# RADIO TEST REPORT

## Test Report No. : 31LE0019-HO-01-A

| | | |
|---|---|---|
| **Applicant** | : | **Fuji Heavy Industries Ltd.** |
| **Type of Equipment** | : | **Smart LF Oscillator** |
| **Model No.** | : | **SSPLF04** |
| **FCC ID** | : | **Y8PSSPLF04** |
| **Test regulation** | : | **FCC Part 15 Subpart C 2010**<br>**Section 15.207, Section 15.209** |
| **Test Result** | : | **Complied** |

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 must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

**Date of test:** July 26, 2011

**Representative test engineer:**

Keisuke Kawamura
Engineer of WiSE Japan, UL Verification Service

**Approved by :**

Shinya Watanabe
Leader of WiSE Japan, UL Verification Service

NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
*As for the range of Accreditation in NVLAP, you may refer to the WEB address, http://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap

**UL Japan, Inc.**
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# SECTION 1: Customer information

| | | |
|---|---|---|
| Company Name | : | Fuji Heavy Industries Ltd. |
| Address | : | 1-1 SUBARU-CHO OTA-SHI GUNMA 373-8555 JAPAN |
| Telephone Number | : | +81-276-26-2381 |
| Facsimile Number | : | +81-276-26-3069 |
| Contact Person | : | Takashi Nishida |

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

## 2.1 Identification of E.U.T.

| | | |
|---|---|---|
| Type of Equipment | : | Smart LF Oscillator |
| Model No. | : | SSPLF04 |
| Serial No. | : | Refer to Section 4, Clause 4.2 |
| Rating | : | DC12.0V (Max 0.5A) |
| Receipt Date of Sample | : | July 7, 2011 |
| Condition of EUT | : | Engineering prototype<br>(Not for Sale: This sample is equivalent to mass-produced items.) |
| Modification of EUT | : | No Modification by the test lab |

## 2.2 Product Description

Smart LF Oscillator, model: SSPLF04 is a transmitter that is installed in a motor vehicle and is used as part of Smart System.

**Radio Specification**

| | | |
|---|---|---|
| Radio Type | : | Transmitter |
| Frequency of Operation | : | 134.2kHz |
| Modulation | : | ASK |
| Method of Frequency Genenration | : | Crystal |
| Antenna type | : | Coil Antenna |

Smart LF Oscillator (model: SSPLF04) consists of the following parts:

- Computer Assy, Smart Key (ECU)
- Door Antenna
- Door Oscillator
- Trunk Antenna
- Room Antenna / Luggage Antenna

# SECTION 3: Test specification, procedures & results

## 3.1 Test Specification

| | | |
|---|---|---|
| Test Specification | : | FCC Part 15 Subpart C: 2011, final revised on July 8, 2011 and effective August 8, 2011 |
| Title | : | FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators<br>Section 15.207 Conducted Emission<br>Section 15.209 Radiated emission limits, general requirements |

*The revision on July 8, 2011 does not affect the test specification applied to the EUT.

**FCC 15.31 (e)**
The stable voltage (DC2.3 to 6.2V*) is constantly provided to RF Part through the regulator regardless of voltage fluctuation of car battery (DC12V). Therefore, this EUT complies with the requirement.
*The regulated voltage value differs depending on connected LF antennas.

**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.

### 3.2 Procedures and results

| No. | Item | Test Procedure | Specification | Remarks | Deviation | Worst margin | Results |
|---|---|---|---|---|---|---|---|
| 1 | Conducted Emission | <FCC><br>ANSI C63.4:2003<br>7. AC powerline conducted emission measurements<br><IC><br>RSS-Gen 7.2.4 | <FCC><br>Section 15.207<br><IC><br>RSS-Gen 7.2.4 | - | N/A *1) | N/A | N/A |
| 2 | Electric Field Strength of Fundamental Emission | <FCC><br>ANSI C63.4:2003<br>13. Measurement of intentional radiators<br><IC><br>RSS-Gen 4.8, 4.11 | <FCC><br>Section 15.209<br><IC><br>RSS-210 2.5.1<br>RSS-Gen 7.2.5 | Radiated | N/A | 22.2dB<br>0.13420MHz,<br>0 deg., AV<br>(Trunk Antenna)<br>(Room Antenna / Luggage Antenna) | Complied |
| 3 | Electric Field Strength of Spurious Emission | <FCC><br>ANSI C63.4:2003<br>13. Measurement of intentional radiators<br><IC><br>RSS-Gen 4.9, 4.11 | <FCC><br>Section 15.209<br><IC><br>RSS-210 2.5.1<br>RSS-Gen 7.2.5 | Radiated | N/A | 9.6dB<br>38.116MHz,<br>Vertical, QP<br>(Room Antenna / Luggage Antenna) | Complied |
| 4 | -26dB Bandwidth | <FCC><br>ANSI C63.4:2003<br>13. Measurement of intentional radiators<br><IC><br>- | <FCC><br>Reference data<br><IC><br>- | Radiated | N/A | N/A | N/A |

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.

### 3.3 Addition to standard

| No. | Item | Test Procedure | Specification | Remarks | Deviation | Worst margin | Results |
|---|---|---|---|---|---|---|---|
| 1 | 99% Occupied Band Width | RSS-Gen 4.6.1 | RSS-Gen 4.6.1 | Radiated | N/A | N/A | N/A |

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.

| Test room (semi-anechoic chamber) | Radiated emission | | | | | | |
|---|---|---|---|---|---|---|---|
| | (3m*)(±dB) | | | | (1m*)(±dB) | | (0.5m*)(±dB) |
| | 9kHz -30MHz | 30MHz -300MHz | 300MHz -1GHz | 1GHz -10GHz | 10GHz -18GHz | 18GHz -26.5GHz | 26.5GHz -40GHz |
| No.1 | 3.5dB | 5.1dB | 5.2dB | 4.8dB | 5.1dB | 4.4dB | 4.3dB |
| No.2 | 4.0dB | 5.1dB | 5.2dB | 4.8dB | 5.0dB | 4.3dB | 4.2dB |
| No.3 | 4.2dB | 4.7dB | 5.2dB | 4.8dB | 5.0dB | 4.5dB | 4.2dB |
| No.4 | 4.0dB | 5.0dB | 5.1dB | 4.8dB | 5.0dB | 5.1dB | 4.2dB |

*3m/1m/0.5m = Measurement distance

Radiated emission test(3m)
The data listed in this test report has enough margin, more than the site margin.

### 3.5 Test Location

UL Japan, Inc. Head Office EMC Lab. *NVLAP Lab. code: 200572-0
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Telephone : +81 596 24 8116 Facsimile : +81 596 24 8124

| | FCC Registration Number | IC Registration Number | Width x Depth x Height (m) | Size of reference ground plane (m) / horizontal conducting plane | Other rooms |
|---|---|---|---|---|---|
| No.1 semi-anechoic chamber | 313583 | 2973C-1 | 19.2 x 11.2 x 7.7m | 7.0 x 6.0m | No.1 Power source room |
| No.2 semi-anechoic chamber | 655103 | 2973C-2 | 7.5 x 5.8 x 5.2m | 4.0 x 4.0m | - |
| No.3 semi-anechoic chamber | 148738 | 2973C-3 | 12.0 x 8.5 x 5.9m | 6.8 x 5.75m | No.3 Preparation room |
| No.3 shielded room | - | - | 4.0 x 6.0 x 2.7m | N/A | - |
| No.4 semi-anechoic chamber | 134570 | 2973C-4 | 12.0 x 8.5 x 5.9m | 6.8 x 5.75m | No.4 Preparation room |
| No.4 shielded room | - | - | 4.0 x 6.0 x 2.7m | N/A | - |
| No.5 semi-anechoic chamber | - | - | 6.0 x 6.0 x 3.9m | 6.0 x 6.0m | - |
| No.6 shielded room | - | - | 4.0 x 4.5 x 2.7m | 4.75 x 5.4 m | - |
| No.6 measurement room | - | - | 4.75 x 5.4 x 3.0m | 4.75 x 4.15 m | - |
| No.7 shielded room | - | - | 4.7 x 7.5 x 2.7m | 4.7 x 7.5m | - |
| No.8 measurement room | - | - | 3.1 x 5.0 x 2.7m | N/A | - |
| No.9 measurement room | - | - | 8.0 x 4.5 x 2.8m | 2.0 x 2.0m | - |
| No.10 measurement room | - | - | 2.6 x 2.8 x 2.5m | 2.4 x 2.4m | - |
| No.11 measurement room | - | - | 3.1 x 3.4 x 3.0m | 2.4 x 3.4m | - |

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 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 set up, Data of EMI, and Test instruments

Refer to APPENDIX 1 to 3.

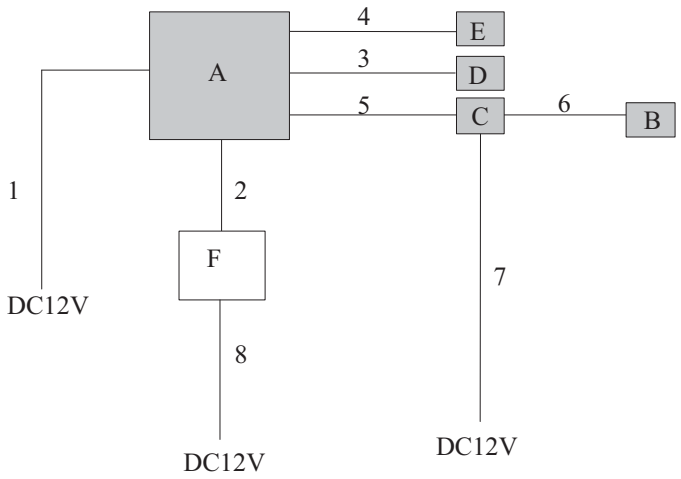
# SECTION 4: Operation of E.U.T. during testing

## 4.1 Operating Modes

The mode is used : 1) Transmitting mode (Tx) 134.2kHz (Door Antenna, Trunk Antenna, Room Antenna / Luggage Antenna, Maximum Output)
2) Transmitting mode (Tx) 134.2kHz (Room Antenna / Luggage Antenna only, Minimum Output)
* LF output power is controlled by Component Assy, Smart Key.

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

## 4.2 Configuration and peripherals




* Cabling and setup 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 | Computer Assy, Smart Key (ECU) | - | 001 | - | EUT |
| B | Door Antenna | - | 001 | - | EUT |
| C | Door Oscillator | - | 003 | - | EUT |
| D | Room Antenna / Luggage Antenna | - | 001 | - | EUT |
| E | Trunk Antenna | - | 001 | - | EUT |
| F | Jig Box | - | - | - | - |

**List of cables used**

| No. | Name | Length (m) | Shield | | Remarks |
|---|---|---|---|---|---|
| | | | Cable | Connector | |
| 1 | DC Cable | 2.9 | Unshielded | Unshielded | - |
| 2 | ECU Cable | 2.0 | Unshielded | Unshielded | - |
| 3 | Room Ant / Luggage Ant Cable | 2.0 | Unshielded | Unshielded | - |
| 4 | Trunk Ant Cable | 2.0 | Unshielded | Unshielded | - |
| 5 | Door Oscillator Cable | 3.2 | Unshielded | Unshielded | - |
| 6 | Signal Cable | 0.5 | Unshielded | Unshielded | - |
| 7 | DC Cable | 4.4 | Unshielded | Unshielded | - |
| 8 | DC Cable | 3.2 | Unshielded | Unshielded | - |

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

**Test Procedure**
The Radiated Electric Field Strength intensity has been measured on No 2 and 4 semi anechoic chambers with a ground plane and at a distance of 3m.

Frequency : From 9kHz to 30MHz at distance 3m
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: 0deg., 45deg., 90deg., 135deg and 180deg.)
and horizontal polarization.
*Refer to Figure 1 about Direction of the Loop Antenna.

Frequency : From 30MHz to 1GHz at distance 3m
The measuring antenna height varied between 1 and 4m 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.

Measurements were performed with a QP, PK, and AV detector.
The radiated emission measurements were made with the following detector function of the test receiver (below 1GHz).

| | From 9kHz to 90kHz and From 110kHz to 150kHz | From 90kHz to 110kHz | From 150kHz to 490kHz | From 490kHz to 30MHz | From 30MHz to 1GHz |
|---|---|---|---|---|---|
| Detector Type | PK/AV | QP | PK/AV | QP | QP |
| IF Bandwidth | 200Hz | 200Hz | 9kHz | 9kHz | 120kHz |

- The carrier level (or, noise levels) was (or were) measured at each position of all three axes X, Y and Z, and the position that has the maximum noise was determined.
With the position, the noise levels of all the frequencies were measured.

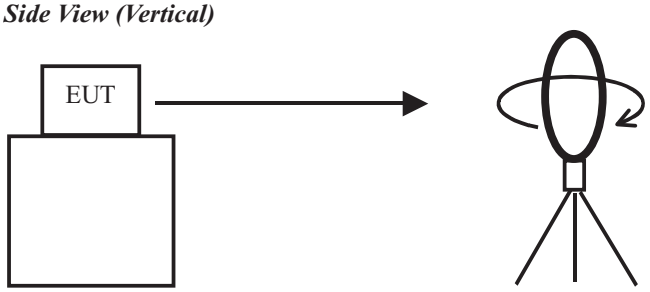
* Part 15 Section 15.31 (f)(2) (9kHz-30MHz)
[Limit at 3m]=[Limit at 300m]-40 x log (3[m]/300[m])
[Limit at 3m]=[Limit at 30m]-40 x log (3[m]/30[m])

**Test data : APPENDIX 2**
**Test result : Pass**

Date: July 26, 2011 Test engineer: Keisuke Kawamura

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

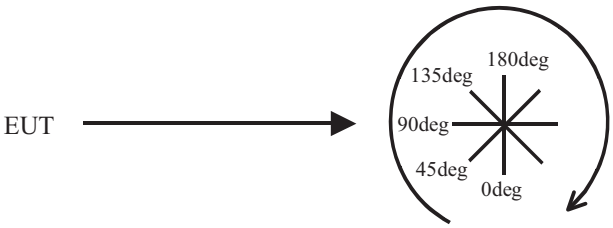
*Side View (Vertical)*




*Top View (Horizontal)*


Antenna was not rotated.

*Top View (Vertical)*




Front side: 0 deg.
Forward direction: clockwise

## SECTION 6: -26dB Bandwidth

**Test Procedure**

The measurement was performed in the antenna height to gain the maximum of Electric field strength.

**Test data** : **APPENDIX 2**
**Test result** : **Pass**

## SECTION 7: 99% Occupied Bandwidth

**Test Procedure**

The measurement was performed in the antenna height to gain the maximum of Electric field strength.

**Test data** : **APPENDIX 2**
**Test result** : **Pass**

## APPENDIX 1: Photographs of test setup

### Radiated emission
**Door Antenna**

**Photo 1**

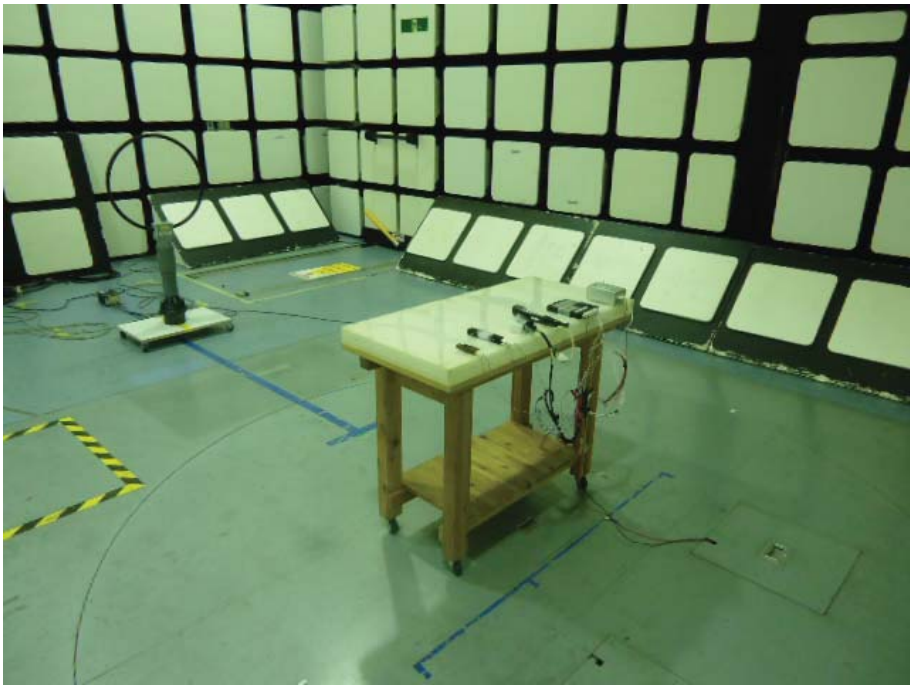


**Photo 2**

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## Radiated emission

**Trunk Antenna**

**Photo 1**

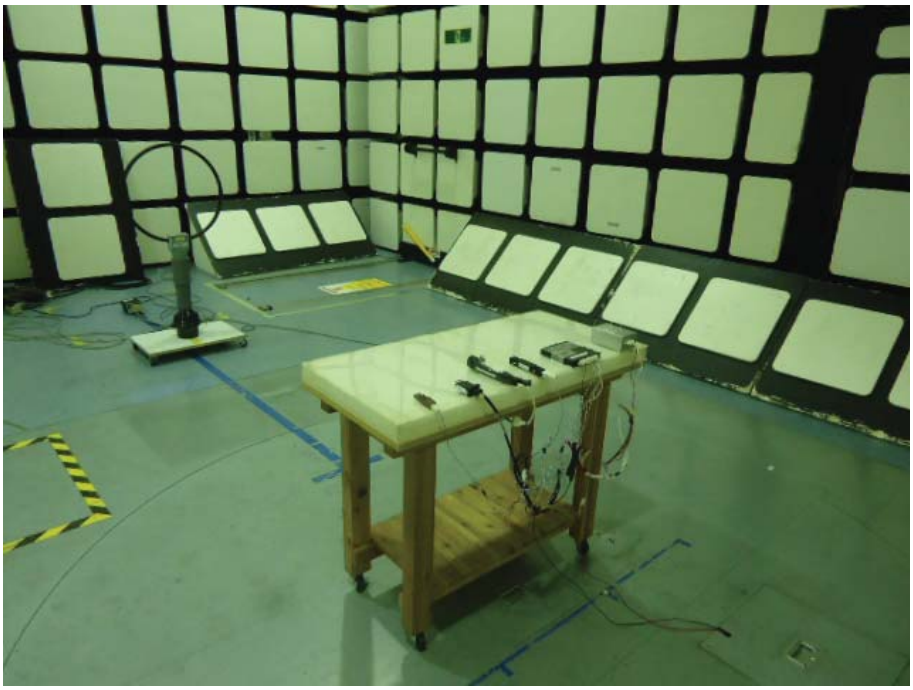

**Photo 2**

## Radiated emission

**Room Antenna / Luggage Antenna**

**Photo 1**

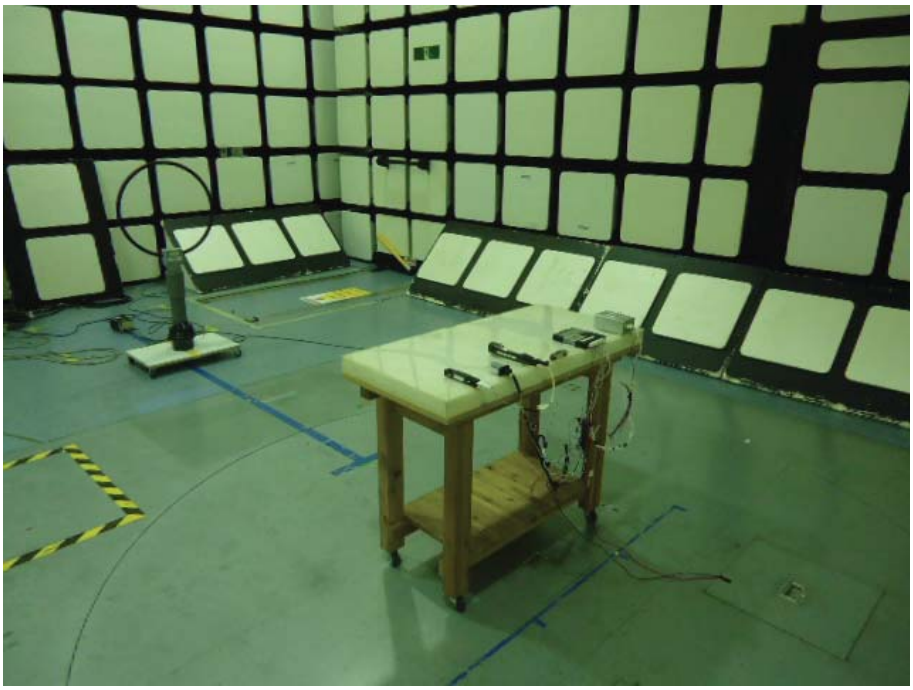

**Photo 2**

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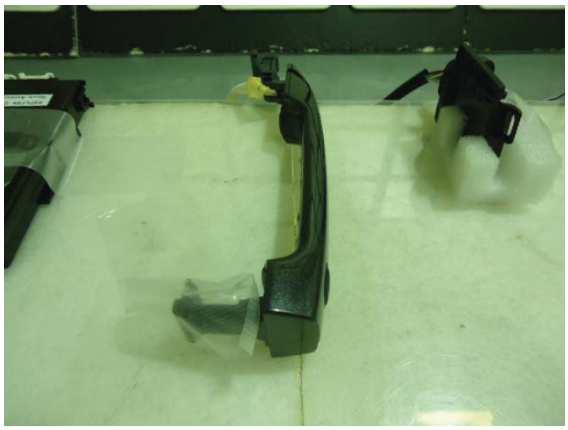
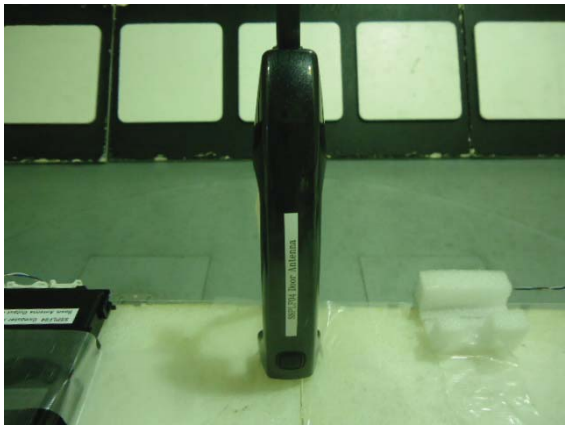
# Worst Case Position

**Door Antenna**
**Below 30MHz:X-axis**
**Above 30MHz(Hori:X-axis /Vert:X-axis)**

**X-axis**



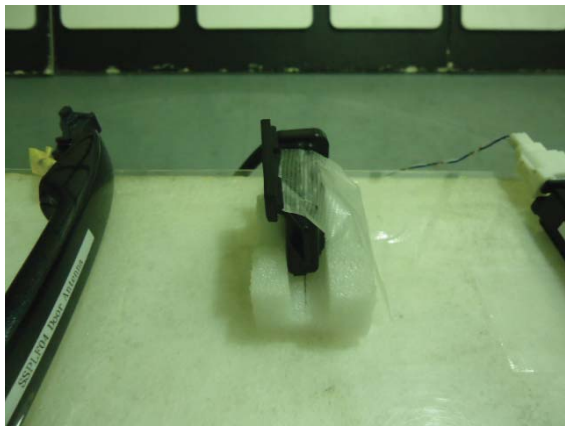
**Y-axis**



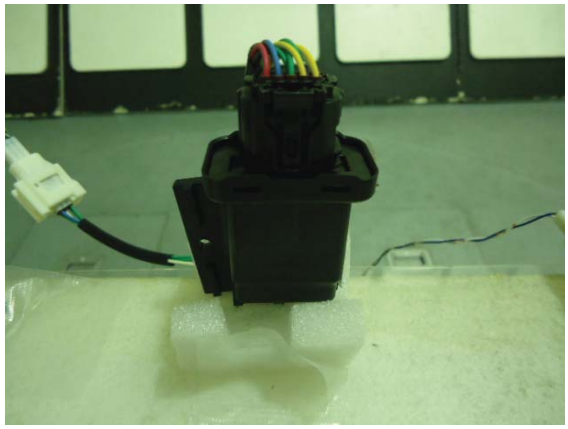
**Z-axis**


**Door Oscillator**
**Below 30MHz:X-axis**
**Above 30MHz(Hori:X-axis /Vert:X-axis)**

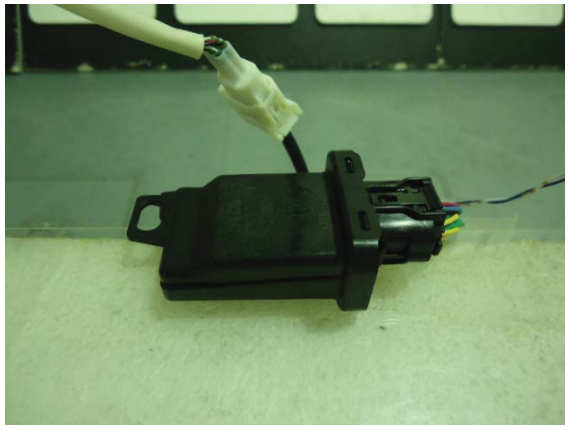
**X-axis**



**Y-axis**



**Z-axis**



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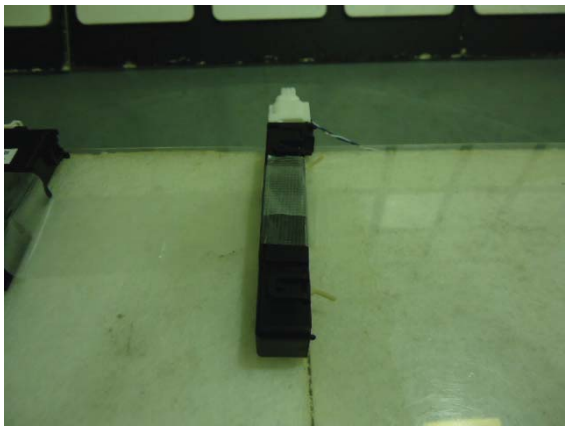
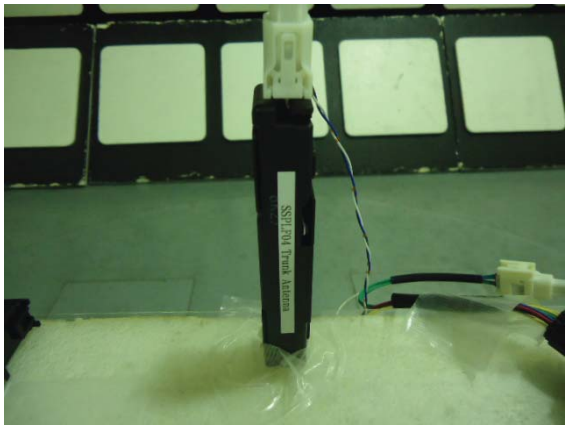
# Worst Case Position

**Trunk Antenna**
**Below 30MHz:X-axis**
**Above 30MHz(Hori:X-axis /Vert:X-axis)**

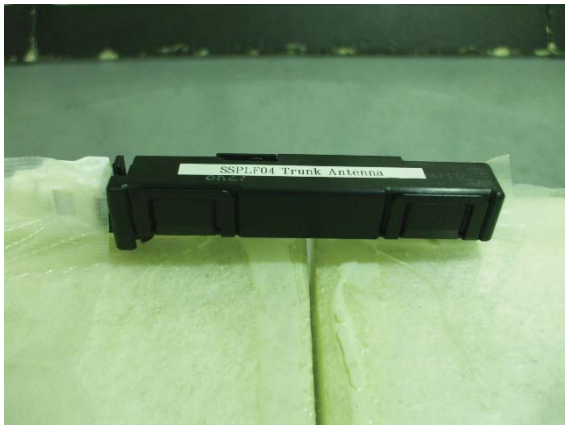
**X-axis**



**Y-axis**

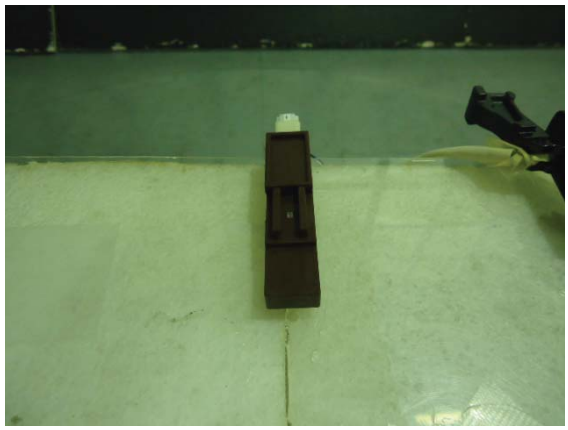



**Z-axis**

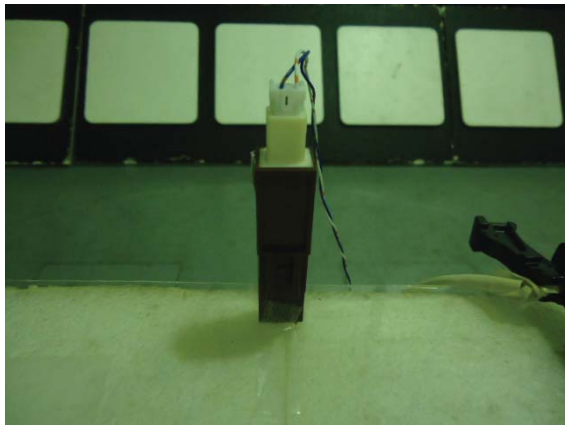



**Room Antenna / Luggage Antenna**
**Below 30MHz:-Zaxis**
**Above 30MHz(Hori:X-axis /Vert:X-axis)**

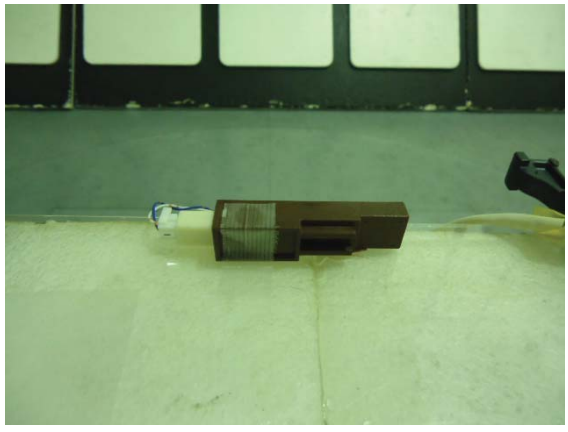
**X-axis**



**Y-axis**



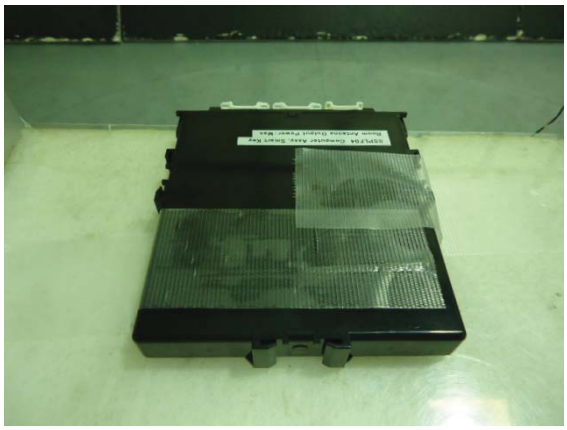
**Z-axis**



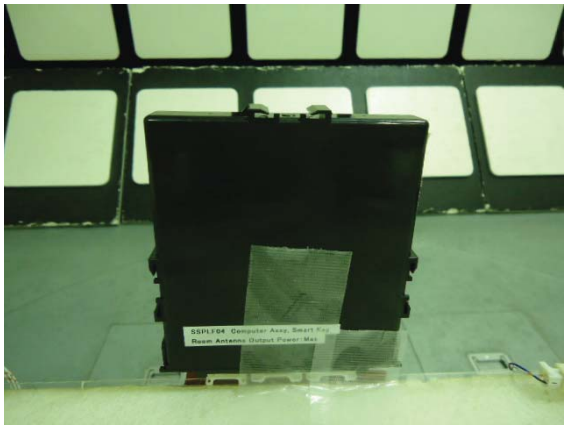
# Worst Case Position

## ECU
## Below 30MHz:X-axis
## Above 30MHz(Hori:X-axis /Vert:X-axis)

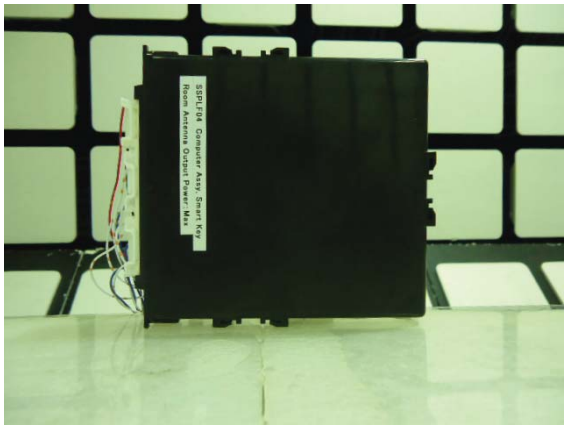
### X-axis



### Y-axis



### Z-axis



# APPENDIX 2: Data of EMI test

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

### Door Antenna

DATA OF RADIATED EMISSION TEST

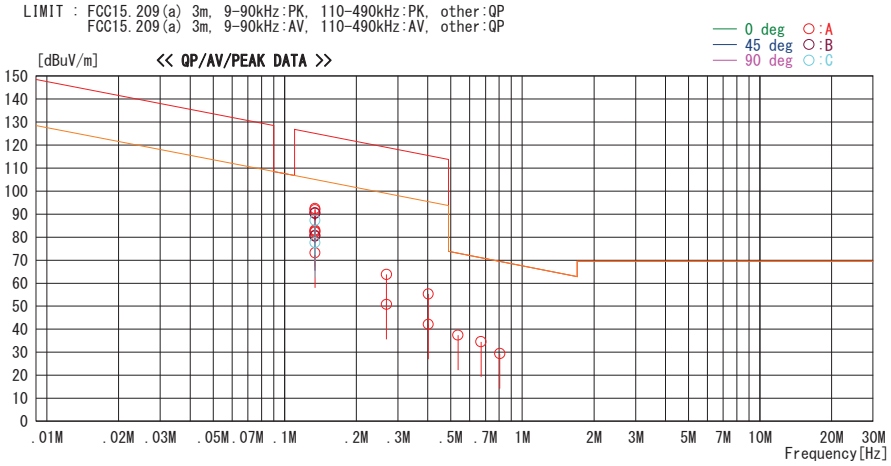
UL Japan, Inc. Head Office EMC Lab. No.2Semi Anechoic Chamber
Date : 2011/07/26

Report No. : 31LE0019-HO-01

Temp. / Humi. : 24deg. C / 62% RH
Engineer : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz Modulation ON, Door Antenna, Worst-Axis(ECU:X , Antenna:X)

LIMIT : FCC15.209(a) 3m, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15.209(a) 3m, 9-90kHz:AV, 110-490kHz:AV, other:QP




| Freq. [MHz] | Reading [dBuV] | DET | Ant.Fac [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Antenna [deg] | | Table [deg] | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.13420 | 98.6 | PEAK | 19.9 | 6.1 | 32.2 | 92.4 | 125.1 | 32.7 | 0 | A | 359 | Worst |
| 0.13420 | 96.5 | PEAK | 19.9 | 6.1 | 32.2 | 90.3 | 125.1 | 34.8 | 45 | B | 94 | |
| 0.13420 | 93.5 | PEAK | 19.9 | 6.1 | 32.2 | 87.3 | 125.1 | 37.8 | 90 | C | 260 | |
| 0.13420 | 96.8 | PEAK | 19.9 | 6.1 | 32.2 | 90.6 | 125.1 | 34.5 | 135 | A | 34 | |
| 0.13420 | 89.2 | PEAK | 19.9 | 6.1 | 32.2 | 83.0 | 125.1 | 42.1 | 0 | A | 173 | Hori |
| 0.13420 | 83.8 | AV | 19.9 | 6.1 | 32.2 | 77.6 | 105.1 | 27.5 | 90 | C | 260 | |
| 0.13420 | 87.0 | AV | 19.9 | 6.1 | 32.2 | 80.8 | 105.1 | 24.3 | 135 | A | 34 | |
| 0.13420 | 86.7 | AV | 19.9 | 6.1 | 32.2 | 80.5 | 105.1 | 24.6 | 45 | B | 94 | |
| 0.13420 | 98.0 | PEAK | 19.9 | 6.1 | 32.2 | 91.8 | 125.1 | 33.3 | 180 | A | 334 | |
| 0.13420 | 88.8 | AV | 19.9 | 6.1 | 32.2 | 82.6 | 105.1 | 22.5 | 0 | A | 359 | Worst |
| 0.13420 | 88.3 | AV | 19.9 | 6.1 | 32.2 | 82.1 | 105.1 | 23.0 | 180 | A | 334 | |
| 0.13420 | 79.4 | AV | 19.9 | 6.1 | 32.2 | 73.2 | 105.1 | 31.9 | 0 | A | 173 | Hori |
| 0.26840 | 57.3 | AV | 19.6 | 6.1 | 32.2 | 50.8 | 99.0 | 48.2 | 0 | A | 359 | |
| 0.26840 | 70.3 | PEAK | 19.6 | 6.1 | 32.2 | 63.8 | 119.0 | 55.2 | 0 | A | 359 | |
| 0.40260 | 48.9 | AV | 19.5 | 6.1 | 32.3 | 42.2 | 95.5 | 53.3 | 0 | A | 359 | |
| 0.40260 | 62.0 | PEAK | 19.5 | 6.1 | 32.3 | 55.3 | 115.5 | 60.2 | 0 | A | 359 | |
| 0.53680 | 44.2 | QP | 19.5 | 6.1 | 32.3 | 37.5 | 73.0 | 35.5 | 0 | A | 189 | |
| 0.67100 | 41.2 | QP | 19.4 | 6.2 | 32.2 | 34.6 | 71.1 | 36.5 | 0 | A | 53 | |
| 0.80520 | 36.0 | QP | 19.4 | 6.2 | 32.2 | 29.4 | 69.5 | 40.1 | 0 | A | 64 | |

CHART: WITH FACTOR , ANT TYPE: LOOP Except for the data below : adequate margin data below the limits.
CALCULATION : RESULT = READING + ANT FACTOR + LOSS( CABLE + ATTEN.) - GAIN(AMP.)

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

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

## Trunk Antenna

## DATA OF RADIATED EMISSION TEST

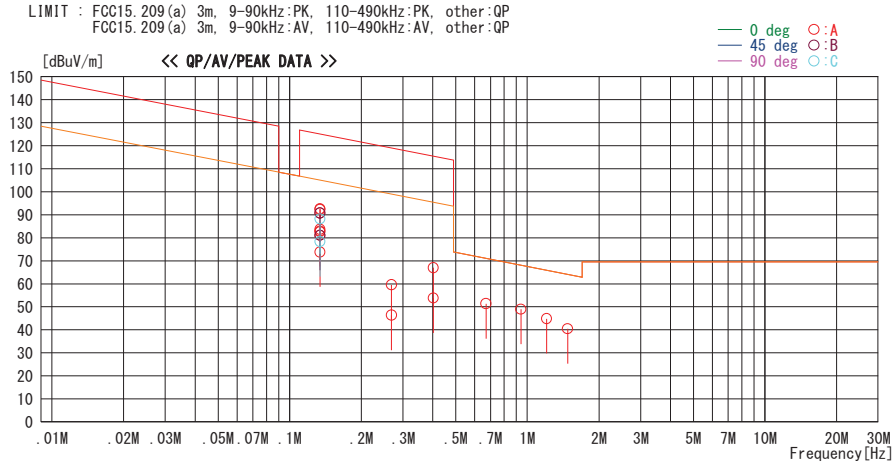
UL Japan, Inc. Head Office EMC Lab. No.2Semi Anechoic Chamber
Date : 2011/07/26

Report No. : 31LE0019-HO-01

Temp./ Humi. : 24deg. C / 62% RH
Engineer : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz Modulation ON, Trunk Antenna, Worst-Axis(ECU:X , Antenna:X)

LIMIT : FCC15.209(a) 3m, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15.209(a) 3m, 9-90kHz:AV, 110-490kHz:AV, other:QP




| Freq. [MHz] | Reading [dBuV] | DET | Ant.Fac [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Antenna [deg] | | Table [deg] | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.13420 | 98.8 | PEAK | 19.9 | 6.1 | 32.2 | 92.6 | 125.1 | 32.5 | 0 | A | 359 | Worst |
| 0.13420 | 97.0 | PEAK | 19.9 | 6.1 | 32.2 | 90.8 | 125.1 | 34.3 | 45 | B | 153 | |
| 0.13420 | 94.4 | PEAK | 19.9 | 6.1 | 32.2 | 88.2 | 125.1 | 36.9 | 90 | C | 84 | |
| 0.13420 | 97.0 | PEAK | 19.9 | 6.1 | 32.2 | 90.8 | 125.1 | 34.3 | 135 | A | 204 | |
| 0.13420 | 98.5 | PEAK | 19.9 | 6.1 | 32.2 | 92.3 | 125.1 | 32.8 | 180 | A | 4 | |
| 0.13420 | 89.8 | PEAK | 19.9 | 6.1 | 32.2 | 83.6 | 125.1 | 41.5 | 0 | A | 359 | Hori |
| 0.13420 | 84.6 | AV | 19.9 | 6.1 | 32.2 | 78.4 | 105.1 | 26.7 | 90 | C | 84 | |
| 0.13420 | 87.3 | AV | 19.9 | 6.1 | 32.2 | 81.1 | 105.1 | 24.0 | 135 | A | 204 | |
| 0.13420 | 88.8 | AV | 19.9 | 6.1 | 32.2 | 82.6 | 105.1 | 22.5 | 180 | A | 4 | |
| 0.13420 | 87.3 | AV | 19.9 | 6.1 | 32.2 | 81.1 | 105.1 | 24.0 | 45 | B | 153 | |
| 0.13420 | 89.1 | AV | 19.9 | 6.1 | 32.2 | 82.9 | 105.1 | 22.2 | 0 | A | 359 | Worst |
| 0.13420 | 80.0 | AV | 19.9 | 6.1 | 32.2 | 73.8 | 105.1 | 31.3 | 0 | A | 359 | Hori |
| 0.26840 | 52.9 | AV | 19.6 | 6.1 | 32.2 | 46.4 | 99.0 | 52.6 | 0 | A | 359 | |
| 0.26840 | 66.0 | PEAK | 19.6 | 6.1 | 32.2 | 59.5 | 119.0 | 59.5 | 0 | A | 359 | |
| 0.40260 | 60.5 | AV | 19.5 | 6.1 | 32.3 | 53.8 | 95.5 | 41.7 | 0 | A | 359 | |
| 0.40260 | 73.7 | PEAK | 19.5 | 6.1 | 32.3 | 67.0 | 115.5 | 48.5 | 0 | A | 359 | |
| 0.67100 | 58.0 | QP | 19.4 | 6.2 | 32.2 | 51.4 | 71.1 | 19.7 | 0 | A | 359 | |
| 0.93940 | 55.5 | QP | 19.4 | 6.2 | 32.2 | 48.9 | 68.1 | 19.2 | 0 | A | 359 | |
| 1.20780 | 51.4 | QP | 19.4 | 6.2 | 32.2 | 44.8 | 65.9 | 21.1 | 0 | A | 359 | |
| 1.47620 | 46.9 | QP | 19.4 | 6.3 | 32.2 | 40.4 | 64.2 | 23.8 | 0 | A | 359 | |

CHART: WITH FACTOR , ANT TYPE: LOOP Except for the data below : adequate margin data below the limits.
CALCULATION : RESULT = READING + ANT FACTOR + LOSS( CABLE + ATTEN.) - GAIN(AMP.)

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

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

## Room Antenna / Luggage Antenna Maximum Output

## DATA OF RADIATED EMISSION TEST

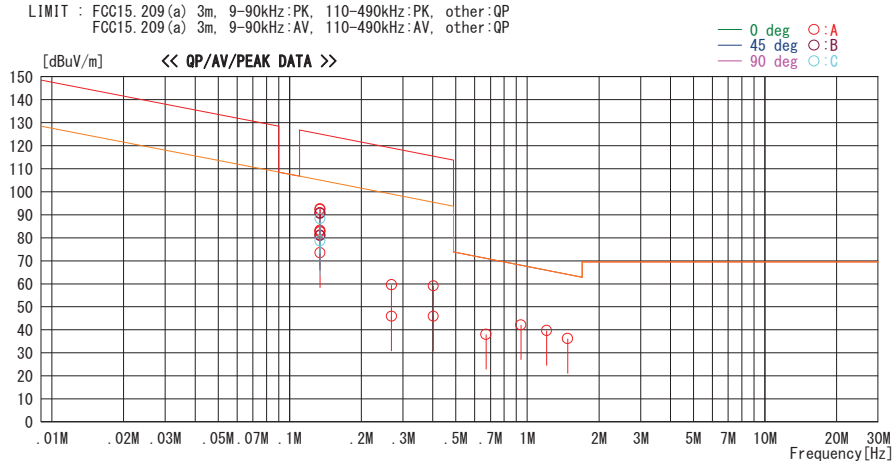
UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2011/07/26

Report No. : 31LE0019-HO-01

Temp. / Humi. : 24deg. C / 62% RH
Engineer : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz Modulation ON, Room Antenna / Luggage Antenna, Worst-Axis(ECU:Z , Antenna:X)

LIMIT : FCC15.209(a) 3m, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15.209(a) 3m, 9-90kHz:AV, 110-490kHz:AV, other:QP




| Freq. [MHz] | Reading [dBuV] | DET | Ant.Fac [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Antenna [deg] | | Table [deg] | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.13420 | 98.8 | PEAK | 19.9 | 6.1 | 32.2 | 92.6 | 125.1 | 32.5 | 0 | A | 96 | Worst |
| 0.13420 | 96.9 | PEAK | 19.9 | 6.1 | 32.2 | 90.7 | 125.1 | 34.4 | 45 | B | 227 | |
| 0.13420 | 94.6 | PEAK | 19.9 | 6.1 | 32.2 | 88.4 | 125.1 | 36.7 | 90 | C | 181 | |
| 0.13420 | 97.2 | PEAK | 19.9 | 6.1 | 32.2 | 91.0 | 125.1 | 34.1 | 135 | A | 125 | |
| 0.13420 | 98.5 | PEAK | 19.9 | 6.1 | 32.2 | 92.3 | 125.1 | 32.8 | 180 | A | 100 | |
| 0.13420 | 84.9 | AV | 19.9 | 6.1 | 32.2 | 78.7 | 105.1 | 26.4 | 90 | C | 181 | |
| 0.13420 | 89.4 | PEAK | 19.9 | 6.1 | 32.2 | 83.2 | 125.1 | 41.9 | 0 | A | 97 | Hori |
| 0.13420 | 87.4 | AV | 19.9 | 6.1 | 32.2 | 81.2 | 105.1 | 23.9 | 135 | A | 125 | |
| 0.13420 | 88.8 | AV | 19.9 | 6.1 | 32.2 | 82.6 | 105.1 | 22.5 | 180 | A | 100 | |
| 0.13420 | 87.1 | AV | 19.9 | 6.1 | 32.2 | 80.9 | 105.1 | 24.2 | 45 | B | 227 | |
| 0.13420 | 89.1 | AV | 19.9 | 6.1 | 32.2 | 82.9 | 105.1 | 22.2 | 0 | A | 96 | Worst |
| 0.13420 | 79.7 | AV | 19.9 | 6.1 | 32.2 | 73.5 | 105.1 | 31.6 | 0 | A | 97 | Hori |
| 0.26840 | 52.5 | AV | 19.6 | 6.1 | 32.2 | 46.0 | 99.0 | 53.0 | 0 | A | 94 | |
| 0.26840 | 66.0 | PEAK | 19.6 | 6.1 | 32.2 | 59.5 | 119.0 | 59.5 | 0 | A | 94 | |
| 0.40260 | 52.6 | AV | 19.5 | 6.1 | 32.3 | 45.9 | 95.5 | 49.6 | 0 | A | 89 | |
| 0.40260 | 65.8 | PEAK | 19.5 | 6.1 | 32.3 | 59.1 | 115.5 | 56.4 | 0 | A | 89 | |
| 0.67100 | 44.7 | QP | 19.4 | 6.2 | 32.2 | 38.1 | 71.1 | 33.0 | 0 | A | 93 | |
| 0.93940 | 48.7 | QP | 19.4 | 6.2 | 32.2 | 42.1 | 68.1 | 26.0 | 0 | A | 90 | |
| 1.20780 | 46.3 | QP | 19.4 | 6.2 | 32.2 | 39.7 | 65.9 | 26.2 | 0 | A | 88 | |
| 1.47620 | 42.8 | QP | 19.4 | 6.3 | 32.2 | 36.3 | 64.2 | 27.9 | 0 | A | 94 | |

CHART: WITH FACTOR , ANT TYPE: LOOP Except for the data below : adequate margin data below the limits.
CALCULATION : RESULT = READING + ANT FACTOR + LOSS( CABLE + ATTEN.) - GAIN(AMP.)

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

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

## Room Antenna / Luggage Antenna Minimum Output

### DATA OF RADIATED EMISSION TEST

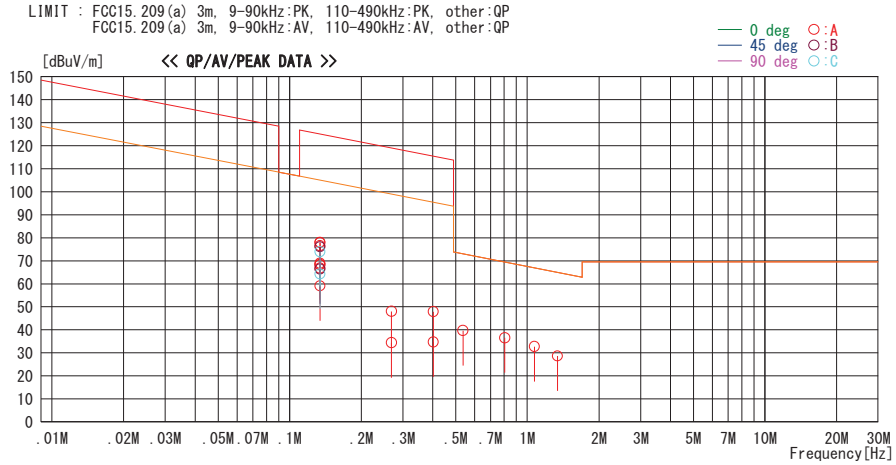
UL Japan, Inc. Head Office EMC Lab. No.2Semi Anechoic Chamber
Date : 2011/07/26

Report No. : 31LE0019-HO-01

Temp. / Humi. : 24deg. C / 62% RH
Engineer : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz Modulation ON, Room Antenna / Luggage Antenna, Worst-Axis(ECU:Z , Antenna:X)

LIMIT : FCC15.209(a) 3m, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15.209(a) 3m, 9-90kHz:AV, 110-490kHz:AV, other:QP




| Freq. [MHz] | Reading [dBuV] | DET | Ant.Fac [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Antenna [deg] | | Table [deg] | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.13420 | 84.3 | PEAK | 19.9 | 6.1 | 32.2 | 78.1 | 125.1 | 47.0 | 0 | A | 97 | Worst |
| 0.13420 | 82.3 | PEAK | 19.9 | 6.1 | 32.2 | 76.1 | 125.1 | 49.0 | 45 | B | 230 | |
| 0.13420 | 80.2 | PEAK | 19.9 | 6.1 | 32.2 | 74.0 | 125.1 | 51.1 | 90 | C | 179 | |
| 0.13420 | 70.5 | AV | 19.9 | 6.1 | 32.2 | 64.3 | 105.1 | 40.8 | 90 | C | 179 | |
| 0.13420 | 82.8 | PEAK | 19.9 | 6.1 | 32.2 | 76.6 | 125.1 | 48.5 | 135 | A | 122 | |
| 0.13420 | 84.1 | PEAK | 19.9 | 6.1 | 32.2 | 77.9 | 125.1 | 47.2 | 180 | A | 95 | |
| 0.13420 | 75.1 | PEAK | 19.9 | 6.1 | 32.2 | 68.9 | 125.1 | 56.2 | 0 | A | 95 | Hori |
| 0.13420 | 73.0 | AV | 19.9 | 6.1 | 32.2 | 66.8 | 105.1 | 38.3 | 135 | A | 122 | |
| 0.13420 | 74.4 | AV | 19.9 | 6.1 | 32.2 | 68.2 | 105.1 | 36.9 | 180 | A | 95 | |
| 0.13420 | 72.6 | AV | 19.9 | 6.1 | 32.2 | 66.4 | 105.1 | 38.7 | 45 | B | 230 | |
| 0.13420 | 74.6 | AV | 19.9 | 6.1 | 32.2 | 68.4 | 105.1 | 36.7 | 0 | A | 97 | Worst |
| 0.13420 | 65.3 | AV | 19.9 | 6.1 | 32.2 | 59.1 | 105.1 | 46.0 | 0 | A | 95 | Hori |
| 0.26840 | 40.9 | AV | 19.6 | 6.1 | 32.2 | 34.4 | 99.0 | 64.6 | 0 | A | 93 | |
| 0.26840 | 54.5 | PEAK | 19.6 | 6.1 | 32.2 | 48.0 | 119.0 | 71.0 | 0 | A | 93 | |
| 0.40260 | 41.4 | AV | 19.5 | 6.1 | 32.3 | 34.7 | 95.5 | 60.8 | 0 | A | 96 | |
| 0.40260 | 54.6 | PEAK | 19.5 | 6.1 | 32.3 | 47.9 | 115.5 | 67.6 | 0 | A | 96 | |
| 0.53680 | 46.4 | QP | 19.5 | 6.1 | 32.3 | 39.7 | 73.0 | 33.3 | 0 | A | 94 | |
| 0.80520 | 43.1 | QP | 19.4 | 6.2 | 32.2 | 36.5 | 69.5 | 33.0 | 0 | A | 94 | |
| 1.07360 | 39.3 | QP | 19.4 | 6.2 | 32.2 | 32.7 | 66.9 | 34.2 | 0 | A | 91 | |
| 1.34200 | 35.1 | QP | 19.4 | 6.3 | 32.2 | 28.6 | 65.0 | 36.4 | 0 | A | 92 | |

CHART: WITH FACTOR , ANT TYPE: LOOP Except for the data below : adequate margin data below the limits.
CALCULATION : RESULT = READING + ANT FACTOR + LOSS( CABLE + ATTEN.) - GAIN(AMP.)

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

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# Radiated Emission above 30MHz (Spurious Emission)

## Door Antenna

## DATA OF RADIATED EMISSION TEST

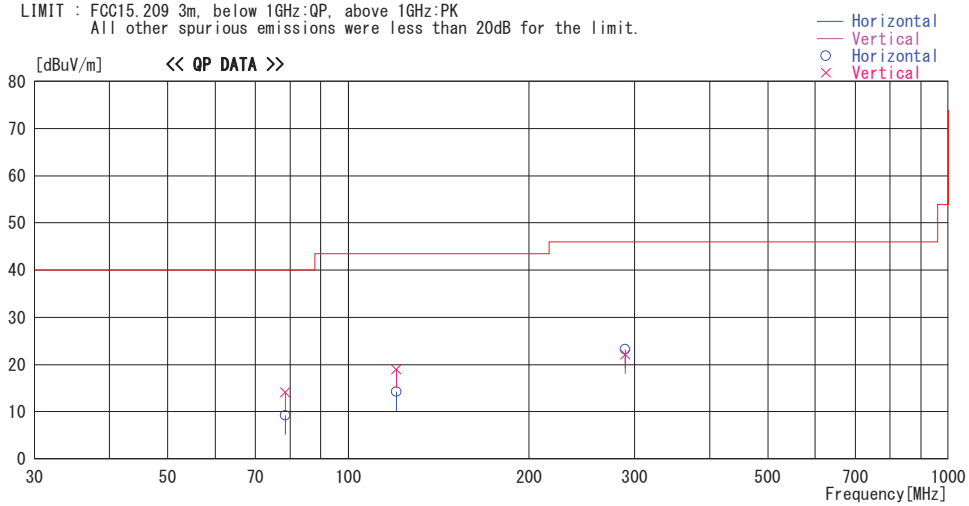
UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2011/07/26

Report No. : 31LE0019-HO-01

Temp./Humi. : 24 deg. C / 62% RH
Engineer : Motoya Imura

Mode / Remarks : Tx 134.2kHz Modulation ON, Door Antenna, Worst-Axis(ECU:X , Hor/Ver:Antenna:X)

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




| Frequency | Reading | DET | Antenna Factor | Loss& Gain | Level | Angle | Height | Polar. | Limit | Margin | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| [MHz] | [dBuV] | | [dB/m] | [dB] | [dBuV/m] | [Deg] | [cm] | | [dBuV/m] | [dB] | |
| 78.508 | 27.6 | QP | 6.4 | -24.8 | 9.2 | 131 | 233 | Hori. | 40.0 | 30.8 | |
| 78.508 | 32.5 | QP | 6.4 | -24.8 | 14.1 | 309 | 100 | Vert. | 40.0 | 25.9 | |
| 120.238 | 25.5 | QP | 13.2 | -24.5 | 14.2 | 144 | 282 | Hori. | 43.5 | 29.3 | |
| 120.245 | 30.3 | QP | 13.2 | -24.5 | 19.0 | 240 | 122 | Vert. | 43.5 | 24.5 | |
| 289.472 | 27.3 | QP | 19.2 | -23.3 | 23.2 | 205 | 298 | Hori. | 46.0 | 22.8 | |
| 289.472 | 26.2 | QP | 19.2 | -23.3 | 22.1 | 3 | 100 | Vert. | 46.0 | 23.9 | |

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION:RESULT = READING + ANT FACTOR + LOSS(CABLE+ATTEN.) - GAIN(AMP)

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

# Radiated Emission above 30MHz (Spurious Emission)

## Trunk Antenna

## DATA OF RADIATED EMISSION TEST

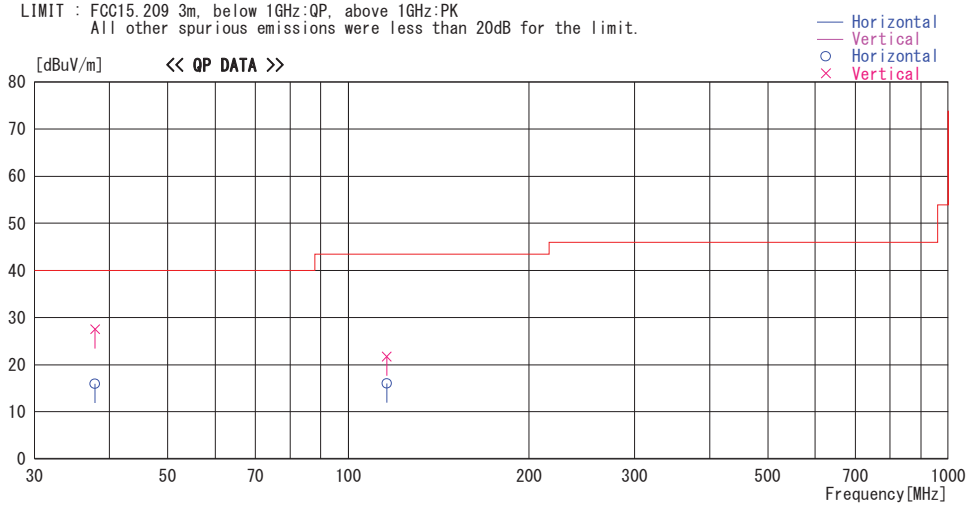
UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2011/07/26

Report No. : 31LE0019-HO-01

Temp./Humi. : 24 deg. C / 62% RH
Engineer : Motoya Imura

Mode / Remarks : Tx 134.2kHz Modulation ON, Trunk Antenna , Worst-Axis(ECU:X , Hor/Ver:Antenna:X)

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




| Frequency [MHz] | Reading [dBuV] | DET | Antenna Factor [dB/m] | Loss& Gain [dB] | Level [dBuV/m] | Angle [Deg] | Height [cm] | Polar. | Limit [dBuV/m] | Margin [dB] | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 37.851 | 25.2 | QP | 16.1 | -25.4 | 15.9 | 351 | 298 | Hori. | 40.0 | 24.1 | |
| 37.851 | 36.8 | QP | 16.1 | -25.4 | 27.5 | 251 | 100 | Vert. | 40.0 | 12.5 | |
| 115.952 | 27.9 | QP | 12.6 | -24.5 | 16.0 | 212 | 337 | Hori. | 43.5 | 27.5 | |
| 115.952 | 33.6 | QP | 12.6 | -24.5 | 21.7 | 86 | 100 | Vert. | 43.5 | 21.8 | |

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION:RESULT = READING + ANT FACTOR + LOSS(CABLE+ATTEN.) - GAIN(AMP)

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

# Radiated Emission above 30MHz (Spurious Emission)

## Room Antenna / Luggage Antenna Maximum Output

## DATA OF RADIATED EMISSION TEST

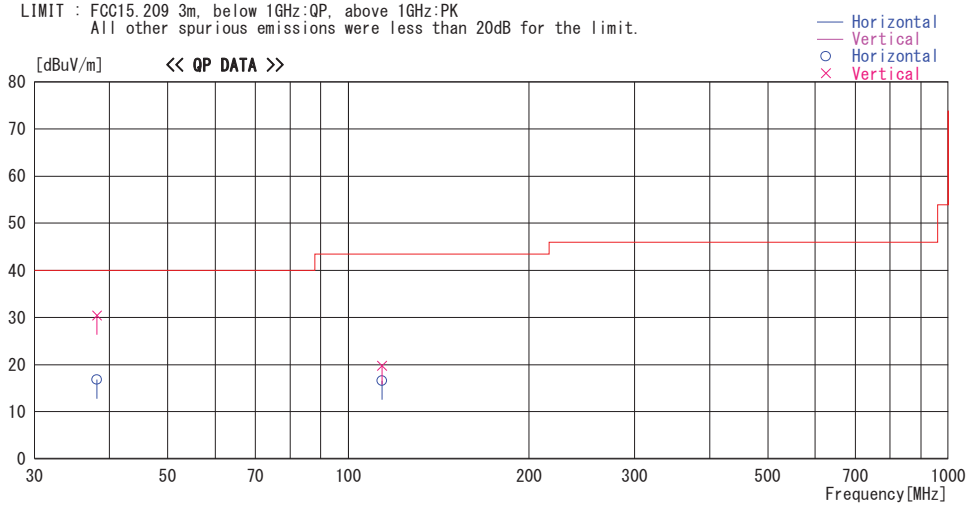
UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2011/07/26

Report No. : 31LE0019-HO-01

Temp./Humi. : 24 deg. C / 62% RH
Engineer : Motoya Imura

Mode / Remarks : Tx 134.2kHz Modulation ON, Room Antenna / Luggage Antenna, Worst-Axis(ECU:X , Hor/Ver:Antenna:X)

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




| Frequency [MHz] | Reading [dBuV] | DET | Antenna Factor [dB/m] | Loss& Gain [dB] | Level [dBuV/m] | Angle [Deg] | Height [cm] | Polar. | Limit [dBuV/m] | Margin [dB] | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 38.114 | 26.2 | QP | 16.0 | -25.4 | 16.8 | 354 | 287 | Hori. | 40.0 | 23.2 | |
| 38.116 | 39.8 | QP | 16.0 | -25.4 | 30.4 | 230 | 100 | Vert. | 40.0 | 9.6 | |
| 113.802 | 28.8 | QP | 12.3 | -24.5 | 16.6 | 195 | 313 | Hori. | 43.5 | 26.9 | |
| 113.804 | 32.0 | QP | 12.3 | -24.5 | 19.8 | 82 | 100 | Vert. | 43.5 | 23.7 | |

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION:RESULT = READING + ANT FACTOR + LOSS(CABLE+ATTEN.) - GAIN(AMP)

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

# Radiated Emission above 30MHz (Spurious Emission)

## Room Antenna / Luggage Antenna Minimum Output

## DATA OF RADIATED EMISSION TEST

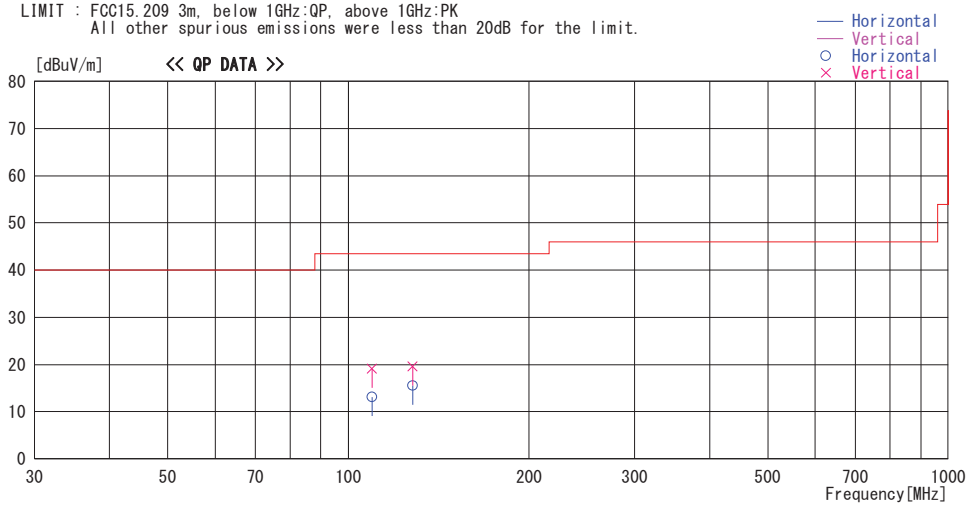
UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2011/07/26

Report No. : 31LE0019-HO-01

Temp./Humi. : 24 deg. C / 62% RH
Engineer : Motoya Imura

Mode / Remarks : Tx 134.2kHz Modulation ON, Room Antenna / Luggage Antenna, Worst-Axis(ECU:X,Hor/Ver:Antenna:X) Mini

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




| Frequency | Reading | DET | Antenna Factor | Loss& Gain | Level | Angle | Height | Polar. | Limit | Margin | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| [MHz] | [dBuV] | | [dB/m] | [dB] | [dBuV/m] | [Deg] | [cm] | | [dBuV/m] | [dB] | |
| 109.508 | 26.0 | QP | 11.7 | -24.6 | 13.1 | 314 | 302 | Hori. | 43.5 | 30.4 | |
| 109.508 | 32.0 | QP | 11.7 | -24.6 | 19.1 | 194 | 100 | Vert. | 43.5 | 24.4 | |
| 128.042 | 26.1 | QP | 13.8 | -24.4 | 15.5 | 123 | 332 | Hori. | 43.5 | 28.0 | |
| 128.044 | 30.2 | QP | 13.8 | -24.4 | 19.6 | 170 | 100 | Vert. | 43.5 | 23.9 | |

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION:RESULT = READING + ANT FACTOR + LOSS(CABLE+ATTEN.) - GAIN(AMP)

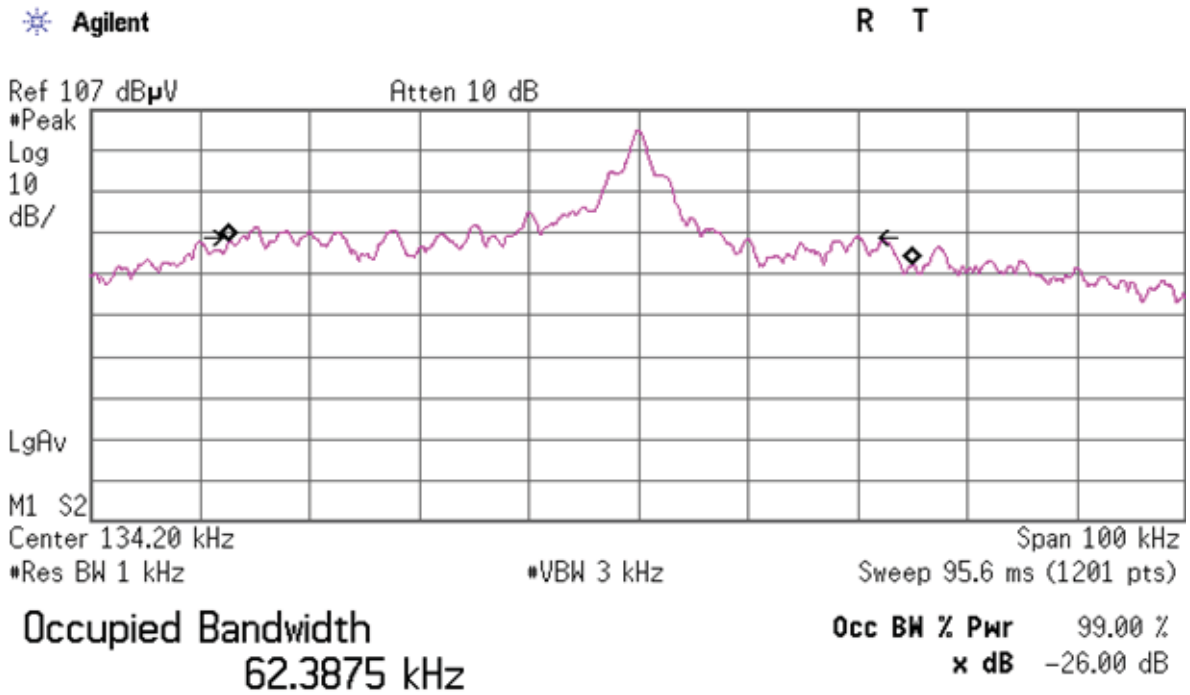
*The limit is rounded down to one decimal place.
*The test result is rounded off to one or two decimal places, so some differences might be observed.

# -26dB Bandwidth and 99% Occupied Bandwidth

## Door Antenna

| | |
|---|---|
| Report No. | 31LE0019-HO-01 |
| Test place | Head Office EMC Lab. |
| Semi Anechoic Chamber | No.2 |
| Date | 07/26/2011 |
| Temperature / Humidity | 24 deg. C / 62 % RH |
| Engineer | Keisuke Kawamura |
| Mode | Tx 134.2KHz Door Antenna |

| FREQ [kHz] | -26dB Bandwidth [kHz] | 99% Occupied Bandwidth [kHz] |
|---|---|---|
| 134.2 | 56.615 | 62.388 |

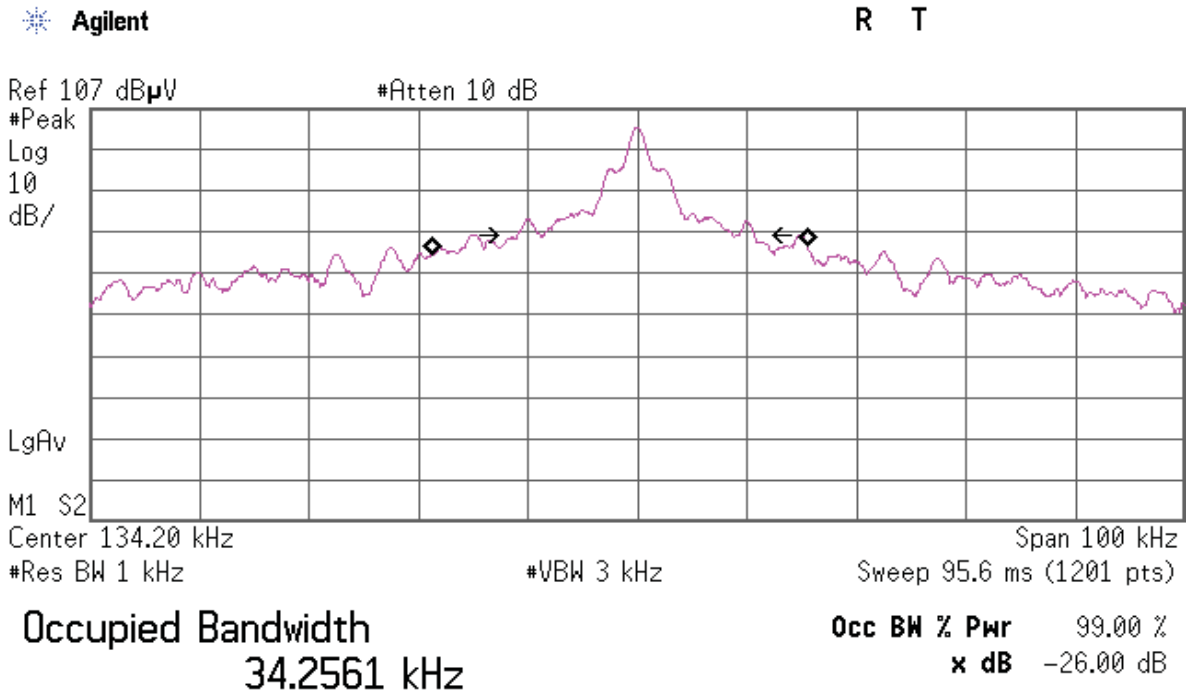


# -26dB Bandwidth and 99% Occupied Bandwidth

## Trunk Antenna

| | |
|---|---|
| Report No. | 31LE0019-HO-01 |
| Test place | Head Office EMC Lab. |
| Semi Anechoic Chamber | No.2 |
| Date | 07/26/2011 |
| Temperature / Humidity | 24 deg. C / 62 % RH |
| Engineer | Keisuke Kawamura |
| Mode | Tx 134.2KHz Trunk Antenna |

| FREQ [kHz] | -26dB Bandwidth [kHz] | 99% Occupied Bandwidth [kHz] |
|---|---|---|
| 134.2 | 21.722 | 34.256 |

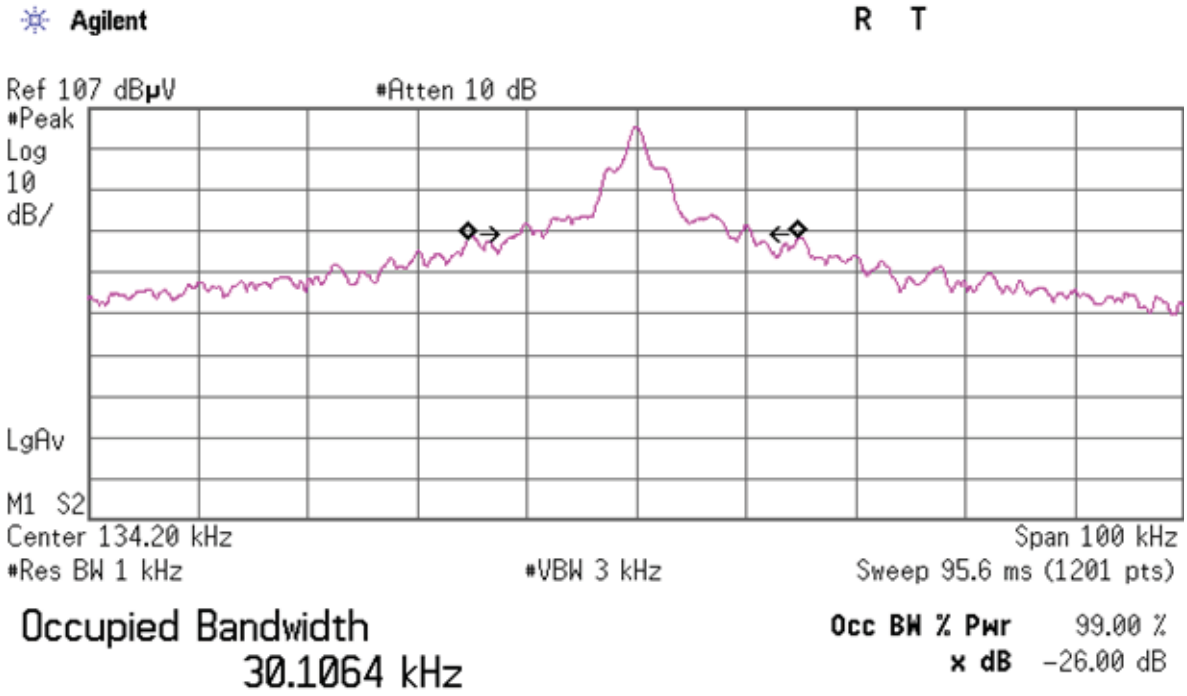


# -26dB Bandwidth and 99% Occupied Bandwidth

## Room Antenna / Luggage Antenna

| | |
|---|---|
| Report No. | 31LE0019-HO-01 |
| Test place | Head Office EMC Lab. |
| Semi Anechoic Chamber | No.2 |
| Date | 07/26/2011 |
| Temperature / Humidity | 24 deg. C / 62 % RH |
| Engineer | Keisuke Kawamura |
| Mode | Tx 134.2KHz Room Antenna / Luggage Antenna |

| FREQ [kHz] | -26dB Bandwidth [kHz] | 99% Occupied Bandwidth [kHz] |
|---|---|---|
| 134.2 | 21.448 | 30.106 |



# APPENDIX 3: Test instruments

**EMI test equipment**

| Control No. | Instrument | Manufacturer | Model No | Serial No | Test Item | Calibration Date * Interval(month) |
|---|---|---|---|---|---|---|
| MAEC-02 | Semi Anechoic Chamber(NSA) | TDK | Semi Anechoic Chamber 3m | DA-06902 | RE | 2010/09/01 * 12 |
| MOS-22 | Thermo-Hygrometer | Custom | CTH-201 | 0003 | RE | 2011/02/23 * 12 |
| MJM-14 | Measure | KOMELON | KMC-36 | - | RE | - |
| COTS-MEMI | EMI measurement program | TSJ | TEPTO-DV | - | RE | - |
| MSA-03 | Spectrum Analyzer | Agilent | E4448A | MY44020357 | RE | 2010/11/30 * 12 |
| MTR-07 | Test Receiver | Rohde & Schwarz | ESCI | 100635 | RE | 2010/10/27 * 12 |
| MLPA-01 | Loop Antenna | Rohde & Schwarz | HFH2-Z2 | 100017 | RE | 2010/10/15 * 12 |
| MCC-13 | Coaxial Cable | Fujikura | 3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m) | - | RE | 2011/02/18 * 12 |
| MCC-31 | Coaxial cable | UL Japan | - | - | RE | 2010/07/20 * 12 |
| MPA-13 | Pre Amplifier | SONOMA INSTRUMENT | 310 | 260834 | RE | 2011/03/04 * 12 |
| MAT-07 | Attenuator(6dB) | Weinschel Corp | 2 | BK7970 | RE | 2010/11/05 * 12 |
| MBA-02 | Biconical Antenna | Schwarzbeck | BBA9106 | VHA91032008 | RE | 2010/10/11 * 12 |
| MLA-02 | Logperiodic Antenna | Schwarzbeck | USLP9143 | 201 | RE | 2010/10/11 * 12 |
| MCC-12 | Coaxial Cable | Fujikura/Agilent | - | - | RE | 2011/02/18 * 12 |

**The expiration date of the calibration is the end of the expired month.**
**All equipment is calibrated with traceable calibrations. Each calibration 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**