



EMI TEST REPORT

Test Report No. : 12651957M-A-R1

Applicant : MIWA LOCK CO., LTD.
Type of Equipment : Contactless Smart Card Reader
Model No. : RDFL-B03H
Test regulation : FCC Part 15 Subpart C: 2018
FCC ID : VBU-RDFLB03H
Test Result : Complied (Refer to Section 3.2)

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 above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
6. The all test items in this test report are conducted by UL Japan, Inc. Kashima EMC Lab.
7. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
8. The information provided from the customer for this report is identified in Section 1.
9. This report is a revised version of 12651957M-A. 12651957M-A is replaced with this report.

Date of test: December 19 – 21, 2018

**Representative
test operator:**

Kazuhiro Ando
Engineer
Consumer Technology Division

Approved by :

Tomoyuki Yamashita
Leader
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.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan
Telephone : +81-478-88-6500
Facsimile : +81-478-82-3373

REVISION HISTORY

Original Test Report No.: 12651957M-A

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SECTION 1: Customer information

Company Name : MIWA LOCK CO., LTD.
Address : 3-1-12, Shiba, Minato-ku, Tokyo 105-8510 JAPAN
Telephone Number : +81-3-4330-3069
Facsimile Number : +81-3-3445-2437
Contact Person : Keiji Iwata

The information provided from the customer is as follows:

- Applicant, Type of Equipment, Model No. on the cover page and other relevant pages
- Section 1: Customer information
- Section 2: Equipment under test (E.U.T.)
- Section 4: Operation of E.U.T. during testing

* The laboratory is exempted from liability of any test results affected from the information in Section 2 and 4.

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

2.1 Identification of E.U.T.

Type of Equipment : Contactless Smart Card Reader
Model No. : RDFL-B03H
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 12.0 V - DC 24.0 V
Receipt Date of Sample : December 19, 2018
(Information from test lab.)
Country of Mass-production : JAPAN
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No Modification by the test lab

2.2 Product Description

Model: RDFL-B03H (referred to as the EUT in this report) is a Contactless Smart Card Reader.

Clock frequency: 12.5 MHz (Crystal), 100 MHz (System), 27.12 MHz (RFID)

The EUT has following similar models:

Model No.	Specifications
RDFL-B03H (EUT)	Available for Mifare Card only
RDFL-B03BLE	Available for Mifare Card and Bluetooth Low Energy (BLE)
RDFL-B03BLES	Available for Mifare Card, Bluetooth Low Energy (BLE) and Infrared Sensor

Information of the BLE(Bluetooth Low Energy) module

FCC ID	Manufacturer
VPYLBZY	Murata Manufacturing Co., Ltd.

Radio Specification

[RFID]

Radio Type : Transceiver
Frequency of Operation : 13.56 MHz
Modulation : ASK
Antenna type : Printed Loop Coil
Operating Temperature : -10 deg. C to +50 deg. C

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Kashima EMC Lab.

1614, Mushiata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on March 12, 2018 and effective April 11, 2018

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.225 Operation within the band 13.110-14.010 MHz.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted emission	ANSI C63.10:2013 6 Standard test methods ----- <IC>RSS-Gen 8.8	Section 15.207 ----- <IC>RSS-Gen 8.8	[QP] 13.9 dB, 27.1200 MHz, N [AV] 5.0 dB, 27.1200 MHz, N	Complied a)	-
Electric Field Strength of Fundamental Emission	ANSI C63.10:2013 6 Standard test methods ----- <IC> RSS-Gen 6.4, 6.12	Section 15.225(a) ----- <IC>RSS-210 B.6	64.3 dB, 13.56000 MHz, QP, 0 deg.	Complied b)	Radiated
Spectrum Mask	ANSI C63.10:2013 6 Standard test methods ----- <IC>RSS-Gen 6.4, 6.13	Section 15.225(b)(c) ----- <IC> RSS-210 B.6	35.7 dB, 13.77127 MHz, QP, 0 deg.	Complied c)	Radiated
20dB Bandwidth	ANSI C63.10:2013 6 Standard test methods ----- <IC> -	Section15.215(c) ----- <IC> -	See data	Complied d)	Radiated
Electric Field Strength of Spurious Emission	ANSI C63.10:2013 6 Standard test methods ----- <IC>RSS-Gen 6.4, 6.13	Section 15.209, Section 15.225 (d) ----- <IC>RSS-210 B.6	13.6 dB 40.68 MHz, Vertical, QP	Complied e)	Radiated
Frequency Tolerance	ANSI C63.10:2013 6 Standard test methods ----- <IC>RSS-Gen 6.11, 8.11	Section 15.225(e) ----- <IC> RSS-210 B.6	See data	Complied f)	Radiated

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422

- a) Refer to Appendix 1 (data of Conducted emission)
- b) Refer to Appendix 1 (data of Fundamental emission and Spectrum Mask)
- c) Refer to Appendix 1 (data of Fundamental emission and Spectrum Mask)
- d) Refer to Appendix 1 (data of 20 dB Bandwidth and 99% Occupied Bandwidth)
- e) Refer to Appendix 1 (data of Spurious emission(Below 30 MHz), Spurious emission (Above 30 MHz))
- f) Refer to Appendix 1 (data of Frequency Tolerance)

Symbols:

Complied	The data of this test item has enough margin, more than the measurement uncertainty.
Complied#	The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

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FCC Part 15.31 (e)

This EUT provides stable voltage 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 6.7	-	Radiated	N/A	N/A	Complied g)

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422

g) Refer to Appendix 1 (data of 20 dB Bandwidth and 99% Occupied Bandwidth)

Symbols:

Complied	The data of this test item has enough margin, more than the measurement uncertainty.
Complied#	The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

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

3.4 Uncertainty

EMI

There is no applicable rule of uncertainty in this applied standard. Therefore, the following results are derived depending on whether or not laboratory uncertainty is applied.

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

Conducted emission

Frequency range	Required Uncertainty (+/-)	Uncertainty (+/-)
0.15 MHz to 30 MHz	3.4 dB	3.2dB

Radiated emission

Measurement distance	Frequency range	Required Uncertainty (+/-)	Uncertainty (+/-)
3 m	9 kHz to 30 MHz	Not Defined	3.0 dB
	30 MHz to 200 MHz	6.3 dB	5.2 dB
	200 MHz to 1000 MHz		6.2 dB
	1 GHz to 6 GHz	5.2 dB	4.7 dB
	6 GHz to 18 GHz	5.5 dB	5.1 dB
	18 GHz to 40 GHz	Not Defined	5.4 dB
1 m	1 GHz to 18 GHz	Not Defined	5.2 dB
	18 GHz to 40 GHz		5.5 dB

Antenna Terminal test

Test Item	Required Uncertainty (+/-)	Uncertainty (+/-)
Frequency Tolerance	1.0×10^{-7}	7.9×10^{-8}
20 dB Bandwidth / 99 % Occupied Bandwidth	Not Defined	1.6 %

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1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

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3.5 Test Location

UL Japan, Inc. Kashima EMC Lab.

1614 Mushihata, Katori-shi, Chiba-ken, 289-0341 JAPAN

Telephone: +81 478 88 6500, Facsimile: +81 478 82 3373

JAB Accreditation No.:RTL02610 / FCC Test Firm Registration Number: 910230

Test site	ISED Assigned Code	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Open site	4659A-1	6.0 x 5.5 x 2.5	20 x 40	10 m
No.5 Open site	4659A-5	8.6 x 7.1 x 2.4	18 x 23	10 m
No.1 Shielded room	4659A-1	5.4 x 4.5 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	4659A-5	4.2 x 3.1 x 2.5	-	-
No.3 Fully Anechoic Chamber	-	7.0 x 3.5 x 3.5	-	-
No.6 Semi-anechoic Chamber	4659A-6	8.5 x 5.5 x 5.2	-	3 m
No.10 Semi-anechoic Chamber	4659A-10	18.4 x 9.9 x 7.7	-	10 m
No.11 Semi-anechoic Chamber	4659A-7	9.0 x 6.5 x 5.2	-	3 m
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 Measurement room	-	4.5 x 5.3 x 2.7	-	-

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

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

4.1 Operating Mode(s)

The mode is used :

Mode	Remarks
Transmitting mode (Tx 13.56MHz) - Mifare	With Tag Without Tag Antenna Terminated
The EUT was operated in a manner similar to typical use during the tests. The EUT has the power settings by the software as follows; Power settings: Fixed Software: Ver.A004-A109-A221	

Test Item	Operating mode*
Conducted emission	Tx Mod on,with Tag / without Tag
Electric Field Strength of Fundamental Emission	Tx Mod on,with Tag / without Tag
Spectrum Mask	Tx Mod on,with Tag / without Tag
20 dB Bandwidth / 99 % Occupied Bandwidth	Tx Mod on,with Tag / without Tag
Electric Field Strength of Spurious Emission	Tx Mod on,with Tag / without Tag
Frequency Tolerance	Tx Mod on, without Tag

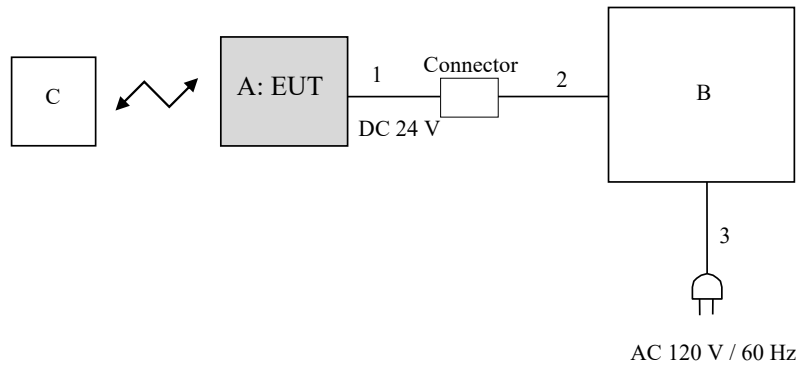
Justification: The system was configured in typical fashion (as a user would normally use it) for testing.

Frequency Tolerance:

Temperature : -20 deg. C to +50 deg. C Step 10 deg. C
Voltage : Normal Voltage AC 120 V
Maximum Voltage AC 138 V,
Minimum Voltage AC 102 V (AC 120 V \pm 15 %)

*This EUT provides stable voltage constantly to RF Part regardless of input voltage
The EUT is provided a power supply connected to a controller.
Therefore the test was performed by AC power supply of a controller.

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	Contactless Smart Card Reader	RDFL-B03H	No.4 *2) No.6 *1)	COWBELL ENGINEERING CO., LTD.	EUT
B	Entrance/ Elevator/ Access Controller	CMHL-404	T1214	MIWA LOCK CO., LTD.	-
C	Tag (Type A)	-	MICSHG001	MIWA LOCK CO., LTD.	-

*1) For Conducted Emission test (Antenna Terminated)

*2) For all tests except for *1)

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC & Signal	0.1	Unshielded	Unshielded	-
2	DC & Signal	4.8	Unshielded	Unshielded	-
3	AC	1.7	Unshielded	Unshielded	-

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Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.

The rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80 cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (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 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber.

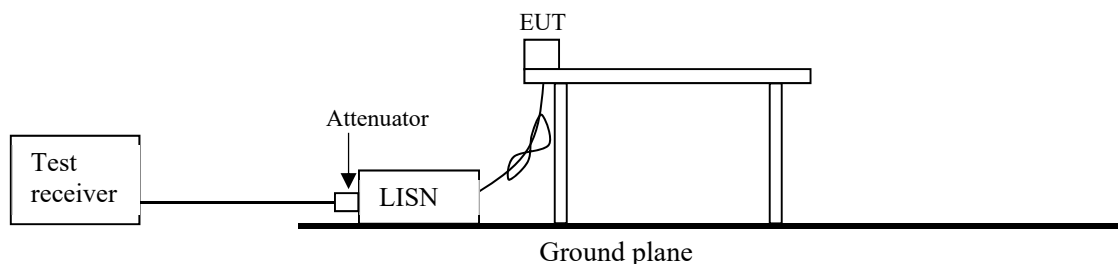
The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

Detector	: QP and CISPR AV
Measurement range	: 0.15 MHz - 30 MHz
Test data	: APPENDIX 1
Test result	: Pass

Figure 1. Connection and configuration of test equipment



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

Test Procedure

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

Frequency: From 9 kHz to 30 MHz

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for vertical polarization (antenna angle: 0 deg., 45 deg., 90 deg., and 135 deg.) and horizontal polarization.

*Refer to Figure 2 about Direction of the Loop Antenna.

Frequency: From 30 MHz to 1 GHz

The measuring antenna height varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for both vertical and horizontal antenna polarization.

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

Frequency	Below 30 MHz	30 MHz to 1 GHz
Antenna Type	Loop	Hybrid

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

*1) Distance Factor: $40 \times \log(3 \text{ m} / 300 \text{ m}) = -80 \text{ dB}$

*2) Distance Factor: $40 \times \log(3 \text{ m} / 30 \text{ m}) = -40 \text{ dB}$

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

These tests were performed in semi anechoic chamber. Therefore the measured level of emissions may be higher than if measurements were made without a ground plane.

However test results were confirmed to pass against standard limit.

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

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

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

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Kashima EMC Lab.

1614, Mushiata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Figure 2. Direction of the Loop Antenna

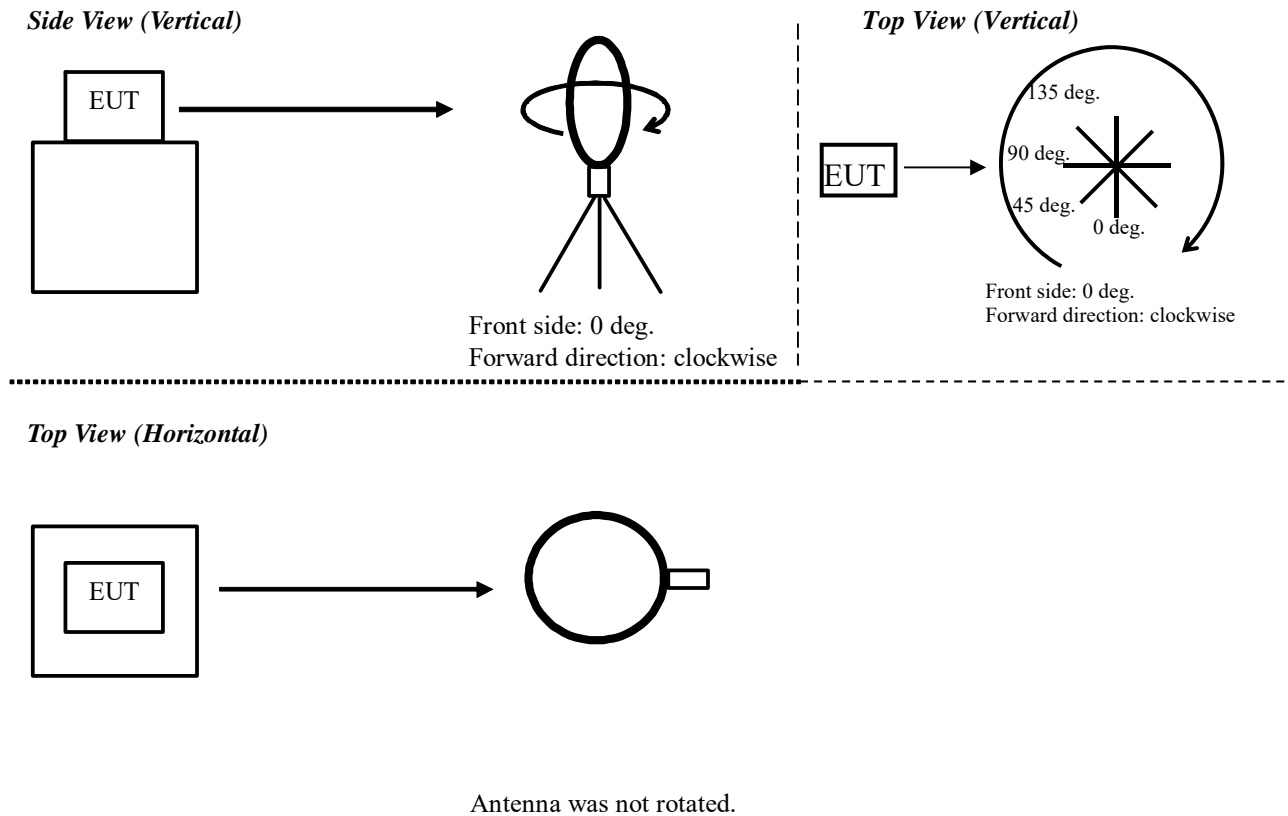


Figure 3. Antenna angle

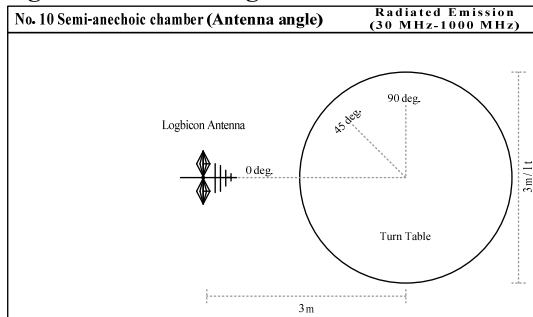
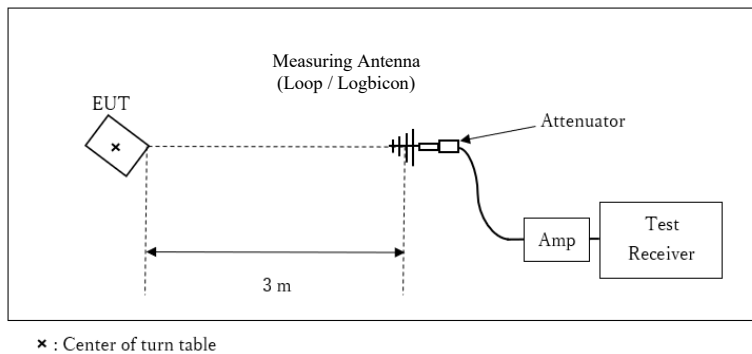


Figure 4. Connection and configuration of test equipment



SECTION 7: Other test

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth	2 MHz	3 kHz	10 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak *1)	Max Hold *1)	Spectrum Analyzer
Frequency Tolerance *2)	-	-	-	-	-	-	Spectrum Analyzer *3)

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

Peak hold was applied as Worst-case measurement.

*2) 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.

*3) The measurement was performed with Marker Frequency Counter Function.

Test data : APPENDIX 1

Test result : Pass

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Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

APPENDIX 1: Test data

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

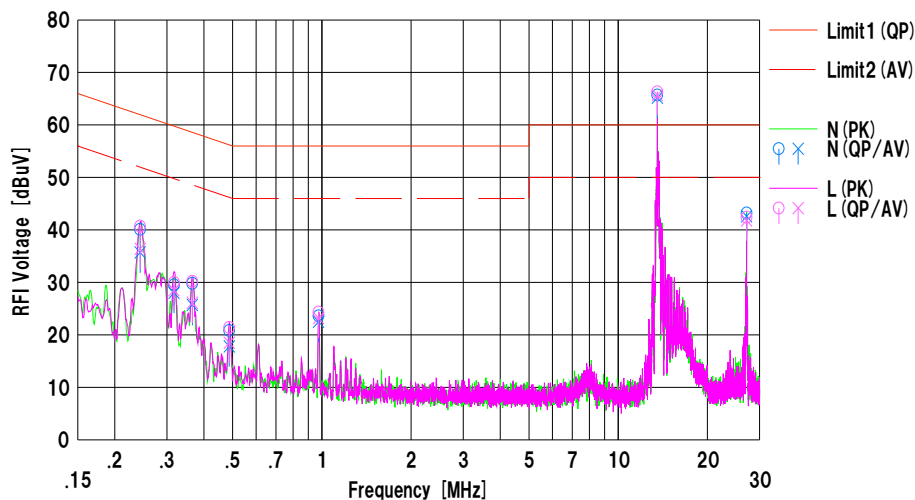
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2018/12/20

Mode : Transmitting 13.56 MHz
Order No. : 12651957M
Power : AC 120V / 60Hz
Temp./Humi. : 20deg.C. / 40%RH

Remarks : Without Tag

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	0.24369	29.6	25.2	10.5	40.1	35.7	62.0	52.0	21.9	16.3	N	
2	0.31704	19.0	17.5	10.5	29.5	28.0	59.8	49.8	30.3	21.8	N	
3	0.36566	19.3	15.2	10.5	29.8	25.7	58.6	48.6	28.8	22.9	N	
4	0.48689	10.3	7.3	10.5	20.8	17.8	56.2	46.2	35.4	28.4	N	
5	0.97503	13.0	11.9	10.6	23.6	22.5	56.0	46.0	32.4	23.5	N	
6	13.56000	54.2	53.7	11.5	65.7	65.2	60.0	50.0	-5.7	-15.2	N	Carrier
7	27.12000	31.2	30.6	12.0	43.2	42.6	60.0	50.0	16.8	7.4	N	
8	0.24369	30.2	25.9	10.5	40.7	36.4	62.0	52.0	21.3	15.6	L	
9	0.31704	19.5	18.0	10.5	30.0	28.5	59.8	49.8	29.8	21.3	L	
10	0.36566	19.7	15.6	10.5	30.2	26.1	58.6	48.6	28.4	22.5	L	
11	0.48689	10.9	8.0	10.5	21.4	18.5	56.2	46.2	34.8	27.7	L	
12	0.97503	13.7	12.6	10.6	24.3	23.2	56.0	46.0	31.7	22.8	L	
13	13.56000	54.8	54.2	11.5	66.3	65.7	60.0	50.0	-6.3	-15.7	L	Carrier
14	27.12000	30.4	29.8	12.0	42.4	41.8	60.0	50.0	17.6	8.2	L	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (AMN+ATT+Cable) [dB]
AMN:CLS-07 (143501)

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

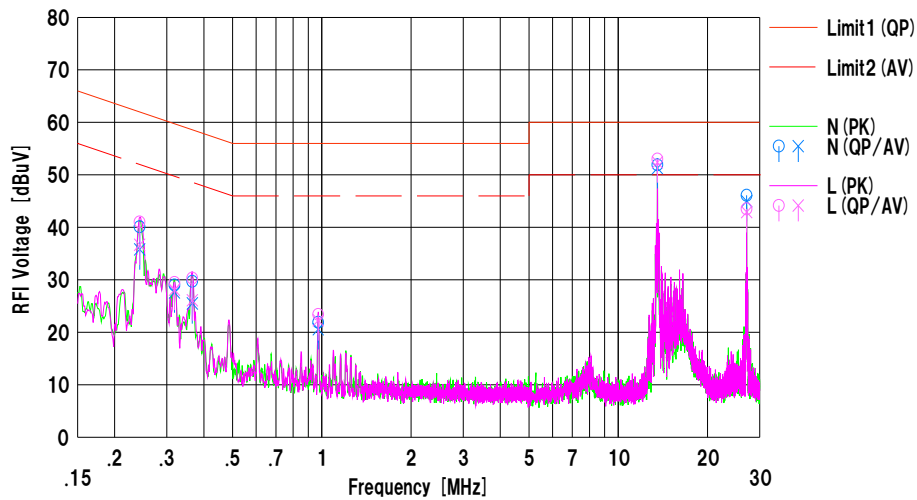
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2018/12/20

Mode : Transmitting 13.56 MHz
Order No. : 12651957M
Power : AC 120V / 60Hz
Temp./Humi. : 20deg.C. / 40%RH

Remarks : With Tag

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	0.24304	29.6	25.3	10.5	40.1	35.8	62.0	52.0	21.9	16.2	N	
2	0.31850	18.5	17.1	10.5	29.0	27.6	59.7	49.7	30.7	22.1	N	
3	0.36566	19.2	15.0	10.5	29.7	25.5	58.6	48.6	28.9	23.1	N	
4	0.97248	11.3	10.0	10.6	21.9	20.6	56.0	46.0	34.1	25.4	N	
5	13.56000	40.4	39.8	11.5	51.9	51.3	60.0	50.0	8.1	-1.3	N	Carrier
6	27.12000	34.1	33.0	12.0	46.1	45.0	60.0	50.0	13.9	5.0	N	
7	0.24304	30.5	26.2	10.5	41.0	36.7	62.0	52.0	21.0	15.3	L	
8	0.31850	19.0	17.6	10.5	29.5	28.1	59.7	49.7	30.2	21.6	L	
9	0.36566	19.8	15.6	10.5	30.3	26.1	58.6	48.6	28.3	22.5	L	
10	0.97248	12.8	11.7	10.6	23.4	22.3	56.0	46.0	32.6	23.7	L	
11	13.56000	41.5	40.9	11.5	53.0	52.4	60.0	50.0	7.0	-2.4	L	Carrier
12	27.12000	31.5	30.9	12.0	43.5	42.9	60.0	50.0	16.5	7.1	L	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (AMN+ATT+Cable) [dB]
AMN:CLS-07 (143501)

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

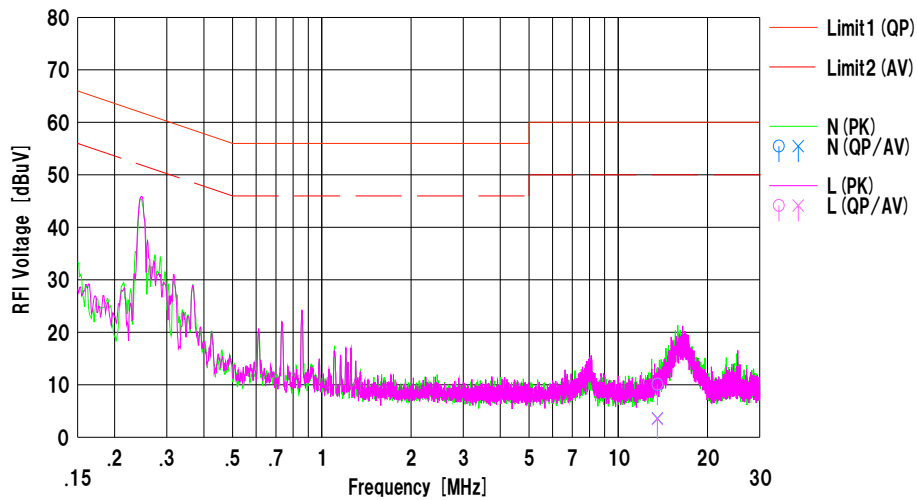
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2018/12/20

Mode : Transmitting 13.56 MHz
Order No. : 12651957M
Power : AC 120V / 60Hz
Temp./Humi. : 20deg.C. / 40%RH

Remarks : Antenna Terminated

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	13.56000	-1.5	-7.9	11.5	10.0	3.6	60.0	50.0	50.0	46.4	N	
2	13.56000	-1.4	-8.0	11.5	10.1	3.5	60.0	50.0	49.9	46.5	L	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (AMN+ATT+Cable) [dB]
AMN:CLS-07 (143501)

Fundamental emission and Spectrum Mask

DATA OF RADIATED EMISSION (below 30MHz) TEST

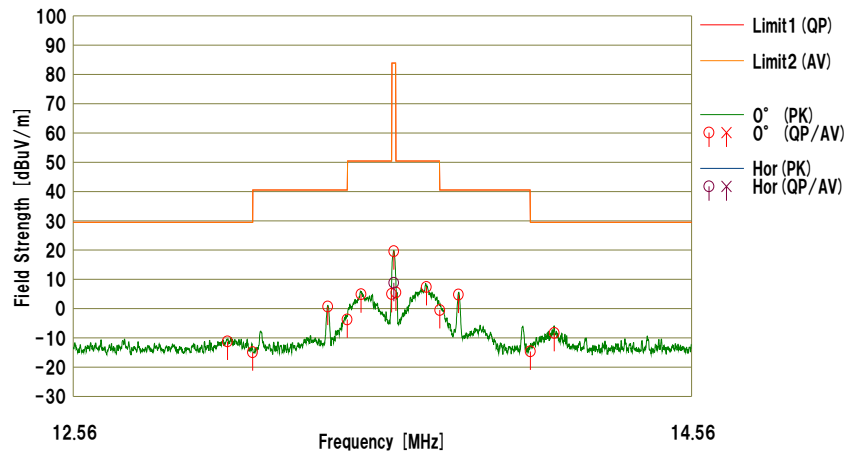
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2018/12/20

Mode : Transmitting 13.56 MHz
Order No. : 12651957M
Power : AC 120V / 60Hz
Temp./Humi. : 20deg.C. / 40%RH

Remarks : Without Tag, EUT-Y-axis

Limit1 : FCC15.225_PKQP, 9-90kHz:PK, 110-490kHz:PK
Limit2 : FCC15.225_AVQP, 9-90kHz:AV, 110-490kHz:AV

Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading		Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result		Limit		Margin		Antenna [deg]	Table	Comment
		<QP> [dBuV]	<AV> [dBuV]				<QP> [dBuV/m]	<AV> [dBuV/m]	<QP> [dBuV/m]	<AV> [dBuV/m]	<QP> [dB]	<AV> [dB]			
1	13.03162	27.0	---	19.0	-33.0	24.2	-11.2	---	29.5	29.5	40.7	---	0°	0	
2	13.11000	23.3	---	19.0	-33.0	24.2	-14.9	---	29.5	29.5	44.4	---	0°	0	
3	13.34782	38.9	---	19.0	-33.0	24.2	0.7	---	40.5	40.5	39.8	---	0°	0	
4	13.41000	34.5	---	19.0	-33.0	24.2	-3.7	---	40.5	40.5	44.2	---	0°	0	
5	13.45481	43.1	---	19.0	-33.0	24.2	4.9	---	50.4	50.4	45.5	---	0°	0	
6	13.55300	43.2	---	19.0	-33.0	24.2	5.0	---	50.4	50.4	45.4	---	0°	0	
7	13.56000	57.8	---	19.0	-33.0	24.2	19.5	---	83.9	83.9	64.3	---	0°	0	
8	13.56700	43.7	---	19.0	-33.0	24.2	5.5	---	50.4	50.4	44.9	---	0°	0	
9	13.66615	45.6	---	19.0	-33.0	24.2	7.4	---	50.4	50.4	43.0	---	0°	0	
10	13.71000	37.7	---	19.0	-33.0	24.2	-0.5	---	40.5	40.5	41.0	---	0°	0	
11	13.77127	43.0	---	19.0	-33.0	24.2	4.8	---	40.5	40.5	35.7	---	0°	0	
12	14.01000	23.6	---	19.0	-33.0	24.2	-14.6	---	29.5	29.5	44.1	---	0°	0	
13	14.09001	29.9	---	19.0	-33.0	24.2	-8.3	---	29.5	29.5	37.8	---	0°	0	
14	13.56000	47.0	---	19.0	-33.0	24.2	8.8	---	83.9	83.9	75.1	---	Hor	0	

Calculation: Result [dBuV/m] = Reading [dBuV] + Ant.Fac [dB/m] + Loss (Cable+Att+D.Fac) [dB] - Gain (AMP) [dB]
Ant.Type=LOOP: Loop Antenna

Result of the fundamental emission at 3 m without Distance factor

QP

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	13.56000	QP	57.8	19.0	7.0	24.2	-	59.6	-	-	Fundamental

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

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Fundamental emission and Spectrum Mask

DATA OF RADIATED EMISSION (below 30MHz) TEST

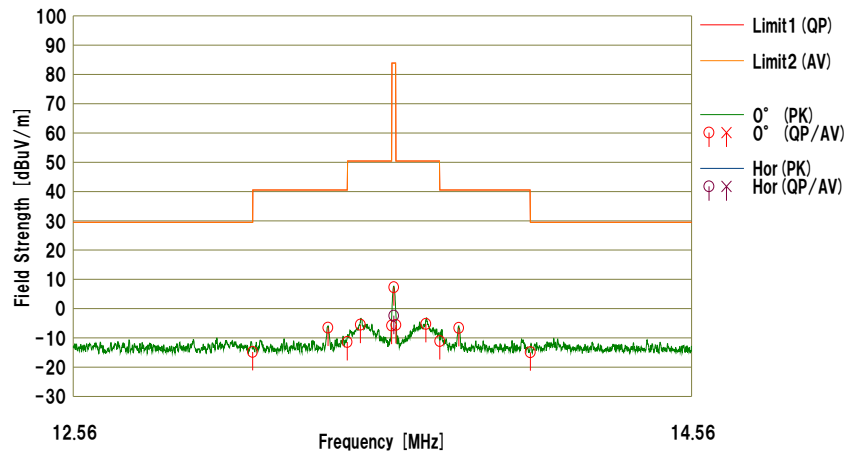
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2018/12/20

Mode : Transmitting 13.56 MHz
Order No. : 12651957M
Power : AC 120V / 60Hz
Temp./Humi. : 20deg.C. / 40%RH

Remarks : With Tag, EUT-Y-axis

Limit1 : FCC15.225_PKQP, 9-90kHz:PK, 110-490kHz:PK
Limit2 : FCC15.225_AVQP, 9-90kHz:AV, 110-490kHz:AV

Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading		Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result		Limit		Margin		Antenna [deg]	Table	Comment
		<QP> [dBuV]	<AV> [dBuV]				<QP> [dBuV/m]	<AV> [dBuV/m]	<QP> [dBuV/m]	<AV> [dBuV/m]	<QP> [dB]	<AV> [dB]			
1	13.11000	23.4	---	19.0	-33.0	24.2	-14.8	---	29.5	29.5	44.3	---	0°	171	
2	13.34843	31.7	---	19.0	-33.0	24.2	-6.5	---	40.5	40.5	47.0	---	0°	171	
3	13.41000	26.8	---	19.0	-33.0	24.2	-11.4	---	40.5	40.5	51.9	---	0°	171	
4	13.45244	32.7	---	19.0	-33.0	24.2	-5.5	---	50.4	50.4	55.9	---	0°	171	
5	13.55300	32.4	---	19.0	-33.0	24.2	-5.8	---	50.4	50.4	56.2	---	0°	171	
6	13.56000	45.5	---	19.0	-33.0	24.2	7.3	---	83.9	83.9	76.6	---	0°	171	
7	13.56700	32.6	---	19.0	-33.0	24.2	-5.6	---	50.4	50.4	56.0	---	0°	171	
8	13.66467	33.0	---	19.0	-33.0	24.2	-5.2	---	50.4	50.4	55.6	---	0°	171	
9	13.71000	27.1	---	19.0	-33.0	24.2	-11.1	---	40.5	40.5	51.6	---	0°	171	
10	13.77238	31.6	---	19.0	-33.0	24.2	-6.6	---	40.5	40.5	47.1	---	0°	171	
11	14.01000	23.3	---	19.0	-33.0	24.2	-14.9	---	29.5	29.5	44.4	---	0°	171	
12	13.56000	35.8	---	19.0	-33.0	24.2	-2.4	---	83.9	83.9	86.3	---	Hor	0	

Calculation: Result [dBuV/m] = Reading [dBuV] + Ant.Fac [dB/m] + Loss (Cable+Att+D.Fac) [dB] - Gain (AMP) [dB]
Ant.Type=LOOP:Loop Antenna

Result of the fundamental emission at 3 m without Distance factor

QP

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	13.56000	QP	45.5	19.0	7.0	24.2	-	47.3	-	-	Fundamental

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

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

Spurious emission (Below 30 MHz)

DATA OF RADIATED EMISSION (below 30MHz) TEST

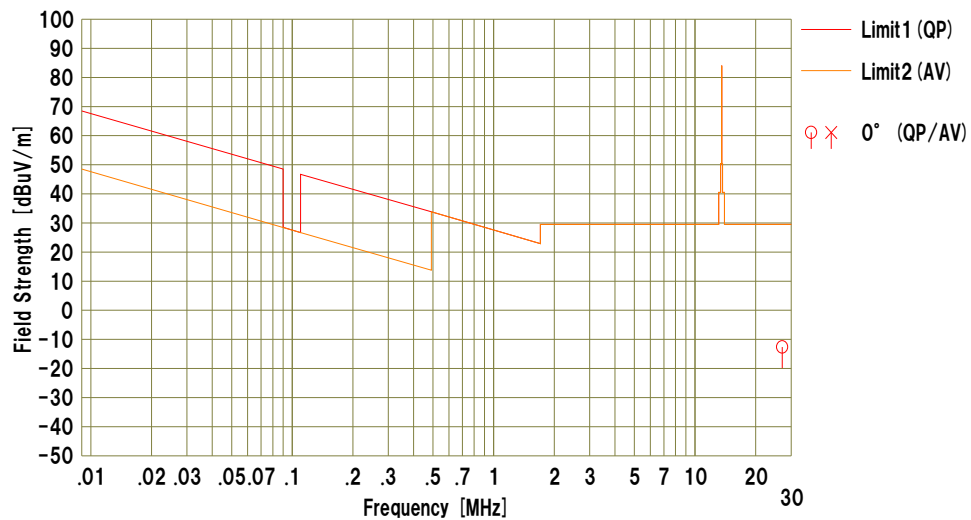
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2018/12/20

Mode : Transmitting 13.56 MHz
Order No. : 12651957M
Power : AC 120V / 60Hz
Temp./Humi. : 20deg.C. / 40%RH

Remarks : Without Tag, EUT:Y-axis

Limit1 : FCC15_225_PKQP, 9-90kHz:PK, 110-490kHz:PK
Limit2 : FCC15_225_AVQP, 9-90kHz:AV, 110-490kHz:AV

Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading		Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result		Limit		Margin		Antenna	Table	Comment
		<QP> [dBuV]	<AV> [dBuV]				<QP> [dBuV/m]	<AV> [dBuV/m]	<QP> [dBuV/m]	<AV> [dBuV/m]	<QP> [dB]	<AV> [dB]			
1	27.12000	24.5	---	19.8	-32.5	24.4	-12.6	---	29.5	29.5	42.1	---	0°	263	

Calculation:Result [dBuV/m] = Reading [dBuV] + Ant.Fac [dB/m] + Loss (Cable+Att+D.Fac) [dB] - Gain (AMP) [dB]
Ant.Type=LOOP:Loop Antenna

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Spurious emission (Below 30 MHz)

DATA OF RADIATED EMISSION (below 30MHz) TEST

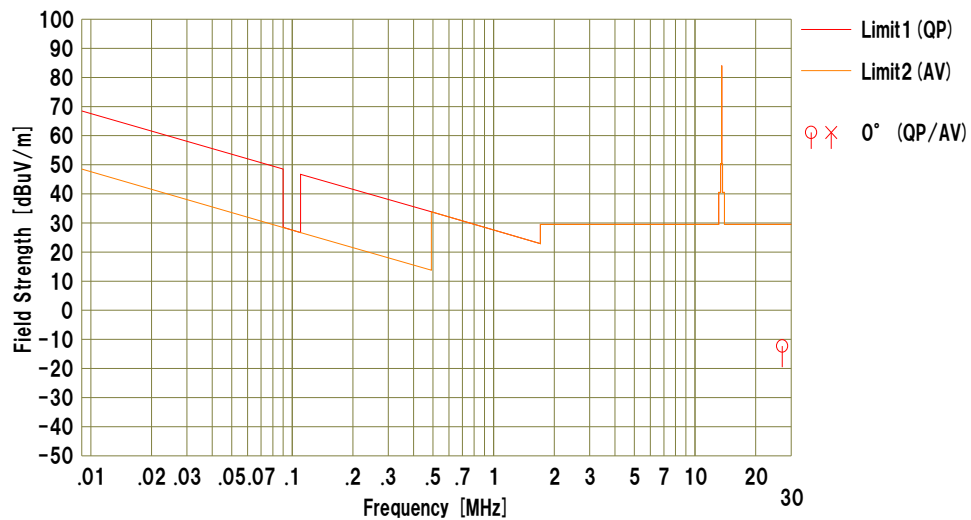
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2018/12/20

Mode : Transmitting 13.56 MHz
Order No. : 12651957M
Power : AC 120V / 60Hz
Temp./Humi. : 20deg.C. / 40%RH

Remarks : With Tag, EUT:Y-axis

Limit1 : FCC15_225_PKQP, 9-90kHz:PK, 110-490kHz:PK
Limit2 : FCC15_225_AVQP, 9-90kHz:AV, 110-490kHz:AV

Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading		Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result		Limit		Margin		Antenna	Table	Comment
		<QP> [dBuV]	<AV> [dBuV]				<QP> [dBuV/m]	<AV> [dBuV/m]	<QP> [dBuV/m]	<AV> [dBuV/m]	<QP> [dB]	<AV> [dB]			
1	27.12000	24.8	---	19.8	-32.5	24.4	-12.3	---	29.5	29.5	41.8	---	0°	239	

Calculation:Result [dBuV/m] = Reading [dBuV] + Ant.Fac [dB/m] + Loss (Cable+Att+D.Fac) [dB] - Gain (AMP) [dB]
Ant.Type=LOOP:Loop Antenna

Spurious emission (Above 30 MHz)

DATA OF RADIATED EMISSION TEST

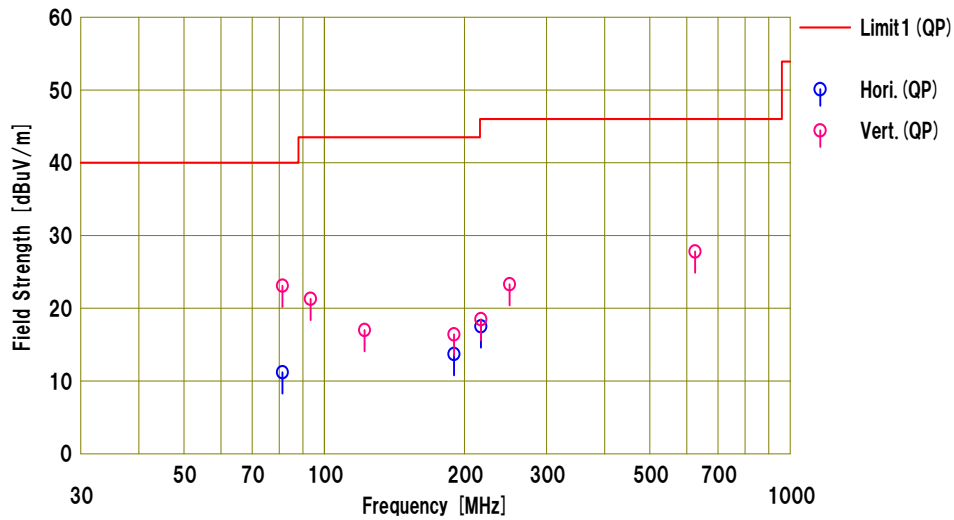
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2018/12/19

Mode : Transmitting 13.56 MHz
Order No. : 12651957M
Power : AC 120V / 60Hz
Temp./Humi. : 23deg.C. / 40%RH

Remarks : Without Tag, EUT:Y-axis

Limit1 : FCC15.209 3m, below 1GHz:QP, above 1GHz:AV

Tested by : Kazuhiro Ando



No.	Freq.	Reading	Ant.Fac	Loss	Gain	Result	Limit	Margin	Pola.	Height	Angle	Ant. Type	Comment
	[MHz]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[H/V]	[cm]	[deg]		
1	81.360	24.3	8.7	5.0	26.8	11.2	40.0	28.8	Hori.	269	232	HB	
2	189.840	23.0	10.7	6.3	26.3	13.7	43.5	29.8	Hori.	200	246	HB	
3	216.960	27.3	9.8	6.6	26.2	17.5	46.0	28.5	Hori.	165	210	HB	
4	81.360	36.2	8.7	5.0	26.8	23.1	40.0	16.9	Vert.	100	332	HB	
5	93.463	34.6	8.2	5.2	26.7	21.3	43.5	22.2	Vert.	108	350	HB	
6	122.040	26.4	11.6	5.6	26.6	17.0	43.5	26.5	Vert.	100	341	HB	
7	189.840	25.7	10.7	6.3	26.3	16.4	43.5	27.1	Vert.	100	209	HB	
8	216.960	28.3	9.8	6.6	26.2	18.5	46.0	27.5	Vert.	100	188	HB	
9	250.000	30.6	11.8	7.0	26.1	23.3	46.0	22.7	Vert.	100	176	HB	
10	625.000	25.3	20.4	9.7	27.6	27.8	46.0	18.2	Vert.	100	64	HB	

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

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

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Spurious emission (Above 30 MHz)

DATA OF RADIATED EMISSION TEST

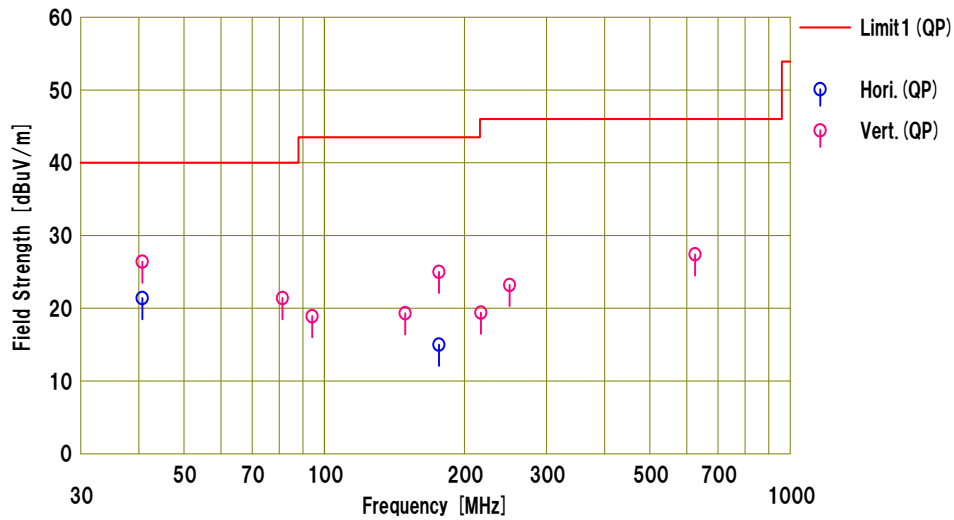
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2018/12/20

Mode : Transmitting 13.56 MHz
Order No. : 12651957M
Power : AC 120V / 60Hz
Temp./Humi. : 23deg.C. / 40%RH

Remarks : With Tag, EUT:Y-axis

Limit1 : FCC15.209 3m, below 1GHz:QP, above 1GHz:AV

Tested by : Kazuhiro Ando



No.	Freq.	Reading	Ant.Fac	Loss	Gain	Result	Limit	Margin	Pola.	Height	Angle	Ant.	Comment
	[MHz]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[H/V]	[cm]	[deg]	Type	
1	40.680	30.6	13.3	4.4	26.9	21.4	40.0	18.6	Hori.	267	172	HB	
2	176.280	22.8	12.4	6.2	26.4	15.0	43.5	28.5	Hori.	271	0	HB	
3	40.680	35.6	13.3	4.4	26.9	26.4	40.0	13.6	Vert.	100	95	HB	
4	81.360	34.5	8.7	5.0	26.8	21.4	40.0	18.6	Vert.	100	348	HB	
5	94.202	32.2	8.2	5.2	26.7	18.9	43.5	24.6	Vert.	132	299	HB	
6	149.160	26.5	13.4	5.9	26.5	19.3	43.5	24.2	Vert.	100	272	HB	
7	176.280	32.8	12.4	6.2	26.4	25.0	43.5	18.5	Vert.	100	270	HB	
8	216.960	29.2	9.8	6.6	26.2	19.4	46.0	26.6	Vert.	100	201	HB	
9	250.000	30.5	11.8	7.0	26.1	23.2	46.0	22.8	Vert.	100	169	HB	
10	625.000	24.9	20.4	9.7	27.6	27.4	46.0	18.6	Vert.	100	63	HB	

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

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

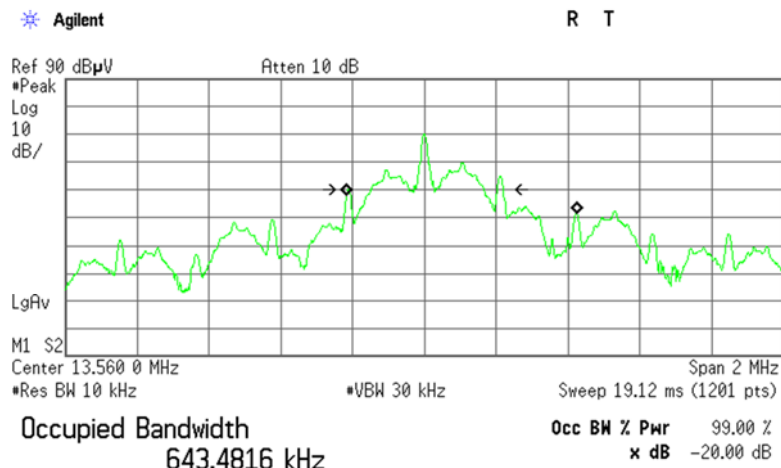
Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373

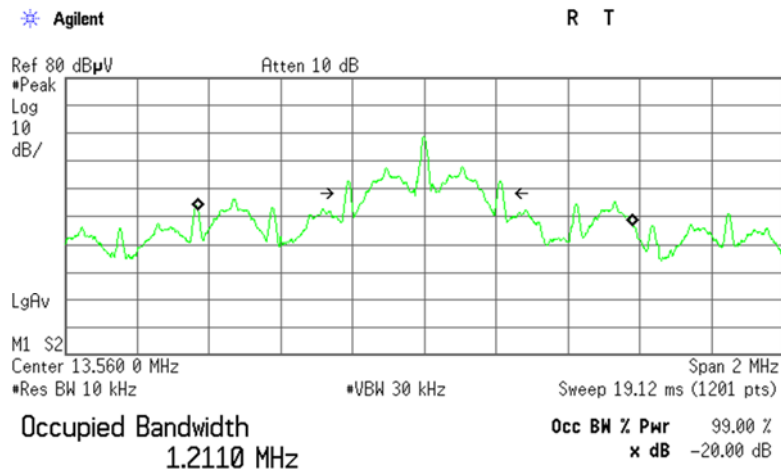
20dB Bandwidth and 99% Occupied Bandwidth

Report No. 12651957M-A-R1
Test place Kashima EMC Lab. No.2 Measurement room
Date December 21, 2018
Temperature / Humidity 21 deg. C / 38 % RH
Engineer Kazuhiro Ando
Mode Transmitting 13.56MHz

FREQ [MHz]	Mode	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	Without Tag	434.15	643.48
	With Tag	439.10	1211.00



Transmit Freq Error 104.590 kHz
x dB Bandwidth 434.148 kHz



Transmit Freq Error -24.935 kHz
x dB Bandwidth 439.095 kHz

Frequency Tolerance

Report No. 12651957M-A-R1
Test place Kashima EMC Lab. No.2 Measurement room
Date December 21, 2018
Temperature / Humidity 21 deg. C / 38 % RH
Engineer Kazuhiro Ando
Mode Transmitting 13.56MHz

Test condition Temp. [deg. C]	Voltage [V]	Tested timing	Measured frequency [MHz]	Frequency error [MHz]	Result		Limit [+/- %]
					[%]	[ppm]	
50	120	Power on	13.560055	0.000055	0.00041	4.1	0.01
		+ 2 min.	13.560055	0.000055	0.00041	4.1	0.01
		+ 5 min.	13.560055	0.000055	0.00041	4.1	0.01
		+ 10 min.	13.560056	0.000056	0.00041	4.1	0.01
40	120	Power on	13.560067	0.000067	0.00049	4.9	0.01
		+ 2 min.	13.560063	0.000063	0.00046	4.6	0.01
		+ 5 min.	13.560061	0.000061	0.00045	4.5	0.01
		+ 10 min.	13.560059	0.000059	0.00044	4.4	0.01
30	120	Power on	13.560090	0.000090	0.00066	6.6	0.01
		+ 2 min.	13.560083	0.000083	0.00061	6.1	0.01
		+ 5 min.	13.560079	0.000079	0.00058	5.8	0.01
		+ 10 min.	13.560076	0.000076	0.00056	5.6	0.01
20	120	Power on	13.560114	0.000114	0.00084	8.4	0.01
		+ 2 min.	13.560108	0.000108	0.00080	8.0	0.01
		+ 5 min.	13.560104	0.000104	0.00077	7.7	0.01
		+ 10 min.	13.560100	0.000100	0.00074	7.4	0.01
20	102 (120V -15%)	Power on	13.560116	0.000116	0.00086	8.6	0.01
		+ 2 min.	13.560108	0.000108	0.00080	8.0	0.01
		+ 5 min.	13.560104	0.000104	0.00077	7.7	0.01
		+ 10 min.	13.560100	0.000100	0.00074	7.4	0.01
20	138 (120V +15%)	Power on	13.560115	0.000115	0.00085	8.5	0.01
		+ 2 min.	13.560107	0.000107	0.00079	7.9	0.01
		+ 5 min.	13.560103	0.000103	0.00076	7.6	0.01
		+ 10 min.	13.560099	0.000099	0.00073	7.3	0.01
10	120	Power on	13.560133	0.000133	0.00098	9.8	0.01
		+ 2 min.	13.560129	0.000129	0.00095	9.5	0.01
		+ 5 min.	13.560126	0.000126	0.00093	9.3	0.01
		+ 10 min.	13.560123	0.000123	0.00091	9.1	0.01
0	120	Power on	13.560138	0.000138	0.00102	10.2	0.01
		+ 2 min.	13.560138	0.000138	0.00102	10.2	0.01
		+ 5 min.	13.560138	0.000138	0.00102	10.2	0.01
		+ 10 min.	13.560137	0.000137	0.00101	10.1	0.01
-10	120	Power on	13.560138	0.000138	0.00102	10.2	0.01
		+ 2 min.	13.560138	0.000138	0.00102	10.2	0.01
		+ 5 min.	13.560138	0.000138	0.00102	10.2	0.01
		+ 10 min.	13.560137	0.000137	0.00101	10.1	0.01
-20	120	Power on	13.560121	0.000121	0.00089	8.9	0.01
		+ 2 min.	13.560128	0.000128	0.00094	9.4	0.01
		+ 5 min.	13.560132	0.000132	0.00097	9.7	0.01
		+ 10 min.	13.560134	0.000134	0.00099	9.9	0.01

Calculation formula: Frequency error = Measured frequency - Tested frequency
Result [%] = Frequency error / Tested frequency * 100

Tested frequency: 13.56 MHz
Limit (+/-): 0.01 % (+/- 100ppm)

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

APPENDIX 2: Test instruments

Test Instruments

Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
CE	143501	A.M.N.	Rohde & Schwarz	ESH3-Z5	844982/034	2018/07/19	2019/07/31	12
CE/RE	144199	Test Receiver	AGILENT	N9038A	MY53290016	2018/07/10	2019/07/31	12
CE/RE	143157	Coaxial Cable	FUJIKURA,FUJIKURA, FUJIKURA,FUJIKURA, FUJIKURA	5D-2W,5D-2W,5D- 2W,5D-2W,5D-2W,	-	2018/08/30	2019/08/31	12
RE	171927	Pre Amplifier	UL Japan Inc.	CALI-84+	1	2018/07/25	2019/07/31	12
RE	143121	LOGBICON	Schwarzbeck	VULB 9168	343	2018/04/05	2019/04/30	12
RE	143050	3dB Fixed Atten.	TAMAGAWA	UFA-01	none	2018/09/12	2019/09/30	12
RE	143165	Coaxial Cable	Fujikura,Fujikura,Agilent, Fujikura,Fujikura,Fujikura, Fuhjikura,Fujikura,Fujikura	5D-2W,5D- 2W,8494A,5D- 2W,5D-2W,5D-2	MY41110200(Step Att)	2018/08/29	2019/08/30	12
RE	142930	Pre-Amplifier	HEWLETT PACKARD	8447D	2944A09041	2018/08/30	2019/08/31	12
EMI	143654	Ruler	TAJIMA	L19-55	-	-	-	-
EMI	143542	Temperature & Humidity Indicator	HIOKI	3641/9680-50	090999895/0909054 06	2018/05/30	2019/05/31	12
EMI	144216	Digital Multimeter	Fluke Corporation	115	994460954	2018/10/09	2019/10/31	12
EMI	142901	EMI Software	TSJ	TEPTO- DV(RE,CE,MF,PE)	Ver.3.3	-	-	-
RE	143833	Loop Antenna	Rohde & Schwarz	HFH2-Z2	827779/008	2018/10/10	2019/10/31	12
RE	143161	Coaxial Cable	FUJIKURA	3D2W	None	2018/05/25	2019/05/31	12
RE	144245	6dB Fixed Atten.	Suhner	6906.01.A	None	2018/07/04	2019/07/31	12
FT	143181	Temperature and Humidity Chamber	ESPEC	PL-1J	15004059	2018/07/09	2019/07/31	12
FT	143643	Spectrum Analyzer	AGILENT	E4448A	MY52490024	2018/05/23	2019/05/31	12
FT	144220	Digital Multimeter	Fluke Corporation	87-3	85220051	2018/10/01	2019/10/31	12
FT	143537	Temperature & Humidity Indicator	A&D	AD-5681	6975761	2018/07/18	2019/07/31	12
FT	143942	Near Field Probe	Langer	LF-R400	02-0815	-	-	-

The expiration date of the calibration is the end of the expired month.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

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

Test item:

CE: Conducted Emission

RE: Radiated Emission

FT: Frequency Tolerance

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushiata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81 478 88 6500

Facsimile : +81 478 82 3373