



Test report No. : 10604958M-A-R1
Page : 1 of 30
Issued date : March 16, 2015
Revised date : March 30, 2015
FCC ID : 2AD9WRR-1356MA1

RADIO TEST REPORT

Test Report No.: 10604958M-A-R1

Applicant : Hitachi Industrial Equipment Systems Co., Ltd.
Type of Equipment : RFID module
Model No. : RR-1356MA1
FCC ID : 2AD9WRR-1356MA1
Test regulation : FCC Part15 Subpart C: 2014
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 the limits of the above regulation.
4. The test results in this test 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 any agency of the Federal Government.
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: December 24, 26, 2014, January 5, March 30, 2015

Tested by:

K. Ando

Kazuhiro Ando
EMC/Wireless Group,
Consumer Technology Division

Approved by :

G. Ishiwata

Go Ishiwata
Site Manager
EMC/Wireless Group,
Consumer Technology Division



- ☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☒ There is no testing item of "Non-accreditation".

UL Japan, Inc.
Kashima EMC Lab.

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13-EM-F0429

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REVISION HISTORY

Original Test Report No. 10604958M-A

Revision	Date	Page revised	Revision Description
00	March 16, 2015	-	Original
01	March 30, 2015	P.9 P.24	Correction of Typo Correction of Data

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SECTION 1: Customer information

Company Name : Hitachi Industrial Equipment Systems Co., Ltd
Brand Name : HITACHI
Address : 1-1-1, Higashitaga-cho, Hitachi-shi, Ibaraki-ken
Telephone Number : +81- 294-36-8684
Facsimile Number : +81- 294-36-8975
Contact Person : Manabu Kato

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

2.1 Identification of E.U.T.

Type of Equipment : RFID module
Model Number : RR-1356MA1
Serial Number : Refer to clause 4.2
Rating : DC 3.65 - 6V (Typical DC 5V), 0.5W
Country of Mass-production : Taiwan (R.O.C)
Condition of EUT : Production prototype
(This sample is equivalent to mass-produced items.)
Receipt Date of Sample : December 24, 2014
Modification of EUT : No modification by the test lab.

2.2 Product description

Model: RR-1356MA1 (referred to as the EUT in this report) is an RFID module.

Clock frequency(ies) in the system : 13.56 MHz

<Radio part>

Equipment type : Transceiver
Frequency of operation : 13.56MHz
Type of modulation : ASK
Antenna type : Printed Loop Coil
Antenna connector type : none
ITU code : A1D
Operation temperature range : -10 to + 60 deg.C.

FCC 15.31 (e)

The RF Module has its own regulator.

The RF Module is constantly provided voltage (DC3.3V) through the regulator regardless of input voltage.
Therefore, this EUT complies with the requirement.

FCC 15.203/212

It is impossible for end users to replace the antenna, because it is printed on the circuit board. Therefore the equipment complies with the requirement of 15.203/212.

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SECTION 3: Test specification, procedures & results

3.1 Test specification

Test specification : FCC Part 15 Subpart C: 2014, final revised on August 15, 2014 and effective October 14, 2014

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	10.5dB Freq.: 0.18990MHz Detector: QP Phase: N Tx with Tag(ISO14443)	Complied
Electric field strength of Fundamental emission	ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.225 (a)	Radiated	N/A	58.3dB 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	4.0dB Freq.: 13.110MHz Polarization: Horizontal	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	8.0dB Freq.: 40.680MHz Polarization: Vertical Tx with Tag(ISO14443)	Complied
20dB bandwidth	ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.215 (c)	Conducted	N/A	-	-
Frequency tolerance	ANSI C63.4:2009 13. Measurement of intentional radiators	FCC 15.225 (e)	Conducted	N/A	*See data	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 6.6	-	Conducted	-	-
Note: UL'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.

Test Items	Frequency range	Uncertainty
Conducted emission (AC Mains) AMN	0.15 MHz-30 MHz	2.8 dB
Radiated emission (Measurement distance: 3 m)	0.009 MHz-30 MHz	2.7 dB
	30 MHz-1000 MHz	6.3 dB

Conducted emission test

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

Radiated emission test

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

Frequency tolerance

Frequency Measurement uncertainty for this test was: $(\pm) 5.3 \times 10^{-6}$

3.5 Test location

UL Japan , Inc.
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Telephone number : +81 478 82 0963
Facsimile number : +81 478 82 3373
A2LA Accreditation No. : 1266-01

	FCC Registration No.	IC Registration No.	Width x Depth x Height (m)	Size of reference ground plane/horizontal conducting plane (m)	Maximum measurement distance
No.1 Open site	90558	IC 4659A-1	6.0 x 5.5 x 2.5	20 x 40	30 m
No.2 Open site	510504	IC 4659A-2	4.4 x 4.4 x 2.15	18 x 20	10 m
No.5 Open site	99356	IC 4659A-5	8.6 x 7.1 x 2.4	18 x 23	10 m
No.1 Shielded room	90558	IC 4659A-1	5.4 x 4.5 x 2.3		-
No.2 Shielded room	510504	IC 4659A-2	3.6 x 2.7 x 2.3		-
No.3 Shielded room	-	-	5.4 x 3.6 x 2.3		-
No.4 Shielded Room	-	-	6.1 x 6.1 x 3.1		-
No.5 Shielded Room	99356	IC 4659A-5	4.2 x 3.1 x 2.5		-
No.1 Measurement room	-	-	5.0 x 3.7 x 2.6		-
No.2 Measurement room	-	-	4.3 x 4.4 x 2.7		-
No.3 Fully Anechoic Chamber	-	-	7.0 x 3.5 x 3.5		-
No.6 Semi-anechoic Chamber	372431	IC 4659A-6	8.5 x 5.5 x 5.2		3 m
No.10 Semi-anechoic Chamber	682397	IC 4659A-10	18.4 x 9.9 x 7.7		10 m
No.11 Semi-anechoic Chamber	718605	IC 4659A-7	9.0 x 6.5 x 5.2		3 m

Our company name was changed from “UL Kashima, Inc.” to “UL Japan, Inc.” on January 1st, 2015

3.6 Test setup, Data of test & Test instruments

Refer to APPENDIX 1 to 3.

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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 except for Frequency tolerances	1. Transmitting without Tag - Modulation ASK100% 2. Transmitting with Tag (ISO15693) - Modulation ASK90% 2. Transmitting with Tag (ISO14443) - Modulation ASK100%	13.56MHz
Frequency tolerances	1. Transmitting without Tag - Modulation ASK100%	13.56MHz

The EUT has the power settings by the software as follows;

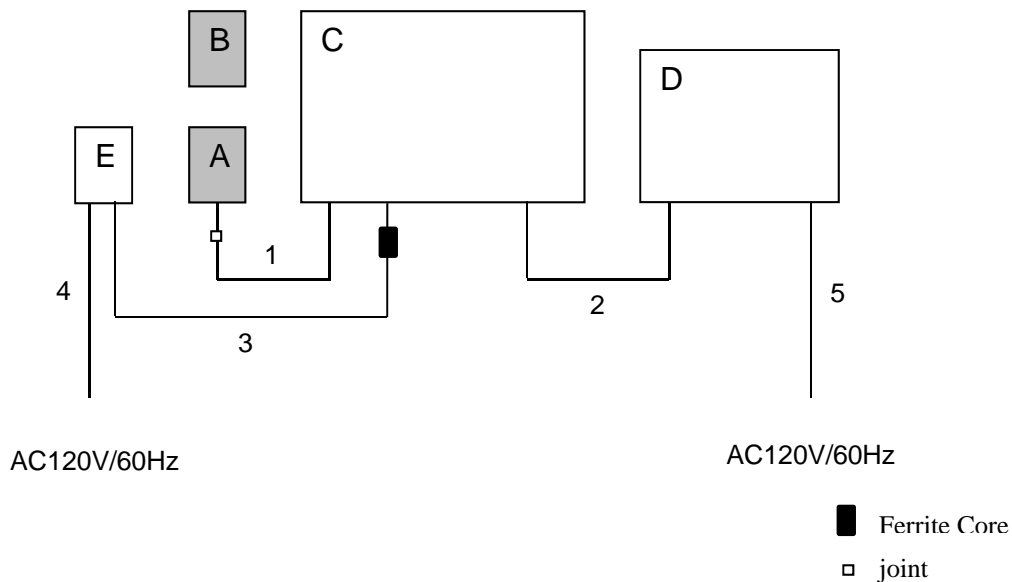
Power settings: Setting is controlled by the firmware and cannot be changed.

Software: rfid RF tester 1.00

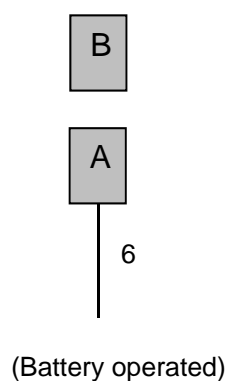
Justification: The system was configured in typical fashion (as customer would normally use it) for testing.

4.2 Configuration and peripherals

Conducted Emissions



Radiated Emissions / Frequency stability Test condition



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

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Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	RFID Module	RR-1356MA1	*1)	Hitachi Industrial Equipment Systems	EUT
B1	Tag (ISO15693)	TP-3L401-1	e0040150440adcb9	TOPPAN	EUT Data rate: 26.48kbps Internal coil size: 76[mm]*45[mm] Internal coil turns: 6
B2	Tag (ISO14443)	Mifare UltraLight	0496dc02b22380	Hitachi High-Tech Materials	EUT Data rate: 106kbps Internal coil size: 70[mm]*45[mm] Internal coil turns: 6
C	PC	PLL20N-007003	49172231K	TOSHIBA	
D	Printer	K10220	FBNN82506	Canon	
E	AC Adapter	PA-1300-03	G71C0009T118	TOSHIBA	

*1) 4K00J80782A40003: Antenna port conducted tests, 4K00J80782A40001: Radiated emission tests

List of cables used

No.	Item	Length(m)	Shield		Remarks
			Cable	Connector	
1	USB - GH Connector	1.8 + 0.1	Shielded	Unshielded	
2	USB	2.0	Shielded	Shielded	
3	DC	1.8	Unshielded	Unshielded	AC Adapter
4	AC	1.7	Unshielded	Unshielded	AC Adapter
5	AC	1.8	Unshielded	Unshielded	Printer
6	DC	0.15	Unshielded	Unshielded	

SECTION 5: Conducted emission

5.1 Operating environment

The test was carried out in a Shielded room.

Temperature : Refer to APPENDIX 1.
Humidity : Refer to APPENDIX 1.

5.2 Test configuration

EUT was placed on a 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 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.

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 in 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, a CISPR average detector. The conducted emission measurements were made with the following detection of the test receiver.

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

5.5 Results

Summary of the test results : Pass

Refer to APPENDIX 1.

SECTION 6: Radiated emission (Fundamental and Spurious emission)

6.1 Operating environment

The test was carried out in a semi-anechoic chamber.

Temperature : Refer to APPENDIX 1.
Humidity : Refer to APPENDIX 1.

6.2 Test configuration

EUT was placed on a platform of nominal size, 0.5m by 0.5m, raised 0.8m above the conducting ground plane.
(Below 30MHz: without conducting ground plane)

The table is made of polystyrene foam. That has very low permittivity.

Photographs of the set up are shown in Appendix.

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 and 30m

Frequency: From 9kHz to 30MHz at distance 3m and 30m

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.

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

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				Logbicon antenna

* FCC 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])

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

Antenna polarization	Below 30MHz	30-1000MHz
Horizontal	Z	X
Vertical	Z	Y

6.5 Results

Summary of the test results : Pass

Refer to APPENDIX 1.

Figure 1. Direction of the Loop Antenna

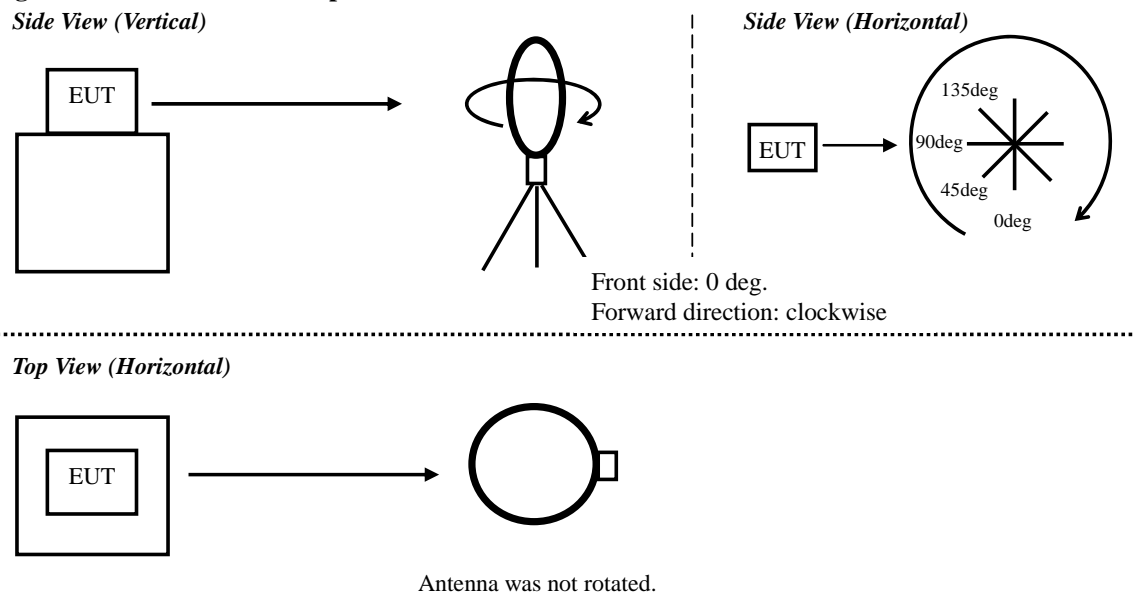
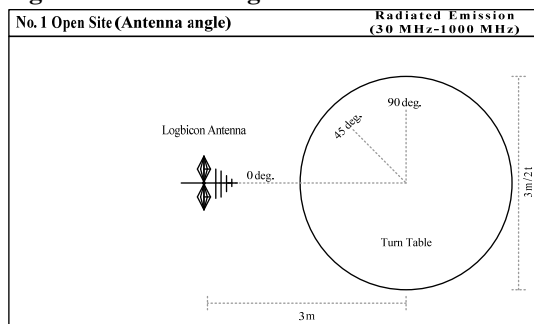


Figure 2. Antenna angle



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

Refer to APPENDIX 1.

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

Refer to APPENDIX 1.

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

DATA OF CONDUCTED EMISSION TEST

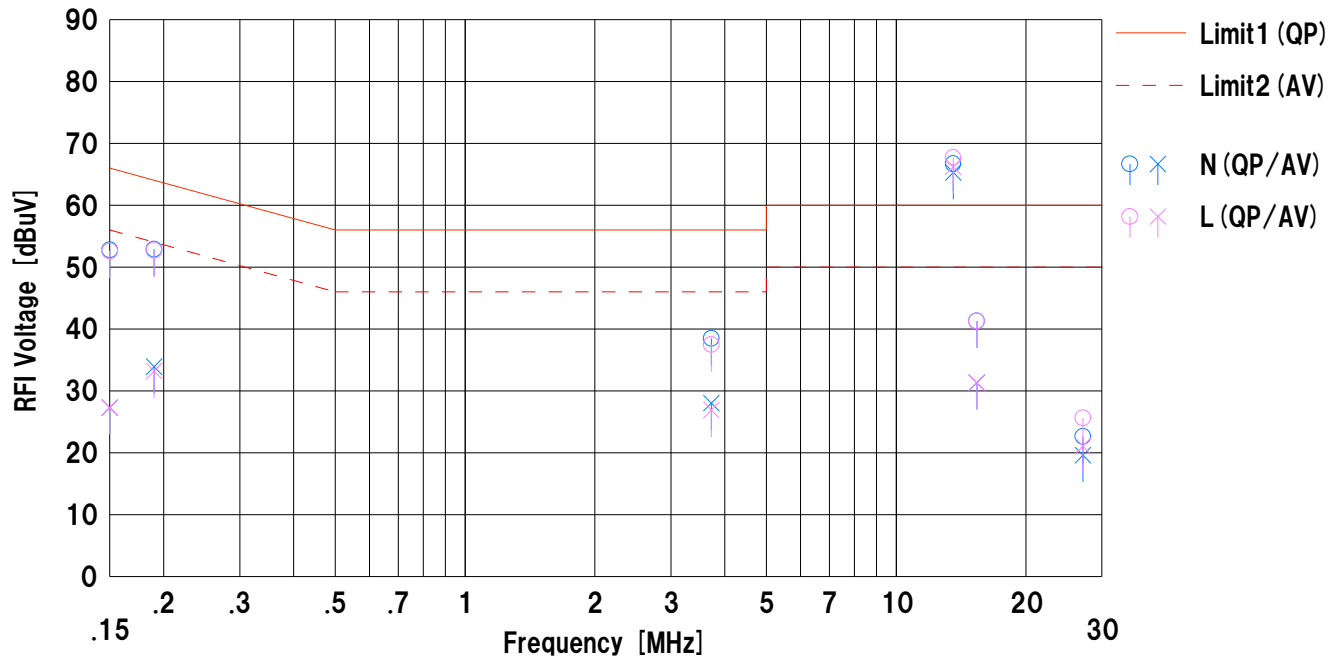
UL Japan Inc.
Kashima EMC Lab. No.1 Test Site
Date : 2014/12/24

Company : Hitachi Industrial Equipment Systems
Kind of EUT : RFID Module
Model No. : RR-1356MA1
Serial No. : 4K00J80782A40001
Remarks : without Tag

Mode : Transmitting
Report No. : 10604958
Power : AC 120V/60Hz (AC Line of PC)
Temp./Humi. : 20deg.C / 40%RH

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

Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	42.6	17.1	10.2	52.8	27.3	66.0	56.0	13.2	28.7	N	Carrier
2	0.18990	42.7	23.7	10.2	52.9	33.9	64.0	54.0	11.1	20.1	N	
3	3.72700	28.0	17.5	10.5	38.5	28.0	56.0	46.0	17.5	18.0	N	
4	13.56000	55.5	54.1	11.2	66.7	65.3	60.0	50.0	-6.7	-15.3	N	
5	15.38300	30.0	20.0	11.3	41.3	31.3	60.0	50.0	18.7	18.7	N	
6	27.12000	10.5	7.5	12.1	22.6	19.6	60.0	50.0	37.4	30.4	N	
7	0.15000	42.4	17.1	10.2	52.6	27.3	66.0	56.0	13.4	28.7	L	Carrier
8	0.18990	42.5	23.0	10.2	52.7	33.2	64.0	54.0	11.3	20.8	L	
9	3.72700	27.0	16.4	10.5	37.5	26.9	56.0	46.0	18.5	19.1	L	
10	13.56000	56.5	55.0	11.2	67.7	66.2	60.0	50.0	-7.7	-16.2	L	
11	15.38300	30.0	20.0	11.3	41.3	31.3	60.0	50.0	18.7	18.7	L	
12	27.12000	13.5	9.0	12.1	25.6	21.1	60.0	50.0	34.4	28.9	L	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]
LISN03

DATA OF CONDUCTED EMISSION TEST

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Kashima EMC Lab. No.1 Test Site

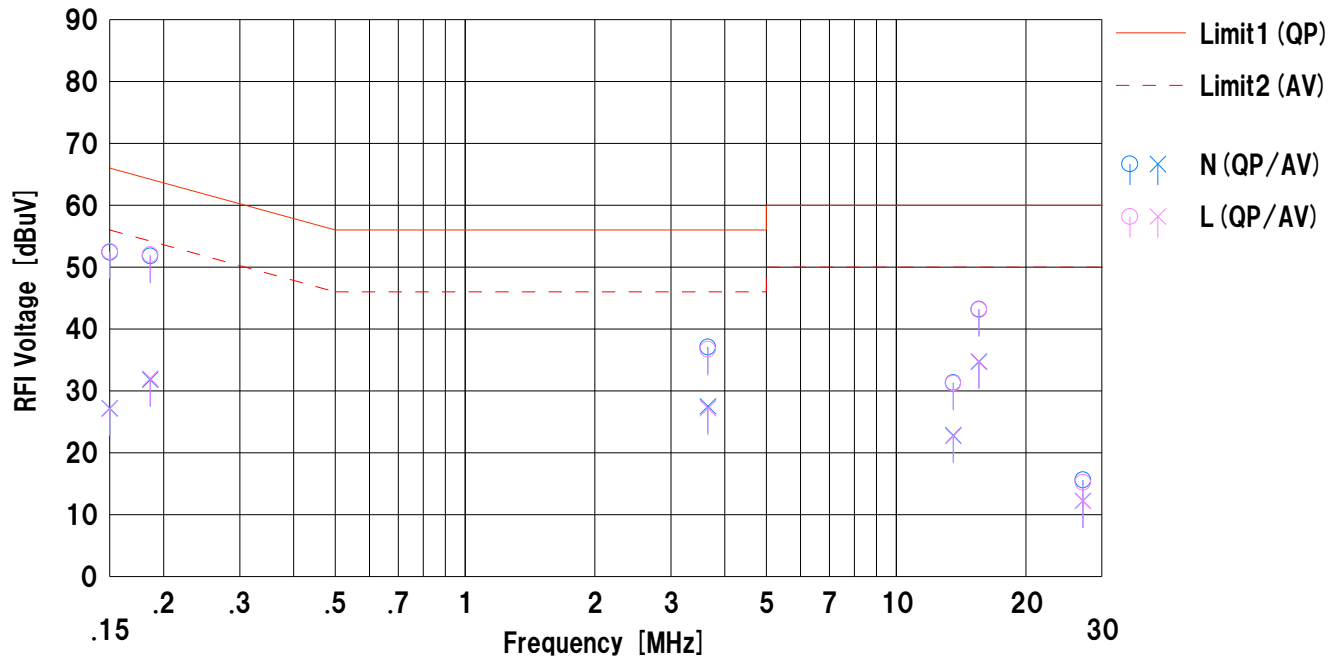
Date : 2014/12/24

Company : Hitachi Industrial Equipment Systems
 Kind of EUT : RFID Module
 Model No. : RR-1356MA1
 Serial No. : 4K00J80782A40001
 Remarks : without Tag (Antenna 50Ω Termination)

Mode : Transmitting
 Report No. : 10604958
 Power : AC 120V/60Hz (AC Line of PC)
 Temp./Humi. : 20deg.C / 40%RH

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

Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	42.2	17.0	10.2	52.4	27.2	66.0	56.0	13.6	28.8	N	
2	0.18610	41.6	21.6	10.2	51.8	31.8	64.2	54.2	12.4	22.4	N	
3	3.65890	26.6	17.0	10.5	37.1	27.5	56.0	46.0	18.9	18.5	N	
4	13.56000	20.1	11.6	11.2	31.3	22.8	60.0	50.0	28.7	27.2	N	
5	15.54800	31.9	23.4	11.3	43.2	34.7	60.0	50.0	16.8	15.3	N	
6	27.12000	3.5	0.1	12.1	15.6	12.2	60.0	50.0	44.4	37.8	N	
7	0.15000	42.3	16.9	10.2	52.5	27.1	66.0	56.0	13.5	28.9	L	
8	0.18610	41.8	21.8	10.2	52.0	32.0	64.2	54.2	12.2	22.2	L	
9	3.65890	26.2	16.7	10.5	36.7	27.2	56.0	46.0	19.3	18.8	L	
10	13.56000	20.0	11.5	11.2	31.2	22.7	60.0	50.0	28.8	27.3	L	
11	15.54800	31.8	23.5	11.3	43.1	34.8	60.0	50.0	16.9	15.2	L	
12	27.12000	3.1	0.1	12.1	15.2	12.2	60.0	50.0	44.8	37.8	L	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]
 LISN03

DATA OF CONDUCTED EMISSION TEST

UL Japan Inc.

Kashima EMC Lab. No.1 Test Site

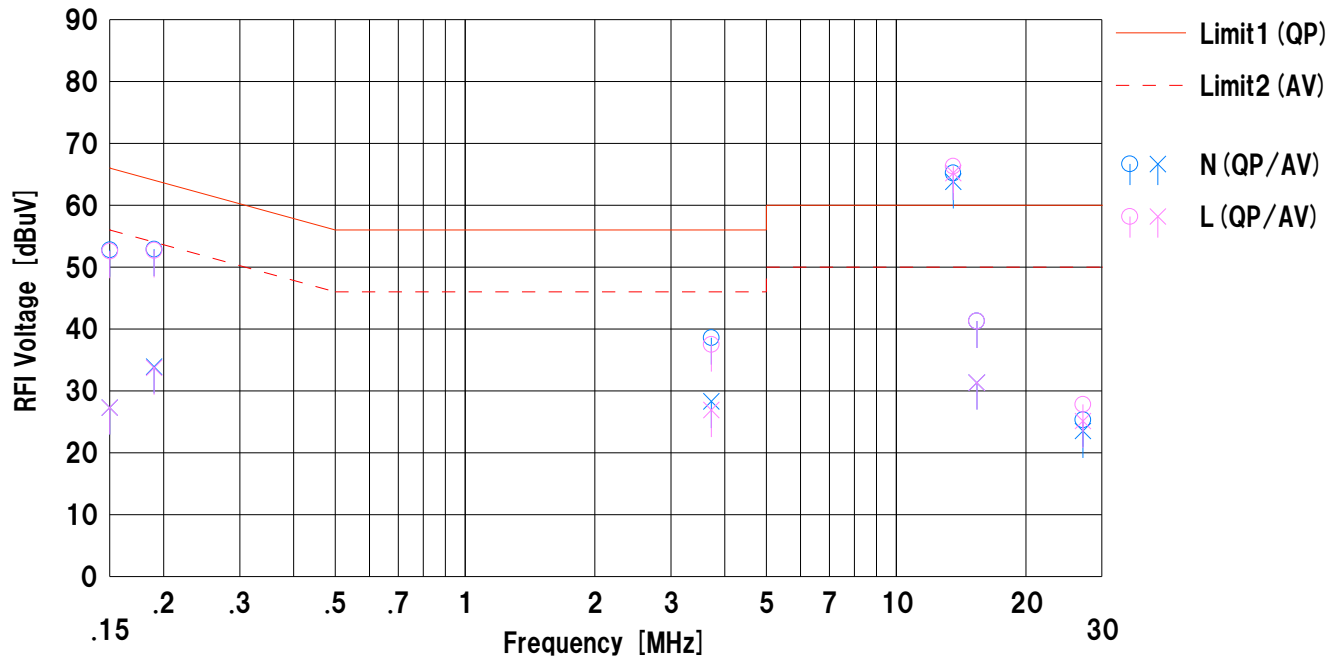
Date : 2014/12/24

Company : Hitachi Industrial Equipment Systems
 Kind of EUT : RFID Module
 Model No. : RR-1356MA1
 Serial No. : 4K00J80782A40001
 Remarks : Tag (ISO15693)

Mode : Transmitting
 Report No. : 10604958
 Power : AC 120V/60Hz (AC Line of PC)
 Temp./Humi. : 20deg.C / 40%RH

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

Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	42.6	17.1	10.2	52.8	27.3	66.0	56.0	13.2	28.7	N	Carrier
2	0.18990	42.7	23.7	10.2	52.9	33.9	64.0	54.0	11.1	20.1	N	
3	3.72700	28.1	17.8	10.5	38.6	28.3	56.0	46.0	17.4	17.7	N	
4	13.56000	54.0	52.6	11.2	65.2	63.8	60.0	50.0	-5.2	-13.8	N	
5	15.38300	30.0	20.0	11.3	41.3	31.3	60.0	50.0	18.7	18.7	N	
6	27.12000	13.2	11.4	12.1	25.3	23.5	60.0	50.0	34.7	26.5	N	
7	0.15000	42.4	17.1	10.2	52.6	27.3	66.0	56.0	13.4	28.7	L	Carrier
8	0.18990	42.5	23.5	10.2	52.7	33.7	64.0	54.0	11.3	20.3	L	
9	3.72700	27.0	16.4	10.5	37.5	26.9	56.0	46.0	18.5	19.1	L	
10	13.56000	55.1	54.0	11.2	66.3	65.2	60.0	50.0	-6.3	-15.2	L	
11	15.38300	30.0	20.0	11.3	41.3	31.3	60.0	50.0	18.7	18.7	L	
12	27.12000	15.7	13.0	12.1	27.8	25.1	60.0	50.0	32.2	24.9	L	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]
 LISN03

DATA OF CONDUCTED EMISSION TEST

UL Japan Inc.

Kashima EMC Lab. No.1 Test Site

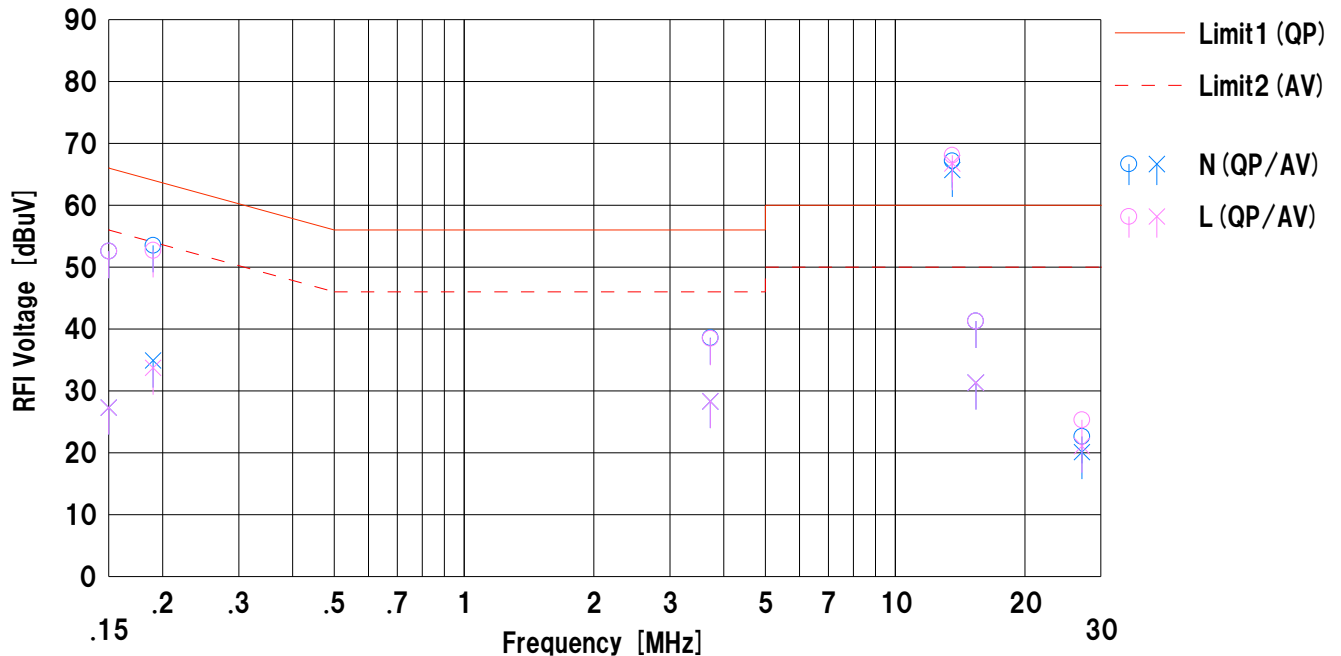
Date : 2014/12/24

Company : Hitachi Industrial Equipment Systems
 Kind of EUT : RFID Module
 Model No. : RR-1356MA1
 Serial No. : 4K00J80782A40001
 Remarks : Tag (ISO14443)

Mode : Transmitting
 Report No. : 10604958
 Power : AC120V/60Hz (AC Line of PC)
 Temp./Humi. : 20deg.C / 40%RH

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

Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	42.4	17.1	10.2	52.6	27.3	66.0	56.0	13.4	28.7	N	Carrier
2	0.18990	43.3	24.7	10.2	53.5	34.9	64.0	54.0	10.5	19.1	N	
3	3.72700	28.1	17.8	10.5	38.6	28.3	56.0	46.0	17.4	17.7	N	
4	13.56000	56.0	54.5	11.2	67.2	65.7	60.0	50.0	-7.2	-15.7	N	
5	15.38300	30.0	20.0	11.3	41.3	31.3	60.0	50.0	18.7	18.7	N	
6	27.12000	10.5	8.0	12.1	22.6	20.1	60.0	50.0	37.4	29.9	N	
7	0.15000	42.4	17.1	10.2	52.6	27.3	66.0	56.0	13.4	28.7	L	Carrier
8	0.18990	42.5	23.5	10.2	52.7	33.7	64.0	54.0	11.3	20.3	L	
9	3.72700	28.0	17.8	10.5	38.5	28.3	56.0	46.0	17.5	17.7	L	
10	13.56000	56.9	55.6	11.2	68.1	66.8	60.0	50.0	-8.1	-16.8	L	
11	15.38300	30.0	20.0	11.3	41.3	31.3	60.0	50.0	18.7	18.7	L	
12	27.12000	13.2	9.0	12.1	25.3	21.1	60.0	50.0	34.7	28.9	L	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]
 LISN03

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

UL Japan, Inc. Kashima EMC Lab.

No.1 Open Site (Open Field, without ground plane)

Company: Hitachi Industrial Equipment Systems Co.,Ltd.
 Equipment: RFID Module
 Model: RR-1356MA1
 Sample No.: 4K00J80782A40001
 Power: DC 4.5V
 Mode: Transmitting 13.56MHz

Regulation: FCC Part15 Subpart C 15.225
 Test Distance: 30m
 Date: December 26, 2014
 Temperature: 21 deg.C
 Humidity: 37 %RH
 ENGINEER: Kazuhiro Ando

Remarks: : without Tag, Z-Axis , Vertical polarization (antenna angle) of the worst case: 0deg
 : with Tag (ISO15693), Z-Axis , Vertical polarization (antenna angle) of the worst case: 0deg
 : with Tag (ISO14443), Z-Axis , Vertical polarization (antenna angle) of the worst case: 0deg

Fundamental emission

No.	FREQ [MHz]	Test Receiver Reading		Antenna Factor [dB/m]	Loss [dB]	AMP GAIN [dB]	Distance factor [dB]	RESULT		LIMIT (30m) [dBuV/m]	MARGIN	
		Hor [dBuV]	Ver [dBuV]					Hor [dBuV/m]	Ver [dBuV/m]		Hor [dB]	Ver [dB]
1	13.560	37.4	37.7	18.2	1.5	31.8	0.0	25.3	25.6	83.9	58.6	58.3

Noise Floor

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

Limits (30m)

• 13.553MHz to 13.567MHz : 83.9dBuV/m (FCC 15.225(a))

Spurious emission within the band

No.	FREQ [MHz]	Test Receiver Reading		Antenna Factor [dB/m]	Loss [dB]	AMP GAIN [dB]	Distance factor [dB]	RESULT		LIMIT (30m) [dBuV/m]	MARGIN	
		Hor [dBuV]	Ver [dBuV]					Hor [dBuV/m]	Ver [dBuV/m]		Hor [dB]	Ver [dB]
1	13.110	-	37.7	18.1	1.5	31.8	0.0	-	25.5	29.5	-	4.0
2	13.410	-	37.8	18.2	1.5	31.8	0.0	-	25.7	40.5	-	14.8
3	13.553	-	37.6	18.2	1.5	31.8	0.0	-	25.5	50.4	-	24.9
4	13.567	-	37.4	18.2	1.5	31.8	0.0	-	25.3	50.4	-	25.1
5	13.710	-	37.3	18.2	1.5	31.8	0.0	-	25.2	40.5	-	15.3
6	14.010	-	37.1	18.3	1.5	31.7	0.0	-	25.2	29.5	-	4.3

Noise Floor

Noise Floor

Noise Floor

Noise Floor

Noise Floor

Noise Floor

Noise Floor

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 (30m)

- 13.410MHz to 13.553MHz and 13.567MHz to 13.710MHz : 50.4dBuV/m (FCC 15.225(b))
- 13.110MHz to 13.410MHz and 13.710MHz to 14.010MHz : 40.5dBuV/m (FCC 15.225(c))
- Below 13.110MHz and Above 14.010MHz : 29.5dBuV/m (FCC 15.225(d) and FCC 15.209)

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Radiated Emission

UL Japan, Inc.

Kashima EMC Lab. No.1 Open Site

Company: Hitachi Industrial Equipment Systems Co.,Ltd.
 Equipment: RFID Module
 Model: RR-1356MA1
 Sample No.: 4K00J80782A40001
 Power: DC 4.5V
 Mode: Transmitting 13.56MHz
 EUT axis: Below 30MHz(Horizontal Z-axis, Vertical Z-axis), without Tag
 Above 30MHz(Horizontal: X-axis, Vertical: Y-axis), without Tag

Regulation: FCC Part15 Subpart C 15.225
 Test Distance: 3m
 Date: December 24, 26, 2014
 Temperature: 20, 21 deg.C
 Humidity: 40, 37 %RH
 ENGINEER: Kazuhiro Ando

Remarks:

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	13.56	QP	61.0	18.2	1.5	31.8	0.0	48.9	-	-	-	180	* Carrier (Reference)
Hori.	40.680	QP	34.1	12.5	4.1	27.6	0.0	23.1	40.0	16.9	270	70	
Hori.	284.760	QP	32.4	13.0	6.2	26.7	0.0	24.9	46.0	21.1	100	56	
Hori.	325.440	QP	30.5	14.1	6.6	26.9	0.0	24.3	46.0	21.7	100	63	
Hori.	366.120	QP	30.5	14.9	6.8	27.2	0.0	25.0	46.0	21.0	100	60	
Hori.	379.680	QP	30.8	15.2	6.9	27.4	0.0	25.5	46.0	20.5	100	60	
Hori.	393.240	QP	31.6	15.5	6.9	27.5	0.0	26.5	46.0	19.5	100	57	
Vert.	13.56	QP	66.1	18.2	1.5	31.8	0.0	54.0	-	-	-	180	* Carrier (Reference)
Vert.	27.12	QP	30.0	24.9	2.0	31.7	-40.0	-14.8	29.5	44.3	-	0	* Noise Floor
Vert.	40.680	QP	35.4	12.5	4.1	27.6	0.0	24.4	40.0	15.6	100	278	

Result = Reading + Ant Factor + Loss (Cable+ATT+ΔAF(above 30MHz)) - Gain(Amplifier) + Distance factor(below 30MHz)

* Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

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Radiated Emission

UL Japan, Inc.

Kashima EMC Lab. No.1 Open Site

Company: Hitachi Industrial Equipment Systems Co.,Ltd.
 Equipment: RFID Module
 Model: RR-1356MA1
 Sample No.: 4K00J80782A40001
 Power: DC 4.5V
 Mode: Transmitting 13.56MHz
 EUT axis: Below 30MHz(Horizontal Z-axis, Vertical Z-axis), with Tag (ISO15693)
 Above 30MHz(Horizontal: X-axis, Vertical: Y-axis), with Tag (ISO15693)

Regulation: FCC Part15 Subpart C 15.225
 Test Distance: 3m
 Date: December 24, 26, 2014
 Temperature: 20, 21 deg.C
 Humidity: 40, 37 %RH
 ENGINEER: Kazuhiro Ando

Remarks:

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	13.56	QP	59.5	18.2	1.5	31.8	0.0	47.4	-	-	-	180	* Carrier (Reference)
Hori.	40.680	QP	35.8	12.5	4.1	27.6	0.0	24.8	40.0	15.2	275	74	
Hori.	67.800	QP	30.6	11.9	4.5	27.5	0.0	19.5	40.0	20.5	270	177	
Hori.	284.760	QP	33.7	13.0	6.2	26.7	0.0	26.2	46.0	19.8	100	63	
Hori.	298.320	QP	33.4	13.5	6.3	26.7	0.0	26.5	46.0	19.5	100	60	
Hori.	325.440	QP	29.1	14.1	6.6	26.9	0.0	22.9	46.0	23.1	100	59	
Hori.	366.120	QP	33.4	14.9	6.8	27.2	0.0	27.9	46.0	18.1	100	66	
Hori.	393.240	QP	28.0	15.5	6.9	27.5	0.0	22.9	46.0	23.1	100	72	
Vert.	13.56	QP	64.0	18.2	1.5	31.8	0.0	51.9	-	-	-	180	* Carrier (Reference)
Vert.	27.12	QP	30.0	24.9	2.0	31.7	-40.0	-14.8	29.5	44.3	-	0	* Noise Floor
Vert.	40.680	QP	41.0	12.5	4.1	27.6	0.0	30.0	40.0	10.0	100	270	
Vert.	67.800	QP	33.1	11.9	4.5	27.5	0.0	22.0	40.0	18.0	100	255	

Result = Reading + Ant Factor + Loss (Cable+ATT+ΔAF(above 30MHz)) - Gain(Amplifier) + Distance factor(below 30MHz)

* Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

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Radiated Emission

UL Japan, Inc.

Kashima EMC Lab. No.1 Open Site

Company: Hitachi Industrial Equipment Systems Co.,Ltd.
 Equipment: RFID Module
 Model: RR-1356MA1
 Sample No.: 4K00J80782A40001
 Power: DC 4.5V
 Mode: Transmitting 13.56MHz
 EUT axis: Below 30MHz(Horizontal Z-axis, Vertical Z-axis), with Tag (ISO14443)
 Above 30MHz(Horizontal: X-axis, Vertical: Y-axis), with Tag (ISO14443)

Regulation: FCC Part15 Subpart C 15.225
 Test Distance: 3m
 Date: December 24, 26, 2014
 Temperature: 20, 21 deg.C
 Humidity: 40, 37 %RH
 ENGINEER: Kazuhiro Ando

Remarks:

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	13.56	QP	61.1	18.2	1.5	31.8	0.0	49.0	-	-	-	180	* Carrier (Reference)
Hori.	40.680	QP	38.0	12.5	4.1	27.6	0.0	27.0	40.0	13.0	255	65	
Hori.	67.800	QP	32.6	11.9	4.5	27.5	0.0	21.5	40.0	18.5	255	60	
Hori.	176.280	QP	38.1	12.0	5.5	27.1	0.0	28.5	43.5	15.0	170	72	
Hori.	284.760	QP	41.3	13.0	6.2	26.7	0.0	33.8	46.0	12.2	100	63	
Hori.	311.880	QP	38.5	13.8	6.5	26.8	0.0	32.0	46.0	14.0	100	208	
Hori.	366.120	QP	33.0	14.9	6.8	27.2	0.0	27.5	46.0	18.5	100	206	
Vert.	13.56	QP	66.8	18.2	1.5	31.8	0.0	54.7	-	-	-	180	* Carrier (Reference)
Vert.	27.12	QP	30.0	24.9	2.0	31.7	-40.0	-14.8	29.5	44.3	-	0	* Noise Floor
Vert.	40.680	QP	43.0	12.5	4.1	27.6	0.0	32.0	40.0	8.0	100	300	
Vert.	67.800	QP	37.0	11.9	4.5	27.5	0.0	25.9	40.0	14.1	100	287	
Vert.	176.280	QP	33.2	12.0	5.5	27.1	0.0	23.6	43.5	19.9	100	250	
Vert.	203.400	QP	33.6	10.1	5.7	27.0	0.0	22.4	43.5	21.1	160	235	

Result = Reading + Ant Factor + Loss (Cable+ATT+ΔAF(above 30MHz)) - Gain(Amplifier) + Distance factor(below 30MHz)

* 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

UL Japan, Inc.

Kashima EMC Lab. No.2 Measurement room

Company	Hitachi Industrial Equipment Systems Co.,Ltd.	Regulation	FCC Part15 Subpart C 15.225 (e)
Equipment	RFID Module	Date	January 5, 2015
Model	RR-1356MA1	Temperature	21 deg.C
Serial No.	4K00J80782A40001	Humidity	38 %RH
Power	DC 5V (Typical)	ENGINEER	Kazuhiro Ando
Mode	Transmitting 13.56 MHz		

Temperature Variation: -20deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.559842	-0.000158	-0.00117	0.010
after 2minutes	13.56	13.559887	-0.000113	-0.00083	0.010
after 5minutes	13.56	13.559888	-0.000112	-0.00083	0.010
after 10minutes	13.56	13.559888	-0.000112	-0.00083	0.010

Temperature Variation: -10deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.559902	-0.000098	-0.00072	0.010
after 2minutes	13.56	13.559928	-0.000072	-0.00053	0.010
after 5minutes	13.56	13.559928	-0.000072	-0.00053	0.010
after 10minutes	13.56	13.559928	-0.000072	-0.00053	0.010

Temperature Variation: 0deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.559937	-0.000063	-0.00046	0.010
after 2minutes	13.56	13.559945	-0.000055	-0.00041	0.010
after 5minutes	13.56	13.559945	-0.000055	-0.00041	0.010
after 10minutes	13.56	13.559945	-0.000055	-0.00041	0.010

Temperature Variation: 10deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.559944	-0.000056	-0.00041	0.010
after 2minutes	13.56	13.559940	-0.000060	-0.00044	0.010
after 5minutes	13.56	13.559940	-0.000060	-0.00044	0.010
after 10minutes	13.56	13.559940	-0.000060	-0.00044	0.010

Temperature Variation: 20deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.559936	-0.000064	-0.00047	0.010
after 2minutes	13.56	13.559926	-0.000074	-0.00055	0.010
after 5minutes	13.56	13.559926	-0.000074	-0.00055	0.010
after 10minutes	13.56	13.559926	-0.000074	-0.00055	0.010

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Data of Frequency Tolerance

Temperature Variation: 30deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.559921	-0.000079	-0.00058	0.010
after 2minutes	13.56	13.559913	-0.000087	-0.00064	0.010
after 5minutes	13.56	13.559912	-0.000088	-0.00065	0.010
after 10minutes	13.56	13.559912	-0.000088	-0.00065	0.010

Temperature Variation: 40deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.559905	-0.000095	-0.00070	0.010
after 2minutes	13.56	13.559899	-0.000101	-0.00074	0.010
after 5minutes	13.56	13.559899	-0.000101	-0.00074	0.010
after 10minutes	13.56	13.559899	-0.000101	-0.00074	0.010

Temperature Variation: 50deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.559894	-0.000106	-0.00078	0.010
after 2minutes	13.56	13.559895	-0.000105	-0.00077	0.010
after 5minutes	13.56	13.559895	-0.000105	-0.00077	0.010
after 10minutes	13.56	13.559895	-0.000105	-0.00077	0.010

Data of Frequency Tolerance

UL Japan, Inc.

Kashima EMC Lab. No.2 Measurement room

Company	Hitachi Industrial Equipment Systems Co.,Ltd.	Regulation	FCC Part15 Subpart C 15.225 (e)
Equipment	RFID Module	Date	March 30, 2015
Model	RR-1356MA1	Temperature	22 deg.C
Serial No.	4K00J80782A40001	Humidity	41 %RH
Power	DC 3.65 - 6V (Typical: DC 5V)	ENGINEER	Kazuhiro Ando
Mode	Transmitting 13.56 MHz		

Voltage Variation: 3.65 V**Temperature Variation: 20deg.C**

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.559931	-0.000069	-0.00051	0.010
after 2minutes	13.56	13.559926	-0.000074	-0.00055	0.010
after 5minutes	13.56	13.559925	-0.000075	-0.00055	0.010
after 10minutes	13.56	13.559925	-0.000075	-0.00055	0.010

Voltage Variation: 6 V**Temperature Variation: 20deg.C**

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.559930	-0.000070	-0.00052	0.010
after 2minutes	13.56	13.559920	-0.000080	-0.00059	0.010
after 5minutes	13.56	13.559920	-0.000080	-0.00059	0.010
after 10minutes	13.56	13.559920	-0.000080	-0.00059	0.010

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

UL Japan, Inc.

Kashima EMC Lab. No.2 Measurement Room

Company: Hitachi Industrial Equipment Systems Co.,Ltd.
Equipment: RFID Module
Model: RR-1356MA1
Sample No.: 4K00J80782A40001
Power: DC 5V
Mode: Transmitting 13.56MHz
: without Tag

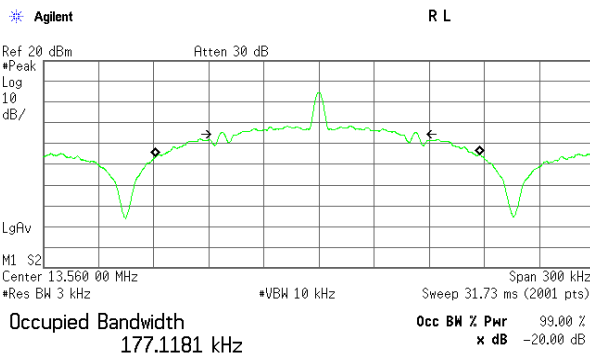
Regulation: FCC Part15 Subpart C 15.215

Date: January 5, 2015

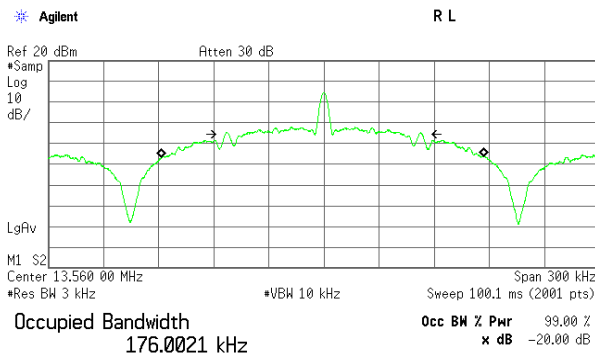
Temperature: 21 deg.C

Humidity: 38 %RH

ENGINEER: Kazuhiro Ando

20dB Bandwidth: 107.871 kHz

Transmit Freq Error -863.844 Hz
x dB Bandwidth 107.871 kHz

99% Occupied Bandwidth: 176.002 kHz

Transmit Freq Error -804.979 Hz
x dB Bandwidth 107.560 kHz*

UL Japan, Inc.**Kashima EMC Lab.**

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Test Report No : 10604958M-A

APPENDIX 2

Test Instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
CLP-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	826532/009	ME	2014/09/05 * 12
CCC-M01	Coaxial Cable	FUJIKURA	3D2W	none	ME	2014/05/10 * 12
CCC-S1-C(3)	Coaxial Cable	FUJIKURA	5D-2W	-	ME	2014/07/22 * 12
CCC-L01	Coaxial Cable	FUJIKURA	5D2W	none	ME	2013/12/05 * 12
CAF-13	Pre-Amplifier	Sonoma Instrument	310N	263020	ME	2013/12/05 * 12
CLS-02	A.M.N.	Rohde & Schwarz	ESH3-Z5	828874/019	CE	2014/07/22 * 12
CLS-03	A.M.N.	Rohde & Schwarz	ESH3-Z5	829567/010	CE	2014/07/22 * 12
CAT10-11	10dB Fixed Atten.	TAMAGAWA	CFA-03	none	CE	2014/07/20 * 12
CCC-S1-C(2/8/9/10)	Coaxial Cable	Fujikura,Fujikura,Fujikura .Fujikura	5D-2W,5D-2W,5D-2W,5D-2W	-	CE	2014/07/22 * 12
CSA-08(D)	Spectrum Analyzer	Hewlett Packard	85662A	2848A17839 Rev 7.4.87	CE/RE/ME	2014/10/07 * 12
CSA-16(R)	Spectrum Analyzer	Hewlett Packard	8568B	2928A04668 Rev 7.4.87	CE/RE/ME	2014/10/07 * 12
CTR-08	Test Receiver	Rohde & Schwarz	ESCS30	834489/018 Ver.2.30	CE/RE/ME	2014/10/02 * 12
CCC-S1-R(1/4/5/CATS-04/6/7/9/10)	Coaxial Cable	Fujikura,Fujikura,Shuner, Agilent,Shuner,Fujikura, Fujikura,Fujikura	12DSFA,12DSFA,S F106A,8494A,SF10 4,5D2W,5D2W,5D2 W	3308A17663(St ep Att)	RE	2014/07/22 * 12
CBL-05	LOGBICON	Schwarzbeck	VULB 9168	128	RE	2014/04/25 * 12
CAF-03	Pre-Amplifier	Hewlett Packard	8447D	2944A08480	RE	2014/07/22 * 12
CAT3-18	3dB Fixed Atten.	JFW	50HF-003 N	none	RE	2014/06/10 * 12
CSCL-17	Ruler	Tajima	L19-55	none	CE/RE/ME	2014/02/03 * 12
COS-01	Temperature & Humidity Indicator	A&D	AD-5681	6877919	CE/RE/ME	2014/07/01 * 12
COTS-CEMI-02	EMI Software	TSJ	TEPTO-DV(RE,CE, MF,PE)	Ver.2.5.0130	CE/RE/ME	-
CSA-07	Spectrum Analyzer	Agilent	E4448A	MY52490024	AT	2014/05/19 * 12
CAT10-17	10dB Fixed Atten.	Weinschel	54A-10	56251	AT	2014/05/23 * 12
CAT20-04	20dB Fixed Atten.	Weinschel	54A-20	41994	AT	2014/05/23 * 12
CCC-W06	Micro Wave Cable	Junkosha	MWX241	MRA-12-14-14 6	AT	2014/05/23 * 12
CCH-04	Temperature and Humidity Chamber	ESPEC	PL-1J	15004059	AT	2014/06/03 * 12
COS-12	Temperature & Humidity Indicator	A&D	AD-5681	6876017	AT	2014/07/01 * 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 ,

ME: Magnetic emission ,

AT: Antenna terminal disturbance voltage

End of Report