



RADIO TEST REPORT

Test Report No. : 12091656H-A-R3

Applicant : Seedsware Corporation
Type of Equipment : NFC Module
Model No. : ARI3000/2250
Test regulation : FCC Part 15 Subpart C: 2018
FCC ID : 2AJ9J003
Test Result : Complied

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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. This report is a revised version of 12091656H-A-R2. 12091656H-A-R2 is replaced with this report.

Date of test: December 18, 2017 to March 27, 2018

Representative test engineer:

Hiroyuki Furutaka
Engineer
Consumer Technology Division

Approved by:

Tsubasa Takayama
Leader
Consumer Technology Division



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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 12091656H-A

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SECTION 1: Customer information

Company Name	:	Seedsware Corporation
Address	:	Seedsware Nanba Office, 3-5-13 Nanba-naka, Naniwa-ku, Osaka-shi, Osaka 556-0011
Telephone Number	:	+81-6-4394-7710
Facsimile Number	:	+81-6-4394-7388
Contact Person	:	Masayuki Tomita

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

2.1 Identification of E.U.T.

Type of Equipment	:	NFC Module
Model No.	:	ARI3000/2250
Serial No.	:	Refer to Section 4, Clause 4.2
Receipt Date of Sample	:	December 18, 2017
Country of Mass-production	:	Japan
Condition of EUT	:	Production model
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model No: ARI3000/2250, (referred to as the EUT in this report), is the NFC Module.

Radio Specification

NFC

Radio Type	:	Transceiver
Frequency of Operation	:	13.56 MHz
Modulation	:	ASK
Antenna type	:	13.56 MHz Pattern antenna
Clock frequency	:	27.12 MHz

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on February 2, 2018 and effective March 5, 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.

* The revision on February 2, 2018, does not affect the test specification applied to the EUT.

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, 1.72556 MHz, N (Cradle)	Complied	Radiated
	<IC>RSS-Gen 8.8	<IC>RSS-Gen 8.8	[AV] 10.8 dB, 1.72556 MHz, N (Cradle)		
Electric Field Strength of Fundamental Emission	ANSI C63.10:2013 6 Standard test methods	Section 15.225(a)	72.0 dB, 13.56000 MHz, QP, 90 deg. (Cradle)	Complied	Radiated
	<IC> RSS-Gen 6.4, 6.12	<IC>RSS-210 B.6			
Spectrum Mask	ANSI C63.10:2013 6 Standard test methods	Section 15.225(b)(c)	46.2 dB, 13.11000 MHz, QP, 0 deg. (Tablet)	Complied	Radiated
	<IC>RSS-Gen 6.4, 6.13	<IC> RSS-210 B.6			
20dB Bandwidth	ANSI C63.10:2013 6 Standard test methods	Section15.215(c)	See data	Complied	Radiated
	<IC> -	<IC> -			
Electric Field Strength of Spurious Emission	ANSI C63.10:2013 6 Standard test methods	Section 15.209, Section 15.225 (d)	1.7 dB 881.408 MHz, Horizontal, QP (Cradle)	Complied	Radiated
	<IC>RSS-Gen 6.4, 6.13	<IC>RSS-210 B.6			
Frequency Tolerance	ANSI C63.10:2013 6 Standard test methods	Section 15.225(e)	See data	Complied	Radiated
	<IC>RSS-Gen 6.11, 8.11	<IC> RSS-210 B.6			
Note: UL Japan, Inc.’s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422					

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

The antenna is not removable from 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 $k = 2$.

Frequency range	Conducted emission using AMN(LISN) (+/-)
0.009 MHz to 0.15 MHz	3.8 dB
0.15 MHz to 30 MHz	3.4 dB

Test distance	Radiated emission (+/-)
	9 kHz to 30 MHz
3 m	3.8 dB
10 m	3.6 dB

*Measurement distance

Polarity	Radiated emission (Below 1 GHz)			
	(3 m*)(+/-)		(10 m*)(+/-)	
	30 MHz to 200 MHz	200 MHz to 1000 MHz	30 MHz to 200 MHz	200 MHz to 1000 MHz
Horizontal	4.8 dB	5.2 dB	4.8 dB	5.0 dB
Vertical	5.0 dB	6.3 dB	4.9 dB	5.0 dB

* Measurement distance

Antenna terminal test	Uncertainty (+/-)
Frequency error	
13.56 MHz	0.01541 ppm

Conducted emission test

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

Radiated emission test (3 m)

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

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3.5 Test Location

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NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.6 shielded room	-	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	-	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	-	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	-	3.1 x 5.0 x 2.7	N/A	-	-
No.9 measurement room	-	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	-	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 m x 2.0 m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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

4.1 Operating Modes

The mode is used :

Mode	Remarks*
Transmitting mode (Tx) 13.56 MHz Mod on	The EUT Transmits and Receives at the same time and there is no receiving mode.
Any condition 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 *1)
Conducted emission	Tx with Tag
Electric Field Strength of Fundamental Emission	Tx with Tag
Spectrum Mask	Tx with Tag
Electric Field Strength of Spurious Emission	Tx with Tag
20dB Bandwidth and 99% Occupied Bandwidth	Tx with Tag
Frequency Tolerance	Tx with Tag

*1) After the comparison of the test data between with Tag and without Tag, the tests were performed with Tag which was the worst case.

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

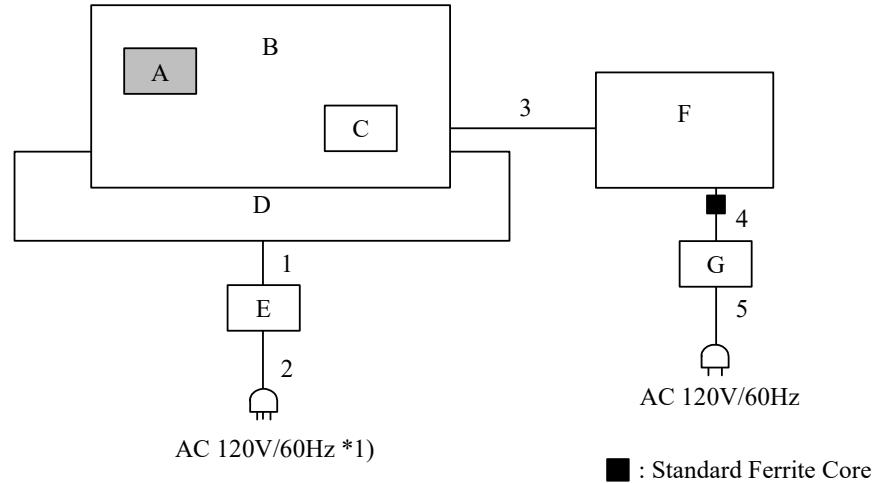
Frequency Tolerance:

Temperature : -20deg.C to +50deg.C Step 10deg.C
Voltage : Normal Voltage DC 3.3 V
Maximum Voltage DC 3.795 V
Minimum Voltage DC 2.805 V
(DC 3.3 V \pm 15%)

4.2 Configuration and peripherals

[Tablet]

For Conducted emission test



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

*1) Conducted emission test was performed on this port

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	NFC Module	ARI3000/2250	14J090022	Seedsware Corporation	EUT
B	WLAN/NFC Tablet	IST01-7WS1-SSS-01	0000000015	Seedsware Corporation	-
C	Battery	BJ-T310016AA	1511A	Panasonic	-
D	Cradle	ISC01-NNB1-SSS	0000000002	Seedsware Corporation	-
E	Power supply Jig	PBA50F-24	4214097TR	COSEL	-
F	Laptop PC	CF-N8HWC DPS	0BKSA08729	Panasonic	-
G	AC Adapter	CF-AA6372B	6372BM610909023E	Panasonic	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC Cable	0.6	Unshielded	Unshielded	-
2	AC Cable	1.8	Unshielded	Unshielded	-
3	LAN Cable	1.9	Unshielded	Unshielded	-
4	DC Cable	1.1	Unshielded	Unshielded	-
5	AC Cable	1.0	Unshielded	Unshielded	-

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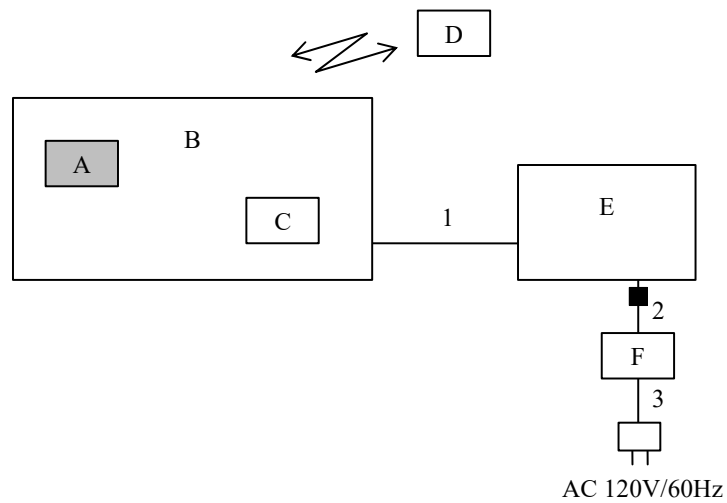
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For Radiated emission test



■ : Standard Ferrite Core

* 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	NFC Module	ARI3000/2250	14J090022	Seedsware Corporation	EUT
B	WLAN/NFC Tablet	IST01-7WS1-SSS-01	0000000015	Seedsware Corporation	-
C	Battery	BJ-T310016AA	1511A	Panasonic	-
D	Tag	MIFARE	2EAD33B1	FUJIFILM Imaging Systems	106kbps
E	Laptop PC	PC-VY22MAN5HJR9	03005371A	NEC	-
F	AC Adapter	ADP-90YB E	2614463DC	NEC	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Lan Cable	1.9	Unshielded	Unshielded	
2	DC Cable	1.8	Unshielded	Unshielded	
3	AC Cable	1.8	Unshielded	Unshielded	

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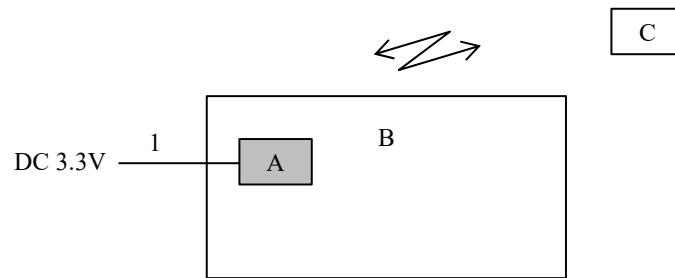
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For Frequency Tolerance



* 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	NFC Module	ARI3000/2250	14J090022	Seedware Corporation	EUT
B	WLAN/NFC Tablet	IST01-7WS1-SSS-01	0000000015	Seedware Corporation	-
C	Tag	MIFARE	2EAD33B1	FUJIFILM Imaging Systems	106kbps

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC Cable	2.0	Unshielded	Unshielded	

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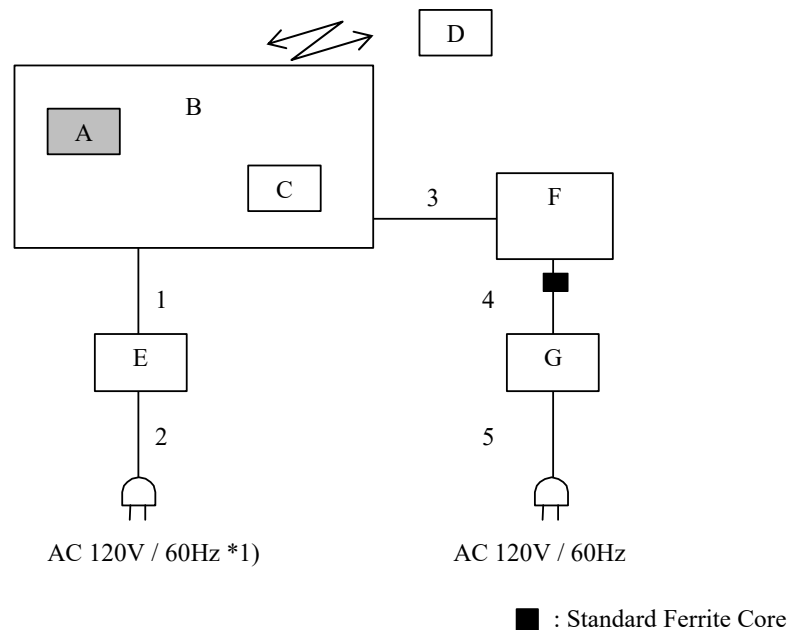
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[Cradle]



* Cabling and setup were taken into consideration and test data was taken under worse case conditions.
*1) Conducted emission test was performed on this port

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	NFC Module	ARI3000/2250	14J090022	Seedsware Corporation	EUT
B	Cradle	ISC01-NNB1-SSS	0000000002	Seedsware Corporation	-
C	SD Card	-	-	-	-
D	Tag	MIFARE	1	FUJIFILM Imaging Systems	106kbps
E	Power supply jig	PMC35-2A	13090501	KIKUSUI	*for CE
		PBA50F-24	4214097TR	COSEL	*for RE
F	Laoptop PC	Pro Book 4340s	SPB14025	hp	*for CE
		PC-VY22MAN5HJR9	03005371A	NEC	*for RE
G	AC Adapter	NSW24187	WCNXA0C1R4VL8R	hp	*for CE
		ADP-90YB E	2614463DC	NEC	*for RE

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC Cable	0.6	Unshielded	Unshielded	-
2	AC Cable	1.8 for CE* 1.8 for RE*	Unshielded	Unshielded	*1)
3	LAN Cable	1.9	Unshielded	Unshielded	-
4	DC Cable	2.9	Unshielded	Unshielded	-
5	AC Cable	0.8	Unshielded	Unshielded	-

*1) Conducted Emission test was performed on this AC Cable.

* CE: Conducted emission test
RE: Radiated emission test

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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.

For the tests on EUT with other peripherals (as a whole system)

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. All unused 50 ohm connectors of the LISN (AMN) were resistivity terminated in 50 ohm when not connected to the measuring equipment.

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
Test result	: Pass

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 1.0 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 200 MHz	200 MHz to 1 GHz
Antenna Type	Loop	Biconical	Logperiodic

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.

<Tablet>

- 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.

<Cradle>

- 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

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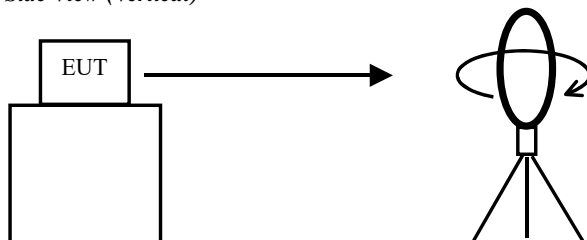
SECTION 7: Other test

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used	Remarks
20 dB Bandwidth	1 MHz	10 kHz	30 kHz	Auto	Peak	Max Hold	Spectrum Analyzer	*1)
Frequency Tolerance	-	-	-	-	-	-	Frequency counter *2)	-
*1) It was confirmed that pre-test was performed and no side bands appeared near the left and right ends.								
*2) The measurement was performed with Marker Frequency Counter Function.								

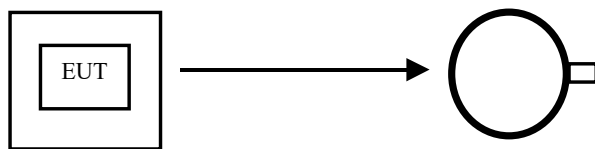
Test data : APPENDIX
Test result : Pass

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

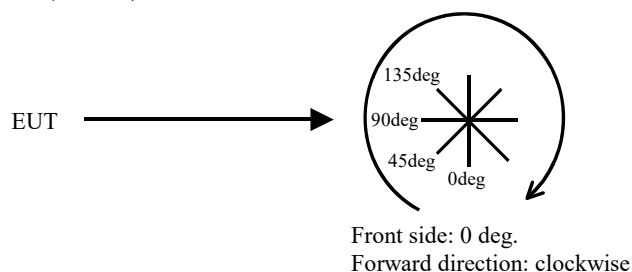


Top View (Horizontal)



Antenna was not rotated.

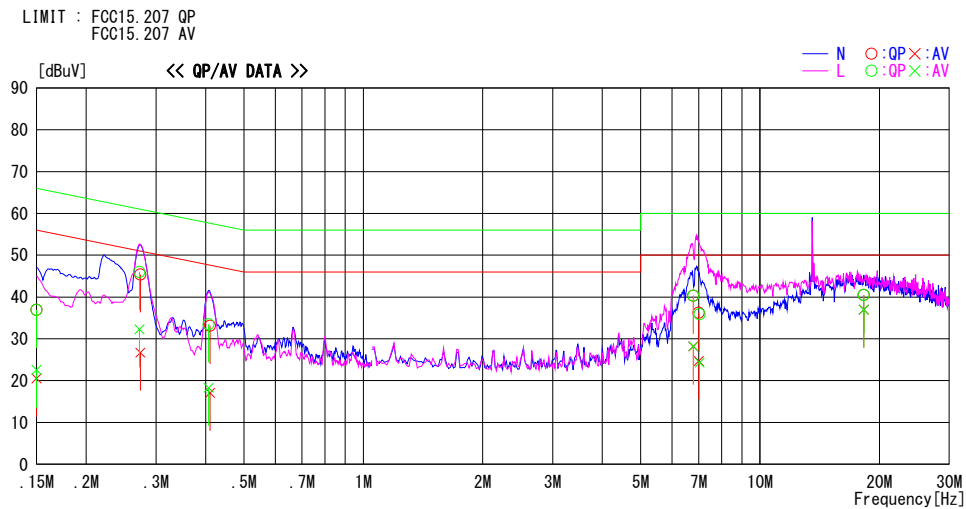
Top View (Vertical)



APPENDIX 1: Test data

Conducted emission Tablet

Report No. 12091656H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date March 27, 2018
Temperature / Humidity 21 deg. C / 33 % RH
Engineer Yuta Moriya
Mode Tx 13.56 MHz with Tag (With Antenna)



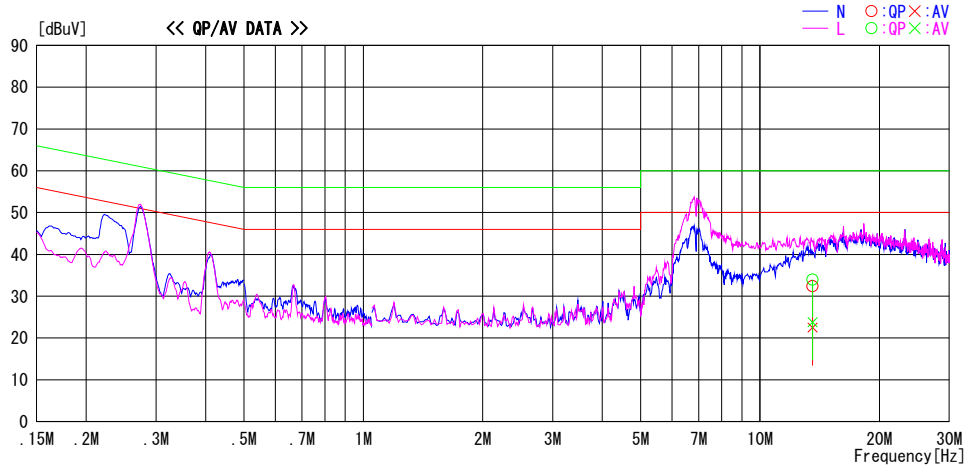
Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15000	23.7	7.3	13.2	36.9	20.5	66.0	56.0	29.1	35.5	N	
0.27391	32.2	13.5	13.2	45.4	26.7	61.0	51.0	15.6	24.3	N	
0.41059	19.8	3.8	13.3	33.1	17.1	57.6	47.6	24.5	30.5	N	
6.78380	26.5	14.4	13.8	40.3	28.2	60.0	50.0	19.7	21.8	N	
7.00730	22.4	10.9	13.8	36.2	24.7	60.0	50.0	23.8	25.3	N	
18.24408	26.2	22.7	14.3	40.5	37.0	60.0	50.0	19.5	13.0	N	
0.15000	23.7	7.3	13.2	36.9	22.6	66.0	56.0	29.1	33.4	L	
0.27250	32.8	19.1	13.2	46.0	32.3	61.0	51.0	15.0	18.7	L	
0.40741	20.2	5.0	13.3	33.5	18.3	57.7	47.7	24.2	29.4	L	
6.79758	26.5	14.4	13.8	40.3	28.2	60.0	50.0	19.7	21.8	L	
7.03908	22.1	10.5	13.8	35.9	24.3	60.0	50.0	24.1	25.7	L	
18.24408	26.2	22.7	14.3	40.5	37.0	60.0	50.0	19.5	13.0	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)
Except for the above table: adequate margin data below the limits.

Conducted emission Tablet

Report No. 12091656H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date March 27, 2018
Temperature / Humidity 21 deg. C / 33 % RH
Engineer Yuta Moriya
Mode Tx 13.56 MHz (Antenna: 50 ohm terminated)

LIMIT : FCC15.207 QP
FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
13.56000	18.3	8.4	14.1	32.4	22.5	60.0	50.0	27.6	27.5	N	
13.56000	19.9	9.7	14.1	34.0	23.8	60.0	50.0	26.0	26.2	L	

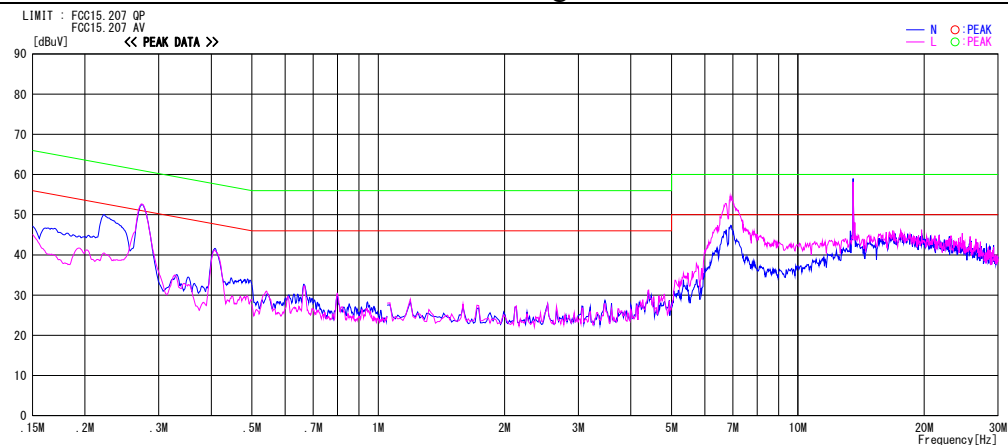
CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)
Except for the above table: adequate margin data below the limits.

Conducted emission Tablet

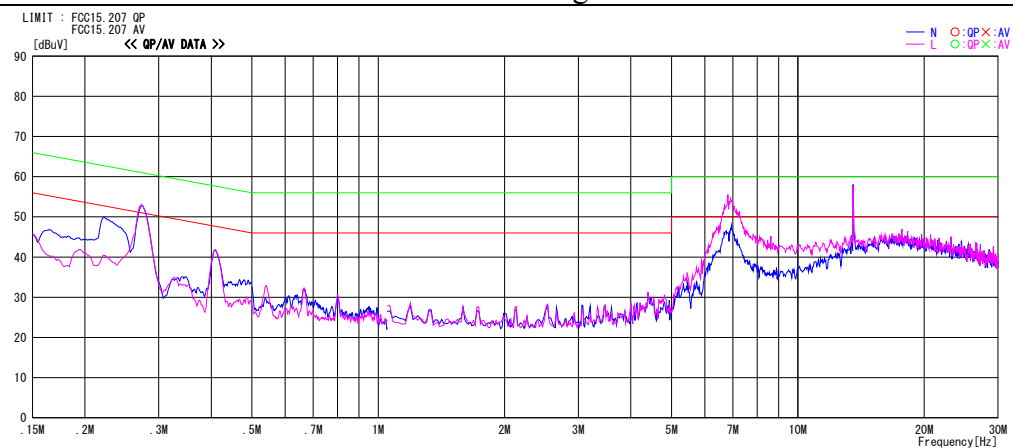
Report No.	12091656H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	March 27, 2018
Temperature / Humidity	21 deg. C / 33 % RH
Engineer	Yuta Moriya
Mode	Tx 13.56 MHz

Tablet

With Tag



Without Tag



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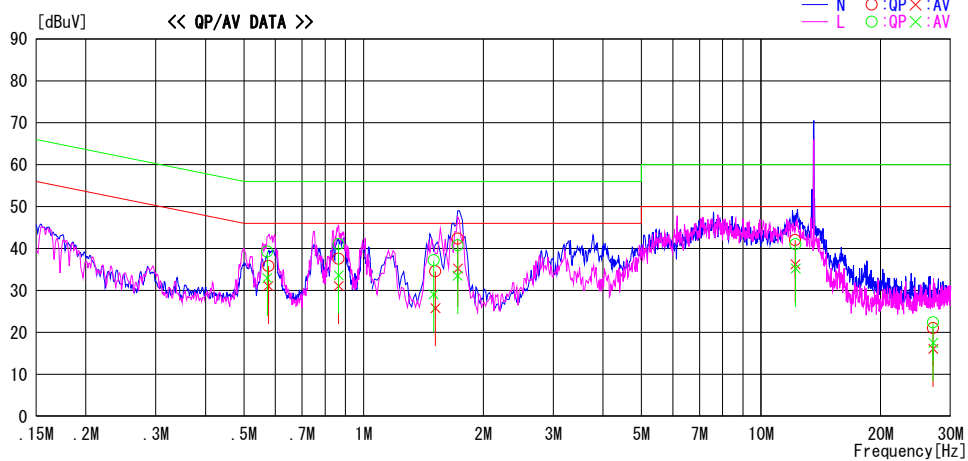
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted emission Cradle

Report No. 12091656H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date February 26, 2018
Temperature / Humidity 22 deg. C / 23 % RH
Engineer Ryota Yamanaka
Mode Tx 13.56 MHz with Tag (With Antenna)

LIMIT : FCC15.207 QP
FCC15.207 AV



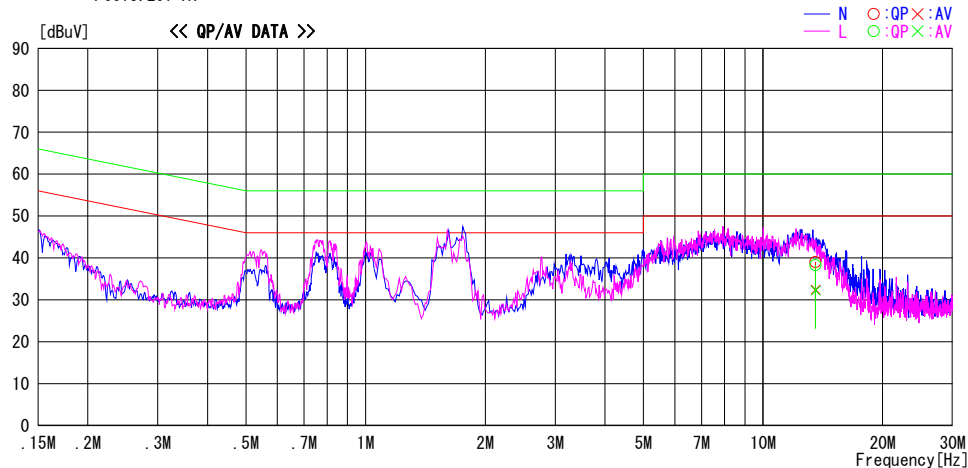
Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.57214	26.1	19.8	13.2	39.3	33.0	56.0	46.0	16.7	13.0	L	
0.57579	22.7	17.9	13.2	35.9	31.1	56.0	46.0	20.1	14.9	N	
0.86491	27.7	20.3	13.3	41.0	33.6	56.0	46.0	15.0	12.4	L	
0.86512	24.3	17.8	13.3	37.6	31.1	56.0	46.0	18.4	14.9	N	
1.50120	23.6	15.5	13.6	37.2	29.1	56.0	46.0	18.8	16.9	L	
1.51600	21.0	12.2	13.6	34.6	25.8	56.0	46.0	21.4	20.2	N	
1.72500	27.3	20.1	13.4	40.7	33.5	56.0	46.0	15.3	12.5	L	
1.72556	29.0	21.8	13.4	42.4	35.2	56.0	46.0	13.6	10.8	N	
12.19770	27.7	21.9	14.3	42.0	36.2	60.0	50.0	18.0	13.8	N	
12.21960	26.7	20.9	14.3	41.0	35.2	60.0	50.0	19.0	14.8	L	
27.12013	5.8	0.9	15.2	21.0	16.1	60.0	50.0	39.0	33.9	N	
27.12022	7.2	2.3	15.2	22.4	17.5	60.0	50.0	37.6	32.5	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)
Except for the above table: adequate margin data below the limits.

Conducted emission Cradle

Report No. 12091656H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date February 26, 2018
Temperature / Humidity 22 deg. C / 23 % RH
Engineer Ryota Yamanaka
Mode Tx 13.56 MHz (Antenna: 50 ohm terminated)

LIMIT : FCC15.207 QP
FCC15.207 AV



Frequency	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP	AV		QP	AV	QP	AV	QP	AV		
[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
13.56000	24.6	18.0	14.4	39.0	32.4	60.0	50.0	21.0	17.6	N	
13.56000	23.9	17.8	14.4	38.3	32.2	60.0	50.0	21.7	17.8	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)
Except for the above table: adequate margin data below the limits.

Conducted emission Cradle

Report No. 12091656H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date February 26, 2018
Temperature / Humidity 22 deg. C / 23 % RH
Engineer Ryota Yamanaka
Mode Tx 13.56MHz

With Tag

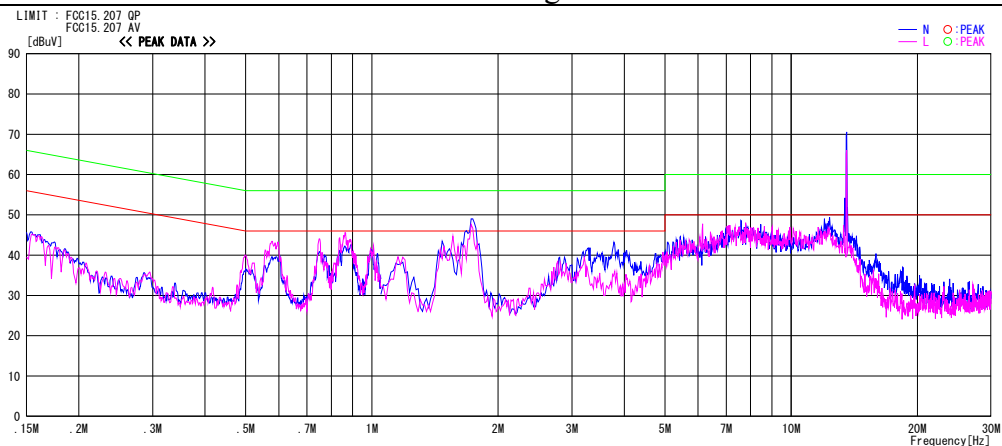


CHART : WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)
Except for the above table: adequate margin data below the limits.

Without Tag

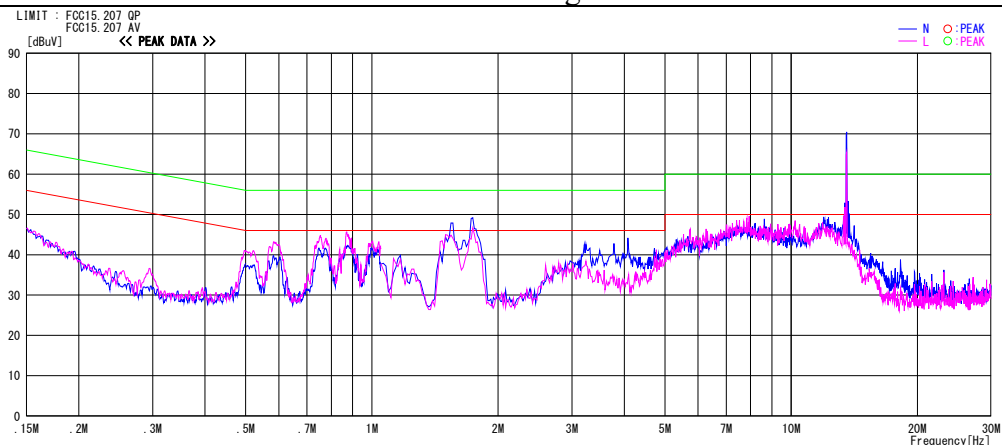


CHART : WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)
Except for the above table: adequate margin data below the limits.

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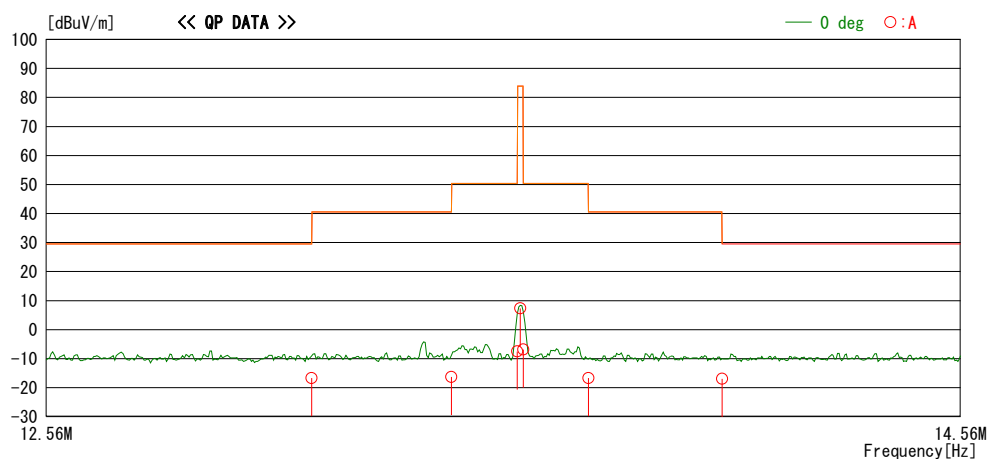
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Fundamental emission and Spectrum Mask Tablet

Report No. 12091656H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date December 18, 2017
Temperature / Humidity 23 deg. C / 30 % RH
Engineer Takumi Shimada
Mode Tx 13.56MHz with Tag

LIMIT : FCC15_225_PKQP, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15_225_AVQP, 9-90kHz:AV, 110-490kHz:AV, other:QP



Freq.	Reading	DET	Ant. Fac	Loss	Gain	Result	Limit	Margin	Antenna	Table	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[deg]	[deg]	
13.11000	28.9	QP	19.6	-32.9	32.3	-16.7	29.5	46.2	0	A	13
13.41000	29.3	QP	19.6	-32.9	32.3	-16.3	40.5	56.8	0	A	187
13.55300	38.1	QP	19.6	-32.9	32.3	-7.5	50.4	57.9	0	A	179
13.56000	52.9	QP	19.6	-32.9	32.3	7.3	83.9	76.6	0	A	180
13.56700	38.7	QP	19.6	-32.9	32.3	-6.9	50.4	57.3	0	A	179
13.71000	28.9	QP	19.6	-32.9	32.3	-16.7	40.5	57.2	0	A	0
14.01000	28.7	QP	19.5	-32.9	32.3	-17.0	29.5	46.5	0	A	0

Result of the fundamental emission at 3 m without Distance factor

QP

Ant Deg [deg]	Frequency	Detector	Reading	Ant Factor	Loss	Gain	Duty Factor	Result	Limit	Margin	Remark
	[MHz]		[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
0	13.56000	QP	52.9	19.6	7.1	32.3	-	47.3	-	-	Fundamental

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

UL Japan, Inc.

Ise EMC Lab.

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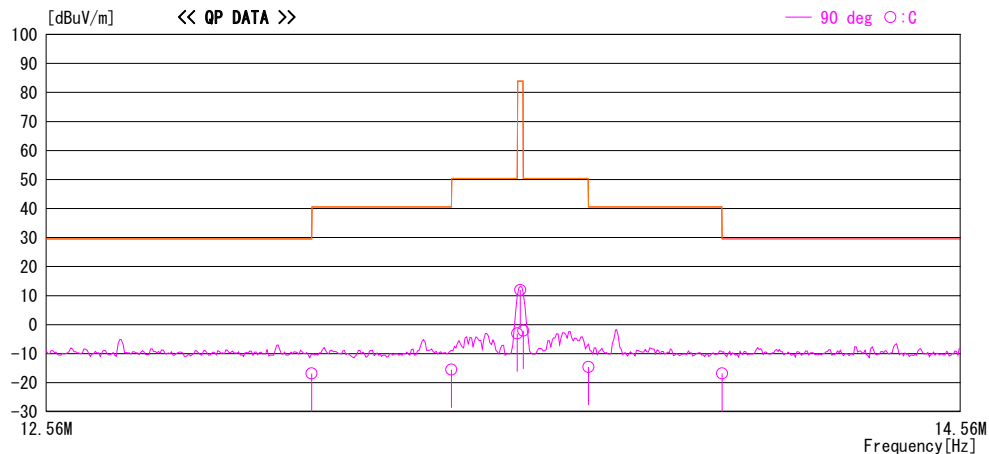
Facsimile : +81 596 24 8124

Fundamental emission and Spectrum Mask

Cradle

Report No. 12091656H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date December 18, 2017
Temperature / Humidity 23 deg. C / 30 % RH
Engineer Takumi Shimada
Mode Tx 13.56MHz with Tag

LIMIT : FCC15_225_PKQP, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15_225_AVQP, 9-90kHz:AV, 110-490kHz:AV, other:QP



Freq.	Reading	DET	Ant. Fac	Loss	Gain	Result	Limit	Margin	Antenna	Table	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[deg]	[deg]	
13.11000	28.8	QP	19.6	-32.9	32.3	-16.8	29.5	46.3	90	C	0
13.41000	30.0	QP	19.6	-32.9	32.3	-15.6	40.5	56.1	90	C	261
13.55300	42.6	QP	19.6	-32.9	32.3	-3.0	50.4	53.4	90	C	265
13.56000	57.5	QP	19.6	-32.9	32.3	11.9	83.9	72.0	90	C	262
13.56700	43.5	QP	19.6	-32.9	32.3	-2.1	50.4	52.5	90	C	264
13.71000	31.0	QP	19.6	-32.9	32.3	-14.6	40.5	55.1	90	C	264
14.01000	28.8	QP	19.5	-32.9	32.3	-16.9	29.5	46.4	90	C	0

Result of the fundamental emission at 3 m without Distance factor

QP

Ant Deg [deg]	Frequency	Detector	Reading	Ant Factor	Loss	Gain	Duty Factor	Result	Limit	Margin	Remark
	[MHz]		[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
90	13.56000	QP	57.5	19.6	7.1	32.3	-	51.9	-	-	Fundamental

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

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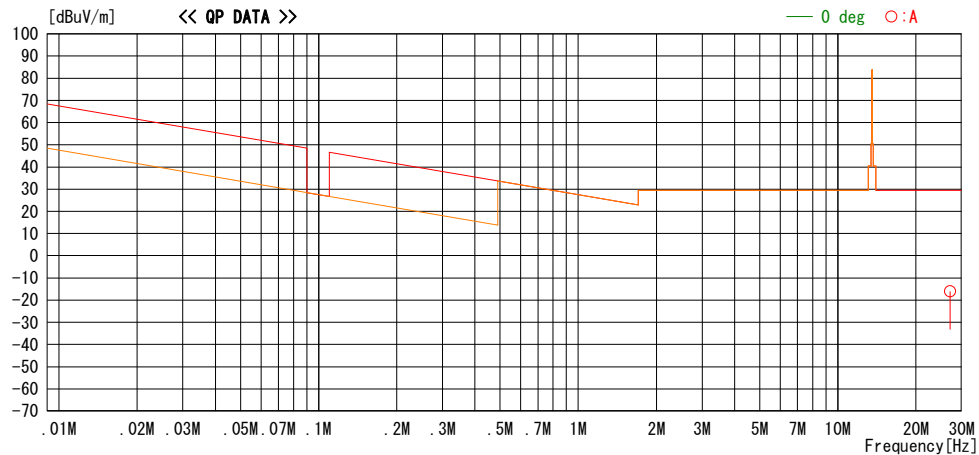
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Spurious emission Tablet

Report No. 12091656H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date December 18, 2017
Temperature / Humidity 23 deg. C / 30 % RH
Engineer Takumi Shimada
(Below 30 MHz)
Mode Tx 13.56MHz with Tag

LIMIT : FCC15_225_PKQP, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15_225_AVQP, 9-90kHz:AV, 110-490kHz:AV, other:QP



Freq.	Reading	DET	Ant. Fac	Loss	Gain	Result	Limit	Margin	Antenna	Table	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[deg]	[deg]	
27.12000	28.2	QP	20.4	-32.4	32.2	-16.0	29.5	45.5	0	A	320

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC,
1000 MHz -: HORN

CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

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Ise EMC Lab.

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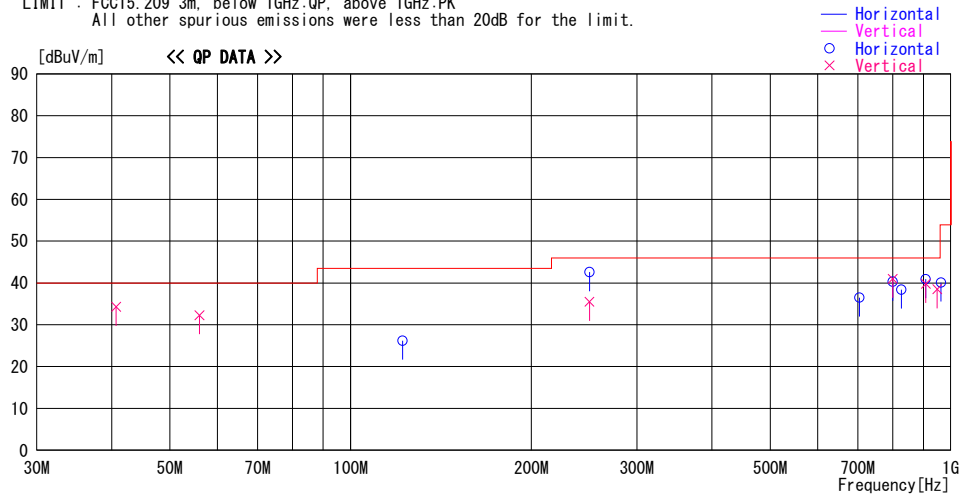
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Spurious emission Tablet

Report No. 12091656H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date February 19, 2018
Temperature / Humidity 23 deg. C / 34 % RH
Engineer Hiroyuki Furutaka
(Above 30 MHz)
Mode Tx 13.56MHz with Tag

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK
All other spurious emissions were less than 20dB for the limit.



Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss&	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Gain [dB]							
40.684	45.2	QP	14.0	-24.9	34.3	256	100	Vert.	40.0	5.7	
55.997	48.3	QP	8.6	-24.6	32.3	310	100	Vert.	40.0	7.7	
250.000	46.3	QP	11.6	-22.4	35.5	67	100	Vert.	46.0	10.5	
800.049	38.9	QP	20.6	-18.5	41.0	352	136	Vert.	46.0	5.0	
908.536	35.3	QP	21.9	-17.4	39.8	179	100	Vert.	46.0	6.2	
949.211	33.4	QP	22.1	-17.0	38.5	189	100	Vert.	46.0	7.5	
122.043	37.1	QP	12.9	-23.8	26.2	325	300	Hori.	43.5	17.3	
250.000	53.4	QP	11.6	-22.4	42.6	323	128	Hori.	46.0	3.4	
704.000	36.5	QP	19.6	-19.6	36.5	32	120	Hori.	46.0	9.5	
800.000	38.2	QP	20.6	-18.5	40.3	333	100	Hori.	46.0	5.7	
827.172	35.6	QP	21.0	-18.2	38.4	9	100	Hori.	46.0	7.6	
908.530	36.4	QP	21.9	-17.4	40.9	190	145	Hori.	46.0	5.1	
962.771	34.9	QP	22.1	-16.9	40.1	160	143	Hori.	53.9	13.8	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC,
1000 MHz -: HORN

CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

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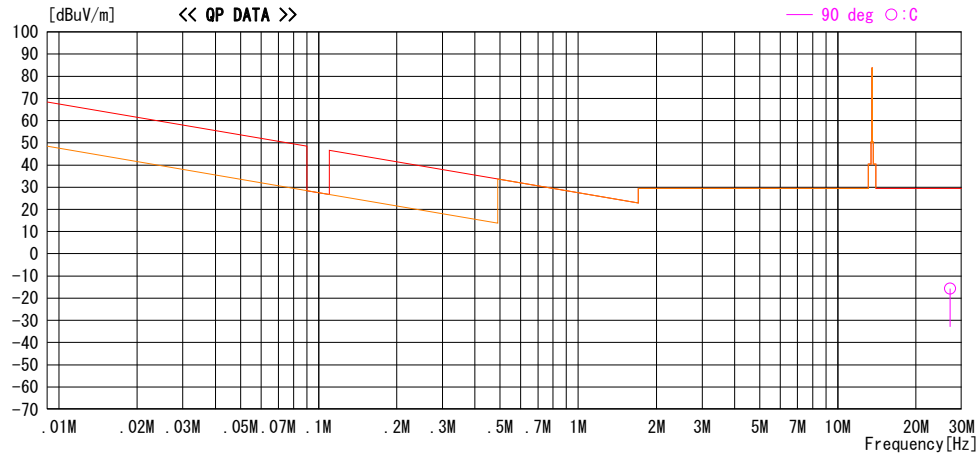
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Spurious emission Cradle

Report No. 12091656H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date December 18, 2017
Temperature / Humidity 23 deg. C / 30 % RH
Engineer Takumi Shimada
(Below 30 MHz)
Mode Tx 13.56MHz with Tag

LIMIT : FCC15_225_PKQP, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15_225_AVQP, 9-90kHz:AV, 110-490kHz:AV, other:QP



Freq.	Reading	DET	Ant. Fac	Loss	Gain	Result	Limit	Margin	Antenna	Table	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[deg]	[deg]	
27.12000	28.5	QP	20.4	-32.4	32.2	-15.7	29.5	45.2	90	11	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC,
1000 MHz -: HORN

CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

UL Japan, Inc.

Ise EMC Lab.

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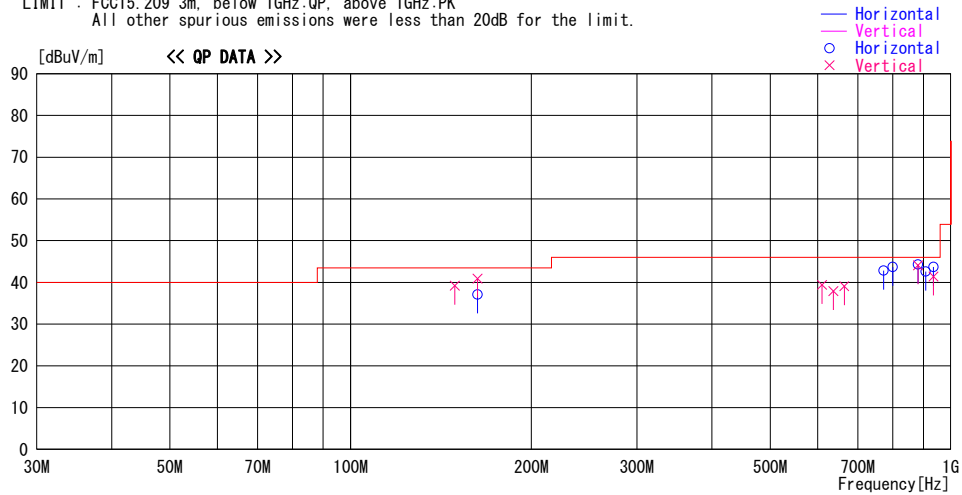
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Spurious emission Cradle

Report No. 12091656H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date February 19, 2018
Temperature / Humidity 23 deg. C / 34 % RH
Engineer Hiroyuki Furutaka
(Above 30 MHz)
Mode Tx 13.56MHz with Tag

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK
All other spurious emissions were less than 20dB for the limit.



Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss&	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Gain [dB]							
162.724	48.5	QP	15.6	-23.2	40.9	234	100	Vert.	43.5	2.6	
149.165	47.7	QP	14.9	-23.4	39.2	199	100	Vert.	43.5	4.3	
162.726	44.7	QP	15.6	-23.2	37.1	290	179	Hori.	43.5	6.4	
610.209	40.3	QP	19.1	-20.0	39.4	26	152	Vert.	46.0	6.6	
637.322	38.7	QP	19.2	-20.0	37.9	274	150	Vert.	46.0	8.1	
664.448	39.5	QP	19.4	-19.8	39.1	267	138	Vert.	46.0	6.9	
772.928	41.4	QP	20.3	-18.9	42.8	169	100	Hori.	46.0	3.2	
800.048	41.6	QP	20.6	-18.5	43.7	168	100	Hori.	46.0	2.3	
881.408	40.3	QP	21.7	-17.7	44.3	24	100	Hori.	46.0	1.7	
881.408	40.1	QP	21.7	-17.7	44.1	329	126	Vert.	46.0	1.9	
908.530	38.1	QP	21.9	-17.4	42.6	29	100	Hori.	46.0	3.4	
935.650	38.8	QP	22.0	-17.1	43.7	37	100	Hori.	46.0	2.3	
935.652	36.5	QP	22.0	-17.1	41.4	324	131	Vert.	46.0	4.6	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC,
1000 MHz -: HORN

CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

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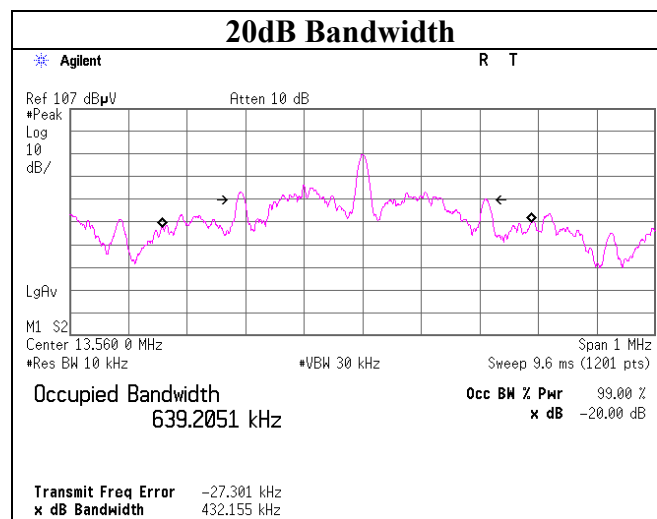
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

20dB Bandwidth Tablet

Test place Ise EMC Lab. No.2 measurement room
Report No. 12091656H
Date 12/18/2017
Temperature/ Humidity 20 deg. C / 33 % RH
Engineer Takumi Shimada
Mode Tx Mod on with Tag

FREQ [MHz]	20dB Bandwidth [kHz]
13.56	432.155



Frequency Tolerance

Test place : Ise EMC Lab. No.6 measurement room
Report No. : 11502065H
Date : 01/20/2018
Temperature/ Humidity : 26 deg. C / 30 % RH
Engineer : Tomoki Matsui
Mode : Tx Mod on with Tag

Test condition		Tested timing	Measured frequency [MHz]	Frequency error [MHz]	Result		Limit [+/- %]
Temp. [deg. C]	Voltage [V]				[%]	[ppm]	
50	3.3	Power on	13.560004	0.000004	0.00003	0.3	0.01
		+ 2 min.	13.560019	0.000019	0.00014	1.4	0.01
		+ 5 min.	13.559964	-0.000036	-0.00026	-2.6	0.01
		+ 10 min.	13.559992	-0.000008	-0.00006	-0.6	0.01
40	3.3	Power on	13.560033	0.000033	0.00024	2.4	0.01
		+ 2 min.	13.560043	0.000043	0.00032	3.2	0.01
		+ 5 min.	13.560010	0.000010	0.00007	0.7	0.01
		+ 10 min.	13.560037	0.000037	0.00027	2.7	0.01
30	3.3	Power on	13.560033	0.000033	0.00024	2.4	0.01
		+ 2 min.	13.560041	0.000041	0.00031	3.1	0.01
		+ 5 min.	13.560033	0.000033	0.00024	2.4	0.01
		+ 10 min.	13.560013	0.000013	0.00009	0.9	0.01
20	3.3	Power on	13.560064	0.000064	0.00047	4.7	0.01
		+ 2 min.	13.560042	0.000042	0.00031	3.1	0.01
		+ 5 min.	13.560043	0.000043	0.00032	3.2	0.01
		+ 10 min.	13.560019	0.000019	0.00014	1.4	0.01
20	2.805 (3.3V -15%)	Power on	13.560034	0.000034	0.00025	2.5	0.01
		+ 2 min.	13.560062	0.000062	0.00046	4.6	0.01
		+ 5 min.	13.560043	0.000043	0.00032	3.2	0.01
		+ 10 min.	13.560033	0.000033	0.00024	2.4	0.01
20	3.795 (3.3V +15%)	Power on	13.560062	0.000062	0.00046	4.6	0.01
		+ 2 min.	13.560041	0.000041	0.00030	3.0	0.01
		+ 5 min.	13.560042	0.000042	0.00031	3.1	0.01
		+ 10 min.	13.560024	0.000024	0.00018	1.8	0.01
10	3.3	Power on	13.560063	0.000063	0.00046	4.6	0.01
		+ 2 min.	13.560042	0.000042	0.00031	3.1	0.01
		+ 5 min.	13.560030	0.000030	0.00022	2.2	0.01
		+ 10 min.	13.560051	0.000051	0.00038	3.8	0.01
0	3.3	Power on	13.560062	0.000062	0.00046	4.6	0.01
		+ 2 min.	13.560012	0.000012	0.00009	0.9	0.01
		+ 5 min.	13.560042	0.000042	0.00031	3.1	0.01
		+ 10 min.	13.560039	0.000039	0.00028	2.8	0.01
-10	3.3	Power on	13.560042	0.000042	0.00031	3.1	0.01
		+ 2 min.	13.560050	0.000050	0.00037	3.7	0.01
		+ 5 min.	13.560028	0.000028	0.00020	2.0	0.01
		+ 10 min.	13.560042	0.000042	0.00031	3.1	0.01
-20	3.3	Power on	13.560047	0.000047	0.00035	3.5	0.01
		+ 2 min.	13.560042	0.000042	0.00031	3.1	0.01
		+ 5 min.	13.560050	0.000050	0.00037	3.7	0.01
		+ 10 min.	13.560042	0.000042	0.00031	3.1	0.01

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

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

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APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	CE/RE	2017/08/31 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	3	CE/RE	2017/12/21 * 12
MJM-14	Measure	KOMELON	KMC-36	-	CE/RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	CE/RE	-
MSA-15	Spectrum Analyzer	Agilent	E4440A	MY46187105	CE	2017/10/16 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	CE/RE	2017/08/21 * 12
MLS-23	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	CE(AE)	2017/07/24 * 12
MLS-24	LISN(AMN)	Schwarzbeck	NSLK8127	8127-730	CE(EUT)	2017/07/20 * 12
MTA-56	Terminator	TME	CT-01BP	-	CE	2017/12/11 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/ 5D-2W(5m)/ 5D-2W(0.8m)/ 5D-2W(1m)	-	CE/RE	2018/02/23 * 12
MAT-65	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2017/12/19 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	CE/RE	2017/08/07 * 12
MTR-10	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	CE	2018/01/30 * 12
MCC-112	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/ SFM141(3m)/ sucoform141-PE(1m)/ 421-010(1.5m)/ RFM-E321(Switcher)	-/00640	CE	2017/07/12 * 12
MAT-66	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2017/12/19 * 12
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE/FT	2017/11/07 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2017/10/11 * 12
MCC-143	Coaxial Cable	UL Japan	-	-	RE	2017/06/12 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2017/03/27 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2017/11/14 * 12
MLPA-03	Loop Antenna	UL Japan	-	-	RE	Pre Check
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	CE/RE	2017/10/31 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	CE/RE	2018/01/24 * 12
MJM-16	Measure	KOMELON	KMC-36	-	CE/RE	-
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2017/08/22 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2017/08/22 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2017/10/02 * 12
MLA-22	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-191	RE	2018/01/30 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2017/07/12 * 12
MAT-98	Attenuator	KEYSIGHT	8491A	MY52462349	RE	2017/12/14 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2017/03/27 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	51201197	CE/RE	2018/01/09 * 12
MCH-07	Temperature Chamber	ESPEC CORP.	SU-241	92013843	FT	2017/07/18 * 12
MMM-12	DIGITAL HiTESTER	Hioki	3805	60500120	FT	2018/02/07 * 12
MLPA-12	Loop Antenna	UL Japan	-	-	FT	Pre Check
MOS-14	Thermo-Hygrometer	Custom	CTH-201	1401	FT	2018/01/24 * 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

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