RADIO TEST REPORT

Test Report No. : 11327848M-C-R1

Applicant	:	**Takazono Technology Incorporated**
Type of Equipment	:	**S Casetter Base**
Model No.	:	**GW-CB-S-001**
Test regulation	:	**FCC Part 15 Subpart C: 2018**
FCC ID	:	**2APN9GW-CB-S-001**
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 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. This report is a revised version of 11327848M-C. 11327848M-C is replaced with this report.

Date of test: June 29, 2016, November 1, 5, 2018

Representative test operator:

K. Ando

Kazuhiro Ando
Engineer
Consumer Technology Division

Approved by :

Kenichi Suda
Manager
Consumer Technology Division

ilac-MRA

LAB JAB Testing RTL02610

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

REVISION HISTORY

Original Test Report No.: 11327848M-C-R1

Revision	Test report No.	Date	Page revised	Contents
- (Original)	11327848M-C	November 5, 2018	-	-
1	11327848M-C-R1	November 8, 2018	P.1, 4, 9	Modification of the Type of Equipment from S Cassetter Base to S Casetter Base.
1	11327848M-C-R1	November 8, 2018	P.11	Modification of the KDB number From KDB 937606 to KDB 414788.
1	11327848M-C-R1	November 8, 2018	P.16, 17	Modification of the Remarks. Delete “with Tag” from Remarks.

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SECTION 1: Customer information

Company Name	:	Takazono Technology Incorporated
Address	:	2-8-1 Tsudayamate, Hirakata-shi 573-0128 Osaka, Japan
Telephone Number	:	+81-72-808-0200
Facsimile Number	:	+81-72-808-0209
Contact Person	:	Katsuhiro Hirai

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

2.1 Identification of E.U.T.

Type of Equipment	:	S Casetter Base
Model No.	:	GW-CB-S-001
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 5 V (-10% to +5%), 150 mA, 750 mW, (Radio and sensor part)
	:	DC 12 V (-5% to +5%), (Motor part)
Receipt Date of Sample	:	June 15, 2016, November 1, 2018
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: GW-CB-S-001 (referred to as the EUT in this report) is an S Casetter Base.

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	13.56 MHz
Modulation	:	ASK
Power Supply (inner)	:	DC 5.0 V
Antenna type	:	Loop Coil
Clock frequency	:	16MHz (CPU), 13.56MHz (Radio)
Operating Temperature	:	-2 deg. C. to +40 deg. C

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

* The revisions made after testing date do not affect the test specification applied to the EUT.

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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted emission	ANSI C63.10:2013 6 Standard test methods	Section 15.207	[QP] 13.6 dB, 0.15000 MHz, N [AV] 24.3 dB, 0.50000 MHz, N	Complied	-
Electric Field Strength of Fundamental Emission	ANSI C63.10:2013 6 Standard test methods	Section 15.225(a)	77.3 dB, 13.56000 MHz, QP, 0 deg.	Complied	Radiated
Spectrum Mask	ANSI C63.10:2013 6 Standard test methods	Section 15.225(b)(c)	43.5 dB, 13.11000 MHz, QP, 0 deg.	Complied	Radiated
20dB Bandwidth	ANSI C63.10:2013 6 Standard test methods	Section15.215(c)	See data	Complied	Radiated
Electric Field Strength of Spurious Emission	ANSI C63.10:2013 6 Standard test methods	Section 15.209, Section 15.225(d)	4.7 dB 908.520 MHz, Horizontal, QP	Complied#	Radiated
Frequency Tolerance	ANSI C63.10:2013 6 Standard test methods	Section 15.225(e)	See data	Complied	Radiated
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422					
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.					

FCC Part 15.31 (e)
The stable voltage will be supplied by the end product, which will be required to have a power supply regulator. Therefore, the 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 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.

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 x 10^-7	7.9 x 10^-8
20 dB Bandwidth / 99 % Occupied Bandwidth	Not Defined	1.6 %

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

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.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.6 Measurement room	-	4.3 x 4.4 x 2.7	-	-

3.6 Test set up, Test data, and Test instruments

Refer to APPENDIX.

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

4.1 Operating Modes

The mode is used :

Mode	Remarks
Transmitting and Receiving mode (with Passive Tag)	The EUT Transmits and Receives at the same time and there is no receiving mode.
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: Setting is controlled by the firmware and cannot be changed. Software: count_sens_2chan	

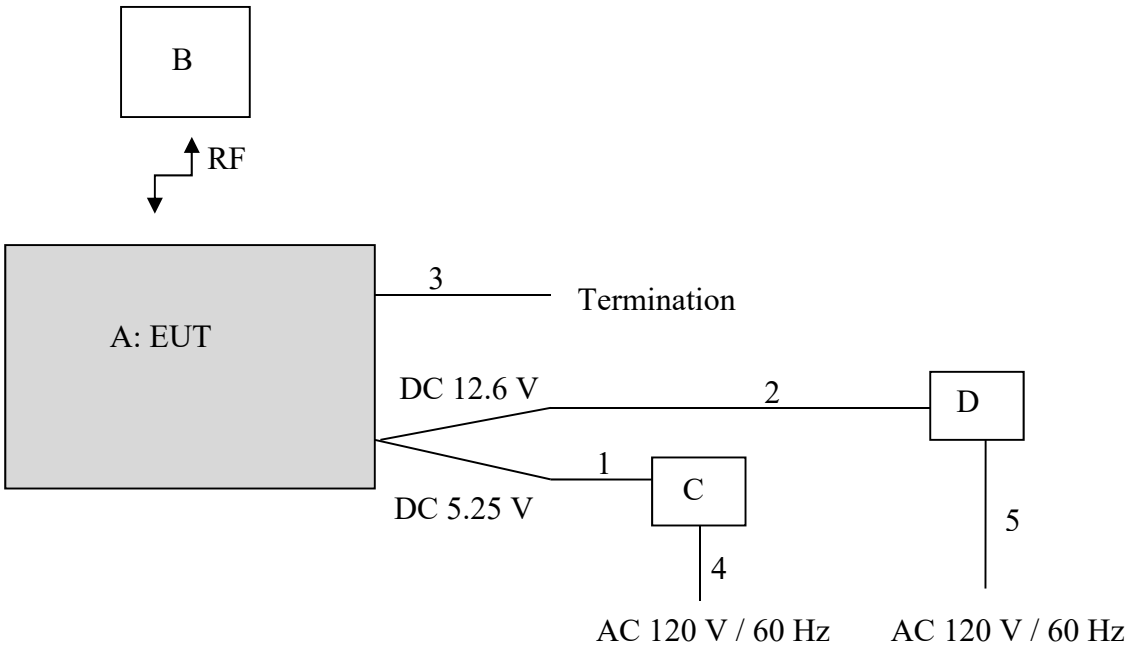
Test Item	Operating mode
Conducted emission	Transmitting and Receiving, with Tag / without Tag
Electric Field Strength of Fundamental Emission	Transmitting and Receiving, with Tag / without Tag
Spectrum Mask	Transmitting and Receiving, with Tag / without Tag
20 dB Bandwidth	Transmitting and Receiving, with Tag / without Tag
Electric Field Strength of Spurious Emission	Transmitting and Receiving, with Tag / without Tag
Frequency Tolerance	Transmitting Mod off

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 5 V
Maximum Voltage DC 5.75 V, Minimum Voltage DC 4.25 V (DC 5 V ±15 %)

4.2 Configuration and peripherals



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	S Casetter Base	GW-CB-S-001	16171375	Takazono Technology Incorporated	EUT
B	Tag	SFE-SLX-3025	18	E-Garde Co., Ltd.	Data rate: 6.62kbps Internal coil size: 37.0[mm]*21.5[mm] Internal coil turns: 10
C	DC Power Supply	GSV3000	1303141419	DIAMOND ANTENNA	Frequency Tolerance test
			1708192900	DIAMOND ANTENNA	Except for Frequency Tolerance test
D	DC Power Supply	GSV3000	60646742	DIAMOND ANTENNA	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC Cable	0.25 + 0.6	Unshield	Unshield	Conducted emission
		0.25	Unshield	Unshield	Except for Conducted emission
2	DC Cable	0.25 + 0.6	Unshield	Unshield	Conducted emission
		0.25	Unshield	Unshield	Except for Conducted emission
3	CAN Cable	0.1	Unshield	Unshield	-
4	AC Cable	1.7	Unshield	Unshield	-
5	AC Cable	1.7	Unshield	Unshield	-

SECTION 5: Conducted emission

Test Procedure and conditions

EUT was placed on a wooden table 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.

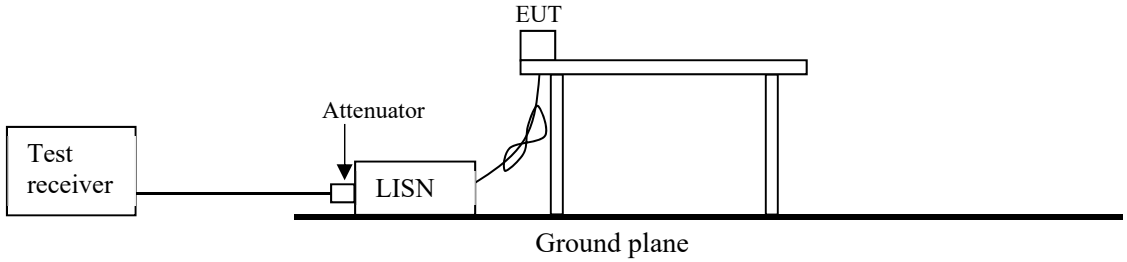
I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Shielded room.
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
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 x log (3 m / 300 m) = -80 dB
*2) Distance Factor: 40 x log (3 m / 30 m) = -40 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 test was made on EUT at the normal use position.

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

Figure 2. Direction of the Loop Antenna

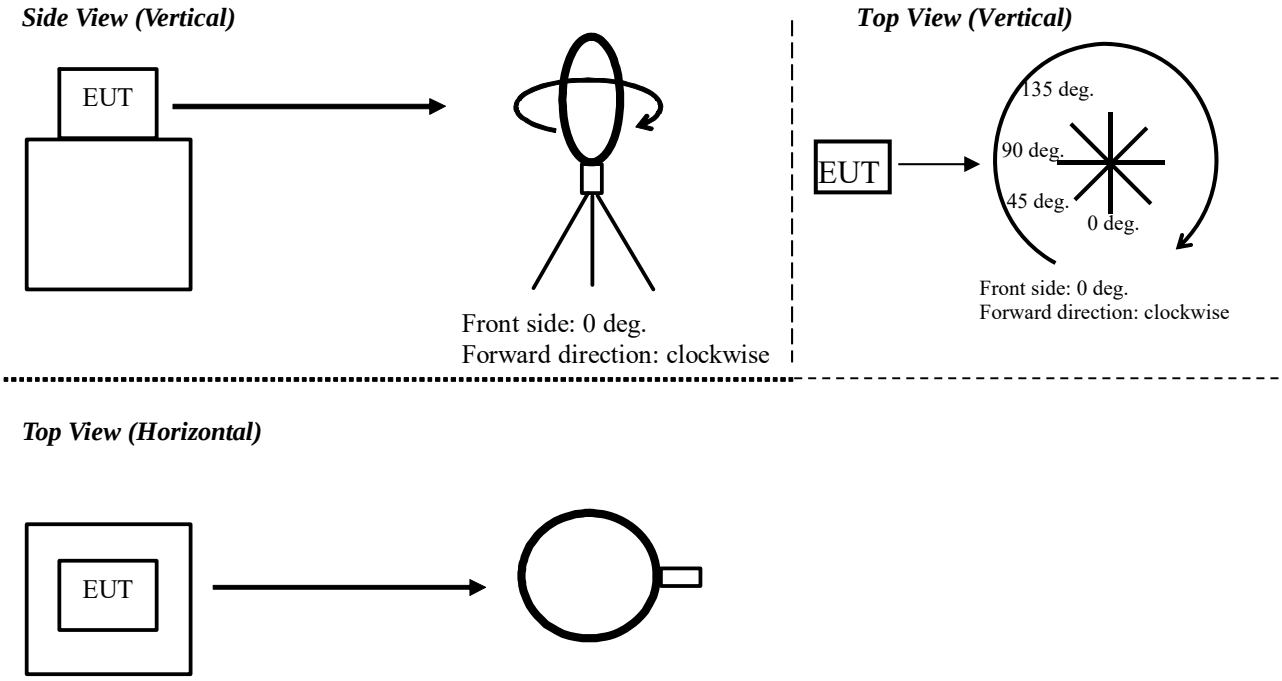


Figure 3. Antenna angle

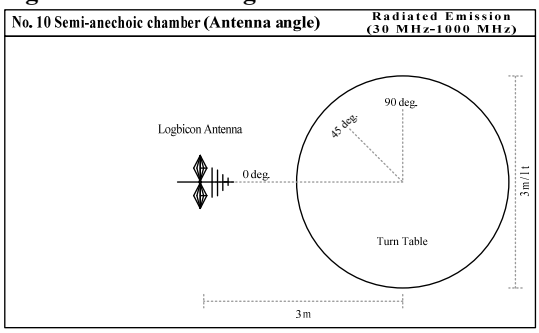
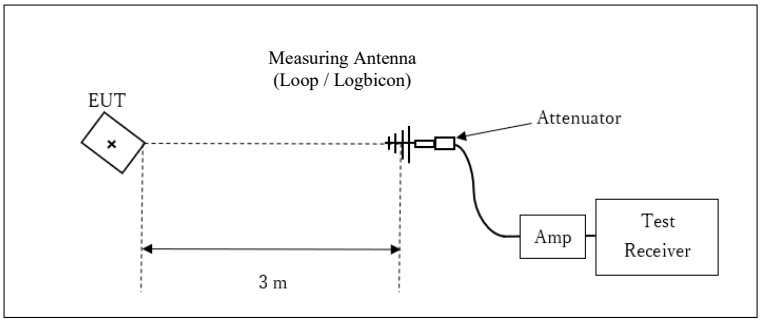


Figure 4. Connection and configuration of test equipment



× : Center of turn table

SECTION 7: Other test

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth	300 kHz	3 kHz	10 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Frequency Tolerance*1)	-	-	-	-	-	-	Frequency counter
*1) 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

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APPENDIX 1: Test data

Conducted emission

DC 5.25V

DATA OF CONDUCTED EMISSION TEST

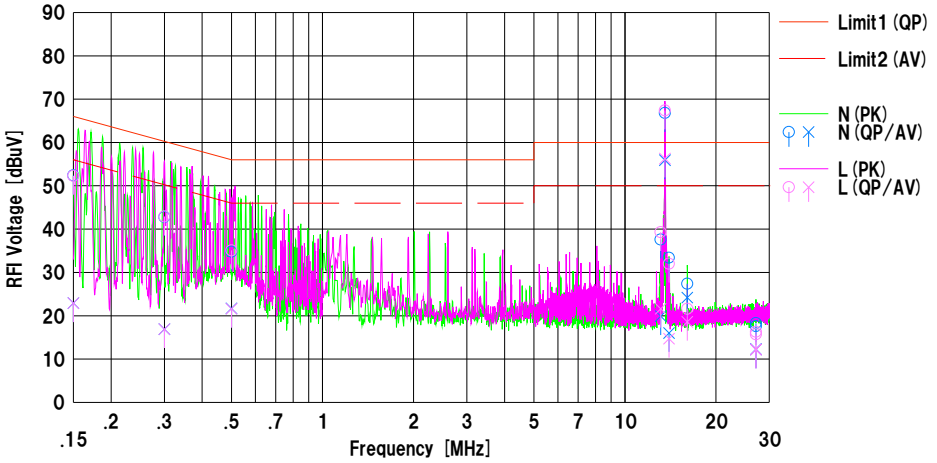
UL Japan, Inc. Kashima EMC Lab. No.1 Shielded Room
Date : 2018/11/05

Mode : Transmitting and Receiving
Order No. : 11327848M
Power : DC 5.25V (DC PS AC120V/60Hz)
Temp./Humi. : 21deg.C / 58%RH

Remarks : with Tag

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

Tested by : Kazuhiro Ando



No.	Freq.	Reading <QP>	Reading <AV>	C.Fac	Results <QP>	Results <AV>	Limit <QP>	Limit <AV>	Margin <QP>	Margin <AV>	Phase	Comment
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	42.2	12.7	10.2	52.4	22.9	66.0	56.0	13.6	33.1	N	
2	0.30000	32.6	6.7	10.2	42.8	16.9	60.2	50.2	17.4	33.3	N	
3	0.50000	24.5	11.4	10.3	34.8	21.7	56.0	46.0	21.2	24.3	N	
4	13.13640	26.5	8.8	11.1	37.6	19.9	60.0	50.0	22.4	30.1	N	
5	13.56000	55.6	44.7	11.2	66.8	55.9	60.0	50.0	-6.8	-5.9	N	Carrier
6	13.98380	22.2	4.8	11.2	33.4	16.0	60.0	50.0	26.6	34.0	N	
7	16.08030	16.1	12.9	11.3	27.4	24.2	60.0	50.0	32.6	25.8	N	
8	27.12000	5.5	0.1	12.1	17.6	12.2	60.0	50.0	42.4	37.8	N	without tag
9	27.12000	6.2	0.2	12.1	18.3	12.3	60.0	50.0	41.7	37.7	N	
10	0.15000	42.1	12.7	10.2	52.3	22.9	66.0	56.0	13.7	33.1	L	
11	0.30000	32.7	6.7	10.2	42.9	16.9	60.2	50.2	17.3	33.3	L	
12	0.50000	24.8	11.3	10.3	35.1	21.6	56.0	46.0	20.9	24.4	L	
13	13.13640	28.2	10.5	11.1	39.3	21.6	60.0	50.0	20.7	28.4	L	
14	13.56000	56.2	45.1	11.2	67.4	56.3	60.0	50.0	-7.4	-6.3	L	Carrier
15	13.98380	20.8	3.5	11.2	32.0	14.7	60.0	50.0	28.0	35.3	L	
16	16.08030	10.3	7.3	11.3	21.6	18.6	60.0	50.0	38.4	31.4	L	
17	27.12000	4.2	0.1	12.1	16.3	12.2	60.0	50.0	43.7	37.8	L	
18	27.12000	3.6	0.1	12.1	15.7	12.2	60.0	50.0	44.3	37.8	L	without tag

Calculation:Result [dBuV] =Reading [dBuV] +C.Fac (LISN+Cable+ATT) [dB]
LISN:CLS-03

Conducted emission

DC 12.6V

DATA OF CONDUCTED EMISSION TEST

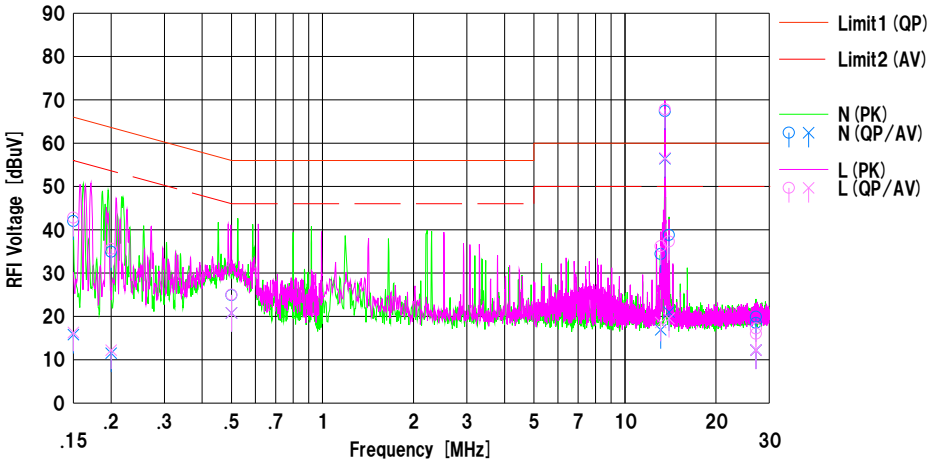
UL Japan, Inc. Kashima EMC Lab. No.1 Shielded Room
Date : 2018/11/05

Mode : Transmitting and Receiving
Order No. : 11327848M
Power : DC 12.6V (DC PS AC120V/60Hz)
Temp./Humi. : 21deg.C / 58%RH

Remarks : with Tag

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

Tested by : Kazuhiro Ando



No.	Freq.	Reading <QP>	Reading <AV>	C.Fac	Results <QP>	Results <AV>	Limit <QP>	Limit <AV>	Margin <QP>	Margin <AV>	Phase	Comment
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	31.8	5.6	10.2	42.0	15.8	66.0	56.0	24.0	40.2	N	
2	0.20000	24.7	1.3	10.2	34.9	11.5	63.6	53.6	28.7	42.1	N	
3	0.50000	14.6	10.5	10.3	24.9	20.8	56.0	46.0	31.1	25.2	N	
4	13.13640	23.3	5.8	11.1	34.4	16.9	60.0	50.0	25.6	33.1	N	
5	13.56000	56.2	45.2	11.2	67.4	56.4	60.0	50.0	-7.4	-6.4	N	Carrier
6	13.98380	27.6	9.8	11.2	38.8	21.0	60.0	50.0	21.2	29.0	N	
7	27.12000	7.8	0.1	12.1	19.9	12.2	60.0	50.0	40.1	37.8	N	
8	27.12000	6.4	0.1	12.1	18.5	12.2	60.0	50.0	41.5	37.8	N	without tag
9	0.15000	32.6	6.1	10.2	42.8	16.3	66.0	56.0	23.2	39.7	L	
10	0.20000	25.4	2.0	10.2	35.6	12.2	63.6	53.6	28.0	41.4	L	
11	0.50000	14.7	10.5	10.3	25.0	20.8	56.0	46.0	31.0	25.2	L	
12	13.13640	25.1	7.5	11.1	36.2	18.6	60.0	50.0	23.8	31.4	L	
13	13.56000	56.6	45.4	11.2	67.8	56.6	60.0	50.0	-7.8	-6.6	L	Carrier
14	13.98380	26.1	8.3	11.2	37.3	19.5	60.0	50.0	22.7	30.5	L	
15	27.12000	5.1	0.1	12.1	17.2	12.2	60.0	50.0	42.8	37.8	L	
16	27.12000	3.9	0.1	12.1	16.0	12.2	60.0	50.0	44.0	37.8	L	without tag

Calculation:Result [dBuV] =Reading [dBuV] +C.Fac (LISN+Cable+ATT) [dB]
LISN:CLS-03

Conducted emission

DC 5.25V, Antenna terminated

DATA OF CONDUCTED EMISSION TEST

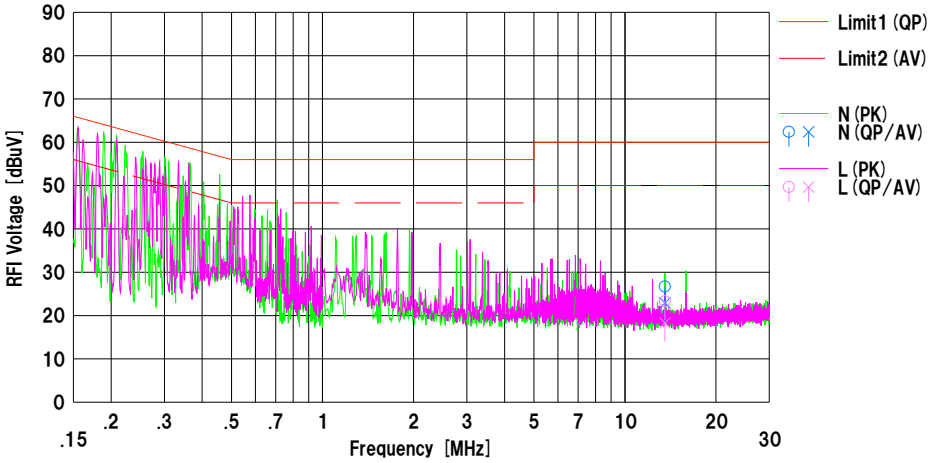
UL Japan, Inc. Kashima EMC Lab. No.1 Shielded Room
Date : 2018/11/05

Mode : Transmitting and Receiving
Order No. : 11327848M
Power : DC 5.25V (DC PS AC120V/60Hz)
Temp./Humi. : 21deg.C / 58%RH

Remarks : Antenna terminated

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

Tested by : Kazuhiro Ando



No.	Freq.	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP>	<AV>		<QP>	<AV>	<QP>	<AV>	<QP>	<AV>		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	13.56000	15.5	11.7	11.2	26.7	22.9	60.0	50.0	33.3	27.1	N	
2	13.56000	12.1	7.1	11.2	23.3	18.3	60.0	50.0	36.7	31.7	L	

Calculation:Result [dBuV] =Reading [dBuV] +C.Fac (LISN+Cable+ATT) [dB]
LISN:CLS-03

Conducted emission

DC 12.6V, Antenna terminated

DATA OF CONDUCTED EMISSION TEST

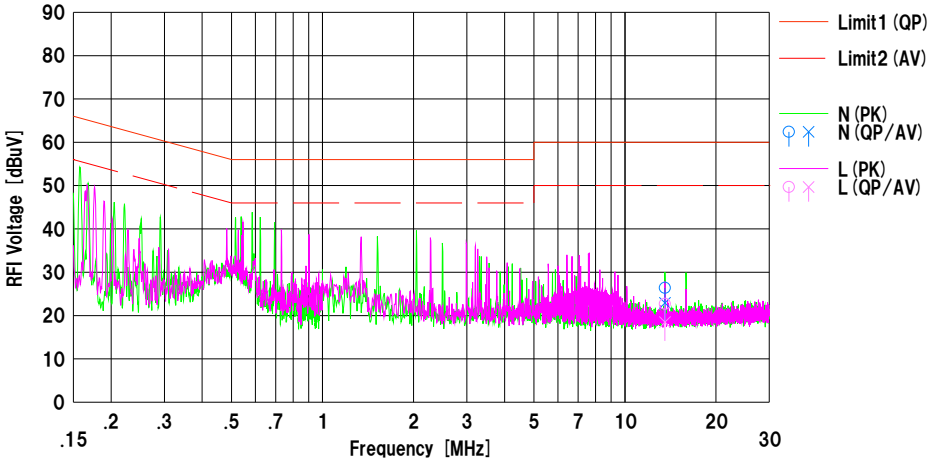
UL Japan, Inc. Kashima EMC Lab. No.1 Shielded Room
Date : 2018/11/05

Mode : Transmitting and Receiving
Order No. : 11327848M
Power : DC 12.6V (DC PS AC120V/60Hz)
Temp./Humi. : 21deg.C / 58%RH

Remarks : Antenna terminated

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

Tested by : Kazuhiro Ando



No.	Freq.	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP>	<AV>		<QP>	<AV>	<QP>	<AV>	<QP>	<AV>		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	13.56000	15.2	11.7	11.2	26.4	22.9	60.0	50.0	33.6	27.1	N	
2	13.56000	11.5	7.3	11.2	22.7	18.5	60.0	50.0	37.3	31.5	L	

Calculation:Result [dBuV] =Reading [dBuV] +C.Fac (LISN+Cable+ATT) [dB]
LISN:CLS-03

Fundamental emission and Spectrum Mask

DATA OF RADIATED EMISSION (below 30MHz) TEST

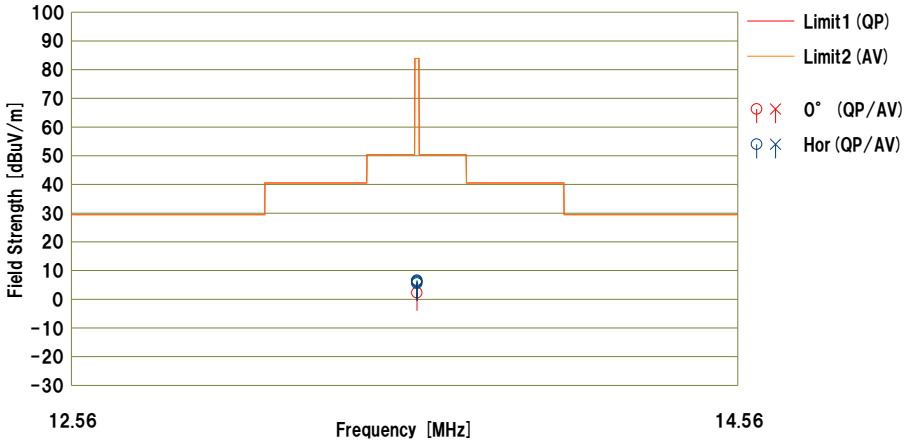
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2018/11/01

Mode : Transmitting and Receiving
Order No. : 11327848M
Power : DC 5.25V (DC PS AC120V/60Hz)
Temp./Humi. : 20deg.C / 45%RH

Remarks : with Tag

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.	Reading <QP>	Reading <AV>	Ant.Fac	Loss	Gain	Result <QP>	Result <AV>	Limit <QP>	Limit <AV>	Margin <QP>	Margin <AV>	Antenna	Comment
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]		
1	13.56000	40.5	---	19.0	-33.0	24.2	2.3	---	83.9	83.9	81.6	---	0°	DC 5.25V (Max)
2	13.56000	44.8	---	19.0	-33.0	24.2	6.6	---	83.9	83.9	77.3	---	Hor	DC 5.25V (Max)
3	13.56000	44.5	---	19.0	-33.0	24.2	6.3	---	83.9	83.9	77.6	---	Hor	DC 5V (Typical)
4	13.56000	43.8	---	19.0	-33.0	24.2	5.6	---	83.9	83.9	78.3	---	Hor	DC 4.5V (Min)
5	13.56000	44.2	---	19.0	-33.0	24.2	6.0	---	83.9	83.9	77.9	---	Hor	DC 5.25V (without tag)

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

Fundamental emission and Spectrum Mask

DATA OF RADIATED EMISSION (below 30MHz) TEST

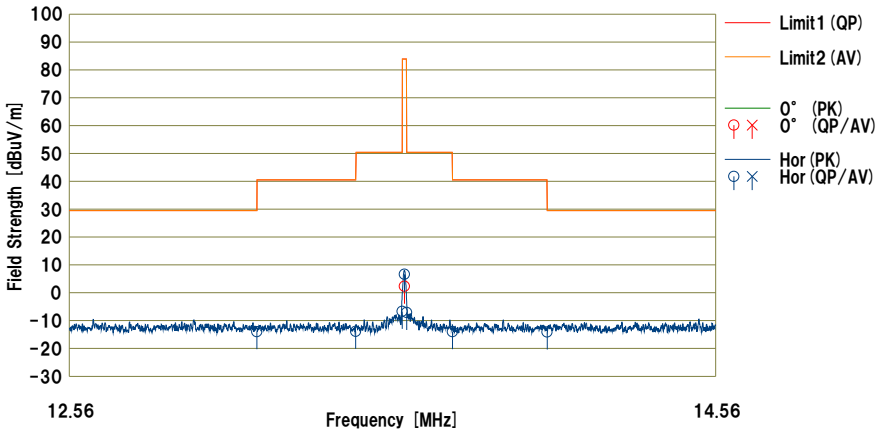
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2018/11/01

Mode : Transmitting and Receiving
Order No. : 11327848M
Power : DC 5.25V (DC PS AC120V/60Hz)
Temp./Humi. : 20deg.C / 45%RH

Remarks : with Tag

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.	Reading <QP>	Reading <AV>	Ant.Fac	Loss	Gain	Result <QP>	Result <AV>	Limit <QP>	Limit <AV>	Margin <QP>	Margin <AV>	Antenna	Table	Comment
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]		[deg]	
1	13.56000	40.5	---	19.0	-33.0	24.2	2.3	---	83.9	83.9	81.6	---	0°	304	
2	13.11000	24.2	---	19.0	-33.0	24.2	-14.0	---	29.5	29.5	43.5	---	Hor	0	
3	13.41000	24.3	---	19.0	-33.0	24.2	-13.9	---	40.5	40.5	54.4	---	Hor	0	
4	13.55300	31.5	---	19.0	-33.0	24.2	-6.7	---	50.4	50.4	57.1	---	Hor	0	
5	13.56000	44.8	---	19.0	-33.0	24.2	6.6	---	83.9	83.9	77.3	---	Hor	0	
6	13.56700	31.1	---	19.0	-33.0	24.2	-7.1	---	50.4	50.4	57.5	---	Hor	0	
7	13.71000	24.2	---	19.0	-33.0	24.2	-14.0	---	40.5	40.5	54.5	---	Hor	0	
8	14.01000	24.1	---	19.0	-33.0	24.2	-14.1	---	29.5	29.5	43.6	---	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
Hor	13.56000	QP	44.8	19.0	7.0	24.2	-	46.6	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Att) - Gain(Amprifier)

Fundamental emission and Spectrum Mask

DATA OF RADIATED EMISSION (below 30MHz) TEST

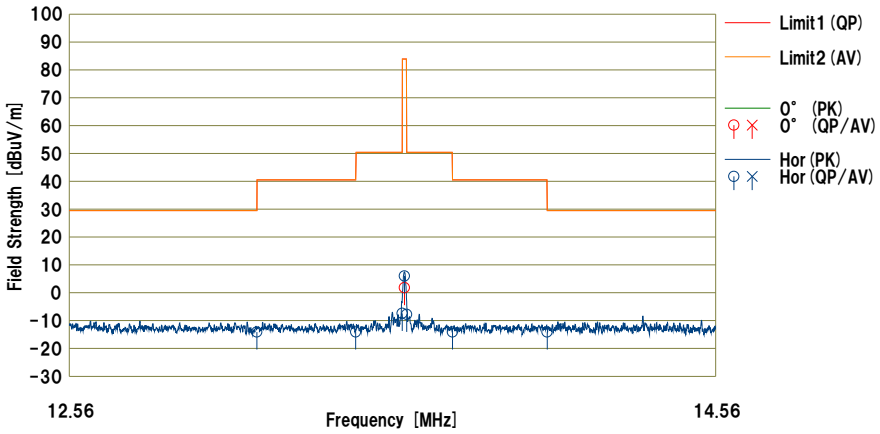
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2018/11/01

Mode : Transmitting and Receiving
Order No. : 11327848M
Power : DC 5.25V (DC PS AC120V/60Hz)
Temp./Humi. : 20deg.C / 45%RH

Remarks : without Tag

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.	Reading <QP>	Reading <AV>	Ant.Fac	Loss	Gain	Result <QP>	Result <AV>	Limit <QP>	Limit <AV>	Margin <QP>	Margin <AV>	Antenna	Table	Comment
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]		[deg]	
1	13.56000	40.0	---	19.0	-33.0	24.2	1.8	---	83.9	83.9	82.1	---	0°	288	
2	13.11000	24.1	---	19.0	-33.0	24.2	-14.1	---	29.5	29.5	43.6	---	Hor	0	
3	13.41000	24.1	---	19.0	-33.0	24.2	-14.1	---	40.5	40.5	54.6	---	Hor	0	
4	13.55300	30.8	---	19.0	-33.0	24.2	-7.4	---	50.4	50.4	57.8	---	Hor	0	
5	13.56000	44.2	---	19.0	-33.0	24.2	6.0	---	83.9	83.9	77.9	---	Hor	0	
6	13.56700	30.4	---	19.0	-33.0	24.2	-7.8	---	50.4	50.4	58.2	---	Hor	0	
7	13.71000	24.1	---	19.0	-33.0	24.2	-14.1	---	40.5	40.5	54.6	---	Hor	0	
8	14.01000	24.1	---	19.0	-33.0	24.2	-14.1	---	29.5	29.5	43.6	---	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
Hor	13.56000	QP	44.2	19.0	7.0	24.2	-	46.0	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Att) - Gain(Amprifier)

Spurious emission (Below 30 MHz)

DATA OF RADIATED EMISSION (below 30MHz) TEST

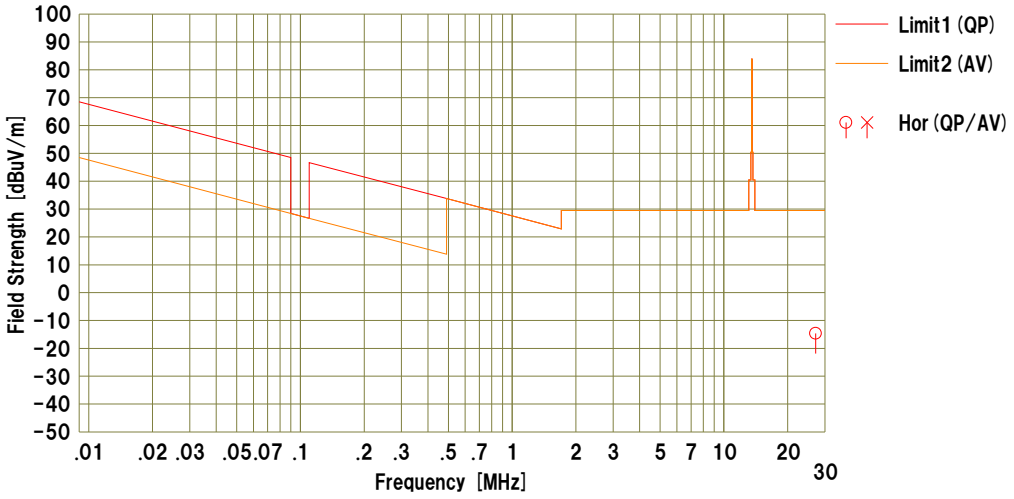
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2018/11/01

Mode : Transmitting and Receiving
Order No. : 11327848M
Power : DC 5.25V (DC PS AC120V/60Hz)
Temp./Humi. : 20deg.C / 45%RH

Remarks : with Tag

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.	Reading <QP>	Reading <AV>	Ant.Fac	Loss	Gain	Result <QP>	Result <AV>	Limit <QP>	Limit <AV>	Margin <QP>	Margin <AV>	Antenna	Table	Comment
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]		[deg]	
1	27.12000	22.5	---	19.8	-32.5	24.4	-14.6	---	29.5	29.5	44.1	---	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

Spurious emission (Below 30 MHz)

DATA OF RADIATED EMISSION (below 30MHz) TEST

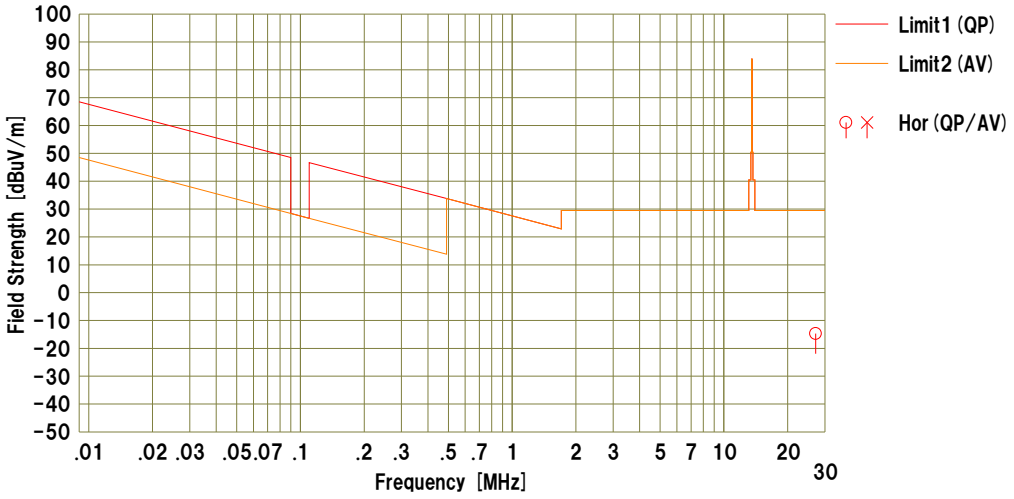
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2018/11/01

Mode : Transmitting and Receiving
Order No. : 11327848M
Power : DC 5.25V (DC PS AC120V/60Hz)
Temp./Humi. : 20deg.C / 45%RH

Remarks : without Tag

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.	Reading <QP>	Reading <AV>	Ant.Fac	Loss	Gain	Result <QP>	Result <AV>	Limit <QP>	Limit <AV>	Margin <QP>	Margin <AV>	Antenna	Table	Comment
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]		[deg]	
1	27.12000	22.4	---	19.8	-32.5	24.4	-14.7	---	29.5	29.5	44.2	---	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

Spurious emission (Above 30 MHz)

DATA OF RADIATED EMISSION TEST

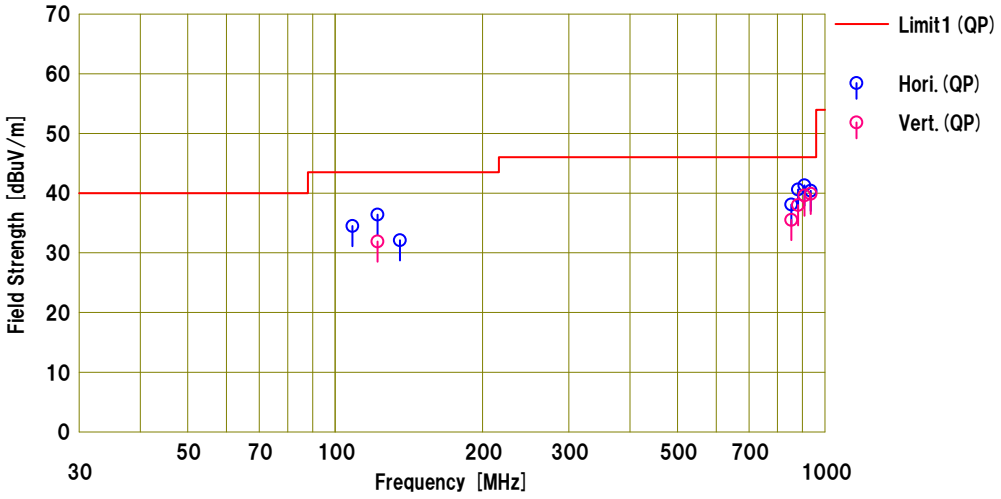
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2018/11/01

Mode : Transmitting and Receiving
Order No. : 11327848M
Power : DC 5.25V (DC PS AC120V/60Hz)
Temp./Humi. : 20deg.C / 45%RH

Remarks : with Tag

Limit1 : FCC 15B Class B (3m)

Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading <QP> [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result <QP> [dBuV/m]	Limit <QP> [dBuV/m]	Margin <QP> [dB]	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
1	108.480	45.5	10.3	5.4	26.7	34.5	43.5	9.0	Hori.	288	116	HB	
2	122.040	45.8	11.6	5.6	26.6	36.4	43.5	7.1	Hori.	262	104	HB	
3	135.600	40.3	12.7	5.7	26.6	32.1	43.5	11.4	Hori.	224	250	HB	
4	854.280	31.7	23.0	10.7	27.3	38.1	46.0	7.9	Hori.	100	326	HB	
5	881.400	34.0	23.0	10.9	27.3	40.6	46.0	5.4	Hori.	100	318	HB	
6	908.520	33.9	23.6	11.0	27.2	41.3	46.0	4.7	Hori.	100	313	HB	
7	935.640	32.5	24.0	11.1	27.2	40.4	46.0	5.6	Hori.	100	306	HB	
8	122.040	41.3	11.6	5.6	26.6	31.9	43.5	11.6	Vert.	100	0	HB	
9	854.280	29.1	23.0	10.7	27.3	35.5	46.0	10.5	Vert.	179	208	HB	
10	881.400	31.4	23.0	10.9	27.3	38.0	46.0	8.0	Vert.	100	203	HB	
11	908.520	32.2	23.6	11.0	27.2	39.6	46.0	6.4	Vert.	100	201	HB	
12	935.640	32.0	24.0	11.1	27.2	39.9	46.0	6.1	Vert.	164	208	HB	

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

Spurious emission (Above 30 MHz)

DATA OF RADIATED EMISSION TEST

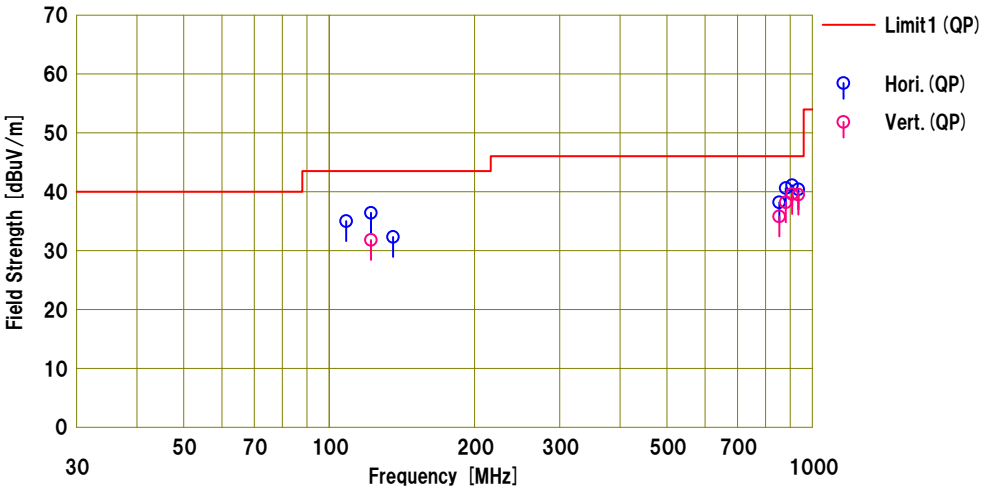
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Date : 2018/11/01

Mode : Transmitting and Receiving
Order No. : 11327848M
Power : DC 5.25V (DC PS AC120V/60Hz)
Temp./Humi. : 20deg.C / 45%RH

Remarks : without Tag

Limit1 : FCC 15B Class B (3m)

Tested by : Kazuhiro Ando



No.	Freq. [MHz]	Reading <QP> [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result <QP> [dBuV/m]	Limit <QP> [dBuV/m]	Margin <QP> [dB]	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
1	108.480	46.0	10.3	5.4	26.7	35.0	43.5	8.5	Hori.	290	102	HB	
2	122.040	45.8	11.6	5.6	26.6	36.4	43.5	7.1	Hori.	257	88	HB	
3	135.600	40.5	12.7	5.7	26.6	32.3	43.5	11.2	Hori.	215	246	HB	
4	854.280	31.8	23.0	10.7	27.3	38.2	46.0	7.8	Hori.	100	328	HB	
5	881.400	34.0	23.0	10.9	27.3	40.6	46.0	5.4	Hori.	100	317	HB	
6	908.520	33.7	23.6	11.0	27.2	41.1	46.0	4.9	Hori.	100	314	HB	
7	935.640	32.5	24.0	11.1	27.2	40.4	46.0	5.6	Hori.	100	302	HB	
8	122.040	41.2	11.6	5.6	26.6	31.8	43.5	11.7	Vert.	100	0	HB	
9	854.280	29.4	23.0	10.7	27.3	35.8	46.0	10.2	Vert.	176	210	HB	
10	881.400	31.6	23.0	10.9	27.3	38.2	46.0	7.8	Vert.	100	207	HB	
11	908.520	32.2	23.6	11.0	27.2	39.6	46.0	6.4	Vert.	100	198	HB	
12	935.640	31.6	24.0	11.1	27.2	39.5	46.0	6.5	Vert.	152	202	HB	

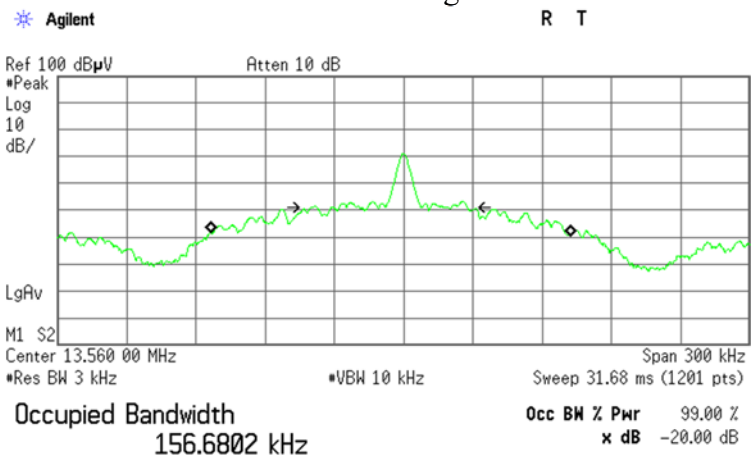
Calculation:Result [dBuV/m] =Reading [dBuV] +Ant.Fac [dB/m] +Loss (Cable) [dB] -Gain (AMP) [dB]
Ant.Type=HB:Hybrid Antenna

20dB Bandwidth

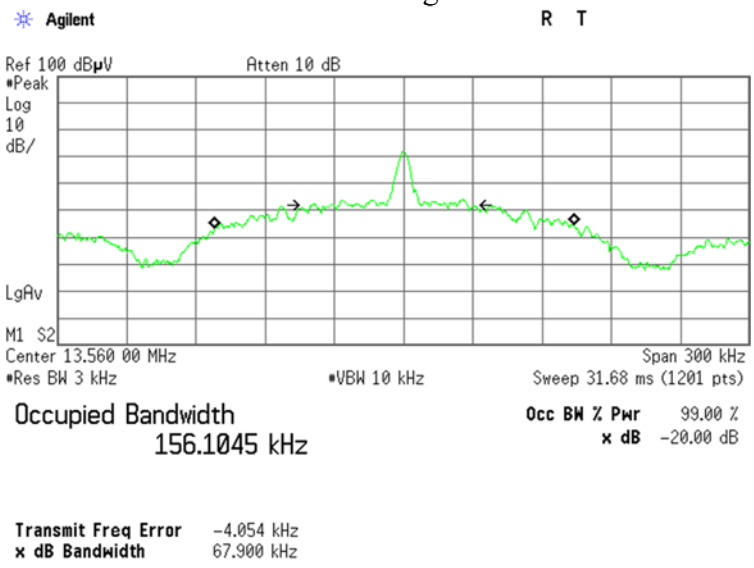
Test place	Kashima EMC Lab. No.10 Semi-Anechoic Chamber
Report No.	11327848M
Date	11/01/2018
Temperature/ Humidity	20 deg. C / 45 % RH
Engineer	Kazuhiro Ando
Mode	Tx Mod on

FREQ [MHz]	Mode	20dB Bandwidth [kHz]
13.56	Without Tag	67.97
	With Tag	67.90

Without Tag



With Tag



Frequency Tolerance

Test place	Kashima EMC Lab. No.2 measurement room
Report No.	11327848M
Date	06/29/2016
Temperature/ Humidity	24 deg. C / 52 % RH
Engineer	Kazuhiro Ando
Mode	Tx Mod off

Test condition		Tested	Measured	Frequency	Result		Limit
Temp.	Voltage	timing	frequency	error			
[deg. C]	[V]		[MHz]	[MHz]	[%]	[ppm]	[+/- %]
50	5	Power on	13.559911	-0.000089	-0.00066	-6.6	0.01
		+ 2 min.	13.559914	-0.000086	-0.00063	-6.3	0.01
		+ 5 min.	13.559919	-0.000081	-0.00060	-6.0	0.01
		+ 10 min.	13.559921	-0.000079	-0.00058	-5.8	0.01
40	5	Power on	13.559924	-0.000076	-0.00056	-5.6	0.01
		+ 2 min.	13.559911	-0.000089	-0.00066	-6.6	0.01
		+ 5 min.	13.559910	-0.000090	-0.00066	-6.6	0.01
		+ 10 min.	13.559910	-0.000090	-0.00066	-6.6	0.01
30	5	Power on	13.559946	-0.000054	-0.00040	-4.0	0.01
		+ 2 min.	13.559924	-0.000076	-0.00056	-5.6	0.01
		+ 5 min.	13.559919	-0.000081	-0.00060	-6.0	0.01
		+ 10 min.	13.559918	-0.000082	-0.00060	-6.0	0.01
20	5	Power on	13.559966	-0.000034	-0.00025	-2.5	0.01
		+ 2 min.	13.559944	-0.000056	-0.00041	-4.1	0.01
		+ 5 min.	13.559937	-0.000063	-0.00046	-4.6	0.01
		+ 10 min.	13.559936	-0.000064	-0.00047	-4.7	0.01
20	4.25	Power on	13.559937	-0.000063	-0.00046	-4.6	0.01
	(5V -15%)	+ 2 min.	13.559922	-0.000078	-0.00058	-5.8	0.01
		+ 5 min.	13.559917	-0.000083	-0.00061	-6.1	0.01
		+ 10 min.	13.559916	-0.000084	-0.00062	-6.2	0.01
20	5.75	Power on	13.559994	-0.000006	-0.00004	-0.4	0.01
	(5V +15%)	+ 2 min.	13.559963	-0.000037	-0.00027	-2.7	0.01
		+ 5 min.	13.559955	-0.000045	-0.00033	-3.3	0.01
		+ 10 min.	13.559954	-0.000046	-0.00034	-3.4	0.01
10	5	Power on	13.559976	-0.000024	-0.00018	-1.8	0.01
		+ 2 min.	13.559964	-0.000036	-0.00027	-2.7	0.01
		+ 5 min.	13.559959	-0.000041	-0.00030	-3.0	0.01
		+ 10 min.	13.559958	-0.000042	-0.00031	-3.1	0.01
0	5	Power on	13.559970	-0.000030	-0.00022	-2.2	0.01
		+ 2 min.	13.559976	-0.000024	-0.00018	-1.8	0.01
		+ 5 min.	13.559974	-0.000026	-0.00019	-1.9	0.01
		+ 10 min.	13.559973	-0.000027	-0.00020	-2.0	0.01
-10	5	Power on	13.559941	-0.000059	-0.00044	-4.4	0.01
		+ 2 min.	13.559971	-0.000029	-0.00021	-2.1	0.01
		+ 5 min.	13.559975	-0.000025	-0.00018	-1.8	0.01
		+ 10 min.	13.559975	-0.000025	-0.00018	-1.8	0.01
-20	5	Power on	13.559883	-0.000117	-0.00086	-8.6	0.01
		+ 2 min.	13.559947	-0.000053	-0.00039	-3.9	0.01
		+ 5 min.	13.559957	-0.000043	-0.00032	-3.2	0.01
		+ 10 min.	13.559958	-0.000042	-0.00031	-3.1	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)

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APPENDIX 2: Test instruments

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
CE	143498	A.M.N.	Rohde & Schwarz	ESH3-Z5	828874/019	2018/07/10	2019/07/31	12
CE	143499	A.M.N.	Rohde & Schwarz	ESH3-Z5	829567/010	2018/07/10	2019/07/31	12
CE	143703	Terminator	Suhner	65_BNC-50-0-2/133_NE	None	2017/11/02	2018/11/30	12
CE	143155	Coaxial Cable	Fujikura,Fujikura,Fujikura,Fujikura	5D-2W,5D-2W,5D-2W,5D-2W	-	2018/07/25	2019/07/31	12
CE	144195	Test Receiver	Rohde & Schwarz	ESCI	100053	2018/09/28	2019/09/30	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	158789	Coaxial Cable	BELDEN	RG214,5D-2W,8494A,5D-2W,5D-2W,5D-2	MY41110200(Step Att)	2018/08/30	2019/08/31	12
RE	143165	Coaxial Cable	Fujikura,Fujikura,Agilent,Fujikura,Fujikura,Fujikura,Fuhjikura,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
RE	144199	Test Receiver	AGILENT	N9038A	MY53290016	2018/07/10	2019/07/31	12
EMI	143654		TAJIMA	L19-55		-	-	
EMI	143542	Temperature & Humidity Indicator	HIOKI	3641/9680-50	090999895/090905406	2018/05/30	2019/05/31	12
EMI	143133	Barometer	Sunoh	SBR-151	'001439	2015/11/18	2018/11/30	36
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	-	-	-
FT	144220	Digital Multimeter	Fluke Corporation	87-3	85220051	2015/10/01	2016/10/31	12
FT	143942	Near Field Probe	Langer	LF-R400	'02-0815	-	-	-
FT	143181	Temperature and Humidity Chamber	ESPEC	PL-1J	15004059	2015/06/01	2016/06/30	12
FT	143423	Frequency Counter	AGILENT	53151A	US40511823	2016/04/08	2017/04/30	12
FT	142991	Micro Wave Cable	Junkosha	MWX241	MRA-12-14-146	2016/05/12	2017/05/31	12
RE	143833	Loop Antenna	Rohde & Schwarz	HFH2-Z2	827779/008	2018/10/10	2019/10/31	12
RE	144245	6dB Fixed Atten.	Suhner	6906.01.A	None	2018/07/04	2019/07/31	12
RE	171927	Pre Amplifier	UL Japan Inc.	CALI-84+	1	2018/07/25	2019/07/31	12
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	143161	Coaxial Cable	FUJIKURA	3D2W	None	2018/05/25	2019/05/31	12

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

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

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