RADIO TEST REPORT

Test Report No. : 4786000715H-A

Applicant	:	**Toyota Motor Corporation**
Type of Equipment	:	**Smart LF Oscillator**
Model No.	:	**TMLF10-50**
FCC ID	:	**NI4TMLF10-50**
Test regulation	:	**FCC Part 15 Subpart C 2012 Section 15.207, Section 15.209**
Test Result	:	**Complied**

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

Date of test: November 15, 2012

Representative test engineer:
T. Sasagawa
Tomotaka Sasagawa
Engineer of WiSE Japan,
UL Verification Service

Approved by:
S. Watanabe
Shinya Watanabe
Leader of WiSE Japan,
UL Verification Service

NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
*As for the range of Accreditation in NVLAP, you may refer to the WEB address,
http://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap

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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.	:	TMLF10-50
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC12.0V (Max 0.5A)
Receipt Date of Sample	:	November 7, 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: TMLF10-50 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 Genenration	:	Crystal
Antenna type	:	Coil Antenna
Duty Cycle	:	up to 100 %

Smart LF Oscillator(model: TMLF10-50) consists of the following parts:

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

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 (Room / Luggage 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	3.1dB 32.242MHz, Vertical, QP (Trunk Antenna)	Complied
4	-26dB Bandwidth	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> -	<FCC> Reference data <IC> -	Radiated	N/A	N/A	N/A

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.
*1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.

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)

[Electric Field Strength of Fundamental Emission]

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

[Electric Field Strength of Spurious Emission]

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

3.5 Test Location

UL Japan, Inc. Head Office EMC Lab. *NVLAP Lab. code: 200572-0
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8116 Facsimile : +81 596 24 8124

	FCC Registration Number	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms
No.1 semi-anechoic chamber	313583	2973C-1	19.2 x 11.2 x 7.7m	7.0 x 6.0m	No.1 Power source room
No.2 semi-anechoic chamber	655103	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	148738	2973C-3	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.3 Preparation room
No.3 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.4 semi-anechoic chamber	134570	2973C-4	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.4 Preparation room
No.4 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.5 semi-anechoic chamber	-	-	6.0 x 6.0 x 3.9m	6.0 x 6.0m	-
No.6 shielded room	-	-	4.0 x 4.5 x 2.7m	4.75 x 5.4 m	-
No.6 measurement room	-	-	4.75 x 5.4 x 3.0m	4.75 x 4.15 m	-
No.7 shielded room	-	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.8 measurement room	-	-	3.1 x 5.0 x 2.7m	N/A	-
No.9 measurement room	-	-	8.0 x 4.5 x 2.8m	2.0 x 2.0m	-
No.10 measurement room	-	-	2.6 x 2.8 x 2.5m	2.4 x 2.4m	-
No.11 measurement room	-	-	3.1 x 3.4 x 3.0m	2.4 x 3.4m	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Test set up, Data of EMI, and Test instruments

Refer to APPENDIX 1 to 3.

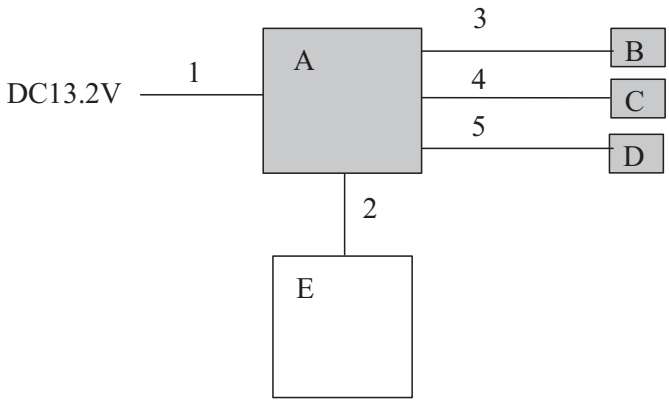
SECTION 4: Operation of E.U.T. during testing

4.1 Operating Modes

The mode is used : 1) Transmitting mode (Tx) 134.2kHz (Door Antenna, Trunk Antenna, Room Antenna / Luggage Antenna, Maximum Output)
2) Transmitting mode (Tx) 134.2kHz (Room Antenna / Luggage Antenna only, Minimum Output)
* LF output power is controlled by Component Assy, Smart Key.

Justification : The system was configured in typical fashion (as a customer would normally use it) for testing.

4.2 Configuration and peripherals



* Cabling and setup were taken into consideration and test data was taken under worse case conditions.
* The test was performed with the representative component which constitute a system.

Description of EUT and Support equipment

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

*1) Used for Operation mode “1)”.
*2) Used for Operation mode “2)”.

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	2.5	Unshielded	Unshielded	-
2	ECU Cable	2.0	Unshielded	Unshielded	-
3	Door Ant Cable	2.0	Unshielded	Unshielded	-
4	Room Ant / Luggage Ant Cable	2.0	Unshielded	Unshielded	-
5	Trunk Ant Cable	2.0	Unshielded	Unshielded	-

SECTION 5: Radiated emission (Fundamental and Spurious Emission)

Test Procedure
The Radiated Electric Field Strength intensity has been measured on No 3 semi anechoic chamber with a ground plane and at a distance of 3m.

Frequency : From 9kHz to 30MHz at distance 3m
The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.
The measurements were performed for vertical polarization (antenna angle: 0deg., 45deg., 90deg., 135 deg., and 180deg.)
and horizontal polarization.
*Refer to Figure 1 about Direction of the Loop Antenna.

Frequency : From 30MHz to 1GHz at distance 3m
The measuring antenna height varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.
The measurements were performed for both vertical and horizontal antenna polarization.

Measurements were performed with a QP, PK, and AV detector.
The radiated emission measurements were made with the following detector function of the test receiver (below 1GHz).

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

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

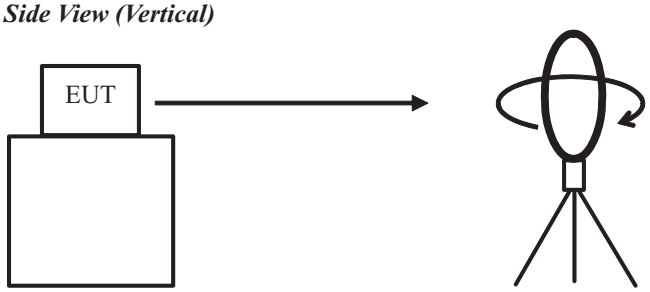
* Part 15 Section 15.31 (f)(2) (9kHz-30MHz)
[Limit at 3m]=[Limit at 300m]-40 x log (3[m]/300[m])
[Limit at 3m]=[Limit at 30m]-40 x log (3[m]/30[m])

Test data : APPENDIX 2
Test result : Pass

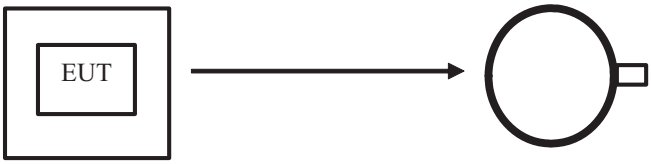
Date: November 15, 2012 Test engineer: Motoya Imura and Tomotaka Sasagawa

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

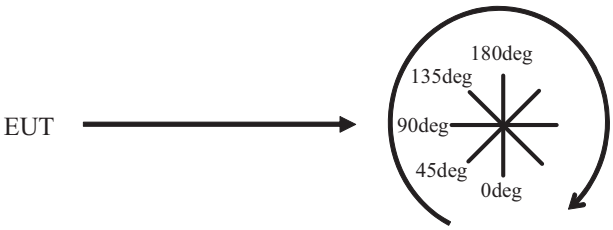


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

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

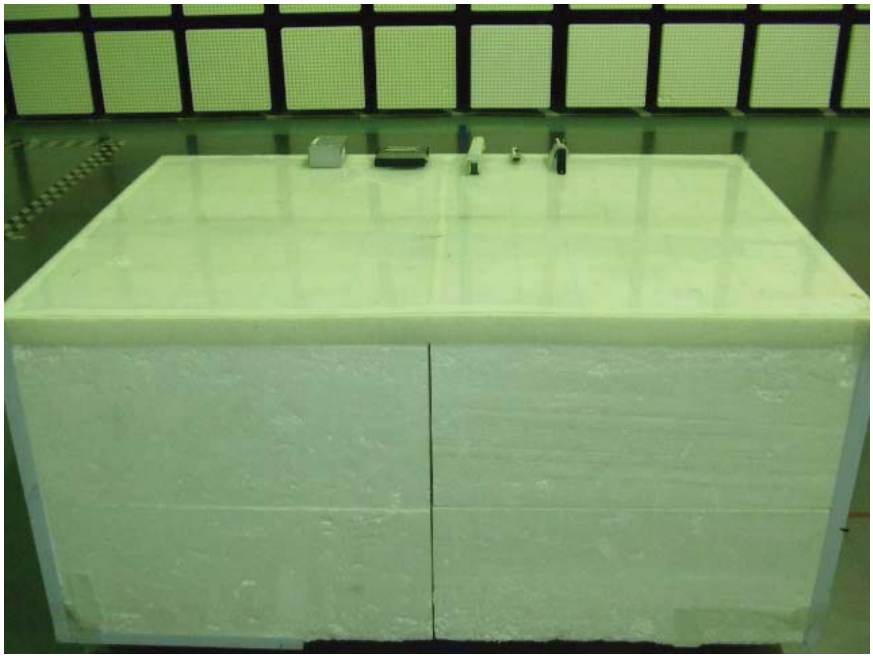


Photo 1

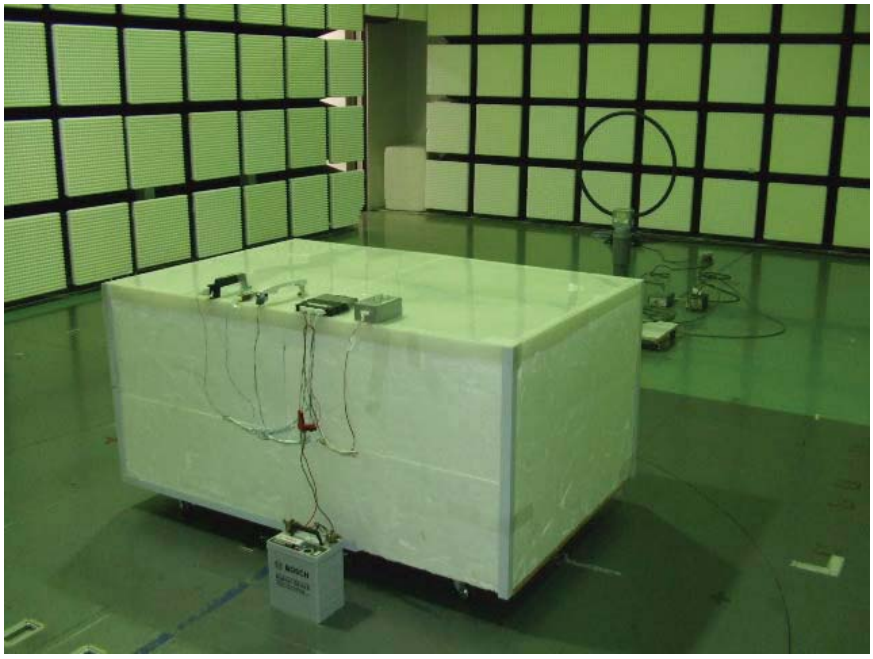


Photo 2

Radiated Emission

Trunk Antenna

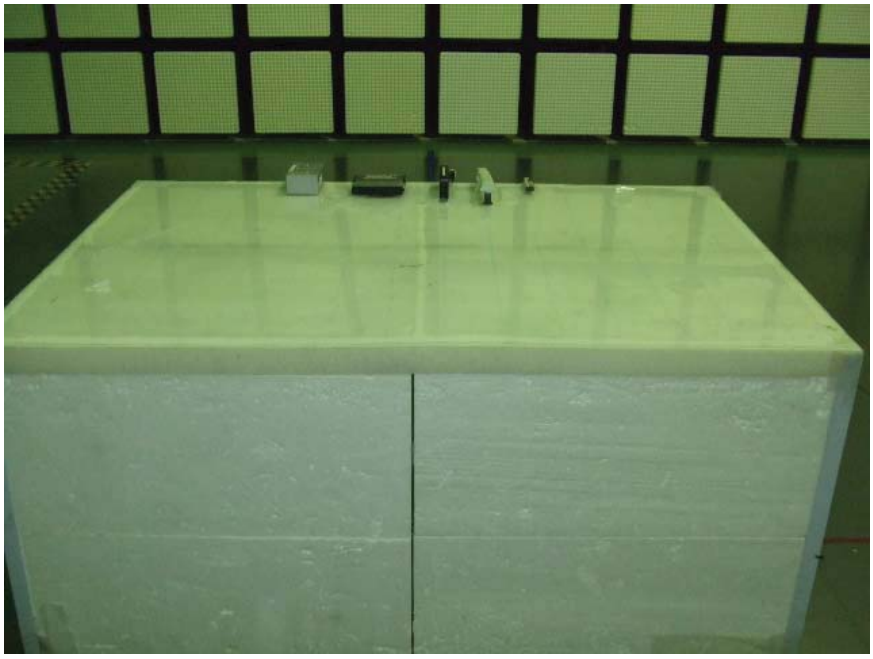


Photo 1

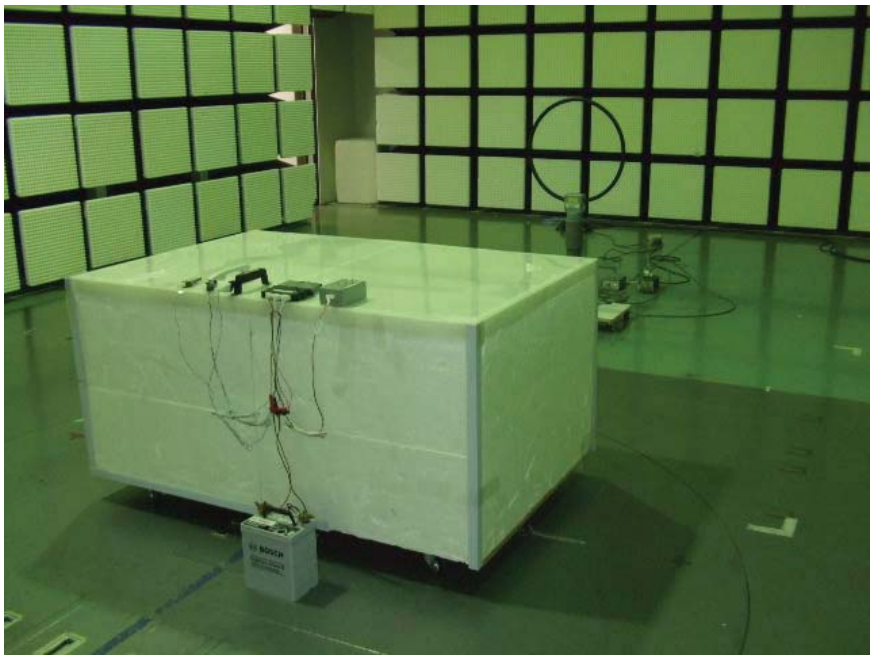


Photo 2

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Radiated Emission

Room Antenna / Luggage Antenna

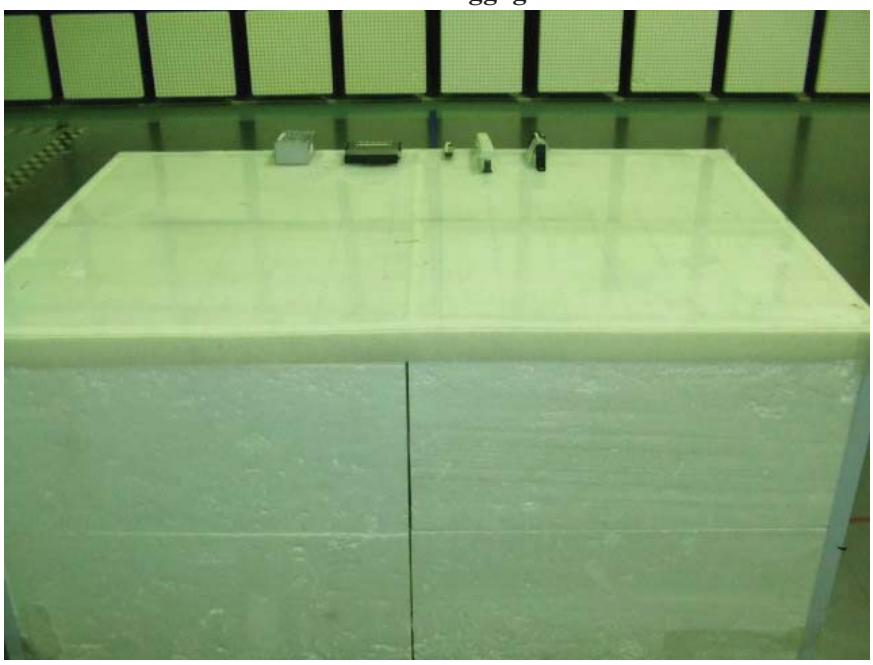
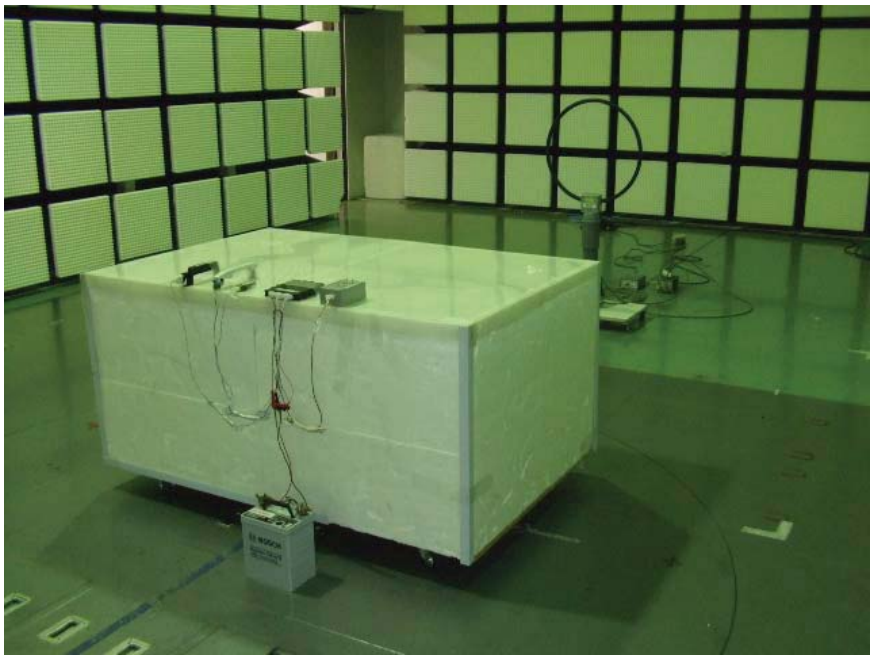


Photo 1



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Worst Case Position

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

X-axis

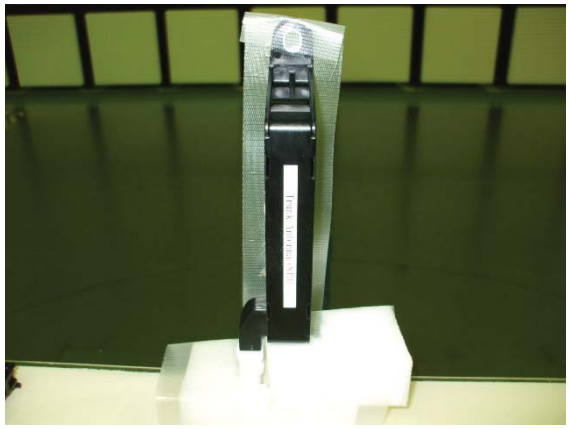
Y-axis

Z-axis

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

X-axis

Y-axis



Z-axis

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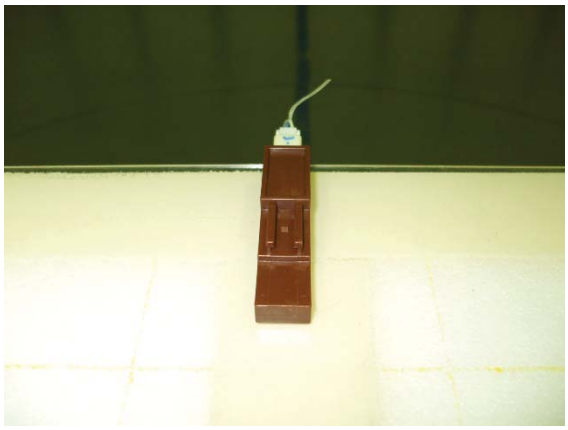
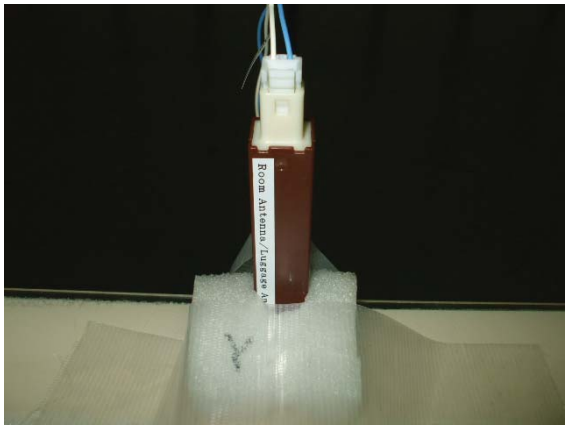
Worst Case Position

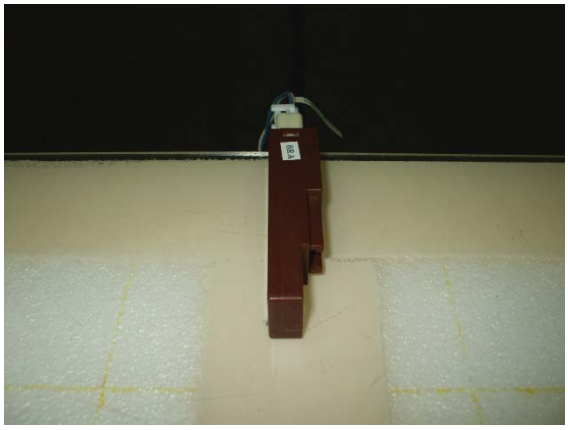
Room Antenna / Luggage Antenna
Below 30MHz:Z-axis
Above 30MHz(Hori:X-axis /Vert:X-axis)
X-axis



Y-axis



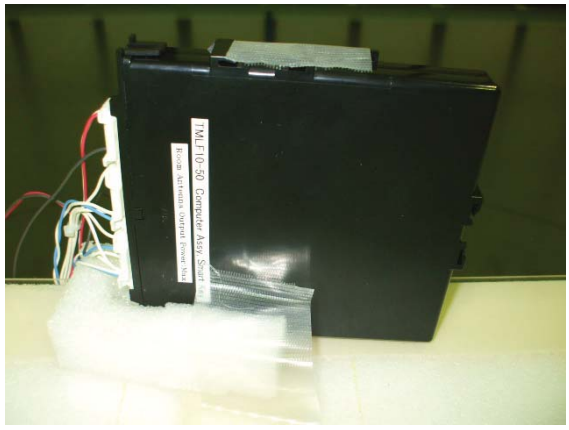
Z-axis



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

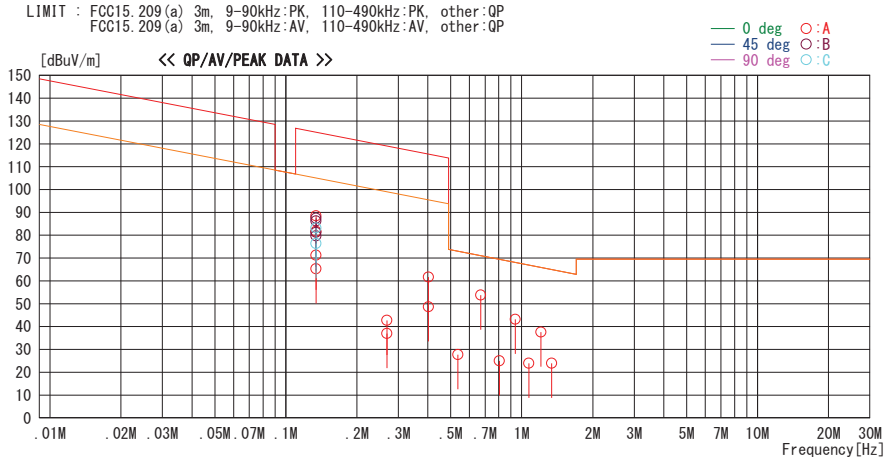
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2012/11/15

Report No. : 4786000715H

Temp. / Humi. : 22deg. C / 41% RH
Engineer : Tomotaka Sasagawa

Mode / Remarks : Tx 134.2kHz, Normal Modulation, Door Antenna, Worst axis (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 [deg]	Comment
0.13420	93.2	PEAK	19.2	6.0	32.2	86.2	125.1	38.9	45	B	16	
0.13420	90.2	PEAK	19.2	6.0	32.2	83.2	125.1	41.9	90	C	221	
0.13420	95.5	PEAK	19.2	6.0	32.2	88.5	125.1	36.6	0	A	2	
0.13420	86.7	AV	19.2	6.0	32.2	79.7	105.1	25.4	45	B	16	
0.13420	83.4	AV	19.2	6.0	32.2	76.4	105.1	28.7	90	C	221	
0.13420	88.7	AV	19.2	6.0	32.2	81.7	105.1	23.4	0	A	2	
0.13420	94.5	PEAK	19.2	6.0	32.2	87.5	125.1	37.6	135	B	16	
0.13420	88.2	AV	19.2	6.0	32.2	81.2	105.1	23.9	135	B	16	
0.13420	78.2	PEAK	19.2	6.0	32.2	71.2	125.1	53.9	0	A	2	LOOP-ANT:HOR
0.13420	72.3	AV	19.2	6.0	32.2	65.3	105.1	39.8	0	A	2	LOOP-ANT:HOR
0.26840	43.9	AV	19.1	6.1	32.1	37.0	99.0	62.0	0	A	0	
0.26840	49.7	PEAK	19.1	6.1	32.1	42.8	119.0	76.2	0	A	0	
0.40260	55.6	AV	19.1	6.1	32.1	48.7	95.5	46.8	0	A	355	
0.40260	68.6	PEAK	19.1	6.1	32.1	61.7	115.5	53.8	0	A	355	
0.53680	34.6	QP	19.1	6.1	32.1	27.7	73.0	45.3	0	A	6	
0.67100	60.6	QP	19.2	6.1	32.1	53.8	71.1	17.3	0	A	1	
0.80520	31.8	QP	19.2	6.1	32.1	25.0	69.5	44.5	0	A	24	
0.93940	50.0	QP	19.2	6.1	32.1	43.2	68.1	24.9	0	A	1	
1.07360	30.9	QP	19.1	6.1	32.1	24.0	66.9	42.9	0	A	243	
1.20780	44.4	QP	19.1	6.2	32.1	37.6	65.9	28.3	0	A	243	
1.34200	30.8	QP	19.1	6.2	32.1	24.0	65.0	41.0	0	A	243	

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

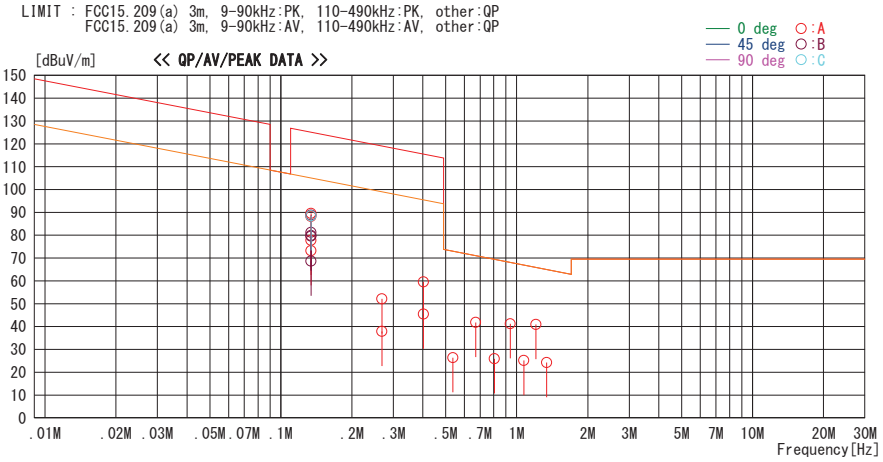
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2012/11/15

Report No. : 4786000715H

Temp. / Humi. : 22deg. C / 41% RH
Engineer : Tomotaka Sasagawa

Mode / Remarks : Tx 134.2kHz, Normal Modulation, Trunk Antenna, Worst axis (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	96.5	PEAK	19.2	6.0	32.2	89.5	125.1	35.6	0	A	3	
0.13420	95.8	PEAK	19.2	6.0	32.2	88.8	125.1	36.3	45	B	322	
0.13420	95.5	PEAK	19.2	6.0	32.2	88.5	125.1	36.6	90	C	49	
0.13420	95.2	PEAK	19.2	6.0	32.2	88.2	125.1	36.9	135	A	3	
0.13420	88.2	AV	19.2	6.0	32.2	81.2	105.1	23.9	0	B	322	
0.13420	86.5	AV	19.2	6.0	32.2	79.5	105.1	25.6	45	B	322	
0.13420	84.7	AV	19.2	6.0	32.2	77.7	105.1	27.4	90	A	3	
0.13420	86.9	AV	19.2	6.0	32.2	79.9	105.1	25.2	135	B	322	
0.13420	80.2	PEAK	19.2	6.0	32.2	73.2	125.1	51.9	135	A	3	LOOP-ANT:HOR
0.13420	75.6	AV	19.2	6.0	32.2	68.6	105.1	36.5	135	B	322	LOOP-ANT:HOR
0.26840	59.2	PEAK	19.1	6.1	32.2	52.2	119.0	66.8	0	A	5	
0.26840	44.9	AV	19.1	6.1	32.2	37.9	99.0	61.1	0	A	5	
0.40260	66.5	PEAK	19.1	6.1	32.2	59.5	115.5	56.0	0	A	8	
0.40260	52.4	AV	19.1	6.1	32.2	45.4	95.5	50.1	0	A	8	
0.53680	33.4	QP	19.1	6.1	32.2	26.4	73.0	46.6	0	A	9	
0.67100	48.7	QP	19.2	6.1	32.2	41.8	71.1	29.3	0	A	356	
0.80520	32.9	QP	19.2	6.1	32.2	26.0	69.5	43.5	0	A	347	
0.93940	48.1	QP	19.2	6.1	32.2	41.2	68.1	26.9	0	A	21	
1.07360	32.1	QP	19.1	6.1	32.2	25.1	66.9	41.8	0	A	26	
1.20780	47.9	QP	19.1	6.2	32.2	41.0	65.9	24.9	0	A	31	
1.34200	31.1	QP	19.1	6.2	32.2	24.2	65.0	40.8	0	A	31	

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

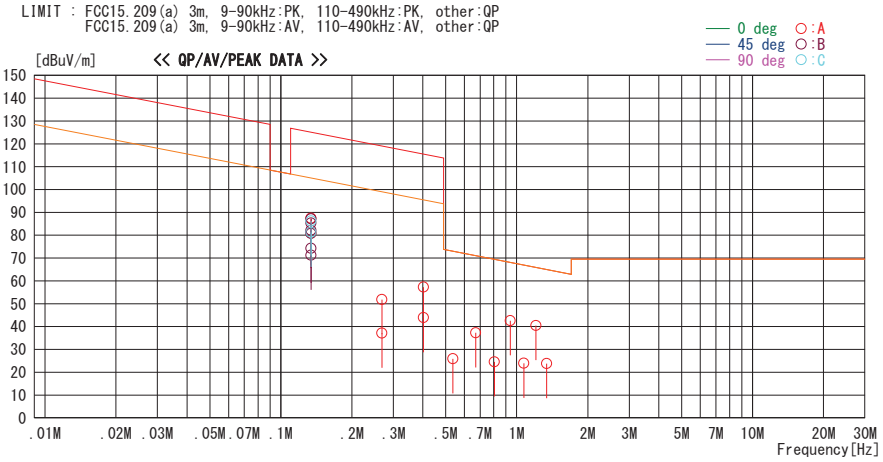
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2012/11/15

Report No. : 4786000715H

Temp. / Humi. : 22deg. C / 41% RH
Engineer : Tomotaka Sasagawa

Mode / Remarks : Tx 134.2kHz, Normal Modulation, Room Antenna, Worst axis (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 [deg]	Comment
0.13420	94.5	PEAK	19.2	6.0	32.2	87.5	125.1	37.6	0	A	94	
0.13420	94.1	PEAK	19.2	6.0	32.2	87.1	125.1	38.0	45	B	133	
0.13420	93.2	PEAK	19.2	6.0	32.2	86.2	125.1	38.9	90	C	81	
0.13420	88.2	AV	19.2	6.0	32.2	81.2	105.1	23.9	90	C	81	
0.13420	89.2	AV	19.2	6.0	32.2	82.2	105.1	22.9	45	B	133	
0.13420	88.0	AV	19.2	6.0	32.2	81.0	105.1	24.1	0	A	94	
0.13420	92.3	PEAK	19.2	6.0	32.2	85.3	125.1	39.8	135	B	132	
0.13420	87.8	AV	19.2	6.0	32.2	80.8	105.1	24.3	135	B	132	
0.13420	81.2	PEAK	19.2	6.0	32.2	74.2	125.1	50.9	135	B	133	LOOP-ANT:HOR
0.13420	78.2	AV	19.2	6.0	32.2	71.2	105.1	33.9	135	B	133	LOOP-ANT:HOR
0.26840	58.9	PEAK	19.1	6.1	32.2	51.9	119.0	67.1	0	A	0	
0.26840	44.2	AV	19.1	6.1	32.2	37.2	99.0	61.8	0	A	0	
0.40260	64.3	PEAK	19.1	6.1	32.2	57.3	115.5	58.2	0	A	357	
0.40260	51.0	AV	19.1	6.1	32.2	44.0	95.5	51.5	0	A	357	
0.53680	32.9	QP	19.1	6.1	32.2	25.9	73.0	47.1	0	A	4	
0.67100	44.2	QP	19.2	6.1	32.2	37.3	71.1	33.8	0	A	30	
0.80520	31.4	QP	19.2	6.1	32.2	24.5	69.5	45.0	0	A	355	
0.93940	49.5	QP	19.2	6.1	32.2	42.6	68.1	25.5	0	A	241	
1.07360	30.9	QP	19.1	6.1	32.2	23.9	66.9	43.0	0	A	218	
1.20780	47.3	QP	19.1	6.2	32.2	40.4	65.9	25.5	0	A	218	
1.34200	30.7	QP	19.1	6.2	32.2	23.8	65.0	41.2	0	A	218	

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

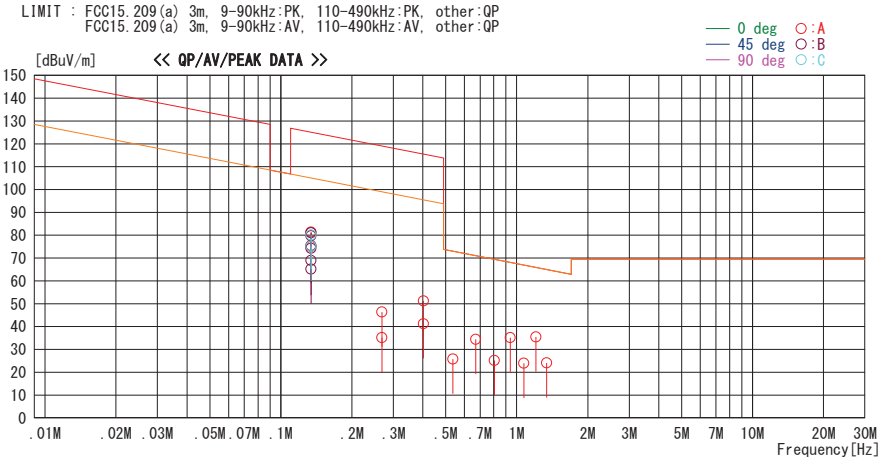
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2012/11/15

Report No. : 4786000715H

Temp. / Humi. : 22deg. C / 41% RH
Engineer : Tomotaka Sasagawa

Mode / Remarks : Tx 134.2kHz, Normal Modulation, Room Antenna, Worst axis (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 [deg]	Comment
0.13420	88.4	PEAK	19.2	6.0	32.2	81.4	125.1	43.7	0	A	94	
0.13420	88.1	PEAK	19.2	6.0	32.2	81.1	125.1	44.0	45	B	133	
0.13420	87.2	PEAK	19.2	6.0	32.2	80.2	125.1	44.9	90	C	81	
0.13420	82.1	AV	19.2	6.0	32.2	75.1	105.1	30.0	90	C	81	
0.13420	82.4	AV	19.2	6.0	32.2	75.4	105.1	29.7	45	B	133	
0.13420	82.0	AV	19.2	6.0	32.2	75.0	105.1	30.1	0	A	94	
0.13420	86.7	PEAK	19.2	6.0	32.2	79.7	125.1	45.4	135	B	132	
0.13420	81.2	AV	19.2	6.0	32.2	74.2	105.1	30.9	135	B	132	
0.13420	76.0	PEAK	19.2	6.0	32.2	69.0	125.1	56.1	135	B	133	LOOP-ANT:HOR
0.13420	72.2	AV	19.2	6.0	32.2	65.2	105.1	39.9	135	B	133	LOOP-ANT:HOR
0.26840	53.3	PEAK	19.1	6.1	32.1	46.4	119.0	72.6	0	A	0	
0.26840	42.0	AV	19.1	6.1	32.1	35.1	99.0	63.9	0	A	0	
0.40260	58.2	PEAK	19.1	6.1	32.1	51.3	115.5	64.2	0	A	357	
0.40260	48.2	AV	19.1	6.1	32.1	41.3	95.5	54.2	0	A	357	
0.53680	32.7	QP	19.1	6.1	32.1	25.8	73.0	47.2	0	A	4	
0.67100	41.2	QP	19.2	6.1	32.1	34.4	71.1	36.7	0	A	30	
0.80520	31.9	QP	19.2	6.1	32.1	25.1	69.5	44.4	0	A	355	
0.93940	42.0	QP	19.2	6.1	32.1	35.2	68.1	32.9	0	A	241	
1.07360	30.8	QP	19.1	6.1	32.1	23.9	66.9	43.0	0	A	218	
1.20780	42.2	QP	19.1	6.2	32.1	35.4	65.9	30.5	0	A	218	
1.34200	30.9	QP	19.1	6.2	32.1	24.1	65.0	40.9	0	A	218	

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

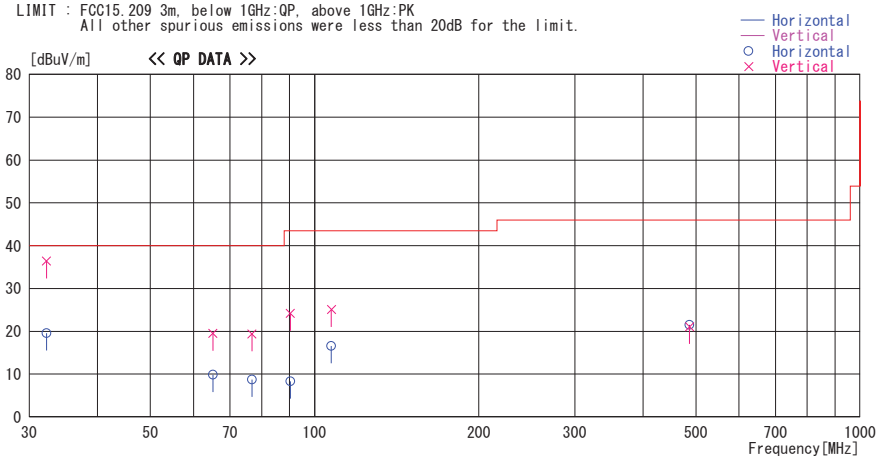
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2012/11/15

Report No. : 4786000715H

Temp./Humi. : 22deg. C / 41% RH
Engineer : Tomtoaka Sasagawa

Mode / Remarks : Tx 134.2KHz , Normal Moduration , Door-ANT Worst-Axis(Hori:X , Vert:X)

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



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
32.250	27.5	QP	17.2	-25.1	19.6	113	300	Hori.	40.0	20.4	
32.250	44.3	QP	17.2	-25.1	36.4	264	100	Vert.	40.0	3.6	
65.100	27.2	QP	7.2	-24.5	9.9	2	300	Hori.	40.0	30.1	
65.100	36.8	QP	7.2	-24.5	19.5	146	100	Vert.	40.0	20.5	
76.800	26.5	QP	6.5	-24.3	8.7	359	268	Hori.	40.0	31.3	
76.800	37.2	QP	6.5	-24.3	19.4	280	100	Vert.	40.0	20.6	
90.300	24.3	QP	8.2	-24.2	8.3	335	300	Hori.	43.5	35.2	
90.300	40.2	QP	8.2	-24.2	24.2	77	100	Vert.	43.5	19.3	
107.400	29.5	QP	11.2	-24.1	16.6	347	300	Hori.	43.5	26.9	
107.400	38.0	QP	11.2	-24.1	25.1	280	100	Vert.	43.5	18.4	
486.665	24.3	QP	18.0	-20.8	21.5	84	100	Hori.	46.0	24.5	
486.665	23.9	QP	18.0	-20.8	21.1	10	100	Vert.	46.0	24.9	

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

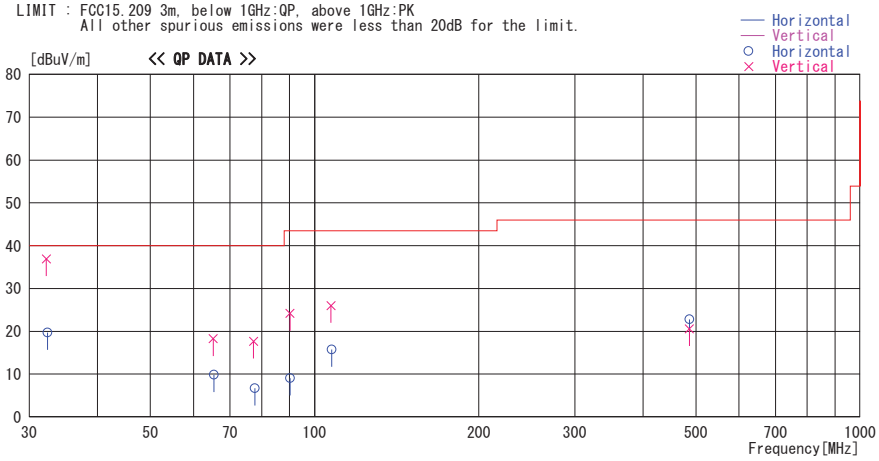
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2012/11/15

Report No. : 4786000715H

Temp./Humi. : 22deg. C / 41% RH
Engineer : Tomtoaka Sasagawa

Mode / Remarks : Tx 134.2KHz , Normal Moduration , Trunk-ANT Worst-Axis(Hori:X , Vert:X)

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



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
32.420	27.7	QP	17.1	-25.1	19.7	113	300	Hori.	40.0	20.3	
32.242	44.8	QP	17.2	-25.1	36.9	264	100	Vert.	40.0	3.1	
65.421	27.2	QP	7.2	-24.5	9.9	2	300	Hori.	40.0	30.1	
65.231	35.6	QP	7.2	-24.5	18.3	146	100	Vert.	40.0	21.7	
77.774	24.5	QP	6.4	-24.2	6.7	219	300	Hori.	40.0	33.3	
77.321	35.6	QP	6.4	-24.3	17.7	275	100	Vert.	40.0	22.3	
90.231	25.1	QP	8.2	-24.2	9.1	335	300	Hori.	43.5	34.4	
90.211	40.2	QP	8.2	-24.2	24.2	77	100	Vert.	43.5	19.3	
107.421	28.7	QP	11.2	-24.1	15.8	347	300	Hori.	43.5	27.7	
107.231	38.9	QP	11.2	-24.1	26.0	280	100	Vert.	43.5	17.5	
486.421	25.6	QP	18.0	-20.8	22.8	84	100	Hori.	46.0	23.2	
486.442	23.4	QP	18.0	-20.8	20.6	10	100	Vert.	46.0	25.4	

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

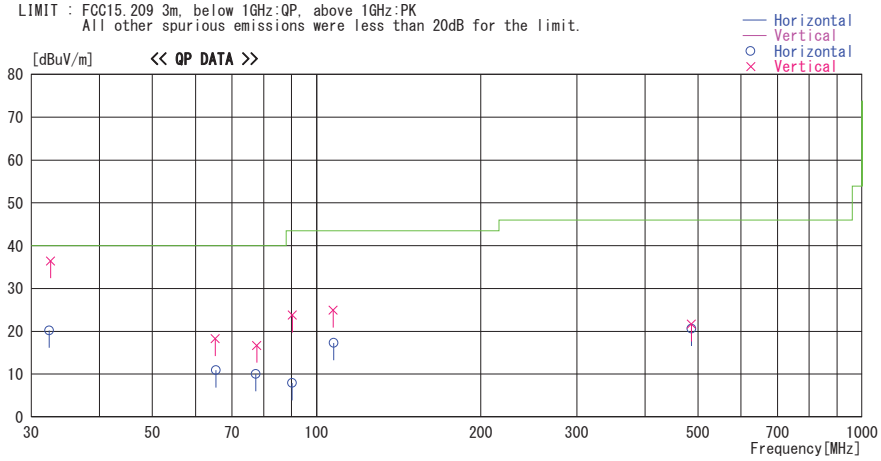
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2012/11/15

Report No. : 4786000715H

Temp./Humi. : 22deg. C / 41% RH
Engineer : Tomtoaka Sasagawa

Mode / Remarks : Tx 134.2KHz , Normal Moduration , Room-ANT Worst-Axis(Hori:X , Vert:X)

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



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
32.340	28.2	QP	17.1	-25.1	20.2	113	300	Hori.	40.0	19.8	
32.540	44.6	QP	17.0	-25.1	36.5	264	100	Vert.	40.0	3.6	
65.212	35.6	QP	7.2	-24.5	18.3	146	100	Vert.	40.0	21.7	
65.432	28.2	QP	7.2	-24.5	10.9	2	300	Hori.	40.0	29.1	
77.421	27.8	QP	6.4	-24.2	10.0	5	300	Hori.	40.0	30.0	
77.721	34.5	QP	6.4	-24.2	16.7	159	100	Vert.	40.0	23.3	
90.210	23.9	QP	8.2	-24.2	7.9	335	300	Hori.	43.5	35.6	
90.321	39.8	QP	8.2	-24.2	23.8	77	100	Vert.	43.5	19.7	
107.321	37.8	QP	11.2	-24.1	24.9	280	100	Vert.	43.5	18.6	
107.421	30.2	QP	11.2	-24.1	17.3	347	300	Hori.	43.5	26.2	
486.322	24.5	QP	18.0	-20.8	21.7	10	100	Vert.	46.0	24.3	
486.421	23.4	QP	18.0	-20.8	20.6	84	100	Hori.	46.0	25.4	

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 Minimum Output

DATA OF RADIATED EMISSION TEST

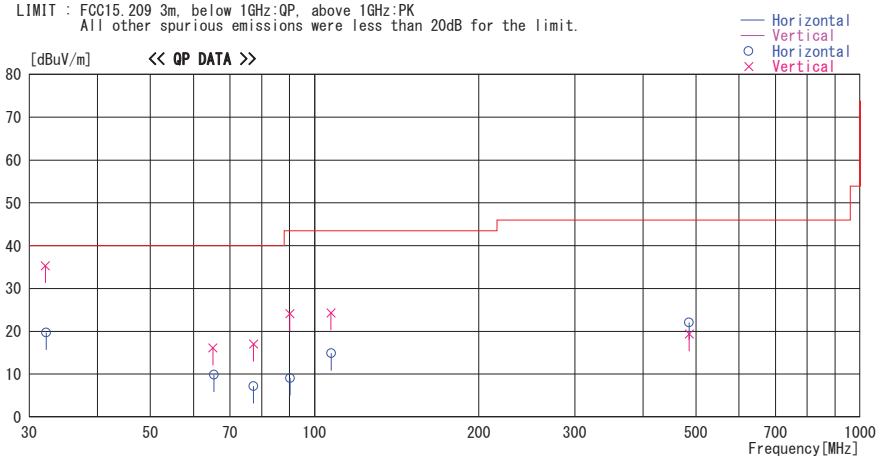
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2012/11/15

Report No. : 4786000715H

Temp./Humi. : 22deg. C / 41% RH
Engineer : Tomtoaka Sasagawa

Mode / Remarks : Tx 134.2KHz , Normal Moduration , Room-ANT Worst-Axis(Hori:X , Vert:X)

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



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
32.240	27.6	QP	17.2	-25.1	19.7	113	300	Hori.	40.0	20.3	
32.123	43.2	QP	17.2	-25.1	35.3	264	100	Vert.	40.0	4.7	
65.421	27.2	QP	7.2	-24.5	9.9	2	300	Hori.	40.0	30.1	
65.123	33.4	QP	7.2	-24.5	16.1	146	100	Vert.	40.0	23.9	
77.321	25.1	QP	6.4	-24.3	7.2	219	300	Hori.	40.0	32.8	
77.321	34.9	QP	6.4	-24.3	17.0	275	100	Vert.	40.0	23.0	
90.212	25.1	QP	8.2	-24.2	9.1	335	300	Hori.	43.5	34.4	
90.123	40.1	QP	8.2	-24.2	24.1	77	100	Vert.	43.5	19.4	
107.321	27.8	QP	11.2	-24.1	14.9	347	300	Hori.	43.5	28.6	
107.224	37.2	QP	11.2	-24.1	24.3	280	100	Vert.	43.5	19.2	
486.241	24.9	QP	18.0	-20.8	22.1	84	100	Hori.	46.0	23.9	
486.224	22.2	QP	18.0	-20.8	19.4	10	100	Vert.	46.0	26.6	

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.

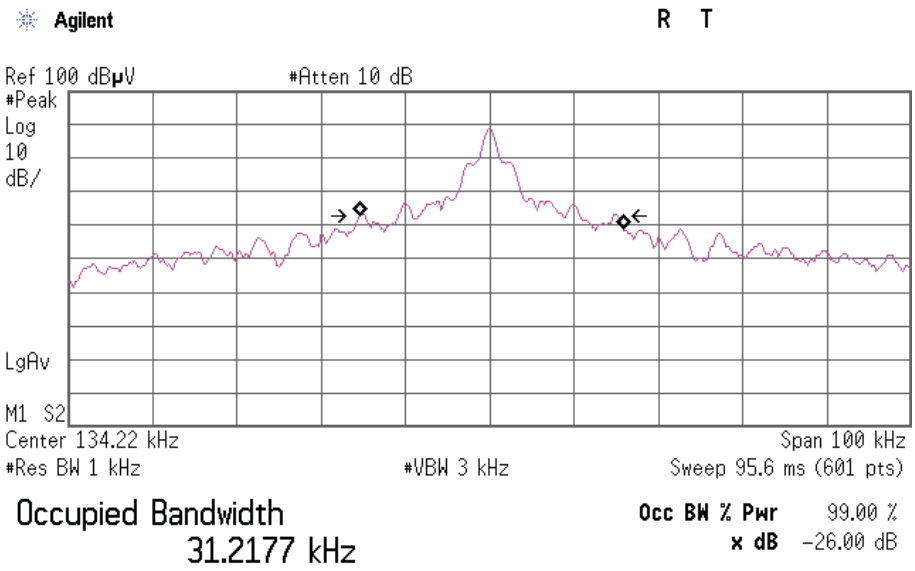
-26dB Bandwidth and 99% Occupied Bandwidth

Door Antenna

UL Japan, Inc.
Head Office EMC Lab. No.3 Semi Anechoic Chamber

			REPORT NO	: 4786000715H
			REGULATION	: -/RSS-Gen 4.6.1
MODEL	:	TMLF10-50	TEST DISTANCE	: 3m
S/ N	:	21	DATE	: 11/15/2012
POWER	:	DC 12.0V	TEMPERATURE	: 22deg. C
MODE	:	Tx	HUMIDITY	: 33% RH
	:	Door Antenna	Engineer	: Motoya Imura

FREQ [kHz]	-26dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
134.2	30.509	31.218



Transmit Freq Error 186.578 Hz
Occupied Bandwidth 30.509 kHz

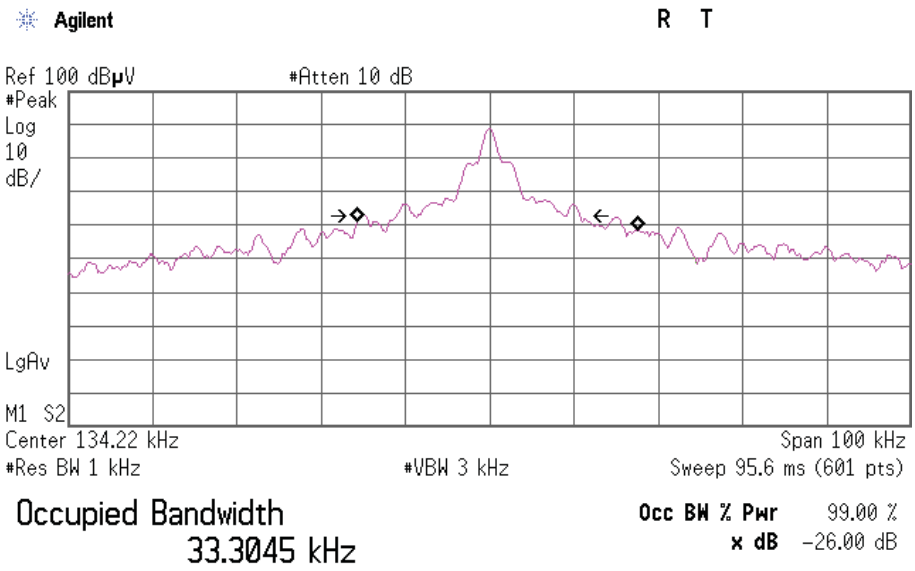
-26dB Bandwidth and 99% Occupied Bandwidth

Trunk Antenna

UL Japan, Inc.
Head Office EMC Lab. No.3 Semi Anechoic Chamber

			REPORT NO	:	4786000715H
			REGULATION	:	-/RSS-Gen 4.6.1
MODEL	:	TMLF10-50	TEST DISTANCE	:	3m
S/ N	:	21	DATE	:	11/15/2012
POWER	:	DC 12.0V	TEMPERATURE	:	22deg. C
MODE	:	Tx	HUMIDITY	:	33% RH
	:	Trunk Antenna	Engineer	:	Motoya Imura

FREQ [kHz]	-26dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
134.2	26.048	33.305



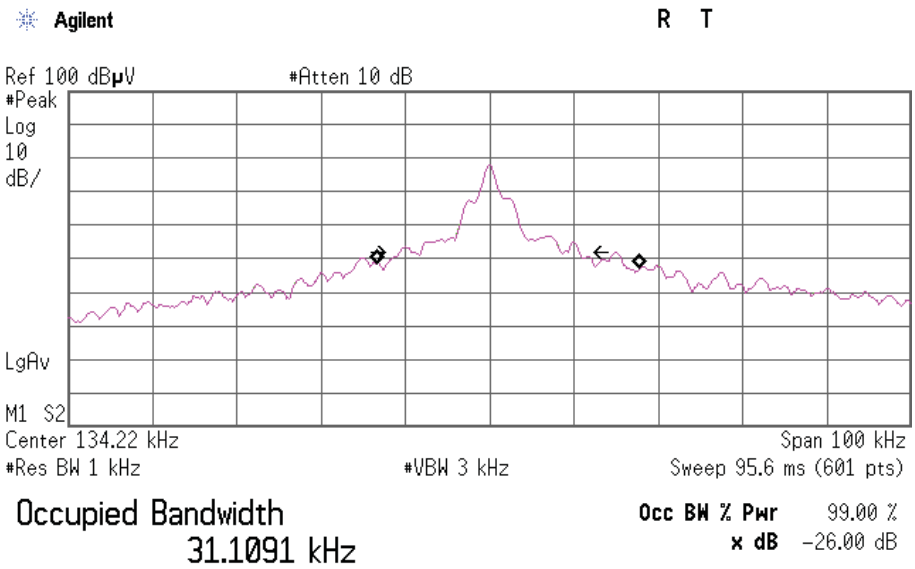
-26dB Bandwidth and 99% Occupied Bandwidth

Room Antenna / Luggage Antenna

UL Japan, Inc.
Head Office EMC Lab. No.3 Semi Anechoic Chamber

			REPORT NO	:	4786000715H
			REGULATION	:	-/RSS-Gen 4.6.1
MODEL	:	TMLF10-50	TEST DISTANCE	:	3m
S/ N	:	21	DATE	:	11/15/2012
POWER	:	DC 12.0V	TEMPERATURE	:	22deg. C
MODE	:	Tx	HUMIDITY	:	33% RH
	:	Room / Luggage Antenna	Engineer	:	Motoya Imura

FREQ [kHz]	-26dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
134.2	21.339	31.109



APPENDIX 3: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2012/02/24 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	-	RE	2012/02/06 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-05	Spectrum Analyzer	Advantest	R3273	160400285	RE	2011/11/23 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2012/08/23 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2012/10/12 * 12
MCC-112	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(3m)/sucoform141-PE(1m)/421-010(1.5m)/RFM-E321(Switcher)	-/00640	RE	2012/07/12 * 12
MCC-143	Coaxial Cable	UL Japan	-	-	RE	2012/07/27 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2012/03/16 * 12
MAT-09	Attenuator(6dB)	Weinschel Corp	2	BK7973	RE	2012/11/06 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2012/10/08 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	174	RE	2012/10/08 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2012/07/12 * 12

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

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