



RADIO TEST REPORT

Test Report No. : 32GE0310-HO-02-A

Applicant : Toyota Motor Corporation
Type of Equipment : Smart LF Oscillator
Model No. : TMLF12-2
FCC ID : NI4TMLF12-2
Test regulation : FCC Part 15 Subpart C 2011
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: March 17 and 29, 2012

Tested by:

Takayuki Shimada
Engineer of WiSE Japan
UL Verification Services

Approved by:

Masanori Nishiyama
Leader of WiSE Japan
UL Verification Services



NVLAP LAB CODE: 200572-0

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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. : TMLF12-2
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC12.0V(Max 0.5A)
Receipt Date of Sample : March 9, 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: TMLF12-2 is a transmitter that is installed in a motor vehicle and is used as part of Smart System.

Radio Specification

Radio Type : Transmitter
Frequency of Operation : 134.2kHz
Modulation : ASK
Method of Frequency Generation : Crystal
Antenna type : Coil Antenna
Duty Cycle : up to 100 %

Smart LF Oscillator(model: TMLF12-2) consists of the following parts:

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

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

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

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

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	26.0dB 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	14.0dB 0.67100MHz, QP (Door 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	4.2dB	5.0dB	5.1dB	4.7dB	5.7dB	4.4dB	4.3dB
No.2	4.1dB	5.2dB	5.1dB	4.8dB	5.6dB	4.3dB	4.2dB
No.3	4.5dB	5.0dB	5.2dB	4.8dB	5.6dB	4.5dB	4.2dB
No.4	4.7dB	5.2dB	5.2dB	4.8dB	5.6dB	5.1dB	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

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.

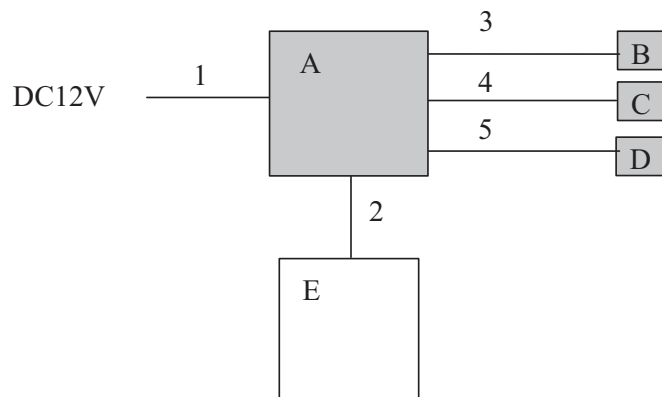
SECTION 4: Operation of E.U.T. during testing

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.
* 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	Remark
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		Remark
			Cable	Connector	
1	DC Cable	2.5	Unshielded	Unshielded	-
2	ECU Cable	3.0	Unshielded	Unshielded	-
3	Door Ant Cable	3.0	Unshielded	Unshielded	-
4	Room Ant / Luggage Ant Cable	3.0	Unshielded	Unshielded	-
5	Trunk Ant Cable	3.0	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: March 17, 2012

Test engineer: Takayuki Shimada and Motoya Imura

UL Japan, Inc.

Head Office EMC Lab.

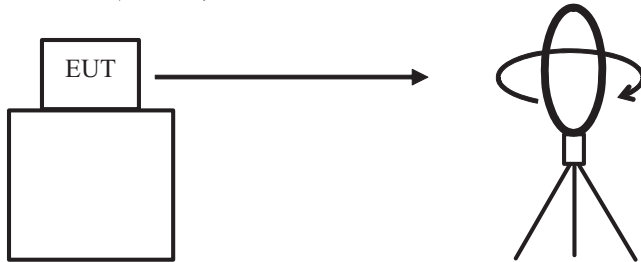
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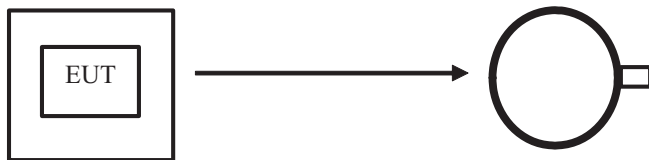
Facsimile : +81 596 24 8124

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

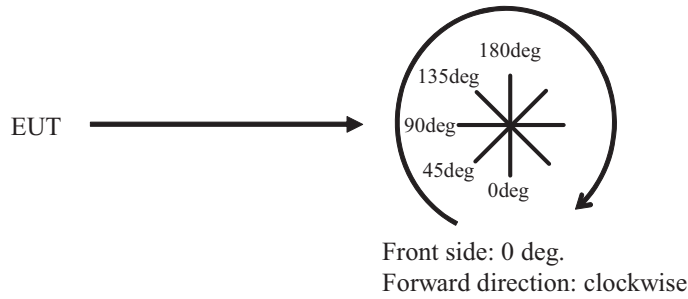


Top View (Horizontal)



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

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APPENDIX 1: Photographs of test setup

Radiated Emission
Door Antenna



Photo 1

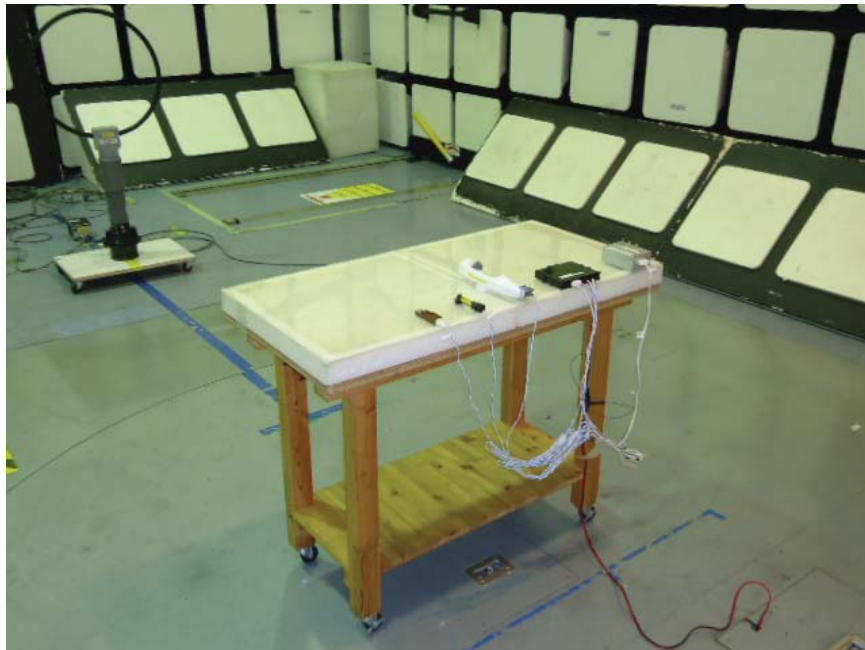


Photo 2

Radiated Emission
Trunk Antenna



Photo 1

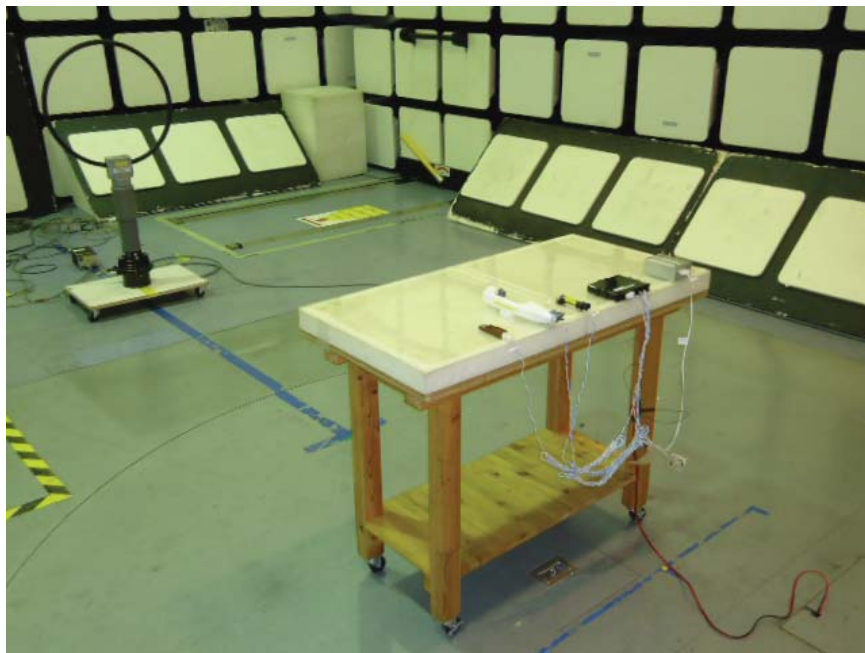


Photo 2

Radiated Emission
Room Antenna / Luggage Antenna

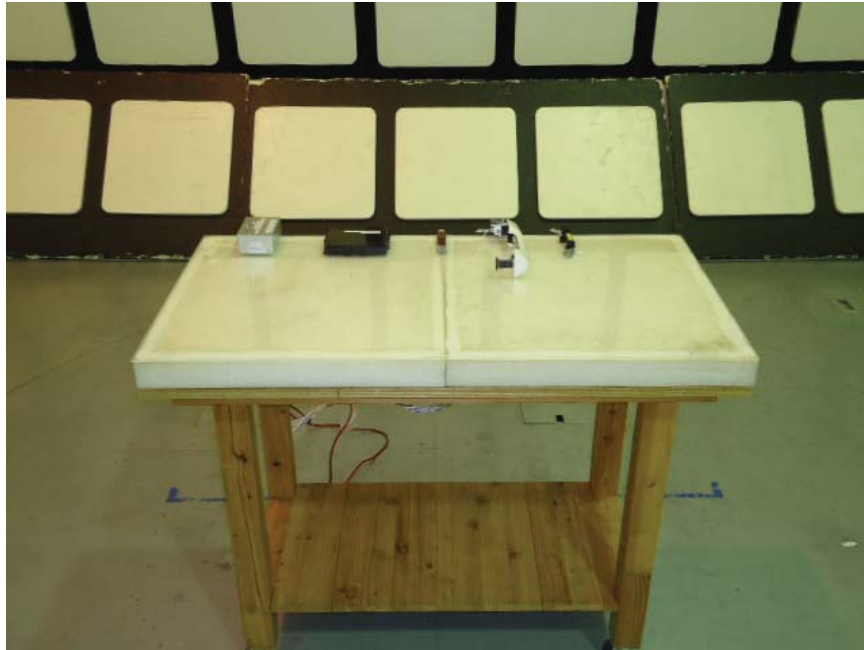


Photo 1

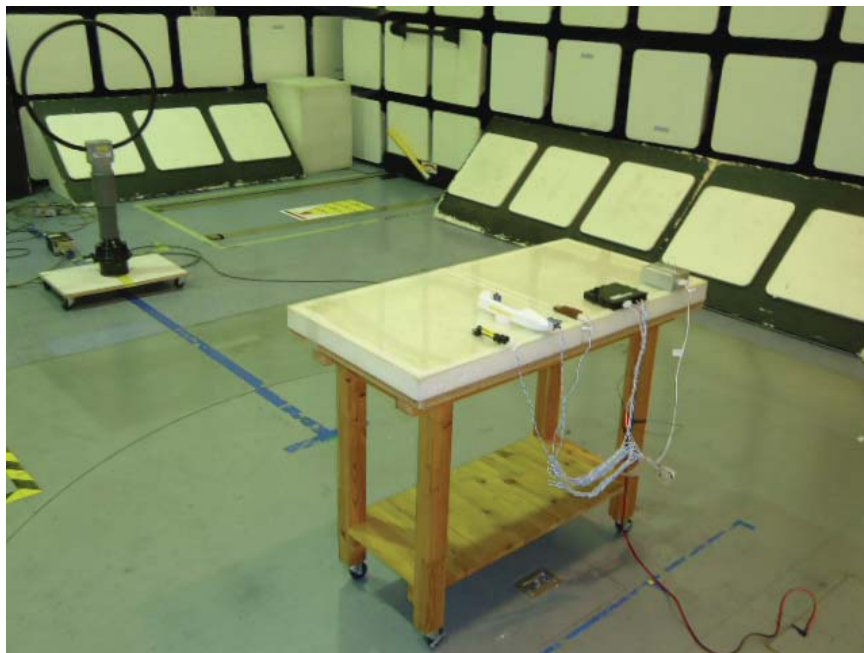
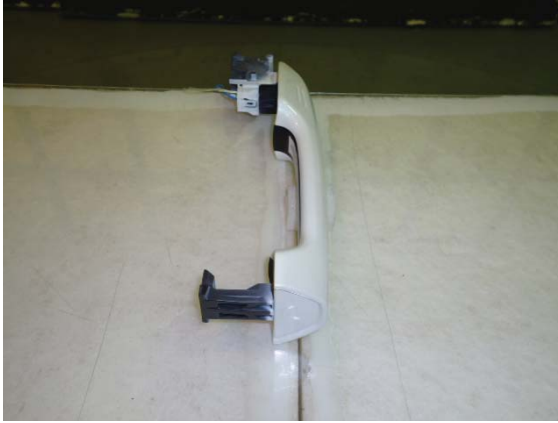


Photo 2

Worst Case Position

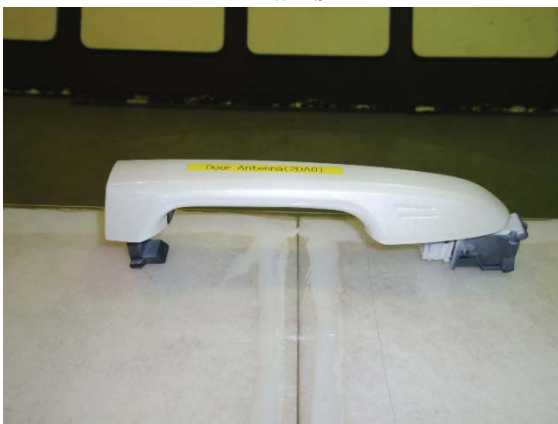
Door Antenna
Below 30MHz:X-axis
Above 30MHz(Hori:X-axis /Vert:X-axis)
X-axis



Y-axis



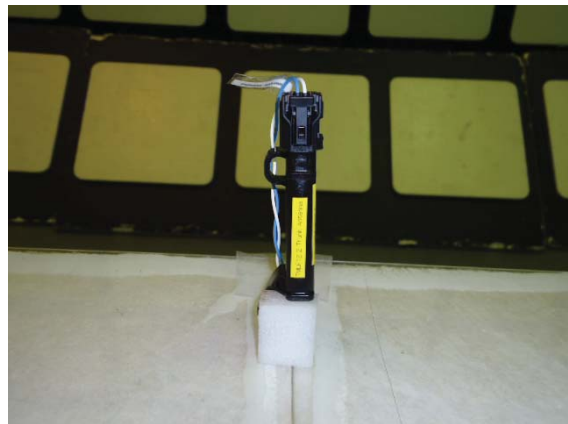
Z-axis



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

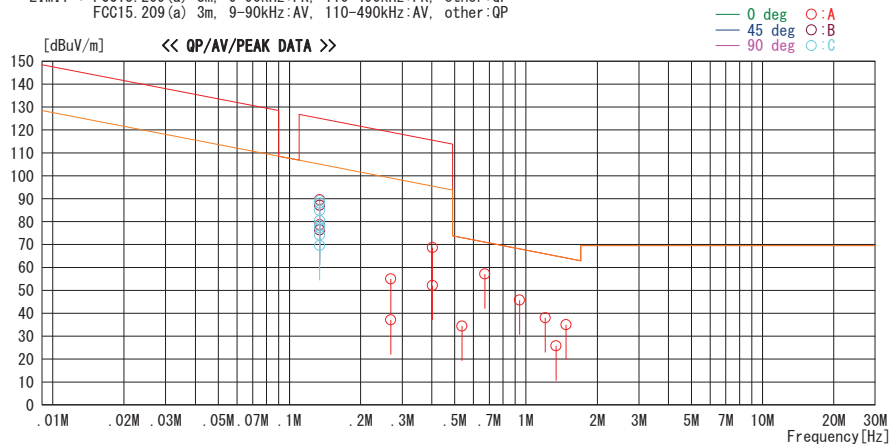
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2012/03/17

Report No. : 32GE0310-HO-02
Temp./ Humi. : 25deg. C / 30% RH
Engineer : Takayuki Shimada

Mode / Remarks : Tx 134.2kHz, Normal modulation, Door Antenna, Worst-axis(ECU:X, Antenna: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	Loss	Gain	Result	Limit	Margin	Antenna	Table	Comment	
			[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[deg]	[deg]		
0.13420	95.8	PEAK	19.9	6.0	32.2	89.5	125.1	35.6	0	A	180	Worst
0.13420	85.0	AV	19.9	6.0	32.2	78.7	105.1	26.4	0	A	180	Worst
0.13420	93.5	PEAK	19.9	6.0	32.2	87.2	125.1	37.9	45	B	147	
0.13420	82.7	AV	19.9	6.0	32.2	76.4	105.1	28.7	45	B	147	
0.13420	91.1	PEAK	19.9	6.0	32.2	84.8	125.1	40.3	90	C	253	
0.13420	80.4	AV	19.9	6.0	32.2	74.1	105.1	31.0	90	C	253	
0.13420	94.3	PEAK	19.9	6.0	32.2	88.0	125.1	37.1	135	C	208	
0.13420	83.6	AV	19.9	6.0	32.2	77.3	105.1	27.8	135	C	208	
0.13420	95.4	PEAK	19.9	6.0	32.2	89.1	125.1	36.0	180	C	180	
0.13420	84.5	AV	19.9	6.0	32.2	78.2	105.1	26.9	180	C	180	
0.13420	86.7	PEAK	19.9	6.0	32.2	80.4	125.1	44.7	0	C	176	Hori
0.13420	75.9	AV	19.9	6.0	32.2	69.6	105.1	35.5	0	C	176	Hori
0.26840	61.4	PEAK	19.7	6.1	32.2	55.0	119.0	64.0	0	A	180	
0.26840	43.6	AV	19.7	6.1	32.2	37.2	99.0	61.8	0	A	180	
0.40260	75.2	PEAK	19.6	6.1	32.2	68.7	115.5	46.8	0	A	180	
0.40260	58.7	AV	19.6	6.1	32.2	52.2	95.5	43.3	0	A	180	
0.53680	40.9	QP	19.6	6.1	32.2	34.4	73.0	38.6	0	A	180	
0.67100	63.5	QP	19.6	6.2	32.2	57.1	71.1	14.0	0	A	180	
0.93940	52.3	QP	19.5	6.2	32.2	45.8	68.1	22.3	0	A	180	
1.20780	44.6	QP	19.5	6.2	32.2	38.1	65.9	27.8	0	A	180	
1.34200	32.1	QP	19.6	6.3	32.2	25.8	65.0	39.2	0	A	180	
1.47620	41.3	QP	19.6	6.3	32.2	35.0	64.2	29.2	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)
Trunk Antenna

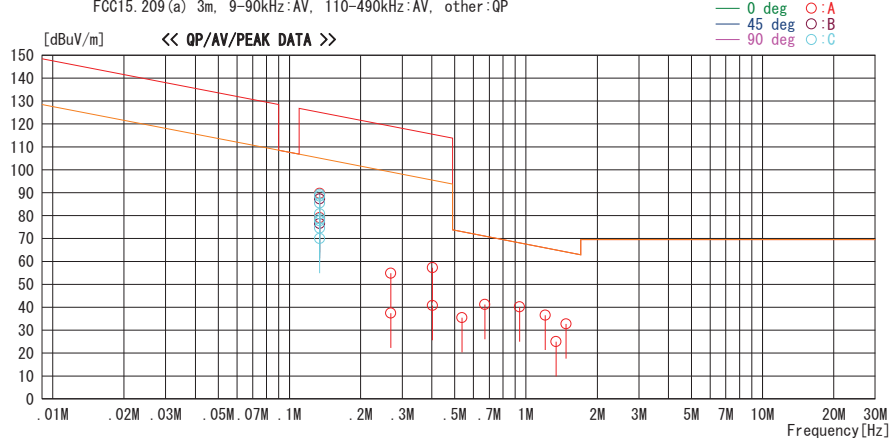
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No. 2 Semi Anechoic Chamber
Date : 2012/03/17

Report No. : 32GE0310-HO-02
Temp. / Humi. : 25deg. C / 30% RH
Engineer : Takayuki Shimada

Mode / Remarks : Tx 134.2kHz, Normal modulation, Trunk Antenna, Worst-axis(ECU:X, Antenna: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	96.0	PEAK	19.9	6.0	32.2	89.7	125.1	35.4	0	A	180 Worst
0.13420	85.4	AV	19.9	6.0	32.2	79.1	105.1	26.0	0	A	180 Worst
0.13420	93.6	PEAK	19.9	6.0	32.2	87.3	125.1	37.8	45	B	145
0.13420	82.9	AV	19.9	6.0	32.2	76.6	105.1	28.5	45	B	145
0.13420	91.7	PEAK	19.9	6.0	32.2	85.4	125.1	39.7	90	C	178
0.13420	80.9	AV	19.9	6.0	32.2	74.6	105.1	30.5	90	C	178
0.13420	94.8	PEAK	19.9	6.0	32.2	88.5	125.1	36.6	135	C	293
0.13420	84.0	AV	19.9	6.0	32.2	77.7	105.1	27.4	135	C	293
0.13420	95.6	PEAK	19.9	6.0	32.2	89.3	125.1	35.8	180	C	259
0.13420	84.9	AV	19.9	6.0	32.2	78.6	105.1	26.5	180	C	259
0.13420	87.1	PEAK	19.9	6.0	32.2	80.8	125.1	44.3	0	C	177 Hori
0.13420	76.3	AV	19.9	6.0	32.2	70.0	105.1	35.1	0	C	177 Hori
0.26840	61.2	PEAK	19.7	6.1	32.2	54.8	119.0	64.2	0	A	180
0.26840	43.9	AV	19.7	6.1	32.2	37.5	99.0	61.5	0	A	180
0.40260	63.8	PEAK	19.6	6.1	32.2	57.3	115.5	58.2	0	A	180
0.40260	47.3	AV	19.6	6.1	32.2	40.8	95.5	54.7	0	A	180
0.53680	41.9	QP	19.6	6.1	32.2	35.4	73.0	37.6	0	A	180
0.67100	47.6	QP	19.6	6.2	32.2	41.2	71.1	29.9	0	A	180
0.93940	46.7	QP	19.5	6.2	32.2	40.2	68.1	27.9	0	A	180
1.20780	43.1	QP	19.5	6.2	32.2	36.6	65.9	29.3	0	A	180
1.34200	31.3	QP	19.6	6.3	32.2	25.0	65.0	40.0	0	A	180
1.47620	39.1	QP	19.6	6.3	32.2	32.8	64.2	31.4	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 Maximum Output

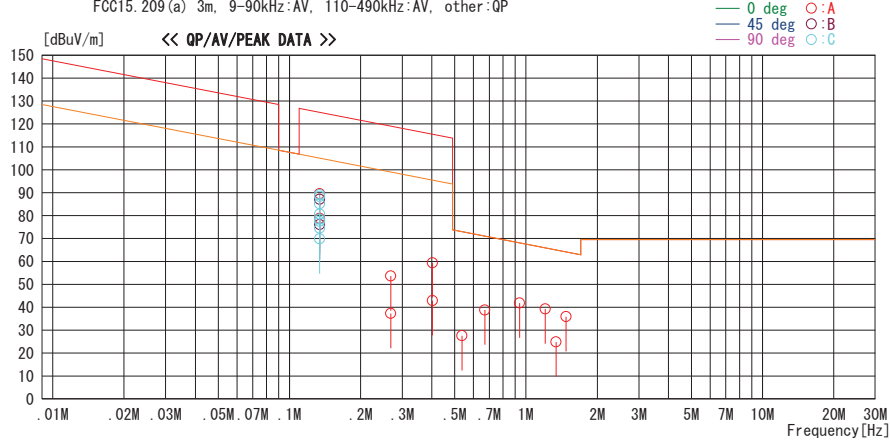
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2012/03/17

Report No. : 32GE0310-HO-02
Temp. / Humi. : 25deg. C / 30% RH
Engineer : Takayuki Shimada

Mode / Remarks : Tx 134.2kHz, Normal modulation, Room Antenna / Luggage Antenna, Worst-axis(ECU:X, Antenna: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	95.8	PEAK	19.9	6.0	32.2	89.5	125.1	35.6	0	A	175	
0.13420	85.1	AV	19.9	6.0	32.2	78.8	105.1	26.3	0	A	175	
0.13420	93.5	PEAK	19.9	6.0	32.2	87.2	125.1	37.9	45	B	136	
0.13420	82.4	AV	19.9	6.0	32.2	76.1	105.1	29.0	45	B	136	
0.13420	91.4	PEAK	19.9	6.0	32.2	85.1	125.1	40.0	90	C	260	
0.13420	80.8	AV	19.9	6.0	32.2	74.5	105.1	30.6	90	C	260	
0.13420	94.6	PEAK	19.9	6.0	32.2	88.3	125.1	36.8	135	C	202	
0.13420	83.7	AV	19.9	6.0	32.2	77.4	105.1	27.7	135	C	202	
0.13420	95.4	PEAK	19.9	6.0	32.2	89.1	125.1	36.0	180	C	173	
0.13420	84.7	AV	19.9	6.0	32.2	78.4	105.1	26.7	180	C	173	
0.13420	86.9	PEAK	19.9	6.0	32.2	80.6	125.1	44.5	0	C	180	Hori
0.13420	76.2	AV	19.9	6.0	32.2	69.9	105.1	35.2	0	C	180	Hori
0.26840	60.1	PEAK	19.7	6.1	32.2	53.7	119.0	65.3	0	A	175	
0.26840	43.7	AV	19.7	6.1	32.2	37.3	99.0	61.7	0	A	175	
0.40260	65.9	PEAK	19.6	6.1	32.2	59.4	115.5	56.1	0	A	175	
0.40260	49.4	AV	19.6	6.1	32.2	42.9	95.5	52.6	0	A	175	
0.53680	34.1	QP	19.6	6.1	32.2	27.6	73.0	45.4	0	A	175	
0.67100	45.2	QP	19.6	6.2	32.2	38.8	71.1	32.3	0	A	175	
0.93940	48.4	QP	19.5	6.2	32.2	41.9	68.1	26.2	0	A	175	
1.20780	45.8	QP	19.5	6.2	32.2	39.3	65.9	26.6	0	A	175	
1.34200	31.2	QP	19.6	6.3	32.2	24.9	65.0	40.1	0	A	175	
1.47620	42.2	QP	19.6	6.3	32.2	35.9	64.2	28.3	0	A	175	

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

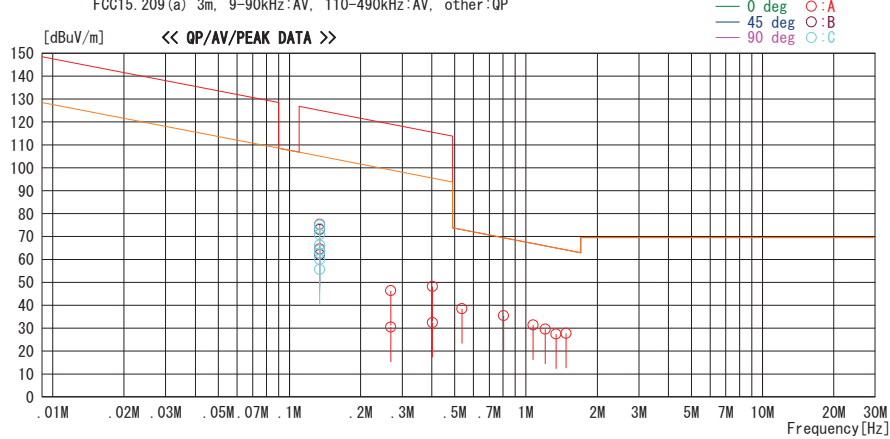
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No. 2 Semi Anechoic Chamber
Date : 2012/03/17

Report No. : 32GE0310-HO-02
Temp. / Humi. : 25deg. C / 30% RH
Engineer : Takayuki Shimada

Mode / Remarks : Tx 134.2kHz, Normal modulation, Room Antenna / Luggage Antenna, Worst-axis(ECU:X, Antenna: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	81.6	PEAK	19.9	6.0	32.2	75.3	125.1	49.8	0	A	176 Worst
0.13420	70.8	AV	19.9	6.0	32.2	64.5	105.1	40.6	0	A	176 Worst
0.13420	79.3	PEAK	19.9	6.0	32.2	73.0	125.1	52.1	45	B	136
0.13420	68.4	AV	19.9	6.0	32.2	62.1	105.1	43.0	45	B	136
0.13420	77.1	PEAK	19.9	6.0	32.2	70.8	125.1	54.3	90	C	262
0.13420	66.3	AV	19.9	6.0	32.2	60.0	105.1	45.1	90	C	262
0.13420	79.8	PEAK	19.9	6.0	32.2	73.5	125.1	51.6	135	C	205
0.13420	69.1	AV	19.9	6.0	32.2	62.8	105.1	42.3	135	C	205
0.13420	81.3	PEAK	19.9	6.0	32.2	75.0	125.1	50.1	180	C	176
0.13420	70.4	AV	19.9	6.0	32.2	64.1	105.1	41.0	180	C	176
0.13420	72.6	PEAK	19.9	6.0	32.2	66.3	125.1	58.8	0	C	180 Hori
0.13420	61.9	AV	19.9	6.0	32.2	55.6	105.1	49.5	0	C	180 Hori
0.26840	52.8	PEAK	19.7	6.1	32.2	46.4	119.0	72.6	0	A	175
0.26840	36.9	AV	19.7	6.1	32.2	30.5	99.0	68.5	0	A	175
0.40260	54.7	PEAK	19.6	6.1	32.2	48.2	115.5	67.3	0	A	175
0.40260	39.0	AV	19.6	6.1	32.2	32.5	95.5	63.0	0	A	175
0.53680	45.0	QP	19.6	6.1	32.2	38.5	73.0	34.5	0	A	175
0.80520	41.9	QP	19.6	6.2	32.2	35.5	69.5	34.0	0	A	175
1.07360	37.9	QP	19.5	6.2	32.2	31.4	66.9	35.5	0	A	175
1.20780	36.0	QP	19.5	6.2	32.2	29.5	65.9	36.4	0	A	175
1.34200	33.8	QP	19.6	6.3	32.2	27.5	65.0	37.5	0	A	175
1.47620	34.0	QP	19.6	6.3	32.2	27.7	64.2	36.5	0	A	175

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

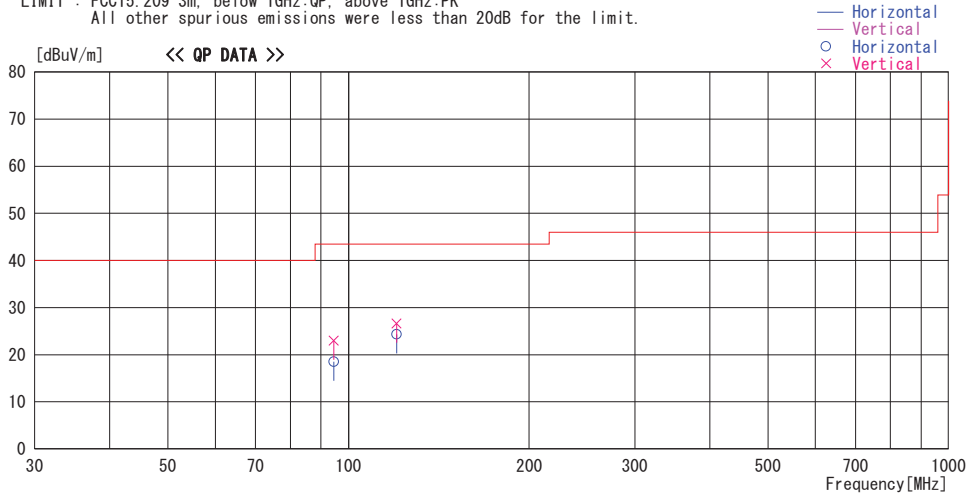
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2012/03/17

Report No. : 32GE0310-HO-02

Temp./Humi. : 22deg. C / 33% RH
Engineer : Motoya Imura

Mode / Remarks : Tx 134.2kHz, Normal modulation, Door Antenna Worst-axis

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



Frequency [MHz]	Reading [dBuV]	DET	Antenna		Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Loss& Gain [dB]							
94.477	33.5	QP	9.2	-24.2	18.5	146	300	Hor i.	43.5	25.0	
94.477	38.0	QP	9.2	-24.2	23.0	325	100	Vert.	43.5	20.5	
120.240	35.2	QP	13.0	-23.9	24.3	261	300	Hor i.	43.5	19.2	
120.240	37.5	QP	13.0	-23.9	26.6	5	100	Vert.	43.5	16.9	

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

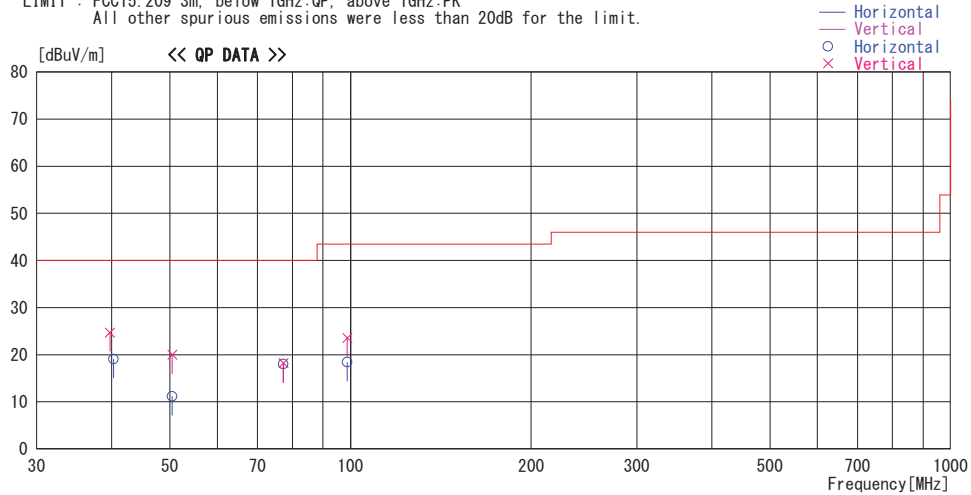
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2012/03/17

Report No. : 32GE0310-HO-02

Temp./Humi. : 22deg. C / 33% RH
Engineer : Motoya Imura

Mode / Remarks : Tx 134.2kHz, Normal modulation, Trunk Antenna Worst-axis

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



Frequency [MHz]	Reading [dBuV]	DET	Antenna		Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Loss& Gain [dB]							
39.732	34.6	QP	15.0	-24.9	24.7	149	100	Vert.	40.0	15.3	
40.281	29.2	QP	14.8	-24.9	19.1	161	156	Hori.	40.0	20.9	
50.456	33.8	QP	10.9	-24.7	20.0	242	100	Vert.	40.0	20.0	
50.461	25.0	QP	10.9	-24.7	11.2	279	300	Hori.	40.0	28.8	
77.304	35.8	QP	6.4	-24.2	18.0	161	298	Hori.	40.0	22.0	
77.310	36.0	QP	6.4	-24.2	18.2	109	100	Vert.	40.0	21.8	
98.772	32.8	QP	9.8	-24.2	18.4	354	245	Hori.	43.5	25.1	
98.773	38.0	QP	9.8	-24.2	23.6	228	100	Vert.	43.5	19.9	

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

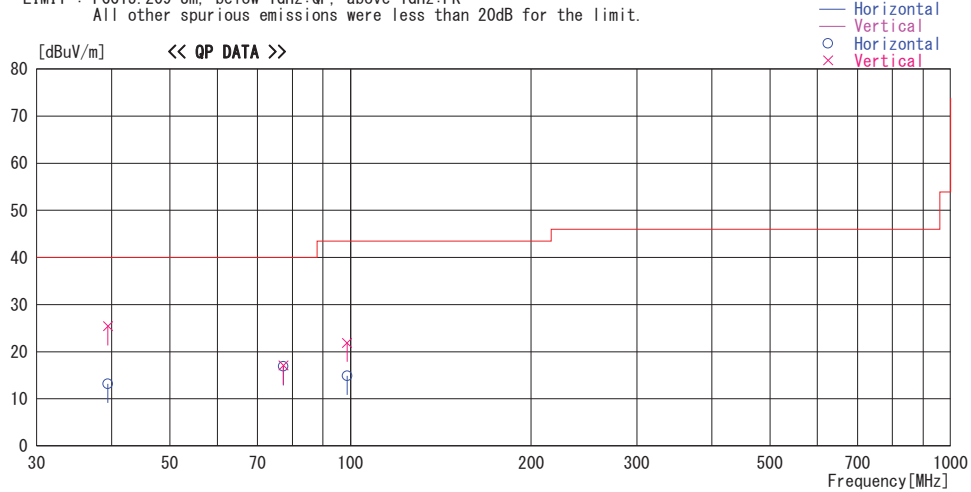
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2012/03/17

Report No. : 32GE0310-HO-02

Temp./Humi. : 22deg. C / 33% RH
Engineer : Motoya Imura

Mode / Remarks : Tx 134.2kHz, Normal modulation, Room Antenna / Luggage Antenna Worst-axis

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



Frequency [MHz]	Reading [dBuV]	DET	Antenna		Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Loss& Gain [dB]							
39.425	23.0	QP	15.1	-24.9	13.2	310	300	Hori.	40.0	26.8	
39.440	35.2	QP	15.1	-24.9	25.4	162	100	Vert.	40.0	14.6	
77.310	34.7	QP	6.4	-24.2	16.9	191	265	Hori.	40.0	23.1	
77.310	34.9	QP	6.4	-24.2	17.1	263	100	Vert.	40.0	22.9	
98.754	36.3	QP	9.8	-24.2	21.9	229	100	Vert.	43.5	21.6	
98.775	29.3	QP	9.8	-24.2	14.9	282	125	Hori.	43.5	28.6	

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

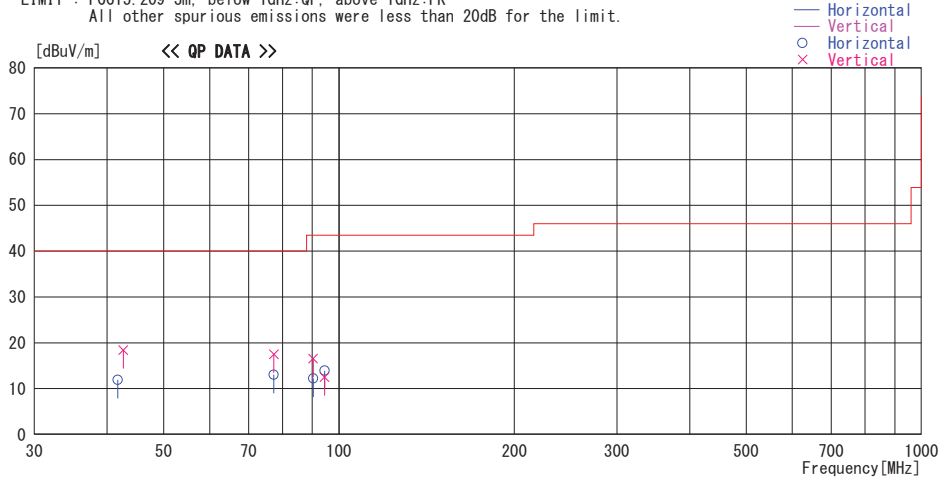
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2012/03/29

Report No. : 32GE0310-HO-02
Temp./Humi. : 24deg. C / 33% RH
Engineer : Shinya Watanabe

Mode / Remarks : Tx 134.2kHz, Normal modulation, Room Antenna / Luggage Antenna Worst-axis

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]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Gain [dB]					
41.700	22.6	QP	14.2	-24.9	11.9	Hori.	40.0	28.1	
42.632	29.5	QP	13.8	-24.9	18.4	Vert.	40.0	21.6	
77.250	30.8	QP	6.4	-24.2	13.0	Hori.	40.0	27.0	
77.300	35.3	QP	6.4	-24.2	17.5	Vert.	40.0	22.5	
90.362	28.0	QP	8.5	-24.3	12.2	Hori.	43.5	31.3	
90.300	32.2	QP	8.5	-24.2	16.5	Vert.	43.5	27.0	
94.478	27.5	QP	9.2	-24.2	12.5	Vert.	43.5	31.0	
94.477	28.9	QP	9.2	-24.2	13.9	Hori.	43.5	29.6	

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.

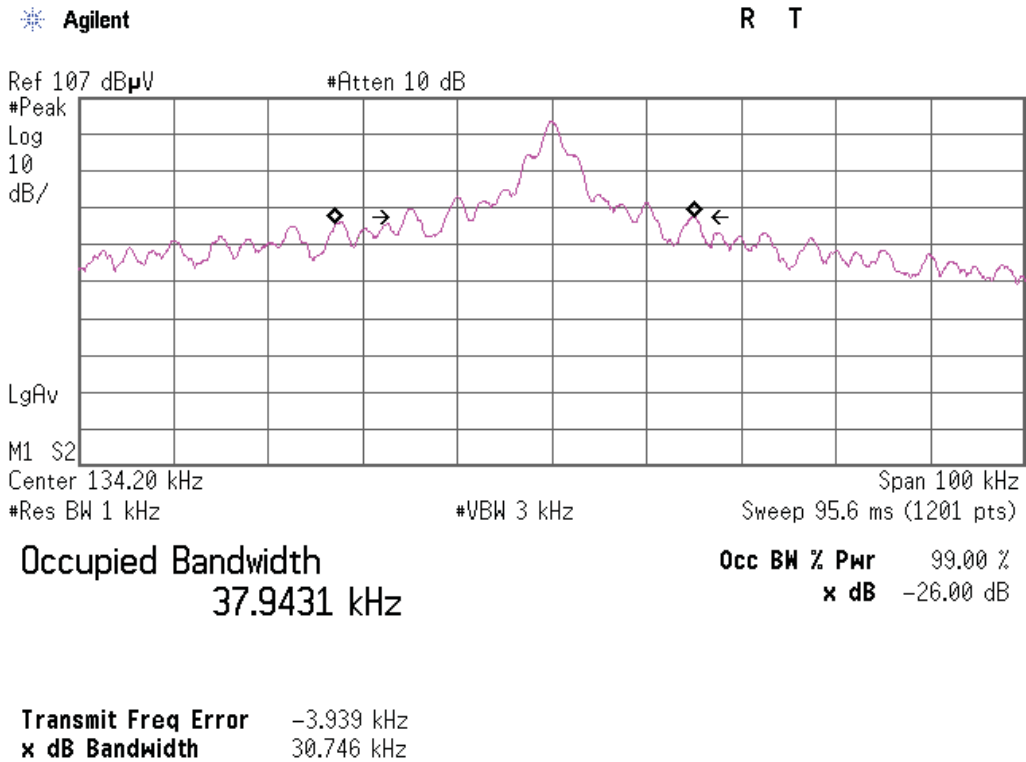
-26dB Bandwidth and 99% Occupied Bandwidth
Door Antenna

Head Office EMC Lab. No.2 Semi Anechoic Chamber

POWER : DC 12.0V
 MODE : Tx
 : Door Antenna

REPORT NO : 32GE0310-HO-02
 REGULATION : -/RSS-Gen 4.6.1
 TEST DISTANCE : 3m
 DATE : 03/17/2012
 TEMPERATURE : 25deg. C
 HUMIDITY : 30% RH
 Engineer : Takayuki Shimada

FREQ	-26dB Bandwidth	99% Occupied Bandwidth
[kHz]	[kHz]	[kHz]
134.2	30.746	37.943



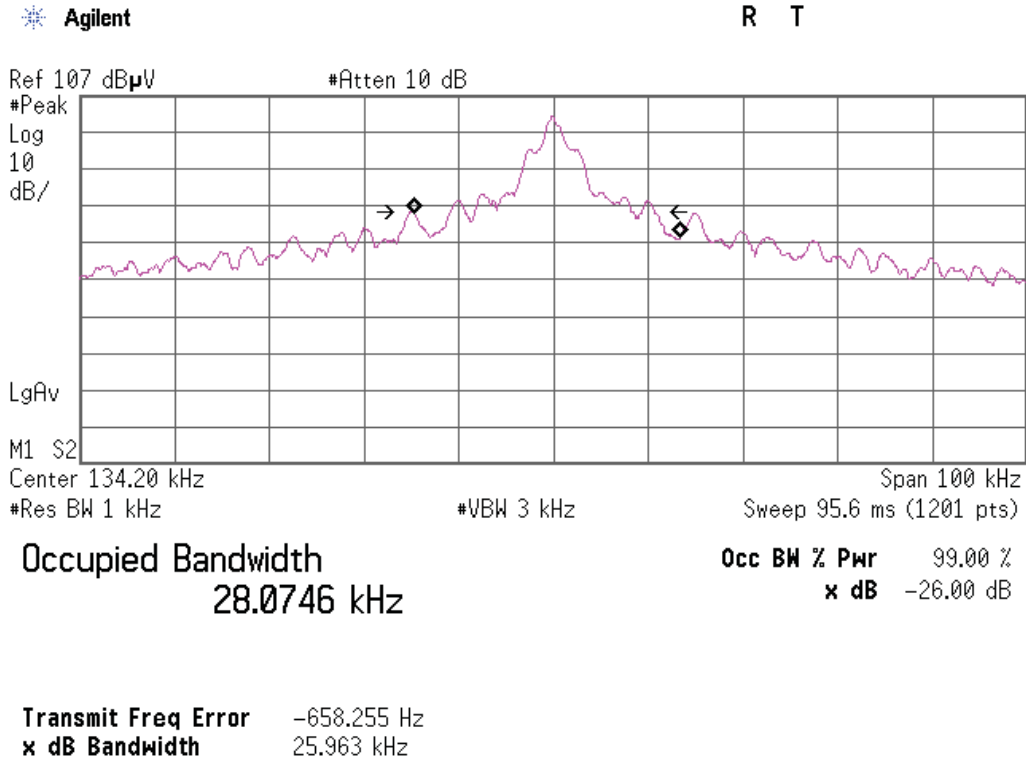
-26dB Bandwidth and 99% Occupied Bandwidth
Trunk Antenna

Head Office EMC Lab. No.2 Semi Anechoic Chamber

POWER : DC 12.0V
MODE : Tx
: Trunk Antenna

REPORT NO : 32GE0310-HO-02
REGULATION : -/RSS-Gen 4.6.1
TEST DISTANCE : 3m
DATE : 03/17/2012
TEMPERATURE : 25deg. C
HUMIDITY : 30% RH
Engineer : Takayuki Shimada

FREQ	-26dB Bandwidth	99% Occupied Bandwidth
[kHz]	[kHz]	[kHz]
134.2	25.963	28.075



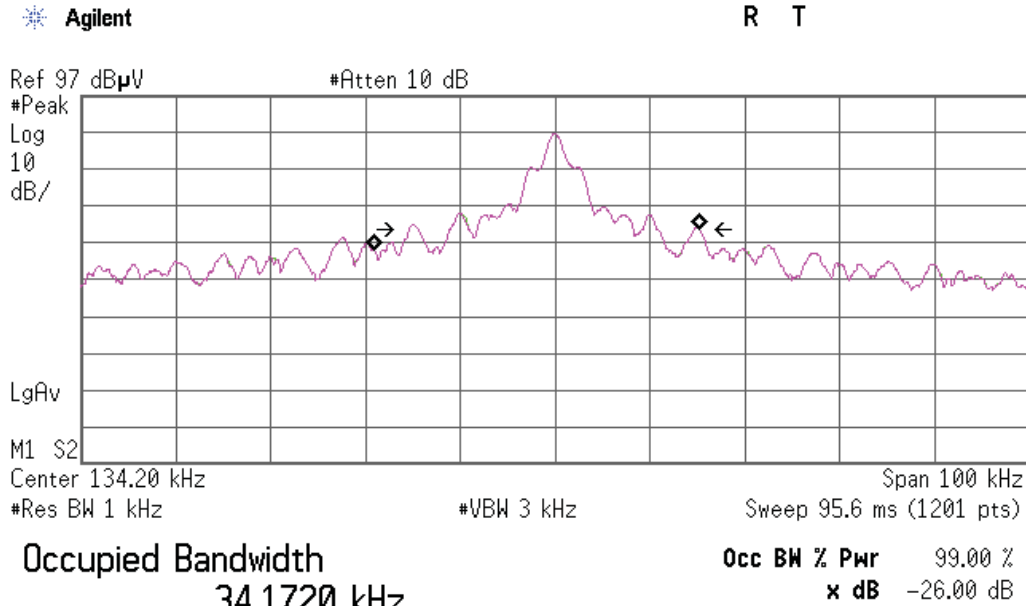
-26dB Bandwidth and 99% Occupied Bandwidth

Room Antenna / Luggage Antenna

Head Office EMC Lab. No.2 Semi Anechoic Chamber

POWER	: DC 12.0V	REPORT NO	: 32GE0310-HO-02
MODE	: Tx	REGULATION	: -/RSS-Gen 4.6.1
		TEST DISTANCE	: 3m
		DATE	: 03/17/2012
		TEMPERATURE	: 25deg. C
		HUMIDITY	: 30% RH
	: Room / Luggage Antenna	Engineer	: Takayuki Shimada

FREQ	-26dB Bandwidth	99% Occupied Bandwidth
[kHz]	[kHz]	[kHz]
134.2	30.705	34.172



Transmit Freq Error -1.900 kHz
x dB Bandwidth 30.705 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	2011/06/21 * 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-04	Spectrum Analyzer	Agilent	E4448A	US44300523	RE	2011/04/08 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE	2011/04/15 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	VHA91032008	RE	2011/10/23 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	201	RE	2011/10/23 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2012/02/16 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2011/11/02 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2011/09/26 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2011/10/19 * 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-31	Coaxial cable	UL Japan	-	-	RE	2011/07/28 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2012/03/05 * 12
APRCV05	Test Receiver	Rohde & Schwarz	ESS	840456/008	RE	2012/01/16 * 12
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2012/02/24 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	-	RE	2012/02/06 * 12
MJM-15	Measure	KOMELON	KMC-36	-	RE	-
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2011/10/15 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	174	RE	2011/10/15 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2012/03/16 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2011/07/15 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2011/08/11 * 12
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	RE	2011/04/08 * 12
MAT-09	Attenuator(6dB)	Weinschel Corp	2	BK7973	RE	2011/11/02 * 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

UL Japan, Inc.

Head Office EMC Lab.

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

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