



# RADIO TEST REPORT

**Test Report No. : 32IE0037-HO**

**Applicant** : Toyota Motor Corporation  
**Type of Equipment** : Smart LF Oscillator  
**Model No.** : TMLF10-18  
**FCC ID** : NI4TMLF10-18  
**Test regulation** : FCC Part 15 Subpart C: 2012  
Section 15.207, Section 15.209  
**Test Result** : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with 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:**

June 27 to July 2, 2010

**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>

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13-EM-F0429

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## **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. : TMLF10-18  
Serial No. : Refer to Section 4, Clause 4.2  
Rating : DC12.0V (Max 0.5A)  
Receipt Date of Sample : June 16, 2010  
Country of Mass-production : Japan  
Condition of EUT : Production model or Production prototype or Engineering 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: TMLF10-18 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: TMLF10-18) consists of the following parts:

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

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

### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C: 2012, final revised on February 1, 2012

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

\*The revision on February 1, 2012 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.

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### 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	21.6dB 0.13420MHz, AV, 0deg. (Door 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	9.9dB 51.535MHz, QP, Vertical (Room Antenna / Luggage Antenna)	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. 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.

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### 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)		
	9kHz -30MHz	30MHz -300MHz	300MHz -1GHz
No.1	2.7dB	4.8dB	5.0dB
No.2	-	-	-
No.3	-	-	-
No.4	-	-	-

\*10m = Measurement distance

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	2.9dB	4.8dB	5.0dB	3.9dB	4.3dB	4.5dB	4.3dB
No.2	3.5dB	4.8dB	5.1dB	4.0dB	4.2dB	4.4dB	4.2dB
No.3	3.8dB	4.6dB	4.7dB	4.0dB	4.2dB	4.5dB	4.2dB
No.4	3.5dB	4.4dB	4.9dB	4.0dB	4.2dB	4.6dB	4.2dB

\*3m/1m/0.5m = 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.

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### 3.5 Test Location

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	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.

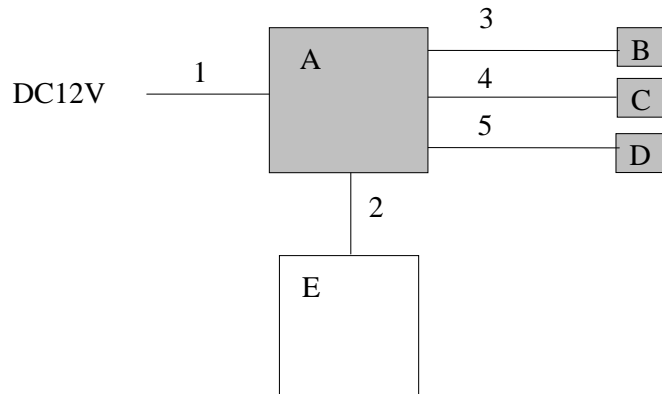
## SECTION 4: Operation of E.U.T. during testing

### 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	-

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

### **Test Procedure**

The Radiated Electric Field Strength intensity has been measured on No 4 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., 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: June 27, 2010  
June 29 and July 2, 2010

Test engineer: Keisuke Kawamura  
Kazuya Yoshioka

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**UL Japan, Inc.**

**Head Office EMC Lab.**

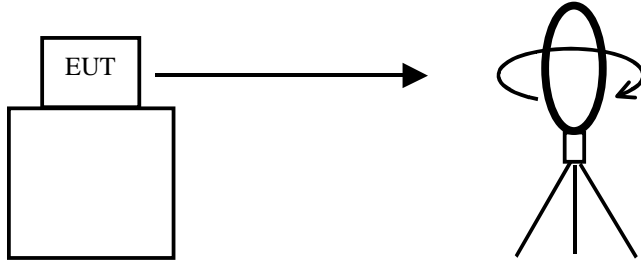
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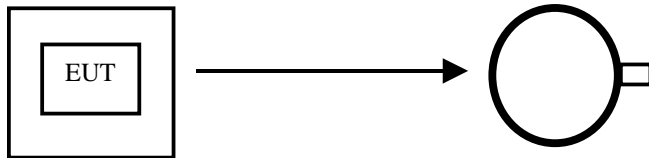
Facsimile : +81 596 24 8124

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

*Side View (Vertical)*

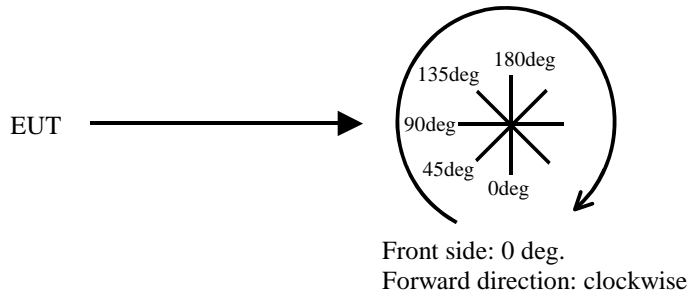


.....  
*Top View (Horizontal)*



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.

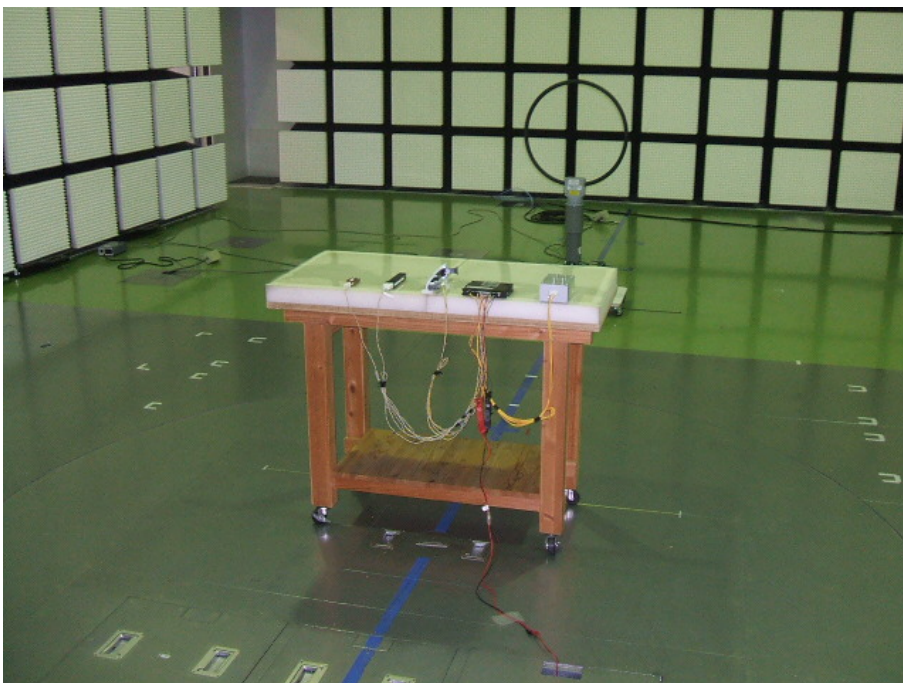
Test data : APPENDIX 2  
Test result : Pass

**APPENDIX 1: Photographs of test setup**

**Radiated emission**  
**Door Antenna**

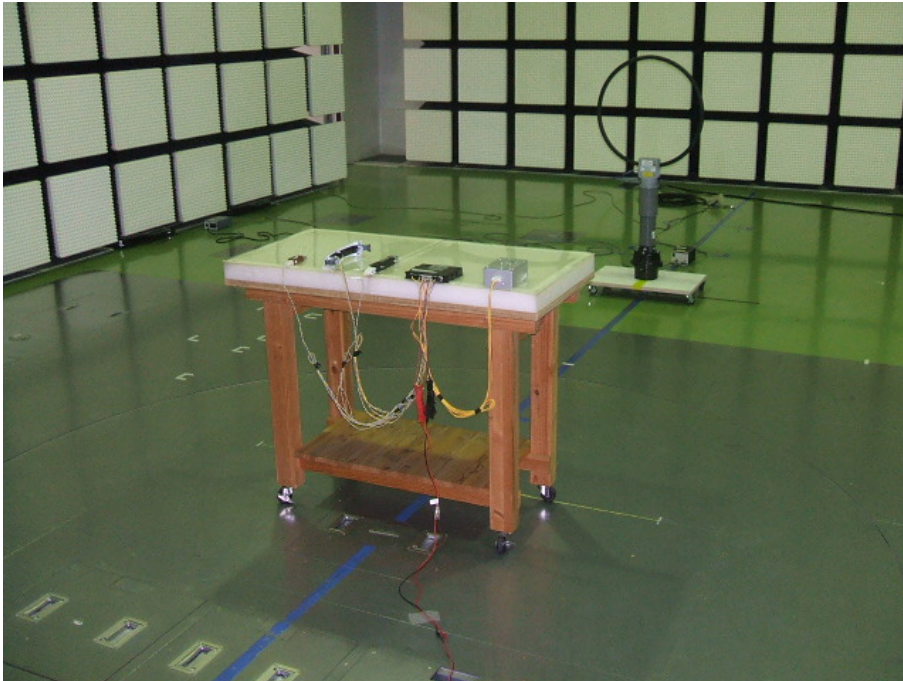


**Photo 1**



**Photo 2**

**Radiated emission**  
**Trunk Antenna**



**Photo 1**

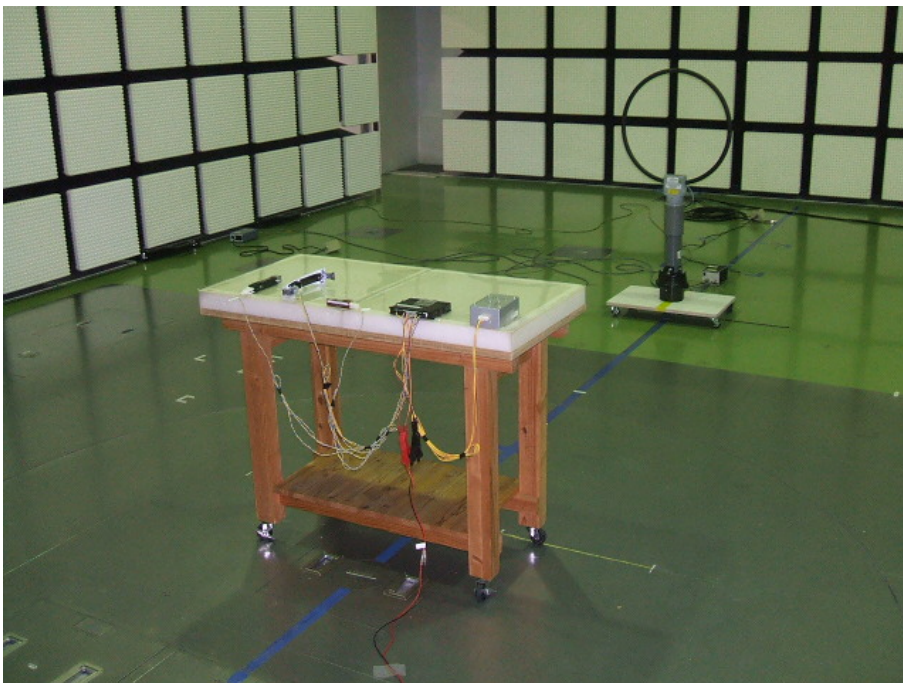


**Photo 2**

**Radiated emission**  
**Room Antenna / Luggage Antenna**



**Photo 1**



**Photo 2**

**Worst Case Position**

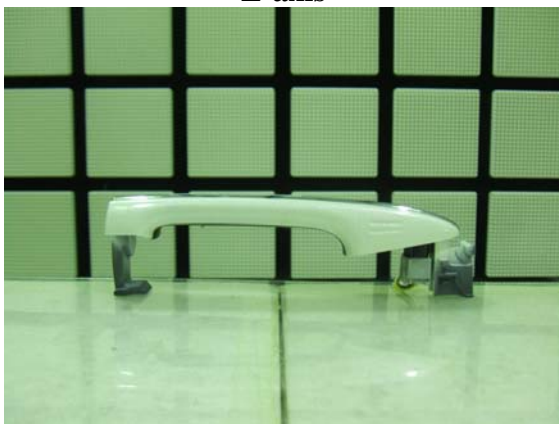
**Door Antenna**  
**Below 30MHz:X-axis**  
**Above 30MHz(Hori:X-axis /Vert:X-axis)**  
**X-axis**



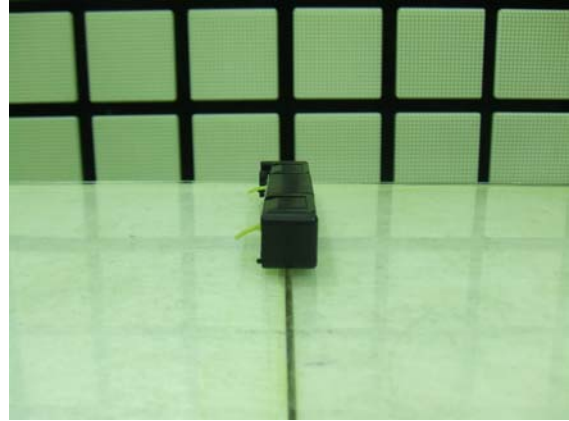
**Y-axis**



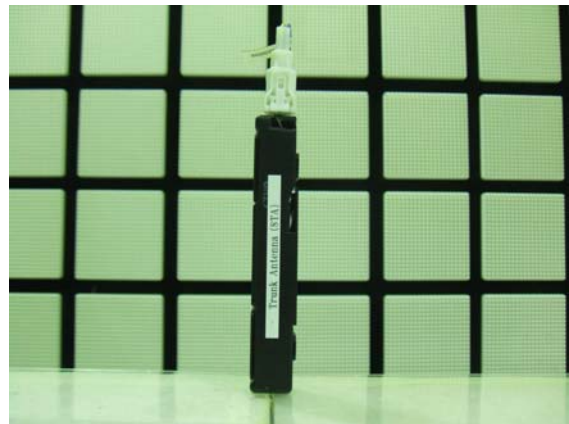
**Z-axis**



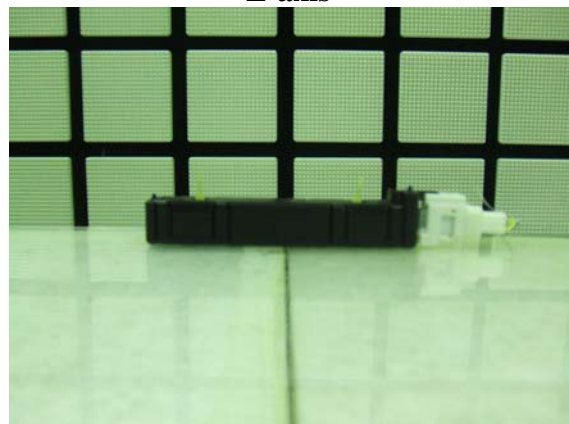
**Trunk Antenna**  
**Below 30MHz:X-axis**  
**Above 30MHz(Hori:X-axis /Vert:X-axis)**  
**X-axis**



**Y-axis**



**Z-axis**

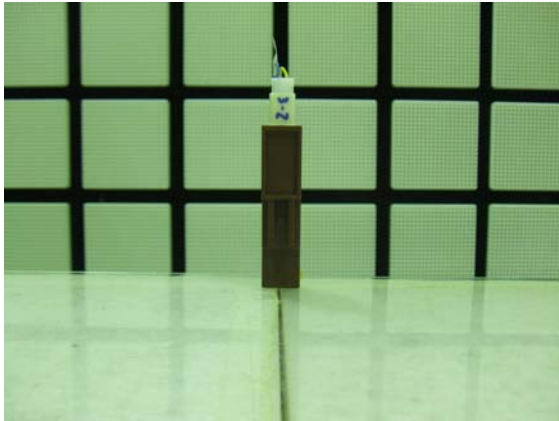


**Worst Case Position**

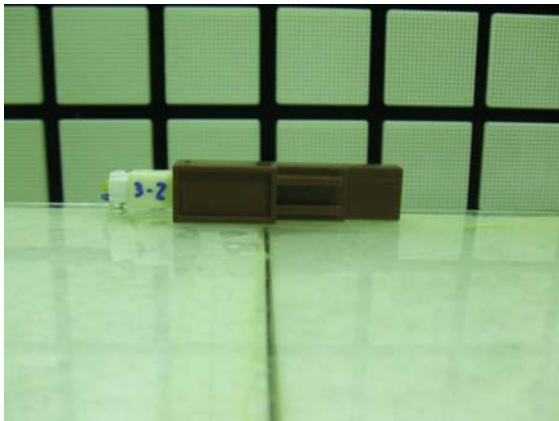
**Room Antenna / Luggage Antenna**  
**Below 30MHz:Z-axis**  
**Above 30MHz(Hori:X-axis /Vert:X-axis)**  
**X-axis**



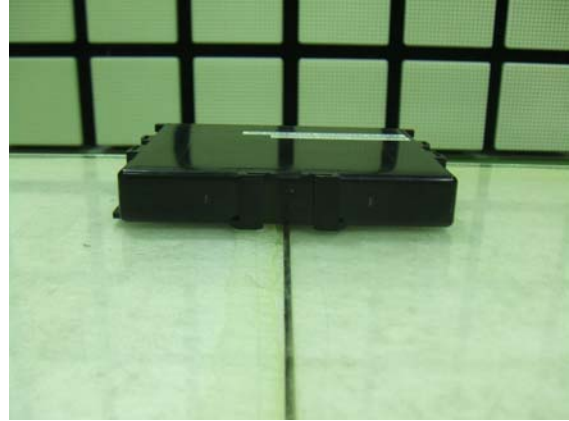
**Y-axis**



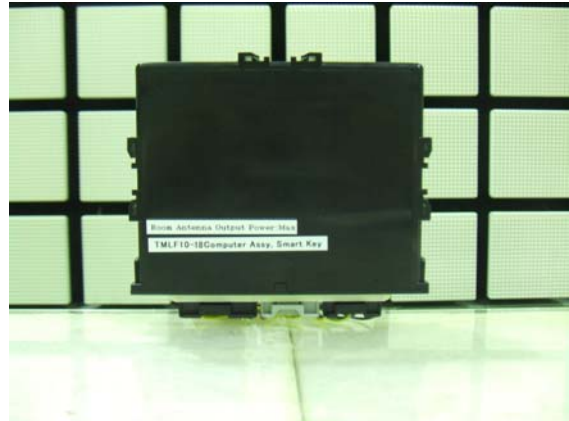
**Z-axis**



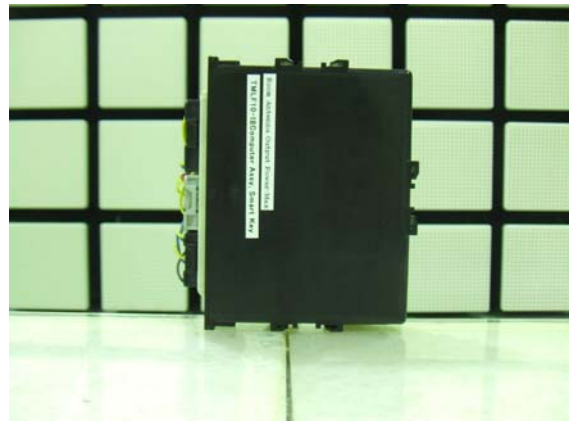
**ECU**  
**Below 30MHz:X-axis**  
**Above 30MHz(Hori:X-axis /Vert:X-axis)**  
**X-axis**



**Y-axis**



**Z-axis**





**APPENDIX 2: Data of EMI test**

**Radiated Emission below 30MHz (Fundamental and Spurious Emission)**  
**Door Antenna**

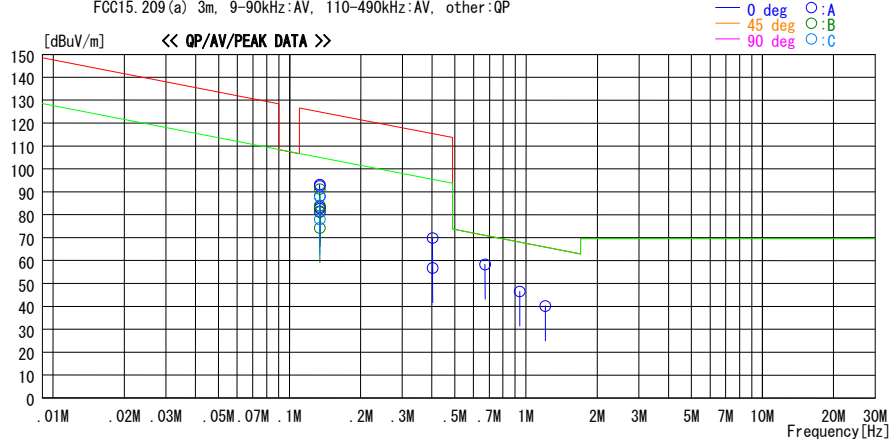
**DATA OF RADIATED EMISSION TEST**

UL Japan, Inc. Head Office EMC Lab. No. 4 Semi Anechoic Chamber  
Date : 2010/06/27

Report No. : 32IE0037-HO  
Temp. / Humi. : 22deg. C / 61%  
Engineer : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz, 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.	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	94.1	PEAK	20.0	5.9	32.1	87.9	125.0	37.1	90	C	288
0.13420	97.5	PEAK	20.0	5.9	32.1	91.3	125.0	33.7	45	B	326
0.13420	99.4	PEAK	20.0	5.9	32.1	93.2	125.0	31.8	0	A	359
0.13420	84.3	AV	20.0	5.9	32.1	78.1	105.0	26.9	90	C	288
0.13420	89.6	AV	20.0	5.9	32.1	83.4	105.0	21.6	0	A	359
0.13420	94.3	PEAK	20.0	5.9	32.1	88.1	125.0	36.9	135	A	25
0.13420	87.5	AV	20.0	5.9	32.1	81.3	105.0	23.7	135	A	25
0.13420	98.8	PEAK	20.0	5.9	32.1	92.6	125.0	32.4	180	A	359
0.13420	89.0	AV	20.0	5.9	32.1	82.8	105.0	22.2	180	A	359
0.13420	87.7	AV	20.0	5.9	32.1	81.5	105.0	23.5	45	B	326
0.13420	90.3	PEAK	20.0	5.9	32.1	84.1	125.0	40.9	0	B	3
0.13420	80.4	AV	20.0	5.9	32.1	74.2	105.0	30.8	0	B	3
0.40260	76.2	PEAK	19.8	6.0	32.1	69.9	115.5	45.6	0	A	359
0.40260	63.2	AV	19.8	6.0	32.1	56.9	95.5	38.6	0	A	359
0.67100	64.6	QP	19.8	6.0	32.1	58.3	71.1	12.8	0	A	359
0.93940	52.7	QP	19.8	6.0	32.0	46.5	68.1	21.6	0	A	359
1.20780	46.3	QP	19.8	6.1	32.0	40.2	65.9	25.7	0	A	359

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**

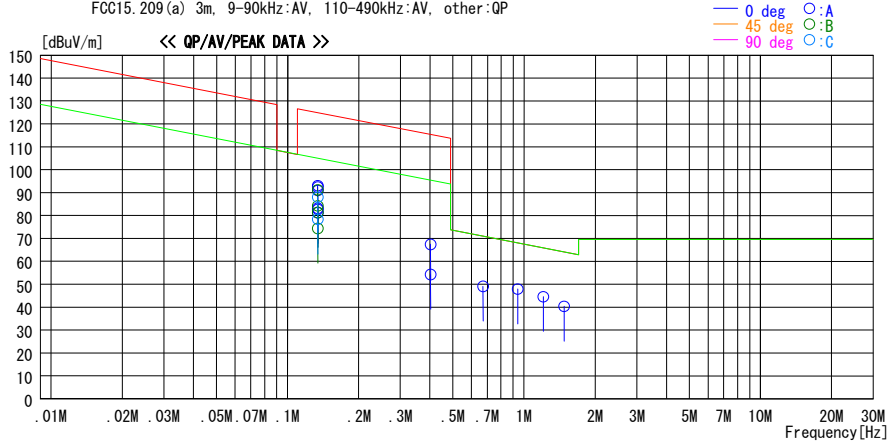
UL Japan, Inc. Head Office EMC Lab. No. 4 Semi Anechoic Chamber  
Date : 2010/06/27

Report No. : 32IE0037-HO

Temp. / Humi. : 22deg. C / 61%  
Engineer : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz, 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	97.4	PEAK	20.0	5.9	32.1	91.2	125.0	33.8	45	B	326
0.13420	94.3	PEAK	20.0	5.9	32.1	88.1	125.0	36.9	90	C	82
0.13420	99.3	PEAK	20.0	5.9	32.1	93.1	125.0	31.9	0	A	359 Worst
0.13420	84.6	AV	20.0	5.9	32.1	78.4	105.0	26.6	90	C	82
0.13420	89.4	AV	20.0	5.9	32.1	83.2	105.0	21.8	0	A	359 Worst
0.13420	97.2	PEAK	20.0	5.9	32.1	91.0	125.0	34.0	135	A	33
0.13420	87.4	AV	20.0	5.9	32.1	81.2	105.0	23.8	135	A	33
0.13420	98.6	PEAK	20.0	5.9	32.1	92.4	125.0	32.6	180	A	359
0.13420	88.9	AV	20.0	5.9	32.1	82.7	105.0	22.3	180	A	359
0.13420	87.6	AV	20.0	5.9	32.1	81.4	105.0	23.6	45	B	326
0.13420	90.4	PEAK	20.0	5.9	32.1	84.2	125.0	40.8	0	B	356 Hori
0.13420	80.6	AV	20.0	5.9	32.1	74.4	105.0	30.6	0	B	356 Hori
0.40260	73.8	PEAK	19.8	6.0	32.1	67.5	115.5	48.0	0	A	359
0.40260	60.6	AV	19.8	6.0	32.1	54.3	95.5	41.2	0	A	359
0.67100	55.4	QP	19.8	6.0	32.1	49.1	71.1	22.0	0	A	359
0.93940	54.1	QP	19.8	6.0	32.0	47.9	68.1	20.2	0	A	359
1.20780	50.6	QP	19.8	6.1	32.0	44.5	65.9	21.4	0	A	359
1.47620	46.4	QP	19.8	6.1	32.0	40.3	64.2	23.9	0	A	359

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**

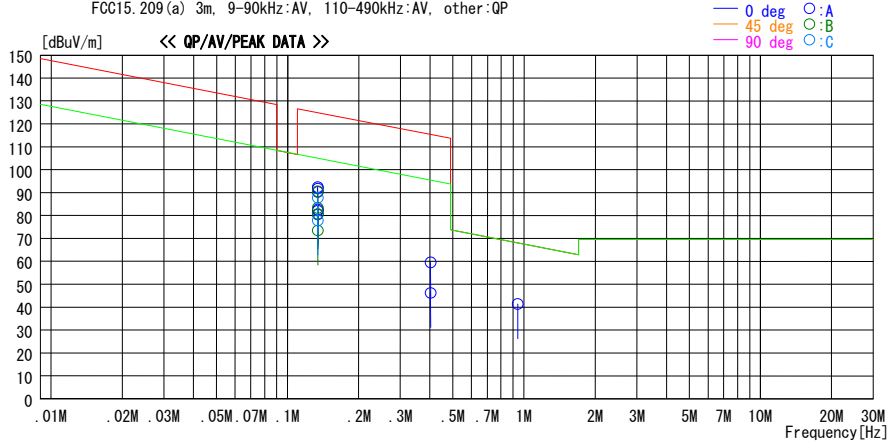
UL Japan, Inc. Head Office EMC Lab. No. 4 Semi Anechoic Chamber  
Date : 2010/06/27

Report No. : 32IE0037-HO

Temp. / Humi. : 22deg. C / 61%  
Engineer : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz, 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	98.7	PEAK	20.0	5.9	32.1	92.5	125.0	32.5	0	A	84 Worst
0.13420	93.9	PEAK	20.0	5.9	32.1	87.7	125.0	37.3	90	C	166
0.13420	96.8	PEAK	20.0	5.9	32.1	90.6	125.0	34.4	45	B	54
0.13420	84.1	AV	20.0	5.9	32.1	77.9	105.0	27.1	90	C	166
0.13420	88.8	AV	20.0	5.9	32.1	82.6	105.0	22.4	0	A	84 Worst
0.13420	96.5	PEAK	20.0	5.9	32.1	90.3	125.0	34.7	135	A	120
0.13420	86.7	AV	20.0	5.9	32.1	80.5	105.0	24.5	135	A	120
0.13420	98.0	PEAK	20.0	5.9	32.1	91.8	125.0	33.2	180	A	84
0.13420	88.3	AV	20.0	5.9	32.1	82.1	105.0	22.9	180	A	84
0.13420	87.0	AV	20.0	5.9	32.1	80.8	105.0	24.2	45	B	54
0.13420	89.5	PEAK	20.0	5.9	32.1	83.3	125.0	41.7	0	B	81 Hori
0.13420	79.7	AV	20.0	5.9	32.1	73.5	105.0	31.5	0	B	81 Hori
0.40260	65.8	PEAK	19.8	6.0	32.1	59.5	115.5	56.0	0	A	89
0.40260	52.5	AV	19.8	6.0	32.1	46.2	95.5	49.3	0	A	89
0.93940	47.6	QP	19.8	6.0	32.0	41.4	68.1	26.7	0	A	83

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 below 30MHz (Fundamental and Spurious Emission)**  
**Room Antenna / Luggage Antenna Minimum Output**

**DATA OF RADIATED EMISSION TEST**

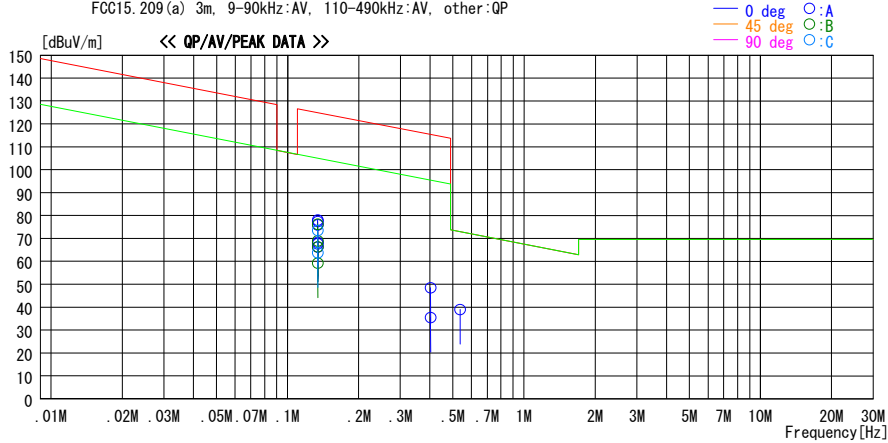
UL Japan, Inc. Head Office EMC Lab. No. 4 Semi Anechoic Chamber  
Date : 2010/06/27

Report No. : 32IE0037-HO

Temp. / Humi. : 22deg. C / 61%  
Engineer : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz, 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. [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]	[deg]	
0.13420	82.4	PEAK	20.0	5.9	32.1	76.2	125.0	48.8	45	B	47	Worst
0.13420	84.3	PEAK	20.0	5.9	32.1	78.1	125.0	46.9	0	A	77	
0.13420	79.7	PEAK	20.0	5.9	32.1	73.5	125.0	51.5	90	C	167	
0.13420	70.0	AV	20.0	5.9	32.1	63.8	105.0	41.2	90	C	167	Worst
0.13420	74.5	AV	20.0	5.9	32.1	68.3	105.0	36.7	0	A	77	
0.13420	82.2	PEAK	20.0	5.9	32.1	76.0	125.0	49.0	135	A	120	
0.13420	72.4	AV	20.0	5.9	32.1	66.2	105.0	38.8	135	A	120	Hori
0.13420	83.7	PEAK	20.0	5.9	32.1	77.5	125.0	47.5	180	A	88	
0.13420	73.9	AV	20.0	5.9	32.1	67.7	105.0	37.3	180	A	88	
0.13420	72.6	AV	20.0	5.9	32.1	66.4	105.0	38.6	45	B	47	Hori
0.13420	75.2	PEAK	20.0	5.9	32.1	69.0	125.0	56.0	0	B	87	
0.13420	65.4	AV	20.0	5.9	32.1	59.2	105.0	45.8	0	B	87	
0.40260	54.8	PEAK	19.8	6.0	32.1	48.5	115.5	67.0	0	A	75	75
0.40260	41.7	AV	19.8	6.0	32.1	35.4	95.5	60.1	0	A	75	
0.53680	45.2	QP	19.8	6.0	32.1	38.9	73.0	34.1	0	A	87	

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 above 30MHz (Spurious Emission)**  
**Door Antenna**

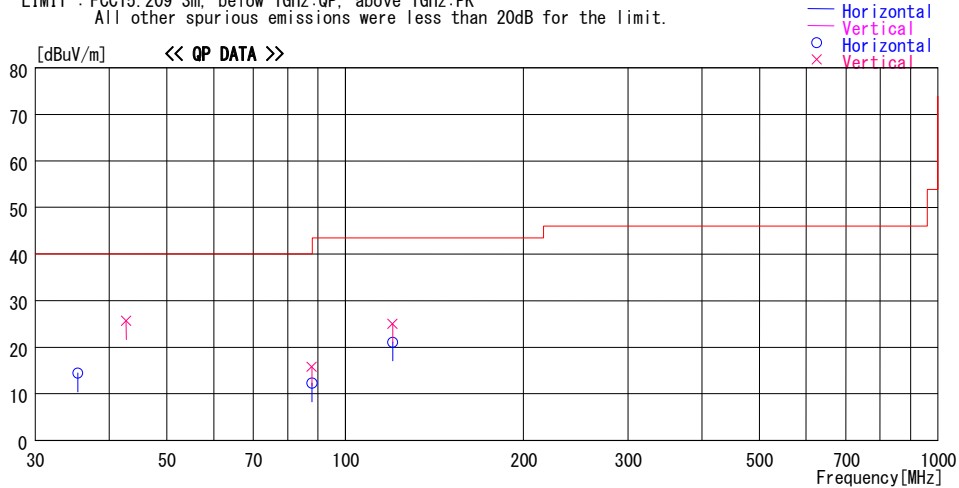
**DATA OF RADIATED EMISSION TEST**

UL Japan, Inc. Head Office EMC Lab. No.4 Anechoic Chamber  
Date : 2010/06/29

Report No. : 32IE0037-HO  
Temp./Humi. : 24deg. C. / 56%  
Engineer : Kazuya Yoshioka

Mode / Remarks : Tx 134.2kHz, 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		Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Loss & Gain [dB]							
35.396	23.0	QP	16.4	-24.9	14.5	360	180	Hori.	40.0	25.5	
42.702	36.8	QP	13.7	-24.8	25.7	112	100	Vert.	40.0	14.3	
87.837	28.8	QP	7.8	-24.3	12.3	335	240	Hori.	40.0	27.7	
87.844	32.3	QP	7.8	-24.3	15.8	105	100	Vert.	40.0	24.2	
120.241	31.6	QP	13.3	-23.8	21.1	186	273	Hori.	43.5	22.4	
120.241	35.5	QP	13.3	-23.8	25.0	270	100	Vert.	43.5	18.5	

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 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**

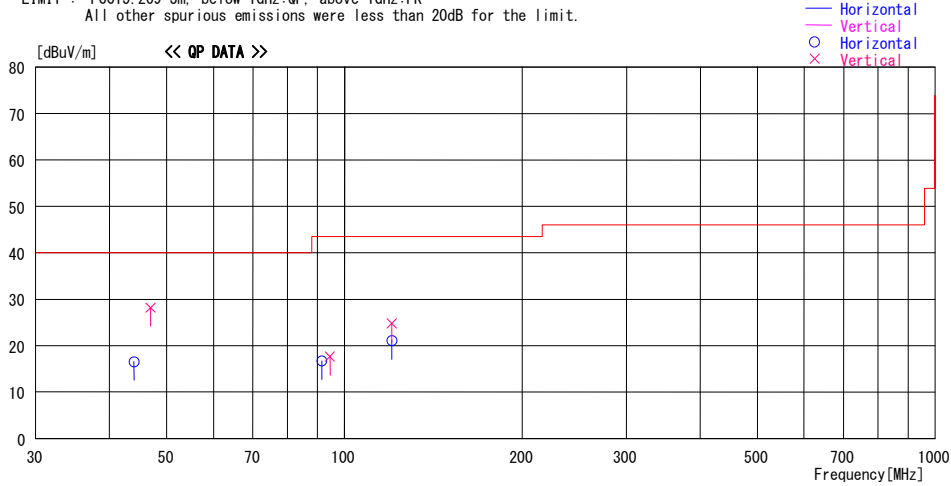
**DATA OF RADIATED EMISSION TEST**

UL Japan, Inc. Head Office EMC Lab. No. 4 Anechoic Chamber  
Date : 2010/06/29

Report No. : 32IE0037-HO  
Temp./Humi. : 24deg. C. / 56%  
Engineer : Kazuya Yoshioka

Mode / Remarks : Tx 134.2kHz, 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 [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Gain [dB]							
44.018	28.1	QP	13.2	-24.7	16.6	166	400	Hori.	40.0	23.4	
46.971	40.6	QP	12.2	-24.6	28.2	177	100	Vert.	40.0	11.8	
91.522	32.4	QP	8.5	-24.2	16.7	178	246	Hori.	43.5	26.8	
94.469	32.7	QP	9.1	-24.1	17.7	105	100	Vert.	43.5	25.8	
120.243	31.6	QP	13.3	-23.8	21.1	359	289	Hori.	43.5	22.4	
120.242	35.3	QP	13.3	-23.8	24.8	269	100	Vert.	43.5	18.7	

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 Maximum Output**

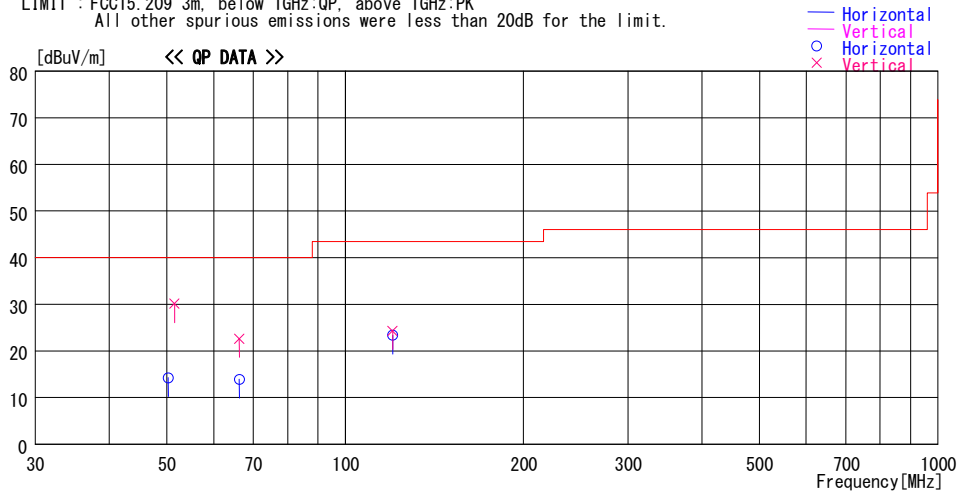
**DATA OF RADIATED EMISSION TEST**

UL Japan, Inc. Head Office EMC Lab. No.4 Anechoic Chamber  
Date : 2010/06/29

Report No. : 32IE0037-HO  
Temp./Humi. : 24deg.C. / 56%  
Engineer : Kazuya Yoshioka

Mode / Remarks : Tx 134.2kHz, 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		Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Loss & Gain [dB]							
50.266	27.7	QP	11.1	-24.6	14.2	174	322	Hori.	40.0	25.8	
51.535	44.1	QP	10.6	-24.6	30.1	192	100	Vert.	40.0	9.9	
66.289	40.1	QP	7.0	-24.5	22.6	271	100	Vert.	40.0	17.4	
66.301	31.4	QP	7.0	-24.5	13.9	193	249	Hori.	40.0	26.1	
120.252	33.9	QP	13.3	-23.8	23.4	359	295	Hori.	43.5	20.1	
120.247	34.8	QP	13.3	-23.8	24.3	278	100	Vert.	43.5	19.2	

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**

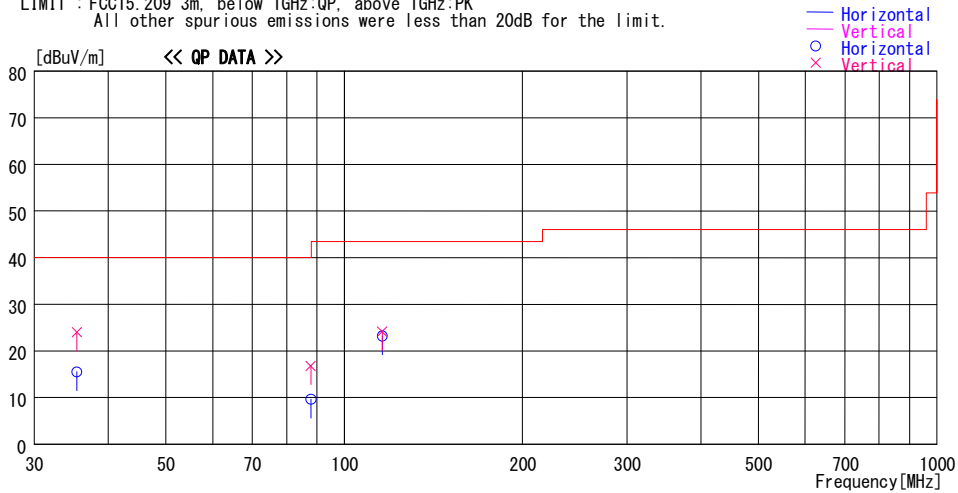
**DATA OF RADIATED EMISSION TEST**

UL Japan, Inc. Head Office EMC Lab. No.4 Anechoic Chamber  
Date : 2010/07/02

Report No. : 32IE0037-HO  
Temp./Humi. : 23deg.C. / 62%  
Engineer : Kazuya Yoshioka

Mode / Remarks : Tx 134.2kHz, 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		Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Loss & Gain [dB]							
35.387	32.5	QP	16.4	-24.9	24.0	77	100	Vert.	40.0	16.0	
35.387	24.0	QP	16.4	-24.9	15.5	159	400	Hori.	40.0	24.5	
87.860	26.1	QP	7.8	-24.3	9.6	196	223	Hori.	40.0	30.4	
87.852	33.3	QP	7.8	-24.3	16.8	272	100	Vert.	40.0	23.2	
115.952	34.4	QP	12.7	-23.9	23.2	359	279	Hori.	43.5	20.3	
115.944	35.3	QP	12.7	-23.9	24.1	266	100	Vert.	43.5	19.4	

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 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**

Head Office EMC Lab. No.4 Semi Anechoic Chamber

REPORT NO : 32IE0037-HO

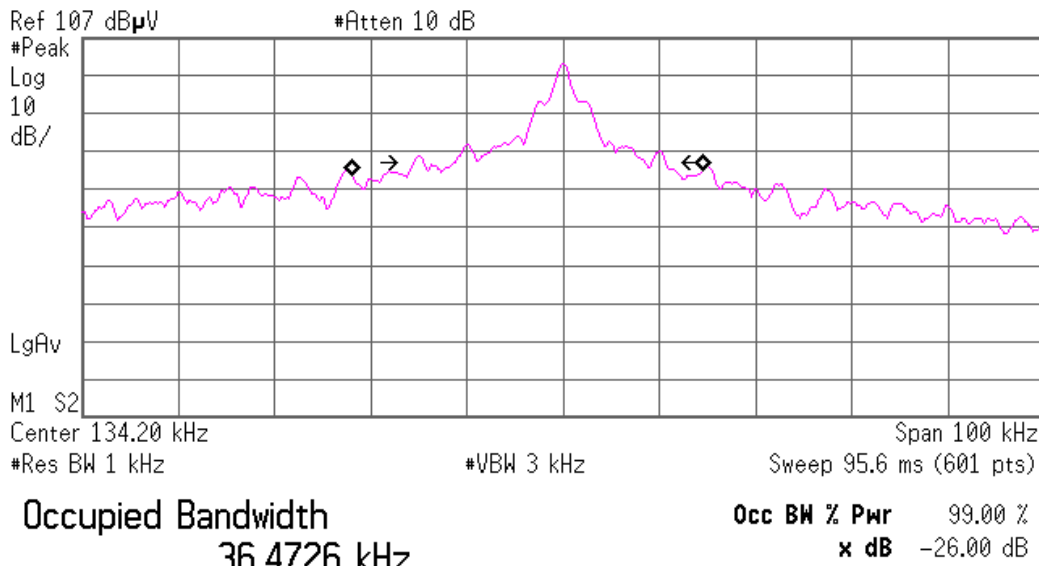
POWER : DC 12.0V  
 MODE : Tx  
 : Door Antenna

TEST DISTANCE : 3m  
 DATE : 06/27/2010  
 TEMPERATURE : 22 deg.C  
 HUMIDITY : 61 %  
 Engineer : Keisuke Kawamura

	FREQ	-26dB Bandwidth	99% Occupied Bandwidth
	[kHz]	[kHz]	[kHz]
	134.2	26.100	36.473

Agilent

R T



Transmit Freq Error -3.773 kHz  
 x dB Bandwidth 26.100 kHz

**-26dB Bandwidth and 99% Occupied Bandwidth**  
**Trunk Antenna**

Head Office EMC Lab. No.4 Semi Anechoic Chamber

REPORT NO : 32IE0037-HO

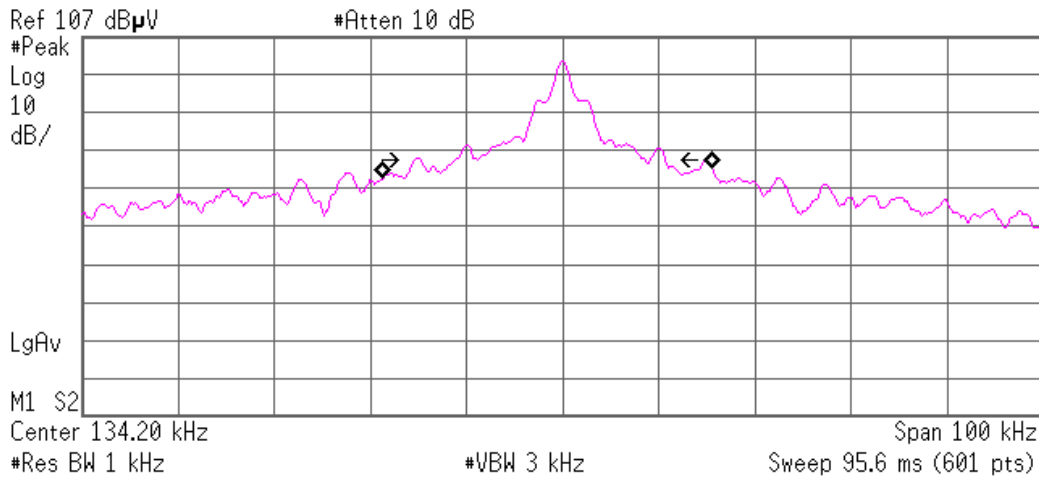
TEST DISTANCE : 3m  
 DATE : 06/27/2010  
 TEMPERATURE : 22 deg.C  
 HUMIDITY : 61 %  
 Engineer : Keisuke Kawamura

POWER : DC 12.0V  
 MODE : Tx  
 : Trunk Antenna

	FREQ	-26dB Bandwidth	99% Occupied Bandwidth
	[kHz]	[kHz]	[kHz]
	134.2	26.107	34.180

Agilent

R T



**Occupied Bandwidth**  
**34.1804 kHz**

**Occ BW % Pwr** 99.00 %  
**x dB** -26.00 dB

**Transmit Freq Error** -1.525 kHz  
**x dB Bandwidth** 26.107 kHz

**-26dB Bandwidth and 99% Occupied Bandwidth**  
**Room Antenna / Luggage Antenna**

Head Office EMC Lab. No.4 Semi Anechoic Chamber

REPORT NO : 32IE0037-HO

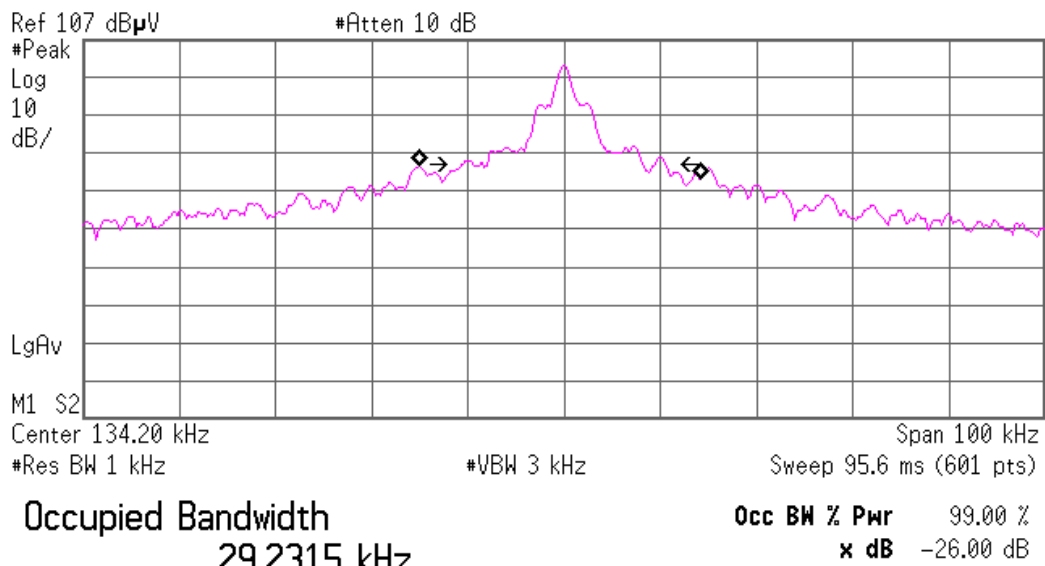
TEST DISTANCE : 3m  
 DATE : 06/27/2010  
 TEMPERATURE : 22 deg.C  
 HUMIDITY : 61 %  
 Engineer : Keisuke Kawamura

POWER : DC 12.0V  
 MODE : Tx  
 : Room Antenna / Luggage Antenna

	FREQ	-26dB Bandwidth	99% Occupied Bandwidth
	[kHz]	[kHz]	[kHz]
	134.2	21.066	29.232

Agilent

R T



Transmit Freq Error -467.235 Hz  
 x dB Bandwidth 21.066 kHz

### **APPENDIX 3: Test instruments**

#### **EMI test equipment**

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2010/02/02 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	-	RE	2010/02/09 * 12
MJM-07	Measure	PROMART	SEN1955	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-05	Spectrum Analyzer	Advantest	R3273	160400285	RE	2009/12/15 * 12
MTR-07	Test Receiver	Rohde & Schwarz	ESCI	100635	RE	2009/10/23 * 12
MLPA-02	Loop Antenna	Rohde & Schwarz	HFH2-Z2	836553/009	RE	2009/11/19 * 12
MCC-113	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(5m)/421-010(1m)/sucoform141-PE(1m)/RFM-E121(Switcher)	-/04178	RE	2009/07/01 * 12
MCC-31	Coaxial cable	UL Japan	-	-	RE	2009/06/22 * 12 *1)
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2010/03/05 * 12
MAT-51	Attenuator(6dB)	Weinschel	2	AS3557	RE	2010/01/20 * 12
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2010/02/03 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2010/03/22 * 12
MLA-08	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	N/A	RE	2010/01/23 * 12
MCC-50	Coaxial cable	UL Japan	-	-	RE	2010/03/18 * 12

\*1) Used for test on June 27, 2010

**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.**

**Head Office EMC Lab.**

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

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