RADIO TEST REPORT

Test Report No. : 10904156H-A-R2

Applicant	:	**Hitachi Maxell, Ltd.**
Type of Equipment	:	**RFID Reader/Writer Module**
Model No.	:	**ME-MR23M4-B-SG**
Test regulation	:	**FCC Part 15 Subpart C: 2015**
FCC ID	:	**UOEME-M23B**
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.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. This report is a revised version of 10904156H-A-R1. 10904156H-A-R1 is replaced with this report.

Date of test: August 1 to 4, 2015

Representative test engineer:
T. Shimada
Takumi Shimada
Engineer
Consumer Technology Division

Approved by:
T. Hatakeda
Takahiro Hatakeda
Engineer
Consumer Technology Division

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,
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REVISION HISTORY

Original Test Report No.: 10904156H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10904156H-A	August 17, 2015	-	-
1	10904156H-A-R1	August 26, 2015	P. 8	Addition of following sentences in Clause 4.1; The EUT does not have concurrent transmission. The worst case was confirmed with all antennas, as a result, the test was performed with CN241 antenna connector as representative.
2	10904156H-A-R2	August 27, 2015	P. 5	Correction of Antenna requirement in Clause 3.2.

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SECTION 1: Customer information

Company Name	:	Hitachi Maxell, Ltd.
Address	:	45-101 Kagamida, Oyamazaki, Otokuni, Kyoto, 618-8558 Japan
Telephone Number	:	+81-75-951-1465
Facsimile Number	:	+81-75-952-5873
Contact Person	:	Yosuke Katayama

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

2.1 Identification of E.U.T.

Type of Equipment	:	RFID Reader/Writer Module
Model No.	:	ME-MR23M4-B-SG
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 12.0 V
Receipt Date of Sample	:	July 31, 2015
Country of Mass-production	:	Japan
Condition of EUT	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model No: ME-MR23M4-B-SG (referred to as the EUT in this report) is the RFID Reader/Writer Module.

General Specification

Clock frequency(ies) in the system	:	27.12 MHz

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	13.56MHz
Modulation	:	ASK
Power Supply (radio part input)	:	DC 3.3 V
Antenna type	:	Printed Loop Coil Pattern Antenna
Operating Temperature	:	0 deg. C to +45 deg. C

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C: 2015, final revised on June 12, 2015 and effective July 13, 2015
Title	:	FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators Section 15.207 Conducted limits Section 15.225 : Operation within the band 13.110-14.010MHz

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted emission	ANSI C63.4:2009 7. AC powerline conducted emission measurements	Section 15.207	[QP] 9.8 dB 27.12000 MHz, N [AV] 0.2 dB 27.12000 MHz, N	Complied	-
	<IC>RSS-Gen 8.8	<IC>RSS-Gen 8.8			
Electric Field Strength of Fundamental Emission	ANSI C63.4:2009 13. Measurement of intentional radiators	Section 15.225(a)	52.5 dB, 13.56000 MHz, QP, 0 deg.	Complied	Radiated
	<IC> RSS-Gen 6.4, 6.12	<IC>RSS-210 A2.6			
Spectrum Mask	ANSI C63.4:2009 13. Measurement of intentional radiators	Section 15.225(b)(c)	32.7 dB, 13.55300 MHz, QP, 0 deg.	Complied	Radiated
	<IC>RSS-Gen 6.4, 6.13	<IC> RSS-210 A2.6			
20dB Bandwidth	ANSI C63.4:2009 13. Measurement of intentional radiators	Section15.215(c)	See data	Complied	Radiated
	<IC> -	<IC> -			
Electric Field Strength of Spurious Emission	ANSI C63.4:2009 13. Measurement of intentional radiators	Section 15.209, Section 15.225 (d)	0.5 dB 56.796 MHz, Vertical, QP	Complied	Radiated
	<IC>RSS-Gen 6.4, 6.13	<IC>RSS-210 A2.6			
Frequency Tolerance	ANSI C63.4:2009 13. Measurement of intentional radiators	Section 15.225(e)	See data	Complied	Radiated
	<IC>RSS-Gen 6.11, 8.11	<IC> RSS-210 A2.6			
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422					

FCC 15.31 (e)
This EUT provides stable voltage (DC 3.3 V) constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203/212 Antenna requirement
The EUT has a unique coupling/antenna connector. Therefore the equipment complies with the requirement of 15.203.

3.3 Addition to standard

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99% Occupied Band Width	RSS-Gen 6.6	-	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)	Conducted emission (±dB)
	150 kHz - 30 MHz
No.1	3.5 dB
No.2	3.5 dB
No.3	3.4 dB
No.4	3.5 dB

Test room (semi-anechoic chamber)	Radiated emission						
	(3 m*)(±dB)				(1 m*)(±dB)		(0.5 m*)(±dB)
	9 kHz - 30 MHz	30 MHz - 300 MHz	300 MHz - 1 GHz	1 GHz - 10 GHz	10 GHz - 18 GHz	18 GHz - 26.5 GHz	26.5 GHz - 40 GHz
No.1	4.3 dB	5.1 dB	6.2 dB	5.5 dB	5.8 dB	5.8 dB	4.3 dB
No.2	4.2 dB	5.1 dB	6.2 dB	5.4 dB	5.7 dB	5.9 dB	5.6 dB
No.3	4.4 dB	5.1 dB	6.3 dB	5.2 dB	5.5 dB	5.8 dB	5.5 dB
No.4	4.7 dB	5.3 dB	6.3 dB	5.3 dB	5.7 dB	5.9 dB	5.5 dB

*3 m / 1 m / 0.5m = Measurement distance

Frequency counter (±)	
Normal condition	Extreme condition
7×10^{-6}	9×10^{-6}

Conducted emission test

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

Radiated emission test (3m)

[Electric Field Strength of Fundamental Emission and Spectrum Mask]

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. Ise 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

	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	2973C-1	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room
No.3 shielded room	-	4.0 x 6.0 x 2.7	N/A	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room
No.4 shielded room	-	4.0 x 6.0 x 2.7	N/A	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9	6.0 x 6.0	-
No.6 shielded room	-	4.0 x 4.5 x 2.7	4.0 x 4.5	-
No.6 measurement room	-	4.75 x 5.4 x 3.0	4.75 x 4.15	-
No.7 shielded room	-	4.7 x 7.5 x 2.7	4.7 x 7.5	-
No.8 measurement room	-	3.1 x 5.0 x 2.7	N/A	-
No.9 measurement room	-	8.0 x 4.6 x 2.8	2.4 x 2.4	-
No.11 measurement room	-	6.2 x 4.7 x 3.0	4.8 x 4.6	-

* 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, Test data, and Test instruments

Refer to APPENDIX.

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

4.1 Operating Modes

The mode is used :

Mode	Remarks
Transmitting mode (Tx 13.56 MHz)	With Tag Without Tag Antenna terminated
The EUT was operated in a manner similar to typical use during the tests. The EUT does not have concurrent transmission. The worst case was confirmed with all antennas, as a result, the test was performed with CN241 antenna connector as representative.	

Test Item	Operating mode *1)
Conducted emission	Tx with Tag Tx without Tag Tx Antenna terminated
Electric Field Strength of Fundamental Emission	Tx without Tag
Spectrum Mask	Tx without Tag
20dB Bandwidth 99% Occupied Bandwidth	Tx with Tag Tx without Tag
Electric Field Strength of Spurious Emission (<30 MHz)	Tx without Tag
Electric Field Strength of Spurious Emission (≥30 MHz)	Tx with Tag
Frequency Tolerance	Tx without Tag

*1) This EUT has two modes which Tag is attached to the EUT or not. The worst case was confirmed with and without Tag. The test was performed with worst case.

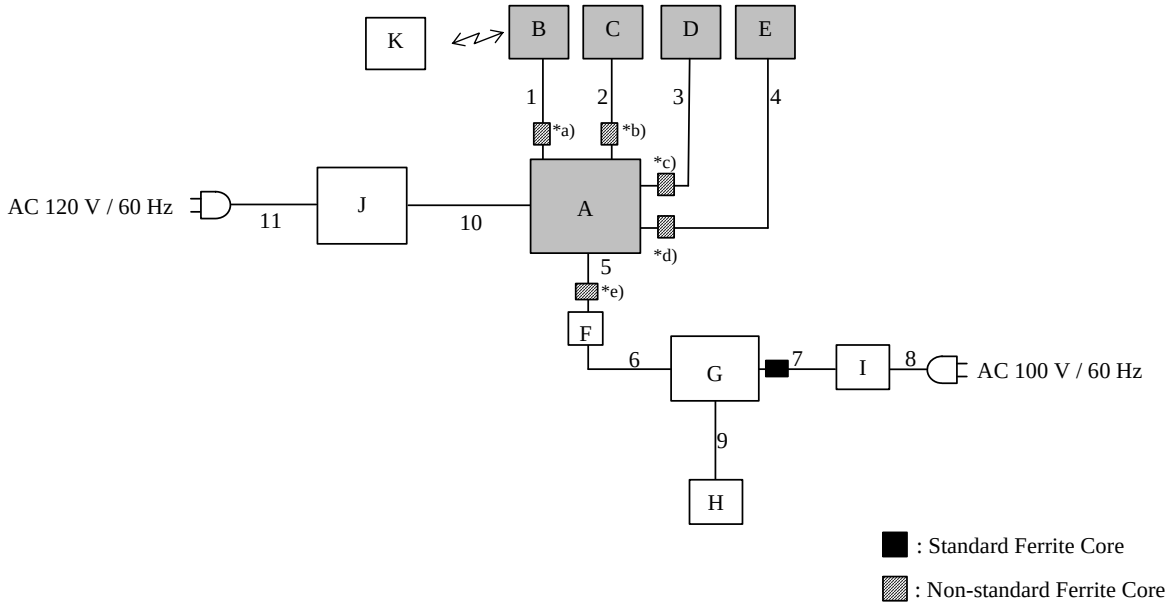
Justification: The system was configured in typical fashion (as a customer would normally use it) for testing.

Frequency Tolerance:

Temperature : -20deg.C to +50deg.C Step 10deg.C
Voltage : Normal Voltage : DC 12.0 V
Maximum Voltage : DC 10.2 V
Minimum Voltage : DC 13.8 V
(DC 12.0 V ±15 %)

*This EUT provides stable voltage (DC 12.0 V) constantly to RF Module regardless of input voltage.

4.2 Configuration and peripherals



*Cabling and setup were taken into consideration and test data was taken under worse case conditions.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remark
A	RFID Module	ME-MR23M4-B-SG	14	Hitachi Maxell, Ltd.	EUT
B	Antenna	ME-MR23M4-A-ANT (AC3)	34	Hitachi Maxell, Ltd.	EUT
C	Antenna	ME-MR23M4-A-ANT (AC3)	12	Hitachi Maxell, Ltd.	EUT
D	Antenna	ME-MR23M4-A-ANT (AC3)	26	Hitachi Maxell, Ltd.	EUT
E	Antenna	ME-MR23M4-A-ANT (AC3)	31	Hitachi Maxell, Ltd.	EUT
F	RS232C-USB conversion board	UC-SGT	-	ELECOM	-
G	Laptop PC	L520	LR-7LF1V	Lenovo	-
H	Mouse	MO56UC	520026409	DELL	-
I	AC Adaptor	DCWP CM-2	11S92P1156Z1 ZDXN1	Lenovo	-
J	Regulated DC Power Supply	PW16-5ADP	171116437	TEXIO	-
K	Tag	ME-Y1E1-BCV-SGC	-	Hitachi Maxell, Ltd	-Data Rate 26.484kbps -Coil size (inside) 18.2 x 8.2mm - Coil turns (inside) 18 turns

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Antenna Cable	0.5	Unshielded	Unshielded	-
2	Antenna Cable	0.5	Unshielded	Unshielded	-
3	Antenna Cable	0.5	Unshielded	Unshielded	-
4	Antenna Cable	0.5	Unshielded	Unshielded	-
5	RS-232C Cable	2.5	Shielded	Shielded	-
6	USB Cable	0.4	Shielded	Shielded	-
7	DC Cable	1.6	Unshielded	Unshielded	-
8	AC Cable	1.0	Unshielded	Unshielded	-
9	USB Cable	1.8	Shielded	Shielded	-
10	DC Cable	1.0	Unshielded	Unshielded	-
11	AC Cable	1.8	Unshielded	Unshielded	-

<Notes for Ferrite cores>
*a) 1 Ferrite Core, Model No. ZCAT1325-0530A (Manufacturer: TDK), 100 mm from Item A, 1 turn
*b) 1 Ferrite Core, Model No. ZCAT1325-0530A (Manufacturer: TDK), 100 mm from Item A, 1 turn
*c) 1 Ferrite Core, Model No. ZCAT1325-0530A (Manufacturer: TDK), 100 mm from Item A, 1 turn
*d) 1 Ferrite Core, Model No. ZCAT1325-0530A (Manufacturer: TDK), 100 mm from Item A, 1 turn
*e) 1 Ferrite Core, Model No. ZCAT1518-0730 (Manufacturer: TDK), 50 mm from Item F, 1 turn

SECTION 5: Conducted emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.
The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

For the tests on EUT with other peripherals (as a whole system)
I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane. All unused 50ohm connectors of the LISN(AMN) were resistivity terminated in 50ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber.
The EUT was connected to a LISN (AMN).
An overview sweep with peak detection has been performed.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Detector	**: QP and CISPR AV**
Measurement range	**: 0.15 - 30 MHz**
Test data	**: APPENDIX**
Test result	**: Pass**

SECTION 6: Radiated emission (Fundamental , Spurious Emission and Spectrum Mask)

Test Procedure

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.
The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

Frequency: From 9 kHz to 30 MHz
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: 0 deg.) and horizontal polarization.
*Refer to Figure 1 about Direction of the Loop Antenna.

Frequency: From 30 MHz to 1 GHz
The measuring antenna height varied between 1 and 4 m 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.

The test was made with the detector (RBW/VBW) in the following table.
When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

Frequency	Below 30 MHz	30 MHz to 300 MHz	300 MHz to 1 GHz
Antenna Type	Loop	Biconical	Logperiodic

Frequency	From 9 kHz to 90 kHz and From 110 kHz to 150 kHz	From 90 kHz to 110 kHz	From 150 kHz to 490 kHz	From 490 kHz to 30 MHz	From 30 MHz to 1 GHz
Instrument used	Test Receiver				
Detector	PK / AV	QP	PK / AV	QP	QP
IF Bandwidth	200 Hz	200 Hz	9 kHz	9 kHz	120 kHz
Test Distance	3 m *1)	3 m *1)	3 m *1)	3 m *2)	3 m

*1) Distance Factor: 40 x log (3 m / 300 m) = -80 dB
*2) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606.

These tests were performed in semi anechoic chamber. Therefore the measured level of emissions may be higher than if measurements were made without a ground plane.
However test results were confirmed to pass against standard limit.

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Measurement range : 9 kHz - 1 GHz
Test data : APPENDIX 1
Test result : Pass

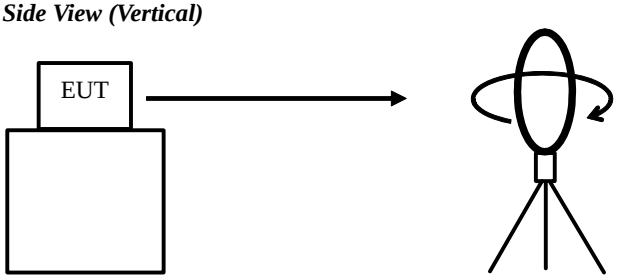
SECTION 7: Other test

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth 99 % Occupied Bandwidth	50 kHz	1 kHz	3 kHz	Auto	Sample	Max Hold	Spectrum Analyzer
Frequency Tolerance	-	-	-	-	-	-	Frequency counter

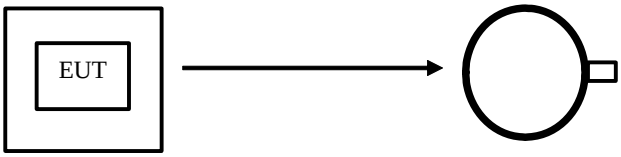
Test data : APPENDIX
Test result : Pass

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

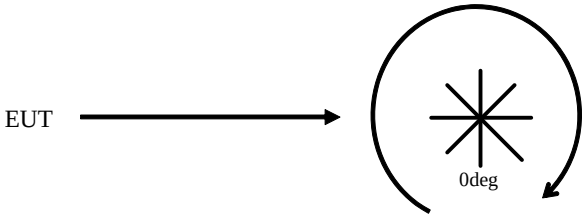


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

APPENDIX 1: Test data

Conducted emission

DATA OF CONDUCTED EMISSION TEST

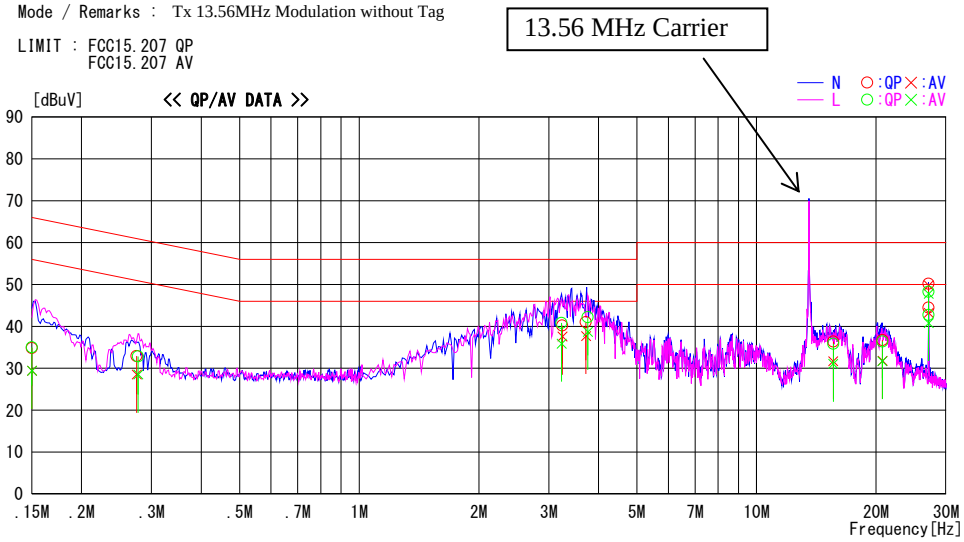
UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber
Date : 2015/08/02

Report No. : 10904156H

Temp./Humi. : 22deg. C / 62% RH
Engineer : Takafumi Noguchi

Mode / Remarks : Tx 13.56MHz Modulation without Tag

LIMIT : FCC15.207 QP
FCC15.207 AV



Frequency	Reading Level		Corr.	Results		Limit		Margin		Phase	Comment
	QP	AV	Factor	QP	AV	QP	AV	QP	AV		
[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
0.15000	21.8	16.2	13.2	35.0	29.4	66.0	56.0	31.0	26.6	L	
0.15000	21.6	16.2	13.2	34.8	29.4	66.0	56.0	31.2	26.6	N	
0.27534	19.7	15.3	13.2	32.9	28.5	61.0	51.0	28.1	22.5	N	
0.27774	19.6	15.3	13.2	32.8	28.5	60.9	50.9	28.1	22.4	L	
3.23239	27.2	22.3	13.6	40.8	35.9	56.0	46.0	15.2	10.1	L	
3.24519	26.6	24.0	13.6	40.2	37.6	56.0	46.0	15.8	8.4	N	
3.72040	27.3	24.0	13.7	41.0	37.7	56.0	46.0	15.0	8.3	N	
3.76147	28.5	25.0	13.7	42.2	38.7	56.0	46.0	13.8	7.3	L	
15.60400	21.8	17.1	14.6	36.4	31.7	60.0	50.0	23.6	18.3	N	
15.59743	21.2	16.5	14.6	35.8	31.1	60.0	50.0	24.2	18.9	L	
20.75981	21.8	16.9	14.9	36.7	31.8	60.0	50.0	23.3	18.2	N	
20.74361	21.5	16.8	14.9	36.4	31.7	60.0	50.0	23.6	18.3	L	
27.12000	27.5	25.6	15.2	42.7	40.8	60.0	50.0	17.3	9.2	L	with tag
27.12000	29.3	28.0	15.2	44.5	43.2	60.0	50.0	15.5	6.8	N	with Tag
27.12000	33.1	32.6	15.2	48.3	47.8	60.0	50.0	11.7	2.2	L	
27.12000	35.0	34.6	15.2	50.2	49.8	60.0	50.0	9.8	0.2	N	

CHART : WITH FACTOR, Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + ATTEN. + CABLE)
Except for the above table : adequate margin data below the limits.

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

Conducted emission

DATA OF CONDUCTED EMISSION TEST

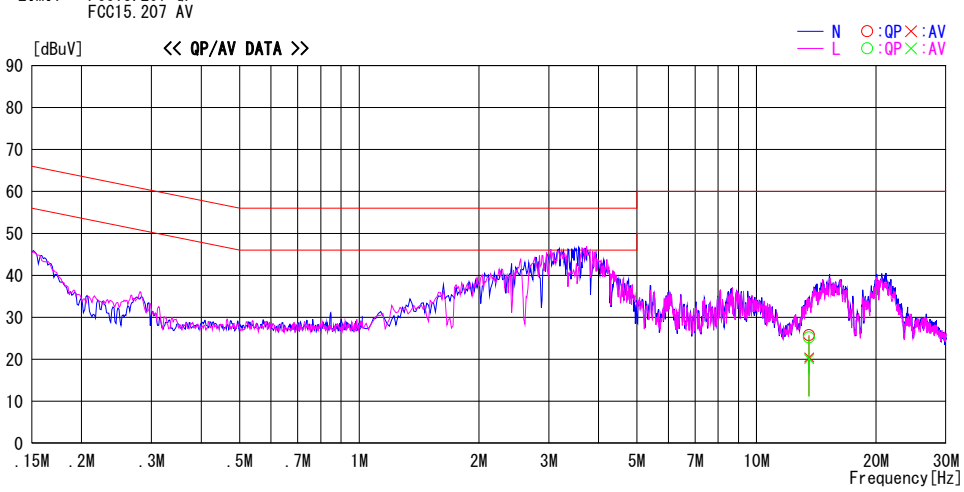
UL Japan, Inc. Ise EMC Lab. No.3 Semi Anechoic Chamber
Date : 2015/08/04

Report No. : 10904156H

Temp./Humi. : 27deg. C / 47% RH
Engineer : Tomoki Matsui

Mode / Remarks : Tx 13.56MHz Antenna Teminated

LIMIT : FCC15.207 QP
FCC15.207 AV



Frequency	Reading Level		Corr.	Results		Limit		Margin		Phase	Comment
	QP	AV	Factor	QP	AV	QP	AV	QP	AV		
[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
13.56000	11.0	5.9	14.2	25.2	20.1	60.0	50.0	34.8	29.9	L	
13.56000	11.5	6.2	14.2	25.7	20.4	60.0	50.0	34.3	29.6	N	

CHART : WITH FACTOR, Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + ATTEN. + CABLE)
Except for the above table : adequate margin data below the limits.

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

Fundamental emission and Spectrum Mask

DATA OF RADIATED EMISSION TEST

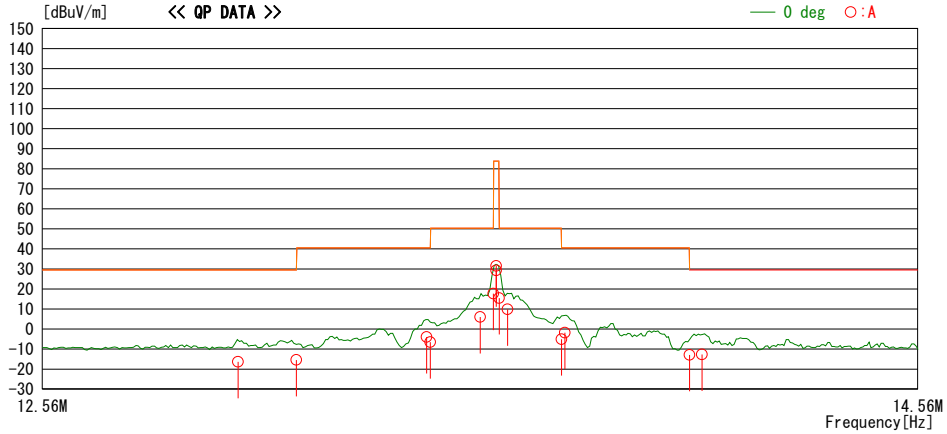
UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber
Date : 2015/08/02

Report No. : 10904156H

Temp./ Humi. : 22deg.C / 62% RH
Engineer : Takafumi Noguchi

Mode / Remarks : Tx 13.56MHz without Tag Worst Axis(Module X Antenna Y)

LIMIT : FCC15_225_PKQP, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15_225_AVQP, 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
12.98200	29.2	QP	19.5	-33.0	32.1	-16.4	29.5	45.9	0	A	180	
13.11000	30.2	QP	19.5	-33.0	32.1	-15.4	29.5	44.9	0	A	180	
13.40200	41.7	QP	19.4	-33.0	32.1	-4.0	40.5	44.5	0	A	180	
13.41000	39.2	QP	19.4	-33.0	32.1	-6.5	40.5	47.0	0	A	180	
13.52380	51.6	QP	19.4	-32.9	32.1	6.0	50.4	44.4	0	A	180	
13.55300	63.4	QP	19.4	-32.9	32.1	17.8	50.4	32.7	0	A	180	
13.56000	77.0	QP	19.4	-32.9	32.1	31.4	83.9	52.5	0	A	180	
13.56000	74.9	QP	19.4	-32.9	32.1	29.3	83.9	54.6	0	A	180	with Tag
13.56700	61.0	QP	19.4	-32.9	32.1	15.4	50.4	35.0	0	A	180	
13.58560	55.4	QP	19.4	-32.9	32.1	9.8	50.4	40.6	0	A	180	
13.71000	40.5	QP	19.4	-32.9	32.1	-5.1	40.5	45.6	0	A	180	
13.71820	43.8	QP	19.4	-32.9	32.1	-1.8	40.5	42.3	0	A	180	
14.01000	32.8	QP	19.3	-32.9	32.1	-12.9	29.5	42.4	0	A	180	
14.03900	33.0	QP	19.3	-32.9	32.1	-12.7	29.5	42.2	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)

Result of the fundamental emission at 3m without Distance factor

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	13.56000	QP	77.0	19.4	7.1	32.1	-	71.4	-	-	Fundamental

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

Spurious emission
(Below 30 MHz)

DATA OF RADIATED EMISSION TEST

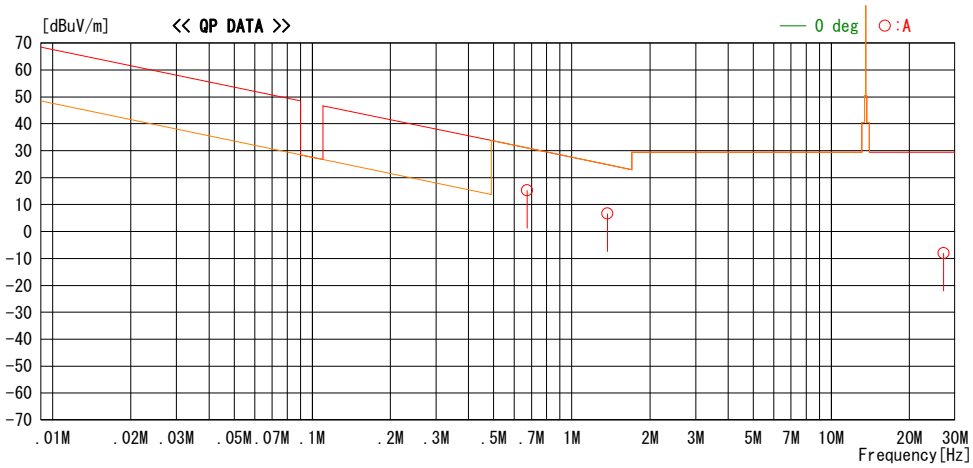
UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber
Date : 2015/08/02

Report No. : 10904156H

Temp. / Humi. : 22deg.C / 62% RH
Engineer : Takafumi Noguchi

Mode / Remarks : Tx 13.56MHz without Tag Worst Axis(Module X Antenna Y)

LIMIT : FCC15_225_PKQP, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15_225_AVQP, 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
0.67275	61.7	QP	19.5	-33.8	32.1	15.3	31.0	15.7	0	A	323	
1.37112	53.0	QP	19.5	-33.7	32.1	6.7	24.8	18.1	0	A	323	
27.12000	36.8	QP	19.7	-32.5	32.1	-8.1	29.5	37.6	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)

Spurious emission
(Above 30 MHz)

DATA OF RADIATED EMISSION TEST

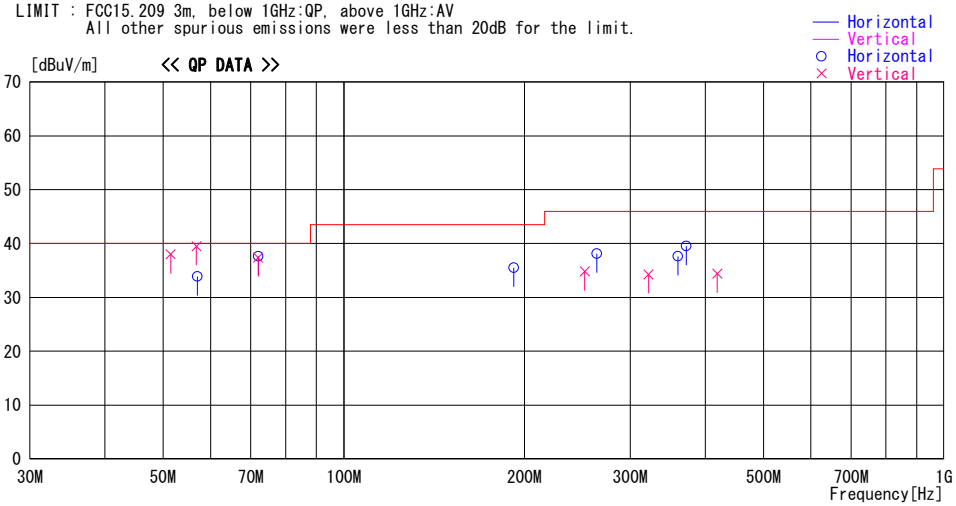
UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber
Date : 2015/08/01

Report No. : 10904156H

Temp./Humi. : 22deg. C / 60% RH
Engineer : Tomoki Matsui

Mode / Remarks : Tx 13.56MHz Module X Ant X with Tag

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



Frequency	Reading	DET	Antenna Factor	Loss& Gain	Level	Angle	Height	Polar.	Limit	Margin	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
51.453	49.3	QP	10.2	-21.5	38.0	270	100	Vert.	40.0	2.0	
56.796	52.5	QP	8.4	-21.4	39.5	230	100	Vert.	40.0	0.5	
72.002	52.3	QP	6.3	-21.2	37.4	243	100	Vert.	40.0	2.6	
56.997	47.0	QP	8.3	-21.4	33.9	280	400	Hori.	40.0	6.1	
71.996	52.5	QP	6.3	-21.2	37.6	0	400	Hori.	40.0	2.4	
191.924	38.9	QP	16.4	-19.8	35.5	220	100	Hori.	43.5	8.0	
264.080	39.1	QP	17.9	-18.9	38.1	212	400	Hori.	46.0	7.9	
360.026	40.0	QP	16.4	-18.8	37.6	148	100	Hori.	46.0	8.4	
372.031	41.5	QP	16.8	-18.8	39.5	156	100	Hori.	46.0	6.5	
251.956	36.6	QP	17.3	-19.1	34.8	290	100	Vert.	46.0	11.2	
321.678	37.7	QP	15.2	-18.6	34.3	318	170	Vert.	46.0	11.7	
418.768	35.4	QP	17.8	-18.8	34.4	178	100	Vert.	46.0	11.6	

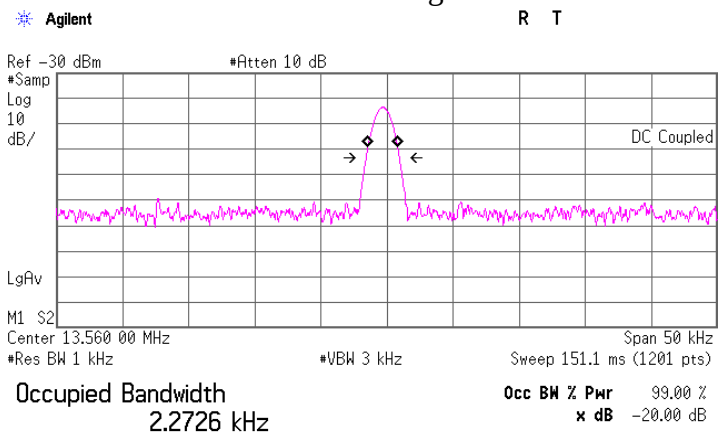
CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE + ATTEN. - GAIN(AMP))

20dB Bandwidth and 99% Occupied Bandwidth

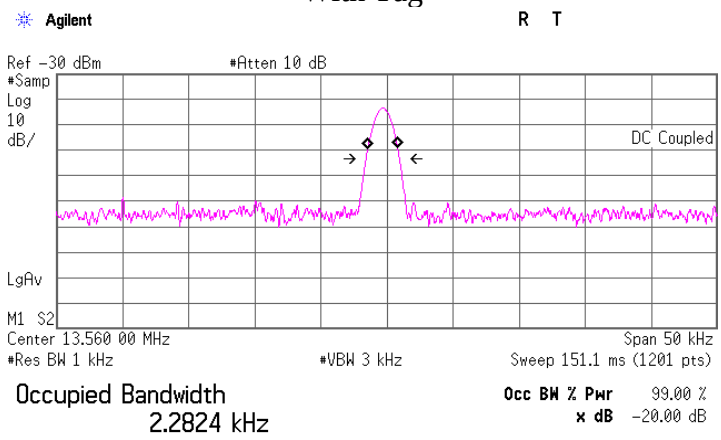
Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	10904156H
Date	08/02/2015
Temperature/ Humidity	22 deg. C / 62% RH
Engineer	Takafumi Noguchi
Mode	Tx Mod on

FREQ [MHz]	Mode	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	Without Tag	2.54	2.27
	With Tag	2.56	2.28

Without Tag



With Tag



Frequency Tolerance

Test place	Ise EMC Lab. No.6 measurement room
Report No.	10904156H
Date	08/03/2015
Temperature/ Humidity	20 deg. C / 40% RH
Engineer	Takumi Shimada
Mode	Tx 13.56MHz CW Without Tag

Test Condition deg.C	Volts	Test Timing	Measured freq [MHz]	Freq error [MHz]	Result [ppm]	Limit (+/- 0.01%) [+/- ppm]	Margin [ppm]
20deg.C	10.2V	Power on	13.5596230	-0.0003770	-27.80	100.00	72.20
		on 2min.	13.5596235	-0.0003765	-27.77	100.00	72.23
		on 5min.	13.5596285	-0.0003715	-27.40	100.00	72.60
		on 10min.	13.5596326	-0.0003674	-27.09	100.00	72.91
	12.0V	Power on	13.5597040	-0.0002960	-21.83	100.00	78.17
		on 2min.	13.5596838	-0.0003162	-23.32	100.00	76.68
		on 5min.	13.5596564	-0.0003436	-25.34	100.00	74.66
		on 10min.	13.5596205	-0.0003795	-27.99	100.00	72.01
	13.8V	Power on	13.5596537	-0.0003463	-25.54	100.00	74.46
		on 2min.	13.5596360	-0.0003640	-26.84	100.00	73.16
		on 5min.	13.5596146	-0.0003854	-28.42	100.00	71.58
		on 10min.	13.5596034	-0.0003966	-29.25	100.00	70.75
50deg.C	12.0V	Power on	13.5596243	-0.0003757	-27.71	100.00	72.29
		on 2min.	13.5596014	-0.0003986	-29.40	100.00	70.60
		on 5min.	13.5595998	-0.0004002	-29.51	100.00	70.49
		on 10min.	13.5595986	-0.0004014	-29.60	100.00	70.40
40deg.C		Power on	13.5596699	-0.0003301	-24.34	100.00	75.66
		on 2min.	13.5596357	-0.0003643	-26.87	100.00	73.13
		on 5min.	13.5596253	-0.0003747	-27.63	100.00	72.37
		on 10min.	13.5596220	-0.0003780	-27.88	100.00	72.12
30deg.C		Power on	13.5597001	-0.0002999	-22.12	100.00	77.88
		on 2min.	13.5596725	-0.0003275	-24.15	100.00	75.85
		on 5min.	13.5596635	-0.0003365	-24.82	100.00	75.18
		on 10min.	13.5596603	-0.0003397	-25.05	100.00	74.95
20deg.C		Power on	13.5597040	-0.0002960	-21.83	100.00	78.17
		on 2min.	13.5596838	-0.0003162	-23.32	100.00	76.68
		on 5min.	13.5596564	-0.0003436	-25.34	100.00	74.66
		on 10min.	13.5596205	-0.0003795	-27.99	100.00	72.01
10deg.C		Power on	13.5597511	-0.0002489	-18.36	100.00	81.64
		on 2min.	13.5597366	-0.0002634	-19.42	100.00	80.58
		on 5min.	13.5597291	-0.0002709	-19.98	100.00	80.02
		on 10min.	13.5597261	-0.0002739	-20.20	100.00	79.80
0deg.C		Power on	13.5597620	-0.0002380	-17.55	100.00	82.45
		on 2min.	13.5597543	-0.0002457	-18.12	100.00	81.88
		on 5min.	13.5597487	-0.0002513	-18.53	100.00	81.47
		on 10min.	13.5597480	-0.0002520	-18.58	100.00	81.42
-10deg.C		Power on	13.5597541	-0.0002459	-18.13	100.00	81.87
		on 2min.	13.5597586	-0.0002414	-17.80	100.00	82.20
		on 5min.	13.5597602	-0.0002398	-17.68	100.00	82.32
		on 10min.	13.5597610	-0.0002390	-17.63	100.00	82.37
-20deg.C		Power on	13.5597144	-0.0002856	-21.06	100.00	78.94
		on 2min.	13.5597380	-0.0002620	-19.32	100.00	80.68
		on 5min.	13.5597464	-0.0002536	-18.70	100.00	81.30
		on 10min.	13.5597478	-0.0002522	-18.60	100.00	81.40

Limit : 13.56 13.56 MHz +/-0.01 % (+/- 100ppm) = +/- 0.001356 MHz

*The test was begun from 50 deg. C and the temperature was lowered each 10 deg. C.

APPENDIX 2: 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,CE	2015/07/01 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE,CE	2015/01/13 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE,CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE,CE	-
MSA-13	Spectrum Analyzer	Agilent	E4440A	MY46185823	RE,CE	2015/06/02 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE,CE	2015/06/08 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	RE,CE	2014/08/28 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	VHA91032008	RE	2014/10/18 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	201	RE	2014/10/18 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2015/02/06 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2014/11/11 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2014/09/26 * 12
MLS-23	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	CE(EUT)	2015/07/10 * 12
MLS-24	LISN(AMN)	Schwarzbeck	NSLK8127	8127-730	CE(AE)	2015/07/10 * 12
MTA-28	Terminator	TME	CT-01	-	CE	2014/11/26 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m) /5D-2W(5m)/ 5D-2W(0.8m)/ 5D-2W(1m)	-	RE,CE	2015/02/06 * 12
MAT-65	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2015/01/29 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2014/10/04 * 12
MCC-143	Coaxial Cable	UL Japan	-	-	RE	2015/06/24 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2015/03/09 * 12
MFC-01	Microwave Counter	Advantest	R5373	120100309	FT	2014/08/11 * 12
MCH-04	Temperature and Humidity Chamber	Tabai Espec	PL-2KP	14015723	FT	2015/08/02 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	1401	FT	2015/01/13 * 12
MLPA-07	Loop Antenna	UL Japan	-	-	FT	Pre Check
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	CE	2015/02/19 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	CE	2015/01/13 * 12
MJM-16	Measure	KOMELON	KMC-36	-	CE	-
MSA-14	Spectrum Analyzer	Agilent	E4440A	MY48250080	CE	2014/10/17 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	CE	2014/08/19 * 12
MTA-01	Terminator	TME	CT-01	-	CE	2015/01/19 * 12
MCC-112	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/ SFM141(3m)/ sucoform141-PE(1m)/ 421-010(1.5m)/ RFM-E321(Switcher)	-/00640	CE	2015/07/02 * 12
MAT-66	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2015/01/29 * 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: CE: Conducted Emission, RE: Radiated Emission, FT: Frequency Tolerance