



RADIO TEST REPORT

Test Report No. : 10006371H-B-R1

Applicant : OMRON Corporation
Type of Equipment : Radio Frequency Identification System (RFID System)
Model No. : V680S-HMD66-ETN
Test regulation : FCC Part 15 Subpart C: 2012
FCC ID : E4EV680S66
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 report is a revised version of 10006371H-B. 10006371H-B is replaced with this report.

Date of test: March 7 to 13, 2013

Representative test engineer:

Satofumi Matsuyama
Engineer of WiSE Japan,
UL Verification Service

Approved by:

Masanori Nishiyama
Manager 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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13-EM-F0429

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SECTION 1: Customer information

Company Name : OMRON Corporation
Address : 2-2-1, Nishikusatsu, Kusatsu-city, Shiga-pref., 525-0035, Japan
Telephone Number : +81-77-565-5287
Facsimile Number : +81-77-565-5569
Contact Person : Tomohiro Nishimura

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

2.1 Identification of E.U.T.

Type of Equipment : Radio Frequency Identification System (RFID System)
Model No. : V680S-HMD66-ETN
Serial No. : Refer to Section 4, Clause 4.2
Receipt Date of Sample : March 5, 2013
Country of Mass-production : Japan
Condition of EUT : Engineering 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

General Specification

Clock frequency(ies) in the system : 13.56MHz

Radio Specification

Radio Type : Transceiver
Frequency of Operation : 13.56MHz
Modulation : ASK
Power Supply (inner) : 7V DC
Antenna type : Loop Coil
Operating Temperature : -25 deg. C - +70 deg. C

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : Test specification: FCC Part 15 Subpart C: 2012, final revised on December 27, 2012 and effective January 28, 2013

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

* The EUT complies with FCC Part 15 Subpart B: 2012, final revised on December 27, 2012 and effective January 28, 2013

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted emission	ANSI C63.4:2003 7. AC powerline conducted emission measurements <IC>RSS-Gen 7.2.2	Section 15.207 ----- <IC>RSS-Gen 7.2.2	[QP] 12.8dB 13.56000MHz, N [AV] 2.9dB 13.56000MHz, N	Complied	Conducted
Electric Field Strength of Fundamental Emission	ANSI C63.4:2003 13. Measurement of intentional radiators <IC> RSS-Gen 4.8, 4.11	Section 15.225(a) ----- <IC>RSS-210 A2.6	47.5dB, 13.56000MHz, QP, 0deg.	Complied	Radiated
Spectrum Mask	ANSI C63.4:2003 13. Measurement of intentional radiators <IC>RSS-Gen 4.9, 4.11	Section 15.225(b)(c) ----- <IC> RSS-210 A2.6	28.2dB, 13.55300MHz, QP, 0deg.	Complied	Radiated
20dB Bandwidth	ANSI C63.4:2003 13. Measurement of intentional radiators <IC> -	Section15.215(c) ----- <IC> -	See data	Complied	Radiated
Electric Field Strength of Spurious Emission	ANSI C63.4:2003 13. Measurement of intentional radiators <IC>RSS-Gen 4.9, 4.11	Section15.209, Section 15.225 (d) ----- <IC>RSS-210 A2.6	0.2dB 732.243MHz, Horizontal, QP	Complied	Radiated
Frequency Tolerance	ANSI C63.4:2003 13. Measurement of intentional radiators <IC>RSS-Gen 4.7	Section15.225(e) ----- <IC> RSS-210 A2.6	See data	Complied	Radiated

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(7V DC) constantly to RF Module regardless of input voltage. 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 EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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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)	Conducted emission (+dB)
	150kHz-30MHz
No.1	3.5dB
No.2	3.6dB
No.3	3.6dB
No.4	3.6dB

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

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)

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

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3.5 Test Location

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

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

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

Refer to APPENDIX.

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

4.1 Operating Modes

The mode is used :

Mode	Remarks*
Transmitting mode (Tx 13.56MHz)	with Tag without Tag
The EUT was operated in a manner similar to typical use during the tests.	

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

Frequency Tolerance:

Temperature : -30deg.C to +50deg.C Step 10deg.C (-30deg.C: Reference)
Voltage : Normal Voltage DC 24V
Maximum Voltage DC 26.4V
Minimum Voltage DC 20.4V (DC 24V +10%, -15%)

*This EUT provides stable voltage(7V DC) constantly to RF Part regardless of input voltage

* Since it is recommended in the user manual that AC Cable with one ferrite core attached is used for DC power supply, the test was performed using AC Cable with a ferrite core attached.

However, Conducted emission test was performed with AC Cable (for DC power supply) without a ferrite core, because the power is supplied to the EUT from DC power supply and also it cannot be judged that there is no influence of a ferrite core.

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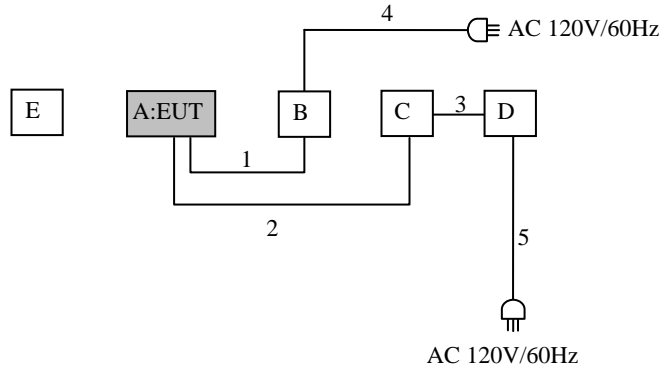
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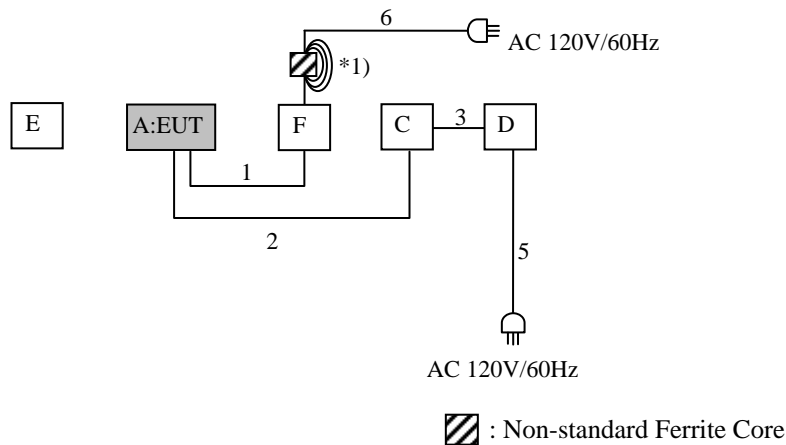
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Configuration and peripherals

[Conducted Emission]



[Radiated Emission]



*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 System	V680S-HMD66-ETN	7	OMRON Corporation	EUT
B	DC Power Supply	PAN35-5A	SF001759	KIKUSUI	-
C	Switching Hub	W4S1-05B	03207002	OMRON Corporation	-
D	Power Supply	S8VS-03024	30	OMRON Corporation	-
E	RFID Tag	-	9	OMRON Corporation	-
F	Power Supply	S8VS-03024	9X12M	OMRON Corporation	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC Cable	2.0	Unshielded	Unshielded	-
2	LAN Cable	2.0	Shielded	Shielded	-
3	DC Cable	0.1	Unshielded	Unshielded	
4	AC Cable	2.0	Unshielded	Unshielded	
5	AC Cable	2.0	Unshielded	Unshielded	-
6	AC Cable	1.6	Unshielded	Unshielded	Core 4 turns

<Notes for Ferrite cores>

*1) 1 Ferrite Core, Model No. E04SR301334 (Manufacturer: SEIWA), 5cm from Item F, 4 turns

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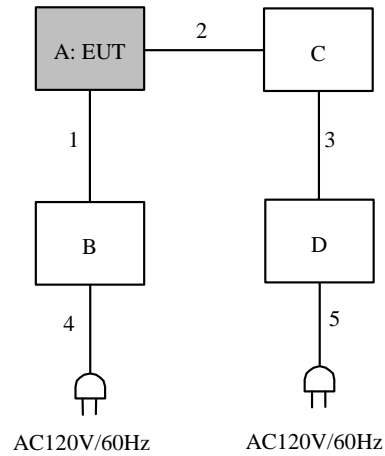
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[Frequency Tolerance]



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	RFID System	V680S-HMD66-ETN	7	OMRON Corporation	EUT
B	Power Supply	PAB70-1	30046240	KIKUSUI	-
C	Switching Hub	W4S1-05B	03207002	OMRON Corporation	-
D	Power Supply	S8VS-03024	30	OMRON Corporation	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC Cable	3.5	Unshielded	Unshielded	-
2	LAN Cable	2.0	Shielded	Shielded	-
3	DC Cable	0.1	Unshielded	Unshielded	-
4	AC Cable	2.0	Unshielded	Unshielded	-
5	AC Cable	2.0	Unshielded	Unshielded	-

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SECTION 5: Conducted emission

5.1 Operating environment

Test place : No.3 semi anechoic chamber.
Temperature : See data
Humidity : See data

5.2 Test configuration

EUT was placed on a urethane platform of nominal size, 1.0m by 1.5m, raised 0.8m above the conducting ground plane. The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT and its peripherals was 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 LISN/AMN and excess AC cable was bundled in center. 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. Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN/ an AMN to the input power source. All unused 50ohm connectors of the LISN/ AMN were resistively terminated in 50ohm when not connected to the measuring equipment. The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT on a horizontal conducting plane 4.0 x 4.0m and a vertical conducting plane 2.0 x 2.0m in a semi Anechoic Chamber. Photographs of the set up are shown in Appendix 3.

5.3 Test conditions

Frequency range : 0.15MHz-30MHz
EUT position : Table top
EUT operation mode : See Clause 4.1

5.4 Test procedure

The AC Mains Terminal Continuous disturbance Voltage had been measured with the EUT in the semi Anechoic Chamber. The EUT was connected to a Line Impedance Stabilization Network (LISN)/ Artificial Mains Network (AMN). An overview sweep with peak detection has been performed. The measurements had been performed with a quasi-peak detector and if required, with an average detector. The conducted emission measurements were made with the following detector function of the test receiver.

Detector Type : QP and CISPR AV
IF Bandwidth : 9kHz

5.5 Test result

Summary of the test results : Pass

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

Test Procedure

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 0.8m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane. The height of the measuring antenna varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength. The measurements were performed for both vertical (angle of loop antenna: 0deg., 45deg., 90deg., and 135 deg.) and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer. The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode). 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 30MHz	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	Loop	Biconical	Logperiodic	Horn

Frequency	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	Above 1GHz	
Instrument used	Test Receiver					Spectrum Analyzer	
Detector	PK/AV	QP	PK/AV	QP	QP	PK	AV
IF Bandwidth	200Hz	200Hz	9kHz	9kHz	120kHz	RBW: 1MHz VBW: 3MHz	RBW: 1MHz VBW: 10Hz

- 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.

* FCC Part 15 Section 15.31 (f)(2) / IC RSS-Gen 4.11 (9kHz-30MHz)

$$9\text{kHz} - 490\text{kHz} [\text{Limit at } 3\text{m}] = [\text{Limit at } 300\text{m}] - 40\log\left(\frac{3}{300}\right)$$

$$490\text{kHz} - 30\text{MHz} [\text{Limit at } 3\text{m}] = [\text{Limit at } 30\text{m}] - 40\log\left(\frac{3}{30}\right)$$

Measurement range : **0.009M-1GHz**
Test data : **APPENDIX**
Test result : **Pass**

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SECTION 7: Other test

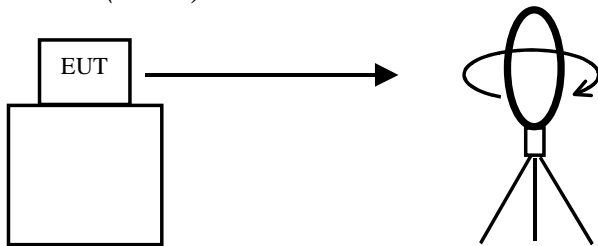
Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20dB Bandwidth	3MHz	30kHz	91kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	1 to 3% of Span	Three times of RBW	Auto	Peak *1)	Max Hold *1)	Spectrum Analyzer
Frequency Tolerance	-	-	-	-	-	-	Frequency counter

*1) The measurement was performed with Peak detector, Max Hold since the duty cycle was not 100%.

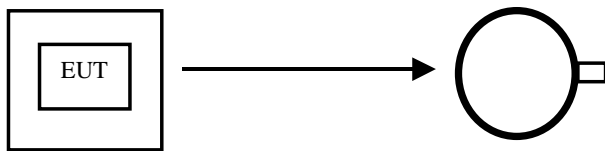
Test data : APPENDIX
Test result : Pass

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

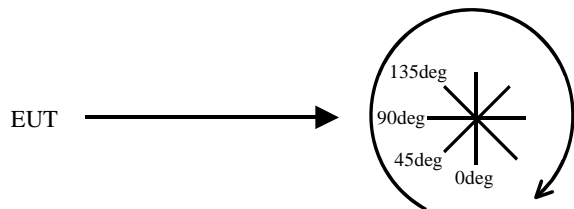


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

APPENDIX 1: Data of EMI test

Conducted emission

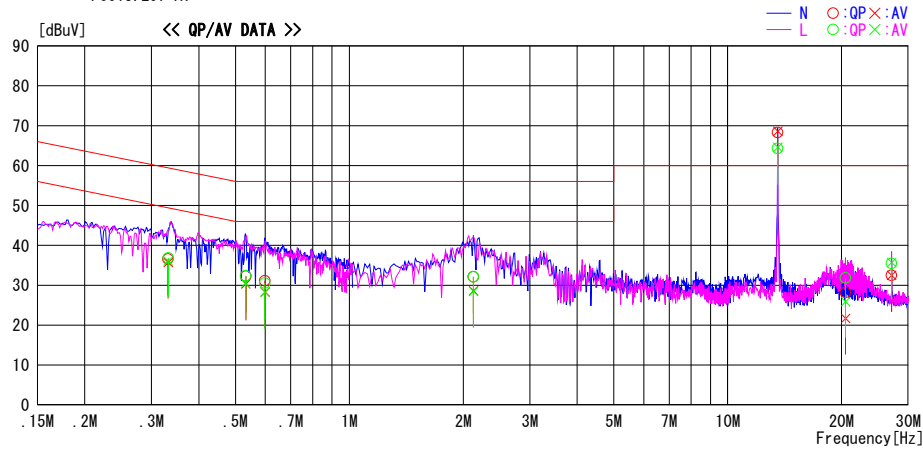
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2013/03/08

Report No. : 10006371H
Temp./Humi. : 20deg. C / 35% RH
Engineer : Hiroshi Kukita

Mode / Remarks : Tx 13.56MHz, without Tag

LIMIT : FCC15.207 QP
FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.33210	23.3	22.4	13.3	36.6	35.7	59.4	49.4	22.8	13.7	N	
0.53310	19.0	17.0	13.3	32.3	30.3	56.0	46.0	23.7	15.7	N	
0.59860	17.8	15.0	13.3	31.1	28.3	56.0	46.0	24.9	17.7	N	
2.12890	18.7	15.2	13.4	32.1	28.6	56.0	46.0	23.9	17.4	N	
13.56000	54.0	54.3	14.3	68.3	68.6	60.0	50.0	-	-	N	
20.48400	13.6	7.1	14.6	28.2	21.7	60.0	50.0	31.8	28.3	N	
27.12000	17.7	17.7	14.8	32.5	32.5	60.0	50.0	27.5	17.5	N	
0.33240	23.5	22.8	13.3	36.8	36.1	59.4	49.4	22.6	13.3	L	
0.53172	19.1	17.2	13.3	32.4	30.5	56.0	46.0	23.6	15.5	L	
0.59866	17.3	14.9	13.3	30.6	28.2	56.0	46.0	25.4	17.8	L	
2.12807	18.7	15.1	13.4	32.1	28.5	56.0	46.0	23.9	17.5	L	
13.56000	50.0	50.3	14.3	64.3	64.6	60.0	50.0	-	-	L	
20.48180	17.2	11.3	14.6	31.8	25.9	60.0	50.0	28.2	24.1	L	
27.12000	20.7	20.9	14.8	35.5	35.7	60.0	50.0	24.5	14.3	L	

CHART: WITH FACTOR, Peak hold data. CALCULATION: RESULT [dBuV]=READING [dBuV]+C. F [dB] (LISN LOSS+CABLE LOSS)
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

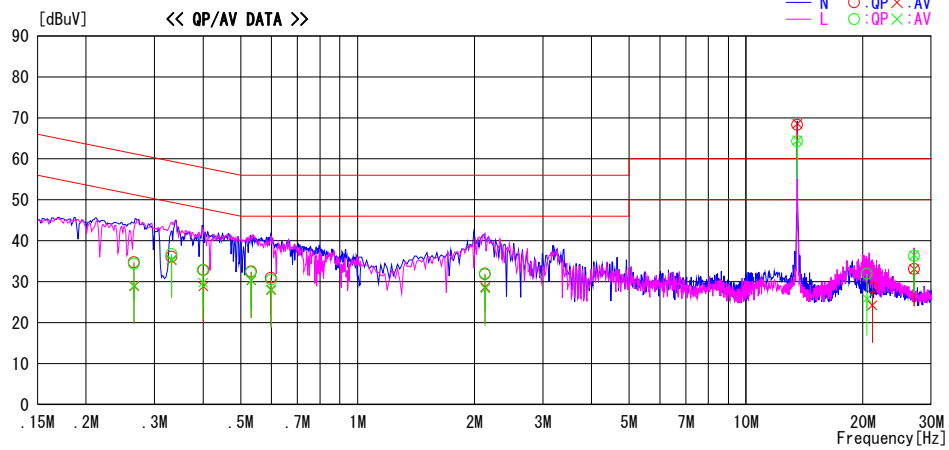
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
 Date : 2013/03/08

Report No. : 10006371H

Temp./Humi. : 20deg. C / 35% RH
 Engineer : Hiroshi Kukita

Mode / Remarks : Tx 13.56MHz, with Tag

LIMIT : FCC15.207 QP
 FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.26570	21.4	15.6	13.3	34.7	28.9	61.3	51.3	26.6	22.4	N	
0.33220	22.8	21.9	13.3	36.1	35.2	59.4	49.4	23.3	14.2	N	
0.40080	19.5	15.6	13.3	32.8	28.9	57.8	47.8	25.0	18.9	N	
0.53250	19.2	17.0	13.3	32.5	30.3	56.0	46.0	23.5	15.7	N	
0.59840	17.6	14.8	13.3	30.9	28.1	56.0	46.0	25.1	17.9	N	
2.12800	18.4	15.3	13.4	31.8	28.7	56.0	46.0	24.2	17.3	N	
13.56000	54.0	54.3	14.3	68.3	68.6	60.0	50.0	-	-	N	
21.14900	14.0	9.6	14.6	28.6	24.2	60.0	50.0	31.4	25.8	N	
27.12000	18.3	18.3	14.8	33.1	33.1	60.0	50.0	26.9	16.9	N	
0.26580	21.1	15.8	13.3	34.4	29.1	61.2	51.2	26.8	22.1	L	
0.33210	23.4	22.1	13.3	36.7	35.4	59.4	49.4	22.7	14.0	L	
0.39960	19.5	16.5	13.3	32.8	29.8	57.9	47.9	25.1	18.1	L	
0.53160	19.0	17.0	13.3	32.3	30.3	56.0	46.0	23.7	15.7	L	
0.59930	17.2	14.6	13.3	30.5	27.9	56.0	46.0	25.5	18.1	L	
2.12840	18.6	14.9	13.4	32.0	28.3	56.0	46.0	24.0	17.7	L	
13.56000	50.0	50.2	14.3	64.3	64.5	60.0	50.0	-	-	L	
20.48410	17.3	11.3	14.6	31.9	25.9	60.0	50.0	28.1	24.1	L	
27.12000	21.5	21.7	14.8	36.3	36.5	60.0	50.0	23.7	13.5	L	

CHART: WITH FACTOR, Peak hold data. CALCULATION: RESULT [dBuV]=READING [dBuV]+C. F [dB] (LISN LOSS+CABLE LOSS)
 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

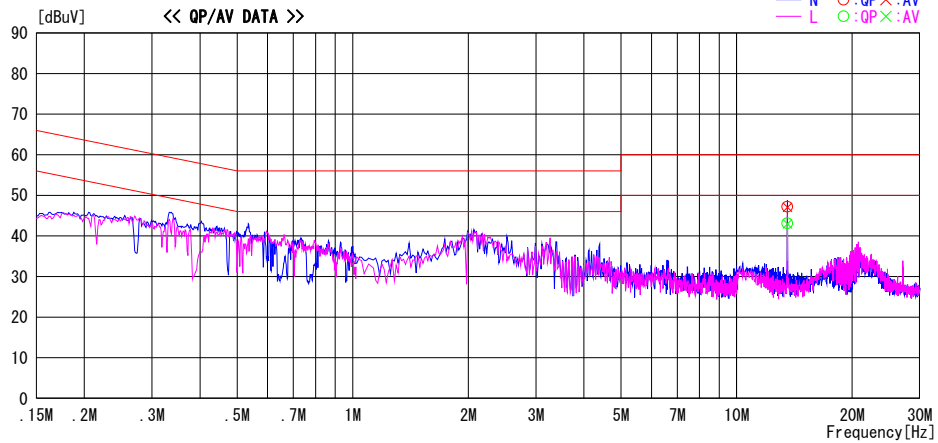
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
 Date : 2013/03/08

Report No. : 10006371H

Temp./Humi. : 20deg. C / 35% RH
 Engineer : Hiroshi Kukita

Mode / Remarks : Tx 13.56MHz, without Tag, Antenna 50ohm terminated.

LIMIT : FCC15.207 QP
 FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
13.56000	32.9	32.8	14.3	47.2	47.1	60.0	50.0	12.8	2.9	N	
13.56000	28.8	28.7	14.3	43.1	43.0	60.0	50.0	16.9	7.0	L	

CHART: WITH FACTOR. Peak hold data. CALCULATION: RESULT [dBuV] = READING [dBuV] + C.F [dB] (LISN LOSS + CABLE LOSS)
 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.

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Fundamental emission and Spectrum Mask
 (Precheck)

DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.1 Semi Anechoic Chamber
 Date : 2013/03/11

Report No. : 10006371H
 Temp./ Humi. : 22deg. C / 33% RH
 Engineer : Hiroshi Kukita

Mode / Remarks : Tx 13.56MHz Worst axis:Z without Tag

LIMIT : FCC15.225 3m, 9-90kHz:AV, 110-490kHz:AV, otehr:QP
 All other spurious emissions were less than 20dB for the limit.

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]	
13.56000	71.0	QP	19.3	7.3	32.3	65.3	123.9	58.6	0		32 X
13.56000	63.9	QP	19.3	7.3	32.3	58.2	123.9	65.7	45		82 X
13.56000	63.2	QP	19.3	7.3	32.3	57.5	123.9	66.4	90		182 X
13.56000	82.0	QP	19.3	7.3	32.3	76.3	123.9	47.6	0		155 Y
13.56000	82.1	QP	19.3	7.3	32.3	76.4	123.9	47.5	0		359 Z*
13.56000	70.4	QP	19.3	7.3	32.3	64.7	123.9	59.2	135		88 X
13.56000	80.0	QP	19.3	7.3	32.3	74.3	123.9	49.6	135		241 Y
13.56000	79.1	QP	19.3	7.3	32.3	73.4	123.9	50.5	135		162 Z
13.56000	79.4	QP	19.3	7.3	32.3	73.7	123.9	50.2	45		355 Y
13.56000	79.2	QP	19.3	7.3	32.3	73.5	123.9	50.4	45		359 Z
13.56000	71.7	QP	19.3	7.3	32.3	66.0	123.9	57.9	45		32 Hori. X
13.56000	71.5	QP	19.3	7.3	32.3	65.8	123.9	58.1	45		176 Hori. Y
13.56000	71.0	QP	19.3	7.3	32.3	65.3	123.9	58.6	45		359 Hori. Z
13.56000	74.6	QP	19.3	7.3	32.3	68.9	123.9	55.0	90		210 Y
13.56000	73.5	QP	19.3	7.3	32.3	67.8	123.9	56.1	90		152 Z
13.56000	82.0	QP	19.3	7.3	32.3	76.3	123.9	47.6	0		359 Z* with Tag

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.)

Fundamental emission and Spectrum Mask

DATA OF RADIATED EMISSION TEST

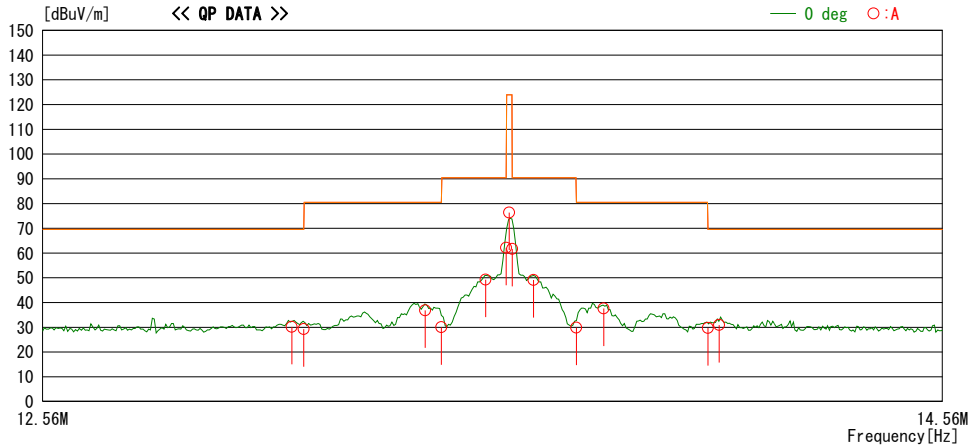
UL Japan, Inc. Head Office EMC Lab. No.1 Semi Anechoic Chamber
Date : 2013/03/12

Report No. : 10006371H

Temp. / Humi. : 22deg. C / 33% RH
Engineer : Hiroshi Kukita

Mode / Remarks : Tx 13.56MHz Worst axis:Z without Tag

LIMIT : FCC15.225 3m, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15.225 3m, 9-90kHz:AV, 110-490kHz:AV, otehr: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]	
13.08420	36.0	QP	19.3	7.2	32.3	30.2	69.5	39.3	0	A	359
13.11000	35.0	QP	19.3	7.2	32.3	29.2	69.5	40.3	0	A	359
13.37400	42.7	QP	19.3	7.2	32.3	36.9	80.5	43.6	0	A	359
13.41000	35.7	QP	19.3	7.3	32.3	30.0	80.5	50.5	0	A	359
13.50780	55.0	QP	19.3	7.3	32.3	49.3	90.4	41.1	0	A	359
13.55300	67.9	QP	19.3	7.3	32.3	62.2	90.4	28.2	0	A	359
13.56000	82.1	QP	19.3	7.3	32.3	76.4	123.9	47.5	0	A	359
13.56700	67.4	QP	19.3	7.3	32.3	61.7	90.4	28.7	0	A	359
13.61410	54.8	QP	19.3	7.3	32.3	49.1	90.4	41.3	0	A	359
13.71000	35.5	QP	19.3	7.3	32.3	29.8	80.5	50.7	0	A	359
13.77164	43.3	QP	19.3	7.3	32.3	37.6	80.5	42.9	0	A	359
14.01000	35.4	QP	19.3	7.3	32.3	29.7	69.5	39.8	0	A	359
14.03560	36.6	QP	19.3	7.3	32.3	30.9	69.5	38.6	0	A	359

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.)

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Spurious emission

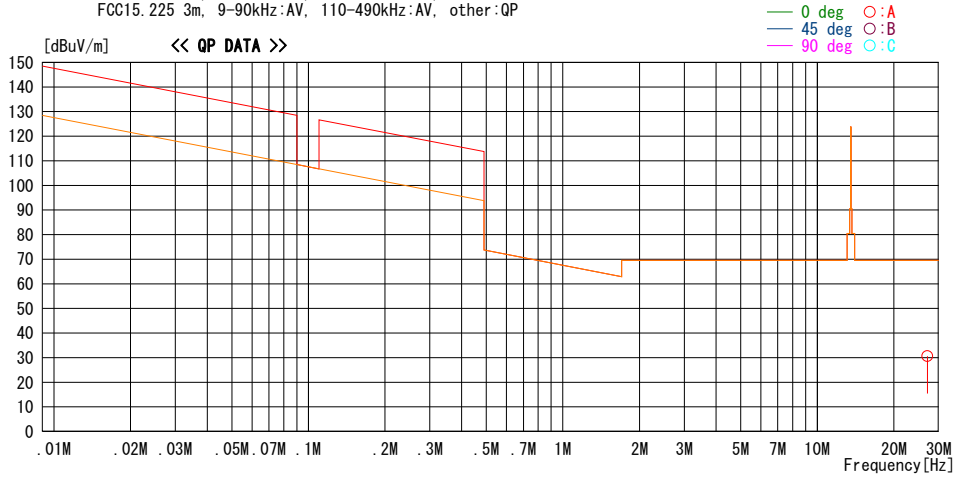
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.1 Semi Anechoic Chamber
 Date : 2013/03/12

Report No. : 10006371H
 Temp. / Humi. : 22deg. C / 33% RH
 Engineer : Hiroshi Kukita

Mode / Remarks : Tx 13.56MHz Worst axis:Z without Tag

LIMIT : FCC15.225 3m, 9-90kHz:PK, 110-490kHz:PK, other:QP
 FCC15.225 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]	
27.12000	34.1	QP	20.9	7.8	32.2	30.6	69.5	38.9	0	A	184

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

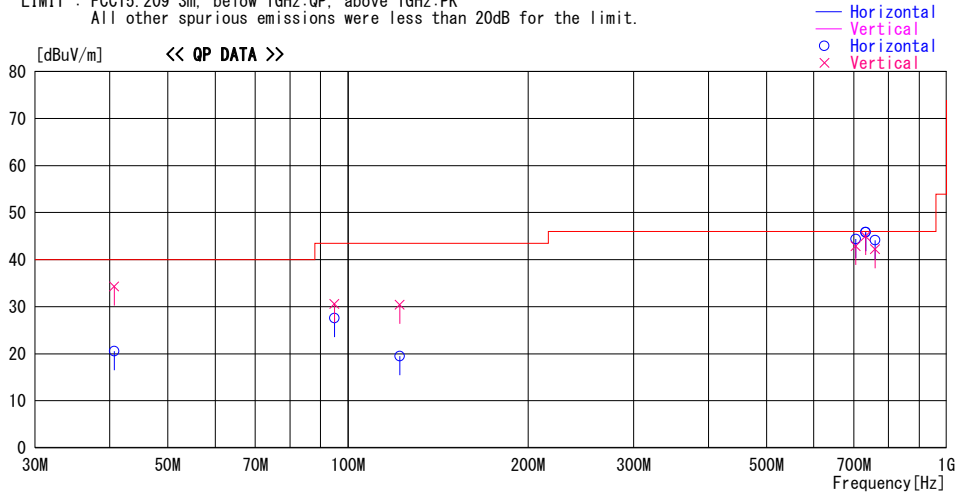
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2013/03/07

Report No. : 10006371H
Temp./Humi. : 20deg. C / 32% RH
Engineer : Satofumi Matsuyama

Mode / Remarks : Tx 13.56MHz, Worst-axis(Hor:Y Ver:Z), without tag

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



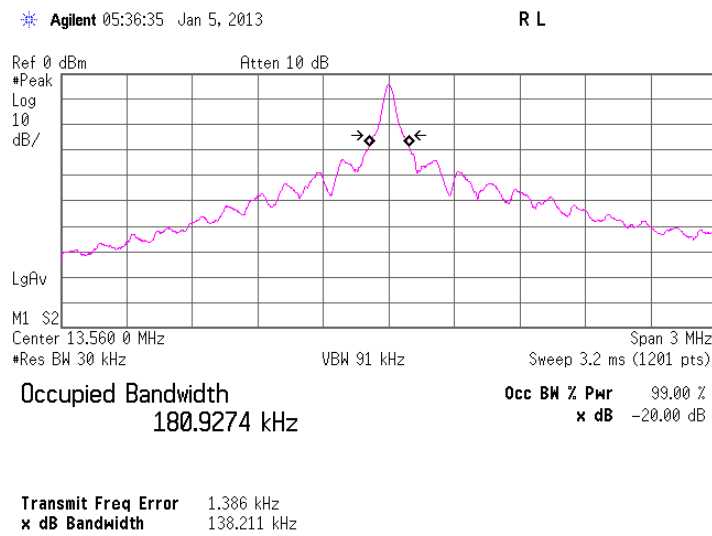
Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss&	Level	Angle	Height	Polar.	Limit	Margin	Comment
			Factor	Gain							
			[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
40.679	31.1	QP	14.3	-24.9	20.5	167	300	Hori.	40.0	19.5	
40.679	44.9	QP	14.3	-24.9	34.3	286	100	Vert.	40.0	5.7	
94.918	42.7	QP	9.1	-24.2	27.6	179	300	Hori.	43.5	15.9	
94.918	45.7	QP	9.1	-24.2	30.6	84	100	Vert.	43.5	12.9	
122.040	41.1	QP	13.2	-23.9	30.4	48	100	Vert.	43.5	13.1	
122.043	30.2	QP	13.2	-23.9	19.5	139	140	Hori.	43.5	24.0	
705.122	41.9	QP	20.4	-19.4	42.9	4	100	Vert.	46.0	3.1	
705.129	43.4	QP	20.4	-19.4	44.4	11	124	Hori.	46.0	1.6	
732.241	43.3	QP	20.8	-19.1	45.0	4	156	Vert.	46.0	1.0	
732.243	44.1	QP	20.8	-19.1	45.8	5	111	Hori.	46.0	0.2	
732.243	44.1	QP	20.8	-19.1	45.8	4	111	Hori.	46.0	0.2	with Tag
759.361	41.8	QP	21.2	-18.9	44.1	197	111	Hori.	46.0	1.9	
759.364	39.9	QP	21.2	-18.9	42.2	0	158	Vert.	46.0	3.8	

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)

20dB Bandwidth and 99% Occupied Bandwidth

Test place	Head Office EMC Lab. No.6 measurement room
Report No.	10006371H
Date	03/13/2013
Temperature/ Humidity	23 deg. C / 40% RH
Engineer	Kazuya Yoshioka
Mode	Tx Mod on with Tag

FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	138.21	180.93



Frequency Tolerance

Test place : Head Office EMC Lab. No.6 measurement room
Report No. : 10006371H
Date : 03/13/2013
Temperature/ Humidity : 23 deg. C / 40% RH
Engineer : Kazuya Yoshioka
Mode : Tx Mod off

Test Condition deg.C Volts	Test Timing	Measured freq [MHz]	Freq error [MHz]	Result [ppm]	Limit (+/- 0.01%) [+/- ppm]	Margin [ppm]	
20deg.C	20.4V	Power on	13.56005150	0.00005150	3.80	100.00	96.20
		on 2min.	13.56004710	0.00004710	3.47	100.00	96.53
		on 5min.	13.56005790	0.00005790	4.27	100.00	95.73
		on 10min.	13.56007660	0.00007660	5.65	100.00	94.35
	24V	Power on	13.56004370	0.00004370	3.22	100.00	96.78
		on 2min.	13.56004410	0.00004410	3.25	100.00	96.75
		on 5min.	13.56004430	0.00004430	3.27	100.00	96.73
		on 10min.	13.56004410	0.00004410	3.25	100.00	96.75
	27.6V	Power on	13.56003870	0.00003870	2.85	100.00	97.15
		on 2min.	13.56009020	0.00009020	6.65	100.00	93.35
		on 5min.	13.56010850	0.00010850	8.00	100.00	92.00
		on 10min.	13.56007510	0.00007510	5.54	100.00	94.46
50deg.C.	Power on	13.56011440	0.00011440	8.44	100.00	91.56	
	on 2min.	13.56013660	0.00013660	10.07	100.00	89.93	
	on 5min.	13.56012360	0.00012360	9.12	100.00	90.88	
	on 10min.	13.56014910	0.00014910	11.00	100.00	89.00	
40deg.C.	Power on	13.56004400	0.00004400	3.24	100.00	96.76	
	on 2min.	13.56004050	0.00004050	2.99	100.00	97.01	
	on 5min.	13.56004030	0.00004030	2.97	100.00	97.03	
	on 10min.	13.56004370	0.00004370	3.22	100.00	96.78	
30deg.C.	Power on	13.56003960	0.00003960	2.92	100.00	97.08	
	on 2min.	13.56004390	0.00004390	3.24	100.00	96.76	
	on 5min.	13.56004490	0.00004490	3.31	100.00	96.69	
	on 10min.	13.56004170	0.00004170	3.08	100.00	96.92	
20deg.C.	Power on	13.56004370	0.00004370	3.22	100.00	96.78	
	on 2min.	13.56004410	0.00004410	3.25	100.00	96.75	
	on 5min.	13.56004430	0.00004430	3.27	100.00	96.73	
	on 10min.	13.56004410	0.00004410	3.25	100.00	96.75	
10deg.C.	Power on	13.56002540	0.00002540	1.87	100.00	98.13	
	on 2min.	13.56001700	0.00001700	1.25	100.00	98.75	
	on 5min.	13.56008500	0.00008500	6.27	100.00	93.73	
	on 10min.	13.56002910	0.00002910	2.15	100.00	97.85	
0deg.C.	Power on	13.56003030	0.00003030	2.23	100.00	97.77	
	on 2min.	13.56003040	0.00003040	2.24	100.00	97.76	
	on 5min.	13.56005030	0.00005030	3.71	100.00	96.29	
	on 10min.	13.56003660	0.00003660	2.70	100.00	97.30	
-10deg.C.	Power on	13.56002890	0.00002890	2.13	100.00	97.87	
	on 2min.	13.56002730	0.00002730	2.01	100.00	97.99	
	on 5min.	13.56002810	0.00002810	2.07	100.00	97.93	
	on 10min.	13.56009340	0.00009340	6.89	100.00	93.11	
-20deg.C	Power on	13.56003030	0.00003030	2.23	100.00	97.77	
	on 2min.	13.56008390	0.00008390	6.19	100.00	93.81	
	on 5min.	13.56004110	0.00004110	3.03	100.00	96.97	
	on 10min.	13.56008290	0.00008290	6.11	100.00	93.89	
-30deg.C	Power on	13.56000200	0.00000200	0.15	100.00	99.85	
	on 2min.	13.56003380	0.00003380	2.49	100.00	97.51	
	on 5min.	13.56000620	0.00000620	0.46	100.00	99.54	
	on 10min.	13.55999880	-0.00000120	-0.09	100.00	99.91	
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-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE/CE	2013/02/28 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	-	RE/CE	2013/02/26 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE/CE	-
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	RE/CE	2012/04/06 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE/CE	2012/08/23 * 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
MAT-09	Attenuator(6dB)	Weinschel Corp	2	BK7973	RE	2012/11/06 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2013/03/12 * 12
MCC-112	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/ /SFM141(3m)/ suoform141- PE(1m)/ 421-010(1.5m)/ RFM-E321 (Switcher)	-/00640	CE	2012/07/12 * 12
MAT-66	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2013/01/22 * 12
MLS-02	LISN(AMN)	Schwarzbeck	NSLK8127	8127383	CE	2012/07/17 * 12
MLS-01	LISN(AMN)	Schwarzbeck	NNLK8121	8121432	CE	2012/04/11 * 12
MTA-31	Terminator	TME	CT-01	-	CE	2013/01/21 * 12
MAEC-01	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	RE	2012/08/01 * 12
MOS-27	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q26	RE	2013/02/26 * 12
MJM-01	Measure	KDS	ES19-55	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MTR-09	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	RE	2012/06/14 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2012/10/12 * 12
MCC-143	Coaxial Cable	UL Japan	-	-	RE	2012/07/27 * 12
MCC-03	Coaxial Cable	Fujikura/Suhner/TSJ	5D-2W(20m)/ 3D-2W(7.5m)/ RG400u(1.5m)/ RFM-E421 (Switcher)	- /01068(Switcher)	RE	2013/01/23 * 12
MAT-08	Attenuator(6dB)	Weinschel Corp	2	BK7971	RE	2012/11/06 * 12
MFC-01	Microwave Counter	Advantest	R5373	120100309	FT	2012/08/16 * 12
MCH-04	Temperature and Humidity Chamber	Tabai Spec	PL-2KP	14015723	FT	2012/08/01 * 12
MLPA-03	Loop Antenna	UL Japan	-	-	FT	Pre Check

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

UL Japan, Inc.

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