

RADIO TEST REPORT

Test Report No. : 31GE0262-HO-A

Applicant : Toyota Motor Corporation
Type of Equipment : Smart LF Oscillator
Model No. : TMLF10-8
FCC ID : NI4TMLF10-8
Test regulation : FCC Part 15 Subpart C 2010
Section 15.207, Section 15.209

Test Result : **Complied**

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Date of test:

April 27 and 28, 2010

Tested by:



Keisuke Kawamura
Engineer of 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.
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<http://www.ul.com/japan/jpn/pages/services/emc/about/mar1/index.jsp#nvlap>

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MF060b (12.01.11)

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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. : TMLF10-8
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC12.0V(Max 0.5A)
Receipt Date of Sample : April 26, 2010
Country of Mass-production : Japan
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No Modification by the test lab

2.2 Product Description

Smart LF Oscillator, model: TMLF10-8 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:TMLF10-8) 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: 2010, final revised on December 6, 2010 and effective January 5, 2011

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 December 6, 2010 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	21.9dB 0.13420MHz, AV (Trunk Antenna)	Complied
3	Electric Field Strength of Spurious Emission	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> RSS-Gen 4.9, 4.11	<FCC> Section 15.209 <IC> RSS-210 2.6, 2.7	Radiated	N/A	6.7dB 37.838MHz, QP, Vertical (Room Antenna / Luggage Antenna Minimum Output)	Complied
4	-26dB Bandwidth	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> -	<FCC> Reference data <IC> -	Radiated	N/A	N/A	N/A

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

*1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.

3.3 Addition to standard

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

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

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

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

Radiated emission test(3m)

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

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3.5 Test Location

UL Japan, Inc. Head Office EMC Lab. *NVLAP Lab. code: 200572-0
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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.

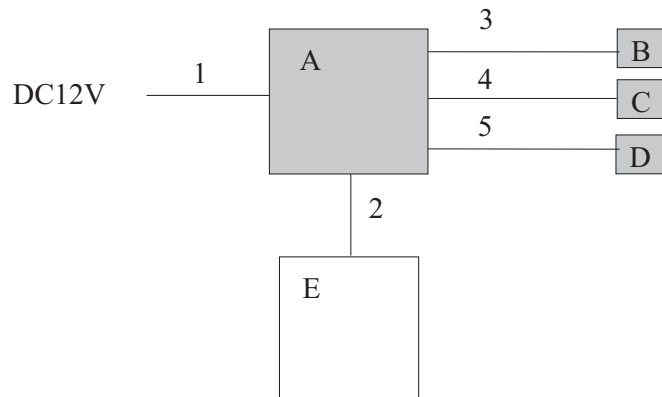
SECTION 4: Operation of E.U.T. during testing

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	Remarks
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		Remarks
			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 2 semi anechoic chamber with a ground plane and at a distance of 3m.

Frequency : From 9kHz to 30MHz at distance 3m

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for vertical polarization (antenna angle: 0deg., 45deg., 90deg., and 135 deg.) and horizontal polarization.

*Refer to Figure 1 about Direction of the Loop Antenna.

Frequency : From 30MHz to 1GHz at distance 3m

The measuring antenna height varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for both vertical and horizontal antenna polarization.

Measurements were performed with a QP, PK, and AV detector.

The radiated emission measurements were made with the following detector function of the test receiver (below 1GHz).

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

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

With the position, the noise levels of all the frequencies were measured.

* Part 15 Section 15.31 (f)(2) (9kHz-30MHz)

[Limit at 3m]=[Limit at 300m]-40 x log (3[m]/300[m])

[Limit at 3m]=[Limit at 30m]-40 x log (3[m]/30[m])

Test data : APPENDIX 2

Test result : Pass

Date: April 27 and 28, 2010

Test engineer: Keisuke Kawamura

UL Japan, Inc.

Head Office EMC Lab.

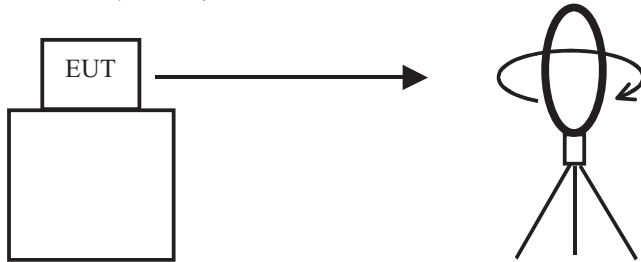
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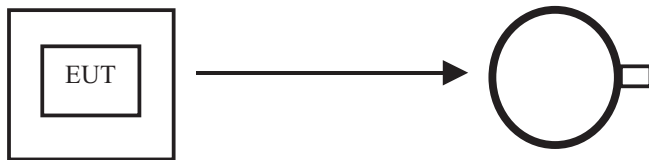
Facsimile : +81 596 24 8124

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

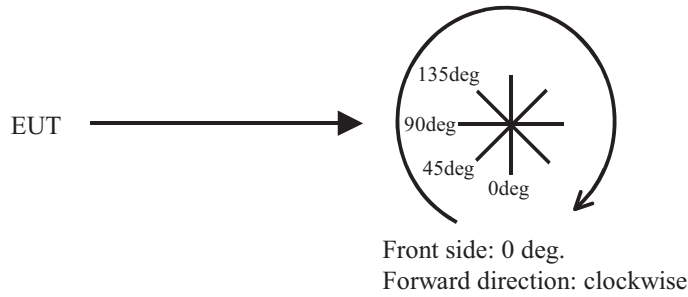


.....
Top View (Horizontal)



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

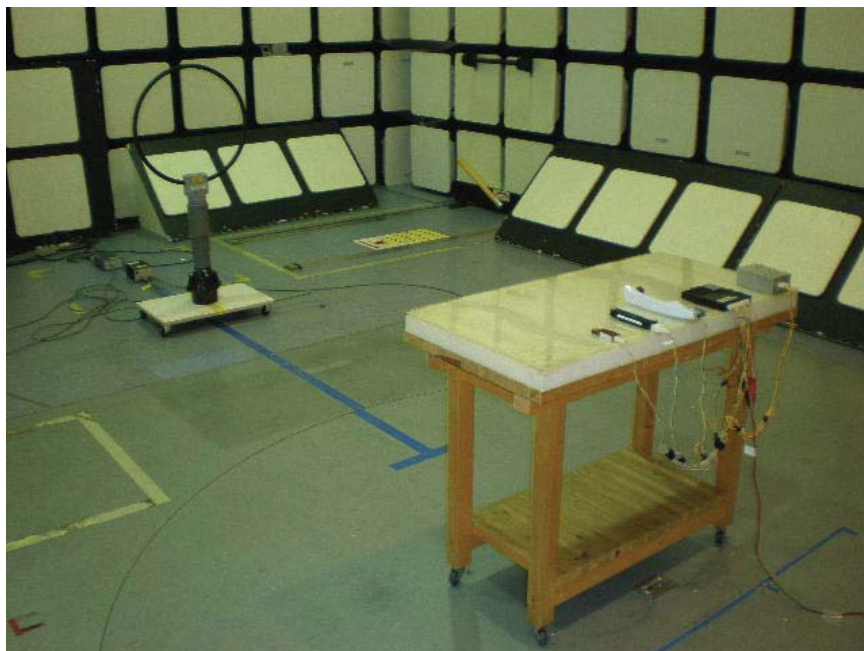


Photo 2

Radiated Emission
Trunk Antenna



Photo 1

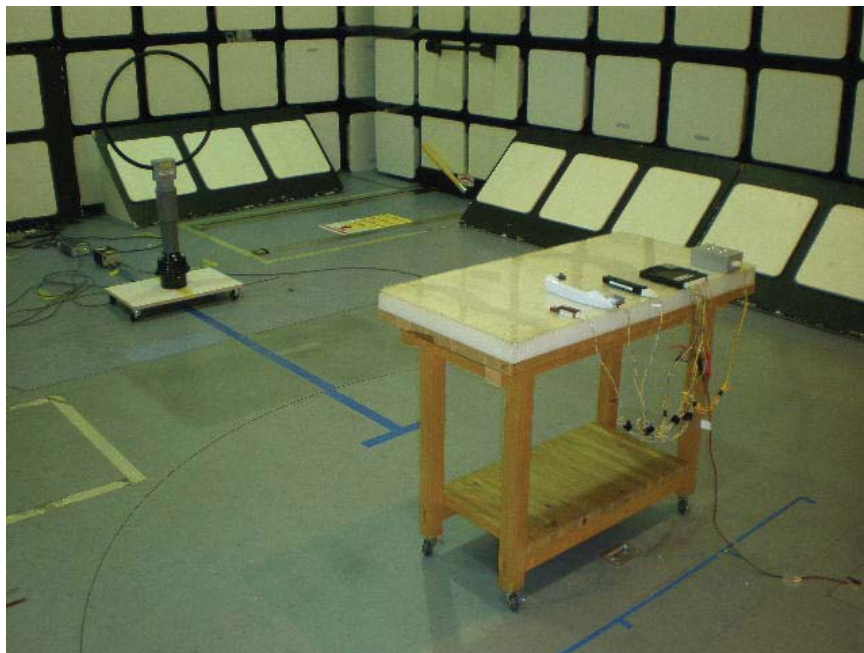


Photo 2

Radiated Emission
Room Antenna / Luggage Antenna



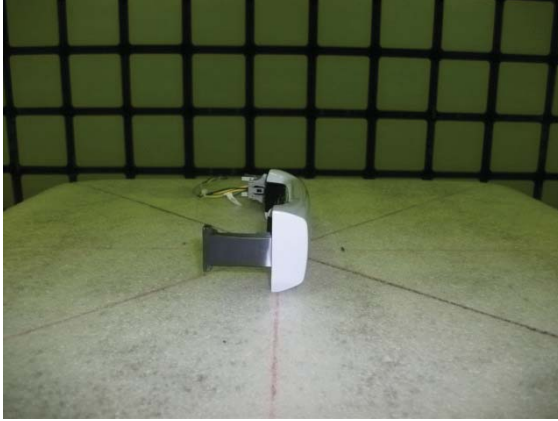
Photo 1



Photo 2

Worst Case Position

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



Y-axis



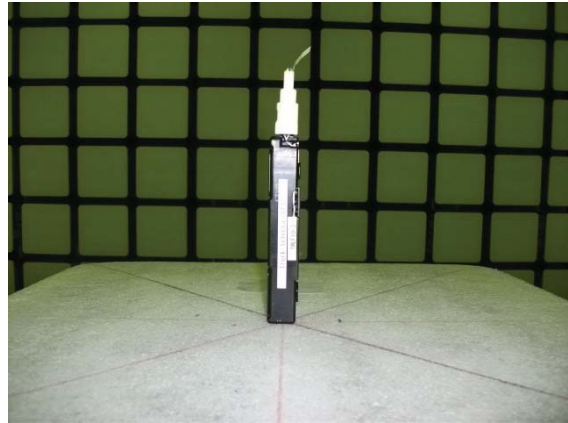
Z-axis



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



Y-axis

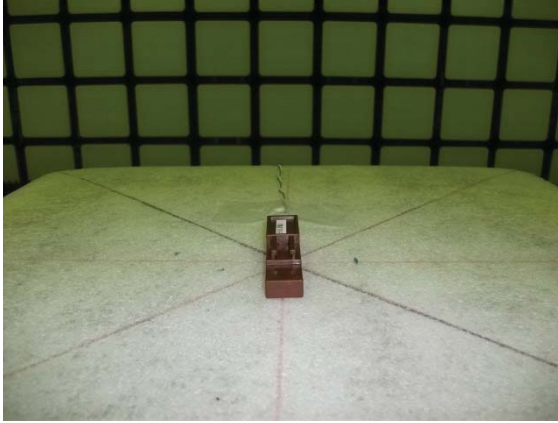


Z-axis

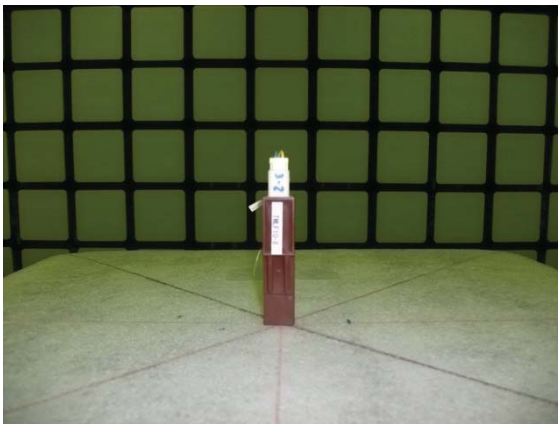


Worst Case Position

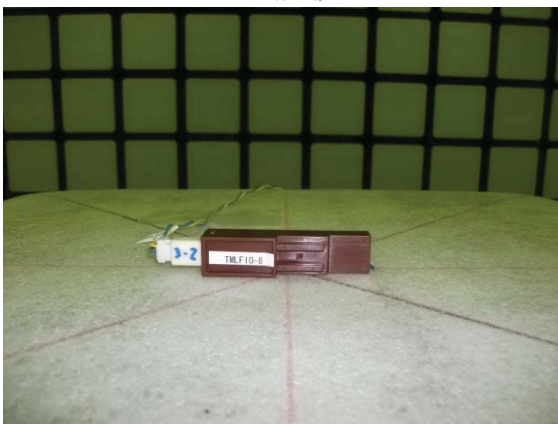
Room Antenna / Luggage Antenna
Below 30MHz:Z-axis
Above 30MHz(Hori:X-axis /Vert:X-axis)
X-axis



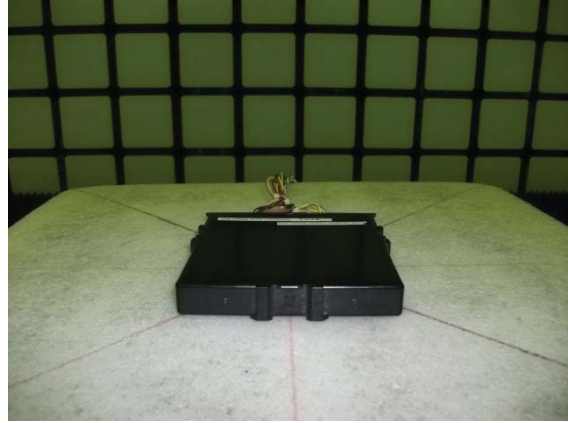
Y-axis



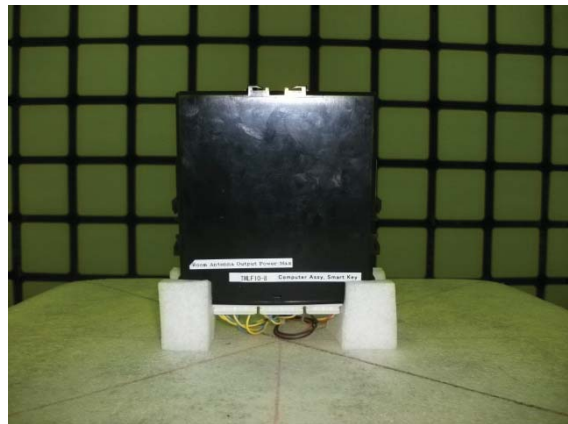
Z-axis



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

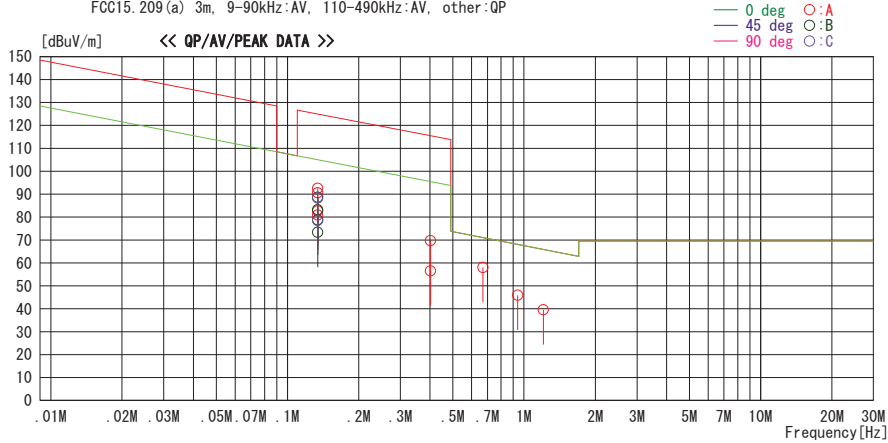
DATA OF RADIATED EMISSION TEST

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

Report No. : 31GE0262-HO
Power : DC 12.0V
Engineer : Keisuke Kawamura

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

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



Freq. [MHz]	Reading [dBUV]	DET	Ant. Fac [dB/m]	Loss [dB]	Gain [dB]	Result [dBUV/m]	Limit [dBUV/m]	Margin [dB]	Antenna [deg]	Table	Comment
										[deg]	
0.13420	99.0	PEAK	19.9	6.1	32.4	92.6	125.0	32.4	0	A	9 Worst
0.13420	95.0	PEAK	19.9	6.1	32.4	88.6	125.0	36.4	45	B	107
0.13420	94.7	PEAK	19.9	6.1	32.4	88.3	125.0	36.7	90	C	85
0.13420	89.2	AV	19.9	6.1	32.4	82.8	105.0	22.2	0	A	9 Worst
0.13420	85.2	AV	19.9	6.1	32.4	78.8	105.0	26.2	45	B	107
0.13420	84.9	AV	19.9	6.1	32.4	78.5	105.0	26.5	90	C	85
0.13420	97.1	PEAK	19.9	6.1	32.4	90.7	125.0	34.3	135	A	34
0.13420	89.6	PEAK	19.9	6.1	32.4	83.2	125.0	41.8	0	B	6 Hori
0.13420	87.3	AV	19.9	6.1	32.4	80.9	105.0	24.1	135	A	34
0.13420	79.8	AV	19.9	6.1	32.4	73.4	105.0	31.6	0	B	6 Hori
0.40260	62.9	AV	19.7	6.1	32.1	56.6	95.5	38.9	0	A	10
0.40260	76.0	PEAK	19.7	6.1	32.1	69.7	115.5	45.8	0	A	10
0.67100	64.3	QP	19.6	6.2	32.1	58.0	71.1	13.1	0	A	10
0.93940	52.4	QP	19.6	6.2	32.2	46.0	68.1	22.1	0	A	10
1.20780	45.9	QP	19.6	6.2	32.2	39.5	65.9	26.4	0	A	12

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

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

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

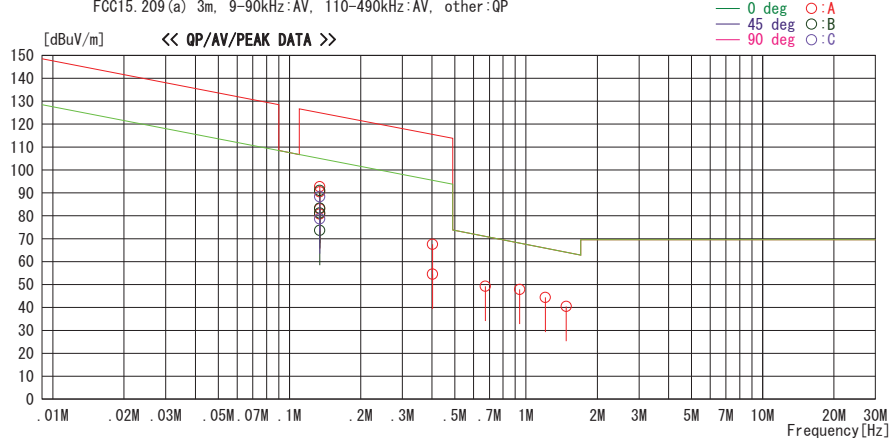
DATA OF RADIATED EMISSION TEST

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

Report No. : 31GE0262-HO
Power : DC 12.0V
Engineer : Keisuke Kawamura

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

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



Freq. [MHz]	Reading [dBuV]	DET	Ant. Fac [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna [deg]	Table	Comment	
										[deg]		
0.13420	99.2	PEAK	19.9	6.1	32.4	92.8	125.0	32.2	0	A	179	Worst
0.13420	97.5	PEAK	19.9	6.1	32.4	91.1	125.0	33.9	45	B	144	
0.13420	94.8	PEAK	19.9	6.1	32.4	88.4	125.0	36.6	90	C	93	
0.13420	87.7	AV	19.9	6.1	32.4	81.3	105.0	23.7	45	B	144	
0.13420	89.7	PEAK	19.9	6.1	32.4	83.3	125.0	41.7	0	B	170	Hori
0.13420	85.0	AV	19.9	6.1	32.4	78.6	105.0	26.4	90	C	93	
0.13420	89.5	AV	19.9	6.1	32.4	83.1	105.0	21.9	0	A	179	Worst
0.13420	96.9	PEAK	19.9	6.1	32.4	90.5	125.0	34.5	135	A	205	
0.13420	87.2	AV	19.9	6.1	32.4	80.8	105.0	24.2	135	A	205	
0.13420	80.0	AV	19.9	6.1	32.4	73.6	105.0	31.4	0	B	170	Hori
0.40260	60.8	AV	19.7	6.1	32.1	54.5	95.5	41.0	0	A	172	
0.40260	73.9	PEAK	19.7	6.1	32.1	67.6	115.5	47.9	0	A	172	
0.67150	55.6	QP	19.6	6.2	32.1	49.3	71.0	21.7	0	A	171	
0.93947	54.3	QP	19.6	6.2	32.2	47.9	68.1	20.2	0	A	178	
1.20780	50.8	QP	19.6	6.2	32.2	44.4	65.9	21.5	0	A	185	
1.47620	46.7	QP	19.6	6.3	32.2	40.4	64.2	23.8	0	A	185	

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

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

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

DATA OF RADIATED EMISSION TEST

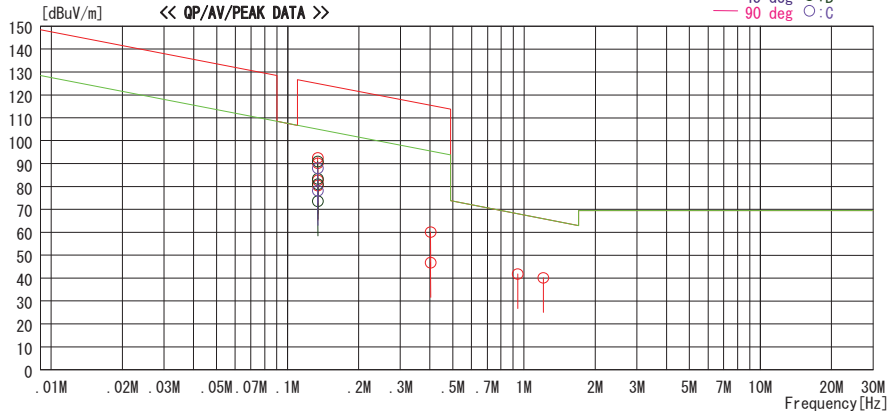
UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2010/04/27

Report No. : 31GE0262-H0
Power : DC 12.0V
Engineer : Keisuke Kawamura

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

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

— 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	99.0	PEAK	19.9	6.1	32.4	92.6	125.0	32.4	0	A	182 Worst
0.13420	97.3	PEAK	19.9	6.1	32.4	90.9	125.0	34.1	45	B	147
0.13420	94.4	PEAK	19.9	6.1	32.4	88.0	125.0	37.0	90	C	94
0.13420	84.6	AV	19.9	6.1	32.4	78.2	105.0	26.8	90	C	94
0.13420	89.2	AV	19.9	6.1	32.4	82.8	105.0	22.2	0	A	182 Worst
0.13420	96.6	PEAK	19.9	6.1	32.4	90.2	125.0	34.8	135	A	210
0.13420	86.8	AV	19.9	6.1	32.4	80.4	105.0	24.6	135	A	210
0.13420	87.5	AV	19.9	6.1	32.4	81.1	105.0	23.9	45	B	147
0.13420	89.8	PEAK	19.9	6.1	32.4	83.4	125.0	41.6	0	B	179 Hori
0.13420	80.0	AV	19.9	6.1	32.4	73.6	105.0	31.4	0	B	179 Hori
0.40260	53.2	AV	19.7	6.1	32.1	46.9	95.5	48.6	0	A	170
0.40260	66.5	PEAK	19.7	6.1	32.1	60.2	115.5	55.3	0	A	170
0.93940	48.2	QP	19.6	6.2	32.2	41.8	68.1	26.3	0	A	175
1.20780	46.5	QP	19.6	6.2	32.2	40.1	65.9	25.8	0	A	174

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

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

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

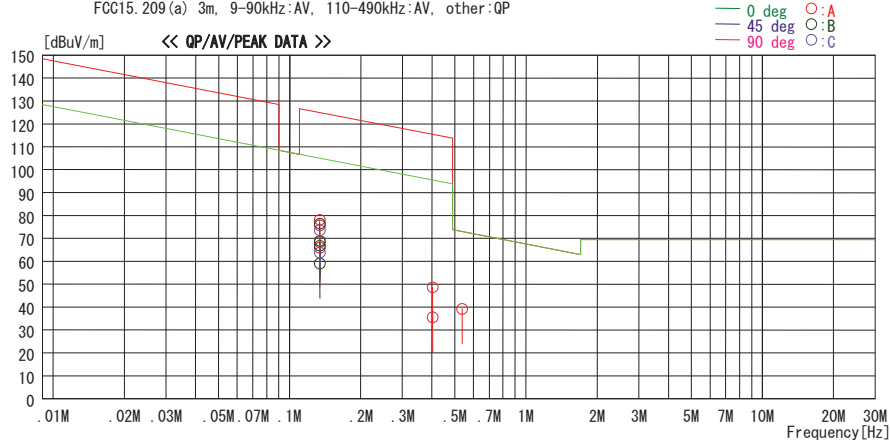
DATA OF RADIATED EMISSION TEST

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

Report No. : 31GE0262-H0
Power : DC 12.0V
Engineer : Keisuke Kawamura

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

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



Freq. [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	84.6	PEAK	19.9	6.1	32.4	78.2	125.0	46.8	0	A	181	Worst
0.13420	83.0	PEAK	19.9	6.1	32.4	76.6	125.0	48.4	45	B	144	
0.13420	80.0	PEAK	19.9	6.1	32.4	73.6	125.0	51.4	90	C	95	
0.13420	70.2	AV	19.9	6.1	32.4	63.8	105.0	41.2	90	C	95	
0.13420	74.9	AV	19.9	6.1	32.4	68.5	105.0	36.5	0	A	181	Worst
0.13420	82.2	PEAK	19.9	6.1	32.4	75.8	125.0	49.2	135	A	213	
0.13420	72.4	AV	19.9	6.1	32.4	66.0	105.0	39.0	135	A	213	
0.13420	73.2	AV	19.9	6.1	32.4	66.8	105.0	38.2	45	B	144	
0.13420	75.3	PEAK	19.9	6.1	32.4	68.9	125.0	56.1	0	B	182	Hori
0.13420	65.5	AV	19.9	6.1	32.4	59.1	105.0	45.9	0	B	182	Hori
0.40260	41.9	AV	19.7	6.1	32.1	35.6	95.5	59.9	0	A	182	
0.40260	55.0	PEAK	19.7	6.1	32.1	48.7	115.5	66.8	0	A	182	
0.53680	45.6	QP	19.6	6.1	32.1	39.2	73.0	33.8	0	A	183	

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

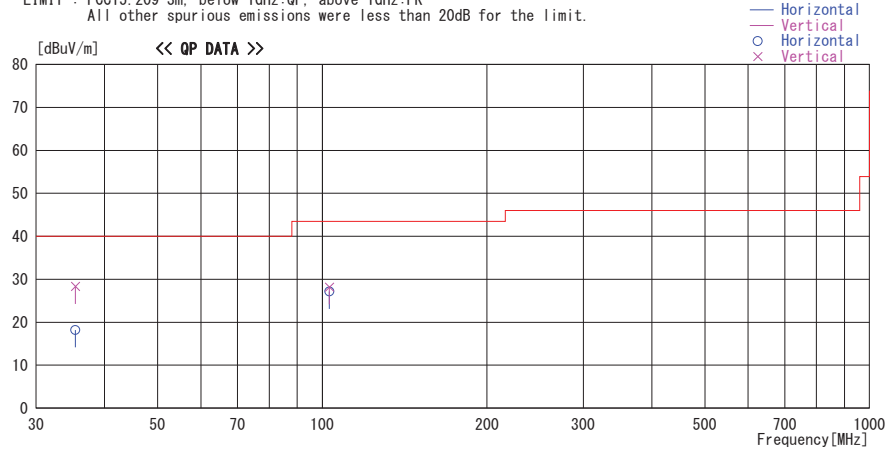
DATA OF RADIATED EMISSION TEST

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

Report No. : 31GE0262-HO
Power : DC 12.0V
Operator : Keisuke Kawamura

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

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



Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss&	Level	Angle	Height	Polar.	Limit	Margin	Comment
			Factor [dB/m]	Gain [dB]							
35.400	23.5	QP	16.6	-21.9	18.2	156	300	Hori.	40.0	21.8	
35.400	33.6	QP	16.6	-21.9	28.3	103	100	Vert.	40.0	11.7	
103.070	37.1	QP	11.1	-21.0	27.2	9	283	Hori.	43.5	16.3	
103.070	38.1	QP	11.1	-21.0	28.2	262	100	Vert.	43.5	15.3	

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

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

Radiated Emission above 30MHz (Spurious Emission)
Trunk Antenna

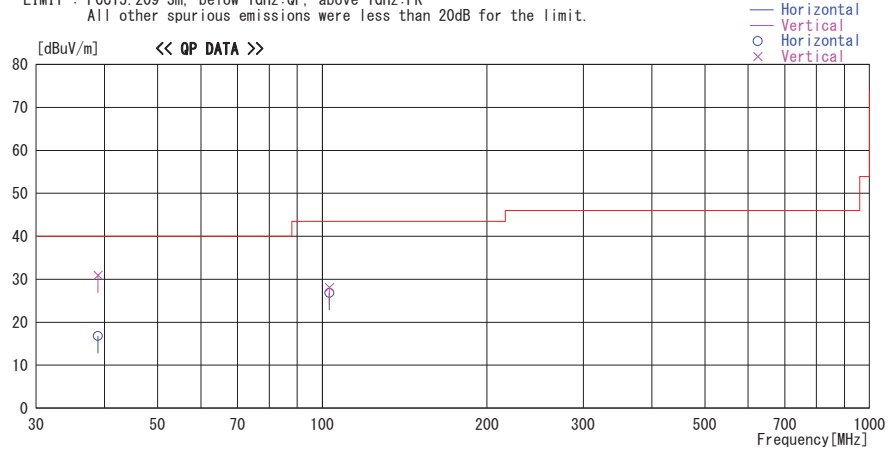
DATA OF RADIATED EMISSION TEST

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

Report No. : 31GE0262-H0
Power : DC 12.0V
Operator : Keisuke Kawamura

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

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



Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss&	Level	Angle	Height	Polar.	Limit	Margin	Comment
			Factor [dB/m]	Gain [dB]							
38.920	23.3	QP	15.4	-21.9	16.8	174	300	Hor.	40.0	23.2	
38.920	37.4	QP	15.4	-21.9	30.9	269	100	Vert.	40.0	9.1	
103.070	36.7	QP	11.1	-21.0	26.8	5	284	Hor.	43.5	16.7	
103.070	38.0	QP	11.1	-21.0	28.1	262	100	Vert.	43.5	15.4	

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

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

Radiated Emission above 30MHz (Spurious Emission)
Room Antenna / Luggage Antenna Maximum Output

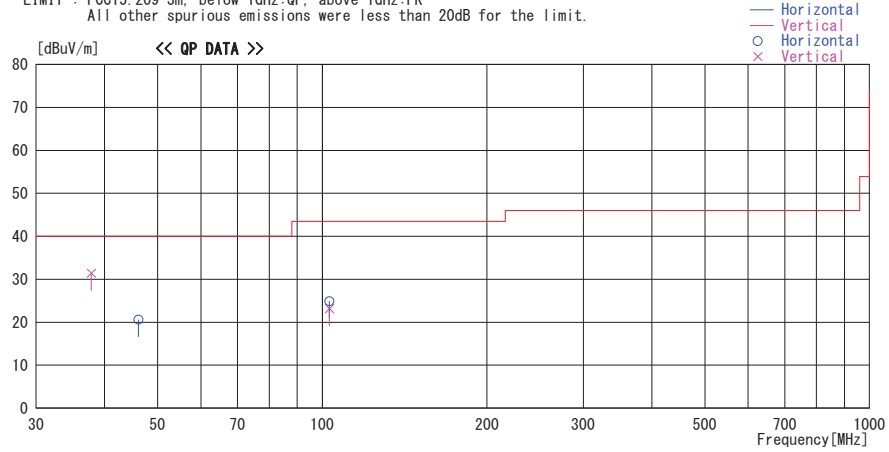
DATA OF RADIATED EMISSION TEST

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

Report No. : 31GE0262-HO
Power : DC 12.0V
Operator : Keisuke Kawamura

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

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



Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss&	Level	Angle	Height	Polar.	Limit	Margin	Comment
			Factor [dB/m]	Gain [dB]							
37.843	37.6	QP	15.7	-21.9	31.4	131	100	Vert.	40.0	8.6	
46.169	29.7	QP	12.7	-21.8	20.6	2	351	Hori.	40.0	19.4	
103.070	34.8	QP	11.1	-21.0	24.9	359	289	Hori.	43.5	18.6	
103.070	33.1	QP	11.1	-21.0	23.2	259	100	Vert.	43.5	20.3	

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

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

Radiated Emission above 30MHz (Spurious Emission)
Room Antenna / Luggage Antenna Minimum Output

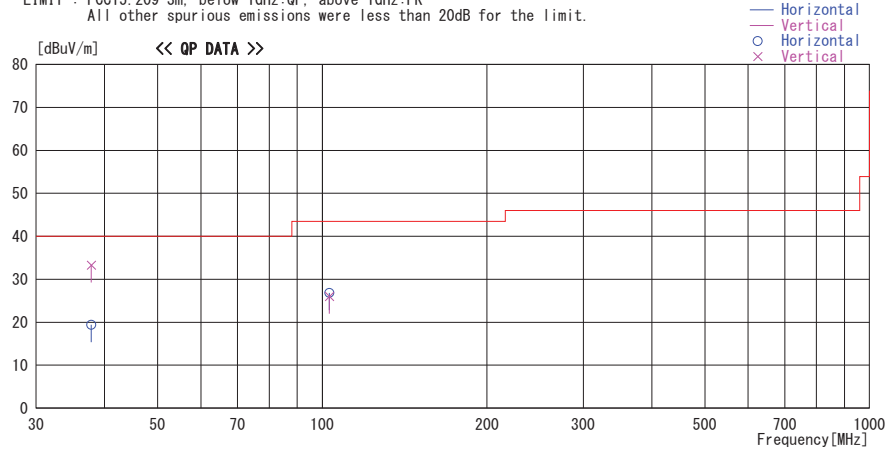
DATA OF RADIATED EMISSION TEST

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

Report No. : 31GE0262-HO
Power : DC 12.0V
Operator : Keisuke Kawamura

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

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



Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss&	Level	Angle	Height	Polar.	Limit	Margin	Comment
			Factor [dB/m]	Gain [dB]							
37.838	25.5	QP	15.8	-21.9	19.4	2	300	Hori.	40.0	20.6	
37.838	39.4	QP	15.8	-21.9	33.3	105	100	Vert.	40.0	6.7	
103.070	36.7	QP	11.1	-21.0	26.8	9	284	Hori.	43.5	16.7	
103.070	35.9	QP	11.1	-21.0	26.0	259	100	Vert.	43.5	17.5	

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

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

-26dB Bandwidth and 99% Occupied Bandwidth
Door Antenna

Head Office EMC Lab. No.2 Semi Anechoic Chamber

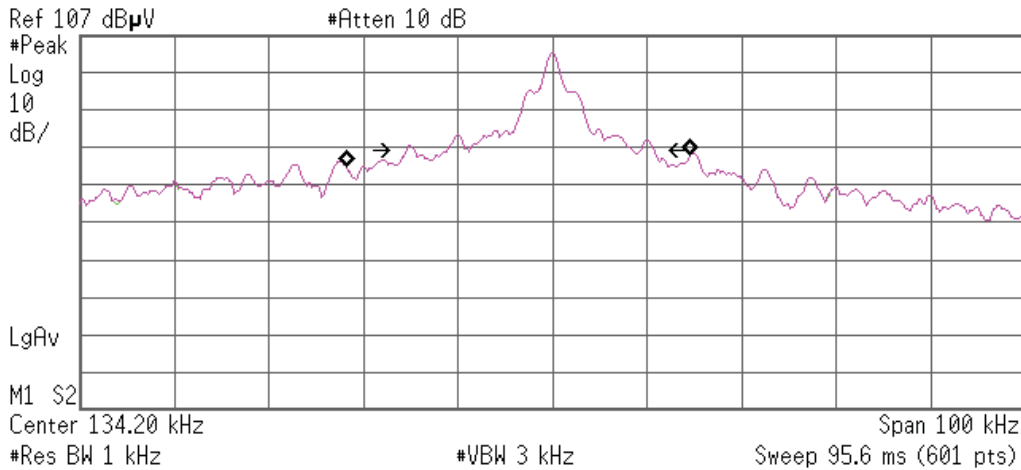
POWER : DC 12.0V
 MODE : Tx
 : Door Antenna

REPORT NO : 31GE0262-HO
 REGULATION : -/RSS-Gen 4.6.1
 TEST DISTANCE : 3m
 DATE : 04/27/2010
 TEMPERATURE : 22 deg.C
 HUMIDITY : 43 %
 Engineer : Keisuke Kawamura

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

Agilent

R T



Occupied Bandwidth
36.5151 kHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error -3.683 kHz
x dB Bandwidth 26.233 kHz

-26dB Bandwidth and 99% Occupied Bandwidth
Trunk Antenna

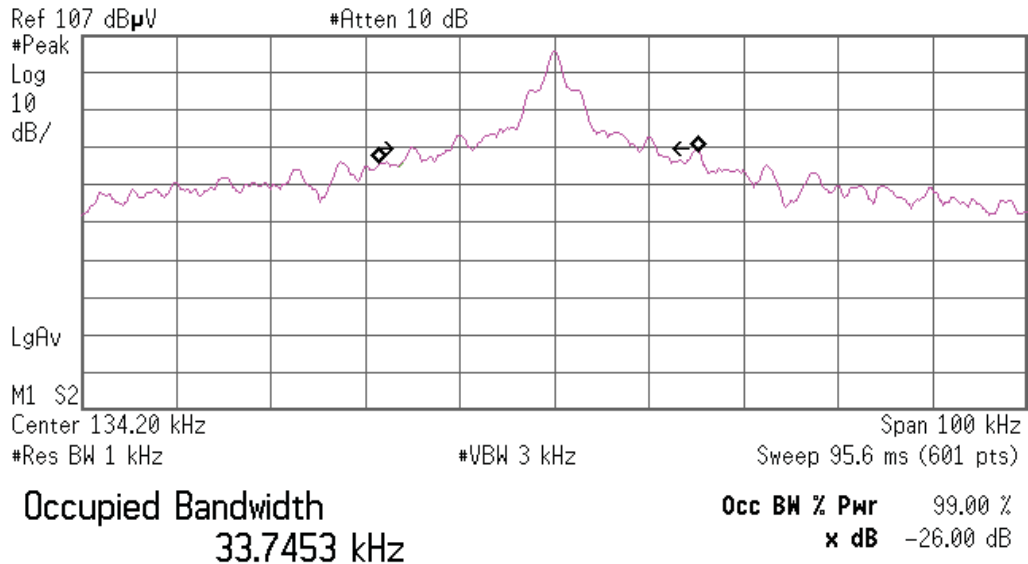
Head Office EMC Lab. No.2 Semi Anechoic Chamber

POWER	: DC 12.0V	REPORT NO	: 31GE0262-HO
MODE	: Tx	REGULATION	: -/RSS-Gen 4.6.1
	: Trunk Antenna	TEST DISTANCE	: 3m
		DATE	: 04/27/2010
		TEMPERATURE	: 22 deg.C
		HUMIDITY	: 43 %
		Engineer	: Keisuke Kawamura

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

Agilent

R T



Transmit Freq Error -1.638 kHz
x dB Bandwidth 26.078 kHz

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

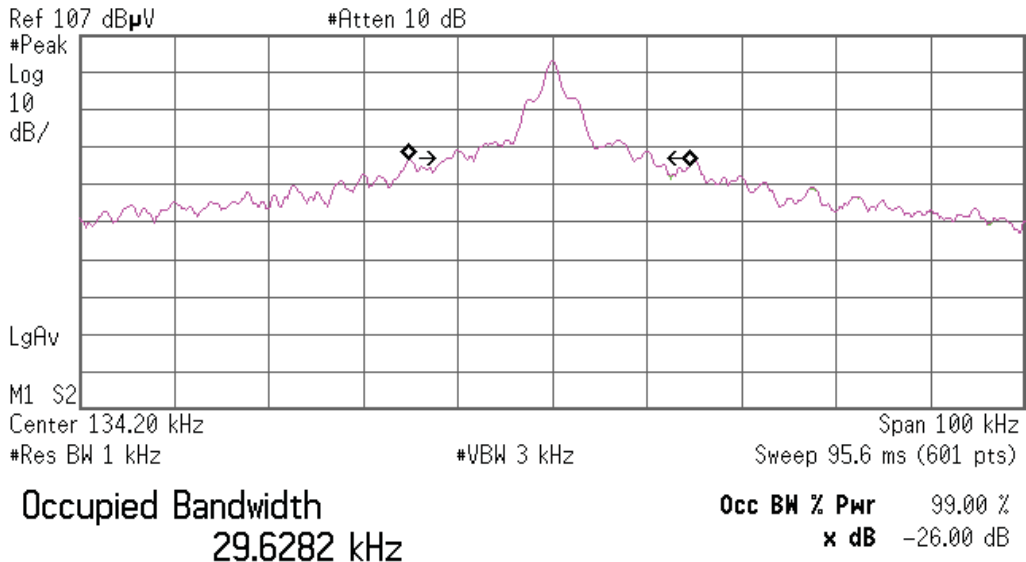
Head Office EMC Lab. No.2 Semi Anechoic Chamber

POWER	: DC 12.0V	REPORT NO	: 31GE0262-HO
MODE	: Tx	REGULATION	: -/RSS-Gen 4.6.1
		TEST DISTANCE	: 3m
		DATE	: 04/27/2010
		TEMPERATURE	: 22 deg.C
		HUMIDITY	: 43 %
	: Room Antenna / Luggage Antenna	Engineer	: Keisuke Kawamura

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

Agilent

R T



Transmit Freq Error -326.685 Hz
x dB Bandwidth 21.190 kHz

APPENDIX 3: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2009/08/17 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2010/02/09 * 12
MJM-05	Measure	PROMART	SEN1955	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2009/11/20 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE	2010/04/19 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2009/10/19 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	RE	2010/02/22 * 12
MCC-30	Coaxial cable	UL Japan	-	-	RE	2009/06/22 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2010/03/23 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2009/11/12 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	VHA91032008	RE	2009/10/05 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	174	RE	2010/01/23 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2010/02/22 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2009/09/02 * 12

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

All equipment is calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

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

Test Item:

RE: Spurious emission

UL Japan, Inc.

Head Office EMC Lab.

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