



RADIO TEST REPORT

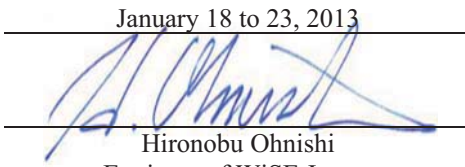
Test Report No. : 10003596H

Applicant : Toyota Motor Corporation
Type of Equipment : Smart LF Oscillator
Model No. : TMLF10-6
FCC ID : NI4TMLF10-6
Test regulation : FCC Part 15 Subpart C 2012
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: January 18 to 23, 2013

Representative test engineer:


Hironobu Ohnishi
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.

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

13-EM-F0429

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	7
SECTION 5: Radiated emission (Fundamental and Spurious Emission)	8
SECTION 6: -26dB Bandwidth.....	10
SECTION 7: 99% Occupied Bandwidth.....	10
APPENDIX 1: Photographs of test setup	11
Radiated emission.....	11
Worst Case Position	14
APPENDIX 2: Data of EMI test.....	16
Radiated Emission below 30MHz (Fundamental and Spurious Emission)	16
-26dB Bandwidth and 99% Occupied Bandwidth	24
APPENDIX 3: Test instruments	27

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. : TMLF10-6
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC12.0V (Max 0.5A)
Receipt Date of Sample : January 18, 2013
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: TMLF10-6 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: TMLF10-6) 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 Part 15 Subpart C: 2012, final revised on August 13, 2012 and effective September 12, 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

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> ANSI C63.4:2003 7. AC powerline conducted emission measurements <IC> RSS-Gen 7.2.4	<FCC> Section 15.207 <IC> RSS-Gen 7.2.4	-	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 2.5.1 RSS-Gen 7.2.5	Radiated	N/A	22.9dB 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 2.5.1 RSS-Gen 7.2.5	Radiated	N/A	11.3dB 47.240MHz, Vertical, QP (Trunk 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.

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

3.3 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	4.3dB	5.0dB	5.1dB	4.9dB	5.8dB	4.4dB	4.3dB
No.2	4.3dB	5.2dB	5.1dB	5.0dB	5.7dB	4.3dB	4.2dB
No.3	4.6dB	5.0dB	5.1dB	5.0dB	5.7dB	4.5dB	4.2dB
No.4	4.8dB	5.2dB	5.0dB	5.0dB	5.7dB	5.2dB	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.

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.

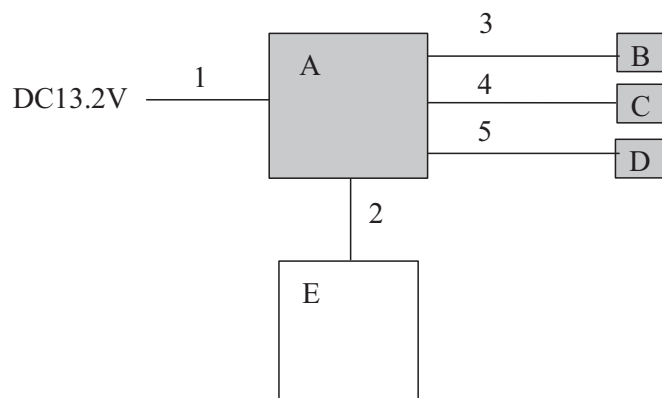
SECTION 4: Operation of E.U.T. during testing

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.
* The test was performed with the representative component which constitute a system.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Computer Assy, Smart Key (ECU)	-	001 *1) 002 *2)	-	EUT
B	Door Antenna	-	001	-	EUT
C	Room Antenna / Luggage Antenna	-	001	-	EUT
D	Trunk Antenna	-	001	-	EUT
E	Jig Box	-	-	-	-

*1) Used for Operation mode “1”).

*2) Used for Operation mode “2”).

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	2.5	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 and 3 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., 135 deg., 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: November 29 and 30, 2012

Test engineer: Hironobu Ohnishi

UL Japan, Inc.

Head Office EMC Lab.

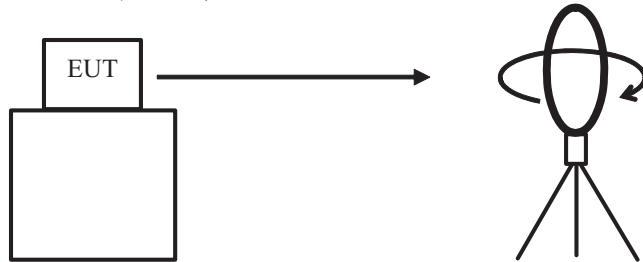
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

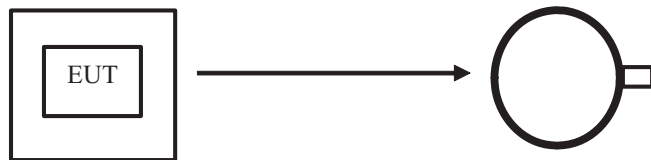
Facsimile : +81 596 24 8124

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

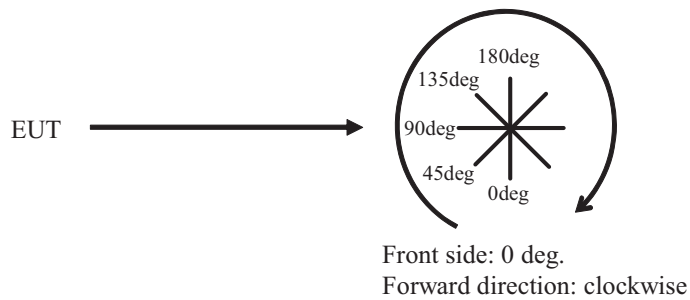


Top View (Horizontal)



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**

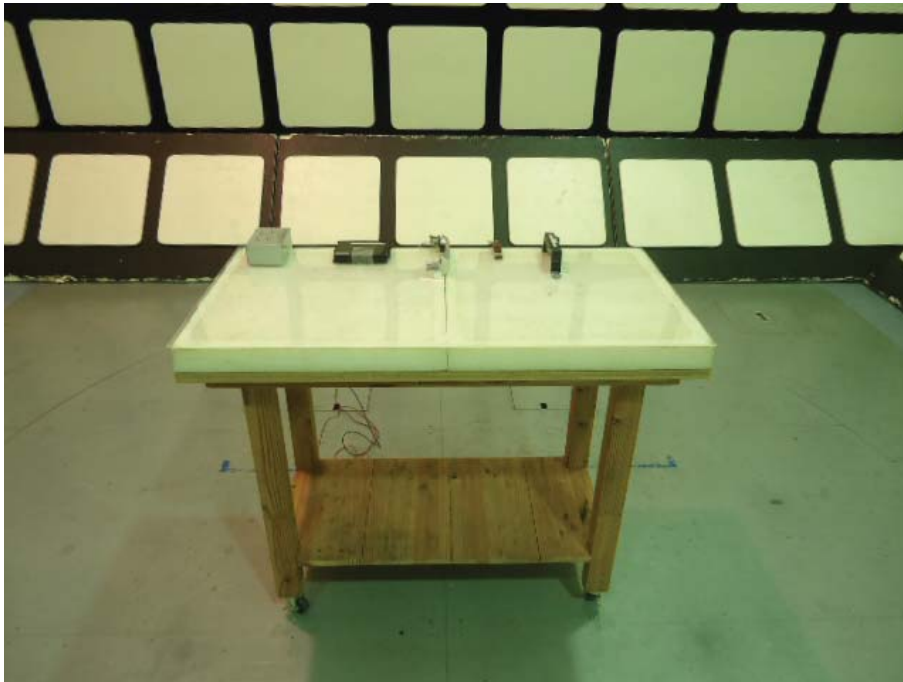


Photo 1

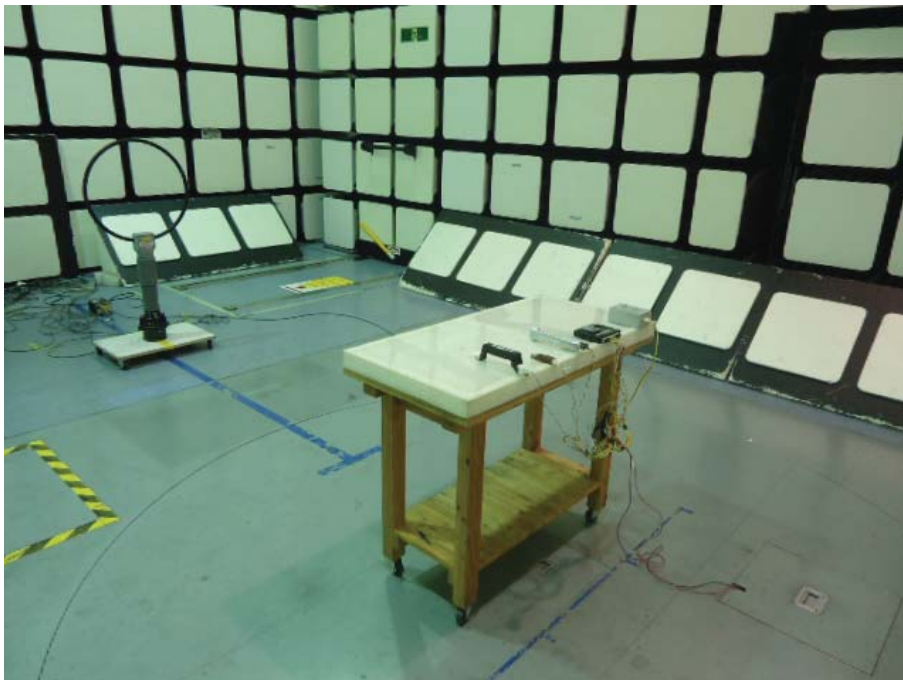


Photo 2

Radiated emission
Trunk Antenna



Photo 1

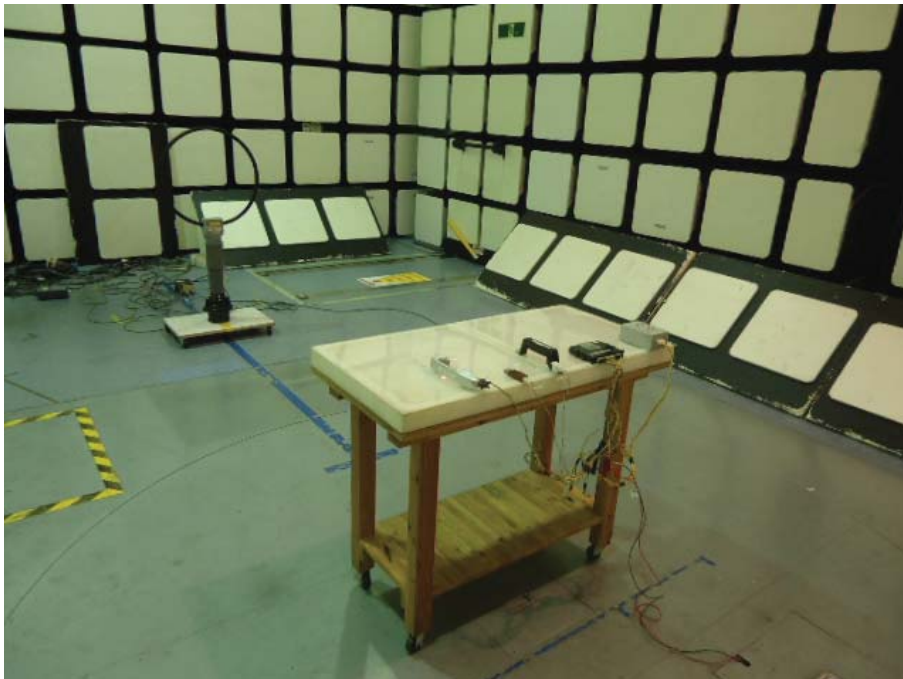


Photo 2

Radiated emission
Room Antenna / Luggage Antenna



Photo 1

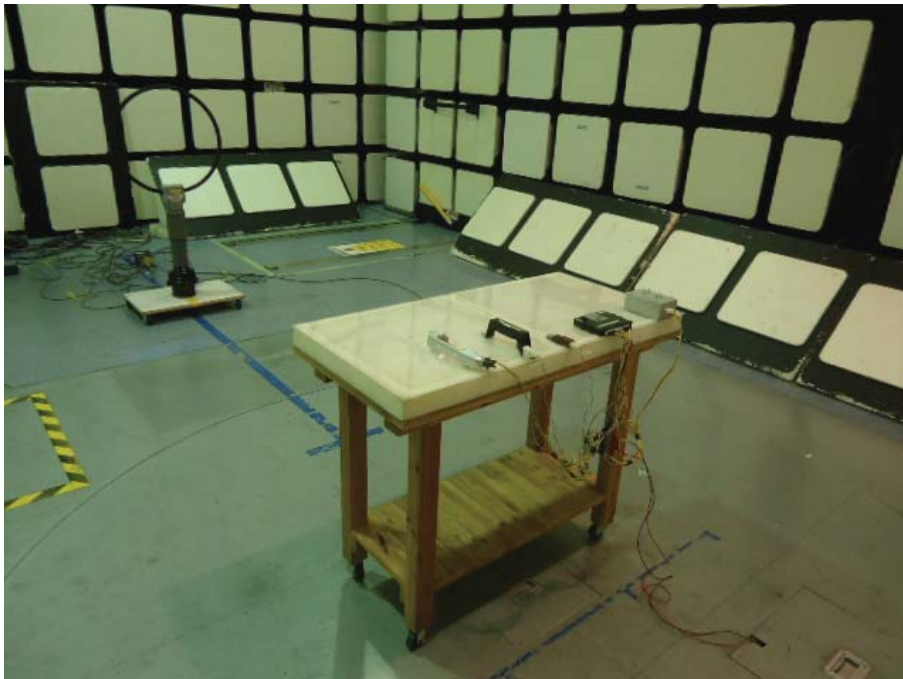
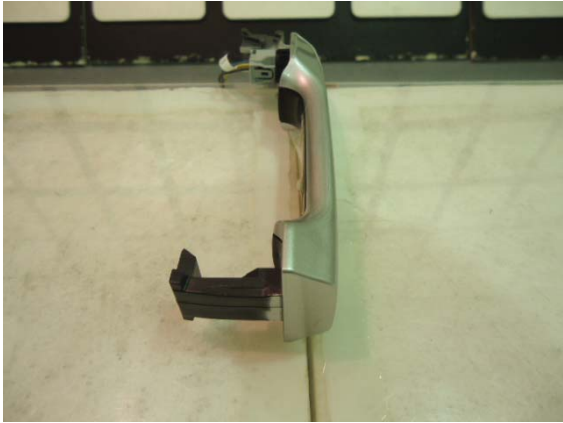


Photo 2

Worst Case Position

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



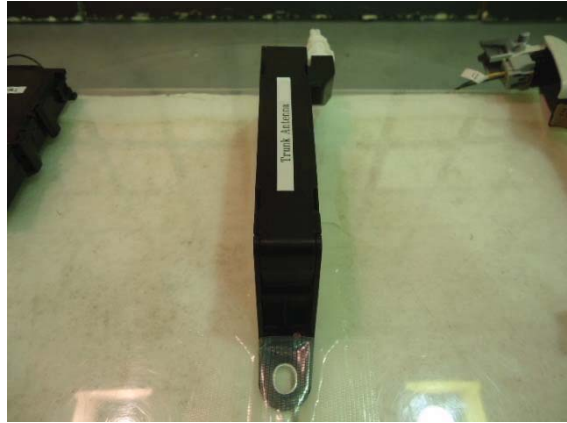
Y-axis



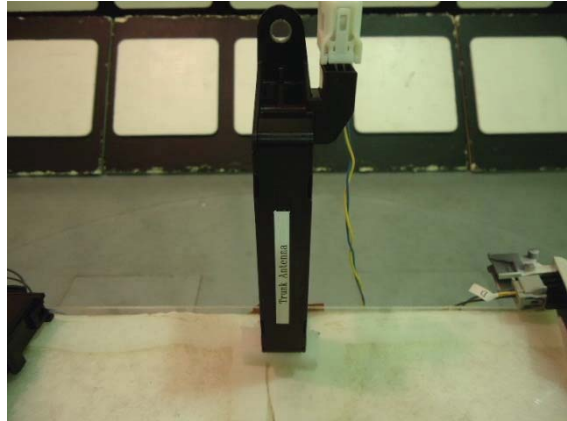
Z-axis



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



Y-axis



Z-axis



UL Japan, Inc.

Head Office EMC Lab.

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

Telephone : +81 596 24 8116

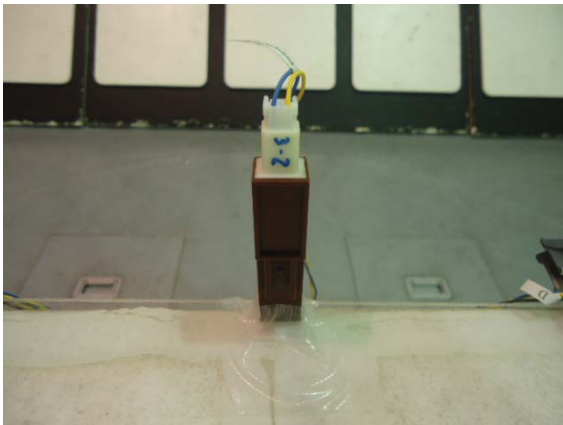
Facsimile : +81 596 24 8124

Worst Case Position

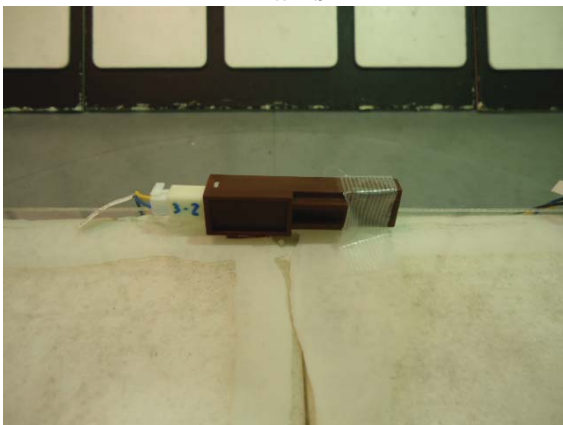
Room Antenna / Luggage Antenna
Below 30MHz:-Xaxis
Above 30MHz(Hori:X-axis /Vert:X-axis)
X-axis



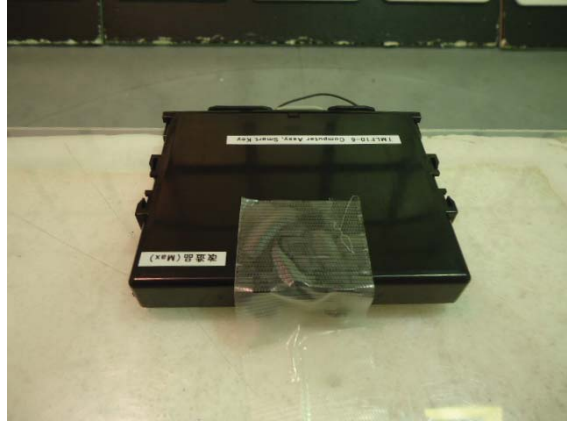
Y-axis



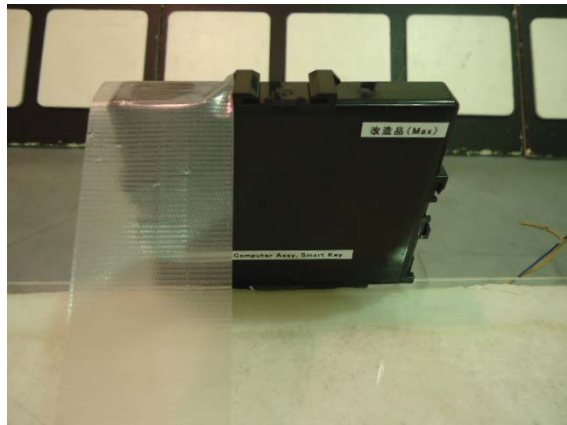
Z-axis



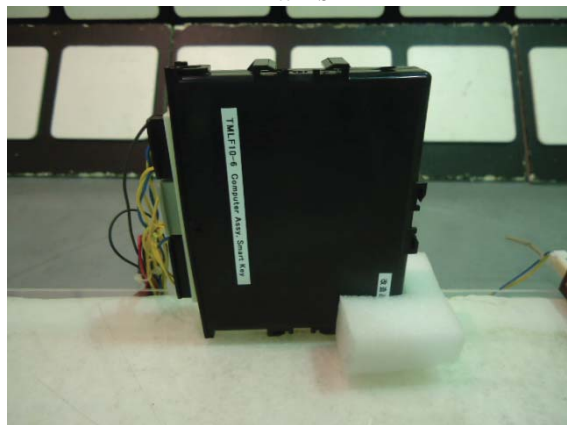
ECU
Below 30MHz:X-axis
Above 30MHz(Hori:X-axis /Vert:X-axis)
X-axis



Y-axis



Z-axis



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 2: Data of EMI test

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

DATA OF RADIATED EMISSION TEST

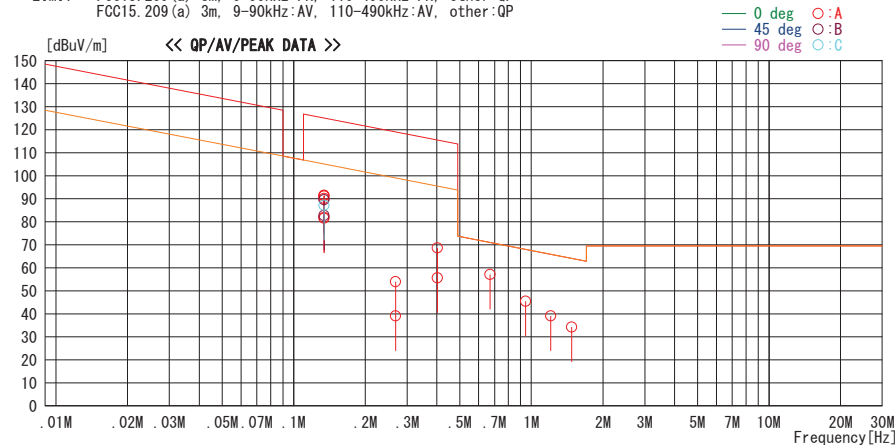
UL Japan, Inc. Head Office EMC Lab. No. 2 Semi Anechoic Chamber
Date : 2013/01/18

Report No. : 10003596H

Temp. / Humi. : 20deg. C / 34% RH
Engineer : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz Modulation On Door Antenna Worst-Axis: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	98.6	PEAK	19.2	6.0	32.2	91.6	125.1	33.5	0	A	359 Axis-X *
0.13420	96.5	PEAK	19.2	6.0	32.2	89.5	125.1	35.6	45	B	333 Axis-X
0.13420	94.2	PEAK	19.2	6.0	32.2	87.2	125.1	37.9	90	C	85 Axis-X
0.13420	88.9	AV	19.2	6.0	32.2	81.9	105.1	23.2	0	A	359 Axis-X *
0.13420	97.1	PEAK	19.2	6.0	32.2	90.1	125.1	35.0	135	A	29 Axis-X
0.13420	89.8	PEAK	19.2	6.0	32.2	82.8	125.1	42.3	0	B	359 Axis-X Hori
0.13420	98.3	PEAK	19.2	6.0	32.2	91.3	125.1	33.8	0	A	359 Ant:X ECU:Y
0.13420	98.3	PEAK	19.2	6.0	32.2	91.3	125.1	33.8	0	A	359 Ant:X ECU:Z
0.13420	88.6	AV	19.2	6.0	32.2	81.6	105.1	23.5	0	A	359 Ant:X ECU:Z
0.26840	60.8	PEAK	19.1	6.1	32.1	53.9	119.0	65.1	0	A	170
0.26840	46.0	AV	19.1	6.1	32.1	39.1	99.0	59.9	0	A	170
0.40260	75.5	PEAK	19.1	6.1	32.1	68.6	115.5	46.9	0	A	359
0.40260	62.5	AV	19.1	6.1	32.1	55.6	95.5	39.9	0	A	359
0.67100	63.9	QP	19.2	6.2	32.1	57.2	71.1	13.9	0	A	359
0.94600	52.1	QP	19.2	6.2	32.1	45.4	68.0	22.6	0	A	359
1.20780	45.9	QP	19.1	6.2	32.1	39.1	65.9	26.8	0	A	359
1.47620	41.0	QP	19.1	6.3	32.1	34.3	64.2	29.9	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)
Trunk Antenna

DATA OF RADIATED EMISSION TEST

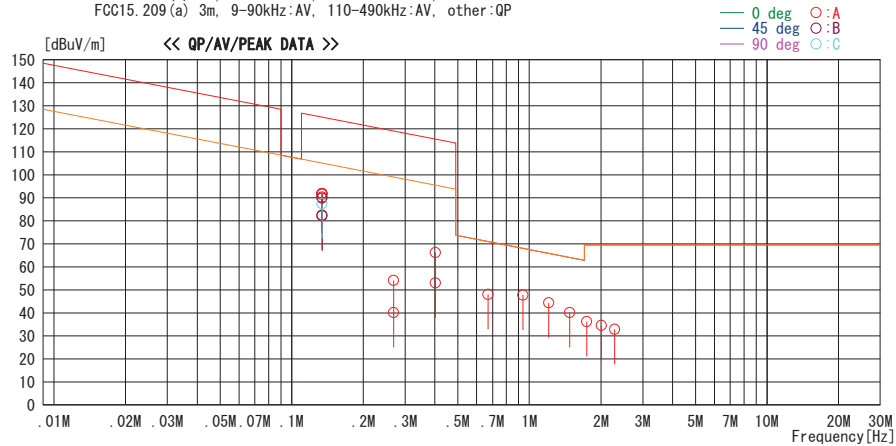
UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2013/01/18

Report No. : 10003596H

Temp./ Humi. : 20deg.C / 34% RH
Engineer : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz Modulation On Trunk Antenna Worst-Axis: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	98.9	PEAK	19.2	6.0	32.2	91.9	125.1	33.2	0	A	359 Axis:X *
0.13420	96.8	PEAK	19.2	6.0	32.2	89.8	125.1	35.3	45	B	145 Axis:X
0.13420	94.5	PEAK	19.2	6.0	32.2	87.5	125.1	37.6	90	C	78 Axis:X
0.13420	89.2	AV	19.2	6.0	32.2	82.2	105.1	22.9	0	A	359 Axis:X *
0.13420	97.3	PEAK	19.2	6.0	32.2	90.3	125.1	34.8	135	A	27 Axis:X
0.13420	98.8	PEAK	19.2	6.0	32.2	91.8	125.1	33.3	0	A	359 Ant:X ECU:Y
0.13420	98.8	PEAK	19.2	6.0	32.2	91.8	125.1	33.3	0	A	359 Ant:X ECU:Z
0.13420	98.6	PEAK	19.2	6.0	32.2	91.6	125.1	33.5	180	A	359 Axis:X
0.13420	89.5	PEAK	19.2	6.0	32.2	82.5	125.1	42.6	0	B	166 Axis:X Hori
0.26840	61.0	PEAK	19.1	6.1	32.1	54.1	119.0	64.9	0	A	185
0.26840	47.1	AV	19.1	6.1	32.1	40.2	99.0	58.8	0	A	185
0.40260	73.1	PEAK	19.1	6.1	32.1	66.2	115.5	49.3	0	A	359
0.40260	59.9	AV	19.1	6.1	32.1	53.0	95.5	42.5	0	A	359
0.67100	54.7	QP	19.2	6.2	32.1	48.0	71.1	23.1	0	A	359
0.93940	54.5	QP	19.2	6.2	32.1	47.8	68.1	20.3	0	A	359
1.20780	51.2	QP	19.1	6.2	32.1	44.4	65.9	21.5	0	A	359
1.47620	46.9	QP	19.1	6.3	32.1	40.2	64.2	24.0	0	A	359
1.74460	43.0	QP	19.1	6.3	32.1	36.3	69.5	33.2	0	A	359
2.01300	41.1	QP	19.2	6.3	32.1	34.5	69.5	35.0	0	A	359
2.28140	39.5	QP	19.2	6.3	32.1	32.9	69.5	36.6	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 Maximum Output

DATA OF RADIATED EMISSION TEST

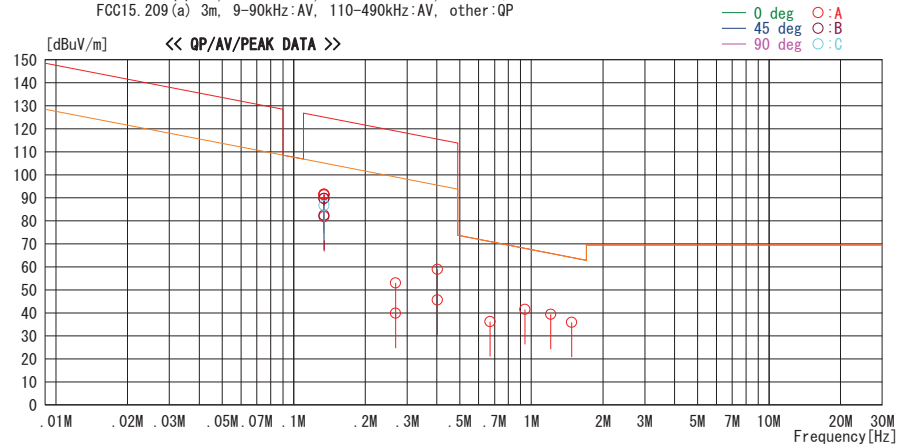
UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2013/01/18

Report No. : 10003596H

Temp./ Humi. : 20deg.C / 34% RH
Engineer : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz Modulation On Room/Luggage Antenna Worst-Axis: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	98.6	PEAK	19.2	6.0	32.2	91.6	125.1	33.5	0	A	177 Axis:X *
0.13420	96.7	PEAK	19.2	6.0	32.2	89.7	125.1	35.4	45	B	151 Axis:X
0.13420	93.7	PEAK	19.2	6.0	32.2	86.7	125.1	38.4	90	C	92 Axis:X
0.13420	88.8	AV	19.2	6.0	32.2	81.8	105.1	23.3	0	A	177 Axis:X *
0.13420	96.7	PEAK	19.2	6.0	32.2	89.7	125.1	35.4	135	A	209 Axis:X
0.13420	98.5	PEAK	19.2	6.0	32.2	91.5	125.1	33.6	0	A	177 Ant:X ECU:Y
0.13420	98.5	PEAK	19.2	6.0	32.2	91.5	125.1	33.6	0	A	177 Ant:X ECU:Z
0.13420	89.5	PEAK	19.2	6.0	32.2	82.5	125.1	42.6	0	B	182 Axis:X Hori
0.13420	98.3	PEAK	19.2	6.0	32.2	91.3	125.1	33.8	180	A	183 Axis:X
0.26840	60.0	PEAK	19.1	6.1	32.1	53.1	119.0	65.9	0	A	181
0.26840	46.8	AV	19.1	6.1	32.1	39.9	99.0	59.1	0	A	181
0.40260	65.9	PEAK	19.1	6.1	32.1	59.0	115.5	56.5	0	A	179
0.40260	52.6	AV	19.1	6.1	32.1	45.7	95.5	49.8	0	A	179
0.67100	42.9	QP	19.2	6.2	32.1	36.2	71.1	34.9	0	A	189
0.93940	48.3	QP	19.2	6.2	32.1	41.6	68.1	26.5	0	A	178
1.20780	46.2	QP	19.1	6.2	32.1	39.4	65.9	26.5	0	A	184
1.47620	42.7	QP	19.1	6.3	32.1	36.0	64.2	28.2	0	A	186

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 Minimum Output

DATA OF RADIATED EMISSION TEST

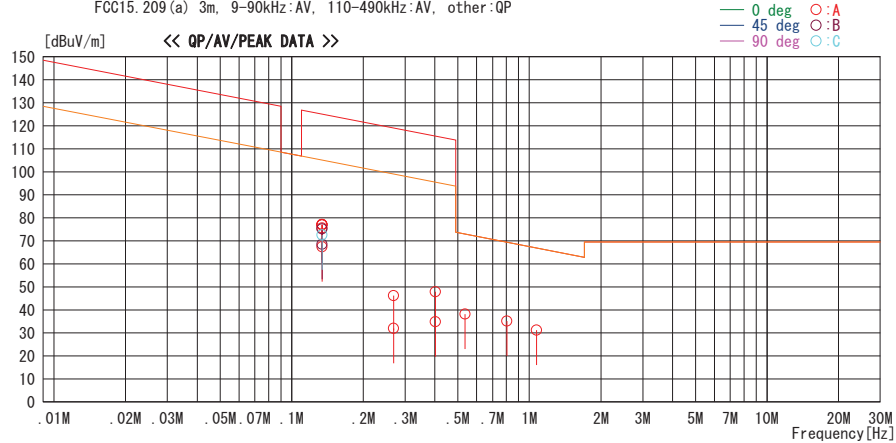
UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2013/01/18

Report No. : 10003596H

Temp./ Humi. : 20deg.C / 34% RH
Engineer : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz Modulation On Room/Luggage Antenna(Min) Worst-Axis: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	84.1	PEAK	19.2	6.0	32.2	77.1	125.1	48.0	0	A	181 Axis:X
0.13420	82.1	PEAK	19.2	6.0	32.2	75.1	125.1	50.0	45	B	147 Axis:X
0.13420	79.6	PEAK	19.2	6.0	32.2	72.6	125.1	52.5	90	C	273 Axis:X
0.13420	75.5	PEAK	19.2	6.0	32.2	68.5	125.1	56.6	45	B	147 Axis:X Hori
0.13420	74.4	AV	19.2	6.0	32.2	67.4	105.1	37.7	0	A	181 Axis:X
0.13420	84.0	PEAK	19.2	6.0	32.2	77.0	125.1	48.1	180	A	185 Axis:X
0.13420	84.0	PEAK	19.2	6.0	32.2	77.0	125.1	48.1	0	A	181 Ant:X ECU:Y
0.13420	84.0	PEAK	19.2	6.0	32.2	77.0	125.1	48.1	0	A	181 Ant:X ECU:Z
0.13420	82.6	PEAK	19.2	6.0	32.2	75.6	125.1	49.5	135	A	215 Axis:X
0.26840	53.1	PEAK	19.1	6.1	32.1	46.2	119.0	72.8	0	A	1
0.26840	38.9	AV	19.1	6.1	32.1	32.0	99.0	67.0	0	A	1
0.40260	54.8	PEAK	19.1	6.1	32.1	47.9	115.5	67.6	0	A	175
0.40260	41.7	AV	19.1	6.1	32.1	34.8	95.5	60.7	0	A	175
0.53680	45.1	QP	19.1	6.1	32.1	38.2	73.0	34.8	0	A	188
0.80520	41.9	QP	19.2	6.2	32.1	35.2	69.5	34.3	0	A	189
1.07360	38.0	QP	19.1	6.2	32.1	31.2	66.9	35.7	0	A	189

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

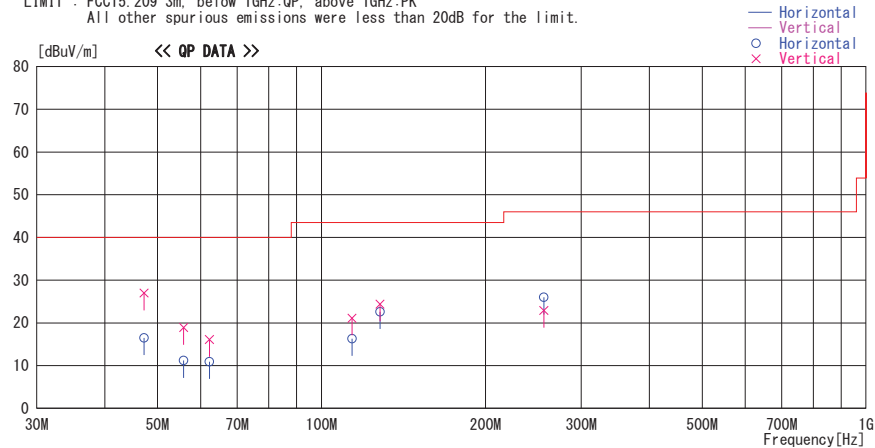
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2013/01/22

Report No. : 10003596H

Temp./Humi. : 25deg. C / 30% RH
Engineer : Hironobu Ohnishi

Mode / Remarks : Tx 134.2kHz Modulation On Door Antenna Worst-Axis (Hori: X, Vert: 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		Level	Angle	Height	Polar.	Limit	Margin	Comment
			Factor	Loss& Gain							
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
47.239	29.7	QP	11.6	-24.8	16.5	350	355	Hori.	40.0	23.5	
47.239	40.2	QP	11.6	-24.8	27.0	195	100	Vert.	40.0	13.0	
55.829	26.8	QP	9.1	-24.7	11.2	170	366	Hori.	40.0	28.8	
55.829	34.5	QP	9.1	-24.7	18.9	176	100	Vert.	40.0	21.1	
62.270	27.9	QP	7.6	-24.6	10.9	180	298	Hori.	40.0	29.1	
62.270	33.1	QP	7.6	-24.6	16.1	227	100	Vert.	40.0	23.9	
113.804	28.1	QP	12.2	-24.0	16.3	197	289	Hori.	43.5	27.2	
113.804	32.9	QP	12.2	-24.0	21.1	279	100	Vert.	43.5	22.4	
128.036	32.7	QP	13.7	-23.8	22.6	270	138	Hori.	43.5	20.9	
128.036	34.5	QP	13.7	-23.8	24.4	354	100	Vert.	43.5	19.1	
256.078	30.9	QP	17.6	-22.5	26.0	190	202	Hori.	46.0	20.0	
256.078	27.8	QP	17.6	-22.5	22.9	169	100	Vert.	46.0	23.1	

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

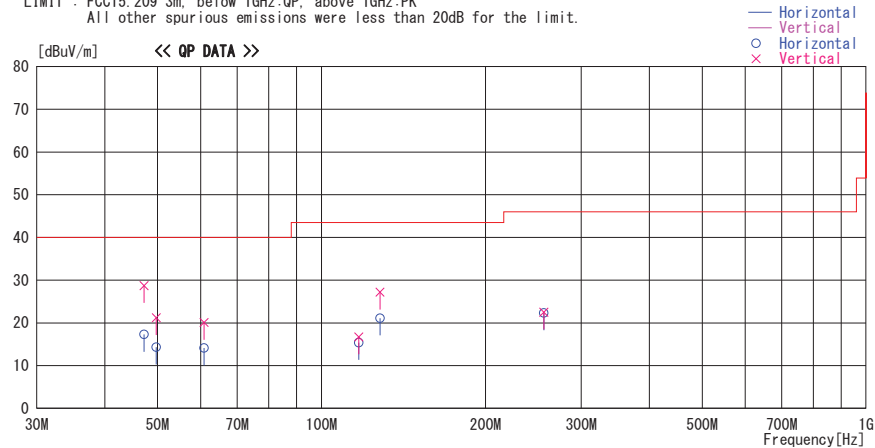
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2013/01/23

Report No. : 10003596H

Temp./Humi. : 25deg. C / 30% RH
Engineer : Hironobu Ohnishi

Mode / Remarks : Tx 134.2kHz Modulation On Trunk Antenna Worst-Axis (Hori: X, Vert: 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		Level	Angle	Height	Polar.	Limit	Margin	Comment
			Factor	Loss& Gain							
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
47.240	30.5	QP	11.6	-24.8	17.3	352	379	Hori.	40.0	22.7	
47.240	41.9	QP	11.6	-24.8	28.7	143	100	Vert.	40.0	11.3	
49.746	28.1	QP	10.9	-24.7	14.3	187	395	Hori.	40.0	25.7	
49.746	35.0	QP	10.9	-24.7	21.2	173	100	Vert.	40.0	18.8	
60.839	30.9	QP	7.8	-24.6	14.1	140	400	Hori.	40.0	25.9	
60.839	36.9	QP	7.8	-24.6	20.1	255	100	Vert.	40.0	19.9	
117.025	26.7	QP	12.6	-23.9	15.4	172	296	Hori.	43.5	28.1	
117.025	28.0	QP	12.6	-23.9	16.7	242	100	Vert.	43.5	26.8	
128.041	31.2	QP	13.7	-23.8	21.1	329	144	Hori.	43.5	22.4	
128.041	37.3	QP	13.7	-23.8	27.2	289	100	Vert.	43.5	16.3	
256.094	27.2	QP	17.6	-22.5	22.3	194	199	Hori.	46.0	23.7	
256.094	27.4	QP	17.6	-22.5	22.5	127	100	Vert.	46.0	23.5	

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)
Room Antenna / Luggage Antenna Maximum Output

DATA OF RADIATED EMISSION TEST

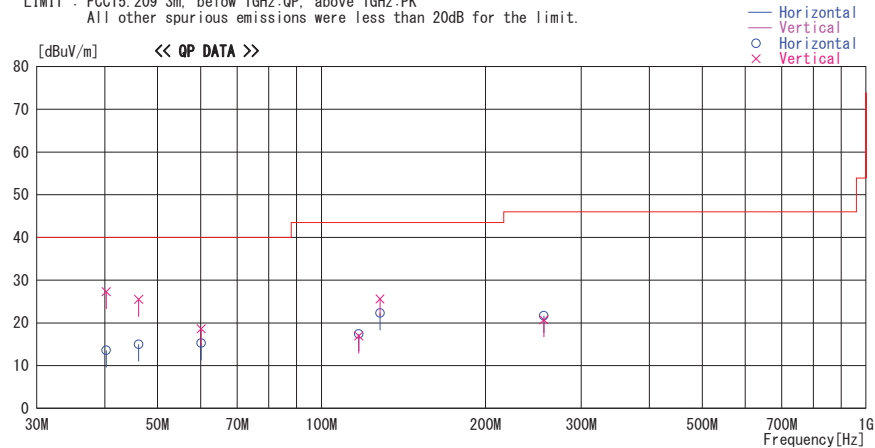
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2013/01/23

Report No. : 10003596H

Temp./Humi. : 25deg. C / 30% RH
Engineer : Hironobu Ohnishi

Mode / Remarks : Tx 134.2kHz Modulation On Room/Luggage Antenna Worst-Axis (Hori: X, Vert: 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	Loss&	Level	Angle	Height	Polar.	Limit	Margin	Comment
			Factor	Gain					[dBuV/m]	[dB]	
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]				
40.243	24.0	QP	14.5	-24.9	13.6	202	400	Hori.	40.0	26.4	
40.243	37.7	QP	14.5	-24.9	27.3	265	100	Vert.	40.0	12.7	
46.166	27.9	QP	11.9	-24.8	15.0	336	383	Hori.	40.0	25.0	
46.166	38.4	QP	11.9	-24.8	25.5	232	100	Vert.	40.0	14.5	
60.123	32.0	QP	7.9	-24.6	15.3	169	370	Hori.	40.0	24.7	
60.123	35.3	QP	7.9	-24.6	18.6	262	100	Vert.	40.0	21.4	
117.076	28.7	QP	12.6	-23.9	17.4	350	292	Hori.	43.5	26.1	
117.076	28.2	QP	12.6	-23.9	16.9	271	100	Vert.	43.5	26.6	
128.028	32.4	QP	13.7	-23.8	22.3	246	150	Hori.	43.5	21.2	
128.028	35.7	QP	13.7	-23.8	25.6	18	100	Vert.	43.5	17.9	
256.070	26.6	QP	17.6	-22.5	21.7	200	202	Hori.	46.0	24.3	
256.070	25.6	QP	17.6	-22.5	20.7	65	100	Vert.	46.0	25.3	

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 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.

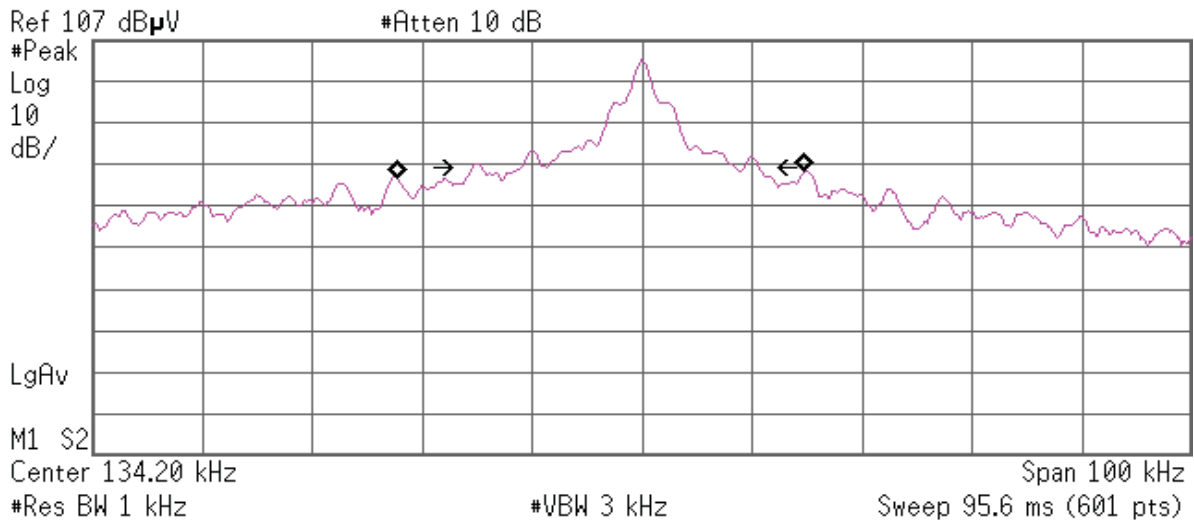
-26dB Bandwidth and 99% Occupied Bandwidth
Door Antenna

Report No. 1003596H
Test place Head Office EMC Lab.
Semi Anechoic Chamber No.2
Date 01/18/2013
Temperature / Humidity 20 deg. C / 34 % RH
Engineer Keisuke Kawamura
Mode Tx 134.2kHz Door Antenna

FREQ	-26dB Bandwidth	99% Occupied Bandwidth
[kHz]	[kHz]	[kHz]
134.2	26.121	37.090

Agilent

R T



Occupied Bandwidth
37.0902 kHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error -3.819 kHz
x dB Bandwidth 26.121 kHz

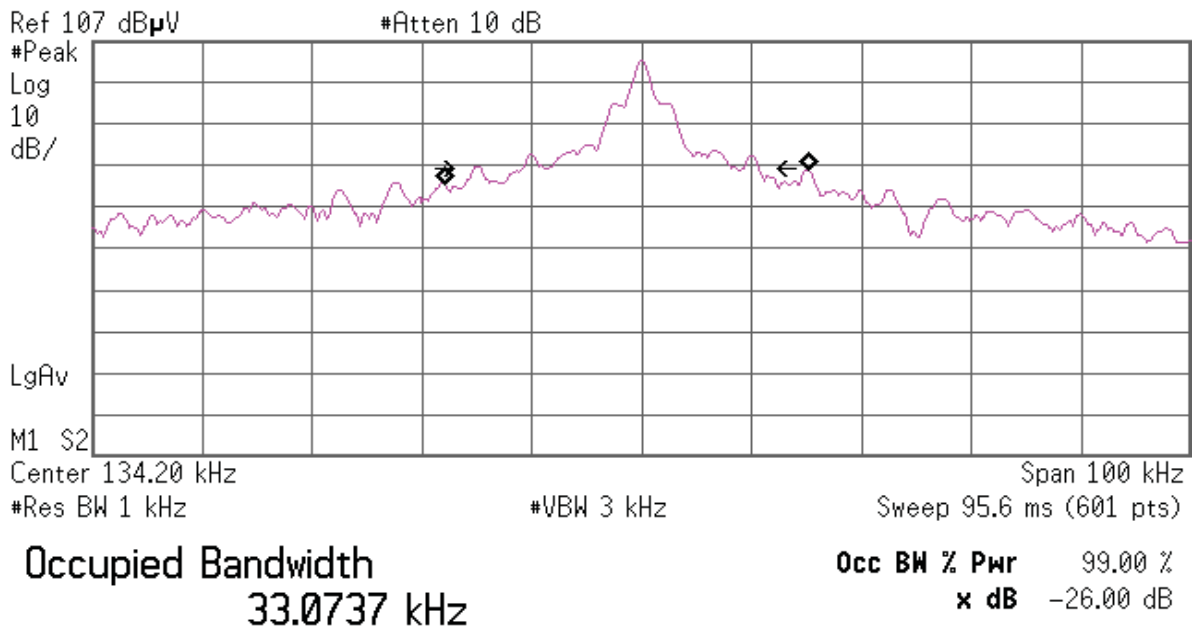
-26dB Bandwidth and 99% Occupied Bandwidth
Trunk Antenna

Report No. 1003596H
Test place Head Office EMC Lab.
Semi Anechoic Chamber No.2
Date 01/18/2013
Temperature / Humidity 20 deg. C / 34 % RH
Engineer Keisuke Kawamura
Mode Tx 134.2kHz Trunk Antenna

FREQ	-26dB Bandwidth	99% Occupied Bandwidth
[kHz]	[kHz]	[kHz]
134.2	25.978	33.074

Agilent

R T



Transmit Freq Error -1.403 kHz
x dB Bandwidth 25.978 kHz

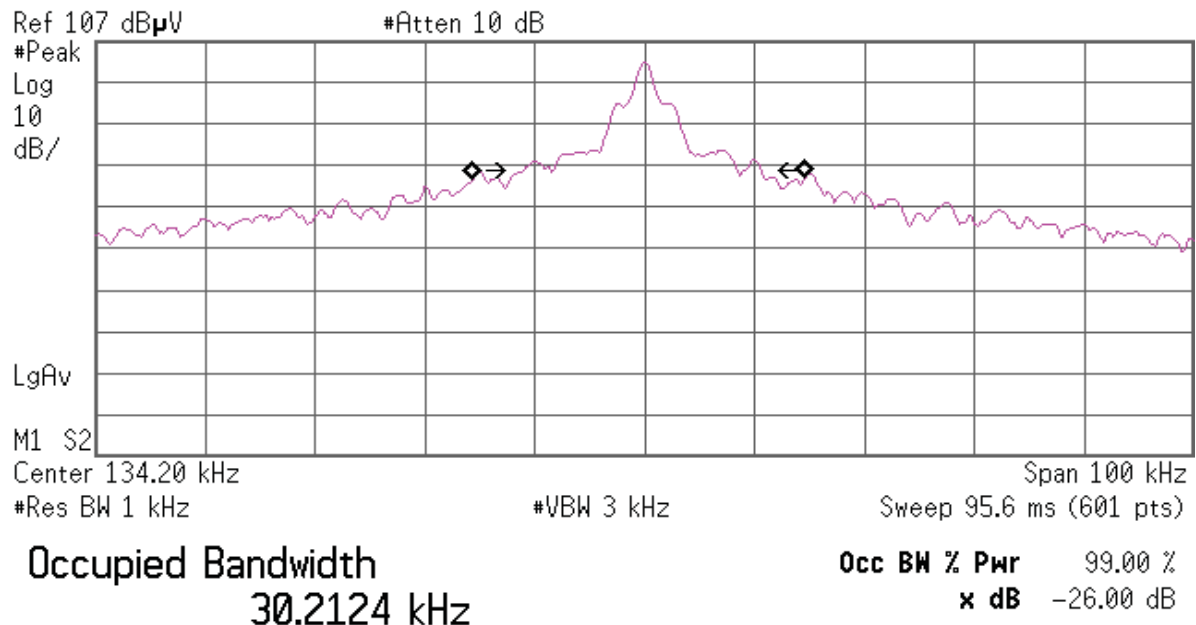
-26dB Bandwidth and 99% Occupied Bandwidth
Room Antenna / Luggage Antenna

Report No. 1003596H
Test place Head Office EMC Lab.
Semi Anechoic Chamber No.2
Date 01/18/2013
Temperature / Humidity 20 deg. C / 34 % RH
Engineer Keisuke Kawamura
Mode Tx 134.2kHz Room Antenna / Luggage Antenna

FREQ	-26dB Bandwidth	99% Occupied Bandwidth
[kHz]	[kHz]	[kHz]
134.2	21.572	30.212

Agilent

R T



Transmit Freq Error -510.203 Hz
x dB Bandwidth 21.572 kHz

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	2012/06/29 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2012/02/06 * 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	2012/11/20 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE	2012/04/03 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2012/10/12 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	RE	2012/02/16 * 12
MCC-143	Coaxial Cable	UL Japan	-	-	RE	2012/07/27 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2012/03/05 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2012/11/06 * 12
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2012/02/24 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	-	RE	2012/02/06 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
MRENT-95	Spectrum Analyzer	Agilent	E4440A	MY46185823	RE	2012/06/19 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2012/08/23 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2012/10/08 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	174	RE	2012/10/08 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2012/07/12 * 12
MAT-09	Attenuator(6dB)	Weinschel Corp	2	BK7973	RE	2012/11/06 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2012/03/16 * 12

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

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

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

Test Item:

RE: Spurious emission

End of Report

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