

RADIO TEST REPORT

Test Report No. : 30IE0166-HO-02-A

Applicant : Toyota Motor Corporation
Type of Equipment : Smart LF Oscillator
Model No. : TMLF10-2
FCC ID : NI4TMLF10-2
Test regulation : FCC Part 15 Subpart C 2010
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:

April 27 and 28, 2010

Tested by:



Keisuke Kawamura
Engineer of EMC Service

Approved by:



Mitsuru Fujimura
Manager of EMC 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.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

MF060b (10.05.10)

| CONTENTS | PAGE |
|--|-------------|
| SECTION 1: Customer information | 3 |
| SECTION 2: Equipment under test (E.U.T.)..... | 3 |
| SECTION 3: Test specification, procedures & results | 4 |
| SECTION 4: Operation of E.U.T. during testing..... | 8 |
| SECTION 5: Radiated emission (Fundamental and Spurious Emission)..... | 9 |
| SECTION 6: -26dB Bandwidth..... | 11 |
| SECTION 7: 99% Occupied Bandwidth..... | 11 |
| APPENDIX 1: Photographs of test setup | 12 |
| Radiated Emission..... | 12 |
| Worst Case Position | 15 |
| APPENDIX 2: Data of EMI test..... | 17 |
| Radiated Emission below 30MHz (Fundamental and Spurious Emission) | 17 |
| Radiated Emission above 30MHz (Spurious Emission)..... | 21 |
| -26dB Bandwidth and 99% Occupied Bandwidth | 25 |
| APPENDIX 3: Test instruments | 28 |

SECTION 1: Customer information

Company Name : Toyota Motor Corporation
Address : 1, Toyota-Cho, Toyota, Aichi, 471-8572 Japan
Telephone Number : +81-565-94-1007
Facsimile Number : +81-565-94-1192
Contact Person : Tetsuya Matsuo

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

2.1 Identification of E.U.T.

Type of Equipment : Smart LF Oscillator
Model No. : TMLF10-2
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC12.0V(Max 0.5A)
Receipt Date of Sample : April 26, 2010
Country of Mass-production : Japan
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No Modification by the test lab

2.2 Product Description

Smart LF Oscillator, model: TMLF10-2 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 Generation : Crystal
Antenna type : Coil Antenna
Duty Cycle : up to 100 %

Smart LF Oscillator(model:TMLF10-2) consists of the following parts:

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

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part15 Subpart C: 2010, final revised on January 22, 2010 and effective March 1, 2010

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

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.

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

3.2 Procedures and results

| No. | Item | Test Procedure | Specification | Remarks | Deviation | Worst margin | Results |
|-----|---|--|---|----------|-----------|--|----------|
| 1 | Conducted Emission | <FCC> ANSI C63.4:2003 7. AC powerline conducted emission measurements <IC> RSS-Gen 7.2.2 | <FCC> Section 15.207 <IC> RSS-Gen 7.2.2 | - | N/A *1) | N/A | N/A |
| 2 | Electric Field Strength of Fundamental Emission | <FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> RSS-Gen 4.8, 4.11 | <FCC> Section 15.209 <IC> RSS-210 2.6, 2.7 | Radiated | N/A | 21.9dB 0.13420MHz, AV (Trunk Antenna) | Complied |
| 3 | Electric Field Strength of Spurious Emission | <FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> RSS-Gen 4.9, 4.11 | <FCC> Section 15.209 <IC> RSS-210 2.6, 2.7 | Radiated | N/A | 6.7dB 37.838MHz, QP, Vertical (Room Antenna / Luggage Antenna Minimum Output) | Complied |
| 4 | -26dB Bandwidth | <FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> - | <FCC> Reference data <IC> - | Radiated | N/A | N/A | N/A |

Note: UL Japan, Inc.'s EMI Work Procedures No.QPM05 and QPM15.

*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.

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

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 (10m*)(±dB) | | | Radiated emission | | | | | |
|--------------------------------------|----------------------------------|------------------|-----------------|-------------------|------------------|-----------------|----------------|-------------------|-------------------|
| | | | | (3m*)(±dB) | | | | | (1m*)(±dB) |
| | 9kHz -30MHz | 30MHz -300MHz | 300MHz -1GHz | 9kHz -30MHz | 30MHz -300MHz | 300MHz -1GHz | 1GHz -18GHz | 18GHz -26.5GHz | 26.5GHz -40GHz |
| No.1 | 2.7dB | 4.8dB | 5.0dB | 2.9dB | 4.8dB | 5.0dB | 3.9dB | 4.5dB | 4.4dB |
| No.2 | - | - | - | 3.5dB | 4.8dB | 5.1dB | 4.0dB | 4.3dB | 4.2dB |
| No.3 | - | - | - | 3.8dB | 4.6dB | 4.7dB | 4.0dB | 4.5dB | 4.4dB |
| No.4 | - | - | - | 3.5dB | 4.4dB | 4.9dB | 4.0dB | 4.6dB | 4.5dB |

*10m/3m/1m = Measurement distance

| Antenna terminal conducted emission and Power density (±dB) | | | Antenna terminal conducted emission (±dB) | | Channel power (±dB) |
|--|-----------|------------|--|---------------|------------------------|
| Below 1GHz | 1GHz-3GHz | 3GHz-18GHz | 18GHz-26.5GHz | 26.5GHz-40GHz | |
| 1.0dB | 1.1dB | 2.7dB | 3.2dB | 3.3dB | 1.5dB |

Radiated emission test(3m)

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

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

3.5 Test Location

UL Japan, Inc. Head Office EMC Lab. *NVLAP Lab. code: 200572-0
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
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.

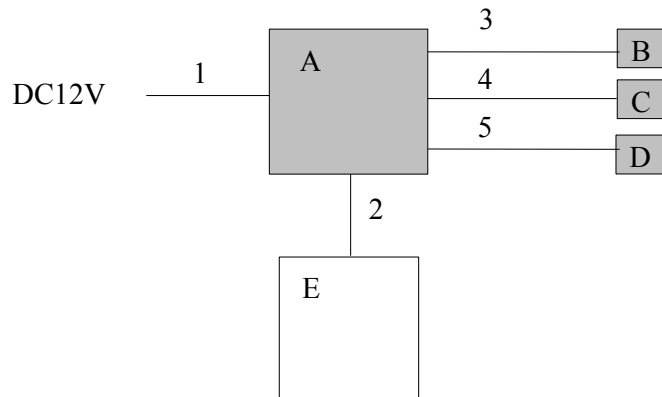
SECTION 4: Operation of E.U.T. during testing

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 | Remark |
|-----|--------------------------------|--------------|---------------|--------------|--------|
| A | Computer Assy, Smart Key (ECU) | - | 001 | - | EUT |
| B | Door Antenna | - | 001 | - | EUT |
| C | Room Antenna / Luggage Antenna | - | 001 | - | EUT |
| D | Trunk Antenna | - | 001 | - | EUT |
| E | Jig Box | - | - | - | - |

List of cables used

| No. | Name | Length (m) | Shield | | Remark |
|-----|------------------------------|------------|------------|------------|--------|
| | | | Cable | Connector | |
| 1 | DC Cable | 3.0 | Unshielded | Unshielded | - |
| 2 | ECU Cable | 2.0 | Unshielded | Unshielded | - |
| 3 | Door Ant Cable | 2.0 | Unshielded | Unshielded | - |
| 4 | Room Ant / Luggage Ant Cable | 2.0 | Unshielded | Unshielded | - |
| 5 | Trunk Ant Cable | 2.0 | Unshielded | Unshielded | - |

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

SECTION 5: Radiated emission (Fundamental and Spurious Emission)

Test Procedure

The Radiated Electric Field Strength intensity has been measured on No 2 semi anechoic chamber 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., and 135 deg.) 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: April 27 and 28, 2010

Test engineer: Keisuke Kawamura

UL Japan, Inc.

Head Office EMC Lab.

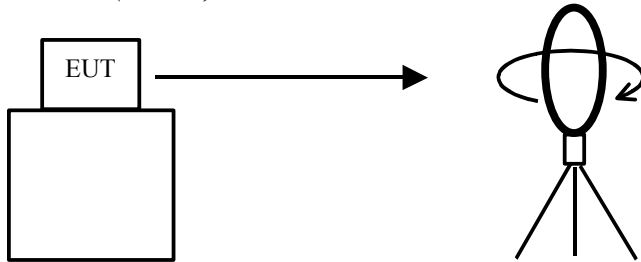
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

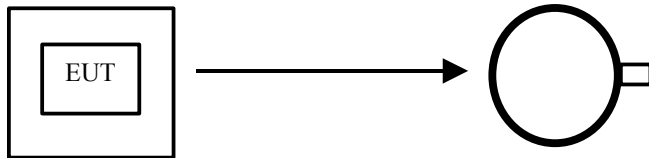
Facsimile : +81 596 24 8124

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

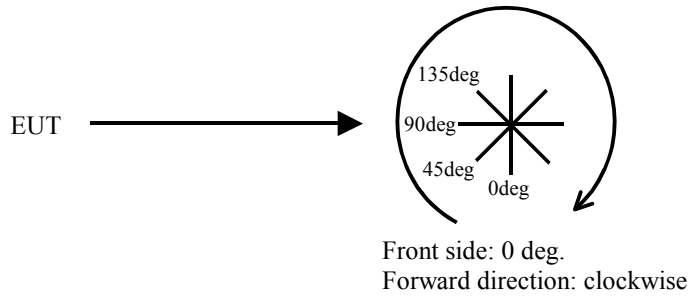


.....
Top View (Horizontal)



Antenna was not rotated.

.....
Top View (Vertical)



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

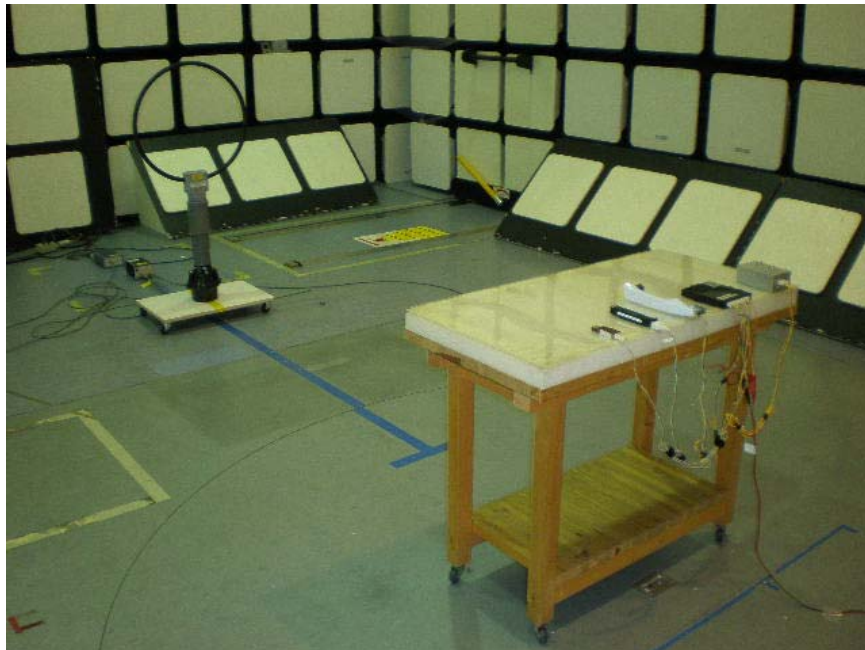


Photo 2

Radiated Emission
Trunk Antenna



Photo 1

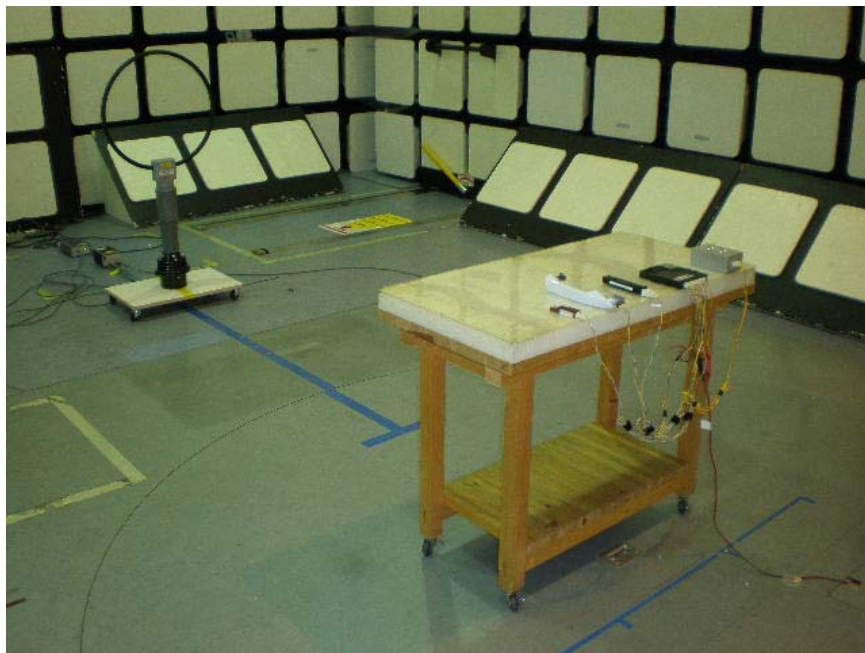


Photo 2

Radiated Emission
Room Antenna / Luggage Antenna



Photo 1

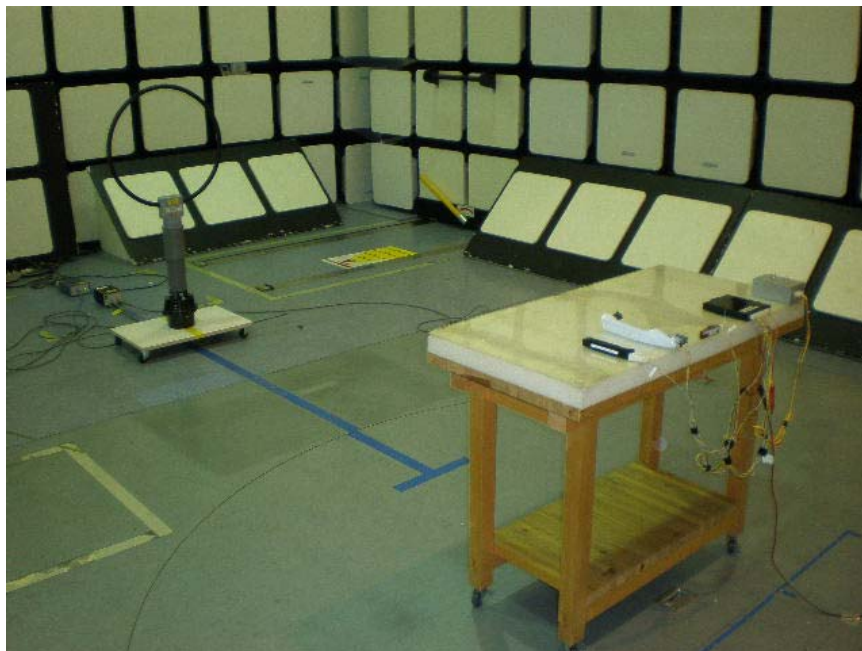


Photo 2

Worst Case Position

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



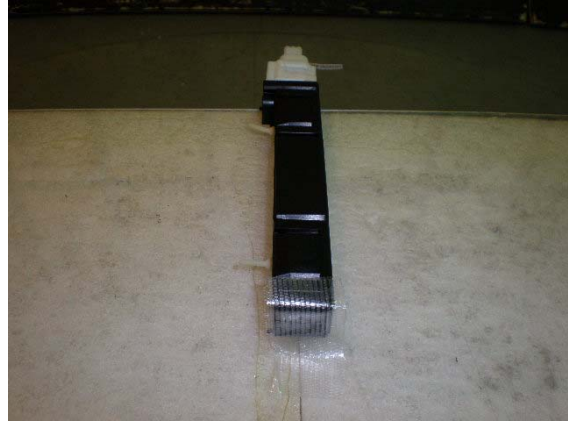
Y-axis



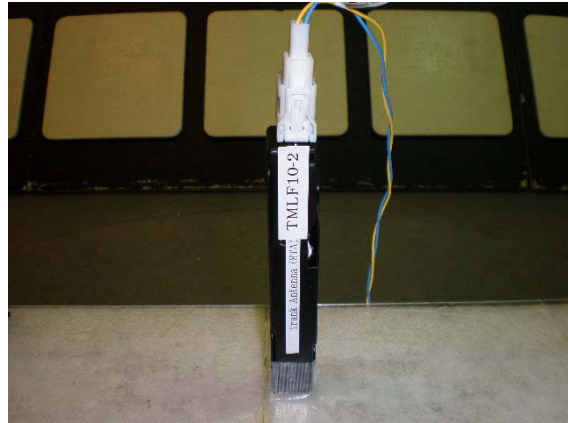
Z-axis



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



Y-axis

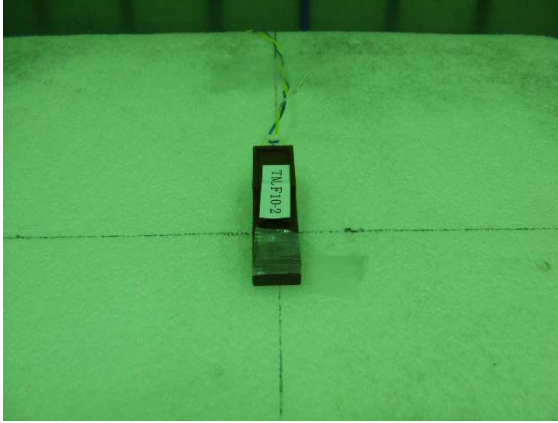


Z-axis

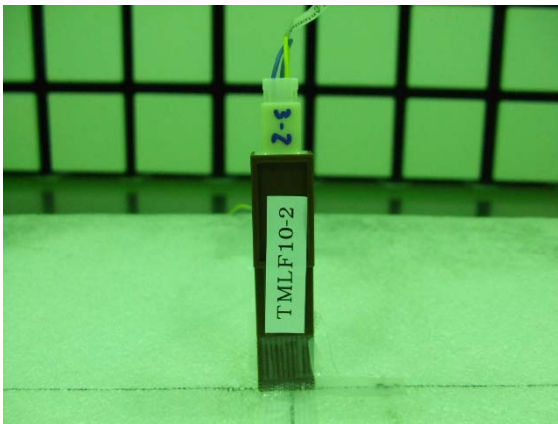


Worst Case Position

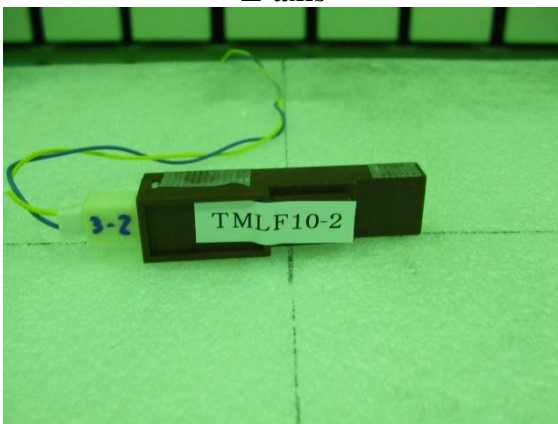
Room Antenna / Luggage Antenna
Below 30MHz:Z-axis
Above 30MHz(Hori:X-axis /Vert:X-axis)
X-axis



Y-axis



Z-axis



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

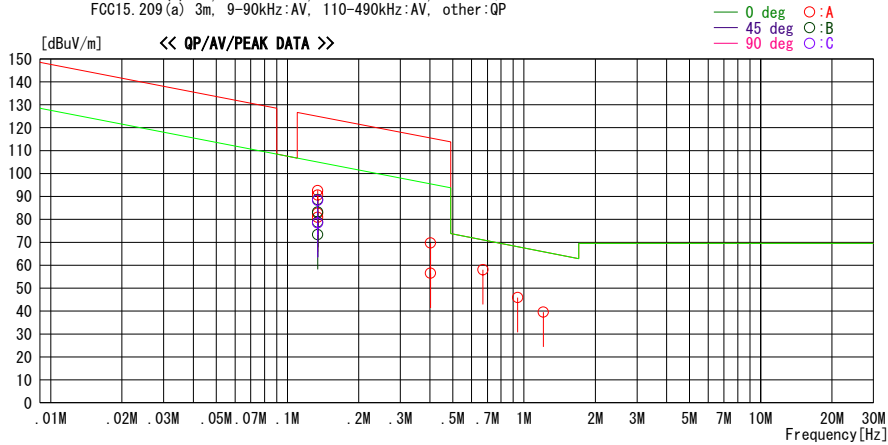
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2010/04/27

Report No. : 30IE0166-HO-02
Power : DC 12.0V
Engineer : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz, Modulation ON, Door Antenna Worst-axis (Ant:X, ECU: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 | Comment |
|----------------|-------------------|------|--------------------|--------------|--------------|--------------------|-------------------|----------------|------------------|-------|---------|
| | | | | | | | | | | [deg] | |
| 0.13420 | 99.0 | PEAK | 19.9 | 6.1 | 32.4 | 92.6 | 125.0 | 32.4 | 0 | A | 9 Worst |
| 0.13420 | 95.0 | PEAK | 19.9 | 6.1 | 32.4 | 88.6 | 125.0 | 36.4 | 45 | B | 107 |
| 0.13420 | 94.7 | PEAK | 19.9 | 6.1 | 32.4 | 88.3 | 125.0 | 36.7 | 90 | C | 85 |
| 0.13420 | 89.2 | AV | 19.9 | 6.1 | 32.4 | 82.8 | 105.0 | 22.2 | 0 | A | 9 Worst |
| 0.13420 | 85.2 | AV | 19.9 | 6.1 | 32.4 | 78.8 | 105.0 | 26.2 | 45 | B | 107 |
| 0.13420 | 84.9 | AV | 19.9 | 6.1 | 32.4 | 78.5 | 105.0 | 26.5 | 90 | C | 85 |
| 0.13420 | 97.1 | PEAK | 19.9 | 6.1 | 32.4 | 90.7 | 125.0 | 34.3 | 135 | A | 34 |
| 0.13420 | 89.6 | PEAK | 19.9 | 6.1 | 32.4 | 83.2 | 125.0 | 41.8 | 0 | B | 6 Hori |
| 0.13420 | 87.3 | AV | 19.9 | 6.1 | 32.4 | 80.9 | 105.0 | 24.1 | 135 | A | 34 |
| 0.13420 | 79.8 | AV | 19.9 | 6.1 | 32.4 | 73.4 | 105.0 | 31.6 | 0 | B | 6 Hori |
| 0.40260 | 62.9 | AV | 19.7 | 6.1 | 32.1 | 56.6 | 95.5 | 38.9 | 0 | A | 10 |
| 0.40260 | 76.0 | PEAK | 19.7 | 6.1 | 32.1 | 69.7 | 115.5 | 45.8 | 0 | A | 10 |
| 0.67100 | 64.3 | QP | 19.6 | 6.2 | 32.1 | 58.0 | 71.1 | 13.1 | 0 | A | 10 |
| 0.93940 | 52.4 | QP | 19.6 | 6.2 | 32.2 | 46.0 | 68.1 | 22.1 | 0 | A | 10 |
| 1.20780 | 45.9 | QP | 19.6 | 6.2 | 32.2 | 39.5 | 65.9 | 26.4 | 0 | A | 12 |

CHART: WITH FACTOR, ANT TYPE: LOOP, Except for the data below: adequate margin data below the limits.
CALCULATION : RESULT[dBuV] = READING[dBuV] + ANT FACTOR[dB] + LOSS[dB] (CABLE + ATTEN. - 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

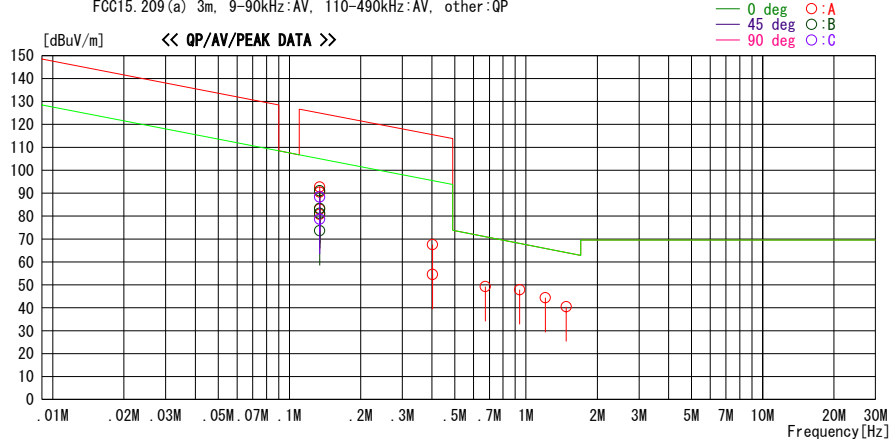
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2010/04/27

Report No. : 30IE0166-HO-02
Power : DC 12.0V
Engineer : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz, Modulation ON, Trunk Antenna Worst-axis (Ant:X, ECU: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 | Comment | |
|----------------|-------------------|------|--------------------|--------------|--------------|--------------------|-------------------|----------------|------------------|-------|---------|-------|
| | | | | | | | | | | [deg] | | |
| 0.13420 | 99.2 | PEAK | 19.9 | 6.1 | 32.4 | 92.8 | 125.0 | 32.2 | 0 | A | 179 | Worst |
| 0.13420 | 97.5 | PEAK | 19.9 | 6.1 | 32.4 | 91.1 | 125.0 | 33.9 | 45 | B | 144 | |
| 0.13420 | 94.8 | PEAK | 19.9 | 6.1 | 32.4 | 88.4 | 125.0 | 36.6 | 90 | C | 93 | |
| 0.13420 | 87.7 | AV | 19.9 | 6.1 | 32.4 | 81.3 | 105.0 | 23.7 | 45 | B | 144 | |
| 0.13420 | 89.7 | PEAK | 19.9 | 6.1 | 32.4 | 83.3 | 125.0 | 41.7 | 0 | B | 170 | Hori |
| 0.13420 | 85.0 | AV | 19.9 | 6.1 | 32.4 | 78.6 | 105.0 | 26.4 | 90 | C | 93 | |
| 0.13420 | 89.5 | AV | 19.9 | 6.1 | 32.4 | 83.1 | 105.0 | 21.9 | 0 | A | 179 | Worst |
| 0.13420 | 96.9 | PEAK | 19.9 | 6.1 | 32.4 | 90.5 | 125.0 | 34.5 | 135 | A | 205 | |
| 0.13420 | 87.2 | AV | 19.9 | 6.1 | 32.4 | 80.8 | 105.0 | 24.2 | 135 | A | 205 | |
| 0.13420 | 80.0 | AV | 19.9 | 6.1 | 32.4 | 73.6 | 105.0 | 31.4 | 0 | B | 170 | Hori |
| 0.40260 | 60.8 | AV | 19.7 | 6.1 | 32.1 | 54.5 | 95.5 | 41.0 | 0 | A | 172 | |
| 0.40260 | 73.9 | PEAK | 19.7 | 6.1 | 32.1 | 67.6 | 115.5 | 47.9 | 0 | A | 172 | |
| 0.67150 | 55.6 | QP | 19.6 | 6.2 | 32.1 | 49.3 | 71.0 | 21.7 | 0 | A | 171 | |
| 0.93947 | 54.3 | QP | 19.6 | 6.2 | 32.2 | 47.9 | 68.1 | 20.2 | 0 | A | 178 | |
| 1.20780 | 50.8 | QP | 19.6 | 6.2 | 32.2 | 44.4 | 65.9 | 21.5 | 0 | A | 185 | |
| 1.47620 | 46.7 | QP | 19.6 | 6.3 | 32.2 | 40.4 | 64.2 | 23.8 | 0 | A | 185 | |

CHART: WITH FACTOR, ANT TYPE: LOOP. Except for the data below: adequate margin data below the limits.
CALCULATION: RESULT[dBuV] = READING[dBuV] + ANT FACTOR[dB] + LOSS[dB] (CABLE + ATTEN. - 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 Maximum Output

DATA OF RADIATED EMISSION TEST

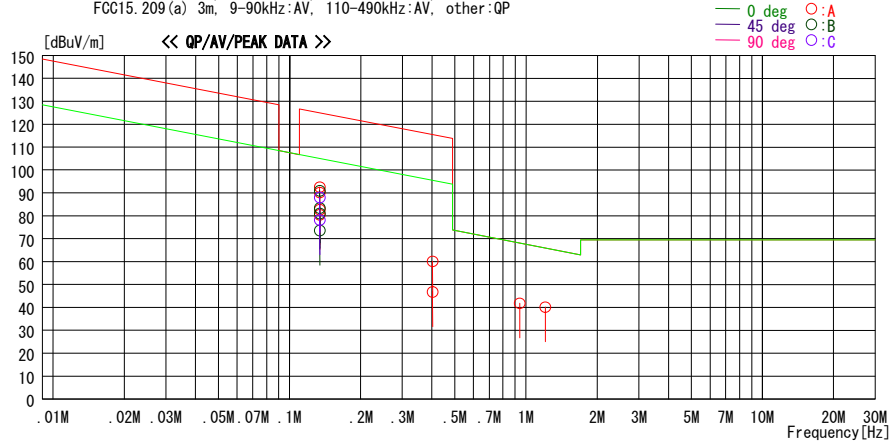
UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2010/04/27

Report No. : 30IE0166-HO-02
Power : DC 12.0V

Engineer : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz, Modulation ON, Room Antenna/Luggage Antenna, Worst-axis (Ant:Z, ECU: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. | Reading | DET | Ant. Fac | Loss | Gain | Result | Limit | Margin | Antenna | Table | Comment |
|---------|---------|------|----------|------|------|----------|----------|--------|---------|-------|-----------|
| [MHz] | [dBuV] | | [dB/m] | [dB] | [dB] | [dBuV/m] | [dBuV/m] | [dB] | [deg] | [deg] | |
| 0.13420 | 99.0 | PEAK | 19.9 | 6.1 | 32.4 | 92.6 | 125.0 | 32.4 | 0 | A | 182 Worst |
| 0.13420 | 97.3 | PEAK | 19.9 | 6.1 | 32.4 | 90.9 | 125.0 | 34.1 | 45 | B | 147 |
| 0.13420 | 94.4 | PEAK | 19.9 | 6.1 | 32.4 | 88.0 | 125.0 | 37.0 | 90 | C | 94 |
| 0.13420 | 84.6 | AV | 19.9 | 6.1 | 32.4 | 78.2 | 105.0 | 26.8 | 90 | C | 94 |
| 0.13420 | 89.2 | AV | 19.9 | 6.1 | 32.4 | 82.8 | 105.0 | 22.2 | 0 | A | 182 Worst |
| 0.13420 | 96.6 | PEAK | 19.9 | 6.1 | 32.4 | 90.2 | 125.0 | 34.8 | 135 | A | 210 |
| 0.13420 | 86.8 | AV | 19.9 | 6.1 | 32.4 | 80.4 | 105.0 | 24.6 | 135 | A | 210 |
| 0.13420 | 87.5 | AV | 19.9 | 6.1 | 32.4 | 81.1 | 105.0 | 23.9 | 45 | B | 147 |
| 0.13420 | 89.8 | PEAK | 19.9 | 6.1 | 32.4 | 83.4 | 125.0 | 41.6 | 0 | B | 179 Hori |
| 0.13420 | 80.0 | AV | 19.9 | 6.1 | 32.4 | 73.6 | 105.0 | 31.4 | 0 | B | 179 Hori |
| 0.40260 | 53.2 | AV | 19.7 | 6.1 | 32.1 | 46.9 | 95.5 | 48.6 | 0 | A | 170 |
| 0.40260 | 66.5 | PEAK | 19.7 | 6.1 | 32.1 | 60.2 | 115.5 | 55.3 | 0 | A | 170 |
| 0.93940 | 48.2 | QP | 19.6 | 6.2 | 32.2 | 41.8 | 68.1 | 26.3 | 0 | A | 175 |
| 1.20780 | 46.5 | QP | 19.6 | 6.2 | 32.2 | 40.1 | 65.9 | 25.8 | 0 | A | 174 |

CHART: WITH FACTOR, ANT TYPE: LOOP, Except for the data below: adequate margin data below the limits.
CALCULATION: RESULT[dBuV] = READING[dBuV] + ANT FACTOR[dB] + LOSS[dB] (CABLE + ATTEN. - 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

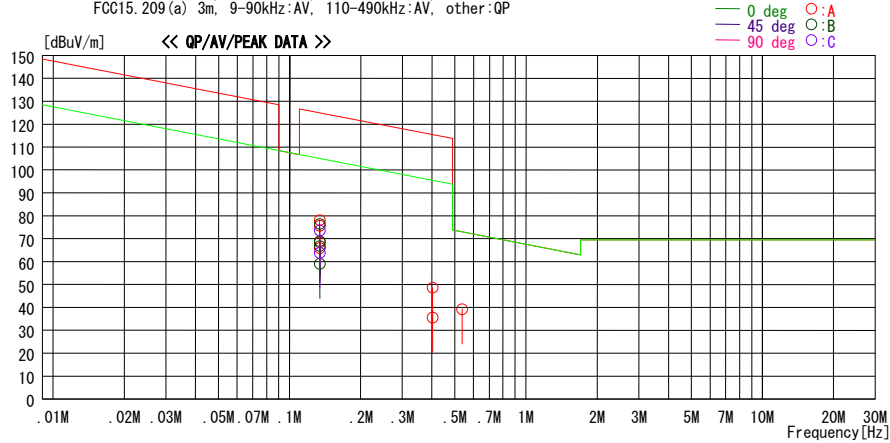
UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2010/04/27

Report No. : 30IE0166-HO-02
Power : DC 12.0V

Engineer : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz, Modulation ON, Room Antenna/Luggage Antenna, Worst-axis (Ant:Z, ECU: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. | Reading | DET | Ant. Fac | Loss | Gain | Result | Limit | Margin | Antenna | Table | Comment |
|---------|---------|------|----------|------|------|----------|----------|--------|---------|-------|-----------|
| [MHz] | [dBuV] | | [dB/m] | [dB] | [dB] | [dBuV/m] | [dBuV/m] | [dB] | [deg] | [deg] | |
| 0.13420 | 84.6 | PEAK | 19.9 | 6.1 | 32.4 | 78.2 | 125.0 | 46.8 | 0 | A | 181 Worst |
| 0.13420 | 83.0 | PEAK | 19.9 | 6.1 | 32.4 | 76.6 | 125.0 | 48.4 | 45 | B | 144 |
| 0.13420 | 80.0 | PEAK | 19.9 | 6.1 | 32.4 | 73.6 | 125.0 | 51.4 | 90 | C | 95 |
| 0.13420 | 70.2 | AV | 19.9 | 6.1 | 32.4 | 63.8 | 105.0 | 41.2 | 90 | C | 95 |
| 0.13420 | 74.9 | AV | 19.9 | 6.1 | 32.4 | 68.5 | 105.0 | 36.5 | 0 | A | 181 Worst |
| 0.13420 | 82.2 | PEAK | 19.9 | 6.1 | 32.4 | 75.8 | 125.0 | 49.2 | 135 | A | 213 |
| 0.13420 | 72.4 | AV | 19.9 | 6.1 | 32.4 | 66.0 | 105.0 | 39.0 | 135 | A | 213 |
| 0.13420 | 73.2 | AV | 19.9 | 6.1 | 32.4 | 66.8 | 105.0 | 38.2 | 45 | B | 144 |
| 0.13420 | 75.3 | PEAK | 19.9 | 6.1 | 32.4 | 68.9 | 125.0 | 56.1 | 0 | B | 182 Hori |
| 0.13420 | 65.5 | AV | 19.9 | 6.1 | 32.4 | 59.1 | 105.0 | 45.9 | 0 | B | 182 Hori |
| 0.40260 | 41.9 | AV | 19.7 | 6.1 | 32.1 | 35.6 | 95.5 | 59.9 | 0 | A | 182 |
| 0.40260 | 55.0 | PEAK | 19.7 | 6.1 | 32.1 | 48.7 | 115.5 | 66.8 | 0 | A | 182 |
| 0.53680 | 45.6 | QP | 19.6 | 6.1 | 32.1 | 39.2 | 73.0 | 33.8 | 0 | A | 183 |

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

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

Radiated Emission above 30MHz (Spurious Emission)
Door Antenna

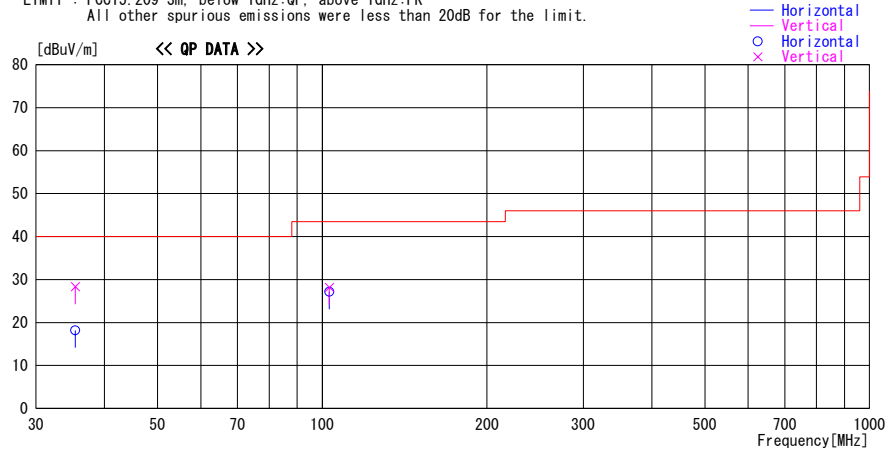
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2010/04/28

Report No. : 30IE0166-HO-02
Power : DC 12.0V
Operator : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz, Modulation ON, Door Antenna, Worst-axis (Ant:X, ECU: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 | Loss& | Level | Angle | Height | Polar. | Limit | Margin | Comment |
|--------------------|-------------------|-----|------------------|--------------|-------|-------|--------|--------|-------|--------|---------|
| | | | Factor [dB/m] | Gain [dB] | | | | | | | |
| 35.400 | 23.5 | QP | 16.6 | -21.9 | 18.2 | 156 | 300 | Hori. | 40.0 | 21.8 | |
| 35.400 | 33.6 | QP | 16.6 | -21.9 | 28.3 | 103 | 100 | Vert. | 40.0 | 11.7 | |
| 103.070 | 37.1 | QP | 11.1 | -21.0 | 27.2 | 9 | 283 | Hori. | 43.5 | 16.3 | |
| 103.070 | 38.1 | QP | 11.1 | -21.0 | 28.2 | 262 | 100 | Vert. | 43.5 | 15.3 | |

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 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

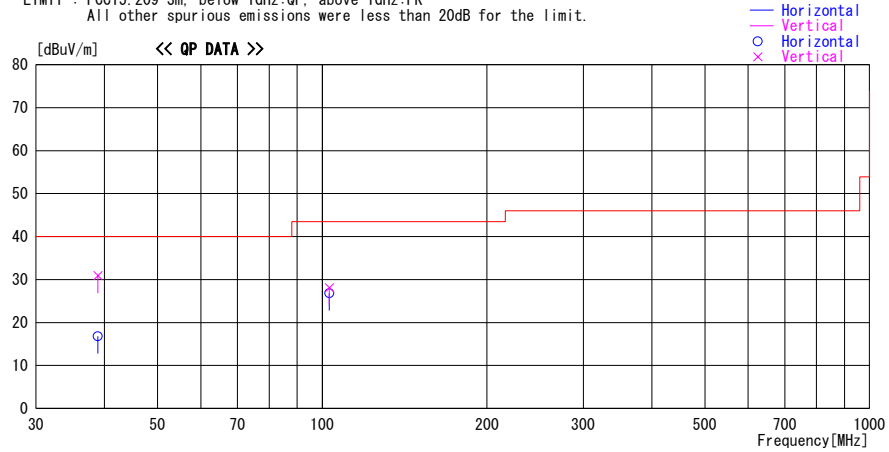
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
 Date : 2010/04/28

Report No. : 30IE0166-HO-02
 Power : DC 12.0V
 Operator : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz, Modulation ON, Trunk Antenna, Worst-axis (Ant:X, ECU: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 | Loss& | Level | Angle | Height | Polar. | Limit | Margin | Comment |
|--------------------|-------------------|-----|------------------|--------------|-------|-------|--------|--------|-------|--------|---------|
| | | | Factor [dB/m] | Gain [dB] | | | | | | | |
| 38.920 | 23.3 | QP | 15.4 | -21.9 | 16.8 | 174 | 300 | Hori. | 40.0 | 23.2 | |
| 38.920 | 37.4 | QP | 15.4 | -21.9 | 30.9 | 269 | 100 | Vert. | 40.0 | 9.1 | |
| 103.070 | 36.7 | QP | 11.1 | -21.0 | 26.8 | 5 | 284 | Hori. | 43.5 | 16.7 | |
| 103.070 | 38.0 | QP | 11.1 | -21.0 | 28.1 | 262 | 100 | Vert. | 43.5 | 15.4 | |

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 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

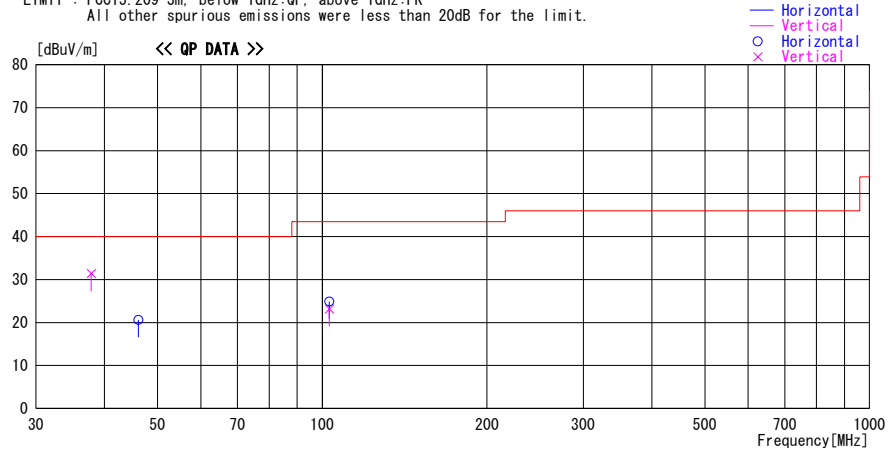
UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2010/04/28

Report No. : 30IE0166-HO-02
Power : DC 12.0V

Operator : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz, Modulation ON, Room Antenna / Luggage Antenna, Worst-axis (Ant:X, ECU: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 | Loss& | Level | Angle | Height | Polar. | Limit | Margin | Comment |
|--------------------|-------------------|-----|------------------|--------------|-------|-------|--------|--------|-------|--------|---------|
| | | | Factor [dB/m] | Gain [dB] | | | | | | | |
| 37.843 | 37.6 | QP | 15.7 | -21.9 | 31.4 | 131 | 100 | Vert. | 40.0 | 8.6 | |
| 46.169 | 29.7 | QP | 12.7 | -21.8 | 20.6 | 2 | 351 | Hori. | 40.0 | 19.4 | |
| 103.070 | 34.8 | QP | 11.1 | -21.0 | 24.9 | 359 | 289 | Hori. | 43.5 | 18.6 | |
| 103.070 | 33.1 | QP | 11.1 | -21.0 | 23.2 | 259 | 100 | Vert. | 43.5 | 20.3 | |

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 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

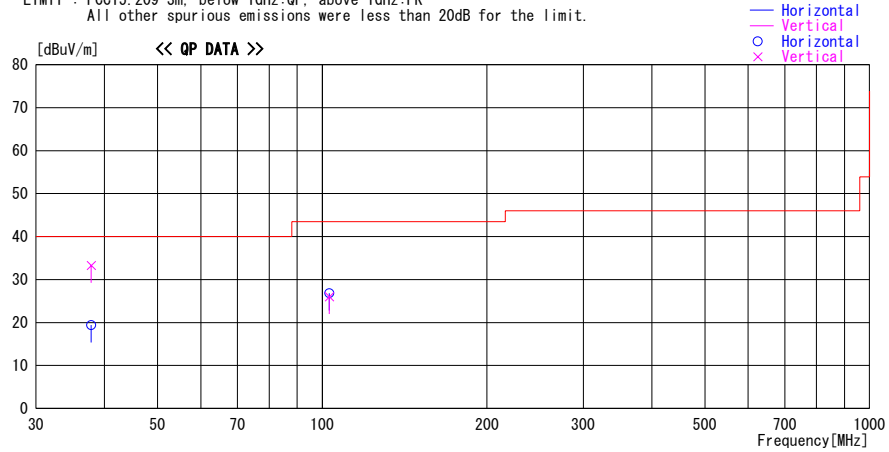
UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2010/04/28

Report No. : 30IE0166-HO-02
Power : DC 12.0V

Operator : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz, Modulation ON, Room Antenna / Luggage Antenna, Worst-axis (Ant:X, ECU: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 | Loss& | Level | Angle | Height | Polar. | Limit | Margin | Comment |
|--------------------|-------------------|-----|---------|-------|----------|-------|--------|--------|----------|--------|---------|
| | | | Factor | Gain | | | | | | | |
| | | | [dB/m] | [dB] | [dBuV/m] | [Deg] | [cm] | | [dBuV/m] | [dB] | |
| 37.838 | 25.5 | QP | 15.8 | -21.9 | 19.4 | 2 | 300 | Hor. | 40.0 | 20.6 | |
| 37.838 | 39.4 | QP | 15.8 | -21.9 | 33.3 | 105 | 100 | Vert. | 40.0 | 6.7 | |
| 103.070 | 36.7 | QP | 11.1 | -21.0 | 26.8 | 9 | 284 | Hor. | 43.5 | 16.7 | |
| 103.070 | 35.9 | QP | 11.1 | -21.0 | 26.0 | 259 | 100 | Vert. | 43.5 | 17.5 | |

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 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

Head Office EMC Lab. No.2 Semi Anechoic Chamber

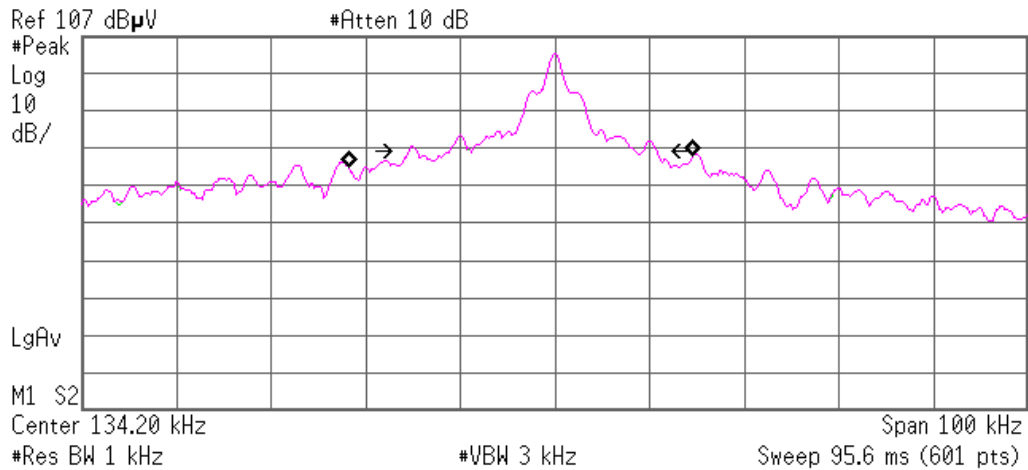
POWER : DC 12.0V
MODE : Tx
: Door Antenna

REPORT NO : 30IE0166-HO-02
REGULATION : -/RSS-Gen 4.6.1
TEST DISTANCE : 3m
DATE : 04/27/2010
TEMPERATURE : 22 deg.C
HUMIDITY : 43 %
Engineer : Keisuke Kawamura

| | FREQ | -26dB Bandwidth | 99% Occupied Bandwidth |
|--|-------|-----------------|------------------------|
| | [kHz] | [kHz] | [kHz] |
| | 134.2 | 26.233 | 36.515 |

Agilent

R T



Occupied Bandwidth
36.5151 kHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error -3.683 kHz
x dB Bandwidth 26.233 kHz

-26dB Bandwidth and 99% Occupied Bandwidth
Trunk Antenna

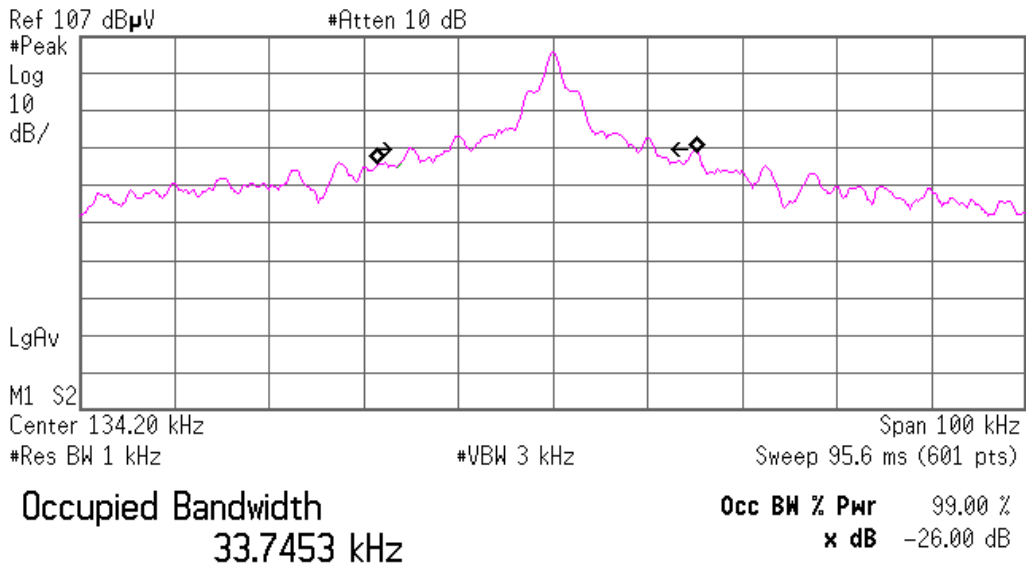
Head Office EMC Lab. No.2 Semi Anechoic Chamber

| | | | |
|-------|-----------------|---------------|--------------------|
| POWER | : DC 12.0V | REPORT NO | : 30IE0166-HO-02 |
| MODE | : Tx | REGULATION | : -/RSS-Gen 4.6.1 |
| | : Trunk Antenna | TEST DISTANCE | : 3m |
| | | DATE | : 04/27/2010 |
| | | TEMPERATURE | : 22 deg.C |
| | | HUMIDITY | : 43 % |
| | | Engineer | : Keisuke Kawamura |

| | FREQ | -26dB Bandwidth | 99% Occupied Bandwidth |
|--|-------|-----------------|------------------------|
| | [kHz] | [kHz] | [kHz] |
| | 134.2 | 26.078 | 33.745 |

Agilent

R T



Transmit Freq Error -1.638 kHz
x dB Bandwidth 26.078 kHz

-26dB Bandwidth and 99% Occupied Bandwidth

Room Antenna / Luggage Antenna

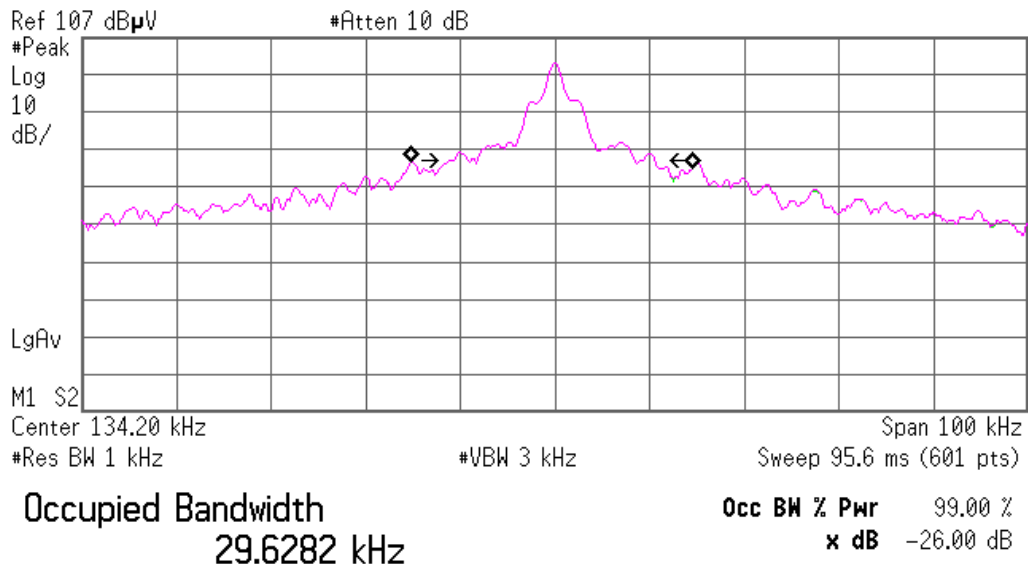
Head Office EMC Lab. No.2 Semi Anechoic Chamber

| | | | |
|-------|----------------------------------|---------------|--------------------|
| POWER | : DC 12.0V | REPORT NO | : 30IE0166-HO-02 |
| MODE | : Tx | REGULATION | : -/RSS-Gen 4.6.1 |
| | | TEST DISTANCE | : 3m |
| | | DATE | : 04/27/2010 |
| | | TEMPERATURE | : 22 deg.C |
| | | HUMIDITY | : 43 % |
| | : Room Antenna / Luggage Antenna | Engineer | : Keisuke Kawamura |

| | FREQ | -26dB Bandwidth | 99% Occupied Bandwidth |
|--|-------|-----------------|------------------------|
| | [kHz] | [kHz] | [kHz] |
| | 134.2 | 21.190 | 29.628 |

Agilent

R T



Transmit Freq Error -326.685 Hz
x dB Bandwidth 21.190 kHz

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

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 | 2009/08/17 * 12 |
| MOS-22 | Thermo-Hygrometer | Custom | CTH-201 | 0003 | RE | 2010/02/09 * 12 |
| MJM-05 | Measure | PROMART | SEN1955 | - | RE | - |
| COTS-MEMI | EMI measurement program | TSJ | TEPTO-DV | - | RE | - |
| MSA-03 | Spectrum Analyzer | Agilent | E4448A | MY44020357 | RE | 2009/11/20 * 12 |
| MTR-03 | Test Receiver | Rohde & Schwarz | ESCI | 100300 | RE | 2010/04/19 * 12 |
| MLPA-01 | Loop Antenna | Rohde & Schwarz | HFH2-Z2 | 100017 | RE | 2009/10/19 * 12 |
| MCC-13 | Coaxial Cable | Fujikura | 3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m) | - | RE | 2010/02/22 * 12 |
| MCC-30 | Coaxial cable | UL Japan | - | - | RE | 2009/06/22 * 12 |
| MPA-13 | Pre Amplifier | SONOMA INSTRUMENT | 310 | 260834 | RE | 2010/03/23 * 12 |
| MAT-07 | Attenuator(6dB) | Weinschel Corp | 2 | BK7970 | RE | 2009/11/12 * 12 |
| MBA-02 | Biconical Antenna | Schwarzbeck | BBA9106 | VHA91032008 | RE | 2009/10/05 * 12 |
| MLA-03 | Logperiodic Antenna | Schwarzbeck | USLP9143 | 174 | RE | 2010/01/23 * 12 |
| MCC-12 | Coaxial Cable | Fujikura/Agilent | - | - | RE | 2010/02/22 * 12 |
| MPA-09 | Pre Amplifier | Agilent | 8447D | 2944A10845 | RE | 2009/09/02 * 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

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124