RADIO TEST REPORT

Test Report No. : 32JE0052-HO-01-B

Applicant	:	**DENSO WAVE INCORPORATED**
Type of Equipment	:	**High Frequency 13.56MHz Transceiver**
Model No.	:	**56RF-TR-M18**
Test regulation	:	**FCC Part 15 Subpart C: 2012**
FCC ID	:	**PZWAN22R01**
Test Result	:	**Complied**

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

Date of test: June 27 to July 18, 2012

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

Approved by:
Norihisa Hashimoto
Leader of WiSE Japan,
UL Verification Service

NVLAP LAB CODE: 200572-0

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

CONTENTS **PAGE**

SECTION 1: Customer information

Company Name	:	DENSO WAVE INCORPORATED
Address	:	1 Yoshiike Kusagi Agui-cho, Chita-gun, 470-2297 Aichi
Telephone Number	:	+81-569-49-5302
Facsimile Number	:	+81-569-49-5488
Contact Person	:	AKIHIRO SUGIURA

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

2.1 Identification of E.U.T.

Type of Equipment	:	High Frequency 13.56MHz Transceiver
Model No.	:	56RF-TR-M18
Serial No.	:	Refer to Section 4, Clause 4.2
Receipt Date of Sample	:	June 26, 2012
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 (10% to 30%)
Operating voltage	:	DC 24V
Power Supply (inner)	:	DC 5V
Antenna type	:	Loop Coil
Antenna Gain	:	-61dBi
Operating Temperature	:	-25 deg. C. - +70 deg. C

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C: 2012, final revised on May 17, 2012 and effective June 18, 2012
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 C63.4:2003 7. AC powerline conducted emission measurements	Section 15.207	[QP] 16.3dB 7.62496MHz, N/L [AV] 9.0dB 7.62496MHz, N	Complied	-
	<IC>RSS-Gen 7.2.2	<IC>RSS-Gen 7.2.2			
Electric Field Strength of Fundamental Emission	ANSI C63.4:2003 13. Measurement of intentional radiators	Section 15.225(a)	69.8dB 13.56000MHz, QP, 45deg.	Complied	Radiated
	<IC> RSS-Gen 4.8, 4.11	<IC>RSS-210 A2.6			
Spectrum Mask	ANSI C63.4:2003 13. Measurement of intentional radiators	Section 15.225(b)(c)	46.4dB 13.11000MHz, QP, 45deg.	Complied	Radiated
	<IC>RSS-Gen 4.9, 4.11	<IC> RSS-210 A2.6			
20dB Bandwidth	ANSI C63.4:2003 13. Measurement of intentional radiators	Section15.215(c)	See data	Complied	Radiated
	<IC> -	<IC> -			
Electric Field Strength of Spurious Emission	ANSI C63.4:2003 13. Measurement of intentional radiators	Section15.209, Section 15.225 (d)	1.6dB 88.000MHz, QP, Vert.	Complied	Radiated
	<IC>RSS-Gen 4.9, 4.11	<IC>RSS-210 A2.6			
Frequency Tolerance	ANSI C63.4:2003 13. Measurement of intentional radiators	Section15.225(e)	See data	Complied	Radiated
	<IC>RSS-Gen 4.7	<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 5V) constantly to RF part 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.

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	4.2dB	5.0dB	5.1dB	4.7dB	5.7dB	4.4dB	4.3dB
No.2	4.1dB	5.2dB	5.1dB	4.8dB	5.6dB	4.3dB	4.2dB
No.3	4.5dB	5.0dB	5.2dB	4.8dB	5.6dB	4.5dB	4.2dB
No.4	4.7dB	5.2dB	5.2dB	4.8dB	5.6dB	5.1dB	4.2dB

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

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

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

Radiated emission test (3m)
The data listed in this report meets the limits unless the uncertainty is taken into consideration.

3.5 Test Location

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

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

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

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

Refer to APPENDIX.

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

4.1 Operating Modes

The mode is used :

Mode	Remarks
Transmitting 13.56MHz mode (Tx)	Without Tag*
The EUT was operated in a manner similar to typical use during the tests. The EUT Transmits and Receives at the same time and there is no receiving mode. * This EUT has two modes, with tag or without tag. The worst case was confirmed with and without tag, as a result, the test without tag was the worst case. Therefore the test without tag was only performed.	

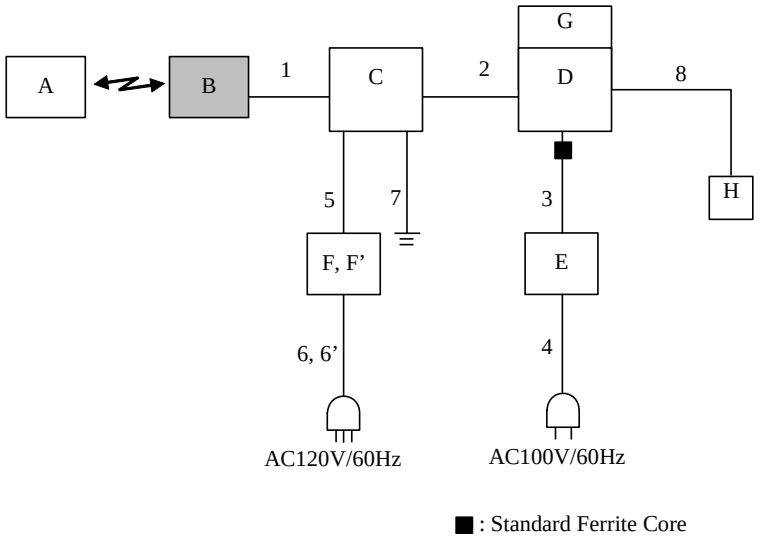
Test Item	Operating mode*
Conducted emission	Tx Mod on, Without Tag
Fundamental emission and Spectrum Mask	Tx Mod on, Without Tag
Spurious emission	Tx Mod on, Without Tag
20dB Bandwidth and 99% Occupied Bandwidth	Tx Mod on, Without Tag
Frequency Tolerance	Tx Mod off, Without Tag

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
Voltage : Normal Voltage DC 24V
Maximum Voltage DC 27.6V, Minimum Voltage DC 20.4V (DC 24V ±15%)

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	Remarks
A	RFID Tag	INTAG 500	A15AI	Sokymat	-
B	High Frequency 13.56MHz Transceiver	56RF-TR-M18	J6-087-002	DENSO WAVE INCORPORATED	EUT
C	Interface Box	IFAN10R-RS-01	995750-0740	DENSO WAVE INCORPORATED	-
D	Laptop PC	FMV-65OMC8/W	CP082814	Fujitsu	-
E	AC Adapter	FMV-AC308	-	Fujitsu	-
F	DC Power Supply	PMC35-2A	13090501	Kikusui	For CE*
F'	AC-DC Converter	S8VS-090245	15Y10M	OMRON	For other tests
G	Port Replicator	CP082850	CP082850-01	Fujitsu	-
H	Mouse	M-P2Y4L2LG	113271	ELECOM	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Interface Cable	2.0	Shielded	Shielded	-
2	RS-232C Cable	1.5	Shielded	Shielded	-
3	DC Cable	1.8	Unshielded	Unshielded	-
4	AC Cable	2.0	Unshielded	Unshielded	-
5	DC Cable	0.2	Unshielded	Unshielded	-
6	AC Cable	2.0	Unshielded	Unshielded	For CE*
6'	AC Cable	1.8	Unshielded	Unshielded	For other tests
7	Earth Cable	2.0	Unshielded	Unshielded	-
8	PS/2 Cable	1.6	Shielded	Shielded	-

*CE: Conducted emission test

SECTION 5: Conducted emission

5.1 Operating environment

Test place : No.2 and No.4 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 AV
IF Bandwidth : 9kHz

5.5 Test result

Summary of the test results : Pass

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

Test Procedure

EUT was placed on a urethane platform of nominal size, 1.0m by 1.5m, 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)

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

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

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

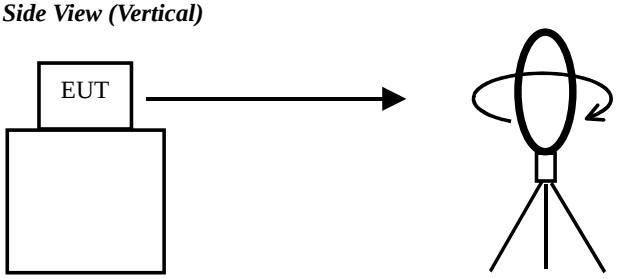
SECTION 7: Other test

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20dB Bandwidth	100kHz	3kHz	10kHz	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%.							

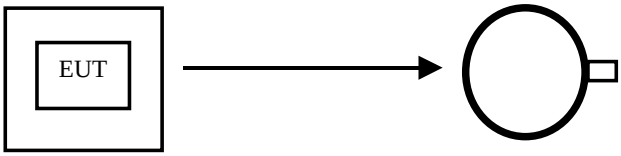
Test data : APPENDIX
Test result : Pass

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

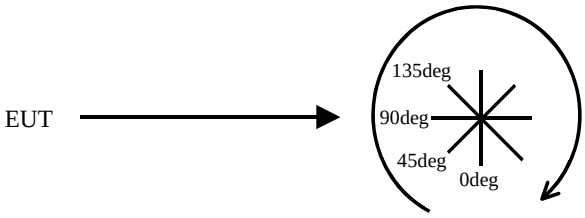


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

APPENDIX 1: Data of EMI test

Conducted emission

(Inside fundamental band)

DATA OF CONDUCTED EMISSION TEST

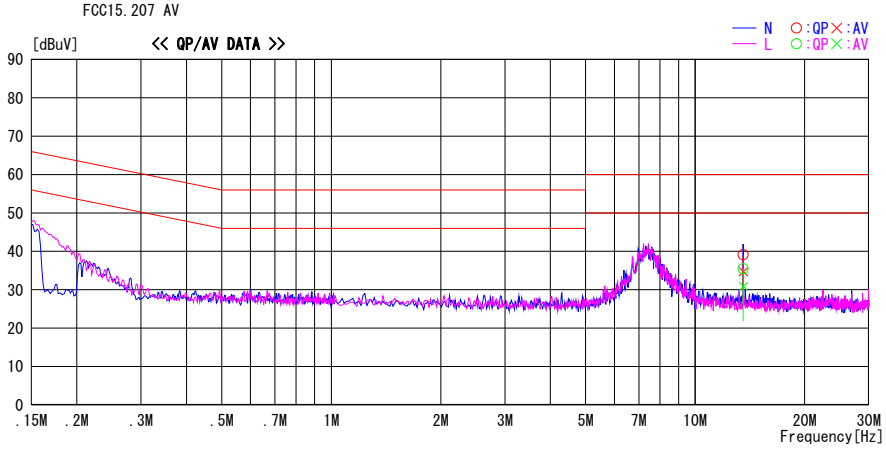
UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2012/07/04

Report No. : 32JE0052-HO-01

Temp./Humi. : 24deg. C / 60% RH
Engineer : Hiroshi Kukita

Mode / Remarks : Tx 13.56MHz, Antenna: 50Ω terminated

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	24.3	19.9	14.8	39.1	34.7	60.0	50.0	20.9	15.3	N	
13.56000	20.7	16.1	14.8	35.5	30.9	60.0	50.0	24.5	19.1	L	

CHART:WITH FACTOR, Peak hold data. CALCULATION:RESULT=READING+C.F(LISN LOSS+ATT 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
(Outside fundamental band)

DATA OF CONDUCTED EMISSION TEST

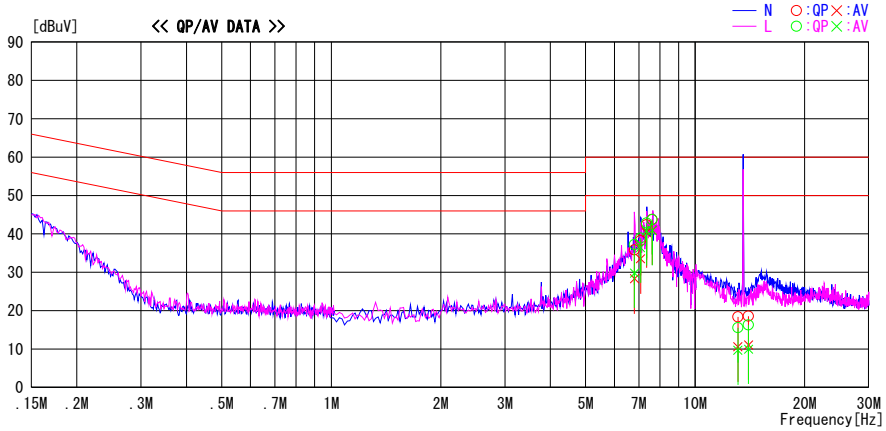
UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic Chamber
Date : 2012/07/18

Report No. : 32JE0052-HO-01

Temp./Humi. : 22deg. C / 55% RH
Engineer : Keisuke Kawamura

Mode / Remarks : Tx 13.56MHz

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]		
6.80864	22.0	14.5	13.8	35.8	28.3	60.0	50.0	24.2	21.7	N	
7.08208	24.5	19.7	13.8	38.3	33.5	60.0	50.0	21.7	16.5	N	
7.35193	28.6	26.5	13.8	42.4	40.3	60.0	50.0	17.6	9.7	N	
7.62496	29.9	27.2	13.8	43.7	41.0	60.0	50.0	16.3	9.0	N	
13.11000	4.1	-3.7	14.3	18.4	10.6	60.0	50.0	41.6	39.4	N	
14.01000	4.3	-3.2	14.3	18.6	11.1	60.0	50.0	41.4	38.9	N	
6.80764	23.4	16.0	13.8	37.2	29.8	60.0	50.0	22.8	20.2	L	
7.07926	25.1	22.6	13.8	38.9	36.4	60.0	50.0	21.1	13.6	L	
7.35153	29.0	27.0	13.8	42.8	40.8	60.0	50.0	17.2	9.2	L	
7.62496	29.9	27.1	13.8	43.7	40.9	60.0	50.0	16.3	9.1	L	
13.11000	1.3	-4.6	14.3	15.6	9.7	60.0	50.0	44.4	40.3	L	
14.01000	2.0	-4.3	14.3	16.3	10.0	60.0	50.0	43.7	40.0	L	

CHART:WITH FACTOR,Peak hold data. CALCULATION:RESULT=READING+C.F(LISN LOSS+ATT 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.

Fundamental emission and Spectrum Mask

DATA OF RADIATED EMISSION TEST

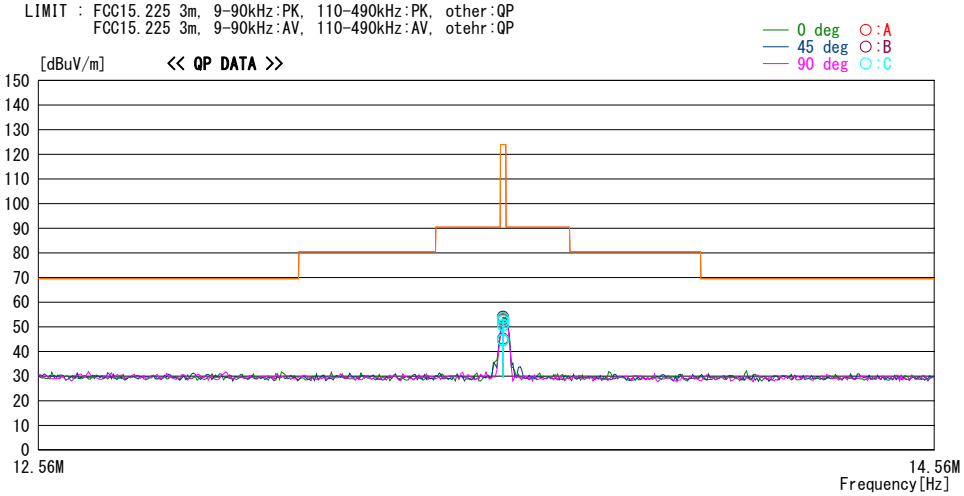
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2012/06/27

Report No. : 32JE0052-HO-01

Temp./ Humi. : 25deg. C / 54% RH
Engineer : Takeshi Choda

Mode / Remarks : Tx 13.56MHz without Tag, Worst-Axis:X

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]	
13.56000	59.9	QP	18.9	6.6	32.2	53.2	123.9	70.7	0	A	182	ANT:Z
13.56000	60.1	QP	18.9	6.6	32.2	53.4	123.9	70.5	322	B	332	ANT:Z
13.56000	59.0	QP	18.9	6.6	32.2	52.3	123.9	71.6	90	C	254	ANT:Z
13.56000	60.3	QP	18.9	6.6	32.2	53.6	123.9	70.3	135	C	206	ANT:Z
13.56000	51.3	QP	18.9	6.6	32.2	44.6	123.9	79.3	0	A	306	ANT:Y
13.56000	51.9	QP	18.9	6.6	32.2	45.2	123.9	78.7	45	B	115	ANT:Y
13.56000	57.5	QP	18.9	6.6	32.2	50.8	123.9	73.1	90	C	97	ANT:Y
13.56000	57.1	QP	18.9	6.6	32.2	50.4	123.9	73.5	135	C	359	ANT:Y
13.56000	59.4	QP	18.9	6.6	32.2	52.7	123.9	71.2	0	A	0	ANT:X
13.56000	60.8	QP	18.9	6.6	32.2	54.1	123.9	69.8	45	B	337	ANT:X
13.56000	59.2	QP	18.9	6.6	32.2	52.5	123.9	71.4	90	C	273	ANT:X
13.56000	60.1	QP	18.9	6.6	32.2	53.4	123.9	70.5	135	C	194	ANT:X
13.56000	51.2	QP	18.9	6.6	32.2	44.5	123.9	79.4	0	C	176	ANT:X Loop:Hori
13.56000	51.6	QP	18.9	6.6	32.2	44.9	123.9	79.0	0	C	231	ANT:Y Loop:Hori
13.56000	51.3	QP	18.9	6.6	32.2	44.6	123.9	79.3	0	C	194	ANT:Z Loop:Hori
13.56000	60.6	QP	18.9	6.6	32.2	53.9	123.9	70.0	45	B	337	ANT:X 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

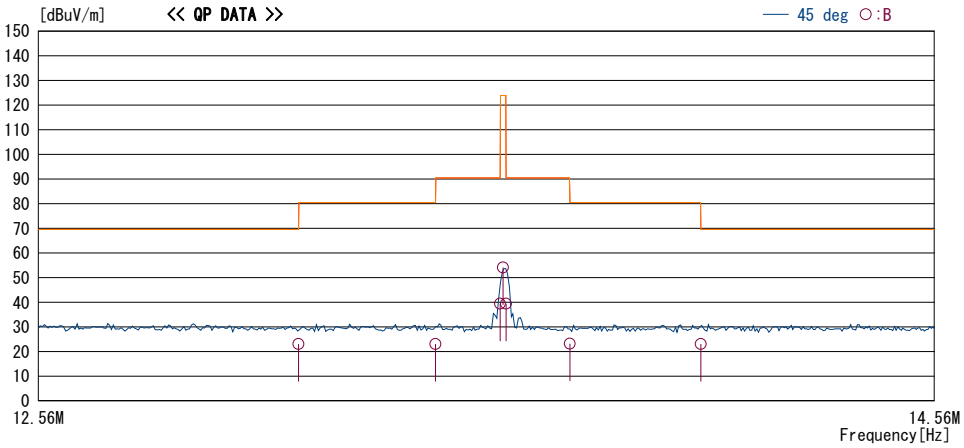
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2012/06/27

Report No. : 32JE0052-HO-01

Temp. / Humi. : 25deg. C / 54% RH
Engineer : Takeshi Choda

Mode / Remarks : Tx 13.56MHz, Worst-Axis:X

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]	
13.11000	29.7	QP	19.1	6.5	32.2	23.1	69.5	46.4	45	B	337	ANT:X
13.41000	29.8	QP	19.0	6.5	32.2	23.1	80.5	57.4	45	B	337	ANT:X
13.55300	46.2	QP	18.9	6.5	32.2	39.4	90.4	51.0	45	B	337	ANT:X
13.56000	60.8	QP	18.9	6.6	32.2	54.1	123.9	69.8	45	B	337	ANT:X
13.56700	46.1	QP	18.9	6.6	32.2	39.4	90.4	51.0	45	B	337	ANT:X
13.71000	29.9	QP	18.9	6.6	32.2	23.2	80.5	57.3	45	B	337	ANT:X
14.01000	29.8	QP	18.8	6.6	32.2	23.0	69.5	46.5	45	B	337	ANT:X

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

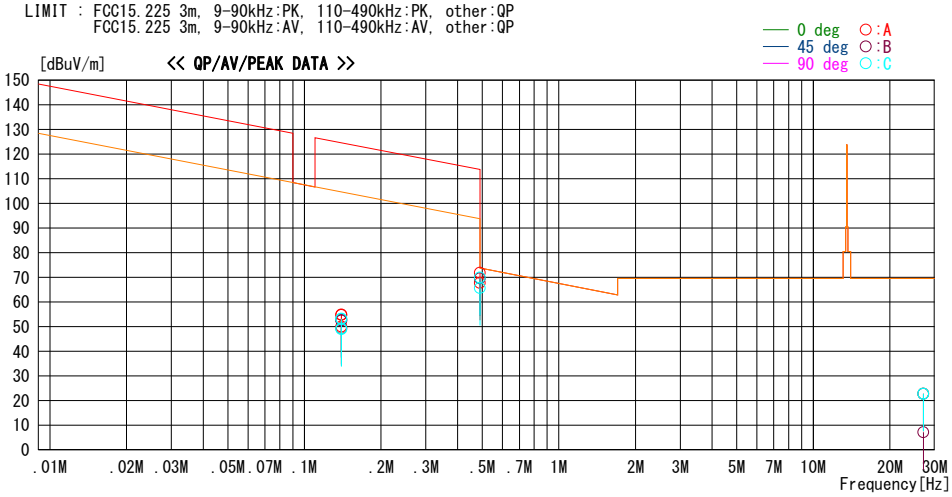
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2012/06/27

Report No. : 32JE0052-HO-01

Temp. / Humi. : 25deg. C / 54% RH
Engineer : Takeshi Choda

Mode / Remarks : Tx 13.56MHz, Worst-Axis:X

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]	
0.13970	61.2	PEAK	19.9	6.0	32.2	54.9	124.6	69.7	0	A	82	
0.13970	61.0	AV	19.9	6.0	32.2	54.7	104.7	50.0	0	A	82	
0.13970	59.0	PEAK	19.9	6.0	32.2	52.7	124.6	71.9	45	B	58	
0.13970	58.8	AV	19.9	6.0	32.2	52.5	104.7	52.2	45	B	58	
0.13970	55.6	PEAK	19.9	6.0	32.2	49.3	124.6	75.3	90	C	144	
0.13970	55.2	AV	19.9	6.0	32.2	48.9	104.7	55.8	90	C	144	
0.13970	59.5	PEAK	19.9	6.0	32.2	53.2	124.6	71.4	135	C	109	
0.13970	59.3	AV	19.9	6.0	32.2	53.0	104.7	51.7	135	C	109	
0.13970	56.3	PEAK	19.9	6.0	32.2	50.0	124.6	74.6	0	A	93	Loop:Hori
0.13970	55.7	AV	19.9	6.0	32.2	49.4	104.7	55.3	0	A	93	Loop:Hori
0.49000	76.1	QP	19.6	6.1	32.3	69.5	73.8	4.3	45	B	63	
0.49000	76.4	QP	19.6	6.1	32.3	69.8	73.8	4.0	135	C	103	
0.49000	72.2	QP	19.6	6.1	32.3	65.6	73.8	8.2	90	C	149	
0.49000	78.4	QP	19.6	6.1	32.3	71.8	73.8	2.0	0	A	87	
0.49000	74.4	QP	19.6	6.1	32.3	67.8	73.8	6.0	0	A	90	Loop:Hori
27.12000	29.2	QP	18.9	6.9	32.2	22.8	69.5	46.7	135	C	0	NS
27.12000	29.2	QP	18.9	6.9	32.2	22.8	69.5	46.7	90	C	0	NS
27.12000	13.6	QP	18.9	6.9	32.2	7.2	69.5	62.3	45	B	0	NS
27.12000	29.2	QP	18.9	6.9	32.2	22.8	69.5	46.7	0	A	0	NS
27.12000	29.2	QP	18.9	6.9	32.2	22.8	69.5	46.7	0	A	0	NS Loop:Hori

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

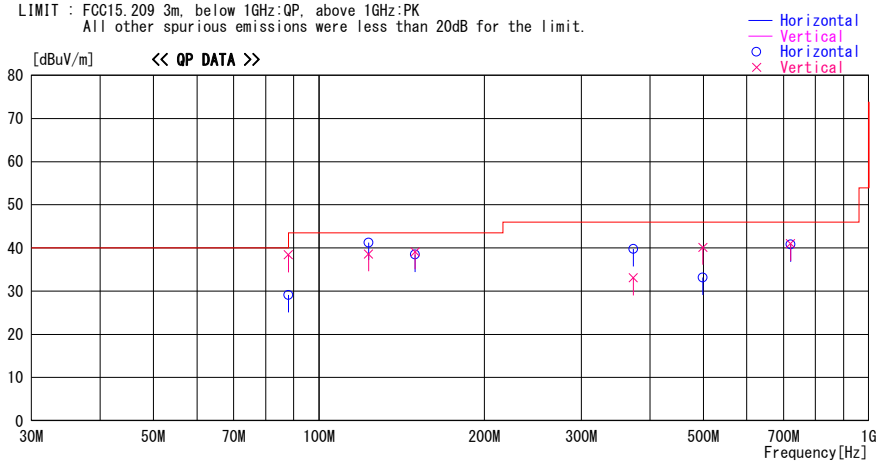
UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2012/06/28

Report No. : 32JE0052-HO-01

Temp./Humi. : 26 deg.C / 48% RH
Engineer : Tomotaka Sasagawa

Mode / Remarks : Tx 13.56MHz

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



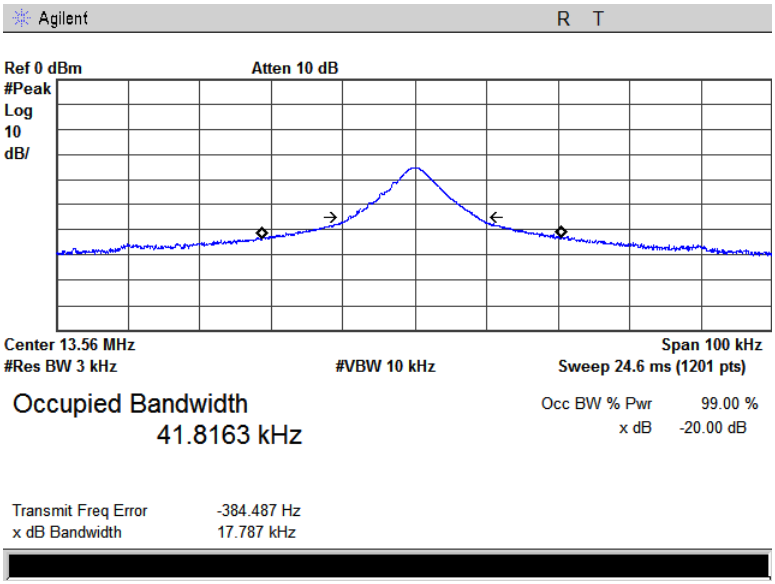
Frequency	Reading	DET	Antenna Factor	Loss& Gain	Level	Angle	Height	Polar.	Limit	Margin	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
88.000	54.6	QP	8.0	-24.2	38.4	347	100	Vert.	40.0	1.6	
88.000	45.3	QP	8.0	-24.2	29.1	298	300	Hori.	40.0	10.9	
123.066	49.3	QP	13.2	-23.9	38.6	307	100	Vert.	43.5	4.9	
123.066	52.0	QP	13.2	-23.9	41.3	70	300	Hori.	43.5	2.2	
149.579	47.2	QP	14.9	-23.6	38.5	1	300	Hori.	43.5	5.0	
149.579	47.8	QP	14.9	-23.6	39.1	268	100	Vert.	43.5	4.4	
372.946	44.5	QP	16.9	-21.6	39.8	31	100	Hori.	46.0	6.2	
372.946	37.8	QP	16.9	-21.6	33.1	215	100	Vert.	46.0	12.9	
499.198	35.5	QP	18.3	-20.7	33.1	280	100	Hori.	46.0	12.9	
499.198	42.6	QP	18.3	-20.7	40.2	189	100	Vert.	46.0	5.8	
720.845	39.2	QP	20.9	-19.3	40.8	262	100	Hori.	46.0	5.2	
720.845	39.4	QP	20.9	-19.3	41.0	1	100	Vert.	46.0	5.0	

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.3 Semi Anechoic Chamber
Report No.	32JE0052-HO-01
Date	06/27/2012
Temperature/ Humidity	25 deg.C / 54% RH
Engineer	Takeshi Choda
Mode	Tx Mod on

FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	17.79	41.82



Frequency Tolerance

Test place	Head Office EMC Lab. No.7 measurement room
Report No.	32JE0052-HO-01
Date	06/29/2012
Temperature/ Humidity	20 deg.C/ 55% RH
Engineer	Takumi Shimada
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	13.55997416	-0.00002584	-1.91	100.00	98.09
		on 2min.	13.55997726	-0.00002274	-1.68	100.00	98.32
		on 5min.	13.55997731	-0.00002269	-1.67	100.00	98.33
		on 10min.	13.55997729	-0.00002271	-1.67	100.00	98.33
	24V	Power on	13.55996631	-0.00003369	-2.48	100.00	97.52
		on 2min.	13.55997014	-0.00002986	-2.20	100.00	97.80
		on 5min.	13.55997668	-0.00002332	-1.72	100.00	98.28
		on 10min.	13.55997937	-0.00002063	-1.52	100.00	98.48
	27.6V	Power on	13.55997133	-0.00002867	-2.11	100.00	97.89
		on 2min.	13.55997860	-0.00002140	-1.58	100.00	98.42
		on 5min.	13.55998048	-0.00001952	-1.44	100.00	98.56
		on 10min.	13.55998134	-0.00001866	-1.38	100.00	98.62
50deg.C.	24V	Power on	13.56006193	0.00006193	4.57	100.00	95.43
		on 2min.	13.56002243	0.00002243	1.65	100.00	98.35
		on 5min.	13.56004602	0.00004602	3.39	100.00	96.61
		on 10min.	13.56003841	0.00003841	2.83	100.00	97.17
40deg.C.		Power on	13.56004857	0.00004857	3.58	100.00	96.42
		on 2min.	13.56005135	0.00005135	3.79	100.00	96.21
		on 5min.	13.56006643	0.00006643	4.90	100.00	95.10
		on 10min.	13.56007941	0.00007941	5.86	100.00	94.14
30deg.C.		Power on	13.56003417	0.00003417	2.52	100.00	97.48
		on 2min.	13.56002395	0.00002395	1.77	100.00	98.23
		on 5min.	13.56005842	0.00005842	4.31	100.00	95.69
		on 10min.	13.56003893	0.00003893	2.87	100.00	97.13
20deg.C.		Power on	13.55996631	-0.00003369	-2.48	100.00	97.52
		on 2min.	13.55997014	-0.00002986	-2.20	100.00	97.80
		on 5min.	13.55997668	-0.00002332	-1.72	100.00	98.28
		on 10min.	13.55997937	-0.00002063	-1.52	100.00	98.48
10deg.C.		Power on	13.56022892	0.00022892	16.88	100.00	83.12
		on 2min.	13.56009872	0.00009872	7.28	100.00	92.72
		on 5min.	13.56002788	0.00002788	2.06	100.00	97.94
		on 10min.	13.56001653	0.00001653	1.22	100.00	98.78
0deg.C.		Power on	13.56015491	0.00015491	11.42	100.00	88.58
		on 2min.	13.56011930	0.00011930	8.80	100.00	91.20
		on 5min.	13.56009390	0.00009390	6.92	100.00	93.08
		on 10min.	13.56013423	0.00013423	9.90	100.00	90.10
-10deg.C.		Power on	13.56018774	0.00018774	13.84	100.00	86.16
		on 2min.	13.56016306	0.00016306	12.03	100.00	87.97
		on 5min.	13.56012619	0.00012619	9.31	100.00	90.69
		on 10min.	13.56013805	0.00013805	10.18	100.00	89.82
-20deg.C		Power on	13.56015764	0.00015764	11.63	100.00	88.37
		on 2min.	13.56022507	0.00022507	16.60	100.00	83.40
		on 5min.	13.56021940	0.00021940	16.18	100.00	83.82
		on 10min.	13.56018217	0.00018217	13.43	100.00	86.57
-30deg.C		Power on	13.56019249	0.00019249	14.20	100.00	85.80
		on 2min.	13.56022848	0.00022848	16.85	100.00	83.15
		on 5min.	13.56019302	0.00019302	14.23	100.00	85.77
		on 10min.	13.56025782	0.00025782	19.01	100.00	80.99
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	2012/02/24 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	-	RE/CE	2012/02/06 * 12
MJM-06	Measure	PROMART	SEN1955	-	RE	
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MTR-07	Test Receiver	Rohde & Schwarz	ESCI	100635	RE	2012/04/05 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2011/10/19 * 12
MCC-112	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(3m)/ sucoform141-PE(1m)/421-010(1.5m)/RFM-E321(Switcher)	-/00640	RE	2011/07/15 * 12
MCC-31	Coaxial cable	UL Japan	-	-	RE	2011/07/28 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2012/03/16 * 12
MAT-09	Attenuator(6dB)	Weinschel Corp	2	BK7973	RE	2011/11/02 * 12
MSA-06	Spectrum Analyzer	Agilent	E4407B	MY45107638	RE	2012/04/04 * 12
EST-45	Universal Counter	Agilent	53132A	MY40008906	FT	2011/08/17 * 12
MCH-06	Temperature and Humidity Chamber	Tabai Espec	PL-1KT	14007630	FT	2012/04/20 * 12
MOS-04	Digital Humidity Indicator	N.T	NT-1800	MOS04	FT	2012/02/06 * 12
MCC-64	Coaxial Cable	UL Japan	-	-	FT	2012/03/22 * 12
MSA-05	Spectrum Analyzer	Advantest	R3273	160400285	RE	2011/11/23 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE/CE	2011/08/11 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2011/10/15 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	174	RE	2011/10/15 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2011/07/15 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	CE	2012/06/29 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	CE	2012/02/06 * 12
MJM-14	Measure	KOMELON	KMC-36	-	CE	-
MRENT-95	Spectrum Analyzer	Agilent	E4440A	MY46185823	CE	2012/06/19 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	CE	2012/04/03 * 12
MLS-06	LISN(AMN)	Schwarzbeck	NSLK8127	8127363	CE(EUT)	2012/02/06 * 12
MLS-07	LISN(AMN)	Schwarzbeck	NSLK8127	8127364	CE(AE)	2012/02/09 * 12
MTA-31	Terminator	TME	CT-01	-	CE	2012/01/11 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/5D-2W(5m)/ 5D-2W(0.8m)/5D-2W(1m)	-	CE	2012/02/16 * 12
MAT-65	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2012/01/28 * 12
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	CE	2012/02/29 * 12
MJM-09	Measure	KDS	E19-55	-	CE	-
MTA-30	Terminator	TME	CT-01	-	CE	2012/01/11 * 12
MCC-113	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(5m)/ 421-010(1m)/sucoform141-PE(1m)/RFM-E121(Switcher)	-/04178	CE	2012/07/12 * 12

The expiration date of the calibration is the end of the expired month.
All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

Test Item: CE: Conducted Emission
RE: Radiated Emission
FT: Frequency Tolerance