------------------|-------------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|-------------|
| 45            | 0.12500            | AV       | 104.3             | 19.7                    | -69.7        | 32.3         | 0.0                    | 22.0               | 25.6              | 3.6            | Fundamental |
| 45            | 0.25000            | AV       | 70.6              | 19.7                    | -69.7        | 32.3         | 0.0                    | -11.7              | 19.6              | 31.3           |             |
| 45            | 0.37500            | AV       | 64.0              | 19.6                    | -69.7        | 32.3         | 0.0                    | -18.4              | 16.1              | 34.5           |             |

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier) + Duty factor \*

\* Since the peak emission result satisfied the average limit, duty factor was omitted.

**Result of the fundamental emission at 3m without Distance factor**

**PK or QP**

| Ant Deg [deg] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|---------------|--------------------|----------|-------------------|-------------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|-------------|
| 45            | 0.12500            | PK       | 104.3             | 19.7                    | 10.3         | 32.3         | -                      | 102.0              | -                 | -              | Fundamental |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

\* All spurious emissions lower than this result.

\*The test result is rounded off to one or two decimal places, so some differences might be observed.

**UL Japan, Inc.**

**Ise EMC Lab.**

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**Radiated Emission below 30 MHz (Fundamental and Spurious Emission)**  
**START SW**

Report No. 12541464H  
Test place Ise EMC Lab. No.3 Semi Anechoic Chamber  
Date January 17, 2019  
Temperature/ Humidity 22 deg. C / 35 % RH  
Engineer Koji Yamamoto  
Mode Mode 5

**PK or QP**

| Ant Deg [deg]<br>or<br>Polarity [Hori/Vert] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|---|--------------------|----------|-------------------|-------------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|-------------|
| 0   | 0.12500            | PK       | 97.7              | 19.7                    | -69.7        | 32.3         | -                      | 15.4               | 45.6              | 30.2           | Fundamental |
| 0   | 0.25000            | PK       | 59.0              | 19.7                    | -69.7        | 32.3         | -                      | -23.3              | 39.6              | 62.9           |             |
| 0   | 0.37500            | PK       | 52.7              | 19.6                    | -69.7        | 32.3         | -                      | -29.7              | 36.1              | 65.8           |             |
| 0   | 0.50000            | QP       | 55.8              | 19.6                    | -29.6        | 32.2         | -                      | 13.6               | 33.6              | 20.0           |             |
| 0   | 0.62500            | QP       | 41.0              | 19.6                    | -29.6        | 32.2         | -                      | -1.2               | 31.7              | 32.9           |             |
| 0   | 0.75000            | QP       | 27.1              | 19.6                    | -29.6        | 32.2         | -                      | -15.1              | 30.1              | 45.2           |             |
| 0   | 0.87500            | QP       | 40.0              | 19.6                    | -29.6        | 32.2         | -                      | -2.2               | 28.7              | 30.9           |             |
| 0   | 1.00000            | QP       | 43.3              | 19.6                    | -29.6        | 32.2         | -                      | 1.1                | 27.6              | 26.5           |             |
| 0   | 1.12500            | QP       | 34.7              | 19.6                    | -29.6        | 32.2         | -                      | -7.5               | 26.5              | 34.0           |             |
| 0   | 1.25000            | QP       | 26.5              | 19.6                    | -29.6        | 32.2         | -                      | -15.7              | 25.6              | 41.3           |             |

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier)

**PK with Duty factor**

| Ant Deg [deg] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|---------------|--------------------|----------|-------------------|-------------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|-------------|
| 0             | 0.12500            | AV       | 97.7              | 19.7                    | -69.7        | 32.3         | 0.0                    | 15.4               | 25.6              | 10.2           | Fundamental |
| 0             | 0.25000            | AV       | 59.0              | 19.7                    | -69.7        | 32.3         | 0.0                    | -23.3              | 19.6              | 42.9           |             |
| 0             | 0.37500            | AV       | 52.7              | 19.6                    | -69.7        | 32.3         | 0.0                    | -29.7              | 16.1              | 45.8           |             |

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier) + Duty factor \*

\* Since the peak emission result satisfied the average limit, duty factor was omitted.

**Result of the fundamental emission at 3m without Distance factor**

**PK or QP**

| Ant Deg [deg] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|---------------|--------------------|----------|-------------------|-------------------------|--------------|--------------|------------------------|--------------------|-------------------|----------------|-------------|
| 0             | 0.12500            | PK       | 97.7              | 19.7                    | 10.3         | 32.3         | -                      | 95.4               | -                 | -              | Fundamental |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

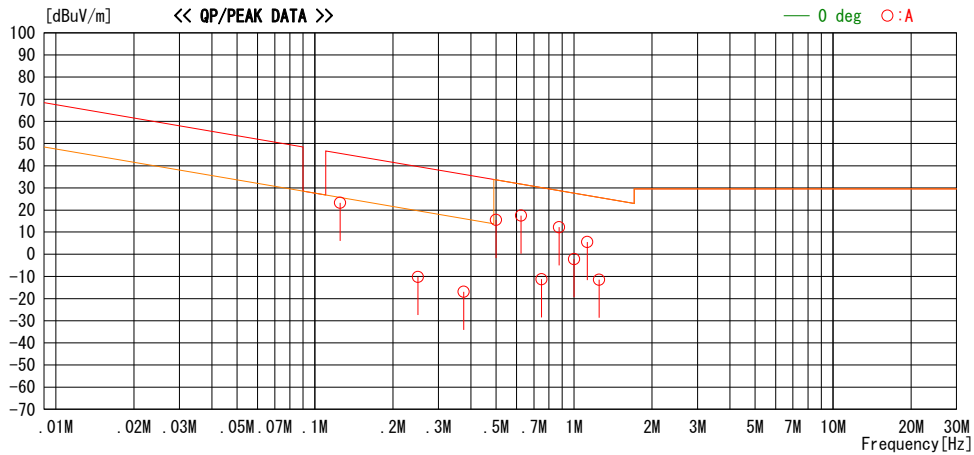
\* All spurious emissions lower than this result.

\*The test result is rounded off to one or two decimal places, so some differences might be observed.

**Radiated Emission below 30 MHz (Fundamental and Spurious Emission)**  
**(Plot data, Worst case)**

Report No. 12541464H  
Test place Ise EMC Lab. No.3 Semi Anechoic Chamber  
Date January 17, 2019  
Temperature/ Humidity 22 deg. C / 35 % RH  
Engineer Koji Yamamoto  
Mode Mode 3

LIMIT : FCC15.209(a), 9-90kHz:PK, 110-490kHz:PK, other:QP  
FCC15.209(a), 9-90kHz:AV, 110-490kHz:AV, other:QP

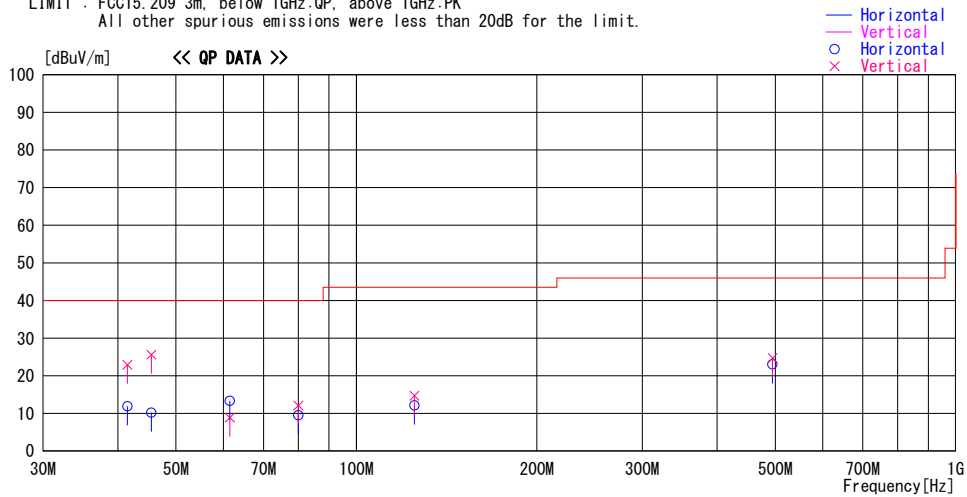


\*These plots data contains sufficient number to show the trend of characteristic features for EUT.

**Radiated Emission above 30 MHz (Spurious Emission)**  
**CENTER**

Report No. 12541464H  
Test place Ise EMC Lab. No.4 Semi Anechoic Chamber  
Date January 23, 2019  
Temperature/ Humidity 21 deg. C / 36 % RH  
Engineer Koji Yamamoto  
Mode Mode 1

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK  
All other spurious emissions were less than 20dB for the limit.



| Frequency<br>[MHz] | Reading<br>[dBuV] | DET | Antenna          | Loss&        | Level | Angle | Height | Polar. | Limit | Margin | Comment |
|--------------------|-------------------|-----|------------------|--------------|-------|-------|--------|--------|-------|--------|---------|
|                    |                   |     | Factor<br>[dB/m] | Gain<br>[dB] |       |       |        |        |       |        |         |
| 41.501             | 22.5              | QP  | 14.1             | -24.7        | 11.9  | 0     | 300    | Hori.  | 40.0  | 28.1   |         |
| 41.501             | 33.5              | QP  | 14.1             | -24.7        | 22.9  | 287   | 100    | Vert.  | 40.0  | 17.1   |         |
| 45.499             | 22.1              | QP  | 12.7             | -24.6        | 10.2  | 0     | 300    | Hori.  | 40.0  | 29.8   |         |
| 45.499             | 37.5              | QP  | 12.7             | -24.6        | 25.6  | 267   | 100    | Vert.  | 40.0  | 14.4   |         |
| 61.501             | 30.5              | QP  | 7.2              | -24.4        | 13.3  | 171   | 300    | Hori.  | 40.0  | 26.7   |         |
| 61.501             | 26.1              | QP  | 7.2              | -24.4        | 8.9   | 286   | 100    | Vert.  | 40.0  | 31.1   |         |
| 80.000             | 26.7              | QP  | 6.9              | -24.1        | 9.5   | 171   | 300    | Hori.  | 40.0  | 30.5   |         |
| 80.000             | 29.3              | QP  | 6.9              | -24.1        | 12.1  | 78    | 100    | Vert.  | 40.0  | 27.9   |         |
| 125.000            | 22.5              | QP  | 13.2             | -23.6        | 12.1  | 0     | 300    | Hori.  | 43.5  | 31.4   |         |
| 125.000            | 25.1              | QP  | 13.2             | -23.6        | 14.7  | 0     | 100    | Vert.  | 43.5  | 28.8   |         |
| 494.748            | 25.9              | QP  | 17.9             | -20.8        | 23.0  | 11    | 100    | Hori.  | 46.0  | 23.0   |         |
| 494.748            | 27.6              | QP  | 17.9             | -20.8        | 24.7  | 88    | 100    | Vert.  | 46.0  | 21.3   |         |

CHART: WITH FACTOR

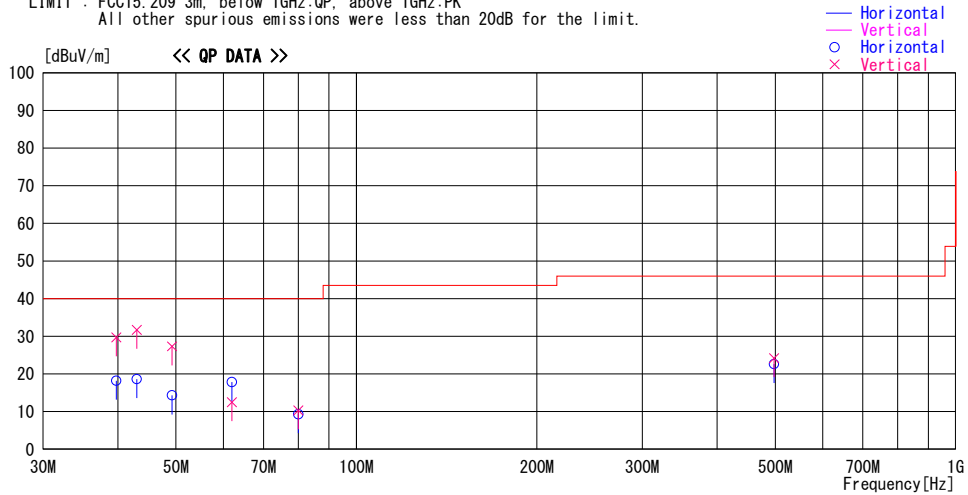
ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN  
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

\*The test result is rounded off to one or two decimal places, so some differences might be observed.

**Radiated Emission above 30 MHz (Spurious Emission)**  
**REAR DR**

Report No. 12541464H  
Test place Ise EMC Lab. No.4 Semi Anechoic Chamber  
Date January 23, 2019  
Temperature/ Humidity 21 deg. C / 36 % RH  
Engineer Koji Yamamoto  
Mode Mode 2

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK  
All other spurious emissions were less than 20dB for the limit.



| Frequency<br>[MHz] | Reading<br>[dBuV] | DET | Antenna          |                       | Level<br>[dBuV/m] | Angle<br>[Deg] | Height<br>[cm] | Polar. | Limit<br>[dBuV/m] | Margin<br>[dB] | Comment |
|--------------------|-------------------|-----|------------------|-----------------------|-------------------|----------------|----------------|--------|-------------------|----------------|---------|
|                    |                   |     | Factor<br>[dB/m] | Loss&<br>Gain<br>[dB] |                   |                |                |        |                   |                |         |
| 39.750             | 28.2              | QP  | 14.7             | -24.7                 | 18.2              | 176            | 300            | Hori.  | 40.0              | 21.8           |         |
| 39.750             | 39.7              | QP  | 14.7             | -24.7                 | 29.7              | 206            | 100            | Vert.  | 40.0              | 10.3           |         |
| 43.001             | 29.6              | QP  | 13.6             | -24.6                 | 18.6              | 0              | 300            | Hori.  | 40.0              | 21.4           |         |
| 43.001             | 42.7              | QP  | 13.6             | -24.6                 | 31.7              | 272            | 100            | Vert.  | 40.0              | 8.3            |         |
| 49.250             | 27.5              | QP  | 11.4             | -24.6                 | 14.3              | 210            | 300            | Hori.  | 40.0              | 25.7           |         |
| 49.250             | 40.5              | QP  | 11.4             | -24.6                 | 27.3              | 272            | 100            | Vert.  | 40.0              | 12.7           |         |
| 62.000             | 35.1              | QP  | 7.1              | -24.4                 | 17.8              | 0              | 300            | Hori.  | 40.0              | 22.2           |         |
| 62.000             | 29.8              | QP  | 7.1              | -24.4                 | 12.5              | 285            | 100            | Vert.  | 40.0              | 27.5           |         |
| 80.000             | 26.5              | QP  | 6.9              | -24.1                 | 9.3               | 0              | 300            | Hori.  | 40.0              | 30.7           |         |
| 80.000             | 27.5              | QP  | 6.9              | -24.1                 | 10.3              | 0              | 100            | Vert.  | 40.0              | 29.7           |         |
| 497.499            | 25.3              | QP  | 18.0             | -20.7                 | 22.6              | 0              | 100            | Hori.  | 46.0              | 23.4           |         |
| 497.499            | 26.9              | QP  | 18.0             | -20.7                 | 24.2              | 87             | 100            | Vert.  | 46.0              | 21.8           |         |

CHART: WITH FACTOR

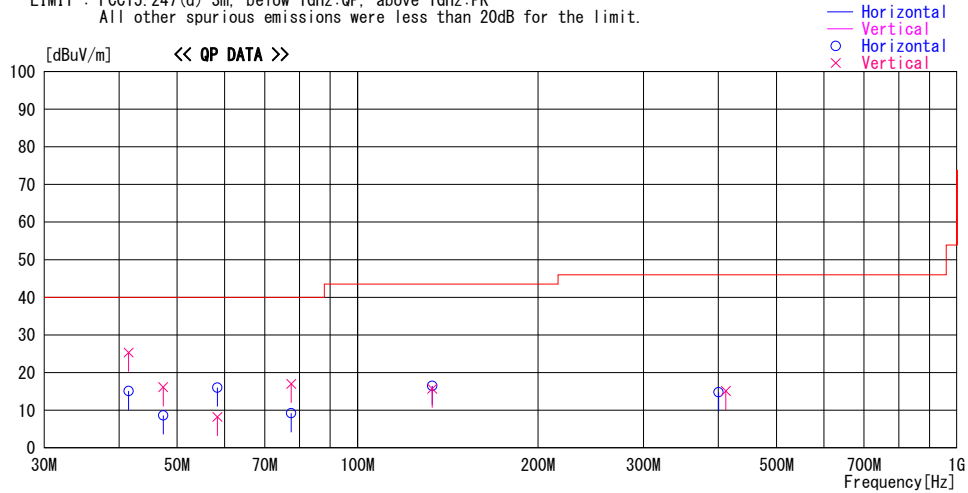
ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN  
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

\*The test result is rounded off to one or two decimal places, so some differences might be observed.

**Radiated Emission above 30 MHz (Spurious Emission)**  
**DOOR DR**

Report No. 12541464H  
Test place Ise EMC Lab. No.4 Semi Anechoic Chamber  
Date January 18, 2019  
Temperature/ Humidity 21 deg. C / 32 % RH  
Engineer Shinya Watanabe  
Mode Mode 3

LIMIT : FCC15.247(d) 3m, below 1GHz:QP, above 1GHz:PK  
All other spurious emissions were less than 20dB for the limit.



| Frequency<br>[MHz] | Reading<br>[dBuV] | DET | Antenna          |                   | Level<br>[dBuV/m] | Angle<br>[Deg] | Height<br>[cm] | Polar. | Limit<br>[dBuV/m] | Margin<br>[dB] | Comment |
|--------------------|-------------------|-----|------------------|-------------------|-------------------|----------------|----------------|--------|-------------------|----------------|---------|
|                    |                   |     | Factor<br>[dB/m] | Loss&Gain<br>[dB] |                   |                |                |        |                   |                |         |
| 41.500             | 25.7              | QP  | 14.1             | -24.7             | 15.1              | 0              | 338            | Hori.  | 40.0              | 24.9           |         |
| 41.500             | 35.9              | QP  | 14.1             | -24.7             | 25.3              | 247            | 100            | Vert.  | 40.0              | 14.7           |         |
| 47.375             | 21.1              | QP  | 12.1             | -24.6             | 8.6               | 0              | 300            | Hori.  | 40.0              | 31.4           |         |
| 47.375             | 28.6              | QP  | 12.1             | -24.6             | 16.1              | 88             | 100            | Vert.  | 40.0              | 23.9           |         |
| 58.375             | 32.2              | QP  | 8.2              | -24.4             | 16.0              | 197            | 393            | Hori.  | 40.0              | 24.0           |         |
| 58.375             | 24.4              | QP  | 8.2              | -24.4             | 8.2               | 0              | 100            | Vert.  | 40.0              | 31.8           |         |
| 77.498             | 26.8              | QP  | 6.6              | -24.2             | 9.2               | 0              | 303            | Hori.  | 40.0              | 30.8           |         |
| 77.498             | 34.6              | QP  | 6.6              | -24.2             | 17.0              | 278            | 100            | Vert.  | 40.0              | 23.0           |         |
| 133.227            | 26.0              | QP  | 14.0             | -23.5             | 16.5              | 0              | 316            | Hori.  | 43.5              | 27.0           |         |
| 133.227            | 25.2              | QP  | 14.0             | -23.5             | 15.7              | 102            | 100            | Vert.  | 43.5              | 27.8           |         |
| 400.401            | 20.3              | QP  | 15.9             | -21.4             | 14.8              | 0              | 100            | Hori.  | 46.0              | 31.2           |         |
| 411.624            | 20.4              | QP  | 16.0             | -21.3             | 15.1              | 0              | 200            | Vert.  | 46.0              | 30.9           |         |

CHART: WITH FACTOR

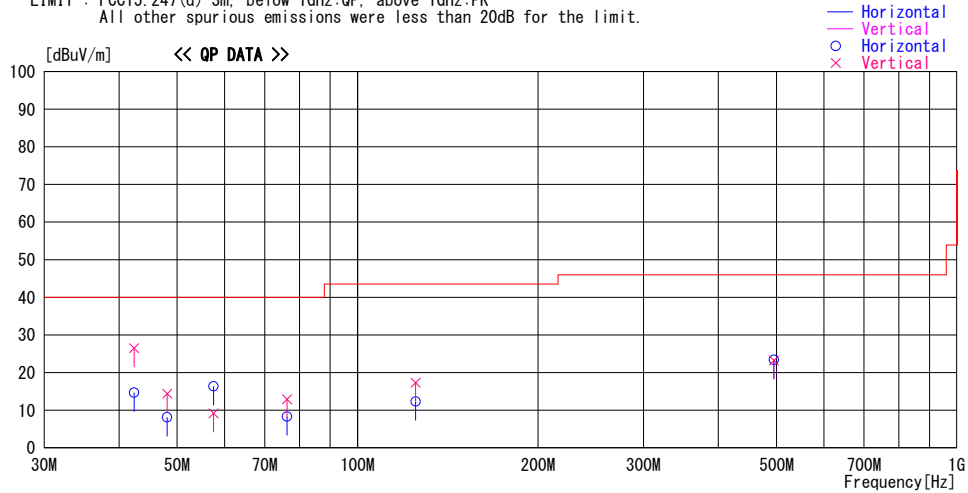
ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN  
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

\*The test result is rounded off to one or two decimal places, so some differences might be observed.

**Radiated Emission above 30 MHz (Spurious Emission)**  
**DOOR AS**

Report No. 12541464H  
Test place Ise EMC Lab. No.4 Semi Anechoic Chamber  
Date January 18, 2019  
Temperature/ Humidity 21 deg. C / 32 % RH  
Engineer Shinya Watanabe  
Mode Mode 4

LIMIT : FCC15.247 (d) 3m, below 1GHz:QP, above 1GHz:PK  
All other spurious emissions were less than 20dB for the limit.



| Frequency<br>[MHz] | Reading<br>[dBuV] | DET | Antenna          |                       | Level<br>[dBuV/m] | Angle<br>[Deg] | Height<br>[cm] | Polar. | Limit<br>[dBuV/m] | Margin<br>[dB] | Comment |
|--------------------|-------------------|-----|------------------|-----------------------|-------------------|----------------|----------------|--------|-------------------|----------------|---------|
|                    |                   |     | Factor<br>[dB/m] | Loss&<br>Gain<br>[dB] |                   |                |                |        |                   |                |         |
| 42.374             | 25.6              | QP  | 13.8             | -24.7                 | 14.7              | 0              | 318            | Hori.  | 40.0              | 25.3           |         |
| 42.374             | 37.4              | QP  | 13.8             | -24.7                 | 26.5              | 291            | 100            | Vert.  | 40.0              | 13.5           |         |
| 48.125             | 20.9              | QP  | 11.8             | -24.6                 | 8.1               | 359            | 300            | Hori.  | 40.0              | 31.9           |         |
| 48.125             | 27.2              | QP  | 11.8             | -24.6                 | 14.4              | 0              | 100            | Vert.  | 40.0              | 25.6           |         |
| 57.500             | 32.3              | QP  | 8.5              | -24.4                 | 16.4              | 176            | 390            | Hori.  | 40.0              | 23.6           |         |
| 57.500             | 25.1              | QP  | 8.5              | -24.4                 | 9.2               | 225            | 100            | Vert.  | 40.0              | 30.8           |         |
| 76.250             | 26.0              | QP  | 6.5              | -24.2                 | 8.3               | 177            | 289            | Hori.  | 40.0              | 31.7           |         |
| 76.250             | 30.6              | QP  | 6.5              | -24.2                 | 12.9              | 285            | 100            | Vert.  | 40.0              | 27.1           |         |
| 125.001            | 22.7              | QP  | 13.2             | -23.6                 | 12.3              | 235            | 271            | Hori.  | 43.5              | 31.2           |         |
| 125.001            | 27.7              | QP  | 13.2             | -23.6                 | 17.3              | 69             | 100            | Vert.  | 43.5              | 26.2           |         |
| 494.996            | 26.3              | QP  | 17.9             | -20.8                 | 23.4              | 172            | 100            | Hori.  | 46.0              | 22.6           |         |
| 494.996            | 26.1              | QP  | 17.9             | -20.8                 | 23.2              | 71             | 100            | Vert.  | 46.0              | 22.8           |         |

CHART: WITH FACTOR

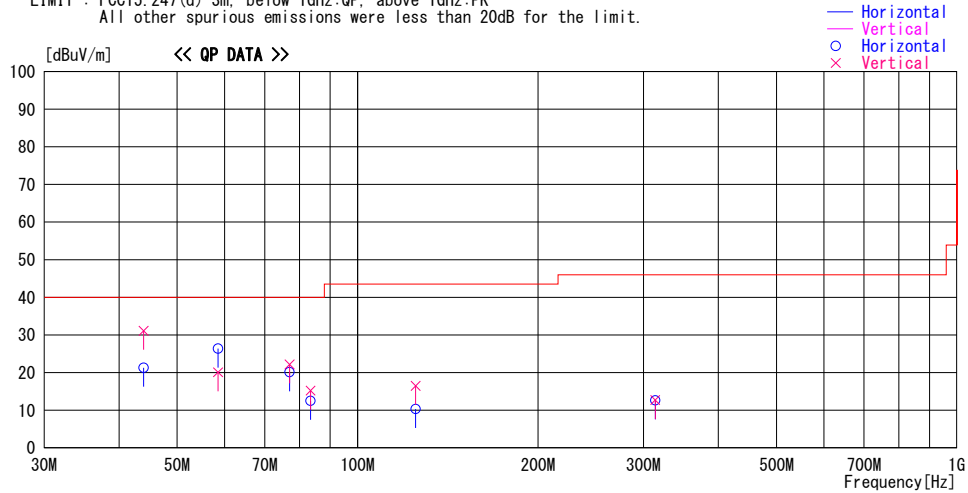
ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN  
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

\*The test result is rounded off to one or two decimal places, so some differences might be observed.

**Radiated Emission above 30 MHz (Spurious Emission)**  
**START SW**

Report No. 12541464H  
Test place Ise EMC Lab. No.4 Semi Anechoic Chamber  
Date January 18, 2019  
Temperature/ Humidity 21 deg. C / 32 % RH  
Engineer Shinya Watanabe  
Mode Mode 5

LIMIT : FCC15.247(d) 3m, below 1GHz:QP, above 1GHz:PK  
All other spurious emissions were less than 20dB for the limit.



| Frequency<br>[MHz] | Reading<br>[dBuV] | DET | Antenna          |                       | Level<br>[dBuV/m] | Angle<br>[Deg] | Height<br>[cm] | Polar. | Limit<br>[dBuV/m] | Margin<br>[dB] | Comment |
|--------------------|-------------------|-----|------------------|-----------------------|-------------------|----------------|----------------|--------|-------------------|----------------|---------|
|                    |                   |     | Factor<br>[dB/m] | Loss&<br>Gain<br>[dB] |                   |                |                |        |                   |                |         |
| 43.968             | 32.7              | QP  | 13.2             | -24.6                 | 21.3              | 0              | 371            | Hor.i. | 40.0              | 18.7           |         |
| 43.968             | 42.5              | QP  | 13.2             | -24.6                 | 31.1              | 266            | 100            | Vert.  | 40.0              | 8.9            |         |
| 58.499             | 42.6              | QP  | 8.2              | -24.4                 | 26.4              | 359            | 381            | Hor.i. | 40.0              | 13.6           |         |
| 58.499             | 36.3              | QP  | 8.2              | -24.4                 | 20.1              | 273            | 100            | Vert.  | 40.0              | 19.9           |         |
| 77.000             | 37.7              | QP  | 6.6              | -24.2                 | 20.1              | 190            | 203            | Hor.i. | 40.0              | 19.9           |         |
| 77.000             | 39.8              | QP  | 6.6              | -24.2                 | 22.2              | 266            | 100            | Vert.  | 40.0              | 17.8           |         |
| 83.500             | 29.4              | QP  | 7.2              | -24.1                 | 12.5              | 0              | 236            | Hor.i. | 40.0              | 27.5           |         |
| 83.500             | 32.1              | QP  | 7.2              | -24.1                 | 15.2              | 81             | 100            | Vert.  | 40.0              | 24.8           |         |
| 124.996            | 20.7              | QP  | 13.2             | -23.6                 | 10.3              | 0              | 300            | Hor.i. | 43.5              | 33.2           |         |
| 124.996            | 26.9              | QP  | 13.2             | -23.6                 | 16.5              | 168            | 100            | Vert.  | 43.5              | 27.0           |         |
| 313.828            | 20.5              | QP  | 14.0             | -21.9                 | 12.6              | 0              | 100            | Hor.i. | 46.0              | 33.4           |         |
| 313.828            | 20.6              | QP  | 14.0             | -21.9                 | 12.7              | 0              | 100            | Vert.  | 46.0              | 33.3           |         |

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN  
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

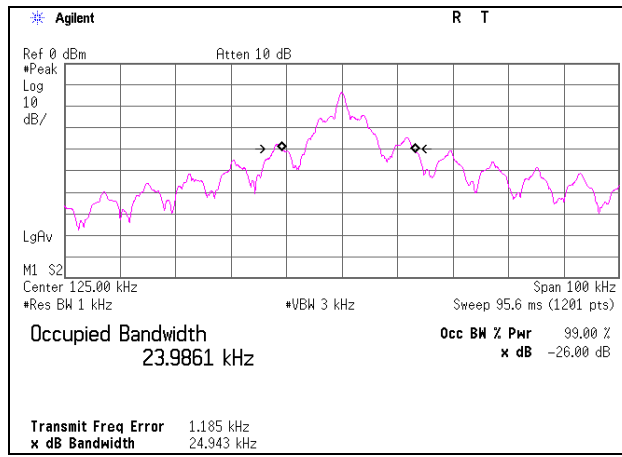
\*The test result is rounded off to one or two decimal places, so some differences might be observed.



**-26 dB Bandwidth and 99 % Occupied Bandwidth**  
**CENTER**

Report No. 12541464H  
 Test place Ise EMC Lab. No.4 Semi Anechoic Chamber  
 Date January 23, 2019  
 Temperature/ Humidity 21 deg. C / 35 % RH  
 Engineer Koji Yamamoto  
 Mode Mode 1

| -26 dB Bandwidth<br>[kHz] | 99 % Occupied Bandwidth<br>[kHz] |
|---------------------------|----------------------------------|
| 24.9430                   | 23.9861                          |



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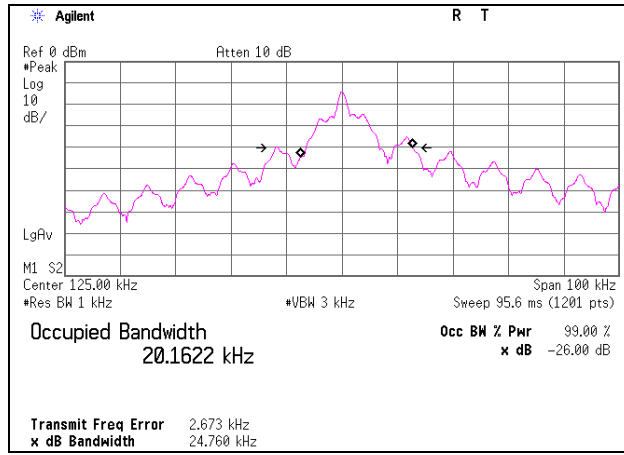
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

**-26 dB Bandwidth and 99 % Occupied Bandwidth**  
**REAR DR**

Report No. 12541464H  
 Test place Ise EMC Lab. No.4 Semi Anechoic Chamber  
 Date January 23, 2019  
 Temperature/ Humidity 21 deg. C / 35 % RH  
 Engineer Koji Yamamoto  
 Mode Mode 2

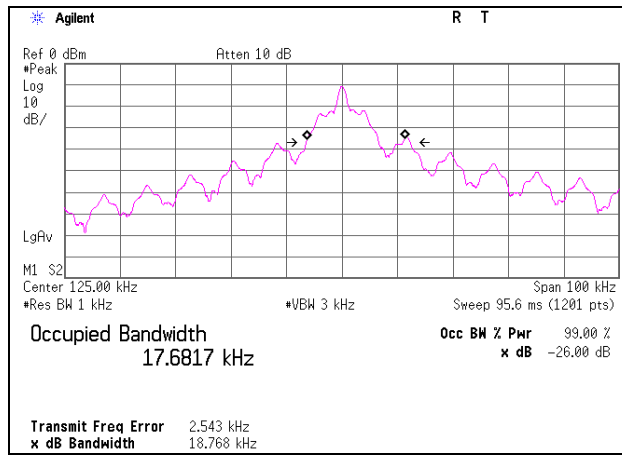
| -26 dB Bandwidth<br>[kHz] | 99 % Occupied Bandwidth<br>[kHz] |
|---------------------------|----------------------------------|
| 24.7600                   | 20.1622                          |



**-26 dB Bandwidth and 99 % Occupied Bandwidth**  
**DOOR DR**

Report No. 12541464H  
 Test place Ise EMC Lab. No.4 Semi Anechoic Chamber  
 Date January 23, 2019  
 Temperature/ Humidity 21 deg. C / 35 % RH  
 Engineer Koji Yamamoto  
 Mode Mode 3

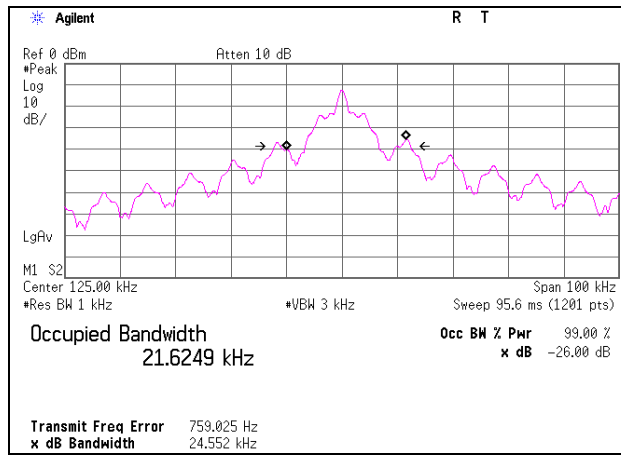
| -26 dB Bandwidth<br>[kHz] | 99 % Occupied Bandwidth<br>[kHz] |
|---------------------------|----------------------------------|
| 18.7680                   | 17.6817                          |



**-26 dB Bandwidth and 99 % Occupied Bandwidth**  
**DOOR AS**

Report No. 12541464H  
Test place Ise EMC Lab. No.4 Semi Anechoic Chamber  
Date January 23, 2019  
Temperature/ Humidity 21 deg. C / 35 % RH  
Engineer Koji Yamamoto  
Mode Mode 4

| -26 dB Bandwidth<br>[kHz] | 99 % Occupied Bandwidth<br>[kHz] |
|---------------------------|----------------------------------|
| 24.5520                   | 21.6249                          |



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**Ise EMC Lab.**

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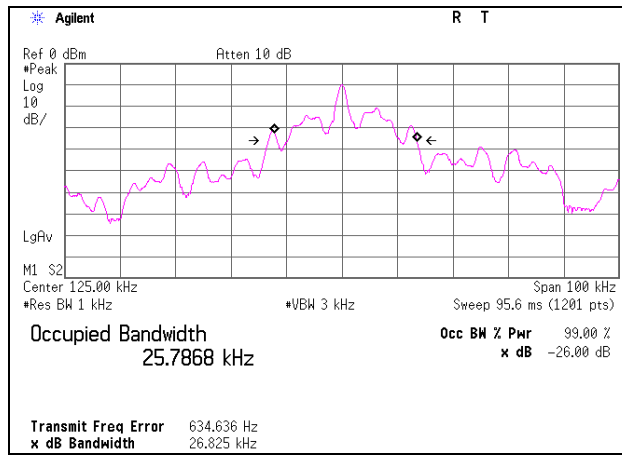
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

**-26 dB Bandwidth and 99 % Occupied Bandwidth**  
**START SW**

Report No. 12541464H  
 Test place Ise EMC Lab. No.4 Semi Anechoic Chamber  
 Date January 23, 2019  
 Temperature/ Humidity 21 deg. C / 35 % RH  
 Engineer Koji Yamamoto  
 Mode Mode 5

| -26 dB Bandwidth<br>[kHz] | 99 % Occupied Bandwidth<br>[kHz] |
|---------------------------|----------------------------------|
| 26.8250                   | 25.7868                          |



## **APPENDIX 2: Test instruments**

### **Test Instruments**

| <b>Test Item</b> | <b>LIMS ID</b> | <b>Description</b>               | <b>Manufacturer</b> | <b>Model</b>                       | <b>Serial</b>  | <b>Last Calibration Date</b> | <b>Calibration Due Date</b> | <b>Cal Int</b> |
|------------------|----------------|----------------------------------|---------------------|------------------------------------|----------------|------------------------------|-----------------------------|----------------|
| RE               | 141583         | Pre Amplifier                    | SONOMA INSTRUMENT   | 310                                | 260833         | 2/27/2018                    | 2/28/2019                   | 12             |
| RE               | 141951         | EMI Test Receiver                | Rohde & Schwarz     | ESR26                              | 101408         | 1/30/2018                    | 1/31/2019                   | 12             |
| RE               | 141267         | Logperiodic Antenna(200-1000MHz) | Schwarzbeck         | VUSLP9111B                         | 911B-192       | 6/1/2018                     | 6/30/2019                   | 12             |
| RE               | 141425         | Biconical Antenna                | Schwarzbeck         | BBA9106                            | 1302           | 6/1/2018                     | 6/30/2019                   | 12             |
| RE               | 141152         | EMI measurement program          | TSJ                 | TEPTO-DV                           | -              | -                            | -                           | -              |
| RE               | 141562         | Thermo-Hygrometer                | CUSTOM              | CTH-201                            | 0010           | 1/11/2019                    | 1/31/2020                   | 12             |
| RE               | 141397         | Coaxial Cable                    | UL Japan            | -                                  | -              | 6/13/2018                    | 6/30/2019                   | 12             |
| RE               | 148898         | Attenuator                       | KEYSIGHT            | 8491A                              | MY52462282     | 10/3/2018                    | 10/31/2019                  | 12             |
| RE               | 141532         | DIGITAL HiTESTER                 | HIOKI               | 3805                               | 51201197       | 1/29/2019                    | 1/31/2020                   | 12             |
| RE               | 141582         | Pre Amplifier                    | SONOMA INSTRUMENT   | 310                                | 260834         | 2/27/2018                    | 2/28/2019                   | 12             |
| RE               | 141363         | Attenuator(10dB)                 | JFW                 | 50FP-010-H2                        | 43608 46-202-1 | 2/28/2018                    | 2/28/2019                   | 12             |
| RE               | 141216         | Coaxial cable                    | Fujikura/Suhner/TSJ | 5D-2W/SFM14/sucoform141-PE/421-010 | -/00640        | 7/3/2018                     | 7/31/2019                   | 12             |
| RE               | 141413         | Coaxial Cable                    | UL Japan            | -                                  | -              | 6/12/2018                    | 6/30/2019                   | 12             |
| RE               | 141254         | Loop Antenna                     | Rohde & Schwarz     | HFH2-Z2                            | 100017         | 10/11/2018                   | 10/31/2019                  | 12             |
| RE               | 141950         | EMI Test Receiver                | Rohde & Schwarz     | ESU26                              | 100412         | 6/15/2018                    | 6/30/2019                   | 12             |
| RE               | 142183         | Measure                          | KOMELON             | KMC-36                             | -              | -                            | -                           | -              |
| RE               | 141554         | Thermo-Hygrometer                | CUSTOM              | CTH-180                            | 1301           | 1/11/2019                    | 1/31/2020                   | 12             |
| RE               | 142008         | AC3_Semi Anechoic Chamber(NSA)   | TDK                 | Semi Anechoic Chamber 3m           | DA-10005       | 6/26/2018                    | 6/30/2020                   | 24             |
| RE               | 141899         | Spectrum Analyzer                | AGILENT             | E4448A                             | MY46180655     | 8/10/2018                    | 8/31/2019                   | 12             |
| RE               | 142645         | Loop Antenna                     | UL Japan            | -                                  | -              | -                            | -                           | -              |
| RE               | 142011         | AC4_Semi Anechoic Chamber(NSA)   | TDK                 | Semi Anechoic Chamber 3m           | DA-10005       | 6/28/2018                    | 6/30/2020                   | 24             |

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

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

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

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

Test item:

RE: Spurious emission

**UL Japan, Inc.**

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