RADIO TEST REPORT

Test Report No.: 10009791S-A

Applicant	:	**KATSURAGAWA ELECTRIC CO., LTD.**
Type of Equipment	:	**RFID Module**
Model No.	:	**13551**
FCC ID	:	**VP8-13551**
Test regulation	:	**FCC Part15 Subpart C: 2012**
Test result	:	**Complied**

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3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
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6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.

Date of test: April 26 to May 9, 2013

Tested by:
Tatsuya Arai
Engineer of WiSE Japan,
UL Verification Service

Approved by :
Toyokazu Imamura
Leader of WiSE Japan,
UL Verification Service

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☒ There is no testing item of "Non-accreditation".

RTL02610

UL Japan, Inc.
Shonan EMC Lab.
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REVISION HISTORY

Original Test Report No.: 10009791S-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10009791S-A	May 15, 2013	-	-
1	10009791S-A	June 25, 2013	P8	Added a description of the ferrite core.

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SECTION 1: Customer information

Company Name	:	KATSURAGAWA ELECTRIC CO., LTD.
Brand Name	:	KIP
Address	:	21-1, SHIMOMARUKO 4-CHOME, OTAKU, TOKYO, 146-8585 Japan
Telephone Number	:	+81-3-3758-5739
Facsimile Number	:	+81-3-3758-2550
Contact Person	:	Yasuyuki Ohta

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

2.1 Identification of E.U.T.

Type of Equipment	:	RFID Module
Model Number	:	13551
Serial Number	:	130422-01
Rating	:	DC 5V
Country of Mass-production	:	Taiwan
Condition of EUT	:	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Receipt Date of Sample	:	April 26, 2013
Modification of EUT	:	No modification by the test lab.

2.2 Product description

Model: 13551 (referred to as the EUT in this report) is a RFID Module.

Clock frequency(ies) in the system : 13.56MHz

<Radio part>

Equipment type	:	Transceiver
Frequency of operation	:	13.56MHz
Type of modulation	:	ASK (OOK)
Antenna type	:	Loop
Antenna connector type	:	None
ITU code	:	A1D
Operation temperature range	:	-20 to +55 deg.C.

FCC 15.31 (e)
The RFID transmitter is provided the stable voltage from the host device.
Therefore, this EUT complies with the requirement.

FCC 15.203
The antenna is not removable from the EUT. Therefore the equipment complies with the requirement.

SECTION 3: Test specification, procedures & results

3.1 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 15.209 Radiated emission limits, general requirements
Section 15.215 Additional provisions to the general radiated emission limitations
Section 15.225 Operation within the band 13.110-14.010MHz

3.2 Procedures & Results

Item	Test Procedure	Specification	Remarks	Deviation	Worst Margin	Results
Conducted emission	ANSI C63.4:2009 7. AC powerline conducted emission measurements	FCC 15.207	-	N/A	2.3dB Freq.: 13.56700MHz Detector: Average Phase: N	Complied
Electric field strength of Fundamental emission	ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.225 (a)	Radiated	N/A	72.2dB Polarization: Vertical	Complied
Electric field strength of Spurious emission (within the 13.110-14.010MHz band)	ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.225 (b)(c)	Radiated	N/A	46.1dB Freq.: 14.010MHz Polarization: Horizontal & Vertical	Complied
Electric field strength of Spurious emission (outside of the 13.110-14.010MHz band)	ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.209 FCC 15.225 (d)	Radiated	N/A	3.7dB Freq.: 813.67MHz Polarization: Horizontal	Complied
20dB bandwidth	ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.215 (c)	Radiated	N/A	-	-
Frequency tolerance	ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.225 (e)	Radiated	N/A	-	Complied
Note: UL Japan's Work Procedures No. 13-EM-W0420 and 13-EM-W0422						

3.3 Addition to standard

Item	Test Procedure	Specification	Remarks	Worst Margin	Results
Occupied Bandwidth (99%)	ANSI C63.4:2009 13. Measurement of intentional radiators, RSS-Gen 4.6.1	RSS-Gen 4.6.1	Radiated	-	-
Note: UL Japan's Work Procedures No. 13-EM-W0420 and 13-EM-W0422					

* Other than above, no addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor k=2.

Item	Frequency range	No.1 SAC*1/SR*2 (±)	No.2 SAC/SR (±)	No.3 SAC/SR (±)
Conducted emission (AC Mains) AMN/LISN	150kHz-30MHz	3.6 dB	3.6 dB	3.5 dB
Radiated emission (Measurement distance: 3m)	9kHz-30MHz	3.7 dB	3.7 dB	3.6 dB
	30MHz-300MHz	4.9 dB	5.1 dB	4.9 dB
	300MHz-1GHz	5.0 dB	5.2 dB	4.9 dB

*1: SAC=Semi-Anechoic Chamber
*2: SR= Shielded Room is applied besides radiated emission

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

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

Frequency tolerance
Frequency (Normal condition) Measurement uncertainty for this test was: (±) 7.9 x 10^-8.
Frequency (Extreme condition) Measurement uncertainty for this test was: (±) 7.9 x 10^-8.

Other tests
Bandwidth Measurement uncertainty for this test was: (±) 5.4%

3.5 Test location

UL Japan, Inc. Shonan EMC Lab.
1-22-3, Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 JAPAN
Telephone number : +81 463 50 6400
Facsimile number : +81 463 50 6401
JAB Accreditation No. : RTL02610

	FCC Registration No.	IC Registration No.	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
☐ No.1 Semi-anechoic chamber	697847	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
☐ No.2 Semi-anechoic chamber	697847	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
☒ No.3 Semi-anechoic chamber	697847	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5m
☐ No.4 Semi-anechoic chamber	-	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
☒ No.1 Shielded room	-	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
☐ No.2 Shielded room	-	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
☐ No.3 Shielded room	-	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
☐ No.4 Shielded room	-	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
☒ No.5 Shielded room	-	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
☐ No.6 Shielded room	-	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-

3.6 Test setup, Data of test & Test instruments

Refer to APPENDIX 1 to 3.

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

4.1 Operating mode

The EUT exercise program used during testing was designed to exercise the various system components in a manner similar to typical use.

Test item	Operating mode	Tested frequency
All items	Transmitting	13.56MHz

Power settings: Setting is controlled by the firmware and cannot be changed.
Software: CPU firmware ver. 134X0 1A
FPGA firmware ver. 0.10

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 carrier level and noise levels were confirmed with and without Tag.

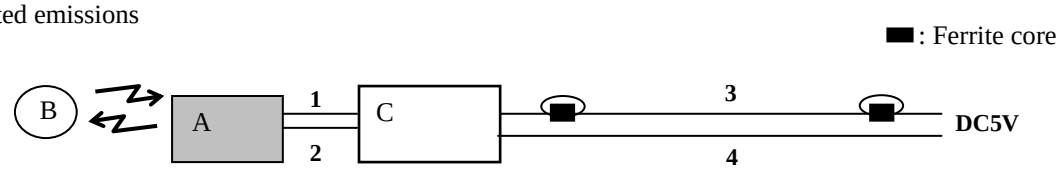
Combinations of the worst case

Test item / Antenna polarization	Conducted emission	Radiated emission (Carrier)	Radiated emission (Below 30MHz)	Radiated emission (Above 30MHz)
Horizontal	-	Z	Z	Z
Vertical	-	Z	Z	Z
Tag	Without Tag	Without Tag	Without Tag	With Tag

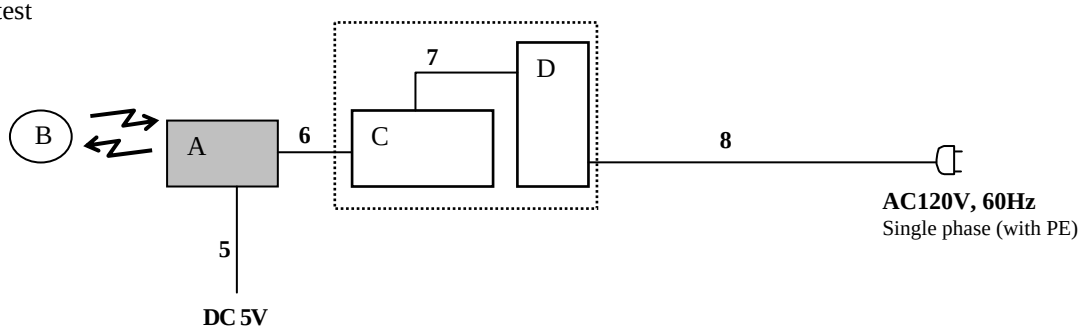
Justification: The system was configured in typical fashion (as customer would normally use it) for testing.

4.2 Configuration and peripherals

Radiated emissions



Other test



* Test data was taken under worse case conditions.
* Ferrite core has no effect the test results.

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	RFID Module	13551	130422-01	KATSURAGAWA ELECTRIC CO., LTD.	EUT
B	Tag	Tag-it HF-1 Pro RI-I16-114A-S1	-	KATSURAGAWA ELECTRIC CO., LTD.	-
C	Control board	PW13420	-	KATSURAGAWA ELECTRIC CO., LTD.	-
D	DC power supply	LEB225F-0524	1029344	KATSURAGAWA ELECTRIC CO., LTD.	-

List of cables used

No.	Item	Length(m)	Shield		Remarks
			Cable	Connector	
1	Signal	0.2	Unshielded	Unshielded	-
2	DC	0.2	Unshielded	Unshielded	-
3	DC	2.5	Unshielded	Unshielded	-
4	GND	2.0	Unshielded	Unshielded	-
5	DC	2.4	Unshielded	Unshielded	-
6	Signal	1.0	Unshielded	Unshielded	-
7	DC	0.4	Unshielded	Unshielded	-
8	AC	2.4	Unshielded	Unshielded	-

SECTION 5: Conducted emission

5.1 Operating environment

The test was carried out in No.1 shielded room.

Temperature : See test data (APPENDIX 2)
Humidity : See test data (APPENDIX 2)

5.2 Test configuration

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 0.8m above the conducting ground plane.
The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity.
The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT was aligned and was 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. I/O cables that were connected to the peripherals were bundled in center. They were folded back and for the forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane.
Each EUT current-carrying power lead was individually connected through a LISN to the input power source.
Photographs of the set up are shown in Appendix 1.

5.3 Test conditions

Frequency range : 0.15 - 30MHz
EUT position : Table top

5.4 Test procedure

The AC Mains Terminal Continuous disturbance Voltage had been measured with the EUT via DC power supply within a Shielded room. The EUT was connected to a Line Impedance Stabilization Network (LISN).
An overview sweep with peak detection has been performed.
The measurements had been performed with a quasi-peak detector and if required, an average detector.
The conducted emission measurements were made with the following detection of the test receiver.

Detection Type : Quasi-Peak/ Average
IF Bandwidth : 9kHz

5.5 Results

Summary of the test results : Pass

SECTION 6: Radiated emission (Fundamental and Spurious emission)

6.1 Operating environment

The test was carried out in No.3 semi-anechoic chamber.

Temperature : See test data (APPENDIX 2)
Humidity : See test data (APPENDIX 2)

6.2 Test configuration

EUT was placed on a urethane platform of nominal size, 0.5m by 0.5m, raised 0.8m above the conducting ground plane.
Photographs of the set up are shown in Appendix 1.

6.3 Test conditions

Frequency range : 9kHz - 1GHz
Test distance : 3m
EUT position : Table top

6.4 Test procedure

The Radiated Electric Field Strength intensity has been measured with a ground plane and at a distance of 3m
Frequency: From 9kHz to 30MHz at distance 3m

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.
The measurements were performed for vertical polarization (antenna angle: 0deg.to 360deg.) and horizontal polarization. Drawing of the antenna direction is shown in Figure 2.

Frequency: From 30MHz to 1GHz at distance 3m (Refer to Figure 1).

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

Measurements were performed with QP, PK, and AV detector.

The radiated emission measurements were made with the following detector function of the test receiver.

	9kHz to 90kHz & 110kHz to 150kHz	90kHz to 110kHz	150kHz to 490kHz	490kHz to 30MHz	30MHz to 1GHz
Detector Type	PK/AV	QP	PK/AV	QP	QP
IF Bandwidth	200Hz	200Hz	9kHz	9kHz	120kHz
Measuring antenna	Loop antenna				Biconical (30-299.99MHz) Logperiodic (300MHz-1GHz)

* FCC 15 Section 15.31 (f)(2) (9kHz-30MHz)
9kHz – 490kHz [Limit at 3m]= [Limit at 300m]-40log (3[m]/300[m])
490kHz – 30MHz [Limit at 3m]= [Limit at 30m]-40log (3[m]/30[m])

6.5 Results

Summary of the test results : Pass

Figure 1. Direction of the Loop Antenna

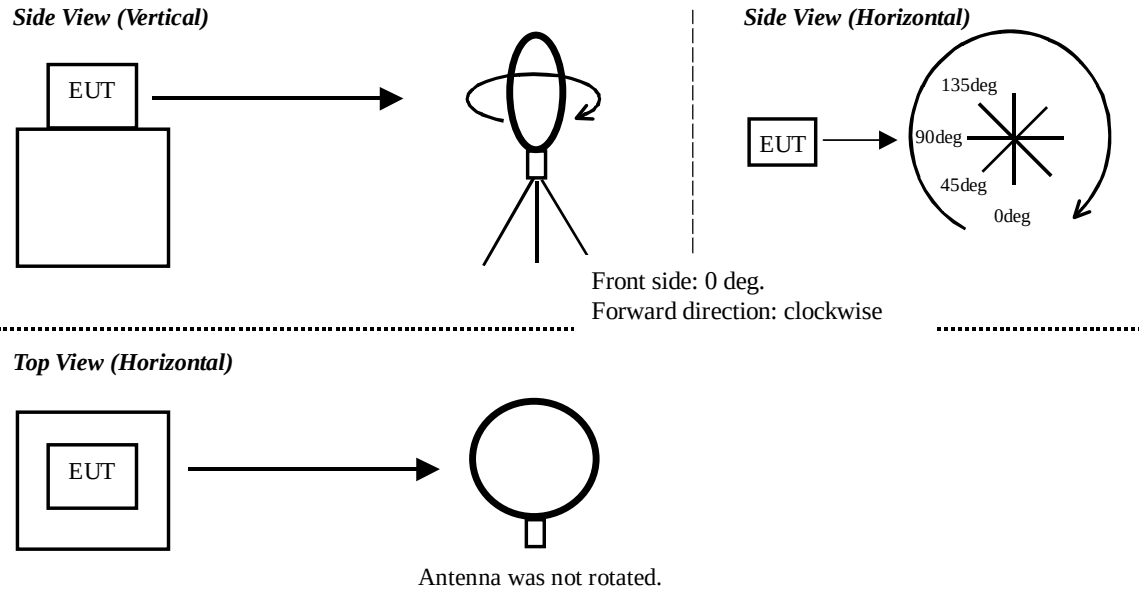
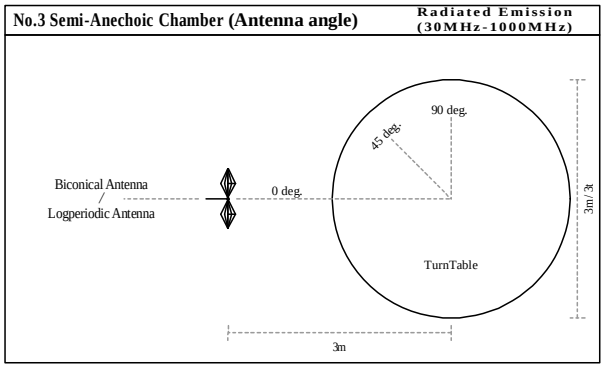


Figure 2. Antenna angle



SECTION 7: 20dB bandwidth & Occupied bandwidth (99%)

Test procedure

The test was measured with a spectrum analyzer using a test fixture.

Summary of the test results: Pass

SECTION 8: Frequency tolerances

Test procedure

The test was measured with a spectrum analyzer using a test fixture.
The temperature test was started after the temperature stabilization time of 30 minutes.
The test was begun from 50 deg.C and the temperature was lowered each 10 deg.C.

Summary of the test results: Pass

Contents of APPENDIXES

APPENDIX 1: Data of Radio tests

Conducted emission
Radiated emission
Frequency tolerance
Bandwidth

APPENDIX 2: Test instruments

Test instruments

APPENDIX 3: Photographs of test setup

Conducted emission
Radiated emission
Pre-check of the worst position

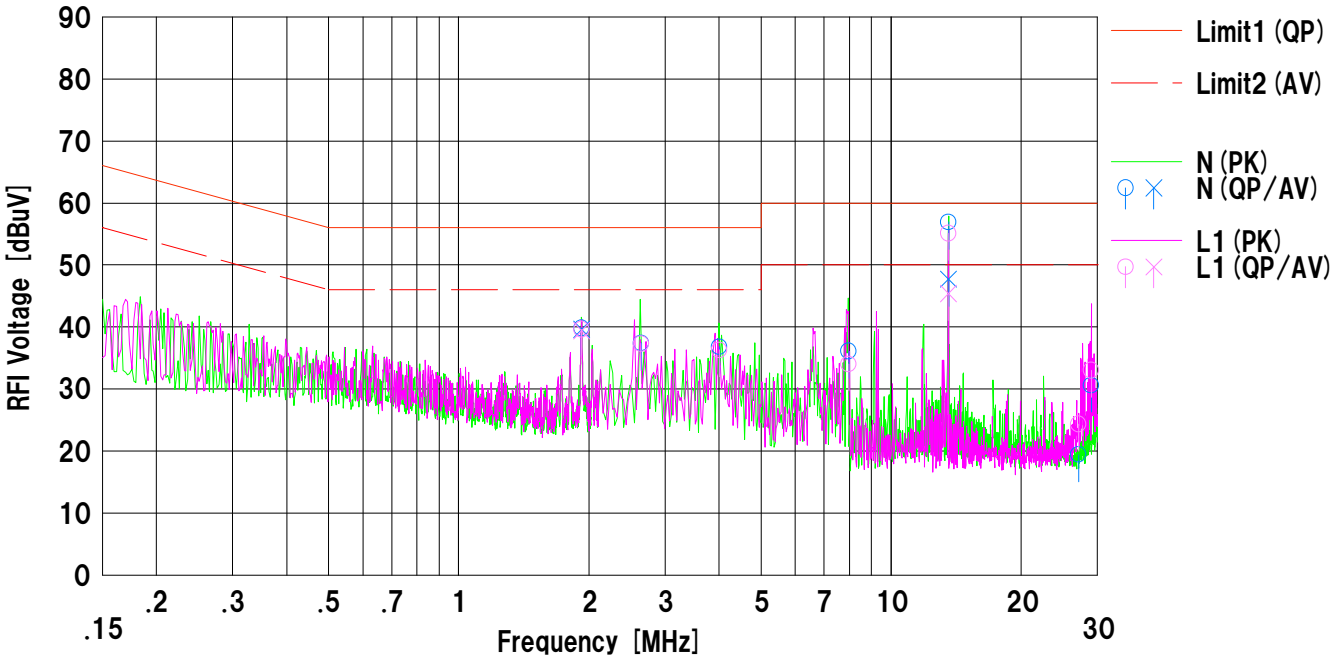
DATA OF CONDUCTED EMISSION TEST

UL Japan,Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2013/04/28

Company	: Katsuragawa Electric Co., Ltd.	Mode	: Transmitting (13.56MHz)
Kind of EUT	: RFID Module	Order No.	: 10009791S
Model No.	: 13551	Power	: AC 120V / 60Hz
Serial No.	: 130422-01	Temp./Humi.	: 22deg.C. / 36%RH
Remarks	: Without Tag		

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV

Engineer : Tatsuya Arai



No.	Freq.	Reading <QP>	Reading <AV>	C.Fac	Results <QP>	Results <AV>	Limit <QP>	Limit <AV>	Margin <QP>	Margin <AV>	Phase	Comment
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	1.92280	27.0	26.8	12.8	39.8	39.6	56.0	46.0	16.2	6.4	N	
2	2.64260	24.6	---	12.8	37.4	---	56.0	46.0	18.6	---	N	
3	4.00630	23.9	---	12.9	36.8	---	56.0	46.0	19.2	---	N	
4	7.97170	23.0	---	13.1	36.1	---	60.0	50.0	23.9	---	N	
5	13.56700	43.5	34.3	13.4	56.9	47.7	60.0	50.0	3.1	2.3	N	
6	27.12000	5.6	---	13.8	19.4	---	60.0	50.0	40.6	---	N	
7	29.01818	16.7	---	13.9	30.6	---	60.0	50.0	29.4	---	N	
8	1.92240	26.8	26.6	12.8	39.6	39.4	56.0	46.0	16.4	6.6	L1	
9	2.64228	24.5	---	12.8	37.3	---	56.0	46.0	18.7	---	L1	
10	4.00642	23.4	---	12.9	36.3	---	56.0	46.0	19.7	---	L1	
11	7.96920	20.9	---	13.1	34.0	---	60.0	50.0	26.0	---	L1	
12	13.56000	41.7	32.0	13.4	55.1	45.4	60.0	50.0	4.9	4.6	L1	
13	27.12000	10.5	---	13.8	24.3	---	60.0	50.0	35.7	---	L1	
14	29.01750	19.1	---	13.9	33.0	---	60.0	50.0	27.0	---	L1	

Calculation:Result [dBuV] =Reading [dBuV] +C.Fac (LISN+Att+Cable) [dB]
LISN:SLS-01

Data of Electric field strength of Fundamental emission and Spurious emission within the band: FCC15.225(a)(b)(c)

UL Japan, Inc.
Shonan EMC Lab., No.3 Semi-Anechoic Chamber

Company:	KATSURAGAWA ELECTRIC CO.,LTD.	Regulation:	FCC Part15 SupartC 15.225
Equipment:	RFID Module	Test Distance:	3m
Model:	13551	Date:	May 9, 2013
Sample No.:	130422-01	Temperature:	22deg.C
Power:	DC5V	Humidity:	36% RH
Mode:	Transmitting 13.56MHz	ENGINEER:	Tatsuya Arai

Remarks: : Axis:Hor_Z / Ver_Z , Vertical polarization (antenna angle) of the worst case: 0deg

Fundamental emission

No.	FREQ	Test Receiver Reading		Antenna Factor	LOSS	AMP GAIN	RESULT		LIMIT (3m)	MARGIN	
		Hor	Ver				Hor	Ver		Hor	Ver
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]
1	13.560	52.3	58.7	18.9	6.3	32.2	45.3	51.7	123.9	78.6	72.2

Calculation:Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]
Field strength of 13.553MHz to 13.567MHz Limit(3m) = 83.9dBuV/m + 40log 30m/3m
= 123.9dBuV/m (FCC15.225(a))

Spurious emission within the band

No.	FREQ	Test Receiver Reading		Antenna Factor	LOSS	AMP GAIN	RESULT		LIMIT (3m)	MARGIN	
		Hor	Ver				Hor	Ver		Hor	Ver
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]
1	13.110	30.3	30.2	18.9	6.3	32.2	23.3	23.2	69.5	46.2	46.3
2	13.410	30.4	30.4	18.9	6.3	32.2	23.4	23.4	80.5	57.1	57.1
3	13.553	33.5	39.0	18.9	6.3	32.2	26.5	32.0	90.4	63.9	58.4
4	13.567	41.5	47.6	18.9	6.3	32.2	34.5	40.6	90.4	55.9	49.8
5	13.710	30.5	30.5	18.9	6.3	32.2	23.5	23.5	80.5	57.0	57.0
6	14.010	30.4	30.4	18.9	6.3	32.2	23.4	23.4	69.5	46.1	46.1

Calculation:Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]

Outside filed strength frequencies
・Fc±7kHz:13.553MHz to 13.567MHz
・Fc±150kHz:13.410MHz to 13.710MHz
・Fc±450kHz:13.110MHz to 14.010MHz
Fc = 13.56MHz

Limits (3m)
・13.410MHz to 13.553MHz and 13.567MHz to 13.710MHz : 50.5dBuV/m + 40log30m/3m = 90.5dBuV/m (FCC15.225(b))
・13.110MHz to 14.010MHz and 13.710MHz to 14.010MHz : 40.5dBuV/m + 40log30m/3m = 80.5dBuV/m (15.225(c))
・Below 13.110MHz and Above 14.010MHz : 29.5dBuV/m + 40log30m/3m = 69.5dBuV/m (FCC15.225(d)and FCC15.209)

Radiated Emission

UL Japan, Inc.
Shonan EMC Lab., No.3 Semi-Anechoic Chamber

Company: KATSURAGAWA ELECTRIC CO.,LTD.
Equipment: RFID Module
Model: 13551
Sample No.: 130422-01
Power: DC5V
Mode: Transmitting 13.56MHz
EUT axis: Below 30MHz(Horizontal Z-axis, Vertical Z-axis),
Above 30MHz(Horizontal: Z-axis, Vertical: Z-axis)

Regulation: FCC Part15 SupartC 15.225
Test Distance: 3m
Date: May 9, 2013
Temperature: 22deg.C
Humidity: 36% RH
ENGINEER: Tatsuya Arai

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	27.12	QP	29.8	19.0	6.5	32.2	23.1	69.5	46.4	-	0	
Hori.	40.68	QP	23.7	14.3	6.7	32.2	12.5	40.0	27.5	337	120	
Hori.	54.24	QP	22.5	9.6	6.8	32.2	6.7	40.0	33.3	100	358	
Hori.	67.80	QP	31.7	6.8	6.9	32.1	13.3	40.0	26.7	280	74	
Hori.	81.36	QP	25.4	6.7	7.1	32.1	7.1	40.0	32.9	235	261	
Hori.	94.92	QP	32.9	9.2	7.2	32.1	17.2	43.5	26.3	314	111	
Hori.	108.48	QP	28.1	11.4	7.3	32.1	14.7	43.5	28.8	314	281	
Hori.	122.04	QP	30.6	13.1	7.4	32.1	19.0	43.5	24.5	156	264	
Hori.	135.60	QP	32.9	14.2	7.5	32.1	22.5	43.5	21.0	239	274	
Hori.	203.42	QP	46.3	16.4	8.0	32.0	38.7	43.5	4.8	169	291	
Hori.	230.54	QP	49.1	16.8	8.1	32.0	42.0	46.0	4.0	141	76	
Hori.	678.06	QP	41.1	20.0	10.1	31.9	39.3	46.0	6.7	146	251	
Hori.	813.67	QP	42.1	21.1	10.6	31.5	42.3	46.0	**3.7**	118	313	
Hori.	840.79	QP	40.1	21.4	10.7	31.4	40.8	46.0	5.2	109	295	
Vert.	27.12	QP	29.9	19.0	6.5	32.2	23.2	69.5	46.3	-	0	
Vert.	40.68	QP	32.5	14.3	6.7	32.2	21.3	40.0	18.7	100	34	
Vert.	54.24	QP	30.1	9.6	6.8	32.2	14.3	40.0	25.7	100	357	
Vert.	67.80	QP	37.8	6.8	6.9	32.1	19.4	40.0	20.6	100	273	
Vert.	81.36	QP	24.4	6.7	7.1	32.1	6.1	40.0	33.9	100	307	
Vert.	94.92	QP	29.1	9.2	7.2	32.1	13.4	43.5	30.1	100	324	
Vert.	108.48	QP	27.5	11.4	7.3	32.1	14.1	43.5	29.4	100	263	
Vert.	122.04	QP	29.6	13.1	7.4	32.1	18.0	43.5	25.5	100	249	
Vert.	135.60	QP	29.5	14.2	7.5	32.1	19.1	43.5	24.4	100	12	
Vert.	678.06	QP	40.4	20.0	10.1	31.9	38.6	46.0	7.4	100	354	
Vert.	813.67	QP	40.2	21.1	10.6	31.5	40.4	46.0	5.6	100	323	
Vert.	840.79	QP	37.3	21.4	10.7	31.4	38.0	46.0	8.0	100	309	

Result = Reading + Ant Factor + Loss (Cable+Attenuator) - Gain(Amprifier)
*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

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Data of Frequency Tolerance: FCC 15.225(e)

UL Japan, Inc.
Shonan EMC Lab. No.5 Shield room

Company:	KATSURAGAWA ELECTRIC CO.,LTD.	Regulation:	FCC Part15 SupartC 15.225
Equipment:	RFID Module		
Model:	13551	Date:	April 30, 2013
Sample No.:	130422-01	Temperature:	26deg.C
Power:	DC5V	Humidity:	41%RH
Mode:	Transmitting 13.56MHz	ENGINEER:	Tatsuya Arai

Temperature Variation: 50deg.C

Test Conditions	Original Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.561034	0.001034	0.00763	0.01
after 2minutes	13.56	13.561027	0.001027	0.00757	0.01
after 5minutes	13.56	13.561026	0.001026	0.00757	0.01
after 10minutes	13.56	13.561026	0.001026	0.00757	0.01

Temperature Variation: 40deg.C

Test Conditions	Original Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.561076	0.001076	0.00794	0.01
after 2minutes	13.56	13.561058	0.001058	0.00780	0.01
after 5minutes	13.56	13.561056	0.001056	0.00779	0.01
after 10minutes	13.56	13.561056	0.001056	0.00779	0.01

Temperature Variation: 30deg.C

Test Conditions	Original Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.561122	0.001122	0.00827	0.01
after 2minutes	13.56	13.561098	0.001098	0.00810	0.01
after 5minutes	13.56	13.561097	0.001097	0.00809	0.01
after 10minutes	13.56	13.561097	0.001097	0.00809	0.01

Temperature Variation: 20deg.C

Test Conditions	Original Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.561151	0.001151	0.00849	0.01
after 2minutes	13.56	13.561142	0.001142	0.00842	0.01
after 5minutes	13.56	13.561145	0.001145	0.00844	0.01
after 10minutes	13.56	13.561142	0.001142	0.00842	0.01

Data of Frequency Tolerance: FCC 15.225(e)

UL Japan, Inc.
Shonan EMC Lab. No.5 Shield room

Company:	KATSURAGAWA ELECTRIC CO.,LTD.	Regulation:	FCC Part15 SupartC 15.225
Equipment:	RFID Module		
Model:	13551	Date:	April 30, 2013
Sample No.:	130422-01	Temperature:	26deg.C
Power:	DC5V	Humidity:	41%RH
Mode:	Transmitting 13.56MHz	ENGINEER:	Tatsuya Arai

Temperature Variation: 10deg.C

Test Conditions	Original Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.561191	0.001191	0.00878	0.01
after 2minutes	13.56	13.561174	0.001174	0.00866	0.01
after 5minutes	13.56	13.561174	0.001174	0.00866	0.01
after 10minutes	13.56	13.561173	0.001173	0.00865	0.01

Temperature Variation: 0deg.C

Test Conditions	Original Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.561203	0.001203	0.00887	0.01
after 2minutes	13.56	13.561198	0.001198	0.00883	0.01
after 5minutes	13.56	13.561199	0.001199	0.00884	0.01
after 10minutes	13.56	13.561198	0.001198	0.00883	0.01

Temperature Variation: -10deg.C

Test Conditions	Original Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.561191	0.001191	0.00878	0.01
after 2minutes	13.56	13.561202	0.001202	0.00886	0.01
after 5minutes	13.56	13.561203	0.001203	0.00887	0.01
after 10minutes	13.56	13.561202	0.001202	0.00886	0.01

Temperature Variation: -20deg.C

Test Conditions	Original Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.561145	0.001145	0.00844	0.01
after 2minutes	13.56	13.561182	0.001182	0.00872	0.01
after 5minutes	13.56	13.561183	0.001183	0.00872	0.01
after 10minutes	13.56	13.561183	0.001183	0.00872	0.01

Data of Frequency Tolerance: FCC 15.225(e)

UL Japan, Inc.
Shonan EMC Lab. No.5 Shield room

Company:	KATSURAGAWA ELECTRIC CO.,LTD.	Regulation:	FCC Part15 SupartC 15.225
Equipment:	RFID Module		
Model:	13551	Date:	April 30, 2013
Sample No.:	130422-01	Temperature:	26deg.C
Power:	DC5V	Humidity:	41%RH
Mode:	Transmitting 13.56MHz	ENGINEER:	Tatsuya Arai

Input Voltage:DC4.25V (85%)
Temperature Variation: 20deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.561110	0.001110	0.00819	0.01
after 2minutes	13.56	13.561101	0.001101	0.00812	0.01
after 5minutes	13.56	13.561102	0.001102	0.00813	0.01
after 10minutes	13.56	13.561102	0.001102	0.00813	0.01

Input Voltage:DC5.75V (115%)
Temperature Variation: 20deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency Tolerance (%)	Limit (%)
startup	13.56	13.561172	0.001172	0.00864	0.01
after 2minutes	13.56	13.561163	0.001163	0.00858	0.01
after 5minutes	13.56	13.561162	0.001162	0.00857	0.01
after 10minutes	13.56	13.561162	0.001162	0.00857	0.01

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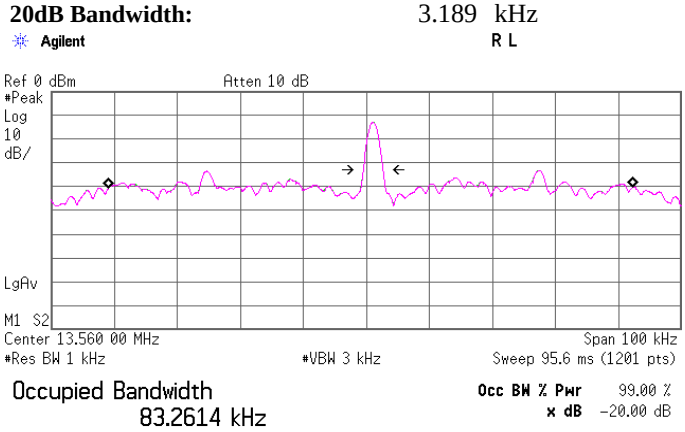
20dB bandwidth & 99% Occupied bandwidth: FCC 15.215 / RSS-Gen

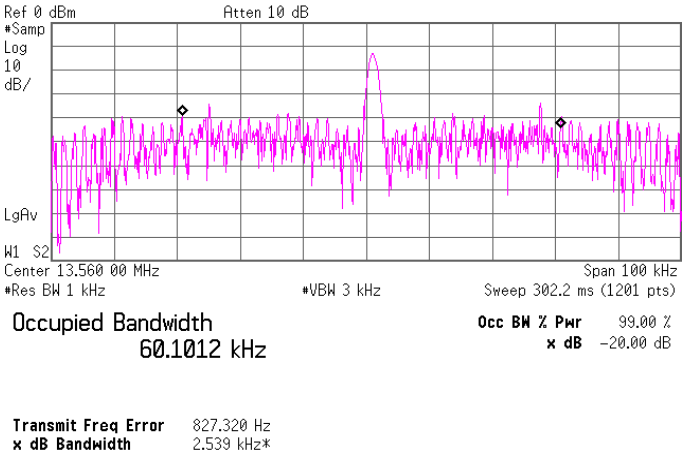
UL Japan, Inc.
Shonan EMC Lab. No.5 Shield room

Company:	KATSURAGAWA ELECTRIC CO.,LTD.	Regulation:	FCC Part15 Subpart C 15.215
Equipment:	RFID Module		
Model:	13551	Date:	April 26, 2013
Sample No.:	130422-01	Temperature:	25deg.C
Power:	DC5V	Humidity:	51%RH
Mode:	Transmitting 13.56MHz	ENGINEER:	Tatsuya Arai

20dB Bandwidth: 3.189 kHz



99% Occupied Bandwidth: 60.101 kHz



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APPENDIX
Test Instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY48250152	BW/FT	2013/01/08 * 12
SSP-01	Search Probe	Nisshin Electric	NSP-01	-	BW/FT	-
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	BW/FT	2013/03/07 * 12
SCH-01	Temperature and Humidity Chamber	Espec	PL-1KT	14020837	FT	2013/04/17 * 12
STR-01	Test Receiver	Rohde & Schwarz	ESU40	100093	CE	2012/10/04 * 12
SJM-08	Measure	PROMART	SEN1935	-	CE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE, RFI,MF)	-	CE/RE	-
SCC-A12/A13/ SRSE-01	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/N S4906	-/0901-269(RF Selector)	CE	2013/04/04 * 12
SLS-01	LISN	Rohde & Schwarz	ENV216	100511	CE	2013/02/22 * 12
SLS-02	LISN	Rohde & Schwarz	ENV216	100512	CE	2013/02/21 * 12
SAT3-03	Attenuator	JFW	50HF-003N	-	CE	2013/02/12 * 12
SOS-02	Humidity Indicator	A&D	AD-5681	4063343	CE	2013/03/07 * 12
STM-01	Terminator	TME	CT-01 BP	-	CE	2013/01/16 * 12
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2013/02/12 * 12
SAT6-06	Attenuator	JFW	50HF-006N	-	RE	2013/02/12 * 12
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	2012/10/08 * 12
SCC-C1/C2/C 3/C4/C5/C10/ SRSE-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhne r/Suhner/Suhner/Suhn er/TOYO	8D2W/12DSFA/14 1PE/141PE/141PE /141PE/NS4906	-/0901-271(RF Selector)	RE	2013/04/03 * 12
SLA-03	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0901	RE	2012/10/08 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2013/02/27 * 12
STR-06	Test Receiver	Rohde & Schwarz	ESCI	101259	RE	2013/02/27 * 12
SJM-11	Measure	PROMART	SEN1935	-	RE	-
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2012/09/21 * 12
SAT6-07	Attenuator	JFW	50HF-006N	-	RE	2013/02/12 * 12
SLP-02	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100218	RE	2012/10/31 * 12

The expiration date of the calibration is the end of the expired month .
As for some calibrations performed after the tested dates , those test equipment have been controlled by means of an unbroken chains of calibrations .

All equipment is calibrated with valid calibrations . Each measurement data is traceable to the national or international standards.
Test Item :
CE: Conducted emission,
RE: Radiated emission,
BW: Bandwidth,
FT: Frequency tolerance