



RADIO TEST REPORT


Test Report No. : 10232779H-A-R1

Applicant : Toyota Motor Corporation
Type of Equipment : Smart LF Oscillator
Model No. : TMLF10-54
FCC ID : NI4TMLF10-54
Test regulation : FCC Part 15 Subpart C: 2014
Test Result : Complied


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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.
6. This report is a revised version of 10232779H-A. 10232779H-A is replaced with this report.

Date of test: February 26, 2014

Representative test engineer:


Masatoshi Nishiguchi
Engineer
Consumer Technology Division

Approved by:


Masanori Nishiyama
Manager
Consumer Technology Division



NVLAP LAB CODE: 200572-0

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UL Japan, Inc.

Ise HQ EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

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 : +81-565-94-1006
Facsimile Number : +81-565-94-1162
Contact Person : Hiroki Okada

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment : Smart LF Oscillator
Model No. : TMLF10-54
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC12.0V (Max 0.5A)
Receipt Date of Sample : February 21, 2014
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: TMLF10-54 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

Smart LF Oscillator (model: TMLF10-54) 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: 2014, final revised on March 6, 2014 and effective April 7, 2014

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 March 6, 2014 does not affect the test specification applied to the EUT.

FCC 15.31 (e)

This test was performed with the New Battery (DC 12V) and the constant voltage was supplied to this EUT during the tests. Therefore, this EUT complies with the requirement.

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	12.2dB 0.13420MHz, PK (PK with Duty factor) <Trunk Antenna>	Complied
3	Electric Field Strength of Spurious Emission	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> RSS-Gen 4.9, 4.11	<FCC> Section 15.209 <IC> RSS-210 2.5.1 RSS-Gen 7.2.5	Radiated	N/A	12.3dB 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	4.0dB	5.1dB	5.0dB	5.1dB	6.0dB	4.9dB	4.3dB
No.2	3.9dB	5.2dB	5.0dB	4.9dB	5.9dB	4.7dB	4.2dB
No.3	4.3dB	5.1dB	5.2dB	5.2dB	6.0dB	4.8dB	4.2dB
No.4	4.6dB	5.2dB	5.0dB	5.2dB	6.0dB	5.7dB	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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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

3.5 Test Location

UL Japan, Inc. Ise HQ EMC Lab. *NVLAP Lab. code: 200572-0
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999 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	-	-	8.8 x 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	-	3.1 x 3.4 x 3.0m	4.8 x 4.6m	-

* 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

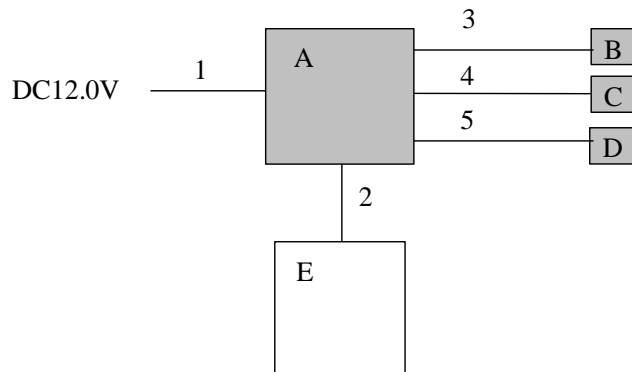
4.1 Operating Modes

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.

* The EUT does not transmit simultaneously from multiple antennas.
During testing, transmitting antenna was fixed to one of three antennas.

4.2 Configuration and peripherals



- * Cabling and setup were taken into consideration and test data was taken under worst 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	2.0	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 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 and PK 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
Distance factor *1)	-80dB	-80dB	-80dB	-40dB	-

*1) -80dB = 40 x log (3m/300m)

-40dB = 40 x log (3m /30m)

- 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.

Test data : APPENDIX 2

Test result : Pass

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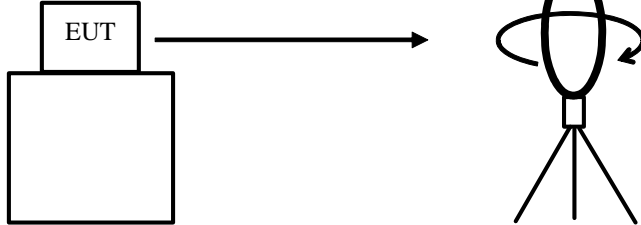
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

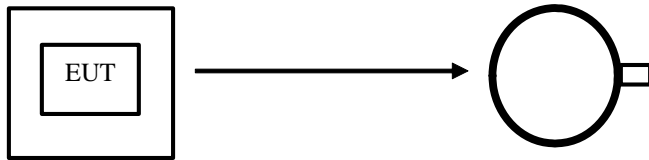
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Figure 1: Direction of the Loop Antenna

Side View (Vertical)

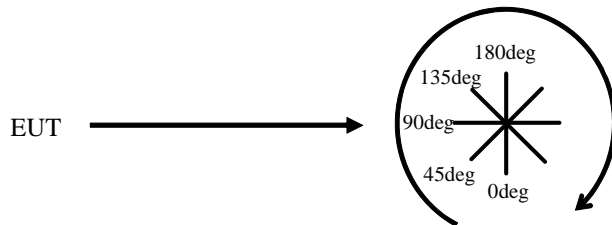


.....
Top View (Horizontal)



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: Data of EMI test

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

Test place : Ise HQ EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 10232779H
Date : 02/26/2014
Temperature/ Humidity : 18 deg. C / 30% RH
Engineer : Masatoshi Nishiguchi
Mode : Tx 134.2kHz

PK or QP

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	0.13420	PK	98.8	20.0	-74.1	32.3	-	12.4	45.0	32.6	Fundamental
0	0.26840	PK	60.4	19.9	-74.0	32.2	-	-25.9	39.0	64.9	
0	0.40260	PK	76.0	19.8	-74.0	32.2	-	-10.4	35.5	45.9	
0	0.53680	QP	43.2	19.8	-34.0	32.2	-	-3.2	33.0	36.2	
0	0.67100	QP	65.2	19.8	-34.0	32.2	-	18.8	31.1	12.3	
0	0.80520	QP	34.8	19.8	-34.0	32.2	-	-11.6	29.5	41.1	
0	0.93940	QP	54.4	19.8	-34.0	32.2	-	8.0	28.1	20.1	
0	1.07360	QP	31.4	19.8	-34.0	32.2	-	-15.0	26.9	41.9	
0	1.20780	QP	44.4	19.8	-33.9	32.2	-	-1.9	25.9	27.8	
0	1.34200	QP	30.9	19.8	-33.9	32.2	-	-15.4	25.0	40.4	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amprifier)

PK with Duty factor

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	0.13420	PK	98.8	20.0	-74.1	32.3	0.0	12.4	25.0	12.6	
0	0.26840	PK	60.4	19.9	-74.0	32.2	0.0	-25.9	19.0	44.9	
0	0.40260	PK	76.0	19.8	-74.0	32.2	0.0	-10.4	15.5	25.9	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amprifier) + Duty factor *

* Since the peak emission result satisfied the average limit, the peak emission result with Duty Factor was calculated as Duty 100%.

Result of the fundamental emission at 3m without Distance factor

PK or QP

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	0.13420	PK	98.8	20.0	5.9	32.3	-	92.4	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amprifier)

* All spurious emissions lower than this result.

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

Test place : Ise HQ EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 10232779H
Date : 02/26/2014
Temperature/ Humidity : 18 deg. C / 30% RH
Engineer : Masatoshi Nishiguchi
Mode : Tx 134.2kHz

PK or QP

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	0.13420	PK	99.2	20.0	-74.1	32.3	-	12.8	45.0	32.2	Fundamental
0	0.26840	PK	60.1	19.9	-74.0	32.2	-	-26.2	39.0	65.2	
0	0.40260	PK	73.8	19.8	-74.0	32.2	-	-12.6	35.5	48.1	
0	0.53680	QP	42.0	19.8	-34.0	32.2	-	-4.4	33.0	37.4	
0	0.67100	QP	58.3	19.8	-34.0	32.2	-	11.9	31.1	19.2	
0	0.80520	QP	34.7	19.8	-34.0	32.2	-	-11.7	29.5	41.2	
0	0.93940	QP	56.0	19.8	-34.0	32.2	-	9.6	28.1	18.5	
0	1.07360	QP	31.8	19.8	-34.0	32.2	-	-14.6	26.9	41.5	
0	1.20780	QP	51.9	19.8	-33.9	32.2	-	5.6	25.9	20.3	
0	1.34200	QP	30.9	19.8	-33.9	32.2	-	-15.4	25.0	40.4	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier)

PK with Duty factor

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	0.13420	PK	99.2	20.0	-74.1	32.3	0.0	12.8	25.0	12.2	
0	0.26840	PK	60.1	19.9	-74.0	32.2	0.0	-26.2	19.0	45.2	
0	0.40260	PK	73.8	19.8	-74.0	32.2	0.0	-12.6	15.5	28.1	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier) + Duty factor *

* Since the peak emission result satisfied the average limit, the peak emission result with Duty Factor was calculated as Duty 100%.

Result of the fundamental emission at 3m without Distance factor

PK or QP

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	0.13420	PK	99.2	20.0	5.9	32.3	-	92.8	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

* All spurious emissions lower than this result.

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

Test place : Ise HQ EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 10232779H
Date : 02/26/2014
Temperature/ Humidity : 18 deg. C / 30% RH
Engineer : Masatoshi Nishiguchi
Mode : Tx 134.2kHz

PK or QP

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	0.13420	PK	98.3	20.0	-74.1	32.3	-	11.9	45.0	33.1	Fundamental
0	0.26840	PK	58.4	19.9	-74.0	32.2	-	-27.9	39.0	66.9	
0	0.40260	PK	65.6	19.8	-74.0	32.2	-	-20.8	35.5	56.3	
0	0.53680	QP	33.1	19.8	-34.0	32.2	-	-13.3	33.0	46.3	
0	0.67100	QP	42.8	19.8	-34.0	32.2	-	-3.6	31.1	34.7	
0	0.80520	QP	31.3	19.8	-34.0	32.2	-	-15.1	29.5	44.6	
0	0.93940	QP	48.8	19.8	-34.0	32.2	-	2.4	28.1	25.7	
0	1.07360	QP	30.8	19.8	-34.0	32.2	-	-15.6	26.9	42.5	
0	1.20780	QP	47.2	19.8	-33.9	32.2	-	0.9	25.9	25.0	
0	1.34200	QP	30.5	19.8	-33.9	32.2	-	-15.8	25.0	40.8	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier)

PK with Duty factor

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	0.13420	PK	98.3	20.0	-74.1	32.3	0.0	11.9	25.0	13.1	
0	0.26840	PK	58.4	19.9	-74.0	32.2	0.0	-27.9	19.0	46.9	
0	0.40260	PK	65.6	19.8	-74.0	32.2	0.0	-20.8	15.5	36.3	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier) + Duty factor *

* Since the peak emission result satisfied the average limit, the peak emission result with Duty Factor was calculated as Duty 100%.

Result of the fundamental emission at 3m without Distance factor

PK or QP

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	0.13420	PK	98.3	20.0	5.9	32.3	-	91.9	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

* All spurious emissions lower than this result.

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

Test place : Ise HQ EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 10232779H
Date : 02/26/2014
Temperature/ Humidity : 18 deg. C / 30% RH
Engineer : Masatoshi Nishiguchi
Mode : Tx 134.2kHz

PK or QP

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	0.13420	PK	83.8	20.0	-74.1	32.3	-	-2.6	45.0	47.6	Fundamental
0	0.26840	PK	52.7	19.9	-74.0	32.2	-	-33.6	39.0	72.6	
0	0.40260	PK	54.3	19.8	-74.0	32.2	-	-32.1	35.5	67.6	
0	0.53680	QP	45.2	19.8	-34.0	32.2	-	-1.2	33.0	34.2	
0	0.67100	QP	35.1	19.8	-34.0	32.2	-	-11.3	31.1	42.4	
0	0.80520	QP	42.0	19.8	-34.0	32.2	-	-4.4	29.5	33.9	
0	0.93940	QP	36.8	19.8	-34.0	32.2	-	-9.6	28.1	37.7	
0	1.07360	QP	38.4	19.8	-34.0	32.2	-	-8.0	26.9	34.9	
0	1.20780	QP	36.2	19.8	-33.9	32.2	-	-10.1	25.9	36.0	
0	1.34200	QP	34.4	19.8	-33.9	32.2	-	-11.9	25.0	36.9	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier)

PK with Duty factor

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	0.13420	PK	83.8	20.0	-74.1	32.3	0.0	-2.6	25.0	27.6	
0	0.26840	PK	52.7	19.9	-74.0	32.2	0.0	-33.6	19.0	52.6	
0	0.40260	PK	54.3	19.8	-74.0	32.2	0.0	-32.1	15.5	47.6	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier) + Duty factor *

* Since the peak emission result satisfied the average limit, the peak emission result with Duty Factor was calculated as Duty 100%.

Result of the fundamental emission at 3m without Distance factor

PK or QP

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	0.13420	PK	83.8	20.0	5.9	32.3	-	77.4	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

*** All spurious emissions lower than this result.**

Radiated Emission above 30MHz (Spurious Emission)
Door Antenna

DATA OF RADIATED EMISSION TEST

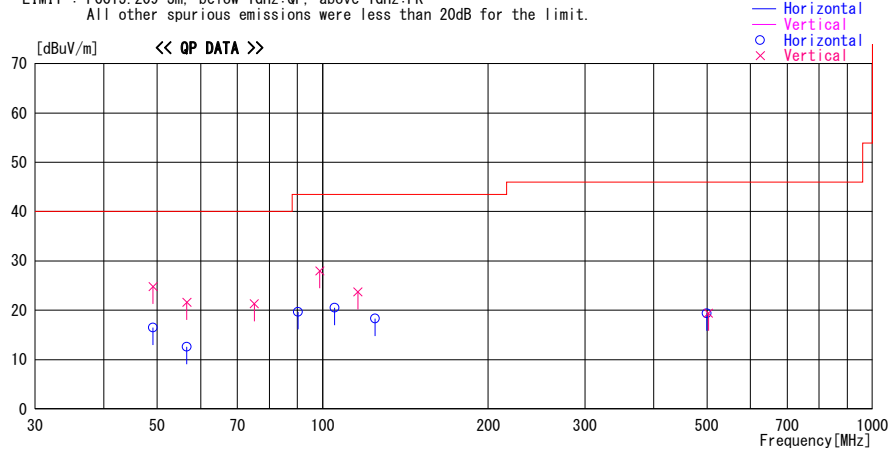
UL Japan, Inc. Ise HQ EMC Lab. No. 3 Semi Anechoic Chamber
Date : 2014/02/26

Report No. : 10232779H

Temp./Humi. : 26deg. C / 36% RH
Engineer : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz Normal Modulation Door Antenna Worst-Axis (ANT:Hori-X/Vert-X ECU: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	Loss&	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Gain [dB]							
49.149	30.1	QP	11.2	-24.8	16.5	137	300	Hori.	40.0	23.5	
49.149	38.4	QP	11.2	-24.8	24.8	135	310	Vert.	40.0	15.2	
56.634	37.4	QP	8.9	-24.7	21.6	0	100	Vert.	40.0	18.4	
56.634	28.4	QP	8.9	-24.7	12.6	0	300	Hori.	40.0	27.4	
75.153	39.4	QP	6.4	-24.5	21.3	279	100	Vert.	40.0	18.7	
90.192	35.9	QP	8.1	-24.3	19.7	0	246	Hori.	43.5	23.8	
98.775	42.3	QP	9.8	-24.1	28.0	305	100	Vert.	43.5	15.5	
105.211	33.6	QP	10.9	-24.0	20.5	0	300	Hori.	43.5	23.0	
115.949	35.2	QP	12.4	-23.9	23.7	258	100	Vert.	43.5	19.8	
124.541	28.8	QP	13.3	-23.8	18.3	0	300	Hori.	43.5	25.2	
499.498	22.1	QP	18.1	-20.8	19.4	0	100	Hori.	46.0	26.6	
502.998	22.0	QP	18.2	-20.8	19.4	0	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(ATT+CABLE) - 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

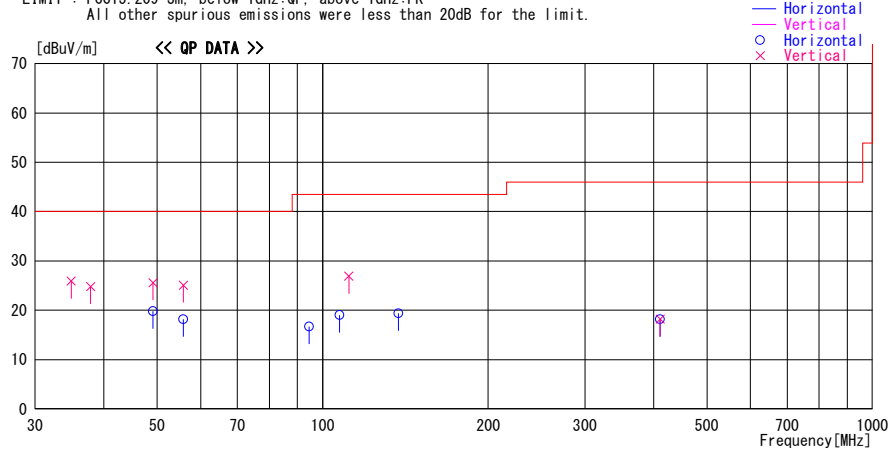
UL Japan, Inc. Ise HQ EMC Lab. No. 3 Semi Anechoic Chamber
 Date : 2014/02/26

Report No. : 10232779H

Temp./Humi. : 26deg. C / 36% RH
 Engineer : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz Normal Modulation Trunk Antenna Worst-Axis (ANT:Hori-X/Vert-X ECU: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	Loss&	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Gain [dB]							
34.893	34.7	QP	16.3	-25.1	25.9	303	100	Vert.	40.0	14.1	
37.849	34.6	QP	15.3	-25.1	24.8	305	100	Vert.	40.0	15.2	
49.151	39.2	QP	11.2	-24.8	25.6	0	302	Vert.	40.0	14.4	
49.151	33.4	QP	11.2	-24.8	19.8	142	300	Hori.	40.0	20.2	
55.829	40.7	QP	9.1	-24.7	25.1	154	100	Vert.	40.0	14.9	
55.831	33.8	QP	9.1	-24.7	18.2	178	180	Hori.	40.0	21.8	
94.481	31.8	QP	9.0	-24.1	16.7	156	300	Hori.	43.5	26.8	
107.362	31.8	QP	11.2	-24.0	19.0	0	300	Hori.	43.5	24.5	
111.656	39.0	QP	11.8	-23.9	26.9	271	100	Vert.	43.5	16.6	
137.423	28.7	QP	14.3	-23.6	19.4	0	217	Hori.	43.5	24.1	
410.832	22.0	QP	17.6	-21.4	18.2	0	100	Hori.	46.0	27.8	
410.832	22.0	QP	17.6	-21.4	18.2	0	100	Vert.	46.0	27.8	

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

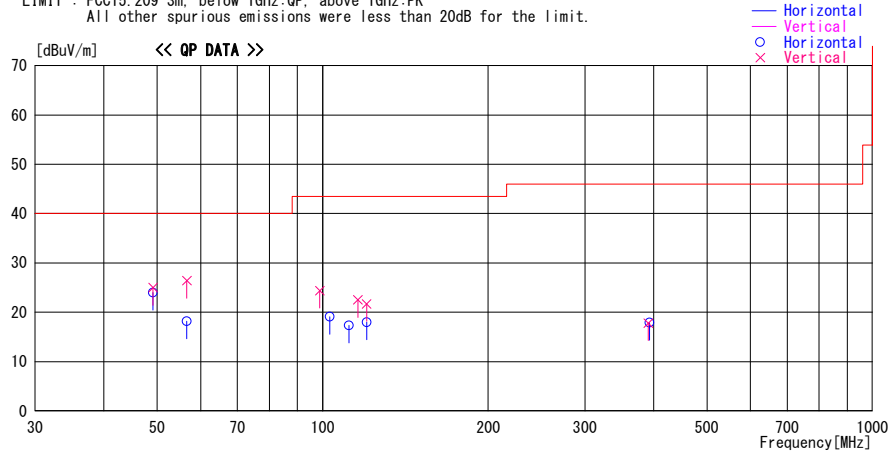
UL Japan, Inc. Ise HQ EMC Lab. No. 3 Semi Anechoic Chamber
Date : 2014/02/26

Report No. : 10232779H

Temp./Humi. : 26deg. C / 36% RH
Engineer : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz Normal Modulation Room/Luggage Antenna(Max) Worst-Axis (ANT:Hori-X/Vert-X ECU: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	Loss&	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Gain [dB]							
49.149	37.6	QP	11.2	-24.8	24.0	356	302	Hori.	40.0	16.0	
49.149	38.6	QP	11.2	-24.8	25.0	0	309	Vert.	40.0	15.0	
56.632	34.0	QP	8.9	-24.7	18.2	153	389	Hori.	40.0	21.8	
56.639	42.2	QP	8.9	-24.7	26.4	70	100	Vert.	40.0	13.6	
98.775	38.7	QP	9.8	-24.1	24.4	303	100	Vert.	43.5	19.1	
103.071	32.5	QP	10.6	-24.0	19.1	196	300	Hori.	43.5	24.4	
111.657	29.4	QP	11.8	-23.9	17.3	177	300	Hori.	43.5	26.2	
115.951	34.0	QP	12.4	-23.9	22.5	267	100	Vert.	43.5	21.0	
120.246	32.5	QP	13.0	-23.8	21.7	81	100	Vert.	43.5	21.8	
120.248	28.8	QP	13.0	-23.8	18.0	187	300	Hori.	43.5	25.5	
390.999	22.0	QP	17.3	-21.5	17.8	0	100	Vert.	46.0	28.2	
393.333	22.1	QP	17.3	-21.5	17.9	0	100	Hori.	46.0	28.1	

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

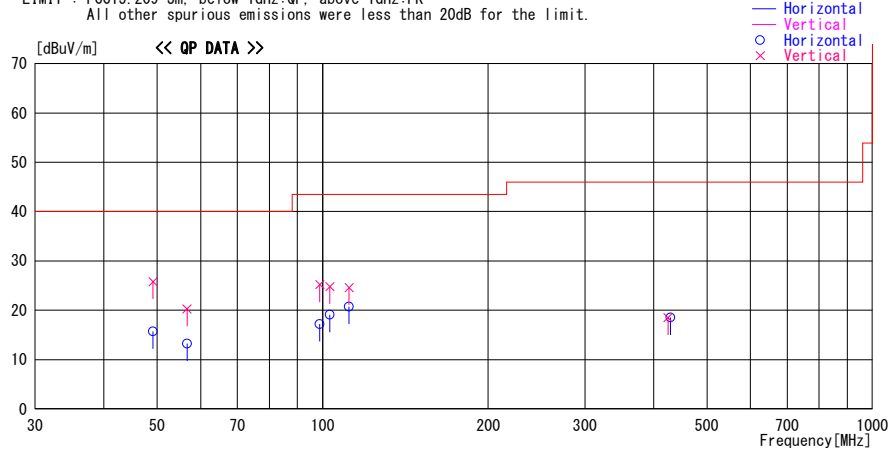
UL Japan, Inc. Ise HQ EMC Lab. No. 3 Semi Anechoic Chamber
 Date : 2014/02/26

Report No. : 10232779H

Temp./Humi. : 26deg. C / 36% RH
 Engineer : Keisuke Kawamura

Mode / Remarks : Tx 134.2kHz Normal Modulation Room/Luggage Antenna(Min) Worst-Axis(ANT:Hori-X/Vert-X ECU: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	Loss&	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Gain [dB]							
49.151	29.3	QP	11.2	-24.8	15.7	135	305	Hori.	40.0	24.3	
49.151	39.4	QP	11.2	-24.8	25.8	314	228	Vert.	40.0	14.2	
56.662	36.1	QP	8.9	-24.7	20.3	72	200	Vert.	40.0	19.7	
56.662	29.0	QP	8.9	-24.7	13.2	165	355	Hori.	40.0	26.8	
98.773	31.5	QP	9.8	-24.1	17.2	188	300	Hori.	43.5	26.3	
98.773	39.5	QP	9.8	-24.1	25.2	273	100	Vert.	43.5	18.3	
103.071	32.5	QP	10.6	-24.0	19.1	0	300	Hori.	43.5	24.4	
103.071	38.2	QP	10.6	-24.0	24.8	293	100	Vert.	43.5	18.7	
111.658	36.7	QP	11.8	-23.9	24.6	273	100	Vert.	43.5	18.9	
111.658	32.8	QP	11.8	-23.9	20.7	0	300	Hori.	43.5	22.8	
424.832	22.1	QP	17.7	-21.3	18.5	0	100	Vert.	46.0	27.5	
429.499	22.1	QP	17.7	-21.3	18.5	0	100	Hori.	46.0	27.5	

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

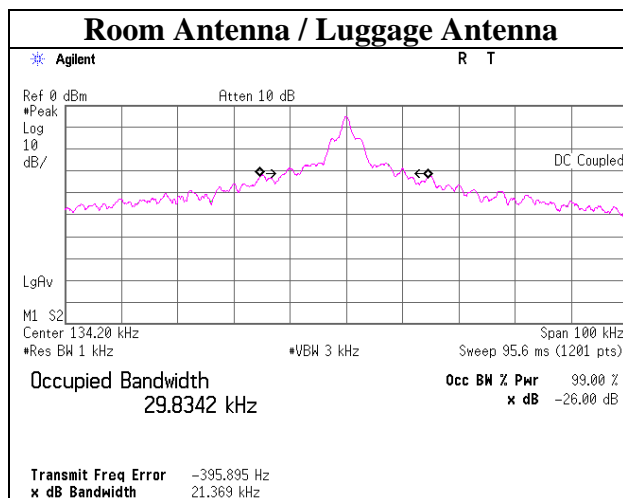
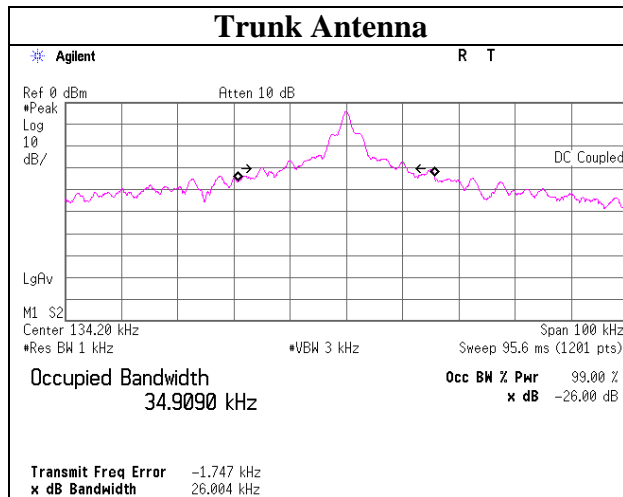
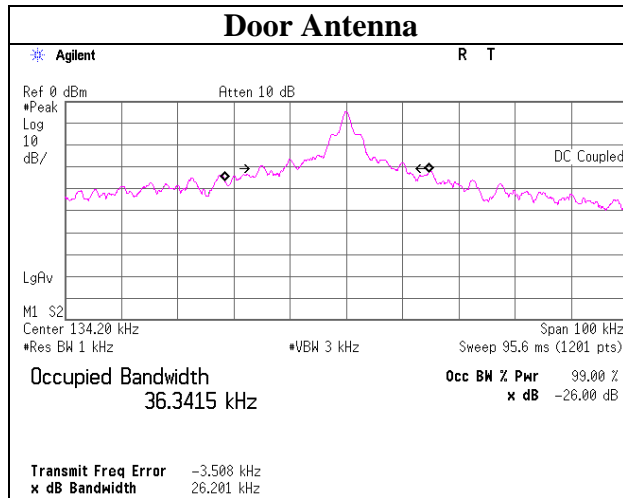
*The test result is rounded off to one or two decimal places, so some differences might be observed.

-26dB Bandwidth and 99% Occupied Bandwidth

Test place Ise HQ EMC Lab. No.3 Semi Anechoic Chamber
Report No. 10232779H
Date 02/26/2014
Temperature/ Humidity 18 deg. C / 30% RH
Engineer Masatoshi Nishiguchi
Mode Tx 134.2kHz

Mode	Frequency [kHz]	-26dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
Door Antenna	134.2	26.201	36.342
Trunk Antenna	134.2	26.004	34.909
Room Antenna / Ruggage Antenna	134.2	21.369	29.834

-26dB Bandwidth and 99% Occupied Bandwidth



APPENDIX 2: 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	2013/02/28 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE	2014/02/20 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MRENT-112	Spectrum Analyzer	Agilent	E4440A	MY48250080	RE	2013/10/04 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2013/08/20 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2013/10/30 * 12
MCC-112	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/ SFM141(3m)/ suoform141-PE(1m)/ 421-010(1.5m)/ RFM-E321(Switcher)	-/00640	RE	2013/07/23 * 12
MCC-143	Coaxial Cable	UL Japan	-	-	RE	2013/07/22 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2013/03/12 * 12
MAT-70	Attenuator(6dB)	Agilent	8491A-006	MY52460153	RE	2013/04/05 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2013/10/13 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	174	RE	2013/10/13 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2013/07/23 * 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.

Ise HQ EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124