RADIO TEST REPORT

Test Report No. : 11842687H-R1

Applicant	:	**YAMAHA FINE TECHNOLOGIES CO., LTD.**
Type of Equipment	:	**RFID-Unit(1ch type)**
Model No.	:	**RF008-1**
Test regulation	:	**FCC Part 15 Subpart C: 2018**
FCC ID	:	**PU8RF008-1**
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 above regulation.
4. The test results in this 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 NVLAP, NIST, or 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. This report is a revised version of 11842687H. 11842687H is replaced with this report.

Date of test: August 22 to September 19, 2017

Representative test engineer:

Masafumi Niwa
Engineer
Consumer Technology Division

Approved by:

Satofumi Matsuyama
Engineer
Consumer Technology Division

NVLAP TESTING
NVLAP LAB CODE: 200572-0

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REVISION HISTORY

Original Test Report No.: 11842687H

Revision	Test report No.	Date	Page revised	Contents
- (Original)	11842687H	January 26, 2018	-	-
1	11842687H-R1	March 28, 2018	P.1	Correction of applicant name in cover page
1	11842687H-R1	March 28, 2018	P.5	Update of FCC version
1	11842687H-R1	March 28, 2018	P.10	Addition of "*1)" notation Clause 4.2.
1	11842687H-R1	March 28, 2018	P.10	Correction of Item G) in Clause 4.2.
1	11842687H-R1	March 28, 2018	P.10	Addition of following sentence in Clause 4.2; *1) Conducted emission test was performed on this port
1	11842687H-R1	March 28, 2018	P.13	Correction of Span, RBW and VBW for 20 dB Bandwidth test in SECTION 7; [Span] From 200 kHz to "Between 2.0 times and 5.0 times of the OBW" [RBW] Form 24 kHz to 10 kHz [VBW] Form 7.5 kHz to 30 kHz
1	11842687H-R1	March 28, 2018	P.13	Correction of Span for 99 % Occupied Bandwidth test in SECTION 7; From "Enough width to display emission skirts" to "Between 2.0 times and 5.0 times of the OBW"

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SECTION 1: Customer information

Company Name	:	YAMAHA FINE TECHNOLOGIES CO., LTD.
Address	:	283 Aoya-cho, Minami-ku, Hamamatsu, 435-8568 Japan
Telephone Number	:	+81-53-467-3604
Facsimile Number	:	+81-53-467-3613
Contact Person	:	Kurata Toshifumi

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

2.1 Identification of E.U.T.

Type of Equipment	:	RFID-Unit(1ch type)
Model No.	:	RF008-1
Serial No.	:	Refer to Section 4, Clause 4.2
Receipt Date of Sample	:	July 31, 2017
Country of Manufacture	:	Japan
Condition of EUT	:	Engineering 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 No: RF008-1 (referred to as the EUT in this report) is the RFID-Unit(1ch type).

RFID unit "RF008-1" is RF tag Reader/ Writer unit designed for FA equipment.
ISO15693-compliant RF tags, such as "Tag-it HF-I" from Texas Instruments, "I･CODE SLI" from NXP Semiconductors and "MB89R118" from Fujitsu Semiconductor Limited, are supported.
RF tag can be read and write by command control from the external equipment which used the RS-232C interface.
Transmitting power is about 10mW.

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	13.56 MHz
Modulation	:	ASK
Power Supply (inner)	:	DC 5.0 V
Antenna type	:	Loop antenna
Antenna connector type	:	nylon connector
Method of frequency generation	:	Crystal
Operating Temperature	:	-20 deg. C to +60 deg. C
Clock frequency(maximum)	:	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 March 12, 2018 and effective April 11, 2018
Title	:	FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators Section 15.207 Conducted limits Section 15.225 Operation within the band 13.110-14.010 MHz.

* The revisions made after testing date do 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] 13.1 dB 24.00032 MHz, L [AV] 3.5 dB 24.00032 MHz, L	Complied	-
	<IC>RSS-Gen 8.8	<IC>RSS-Gen 8.8			
Electric Field Strength of Fundamental Emission	ANSI C63.10:2013 6 Standard test methods	Section 15.225(a)	76.9 dB, 13.56000 MHz, QP, 0 deg.	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)	45.7 dB, 13.11000 MHz, QP, 0 deg. 14.01000 MHz, QP, 0 deg.	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)	1.4 dB 54.240 MHz, Vertical, QP	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)
This EUT provides stable voltage (DC 5.0 V) constantly to RF Module regardless of input voltage. Therefore, this 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 EUT has an external antenna connector, but it is installed by the professionals.
Therefore, the equipment complies with the antenna requirement of Section 15.203.

3.3 Addition to standard

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

Frequency range	Conducted emission using AMN(LISN) (+/-)
0.009 MHz to 0.15 MHz	3.1 dB
0.15 MHz to 30 MHz	2.5 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	5.0 dB	5.3 dB	5.0 dB	5.0 dB
Vertical	5.2 dB	6.3 dB	5.0 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)
[Electric Field Strength of Fundamental Emission / Spectrum Mask]
The data listed in this test report has enough margin, more than the site margin.

[Electric Field Strength of Spurious Emission]
The data listed in this report meets the limits unless the uncertainty is taken into consideration.

3.5 Test Location

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Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124
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 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 mode (Tx)	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.	

Test Item	Operating mode*
Conducted emission	Tx Mod on, without Tag Tx Mod on, Terminated *1)
Electric Field Strength of Fundamental Emission	Tx Mod on, without Tag
Spectrum Mask	Tx Mod on, without Tag
20 dB Bandwidth 99 % OccupiedBandwidth	Tx Mod on, with Tag Tx Mod on, without Tag
Electric Field Strength of Spurious Emission	Tx Mod on, without Tag
Frequency Tolerance	Tx Mod off

*1) 50 ohm termination was installed instead of the antenna.

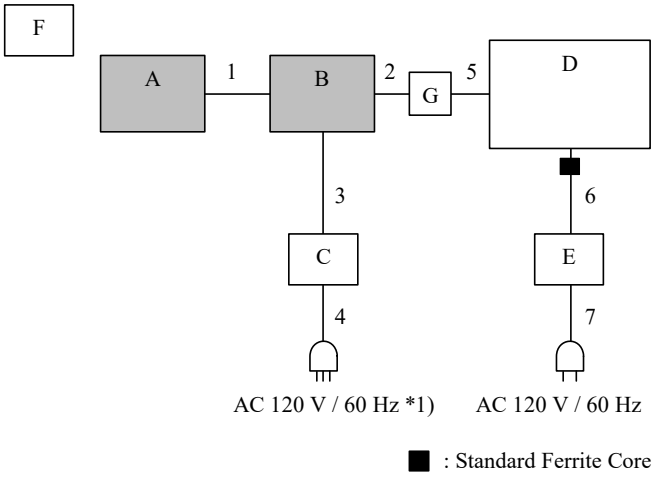
* After the comparison of the test data between with Tag and without Tag, the tests were performed with the worst case.

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

Frequency Tolerance:

Temperature : -30 deg. C to +50 deg. C Step 10 deg. C (-30deg.C: Reference)
Voltage : Normal Voltage DC 5 V
Maximum Voltage DC 5.75 V, Minimum Voltage DC 4.25 V (DC 5 V ±15 %)
*This EUT provides stable voltage(DC 5 V) constantly to RF Part regardless of input voltage

4.2 Configuration and peripherals



* 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	Antenna	AMIANT-Y1	2	YAMAHA FINE TECHNOLOGIES CO., LTD.	EUT
B	RFID-Unit (1ch type)	RF008-1	2	YAMAHA FINE TECHNOLOGIES CO., LTD.	EUT
C	Power Supply	PBA10F-5	-	COSEL	* for RE
	DC Power Suppy	PMC35-2A	0200022501	KIKUSUI	* for CE
D	Laptop PC	CF-N8HWCDPS	0CKSA09265	Panasonic	-
E	AC Adapter	CF-AA6372B	6372BM610X10953E	Panasonic	-
F	Tag	Baby-9	009E7E1024	KRD Corporation	-
G	USB Serial Converter	BSUSRC06	0280521	BUFFALO	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Antenna Cable	1.0 or 0.4	Unshielded	Unshielded	*1)
2	Signal Cable	3.0	Shielded	Shielded	-
3	DC Cable	3.0	Unshielded	Unshielded	-
4	AC Cable	1.0	Unshielded	Unshielded	-
5	USB Cable	0.5	Shielded	Shielded	-
6	DC Cable	1.1	Unshielded	Unshielded	-
7	AC Cable	0.9	Unshielded	Unshielded	-

*1) The worst case was confirmed for 0.4 m cable and 1.0 m cable by pre-check, the test was performed with 0.4 m cable as its result was the worst one.

* CE: Conducted emission
RE: Radiated emission

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

[For below 1GHz]
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 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 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 carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

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

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

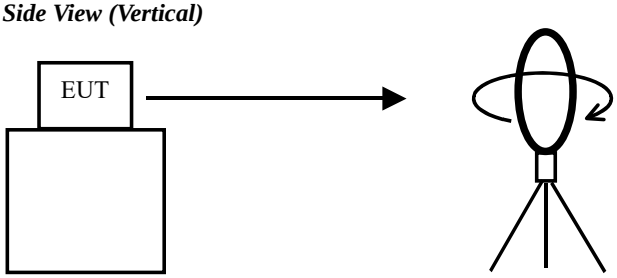
SECTION 7: Other test

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth	Between 2.0 times and 5.0 times of the OBW	10 kHz	30 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth	Between 1.5 times and 5.0 times of the OBW	1 to 5 % of OBW	Three times of RBW	Auto	Peak *1)	Max Hold *1)	Spectrum Analyzer
Frequency Tolerance	-	-	-	-	-	-	Frequency counter
*1) The measurement was performed with Peak detector, Max Hold since the duty cycle was not 100 %. Peak hold was applied as Worst-case measurement.							

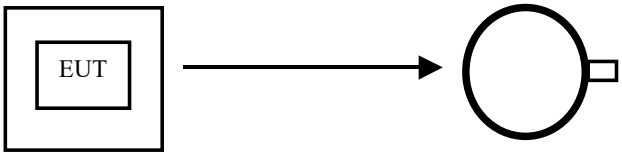
Test data : APPENDIX
Test result : Pass

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

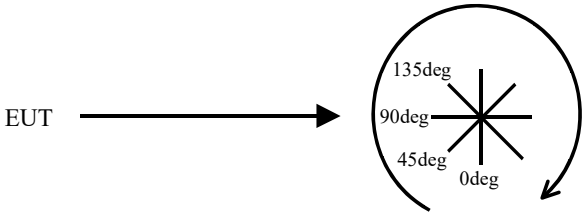


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)

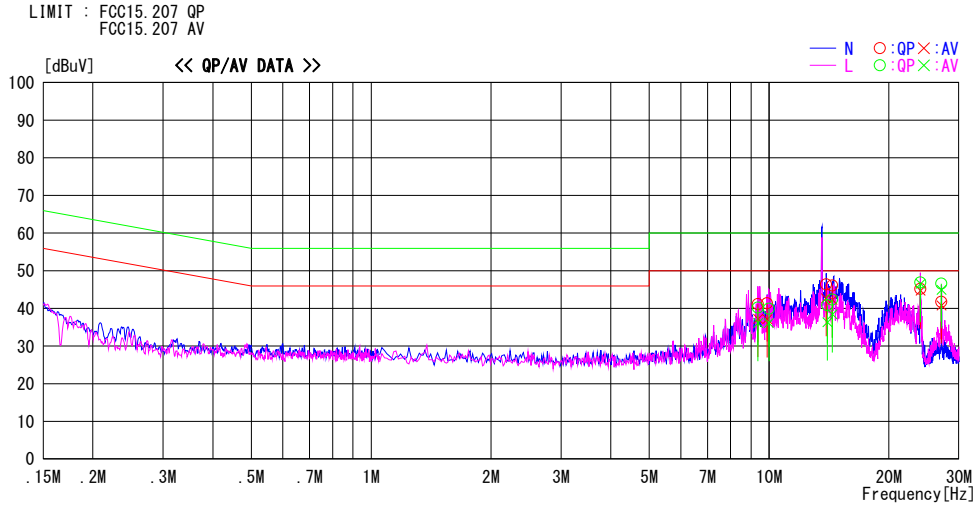


Front side: 0 deg.
Forward direction: clockwise

APPENDIX 1: Test data

Conducted emission

Report No.	11842687H
Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Date	September,19, 2017
Temperature / Humidity	23 deg. C / 64 % RH
Engineer	Tomoki Matsui
Mode	Tx 13.56MHz Without Tag (Antenna Cable 40cm)

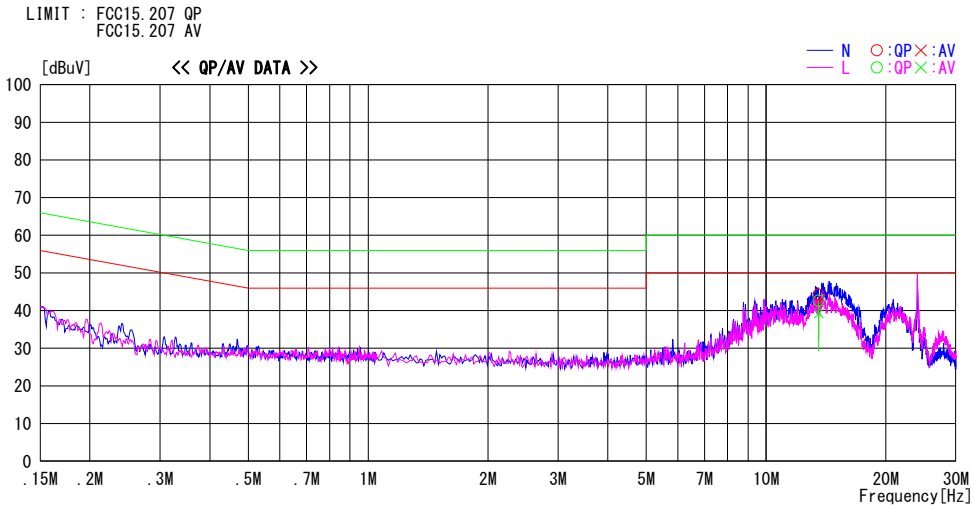


Frequency	Reading Level		Corr.	Results		Limit		Margin		Phase	Comment
	QP	AV	Factor	QP	AV	QP	AV	QP	AV		
[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
9.37981	27.2	23.3	13.9	41.1	37.2	60.0	50.0	18.9	12.8	N	
9.88569	27.4	23.2	13.9	41.3	37.1	60.0	50.0	18.7	12.9	N	
13.91414	32.3	28.6	14.1	46.4	42.7	60.0	50.0	13.6	7.3	N	
14.42123	32.0	28.2	14.1	46.1	42.3	60.0	50.0	13.9	7.7	N	
24.00032	30.7	30.2	14.5	45.2	44.7	60.0	50.0	14.8	5.3	N	
27.12000	27.2	26.3	14.5	41.7	40.8	60.0	50.0	18.3	9.2	N	
9.37605	26.3	22.2	13.9	40.2	36.1	60.0	50.0	19.8	13.9	L	
9.98492	26.0	22.2	13.9	39.9	36.1	60.0	50.0	20.1	13.9	L	
14.01222	26.7	22.2	14.1	40.8	36.3	60.0	50.0	19.2	13.7	L	
14.42116	28.2	24.3	14.1	42.3	38.4	60.0	50.0	17.7	11.6	L	
24.00032	32.4	32.0	14.5	46.9	46.5	60.0	50.0	13.1	3.5	L	
27.12000	32.1	30.4	14.5	46.6	44.9	60.0	50.0	13.4	5.1	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

Report No.	11842687H
Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Date	September,19, 2017
Temperature / Humidity	23 deg. C / 64 % RH
Engineer	Tomoki Matsui
Mode	Tx 13.56MHz Terminated (Antenna Cable 40cm)

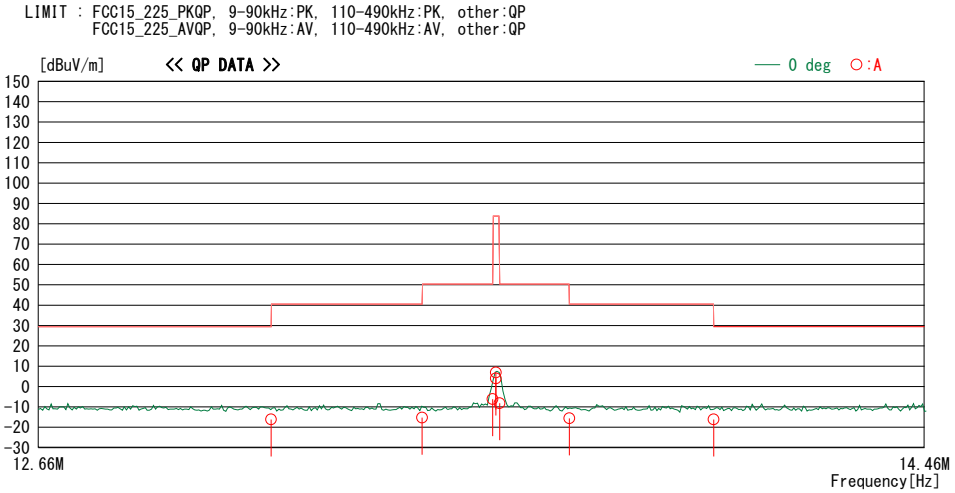


Frequency	Reading Level		Corr.	Results		Limit		Margin		Phase	Comment
	QP	AV	Factor	QP	AV	QP	AV	QP	AV		
[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
13.56000	30.2	28.1	14.1	44.3	42.2	60.0	50.0	15.7	7.8	N	
13.56000	28.5	25.2	14.1	42.6	39.3	60.0	50.0	17.4	10.7	L	

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.

Fundamental emission and Spectrum Mask

Report No.	11842687H
Test place	Ise EMC Lab. No.1 Semi Anechoic Chamber
Date	August 22, 2017
Temperature / Humidity	22 deg. C / 61 % RH
Engineer	Masafumi Niwa
Mode	Tx 13.56MHz Without Tag worst axis (Ant Y / Mod. X) (Antenna Cable 40cm)



Freq. [MHz]	Reading [dBuV]	DET	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna [deg]		Table [deg]	Comment
13.11000	29.4	QP	19.4	-32.9	32.1	-16.2	29.5	45.7	0	A	180	
13.41000	30.3	QP	19.4	-32.9	32.1	-15.3	40.5	55.8	0	A	180	
13.55300	39.4	QP	19.4	-32.9	32.1	-6.2	50.4	56.6	0	A	180	
13.56000	52.6	QP	19.4	-32.9	32.1	7.0	83.9	76.9	0	A	180	
13.56000	49.7	QP	19.4	-32.9	32.1	4.1	83.9	79.8	0	A	180	with tag
13.56700	37.5	QP	19.4	-32.9	32.1	-8.1	50.4	58.5	0	A	180	
13.71000	30.0	QP	19.4	-32.9	32.1	-15.6	40.5	56.1	0	A	180	
14.01000	29.4	QP	19.4	-32.9	32.1	-16.2	29.5	45.7	0	A	180	

CALCULATION: RESULT = READING + ANT FACTOR + LOSS (CABLE + ATTTEN +D.FACTOR) - GAIN(AMP)
CHART: WITH FACTOR ANT TYPE: LOOP. Except for the data below: adequate margin data below the limits.

Result of the fundamental emission at 3 m without Distance factor

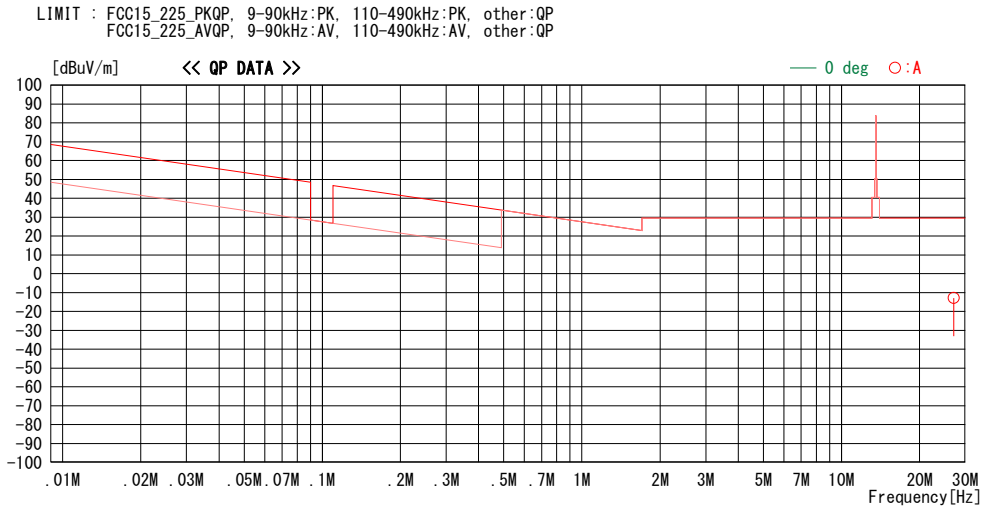
QP

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	52.6	19.4	7.1	32.1	-	47.0	-	-	Fundamental

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

Spurious emission

Report No.	11842687H
Test place	Ise EMC Lab. No.1 Semi Anechoic Chamber
Date	August 22, 2017
Temperature / Humidity	22 deg. C / 61 % RH
Engineer	Masafumi Niwa
Mode	Tx 13.56MHz Without Tag worst axis (Ant Y / Mod. X) (Antenna Cable 40cm)

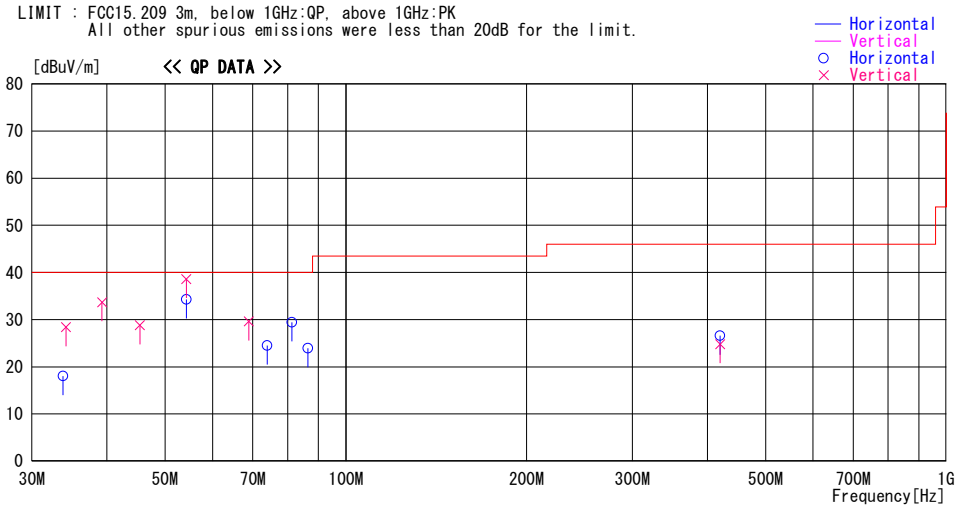


Freq. [MHz]	Reading [dBuV]	DET	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna [deg]		Table [deg]	Comment
27.12000	31.2	QP	20.3	-32.4	32.1	-13.0	29.5	42.5	0	A	180	

CALCULATION: RESULT = READING + ANT FACTOR + LOSS (CABLE + ATTTEN +D.FACTOR) - GAIN(AMP)
CHART: WITH FACTOR ANT TYPE: LOOP. Except for the data below: adequate margin data below the limits.

Spurious emission

Report No.	11842687H
Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Date	September,19, 2017
Temperature / Humidity	23 deg. C / 64 % RH
Engineer	Tomoki Matsui
Mode	Tx 13.56MHz Without Tag (Antenna Cable 40cm)



Frequency	Reading	DET	Antenna Factor	Loss& Gain	Level	Angle	Height	Polar.	Limit	Margin
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]
33.819	26.6	QP	16.4	-25.0	18.0	359	305	Hori.	40.0	22.0
34.183	37.0	QP	16.4	-25.0	28.4	105	100	Vert.	40.0	11.6
39.248	44.0	QP	14.6	-24.9	33.7	128	100	Vert.	40.0	6.3
45.410	41.1	QP	12.5	-24.8	28.8	108	100	Vert.	40.0	11.2
54.240	53.8	QP	9.5	-24.7	38.6	294	100	Vert.	40.0	1.4
54.240	49.5	QP	9.5	-24.7	34.3	196	382	Hori.	40.0	5.7
68.932	47.5	QP	6.5	-24.4	29.6	102	100	Vert.	40.0	10.4
73.952	42.5	QP	6.4	-24.4	24.5	184	239	Hori.	40.0	15.5
81.359	47.1	QP	6.6	-24.3	29.4	198	223	Hori.	40.0	10.6
86.424	40.6	QP	7.5	-24.2	23.9	191	223	Hori.	40.0	16.1
420.001	31.7	QP	16.1	-21.2	26.6	201	100	Hori.	46.0	19.4
420.001	29.9	QP	16.1	-21.2	24.8	326	136	Vert.	46.0	21.2

CHART: WITH FACTOR ANT TYPE: -30MHz: LOOP, 30-200MHz: BICONICAL, 200-1000MHz: LOGPERIODIC, 1000MHz-: HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

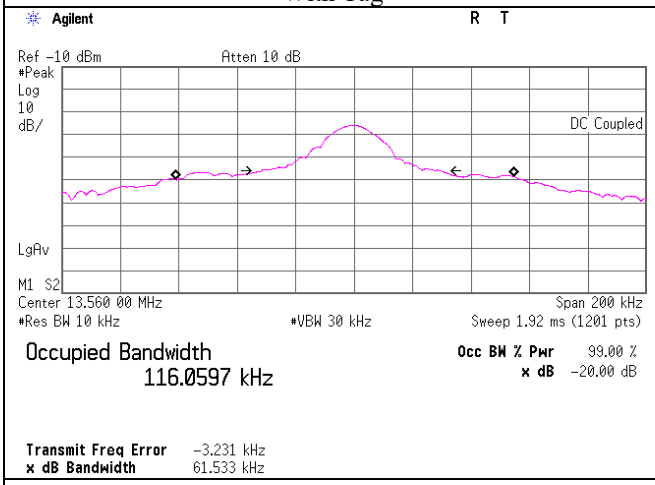
20dB Bandwidth and 99% Occupied Bandwidth

Report No.	11842687H
Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Date	September,19, 2017
Temperature / Humidity	23 deg. C / 64 % RH
Engineer	Tomoki Matsui
Mode	Tx Mod On

FREQ [MHz]	Mode	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	With Tag	61.533	228.348
	Without Tag	55.765	141.631

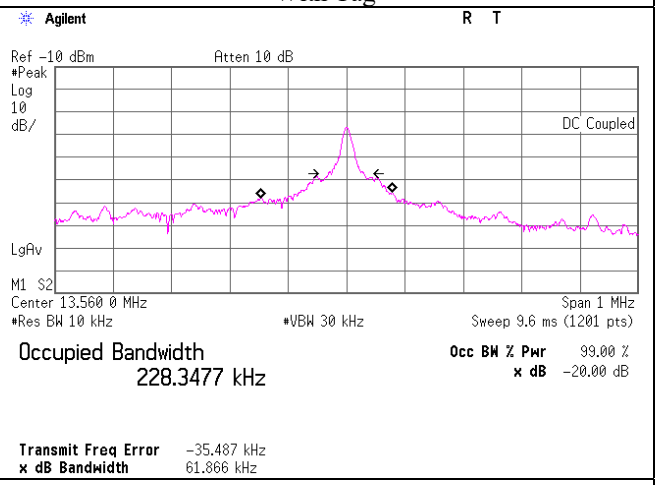
20dB Bandwidth

With Tag

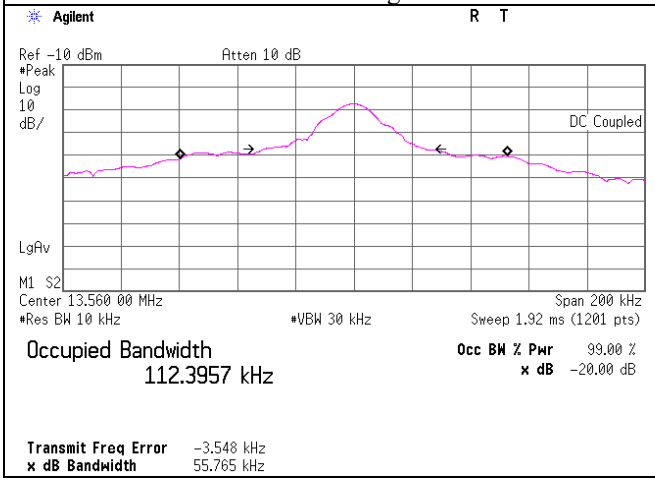


99% Occupied Bandwidth

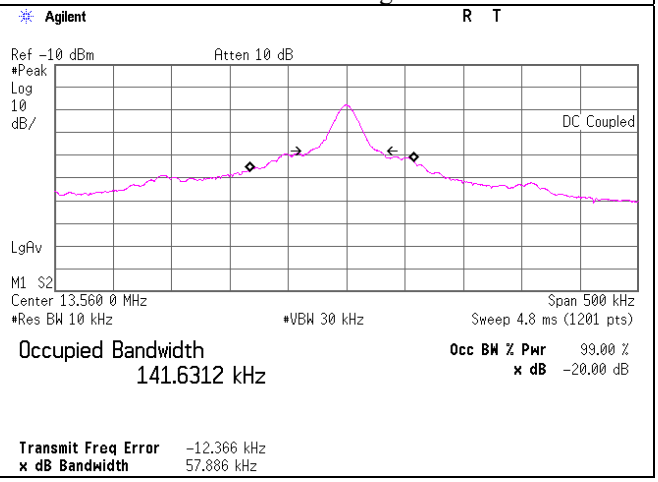
With Tag



Without Tag



Without Tag



Frequency Tolerance

Test place	Ise EMC Lab. No.6 measurement room
Report No.	11842687H
Date	09/13/2017
Temperature/ Humidity	25 deg. C / 56 % RH
Engineer	Masafumi Niwa
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	13.559699	-0.000302	-0.00222	-22.2	0.01
		+ 2 min.	13.559696	-0.000304	-0.00224	-22.4	0.01
		+ 5 min.	13.559699	-0.000301	-0.00222	-22.2	0.01
		+ 10 min.	13.559701	-0.000299	-0.00221	-22.1	0.01
40	5	Power on	13.559712	-0.000288	-0.00213	-21.3	0.01
		+ 2 min.	13.559699	-0.000301	-0.00222	-22.2	0.01
		+ 5 min.	13.559698	-0.000302	-0.00223	-22.3	0.01
		+ 10 min.	13.559698	-0.000302	-0.00222	-22.2	0.01
30	5	Power on	13.559743	-0.000257	-0.00189	-18.9	0.01
		+ 2 min.	13.559723	-0.000277	-0.00204	-20.4	0.01
		+ 5 min.	13.559718	-0.000282	-0.00208	-20.8	0.01
		+ 10 min.	13.559727	-0.000273	-0.00201	-20.1	0.01
20	5	Power on	13.559768	-0.000232	-0.00171	-17.1	0.01
		+ 2 min.	13.559753	-0.000247	-0.00182	-18.2	0.01
		+ 5 min.	13.559749	-0.000252	-0.00185	-18.5	0.01
		+ 10 min.	13.559748	-0.000252	-0.00186	-18.6	0.01
20	4.25	Power on	13.559765	-0.000235	-0.00174	-17.4	0.01
	(5V -15%)	+ 2 min.	13.559753	-0.000248	-0.00183	-18.3	0.01
		+ 5 min.	13.559751	-0.000249	-0.00183	-18.3	0.01
		+ 10 min.	13.559750	-0.000250	-0.00184	-18.4	0.01
20	5.75	Power on	13.559762	-0.000238	-0.00176	-17.6	0.01
	(5V +15%)	+ 2 min.	13.559748	-0.000252	-0.00186	-18.6	0.01
		+ 5 min.	13.559726	-0.000274	-0.00202	-20.2	0.01
		+ 10 min.	13.559745	-0.000255	-0.00188	-18.8	0.01
10	5	Power on	13.559782	-0.000218	-0.00161	-16.1	0.01
		+ 2 min.	13.559780	-0.000220	-0.00162	-16.2	0.01
		+ 5 min.	13.559792	-0.000208	-0.00153	-15.3	0.01
		+ 10 min.	13.559791	-0.000209	-0.00154	-15.4	0.01
0	5	Power on	13.559835	-0.000165	-0.00122	-12.2	0.01
		+ 2 min.	13.559825	-0.000175	-0.00129	-12.9	0.01
		+ 5 min.	13.559821	-0.000179	-0.00132	-13.2	0.01
		+ 10 min.	13.559819	-0.000181	-0.00133	-13.3	0.01
-10	5	Power on	13.559833	-0.000167	-0.00123	-12.3	0.01
		+ 2 min.	13.559835	-0.000165	-0.00122	-12.2	0.01
		+ 5 min.	13.559834	-0.000167	-0.00123	-12.3	0.01
		+ 10 min.	13.559833	-0.000167	-0.00123	-12.3	0.01
-20	5	Power on	13.559805	-0.000195	-0.00144	-14.4	0.01
		+ 2 min.	13.559828	-0.000172	-0.00127	-12.7	0.01
		+ 5 min.	13.559832	-0.000168	-0.00124	-12.4	0.01
		+ 10 min.	13.559832	-0.000168	-0.00124	-12.4	0.01
-30 *1)	5	Power on	13.559745	-0.000255	-0.00188	-18.8	0.01
		+ 2 min.	13.559761	-0.000239	-0.00176	-17.6	0.01
		+ 5 min.	13.559803	-0.000197	-0.00145	-14.5	0.01
		+ 10 min.	13.559806	-0.000195	-0.00143	-14.3	0.01

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

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

*The test was begun from 50 deg.C and the temperature was lowered each 10 deg.C.
*1) for IC application (RSS-Gen 6.11 requirement)

APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MLS-23	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	CE(EUT)	2017/07/24 * 12
MLS-24	LISN(AMN)	Schwarzbeck	NSLK8127	8127-730	CE(AE)	2017/07/20 * 12
MTA-52	Terminator	TME	CT-01BP	-	CE	2016/12/01 * 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	2016/12/24 * 12
MAEC-01	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	RE	2016/09/30 * 12
MOS-27	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q26	RE	2017/01/20 * 12
MJM-25	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MTR-09	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	RE	2017/06/27 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2016/10/14 * 12
MCC-143	Coaxial Cable	UL Japan	-	-	RE	2017/06/12 * 12
MCC-03	Coaxial Cable	Fujikura/Suhner/TSJ	5D-2W(20m)/ 3D-2W(7.5m)/ RG400u(1.5m)/ RFM-E421(Switcher)	-/01068 (Switcher)	RE	2017/06/26 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2017/03/27 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2017/03/27 * 12
MAT-08	Attenuator(6dB)	Weinschel Corp	2	BK7971	RE	2016/11/28 * 12
MMM-03	Digital Tester	Fluke	FLUKE 26-3	78030621	RE	2017/08/07 * 12
MFC-01	Microwave Counter	Advantest	R5373	120100309	FT	2017/06/21 * 12
MCH-04	Temperature and Humidity Chamber	Tabai Espec	PL-2KP	14015723	FT	2017/08/07 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	1401	FT	2017/01/20 * 12
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE/CE	2016/10/20 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE/CE	2017/01/20 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE/CE	-
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE/CE	2017/08/22 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE/CE	2017/08/22 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2016/10/15 * 12
MLA-22	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-191	RE	2017/01/26 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2017/07/12 * 12
MAT-98	Attenuator	KEYSIGHT	8491A	MY52462349	RE	2016/12/05 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	RE/CE	2017/01/19 * 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