



RADIO TEST REPORT

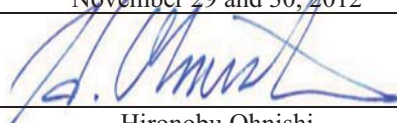
Test Report No. : 4786001420H-A

Applicant : Toyota Motor Corporation
Type of Equipment : Smart LF Oscillator
Model No. : TMLF10-51
FCC ID : NI4TMLF10-51
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: November 29 and 30, 2012

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.

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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. : TMLF10-51
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC12.0V (Max 0.5A)
Receipt Date of Sample : November 23, 2012
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: TMLF10-51 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: TMLF10-51) 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 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	12.3dB 41.869MHz, Vertical, QP (Room / 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.

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3.3 Addition to standard

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99% Occupied Band Width	RSS-Gen 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.

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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.

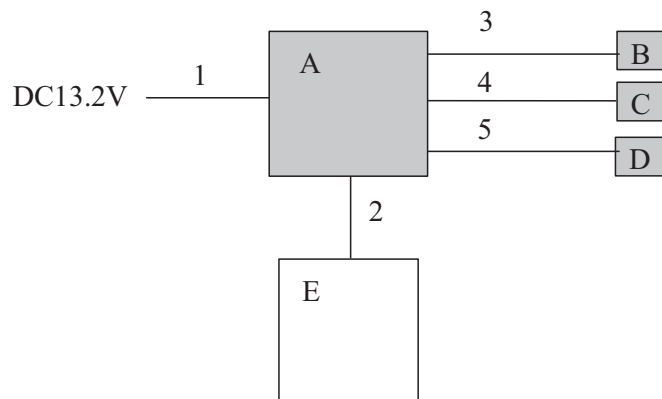
SECTION 4: Operation of E.U.T. during testing

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.
* 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	-

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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 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., 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.

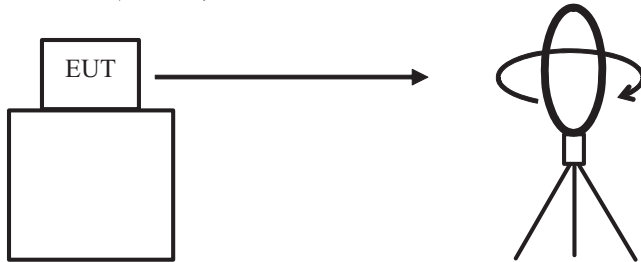
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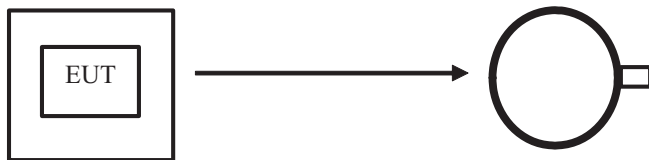
Facsimile : +81 596 24 8124

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

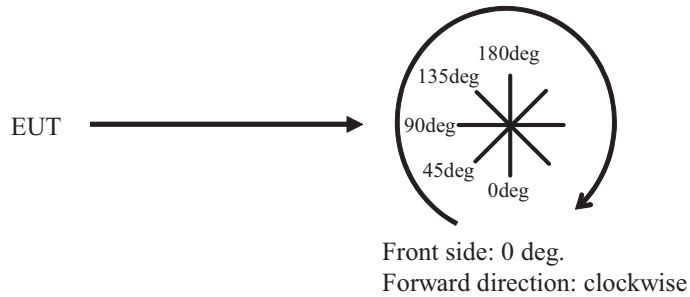


Top View (Horizontal)



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

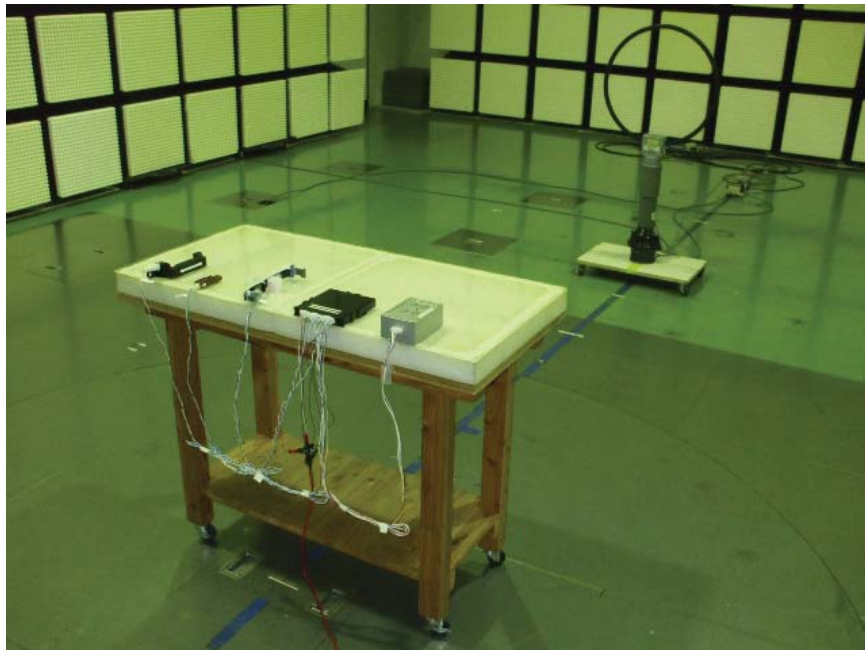


Photo 2

Radiated Emission
Trunk Antenna



Photo 1

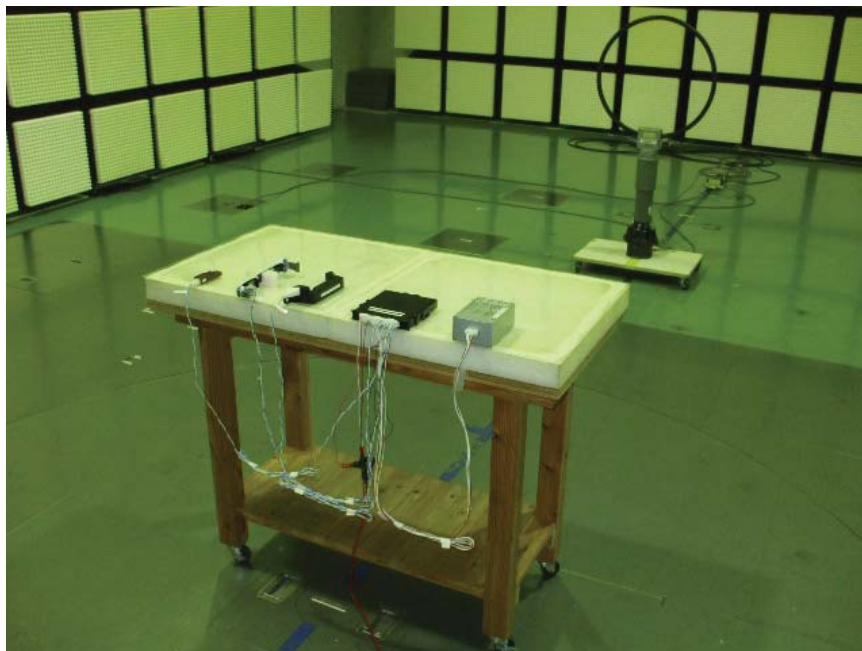


Photo 2

Radiated Emission
Room Antenna / Luggage Antenna

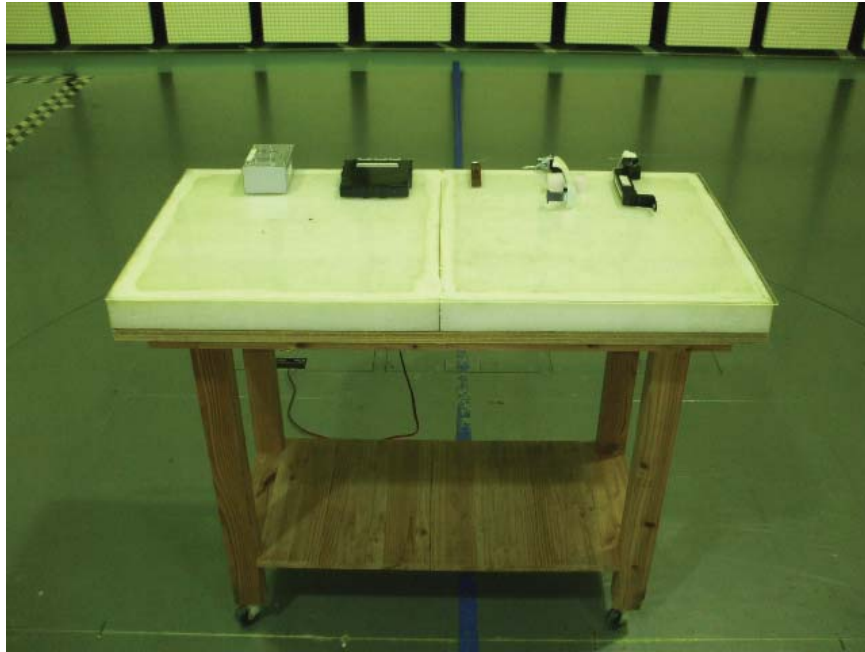


Photo 1

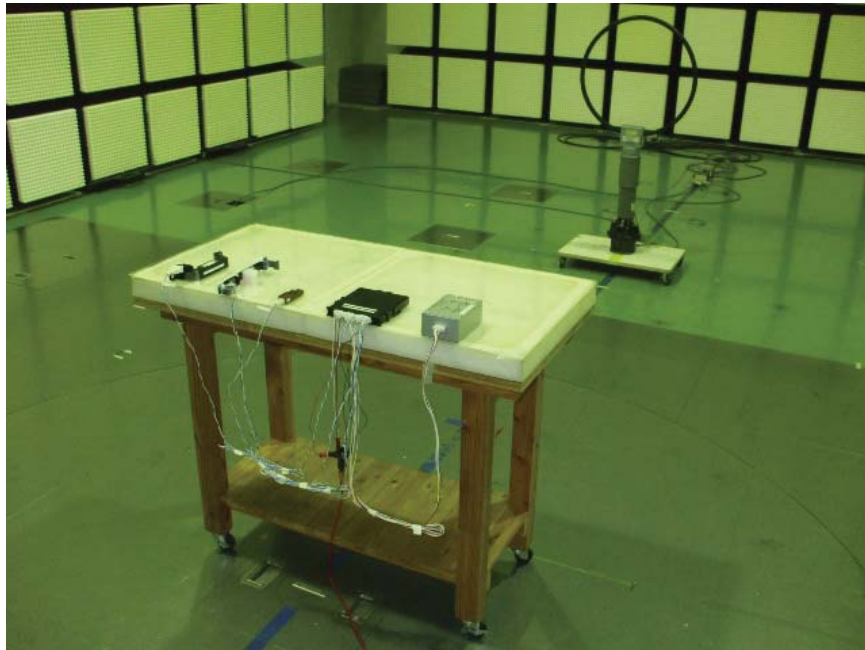


Photo 2

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

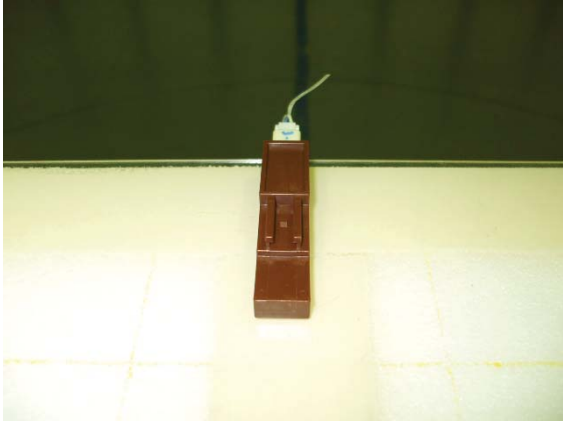


Z-axis



Worst Case Position

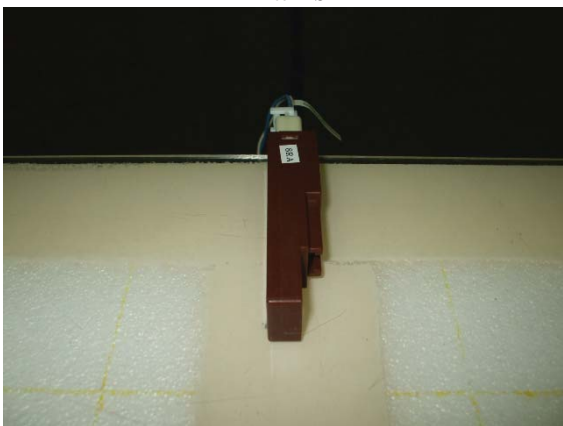
Room Antenna / Luggage Antenna
Below 30MHz:X-axis
Above 30MHz(Hori:X-axis /Vert:X-axis)
X-axis



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

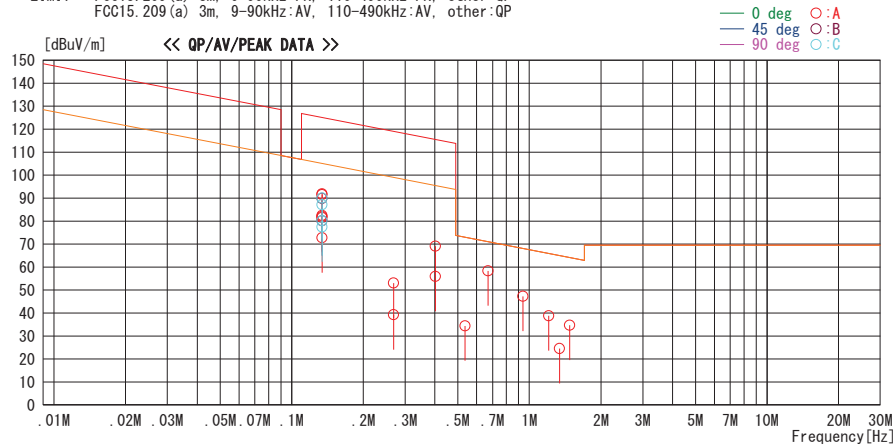
UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic Chamber
Date : 2012/11/30

Report No. : 4786001420H

Temp./ Humi. : 22deg. C / 36% RH
Engineer : Hironobu Ohnishi

Mode / Remarks : Tx 134.2kHz, Normal Modulation, Door Antenna, Worst axis (Antenna: 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	98.8	PEAK	19.2	6.1	32.2	91.9	125.1	33.2	0	A	1
0.13420	88.9	AV	19.2	6.1	32.2	82.0	105.1	23.1	0	A	1
0.13420	96.7	PEAK	19.2	6.1	32.2	89.8	125.1	35.3	45	B	334
0.13420	87.0	AV	19.2	6.1	32.2	80.1	105.1	25.0	45	B	334
0.13420	94.1	PEAK	19.2	6.1	32.2	87.2	125.1	37.9	90	C	90
0.13420	84.4	AV	19.2	6.1	32.2	77.5	105.1	27.6	90	C	90
0.13420	96.9	PEAK	19.2	6.1	32.2	90.0	125.1	35.1	135	C	31
0.13420	87.1	AV	19.2	6.1	32.2	80.2	105.1	24.9	135	C	31
0.13420	98.4	PEAK	19.2	6.1	32.2	91.5	125.1	33.6	180	A	1
0.13420	88.5	AV	19.2	6.1	32.2	81.6	105.1	23.5	180	A	1
0.13420	89.4	PEAK	19.2	6.1	32.2	82.5	125.1	42.6	0	A	1
0.13420	79.7	AV	19.2	6.1	32.2	72.8	105.1	32.3	0	A	1
0.26840	59.9	PEAK	19.1	6.1	32.1	53.0	119.0	66.0	0	A	1
0.26840	46.1	AV	19.1	6.1	32.1	39.2	99.0	59.8	0	A	1
0.40260	75.9	PEAK	19.1	6.2	32.1	69.1	115.5	46.4	0	A	1
0.40260	62.8	AV	19.1	6.2	32.1	56.0	95.5	39.5	0	A	1
0.53680	41.2	QP	19.1	6.2	32.1	34.4	73.0	38.6	0	A	178
0.67100	65.0	QP	19.2	6.2	32.1	58.3	71.1	12.8	0	A	359
0.93940	54.0	QP	19.2	6.2	32.1	47.3	68.1	20.8	0	A	1
1.20780	45.6	QP	19.1	6.2	32.1	38.8	65.9	27.1	0	A	1
1.34200	31.3	QP	19.1	6.2	32.1	24.5	65.0	40.5	0	A	359
1.47620	41.4	QP	19.1	6.3	32.1	34.7	64.2	29.5	0	A	2

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

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

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

DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic Chamber
Date : 2012/11/30

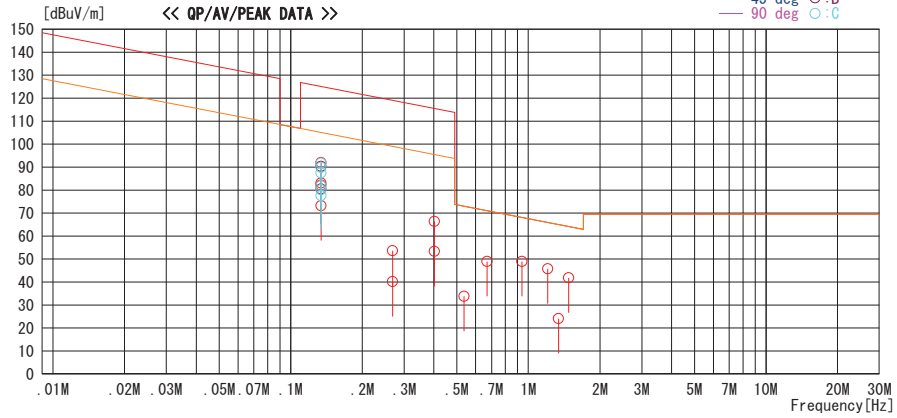
Report No. : 4786001420H

Temp./ Humi. : 22deg. C / 36% RH
Engineer : Hironobu Ohnishi

Mode / Remarks : Tx 134.2kHz, Normal Modulation, Trunk Antenna, Worst axis (Antenna: 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

— 0 deg ○ :A
— 45 deg ○ :B
— 90 deg ○ :C



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	6.1	32.2	92.0	125.1	33.1	0	A	1
0.13420	89.1	AV	19.2	6.1	32.2	82.2	105.1	22.9	0	A	1
0.13420	97.2	PEAK	19.2	6.1	32.2	90.3	125.1	34.8	45	B	331
0.13420	87.4	AV	19.2	6.1	32.2	80.5	105.1	24.6	45	B	331
0.13420	94.3	PEAK	19.2	6.1	32.2	87.4	125.1	37.7	90	C	90
0.13420	84.5	AV	19.2	6.1	32.2	77.6	105.1	27.5	90	C	90
0.13420	96.8	PEAK	19.2	6.1	32.2	89.9	125.1	35.2	135	C	35
0.13420	87.0	AV	19.2	6.1	32.2	80.1	105.1	25.0	135	C	35
0.13420	98.6	PEAK	19.2	6.1	32.2	91.7	125.1	33.4	180	C	1
0.13420	88.8	AV	19.2	6.1	32.2	81.9	105.1	23.2	180	C	1
0.13420	89.9	PEAK	19.2	6.1	32.2	83.0	125.1	42.1	0	A	1 Loop: Hori.
0.13420	80.1	AV	19.2	6.1	32.2	73.2	105.1	31.9	0	A	1 Loop: Hori.
0.26840	60.5	PEAK	19.1	6.1	32.1	53.6	119.0	65.4	0	A	1
0.26840	47.1	AV	19.1	6.1	32.1	40.2	99.0	58.8	0	A	1
0.40260	73.2	PEAK	19.1	6.2	32.1	66.4	115.5	49.1	0	A	1
0.40260	60.1	AV	19.1	6.2	32.1	53.3	95.5	42.2	0	A	1
0.53680	40.6	QP	19.1	6.2	32.1	33.8	73.0	39.2	0	A	358
0.67100	55.7	QP	19.2	6.2	32.1	49.0	71.1	22.1	0	A	1
0.93940	55.7	QP	19.2	6.2	32.1	49.0	68.1	19.1	0	A	359
1.20780	52.6	QP	19.1	6.2	32.1	45.8	65.9	20.1	0	A	1
1.34200	30.9	QP	19.1	6.2	32.1	24.1	65.0	40.9	0	A	1
1.47620	48.6	QP	19.1	6.3	32.1	41.9	64.2	22.3	0	A	1

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

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

Radiated Emission below 30MHz (Fundamental and Spurious Emission)
Room Antenna / Luggage Antenna Maximum Output

DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic Chamber
Date : 2012/11/29

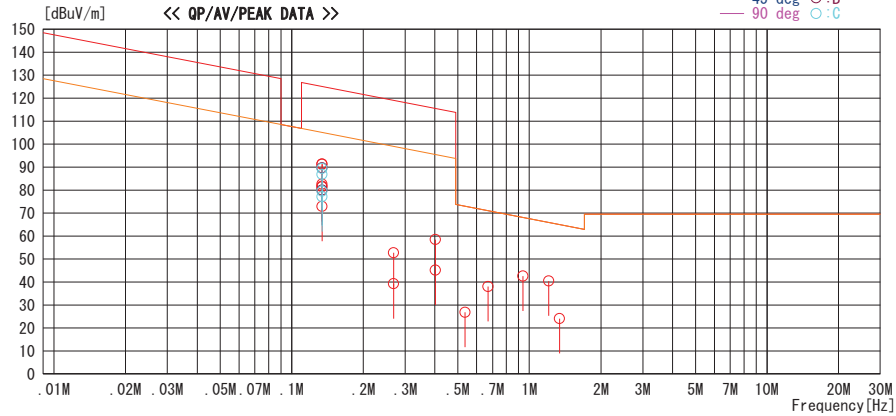
Report No. : 4786001420H

Temp./ Humi. : 22deg. C / 36% RH
Engineer : Hironobu Ohnishi

Mode / Remarks : Tx 134.2kHz, Normal Modulation, Room / Luggage Antenna (Max.), Worst axis (Antenna: 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

— 0 deg ○ :A
— 45 deg ○ :B
— 90 deg ○ :C



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	98.3	PEAK	19.2	6.1	32.2	91.4	125.1	33.7	0	A	180
0.13420	88.6	AV	19.2	6.1	32.2	81.7	105.1	23.4	0	A	180
0.13420	96.6	PEAK	19.2	6.1	32.2	89.7	125.1	35.4	45	B	147
0.13420	86.9	AV	19.2	6.1	32.2	80.0	105.1	25.1	45	B	147
0.13420	93.8	PEAK	19.2	6.1	32.2	86.9	125.1	38.2	90	C	91
0.13420	84.0	AV	19.2	6.1	32.2	77.1	105.1	28.0	90	C	91
0.13420	96.3	PEAK	19.2	6.1	32.2	89.4	125.1	35.7	135	C	214
0.13420	86.5	AV	19.2	6.1	32.2	79.6	105.1	25.5	135	C	214
0.13420	98.1	PEAK	19.2	6.1	32.2	91.2	125.1	33.9	180	A	179
0.13420	88.3	AV	19.2	6.1	32.2	81.4	105.1	23.7	180	A	179
0.13420	89.5	PEAK	19.2	6.1	32.2	82.6	125.1	42.5	0	A	178 Loop: Hori.
0.13420	79.8	AV	19.2	6.1	32.2	72.9	105.1	32.2	0	A	178 Loop: Hori.
0.26840	59.6	PEAK	19.1	6.1	32.1	52.7	119.0	66.3	0	A	180
0.26840	46.2	AV	19.1	6.1	32.1	39.3	99.0	59.7	0	A	180
0.40260	65.3	PEAK	19.1	6.2	32.1	58.5	115.5	57.0	0	A	181
0.40260	52.0	AV	19.1	6.2	32.1	45.2	95.5	50.3	0	A	181
0.53680	33.7	QP	19.1	6.2	32.1	26.9	73.0	46.1	0	A	1
0.67100	44.7	QP	19.2	6.2	32.1	38.0	71.1	33.1	0	A	179
0.93940	49.3	QP	19.2	6.2	32.1	42.6	68.1	25.5	0	A	180
1.20780	47.3	QP	19.1	6.2	32.1	40.5	65.9	25.4	0	A	180
1.34200	30.9	QP	19.1	6.2	32.1	24.1	65.0	40.9	0	A	180

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

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

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

DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic Chamber
Date : 2012/11/29

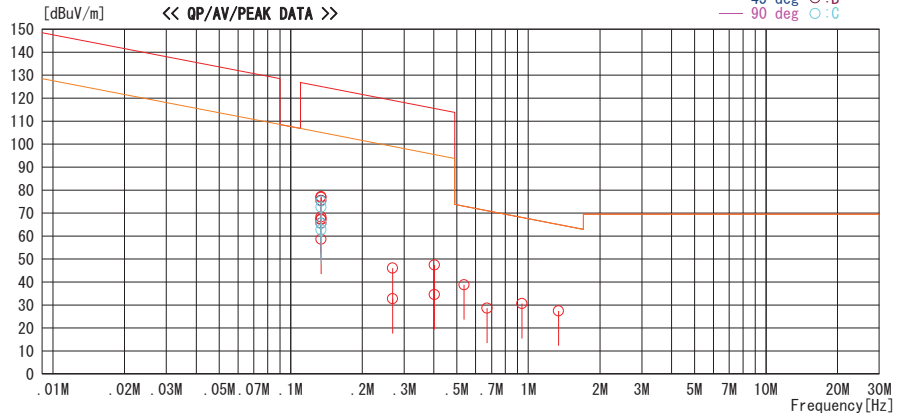
Report No. : 4786001420H

Temp./ Humi. : 22deg. C / 36% RH
Engineer : Hironobu Ohnishi

Mode / Remarks : Tx 134.2kHz, Normal Modulation, Room / Luggage Antenna (Min.), Worst axis (Antenna: 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

— 0 deg ○ :A
— 45 deg ○ :B
— 90 deg ○ :C



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	6.1	32.2	77.2	125.1	47.9	0	A	180
0.13420	74.3	AV	19.2	6.1	32.2	67.4	105.1	37.7	0	A	180
0.13420	82.3	PEAK	19.2	6.1	32.2	75.4	125.1	49.7	45	B	147
0.13420	72.6	AV	19.2	6.1	32.2	65.7	105.1	39.4	45	B	147
0.13420	79.5	PEAK	19.2	6.1	32.2	72.6	125.1	52.5	90	C	89
0.13420	69.7	AV	19.2	6.1	32.2	62.8	105.1	42.3	90	C	89
0.13420	82.1	PEAK	19.2	6.1	32.2	75.2	125.1	49.9	135	C	212
0.13420	72.4	AV	19.2	6.1	32.2	65.5	105.1	39.6	135	C	212
0.13420	83.8	PEAK	19.2	6.1	32.2	76.9	125.1	48.2	180	A	179
0.13420	74.0	AV	19.2	6.1	32.2	67.1	105.1	38.0	180	A	179
0.13420	75.3	PEAK	19.2	6.1	32.2	68.4	125.1	56.7	0	A	180 Loop: Hori.
0.13420	65.5	AV	19.2	6.1	32.2	58.6	105.1	46.5	0	A	180 Loop: Hori.
0.26840	53.0	PEAK	19.1	6.1	32.1	46.1	119.0	72.9	0	A	359
0.26840	39.6	AV	19.1	6.1	32.1	32.7	99.0	66.3	0	A	359
0.40260	54.3	PEAK	19.1	6.2	32.1	47.5	115.5	68.0	0	A	181
0.40260	41.3	AV	19.1	6.2	32.1	34.5	95.5	61.0	0	A	181
0.53680	45.6	QP	19.1	6.2	32.1	38.8	73.0	34.2	0	A	179
0.67100	35.3	QP	19.2	6.2	32.1	28.6	71.1	42.5	0	A	180
0.93940	37.4	QP	19.2	6.2	32.1	30.7	68.1	37.4	0	A	182
1.34200	34.3	QP	19.1	6.2	32.1	27.5	65.0	37.5	0	A	180

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

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

Radiated Emission above 30MHz (Spurious Emission)
Door Antenna

DATA OF RADIATED EMISSION TEST

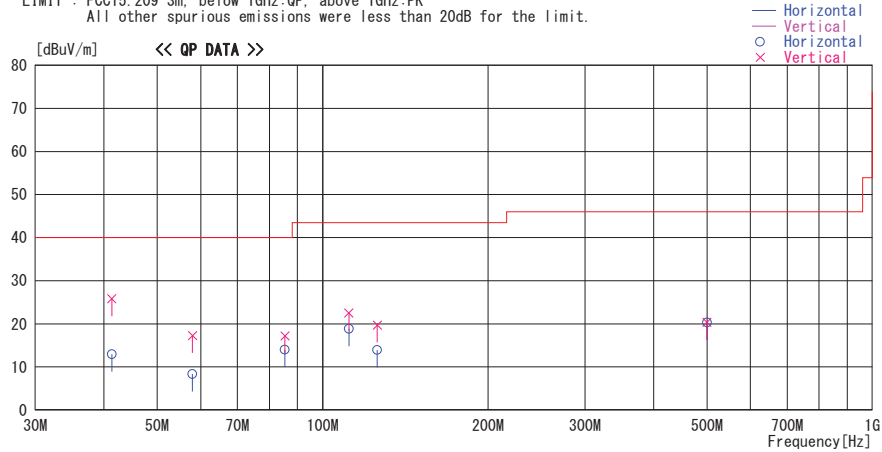
UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic Chamber
Date : 2012/11/29

Report No. : 4786001420H

Temp./Humi. : 23deg. C / 45% RH
Engineer : Hironobu Ohnishi

Mode / Remarks : Tx 134.2kHz, Normal Modulation, Door Antenna, Worst axis (Antenna: 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]							
41.337	23.4	QP	14.2	-24.7	12.9	183	296	Hori.	40.0	27.1	
41.337	36.3	QP	14.2	-24.7	25.8	120	100	Vert.	40.0	14.2	
57.977	24.2	QP	8.6	-24.5	8.3	350	398	Hori.	40.0	31.7	
57.977	33.2	QP	8.6	-24.5	17.3	87	100	Vert.	40.0	22.7	
85.352	30.7	QP	7.5	-24.2	14.0	2	226	Hori.	40.0	26.0	
85.352	33.9	QP	7.5	-24.2	17.2	280	100	Vert.	40.0	22.8	
111.656	30.7	QP	11.9	-23.8	18.8	4	296	Hori.	43.5	24.7	
111.656	34.4	QP	11.9	-23.8	22.5	273	100	Vert.	43.5	21.0	
125.759	24.1	QP	13.4	-23.6	13.9	352	320	Hori.	43.5	29.6	
125.759	29.9	QP	13.4	-23.6	19.7	248	100	Vert.	43.5	23.8	
500.000	22.1	QP	19.0	-20.8	20.3	0	100	Hori.	46.0	25.7	
500.000	22.1	QP	19.0	-20.8	20.3	0	100	Vert.	46.0	25.7	

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 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

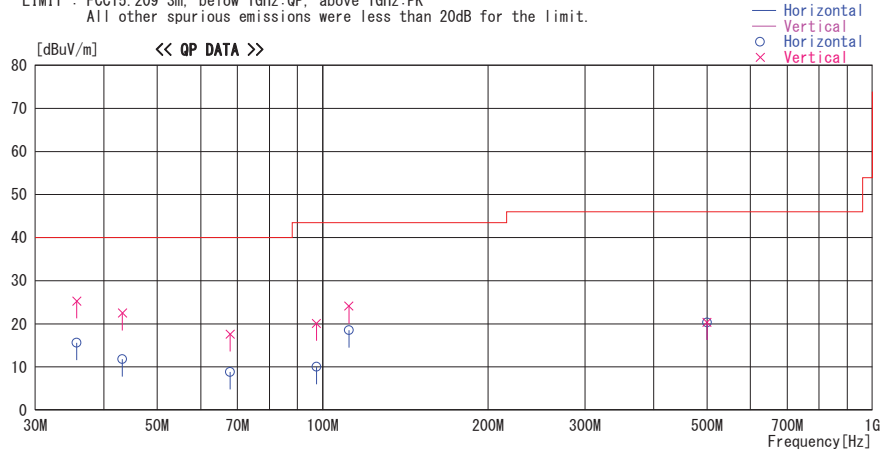
UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic Chamber
Date : 2012/11/29

Report No. : 4786001420H

Temp./Humi. : 23deg. C / 45% RH
Engineer : Hironobu Ohnishi

Mode / Remarks : Tx 134.2kHz, Normal Modulation, Trunk Antenna, Worst axis (Antenna: 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]							
35.699	24.1	QP	16.3	-24.8	15.6	180	400	Hori.	40.0	24.4	
35.699	33.8	QP	16.3	-24.8	25.3	164	100	Vert.	40.0	14.7	
43.214	23.0	QP	13.5	-24.7	11.8	359	400	Hori.	40.0	28.2	
43.214	33.7	QP	13.5	-24.7	22.5	73	100	Vert.	40.0	17.5	
67.907	26.3	QP	6.9	-24.4	8.8	195	400	Hori.	40.0	31.2	
67.907	35.1	QP	6.9	-24.4	17.6	269	100	Vert.	40.0	22.4	
97.423	24.3	QP	9.7	-24.0	10.0	5	322	Hori.	43.5	33.5	
97.423	34.4	QP	9.7	-24.0	20.1	235	100	Vert.	43.5	23.4	
111.655	30.4	QP	11.9	-23.8	18.5	13	298	Hori.	43.5	25.0	
111.655	36.0	QP	11.9	-23.8	24.1	272	100	Vert.	43.5	19.4	
500.000	22.1	QP	19.0	-20.8	20.3	0	100	Hori.	46.0	25.7	
500.000	22.1	QP	19.0	-20.8	20.3	0	100	Vert.	46.0	25.7	

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 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

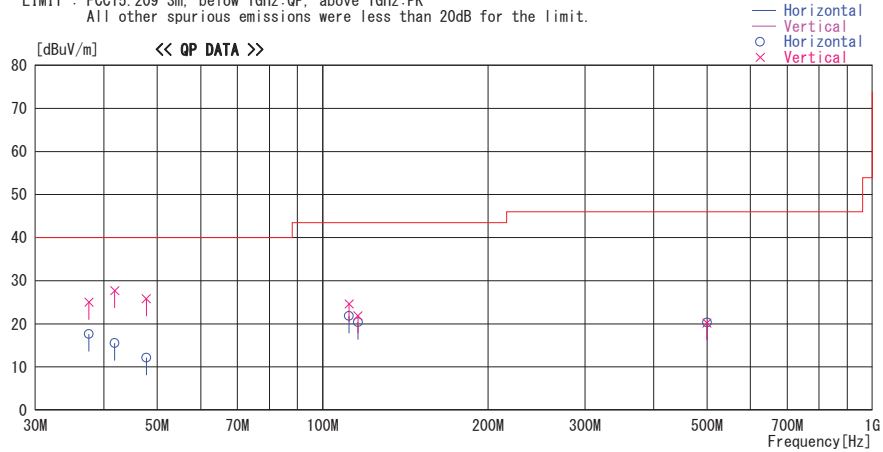
UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic Chamber
Date : 2012/11/29

Report No. : 4786001420H

Temp./Humi. : 23deg. C / 45% RH
Engineer : Hironobu Ohnishi

Mode / Remarks : Tx 134.2kHz, Normal Modulation, Room / Luggage Antenna (Max.), Worst axis (Antenna: 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]							
37.573	26.7	QP	15.7	-24.8	17.6	192	400	Hori.	40.0	22.4	
37.573	34.1	QP	15.7	-24.8	25.0	206	100	Vert.	40.0	15.0	
41.869	26.2	QP	14.0	-24.7	15.5	143	389	Hori.	40.0	24.5	
41.869	38.4	QP	14.0	-24.7	27.7	279	100	Vert.	40.0	12.3	
47.779	25.0	QP	11.8	-24.7	12.1	355	400	Hori.	40.0	27.9	
47.779	38.7	QP	11.8	-24.7	25.8	104	100	Vert.	40.0	14.2	
111.663	33.7	QP	11.9	-23.8	21.8	11	296	Hori.	43.5	21.7	
111.663	36.5	QP	11.9	-23.8	24.6	268	100	Vert.	43.5	18.9	
115.959	31.7	QP	12.4	-23.7	20.4	359	294	Hori.	43.5	23.1	
115.959	33.2	QP	12.4	-23.7	21.9	272	100	Vert.	43.5	21.6	
500.000	22.1	QP	19.0	-20.8	20.3	0	100	Hori.	46.0	25.7	
500.000	22.0	QP	19.0	-20.8	20.2	0	100	Vert.	46.0	25.8	

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

*The 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

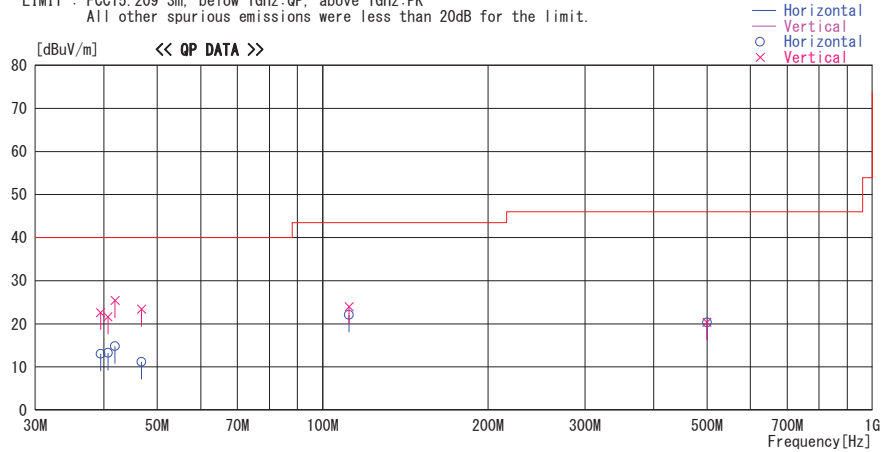
UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic Chamber
Date : 2012/11/29

Report No. : 4786001420H

Temp./Humi. : 23deg. C / 45% RH
Engineer : Hironobu Ohnishi

Mode / Remarks : Tx 134.2kHz, Normal Modulation, Room / Luggage Antenna (Min.), Worst axis (Antenna: 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]							
39.469	22.8	QP	15.0	-24.8	13.0	3	400	Hori.	40.0	27.0	
39.469	32.4	QP	15.0	-24.8	22.6	134	100	Vert.	40.0	17.4	
40.700	23.5	QP	14.5	-24.7	13.3	357	400	Hori.	40.0	26.7	
40.700	31.8	QP	14.5	-24.7	21.6	255	100	Vert.	40.0	18.4	
41.931	25.5	QP	14.0	-24.7	14.8	359	400	Hori.	40.0	25.2	
41.931	36.1	QP	14.0	-24.7	25.4	272	100	Vert.	40.0	14.6	
46.856	23.8	QP	12.1	-24.7	11.2	179	395	Hori.	40.0	28.8	
46.856	36.0	QP	12.1	-24.7	23.4	95	100	Vert.	40.0	16.6	
111.657	34.0	QP	11.9	-23.8	22.1	10	293	Hori.	43.5	21.4	
111.657	35.9	QP	11.9	-23.8	24.0	270	100	Vert.	43.5	19.5	
500.000	22.1	QP	19.0	-20.8	20.3	0	100	Hori.	46.0	25.7	
500.000	22.1	QP	19.0	-20.8	20.3	0	100	Vert.	46.0	25.7	

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)

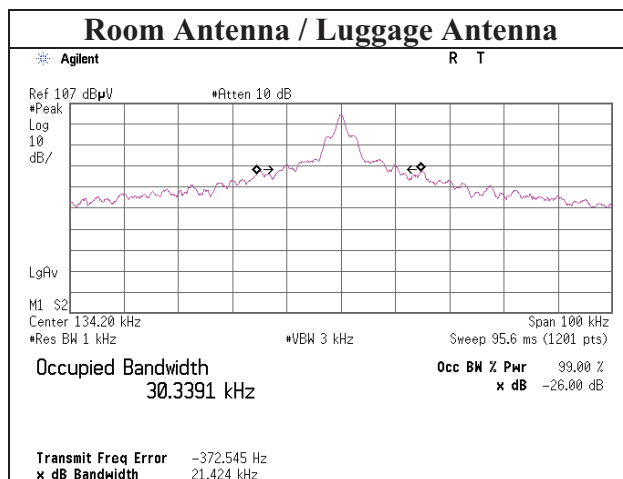
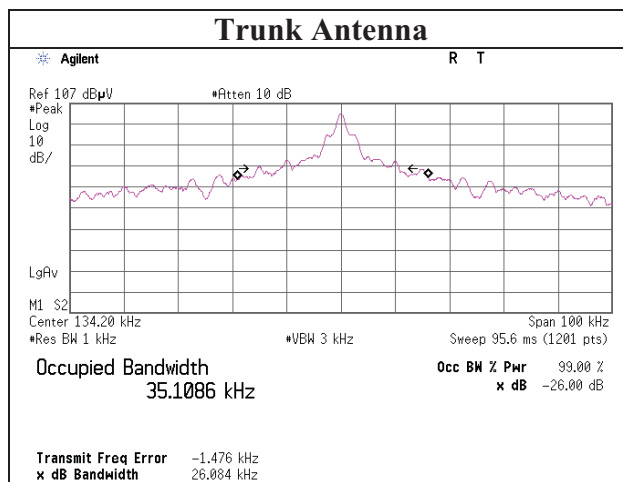
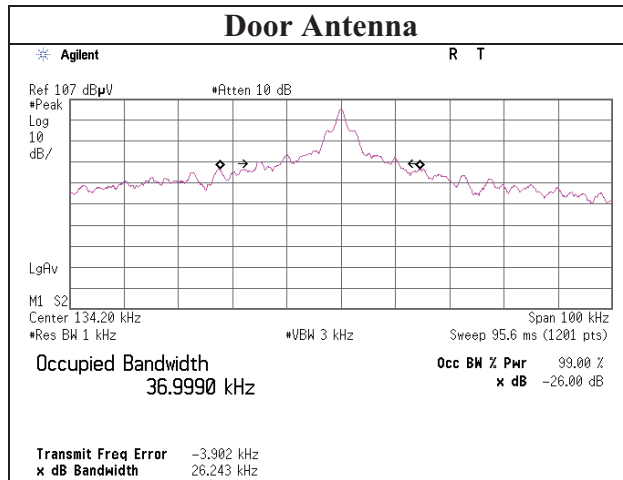
*The test result is rounded off to one or two decimal places, so some differences might be observed.

-26dB Bandwidth and 99% Occupied Bandwidth

Test place Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No. 4786001420H
Date 11/29/2012
Temperature/ Humidity 22 deg. C / 36% RH
Engineer Hironobu Ohnishi
Mode Tx

Mode	Frequency [kHz]	-26dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
Door Antenna	134.2	26.243	36.999
Trunk Antenna	134.2	26.084	35.109
Room Antenna / Ruggage Antenna	134.2	21.424	30.339

-26dB Bandwidth and 99% Occupied Bandwidth



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	2012/02/29 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	-	RE	2012/02/06 * 12
MJM-07	Measure	PROMART	SEN1955	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2012/11/20 * 12
MTR-07	Test Receiver	Rohde & Schwarz	ESCI	100635	RE	2012/04/05 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2011/11/16 * 12
MLA-08	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	N/A	RE	2012/11/18 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2012/06/01 * 12
MAT-68	Attenuator	Anritsu	MP721B	6200961025	RE	2012/11/21 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2012/03/05 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2012/10/12 * 12
MCC-113	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(5m)/421-010(1m)/sucoform141-PE(1m)/RFM-E121(Switcher)	-/04178	RE	2012/07/12 * 12
MCC-143	Coaxial Cable	UL Japan	-	-	RE	2012/07/27 * 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

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Facsimile : +81 596 24 8124