



RADIO TEST REPORT

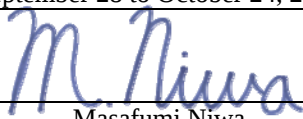
Test Report No. : 11968653H-A-R1

Applicant : ART Finex Co.,Ltd.
Type of Equipment : RFID reader writer
Model No. : AMI2450-AT09/H
Test regulation : FCC Part 15 Subpart C: 2017
FCC ID : 2AM8PAMI2450-AT09H
Test Result : Complied

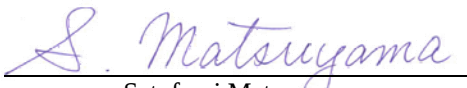
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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be 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 11968653H-A. 11968653H-A is replaced with this report.

Date of test: September 28 to October 24, 2017

Representative test engineer:


Masafumi Niwa
Engineer
Consumer Technology Division

Approved by:


Satofumi Matsuyama
Engineer
Consumer Technology Division



NVLAP LAB CODE: 200572-0

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*As for the range of Accreditation in NVLAP, you may refer to the WEB address,
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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 11968653H-A

[illegible]

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SECTION 1: Customer information

Company Name : ART Finex Co.,Ltd.
Address : 6-1-33, Kamikobatacho, Sabae-shi, Fukui, 916-0037, Japan
Telephone Number : +81-778-54-8085
Facsimile Number : +81-778-54-8092
Contact Person : Takeshi Kuwabara

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

2.1 Identification of E.U.T.

Type of Equipment : RFID reader writer
Model No. : AMI2450-AT09/H
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 5.0 V
Receipt Date of Sample : September 26, 2017
Country of Mass-production : 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

General Specification

Clock frequency(ies) in the system : 27.12 MHz

Radio Specification

Radio Type : Transceiver
Frequency of Operation : 13.56 MHz
Modulation : ASK
Power Supply (radio part input) : DC 5.0 V, DC 3.3 V
Antenna type : Loop Coil Antenna
Operating Temperature : 0 deg. C to +50 deg. C

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on September 20, 2017 and effective October 20, 2017

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

* The revision on September 20, 2017, does not affect the test specification applied to the EUT.

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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted emission	ANSI C63.10:2013 6 Standard test methods	Section 15.207	[QP] 12.9 dB 0.54954 MHz, L <FeliCa without Tag>	Complied	-
	<IC>RSS-Gen 8.8	<IC>RSS-Gen 8.8	[AV] 6.2 dB 0.54954 MHz, L < FeliCa without Tag >		
Electric Field Strength of Fundamental Emission	ANSI C63.10:2013 6 Standard test methods	Section 15.225(a)	43.7 dB, 13.56000 MHz, QP, 0 deg.	Complied	Radiated
	<IC> RSS-Gen 6.4, 6.12	<IC>RSS-210 B.6	<ISO15693 without Tag>		
Spectrum Mask	ANSI C63.10:2013 6 Standard test methods	Section 15.225(b)(c)	20.9 dB, 14.19638 MHz, QP, 0 deg.	Complied	Radiated
	<IC>RSS-Gen 6.4, 6.13	<IC> RSS-210 B.6	< FeliCa without Tag >		
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)	0.4 dB 895.019 MHz, Horizontal, QP	Complied	Radiated
	<IC>RSS-Gen 6.4, 6.13	<IC>RSS-210 B.6	<ISO15693 without Tag>		
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, DC 3.3 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

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

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3.3 Addition to standard

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

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

3.4 Uncertainty

EMI

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

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

Radiated emission (Above 1 GHz)				
(3 m*)(+/-)		(1 m*)(+/-)		(10 m*)(+/-)
1 GHz to 6 GHz	6 GHz to 18 GHz	10 GHz to 26.5 GHz	26.5 GHz to 40 GHz	1 GHz to 18 GHz
5.2 dB	5.5 dB	5.5 dB	5.4 dB	5.5 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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	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7m	7.0 x 6.0m	No.1 Power source room
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.3 Preparation room
No.3 shielded room	-	4.0 x 6.0 x 2.7m	N/A	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.4 Preparation room
No.4 shielded room	-	4.0 x 6.0 x 2.7m	N/A	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9m	6.0 x 6.0m	-
No.6 shielded room	-	4.0 x 4.5 x 2.7m	4.0 x 4.5m	-
No.6 measurement room	-	4.75 x 5.4 x 3.0m	4.75 x 4.15m	-
No.7 shielded room	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.8 measurement room	-	3.1 x 5.0 x 2.7m	N/A	-
No.9 measurement room	-	8.0 x 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	6.2 x 4.7 x 3.0m	4.8 x 4.6m	-

* Size of vertical conducting plane (for Conducted Emission test): 2.0 x 2.0m 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) - FeliCa - ISO15693	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 *1) Tx Mod on, Terminated *2)
Electric Field Strength of Fundamental Emission	Tx Mod on, with Tag Tx Mod on, without Tag
Spectrum Mask	Tx Mod on, with Tag Tx Mod on, without Tag
20 dB Bandwidth 99 % Occupied Bandwidth	Tx Mod on, with Tag Tx Mod on, without Tag
Electric Field Strength of Spurious Emission	Tx Mod on, without Tag *1)
Frequency Tolerance	Tx Mod off

*1) This EUT has two modes which Tag is attached to the EUT or not.

The worst case was confirmed with and without Tag. The test was performed with worst case.

*2) 50 ohm termination was installed instead of the antenna.

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 5.00 V
Maximum Voltage : DC 5.75 V
Minimum Voltage : DC 4.25 V
(DC 5.00 V $\pm$ 15 %)

*This EUT provides stable voltage (DC 5.0 V, DC 3.3 V) constantly to RF Module regardless of input voltage.

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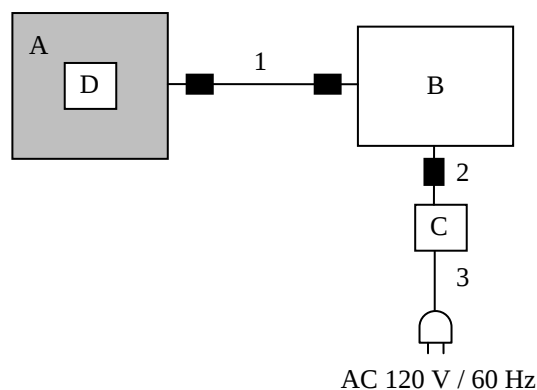
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4.2 Configuration and peripherals



■ : 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	Remark
A	RFID reader writer	AMI2450-AT09/H	003	ART Finex Co.,Ltd.	EUT
B	Laptop PC	2522-C49	R8-9LMPO 10/09	Lenovo	-
C	AC adaptor	DCWP CM-2	92P1156	Lenovo	-
D	Tag	FeliCa	-	FUJIFILM Imaging Systems Co., Ltd.	-
		ISO15693	-	SMARTRAC	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	USB Cable(A-miniB)	2.0	Shielded	Shielded	*1)
2	DC Cable	1.8	Unshielded	Unshielded	-
3	AC Cable	0.9	Unshielded	Unshielded	-

*1) USB Cable designated for the EUT (M/N:USC-MF20BK, Manufacturer: ELECOM) was used for the 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

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

Test Procedure

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.

[For above 1GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on 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.) 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.

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

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

Measurement range : 9 kHz - 1 GHz

Test data : APPENDIX 1

Test result : Pass

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SECTION 7: Other test

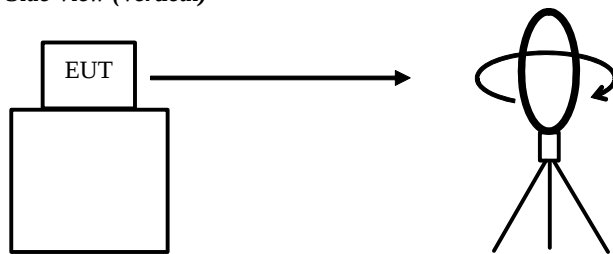
Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth	Between 2.0 times and 5.0 times of the OBW	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth	Between 1.5 times and 5.0 times of the OBW	1 to 5 % of OBW	Three times of RBW	Auto	Peak *1)	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.

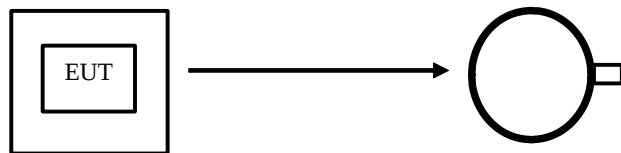
Test data : APPENDIX
Test result : Pass

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

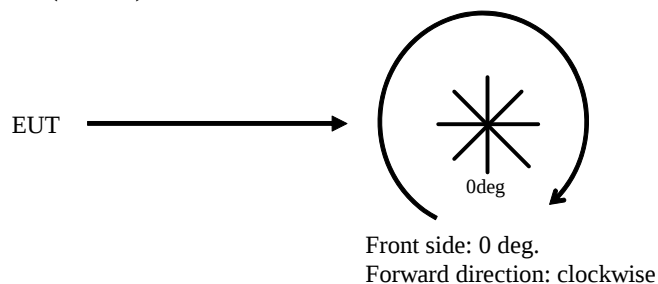


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)

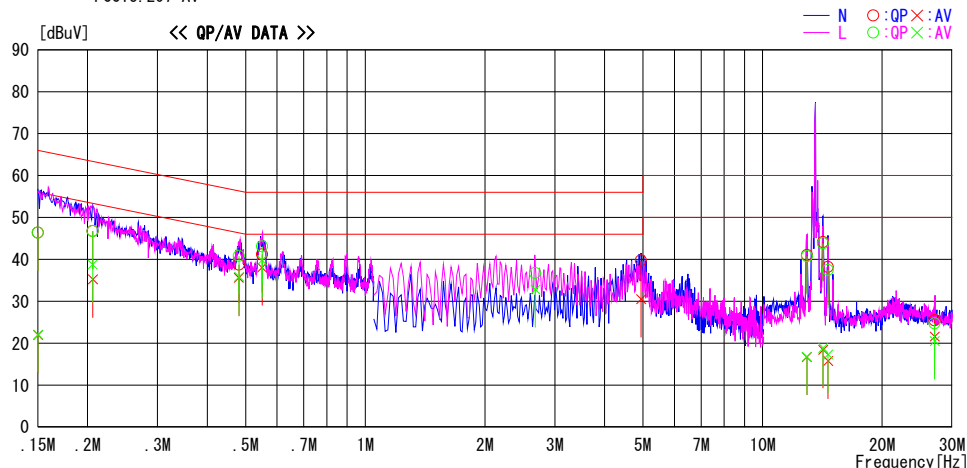


APPENDIX 1: Test data

Conducted emission

Report No. 11968653H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.1
Date October 7, 2017
Temperature / Humidity 24 deg. C / 42% RH
Engineer Masafumi Niwa
Mode Tx Mod on, Without Tag (FeliCa)

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]		
0.15000	33.3	8.9	13.1	46.4	22.0	66.0	56.0	19.6	34.0	N	
0.20615	33.6	22.1	13.1	46.7	35.2	63.4	53.4	16.7	18.2	N	
0.48042	25.4	22.3	13.3	38.7	35.6	56.3	46.3	17.6	10.7	N	
0.54951	27.9	24.8	13.3	41.2	38.1	56.0	46.0	14.8	7.9	N	
4.94520	25.8	16.6	13.9	39.7	30.5	56.0	46.0	16.3	15.5	N	
12.92524	26.5	2.2	14.5	41.0	16.7	60.0	50.0	19.0	33.3	N	
14.19731	29.6	3.9	14.5	44.1	18.4	60.0	50.0	15.9	31.6	N	
14.61489	23.7	1.3	14.5	38.2	15.8	60.0	50.0	21.8	34.2	N	
27.12000	10.2	6.3	15.3	25.5	21.6	60.0	50.0	34.5	28.4	N	
0.15000	33.3	9.0	13.1	46.4	22.1	66.0	56.0	19.6	33.9	L	
0.20604	33.6	25.7	13.1	46.7	38.8	63.4	53.4	16.7	14.6	L	
0.48104	27.5	22.6	13.3	40.8	35.9	56.3	46.3	15.5	10.4	L	
0.54954	29.8	26.5	13.3	43.1	39.8	56.0	46.0	12.9	6.2	L	
2.67913	23.1	19.2	13.6	36.7	32.8	56.0	46.0	19.3	13.2	L	
12.92530	26.2	2.3	14.5	40.7	16.8	60.0	50.0	19.3	33.2	L	
14.19669	29.3	4.4	14.5	43.8	18.9	60.0	50.0	16.2	31.1	L	
14.62150	23.0	2.8	14.5	37.5	17.3	60.0	50.0	22.5	32.7	L	
27.12000	9.4	5.2	15.3	24.7	20.5	60.0	50.0	35.3	29.5	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.

*The test result is rounded off to one or two decimal places, so some differences might be observed.

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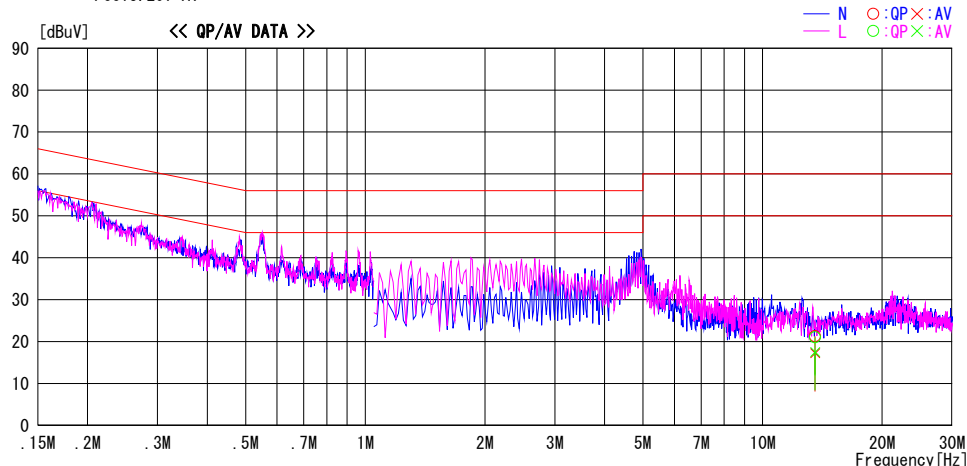
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Conducted emission

Report No. 11968653H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.1
Date October 7, 2017
Temperature / Humidity 24 deg. C / 42% RH
Engineer Masafumi Niwa
Mode Antenna Terminated

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]		
13.56000	6.8	2.7	14.5	21.3	17.2	60.0	50.0	38.7	32.8	N	
13.56000	6.5	3.0	14.5	21.0	17.5	60.0	50.0	39.0	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.

*The test result is rounded off to one or two decimal places, so some differences might be observed.

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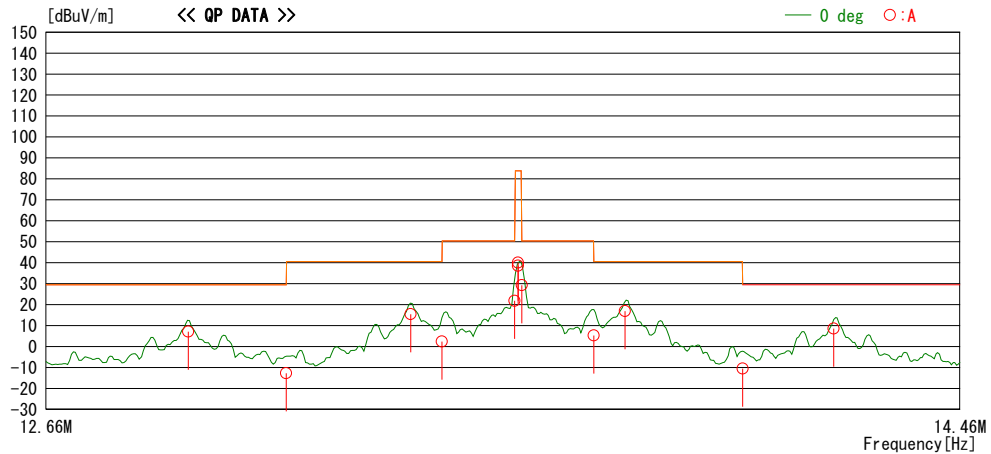
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Fundamental emission and Spectrum Mask

Report No. 11968653H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date October 6, 2017
Temperature / Humidity 24 deg. C / 60 % RH
Engineer Koji Yamamoto
Mode Tx Mod on, Without Tag (FeliCa)

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]	
12.92511	52.9	QP	19.5	-33.2	32.1	7.1	29.5	22.4	0	A	170
13.11000	33.2	QP	19.4	-33.2	32.1	-12.7	29.5	42.2	0	A	170
13.34922	61.4	QP	19.4	-33.2	32.1	15.5	40.5	25.0	0	A	170
13.41000	48.2	QP	19.4	-33.2	32.1	2.3	40.5	38.2	0	A	170
13.55300	67.7	QP	19.4	-33.2	32.1	21.8	50.4	28.6	0	A	170
13.56000	86.0	QP	19.4	-33.2	32.1	40.1	83.9	43.8	0	A	170
13.56000	84.5	QP	19.4	-33.2	32.1	38.6	83.9	45.3	0	A	176
13.56700	75.2	QP	19.4	-33.2	32.1	29.3	50.4	21.1	0	A	170
13.71000	51.2	QP	19.4	-33.2	32.1	5.3	40.5	35.2	0	A	170
13.77257	62.8	QP	19.4	-33.2	32.1	16.9	40.5	23.6	0	A	170
14.01000	35.4	QP	19.4	-33.2	32.1	-10.5	29.5	40.0	0	A	170
14.19638	54.5	QP	19.4	-33.2	32.1	8.6	29.5	20.9	0	A	170

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	86.0	19.4	6.8	32.1	-	80.1	-	-	Fundamental

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

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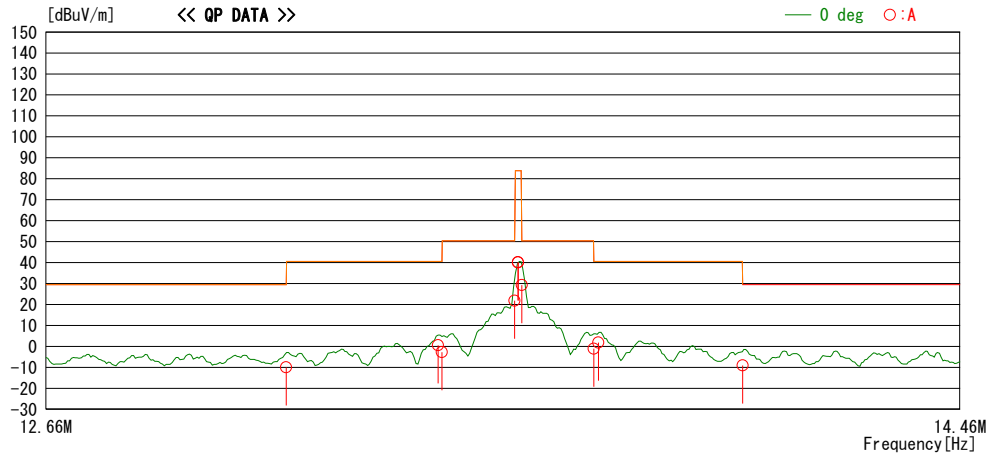
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Fundamental emission and Spectrum Mask

Report No. 11968653H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date October 6, 2017
Temperature / Humidity 24 deg. C / 60 % RH
Engineer Koji Yamamoto
Mode Tx Mod on, Without Tag (ISO15693)

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	35.9	QP	19.4	-33.2	32.1	-10.0	29.5	39.5	0	A	181
13.40251	46.5	QP	19.4	-33.2	32.1	0.6	40.5	39.9	0	A	181
13.41000	43.2	QP	19.4	-33.2	32.1	-2.7	40.5	43.2	0	A	181
13.55300	67.8	QP	19.4	-33.2	32.1	21.9	50.4	28.5	0	A	181
13.56000	86.0	QP	19.4	-33.2	32.1	40.1	83.9	43.8	0	A	173
13.56000	86.1	QP	19.4	-33.2	32.1	40.2	83.9	43.7	0	A	181
13.56700	75.2	QP	19.4	-33.2	32.1	29.3	50.4	21.1	0	A	181
13.71000	44.9	QP	19.4	-33.2	32.1	-1.0	40.5	41.5	0	A	181
13.71928	47.8	QP	19.4	-33.2	32.1	1.9	40.5	38.6	0	A	181
14.01000	36.9	QP	19.4	-33.2	32.1	-9.0	29.5	38.5	0	A	181

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	86.1	19.4	6.8	32.1	-	80.2	-	-	Fundamental

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

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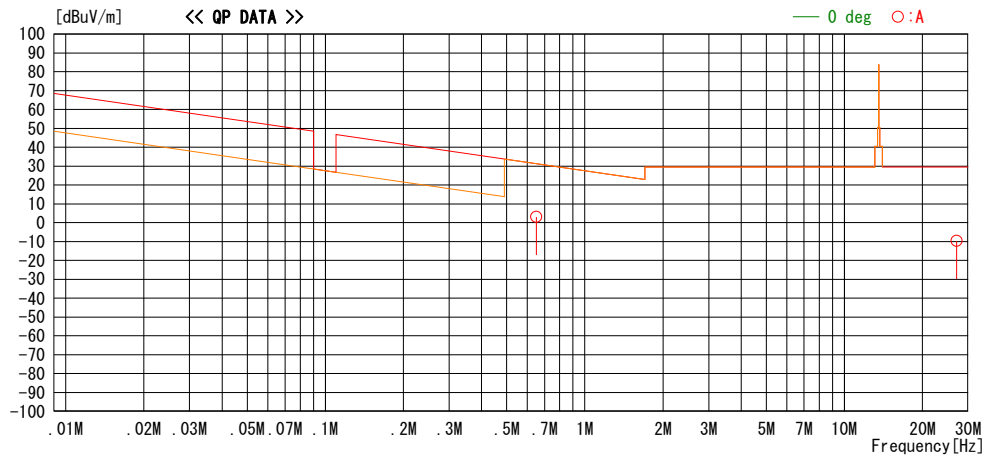
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Spurious emission (Below 30 MHz)

Report No. 11968653H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date October 6, 2017
Temperature / Humidity 24 deg. C / 60 % RH
Engineer Koji Yamamoto
Mode Tx Mod on, Without Tag (ISO15693)

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]	
0.64932	49.6	QP	19.5	-33.8	32.2	3.1	31.3	28.2	0	A	75
27.12000	35.0	QP	20.3	-32.9	32.1	-9.7	29.5	39.2	0	A	188

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))

*The test result is rounded off to one or two decimal places, so some differences might be observed.

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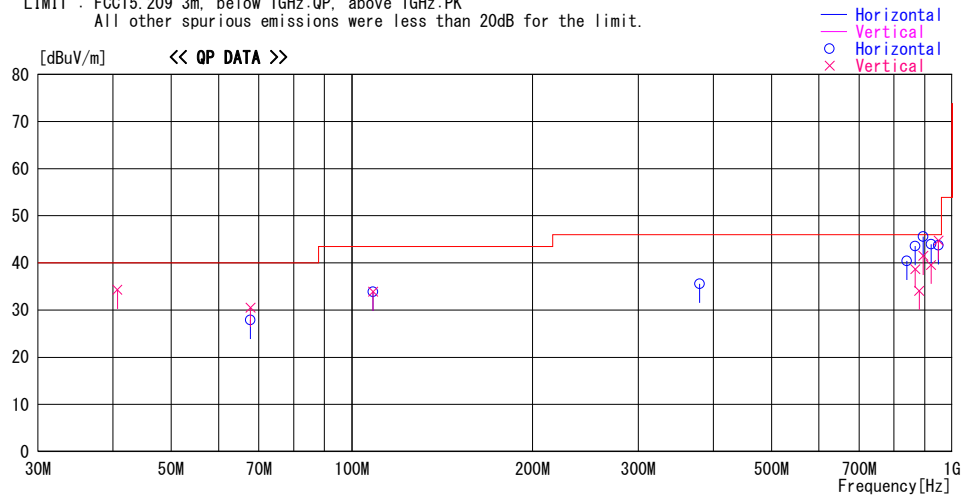
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Spurious emission (Above 30 MHz)

Report No. 11968653H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date October 6, 2017
Temperature / Humidity 23 deg. C / 45 % RH
Engineer Tomoki Matsui
Mode Tx Mod on, Without Tag (ISO15693)

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]							
40.685	44.9	QP	14.2	-24.8	34.3	85	100	Vert.	40.0	5.7	
67.804	45.7	QP	6.6	-24.4	27.9	12	296	Hori.	40.0	12.1	
67.805	48.3	QP	6.6	-24.4	30.5	279	100	Vert.	40.0	9.5	
108.487	46.4	QP	11.3	-23.8	33.9	15	301	Hori.	43.5	9.6	
108.489	46.4	QP	11.3	-23.8	33.9	293	100	Vert.	43.5	9.6	
379.706	41.8	QP	15.3	-21.5	35.6	299	100	Hori.	46.0	10.4	
840.777	37.7	QP	21.2	-18.5	40.4	189	100	Hori.	46.0	5.6	
867.896	35.4	QP	21.6	-18.3	38.7	179	100	Vert.	46.0	7.3	
867.898	40.3	QP	21.6	-18.3	43.6	183	100	Hori.	46.0	2.4	
881.455	30.4	QP	21.8	-18.1	34.1	180	100	Vert.	46.0	11.9	
895.018	37.4	QP	22.0	-17.9	41.5	170	115	Vert.	46.0	4.5	
895.019	41.5	QP	22.0	-17.9	45.6	190	100	Hori.	46.0	0.4	
922.140	35.2	QP	22.1	-17.7	39.6	164	100	Vert.	46.0	6.4	
922.141	39.6	QP	22.1	-17.7	44.0	179	100	Hori.	46.0	2.0	
949.263	40.0	QP	22.2	-17.5	44.7	64	108	Vert.	46.0	1.3	
949.263	39.0	QP	22.2	-17.5	43.7	214	100	Hori.	46.0	2.3	

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))

*The test result is rounded off to one or two decimal places, so some differences might be observed.

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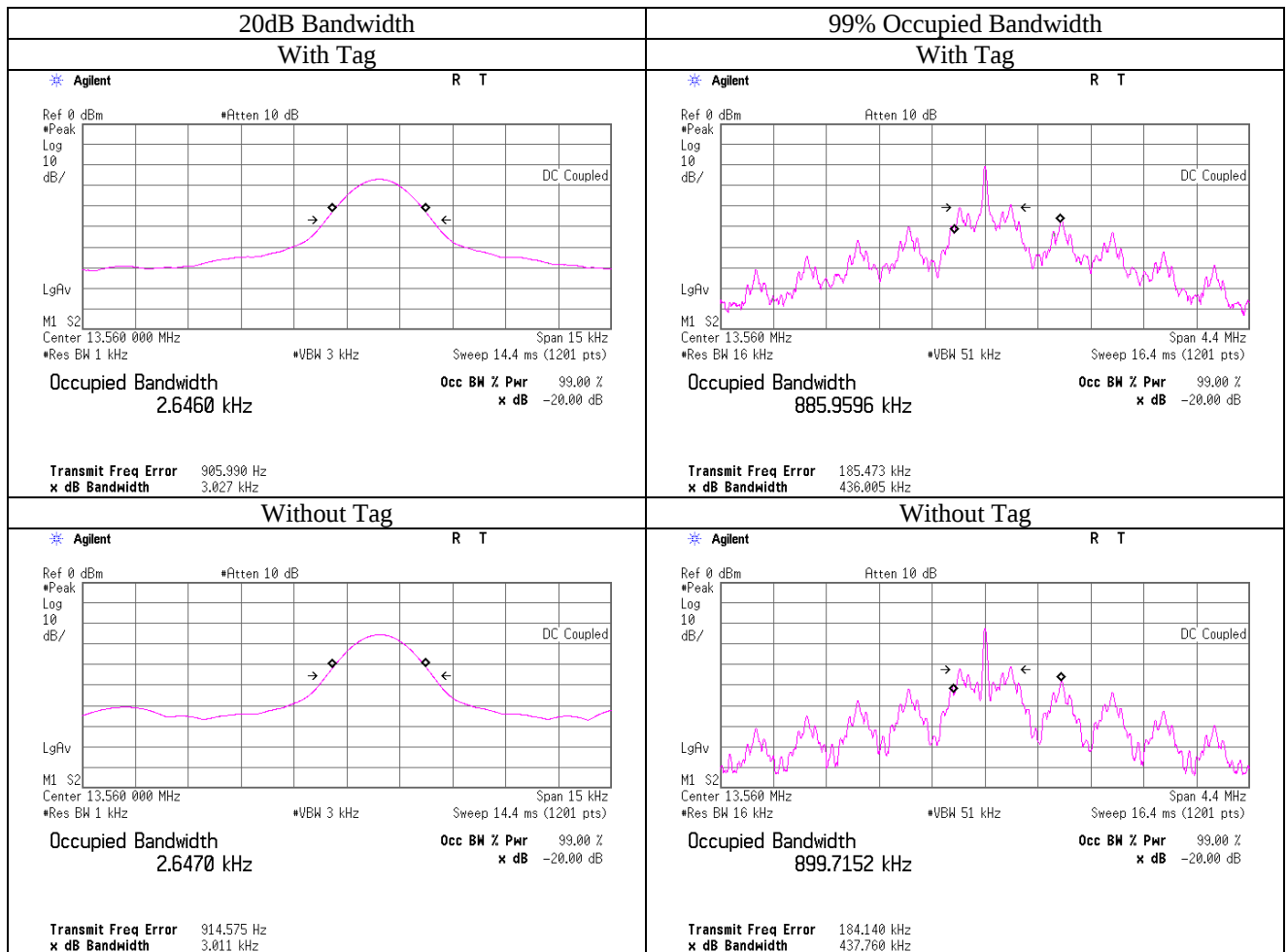
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Facsimile : +81 596 24 8124

20dB Bandwidth and 99% Occupied Bandwidth FeliCa

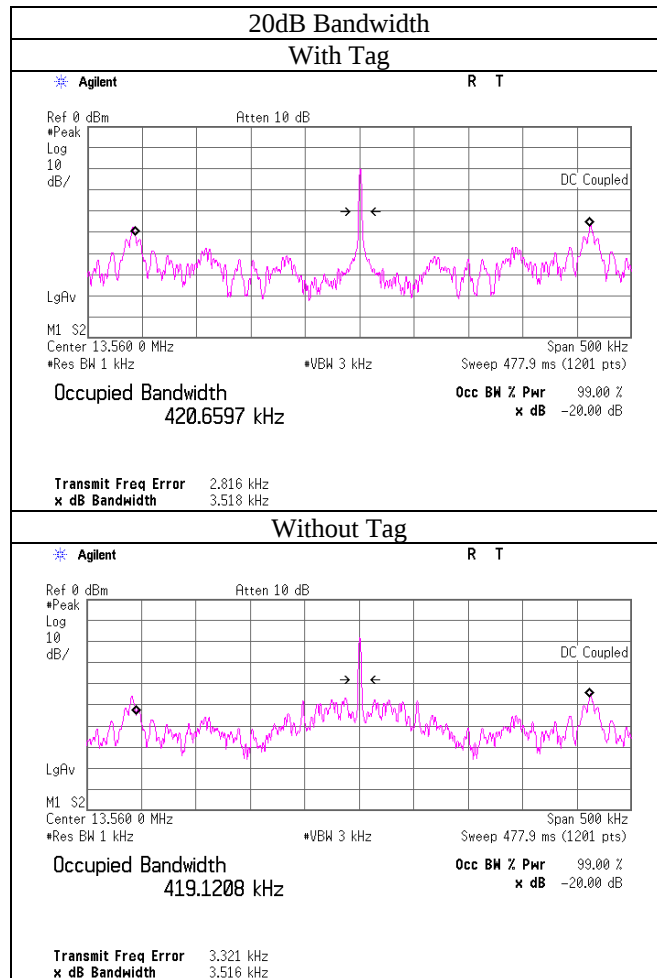
Test place	Ise EMC Lab. No.6 measurement room
Report No.	11968653H
Date	09/28/2017
Temperature/ Humidity	25 deg. C / 61 % RH
Engineer	Takafumi Noguchi
Mode	Tx Mod on (FeliCa)

FREQ [MHz]	Mode	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	With Tag	3.03	885.96
	Without Tag	3.01	899.72



20dB Bandwidth and 99% Occupied Bandwidth
FeliCa
(Reference Data)

Test place	Ise EMC Lab. No.6 measurement room
Report No.	11968653H
Date	10/24/2017
Temperature/ Humidity	24 deg. C / 55 % RH
Engineer	Takafumi Noguchi
Mode	Tx Mod on (FeliCa)



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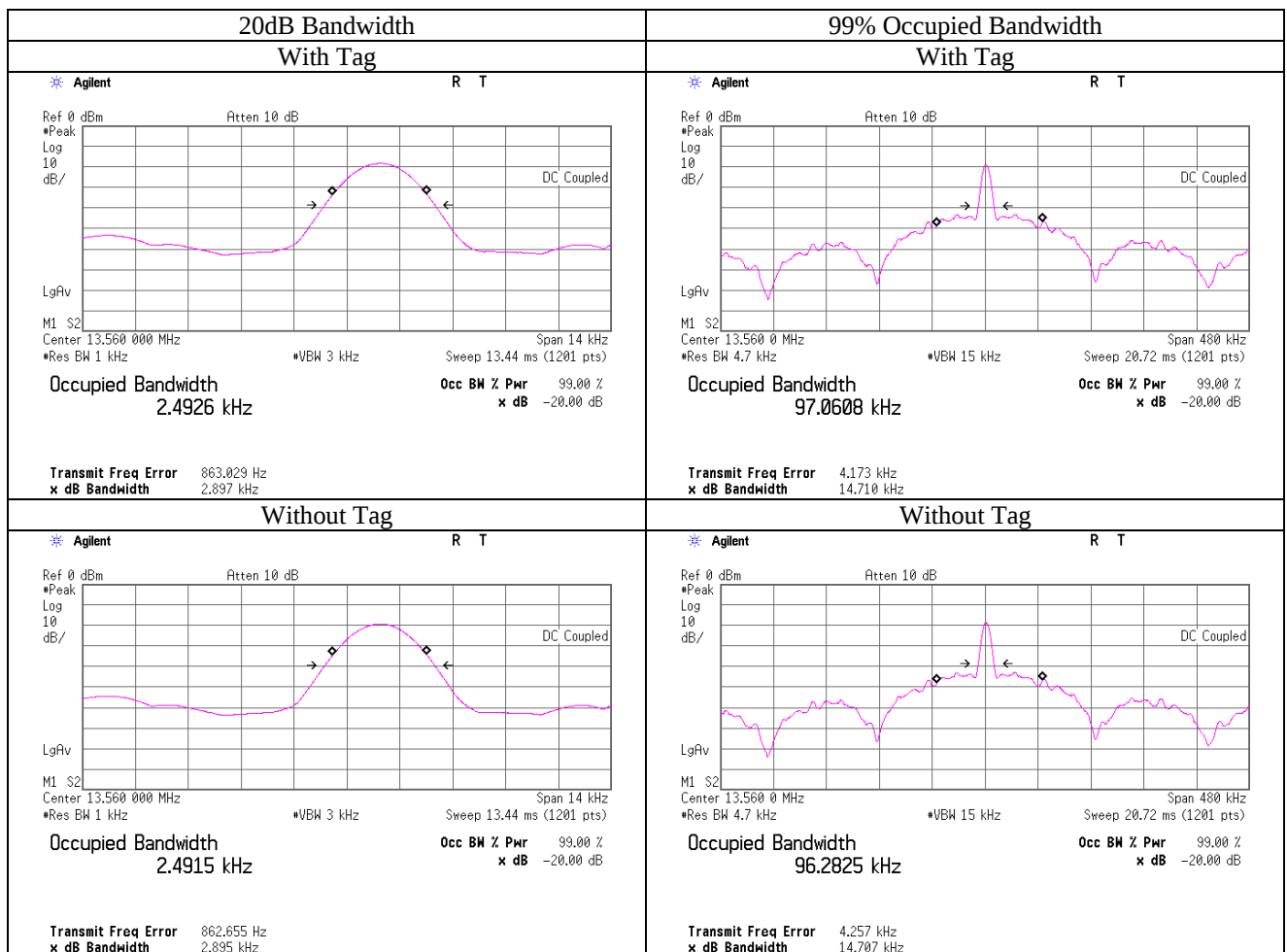
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

20dB Bandwidth and 99% Occupied Bandwidth ISO15693

Test place	Ise EMC Lab. No.6 measurement room
Report No.	11968653H
Date	09/28/2017
Temperature/ Humidity	25 deg. C / 61 % RH
Engineer	Takafumi Noguchi
Mode	Tx Mod on (ISO15693)

FREQ [MHz]	Mode	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	With Tag	2.90	97.06
	Without Tag	2.90	96.28



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Ise EMC Lab.

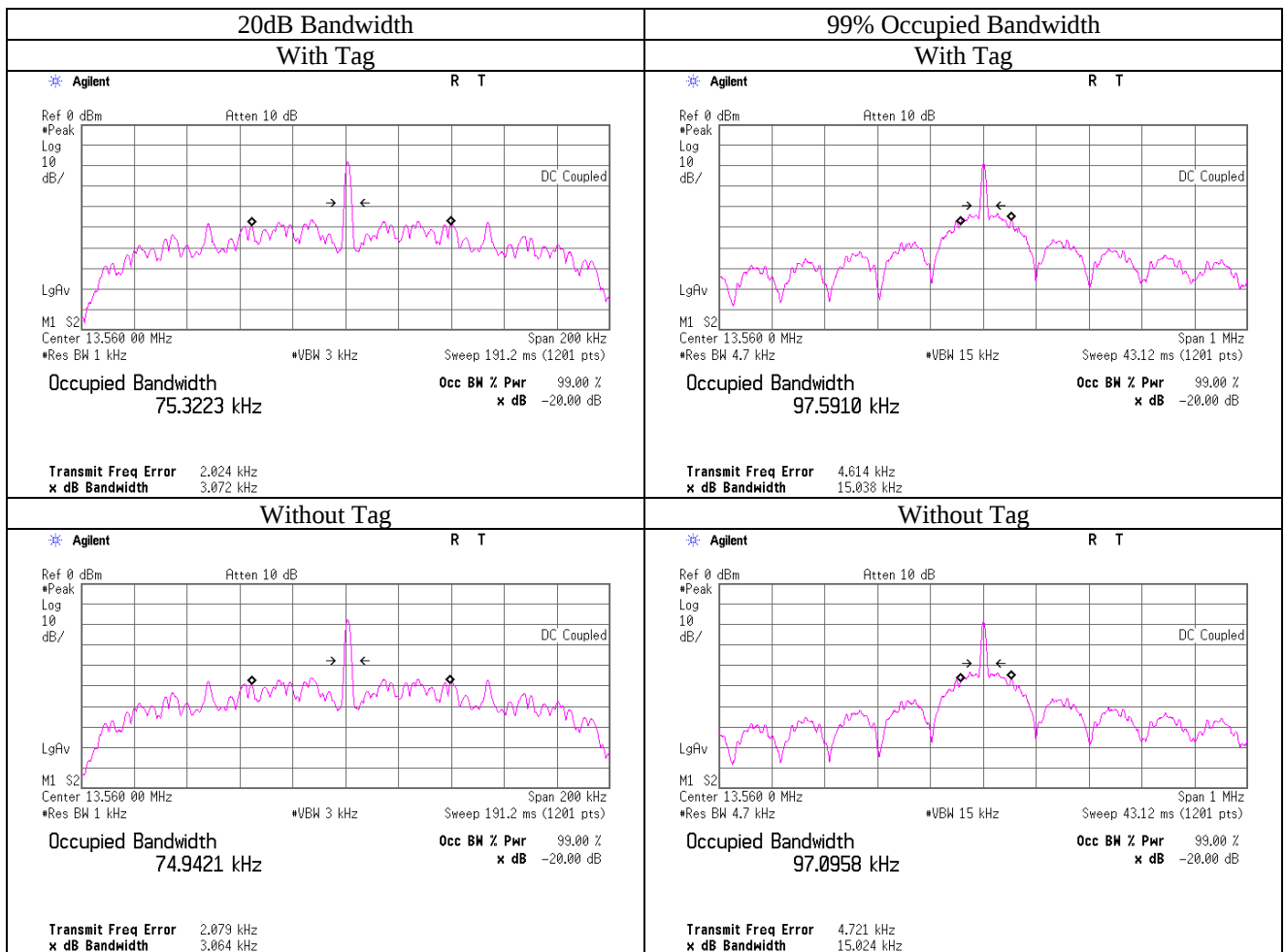
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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

20dB Bandwidth and 99% Occupied Bandwidth
ISO15693
(Reference Data)

Test place	Ise EMC Lab. No.6 measurement room
Report No.	11968653H
Date	09/28/2017
Temperature/ Humidity	25 deg. C / 61 % RH
Engineer	Takafumi Noguchi
Mode	Tx Mod on (ISO15693)



Frequency Tolerance

Test place : Ise EMC Lab. No.6 measurement room
Report No. : 11968653H
Date : 09/28/2017
Temperature/ Humidity : 25 deg. C / 61 % RH
Engineer : Takafumi Noguchi
Mode : Tx Mod off

Test condition		Tested timing	Measured frequency [MHz]	Frequency error [MHz]	Result		Limit [+/- %]
Temp. [deg. C]	Voltage [V]				[%]	[ppm]	
50	5	Power on	13.560867	0.000867	0.00639	63.9	0.01
		+ 2 min.	13.560869	0.000869	0.00641	64.1	0.01
		+ 5 min.	13.560875	0.000875	0.00645	64.5	0.01
		+ 10 min.	13.560880	0.000880	0.00649	64.9	0.01
40	5	Power on	13.560872	0.000872	0.00643	64.3	0.01
		+ 2 min.	13.560870	0.000870	0.00642	64.2	0.01
		+ 5 min.	13.560870	0.000870	0.00642	64.2	0.01
		+ 10 min.	13.560871	0.000871	0.00642	64.2	0.01
30	5	Power on	13.560923	0.000923	0.00681	68.1	0.01
		+ 2 min.	13.560897	0.000897	0.00661	66.1	0.01
		+ 5 min.	13.560886	0.000886	0.00653	65.3	0.01
		+ 10 min.	13.560883	0.000883	0.00651	65.1	0.01
20	5	Power on	13.560943	0.000943	0.00696	69.6	0.01
		+ 2 min.	13.560921	0.000921	0.00679	67.9	0.01
		+ 5 min.	13.560913	0.000913	0.00673	67.3	0.01
		+ 10 min.	13.560909	0.000909	0.00670	67.0	0.01
20	4.25 (5V -15%)	Power on	13.560921	0.000921	0.00679	67.9	0.01
		+ 2 min.	13.560922	0.000922	0.00680	68.0	0.01
		+ 5 min.	13.560922	0.000922	0.00680	68.0	0.01
		+ 10 min.	13.560923	0.000922	0.00680	68.0	0.01
20	5.75 (5V +15%)	Power on	13.560933	0.000933	0.00688	68.8	0.01
		+ 2 min.	13.560912	0.000912	0.00673	67.3	0.01
		+ 5 min.	13.560906	0.000906	0.00668	66.8	0.01
		+ 10 min.	13.560905	0.000905	0.00667	66.7	0.01
10	5	Power on	13.560983	0.000983	0.00725	72.5	0.01
		+ 2 min.	13.560969	0.000969	0.00715	71.5	0.01
		+ 5 min.	13.560953	0.000953	0.00703	70.3	0.01
		+ 10 min.	13.560945	0.000945	0.00697	69.7	0.01
0	5	Power on	13.561011	0.001011	0.00746	74.6	0.01
		+ 2 min.	13.561000	0.001000	0.00738	73.8	0.01
		+ 5 min.	13.560984	0.000984	0.00726	72.6	0.01
		+ 10 min.	13.560978	0.000978	0.00721	72.1	0.01
-10	5	Power on	13.561023	0.001023	0.00754	75.4	0.01
		+ 2 min.	13.561012	0.001012	0.00747	74.7	0.01
		+ 5 min.	13.560995	0.000994	0.00733	73.3	0.01
		+ 10 min.	13.560972	0.000972	0.00717	71.7	0.01
-20	5	Power on	13.561027	0.001027	0.00757	75.7	0.01
		+ 2 min.	13.561019	0.001019	0.00752	75.2	0.01
		+ 5 min.	13.561001	0.001001	0.00738	73.8	0.01
		+ 10 min.	13.560989	0.000989	0.00729	72.9	0.01

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

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

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

*As for the range of specification operating temperature, the test was performed with required temperature range on Frequency Tolerance.

APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-01	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	CE	2017/09/30 * 12
MOS-27	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q26	CE	2017/01/20 * 12
MJM-25	Measure	KOMELON	KMC-36	-	CE	-
MTR-09	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	CE	2017/06/27 * 12
MLS-25	LISN(AMN)	Schwarzbeck	NSLK8127	8127-731	CE	2017/07/21 * 12
MCC-03	Coaxial Cable	Fujikura/Suhner/ TSJ	5D-2W(20m)/ 3D-2W(7.5m)/ RG400u(1.5m)/ RFM-E421(Switcher)	-/ 01068(Switcher)	CE	2017/06/26 * 12
MAT-64	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2016/12/21 * 12
MMM-03	Digital Tester	Fluke	FLUKE 26-3	78030621	CE	2017/08/07 * 12
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2016/10/19 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE	2017/01/20 * 12
MJM-26	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE,CE	-
MTR-10	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	RE	2017/01/12 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2016/10/14 * 12
MCC-113	Coaxial cable	Fujikura/Suhner/ TSJ	5D-2W(10m)/ SFM141(5m)/ 421-010(1m)/ suoform141-PE(1m)/ RFM-E121(Switcher)	-/04178	RE	2017/07/26 * 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-97	Attenuator	KEYSIGHT	8491A	MY52462282	RE	2016/10/31 * 12
MMM-10	DIGITAL HiTESTER	Hioki	3805	051201148	RE	2017/01/19 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2016/11/23 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2017/06/26 * 12
MLA-23	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-192	RE	2017/01/26 * 12
MRENT-130	Spectrum Analyzer	Agilent	E4440A	MY46187750	RE	2017/06/20 * 12
MCC-219	Coaxial Cable	UL Japan	-	-	RE	2016/11/10 * 12
MLPA-02	Loop Antenna	Rohde & Schwarz	HFH2-Z2	836553/009	RE	2016/11/02 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	1401	FT	2017/01/20 * 12
MMM-12	DIGITAL HiTESTER	Hioki	3805	060500120	FT	2017/02/15 * 12
MFC-01	Microwave Counter	Advantest	R5373	120100309	FT	2017/06/21 * 12
MSA-15	Spectrum Analyzer	Agilent	E4440A	MY46187105	FT	2016/10/13 * 12
MCH-04	Temperature and Humidity Chamber	Tabai Espec	PL-2KP	14015723	FT	2017/08/07 * 12
MLPA-07	Loop Antenna	UL Japan	-	-	FT	Pre Check

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

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

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

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

UL Japan, Inc.

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