



RADIO TEST REPORT

Test Report No. : 11984035M-A-R2

Applicant : MIWA LOCK CO., LTD.
Type of Equipment : Slim Type Hotel Card Lock
Model No. : ALVBS
Test regulation : FCC Part 15 Subpart C: 2017
FCC ID : VBU-ALVBS2S
Test Result : **Complied**

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with 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. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Kashima EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. This report is a revised version of 11984035M-A-R1. 11984035M-A-R1 is replaced with this report.

Date of test: November 14 – 21, 2017

Representative test operator:

K. Ando

Kazuhiro Ando
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Approved by :

T. Yamashita

Tomoyuki Yamashita
Engineer
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"

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SECTION 1: Customer information

Company Name : MIWA LOCK CO., LTD.
Address : 3-1-12, Shiba, Minato-ku, Tokyo, Japan, 105-8510
Telephone Number : +81-3-4330-3069
Facsimile Number : +81-3-3455-2437
Contact Person : Keiji Iwata

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

2.1 Identification of E.U.T.

Type of Equipment : Slim Type Hotel Card Lock
Model No. : ALVBS
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 3.0 V (AA Type Alkaline batteries)
Receipt Date of Sample : November 2, 2017
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: ALVBS/ALV2S is a card lock system for hotel use.

The EUT has following similar model:

Model No.	Specifications
ALVBS (EUT)	Supports MIFARE card and Bluetooth Low Energy
ALV2S	Supports MIFARE card only

The clock maximum frequencies used in the EUT:
32.768 kHz, 13.56 MHz, 20 MHz (CPU), 27.12 MHz (RFID module), 16 MHz (BLE)

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Radio Specification

[NFC]

Equipment Type : Transceiver
Frequency of Operation : 13.56 MHz
Modulation : ASK
Power Supply (inner) : DC 3.0 V
Antenna type : Printed Loop Coil
Antenna connector type : PH
Operation temperature range : 0 deg. C. to +40 deg. C
Baud rate : 106 kbps
Card information : Mifare (Standard, Ultra Light)

[Detector]

Equipment Type : Transceiver
Frequency of Operation : 13.56 MHz
Modulation : ASK
Power Supply (inner) : DC 3.0 V
Antenna type : Printed Loop Coil
Antenna connector type : PH
Operation temperature range : 0 deg. C. to +40 deg. C

[Bluetooth Low Energy (BLE)]

Equipment Type : Transceiver
Frequency of Operation : 2402 MHz - 2480 MHz
Modulation : GFSK
Antenna type : Monopole antenna

* The BLE module is a FCC certificated module made by Murata Manufacturing Co., Ltd..
Model number: ZY 0001 (FCC ID: VPYLBZY).

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on November 2, 2017

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.

* Also the EUT complies with FCC Part 15 Subpart B.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted emission	ANSI C63.10:2013 6 Standard test methods	Section 15.207	N/A	N/A *1)	-
	<ISED>RSS-Gen 8.8	<ISED>RSS-Gen 8.8			
Electric Field Strength of Fundamental Emission	ANSI C63.10:2013 6 Standard test methods	Section 15.225(a)	65.6 dB, 13.56000 MHz, QP, 0 deg.	Complied	Radiated
	<ISED>RSS-Gen 6.4, 6.12	<ISED>RSS-210 B.6			
Spectrum Mask	ANSI C63.10:2013 6 Standard test methods	Section 15.225(b)(c)	35.1 dB, 13.34823 MHz, QP, 0 deg.	Complied	Radiated
	<ISED>RSS-Gen 6.4, 6.13	<ISED> RSS-210 B.6			
20dB Bandwidth	ANSI C63.10:2013 6 Standard test methods	Section15.215(e)	See data	Complied	Radiated
	<ISED> -	<ISED> -			
Electric Field Strength of Spurious Emission	ANSI C63.10:2013 6 Standard test methods	Section 15.209, Section 15.225 (d)	7.4 dB 420.362 MHz, Horizontal, QP	Complied	Radiated
	<ISED>RSS-Gen 6.4, 6.13	<ISED>RSS-210 B.6			
Frequency Tolerance	ANSI C63.10:2013 6 Standard test methods	Section 15.225(e)	See data	Complied	Radiated
	<ISED>RSS-Gen 6.11, 8.11	<ISED> RSS-210 B.6			

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

*1) The test was not performed since the EUT was DC device (AA Type Alkaline batteries).

FCC Part 15.31 (e)

The stable voltage was supplied by the end product which was required to have a power supply regulator.

Therefore, the EUT complies with the requirement.

However, the supply voltage was varied and tested at 85 % and 115 % of the nominal rated supply voltage during frequency tolerance test according to Section 15.225(e).

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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3.3 Addition to standard

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99 % Occupied Band Width	RSS-Gen 6.6	-	Radiated	N/A	N/A	N/A

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

3.4 Uncertainty

EMI

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

Test Items	Frequency range	Uncertainty(+/-)
Radiated emission (Measurement distance: 3 m)	0.009 MHz - 30 MHz	3.0 dB
	30 MHz - 1000 MHz	5.8 dB

Radiated emission test

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

Frequency tolerance

Frequency Measurement uncertainty for this test was: $(\pm) 7.9 \times 10^{-8}$

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3.5 Test Location

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

Test site	ISED Registration Number	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.2 Open site	4659A-2	4.4 x 4.4 x 2.15	18 x 20	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.2 Shielded room	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	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	-	4.3 x 4.4 x 2.7	-	-

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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

4.1 Operating Mode(s)

The mode is used :

Mode	Remarks*
Transmitting mode (Tx)	Modulated on (Mod on)
- NFC	The EUT communicates with the Mifare card.
- Detector	The EUT detects objects. *The EUT does not communicate with the Mifare card on the Detector mode.
*Power of the EUT was set by the software as follows; Software: 8AK4 (RFID), Ver.1.2.6 (BLE) *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product	

Test Item	Operating mode	
	NFC*	Detector
Electric Field Strength of Fundamental Emission	Tx Mod on, without MIFARE Card	Tx Mod on
Spectrum Mask	Tx Mod on, without MIFARE Card	Tx Mod on
20 dB Bandwidth	Tx Mod on, without MIFARE Card	Tx Mod on
99 % OccupiedBandwidth	Tx Mod on, without MIFARE Card	Tx Mod on
Electric Field Strength of Spurious Emission	Tx Mod on, without MIFARE Card	Tx Mod on
Frequency Tolerance	Tx Mod off	Tx Mod on

* After the comparison of the test data between with MIFARE Card and without MIFARE Card, the tests were performed with the worst case.

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 DC 3.0 V
Maximum Voltage DC 3.45 V, Minimum Voltage DC 2.55 V (DC 3.0 V ±15 %)

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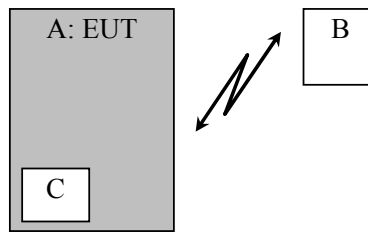
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4.2 Configuration and peripherals



*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	Slim Type Hotel Card Lock	ALVBS	JSS16E T00002A	MIWA LOCK CO., LTD.	EUT
B	MIFARE Card	-	-	MIWA LOCK CO., LTD.	-
C	Bluetooth Low Energy module	ZY 0001	SS7215008	Murata Manufacturing Co., Ltd.	FCC ID: VPYLBZY

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SECTION 5: 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 1 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 1GHz
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 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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SECTION 6: Other test

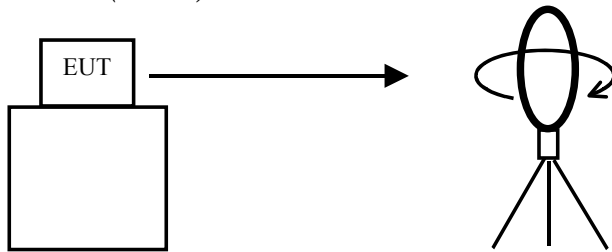
Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth	50 kHz / 5 MHz	1 kHz / 30 kHz	3 kHz / 100 KHz	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak *1)	Max Hold *2)	Spectrum Analyzer
Frequency Tolerance *3)	-	-	-	-	-	-	Frequency counter

*1) The measurement was performed with Peak detector, Max Hold since the duty cycle was not 100 %.
*2) The measurement was performed with Max Hold since the duty cycle was not 100 %. Peak hold was applied as Worst-case measurement.
*3) 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.

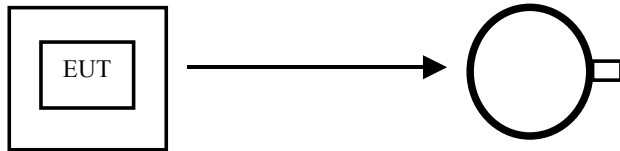
Test data : APPENDIX
Test result : Pass

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

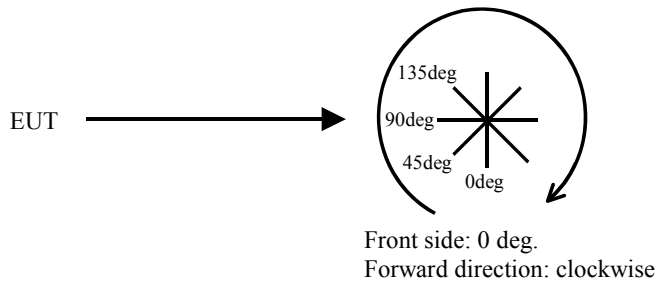


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



APPENDIX 1: Test data

**Fundamental emission and Spectrum Mask
(NFC)**

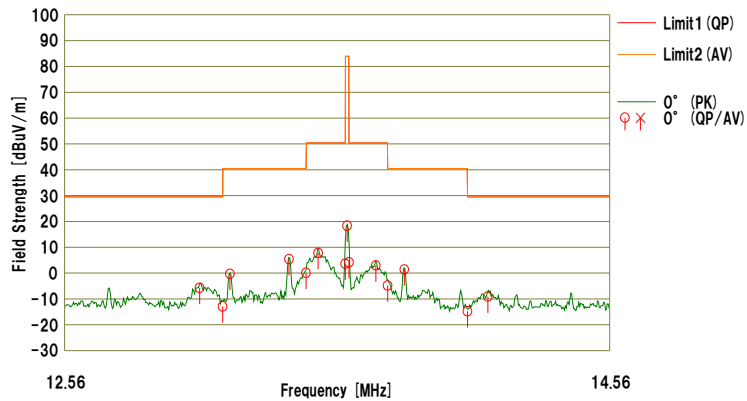
DATA OF RADIATED EMISSION (below 30MHz) TEST

UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2017/11/14

Mode : NFC mode
Order No. : 11984035M
Power : DC 3V
Temp./Humi. : 23deg.C / 48%RH

Remarks : Z-axis, without MIFARE Card

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> [dB]	<AV> [dB]					
1	13.02881	40.2	---	19.6	-33.0	32.5	-5.7	---	29.5	29.5	35.2	---	0'	0	
2	13.11000	33.0	---	19.6	-33.0	32.5	-12.3	---	29.5	29.5	42.4	---	0'	0	
3	13.13632	45.6	---	19.6	-33.0	32.5	-0.3	---	40.5	40.5	40.8	---	0'	0	
4	13.34823	51.3	---	19.6	-33.0	32.5	5.4	---	40.5	40.5	35.1	---	0'	0	
5	13.41000	46.0	---	19.6	-33.0	32.5	0.1	---	40.5	40.5	40.4	---	0'	0	
6	13.45413	53.7	---	19.6	-33.0	32.5	7.8	---	50.4	50.4	42.6	---	0'	0	
7	13.55300	49.6	---	19.5	-33.0	32.5	3.6	---	50.4	50.4	46.8	---	0'	0	
8	13.56000	64.3	---	19.5	-33.0	32.5	18.3	---	63.9	63.9	65.6	---	0'	0	
9	13.56700	50.2	---	19.5	-33.0	32.5	4.2	---	50.4	50.4	46.2	---	0'	0	
10	13.66616	49.0	---	19.5	-33.0	32.5	3.0	---	50.4	50.4	47.4	---	0'	0	
11	13.71000	41.2	---	19.5	-33.0	32.5	-4.8	---	40.5	40.5	45.3	---	0'	0	
12	13.77217	47.4	---	19.5	-33.0	32.5	1.4	---	40.5	40.5	39.1	---	0'	0	
13	14.01000	31.2	---	19.5	-33.0	32.5	-14.8	---	29.5	29.5	44.3	---	0'	0	
14	14.08731	36.9	---	19.5	-33.0	32.5	-9.1	---	29.5	29.5	38.6	---	0'	0	

Calculation:Result [dBuV/m]=Reading [dBuV]+Ant.Fac [dB/m]+Loss (Cable) [dB]+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	64.3	19.5	7.0	32.5	-	58.3	-	-	Fundamental

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

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Fundamental emission and Spectrum Mask (Detector)

DATA OF RADIATED EMISSION (below 30MHz) TEST

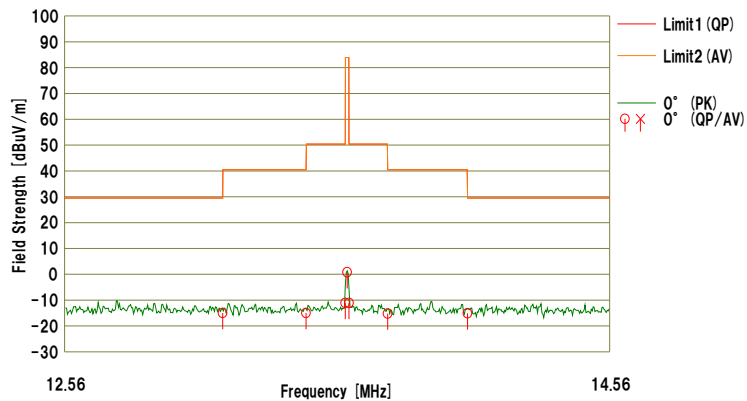
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2017/11/14

Mode : Detector mode
Order No. : 11984035M
Power : DC 3V
Temp./Humi. : 23deg.C / 48%RH

Remarks : Z-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> [dB]	<AV> [dB]					
1	13.71000	30.9	---	19.6	-33.0	32.5	-15.0	---	29.5	29.5	44.5	---	0'	0	
2	13.41000	30.9	---	19.6	-33.0	32.5	-15.0	---	40.5	40.5	55.5	---	0'	0	
3	13.55300	34.9	---	19.5	-33.0	32.5	-11.1	---	50.4	50.4	61.5	---	0'	0	
4	13.56000	46.8	---	19.5	-33.0	32.5	0.8	---	83.9	83.9	83.1	---	0'	0	
5	13.56700	34.9	---	19.5	-33.0	32.5	-11.1	---	50.4	50.4	61.5	---	0'	0	
6	13.71000	30.8	---	19.5	-33.0	32.5	-15.2	---	40.5	40.5	55.7	---	0'	0	
7	14.01000	30.9	---	19.5	-33.0	32.5	-15.1	---	29.5	29.5	44.6	---	0'	0	

Calculation:Result [dBuV/m]=Reading [dBuV]+Ant.Fac [dB/m]+Loss (Cable) [dB]+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	46.8	19.5	7.0	32.5	-	40.8	-	-	- Fundamental

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

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Spurious emission
(NFC)

DATA OF RADIATED EMISSION (below 30MHz) TEST

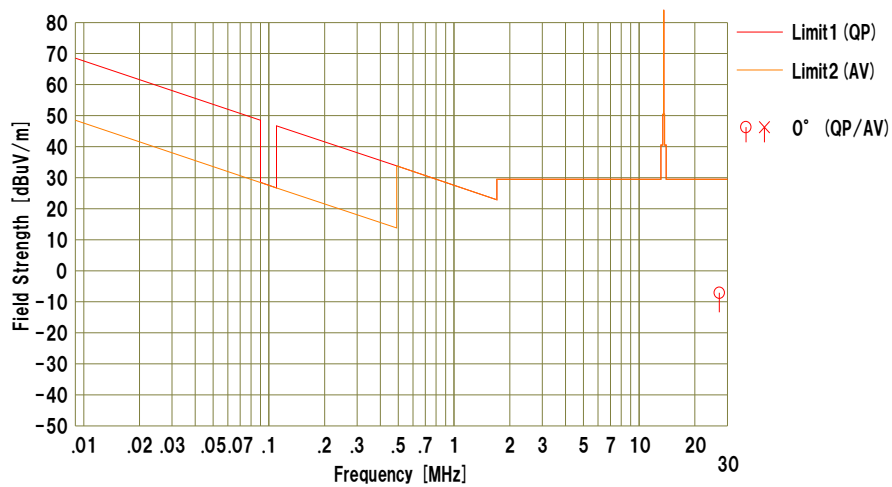
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2017/11/14

Mode : NFC mode
Order No. : 11984035M
Power : DC 3V
Temp./Humi. : 23deg.C / 48%RH

Remarks : Z-axis, without MIFARE Card

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 [deg]	Comment
		<QP> [dBuV]	<AV> [dBuV]				<QP> [dBuV/m]	<AV> [dBuV/m]	<QP> [dBuV/m]	<AV> [dBuV/m]	<QP> [dB]	<AV> [dB]			
1	27.12000	37.8	---	20.1	-32.5	32.5	-7.1	---	29.5	29.5	36.6	---	0°	0	

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

Spurious emission
(Detector)

DATA OF RADIATED EMISSION (below 30MHz) TEST

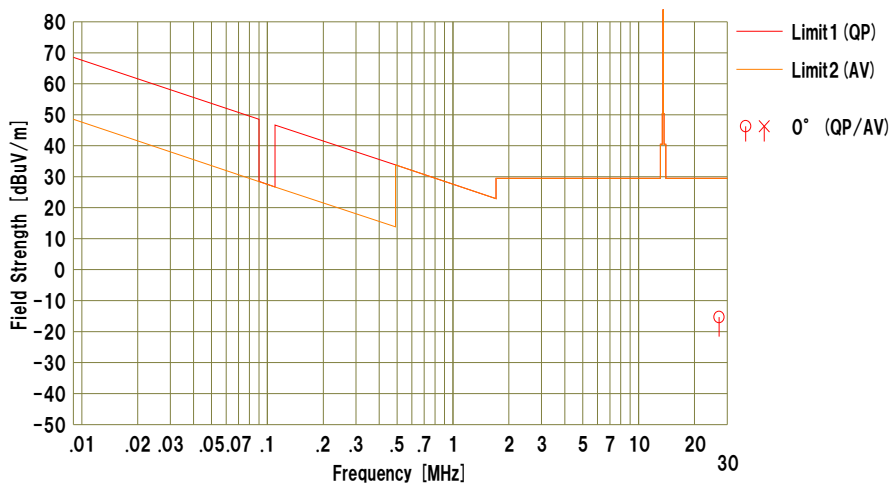
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2017/11/14

Mode : Detector mode
Order No. : 11984035M
Power : DC 3V
Temp./Humi. : 23deg.C / 48%RH

Remarks : Z-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 [deg]	Comment
		<QP> [dBuV]	<AV> [dBuV]				<QP> [dBuV/m]	<AV> [dBuV/m]	<QP> [dBuV/m]	<AV> [dBuV/m]	<QP> [dB]	<AV> [dB]			
1	27.12000	29.6	---	20.1	-32.5	32.5	-15.3	---	29.5	29.5	44.8	---	0°	0	

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

Spurious emission
(NFC)

DATA OF RADIATED EMISSION TEST

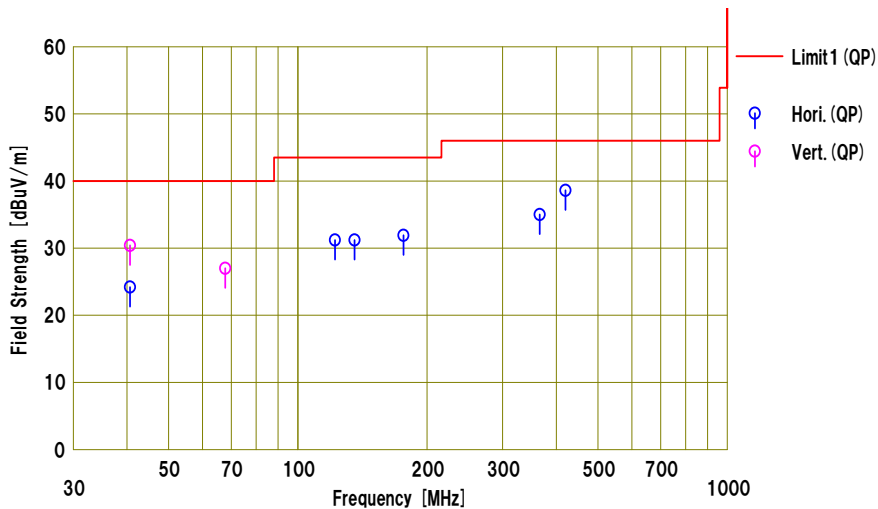
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2017/11/14

Mode : NFC mode
Order No. : 11984035M
Power : DC 3V
Temp./Humi. : 23deg.C / 48%RH

Remarks : Z-axis, with MIFARE Card

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

Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading	Ant.Fac	Loss	Gain	Result	Limit	Margin	Pola.	Height	Angle	Ant. Type	Comment
		<QP>				<QP>	<QP>	[dB]					
1	40.680	33.3	13.3	4.4	26.8	24.2	40.0	15.8	Hori.	260	352	HB	
2	122.040	40.7	11.6	5.5	26.6	31.2	43.5	12.3	Hori.	253	254	HB	
3	135.600	39.3	12.8	5.7	26.6	31.2	43.5	12.3	Hori.	216	258	HB	
4	176.281	39.7	12.4	6.2	26.4	31.9	43.5	11.6	Hori.	161	69	HB	
5	366.122	38.6	14.8	8.1	26.5	35.0	46.0	11.0	Hori.	100	0	HB	
6	420.362	40.8	16.2	8.5	26.9	38.6	46.0	7.4	Hori.	232	357	HB	
7	40.680	39.5	13.3	4.4	26.8	30.4	40.0	9.6	Vert.	100	80	HB	
8	67.800	37.0	12.0	4.8	26.8	27.0	40.0	13.0	Vert.	100	273	HB	

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

Spurious emission
(Detector)

DATA OF RADIATED EMISSION TEST

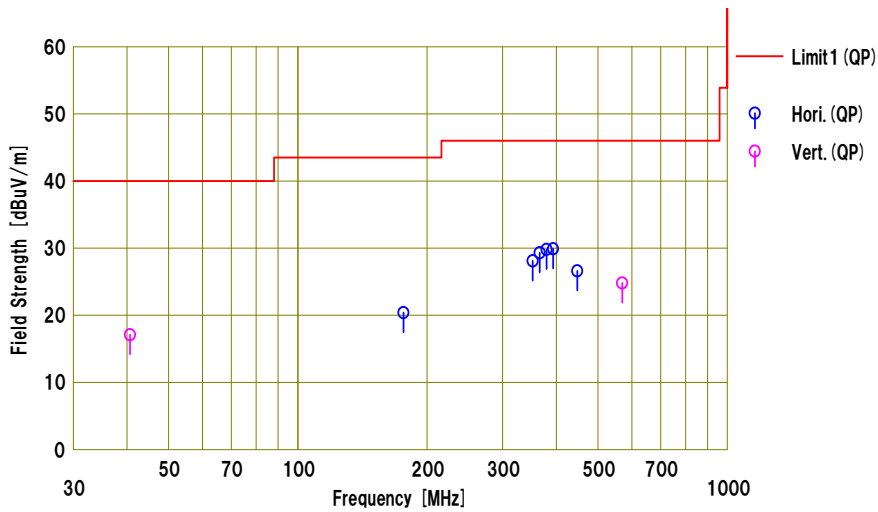
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2017/11/14

Mode : Detector mode
Order No. : 11984035M
Power : DC 3V
Temp./Humi. : 23deg.C / 48%RH

Remarks : Z-axis

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

Tested by : Kazuhiro Ando



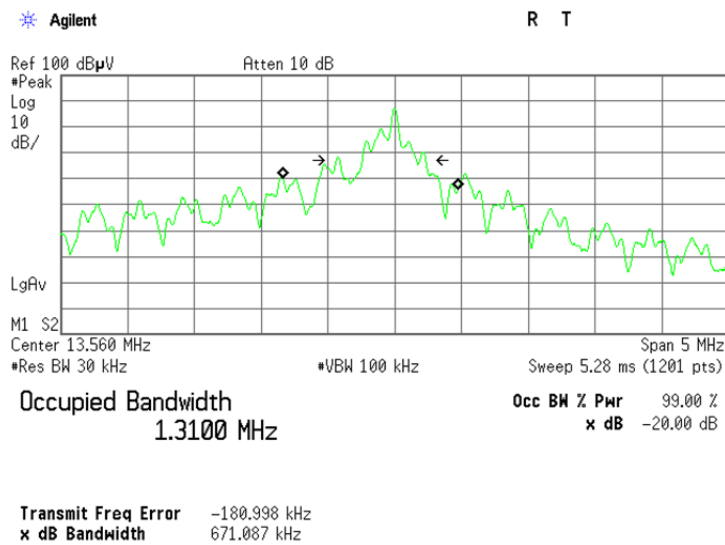
No.	Freq. [MHz]	Reading	Ant.Fac	Loss	Gain	Result	Limit	Margin	Pola.	Height	Angle	Ant. Type	Comment
		<QP>				<QP>	<QP>	[dB]					
1	176.282	28.2	12.4	6.2	26.4	20.4	43.5	23.1	Hori.	169	277	HB	
2	352.561	32.0	14.4	8.0	26.3	28.1	46.0	17.9	Hori.	100	7	HB	
3	366.122	32.9	14.8	8.1	26.5	29.3	46.0	16.7	Hori.	100	355	HB	
4	379.685	33.0	15.2	8.2	26.6	29.8	46.0	16.2	Hori.	100	0	HB	
5	393.265	32.9	15.4	8.3	26.7	29.9	46.0	16.1	Hori.	100	356	HB	
6	447.483	28.0	17.0	8.7	27.1	26.6	46.0	19.4	Hori.	202	350	HB	
7	40.681	26.2	13.3	4.4	26.8	17.1	40.0	22.9	Vert.	100	75	HB	
8	569.522	24.1	18.8	9.5	27.6	24.8	46.0	21.2	Vert.	100	190	HB	

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

20dB Bandwidth and 99% Occupied Bandwidth

Test place	Kashima EMC Lab. No.2 measurement room
Report No.	11300637M
Date	11/21/2017
Temperature/ Humidity	24 deg. C / 38 % RH
Engineer	Kazuhiro Ando
Mode	NFC mode, without MIFARE Card

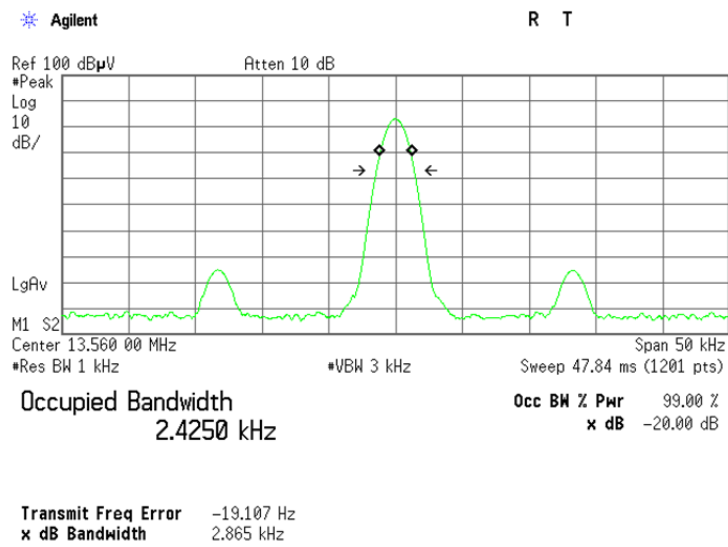
FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	671.09	1310.00



20dB Bandwidth and 99% Occupied Bandwidth

Test place	Kashima EMC Lab. No.2 measurement room
Report No.	11300637M
Date	11/21/2017
Temperature/ Humidity	24 deg. C / 38 % RH
Engineer	Kazuhiro Ando
Mode	Detector mode

FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	2.87	2.43



Frequency Tolerance

Test place : Kashima EMC Lab. No.2 measurement room
Report No. : 11300637M
Date : 11/15/2017
Temperature/ Humidity : 23 deg. C / 41 % RH
Engineer : Kazuhiro Ando
Mode : NFC mode

Test condition		Tested timing	Measured frequency [MHz]	Frequency error [MHz]	Result		Limit [+/- %]
Temp. [deg. C]	Voltage [V]				[%]	[ppm]	
50	3	Power on	13.560043	0.000043	0.00032	3.2	0.01
		+ 2 min.	13.560042	0.000042	0.00031	3.1	0.01
		+ 5 min.	13.560042	0.000042	0.00031	3.1	0.01
		+ 10 min.	13.560042	0.000042	0.00031	3.1	0.01
40	3	Power on	13.560056	0.000056	0.00041	4.1	0.01
		+ 2 min.	13.560051	0.000051	0.00038	3.8	0.01
		+ 5 min.	13.560050	0.000050	0.00037	3.7	0.01
		+ 10 min.	13.560050	0.000050	0.00037	3.7	0.01
30	3	Power on	13.560078	0.000078	0.00058	5.8	0.01
		+ 2 min.	13.560070	0.000070	0.00052	5.2	0.01
		+ 5 min.	13.560069	0.000069	0.00051	5.1	0.01
		+ 10 min.	13.560069	0.000069	0.00051	5.1	0.01
20	3	Power on	13.560100	0.000100	0.00074	7.4	0.01
		+ 2 min.	13.560093	0.000093	0.00069	6.9	0.01
		+ 5 min.	13.560092	0.000092	0.00068	6.8	0.01
		+ 10 min.	13.560092	0.000092	0.00068	6.8	0.01
20	2.55 (3V -15%)	Power on	13.560100	0.000100	0.00074	7.4	0.01
		+ 2 min.	13.560093	0.000093	0.00069	6.9	0.01
		+ 5 min.	13.560092	0.000092	0.00068	6.8	0.01
		+ 10 min.	13.560092	0.000092	0.00068	6.8	0.01
20	3.45 (3V +15%)	Power on	13.560100	0.000100	0.00074	7.4	0.01
		+ 2 min.	13.560093	0.000093	0.00069	6.9	0.01
		+ 5 min.	13.560092	0.000092	0.00068	6.8	0.01
		+ 10 min.	13.560092	0.000092	0.00068	6.8	0.01
10	3	Power on	13.560117	0.000117	0.00086	8.6	0.01
		+ 2 min.	13.560113	0.000113	0.00083	8.3	0.01
		+ 5 min.	13.560112	0.000112	0.00083	8.3	0.01
		+ 10 min.	13.560112	0.000112	0.00083	8.3	0.01
0	3	Power on	13.560118	0.000118	0.00087	8.7	0.01
		+ 2 min.	13.560119	0.000119	0.00088	8.8	0.01
		+ 5 min.	13.560120	0.000120	0.00088	8.8	0.01
		+ 10 min.	13.560120	0.000120	0.00088	8.8	0.01
-10	3	Power on	13.560099	0.000099	0.00073	7.3	0.01
		+ 2 min.	13.560107	0.000107	0.00079	7.9	0.01
		+ 5 min.	13.560109	0.000109	0.00080	8.0	0.01
		+ 10 min.	13.560109	0.000109	0.00080	8.0	0.01
-20	3	Power on	13.560044	0.000044	0.00032	3.2	0.01
		+ 2 min.	13.560064	0.000064	0.00047	4.7	0.01
		+ 5 min.	13.560068	0.000068	0.00050	5.0	0.01
		+ 10 min.	13.560068	0.000068	0.00050	5.0	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)

Frequency Tolerance

Test place : Kashima EMC Lab. No.2 measurement room
Report No. : 11300637M
Date : 11/17/2017
Temperature/ Humidity : 24 deg. C / 41 % RH
Engineer : Kazuhiro Ando
Mode : Detector mode

Test condition		Tested timing	Measured frequency [MHz]	Frequency error [MHz]	Result		Limit [+/- %]
Temp. [deg. C]	Voltage [V]				[%]	[ppm]	
50	3	Power on	13.559931	-0.000069	-0.00051	-5.1	0.01
		+ 2 min.	13.559930	-0.000070	-0.00052	-5.2	0.01
		+ 5 min.	13.559930	-0.000070	-0.00052	-5.2	0.01
		+ 10 min.	13.559930	-0.000070	-0.00052	-5.2	0.01
40	3	Power on	13.559951	-0.000049	-0.00036	-3.6	0.01
		+ 2 min.	13.559949	-0.000051	-0.00038	-3.8	0.01
		+ 5 min.	13.559948	-0.000052	-0.00038	-3.8	0.01
		+ 10 min.	13.559948	-0.000052	-0.00038	-3.8	0.01
30	3	Power on	13.559980	-0.000020	-0.00015	-1.5	0.01
		+ 2 min.	13.559978	-0.000022	-0.00016	-1.6	0.01
		+ 5 min.	13.559977	-0.000023	-0.00017	-1.7	0.01
		+ 10 min.	13.559977	-0.000023	-0.00017	-1.7	0.01
20	3	Power on	13.560010	0.000010	0.00007	0.7	0.01
		+ 2 min.	13.560008	0.000008	0.00006	0.6	0.01
		+ 5 min.	13.560008	0.000008	0.00006	0.6	0.01
		+ 10 min.	13.560007	0.000007	0.00005	0.5	0.01
20	2.55 (3V -15%)	Power on	13.560010	0.000010	0.00007	0.7	0.01
		+ 2 min.	13.560008	0.000008	0.00006	0.6	0.01
		+ 5 min.	13.560007	0.000007	0.00005	0.5	0.01
		+ 10 min.	13.560007	0.000007	0.00005	0.5	0.01
20	3.45 (3V +15%)	Power on	13.560010	0.000010	0.00007	0.7	0.01
		+ 2 min.	13.560007	0.000007	0.00005	0.5	0.01
		+ 5 min.	13.560007	0.000007	0.00005	0.5	0.01
		+ 10 min.	13.560007	0.000007	0.00005	0.5	0.01
10	3	Power on	13.560034	0.000034	0.00025	2.5	0.01
		+ 2 min.	13.560032	0.000032	0.00024	2.4	0.01
		+ 5 min.	13.560032	0.000032	0.00024	2.4	0.01
		+ 10 min.	13.560032	0.000032	0.00024	2.4	0.01
0	3	Power on	13.560044	0.000044	0.00032	3.2	0.01
		+ 2 min.	13.560044	0.000044	0.00032	3.2	0.01
		+ 5 min.	13.560044	0.000044	0.00032	3.2	0.01
		+ 10 min.	13.560043	0.000043	0.00032	3.2	0.01
-10	3	Power on	13.560032	0.000032	0.00024	2.4	0.01
		+ 2 min.	13.560035	0.000035	0.00026	2.6	0.01
		+ 5 min.	13.560035	0.000035	0.00026	2.6	0.01
		+ 10 min.	13.560036	0.000036	0.00027	2.7	0.01
-20	3	Power on	13.559992	-0.000008	-0.00006	-0.6	0.01
		+ 2 min.	13.559997	-0.000003	-0.00002	-0.2	0.01
		+ 5 min.	13.559998	-0.000002	-0.00001	-0.1	0.01
		+ 10 min.	13.559998	-0.000002	-0.00001	-0.1	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)

APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
KLP-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	827779/008	ME	2017/10/02 * 12
CCC-M01	Coaxial Cable	FUJIKURA	3D2W	none	ME	2017/05/19 * 12
CAF-07	Pre-Amplifier	Sonoma Instrument	310N	240505	ME	2016/11/04 * 12
CAT6-17	6dB Fixed Atten.	Suhner	6906.01.A	none	ME	2017/06/27 * 12
COTS-CEMI-02	EMI Software	TSJ	TEPTO-DV(RE,CE, MF,PE)	Ver, RE: 2.5.0131, CE: 2.5.0131, ME: 2.5.0129, PE: 2.5.0129	ME/RE	-
CCC-S10-C (3/9/10/11/12)	Coaxial Cable	FUJIKURA,FUJIKURA, FUJIKURA,FUJIKURA	5D-2W,5D-2W,5D-2W, 5D-2W,5D-2W,	-	ME	2017/08/25 * 12
CTR-09	Test Receiver	Agilent	N9038A	MY53290016 Version A.14.03	ME/RE	2017/06/27 * 12
CBL-08	LOGBICON	Schwarzbeck	VULB 9168	343	RE	2017/04/10 * 12
CAT3-04	3dB Fixed Atten.	TAMAGAWA	UFA-01	none	RE	2017/09/04 * 12
CCC-S10-R (2/4/CATS-11/5/6 /7/8/11/12)	Coaxial Cable	Fujikura,Fujikura,Agilent, Fujikura,Fujikura,Fujikura, Fujikura,Fujikura	5D-2W,5D-2W,8494A, 5D-2W,5D-2W,5D-2W, 5D-2W,5D-2W,5D-2W,5D-2W	MY41110200 (Step Att)	RE	2017/08/25 * 12
CAF-08	Pre-Amplifier	Hewlett Packard	8447D	2944A09041	RE	2017/08/25 * 12
CSCL-13	Ruler	Tajima	L19-55	none	ME/RE	-
COS-10	Temperature & Humidity Indicator	HIOKI	3641/9680-50	090999895/090905406	ME/RE	2017/05/16 * 12
CTS-14	Digital Multimeter	FLUKE	115	994460954	ME/RE	2017/10/02 * 12
CSA-07	Spectrum Analyzer	Agilent	E4448A	MY52490024 Version A.11.21	FT	2017/05/31 * 12
CFC-02	Frequency Counter	Agilent	53151A	US40511823	FT	2017/04/24 * 12
CCH-04	Temperature and Humidity Chamber	ESPEC	PL-1J	15004059	FT	2017/06/30 * 12
CTS-18	Digital Multimeter	FLUKE	87-3	85220051	FT	2017/09/11 * 12
COS-05	Temperature & Humidity Indicator	A&D	AD-5681	6975761	FT	2017/07/20 * 12
CMS-07	Near Field Probe	Langer	LF-R400	02-0815	FT	Pre Check

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

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

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

Test Item: ME: Magnetic Emission
RE: Radiated Emission
FT: Frequency Tolerance

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